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Water-Supply Paper 843

FLOODS OF DECEMBER 1937 IN NORTHERN CALIFORNIA

BY

H. D. McGLASHAN AND R. C. BRIGGS

Prepared in cooperation with the
FEDERAL EMERGENCY ADMINISTRATION
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THE FLOODS OF DECEMBER 1937 IN NORTHERN CALIFORNIA

By H. D. McGlashan and R. C. Briggs

ABSTRACT

During the period December 9-12, 1937, streams in northern California were subjected to severe floods which, at 80 river-measurement stations, exceeded previously recorded maximum discharges. Flood stages prevailed from the Kaweah River Basin in the south to the Pit and Trinity River Basins in the north, and from the Pacific Ocean to the Sierras. Farm lands, highways, bridges, and public utility systems were seriously damaged.

The floods were caused by an exceptionally intense rainstorm of wide extent, which formed over the Pacific Ocean and moved rapidly eastward into northern California on December 9. It was a well-defined single storm, and most of the precipitation fell within a 48-hour period. The storm was notable for the accompanying warm temperature, which caused precipitation to have the form of rain, rather than snow, up to high altitudes in the Sierras. Other distinctive features were the relatively small amounts of rainfall in the lower altitudes of the Central Valley, and the large amounts of rainfall in the middle altitudes of the Sierras where normally much of the precipitation during December storms is in the form of snow.

In general, there was little snow on the ground at the beginning of the storm period, and contribution from melting snow was not an important factor in the flood run-off.

An interesting characteristic of the floods was the absence of high water along the lower reaches of the San Joaquin River, in contrast to the flooded areas along the lower Sacramento River. Large volumes of flood waters were withheld by the many storage reservoirs on tributaries of the San Joaquin River, whereas much smaller volumes were detained by the comparatively few storage reservoirs in the Sacramento River Basin.

The extent to which the absorptive capacity of the soil had been utilized by antecedent precipitation at the time of the December storm had an important influence on the relative magnitude of the flood run-off from different areas. In general, this factor tended to make the floods in the northern part of the Central Valley more severe than those in the southern part. A study of the conditions of antecedent precipitation and probable ground moisture associated with previous great floods supports the conclusion that the ground storage is generally a very critical factor in the development of floods in this region.

This water-supply paper presents, for the period that included the floods, records of stage and discharge at about 170 river-measurement stations and records of storage in all the larger reservoirs. It also presents a summary of peak discharges with comparative data for other floods at 74 measurement points, and tables and graphs showing crest stages along the Sacramento and San Joaquin Rivers.

The paper includes information about the weather associated with the floods; the results of studies of the rainfall and run-off; discussions of flood characteristics; and other pertinent information about the meteorologic and hydrologic conditions prior to and during the flood period.

The main flood report is followed by a section on floods that occurred before the beginning of systematic stream-flow records. The early flood data, although lacking in quantitative information, indicate that the floods of the winter seasons of 1861-62 and 1867-68 were the most outstanding in magnitude. The peak discharges of the lower San Joaquin and Sacramento Rivers in January 1862 appear to have been the greatest since early in the nineteenth century at least; those in some localities, however, were closely approached in December 1867. In general, the floods of December 1937 were materially less in total volume than those just mentioned, but in some places they probably exceeded all other known floods in peak discharge.

The final section of the paper presents data on floods that brought record stages to some streams in 1938.

INTRODUCTION

The storm of December 9-12, 1937, in northern California, was notable both for its severity and for the extent of the area that it covered. Extreme storm conditions prevailed throughout the Central Valley, from the Kaweah River northward, and from the Salinas River Basin northward along the coast to Oregon. Figure 1 shows the location of the area covered by this report.

Since 1867 there has been no other major flood in northern California so early in the season as that of December 1937. The plentiful rainfall in October and especially heavy rains during November in Sacramento River Basin, associated with temperatures well above normal and an absence of snow-cover except at high altitudes, produced conditions favorable for high run-off rates at the time of the December storm.

The intensity and speed with which the storm swept across the State, and extended to forty-three of the fifty-eight counties, make it one of the outstanding storms of record. The precipitation lasted about two and one-half days in the affected area as a whole, but in general it lasted less than two days at any one place. It resulted in rates and volumes of run-off equalling or exceeding those for storms of 6 to 14 days' duration in earlier years. The maximum rainfall record for the 2-day period, December 10-11, was that of more than 18 inches in Feather River Basin.

In its swift passage across the State, the storm and resulting floods left an area of devastation marked by damaged highways, wrecked bridges, broken levees, and flooded homes and ranches. Transportation in many areas was interrupted or stopped entirely for varying periods, lines of communication as well as those for transmission of power were down, and many towns were thus isolated. The total damage was estimated by Edward Hyatt, State Engineer, at nearly $15,000,000.

The outstanding flood period recorded in California has long been considered as the one caused by the storms of 1861-62 which extended from Alaska to Mexico. In some sections of the Great Central Valley and especially in the southern half of the San Joaquin Valley, the flood of 1867 exceeded that of 1861-62. Notable floods in 1881, 1907, 1909, and 1928 were confined to smaller areas.

Reliable evidence indicates that the highest river stages ever noted were reached in December 1937 at certain points on the Sacramento River and tributaries in the general vicinity of Red Bluff.

Maximum discharges were recorded in December 1937 on the Sacramento,

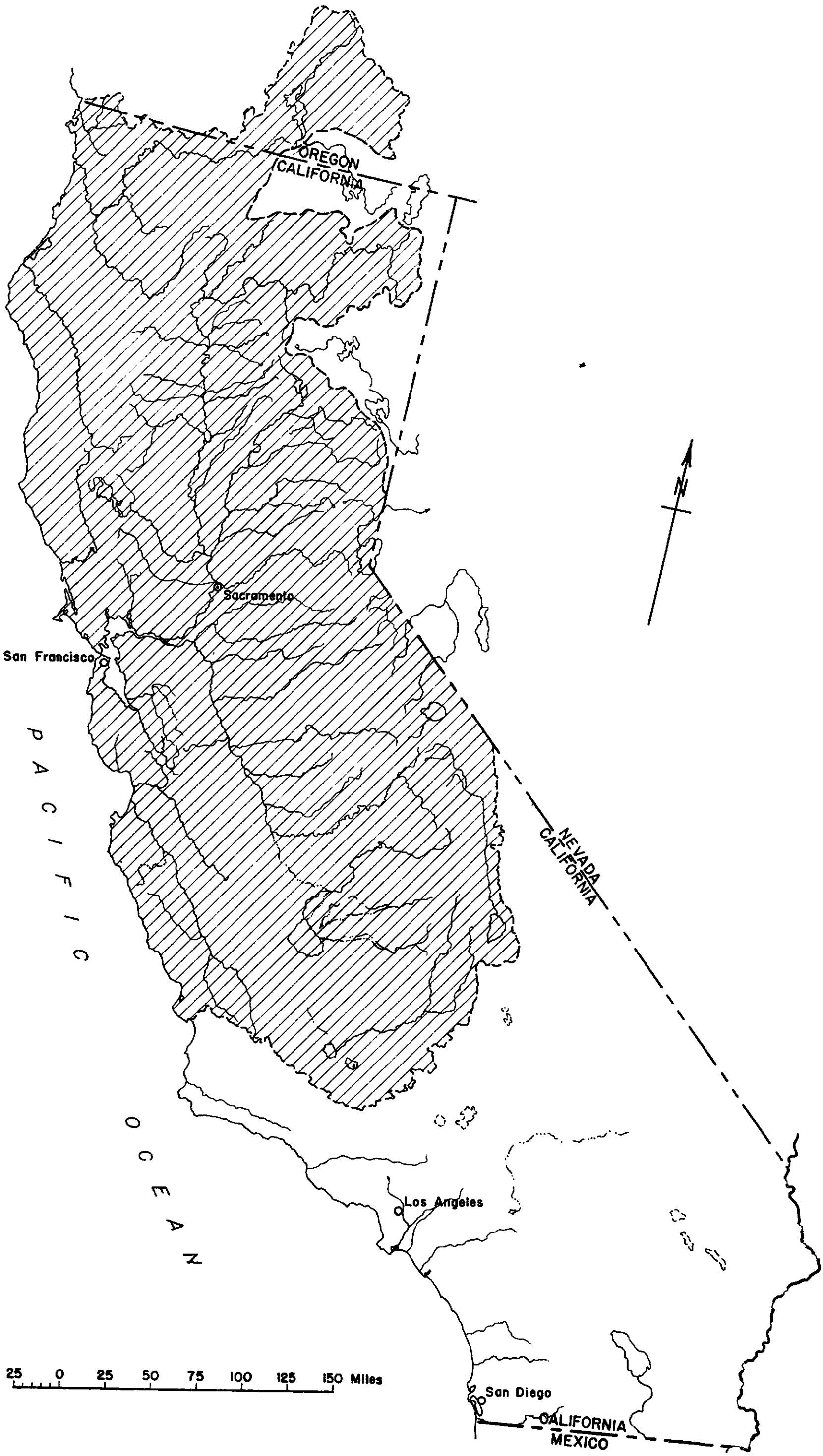


Figure 1.--Map showing location of area covered by this report.

upper San Joaquin, Kings, and Kaweah Rivers, as well as on many tributaries. On the Feather River the peak discharge was approximately that of 1928, whereas on the American River it was considerably less than in that record year. The storm was much less severe in the extreme southern part of the San Joaquin Valley, and the crest discharge of the Kern River did not equal that of the flood of February 1937. As the storage reservoirs on the Mokelumne, Stanislaus, Tuolumne, and Merced Rivers were not filled in December 1937, there was no high water along the lower reaches of these streams or on the San Joaquin downstream from these tributaries.

As a part of its regular nation-wide stream-gaging program, the Geological Survey maintains about 185 river-measurement stations within the area covered by the flood of December 1937. These stations have been operated by the Geological Survey in cooperation with the State and many counties, cities, irrigation districts, public utilities, and other agencies, generally for periods beginning many years prior to the storm of December 1937. By this program the Survey has obtained continuous records of stage and rates and volumes of flow of the streams, covering the range from dry-season flows to major floods.

The records of stage, discharges, and other characteristics of the floods of December 1937 are of great interest and importance, and furnish basic information needed in the design and construction of hydraulic works and in the study of flood control and land-use measures.

In addition to detailed data concerning the floods of December 1937, this report includes a section on floods prior to the beginning of stream-flow records, and a section on floods in 1938.

ADMINISTRATION AND PERSONNEL

The field and office work incident to the preparation of this report was performed by the water-resources branch of the Geological Survey under the general administrative direction of N. C. Grover, chief hydraulic engineer, and C. G. Paulsen, chief, division of surface water. The field work, the collection and tabulation of the basic information with respect to stages and discharges, and the many other tasks in the preparation of the report were done by the personnel of the San Francisco district office in the division of surface water, under the direction of H. D. McGlashan, district engineer, assisted by R. C. Briggs, hydraulic engineer, who were primarily responsible for the authorship. General supervision and coordination of the collection of data and the final assembling of the report were carried on in the division of water utilization, R. W. Davenport, chief. W. G. Hoyt, consulting engineer, conservation branch, has directed and prepared the presentation of information on rainfall and other climatologic features and is the author of the section on rainfall and run-off studies. He was aided by H. M. Orem, assistant engineer. Most of the data in the chapter concerning previous floods was collected by F. A. Johnson, assistant engineer. Many other members of the Geological Survey's staff have participated in important ways in the collection and preparation of the information in this report including Peter Alexander, Jesse Arnold, L. E. Bossen, B. C. Colby, C. J. Emerson, A. B. Goodwin, Charles Leidl, H. F. Matthai, and H. J. Sexton in the San Francisco office. In carrying on all this work the permanent field and office staffs were assisted by temporary employees appointed by the Secretary of the Interior, a part of whom were furnished by the Public Works Administration. Office assistance was given by the Works Progress Administration.

ACKNOWLEDGMENTS

The Geological Survey, acting through its San Francisco district office, cooperates with the State and many municipal agencies in California. Acknowledgment is made to these cooperating agencies for participation in the collection of the systematic records of river discharge that form the broad base on which the specific flood information has been placed, also for furnishing a number of complete records of discharge at river-measurement stations which they maintain independently.

Information appearing in this report has been obtained from many sources, including individuals, corporations, and governmental organizations, local, State, and Federal. Financial cooperation in connection with the regular river-measurement program of the Geological Survey in the areas in northern California covered by this report has been received from the Bureau of Reclamation, United States Department of the Interior; the State of California, through Edward Hyatt, State Engineer; the East Bay Municipal Utility District; the Santa Clara Valley Water Conservation District; Stanford University; and the cities of San Francisco, Santa Cruz, and San Luis Obispo. In addition to this regular cooperation, special allotments were made by Governor Frank F. Merriam through the State Director of Finance, by the United States Bureau of Reclamation, and by the Public Works Administration, to supplement the funds available for the preparation of this report.

Federal agencies to whom acknowledgments are made for services rendered or data furnished include the United States Weather Bureau; the Corps of Engineers, United States Army; the United States Forest Service; the National Park Service; and the Works Progress Administration.

Other agencies in California that furnished data or rendered services are the following: Pacific Gas & Electric Co.; San Joaquin Light and Power Corp.; Southern California Edison Co., Ltd.; City of Sacramento; Merced Irrigation District; Turlock & Modesto Irrigation Districts; Emma Rose & Hobart Estate Co.; and Thermalito and Table Mountain Irrigation District. The city of Los Angeles prepared the complete records for their stations in Owens River Basin. Where practicable, acknowledgments for individual contributions of information are given at appropriate places in the report.

GENERAL FEATURES OF THE FLOODS

The rivers and creeks over most of northern California, from the Kaweah on the south to the Pit and Trinity on the north, rose rapidly to very high stages as a result of the storm of December 9-12, 1937. From west to east the storm was severe from the coast of California to the State of Nevada, and many streams on both sides of the Coast Ranges and the Sierra Nevada exceeded previously recorded maximum flood discharges. Figure 2 is a map showing the principal river systems and cities mentioned in the text of this report.

A notable characteristic of the storm was the relatively small amount of rainfall on the floor of the Great Central Valley. The rainfall was also of only moderate depth and intensity in the coastal areas south of the Salinas Basin, and in Owens Valley on the east side of the Sierra Nevada. Consequently, streams in those localities did not reach excessive stages.

South of the Kaweah River the intensity of the storm was much less, and the peak discharges did not equal those of February 1937. The discharge of the Kaweah and Kings Rivers and tributaries far exceeded previous long-period records. Excessive and record-breaking run-off rates were recorded in the foothill and mountain areas in the San Joaquin, Merced, Tuolumne, Stanislaus, and Mokelumne Basins but, because of available storage in Lake McClure, Hetch Hetchy, Don Pedro, Melones, Salt Springs, Pardee, and other, but smaller, reservoirs there was no heavy run-off along the lower reaches of these streams.

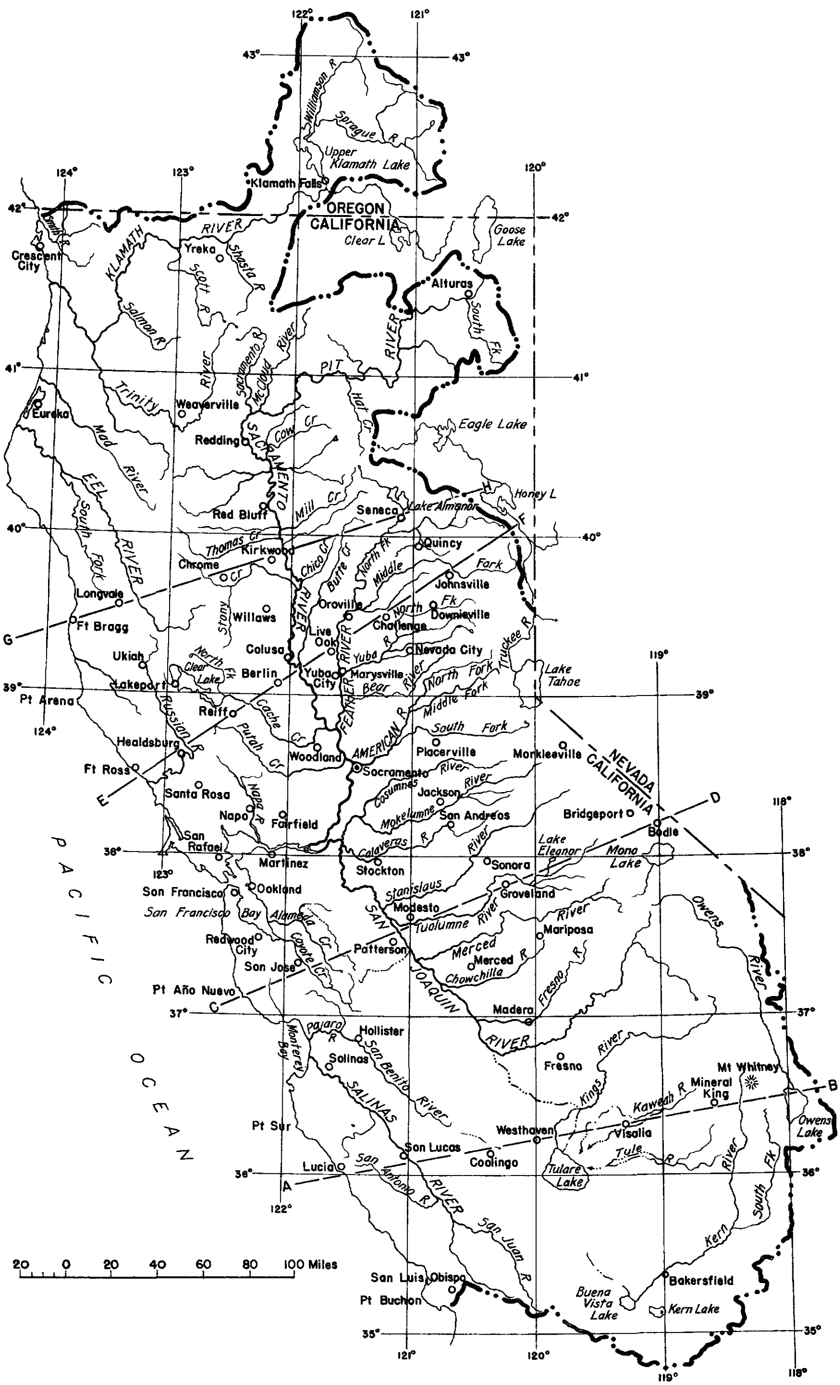


Figure 2.--Map showing the principal river systems and cities mentioned in text.

From the headwaters of the Sacramento downstream to and including the Feather River Basin major flood conditions prevailed. On the Sacramento River near Red Bluff the stage was 1.3 feet above that recorded in 1909, but owing to changes in the channel the discharge was only slightly greater than the revised maximum for that year.

On the Feather River near Oroville the discharge equalled the revised maximum for 1928, but was less than the revised discharge for the record year 1907.

Along the coast from San Francisco Bay to Oregon many new maxima were established, but the length of record at these stations is relatively short. The storm was particularly heavy in the Russian River Basin and in the upper part of Putah Creek Basin.

The damage resulting from the flood of December 1937 has been estimated at nearly $15,000,000. The principal items were about $4,500,000 in damage to roads, bridges, and streets; $3,500,000 classed as agricultural; $2,500,000 for river protection works and debris removal; and $1,000,000 for public utilities. The damage reported for Butte County was more than $2,000,000; the next highest were for Sonoma and Tehama Counties, each with damages exceeding $1,000,000. Most of the main highways were made passable in three or four days after the storm, but in some areas normal traffic was not restored for a week or more. There was heavy damage to Donner Highway, which was opened to normal traffic December 20; Walker Canyon Highway, south of Coleville, was opened January 3, 1938; and Feather River Highway was opened January 16, 1938. (See pl. 1.) The All-year Yosemite Highway, in Merced Canyon, was reopened December 30, 1937, on a one-way schedule which was continued through 1938. The Yosemite Valley Railroad grade, on the opposite side of the canyon, was also severely damaged. (See pl. 2.)

In the coastal valleys and in parts of the Great Central Valley many farms and orchards were damaged. (See pl. 3.) The rains and inundation of the land so saturated the soil that the heavy winds that followed the storm uprooted the trees.

In San Joaquin Valley the damage was largely limited to the foothill and mountain areas and to the lower lands along the Kings, Kaweah, and San Joaquin Rivers where large areas of farm lands were flooded. About 15,000 acres in Centerville Bottoms, on the Kings River at the edge of the foothills below Piedra, and 30,000 acres in Burris Park, Laton, and Lemoore areas were inundated. The "Bottoms" acted as a reservoir until the crest of the flood had passed, and then the water

A. ROCK SLIDE ON FEATHER RIVER HIGHWAY AT BUTTE-PLUMAS COUNTY LINE.
Courtesy of Division of Highways, State of California.

B. WASHOUT ON MAIN STREET, CHESTER, CALIF.
Caused by overflow from North Fork of Feather River. Courtesy of Division of Highways, State of California.

FLOOD DAMAGE IN FEATHER RIVER BASIN.

A. YOSEMITE VALLEY RAILWAY IN FOREGROUND AND HIGHWAY TO YOSEMITE VALLEY ON OPPOSITE BANK.

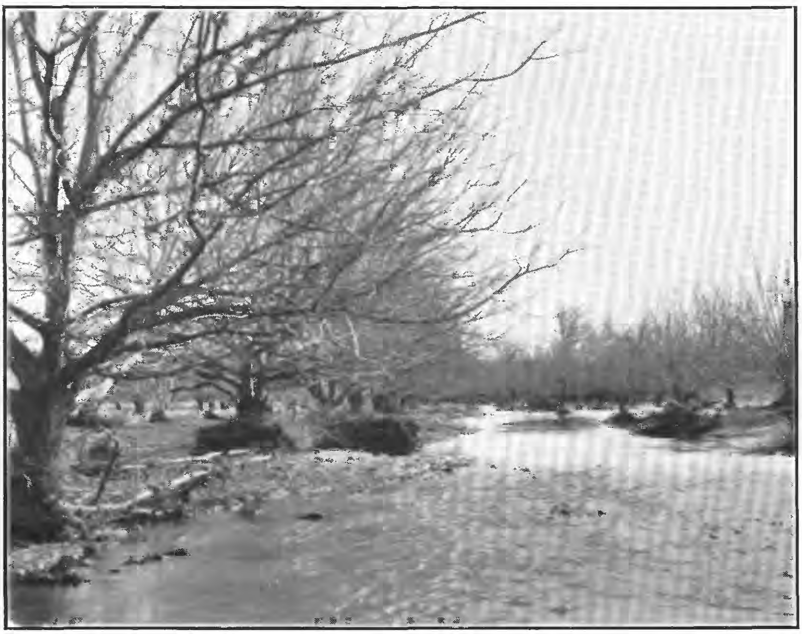
Courtesy of Division of Highways, State of California.

B. YOSEMITE VALLEY RAILWAY AT RIGHT AND HIGHWAY TO YOSEMITE VALLEY AT LEFT.

Courtesy of Division of Highways, State of California.

MERCED RIVER UPSTREAM FROM BRICEBURG DURING FLOOD OF 1937.

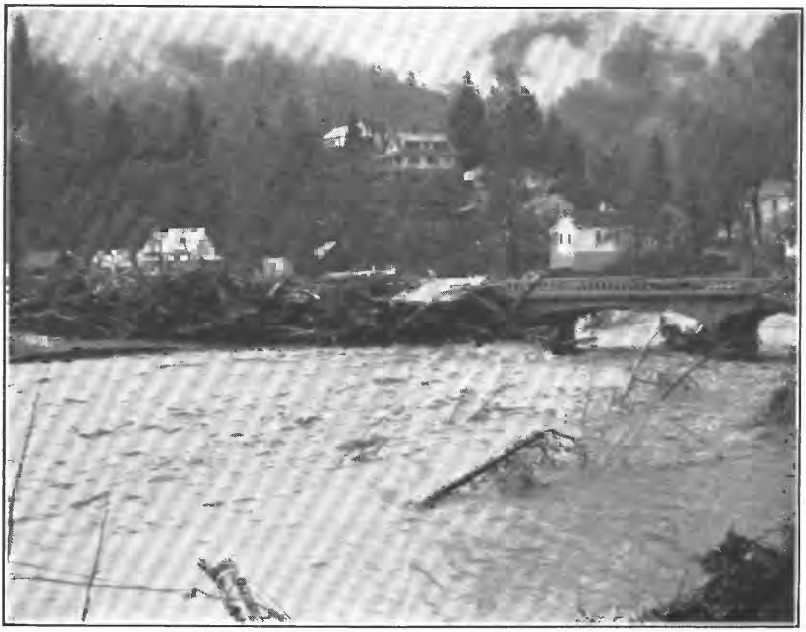
A. FLOODED FARM NORTH OF MARYSVILLE.
Overflow from Feather River, December 12, 1937. Courtesy of the Sacramento Bee.



B. FLOODED ORCHARD NEAR ANDERSON.
New channel cut by Battle Creek. Courtesy of Department of Public Works, State of California.

A. LOOKING UP NORTH FORK OF YUBA RIVER TO JUNCTION WITH THE NORTH FORK OF NORTH FORK.

Courtesy of United States Forest Service.



B. LOOKING DOWN NORTH FORK OF NORTH FORK OF YUBA RIVER TO WRECKED BRIDGE AND DEBRIS.

Courtesy of United States Forest Service.

DESTRUCTION BY FLOOD ON NORTH FORK OF YUBA RIVER AT drained back into the Kings River and thus increased the flow in the lower reaches.

The discharge of the Merced River at Pohono Bridge near Yosemite was nearly four times the previous maximum recorded in 1922, and about one-half of the valley floor in Yosemite Valley was flooded.

From Alturas, on the upper Pit River, to Visalia in the Tulare Lake Basin several towns and cities suffered severe damage from overflow, and large areas of agricultural land were covered by flood water. At Chester the streets were flooded and seriously eroded, owing to debris jams that diverted water from the North Fork of the Feather River. (See pl. 1, B.)

At the historic town of Downieville, at the junction of the North Fork of the North Fork of the Yuba River with the North Fork, there was severe damage to both the community and the highway. (See pl. 4.) Many homes and business buildings were wrecked or moved from their foundations, but fortunately there was no loss of life. The loss of bridges and damage to highways greatly hampered and delayed relief parties that were bringing supplies to Downieville, and retarded the rehabilitation of public utility services.

In the upper Sacramento Valley, mile after mile of highway was inundated, motor vehicles were trapped, and entire towns were isolated. (See pl. 5.) Of the 70 miles of State Highway between Gridley and Red Bluff, 45 miles were under water. Sacramento River overflowed its banks below Red Bluff and flooded the towns of Gerber and Tehama and lands in Tehama and Butte Counties. (See pl. 6.)

The 48 gates of Sacramento weir, just above the mouth of the American River, were opened about 5 p.m. December 11. (See pl. 7, A.) The discharge of the flood waters at this point into Yolo By-pass materially reduced the flood height at Sacramento. The situation did not become serious in the Sacramento-San Joaquin Delta, outside the Yolo By-pass district, for the San Joaquin River was at relatively low stage owing to storage on the lower tributaries.

The Sacramento levee system, built to protect the city and agricultural land from floods, was overtaxed and failed at several points, (see pl. 7, B) allowing the flood waters to spread over many thousand acres of agricultural land in Glenn and Colusa Counties. (See fig. 3 and pl. 9, A.) From Knights Landing south the levee system held.

The Feather River broke through the levee at Hamilton Bend, below Oroville, and sent a large flow west across developed farm land into

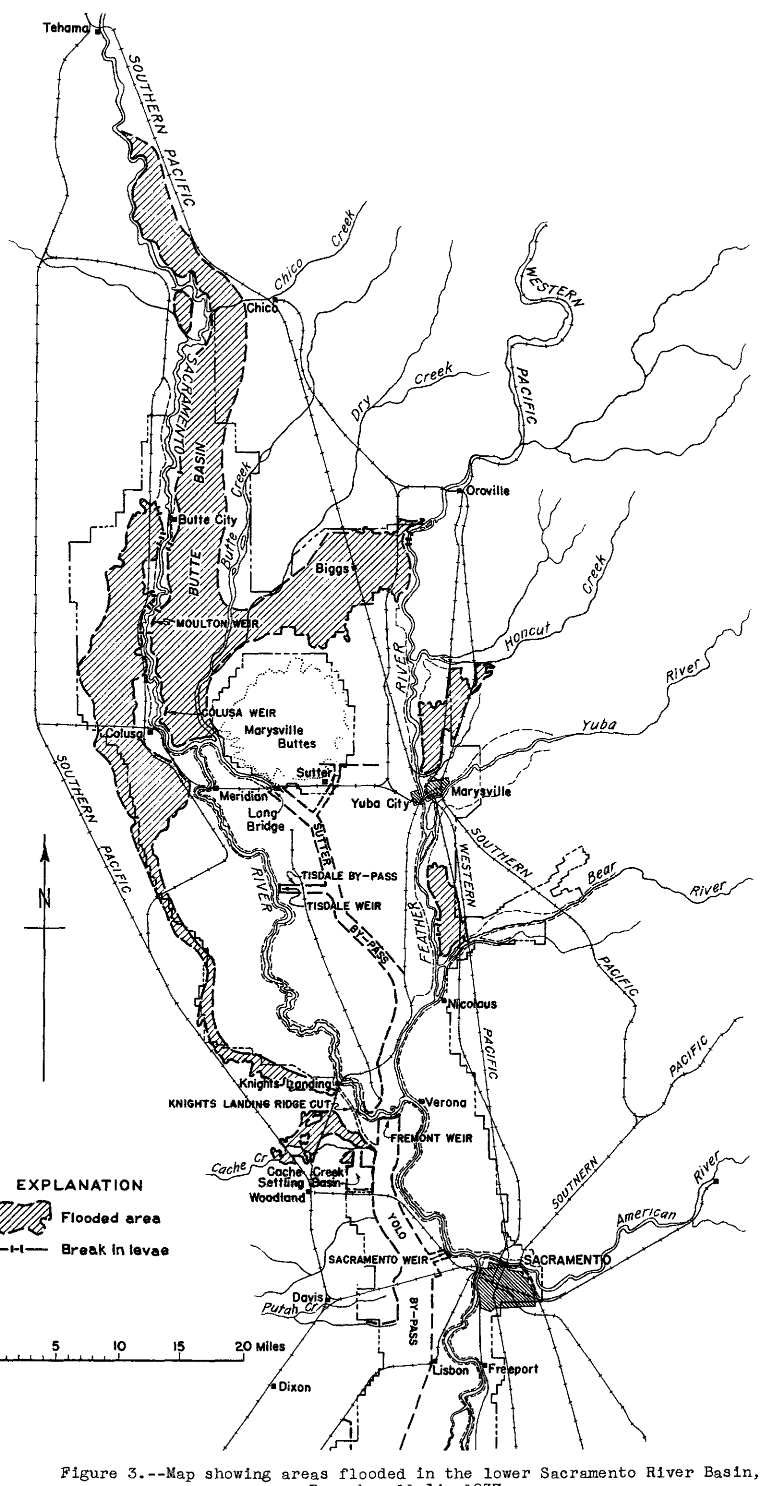


Figure 3.--Map showing areas flooded in the lower Sacramento River Basin, December 11-14, 1937.

Butte Basin, north of Marysville Buttes, flooding settled areas including the city of Biggs. (See pl. 8.) There were also serious breaks north and south of Marysville that inundated a large acreage of diversified ranch land.

Serious damage occurred in the smaller basins along and adjacent to the coast south and north of San Francisco Bay. Gilroy was flooded by water from Uvas Creek (see pl. 9, B) and the southern part of Watsonville by the overflow from the Pajaro River. The Russian River made practically a clean sweep of the resort areas and flooded part of Healdsburg and fertile farm lands in the vicinity. (See pl. 10.) The damage in Mendocino County was chiefly to roads and bridges, and in Lake and Humboldt Counties to agricultural developments.

High water at or near river-measurement stations is shown in plates 11 and 12. The latter shows the Kaweah River station at low stage (pl. 12, A) and at a high-stage (pl. 12, B) immediately preceding the peak of December 11, 1937.

The momentary peak discharge in December 1937 was the maximum for the period of record, to December 31, 1937, at the following river-measurement stations:

Pajaro River Basin.--Uvas Creek near Morgan Hill.

Tulare Lake Basin.--Kaweah River near Three Rivers; North Fork of Kaweah River at Kaweah; Kings River above North Fork; Kings River at Piedra; North Fork of Kings River near Cliff Camp; North Fork of Kings River below Rancheria Creek; Los Gatos Creek near Coalinga.

San Joaquin River Basin.--San Joaquin River above Big Creek; San Joaquin River below Kerckhoff power house; San Joaquin River near Friant; Pitman Creek below Tamarack Creek.

Merced River Basin.--Merced River at Happy Isles Bridge, near Yosemite; Merced River at Pohono Bridge, near Yosemite; Merced River at Kittridge; Tenaya Creek near Yosemite.

Tuolumne River Basin.--Tuolumne River near Hetch Hetchy; Falls Creek near Hetch Hetchy; Cherry Creek near Hetch Hetchy; Eleanor Creek near Hetch Hetchy; South Fork of Tuolumne River near Oakland Recreation Camp; Middle Tuolumne River near Buck Meadows.

Stanislaus River Basin.--Middle Fork of Stanislaus River at Sand Bar Flat, near Avery; North Fork of Stanislaus River near Avery.

Mokelumne River Basin.--North Fork of Mokelumne River below Salt Springs Dam; Cold Creek near Mokelumne Peak; Bear River at Pardoe Camp.

Sacramento River Basin.--Sacramento River at Kennett; Sacramento River near Red Bluff; Sacramento River at Verona.

Pit River Basin.--Pit River at Fall River Mills; Pit River below Pit No. 4 dam; Pit River at Big Bend; Pit River near Ydalpom; Hat Creek near Hat Creek; McCloud River near McCloud; McCloud River at Baird.

Mill Creek Basin.--Mill Creek near Los Molinos.

Elder Creek Basin.--Elder Creek near Henleyville.

Deer Creek Basin.--Deer Creek near Vina.

Chico Creek Basin.--Chico Creek near Chico.

Stony Creek Basin.--Butte Creek near Chico.

Feather River Basin.--Spanish Creek at Keddie; Grizzly Creek near Storrie; West Branch of Feather River near Yankee Hill; South Fork of Feather River at Enterprise; Lost Creek near Clipper Mills; Middle Fork of Yuba River at Milton; North Fork of Yuba River near Sierra City; North Fork of Yuba River below Goodyears Bar; Canyon Creek below Bowman Lake; Deer Creek near Smartville.

American River Basin.--North Fork of American River at Rattlesnake Bridge; South Fork of American River near Kyburz; South Fork of American River near Camino; South Fork of American River at Coloma; Silver Lake outlet near Kirkwood; Silver Fork of South Fork of American River near Kyburz; Twin Lakes outlet near Kirkwood; Silver Creek at Union Valley; Silver Creek near Placerville; South Fork of Silver Creek near Ice House.

Cache Creek Basin.--North Fork of Cache Creek near Lower Lake.

Eel River Basin.--Eel River at Hullville.

Klamath River Basin.--Klamath River at Somesbar; Shasta River near Yreka; Salmon River at Somesbar; Trinity River at Lewiston; Trinity River near Burnt Ranch; Trinity River near Hoopa.

Smith River Basin.--Smith River near Crescent City.

Owens Lake Basin.--Owens River near Round Valley.

Walker Lake Basin.--West Walker River near Coleville.

Humboldt-Carson Sink Basin.--East Fork of Carson River near Markleeville; Markleeville Creek at Markleeville; West Fork of Carson River at Woodfords.

Pyramid and Winnemucca Lakes Basin.--Truckee River at Iceland; Donner Creek near Truckee; Little Truckee River near Boca.

The drainage basins of the various streams seriously affected by the storm and resulting floods are shown in figures 4 to 12.

A. HIGHWAY FLOODED BY SACRAMENTO RIVER.

View on Williams-Colusa highway 6½ miles east of Williams, December 14, 1937. Courtesy of United States Forest Service.

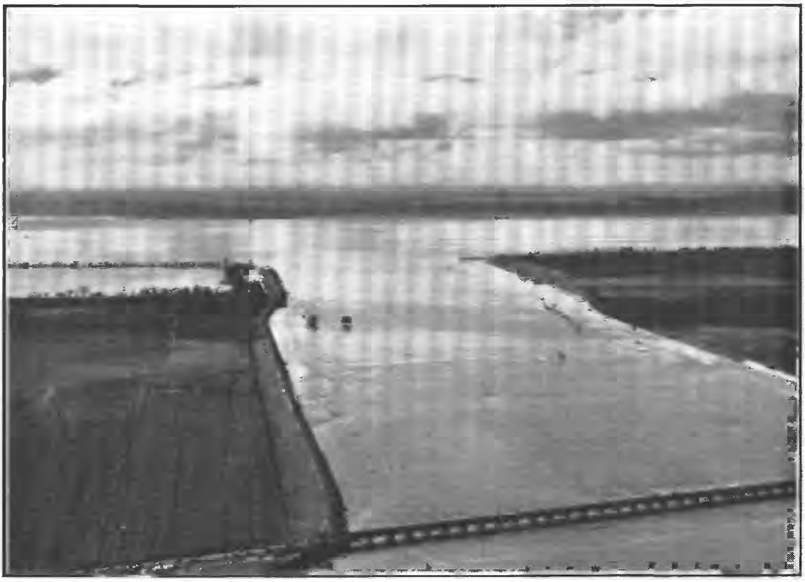
B. DAMAGED HIGHWAY BRIDGE ON BEAR CREEK SOUTH OF LOS MOLINOS.

Courtesy of Division of Highways, State of California.

A. SUBMERGED BUILDINGS NEAR TOWN.

B. RIGHT-OF-WAY OF SOUTHERN PACIFIC LINES SOUTH OF TOWN.

SACRAMENTO RIVER OVERFLOW NEAR GERBER.



A. SACRAMENTO RIVER (IN FOREGROUND) DISCHARGING THROUGH WEIR INTO YOLO BYPASS.

Courtesy of the Sacramento Bee.

B. ONE OF MANY BREAKS IN RIVER LEVEE.

Courtesy of the Sacramento Union.

FLOOD SCENES ON SACRAMENTO RIVER, DECEMBER 12, 1937.

A. FLOODWATERS OF FEATHER RIVER IN TOWN OF BIGGS.
Courtesy of the Sacramento Bee.

B. LOOKING WEST FROM BIGGS OVER BUTTE BASIN.
Courtesy of the Sacramento Bee.

FLOODED AREAS IN BUTTE BASIN IN VICINITY OF BIGGS.

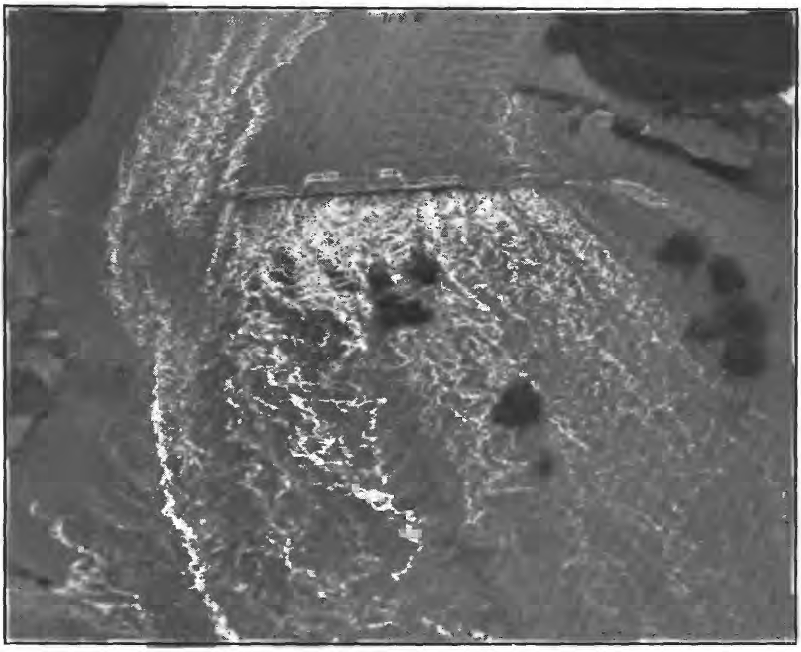
A. INUNDATED FARM LANDS IN SACRAMENTO VALLEY, DECEMBER 12, 1937.
Area north of Colusa, flooded by Sacramento River. Courtesy of the Sacramento Union.

B. TOWN OF GILROY FLOODED BY WATER FROM UVAS CREEK.

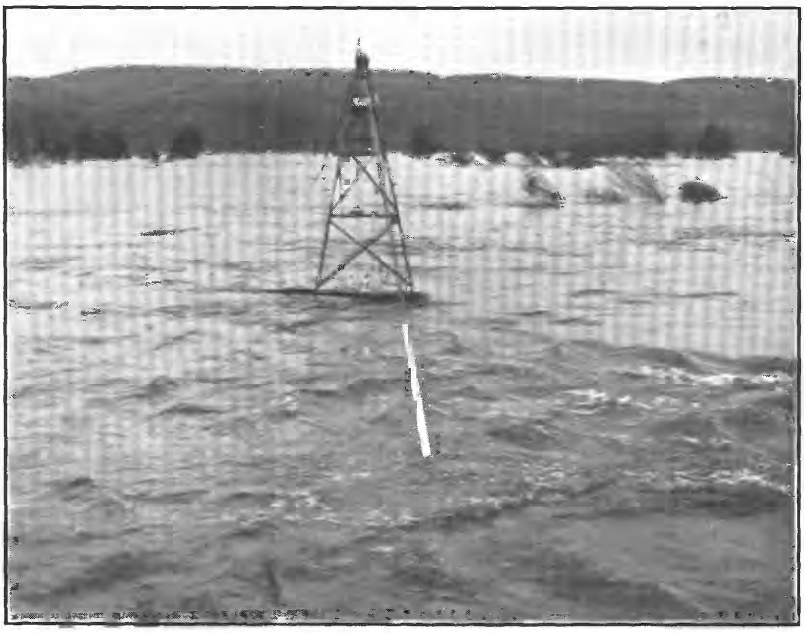
A. INDUSTRIAL DISTRICT IN NORTH SECTION OF HEALDSBURG.

B. HOME NEAR FITCH MOUNTAIN, EAST OF HEALDSBURG.

FLOODED AREAS ALONG RUSSIAN RIVER IN VICINITY OF HEALDSBURG, DECEMBER 11, 1937.



A. LOOKING UP KINGS RIVER AT HIGHWAY BRIDGE AT PIEDRA.



B. CABLEWAY AT RIVER-MEASUREMENT STATION ON SAN JOAQUIN RIVER BELOW FRIANT.

Stage about half a foot below peak.

FLOOD SCENES IN SAN JOAQUIN VALLEY, DECEMBER 11, 1937.

A. LOW-WATER STAGE PRIOR TO FLOOD OF DECEMBER 1937.

B. FLOOD STAGE IMMEDIATELY PRECEDING PEAK.
Courtesy of H. H. Holley.

RIVER-MEASUREMENT STATION ON KAWEAH RIVER NEAR THREE RIVERS.

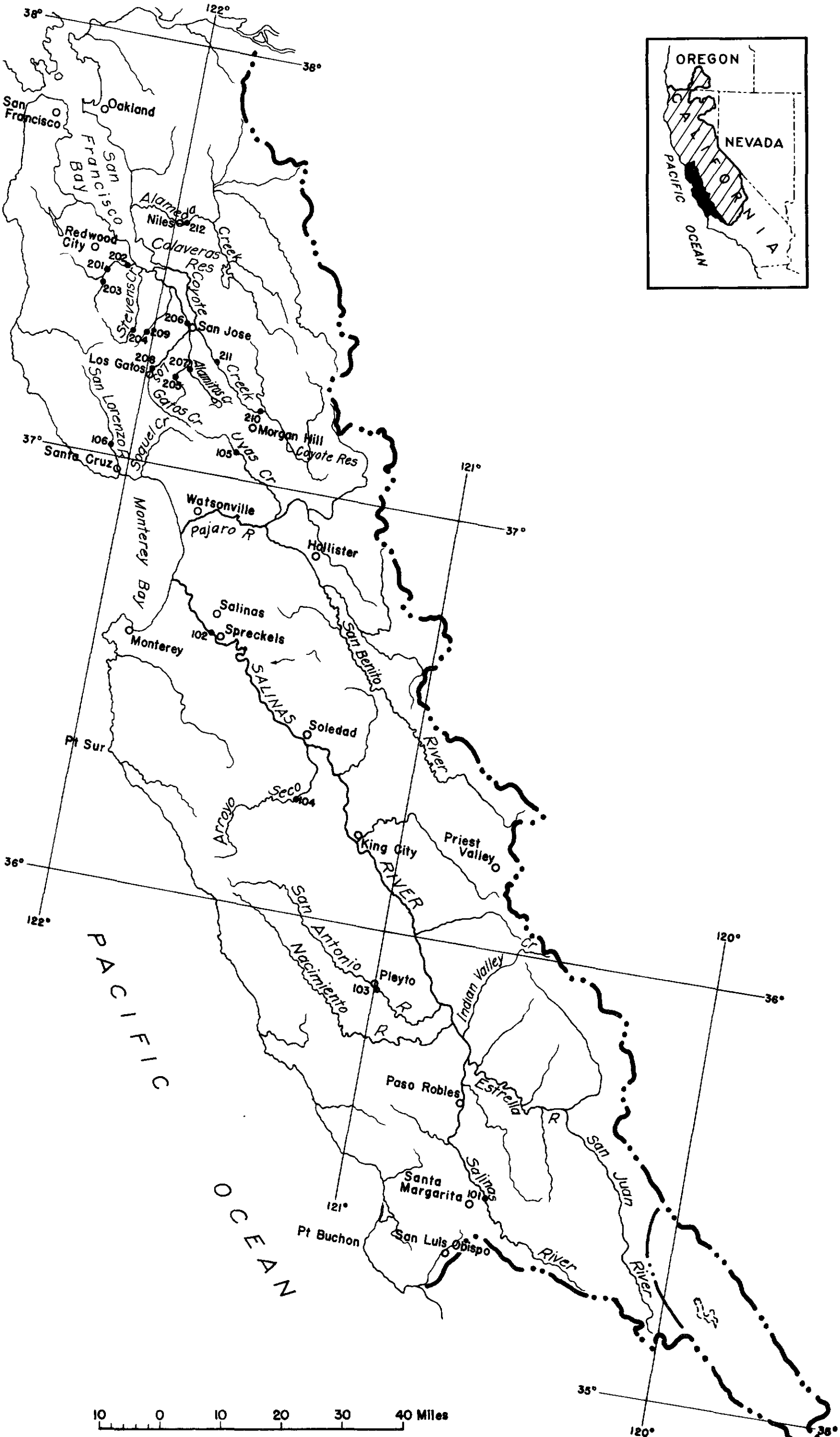


Figure 4.--Drainage basins of the Salinas River, coastal streams from San Luis Obispo Creek to San Francisco Bay, and streams tributary to San Francisco Bay from the south.

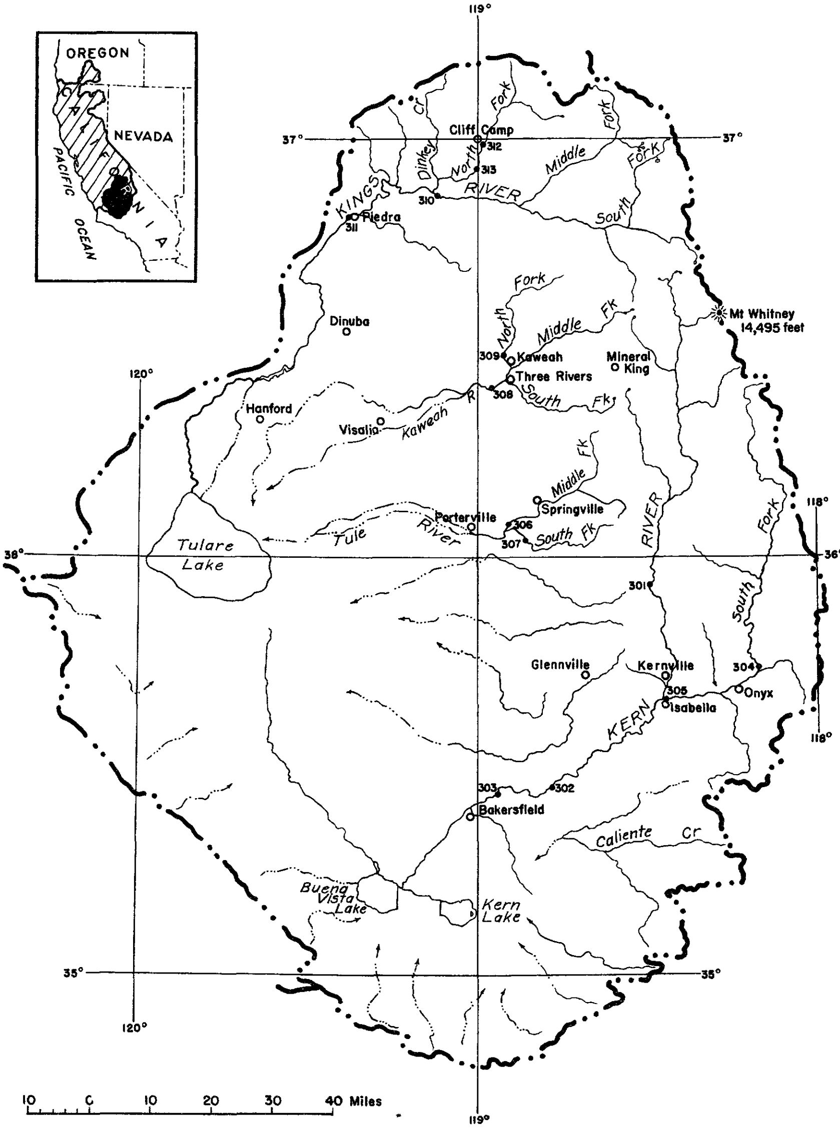


Figure 5.--Drainage basins of Buena Vista Lake and Tulare Lake.

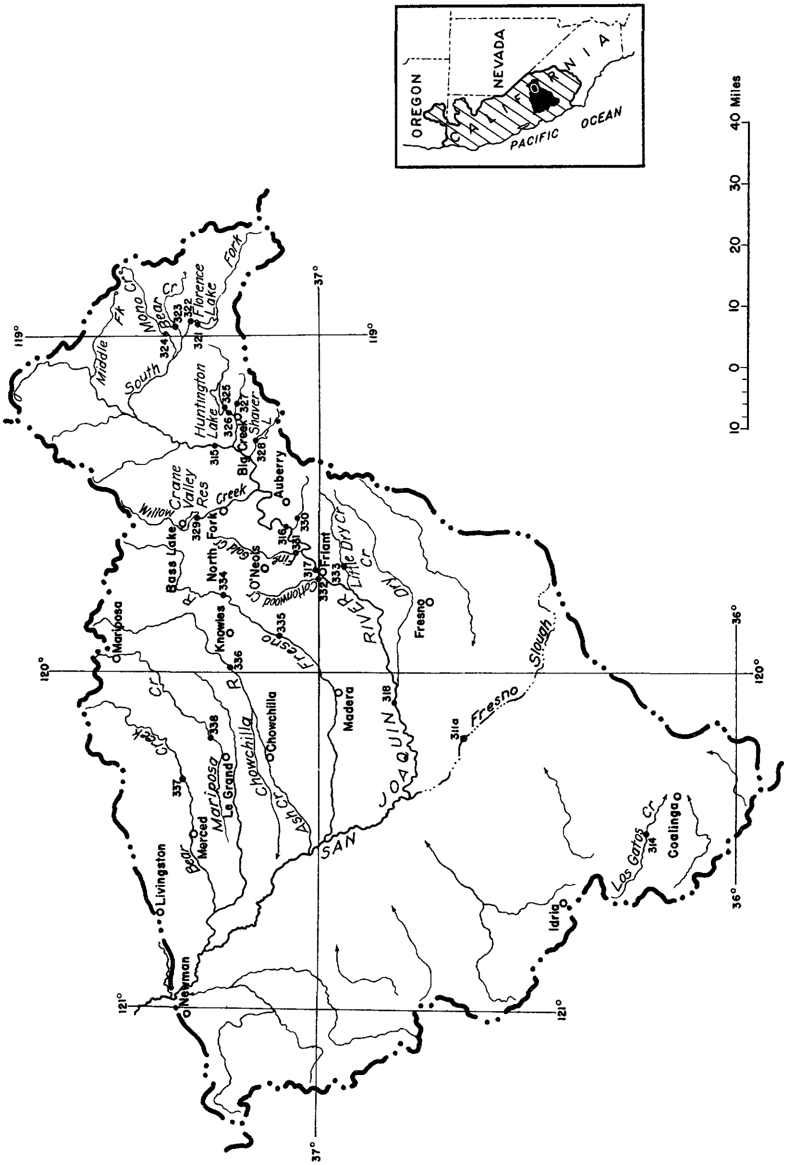


Figure 6.--Drainage basin of the San Joaquin River above the mouth of the Merced River.

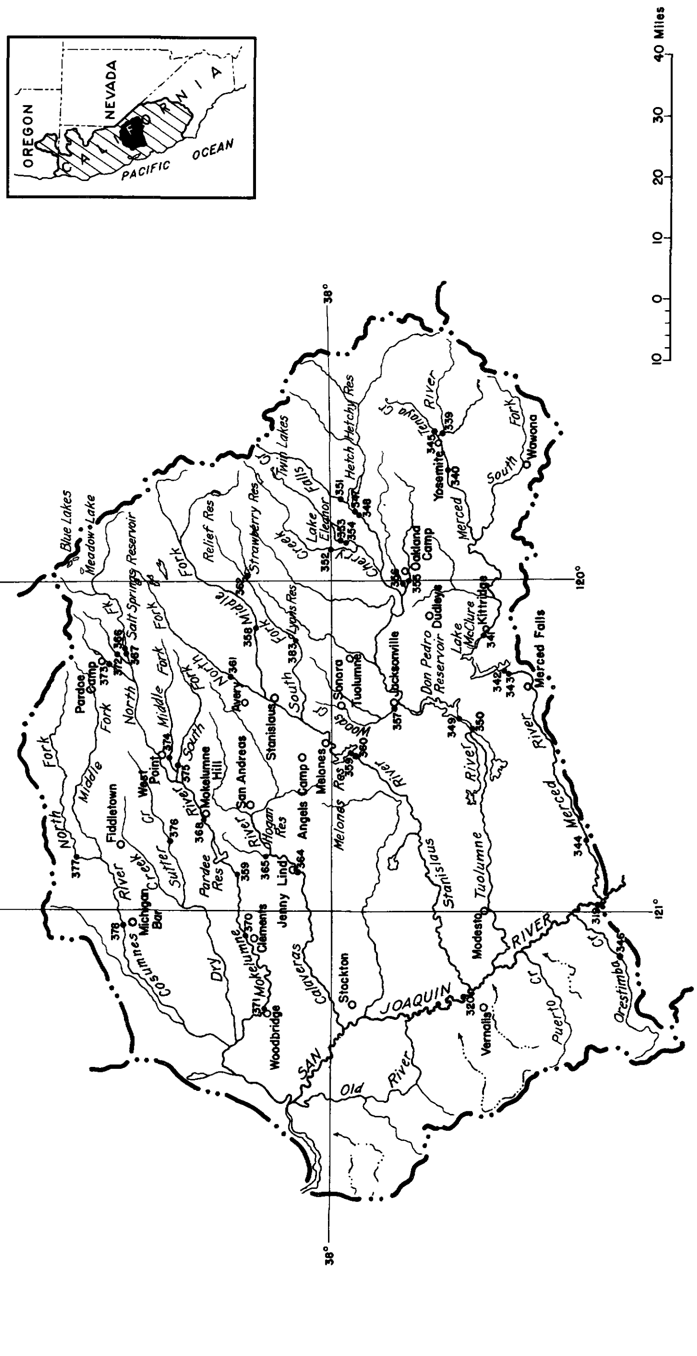


Figure 7.--Drainage basin of the San Joaquin River below and including the Merced River.

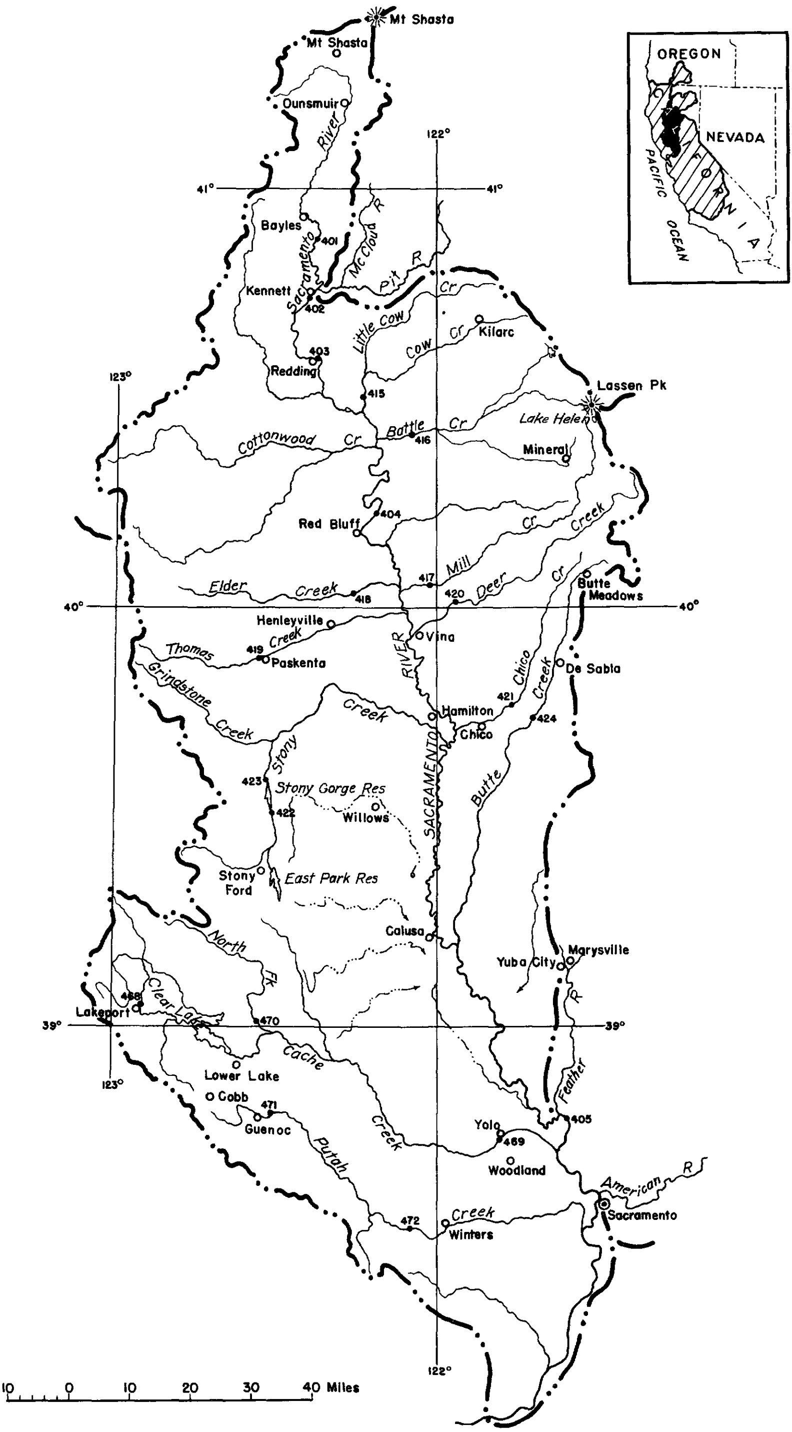


Figure 8.--Drainage basin of the Sacramento River, except the Pit, Feather, and American Rivers.

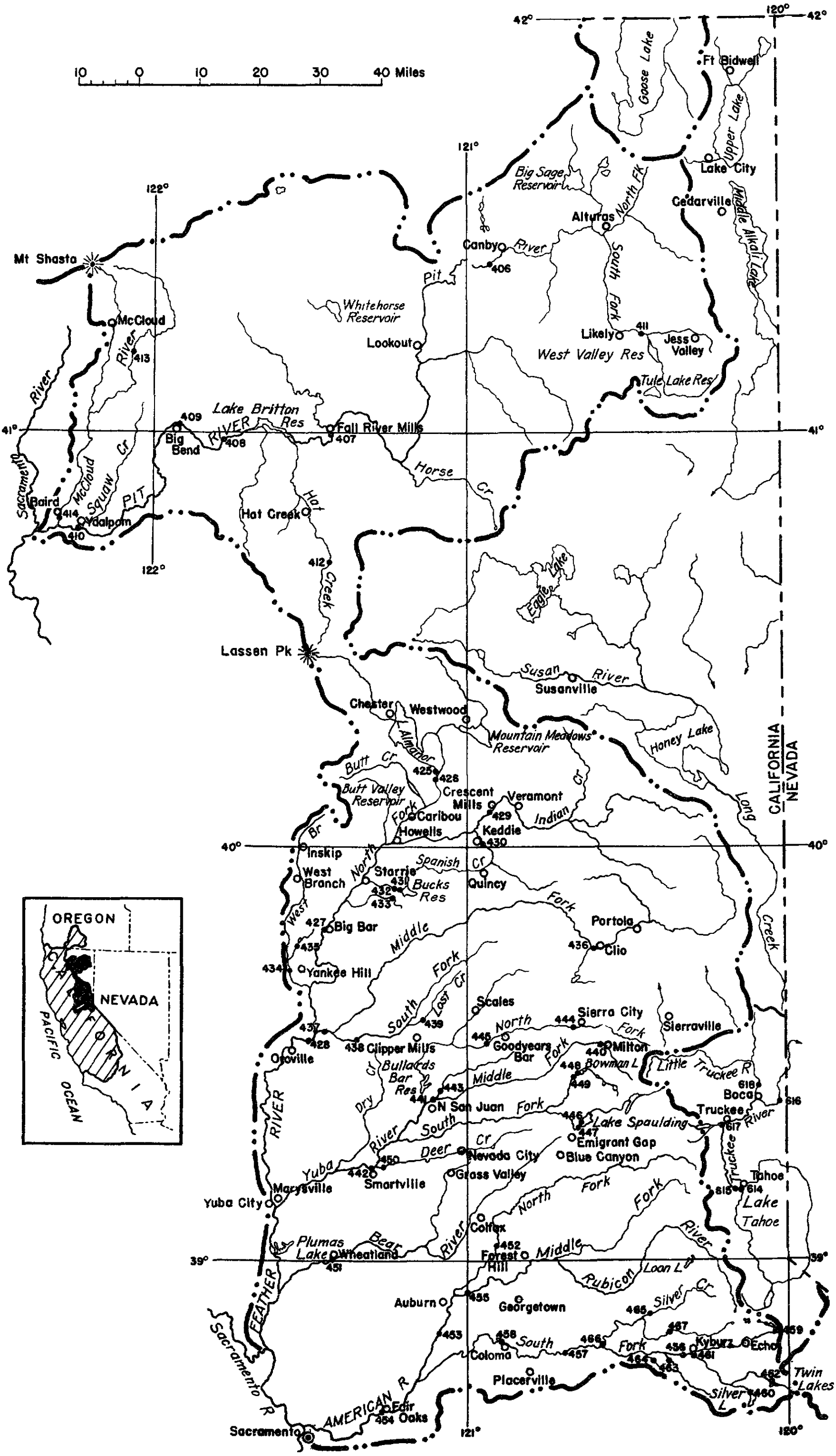


Figure 9.--Drainage basins of the Pit, Feather, American, and Truckee Rivers.

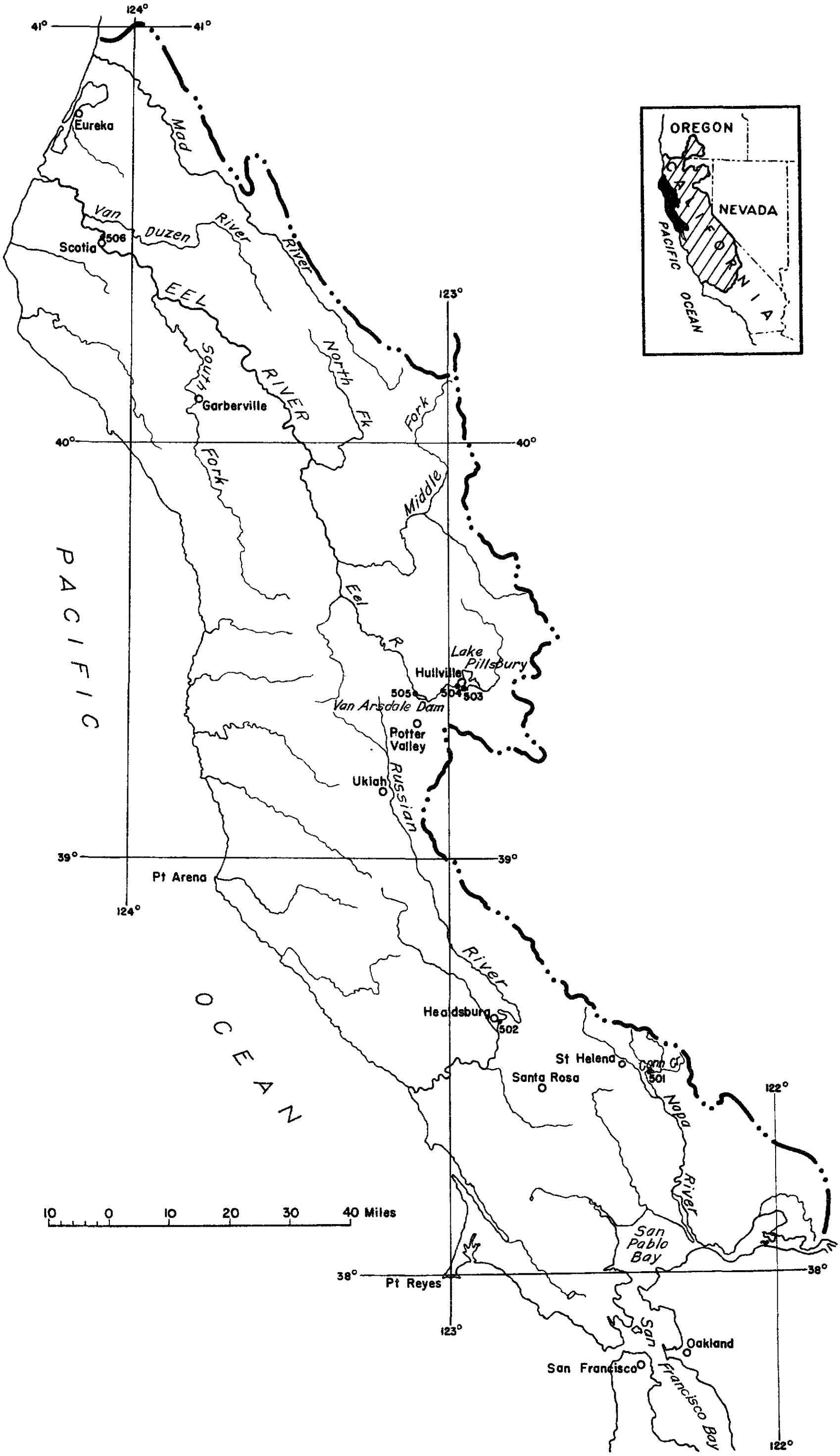


Figure 10.--Drainage basins of the Mad and Eel Rivers, streams tributary to San Francisco Bay from the north, and coastal streams between San Francisco Bay and Mad River.

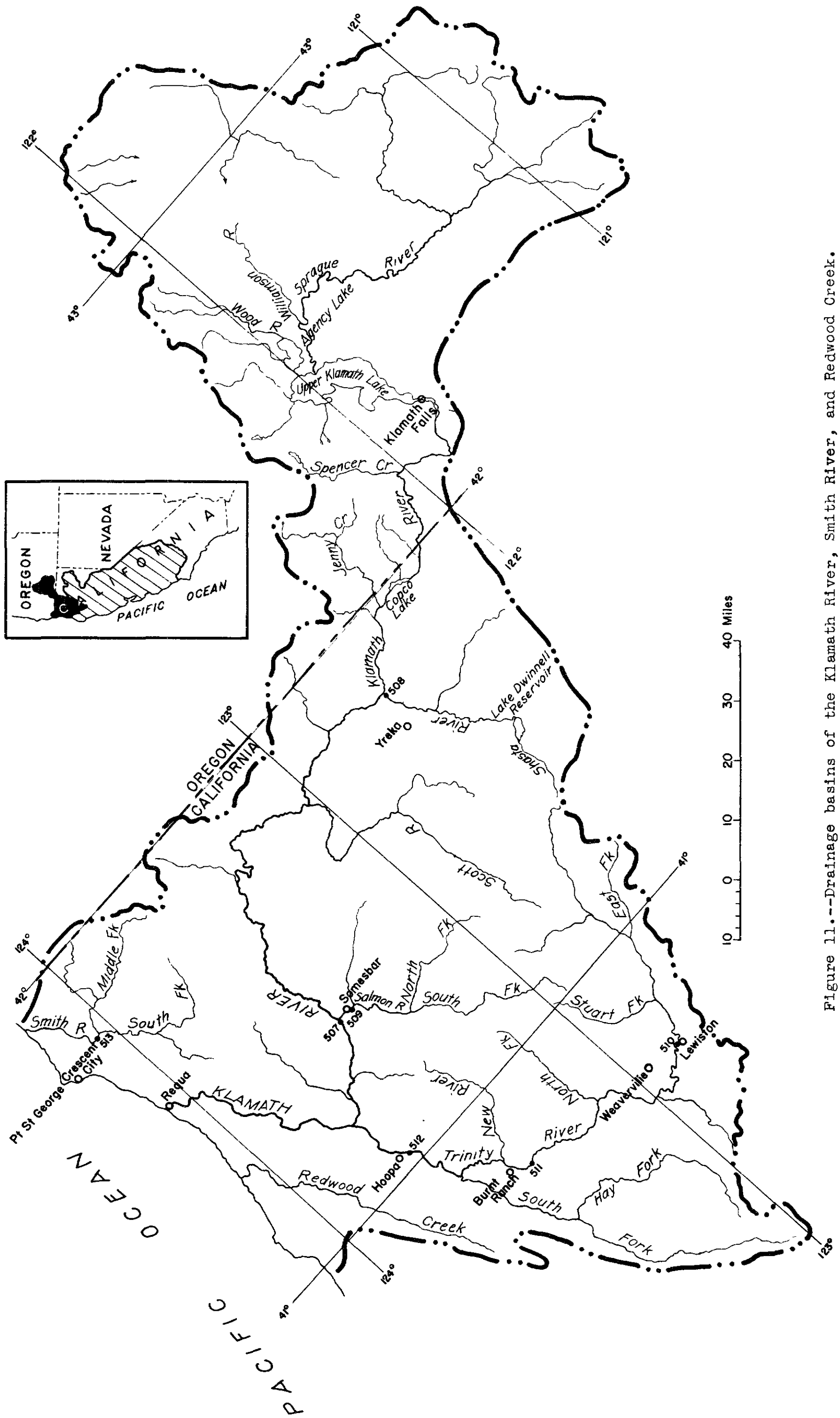


Figure 11.--Drainage basins of the Klamath River, Smith River, and Redwood Creek.

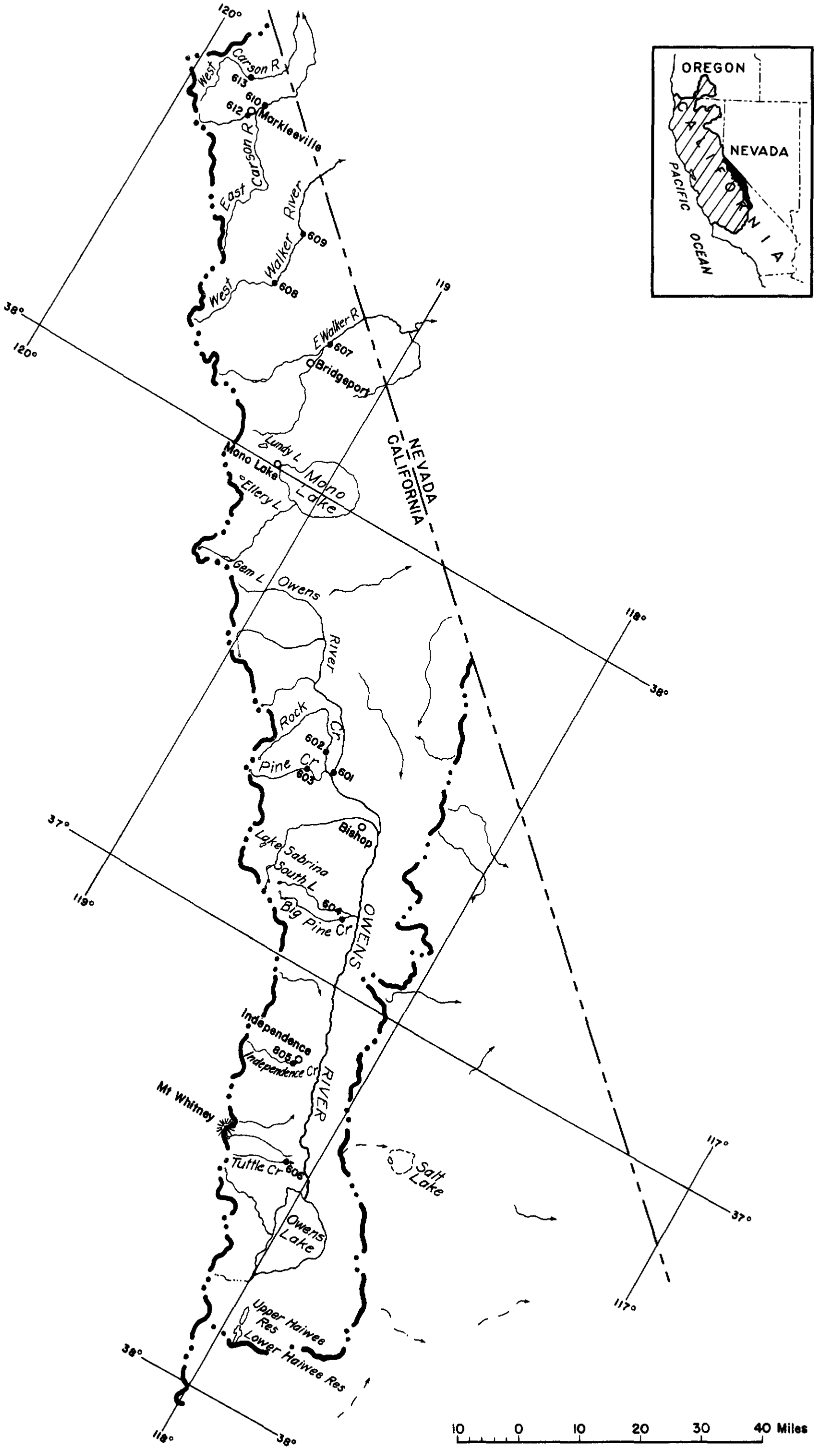


Figure 12.--Drainage basins from the Carson River to Owens Lake, inclusive, along the western boundary of the Great Basin.

METEOROLOGIC AND HYDROLOGIC CONDITIONS

The outstanding characteristics of the storm of December 1937 were the speed with which it swept across the northern part of California, the relatively small amount of rainfall on the floor of the Great Central Valley, and the excessive amount of rainfall and abnormally high temperature at high altitudes. The storm was notable also for the time of its occurence, and for causing, during early winters, the largest floods in the Sacramento River Basin since 1861-62 and in the San Joaquin since 1867.

In view of these unusual aspects, special effort has been made to collect and to compile in this report all available basic information relating to meteorologic conditions that may have had a bearing on the characteristics of the floods. The information is analyzed to a moderate extent, and the effects of meteorologic conditions on the run-off are discussed.

In connection with the discussion, however, it should be recognized that in most of the major and minor drainage basins in California there are pronounced and abrupt changes in altitude and in topographic aspect, which have a marked effect on the amount of precipitation and on its occurrence as rain or snow in different parts of the basin. These factors hamper the translation of limited observations into values that are representative of conditions over entire drainage basins. Although these factors exist in most drainage basins, they are more pronounced in the Western States than in the Central and Eastern States, and they are probably more pronounced in California than in Mountain States to the east, because of its proximity to the Pacific Ocean and the varying ways in which the Coast Ranges affect the moisture-laden winds from that ocean. A density of precipitation stations, which might be quite adequate for a study of flood characteristics in an area where meteorologic and topographic features are more uniform, may therefore be inadequate for most basins in California.

Briefly, the unusual meteorologic conditions that affected the floods of December 1937 were as follows: Preceding and during the 48-hour storm there were abnormally high temperatures that caused the precipitation in headwater areas to take the form of heavy warm rain instead of the snow that is usual with the normal December temperatures; there was a deficiency or a complete absence of snow cover in headwater areas where temperatures are normally such that snow melts but slowly even during periods of rain; and in the northern part of the area there was an excess of antecedent rainfall, which probably was reflected in an increased run-off by reason of a decreased infiltration capacity during the storm period.

The meteorologic and related data are here presented in detail, with a view to their usefulness to engineers and others who are studying the causes of floods and the measures that may be taken for protection against them.

Antecedent conditions

During October 1937 there was a tendency for the precipitation to be deficient in the San Joaquin River Basin and excessive in the Sacramento River Basin. However, departures from normal were small as compared with those of November 1937, when deficiencies in precipitation were recorded at practically all of the stations in the San Joaquin River Basin and excesses at all stations in the Sacramento River Basin.

In the northern areas, rains were more or less continuous from November 11 to November 24, and the resulting run-off brought record November flood stages in many parts of the Sacramento River Basin. The mean discharge during November for the Sacramento River near Red Bluff was the third highest ever recorded for that month, and was more than two and a half times the 42-year average. The rainfall and run-off records in several basins in the northern part of the area indicate that an average depth of 10 to 12 inches of water was retained in the basins during the November storm period by means of infiltration and surface and ground storage. This probably aggravated the December flood conditions in the Sacramento River Basin.

In contrast, the December flood run-off in the San Joaquin River Basin and southern Coast Ranges area was probably less than it would have been had the November precipitation been normal or excessive. Over much of the San Joaquin Basin the November precipitation was only one-fourth to one-half of the normal. Mean discharge of the Kings River at Piedra, for November, was about half the 43-year average for that month.

A discussion of the meteorologic and hydrologic conditions during maximum floods of record as compared with the conditions during the flood of December 1937 is found in another part of this report. Comparisons taken up as a part of the discussion of each basin show qualitatively the very important part that antecedent precipitation plays in the flood run-off in California.

Precipitation

All available records of precipitation for the period from December 9 to 13 inclusive, which embraced the storm primarily causing the floods, are published in this report. (See table 1.) In addition, records are included for 14 places where recording precipitation records are available, showing duration and intensity of the rainfall. (See table 2.) The records of daily precipitation in table 1 are grouped by major basins covering the area in California where the storm reached significant magnitude.

Unfortunately, there were no recording precipitation stations in areas where the total storm precipitation was the heaviest. The duration of the storm period was probably nearly the same at all points in the area. The maximum recorded intensity was about one inch per hour at an experimental area maintained by United States Forest Service near O'Neals. The intensity, at least near the outstanding storm centers, was probably greater than any shown by the recording precipitation graphs.

About half of the records of precipitation were obtained from the Weather Bureau, and the other half from numerous sources indicated in the tables. These additional records have been of great value in supplementing the Weather Bureau data. Many supplemental records are based on observations in 3-inch gages maintained by ranchers, irrigationists, and others who have a vital interest in rainfall. In using the observations, essentially the same weight has been given to each record regardless of its source and but few records have been discarded. In the valley areas, where the precipitation was relatively low and conditions were more or less uniform, less attempt was made to collect precipitation data than in headwater areas where the precipitation was heaviest and where at best there was, and still is, a scarcity of observational data. Such areas were fairly well canvassed to locate available records. In the valley areas, many more precipitation records could probably be located.

The figures in table 1 represent the amounts of precipitation as reported by observers and are not strictly comparable on individual days, because the observations at the various stations are not always made simultaneously. The amount recorded for a given day in most cases represents the rainfall for the 24-hour period preceding the time of observation. Rain falling during the daylight hours may be recorded under the date of fall when observations are made in the late afternoon or under the date of the next day when readings are made in the morning.

General features[1]

On December 7, 1937, when the barometric pressures were relatively high in California and in the Pacific northwest, storm disturbances with accompanying low barometric observations were reported by ships in the Pacific in the vicinity of lat. 30° north, long. 140° west, and in lat. 50° north, long. 165° west. By Wednesday morning, December 8, when these disturbances were more defined, southwest winds accompanied by rains were forecast by the Weather Bureau for California. On the morning of December 9, when the disturbance was about 900 miles off the coast, storm warnings of gale intensity were being displayed between Cape Blanco and Point Conception, and the Sacramento office of the Weather Bureau forecast a general rise in all streams in the Sacramento river basin. By noon it was raining throughout the western half of the State, and by evening over all of the State north of Bakersfield.

The weather map of the next morning (December 10) showed the storm to be of record magnitude and almost of hurricane intensity (barometer, 28.1 inches at its center) off the coast of Washington and Oregon, and the Weather Bureau issued additional flood warnings by means of the press, radio, and telegraph throughout the Central Valley. During the day the maritime tropical air at a record-breaking high temperature for December was flowing rapidly across California at gale velocity and converging against the Coast Range and the Sierra Nevada. The cooling of this moisture-laden air produced the heavy precipitation forecast for December 10. The precipitation continued with little interruption until late afternoon on December 11, and there were occasional showers on December 12. In the northern part of the State, the rain was nearly continuous. In the southern part of the area, there was a tendency for the precipitation to be concentrated in two storm periods, apparently of about equal intensity and depth.

Bennett Swenson of the River and Flood Division, the Weather Bureau, Washington, D. C. describes the storm in part as follows:

> The heavy rains of December 9-11, 1937, resulting in floods in the Sacramento River Basin, were almost entirely due to orographic effects and any fronts which passed over the region during this period played a very minor part in the causation of this precipitation. The situation was such that very strong southwesterly winds prevailed over northern and central California from the 9th to the 11th importing warm moist air from the ocean areas. This moisture laden air was forced to rise rapidly over the steep slopes of the mountains forming the eastern and northern boundaries of the Sacramento River Basin and resulted in excessive precipitation.

1/ Also see report by Fletcher, E. H., Floods in the Sacramento Valley, Calif., December 1937: Monthly Weather Rev., vol. 65, no. 12, pp. 441-444, December 1937.

Table 1.- Precipitation, in inches, December 1937
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date					Total for storm	Data furnished by
				9	10	11	12	13		
Basins tributary to Pacific Ocean from San Luis Obispo Creek to San Francisco Bay										
Arroyo Seco (mouth) a/	36°18'	121°19'	420	-	1.20	1.25	0.25	-	2.70	L. W. Wiley.
Arroyo Seco guard station a/	36°14'	121°29'	780	b	b	b	10.25	-	10.25	Philip Cook.
Atascadero a/	35°30'	120°40'	830	-	1.83	2.05	1.28	-	5.16	A. H. Wheatley.
Atascadero (near) c/	35°31'	120°35'	1,196	0.96	.70	2.51	-	-	4.17	J. L. Langston.
Ben Lomond a/	37°05'	122°06'	800	.09	9.04	5.47	.72	0.11	15.43	Nelson T. Shaw.
Big Basin	37°10'	122°12'	1,200	1.20	9.15	5.45	.45	-	16.25	Charles M. Lewis.
Big Creek Dam a/	37°06'	122°12'	1,250	-	5.64	2.80	.20	-	8.64	Coast Counties Gas & Electric Co.
Big Sur a/	36°15'	121°47'	300	-	2.00	4.45	4.62	1.13	12.20	
Boulder Creek a/	37°07'	122°07'	480	b	8.93	8.13	1.00	-	18.06	George D. Cress.
Brookdale	37°06'	122°07'	360	b	9.40	6.81	.46	-	16.67	A. J. Schumacher.
Creston pumping station a/	35°32'	120°31'	1,100	-	1.04	.25	2.00	-	3.29	Joe Schlegel.
Cushing ranch	37°02'	121°41'	375	b	5.76	5.05	-	-	10.81	John Roffinella.
Del Monte a/	36°36'	121°53'	40	.02	1.36	2.05	.25	.18	3.86	
Estero a/	35°25'	120°52'	20	-	2.13	1.02	2.00	.06	5.21	Standard Oil Co. of California.
Felton a/	37°03'	122°04'	276	9.40	4.80	.70	-	-	14.90	R. Danneberg.
Gilroy a/	37°00'	121°34'	200	-	4.14	3.00	.74	-	7.88	Carroll Wentz.
Gonzales a/	36°31'	121°27'	126	-	.98	.88	-	.58	2.44	Joseph Juri.
Greenfield a/	36°20'	121°15'	286	-	-	.45	.20	.10	.75	Greenfield Branch, Monterey County Bank.
Greenfield (near) a/	36°17'	121°11'	310	.91	.46	.34	.18	-	1.89	S. S. Smith.
Hollister	36°51'	121°24'	284	-	1.70	1.90	1.30	.07	4.97	
Jolon a/	35°58'	121°10'	960	-	2.78	2.60	.45	.08	5.91	Mr. Merritt.
Kings City a/	36°13'	121°07'	331	.93	.58	.38	.13	-	2.02	
Kings City (near) c/	36°14'	121°09'	290	-	.88	.62	.57	.20	2.27	J. B. Larsen.
Lake Merced a/	37°43'	122°29'	25	.07	1.98	1.05	.22	-	3.32	City of San Francisco.
Laurel a/	37°08'	121°58'	1,200	-	9.50	6.00	.95	-	16.45	R. L. Dodge.
Little Uvas Creek a/	37°06'	121°45'	625	.88	7.62	10.00	.25	-	18.75	H. A. Dahlgren.
Lonoak (near) a/	36°15'	120°50'	1,400	-	1.17	1.83	-	.20	3.20	A. S. Jones.
Los Gatos Summit	37°08'	121°58'	1,700	.90	7.15	6.92	.30	-	15.27	G. J. Papac.
Mount Madonna Park a/	37°01'	121°42'	1,900	-	4.15	3.85	.75	-	8.75	Manuel Arano.
Morgan Hill a/	37°08'	121°39'	350	.10	4.30	6.45	.30	-	11.15	C. O. Eies.

Parkfield (near)	35°54'	120°21'	1,700	.84	.68	2.08	.08	-	3.68	
Paso Robles a/	35°38'	120°43'	1,019	-	2.56	3.59	1.18	-	7.33	
Pigeon Point lighthouse c/	37°11'	122°24'	50	2.57	1.87	1.12	.22	-	5.78	G. W. Jaehne.
Pilarcitos a/	37°33'	122°25'	650	.04	3.90	2.53	1.24	-	7.71	City of San Francisco.
Pinnacles	36°31'	121°08'	1,389	.64	.42	2.04	.41	Tr.	3.51	
Priest Valley a/	36°12'	120°42'	2,400	-	1.62	2.00	1.41	.06	5.09	
Rancho San Lucas a/	36°03'	121°00'	700	b	b	b	b	4.01	4.01	Julius Trescony.
Salinas	36°40'	121°39'	45	.55	1.48	1.45	.50	-	3.98	
San Antonio School a/	35°58'	121°05'	1,100	-	2.55	2.59	-	-	5.14	F. F. Weferling.
San Juan Bautista a/	36°51'	121°32'	210	.03	2.95	2.72	.80	-	6.50	Georgs E. Abbs.
San Luis Obispo a/	35°17'	120°40'	300	.01	3.63	1.66	1.93	.05	7.28	
San Lucas a/	36°08'	121°01'	420	-	1.22	.86	.46	.10	2.64	J. E. Reinhart.
Santa Cruz	36°58'	122°02'	125	2.56	3.55	2.76	.32	-	9.19	
Santa Margarita a/	35°24'	120°36'	980	-	2.26	2.05	4.30	-	8.61	Orval Gould.
Saratoga Summit c/	37°15'	122°07'	2,600	-	7.43	8.23	2.86	-	18.52	J. H. Beeson.
Shandon pumping station a/	35°41'	120°21'	1,050	.71	.06	1.27	-	-	2.04	W. H. Offerman.
Soledad a/	36°26'	121°20'	189	-	.56	.54	.42	-	1.52	S. P. Milling Co.
Soquel	37°00'	121°57'	80	1.46	3.59	2.83	.29	-	8.17	O. R. Sheppa.
Spence a/	36°37'	121°34'	80	-	-	.78	-	.70	1.48	A. S. Jones.
Spreckels a/	36°37'	121°38'	48	.04	1.64	1.09	.43	.20	3.40	
Uvas Creek a/	37°04'	121°42'	430	-	7.48	7.99	.72	.15	16.34	E. F. Eastman.
Watsonville Junction a/	36°54'	121°45'	29	-	4.82	2.01	.15	.35	7.33	R. H. Davis.
		Minor basins tributary to Suisun, San Pablo, and San Francisco Bays								
Almaden Reservoir a/	37°10'	121°50'	520	-	4.93	8.54	0.71	-	14.18	Santa Clara Valley Water Conservation District.
Alvarado (near) a/	37°34'	122°07'	3	0.05	1.36	.84	.61	-	2.86	
Berkeley	37°52'	122°16'	299	1.71	1.85	.68	.43	-	4.67	
Calaveras Dam a/	37°29'	121°50'	600	-	1.93	1.69	.99	0.02	4.63	City of San Francisco.
Campbell	37°17'	121°57'	195	.18	1.60	2.02	.46	-	4.26	Campbell Water Co.
Chabot Observatory	37°47'	122°14'	322	.72	2.54	.75	.32	-	4.33	
Chabot Reservoir a/	37°44'	122°07'	235	.03	2.85	1.15	.45	-	4.48	East Bay Municipal Utility District.
Coyote Reservoir	37°07'	121°33'	790	-	2.93	4.50	.28	.10	7.81	Santa Clara Valley Water Conservation District.
Crockett	38°03'	122°13'	12	.84	1.42	.14	1.38	-	3.78	
Crystal Springs Cottage a/	37°29'	122°20'	250	-	1.93	1.78	.74	-	4.45	City of San Francisco.

a Measured in the morning. b Included in next measurement. c Time of measurement not reported.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	Date 10	Date 11	Date 12	Date 13	Total for storm	Data furnished by
Minor basins tributary to Suisun, San Pablo, and San Francisco Bays--Continued										
Cupertino	37°19'	122°02'	215	0.16	1.67	2.42	0.25	-	4.50	G. H. Burtner.
Guadalupe Reservoir a/	37°12'	121°53'	530	-	4.46	6.05	.25	-	10.76	Santa Clara Valley Water Conservation District.
Howell Reservoir a/	37°11'	122°01'	1,350	.09	6.20	6.40	1.43	-	14.12	San Jose Water Works.
Kentfield	37°57'	122°33'	65	1.93	8.04	2.15	.48	-	12.60	
Lafayette a/	37°53'	122°07'	470	.03	3.67	3.08	.83	-	7.61	East Bay Municipal Utility District.
Lake Curry c/	38°21'	122°08'	400	.04	3.45	2.26	.87	-	6.62	City of Vallejo.
Lake Ranch Reservoir a/	37°13'	122°03'	1,850	.05	6.40	5.35	1.69	-	13.49	San Jose Water Works.
Liok Observatory	37°20'	121°39'	4,209	.17	2.87	3.57	.82	-	7.43	
Livermore	37°41'	121°46'	480	.41	1.38	1.78	.77	-	4.34	
Los Altos No. 1	37°22'	122°06'	225	.24	b	3.75	.31	-	4.30	W. H. Quinn.
Los Altos No. 2	37°21'	122°06'	275	b	b	b	5.50	-	5.50	W. H. Quinn.
Los Gatos a/	37°14'	121°59'	500	-	3.66	4.54	.77	0.03	9.00	
Los Gatos Reservoir a/	37°13'	121°59'	550	.10	5.09	6.04	.78	-	12.01	San Jose Water Works.
Lower Crystal Springs a/	37°32'	122°22'	300	.02	2.27	1.87	.68	-	4.84	City of San Francisco.
Madera Colorado Reservoir a/	37°12'	121°59'	710	-	6.00	5.95	1.31	-	13.26	San Jose Water Works.
McClay Ranch c/	37°20'	121°47'	235	-	1.33	2.00	.67	.19	4.19	Santa Clara Valley Water Conservation District.
Milpitas a/	37°26'	121°52'	180	-	.96	1.17	.72	-	2.85	J. C. Rose.
Mountain View	37°24'	122°05'	75	.13	1.22	1.44	.36	-	3.15	Mrs. J. S. Mockbee.
Napa	38°18'	122°17'	60	.65	2.02	1.15	.93	-	4.75	
Niles a/	37°35'	121°58'	100	-	1.61	.66	1.14	.07	3.48	City of San Francisco.
Oakland Airport d/	37°47'	122°17'	3	.54	.59	.26	.32	-	1.71	
Palo Alto	37°27'	122°09'	57	Tr.	1.78	1.15	.53	-	3.46	
Petaluma	38°14'	122°38'	10	.68	1.63	.90	.78	-	3.99	
Pleasanton pumps a/	37°39'	121°53'	360	-	2.10	1.10	.91	-	4.11	City of San Francisco.
Pueblo Reservoir a/	37°16'	121°57'	225	-	1.55	1.63	0.64	-	3.82	City of San Francisco.
Rancho Yerba Buena a/	37°18'	121°45'	650	-	1.31	1.98	.43	-	3.72	Santa Clara Valley Water Conservation District.
Redwood City	37°29'	122°14'	31	.23	2.00	1.42	.30	-	3.95	
St. Helena	38°30'	122°28'	255	.85	4.42	2.13	.46	-	7.86	
St. Helena Pass	38°39'	122°36'	2,900	2.00	5.00	4.50	1.60	-	13.10	George Dyer.
San Francisco Airport a/	37°37'	122°23'	1	Tr.	1.85	1.50	.40	.31	4.06	

San Francisco d/	37°47'	122°25'	52	1.21	1.03	.54	.22	-	3.00	
San Andreas Reservoir a/	37°35'	122°25'	450	.08	2.67	2.40	.68	-	5.83	City of San Francisco.
San Jose d/	37°20'	121°54'	95	.34	1.26	.75	.14	-	2.49	
San Mateo	37°34'	122°19'	22	.39	1.38	1.13	.66	-	3.56	
San Pablo a/	37°57'	122°21'	25	Tr.	2.00	1.16	.60	-	3.76	Standard Oil Co. of California
San Pablo Reservoir a/	37°57'	122°16'	330	.02	3.76	1.62	.85	-	6.25	East Bay Municipal Utility District.
San Rafael a/	37°58'	122°31'	5	.27	4.90	1.55	-	1.01	7.73	Northwestern Pacific Railroad.
San Tomas a/	37°16'	122°00'	325	-	3.00	3.63	.55	-	7.18	C. E. York.
Santa Clara	37°21'	121°57'	90	.11	1.18	1.84	.22	-	3.35	
Saratoga Reservoir a/	37°15'	122°03'	675	-	5.35	6.05	1.37	-	12.77	San Jose Water Works.
Seven-mile Reservoir a/	37°15'	121°57'	320	-	2.31	3.69	.34	-	6.34	San Jose Water Works.
Stevens Reservoir a/	37°18'	122°05'	550	-	2.90	3.85	1.30	-	8.05	Santa Clara Valley Water Conservation District.
Sunnyvale	37°23'	122°02'	97	.15	1.19	1.54	.27	-	3.15	
Sunol a/	37°36'	121°53'	230	.04	1.75	.96	1.76	-	4.51	City of San Francisco.
Upper Crystal Springs a/	37°31'	122°21'	300	-	2.30	1.80	.83	-	4.93	City of San Francisco.
Upper San Leandro Reservoir a/	37°46'	122°05'	475	.01	3.51	1.70	.41	-	5.63	East Bay Municipal Utility District.
Walnut Creek a/	37°54'	122°04'	149	-	2.68	2.17	.94	-	5.79	
Williams Reservoir a/	37°07'	121°54'	1,250	-	7.75	8.60	1.10	-	17.45	San Jose Water Works.
Willow Glen a/	37°18'	121°54'	150	-	1.26	1.58	.39	-	3.23	E. O. Billwiller.
Wrights	37°08'	121°57'	1,600	1.10	7.70	6.65	.35	-	15.80	

Buena Vista Lake Basin

Bakersfield a/	35°22'	119°01'	404	0.06	0.12	0.46	0.11	Tr.	0.75	
Bakersfield (near) a/	35°25'	119°00'	460	.17	Tr.	.52	.01	-	.70	Standard Oil Co. of California.
Borel power house	35°35'	118°31'	2,280	.31	1.98	.73	.65	0.03	3.70	Southern California Edison Co., Ltd.
Johnsondale a/	35°58	118°31'	4,545	6.38	.20	2.88	.10	-	9.56	State engineer.
Kern Canyon power house	35°26'	118°48'	700	.07	.12	.52	.12	-	.83	San Joaquin Light & Power Corp.
Kernville a/	35°44'	118°22'	2,565	3.13	Tr.	.98	-	-	4.11	
Kern No. 1 power house	35°28'	118°47'	960	.06	.32	.61	.47	.02	1.48	Southern California Edison Co., Ltd.
Kern No. 3 power house	35°46'	118°26'	2,700	.58	2.96	1.03	.20	-	4.77	Southern California Edison Co., Ltd.
Maricopa a/	35°04	119°24'	640	.03	-	.36	.02	-	.41	
Pattiway	34°56'	119°23'	3,790	Tr.	Tr.	.86	.20	.08	1.14	
Tejon ranch a/	35°02'	118°45'	1,425	-	-	.70	.55	.43	1.68	

a Measured in the morning. b Included in next measurement. c Time of measurement not reported. d Measured at midnight.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	10	11	12	13	Total for storm	Data furnished by
Tulare Lake Basin										
Angiola a/	35°59'	119°29'	208	e	0.08	0.78	-	-	1.30	
Antelope Valley a/	35°43'	120°10'	1,205	-	.78	.03	1.52	-	2.33	
Ash Mountain	36°29'	118°50'	1,600	0.71	5.75	3.06	1.35	0.06	10.93	
Balch power house	36°55'	119°06'	1,750	.24	5.53	4.00	.50	Tr.	10.27	San Joaquin Light & Power Corp.
Bitterwater a/	35°35'	120°09'	1,900	-	.59	-	1.36	-	1.95	Standard Oil Co. of California.
California Hot Springs	35°53'	118°41'	3,068	-	3.40	2.24	.65	.98	7.27	
Cliff Camp	37°00'	119°00'	6,150	.60	6.09	3.96	1.54	-	12.19	
Corcoran c/	36°06'	119°33'	200	-	.51	.11	-	-	.62	State engineer.
Dinuba	36°33'	119°23'	333	1.38	.09	1.08	.01	-	2.56	
Dudley a/	35°49'	120°03'	595	Tr.	.53	Tr.	.63	-	1.16	
Dunlap	36°44'	119°07'	1,945	.35	5.77	2.55	.62	-	9.29	
General Grant National Park	36°44'	118°58'	6,775	.56	7.10	5.68	1.76	-	15.10	
Giant Forest	36°34'	118°46'	6,360	.37	8.26	5.45	2.20	-	16.28	
Glennville (near) a/	35°42'	118°44'	3,300	1.18	2.12	.18	-	-	3.48	
Hanford a/	36°19'	119°40'	249	.01	.89	.07	.88	-	1.85	
Kaweah No. 1 power house	36°28'	118°51'	1,140	.10	5.76	2.59	.76	-	9.21	Southern California Edison Co., Ltd.
Kaweah No. 3 power house	36°29'	118°50'	1,370	.13	6.40	3.25	1.22	.05	11.10	Southern California Edison Co., Ltd.
Kettleman a/	36°00'	119°58'	310	Tr.	.34	Tr.	.24	-	.58	Standard Oil Co. of California.
Lemon Cove	36°23'	119°01'	600	1.07	1.30	1.35	.31	-	4.03	
Lindsay a/	36°13'	119°06'	384	-	1.33	.05	1.44	-	2.82	
Middlewater	35°33'	119°52'	803	-	.29	-	.87	-	1.16	
Orange Cove a/	36°36'	119°18'	431	1.55	.57	.76	-	-	2.88	
Piedra a/	36°48'	119°22'	510	-	2.50	.45	2.25	-	5.20	
Pinehurst ranger station a/	36°42'	119°01'	4,000	-	6.72	3.90	1.16	-	11.78	U. S. Forest Service.
Porterville a/	36°04'	119°00'	464	-	1.10	.05	1.25	-	2.40	
Rector substation	36°19'	119°15'	350	.38	1.13	1.90	.35	-	3.76	Southern California Edison Co., Ltd.
Springville (near)	36°13'	118°40'	4,050	.52	8.08	3.70	2.35	.03	14.68	
Springville ranger station a/	36°08'	118°48'	1,000	-	2.50	2.31	.01	-	4.82	U. S. Forest Service.
Three Rivers	36°27'	118°54'	840	.70	3.80	2.20	.32	.02	7.04	
Trimmer Experiment station a/	35°55'	119°15'	1,950	3.43	.77	7.79	.03	-	12.02	U. S. Forest Service.

Tule power house	36°08'	118°47'	1,240	.42	2.70	2.25	.62	-	5.99	Southern California Edison Co.,Ltd.
Vestal substation	35°51'	119°05'	500	.14	.26	.67	.08	-	1.15	Southern California Edison Co.,Ltd.
Visalia a/	36°19'	119°18'	334	-	1.50	-	1.16	-	2.66	
Wasco	35°36'	119°21'	336	.11	.11	.93	.02	0.03	1.20	
Westhaven	36°13'	119°59'	285	-	.44	.59	-	-	1.03	
San Joaquin River Basin										
San Joaquin River Basin above Firebaugh, Calif.										
Auberry	37 06'	119°29'	2,065	0.50	4.33	4.00	0.40	-	9.23	
Bass Lake d/	37 19'	119°35'	3,700	3.03	6.51	5.42	-	-	14.96	U. S. Forest Service.
Big Creek No. 1 power house	37 12'	119°14'	4,900	.39	5.25	4.17	1.00	-	10.81	Southern California Edison Co., Ltd.
Big Creek No. 2 power house	37 12'	119°18'	3,000	.37	5.77	2.14	.44	-	8.72	Southern California Edison Co., Ltd.
Big Creek No. 3 power house	37 09'	119°23'	1,400	.24	3.35	3.58	.51	-	7.68	Southern California Edison Co., Ltd.
Big Creek No. 8 power house	37°13'	119°20'	2,300	.31	6.32	2.20	.31	-	9.14	Southern California Edison Co., Ltd.
Central Camp	37°21'	119°29'	5,364	.42	7.40	9.45	-	-	17.27	
Clovis (near)	36°52'	119°42'	400	.28	1.38	2.53	.03	-	4.22	
Coalinga a/	36°09'	120°22'	663	-	.76	.40	1.00	0.02	2.18	
Crane Valley Reservoir	37°17'	119°32'	3,500	.41	8.14	6.02	.16	-	14.73	San Joaquin Light & Power Corp.
Firebaugh a/	36°44'	120°25'	149	.03	.70	.06	.35	.05	1.19	
Florence Lake	37°16'	118°58'	7,400	.36	3.15	3.05	.75	-	7.31	Southern California Edison Co., Ltd.
Fresno d/	36°43'	119°49'	287	.91	.25	1.62	.04	-	2.82	
Friant a/	36°59'	119°42'	306	-	1.54	.40	1.12	-	3.06	
Helm a/	36°32'	120°08'	185	-	.90	.43	.48	-	1.81	
Huntington Lake	37°14'	119°13'	7,000	.36	4.70	4.31	.77	-	10.14	
Idria	36°25'	120°40'	3,000	.28	1.07	2.89	.30	-	4.54	
Kerckhoff power house	37°06'	119°33'	650	.40	3.50	1.30	.08	.08	5.36	San Joaquin Light & Power Corp.
North Fork a/	37°14'	119°30'	3,000	-	6.08	3.29	2.73	-	12.10	
North Fork No. 1 d/	37°14'	119°31'	2,700	2.70	4.48	4.66	.06	-	11.90	U. S. Forest Service.
North Fork No. 4 d/	37°14'	119°31'	2,675	2.78	4.56	4.94	.05	-	12.33	U. S. Forest Service.
O'Neals d/	37°08'	119°43'	1,200	1.73	1.28	2.74	-	-	5.75	U. S. Forest Service.
San Joaquin No. 1 power house	37°09'	119°30'	990	-	.29	4.48	f1.92	.10		San Joaquin Light & Power Corp.
Shaver Lake	37°09'	119°18'	5,400	.24	4.78	3.91	1.36	-	10.29	Southern California Edison Co., Ltd.
Waltham Creek No. 1 a/	36°09'	120°37'	1,860	-	1.85	3.10	1.65	-	6.60	Tide Water Associated Oil Co.
Waltham Creek No. 2 a/	36°05'	120°29'	1,300	-	1.10	1.42	1.05	-	3.57	Tide Water Associated Oil Co.

a Measured in the morning.
c Time of measurement not reported.
d Measured at midnight.
e Rainfall Dec. 8, 0.44; Dec. 9, 0.
f Record incomplete; gage washed away.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	10	11	12	13	Total for storm	Data furnished by
San Joaquin River Basin--Continued										
Merced River Basin										
Dudley's	37°45'	120°06'	3,000	0.41	4.91	4.41	0.81	-	10.54	
Merced Falls	37°32'	120°20'	321	.24	.86	1.31	.54	0.01	2.96	
Wawona	37°32'	119°40'	3,960	.32	6.00	5.50	.60	-	12.42	
Yosemite	37°45'	119°35'	3,983	.32	4.60	5.94	.68	-	11.54	
Tuolumne River Basin										
Groveland c/	37°50'	120°13'	2,800	.30	2.78	4.05	1.14	-	8.27	State engineer.
Hetch Hetchy a/	37°57'	119°48'	3,530	-	4.50	2.30	2.82	.04	9.66	
Lake Eleanor	37°59'	119°53'	4,650	.39	6.54	4.38	1.10	-	12.41	
Moccasin a/	37°49'	120°18'	950	-	1.62	1.90	1.26	-	4.78	City of San Francisco.
Modesto a/	37°39'	121°00'	90	-	1.48	1.14	.34	.21	3.17	
Sonora	37°58'	120°24'	1,825	.18	2.56	2.90	.73	-	6.37	
Stanislaus River Basin										
Lake Alpine c/	38°29'	120°00'	7,500	.40	2.41	4.90	.45	-	8.16	State engineer.
Murphy c/	38°08'	120°27'	2,400	.16	2.81	4.09	-	-	7.06	U. S. Forest Service.
Oakdale (near) a/	37°51'	120°53'	215	-	1.00	1.45	.30	-	2.75	
Sand Bar Flat	38°11'	120°10'	2,700	.38	3.86	6.12	1.34	-	11.70	Pacific Gas & Electric Co.
Spring Gap	38°10'	120°07'	4,875	.36	3.62	5.99	1.12	-	11.09	Pacific Gas & Electric Co.
Stanislaus forebay	38°09'	120°21'	2,550	.12	2.14	3.24	.89	-	6.39	Pacific Gas & Electric Co.
Strawberry	38°12'	120°00'	5,620	.37	3.73	4.72	.65	-	9.47	Pacific Gas & Electric Co.
Calaveras River Basin										
Big Trees c/	38°17'	120°19'	4,700	.67	5.30	7.96	.71	-	14.64	State engineer.
Fricot City d/	38°10'	120°31'	1,900	.54	2.17	3.48	.43	-	6.62	D. Fricot.
Jenny Lind a/	38°06'	120°52'	300	.90	.45	1.50	.80	-	3.65	
Letora's a/	38°11'	120°29'	1,600	-	1.96	6.20	.73	-	8.89	Mark Letora.
San Andreas a/	38°11'	120°41'	996	-	1.73	2.54	.50	-	4.77	
Valley Springs	38 11'	120 50'	800	1.05	1.74	.65	-	-	3.44	Pliler and Lillie.

Mokelumne River Basin										
Benson Ferry a/	38°14'	121°23'	17	-	.30	.69	.45	.13	1.57	
Child Ranch c/	38°13'	120°59'	200	b	b	2.33	.38	-	2.71	Charles Child.
Clay a/	38°20'	121°10'	100	-	1.05	1.20	-	-	2.25	Mrs. Bolton.
Electra	38°20'	120°40'	699	0.12	1.90	1.77	.41	-	4.20	
Elliott a/	38°15'	121°12'	85	-	1.63	1.23	.89	.06	3.81	
Fiddletown (near) a/	38°31'	120°41'	2,100	-	1.50	2.30	1.40	-	5.20	
Galt a/	38°15'	121°18'	46	-	1.56	.90	.36	.27	3.09	J. H. Sobey.
Kennedy mine	38°21'	120°46'	1,500	-	1.04	1.32	.56	-	2.92	
Lancha Plana a/	38°13'	120°55'	500	-	.98	1.53	.49	.01	3.01	
Lockford	38°10'	121°09'	100	1.45	1.16	.37	-	-	2.98	James Hammond.
Lodi a/	38°08'	121°16'	52	.01	1.49	1.23	.98	-	3.71	
Marshall ranch a/	38°06'	121°13'	60	-	1.53	1.23	.53	-	3.29	L. K. Marshall.
Salt Springs	38°30'	120°13'	3,660	.16	3.81	4.60	.85	-	9.42	Pacific Gas & Electric Co.
Tiger Crsek	38°27'	120°29'	2,341	.16	4.01	3.66	.80	-	8.63	
Wallace a/	38°12'	120°58'	200	-	1.40	1.55	.53	1.00	4.48	
West Point	38°25'	120°32'	2,736	.08	2.78	3.85	.65	-	7.36	
Woodbridge a/	38°09'	121°18'	40	-	1.63	1.36	.56	.02	3.57	John H. Wilms.
Minor basins east of San Joaquin River										
Denair	37°32'	120°48'	126	-	.81	1.17	.30	-	2.28	
Hornitos a/	37°30'	120°12'	900	-	1.21	1.01	1.55	-	3.77	Postmaster.
Lathorp a/	37°49'	121°17'	27	.02	1.68	.62	.50	.34	3.16	
Le Grand	37°14'	120°14'	255	.60	.61	.90	.05	-	2.16	
Madera a/	36°58'	120°02'	296	-	1.18	.21	.81	-	2.20	
Mariposa a/	37°30'	119°58'	2,022	-	4.72	2.44	1.10	-	8.26	
Merced a/	37°19'	120°30'	173	-	.94	.68	.43	.10	2.15	
Stockton a/	37°58'	121°17'	20	-	1.76	1.15	.56	.47	3.94	
Turlock	37°29'	120°51'	105	-	1.16	1.04	.31	-	2.51	
Vignola ranch	37°12'	120°00'	450	-	1.45	1.30	.20	-	2.95	Caesar Vignola.

a Measured in the morning. b Included in next measurement. c Time of measurement not reported. d Measured at midnight.

Table 1.- Precipitation, in inches, December 1937--Continued
(measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	Date 10	Date 11	Date 12	Date 13	Total for storm	Data furnished by
San Joaquin River Basin--Continued										
Minor basins west of San Joaquin River below Firebaugh, Calif.										
Antioch	38°00'	121°46'	46	0.55	0.65	0.83	0.92	-	2.95	
Los Banos a/	37°04'	120°50'	120	-	1.23	.45	.45	0.19	2.32	
Los Banos Valley a/	36°58'	121°01'	600	-	1.30	.92	.27	-	2.49	
Los Medanos a/	38°00'	121°51'	133	1.01	.64	.52	.21	-	2.38	Standard Oil Co. of California.
Mercy Hot Springs	36°45'	120°52'	1,200	1.05	1.00	.50	Tr.	-	2.55	
Newman	37°19'	121°02'	91	1.21	.92	.32	.01	-	2.46	
Tracy a/	37°44'	121°25'	64	1.13	.55	-	1.00	-	2.68	Southern Pacific Co.
Tracy (near) a/	37°46'	121°29'	39	.02	1.25	.57	.37	.41	2.62	Standard Oil Co. of California.
Sacramento River Basin										
Sacramento River Basin except Pit, Feather, and American River Basins										
Aetna Springs c/	38°39'	122°29'	800	-	5.74	4.46	0.38	-	10.58	L. D. Owens.
Beegum a/	40°20'	123°00'	1,291	0.04	3.09	2.12	.15	Tr.	5.36	
Brooks	38°46'	122°08'	350	.67	1.83	1.25	.05	-	3.80	
Cellier Place	38°48'	122°42'	2,100	6.88	12.27	1.25	-	-	20.40	J. L. Naylor.
Centerville power house	39°47'	121°40'	490	1.40	3.20	4.40	-	-	9.00	
Chico a/	39°42'	121°49'	189	.79	2.58	2.00	-	-	5.37	
Clarksburg	38°25'	121°32'	14	1.83	1.35	.40	-	-	3.58	
Clear Lake (near)	38°57'	122°38'	1,350	.67	3.87	2.17	.16	-	6.87	
Cobb a/	38°49'	122°43'	2,600	.15	5.81	13.65	.75	-	20.36	C. Cadman.
Colusa a/	39°13'	122°00'	60	-	1.12	2.50	.05	-	3.67	
Corning a/	39°56'	122°11'	277	.01	1.68	3.49	.19	-	5.37	"Corning Observer".
Davis	38°32'	121°44'	51	.20	2.01	1.53	.07	-	3.81	
Delta d/	40°57'	122°26'	1,140	2.44	5.48	2.08	.01	-	10.01	Southern Pacific Co.
De Sabla	39°52'	121°35'	2,700	.75	6.66	5.99	.02	-	13.42	
Dunsmuir d/	41°13'	122°16'	2,290	-	1.95	5.06	1.62	-	8.63	Southern Pacific Co.

East Park Reservoir	39°22'	122°30'	1,205	.99	2.14	1.34	-	-	4.47	
Guenoc Ranch a/	38°44'	122°31'	1,100	b	b	b	8.94	-	8.94	E. S. Campbell.
Hamilton City a/	39°45'	122°00'	162	2.20	2.77	Tr.	-	-	4.97	
Harbin Springs a/	38°47'	122°39'	1,700	-	6.65	9.60	.65	-	16.90	N. S. Bccth.
Hobergs a/	38°50'	122°43'	3,000	.10	6.30	14.20	1.10	-	21.70	Henry Schleyer.
Kelseyville a/	38°59'	122°50'	1,390	-	2.41	4.91	.33	-	7.65	
Kennett a/	40°44'	122°24'	661	-	3.67	7.75	1.03	-	12.45	
Kilaro	40°41'	121°52'	2,642	.50	5.95	3.95	.20	-	10.60	Pacific Gas & Electric Co.
Knights Landing a/	38°48'	121°43'	16	-	1.14	1.62	.15	-	2.91	
Lakeport a/	39°03'	122°55'	1,450	2.45	5.43	.53	-	-	8.41	
Middletown	38°44'	122°36'	1,150	b	b	b	b	g	15.82	L. Lundquist.
Mineral	40°21'	121°34'	4,950	.57	6.88	7.25	.18	-	14.88	
Monticello a/	38°26'	122°13'	360	-	3.18	2.72	.41	-	6.31	Wayne Sharp.
Monticello (near) a/	38°38'	122°15'	350	-	2.96	2.03	.33	-	5.32	N. D. Clark.
Mount Shasta	41°22'	122°18'	3,555	1.05	3.34	1.49	-	-	5.88	
Orland a/	39°45'	122°12'	254	.73	1.59	1.97	-	-	4.29	
Pope Valley (near)	38°35'	122°21'	750	-	b	b	9.00	-	9.00	Mrs. Y. M. Hardin.
Red Bluff a/	40°10'	122°15'	303	-	1.82	2.72	.10	-	4.64	
Redding d/	40°35'	122°24'	718	2.63	4.85	.66	.01	-	8.15	
Rio Vista a/	38°10'	121°41'	22	.02	2.53	.77	1.02	0.04	4.38	
Rocklin a/	38°48'	121°15'	239	-	1.54	2.57	.06	-	4.17	
Sacramento d/	38°35'	121°30'	25	.85	1.92	.98	.21	-	3.96	
St. John a/	39°42'	122°01'	143	-	2.05	2.69	-	-	4.74	
Stonyford	39°23'	122°32'	1,205	2.14	.63	2.19	h	h		U. S. Forest Service.
Stony Gorge Reservoir	39°35'	122°33'	800	.95	1.98	1.86	.10	-	4.89	
Suisun	38°16'	122°05'	40	.97	2.53	1.10	.46	-	5.06	
Upper Lake	39°11'	122°55'	1,343	.72	5.35	3.30	.60	-	9.97	
Vacaville	38°23'	122°00'	175	1.00	3.05	1.55	.41	-	6.01	
Vollmer's ranch a/	40°57'	122°26'	1,332	-	4.15	4.10	.85	-	9.10	
Volta	40°26'	121°49'	2,200	.36	1.60	4.05	4.06	-	10.07	
Williams a/	39°09'	122°09'	84	Tr.	1.21	2.65	.05	Tr.	3.91	Southern Pacific Co.
Willows a/	39°37'	120°12'	136	.03	1.50	2.47	Tr.	-	4.00	
Winters a/	38°31'	121°58'	136	-	2.88	1.91	.12	-	4.91	Southern Pacific Co.
Woodland a/	38°41'	121°46'	63	.03	1.39	1.88	.09	-	3.39	

a Measured in the morning.
b Included in next measurement.
c Time of measurement not reported.
d Measured at midnight.
g Total rainfall Dec. 9-16, 15.82.
h No record.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	10	11	12	13	Total for storm	Data furnished by
Sacramento River Basin--Continued										
Pit River Basin										
Alturas	41°28'	120°32'	4,346	-	1.57	3.51	0.16	-	5.24	
Bieber	41°07'	121°08'	4,200	-	2.40	2.55	.05	-	5.00	State engineer.
Big Bend	41°01'	121°55'	1,700	1.01	5.70	4.40	.68	-	11.79	Edwin Fowler.
Blacks Mountain c/	40°44'	121°15'	5,600	-	.63	3.05	.35	0.52	4.55	U. S. Forest Service.
Fall River Mills a/	41°01'	121°28'	3,340	1.06	3.29	.23	-	-	4.58	
Hat Creek	40°46'	121°30'	3,400	.14	1.36	1.61	.23	.02	3.36	
Jess Valley c/	41°14'	120°17'	5,400	-	.97	2.75	.10	-	3.82	State engineer.
Lookout	41°13'	121°09'	4,296	.86	5.11	.53	.07	-	6.57	
McCloud	41°15'	122°08'	3,270	.82	3.94	2.71	Tr.	-	7.47	
Montgomery Creek c/	40°50'	121°56'	2,135	-	4.58	7.92	2.27	-	14.77	State engineer.
Squaw Creek Ranger Station a/	40°49'	122°09'	1,130	4.55	5.89	1.57	-	-	12.01	
Feather River Basin except Yuba River Basin										
Brush Creek Ranger Station a/	39°41'	121°20'	3,500	-	6.35	11.60	.96	-	18.91	
Bucks Lake	39°54'	121°12'	5,070	.46	8.04	9.04	1.87	-	19.41	Pacific Gas & Electric Co.
Canyon Dam	40°11'	121°05'	4,570	.52	3.90	3.10	.47	-	7.99	
Caribou	40°05'	121°09'	3,000	.42	5.10	3.16	.74	-	9.42	Pacific Gas & Electric Co.
Challenge Ranger Station a/	39°29'	121°14'	2,700	-	6.12	4.00	6.30	-	16.42	
Chester	40°19'	121°13'	4,550	.22	3.56	2.50	.38	-	6.66	
Forbestown c/	39°32'	121°17'	2,800	b	11.24	6.20	-	-	17.44	M. Fernandez.
Grass Valley	39°13'	121°03'	2,690	.10	5.88	4.46	.34	-	10.78	
Greenville Ranger Station c/	40°08'	120°58'	3,600	-	3.79	3.19	.55	-	7.53	U. S. Forest Service.
Howells	40°01'	121°14'	2,400	.64	7.27	5.40	.77	-	14.08	Pacific Gas & Electric Co.
Inskip	40°00'	121°31'	4,808	.59	9.32	9.05	.83	-	19.79	
Intake	39°43'	121°28'	900	.84	5.40	3.61	-	-	9.85	Pacific Gas & Electric Co.
Lake Wilenor c/	39°45'	121°30'	2,000	-	3.51	6.07	-	-	9.58	State engineer.
Las Plumas	39°40'	121°29'	569	.87	7.54	4.46	.04	-	12.91	
Lost Creek Dam a/	39°35'	121°08'	3,100	5.50	9.75	1.00	-	-	16.25	Oroville-Wyandotte Irrigation District.

Marysville a/	39°08'	121°34'	67	1.11	.86	1.86	.04	-	3.87	
Mohawk Ranger Station c/	39°47'	120°38'	4,400	2.84	6.24	.75	-	-	9.83	U. S. Forest Service.
Nicolaus a/	38°54'	121°35'	47	-	1.12	1.96	.24	-	3.32	
Oroville a/	39°31'	121°33'	273	-	2.23	3.51	.01	-	5.75	
Portola a/	39°48'	120°28'	4,832	1.50	2.60	.55	-	-	4.65	
Prattville	40°13'	121°10'	4,600	0.56	3.14	3.18	0.32	-	7.20	Pacific Gas & Electric Co.
Quincy	39°56'	120°55'	3,409	-	3.10	5.25	.75	-	9.10	
Seriterre a/	39°25'	121°28'	629	1.75	4.45	Tr.	-	-	6.20	
Sierraville	39°35'	120°23'	5,000	.20	4.70	5.20	-	-	10.10	
Storrie	39°55'	121°20'	1,760	.70	6.47	6.45	.50	-	14.12	Pacific Gas & Electric Co.
Veramont	40°06'	120°50'	3,500	.21	4.01	3.10	.70	-	8.02	Pacific Gas & Electric Co.
West Branch	39°56'	121°32'	3,216	.73	8.00	7.58	.39	-	16.70	
Westwood	40°18'	120°59'	5,000	.01	2.46	3.36	.32	-	6.15	
Yuba River Basin										
Bowman Dam	39°26'	120°39'	5,347	.26	7.83	5.31	.38	-	13.78	
Chute Camp	39°24'	121°09'	1,358	.32	4.60	4.10	.30	-	9.32	
Colgate a/	39°19'	121°12'	572	-	2.23	3.90	.40	0.02	6.55	
Deer Creek	39°18'	120°50'	3,700	.30	7.92	4.59	.90	-	13.71	
Dobbins (near)	39°22'	121°10'	1,235	.20	2.87	2.90	.22	-	6.19	
Downieville a/	39°34'	120°49'	2,950	3.73	4.45	1.73	-	-	9.91	R. F. Taylor.
Lake Spaulding	39°19'	120°39'	5,075	.54	8.43	5.20	.60	-	14.77	
Nevada City a/	39°16'	121°01'	2,570	-	3.95	4.72	1.17	-	9.84	
Scales	39°36'	120°59'	4,300	1.01	11.48	7.37	.67	-	20.53	
Soda Springs a/	39°19'	120°23'	6,752	-	5.00	5.80	2.03	-	12.83	
American River Basin										
Auburn a/	38°53'	121°03'	1,360	-	1.80	2.00	.62	-	4.42	
Blue Canyon	39°14'	120°41'	4,750	.58	5.27	3.28	.65	-	9.78	
Colfax	39°06'	120°58'	2,421	-	3.92	4.65	1.40	-	9.97	
Eldorado power house	38°47'	120°37'	1,900	-	4.70	3.65	.70	-	9.05	Pacific Gas & Electric Co.
Folsom a/	38°41'	121°10'	252	-	1.28	1.57	.10	-	2.95	
Foresthill a/	39°01'	120°50'	3,200	-	2.14	3.58	1.31	.01	7.04	
Georgetown a/	38°55'	120°50'	2,300	-	3.50	3.10	1.05	-	7.65	
Placerville	38°43'	120°47'	1,925	.38	2.80	3.04	.39	-	6.61	
Placerville (near)	38°44'	120°44'	2,750	.13	2.85	2.00	-	1.37	6.35	Institute of Forest Genetics.
Repressa	38°41'	121°10'	305	-	1.10	1.43	.07	-	2.60	

a Measured in the morning. b Included in next measurement. c Time of measurement not reported.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	Date 10	Date 11	Date 12	Date 13	Total for storm	Data furnished by
				Sacramento River Basin--Continued						
American River Basin--Continued										
Twin Lakes	38°42'	120°03'	7,920	0.18	3.82	3.78	0.84	-	8.62	
Basins tributary to Pacific Ocean in California north of San Francisco Bay, and adjacent areas in Oregon										
California										
Arena Cove Coast Guard Station	38°55'	123°43'	50	1.76	2.13	1.99	0.44	-	6.32	
Big Bar a/	40°44'	123°15'	1,248	-	1.62	3.22	.53	-	5.37	U. S. Forest Service.
Boonville	39°01'	123°22'	500	.39	5.41	3.65	.54	-	9.99	State Division of Highways.
China Flat	40°57'	123°38'	600	.41	3.21	2.55	.06	-	6.23	
Cloverdale	38°48'	123°01'	315	.80	5.70	2.58	.39	-	9.47	
Cotati a/	38°20'	122°41'	112	1.38	1.15	.57	-	-	3.10	Northwestern Pacific R. R.
Covelo	39°47'	123°15'	1,385	.53	6.32	3.11	1.96	-	11.92	
Crescent City (near)	41°50'	124°07'	125	j	Tr.	2.90	-	-	3.94	
Cummings a/	39°50'	123°34'	1,200	.15	4.90	8.65	1.80	-	15.50	
Dos Rios a/	39°43'	123°22'	923	-	3.82	5.83	.16	-	9.81	Northwestern Pacific R. R.
Eureka d/	40°48'	124°10'	44	.07	1.23	1.36	.17	-	2.83	
Fort Bragg	39°27'	123°48'	74	.21	3.70	1.33	.59	-	5.83	
Fort Jones	41°36'	122°51'	2,747	.10	2.10	1.51	.02	-	3.73	State engineer.
Fort Ross	38°31'	123°14'	100	.74	2.83	2.95	.42	0.02	6.96	
Garberville a/	40°06'	123°48'	524	-	5.85	2.74	.72	-	9.31	State Division of Highways.
Gazelle a/	41°31'	122°31'	2,780	-	.37	1.98	.51	.09	2.95	Lewis M. Foulke.
Graton	38°26'	122°52'	190	1.05	4.40	2.31	.69	-	8.45	
Grenada	41°39'	122°31'	2,550	Tr.	1.82	.99	-	-	2.81	Miss Gladys Julian.
Happy Camp	41°48'	123°23'	1,132	.18	3.57	2.37	.18	-	6.30	
Hayfork	40°33'	123°10'	2,340	b	3.88	2.16	h	h		U. S. Forest Service.

Healdsburg a/	38°37'	122°52'	110	k	5.10	3.38	.72	-	9.27	
Healdsburg (near) c/	38°40'	122°56'	160	5.00	6.00	.60	-	-	11.60	Albert Kron.
Island Mountain a/	40°02'	123°30'	549	-	.40	3.50	1.20	-	5.10	Northwestern Pacific R. R.
Lagunitas Dam a/	37°57'	122°36'	800	4.27	2.33	1.10	.15	-	7.85	Marin Municipal Water District.
Macdoel a/	41°50'	122°00'	4,260	-	.25	1.10	.17	-	1.52	Butte Valley Irrigation District.
Mad River c/	40°28'	123°31'	3,175	b	b	b	9.41	-	9.41	Henry Kohnenberger.
Montague	41°44'	122°31'	2,522	.17	1.71	.67	-	-	2.55	
Mount Hebron c/	41°47'	122°00'	4,260	b	2.50	.28	-	-	2.78	U. S. Forest Service.
Orick (near)	41°20'	124°01'	152	.08	1.33	1.65	.81	-	3.87	
Orleans a/	41°18'	123°32'	401	1.47	2.93	.99	-	-	5.39	
Point Reyes	38°00'	123°01'	510	.50	1.20	.43	.05	-	2.18	
Potter Valley (near)	39°22'	123°09'	1,014	.76	5.22	4.00	.84	-	10.82	
Ruth (near)	40°22'	123°20'	2,750	.96	4.94	2.76	.48	-	9.14	
Salyer a/	40°53'	123°35'	600	1.57	3.86	.35	-	-	5.78	U. S. Forest Service.
Santa Rosa	38°27'	122°43'	167	.57	2.39	1.56	.47	-	4.99	
Scotia a/	40°29'	124°06'	151	.02	1.31	4.55	.97	-	6.85	
Steele Swamp	41°53'	120°58'	5,000	Tr.	1.65	1.22	-	-	2.87	
Tule Lake	41°52'	121°32'	4,036	Tr.	.78	1.15	-	-	1.93	
Ukiah	39°09'	123°13'	650	.34	4.26	3.93	.54	-	9.07	
Upper Mattole	40°15'	124°11'	400	-	3.02	5.65	-	0.82	9.49	
Weaverville	40°44'	122°56'	2,030	2.00	1.70	1.37	.32	-	5.39	
Willits a/	39°25'	123°21'	1,363	-	3.09	7.61	2.40	-	13.10	Northwestern Pacific R. R.
Yreka a/	41°44'	122°38'	2,625	1.10	2.29	.43	-	.06	3.88	
Oregon										
Brookings	42°03'	124°17'	120	.70	2.17	1.88	.02	-	4.77	
Chiloquin	42°35'	121°52'	4,200	Tr.	1.40	.96	Tr.	Tr.	2.36	
Crater Lake	42°53'	122°10'	6,475	.29	3.93	1.84	-	-	6.06	
Keno	42°08'	121°56'	4,040	.09	1.85	1.27	Tr.	-	3.21	
Klamath Falls	42°13'	121°47'	4,100	.10	1.48	1.05	Tr.	-	2.63	
Round Grove	42°20'	120°53'	4,888	.11	1.20	1.98	-	-	3.29	
Sand Creek	42°50'	121°59'	4,682	.20	4.03	1.82	.30	-	6.35	
Siskiyou Summit a/	42°04'	122°36'	4,522	.70	2.00	.66	-	-	3.36	

a Measured in the morning.
b Included in next measurement.
c Time of measurement not reported.
d Measured at midnight.
h No record.
j Total rainfall Dec. 8-9, 1.04.
k Total rainfall Dec. 8-9, 0.07.

Table 1.- Precipitation, in inches, December 1937--Continued
(Measured in the afternoon except as noted)

Station	Latitude	Longitude	Altitude (feet)	Date 9	Date 10	Date 11	Date 12	Date 13	Total for storm	Data furnished by
Western part of Great Basin in California and Nevada										
Owens River Basin										
Big Pine power house No. 3 a/	37°09'	118°19'	4,500	-	0.71	0.38	2.93	-	4.02	City of Los Angeles.
Bishop a/	37°22'	118°24'	4,147	0.27	-	2.18	-	-	2.45	City of Los Angeles.
Bishop Creek	37°15'	118°36'	8,390	.56	2.76	3.27	.16	-	6.75	
Cottonwood Gates a/	36°25'	118°01'	3,800	-	1.15	b	1.38	-	2.53	City of Los Angeles.
Cottonwood power house a/	36°27'	118°02'	3,800	-	1.60	Tr.	1.33	-	2.93	City of Los Angeles.
Crooked Creek a/	37°35'	118°43'	6,700	-	.93	.56	2.50	-	3.99	City of Los Angeles.
Independence	36°48'	118°12'	3,943	-	.53	1.55	.23	-	2.31	
Intake Los Angeles Aqueduct a/	36°58'	118°13'	3,830	-	.49	1.74	-	-	2.23	City of Los Angeles.
Lake Sabrina	37°13'	118°37'	9,100	.16	4.57	3.31	.68	-	8.72	
Lone Pine a/	36°36'	118°04'	3,725	-	.48	b	b	0.96	1.44	City of Los Angeles.
North Haiwee a/	36°14'	117°58'	3,768	-	.93	-	.90	-	1.83	City of Los Angeles.
Point of Hills a/	36°40'	118°06'	3,790	-	.61	b	1.40	-	2.01	City of Los Angeles.
South Haiwee a/	36°08'	117°57'	3,800	-	1.06	-	.88	-	1.94	City of Los Angeles.
South Lake	37°10'	118°34'	9,620	Tr.	2.70	2.10	.60	-	5.40	
Tinemaha Reservoir a/	37°03'	118°14'	3,865	-	.84	1.55	.43	-	2.82	City of Los Angeles.
Mono Lake Basin										
Ellery Lake	37°56'	119°14'	9,600	.27	3.09	3.06	.42	-	6.84	
Gem Lake	37°45'	119°09'	9,120	Tr.	2.05	2.28	.33	-	4.66	
Lundy Lake	38°02'	119°13'	7,760	Tr.	3.21	3.00	.25	-	6.46	
Shaft No. 1 a/	37°49'	118°59'	7,941	.94	1.97	b	1.29	-	4.20	City of Los Angeles.
West Portal a/	37°51'	119°03'	7,075	-	1.95	1.05	1.09	-	4.09	City of Los Angeles.
Walker River Basin										
Bridgeport	38°15'	119°14'	6,440	Tr.	1.02	1.74	Tr.	-	2.76	
Bridgeport Dam c/	38°20	119°13'	6,470	b	b	b	3.75	-	3.75	State engineer.
Hawthorne	38°32'	118°37'	4,168	-	-	.05	.91	-	.96	
Mina a/	38°23'	118°06'	4,350	-	.50	-	-	-	.50	
Schurz	38°57'	118°48'	4,124	Tr.	.13	.97	.01	-	1.11	

Shields ranch	38°24'	119°15'	5,300	-	1.80	2.40	.10	-	4.30
Smith	38°48'	119°20'	4,800	-	.55	1.80	-	-	2.35
Thorne	38°36'	118°36'	4,200	-	-	.61	-	-	.61
Yerington	38°59'	119°10'	4,375	-	.30	1.21	-	-	1.51
Carson River Basin									
Carson City	39°10'	119°46'	4,675	-	2.23	1.60	-	-	3.83
Fallon	39°28'	118°47'	3,965	0.10	.35	.45	.03	-	.93
Lahontan a/	39°30'	119°05'	4,200	-	.29	.60	-	-	.89
Minden	38°57'	119°46'	4,730	-	1.57	1.75	.47	-	3.79
Truckee River Basin									
Boca	39°23'	120°05'	5,535	Tr.	1.91	1.45	.40	-	3.76
Lewers ranch	39°14'	119°51'	5,200	-	3.70	4.37	.60	0.05	8.72
Marlette Lake	39°10'	119°55'	8,000	.05	1.95	1.27	.50	-	3.77
Nixon	39°50'	119°21'	3,910	-	.41	.49	.16	-	1.06
Reno d/	39°32'	119°49'	4,532	.35	.50	.72	-	-	1.57
Tahoe a/	39°10'	120°09'	6,230	-	3.49	4.73	1.52	-	9.74
Truckee a/	39°20'	120°11'	5,818	2.60	3.10	1.08	Tr.	-	6.78
Minor basins									
Cedarville	41°32'	120°10'	4,675	Tr.	2.85	2.09	-	-	4.94
Doyle	40°01'	120°06'	4,300	-	1.75	1.90	.12	-	3.77
Ford Bidwell	41°52'	120°09'	4,735	-	1.25	1.87	-	-	3.12
Lake City	41°38'	120°13'	4,680	.05	2.20	4.60	Tr.	-	6.85
Susanville a/	40°25'	120°39'	4,271	.80	3.65	1.30	-	-	5.75

a Measured in the morning. b Included in next measurement. c Time of measurement not reported. d Measured at midnight.

160302 O—39——4

Table 2.--Rate and duration of precipitation at available stations for period December 9 to 12, 1937.

Station	Altitude (feet)	Location		Total precipitation (inches)	Total time, in hours, in which precipitation exceeded indicated rate, in inches per hour								Maximum rate (inches per hour)	Data furnished by
		Latitude	Longitude		0.02	0.04	0.06	0.08	0.10	0.20	0.30	0.40		
Fresno	287	36°43'	119°49'	2.82	20	18	14	13	10	3	1	1	0.56	U. S. Weather Bureau
O'Neals	1,200	37°08'	119°43'	5.75	35	31	28	25	17	10	2	1	.98	U. S. Forest Service
North Fork No. 1	2,700	37°14'	119°31'	11.9	44	37	34	33	31	26	19	10	.66	Do.
North Fork No. 4	2,675	37°14'	119°31'	12.33	44	37	36	34	33	25	19	12	.7	Do.
Bass Lake	3,000	37°19'	119°35'	14.96	50	38	37	35	32	25	20	13	.74	Do.
San Francisco	52	37°47'	122°25'	3.0	27	22	19	15	11	1	0	0	.26	U. S. Weather Bureau
Fricot City	1,900	38°10'	120°31'	6.62	46	34	28	20	18	8	4	4	.84	D. Fricot
Fiddletown	2,100	38°31'	120°41'	5.2	40	35	29	27	21	5	1	0	.38	U. S. Weather Bureau
Sacramento	25	38°35'	121°30'	3.75	34	23	19	14	13	4	3	0	.39	Do.
Georgetown	2,300	38°55'	120°50'	7.62	46	40	36	34	25	9	3	1	.6	Do.
Redding	718	40°35'	122°24'	8.15	46	45	37	33	29	15	4	3	.84	Do.
Eureka	44	40°48'	124°10'	2.83	27	19	16	12	6	3	2	0	.38	Do.
Vollmers	1,332	40°57'	122°26'	9.1	50	44	43	42	35	13	6	3	.5	Do.
Mount Shasta City	3,555	41°22'	122°18'	5.88	46	41	36	30	24	6	2	0	.33	Do.

The rather simple situation that existed may be illustrated by the following brief description: On December 9 an intense disturbance was centered about 900 miles off the central California coast. This storm was of unusual extent, as well as intensity, covering most of the ocean area north of about latitude 20°N. The strong westerly and southwesterly currents prevailing in the southern and southeastern portions of the disturbance resulted in extensive transport of a large mass of warm moist air which was originally Polar Pacific air but had been modified considerably in its trajectory over the warm ocean surface in the lower latitudes. The disturbance as it moved slowly northeastward, increased in intensity, the winds approaching hurricane force. On the morning of the 10th it was centered off the coast of Washington and Oregon with lowest pressure about 28.10 inches and by December 11 it had reached the lower Alaskan Coast.

The warm moist air mass began invading northern and central California on the morning of December 9, the flow of air from the Southwest reaching gale velocity at times. The air as it was forced to rise rapidly over the steep slopes of the mountains released its abundant moisture, mostly in the form of rain except at extremely high elevations. By the night of the 11th the disturbance had moved far enough northward so that the western coast of the United States was out of the influence of the strong southwesterly winds and moderately high pressure prevailed over northern California, resulting in a cessation of the rains.

Based on the behavior of the streams as recorded at the river-measurement stations, the center of the storm seemed to progress across the State in about 48 hours, moving generally eastward and southeastward. Most of the streams in the northern part of the area reached peak stages beginning late in the evening of December 10 or early in the morning of December 11, whereas those along the western slope of the Sierra Nevada tributary to the southern part of the Central Valley reached their crest stages between three and four in the afternoon of December 11.

The total precipitation during the storm period from December 9 to 12 was heaviest along the Coast Ranges between the Central Valley and the Pacific Ocean, and at altitudes of 4,000 to 6,000 feet along the western slope of the Sierra Nevada. At altitudes above 9,000 feet, the precipitation was largely in the form of snow.

There were two distinct areas of exceptionally heavy rainfall along the Coast Ranges. One area was along the divide between Upper Putah Creek and Russian River, where three supplemental records furnished to the Geological Survey by private parties at Cobb (altitude, 2,600 feet), Cellier Place (altitude, 2,100 feet), and Hoberg's (altitude, 3,000 feet) indicate a total storm precipitation of 20 to 22 inches and maximum daily depths of 13.65, 12.27, and 14.20 inches respectively. Precipitation was unusually heavy also in the Santa Cruz mountains, the headwater areas of Los Gatos Creek, San Lorenzo River, and Uvas Creek. In this area, supplemental records indicate a total storm precipitation of 18 to 19 inches; a maximum of 18.75 inches was recorded at Little Uvas Creek (altitude, 625 feet), and 18.52 inches at Saratoga Summit (altitude, 2,600 feet). At several precipitation stations in this area, between 9 and 10 inches were recorded on December 10. These high precipitation amounts are largely substantiated by the evidence of flood run-off, especially in the Uvas Creek Basin.

Precipitation was heavy and general along the western front of the Sierra Nevada at altitudes of 4,000 to 6,000 feet. A storm total of 17.27 inches was recorded at Central Camp (altitude, 5,364 feet), of 18.91 inches at Brush Creek (altitude, 3,500 feet), of 19.41 inches at Bucks Lake (altitude, 5,070 feet), of 19.79 at Inskip (altitude, 4,808 feet), and of 20.53 inches at Scales (altitude, 4,300 feet). A maximum daily depth of 11.48 inches was recorded at Scales on December 10, and many other stations recorded between 9 and 10 inches for approximately a 24-hour period.

In view of the sparsity of precipitation stations along parts of the Coast Ranges and in the high Sierra, it is probable that there were unrecorded variations of precipitation in addition to those defined and delineated on the precipitation maps included in this report (figs. 13 to 21).

On an areal basis, storm precipitation apparently ranged from 11 to 13 inches over considerable parts of headwater areas in Tulare Lake, Kings, San Joaquin, Fresno, Merced, Tuolumne, Stanislaus, American, Eel, and Russian River Basins; from 14 to 18 inches over considerable parts of Pajaro and Guadalupe River Basins; and from 12 to 19 inches in parts of the Feather, Yuba, and Putah Basins.

No figures on the area-depth characteristics of past great storms of California are available for comparison. However, the storm of December 1937 was unquestionably one of the great early-winter storms of which there is record for central and northern California.

Distribution

During the storm period significant amounts of rain fell in an area extending from the California-Oregon boundary to the southern limits of the Central Valley and from the Pacific Ocean to the eastern slopes of the Sierra Nevada. In the northern half of the area the precipitation was almost continuous from about 6 a.m. on December 9 to 1 p.m. on December 11. In the southern part of the area the storm lasted from about noon on December 9 to 6 p.m. on December 11. In the northern part of the area there seemed to be more of a tendency for the precipitation to be continuous than in the southern part, where there was a lull in the storm during the afternoon of December 10.

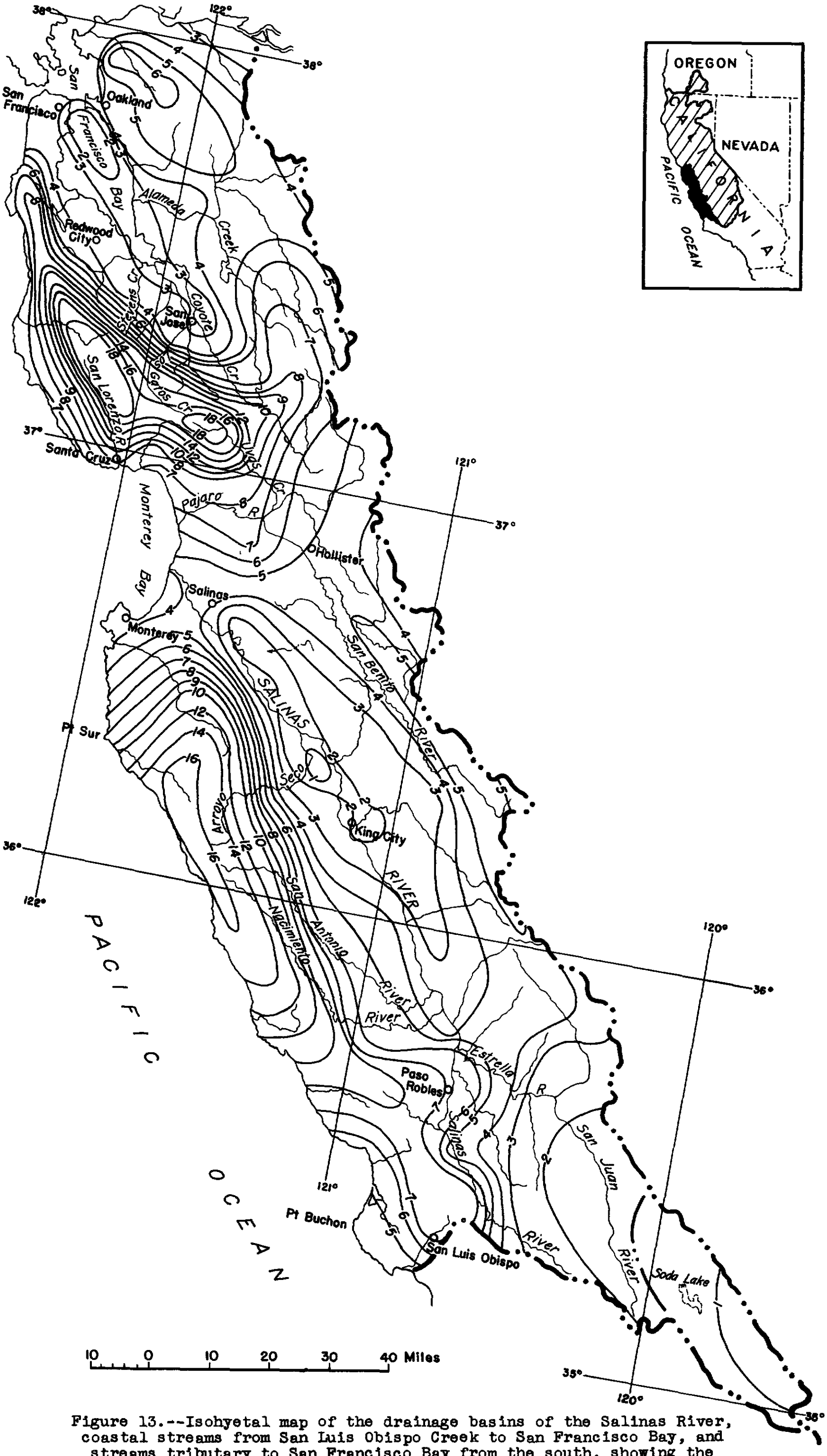


Figure 13.--Isohyetal map of the drainage basins of the Salinas River, coastal streams from San Luis Obispo Creek to San Francisco Bay, and streams tributary to San Francisco Bay from the south, showing the total precipitation, in inches, December 8-13, 1937.

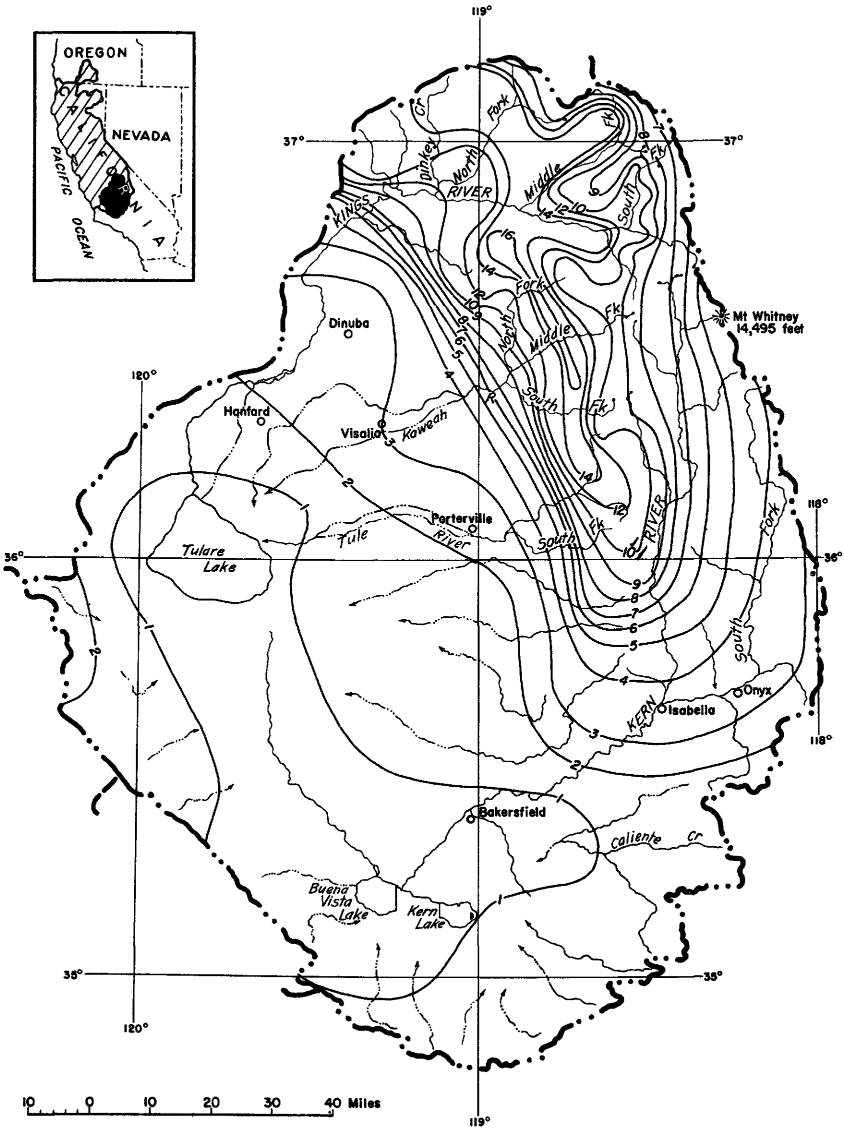


Figure 14.--Isohyetal map of the drainage basins of Buena Vista Lake and Tulare Lake, showing the total precipitation, in inches, December 8-13, 1937.

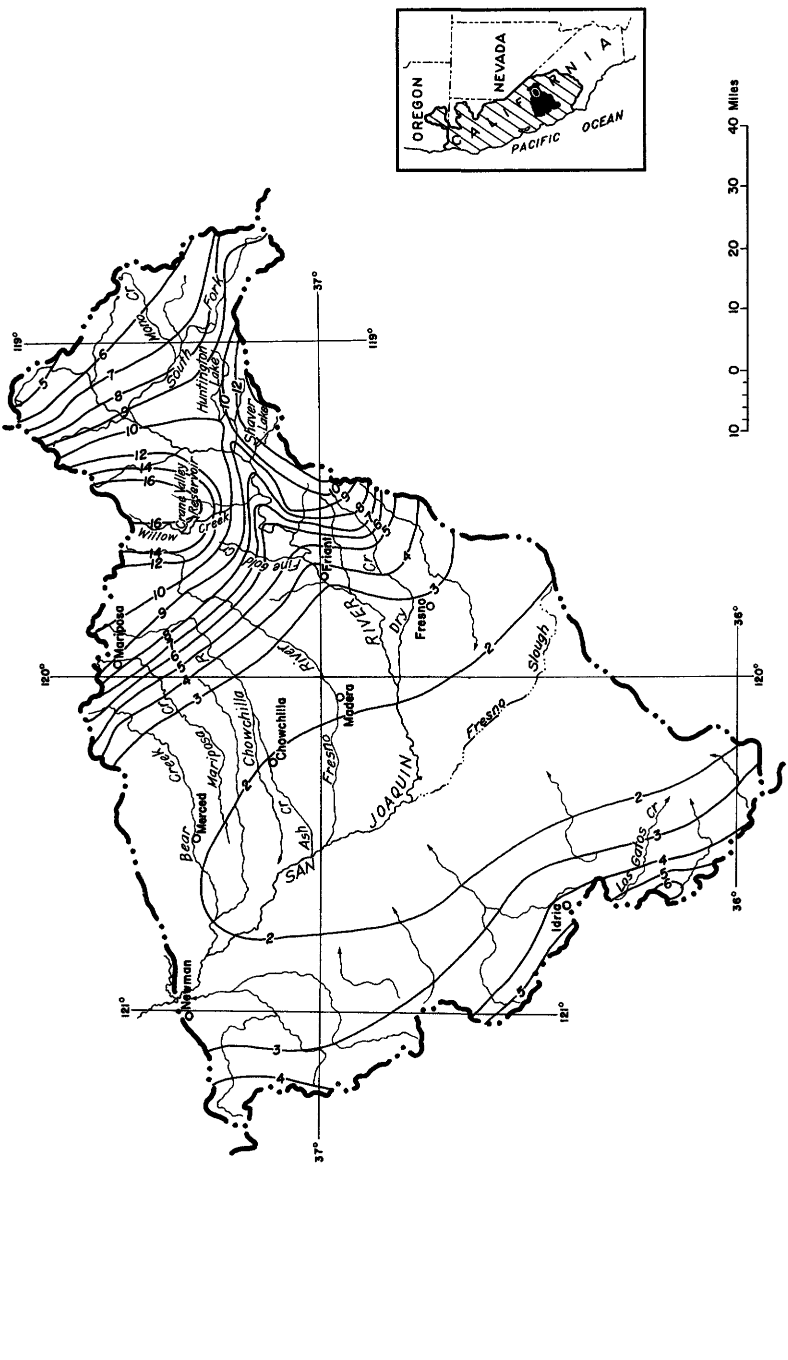


Figure 15.--Isohyetal map of the drainage basin of the San Joaquin River above the mouth of the Merced River, showing the total precipitation, in inches, December 8-13, 1937.

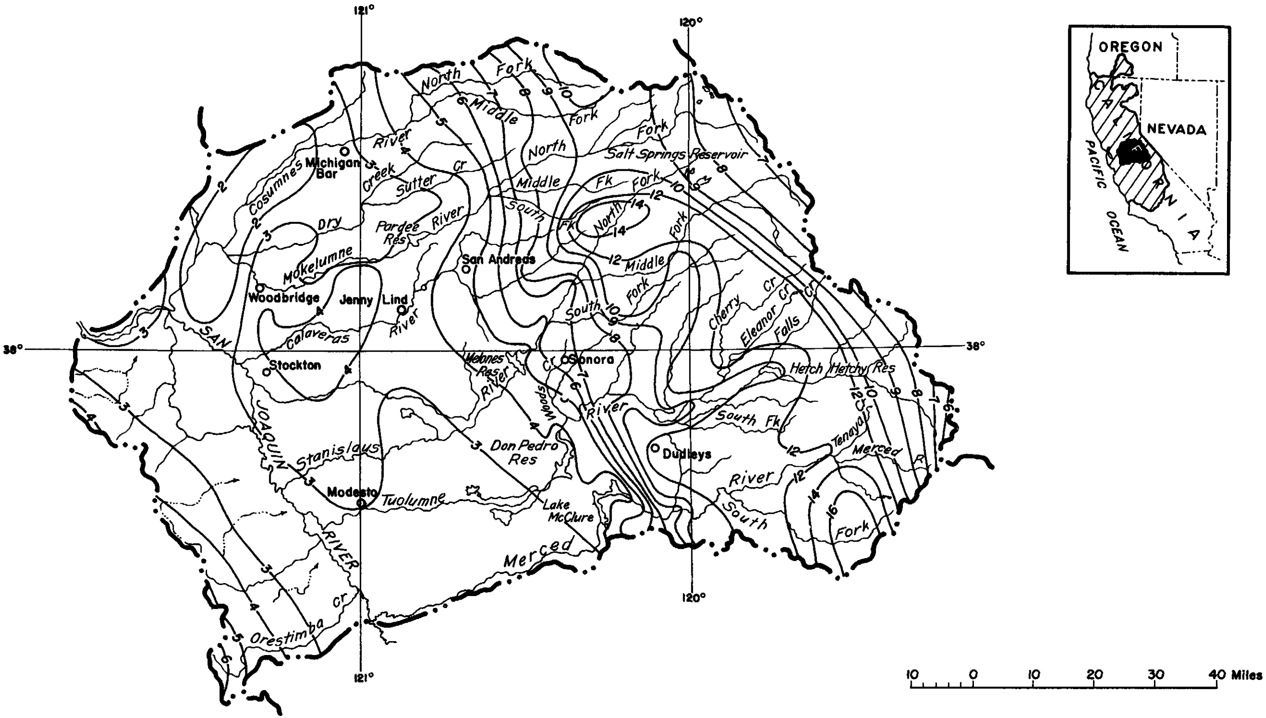


Figure 16.--Isohyetal map of the drainage basin of the San Joaquin River below and including the Merced River, showing the total precipitation, in inches, December 8-13, 1937.

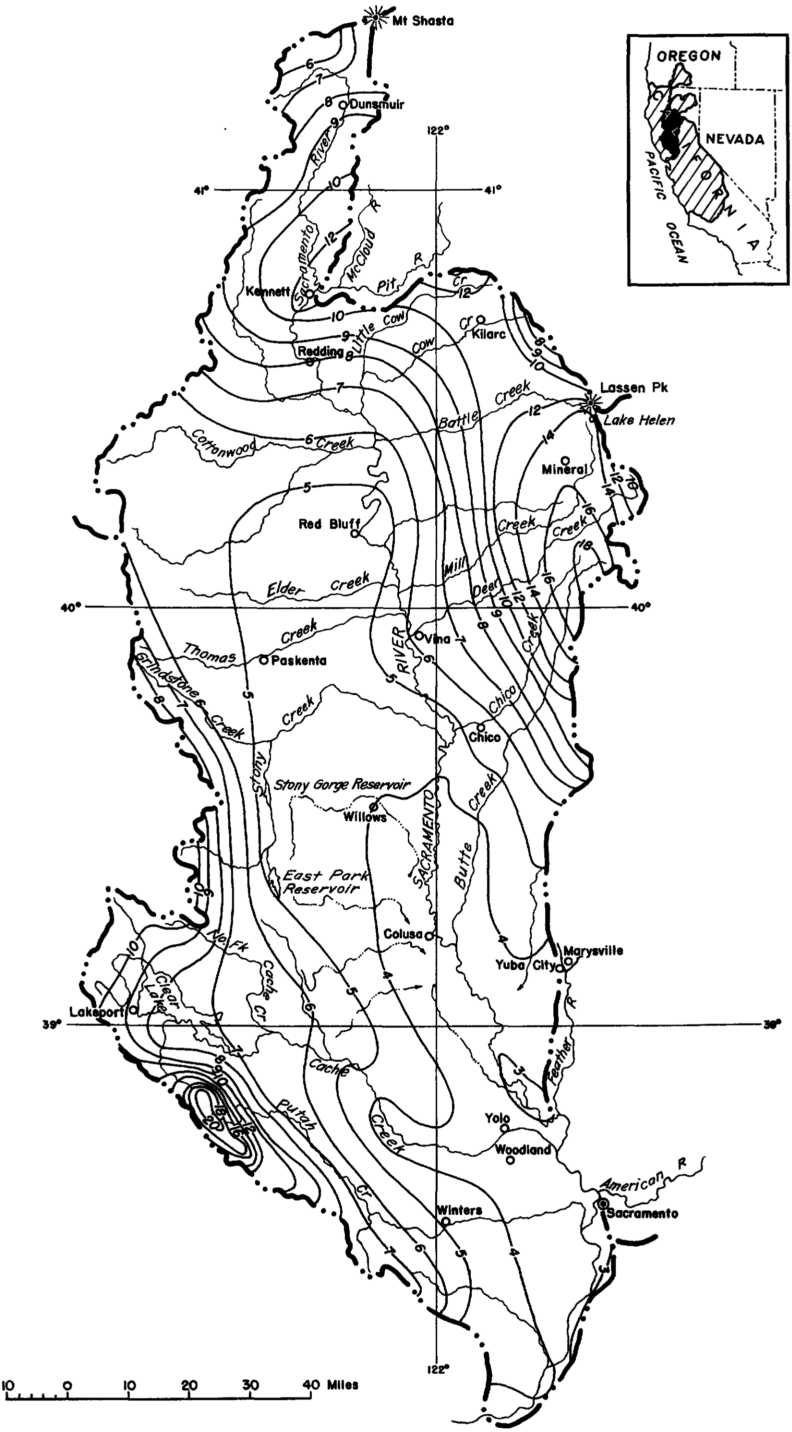


Figure 17.--Isohyetal map of the drainage basin of the Sacramento River, except the Pit, Feather, and American Rivers, showing the total precipitation, in inches, December 8-13, 1937.

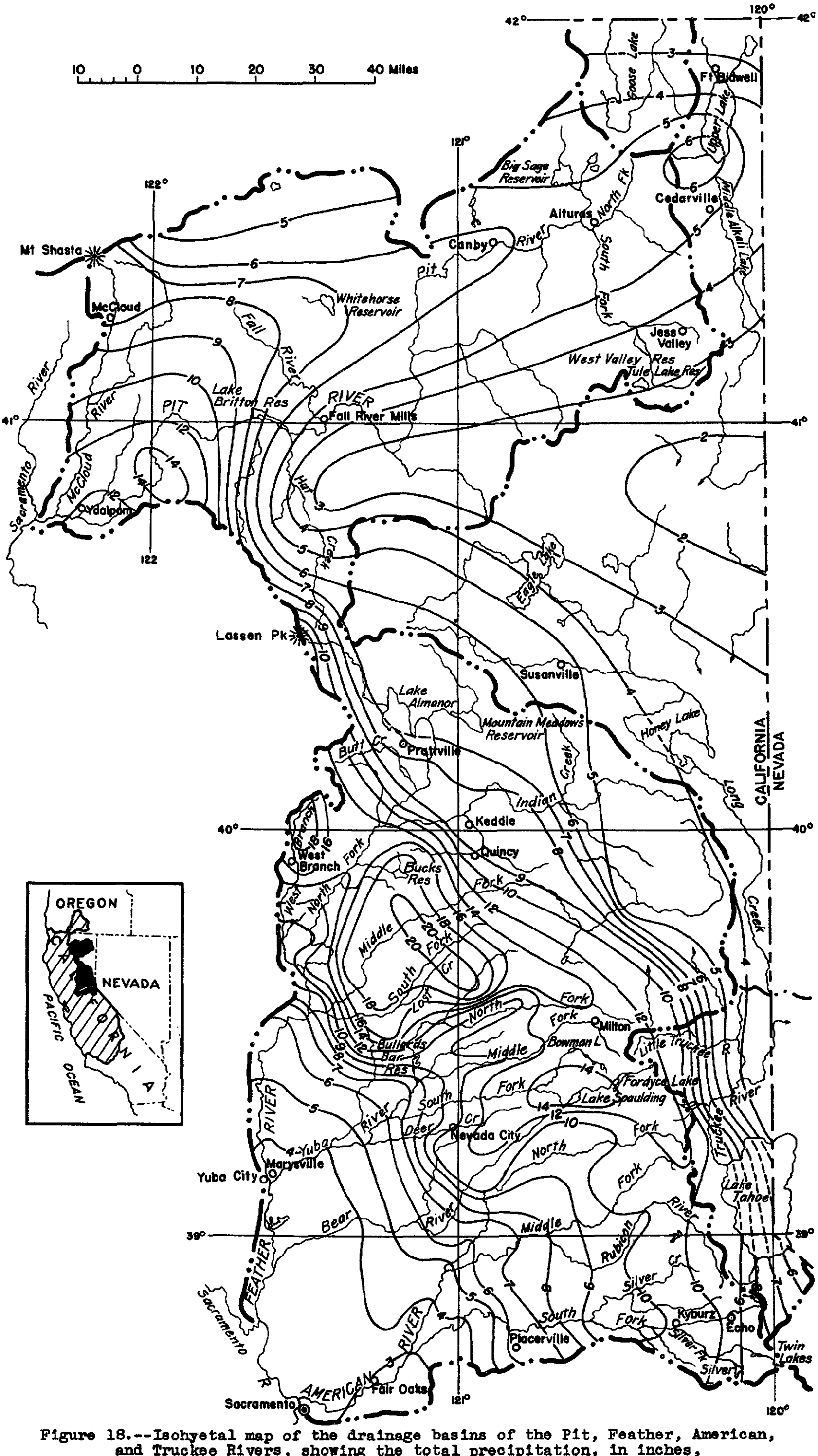


Figure 18.--Isohyetal map of the drainage basins of the Pit, Feather, American, and Truckee Rivers, showing the total precipitation, in inches, December 8-13, 1937.

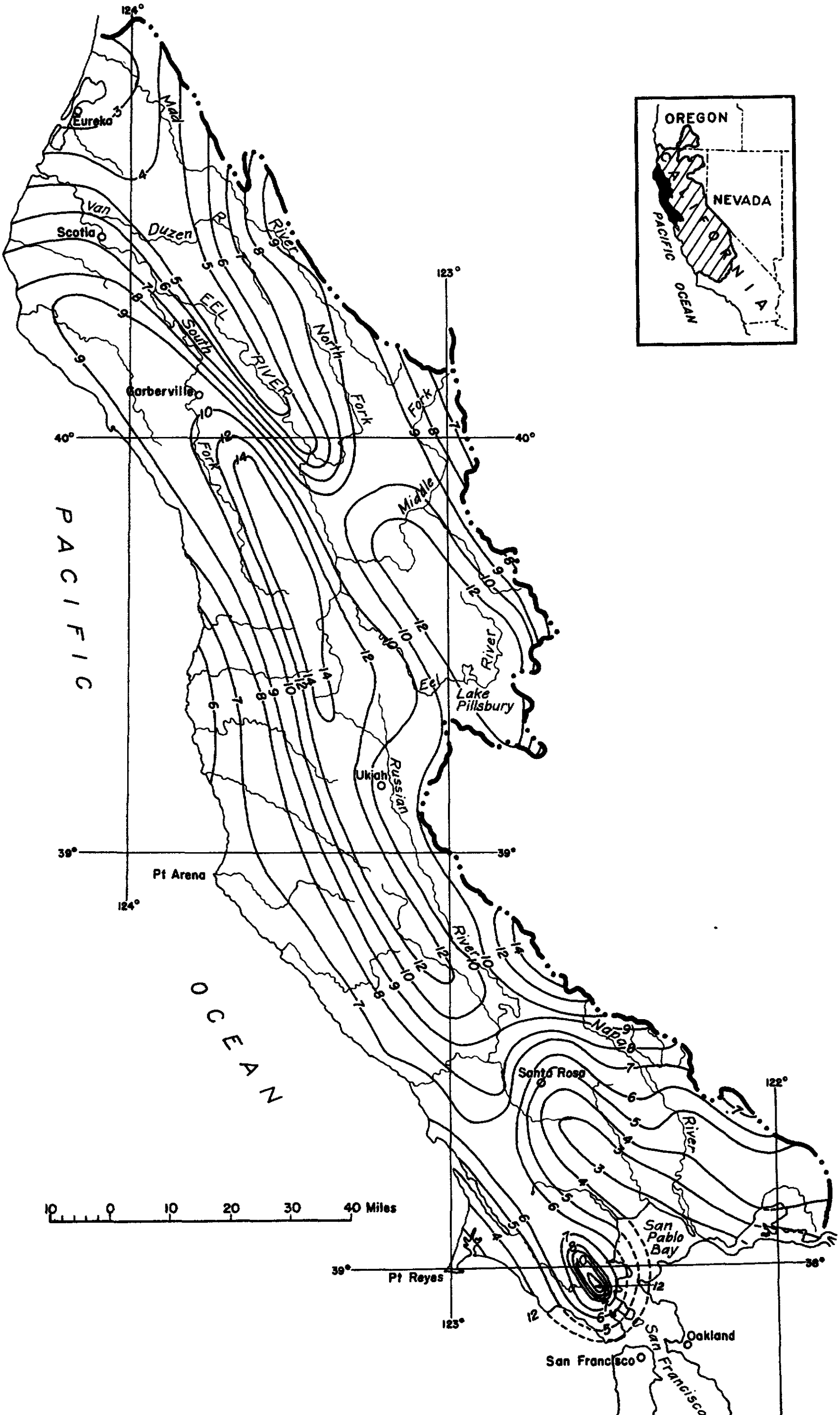


Figure 19.--Isohyetal map of the drainage basins of the Mad and Eel Rivers, streams tributary to San Francisco Bay from the north, and coastal streams between San Francisco Bay and Mad River, showing the total precipitation, in inches, December 8-13, 1937.

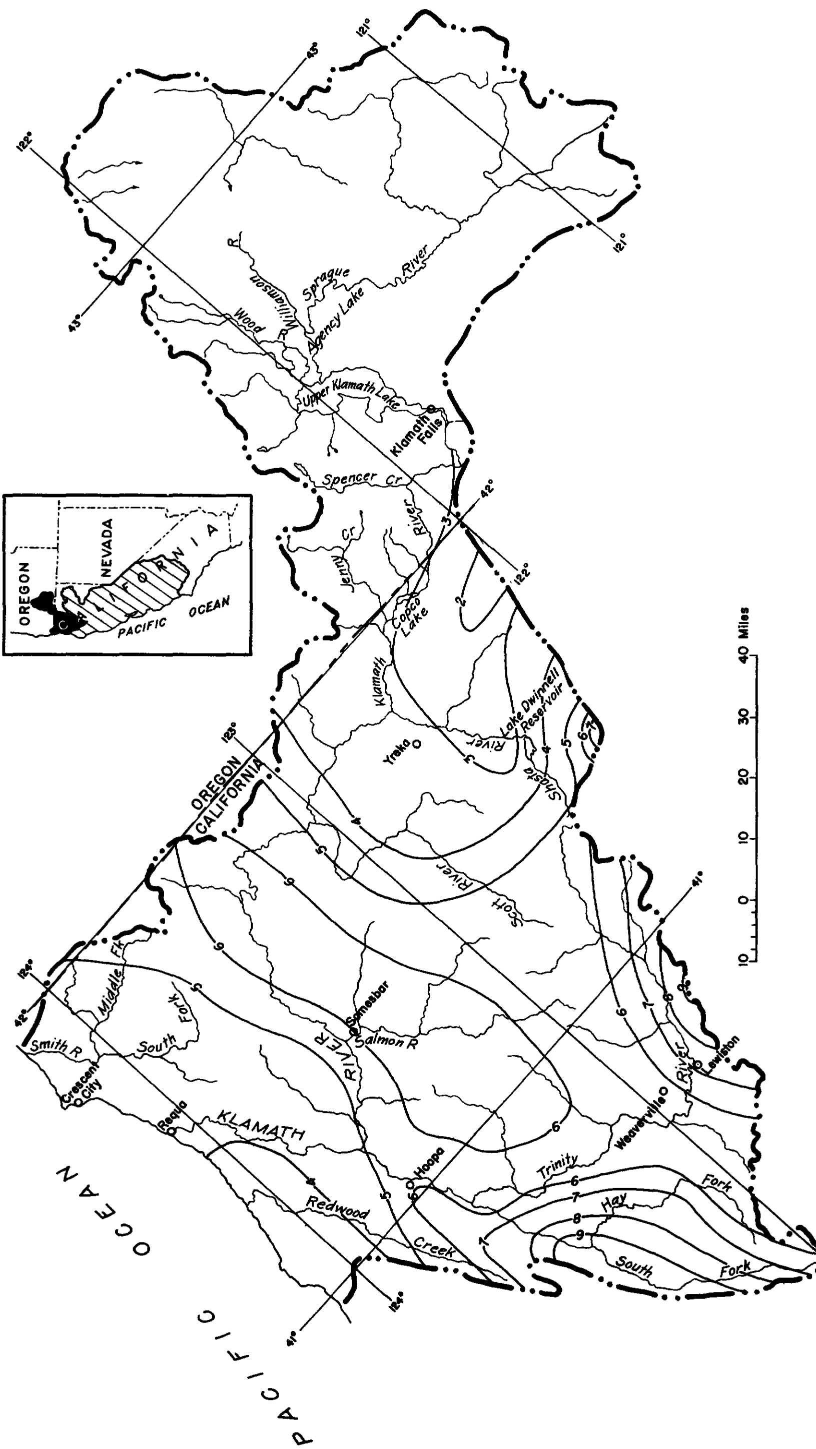


Figure 20.--Isohyetal map of the drainage basins of the Klamath River, Smith River, and Redwood Creek, showing the total precipitation, in inches, December 8-13, 1937.

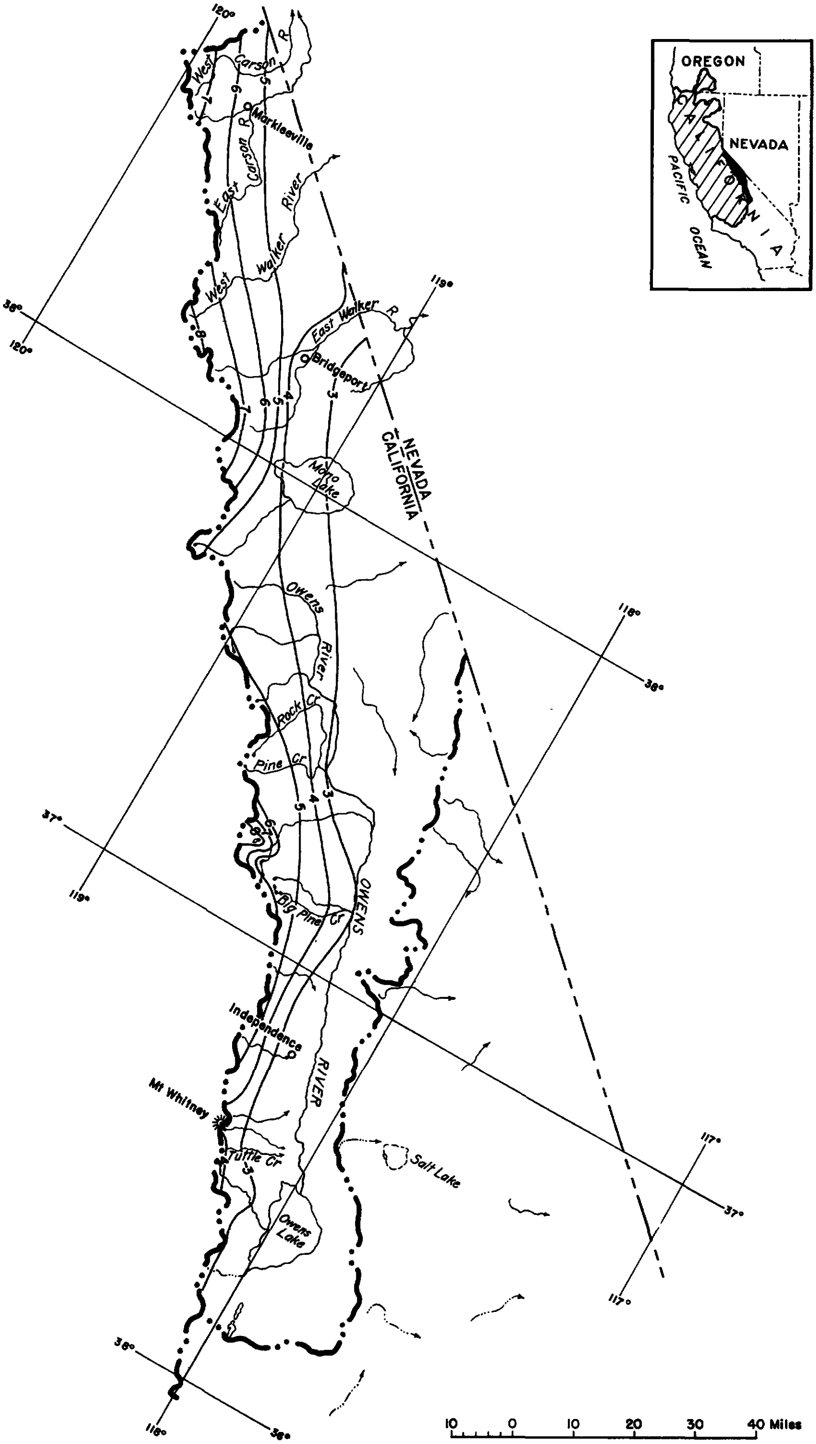


Figure 21.--Isohyetal map of the drainage basins from the Carson River to Owens Lake, inclusive, along the western boundary of the Great Basin, showing the total precipitation, in inches, December 8-13, 1937.

The entire period from December 9 to 12 has been treated as a unit in the preparation of a precipitation map, although, as indicated, most of the precipitation fell during 48 hours. The recorded precipitation for the period from December 9 to 12 has been plotted on Geological Survey base maps (scale 1:500,000), and an isohyetal map has been prepared. This base map has been transferred and reduced to appropriate scales for publication by major drainage basins (figs. 13 to 21).

The areas between the isohyetal lines on the original base map were measured by planimeter for the drainage basin upstream from each river-measurement station, and a value was obtained for the average total precipitation in each basin. The results of these determinations are given in the section on "Rainfall and run-off studies" in table 7.

If the storm precipitation were accurately known at every point, an isohyetal map might reflect the influence of altitude and topographic aspect on the precipitation. In much of the area it would be hazardous to estimate the number of observations that would be required to construct an isohyetal map from which the average precipitation over widespread areas could be determined with reasonable accuracy. In parts of the area, especially along the valley floor, distribution of rainfall was relatively uniform and sufficient records are available to permit the construction of a precipitation map that is fairly accurate. This applies also to a limited extent for portions of the Coast Ranges and in the foothill area of the Sierra Nevada where, although regular Weather Bureau stations are scattered, it has been possible to compile a considerable number of supplemental precipitation records and thereby fill in the gaps. But many of the Coast Ranges north of Clear Lake and all of the higher Sierra Nevada are sparsely inhabited, especially during winter months. In these areas there is a serious deficiency in basic meteorologic data, hence the isohyetals as drawn may not reflect actual conditions in every particular.

As an aid in constructing the isohyetals in areas where there were deficient observations, some attempt has been made to use such relations as could be determined between altitude and the total storm precipitation. The available data are sufficient to warrant only the most general conclusions. From south to north along the western slopes of the Sierra Nevada, the observed precipitation was correlated with the altitude with results generalized as follows:

On a line between Visalia and Giant Forest there was an increase of 6.9 inches per thousand feet up to an altitude of 2,000 feet and an increase of 1.1 inches per thousand feet between altitudes of 2,000 feet and 6,300 feet. Between Dinuba and General Grant National Park there was an increase of 4.3 inches per thousand feet up to an altitude of 2,000 feet and an increase of 1.2 inches per thousand feet between 2,000 and 6,700 feet. Between Friant and Big Creek No. 1 power house the increase was 3.4 inches per thousand feet up to 2,000 feet and 0.5 inch between 2,000 and 5,000 feet. There was an increase of 3.7 inches per thousand feet up to 4,300 feet on a line between Hamilton City and Downieville, and of 2.6 inches up to 4,000 feet between Marysville and Lake Spaulding.

It seems evident that, in the storm of December 1937, altitude was a dominant but not wholly controlling factor in the determination of precipitation; and that, although there was a marked tendency for the rainfall to increase with altitude up to a certain limit, the relations were not uniform either in a north and south direction along the western front or vertically in the same vicinity. A part of the variations disclosed may be due to the location of the precipitation stations in relation to topographic features, or they may have resulted from the inherent meteorologic characteristics of the storm.

There seems to have been a tendency for the rate of increase of precipitation with altitude to be somewhat larger in the southern part of the area than in the northern, and a tendency for a decreased rate of increase at the higher altitudes. As drawn, the isohyetals indicate an average increase in precipitation of about 3 inches per thousand feet up to an altitude of 5,000 feet. What happened at the higher altitudes during the storm period is somewhat problematical. At an altitude of about 9,000 feet, at least a part of the precipitation took the form of snow, and it seems probable, from the available data, that at altitudes between 5,000 and 6,000 feet the water equivalent of the snow was considerably less than the depth of rainfall. Along the foot of the eastern slopes of the Sierra Nevada the total storm precipitation was between 3 and 4 inches. The isohyetals for areas in the high Sierra Nevada (figs. 14 to 16 and 21) have been constructed, without definite data, on the assumption that, with some possible exceptions, there was a general decrease in precipitation in those areas between an altitude of about 6,000 feet and the crest of the Sierra Nevada. This assumption apparently conforms with the observation and experience of those who are familiar with climatic conditions and life zones along the Sierra Nevada as a whole. Along the Coast Ranges, isohyetals have been constructed almost entirely from observed data.

Users of the precipitation maps (figs. 13 to 21) and of the precipitation values (see table 7) derived therefrom are referred to the discussion relating to "Rainfall and run-off studies" wherein there are comments on the probable accuracy of the maps as judged from an analysis of the measured run-off from individual drainage basins.

Figures 22 to 25 show graphically the relation of topography and altitude to precipitation during the storm of December 1937, on four generally east-and-west lines across California. (See fig. 2.) The land profiles on these figures are based on topographic maps, and the profile of precipitation is based on the isohyetal map of the storm.

Graphs indicating hourly precipitation at various precipitation stations between Mount Shasta City and Fresno are shown in figures 26 and 27.

Temperature

Temperature had a large influence on the characteristics and magnitude of the December floods. This feature has been noted by E. H. Fletcher, meteorologist of the United States Weather Bureau at Sacramento, in his report previously cited, and by many others who are familiar with the meteorologic and hydrologic conditions.

At altitudes up to 3,000 feet or more, along the slopes of the Sierra Nevada tributary to the great Central Valley, mean temperatures were about 2° F. above normal during November 1937 and nearly 5° F. above normal during December. The temperatures did not follow the normal seasonal decline through November and December. Instead, as shown by daily maximum and minimum temperature for November and December at Fresno (altitude, 287 feet), Lake Sebrina (altitude, 9,100 feet), Marysville (altitude, 67 feet), and Soda Springs (altitude, 6,752 feet), there was a general tendency (see fig. 28) for the temperatures even to increase somewhat beginning about November 15. They culminated in an unusually warm period from December 5 to 8, when minimum temperatures even at the higher altitudes were above freezing. During the storm period from December 9 to 12, mean temperatures ranged from 55° F. on the valley floor to 32° F. at the higher altitudes, and averaged 7° to 8° F. above normal. The correlation of temperature and altitude along the western front of the Sierra Nevada indicates that the rate of decrease in temperature per thousand feet increase in altitude during the December storm period corresponded with the rate of change indicated by the long-time

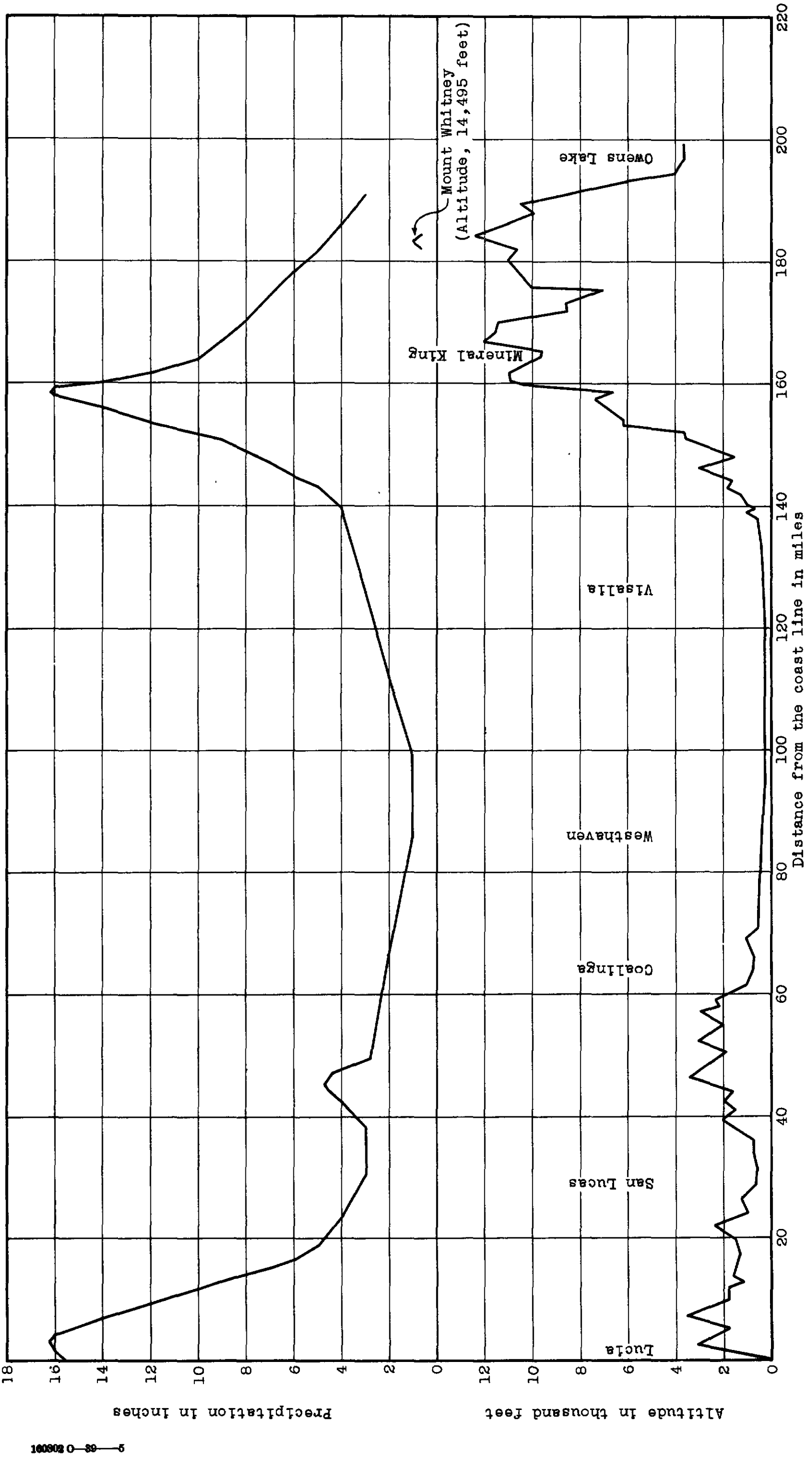


Figure 22.--Section A-B; location shown on figure 2.

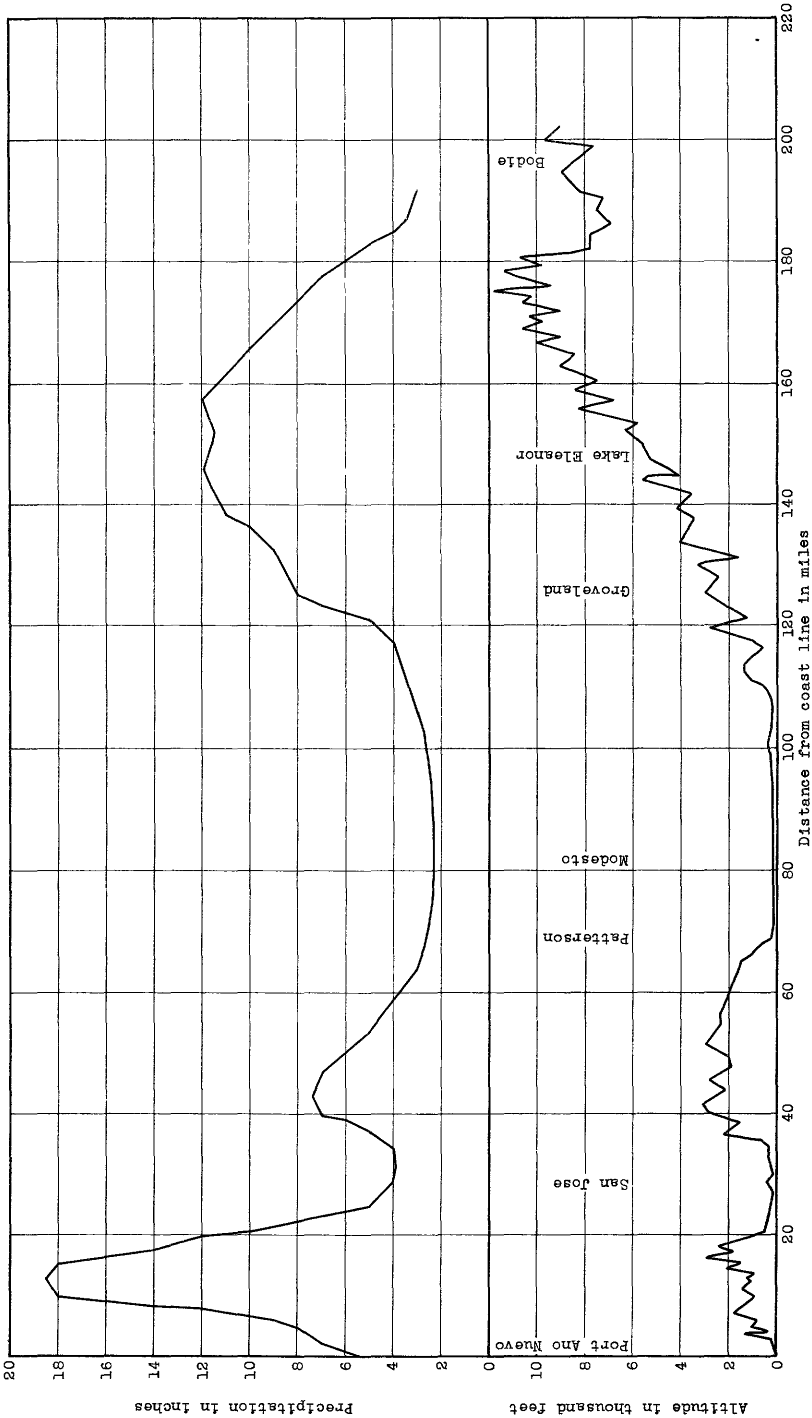


Figure 23.--Section C-D; location shown on figure 2.

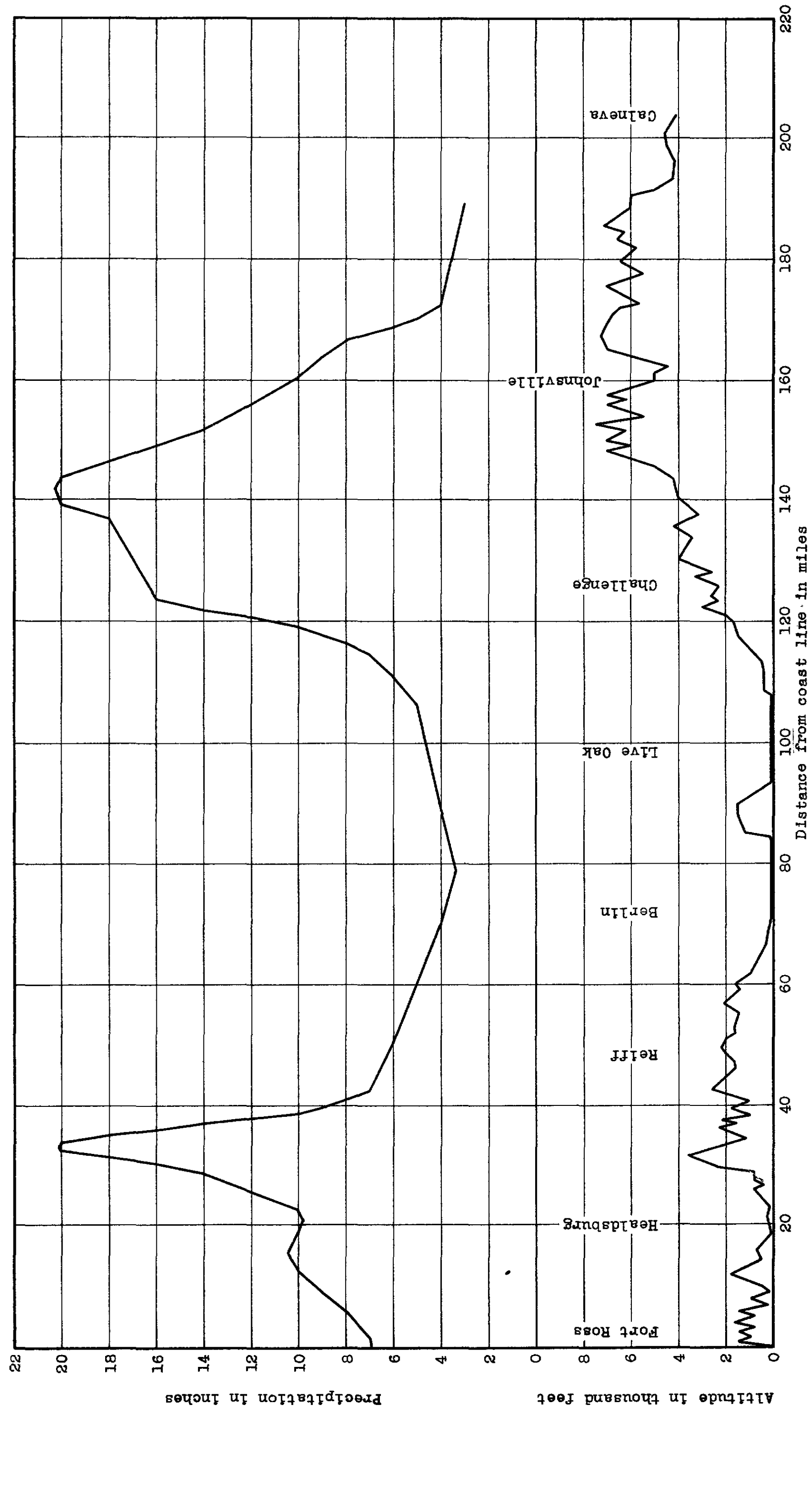


Figure 24.--Section E-F; location shown on figure 2.

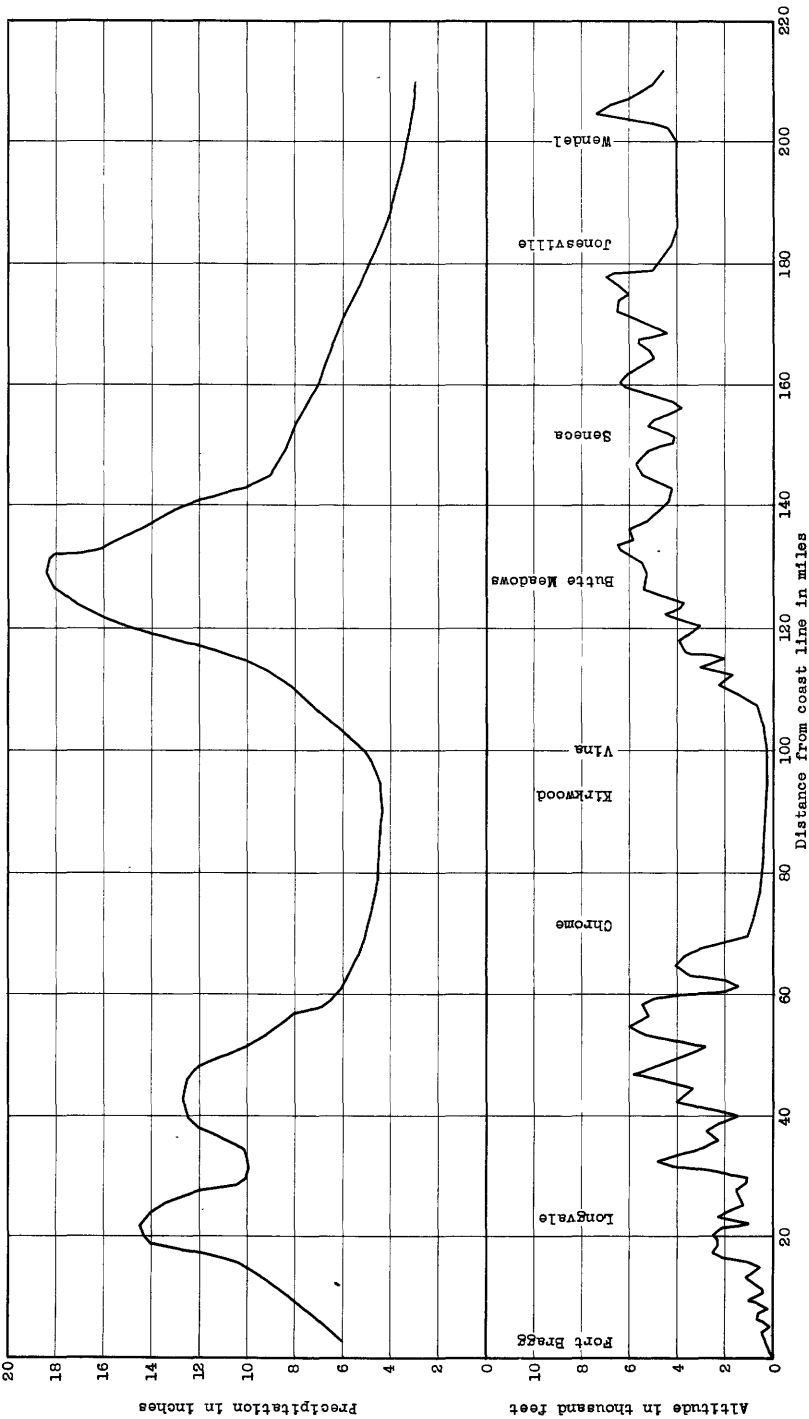


Figure 25.--Section G-H; location shown on figure 2.

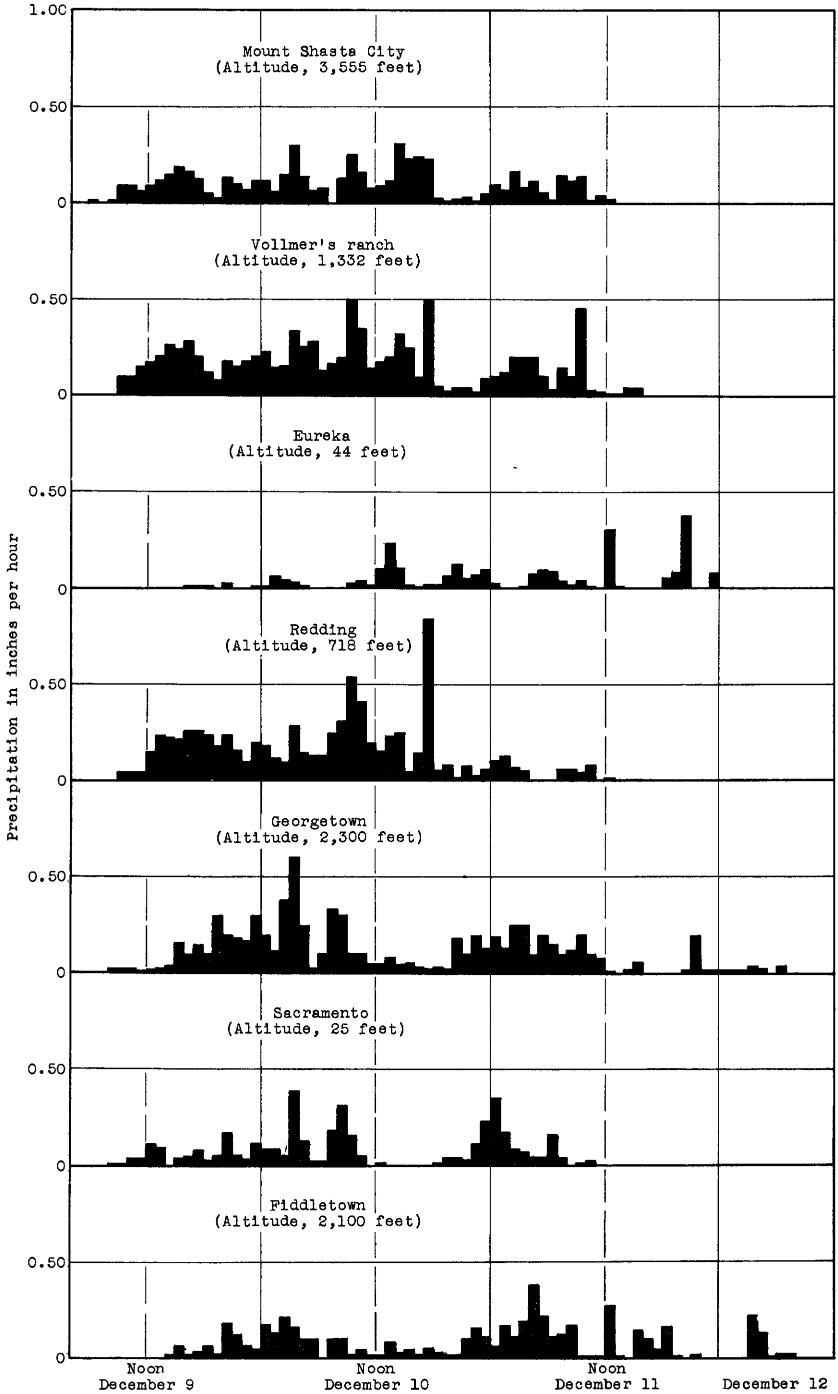


Figure 26.--Hourly precipitation, in inches, at various precipitation stations, Mount Shasta City to Fiddletown December 8-13, 1937.

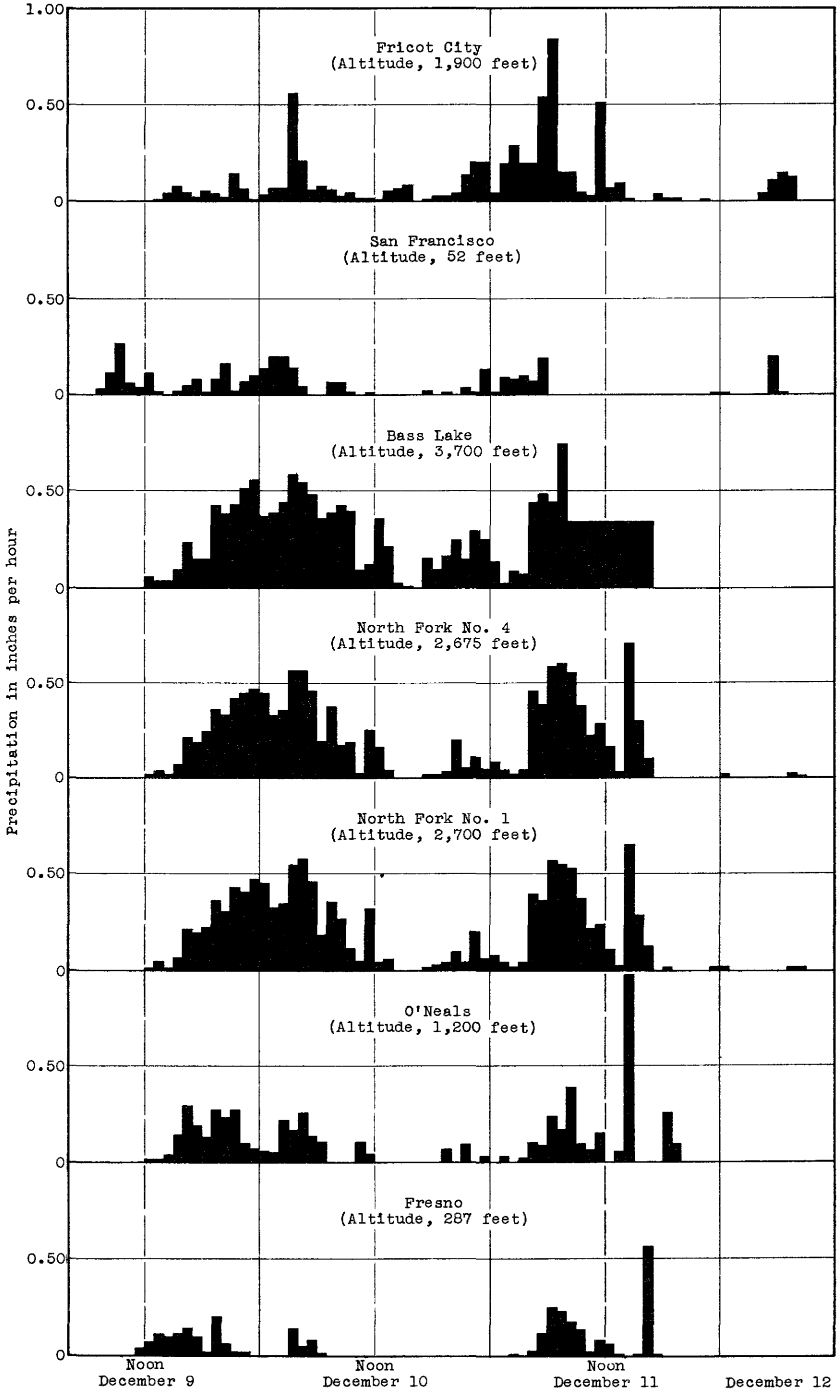


Figure 27.--Hourly precipitation, in inches, at various precipitation stations, Fricot City to Fresno December 8-13, 1937.

December temperatures, namely, about 2° F. decrease in maximum daily temperature, $2\frac{1}{2}^{\circ}$ F. decrease in mean daily temperatures, and 3° F. decrease in maximum temperature, for each increase of 1,000 feet in altitude.

One effect, therefore, of the high temperatures during the storm period from December 9 to 12 was to increase the area that contributed to the December flood run-off by raising the altitude limit at which the precipitation took the form of rain. Another effect was to increase greatly the amount of precipitation which fell as rain and which, in the absence of a deep snow cover, was an immediate source of run-off.

A study was made to determine the approximate number of square miles in the drainage area contributing to the Central Valley along the western front of the Sierra Nevada which lie between certain contours. These values were obtained by sketching the 5,000, 7,000 and 9,000 foot contours on the 1:500,000 base map from standard topographic maps where available, and by measuring the area between each pair of contours. The values are only approximate, but the totals for any major basin should be reasonably correct. The results of these determinations are shown under "Rainfall and run-off studies" in table 6.

Of the 12,300 square miles of the western front tributary to the San Joaquin system, upstream from the several gaging stations, nearly 2,000 square miles lie above an altitude of 9,000 feet; 2,500 square miles between altitudes of 7,000 and 9,000 feet; 2,300 square miles between altitudes of 5,000 and 7,000 feet; and about 5,500 square miles below an altitude of 5,000 feet.

In the area along the western slope, tributary to the Sacramento River and above the several gaging stations, only a negligible amount of the 16,900 square miles is above an altitude of 9,000 feet, and somewhat less than 500 square miles is above an altitude of 7,000 feet. About 5,200 square miles lie between altitudes of 5,000 and 7,000 feet, and about 11,200 square miles are below 5,000 feet.

The Sierra Nevada area contributing to the San Joaquin River contains about 4,500 square miles above an altitude of 7,000 feet whereas that tributary to the Sacramento River has only about 500 square miles above the 7,000 foot contour. The effect of this factor upon the run-off of the two basins is discussed in other sections of this paper.

Considering the area upstream from gaging stations on the western slope as a whole, the areas between the several pairs of 1,000-foot contours average about 3,600 square miles each up to an altitude of about

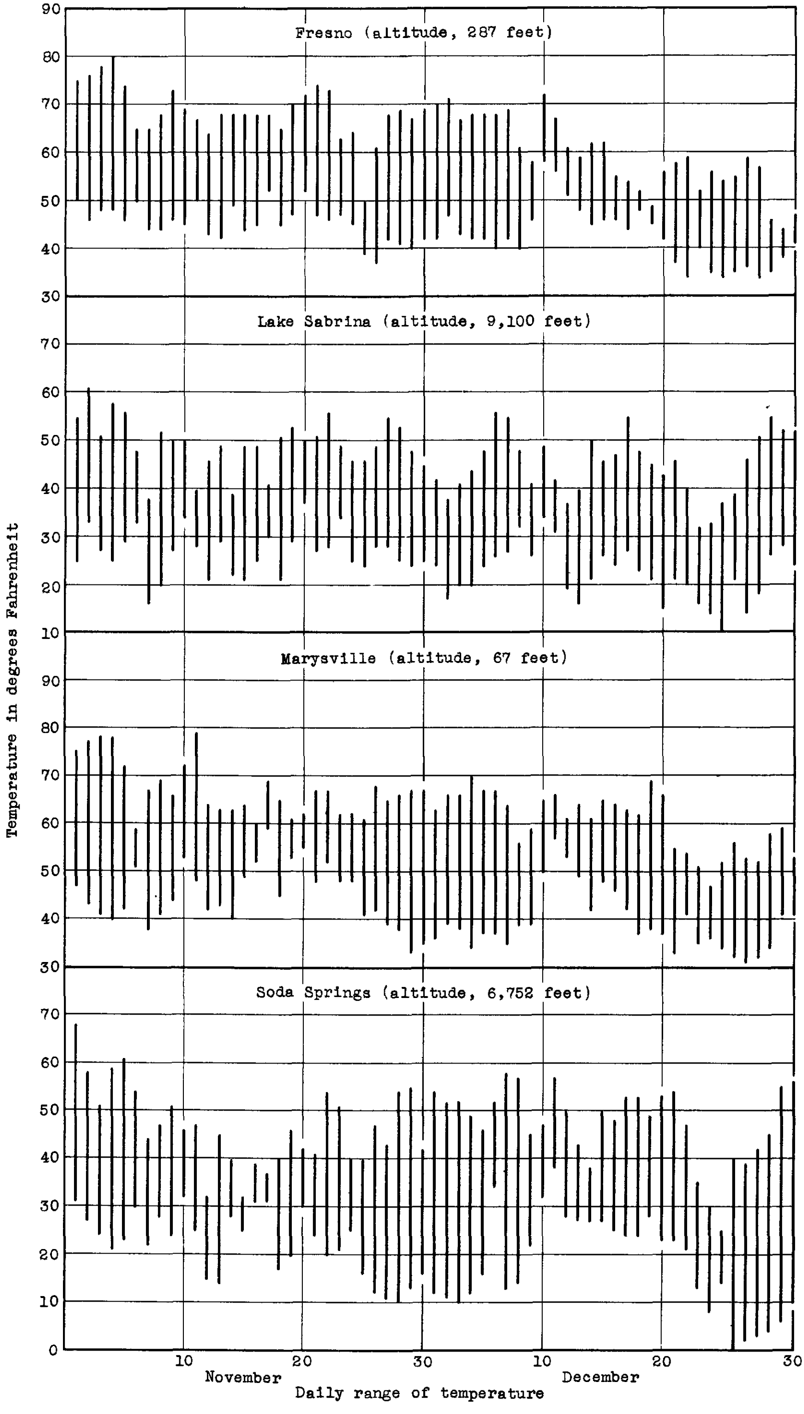


Figure 28.--Daily range of temperature at various places in northern California, November and December 1937.

7,000 feet, and 1,200 square miles above 7,000 feet. At critical temperatures a change of 2° F. might change the character of the precipitation from rain to snow or vice versa over more than 3,000 square miles; and an increase in temperature of 7° or 8° F., such as occurred during December 1937, might result in precipitation as rain instead of snow over an area of as much as 10,000 to 12,000 square miles, which is roughly 40 percent of the contributing area along the western front of the Sierra Nevada.

Snow

In California, as in other western states, snow surveys as an aid in forecasting probable spring and summer run-off are systematically carried on by State and Federal agencies in cooperation with irrigation, power, and other organizations which are vitally interested in the conservation and use of water. Thus, in California, the Division of Water Resources of the California Department of Public Works, in cooperation with the Bureau of Agricultural Engineering, the United States Weather Bureau, irrigation districts, and public utilities, makes observations of snow in headwater areas and issues monthly bulletins about snow conditions and forecasts of probable run-off. However, these observations are normally carried on only from January through May, hence at the time of the flood of December 1937 there was comparatively little information available about snow conditions. Even though data be available concerning the amount of snow on the ground there is relatively little quantitative information available about the effect of snow on flood discharge and run-off.

Studies and observations made by the United States Weather Bureau (see report by E. H. Fletcher, previously cited) and by the State Engineer's office indicate that the abnormal occurrence of rain rather than snow was one of the principal aggravating factors in connection with the intensities of run-off in many of the streams draining the Sierra Nevada during the flood of December 1937. Special effort has therefore been made to collect and compile all readily available information about snow during November and December 1937. The data are summarized in table 3.

The United States Weather Bureau[2/] also furnishes the following information:

Snowfall was negligible prior to November 10, and was generally subnormal thereafter (to the end of December). The average fall for

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2/ U. S. Dept. Agr., Weather Bur., Climatological Data, vol. 24, no. 12, California sec., p. 96, Dec. 1937.

Table 3.--Snow conditions in November and during storm of December 1937

Station	Sub-basin	Altitude (feet)	Total snowfall for Nov. (inches)	Type of precipitation Dec. 9-12	Snow on ground (inches) Nov. 30	Snow on ground December a/ 9	Snow on ground December a/ 12	Daily snowfall (inches) December a/ 9	Daily snowfall (inches) December a/ 12
			Kern River Basin						
Johnsondale	Kern	4,545	0	Rain	0	0	0	0	0
			Tulare Lake Basin						
Glennville	Poso Creek	3,300	0	Rain	0	0	0	0	0
Springville	Tule	4,050	0	do.	0	0	0	0	0
Cliff Camp	Kings	6,150	Tr.	b	0	0	-	0	5
Gen. Grant Nat. Park	do.	6,775	1.5	b	0	0	-	0	b
			San Joaquin River Basin						
Sand Bar Flat	Stanislaus	2,700	0	Rain	0	0	0	0	0
Dudleys	Merced	3,000	0	do.	0	0	0	0	0
North Fork	Willow Creek	3,000	0	do.	0	0	0	0	0
Crane Valley	do.	3,500	0	do.	0	0	0	0	0
Hetch Hetchy	Tuolumne	3,530	0	do.	0	0	0	0	0
Salt Springs	Mokelumne	3,660	.5	do.	0	0	0	0	0
Yosemite	Merced	3,983	0	do.	0	0	0	0	0
Lake Eleanor	Tuolumne	4,650	1	do.	0	0	0	0	0
Big Trees	Calaveras	4,700	1 to 2	do.	0	0	0	0	0
Spring Gap	Stanislaus	4,875	1.5	b	0	0	-	0	.5
Big Creek No. 1	Big Creek	4,900	Tr.	Rain	0	0	0	0	0
Shaver Lake	Stevenson Cr.	5,400	Tr.	do.	0	0	0	0	0
Strawberry	Stanislaus	5,620	4.5	b	0	0	-	0	2
Huntington Lake	Big Creek	7,000	5	b	0	Tr.	Tr.	Tr.	1
Florence Lake	South Fork	7,400	4	b	0	-	-	0	5.5
Lake Alpine	Stanislaus	7,500	27.4 c4.67	b	13	-	-	2.5 c.46	3.2 c.45
Badger Flats	Big Creek	8,300	-	-	8	-	-	-	-
Kaiser Pass	South Fork	9,300	-	Snow	12	-	-	-	-
			Sacramento River Basin						
Vollmers ranch	Sacramento	1,332	0	Rain	0	0	0	0	0
Chute Camp	Yuba	1,358	0	do.	0	0	0	0	0
Storrie	Feather	1,760	0	do.	0	0	0	0	0
Dunsmuir	Sacramento	2,290	0	do.	0	0	0	0	0
Howells	Feather	2,400	0	do.	0	0	0	0	0
Nevada City	Yuba	2,570	0	do.	0	0	0	0	0
Kilarc	Cow Creek	2,642	0	do.	0	0	0	0	0
Grass Valley	Feather	2,690	0	do.	0	0	0	0	0
Challenge	do.	2,700	0	do.	0	0	0	0	0
De Sabla	Butte Creek	2,700	0	do.	0	0	0	0	0
Caribou	Feather	3,000	0	do.	0	0	0	0	0
Forest Hill	American	3,200	0	do.	0	0	0	0	0
West Branch	Feather	3,216	0	do.	0	0	0	0	0
McCloud	Pit	3,270	Tr.	do.	0	0	0	0	0
Fall River Mills	do.	3,340	Tr.	do.	0	0	0	Tr.	0
Hat Creek	do.	3,400	0	do.	0	0	0	0	0
Quincy	Feather	3,409	0	do.	0	0	0	0	0
Brush Creek	do.	3,500	0	do.	0	0	0	0	0
Veramount	do.	3,500	0	do.	0	0	0	0	0
Mount Shasta	Sacramento	3,555	0	do.	0	0	0	0	0
Deer Creek	Yuba	3,700	0	do.	0	0	0	0	0
Lookout	Pit	4,296	0	do.	0	0	0	0	0
Scales	Yuba	4,300	0	do.	0	0	0	0	0
Alturas	Pit	4,346	0	do.	0	0	0	0	0
Chester	Feather	4,550	12	do.	0	0	0	0	0
Canyon Dam	do.	4,570	Tr.	do.	0	0	0	0	0
Prattville	do.	4,600	3	do.	0	0	0	0	0
Drum Forebay	Yuba	4,653	2	do.	0	0	0	0	0
Blue Canyon	American	4,750	3	do.	0	0	0	0	0
Inskip	Feather	4,808	Tr.	do.	0	0	0	Tr.	0

a Any snow on ground or additional snowfall on Dec. 10 or 11 is indicated by footnotes.
b Rain and snow.
c Water content in inches.

Table 3.--Snow conditions in November and during storm of December 1937--Continued

Station	Sub-basin	Altitude (feet)	Total snowfall for Nov. (inches)	Type of precipitation Dec. 9-12	Snow on ground (inches) Nov. 30	Snow on ground December a/ 9	Snow on ground December a/ 12	Daily snowfall (inches) December a/ 9	Daily snowfall (inches) December a/ 12
				Sacramento River Basin--Continued					
Portola	Feather	4,832	0	Rain	0	0	0	0	0
Mineral	Battle Creek	4,950	2.5	do.	0	0	0	Tr.	0
Sierraville	Feather	5,000	2	do.	0	0	0	0	0
Westwood	do.	5,000	4	do.	0	0	0	0	0
Bucks Lake	do.	5,070	11	do.	-	0	0	0	0
Lake Spaulding	Yuba	5,075	10	b	Tr.	0	0	0	1
Bowman Dam	do.	5,347	18.3	b	1	0	1	Tr.	1
Jess Valley	Pit	5,400	1	-	0	0	-	-	-
Soda Springs	Yuba	6,752	70	b	20	d13	e8	0	f5
Twin Lakes	American	7,920	29.5 c4.44	b	11	g8	8	.5 c.18	h6.0 c.84
Helen Lake	Mill Creek	8,300	-	b	j96±	-	60±	-	-
				The Great Basin					
Independence	Owens	3,943	0	Rain	0	0	0	0	0
Cedarville	Alkali Lake	4,675	8.5	do.	0	0	0	0	0
Lake City	do.	4,680	6	do.	0	0	0	0	0
Fort Bidwell	do.	4,735	8	do.	0	0	0	0	0
Boca	Truckee	5,535	5.25	b	0	0	0	0	k.5
Truckee	do.	5,818	10.5	b	m	0	0	0	Tr.n/
Tahoe	do.	6,230	15	b	Tr.	Tr.p/	2	0	2
Bridgeport	Walker	6,440	5	b	0	0	Tr.q/	0	Tr.q/
Lundy Lake	Mono	7,760	7 c.76	b	0	0	2	0	r2 c.25
Bishop Creek	Owens	8,390	1	b	0	0	s3	Tr.	t1
Lake Sabrina	do.	9,100	5 c.35	b	0	.5	u7	.5 c.25	u6 c.68
Gem Lake	Mono	9,120	8.5 c1.04	b	1	p1	v7	Tr.	w5
Ellery Lake	do.	9,600	27 c3.13	b	5	x2	20	2 c.32	y3 c.44
South Lake	Owens	9,620	6 c.28	b	0	Tr.	z12	Tr.	aa5 c.72

a Snow on ground or additional snowfall on Dec. 10 or 11 is indicated by footnotes.
b Rain and snow.
c Water content in inches.
d 19 inches Dec. 1; 13 inches Dec. 8.
e 10 inches Dec. 10; 5 inches Dec. 11; 7 inches Dec. 13.
f 4 inches Dec. 10.
g 11 inches Dec. 1; 8 inches Dec. 8.
h 1 inch Dec. 11 (water content, 0.20 inch).
j Snows of November accumulated to a depth of about 8 feet; warm rains of December reduced the snow to about 5 feet of slush, which subsequently froze into granular ice.
k Disappeared same day.
m Patches of snow on ground.
n 1.5 inches Dec. 11; melted by Dec. 12.
p Snow on ground for period Dec. 1-9.
q 2-inch snowfall Dec. 10; disappeared immediately, as did trace Dec. 12.
r Disappeared by Dec. 14.
s 2 inches Dec. 11; 1 inch Dec. 15.
t Trace Dec. 10; 2 inches Dec. 11.
u 2 inches Dec. 11.
v 3 inches Dec. 10; 2 inches Dec. 11; and 7 inches Dec. 15.
w 2 inches Dec. 10.
x None Dec. 8; 19 inches Dec. 10; 18 inches Dec. 11; 14 inches Dec. 15.
y 17 inches Dec. 10 (water content, 3.75 inches); 4 inches Dec. 11 (water content, 1.92 inches).
z 6 inches Dec. 10; 11 inches Dec. 11; 7 inches Dec. 15.
aa 6 inches Dec. 10 (water content, 3.07 inches); 5 inches Dec. 11 (water content, 2.16 inches).

November was 52 percent and for December was 34 percent of the 41-year mean (for those months). The November fall occurred over the Modoc Plateau, above the 4,500 foot level over the northern and middle Sierra Nevada, and above 6,500 foot level over the southern Sierra Nevada. The December fall exceeded the normal at low level stations in the Klamath basin, but was decidedly deficient elsewhere . . . .

The total seasonal snowfall to the close of December was 36 percent and the average depth of snow on the ground on the last day of December was 21 percent of normal. A large part of the November accumulation was melted by the warm rains of December 10-11, except over the high Sierra, and most of the snow on the ground at the end of December fell after the 11th of that month . . . . The snow cover was deficient in all sections and at all levels on December 31.

In compiling the data shown in table 3, full use has been made of observations and records derived from the following sources:- the United States Weather Bureau; the Division of Water Resources, California Department of Public Works; the United States Forest Service, in connection with operations at their experimental stations, and also the reports of forest supervisors and forest rangers to the regional forester; the Bureau of Water Works and Supply of the Los Angeles Department of Water and Power; public utility companies; postmasters; and others.

The snow observations herein recorded relate largely to conditions on the slopes of the Sierra Nevada. In the Coast Ranges to the west of the Central Valley there was apparently complete absence of snow, with the possible exception of drifts and patches on northern slopes in the relatively small areas lying above 6,500 feet north of Clear Lake. The records are discussed by major subdivisions of area: namely, the slopes of the Sierra Nevada tributary to the southern part of the Central Valley, the slopes tributary to the northern part of the Central Valley, and the slopes tributary to the Great Basin. The influence of snow, as reflected by stream flow records, is discussed to a limited extent by drainage basins in the section of this report relating to rainfall and run-off.

Sierra Nevada slopes tributary to south half of Central Valley

Under normal climatic conditions in San Joaquin River Basin, there may be precipitation in the form of snow from November to March at altitudes above 3,000 feet. During November 1937, mean daily temperatures at altitudes over 3,000 feet averaged from $1\frac{1}{2}^{\circ}$ to $2\frac{1}{2}^{\circ}$ F. above normal, and the precipitation, although of substantial amount, averaged from 1 to 3 inches below normal. Very little or no precipitation fell as snow below altitudes of about 4,500 feet, and there was considerably less than normal snowfall at altitudes above 4,500 feet.

At stations above 5,600 feet, much of the precipitation took the form of snow during four general storm periods, November 6, 11-14, 16-20, and 23-24; and at stations above 7,500 feet, snow was reported on the ground at the end of the month.

The fragmentary observations of snowfall given in table 3 indicate an apparent absence of snow on Sierra Nevada slopes tributary to the south half of Central Valley during November at altitudes up to 4,000 feet. Between altitudes of 4,000 and 5,500 feet, from a trace to 1½ inches of snow fell, with no snow on the ground at the end of the month. Between altitudes of 7,500 and about 9,000 feet, there were appreciable snowfalls, and at the end of November there was approximately one foot of snow on the ground.

Between November 30 and December 9, preceding the general storm period, there was little if any precipitation in the form of either rain or snow recorded in San Joaquin River Basin. Therefore, any snow on the ground at the beginning of the general storm period was a remnant of the November snowfall, the last of which fell on November 24. During the period from November 24 to December 9, maximum temperatures at altitudes up to 7,500 feet were well above freezing; and during the period from December 4 to 8 the minimum temperatures also were above freezing, a condition unusual for December at these altitudes. Below an altitude of 8,000 feet there was apparently a marked recession in the extent of snow cover during the period just preceding the storm.

For the storm period, from December 9 to 12, all the precipitation was reported as rain or as snow at certain localities shown in table 3.

From the foregoing records it is indicated that, up to an altitude of about 7,500 feet in the south half of the Central Valley, little snow fell on December 10 and 11 during the greater part of the storm precipitation, but that in general above an altitude of 5,000 feet snow was associated with the rain on December 12, the last day of the storm. As to conditions at altitudes above 7,500 feet, the following observations have been furnished by W. A. Lang, chief hydrographer of the Southern California Edison Co., Ltd., based on observations by an employee of that company:

December 9, 10, and 11, raining up to altitude of 8,500 feet, with storm ending on December 12, with 5½ inches of very wet snow at Florence Lake. General observations on December 18 in the vicinity of Kaiser Pass, altitude, 9,300 feet, indicate that 100 percent rainfall prevailed up to 8,500 feet during the storm period. From 8,500 to 9,000 feet, rain and snow combined, with 100 percent snow at altitudes of 9,000 feet and above. December 19, 19 inches snow on ground at Kaiser Pass and 11 inches of snow on ground at Badger Flats (8,300 feet). Road from Huntington Lake to Kaiser Pass badly washed out but passable to elevation 8,500 feet where it was closed by washouts.

Mr. W. E. Bonnett, meteorologist, United States Weather Bureau, Fresno, concludes in the absence of definite observations that:

At some time near the middle of the storm period, it is highly probable that precipitation was rain to and even above the 9,000-foot level, although the storm began and ended with snow at those altitudes. Aside from the initial temperatures of the air mass, the condensation of the enormous quantities of moisture released additional heat which undoubtedly was effective in keeping temperatures above the freezing point to an unknown altitude above 9,000 feet about the time of maximum precipitation at the known levels. (Letter dated Sept. 19, 1938.)

Sierra Nevada slopes tributary to north half of Central Valley

From November to March in most years, in the Sacramento River Basin, precipitation in the form of snow may be expected at altitudes above 3,000 feet. During November 1937 there was apparently no outstanding abnormality with respect to temperatures above an altitude of 3,000 feet, for about as many stations recorded mean daily temperatures of 1° to 2° F. below normal as reported temperatures above normal. The monthly precipitation along the western slopes of the northern Sierra Nevada was from 3 to 10 inches above normal.

The records show that in general there was no snow in the north half of the Central Valley below an altitude of about 4,500 feet prior to or during the flood period from December 9 to 13. The records also show there was some snow between 4,500 and 5,500 feet prior to the flood period, but that it had generally disappeared before the heavy rains of December 10 and 11. The forest supervisor reports that in the Upper Pit River Basin there was approximately 3 inches of snow between elevations of 5,000 and 6,000 feet which melted and ran off during the flood period. Above 6,000 feet there was snow on the ground at the beginning of the storm. Below an altitude of about 5,000 feet there was no snow associated with the precipitation during this storm. At 7,000 feet a part of the precipitation from December 9 to 12 was snow.

E. H. Fletcher, associate meteorologist, United States Weather Bureau, Sacramento, reports as follows with respect to snow depths:

The late November storms deposited about 3 feet of snow over the headwaters of the American River, but at the beginning of the December storm the snow cover above the 6,500-foot level had settled to about 12 inches. During the first day of the heavy rainfall, December 10, the old snow mostly melted, releasing (it is estimated) 2 or 3 inches of additional water between 6,500 and 7,500 feet over the American River Basin.

The acting superintendent of Lassen Volcanic National Park reports as follows with respect to snow observations at an altitude of about 8,300 feet near Lake Helen at the foot of Lassen Peak.

March 14, 1938--The history of the great snow pack in the park is interesting. The first fall storm, October 1 to 5, put down three feet of heavy snow at Lake Helen. Most of this melted, but left some in hollows and between rocks. The storms of November built the snow pack at Lake Helen to about 8 feet. Then the warm rains of December packed it down to about five feet of slush, which subsequently froze into granular ice. The pack built up to about 10 feet again in January, settling to 8 feet by January 26. On January 30, the big snow storm began.

Sierra Nevada slopes tributary to the Great Basin

Along the western margin of the Great Basin, to the east of the Sacramento and San Joaquin Basins, temperatures during November and the first part of December 1937 were definitely above normal. From Lake Tahoe northward the precipitation was materially above normal whereas to the south it was subnormal, corresponding with the precipitation characteristics in the San Joaquin River Basin. Snow normally accumulates to a considerable extent in this region throughout November. The following records indicate that, although there were several falls of snow during November 1937, there was also considerable depletion of the snow, and that by the end of the month there was appreciable snow cover only at the higher altitudes in the central and southern portions. In nearly all the area above an altitude of about 6,500 feet, snow was associated with the storm of December 9-12, and in general there was an accumulation of snow cover throughout this storm period above an altitude of about 9,000 feet. Below an altitude of 6,500 feet, some precipitation took the form of snow, but melted soon after it fell. A forest ranger reports that, in the vicinity of Truckee, southern slopes were bare prior to the storm, but that there was some snow on the northern slopes which melted and ran off toward the end of the storm period. Although some precipitation fell as rain above an altitude of 9,000 feet, it appears that much fell as snow.

DETERMINATION OF FLOOD DISCHARGES

General discussion

In the usual method of determining discharge at a river-measurement station, hydraulic engineers of the Geological Survey make current-meter measurements to establish a rating curve that will show the discharge for any given stage.

Obviously the rating curve can be well defined by measurements for the usual range of stage. Its definition is more difficult for high water stages, and increasingly difficult for flood stages of rare occurrence when conditions for obtaining measurements are most unfavorable.

Complete definition of the rating curve to the highest peak can be obtained only by an adequate number of timely measurements and a record of channel conditions during the flood. This ideal is difficult to realize. Most California streams have very flashy floods and high momentary peaks. They usually carry large quantities of debris and suspended material, and many of their floods rise and pass almost simultaneously, and many of them take place during the night. The field engineer is further handicapped during flood periods by washed-out or obstructed routes of travel and at times by damage to bridges or cableways from which discharge measurements are made.

When a current-meter measurement of flood flow is lacking, one or more of four different methods is comonly used to determine the maximum discharge. The methods are: (1) extension of rating curves for river-measurement stations, (2) computation of flow over dams, (3) computation of flow from slope-area data, (4) computation of flow through contracted openings. The method used depends upon the physical conditions at the location and the availability of necessary information. Whenever practicable, the result obtained by one method is checked by another. Often the results of two different methods may be combined so as to produce the most probable value.

The methods mentioned are described in standard textbooks and manuals concerning hydraulics and have been discussed in previous reports of the Geological Survey[3].

Extension of rating curves for river-measurement stations

When a rating curve is extended beyond the range of discharge measurements, proper consideration of all the factors involved is important. Knowledge of channel characteristics upstream and downstream from the river-measurement station is required. The changing influence of contracted sections downstream and the possibility of backwater from lower tributaries should not be overlooked. The channel conditions most favorable for the accurate extension of a rating curve consist of a pool, or stretch, with comparatively low velocity at the gage, and well-defined rapids, riffles, or stable control section not exceeding a few hundred feet downstream. If, also, the cross section of the channel increases uniformly with stage, then the hydraulic features of the familiar

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3/ See Water-Supply Paper 773-E, The New York State flood of July 1935, pp. 251-254, 1936; Water-Supply Paper 798, The floods of March 1936, Part 1, New England Rivers, pp. 70-77, 1937; and Water-Supply Paper 816, Major Texas floods of 1936, pp. 12-18, 1937.

rectangular or trapezoidal weir are roughly duplicated, and the shape of the extension of the rating curve can be determined within reasonable limits.

The cross section of the channel at flood stage, including all overflow and by-pass channels, should be determined by instrumental surveys. It may be advisable to obtain such a cross section at more than one point. If the measuring section is not at the station gage, rating curves for both locations should be extended and the results compared.

When the stream channel at the measuring section is permanent, plotting of both area and velocity curves for the measuring section is always advisable, using gage height as the ordinate. The area curve is developed from field observations. The velocity curve is drawn through values of mean velocity, as determined from current-meter measurements, and may be extended to peak stage on the basis of knowledge of channel conditions. A quantitative study of the variation of the slope and channel roughness, as computed from discharge measurements made at a standard cross section, will, for some measuring sections, furnish a dependable basis for the velocity curve extension. The product of the velocity and area at peak gage height gives a check upon peak discharge as determined by other methods. In the final result, the product of area and velocity, as taken from their respective curves for any gage height, must check the discharge indicated by the rating curve for the same gage height.

The construction and study of a curve showing the relation of the product of the cross-sectional area of the channel and the square root of the mean depth ($A\sqrt{d}$), to the corresponding discharge, may be helpful. The resulting curve will generally approach a straight line.

Plotting of both stage and discharge on logarithmic scales may also be useful in making the extension. Before plotting stage, the observed gage height should be adjusted, by the addition or subtraction of a constant, to the physical conditions of the location. For example, at a gaging station with a stable control of uniform elevation across the channel, the gage height of zero flow should be subtracted from each observed gage reading. Most logarithmic rating curves tend to be very flat curves or straight lines. It is not safe to assume without confirmation that a short portion that may be defined as a straight line can be extended as a straight line throughout. A difference in the upper ends of two curves may appear slight on logarithmic scales and yet be surprisingly large in absolute amount. Experience and discrimination are essential to the effective use of the logarithmic method of extension.

Very often extreme floods will change the channel conditions at gaging stations. Discharge measurements made after a peak may define a rating curve that is very different from the one previously developed. Both curves must then be extended, and as it is generally assumed that the change occurred during the time of maximum flow, the curves are merged at or near the maximum stage.

Notwithstanding the application of the best available knowledge and experience, the results obtained by extension of the rating curve may be subject to considerable error, particularly if the extension is carried far beyond the range defined by current-meter measurements. Therefore, special efforts are made to obtain high water measurements and to check extensions of rating curves by one or more of the other methods of determining discharge.

It should be recognized that, even though the extreme high water portion of a rating curve may be somewhat uncertain, the effect upon the accuracy of the total measured run-off for a certain storm may be relatively slight. This will be readily appreciated when it is considered that many flashy streams in California are at or near peak stage for a period of only one to three hours.

Computation of flow over dams

The computation of flow over dams often affords a reliable means of determining flood discharge. The common method is use of a weir formula, in which the principal factors are length of crest between abutments, head on the crest, and a coefficient (C) which varies with shape of the crest and the head. The basic formula is commonly expressed as $Q=CLH^n$ where Q is the discharge in second-feet; C, the coefficient for the dam; L, the effective length of the crest in feet; H, the head in feet on the crest, measured far enough upstream from the dam to avoid surface drawdown; and n, the exponent of H.

The exponent n is usually assumed as 1.5 and then coefficient C will generally vary with the head and with different shapes of the crest. When several discharge measurements are available, the rating may be determined for a sufficient range of stage to define both n and C as constants. When C is constant, n will often be somewhat greater than 1.5. The velocity of approach in the channel above a dam has an influence on the discharge over the dam and in effect increases the head on the crest. The cross-sectional area just upstream from the dam should therefore be determined so that the velocity of approach may be computed.

Information as to the shape and profile of the crest and other essential features should be obtained from construction plans of the dam or by measurement of the dam itself. The head over the dam may be ascertained from gage readings made during the flood or from high water marks. Profiles of the high water marks above and below the dam may also be desirable.

Data concerning submergence, over-flow channels or other by-passes, and diversions through flood gates, sluice ways, and water-wheels should be collected. Discharge over a dam may also be affected by an accumulation of logs or other floating debris on the crest. This is especially likely to occur if the dam crest carries a bridge or other superstructure, or gates with piers, or if it has equipment for the installation of flashboards.

A large number of dams in California have gates, auxiliary equipment, or superstructures of some kind, so that methods of determination required special adaptation to individual conditions. Wherever discharge over a dam was used, an effort was made to obtain all pertinent facts about the conditions during the flood period.

The exponent n was in general taken as 1.5 and the values for the coefficient C were selected from data summarized in Water-Supply Paper 200 or from those contained in recent handbooks. For some dams the coefficients were determined by Creager's method[4] for ogee sections, for which the coefficients depend on the ratio of the heads on the crest to the head for which the crest was designed. The results obtained are believed to be reliable, although many of the determinations were made for heads considerably greater than those for which coefficients are well established.

Computation of flow from slope-area observations

In the slope-area method, discharge is based upon measurements of the slope along a suitable reach of channel and of cross-sectional areas at representative points in the reach. The basic formula $V = C\sqrt{RS}$ is that of Chezy for the mean velocity of a stream, in which R is the hydraulic radius, S the slope (energy gradient), and C a coefficient whose value

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4/ Creager, W. P., and Justin, J. D., Hydro-electric handbook, depends upon the roughness of the channel and the hydraulic radius. This coefficient may be determined by one of several well-known formulas. Manning's formula was used in computations for this report. In its simplified form the Chezy-Manning formula becomes $V = \frac{1.486}{n} R^{2/3} S^{1/2}$. The coefficient n is intended to express the degree of roughness of the channel. However, it contains other elements that absorb the energy of flowing water. Among these elements are adverse bottom slope, and also irregularities of alinement in banks and stream bed and other physical factors that cause cross currents, eddies, and turbulence.

The values of n chosen and used in this report were based upon available published data and the experience of engineers of the Geological Survey in preparing earlier flood reports, such as the series on the floods of March 1936 in the eastern part of the United States.

Many of the data from which the formulas and coefficients were derived were based on observation in stream channels with gentle slopes, little turbidity, and uniform beds and cross sections that were free from bends or other characteristics that would tend to produce irregular and turbulent flow. The applicability of formulas and coefficients thus derived, to streams of steep slope, great turbulence, high silt load, and perhaps a large volume of coarser material moving as a bed load, is somewhat doubtful. Unfortunately the flashy streams, which are very difficult to reach and measure by current meter at high stages, often have these unfavorable characteristics. Therefore, the slope-area method was used for such streams only in conjunction with some other method or, at a very few locations, because no other method was available.

Surveys to obtain slopes and areas were necessarily made after the flood had passed. The most favorable reach available was selected and the high water line was staked out on both banks, from observation of flood marks left by the stream, or as marked by reliable observers. Two or more cross sections were obtained for all reaches. After the field notes were plotted, an allowance, based on field observation, was made for surge and splash of waves on the banks, and slope lines and cross sections were appropriately adjusted thereto. If the cross sections were not reasonably uniform and symmetrical, or if there was a noticable difference in the character of the two banks, the channel was divided into more than one section, each with its suitable value of n. By selecting a reach with nearly uniform area throughout, it was not necessary to compute the velocity head or to correct the surface slope to show the energy grade line. For the few locations where it was necessary to consider these factors the correction was very small.

As an example of the application of the slope-area method, the basic data used in the determination of discharge of the Little Truckee River near Boca, Calif., are shown in figure 29.

Computation of flow through contracted openings

Peak discharge may sometimes be computed from data obtained where a stream passes through a contracted opening, such as the space between bridge abutments. There is an increase in velocity at the contraction, resulting from conversion of potential to kinetic energy. The velocity is determined from the increase in velocity head in entering the contraction with appropriate allowance for the influence of friction and velocity of approach. The velocity of approach is computed from the cross-sectional area of approach channel by using a kind of successive approximations until the contracted-opening formula is satisfied. The determination, from flood marks, of the surface profile through the contraction is generally subject to considerable error and in some cases is impracticable. An accurate estimation of the friction loss, particularly when it is large, is likewise subject to considerable error. In northern California, opportunities to use this method in a satisfactory way are limited.

Only a few suitable contracted-opening sections were available for determining the discharge for inclusion in this report, and they were used only to verify the results obtained by other methods. The following formula[5/] was applied:

$$Q = k\ A\sqrt{2g\ (H + \frac{V^2}{2g} - h_f)}$$

Where Q = discharge in second-feet

k = coefficient of contraction

A = area, in square feet, of most contracted section

H = surface drop, in feet, at entrance to the contracted section

V = velocity of approach, in feet per second

h_f = head loss, in feet, due to friction.

5/ See Houk, I. E., Calculation of flow in open channels; Miami Conservancy Dist. Tech. Repts., pt. 4, p. 262, 1918.

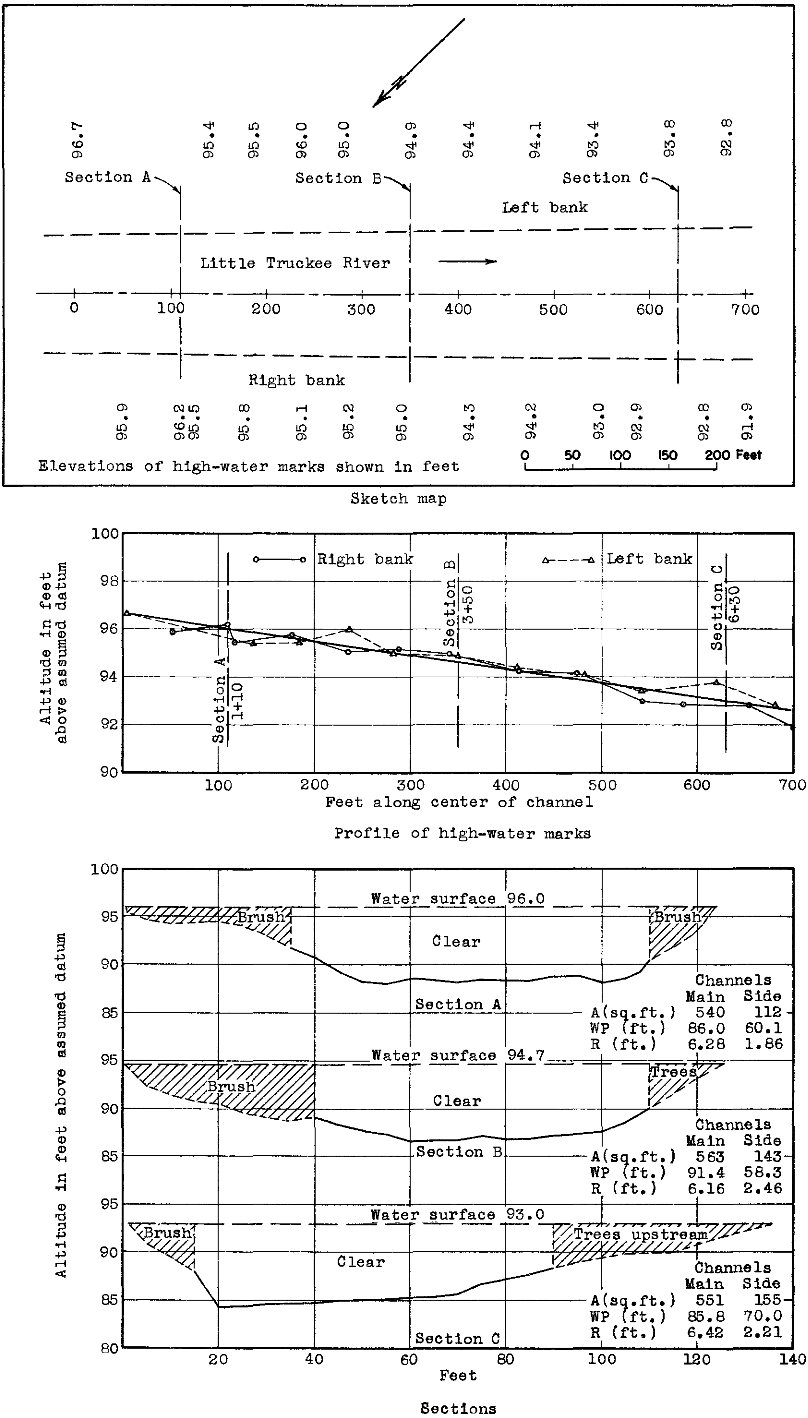


Figure 29.--Map, profile of high-water marks, and sections of the slope-area reach for Little Truckee River near Boca, Calif.

One of the principal purposes of this report is to make available information about the stages and discharges of streams during the flood of December 1937 in more detail than appears in the annual water-supply papers of the Geological Survey. Basic information is furnished for use in the study of the flood crests, the influence of crests from various tributaries, and the progress of flood peaks throughout a river system. This information is valuable for comparative studies of the characteristics of floods and for analysis that may lead to reliable forecasting of flood stages. The data are useful in planning flood protection and control works by reservoirs, levees, and channel improvements. The records should also be helpful in planning future bridge and highway construction as well as in the design and layout of hydraulic structures, other improvements, and urban development which may have a relation to stream channels or their flood plains.

Records published in this report are for streams on which floods occurred in December 1937, or that are situated adjacent to the margins of the storm-area and therefore serve to define the extent of the floods.

Explanation of data

The basic data systematically collected at river-measurement stations consist of stage, measurement of discharge, and general information useful in determining the daily flow. The records of stage are obtained by water-stage recorders, which give a continuous record of the fluctuations, or for a very few river-measurement stations, by direct readings on nonrecording gages. Peak stages during flood periods are obtained from flood marks at the station if they have not been previously observed or recorded. Measurements of discharge are generally made with a current meter according to methods outlined in standard text books on the measurement of river discharge. Typical river-measurement stations, equipped with water-stage recorder and measuring cable and car, are shown in plate 12, A, on page 12. At a few stations discharge is determined from venturi meters, calibrated gates, or output from hydroelectric plants.

In general the data presented for each river-measurement station in this report comprise a description of the station, a table of daily and monthly discharge throughout the 3-month period, November 1937 to January 1938, and a second table of stage and discharge at bi-hourly intervals from December 8 to 25, 1937. The presentation of the data has followed a uniform plan as far as practicable.

The description of the station contains in the first paragraph information about the location of the gage and its datum in reference to mean sea level, when known. A second paragraph gives the size of the drainage area upstream from the station. The next paragraph, about gage-height record, describes the method of determining the stage during the flood. In a fourth paragraph, on stage-discharge relation, there is information about the range to which the rating curve is defined by current-meter measurements and the method used to extend the rating curve to the peak of the flood. This is followed by a paragraph on maximum stages which lists the discharge, time, date, and gage height of the peak flow during the December flood. Similar data are included for the largest flood that occurred during the period of continuous record preceding December 1937, and also at some stations for floods antedating such period of record. The year indicating the beginning of the continuous record is the first year for which flood records are available. Therefore the initial year shown may be one year later than that indicated in the annual water-supply papers of the Geological Survey. For a few stations, where the December flood was followed by a flood peak in February or March 1938 which was higher than any previously recorded, the flood peak of 1938 has also been listed. The sixth and final paragraph, under the heading of "Remarks", furnishes data about storage or diversions upstream from the station, and other miscellaneous information.

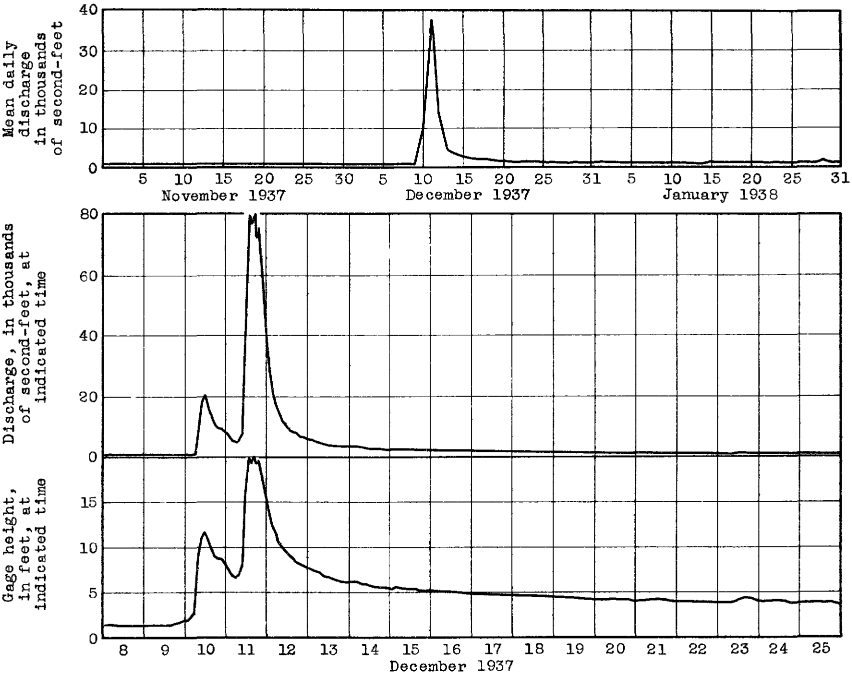
The table following each description shows mean daily discharge in second-feet, mean monthly discharge in second-feet, and monthly run-off in acre-feet for the period November 1, 1937, to January 31, 1938. This covers the flood period and sufficient time before and after it to show the relation of flood discharges to the prevalent discharges, and to give a general perspective of the December flood. For stations at which the records are materially affected by storage or diversions, the natural monthly run-off in acre-feet has been computed and added to the table when the information necessary for the correction was available.

The table of gage height and discharge at indicated times was designed to present the details of the rise and recession of the flood. It begins on December 8, one to three days before the start of the flood rise, and continues through December 25, when the flood had largely passed out of the river system into either the ocean or the lower broad reaches of the Central Valley. This table is accompanied by footnotes of supplemental records of stage and discharge when needed to define accurately subsidiary peaks or valleys in the hydrograph that would otherwise not be disclosed in the bi-hourly listing. The table is designed to give sufficient data so that complete stage or discharge graphs may be plotted. Some streams showed steady or slowly changing stages before and after the flood period and so it was not considered necessary to list in those records the bi-hourly data for the whole 18-day period. In reducing the number of items shown for each day, no data were omitted that would appreciably affect the accuracy when reproducing a graph of stage or discharge. Figure 30 gives two examples of stage and discharge plotted from typical computations of data; figure 31 shows graphs of mean daily discharge at selected river-measurement stations for the 3-month period; and discharge graphs for various streams are shown in figures 32 to 41.

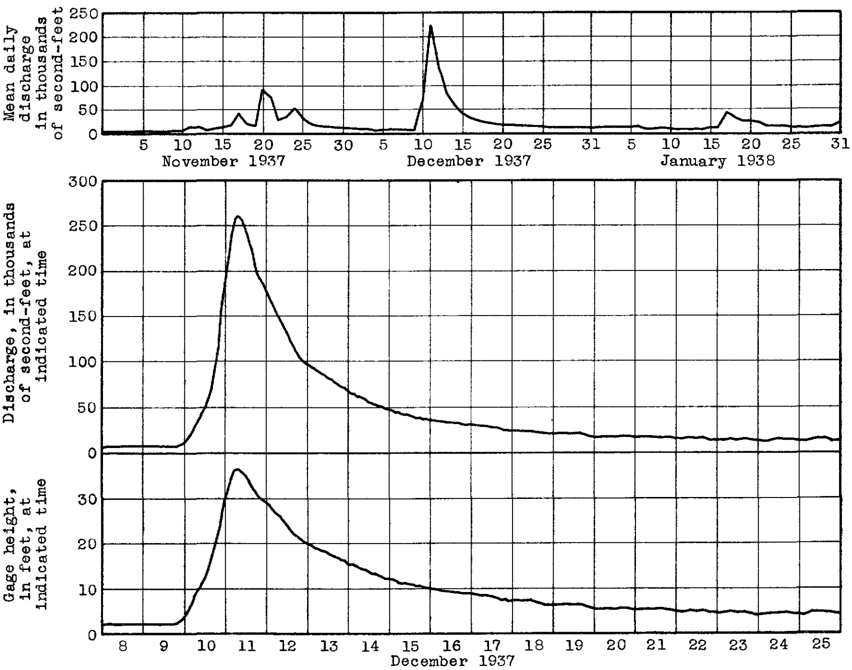
The stages at indicated times were obtained from the water-stage recorders so far as such records were available. At a very few stations the records consist of a small number of gage readings each day, and at several others the water-stage recorders failed to operate or were submerged by high water. At the latter stations the peak stages were determined from flood marks. Where the available information was sufficient, stage graphs were completed by comparison with other records on the same stream or on nearby streams. Stages at indicated times were then taken from the constructed graphs. At a small number of stations the data were so meager that no attempt was made to complete the flood record.

The discharges at indicated times were obtained from the gage heights by application of the rating table. At some river-measurement stations the flood caused a change in stage-discharge relation and two rating tables were used, one up to the peak and the other afterwards. It is assumed that generally the two rating curves and tables merge at the peak. For some stations, such as those with shifting sand channels, the stage-discharge relation changed continuously and a graduated correction was applied to the gage heights before computing the discharges. For these stations it is explained in the paragraph on stage-discharge relation that the shifting control method was used. Where the normal stage-discharge relation was affected by backwater from tributaries or other cause, proper correction was made in the computation of discharge.

For six stations in Owens River Basin the bi-hourly data, as furnished by the city of Los Angeles, show mean gage height and discharge for the two-hour period immediately preceding the hour listed, instead



Kings River at Piedra



Sacramento River near Red Bluff

Figure 30.--Typical graphs of stage and discharge at river-measurement stations, plotted from records in this report.

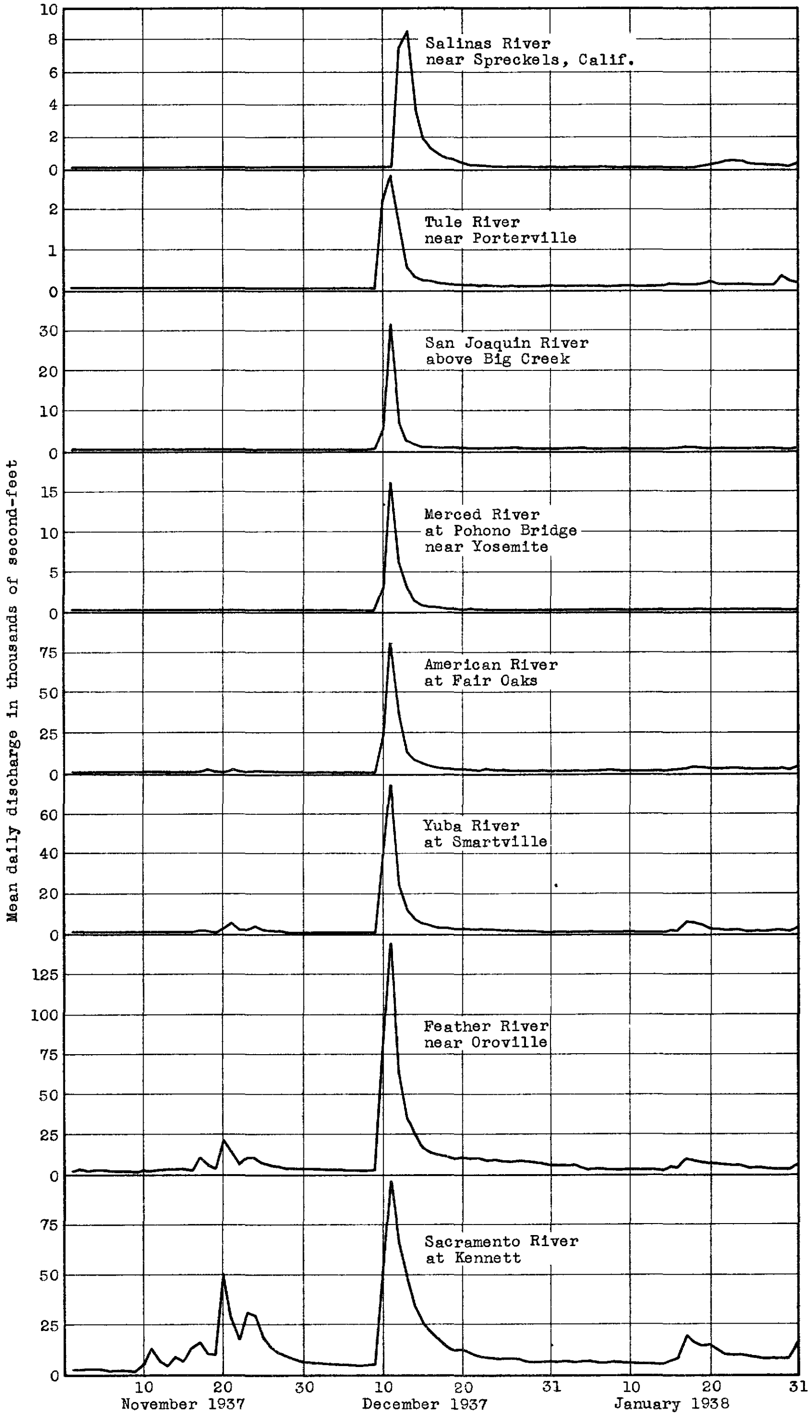


Figure 31.--Graphs of mean daily discharge at various river-measurement stations in northern California for the period November 1, 1937, to January 31, 1938.

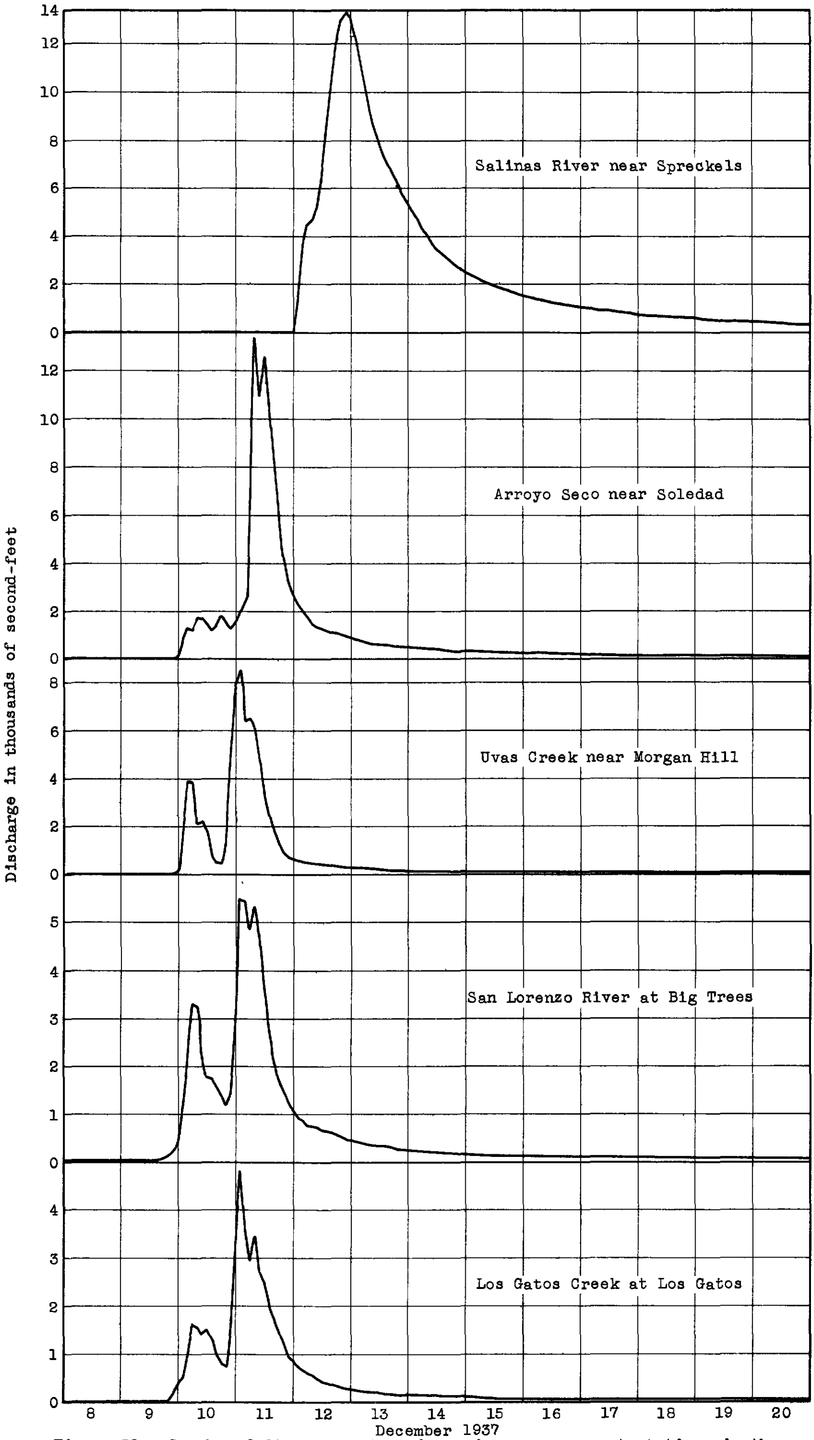


Figure 32.--Graphs of discharge at various river-measurement stations in the Salinas River Basin and on nearby coastal and San Francisco Bay streams, December 8-20, 1937.

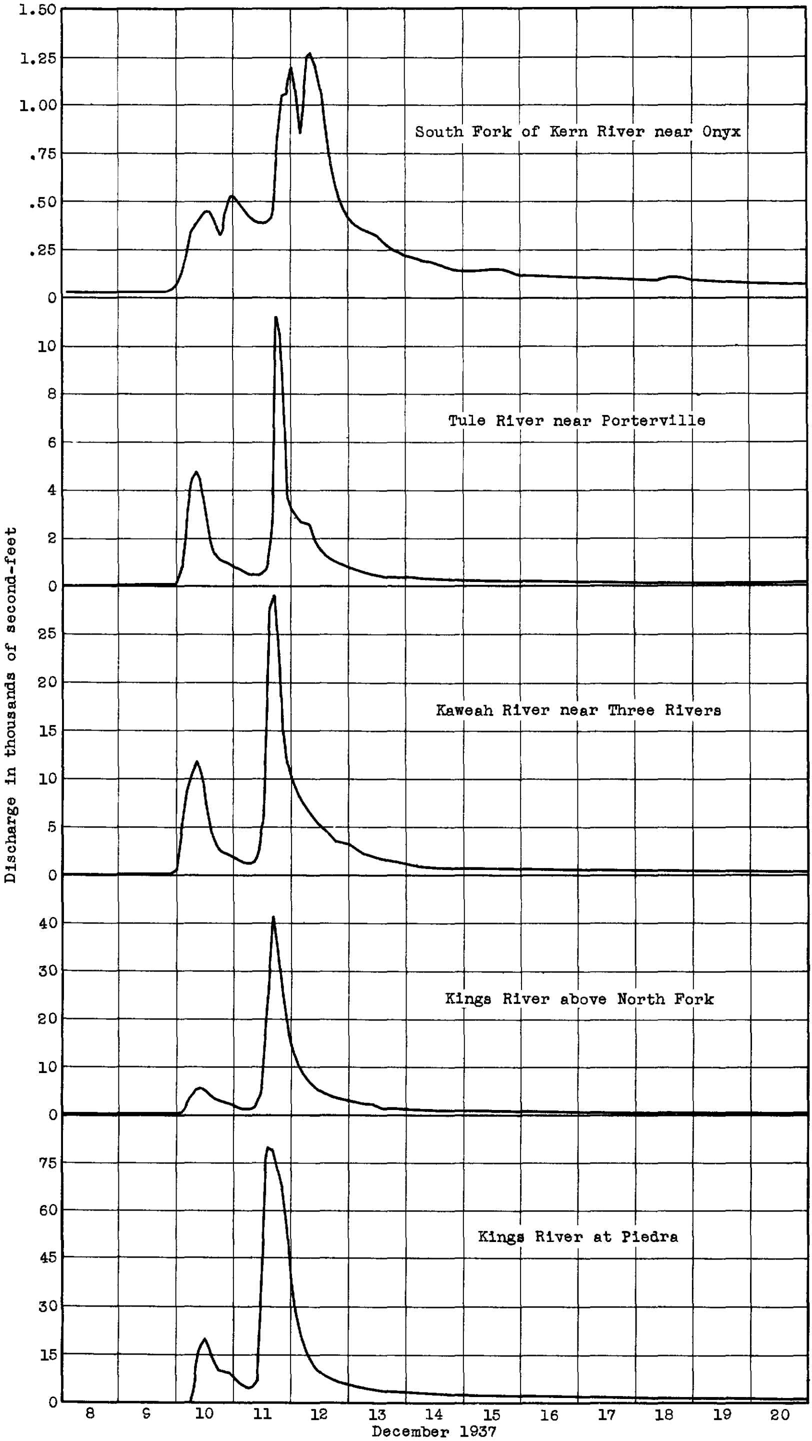


Figure 33.--Graphs of discharge at various river-measurement stations in Buena Vista and Tulare Lake Basins, December 8-20, 1937.

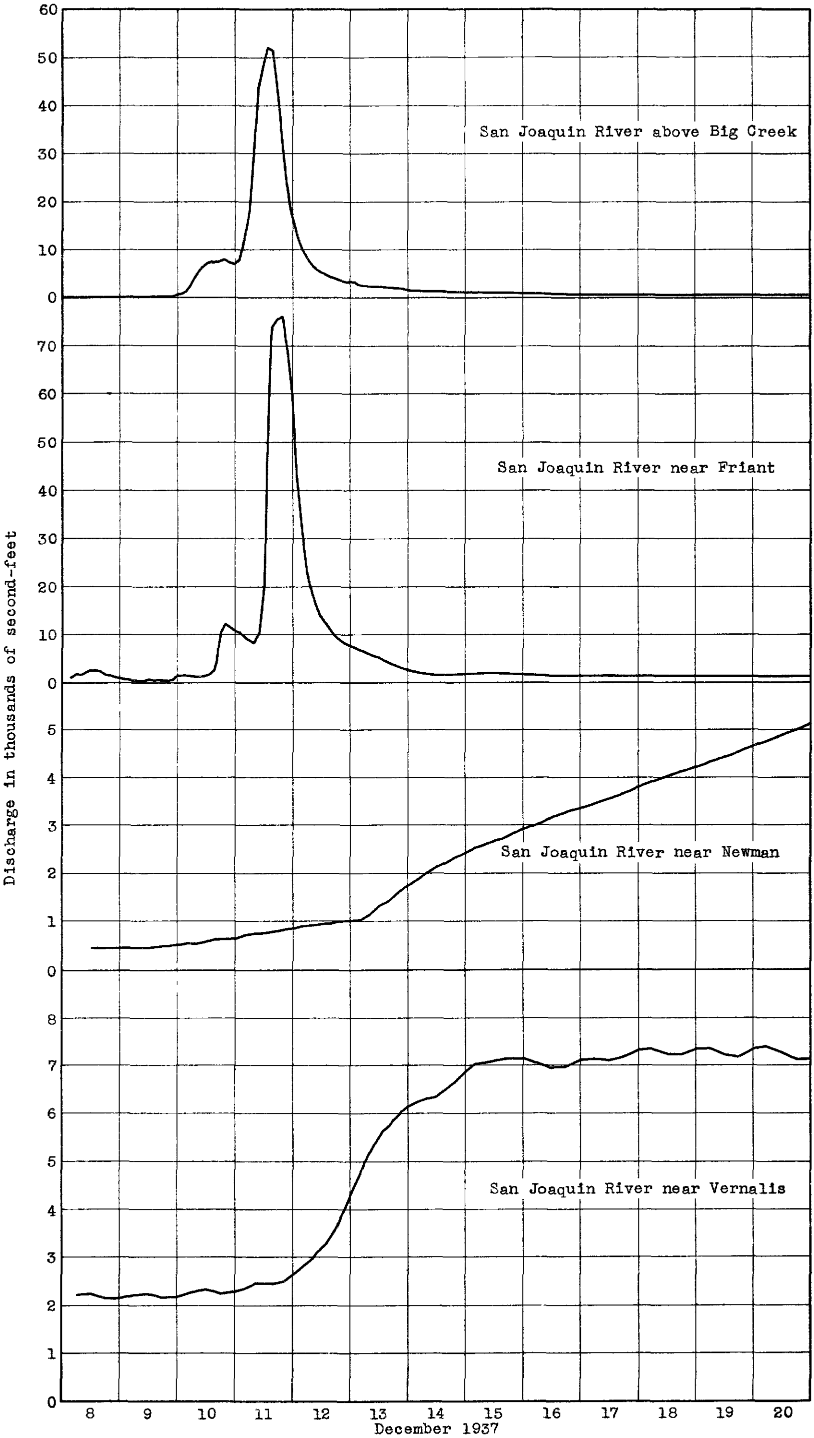


Figure 34.--Graphs of discharge at various river-measurement stations on the San Joaquin River, December 8-20, 1937.

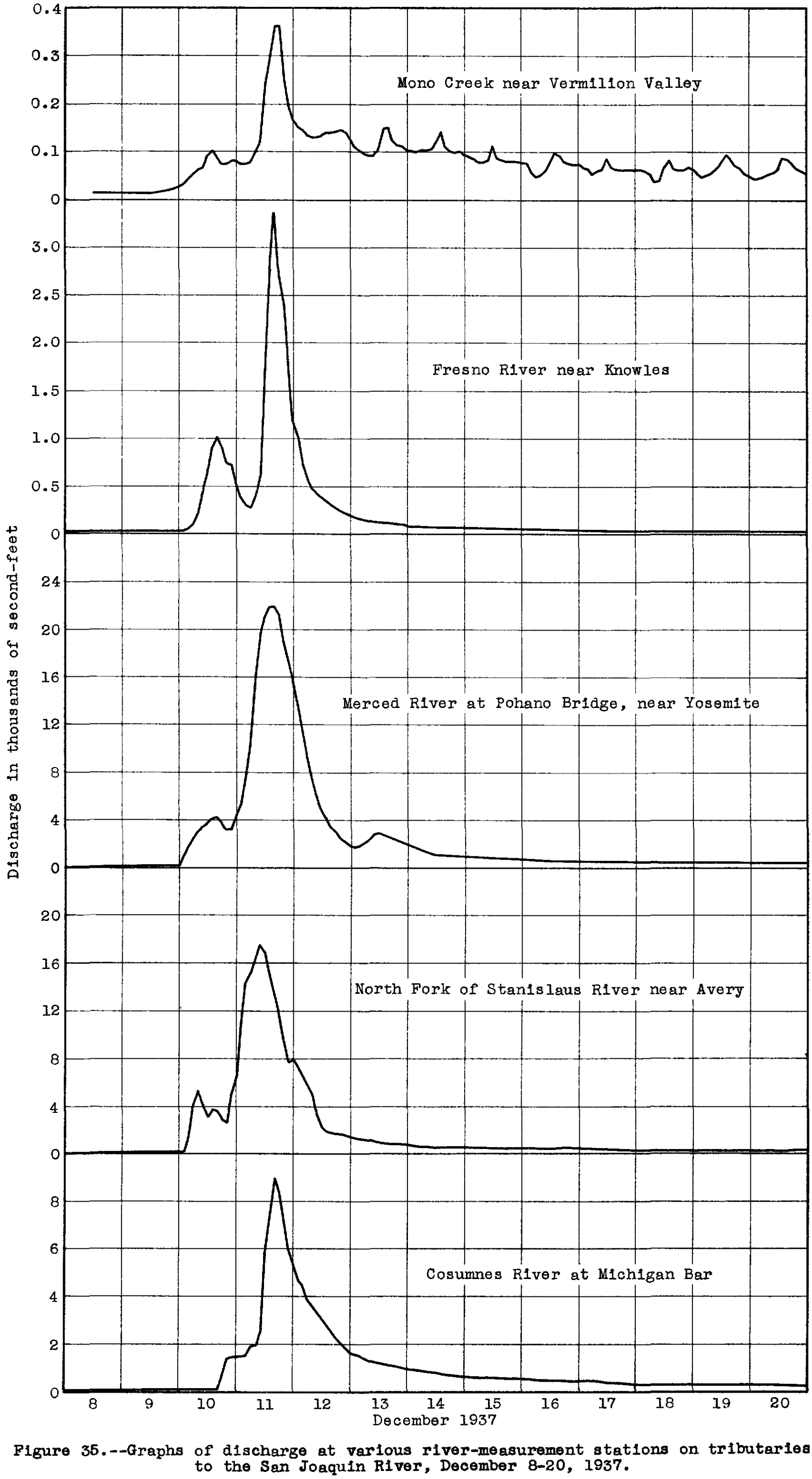


Figure 35.--Graphs of discharge at various river-measurement stations on tributaries to the San Joaquin River, December 8-20, 1937.

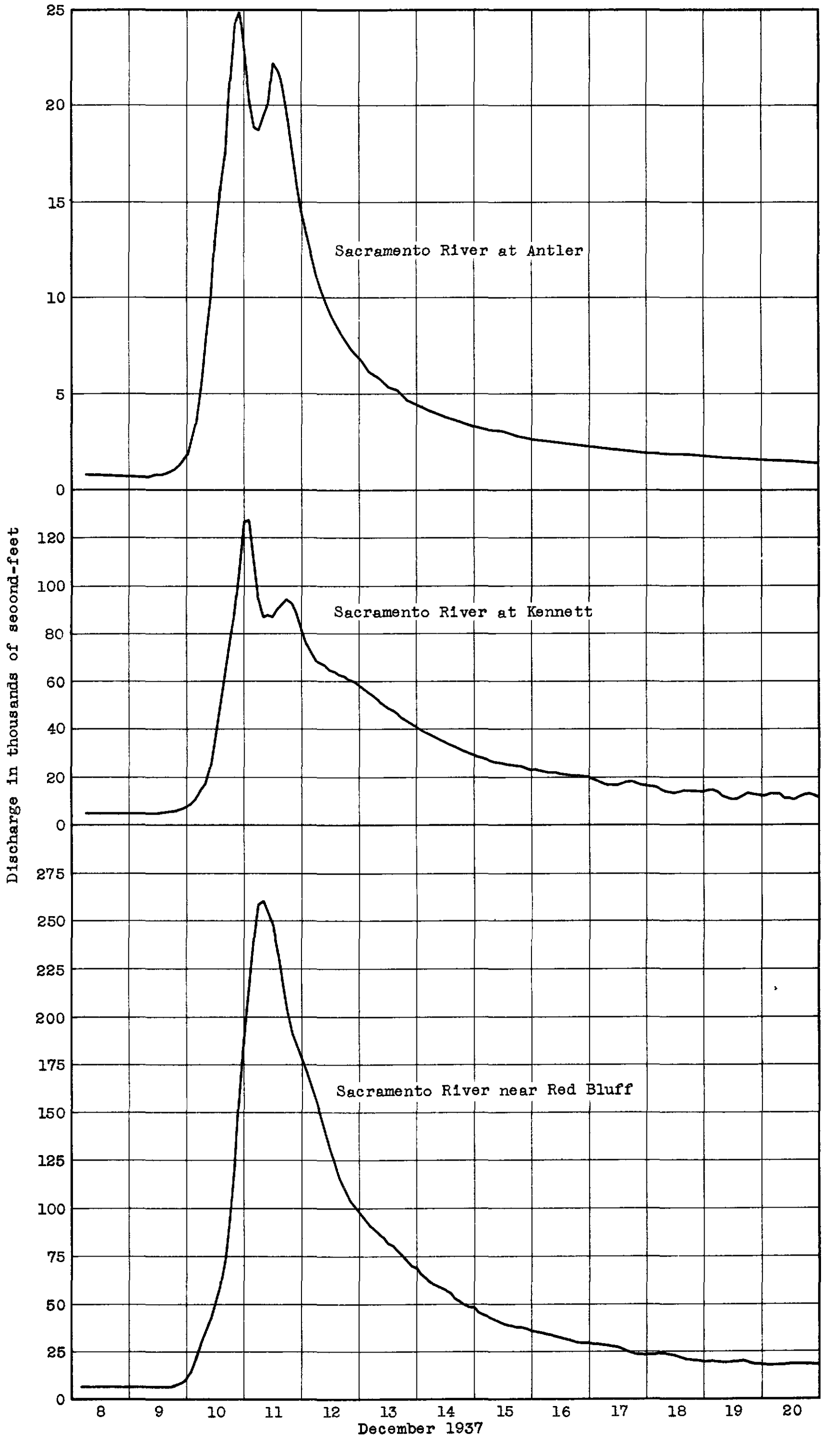


Figure 36.--Graphs of discharge at various river-measurement stations on the Sacramento River, December 8-20, 1937.

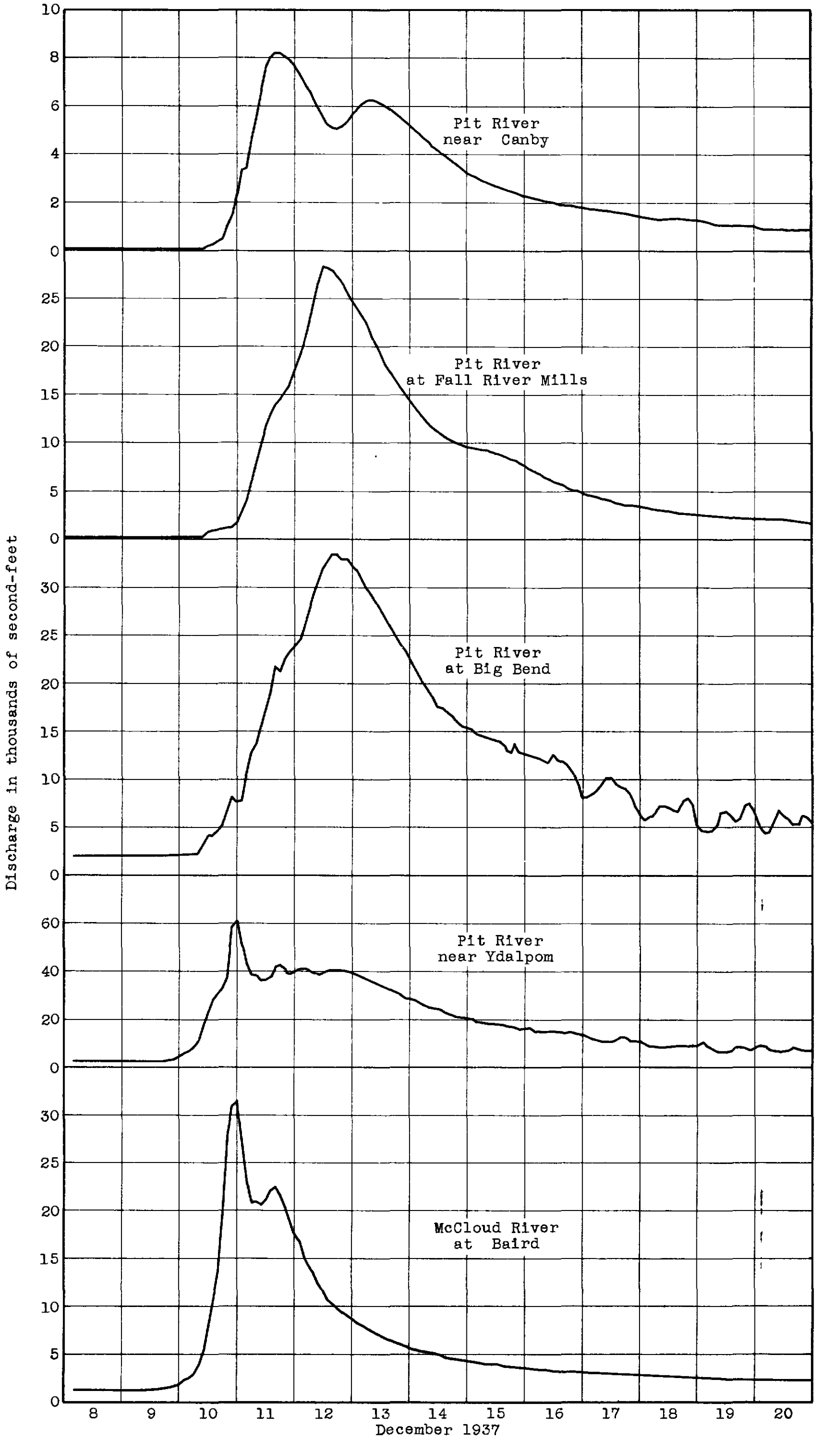


Figure 37.--Graphs of discharge at various river-measurement stations in the Pit River Basin, December 8-20, 1937.

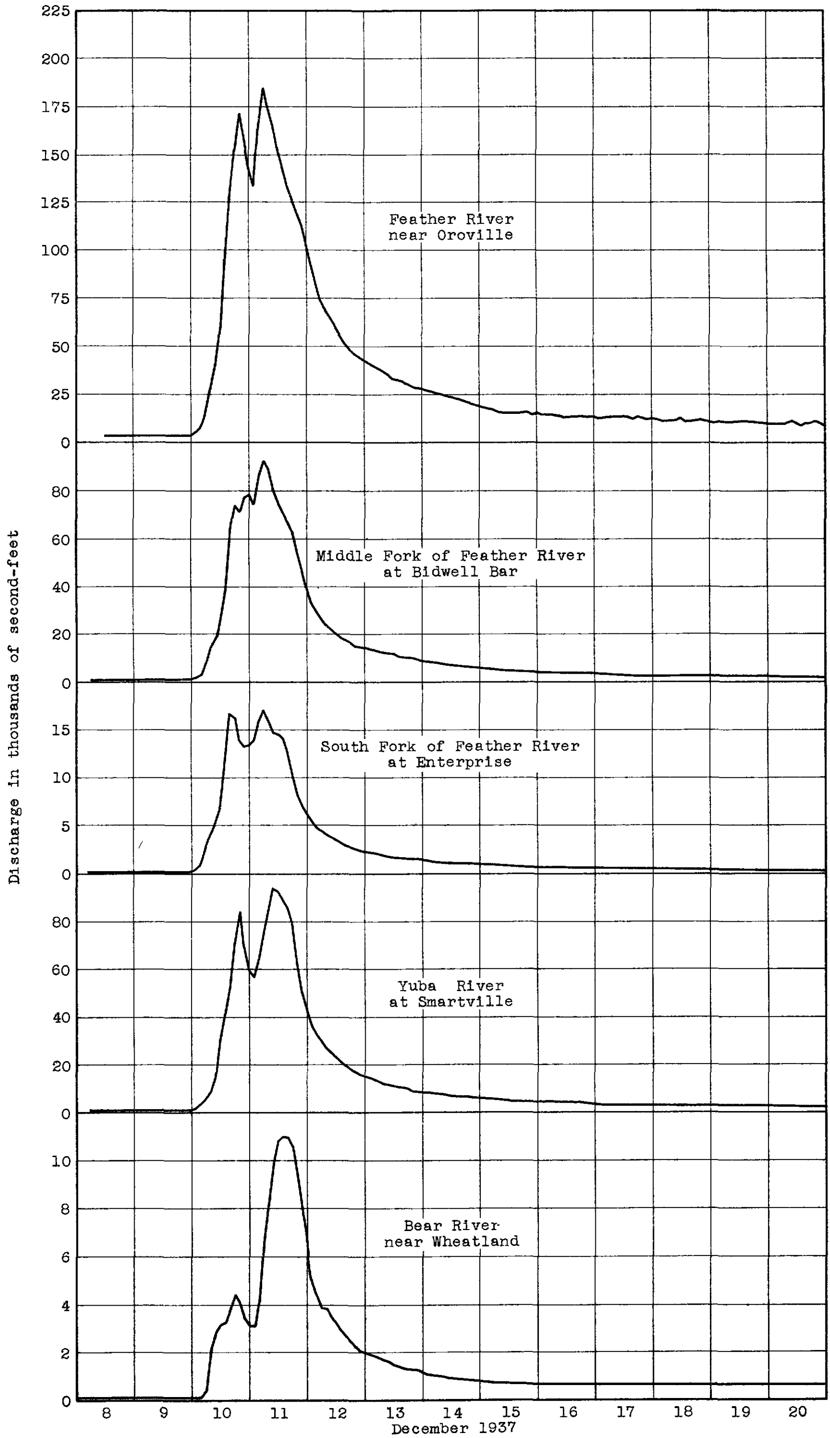


Figure 38.--Graphs of discharge at various river-measurement stations in the Feather River Basin, December 8-20, 1937.

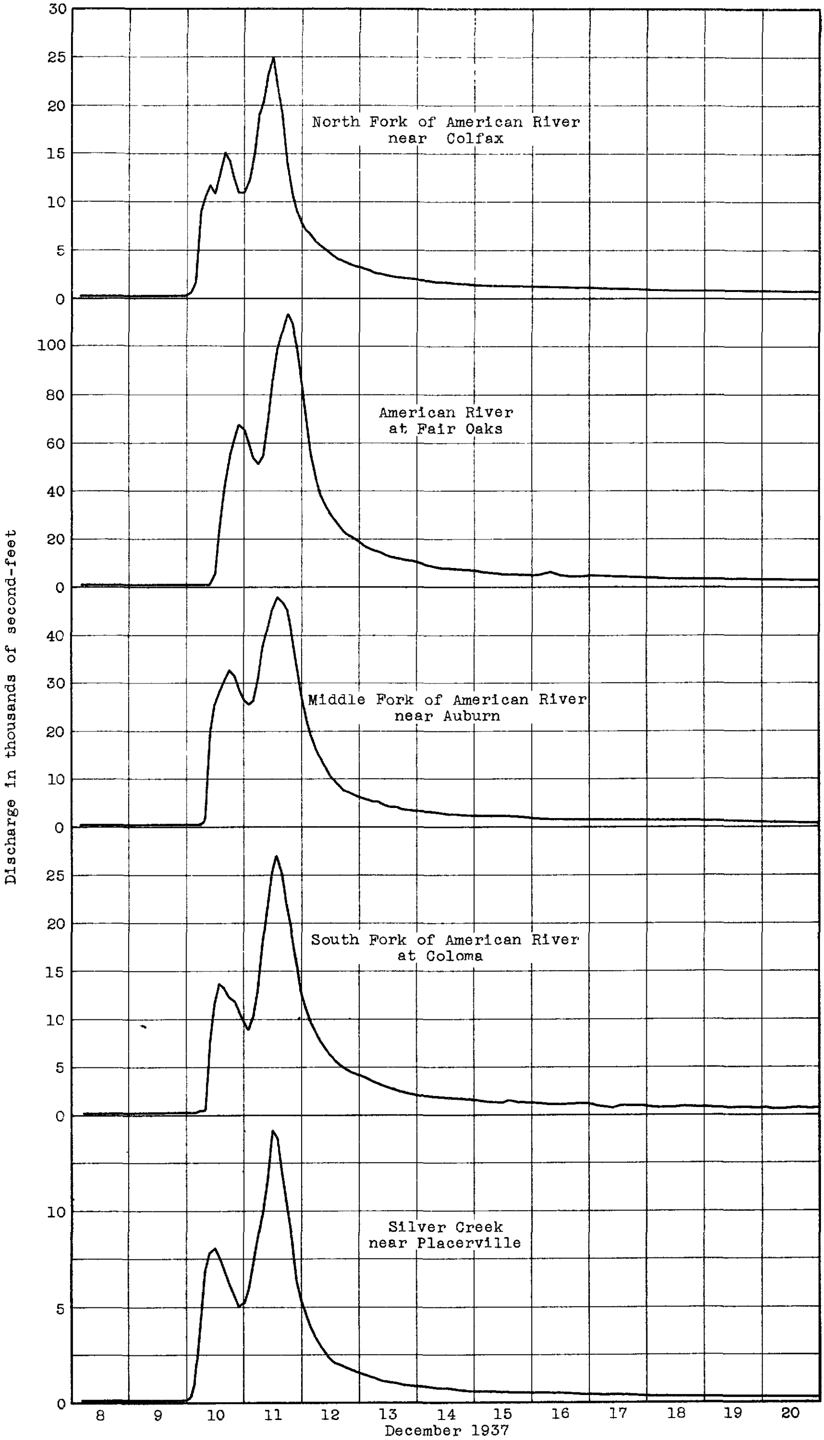


Figure 39.--Graphs of discharge at various river-measurement stations in the American River Basin, December 8-20, 1937.

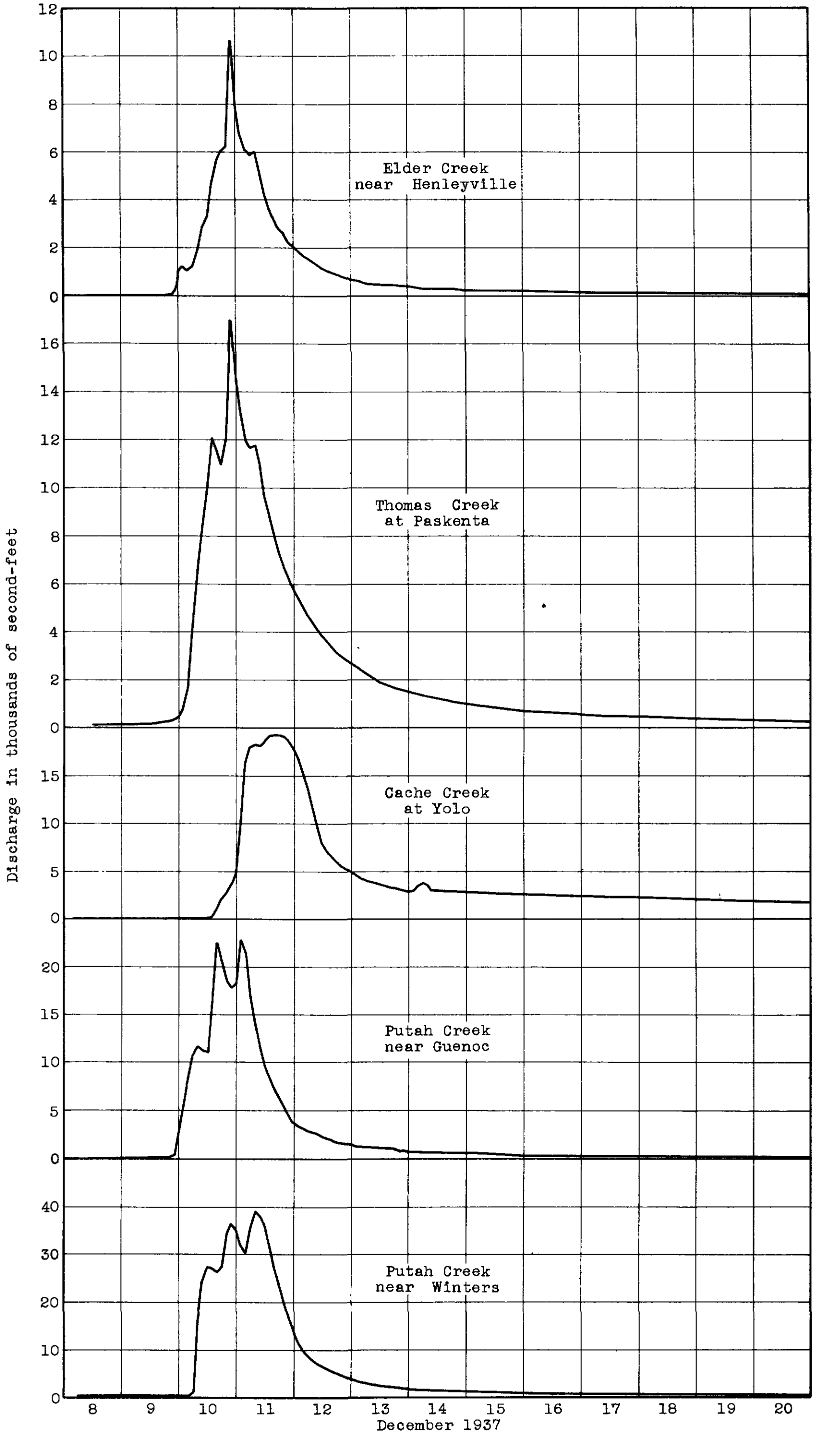


Figure 40.--Graphs of discharge at various river-measurement stations on tributaries to the Sacramento River from the west, December 8-20, 1937.

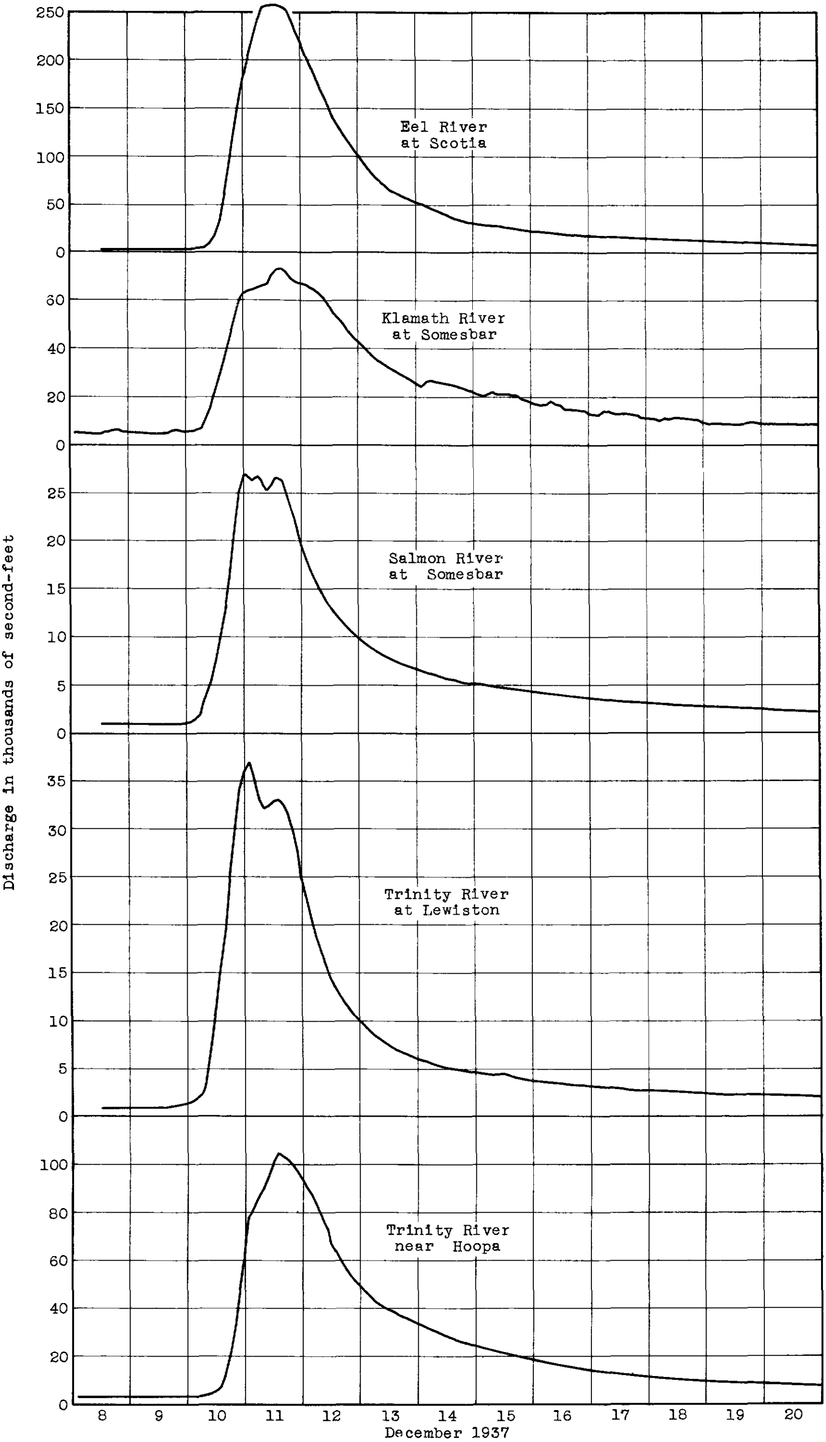


Figure 41.--Graphs of discharge at various river-measurement stations in the Eel and Klamath River Basins, December 8-20, 1937.

of gage height and discharge at the hour as for other records in the report.

The standardized forms for descriptions and tables have been modified to meet the various types of records for storage reservoirs, and for special combinations of records for reservoirs, diversions, and river records.

Where a water-stage recorder record was available for reservoirs, the stage at midnight of any day was taken directly from the original graph. But for many reservoirs a staff gage was read at a regular hour each day; for most of these a stage graph was constructed on the basis of the regular readings, peak stage, and any additional gage readings that may have been made during the flood period. From this constructed graph the daily midnight stage was obtained and used in computing contents for the day. As daily discharge records are based on the 24-hour period from midnight to midnight, reservoir records that are used for correction of river discharge records to ascertain natural flow should be based on contents at midnight.

The records are arranged in accordance with the regular plan used by the Geological Survey in its water-supply papers. The only exception is that, in the annual papers, records for the Great Basin in California are published in part 10 and those for the remainder of California in part 11 whereas in this special paper the Great Basin records are included, immediately following those for the North Pacific basins.

The maximum discharges at river-measurement stations for the December flood, the highest flood in previous years, and other related information is summarized in table 4 (pp. 288-298). The momentary peak discharges for December 1937 as determined for a number of miscellaneous streams and locations have also been included in table 4.

One of the items included in table 4 is discharge for the 24 consecutive hours of highest discharge. This item is listed under the heading of "maximum 24-hour average", and is to be distinguished from the maximum mean daily discharge, which is the largest mean discharge for a calendar day. The largest discharge for a calendar day may range from 50 percent to 100 percent of the maximum 24-hour discharge, and always includes the element of chance in the timing of the momentary peak. For any given basin the momentary peak may be influenced by such variable factors as soil moisture, temperature, frost, snow on the ground, vegetation, direction of storm movement, intensity and distribution of rainfall, and channel storage. The variable influence of many of these factors will be reduced or offset when maximum 24-hour discharge is used, and for some studies it therefore has definite advantages over the momentary peak discharge and maximum calendar day discharge. There are unexplored possibilities in the study of the maximum 24-hour discharge in comparison with the momentary peak and with the total and average run-off for a storm. These relations are discussed in the section on "Run-off characteristics".

Table 4 also gives maximum 24-hour discharge per square mile. This term may possibly be more valuable for analysis of flood concentration than any other expression of discharge. It is especially useful in comparing the effects of a given storm upon adjacent basins.

Reference should be made to the water-supply papers of the Geological Survey for other records of flow of the streams discussed in this report. The records in this report are based on all information available at the time of compilation. Changes in river channels due to floods may have affected the stage-discharge relation for some river-measurement stations at medium and low discharges, without such changes being fully defined at the time these records were compiled. Any revisions found necessary will be published in subsequent water-supply papers.

Miscellaneous flood stages on the San Joaquin River

Records of stage have been maintained by the California State Division of Water Resources in cooperation with the United States Bureau of Reclamation, and by Miller & Lux, Inc., at several locations on the San Joaquin River in addition to those for which discharge has been computed. The crest stages at these stations are summarized in table 10 in the section entitled "Flood crests".

The total flow of the San Joaquin River is in one channel and can be measured at the river-measurement stations near Friant and at Skaggs Bridge. Downstream from Skaggs Bridge the river, at flood stages, spreads over a wide area of overflow lands and sloughs, and it is not practicable to measure the total flow of the river again until the river-measurement station near Newman, below the mouth of the Merced River, is reached. Between Skaggs Bridge and Newman, records of stage only are available at several places. In order to show the relative stages at various places along the river, figure 42 has been prepared. It shows graphically the flattening effect of natural channel storage as the river spreads out downstream from Skaggs Bridge.

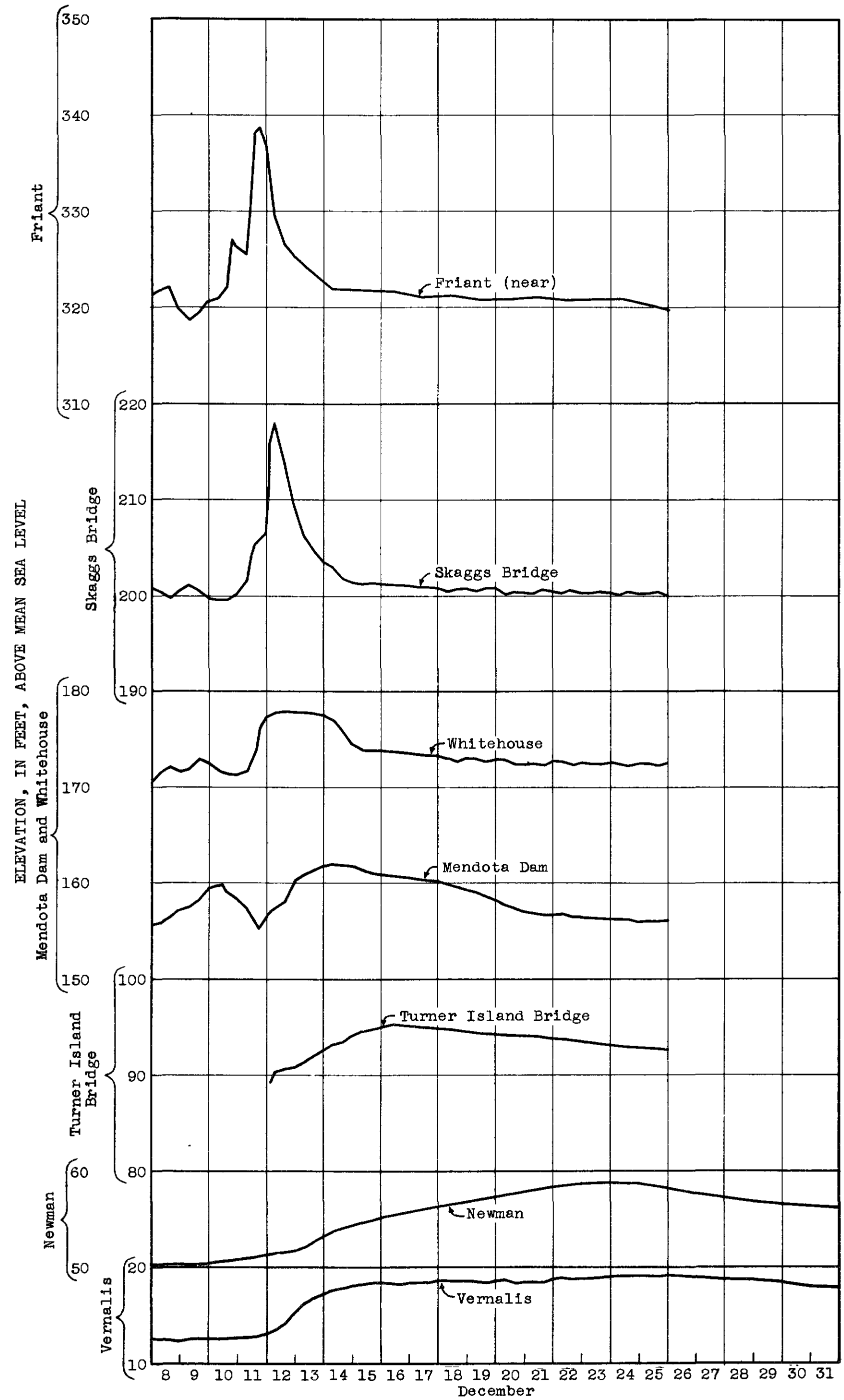


Figure 42.--Graphs of stage at various river-stage stations on the San Joaquin River, December 1937.

Salinas River near Santa Margarita, Calif.

Location.- Lat. 35°24'20", long. 120°34'05", in N½ sec. 15, T. 29 S., R. 13 E., 250 feet below Calf Canyon highway bridge, 250 feet above Morano Creek, and 2½ miles northeast of Santa Margarita, San Luis Obispo County. Altitude, about 960 feet above mean sea level.

Drainage area.- 150 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 1,000 second-feet; extended to peak stage on basis of shape of former rating curve defined to 3,000 second-feet. Shifting-control method used Nov. 1 to Dec. 11. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 3,550 second-feet 9:30 p.m. Dec. 11 (gage height, 10.24 feet).

1932-November 1937: Discharge, 7,260 second-feet Feb. 6, 1937 (gage height, 14.35 feet), from rating curve extended above 3,000 second-feet on basis of velocity-area study.

January-September 1938: Discharge, about 11,000 second-feet 10 a.m. Feb. 11 (gage height, 17.0 feet), from rating curve extended above 1,900 second-feet on basis of velocity-area study.

Remarks.- Flood run-off not affected by artificial storage or diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0.8	7	11	0.5	1,400	4.7	21	0.5	11	8
2	.1	1.2	7.5	12	.8	553	4.4	22	.5	10	7
3	.1	1.2	6.5	13	.3	62	4.4	23	.5	10	6.5
4	.1	1.2	6	14	.5	34	4.4	24	.8	9	6.5
5	.1	1.6	5.5	15	.5	24	11	25	.5	8.5	6.5
6	.2	1.6	5	16	.5	19	9	26	.5	9	6.5
7	.2	1.6	5	17	3.3	15	8	27	.5	8.5	6
8	.2	2.0	4.9	18	2.4	13	8	28	.8	8	8
9	.2	2.4	4.7	19	.8	12	10	29	.8	8	10
10	.2	4.2	4.7	20	.5	11	9.5	30	.8	7.5	9
								31		7	12
Mean monthly discharge, in second-feet									0.59	72.8	6.97
Run-off, in acre-feet									35	4,480	429

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	-	-	4.00	3.7	7.70	1,560	-	-
4	-	-	-	-	-	-	4.00	3.7	6.95	1,070	4.32	86
6	-	-	3.96	2.0	4.02	4.6	4.00	3.7	6.50	800	-	-
8	-	-	-	-	-	-	4.20	23	5.97	516	4.18	69
10	-	-	-	-	-	-	4.50	97	5.63	376	-	-
N	3.96	2.0	3.97	2.4	4.02	4.6	5.35	407	5.34	285	4.09	59
2	-	-	-	-	-	-	8.26	2,080	5.11	226	-	-
4	-	-	-	-	-	-	9.35	2,870	4.94	188	4.00	51
6	-	-	3.99	3.3	4.02	4.6	9.65	3,110	4.79	159	-	-
8	-	-	-	-	-	-	9.90	3,310	4.67	138	3.94	46
10	-	-	-	-	-	-	10.20	3,550	4.57	121	-	-
M	3.96	2.0	3.99	3.3	4.00	3.7	8.97	2,480	4.47	106	3.89	42
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.83	38	3.63	25	3.54	20	3.45	16	3.40	13	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.77	34	3.60	23	3.52	19	3.44	15	3.40	13	3.37	12
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.72	30	3.58	22	3.49	18	3.43	14	3.39	13	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.67	27	3.56	21	3.48	17	3.41	14	3.38	12	3.36	11
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.35	11	3.34	11	3.32	10	3.33	10	3.30	9	3.29	8.5
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.34	11	3.33	10	3.33	10	3.31	9.5	3.29	8.5	3.29	8.5

Supplemental records.- Dec. 11, 9:30 p.m., 10.24 ft., 3,550 sec.-ft.

Salinas River near Spreckels, Calif.

Location.- Lat. 36°37'50", long. 121°40'40", in El Toro grant, at bridge on Salinas-Monterey highway, half a mile above Toro Creek, 2 miles west of Spreckels, and 4 miles south of Salinas, Monterey County. Altitude, about 50 feet above mean sea level.

Drainage area.- 4,180 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements for entire range of stage. Subject to large shifts at high stages. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 13,400 second-feet 10 p.m. Dec. 12 (gage height, 16.77 feet).

1930-November 1937: Discharge, about 42,100 second-feet Dec. 29, 1931 (gage height, 20.40 feet), from rating curve extended above 26,000 second-feet on basis of slope-area determination of flood flow.

January-September 1938: Discharge, about 75,000 second-feet 6:30 a.m. Feb. 12 (gage height, 25.0 feet), from rating curve extended above 25,800 second-feet with aid of area-velocity study, verified by slope-area determination of flood flow.

1911-38: Maximum stage known, 26.6 feet, Mar. 7, 1911, from floodmark (discharge not determined).

Remarks.- Flood run-off not affected by artificial storage or diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.7	3.5	66	11	3.5	6	24	21	3.6	305	412
2	2.5	3.5	57	12	3.5	7,520	23	22	3.5	252	535
3	2.5	3.5	52	13	3.5	8,500	22	23	3.5	230	602
4	2.7	3.5	44	14	3.8	3,650	21	24	3.5	185	490
5	3.0	3.3	39	15	3.8	1,960	21	25	3.5	158	400
6	2.8	3.3	37	16	3.8	1,290	20	26	3.5	136	340
7	3.0	3.5	33	17	4.3	925	29	27	3.3	120	301
8	3.2	3.6	31	18	4.1	670	167	28	3.3	104	272
9	3.3	3.8	28	19	3.8	508	246	29	3.3	92	266
10	3.5	5.5	27	20	3.6	392	309	30	3.3	79	252
								31		72	340
Mean monthly discharge, in second-feet									3.37	877	178
Run-off, in acre-feet									201	53,930	10,920

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	-	-	-	-	7.45	1,570	16.15	12,300
4	-	-	3.69	3.6	3.77	5.5	3.76	5.5	10.20	3,650	15.62	11,400
6	-	-	-	-	-	-	-	-	11.02	4,520	15.02	10,300
8	-	-	3.67	3.3	3.76	5.5	3.80	6.5	11.23	4,780	14.41	9,300
10	-	-	-	-	-	-	-	-	11.60	5,220	13.90	8,450
N	3.69	3.6	3.68	3.5	3.76	5.5	3.80	6.5	12.59	6,530	13.52	7,880
2	-	-	-	-	-	-	-	-	13.85	8,380	13.17	7,360
4	-	-	3.72	4.3	3.75	5	3.78	6	15.11	10,500	12.88	6,930
6	-	-	-	-	-	-	-	-	15.98	12,000	12.59	6,530
8	-	-	3.73	4.6	3.74	4.9	3.77	5.5	16.55	13,000	12.32	6,150
10	-	-	-	-	-	-	-	-	16.77	13,400	12.04	5,760
M	3.69	3.6	3.74	4.9	3.73	4.6	3.76	5.5	16.62	13,100	11.75	5,400
	December 14		December 15		December 16		December 17		December 18		December 19	
2	11.44	5,030	-	-	-	-	-	-	-	-	-	-
4	11.14	4,670	8.63	2,320	7.24	1,450	6.44	1,020	5.86	742	5.45	558
6	10.85	4,340	-	-	-	-	-	-	-	-	-	-
8	10.58	4,040	8.32	2,100	7.08	1,360	6.32	960	5.79	710	5.39	530
10	10.31	3,760	-	-	-	-	-	-	-	-	-	-
N	10.06	3,510	8.06	1,940	6.92	1,280	6.22	910	5.71	674	5.33	504
2	9.89	3,350	-	-	-	-	-	-	-	-	-	-
4	9.69	3,170	7.84	1,800	6.80	1,210	6.12	860	5.65	648	5.29	486
6	9.50	3,000	-	-	-	-	-	-	-	-	-	-
8	9.32	2,860	7.63	1,680	6.67	1,140	6.01	810	5.58	616	5.24	464
10	9.13	2,700	-	-	-	-	-	-	-	-	-	-
M	8.96	2,570	7.45	1,570	6.54	1,070	5.95	782	5.52	589	5.18	438
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.14	421	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.10	404	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.06	388	4.85	305	4.70	252	4.63	230	4.49	185	4.40	158
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.02	372	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.98	356	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.96	348	4.79	283	4.66	239	4.57	210	4.45	173	4.35	144

San Antonio River at Pleyto, Calif.

Location.- Lat. 35°51'55", long. 120°59'30", in Pleyto grant, at highway bridge at old town site of Pleyto, Monterey County, 1.1 miles below Copperhead Creek and 15 miles west of Bradley. Altitude, about 720 feet above mean sea level.
Drainage area.- 282 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 6,100 second-feet 4:30 p.m. Dec. 11 (gage height, 4.30 feet).
1930-November 1937: Discharge, 7,460 second-feet Dec. 28, 1931 (gage height, 4.55 feet), from rating curve extended above 7,300 second-feet.
January-September 1938: Discharge, 10,700 second-feet 7 a.m. Feb. 11 (gage height, 5.10 feet), from rating curve extended above 7,300 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	58	11	0	3,140	34	21	0	130	136
2	0	0	54	12	0	1,660	33	22	0	128	112
3	0	0	50	13	0	639	30	23	0	128	99
4	0	0	47	14	0	429	30	24	0	125	89
5	0	0	43	15	0	326	36	25	0	114	81
6	0	0	43	16	0	243	40	26	0	109	72
7	0	0	43	17	0	204	45	27	0	96	66
8	0	0	40	18	0	194	117	28	0	85	87
9	0	0	38	19	0	187	117	29	0	78	96
10	0	299	36	20	0	147	156	30	0	72	114
								31		66	189
Mean monthly discharge, in second-feet									0	277	72.0
Run-off, in acre-feet									0	17,060	4,430

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	2.40	850	3.58	2,990	2.32	786
4					-	0	2.32	786	3.41	2,480	2.28	755
6					-	0	2.49	931	3.26	2,100	2.22	710
8					-	0	2.88	1,380	3.12	1,790	2.19	688
10					-	0	2.93	1,460	2.98	1,540	2.15	660
N					-	0	3.19	1,930	2.88	1,380	2.11	632
2					1.80	440	4.15	5,350	2.75	1,210	2.07	606
4					2.08	612	4.23	5,750	2.67	1,120	2.04	586
6					2.23	718	4.21	5,650	2.58	1,020	2.01	566
8					2.21	702	4.18	5,500	2.51	950	1.98	548
10					2.28	755	4.18	5,500	2.43	877	1.95	530
M					2.40	850	3.87	4,080	2.37	826	1.91	506
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.86	476	1.63	350	1.44	266	1.30	215	-	-	-	-
6	-	-	-	-	-	-	-	-	1.26	201	1.22	187
8	1.81	446	1.61	340	1.40	250	1.27	204	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.77	424	1.57	322	1.36	236	1.27	204	1.24	194	1.23	190
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.73	402	1.53	304	1.33	226	1.26	201	-	-	-	-
6	-	-	-	-	-	-	-	-	1.23	190	1.22	187
8	1.70	385	1.51	294	1.32	222	1.26	201	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.67	370	1.47	278	1.31	218	1.26	201	1.22	187	1.19	177
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.17	171	-	-	-	-	-	-	-	-	-	-
6	-	-	1.04	133	1.02	128	1.02	128	1.01	125	0.98	117
8	1.13	159	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.07	142	1.03	130	1.02	128	1.03	130	1.01	125	.97	114
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.03	130	-	-	-	-	-	-	-	-	-	-
6	-	-	1.04	133	1.01	125	1.03	130	1.00	122	.97	114
8	1.04	133	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.04	133	1.02	128	1.02	128	1.02	128	.99	119	.96	112

Supplemental records.- Dec. 10, 12:30 p.m., no flow; 1 p.m., 1.50 ft., 290 sec.-ft. Dec. 11, 4:30 p.m., 4.30 ft., 6,100 sec.-ft.

Arroyo Seco near Soledad, Calif.

Location.- Lat. 36°16'05", long. 121°19'55", in NW¼ sec. 21, T. 19 S., R. 6 E., half a mile downstream from Vaquero Creek and 11 miles south of Soledad, Monterey County. Altitude, about 370 feet above mean sea level.

Drainage area.- 238 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 7,000 second-feet; extended to peak stage by A√d method, verified by area-velocity study. Shifting-control method used Nov. 1 to Jan. 5. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, about 13,400 second-feet 8 a.m. Dec. 11 (gage height, 15.1 feet).

1901-November 1937: Discharge observed, about 22,000 second-feet Feb. 21, 1917, and Nov. 25, 1926 (gage height, 16.5 feet, from nonrecording gage), from rating curve extended above 7,500 second-feet.

January-September 1938: Discharge, about 16,000 second-feet Feb. 11 (gage height, 16.5 feet), from rating curve extended above 7,000 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	3.3	12	67	11	6	6,880	57	21	12	117	170
2	3.3	12	70	12	10	1,470	56	22	12	108	144
3	3.6	12	77	13	12	669	55	23	12	105	128
4	4.3	12	70	14	10	426	55	24	12	99	114
5	4.3	13	67	15	11	299	72	25	12	91	105
6	4.6	13	65	16	12	233	75	26	12	86	97
7	5	13	63	17	11	190	137	27	12	81	91
8	5	13	62	18	15	166	142	28	12	79	97
9	5.5	17	60	19	16	144	162	29	12	76	220
10	5.5	1,380	59	20	13	132	238	30	12	74	181
								31		71	1,700
Mean monthly discharge, in second-feet									9.35	422	153
Run-off, in acre-feet									556	25,970	9,430

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	5.13	865	6.90	2,040	7.21	2,360	-	-
4	-	-	2.25	13	5.91	1,300	7.48	2,550	6.85	2,040	4.95	805
6	-	-	-	-	5.84	1,250	11.00	6,850	6.50	1,760	-	-
8	-	-	2.26	14	6.58	1,780	15.10	13,400	6.16	1,510	4.76	716
10	-	-	-	-	6.52	1,740	13.78	11,000	5.95	1,370	-	-
N	2.25	13	2.26	14	6.19	1,490	14.63	12,600	5.82	1,290	4.62	656
2	-	-	-	-	5.85	1,260	13.34	10,400	5.70	1,220	-	-
4	-	-	2.31	18	6.10	1,430	11.93	8,240	5.60	1,160	4.50	608
6	-	-	-	-	6.61	1,810	10.38	5,980	5.50	1,100	-	-
8	-	-	2.37	23	6.31	1,580	9.15	4,380	5.38	1,030	4.38	562
10	-	-	-	-	5.95	1,320	8.20	3,300	5.25	958	-	-
M	2.25	13	2.50	33	6.33	1,590	7.66	2,760	5.15	905	4.26	518
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.16	482	-	-	-	-	-	-	-	-	-	-
6	-	-	3.67	317	3.41	241	3.23	195	-	-	-	-
8	4.07	450	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.00	426	3.61	299	3.38	233	3.21	190	3.10	166	2.98	142
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.92	399	-	-	-	-	-	-	-	-	-	-
6	-	-	3.54	278	3.34	222	3.18	184	-	-	-	-
8	3.83	368	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.75	342	3.47	258	3.29	210	3.13	173	3.04	154	2.95	137
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.91	130	2.85	117	2.80	108	2.79	107	2.74	99	2.69	91
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.88	124	2.83	114	2.78	105	2.77	104	2.71	94	2.68	90

Uvas Creek near Morgan Hill, Calif.

Location.- Lat. 37°04'00", long. 121°41'30", in Las Uvas grant, 500 feet above Uvas Dam, 0.6 mile below Eastman Canyon, and 4.8 miles southwest of Morgan Hill, Santa Clara County. Altitude, about 390 feet above mean sea level.
Drainage area.- 30.2 square miles.
Gage-height record.- Water-stage recorder graph except for period 11 p.m. Dec. 10 to 3 p.m. Dec. 14, when stage graph was based on peak stage obtained from floodmark in well, partial recorder graph, two staff gage readings Dec. 11, and shape of stage graphs for nearby streams.
Stage-discharge relation.- Defined by current-meter measurements below 2,750 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 8,630 second-feet 1 a.m. Dec. 11 (gage height, 13.7 feet, from floodmark in well).
1930-November 1937: Discharge, 4,340 second-feet Dec. 27, 1931 (gage height, 10.82 feet), from rating curve extended above 2,100 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.5	1.2	18	11	2.0	3,950	14	21	4.9	37	27
2	.5	1.2	20	12	2.0	438	14	22	2.6	33	24
3	.5	1.2	18	13	1.1	194	14	23	1.9	31	21
4	.5	1.2	17	14	1.9	121	14	24	1.7	29	19
5	.5	1.2	17	15	2.2	93	14	25	1.7	27	18
6	.5	1.2	16	16	1.4	74	14	26	1.5	25	17
7	.7	1.2	15	17	4.1	61	28	27	1.4	23	17
8	.6	1.4	15	18	2.4	52	21	28	1.2	22	62
9	.6	12	15	19	1.5	46	47	29	1.2	21	66
10	.7	2,390	14	20	1.2	40	37	30	1.2	20	44
								31		19	523
Mean monthly discharge, in second-feet									1.49	251	39.4
Run-off, in acre-feet									89	15,410	2,420

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.31	1.5	7.23	1,840	13.62	8,530	-	-	-	-
4	-	-	2.31	1.5	9.78	3,930	11.90	6,370	4.98	559	4.00	234
6	-	-	2.31	1.5	9.74	3,890	12.00	6,490	-	-	-	-
8	-	-	2.31	1.5	7.75	2,160	11.65	6,070	4.78	487	3.90	208
10	-	-	2.32	1.7	7.83	2,220	10.00	4,160	-	-	-	-
N	2.29	1.2	2.33	1.9	7.07	1,740	9.35	3,500	4.60	424	3.82	189
2	-	-	2.35	2.2	5.50	845	8.22	2,510	-	-	-	-
4	-	-	2.40	3.3	4.84	541	7.45	1,920	4.45	373	3.75	173
6	-	-	2.45	4.6	4.74	499	6.69	1,380	-	-	-	-
8	-	-	2.55	8	6.47	1,380	5.95	965	4.30	324	3.67	156
10	-	-	2.86	26	11.00	5,290	5.50	760	-	-	-	-
M	2.31	1.5	3.98	232	13.19	7,970	5.25	661	4.17	283	3.60	142
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.52	127	3.36	98	3.23	77	3.14	64	3.07	54	3.01	47
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.48	119	3.34	95	3.21	74	3.12	61	3.05	52	3.00	46
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.46	116	3.30	88	3.18	69	3.10	58	3.04	51	2.98	44
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.43	110	3.26	82	3.16	66	3.09	57	3.03	50	2.97	43
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.96	42	2.93	38	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.95	40	2.92	37	2.88	33	2.86	31	2.83	29	2.81	27
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.93	38	2.91	36	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.93	38	2.90	35	2.88	33	2.84	30	2.82	28	2.80	26

Supplemental records.- Dec. 9, 11 p.m., 3.32 ft., 86 sec.-ft. Dec. 10, 3:30 a.m., 10.30 ft., 4,490 sec.-ft.; 5 a.m., 9.23 ft., 3,380 sec.-ft.; 9 a.m., 6.90 ft., 1,640 sec.-ft.; 10:30 a.m., 8.50 ft., 2,730 sec.-ft,; 5:30 p.m., 4.60 ft., 442 sec.-ft. Dec. 11, 1 a.m., 13.70 ft., 8,630 sec.-ft.; 5 a.m., 11.50 ft., 5,890 sec.-ft.; 7 a.m., 12.75 ft., 7,400 sec.-ft.

San Lorenzo River at Big Trees, Calif.

Location.- Lat. 37°01'40", long. 122°03'30", in Canada Del Rincon grant, Santa Cruz County, half a mile south of Big Trees and 4 miles north of Santa Cruz. Altitude, about 150 feet above mean sea level.
Drainage area.- 110 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 2,600 second-feet; extended to peak stage. Rating curve changed Dec. 10.
Maxima.- December 1937: Discharge, 5,590 second-feet 3 a.m. Dec. 11 (gage height, 11.74 feet).
1936-November 1937: Discharge, 8,700 second-feet Feb. 14, 1937 (gage height, 14.1 feet, from floodmarks), from rating curve extended above 2,600 second-feet.
January-September 1938: Discharge, 12,000 second-feet 3 p.m. Jan. 31 (gage height, 16.8 feet from drift marks outside of well; 16.3 feet inside of well, affected by drawdown), from rating curve extended above 2,800 second-feet by averaging discharges obtained from extensions by area-velocity and $A\sqrt{d}$ methods.
Remarks.- Flood run-off not affected by artificial storage; very slightly affected by many small diversions for domestic use above station.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	19	24	52	11	59	3,380	46	21	47	74	113
2	18	23	72	12	38	688	46	22	36	72	96
3	17	23	61	13	25	352	45	23	33	71	87
4	17	23	55	14	45	213	45	24	34	66	79
5	17	23	53	15	32	152	49	25	30	64	74
6	17	23	52	16	26	124	51	26	28	62	71
7	16	23	51	17	57	107	189	27	26	59	69
8	17	23	49	18	39	94	99	28	25	57	104
9	18	81	48	19	29	85	197	29	24	56	140
10	19	1,880	47	20	32	80	164	30	24	55	116
								31		54	4,850
Mean monthly discharge, in second-feet									28.8	262	235
Run-off, in acre-feet									1,710	16,090	14,420

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.13	22	1.14	23	5.88	1,150	11.63	5,510	5.28	921	3.75	435
4	-	-	1.13	22	8.03	2,260	11.60	5,480	5.09	853	3.67	414
6	1.13	22	1.13	22	9.43	3,290	11.06	4,890	4.83	764	3.60	396
8	-	-	1.14	23	9.38	3,240	11.45	5,320	4.79	751	3.52	375
10	-	-	1.21	26	7.83	2,140	10.92	4,730	4.72	727	3.45	357
N	1.13	22	1.35	32	7.24	1,790	9.71	3,540	4.60	688	3.39	341
2	-	-	1.57	45	7.14	1,740	8.66	2,680	4.52	662	3.34	328
4	-	-	1.76	57	6.78	1,560	7.79	2,110	4.39	621	3.28	313
6	1.14	23	2.06	81	6.35	1,360	7.00	1,670	4.24	574	3.23	297
8	-	-	2.59	140	6.00	1,200	6.49	1,430	4.08	526	3.17	279
10	-	-	3.46	289	6.56	1,460	6.04	1,220	3.95	490	3.13	267
M	1.14	23	4.14	440	9.00	2,940	5.63	1,050	3.84	459	3.09	255
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.05	245	-	-	-	-	-	-	-	-	-	-
4	3.02	237	2.69	164	2.48	132	2.33	110	-	-	-	-
6	2.99	230	-	-	-	-	-	-	-	-	-	-
8	2.95	220	2.65	158	2.45	128	2.32	109	-	-	-	-
10	2.92	213	-	-	-	-	-	-	-	-	-	-
N	2.89	206	2.61	152	2.43	124	2.31	107	2.19	94	2.10	85
2	2.87	201	-	-	-	-	-	-	-	-	-	-
4	2.85	197	2.58	147	2.40	120	2.28	104	-	-	-	-
6	2.83	193	-	-	-	-	-	-	-	-	-	-
8	2.93	215	2.54	141	2.38	117	2.26	102	-	-	-	-
10	2.78	182	-	-	-	-	-	-	-	-	-	-
M	2.73	172	2.51	136	2.36	114	2.24	99	2.14	89	2.07	82
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	1.95	72	1.89	67	1.86	65
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.04	80	1.98	74	1.95	72	1.95	72	1.88	66	1.85	64
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	1.93	70	1.87	66	1.85	64
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.00	76	1.96	73	1.95	72	1.90	68	1.86	65	1.84	63

Supplemental records.- Dec. 10, 7 a.m., 9.79 ft., 3,610 sec.-ft.; 11 a.m., 7.31 ft., 1,830 sec.-ft. Dec. 11, 3 a.m., 11.74 ft., 5,590 sec.-ft. Dec. 14, 7 p.m., 2.99 ft., 230 sec.-ft.

San Francisquito Creek at Stanford University, Calif.

Location.- Lat. 37°25'20", long. 122°11'25", in Rinconada del Arroyo de San Francisquito grant, at golf course, three-quarters of a mile below junction with Los Trancos Creek, and 1.2 miles west of Stanford University post office, Santa Clara County. Altitude, about 120 feet above mean sea level.
Drainage area.- 37.7 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements for range of stage of high water in December.
Maxima.- December 1937: Discharge, 940 second-feet 11 a.m. Dec. 11 (gage height, 5.00 feet).
1931-November 1937: Discharge, 2,620 second-feet Feb. 4, 1937 (gage height, 9.15 feet), from rating curve extended above 1,800 second-feet on basis of area-velocity study.
Remarks.- Flood run-off materially affected by artificial storage in Searsville Lake (capacity, 952 acre-feet). Los Trancos and Lagunita canals divert above station. Monthly summaries adjusted for storage and diversion. Most of basic data furnished by Stanford University.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0.6	0.3	11	0.1	588	0.3	21	0.3	0.2	4.3
2	0	.6	.3	12	.1	136	.3	22	.3	.2	.3
3	0	.6	.3	13	.1	19	.3	23	.6	.3	.3
4	0	.6	.3	14	.2	2.7	.3	24	.6	.3	.2
5	0	.6	.3	15	.2	.7	.4	25	.6	.2	.2
6	0	.6	.3	16	.2	.3	.4	26	.6	.2	.2
7	0	.6	.4	17	.3	.3	3.8	27	.6	.2	.2
8	0	.6	.4	18	.3	.3	.4	28	.6	.2	6.5
9	0	.7	.3	19	.2	.2	107	29	.6	.3	31
10	0	147	.3	20	.4	.2	34	30	.6	.3	13
								31		.3	544
Mean monthly discharge, in second-feet (observed)............									0.25	29.1	24.2
Mean monthly discharge, in second-feet (adjusted)............									0.69	42.6	34.2
Run-off, in acre-feet (adjusted)............................									41	2,620	2,100

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.26	0.6	0.39	1.7	4.12	628	2.58	215	1.12	29
4	0.26	0.6	.26	.6	.32	1.0	3.91	561	2.47	194	1.11	29
6	-	-	.27	.6	.27	.6	4.59	786	2.34	170	1.10	28
8	.26	.6	.27	.6	2.39	179	4.73	837	2.49	197	1.09	27
10	-	-	.27	.6	2.42	185	4.50	754	2.43	186	1.08	27
N	.26	.6	.27	.6	3.38	406	4.83	875	2.28	160	.97	21
2	-	-	.27	.6	2.74	247	4.00	590	2.16	141	.96	20
4	.26	.6	.27	.6	2.24	153	3.57	460	2.02	120	.82	14
6	-	-	.28	.7	1.92	107	3.50	440	1.35	47	.63	6.5
8	.26	.6	.31	.9	1.93	108	3.45	426	1.24	38	.59	5.5
10	-	-	.35	1.3	2.30	163	3.13	340	1.18	34	.57	4.9
M	.26	.6	.35	1.3	3.16	348	2.73	245	1.14	31	.54	4.2
	December 14		December 15		December 16		December 17		December 18		December 19	
2	0.52	3.8	-	-	-	-	-	-	-	-	-	-
4	.50	3.3	0.33	1.1	-	-	-	-	-	-	-	-
6	.49	3.2	-	-	0.21	0.4	0.19	0.3	0.19	0.3	-	-
8	.48	3.0	.30	.8	-	-	-	-	-	-	-	-
10	.47	2.8	-	-	-	-	-	-	-	-	-	-
N	.46	2.7	.27	.6	.20	.3	.19	.3	.19	.3	0.18	0.2
2	.45	2.6	-	-	-	-	-	-	-	-	-	-
4	.47	2.8	.25	.6	-	-	-	-	-	-	-	-
6	.47	2.8	-	-	.20	.3	.19	.3	.19	.3	-	-
8	.44	2.4	.23	.4	-	-	-	-	-	-	-	-
10	.39	1.7	-	-	-	-	-	-	-	-	-	-
M	.36	1.4	.22	.4	.20	.3	.19	.3	.18	.2	.18	.2
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	0.18	0.2	0.21	0.4	0.19	0.3	0.18	0.2
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	0.18	0.2	0.18	0.2	.18	.2	.21	.4	.19	.3	.18	.2
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	.19	.3	.20	.3	.19	.3	.18	.2
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	.18	.2	.18	.2	.20	.3	.19	.3	.18	.2	.18	.2

Supplemental records.- Dec. 10, 6:30 a.m., 0.27 ft., 0.6 sec.-ft.; 7 a.m., 2.41 ft., 183 sec.-ft.; 9 a.m., 2.28 ft., 160 sec.-ft.; 7:30 p.m., 1.81 ft., 93 sec.-ft. Dec. 11, 11 a.m., 5.00 ft., 940 sec.-ft.

San Francisquito Creek at Palo Alto, Calif.

Location.- Lat. 37°27'10", long. 122°08'20", in Rancho de las Pulgas grant, 175 feet above Newell Avenue bridge in Palo Alto, Santa Clara County, and about 2 miles above mouth. Altitude, about 5 feet above mean sea level.
Drainage area.- 38.6 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements for range of stage of high water in December.
Maxima.- December 1937: Discharge, 840 second-feet 1:30 p.m. Dec. 11 (gage height, 8.90 feet).
1931-November 1937: Discharge, 2,550 second-feet Feb. 4, 1937 (gage height, 16.05 feet), from rating curve extended above 1,900 second-feet.
Remarks.- Flood run-off materially affected by artificial storage in Searsville Lake (capacity, 952 acre-feet). Los Trancos and Lagunita canals divert above station. Monthly summaries adjusted for storage and diversions. Most of basic data furnished by Stanford University.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0	11	0	544	0	21	0	0	5
2	0	0	0	12	0	156	0	22	0	0	.1
3	0	0	0	13	0	21	0	23	0	0	0
4	0	0	0	14	0	1.9	0	24	0	0	0
5	0	0	0	15	0	.2	0	25	0	0	0
6	0	0	0	16	0	0	0	26	0	0	0
7	0	0	0	17	0	0	0	27	0	0	0
8	0	0	0	18	0	0	0	28	0	0	.3
9	0	.0	0	19	0	0	99	29	0	0	27
10	0	116	0	20	0	0	40	30	0	0	13
								31			510
Mean monthly discharge, in second-feet (observed)............									0	27.1	22.4
Mean monthly discharge, in second-feet (adjusted)............									0.44	40.5	32.4
Run-off, in acre-feet (adjusted)...........................									26	2,490	1,990

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	5.47	334	4.68	247	1.86	30
4					-	0	7.05	535	4.38	216	1.80	28
6					-	0	7.13	547	4.18	196	1.76	26
8					0.46	1.7	8.13	707	3.97	175	1.75	26
10					3.96	174	8.52	772	4.20	198	1.74	26
N					4.20	198	8.30	734	4.05	183	1.71	24
2					5.94	389	8.65	795	3.78	157	1.62	21
4					4.60	238	7.16	552	3.53	135	1.48	17
6					3.75	154	6.41	445	3.27	114	1.45	16
8					3.20	108	6.32	434	2.28	50	1.22	11
10					3.20	108	6.12	410	2.08	40	.97	6.5
M					3.88	166	5.43	329	1.97	35	.82	4.7
	December 14		December 15		December 16		December 17		December 18		December 19	
2	0.75	3.8	0.27	0.7								
4	.69	3.3	.24	.6								
6	.64	2.9	.19	.4								
8	.57	2.4	.15	.2								
10	.51	2.0	-	0								
N	.45	1.6	-	0								
2	.41	1.4	-	0								
4	.38	1.2	-	0								
6	.33	1.0	-	0								
8	.28	.7	-	0								
10	.23	.5	-	0								
M	.19	.4	-	0								

Supplemental records.- Dec. 10, 9:30 a.m., 0.22 ft., 0.5 sec.-ft.; 9 p.m., 3.07 ft., 98 sec.-ft. Dec. 11, 11:30 a.m., 7.90 ft., 670 sec.-ft.; 1:30 p.m., 8.90 ft., 840 sec.-ft.

Los Trancos Creek at Stanford University, Calif.

Location.- Lat. 37°24'35", long. 122°11'35", in El Corte de Madera grant, about 800 feet above mouth and 1.6 miles southwest of Stanford University post office, Santa Clara County. Altitude, about 160 feet above mean sea level.
Drainage area.- 7.5 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 310 second-feet.
Maxima.- December 1937: Discharge, 120 second-feet 8:30 a.m. Dec. 11 (gage height, 1.94 feet).
1931-November 1937: Discharge, 399 second-feet Mar. 21, 1937 (gage height, 3.13 feet), from rating curve extended above 310 second-feet.
Remarks.- Flood run-off not affected by artificial storage. Los Trancos canal diverts above station. Monthly summaries adjusted for diversion. Most of basic data furnished by Stanford University.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0	11	0	37	0	21	0	0	0.3
2	0	0	0	12	0	3.8	0	22	0	0	.2
3	0	0	0	13	0	.7	0	23	0	0	.2
4	0	0	0	14	0	.3	0	24	0	0	.1
5	0	0	0	15	0	.1	0	25	0	0	.1
6	0	0	0	16	0	.1	.1	26	0	0	.1
7	0	0	0	17	0	0	.1	27	0	0	.1
8	0	0	0	18	0	0	.1	28	0	0	.7
9	0	0	0	19	0	0	5	29	0	0	1.6
10	0	2.2	0	20	0	0	.6	30	0	0	.4
								31		0	109
Mean monthly discharge, in second-feet (observed)............									0	1.43	3.83
Mean monthly discharge, in second-feet (adjusted)............									0.11	4.18	6.59
Run-off, in acre-feet (adjusted)............................									6.3	257	405

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					0.19	0	1.58	60	0.46	2.7	-	-
4					.33	1.4	1.50	51	.44	2.5	0.27	0.9
6					.30	1.1	1.57	59	.48	3.0	-	-
8					.23	.7	1.90	112	.86	10	.24	.7
10					.19	0	1.48	49	.79	8	-	-
N					.16	0	1.24	30	.63	5	.22	.6
2					.15	0	.90	12	.53	3.6	-	-
4					.14	0	.65	5.5	.47	2.8	.20	.5
6					.13	0	1.00	16	.43	2.4	-	-
8					.15	0	.99	16	.39	1.9	.18	0
10					.20	.5	.65	5.5	.36	1.6	-	-
M					1.42	44	.50	3.2	.33	1.4	.17	0

Supplemental records.- Dec. 10, 11 p.m., 0.7 ft., 6.5 sec.-ft. Dec. 11, 8:30 a.m., 1.94 ft., 120 sec.-ft. Dec. 12, 9 a.m., 0.97 ft., 15 sec.-ft.

Stevens Creek near Cupertino, Calif.

Location.- Lat. 37°18'20", long. 122°04'25", in SW¼ sec. 22, T. 7 S., R. 2 W., at county highway bridge, a quarter of a mile below Stevens Creek Dam and about 4 miles west of Cupertino, Santa Clara County. Altitude, about 385 feet above mean sea level.
Drainage area.- 18.1 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge (regulated), 55 second-feet 12:30 a.m. Dec. 11 (gage height, 2.17 feet).
1930-November 1937: Discharge (unregulated), 709 second-feet Dec. 27, 1931 (gage height, 4.57 feet), from rating curve extended above 670 second-feet.
Remarks.- Flood run-off completely regulated by artificial storage in Stevens Creek Reservoir (capacity, about 4,000 acre-feet). Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.5	1.4	4.9	11	0.7	24	4.4	21	2.2	14	14
2	.5	1.6	7	12	1.4	22	4.1	22	2.2	12	12
3	.5	1.7	9.5	13	1.8	18	4.1	23	2.2	9.5	9.5
4	.5	1.7	7	14	1.8	21	4.1	24	2.2	8.5	9
5	.5	1.7	5.5	15	1.8	21	4.1	25	2.2	8.5	8.5
6	.5	1.7	4.6	16	1.8	22	4.6	26	2.0	8.5	7.5
7	.5	1.1	4.4	17	2.0	20	6	27	2.0	8.5	7
8	.5	.4	4.4	18	2.2	25	8	28	2.0	8.5	9.5
9	.5	1.1	4.6	19	2.2	23	11	29	2.0	7	20
10	.5	17	4.6	20	2.2	24	14	30	1.7	4.6	26
								31		4.6	28
Mean monthly discharge, in second-feet (observed)...........									1.45	11.1	8.77
Mean monthly discharge, in second-feet (adjusted)...........									1.45	22.9	9.50
Run-off, in acre-feet (adjusted)...........................									86	1,410	584

Guadalupe Creek at Guadalupe, Calif.

Location.- Lat. 37°13'05", long. 121°54'35", in SW¼ sec. 19, T. 8 S., R. 1 E., half a mile northwest of Guadalupe, Santa Clara County, and 3.4 miles upstream from junction with Alamitos Creek. Altitude, about 325 feet above mean sea level.
Drainage area.- 12.6 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 550 second-feet; extended to peak stage. Shifting-control method used for period Nov. 1 to Dec. 9.
Maxima.- December 1937: Discharge, 826 second-feet 1 a.m. Dec. 11 (gage height, 3.41 feet).

1930-November 1937: Discharge (unregulated), 1,160 second-feet Dec. 28, 1931 (gage height, 4.05 feet, inside of well; about 4.5 feet, outside of well, determined from drawdown relation observed at lower stages), from rating curve extended above 850 second-feet.

Remarks.- Flood run-off affected by artificial storage in Guadalupe Reservoir (capacity, 3,500 acre feet); unaffected by diversions. Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.6	0.6	4.5	11	3.7	248	5	21	1.7	5.5	6.5
2	.5	.6	5	12	1.3	49	5.5	22	1.3	5.5	6
3	.5	.6	5	13	.9	22	5.5	23	1.1	5.5	6
4	.4	.6	5.5	14	1.2	15	5.5	24	1.1	5.5	6.5
5	.5	.7	5.5	15	1.0	11	5.5	25	.9	5	6.5
6	.5	.6	5.5	16	.8	8	5.5	26	.8	5	6
7	.5	.6	5.5	17	.8	6.5	5.5	27	.7	4.8	6
8	.5	.6	5.5	18	1.7	5.5	5.5	28	.8	4.8	13
9	.5	1.7	5.5	19	1.0	4.8	11	29	.7	4.5	15
10	.6	117	5	20	.9	5	7.5	30	.7	4.5	11
								31		4.5	137
Mean monthly discharge, in second-feet (observed)...........									0.94	17.9	10.8
Mean monthly discharge, in second-feet (adjusted)...........									.94	52.4	13.6
Run-off, in acre-feet (adjusted)...........................									56	3,220	838

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.50	0.6	1.10	26	2.83	505	1.50	70	-	-
4	-	-	.50	.6	1.30	45	2.36	294	1.45	64	1.10	26
6	-	-	.50	.6	1.41	58	2.47	338	1.40	57	-	-
8	-	-	.50	.6	1.36	52	2.38	302	1.44	62	1.07	24
10	-	-	.51	.7	1.64	92	2.36	294	1.36	52	-	-
N	0.50	0.6	.52	.7	1.72	106	2.25	252	1.31	46	1.05	22
2	-	-	.54	.9	1.53	74	2.05	185	1.28	43	-	-
4	-	-	.55	1.0	1.43	61	1.93	152	1.25	40	1.02	20
6	-	-	.57	1.2	1.37	53	1.82	126	1.22	37	-	-
8	-	-	.63	2.0	1.89	142	1.73	108	1.20	35	1.00	19
10	-	-	.84	7.5	2.75	465	1.64	92	1.17	32	-	-
M	.50	.6	.88	9	3.16	683	1.55	78	1.15	30	.98	18
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	0.95	16	0.86	12	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	.93	15	.84	11	0.78	8	0.74	6.5	0.71	5.5	0.69	4.8
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	.90	14	.82	9.5	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	.88	13	-	8.5	.75	6.5	.73	6	.70	5	.68	4.5
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	0.68	4.5	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	.67	4.2	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	.67	4.2	0.71	5.5	0.71	5.5	0.72	5.5	0.71	5.5	0.70	5
2	-	-	-	-	-	-	-	-	-	-	-	-
4	.72	5.5	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	.72	5.5	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	.72	5.5	.71	5.5	.72	5.5	.71	5.5	.70	5	.70	5

Supplemental records.- Dec. 10, 5 a.m., 1.50 ft., 70 sec.-ft.; 11 a.m., 1.76 ft., 114 sec.-ft.; 7 p.m., 1.45 ft., 64 sec.-ft.; 9 p.m., 2.18 ft., 228 sec.-ft.; 11 p.m., 2.70 ft., 440 sec.-ft. Dec. 11, 1 a.m., 3.41 ft., 826 sec.-ft.

Guadalupe Creek at San Jose, Calif.

Location.- Lat. 37°20', long. 121°54', 100 feet downstream from junction with Los Gatos Creek, in city of San Jose, Santa Clara County. Altitude, about 80 feet above mean sea level.

Drainage area.- 131 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 3,500 second-feet; extended to peak stage. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 6,660 second-feet 4 a.m. Dec. 11 (gage height, 9.80 feet).

1930-November 1937: Discharge (unregulated), 6,700 second-feet Dec. 27, 1931 (gage height, 11.12 feet), from rating curve extended above 3,200 second-feet on basis of area-velocity study.

Remarks.- Flood run-off affected by artificial storage in 4 reservoirs on Los Gatos, Alamitos, and Guadalupe Creeks (total capacity, about 15,600 acre-feet). Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0	11	0	3,940	0	21	0	0	0
2	0	0	0	12	0	887	0	22	0	0	0
3	0	0	0	13	0	218	0	23	0	0	0
4	0	0	0	14	0	62	0	24	0	0	0
5	0	0	0	15	0	6	0	25	0	0	0
6	0	0	0	16	0	.1	0	26	0	0	0
7	0	0	0	17	0	0	0	27	0	0	0
8	0	0	0	18	0	0	0	28	0	0	0
9	0	0	0	19	0	0	0	29	0	0	0
10	0	385	0	20	0	0	0	30	0	0	0
								31		0	1,460
Mean monthly discharge, in second-feet (observed)									0	177	47.1
Mean monthly discharge, in second-feet (adjusted)									0	264	56.2
Run-off, in acre-feet (adjusted)									0	16,240	3,460

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	December 8 Feet	December 8 Sec.ft.	December 9 Feet	December 9 Sec.ft.	December 10 Feet	December 10 Sec.ft.	December 11 Feet	December 11 Sec.ft.	December 12 Feet	December 12 Sec.ft.	December 13 Feet	December 13 Sec.ft.
2					-	0	5.83	2,690	4.25	1,560	2.68	344
4					-	0	9.80	6,660	3.96	1,320	2.62	309
6					-	0	8.35	5,280	3.74	1,140	2.56	280
8					3.36	772	7.47	4,450	3.57	1,010	2.50	252
10					2.87	430	8.15	5,090	3.40	870	2.44	227
N					2.56	257	8.30	5,240	3.36	838	2.34	187
2					2.59	270	7.76	4,720	3.20	710	2.32	180
4					3.31	737	6.95	3,960	3.07	612	2.29	169
6					3.20	660	6.18	3,260	2.97	539	2.24	152
8					2.85	417	5.63	2,770	2.90	490	2.23	148
10					2.94	478	5.10	2,290	2.83	441	2.19	135
M					3.55	905	4.64	1,890	2.76	388	2.14	120

Hour	December 14 Feet	December 14 Sec.ft.	December 15 Feet	December 15 Sec.ft.	December 16 Feet	December 16 Sec.ft.	December 17 Feet	December 17 Sec.ft.	December 18 Feet	December 18 Sec.ft.	December 19 Feet	December 19 Sec.ft.
2	2.08	103	1.41	19	0.54	0.4						
4	2.03	90	1.18	11	.53	.3						
6	1.98	79	1.05	7.5	.51	.2						
8	1.97	77	.97	5.5	.49	.2						
10	1.94	71	.89	4.0	.46	0						
N	1.87	58	.82	2.8	-	0						
2	1.82	51	.92	4.6	-	0						
4	1.76	44	.72	1.6	-	0						
6	1.73	40	.63	.8	-	0						
8	1.69	36	.60	.6	-	0						
10	1.64	32	.58	.5	-	0						
M	1.52	24	.56	.4	-	0						

Supplemental records.- Dec. 10, 6:30 a.m., no flow; 7 a.m., 3.00 ft., 520 sec.-ft.; 9 a.m., 3.92 ft., 1,170 sec.-ft.; 11 p.m., 3.01 ft., 527 sec.-ft. Dec. 11, 3 a.m., 6.80 ft., 3,550 sec.-ft.; 7 a.m., 7.15 ft., 4,140 sec.-ft.

Alamitos Creek near Edenvale, Calif.

Location.- Lat. 37°14'20", long. 121°52'15", in SW¼ sec. 16, T. 8 S., R. 1 E., 0.4 mile above junction with Guadalupe Creek and 4 miles southwest of Edenvale, Santa Clara County. Altitude, about 200 feet above mean sea level.
Drainage area.- 35.0 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,750 second-feet; extended to peak stage.
Maxima.- December 1937: Discharge, 2,280 second-feet 1:30 a.m. Dec. 11 (gage height, 6.35 feet).
1930-November 1937: Discharge (unregulated), 2,670 second-feet Dec. 27, 1931 (gage height, 6.60 feet).
Remarks.- Flood run-off affected by artificial storage in Almaden and Calero Reservoirs (capacities, 2,000 and 9,500 acre-feet, respectively); not appreciably affected by diversion. Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	24	11	0	1,340	7.5	21	0	39	15
2	0	0	15	12	0	307	7	22	0	36	12
3	0	0	14	13	0	100	7	23	0	31	11
4	0	0	12	14	0	51	7	24	0	35	10
5	0	0	10	15	0	27	7	25	0	34	11
6	0	0	4.8	16	0	29	7	26	0	33	10
7	0	0	15	17	0	32	7.5	27	0	38	11
8	0	0	9	18	0	39	7.5	28	0	37	16
9	0	0	6.5	19	0	34	17	29	0	32	32
10	0	28	8.5	20	0	36	21	30	0	22	15
								31		31	358
Mean monthly discharge, in second-feet (observed)...........									0	77.1	23.1
Mean monthly discharge, in second-feet (adjusted)...........									0	129	29.3
Run-off, in acre-feet (adjusted)...........................									0	7,940	1,800

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	6.27	2,160	4.60	485	3.56	119
4					-	0	5.63	1,310	4.47	420	3.51	109
6					-	0	5.01	737	4.33	355	3.46	100
8					-	0	5.58	1,250	4.26	326	3.48	103
10					-	0	6.30	2,200	4.25	322	3.50	107
N					-	0	6.23	2,100	4.21	306	3.50	107
2					-	0	5.91	1,650	4.12	273	3.49	105
4					-	0	5.61	1,280	4.02	240	3.47	102
6					-	0	5.38	1,040	3.96	222	3.45	98
8					-	0	5.15	840	3.87	196	3.39	87
10					3.42	93	4.93	684	3.74	160	3.32	76
M					5.13	824	4.75	570	3.64	136	3.27	69
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.24	65	2.85	21	2.87	22	3.05	40	-	-	-	-
4	3.23	63	2.83	19	2.85	21	3.06	42	3.05	40	-	-
6	3.22	62	2.82	18	2.85	21	3.06	42	-	-	2.99	34
8	3.22	62	2.80	16	2.84	20	2.91	26	3.06	42	-	-
10	3.21	60	2.79	16	2.83	19	2.83	19	-	-	-	-
N	3.21	60	2.96	31	2.83	19	2.80	16	3.06	42	2.99	34
2	3.20	59	3.03	38	3.01	36	2.77	15	-	-	-	-
4	3.20	59	3.06	42	3.03	38	2.97	32	3.02	37	-	-
6	3.04	39	3.07	43	3.04	39	3.02	37	-	-	2.99	34
8	2.95	30	3.00	35	3.05	40	3.03	38	3.00	35	-	-
10	2.91	26	2.94	29	3.05	40	3.04	39	-	-	-	-
M	2.87	22	2.89	24	3.05	40	3.05	40	3.00	35	2.99	34
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	2.97	32	-	-	-	-
4	-	-	-	-	-	-	2.97	32	-	-	-	-
6	2.99	34	3.04	39	3.03	38	3.96	31	3.00	35	2.99	34
8	-	-	-	-	-	-	2.96	31	-	-	-	-
10	-	-	-	-	-	-	2.96	31	-	-	-	-
N	2.99	34	3.05	40	3.03	38	2.96	31	3.00	35	2.99	34
2	-	-	-	-	-	-	2.86	22	-	-	-	-
4	-	-	-	-	-	-	2.96	31	-	-	-	-
6	3.04	39	3.04	39	2.99	34	2.99	34	3.00	35	2.98	33
8	-	-	-	-	-	-	3.00	35	-	-	-	-
10	-	-	-	-	-	-	3.00	35	-	-	-	-
M	3.04	39	3.03	38	2.97	32	3.00	35	3.00	35	2.97	32

Supplemental records.- Dec. 10 9:30 p.m., no flow; 11 p.m., 4.17 ft., 291 sec.-ft. Dec. 11, 1:30 a.m., 6.35 ft., 2,280 sec.-ft.

Los Gatos Creek at Los Gatos, Calif.

Location.- Lat. 37°13'15", long. 121°59'00", in SW¼ sec. 21, T. 8 S., R. 1 W., about 700 feet upstream from highway bridge at Los Gatos, Santa Clara County. Altitude, about 360 feet above mean sea level.

Drainage area.- 40.0 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 2,600 second-feet; extended to peak stage with aid of area-velocity study. Shifting-control method used for period Nov. 1 to Dec. 8.

Maxima.- December 1937: Discharge, 4,800 second-feet 2 a.m. Dec. 11 (gage height, 12.20 feet).

1930-November 1937: Discharge, 5,500 second-feet Feb. 13, 1937 (gage height, 12.90 feet), from rating curve extended above 2,600 second-feet with aid of area-velocity study.

Remarks.- Flood run-off slightly affected by artificial storage in four small reservoirs and by small diversions above station.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.6	0.8	17	11	24	2,460	11	21	19	35	33
2	.6	.7	31	12	10	480	12	22	7	33	27
3	.3	.6	23	13	6.5	200	11	23	3.9	31	24
4	.3	.6	16	14	11	131	11	24	7.5	28	18
5	.4	.6	15	15	8	88	13	25	1.8	28	16
6	3.4	1.0	14	16	1.7	65	14	26	1.2	27	16
7	3.1	.6	14	17	22	55	39	27	1.0	23	16
8	.4	.6	14	18	8.5	48	26	28	.8	22	75
9	.4	29	13	19	1.7	43	81	29	1.4	20	90
10	.4	1,250	11	20	4.8	38	47	30	.8	18	56
								31		18	1,590
Mean monthly discharge, in second-feet									5.08	167	77.2
Run-off, in acre-feet									302	10,270	4,750

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.23	0.6	4.95	528	12.20	4,800	5.56	732	3.95	255
4	-	-	1.23	.6	6.43	1,050	10.78	3,520	5.40	678	3.88	240
6	-	-	1.23	.6	7.82	1,630	10.00	2,940	5.18	603	3.82	226
8	-	-	1.23	.6	7.70	1,580	10.66	3,430	5.10	576	3.77	216
10	-	-	1.25	.8	7.34	1,420	9.66	2,700	4.83	490	3.72	206
N	1.23	0.6	1.27	.9	7.55	1,510	9.28	2,460	4.64	430	3.67	196
2	-	-	1.34	1.5	6.95	1,260	8.50	1,990	4.52	396	3.62	186
4	-	-	1.37	1.8	6.23	977	7.95	1,700	4.38	357	3.58	178
6	-	-	1.93	12	5.78	811	7.53	1,500	4.30	336	3.53	169
8	-	-	2.31	25	5.70	782	6.85	1,220	4.20	312	3.50	163
10	-	-	3.80	214	8.05	1,740	6.22	974	4.11	290	3.48	159
M	1.23	.6	3.95	251	10.99	3,690	5.86	840	4.03	273	3.46	156
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	3.17	106	2.90	70	2.81	61	-	-	-	-
4	3.42	149	3.16	104	2.88	68	2.80	60	2.68	50	2.60	44
6	-	-	3.13	100	2.87	67	2.79	59	-	-	-	-
8	3.36	138	3.12	98	2.86	66	2.78	58	2.67	49	2.58	43
10	-	-	3.10	95	2.84	64	2.73	54	-	-	-	-
N	3.31	129	3.04	87	2.83	63	2.72	53	2.66	48	2.57	42
2	-	-	3.02	85	2.82	62	2.72	53	-	-	-	-
4	3.25	118	3.01	83	2.81	61	2.71	52	2.63	46	2.56	42
6	-	-	2.96	77	2.86	66	2.70	51	-	-	-	-
8	3.22	113	2.95	76	2.85	65	2.70	51	2.62	45	2.53	40
10	-	-	2.93	74	2.83	63	2.69	50	-	-	-	-
M	3.18	107	2.92	72	2.82	62	2.69	50	2.61	45	2.52	39
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.50	38	2.45	35	2.41	33	2.38	31	2.33	28	2.32	28
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.47	36	2.43	34	2.42	33	2.35	30	2.32	28	2.30	27

Supplemental records.- Dec. 9, 9 p.m., 2.70 ft., 48 sec.-ft.

Campbell Creek at Saratoga, Calif.

<u>Location</u>.- Lat. 37°15'15", long. 122°02'25", in Quito grant, half a mile southwest of Saratoga post office, Santa Clara County. Altitude, about 500 feet above mean sea level.

<u>Drainage area</u>.- 8.8 square miles.

<u>Gage-height record</u>.- Water-stage recorder graph.

<u>Stage-discharge relation</u>.- Defined by current-meter measurements for range of stage of high water in December. Shifting-control method used for period Dec. 12 to Jan. 4.

<u>Maxima</u>.- December 1937: Discharge, 534 second-feet 1 a.m. Dec. 11 (gage height, 3.57 feet; no drawdown of water level in well).

1933-November 1937: Discharge, 910 second-feet Feb. 13, 1937 (gage height, 3.8 feet, outside of well, from drawdown relation determined at lower stages; 3.4 feet, inside of well, affected by drawdown), from rating curve extended above 430 second-feet.

January-September 1938: Discharge, 611 second-feet 8 a.m. Feb. 2 (gage height, 3.71 feet; no drawdown of water level in well).

<u>Remarks</u>.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.8	1.2	3.7	11	3.9	275	3.0	21	2.6	7	9
2	.8	1.2	4.2	12	1.6	77	2.7	22	1.8	7	8
3	.8	1.3	3.7	13	1.1	30	3.0	23	1.8	6.5	7.5
4	.5	1.1	3.6	14	2.8	17	3.0	24	1.8	6	7
5	.4	.9	3.6	15	1.5	13	3.3	25	1.6	5.5	7
6	.5	1.2	3.2	16	.9	11	3.5	26	1.3	5.5	7
7	.7	1.2	3.2	17	3.8	9.5	9.5	27	1.0	5	6.5
8	.8	1.2	3.2	18	1.9	9	7.5	28	1.1	4.8	11
9	.6	5	3.2	19	1.0	8	17	29	1.3	4.5	15
10	.5	156	3.1	20	1.8	7.5	12	30	1.3	4.2	12
								31		4.0	224
Mean monthly discharge, in second-feet									1.41	22.2	13.2
Run-off, in acre-feet									84	1,360	820

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	0.81	1.2	0.82	1.3	2.35	100	3.44	465	2.36	106	1.88	43
4	-	-	.82	1.3	2.83	213	3.35	420	2.35	105	1.82	37
6	-	-	.82	1.3	2.85	219	3.25	372	2.28	93	1.80	36
8	-	-	.82	1.3	2.62	155	3.42	455	2.29	94	1.78	34
10	-	-	.82	1.3	2.58	145	3.02	278	2.26	89	1.76	33
N	.81	1.2	.84	1.5	2.52	132	2.92	242	2.18	77	1.72	30
2	-	-	.86	1.6	2.46	119	2.74	186	2.13	69	1.69	28
4	-	-	.87	1.7	2.36	101	2.65	162	2.11	67	1.66	25
6	-	-	.92	2.2	2.30	91	2.65	162	2.06	60	1.66	25
8	-	-	1.00	3.2	2.40	108	2.57	143	2.02	55	1.66	25
10	-	-	1.45	12	2.95	252	2.50	127	1.97	49	1.65	25
M	.82	1.3	1.92	41	3.45	470	2.40	108	1.94	46	1.64	24
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.62	19	-	-	-	-	-	-	-	-	-	-
6	-	-	1.51	14	-	-	-	-	-	-	-	-
8	1.59	18	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.57	17	1.49	13	1.44	11	1.41	10	1.38	9	1.36	8
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.57	17	-	-	-	-	-	-	-	-	-	-
6	-	-	1.48	13	-	-	-	-	-	-	-	-
8	1.56	16	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.53	15	1.47	12	1.42	10	1.39	9.5	1.37	8.5	1.35	8
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.34	7.5	1.33	7	1.32	7	1.32	6.5	1.31	6	1.29	5.5
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.33	7.5	1.33	7	1.34	7	1.32	6.5	1.31	6	1.29	5.5

Supplemental records.- Dec. 9, 11 p.m., 1.93 ft., 42 sec.-ft. Dec. 10, 12:30 a.m., 1.89 ft., 38 sec.-ft. Dec. 11, 1 a.m., 3.57 ft., 534 sec.-ft.; 5 a.m., 3.07 ft., 298 sec.-ft.; 7 a.m., 3.47 ft., 480 sec.-ft.

Coyote Creek near Madrone, Calif.

Location.- Lat. 37°10'00", long. 121°37'40", in northwest corner of San Jose grant, a quarter of a mile above highway bridge at mouth of canyon, a quarter of a mile below Las Animas Creek, and 2.8 miles northeast of Madrone, Santa Clara County. Altitude, about 420 feet above mean sea level.

Drainage area.- 193 square miles.

Gage-height record.- Water-stage recorder graph. Record unreliable in periods Jan. 4-6, 20, when record was determined from partial recorder graph.

Stage-discharge relation.- Defined by current-meter measurements.

Maxima.- December 1937: Discharge, 2,750 second-feet 4 a.m. Dec. 11 (gage height, 9.19 feet).

1902-12; 1917-November 1937: Discharge, about 25,000 second-feet (unregulated) Mar. 7, 1911, furnished by Duryea, Haehl & Gilman.

Remarks.- Flood run-off affected by artificial storage in Coyote Reservoir (capacity, 30,000 acre-feet). Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	55	1.2	6.5	11	51	1,230	7.5	21	1.9	10	31
2	55	1.3	7	12	50	129	19	22	1.7	11	30
3	52	1.2	6.5	13	50	39	19	23	1.7	10	30
4	52	1.1	6	14	51	17	21	24	1.6	9.5	29
5	52	1.1	5.5	15	50	9.5	27	25	1.4	9	23
6	51	1.1	5.5	16	46	7	28	26	1.4	9.5	32
7	51	1.1	5.5	17	6.5	6	29	27	1.4	9.5	32
8	51	1.1	5.5	18	3.2	5.5	27	28	1.3	9	52
9	51	6	5	19	2.5	5	31	29	1.3	9.5	81
10	50	70	5	20	2.1	5	34	30	1.2	9	69
								31		9	312
Mean monthly discharge, in second-feet (observed)									28.2	53.0	33.0
Mean monthly discharge, in second-feet (observed)									-	251	33.0
Run-off, in acre-feet (adjusted)									-	15,410	2,030

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.02	1.1	2.75	12	8.01	1,670	5.03	214	-	-
4	-	-	2.40	5.5	3.01	20	9.19	2,750	4.82	174	3.77	53
6	-	-	2.41	5.5	3.09	23	7.96	1,630	4.67	148	-	-
8	-	-	2.42	6	3.02	20	8.55	2,120	4.53	129	3.62	43
10	-	-	2.43	6	3.13	24	8.80	2,350	4.54	130	-	-
N	2.02	1.1	2.44	6	3.47	40	7.72	1,450	4.53	129	3.50	37
2	-	-	2.45	6	3.46	39	6.78	880	4.49	124	-	-
4	-	-	2.45	6	3.27	30	6.18	587	4.36	107	3.38	31
6	-	-	2.47	6.5	3.42	37	5.77	415	4.23	92	-	-
8	-	-	2.52	7.5	4.72	158	5.55	339	4.11	80	3.26	26
10	-	-	2.65	10	5.02	212	5.53	333	4.01	71	-	-
M	2.02	1.1	2.70	11	6.04	526	5.27	267	3.93	64	3.16	23
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.09	21	-	-	-	-	-	-	-	-	-	-
6	-	-	2.73	11	2.57	7.5	-	-	-	-	-	-
8	3.01	18	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.97	17	2.69	10	2.56	7	2.50	6	2.46	5.5	2.44	5
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.90	15	-	-	-	-	-	-	-	-	-	-
6	-	-	2.64	9	2.53	6.5	-	-	-	-	-	-
8	2.83	13	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.79	12	2.59	8	2.51	6.5	2.47	5.5	2.45	5.5	2.43	5
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	2.42	4.8	-	-	-	-	-	-	-	-
4	-	-	2.63	8.5	-	-	-	-	-	-	-	-
6	-	-	2.75	11	-	-	-	-	-	-	-	-
8	-	-	2.76	12	-	-	-	-	-	-	-	-
10	-	-	2.76	12	-	-	-	-	-	-	-	-
N	2.43	5	2.76	12	2.74	11	2.70	10	2.67	9.5	2.66	9
2	-	-	2.75	11	-	-	-	-	-	-	-	-
4	-	-	2.75	11	-	-	-	-	-	-	-	-
6	-	-	2.75	11	-	-	-	-	-	-	-	-
8	-	-	2.75	11	-	-	-	-	-	-	-	-
10	-	-	2.75	11	-	-	-	-	-	-	-	-
M	2.43	5	2.75	11	2.73	11	2.67	9.5	2.66	9	2.66	9

Supplemental records.- Dec. 10, 7 p.m., 3.99 ft., 72 sec.-ft.; 9 p.m., 4.78 ft., 169 sec.-ft.; 11 p.m., 5.47 ft., 316 sec.-ft.

Coyote Creek near Edenvale, Calif.

Location.- Lat. 37°16'15", long. 121°47'55", at east boundary of Santa Teresa grant, at "The Narrows", 1½ miles northeast of Edenvale, Santa Clara County, and 7 miles south of San Jose. Altitude, about 190 feet above mean sea level.
Drainage area.- 229 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,200 second-feet; extended to peak stage parallel to rating curve for 1937, which is defined by current-meter measurements to 3,500 second-feet.
Maxima.- December 1937: Discharge, 3,060 second-feet 8 a.m. Dec. 11 (gage height, 6.00 feet).
1917-November 1937: Discharge (unregulated), 10,000 second-feet Feb. 10, 1922 (gage height, 12.8 feet, from floodmarks), from rating curve extended above 4,900 second-feet parallel to curve for 1917 which was defined by current-meter measurements to 8,400 second-feet.
Remarks.- Flood run-off materially affected by artificial storage in Coyote Reservoir (capacity, 30,000 acre-feet).

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	9.5	0	0	11	7.5	1,370	0	21	0	0	0
2	9	0	0	12	5	365	0	22	0	0	0
3	8	0	0	13	4.9	150	0	23	0	0	0
4	5	0	0	14	8	75	0	24	0	0	0
5	3.6	0	0	15	8	32	0	25	0	0	0
6	4.6	0	0	16	8	12	0	26	0	0	0
7	6	0	0	17	3.5	2.3	.8	27	0	0	0
8	6	0	0	18	0	0	7	28	0	0	0
9	6	0	0	19	0	0	9	29	0	0	3.0
10	4.9	0	0	20	0	0	.6	30	0	0	30
								31		0	278
Mean monthly discharge, in second-feet									3.58	64.7	10.6
Run-off, in acre-feet									213	3,980	651

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2							-	0	3.91	492	-	-
4							2.66	14	3.85	455	3.37	188
6							4.20	705	3.77	407	-	-
8							6.00	3,060	3.70	365	3.30	158
10							5.75	2,650	3.65	335	-	-
N							5.72	2,600	3.65	335	3.26	143
2							5.67	2,520	3.64	329	-	-
4							5.15	1,780	3.62	317	3.22	128
6							4.69	1,200	3.60	305	-	-
8							4.39	880	3.61	311	3.20	120
10							4.17	681	3.55	278	-	-
M							4.00	550	3.48	240	3.16	106
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-				
4	3.13	96	2.91	42	2.71	18	2.45	4.6				
6	-	-	-	-	-	-	-	-				
8	3.09	83	2.88	37	2.67	15	2.40	3.0				
10	-	-	-	-	-	-	-	-				
N	3.05	72	2.84	32	2.64	13	2.33	1.6				
2	-	-	-	-	-	-	-	-				
4	3.02	64	2.81	27	2.60	10	2.26	.7				
6	-	-	-	-	-	-	-	-				
8	2.99	57	2.78	24	2.55	8	2.21	.3				
10	-	-	-	-	-	-	-	-				
M	2.95	50	2.75	22	2.51	6.5	2.19	.2				

Supplemental records.- Dec. 11, 3:30 a.m., no flow.

Alameda Creek near Niles, Calif.

Location.- Lat. 37°35'15", long. 121°57'35", in Arroyo de la Alameda grant, an eighth of a mile above highway bridge and 1¼ miles northeast of Niles, Alameda County. Altitude, about 100 feet above mean sea level.

Drainage area.- 633 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements for entire range of stage. Shifting-control method used for period Nov. 20 to Dec. 9.

Maxima.- December 1937: Discharge, 5,180 second-feet 9 p.m. Dec. 11 (gage height, 8.85 feet).

1917-November 1937: Discharge, 13,900 second-feet Feb. 10, 1922 (gage height, 12.44 feet, former site and datum, 800 feet upstream), from rating curve extended above 7,600 second-feet.

Remarks.- Flood run-off affected by artificial storage in Calaveras Reservoir (capacity, 100,000 acre-feet) and by diversions for San Francisco water supply and other diversions above station. Table on following page gives storage in Calaveras Reservoir, diversions, and adjusted daily discharge for Alameda Creek. Most of basic data furnished by city of San Francisco.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	13	1.6	148	11	11	2,750	151	21	8.5	148	133
2	13	1.8	148	12	13	2,040	151	22	6	148	112
3	13	2.1	148	13	15	688	151	23	6	148	108
4	13	2.4	148	14	17	265	136	24	6	148	105
5	13	2.4	148	15	16	95	105	25	4.3	145	108
6	13	2.4	148	16	17	172	101	26	2.5	145	112
7	13	2.5	148	17	19	172	115	27	2.1	148	112
8	13	2.8	151	18	18	160	110	28	1.8	148	142
9	13	17	151	19	17	154	115	29	1.6	148	172
10	11	77	151	20	9	151	136	30	1.6	148	160
								31		148	631
Mean monthly discharge, in second-feet									10.7	270	150
Run-off, in acre-feet									636	16,620	9,230

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.09	2.8	2.80	28	3.10	55	7.52	3,470	5.17	1,040
4	-	-	2.35	10	2.85	32	3.05	50	6.95	2,780	5.08	965
6	2.09	2.8	2.55	16	2.89	34	5.25	1,100	6.49	2,270	4.94	860
8	-	-	2.60	18	2.93	38	6.51	2,290	6.35	2,120	4.81	767
10	-	-	2.62	19	2.96	40	6.50	2,280	6.25	2,010	4.70	695
N	2.09	2.8	2.65	20	2.92	37	6.35	2,120	6.42	2,190	4.60	630
2	-	-	2.66	21	3.96	289	7.75	3,760	6.07	1,830	4.51	576
4	-	-	2.67	22	3.66	178	8.33	4,520	5.75	1,520	4.47	552
6	2.09	2.8	2.69	22	3.41	108	8.66	4,980	5.61	1,400	4.47	552
8	-	-	2.70	22	3.24	75	8.84	5,180	5.56	1,350	4.39	504
10	-	-	2.72	24	3.15	62	8.65	4,970	5.42	1,240	4.31	460
M	2.09	2.8	2.74	25	3.10	55	7.97	4,050	5.28	1,120	4.25	428
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	3.64	172	-	-	-	-	-	-
4	4.12	360	3.50	130	3.67	181	-	-	-	-	-	-
6	-	-	-	-	3.67	181	3.65	175	3.60	160	3.58	154
8	4.00	305	3.40	105	3.67	181	-	-	-	-	-	-
10	-	-	-	-	3.66	178	-	-	-	-	-	-
N	3.85	245	3.33	91	3.66	178	3.63	169	3.60	160	3.58	154
2	-	-	-	-	3.65	175	-	-	-	-	-	-
4	3.77	214	3.27	80	3.65	175	-	-	-	-	-	-
6	-	-	-	-	3.66	178	3.62	166	3.59	157	3.58	154
8	3.71	194	3.22	71	3.66	178	-	-	-	-	-	-
10	-	-	-	-	3.66	178	-	-	-	-	-	-
M	3.62	166	3.18	65	3.66	178	3.61	163	3.59	157	3.58	154
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.57	151	3.57	151	-	-	-	-	-	-	3.56	148
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.57	151	3.57	151	3.56	148	3.56	148	3.56	148	3.55	145
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.57	151	3.56	148	-	-	-	-	-	-	3.55	145
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.57	151	3.56	148	3.56	148	3.56	148	3.56	148	3.55	145

Supplemental records.- Dec. 11, 9 p.m., 8.85 ft., 5,180 sec.-ft.

Alameda Creek near Niles, Calif.--Continued

Gain or loss in storage, diversions, and adjusted daily discharge, December 1937 to January 1938

	December				January			
	Calaveras Reservoir				Calaveras Reservoir			
Day	Contents (acre-feet)	Gain or loss (acre-feet)	Diversions (acre-feet)	Adjusted discharge (sec.-ft.)	Contents (acre-feet)	Gain or loss (acre-feet)	Diversions (acre-feet)	Adjusted discharge (sec.-ft.)
1	52,817	-195	225	17	59,869	-280	44	29
2	52,622	-195	226	17	59,589	-280	44	29
3	52,427	-195	224	17	59,311	-278	44	30
4	52,232	-195	223	16	59,058	-253	44	43
5	52,037	-195	226	18	58,782	-276	44	31
6	51,843	-194	224	18	58,482	-300	44	19
7	51,649	-194	223	17	58,161	-321	44	8
8	51,455	-194	236	24	57,910	-251	44	47
9	51,670	+215	243	248	57,635	-275	44	35
10	56,884	+5,214	240	2,830	57,360	-275	44	35
11	62,667	+5,783	69	5,700	57,065	-295	44	24
12	63,960	+1,293	33	2,710	56,771	-294	44	25
13	64,250	+290	6.9	838	56,454	-317	-16	-17
14	64,467	+217	33	391	56,341	-113	-89	34
15	64,443	-24	28	97	56,205	-136	42	58
16	64,201	-242	42	71	56,115	-90	43	77
17	63,936	-265	43	60	56,003	-112	42	80
18	63,672	-264	43	49	55,891	-112	43	75
19	63,457	-215	43	67	56,048	+157	44	216
20	63,193	-264	43	40	55,981	-67	44	124
21	62,953	-240	39	47	55,914	-67	45	122
22	62,667	-286	42	25	55,780	-134	44	67
23	62,288	-379	43	-21	55,623	-157	44	51
24	62,074	-214	43	62	55,466	-157	44	48
25	61,861	-213	44	60	55,310	-156	44	52
26	61,578	-283	44	25	55,108	-202	44	32
27	61,296	-282	45	29	54,958	-155	44	56
28	60,991	-305	45	17	55,220	+267	44	299
29	60,710	-281	44	29	55,578	+358	43	374
30	60,429	-281	44	29	55,735	+157	44	261
31	60,149	-280	44	29	59,729	+3,994	25	2,660

	December	January
Mean monthly discharge, in second-feet (observed)............	270	150
Gain or loss in storage, in acre-feet........................	+7,140	-420
Diversions, in acre-feet.....................................	+3,150	+1,150
Mean monthly discharge, in second-feet (adjusted)............	438	162
Run-off, in acre-feet (adjusted).............................	26,930	9,960

Kern River near Kernville, Calif.

Location.- Lat. 35°56', long. 118°29', in NE¼ sec. 14, T. 23 S., R. 32 E., 3 miles above Salmon Creek and 15 miles north of Kernville, Kern County. Altitude, about 3,550 feet above mean sea level.

Drainage area.- 845 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 6,200 second-feet; extended to peak stage on basis of computation of peak flow of flood of Feb. 6, 1937, over diversion dam 1 mile above gage; verified by area-velocity study at gage. Shifting-control method used for periods Nov. 1 to Dec. 10, Dec. 23 to Jan. 31.

Maxima.- December 1937: Discharge, 6,800 second-feet 8 p.m. Dec. 11 (gage height, 11.58 feet).

1912-November 1937: Discharge (unregulated), 9,690 second-feet Jan. 17, 1916 (gage height, 8.8 feet, former datum), from rating curve extended above 4,100 second-feet.

Remarks.- Flood run-off not affected by artificial storage. Kern River No. 3 canal diverts above station. Monthly summaries adjusted for diversion. Most of basic data furnished by Southern California Edison Co., Ltd.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6	1.4	0.6	11	1.4	2,120	0.6	21	1.3	92	1.4
2	9.5	1.5	.6	12	1.4	1,900	.6	22	1.3	79	1.5
3	6	1.3	.6	13	1.5	718	.6	23	1.3	45	1.4
4	1.5	1.2	.7	14	1.5	460	.6	24	1.4	2.0	1.5
5	1.4	1.2	.8	15	1.5	339	12	25	1.4	1.2	1.5
6	1.4	1.2	.8	16	1.5	269	9.5	26	1.4	1.1	1.4
7	1.4	1.1	.8	17	1.5	214	1.7	27	1.4	1.0	1.4
8	1.3	1.2	.8	18	1.5	170	1.5	28	1.3	.9	1.4
9	1.2	15	.7	19	1.5	136	1.5	29	1.3	.8	1.5
10	1.3	2,110	.7	20	1.3	109	1.5	30	1.3	.6	1.5
								31		.6	1.6
Mean monthly discharge, in second-feet (observed)............									1.97	284	1.72
Mean monthly discharge, in second-feet (adjusted)............									240	610	345
Run-off, in acre-feet (adjusted)............................									14,310	37,500	21,190

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.66	1.2	9.43	3,220	6.07	598	9.48	3,280	6.81	946
4	-	-	2.66	1.2	9.45	3,240	5.87	518	9.15	2,870	6.71	895
6	-	-	2.66	1.2	9.87	3,840	5.72	460	8.85	2,540	6.61	845
8	-	-	2.66	1.2	9.78	3,710	5.66	438	8.55	2,230	6.52	800
10	-	-	2.66	1.2	9.28	3,030	5.63	428	8.18	1,880	6.43	755
N	2.66	1.2	2.66	1.2	8.78	2,460	5.69	449	7.88	1,640	6.33	708
2	-	-	2.67	1.2	8.16	1,870	6.18	642	7.62	1,450	6.24	668
4	-	-	2.68	1.3	7.55	1,400	8.57	2,250	7.44	1,330	6.16	634
6	-	-	2.72	1.8	7.08	1,110	10.58	4,970	7.30	1,240	6.10	610
8	-	-	2.80	3.1	6.73	905	11.58	6,800	7.17	1,160	6.05	590
10	-	-	2.91	5.7	6.47	775	10.86	5,450	7.05	1,090	6.01	574
M	2.66	1.2	6.20	650	6.27	682	9.95	3,960	6.93	1,020	5.97	558
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.90	530	5.45	371	-	-	-	-	-	-	-	-
6	-	-	-	-	5.15	287	4.92	228	4.71	181	4.51	145
8	5.82	498	5.41	359	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.71	456	5.35	342	5.08	269	4.88	218	4.67	173	4.46	137
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.60	418	5.28	322	-	-	-	-	-	-	-	-
6	-	-	-	-	5.01	251	4.80	200	4.60	160	4.38	124
8	5.53	396	5.23	308	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.49	383	5.19	297	4.94	233	4.73	185	4.55	152	4.32	116
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	3.91	69	-	-	-	-
4	-	-	-	-	4.05	83	3.95	73	-	-	-	-
6	4.31	114	4.17	96	-	-	3.97	75	2.80	2.3	-	-
8	-	-	-	-	4.08	86	4.04	82	-	-	-	-
10	-	-	-	-	-	-	4.05	83	-	-	-	-
N	4.32	116	4.18	98	4.07	85	3.71	49	2.75	1.7	2.70	1.2
2	-	-	-	-	-	-	3.44	28	-	-	-	-
4	-	-	-	-	4.00	78	3.25	17	-	-	-	-
6	4.20	100	4.08	86	-	-	3.12	10	2.74	1.6	-	-
8	-	-	-	-	3.90	68	3.01	7	-	-	-	-
10	-	-	-	-	-	-	2.94	5	-	-	-	-
M	4.16	95	4.05	83	3.88	66	2.89	3.9	2.72	1.4	2.69	1.2

Supplemental records.- Dec. 9, 11 p.m., 3.65 ft., 47 sec.-ft.

Kern River above Kern Canyon power house, Calif.

Location.- Lat. 35°27', long. 118°47', in sec. 31, T. 28 S., R. 30 E., about three-quarters of a mile above Kern Canyon power house, Kern County. Altitude, about 770 feet above mean sea level.
Drainage area.- 2,310 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,200 second-feet; extended to peak stage of February 1937 on basis of computation of flow over Kern River No. 1 intake dam, 11 miles above gage, plus flow through Kern River No. 1 power house, and by comparison of peak discharge and total runoff of flood with records for other stations in Kern River Basin.
Maxima.- December 1937: Discharge, 7,900 second-feet 5:30 a.m. Dec. 12 (gage height, 16.65 feet).
1929-November 1937: Discharge, 19,200 second-feet Feb. 7, 1937 (gage height, 22.4 feet, from floodmarks).
Remarks.- Flood run-off not affected by artificial storage but by diversion above the station for Kern Canyon power house. Monthly summaries adjusted for diversion. Most of basic data furnished by San Joaquin Light & Power Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4.8	2.6	5	11	3.2	1,060	5	21	2.7	49	5
2	4.4	2.6	5	12	3.2	4,300	5	22	2.6	50	4.9
3	3.9	2.6	5	13	3.0	1,780	5	23	2.6	9.5	5
4	3.5	2.7	5	14	2.9	844	5	24	2.6	34	5
5	3.3	2.6	5	15	3.0	545	5.5	25	2.6	8.5	4.8
6	3.2	2.6	5	16	2.9	333	5	26	2.6	8.5	5
7	3.2	2.6	5	17	2.8	246	5	27	2.6	7	5
8	3.2	2.6	5	18	2.8	181	23	28	2.6	7	5
9	3.2	2.6	5	19	2.8	138	9	29	2.6	6	5
10	3.1	1,450		20	2.8	84	5.5	30	2.6	5.5	5
								31		5.5	5
Mean monthly discharge, in second-feet (observed)............									3.04	360	5.73
Mean monthly discharge, in second-feet (adjusted)............									272	824	474
Run-off, in acre-feet (adjusted)...........................									16,200	50,660	29,130

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	3.13	2.8	11.15	1,990	9.30	1,050	11.66	2,320
4	-	-	3.10	2.6	3.14	2.9	10.42	1,580	16.40	7,580	11.46	2,180
6	-	-	-	-	3.15	3.0	9.80	1,270	16.50	7,740	11.35	2,110
8	-	-	3.10	2.6	3.20	3.4	9.42	1,100	15.68	6,510	11.30	2,080
10	-	-	-	-	3.37	4.8	9.12	972	14.80	5,320	11.16	2,000
N	3.10	2.6	3.10	2.6	5.60	102	8.87	872	14.30	4,720	11.00	1,900
2	-	-	-	-	11.50	2,210	8.68	798	13.77	4,110	10.70	1,720
4	-	-	3.10	2.6	12.98	3,340	8.55	749	13.12	3,470	10.43	1,580
6	-	-	-	-	13.48	3,810	8.45	711	12.80	3,180	10.16	1,450
8	-	-	3.10	2.6	13.12	3,470	8.32	663	12.48	2,920	9.90	1,320
10	-	-	-	-	12.49	2,930	8.25	638	12.14	2,660	9.70	1,220
M	3.10	2.6	3.12	2.8	11.82	2,430	8.25	638	11.90	2,490	9.54	1,150
	December 14		December 15		December 16		December 17		December 18		December 19	
2	9.40	1,090	8.18	613	7.40	390	6.92	286	6.42	201	6.19	169
4	9.24	1,020	8.07	576	7.34	376	6.87	277	6.40	198	6.18	167
6	9.10	964	7.96	542	7.28	362	7.02	306	6.39	197	6.16	165
8	8.99	920	9.36	1,070	7.22	348	6.78	260	6.34	190	6.14	162
10	8.85	864	7.74	477	7.18	340	6.71	248	6.30	184	5.82	124
N	8.78	836	7.64	450	7.14	331	6.66	239	6.27	180	5.88	131
2	8.70	806	7.69	463	7.10	322	6.62	232	6.22	173	5.83	125
4	8.57	757	7.62	445	7.07	316	6.59	226	6.20	170	5.80	122
6	8.50	730	7.57	432	7.03	308	6.55	220	6.17	166	5.73	115
8	8.42	700	7.53	422	6.99	300	6.52	215	6.11	158	5.71	113
10	8.35	674	7.47	407	6.96	294	6.49	211	6.08	155	5.70	112
M	8.26	642	7.45	502	6.95	292	6.46	206	6.21	171	5.68	110
	December 20		December 21		December 22		December 23		December 24		December 25	
2	5.64	106	5.20	67	4.52	28	3.84	10	3.71	8.5	3.84	10
4	5.62	104	5.20	67	4.49	27	3.80	9.5	3.69	8	3.73	8.5
6	5.56	98	5.10	60	4.49	27	3.77	9	4.76	39	3.71	8.5
8	5.52	94	5.03	55	4.48	26	3.75	9	5.10	60	3.70	8
10	5.48	90	4.99	52	4.47	26	3.74	8.5	5.21	68	3.67	8
N	5.43	86	4.96	51	4.45	26	3.73	8.5	5.11	61	3.66	7.5
2	5.35	79	4.91	48	6.90	282	3.81	9.5	4.92	48	3.66	7.5
4	5.32	77	4.84	43	5.20	67	3.90	11	4.72	37	3.66	7.5
6	5.28	73	4.76	39	4.34	22	3.82	10	4.56	29	3.66	7.5
8	5.20	67	4.71	36	4.16	17	3.78	9	4.40	24	3.66	7.5
10	5.17	65	4.62	32	4.04	14	3.76	9	4.20	18	3.73	8.5
M	5.16	64	4.55	29	3.90	11	3.74	8.5	4.01	13	3.96	12

Supplemental records.- Dec. 12, 5:30 a.m., 16.65 ft., 7,900 sec.-ft. Dec. 15, 7 a.m., 9.40 ft., 1,090 sec.-ft.; 9 a.m., 9.32 ft., 1,060 sec.-ft. Dec. 22, 1:30 p.m., 6.88 ft., 278 sec.-ft.; 3 p.m., 6.90 ft., 282 sec.-ft.

Kern River near Bakersfield, Calif.

Location.- Lat. 35°25'54", long. 118°56'43", in SW$\frac{1}{4}$ sec. 2, T. 29 S., R. 28 E., at mouth of lower canyon, 5 miles northeast of Bakersfield, Kern County. Altitude, about 470 feet above mean sea level.

Drainage area.- 2,420 square miles (revised).

Gage-height record.- Water-stage recorder graph.

Maxima.- December 1937: Discharge, 6,859 second-feet 11:30 a.m. Dec. 12.
1893-November 1937: Discharge, 20,000 second-feet Feb. 7, 1937 (gage height, 9.12 feet).

Remarks.- Flood run-off not materially affected by artificial storage or diversion. Complete record, except run-off in acre-feet and monthly summaries, furnished by Kern County Land Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	245	272	553	11	264	2,175	471	21	297	724	539
2	262	268	552	12	268	4,227	471	22	298	707	501
3	253	269	568	13	270	2,711	469	23	294	701	507
4	257	270	569	14	273	1,353	469	24	290	705	503
5	260	270	540	15	281	1,158	471	25	289	656	484
6	255	271	520	16	282	1,049	478	26	288	609	467
7	260	277	509	17	280	940	488	27	288	596	469
8	267	286	495	18	284	859	536	28	284	589	470
9	259	296	490	19	300	794	598	29	279	566	491
10	259	926	477	20	296	753	558	30	275	552	536
								31		554	513
Mean monthly discharge, in second-feet									275	851	508
Run-off, in acre-feet									16,380	52,320	31,270

Supplemental records.- Dec. 12, 11:30 a.m., 6,859 sec.-ft.

South Fork of Kern River near Onyx, Calif.

Location.- Lat. 35°44', long. 118°10', in SW¼ sec. 24, T. 25 S., R. 35 E., three-quarters of a mile north of Kernville-Walker Pass road, 1.4 miles above Canebrake Creek, and 5 miles northeast of Onyx, Kern County. Altitude, about 2,900 feet above mean sea level.

Drainage area.- 531 square miles.

Gage-height record.- Water-stage recorder graph except for period 9 p.m. Jan. 30 to midnight Jan. 31, when it was based on partial recorder graph, shape of stage graph for South Fork at Isabella, and range of stage indicated on the recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 1,900 second-feet. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 1,260 second-feet 8 a.m. Dec. 12 (gage height, 4.81 feet).

1911-14, 1919-November 1937: Discharge, 3,130 second-feet Feb. 6, 1937 (gage height, 6.50 feet), from rating curve extended above 1,900 second-feet.

January-September 1938: Discharge, 3,450 second-feet 6 p.m. Mar. 2 (gage height, 6.69 feet), from rating curve extended above 1,900 second-feet with aid of area-velocity study.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	27	27	59	11	29	597	47	21	34	66	38
2	27	29	60	12	30	864	47	22	33	66	49
3	27	33	61	13	29	304	42	23	32	69	52
4	27	31	54	14	30	180	48	24	32	47	45
5	27	29	52	15	32	145	52	25	32	40	43
6	27	29	45	16	30	122	47	26	32	49	44
7	29	27	43	17	31	105	45	27	32	56	44
8	29	27	43	18	35	96	52	28	31	47	45
9	28	32	41	19	33	86	45	29	29	44	48
10	29	356	46	20	32	74	41	30	28	48	40
								31		47	44
Mean monthly discharge, in second-feet									30.1	122	47.2
Run-off, in acre-feet									1,790	7,480	2,900

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.49	30	1.46	29	2.28	124	3.46	497	4.39	994	3.20	393
4	1.48	30	1.46	29	2.72	234	3.38	462	4.14	852	3.15	376
6	1.49	30	1.49	30	3.06	341	3.30	430	4.58	1,110	3.10	358
8	1.53	33	1.52	32	3.18	383	3.23	402	4.81	1,260	3.05	341
10	1.50	31	1.51	32	3.25	410	3.19	386	4.72	1,200	3.01	327
N	1.47	29	1.48	30	3.37	458	3.17	380	4.51	1,070	2.96	311
2	1.46	29	1.47	29	3.33	442	3.19	386	4.17	868	2.90	291
4	1.41	26	1.47	29	3.18	383	3.36	454	3.88	709	2.82	267
6	1.36	23	1.51	32	2.98	314	4.11	836	3.67	600	2.76	250
8	1.35	23	1.56	35	3.37	458	4.49	1,050	3.48	506	2.71	236
10	1.35	23	1.66	42	3.52	525	4.48	1,050	3.36	454	2.67	225
M	1.39	25	1.86	59	3.52	525	4.70	1,190	3.26	415	2.63	214

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 14		December 15		December 16		December 17		December 18		December 19	
2	2.59	203	2.34	143	2.24	122	2.16	107	2.09	94	2.04	87
4	2.57	198	2.33	141	2.23	120	2.15	105	2.07	92	2.03	86
6	2.55	193	2.35	145	2.23	120	2.15	105	2.07	92	2.02	84
8	2.53	188	2.36	147	2.23	120	2.15	105	2.08	93	2.03	86
10	2.52	185	2.34	143	2.23	120	2.16	107	2.09	94	2.03	86
N	2.51	183	2.35	145	2.22	118	2.14	103	2.07	92	2.03	86
2	2.50	180	2.37	149	2.24	122	2.15	105	2.09	94	2.01	82
4	2.47	173	2.36	147	2.26	126	2.17	109	2.13	101	1.99	80
6	2.45	168	2.33	141	2.26	126	2.17	109	2.13	101	2.03	86
8	2.43	163	2.31	136	2.23	120	2.16	107	2.12	100	2.03	86
10	2.39	154	2.28	130	2.21	116	2.13	101	2.09	94	2.02	84
M	2.36	147	2.26	126	2.18	110	2.11	98	2.07	92	2.01	82

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 20		December 21		December 22		December 23		December 24		December 25	
2	1.99	80	1.98	78	1.88	66	1.98	78	1.87	65	1.65	45
4	1.98	78	1.93	72	1.87	65	1.97	77	1.84	62	1.82	60
6	1.97	77	1.91	69	1.84	62	1.93	72	1.79	57	1.79	57
8	1.97	77	1.91	69	1.83	61	1.92	71	1.76	54	1.72	51
10	1.97	77	1.89	67	1.87	65	1.90	68	1.72	51	1.65	45
N	1.97	77	1.88	66	1.94	73	1.88	66	1.67	47	1.58	40
2	1.95	74	1.89	67	1.90	68	1.88	66	1.62	43	1.52	35
4	1.89	67	1.84	62	1.86	64	1.88	66	1.57	39	1.47	32
6	1.89	67	1.82	60	1.83	61	1.86	64	1.54	37	1.43	30
8	1.90	68	1.82	60	1.89	67	1.84	62	1.51	35	1.40	28
10	1.91	69	1.81	59	1.89	67	1.85	63	1.52	35	1.41	29
M	1.96	76	1.82	60	1.93	72	1.88	66	1.62	43	1.71	50

South Fork of Kern River at Isabella, Calif.

Location.- Lat. 35°40', long. 118°28', in NW¼ sec. 20, T. 26 S., R. 33 E., a quarter of a mile above junction with Kern River, at Isabella, Kern County. Altitude, about 2,480 feet above mean sea level.

Drainage area.- 985 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements for range of stage of high water in December. Shifting-control method used for period Nov. 1 to Jan. 31.

Maxima.- December 1937: Discharge, about 1,140 second-feet 2 a.m. Dec. 13 (gage height, 4.52 feet).

1929-November 1937: Discharge, about 4,100 second-feet Feb. 7, 1937 (gage height, 6.92 feet), from rating curve extended above 1,600 second-feet; verified by area-velocity study. Peak gage height is adjusted for estimated effect of back-water from Kern River.

Remarks.- Flood run-off not affected by artificial storage or diversion but by channel storage, largely in overflow areas between Onyx and Isabella.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	12	16	80	11	13	249	78	21	11	105	79
2	12	15	82	12	13	720	78	22	11	100	77
3	12	15	83	13	13	725	78	23	12	98	80
4	13	15	83	14	13	303	79	24	16	96	79
5	13	16	83	15	13	204	82	25	16	88	76
6	13	16	80	16	10	168	83	26	16	85	73
7	13	16	77	17	9	145	81	27	15	84	72
8	13	16	77	18	9	132	84	28	15	84	72
9	13	17	74	19	11	122	84	29	16	81	74
10	12	32	76	20	13	114	84	30	16	80	72
								31		81	69
Mean monthly discharge, in second-feet									12.9	130	78.4
Run-off, in acre-feet									768	8,010	4,820

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.32	16	1.33	16	1.42	19	2.42	159	3.27	391	4.52	1,140
4	1.32	16	1.33	16	1.55	25	2.52	177	3.32	410	4.43	1,080
6	1.32	16	1.34	16	1.59	27	2.56	185	3.38	436	4.28	954
8	1.33	16	1.33	16	1.61	28	2.57	187	3.53	505	4.12	834
10	1.32	16	1.33	16	1.61	28	2.67	208	3.72	601	3.96	736
N	1.32	16	1.33	16	1.60	28	2.77	232	3.95	730	3.81	650
2	1.32	16	1.35	17	1.57	26	2.88	262	4.14	848	3.69	585
4	1.32	16	1.36	17	1.52	24	2.99	294	4.24	922	3.60	540
6	1.32	16	1.36	17	1.48	22	3.07	319	4.27	946	3.53	505
8	1.32	16	1.36	17	1.49	22	3.13	340	4.33	994	3.46	472
10	1.32	16	1.37	17	2.00	67	3.20	364	4.45	1,100	3.40	444
M	1.33	16	1.38	17	2.29	120	3.22	372	4.50	1,140	3.34	419
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.27	391	2.75	228	-	-	-	-	-	-	-	-
4	3.20	364	2.73	222	2.52	177	-	-	-	-	-	-
6	3.15	346	2.70	215	-	-	-	-	-	-	-	-
8	3.10	329	2.68	211	2.50	173	-	-	-	-	-	-
10	3.05	313	2.66	206	-	-	-	-	-	-	-	-
N	3.00	297	2.65	204	2.47	168	2.35	145	2.27	132	2.20	122
2	2.96	285	2.62	197	-	-	-	-	-	-	-	-
4	2.92	273	2.59	191	2.44	162	-	-	-	-	-	-
6	2.88	262	2.58	189	-	-	-	-	-	-	-	-
8	2.85	254	2.57	187	2.41	157	-	-	-	-	-	-
10	2.81	243	2.56	185	-	-	-	-	-	-	-	-
M	2.78	235	2.55	183	2.39	153	2.30	136	2.22	124	2.17	118
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.14	114	2.07	105	2.03	100	2.01	98	1.99	96	1.93	88
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.10	109	2.04	102	2.02	99	2.01	98	1.96	92	1.90	85

Tulare Lake in Kings County, Calif.

Location.- Staff gage, lat. 36°05', long. 119°44', at SW corner sec. 31, T. 21 S., R. 21 E., 12 miles southeast of Stratford, Kings County, Calif.
Records available.- March 1906 to September 1920 (incomplete) at various sites. No record 1921-23. Lake practically dry 1924-36.
Extremes.- 1906-December 1937. Maximum stage probably occurred June 21, 1907 (gage height, 14.0 feet, former site and datum). Lake empty or practically dry part of 1906, 1914, 1916, 1919, 1920-22, 1924-36.
Remarks.- Gage heights interpolated for periods Dec. 2-7, 9, 12, 19, 25. Tulare Lake receives water from Kings, Keweah, and Tule Rivers during high-water periods and occasionally from Kern River, Deer Creek, and smaller intermittent streams. Lake boundaries have been greatly altered in recent years by levees and reclamation work. About Feb. 10, 1937, water reached lake for first time since April 1923. After reaching a stage of 192.28 feet on June 16 (contents, about 420,000 acre-feet) the lake receded until Dec. 14, when it began to receive water due to the December flood. Later in 1938 a much higher stage was reached. See 1938 annual water supply paper for the complete 1937 and 1938 record. Data furnished by Tulare Lake Reclamation District No. 749.

Daily gage height, in feet, December 1937

Day	Gage height	Day	Gage height	Day	Gage height	Day	Gage height	Day	Gage height	Day	Gage height
1	186.0	6	186.0	11	186.0	16	186.6	21	186.9	26	186.9
2	186.0	7	186.0	12	186.0	17	186.7	22	186.9	27	186.9
3	186.0	8	185.9	13	186.0	18	186.7	23	186.9	28	186.9
4	186.0	9	186.0	14	186.2	19	186.8	24	186.9	29	186.9
5	186.0	10	186.0	15	186.4	20	186.8	25	186.9	30	186.9
										31	186.9

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Tule River near Porterville, Calif.

Location.- Lat. 36°05', long. 118°55', in NW¼ sec. 25, T. 21 S., R. 28 E., at highway bridge 1 mile above South Fork and 6 miles east of Porterville, Tulare County. Altitude, about 580 feet above mean sea level.
Drainage area.- 266 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,300 second-feet; extended to peak stage with aid of area-velocity study and slope-area determination of flood flow. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 11,300 second-feet 6 p.m. Dec. 11 (gage height, 10.3 feet, observed outside of well, and 9.5 feet, inside of well, affected by drawdown).
1901-November 1937: Discharge, 12,500 second-feet (revised) Feb. 13, 1936 (gage height, 10.55 feet, inside of well; 11.4 feet, outside of well, determined from observations of drawdown at lower stages), from rating curve extended above 3,700 second-feet on basis of slope-area determination of flood flow and area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	15	27	98	11	23	2,880	84	21	27	130	156
2	14	27	100	12	28	1,800	82	22	28	123	148
3	14	27	106	13	30	545	81	23	27	147	141
4	15	21	98	14	28	334	79	24	28	134	134
5	15	21	96	15	27	254	167	25	30	120	125
6	17	20	91	16	27	214	134	26	31	114	123
7	21	19	90	17	27	188	150	27	30	111	120
8	22	20	88	18	36	166	165	28	28	105	118
9	21	26	85	19	34	152	184	29	28	102	387
10	21	2,200	85	20	29	141	210	30	27	102	228
								31		100	182
Mean monthly discharge, in second-feet									24.9	335	133
Run-off, in acre-feet									1,480	20,570	8,200

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.85	22	5.00	860	4.75	735	7.20	2,800	4.77	745
4	1.80	18	1.85	22	6.80	2,290	4.54	636	7.15	2,730	4.65	685
6	-	-	1.85	22	7.90	4,120	4.41	584	7.10	2,660	4.52	628
8	1.82	20	1.85	22	8.15	4,810	4.26	524	6.93	2,450	4.41	584
10	-	-	1.85	22	7.95	4,250	4.22	508	6.45	1,920	4.30	540
N	1.82	20	1.85	22	7.50	3,280	4.34	556	6.00	1,530	4.20	500
2	-	-	1.86	23	6.55	2,020	4.75	735	5.70	1,300	4.16	486
4	1.83	20	1.87	24	5.70	1,300	7.25	2,880	5.50	1,160	4.07	457
6	-	-	1.92	28	5.47	1,140	9.50	11,300	5.35	1,070	4.02	441
8	1.84	21	1.96	32	5.35	1,070	9.10	9,050	5.28	1,030	3.96	423
10	-	-	2.05	41	5.15	950	8.10	4,660	5.08	908	3.94	417
M	1.85	22	2.30	71	4.90	810	7.47	3,230	4.92	820	3.90	405
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.87	396	-	-	-	-	-	-	-	-	-	-
4	3.81	379	3.41	274	3.18	226	-	-	-	-	-	-
6	3.77	368	-	-	-	-	3.03	196	2.91	172	-	-
8	3.72	354	3.35	261	3.16	222	-	-	-	-	-	-
10	3.68	343	-	-	-	-	-	-	-	-	-	-
N	3.64	332	3.31	252	3.13	216	2.98	186	2.88	166	2.80	152
2	3.60	321	-	-	-	-	-	-	-	-	-	-
4	3.57	314	3.29	248	3.05	200	-	-	-	-	-	-
6	3.52	301	-	-	-	-	2.96	182	2.86	163	-	-
8	3.50	296	3.25	240	3.06	202	-	-	-	-	-	-
10	3.48	291	-	-	-	-	-	-	-	-	-	-
M	3.46	286	3.22	234	3.06	202	2.92	174	2.84	159	2.76	145
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.66	127	-	-	-	-
6	-	-	-	-	-	-	-	-	2.74	141	-	-
8	-	-	-	-	-	-	2.74	141	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.74	141	2.68	130	2.64	123	2.96	182	2.70	134	2.63	121
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.87	165	-	-	-	-
6	-	-	-	-	-	-	-	-	2.65	125	-	-
8	-	-	-	-	-	-	2.77	147	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.71	136	2.65	125	2.62	120	2.76	145	2.65	125	2.61	118

Supplemental records.- Dec. 10, 1 a.m., 2.53 ft., 105 sec.-ft. Dec. 11, 3. p.m., 5.45 ft., 1,130 sec.-ft.; 5 p.m., 9,00 ft., 8,500 sec.-ft.

South Fork of Tule River near Success, Calif.

Location.- Lat. 36°03', long. 118°51', in NW¼ sec. 4, T. 22 S., R. 29 E., 3 miles southeast of Success, Tulare County, and 5 miles above mouth. Altitude, about 750 feet above mean sea level.

Drainage area.- 106 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 950 second-feet.

Maxima.- December 1937: Discharge, 1,060 second-feet 7 p.m. Dec. 11 (gage height, 4.80 feet).

1930-November 1937: Discharge, 3,370 second-feet Feb. 6, 1937 (gage height, 6.36 feet, inside of well; 7.1 feet, outside of well, from floodmarks), from rating curve extended above 1,100 second-feet on basis of area-velocity study; verified on basis of contracted-opening determination of discharge of 2,960 second-feet March 1938.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.8	7.5	21	11	5	276	16	21	7	25	39
2	2.8	7.5	22	12	8	267	16	22	6.5	24	37
3	2.3	7.5	23	13	6.5	99	16	23	6.5	32	34
4	2.0	7.5	21	14	6.5	62	16	24	6.5	27	31
5	1.9	7.5	20	15	6.5	47	33	25	7.5	24	29
6	2.0	7.5	19	16	6.5	39	28	26	8	24	27
7	2.8	7.5	19	17	7	35	38	27	8	24	27
8	3.9	7.5	18	18	12	31	41	28	7.5	23	27
9	5.5	8	17	19	8	28	49	29	7.5	22	74
10	5	300	16	20	7.5	26	55	30	7.5	22	57
								31		21	49
Mean monthly discharge, in second-feet									5.90	49.9	30.2
Run-off, in acre-feet									351	3,070	1,850

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.75	210	2.09	76	3.41	418	-	-
4	-	-	1.38	7.5	3.75	550	2.05	70	3.35	396	2.37	122
6	-	-	-	-	3.95	632	2.01	64	3.32	385	-	-
8	-	-	1.38	7.5	3.80	570	1.98	61	3.27	368	2.29	107
10	-	-	-	-	3.58	482	1.96	58	3.02	288	-	-
N	1.38	7.5	1.38	7.5	3.18	338	2.02	66	2.87	244	2.23	97
2	-	-	-	-	2.84	235	2.12	80	2.74	207	-	-
4	-	-	1.39	8	2.60	170	2.48	144	2.64	180	2.17	88
6	-	-	-	-	2.45	138	4.65	972	2.63	178	-	-
8	-	-	1.41	9	2.32	113	4.54	912	2.57	163	2.12	80
10	-	-	-	-	2.23	97	3.86	594	2.55	159	-	-
M	1.38	7.5	1.53	16	2.15	84	3.51	456	2.47	142	2.08	74
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.03	67	1.88	49	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.99	62	1.86	47	1.79	39	1.75	35	1.71	31	1.68	28
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.95	57	1.84	44	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.91	52	1.82	42	1.77	37	1.73	33	1.70	30	1.67	27
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.64	25	-	-	-	-
6	-	-	-	-	-	-	-	-	1.69	29	-	-
8	-	-	-	-	-	-	1.68	28	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.66	26	1.64	25	1.63	24	1.80	40	1.67	27	1.63	24
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.81	41	-	-	-	-
6	-	-	-	-	-	-	-	-	1.65	26	-	-
8	-	-	-	-	-	-	1.71	31	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.65	26	1.64	25	1.63	24	1.71	31	1.63	24	1.63	24

Supplemental records.- Dec. 11, 7 p.m., 4.80 ft., 1,060 sec.-ft.

Kaweah River near Three Rivers, Calif.

<u>Location</u>.- Lat. 36°24', long. 118°57', in SW¼ sec. 33, T. 17 S., R. 28 E., 2½ miles b low South Fork and 3 miles southwest of Three Rivers, Tulare County. Altitude, about 620 feet above mean sea level.

<u>Drainage area</u>.- 520 square miles.

<u>Gage-height record</u>.- Water-stage recorder graph except for period 2 p.m. Dec. 11 to 4 p.m. Dec. 17, when the record was unreliable. Peak stage determined from observed level on outside of gage house; verified by drift-marks on banks.

<u>Stage-discharge relation</u>.- Defined by current-meter measurements below 5,200 second-feet; extended to peak stage with aid of area-velocity study; verified by $A\sqrt{d}$ method. Rating curve changed at peak stage.

<u>Maxima</u>.- December 1937: Discharge, about 33,300 second-feet 3 p.m. Dec. 11 (gage height, about 16.0 feet).

1903-November 1937: Discharge, 18,900 second-feet Feb. 6, 1937 (gage height, 12.65 feet), from rating curve extended above 5,200 second-feet with aid of area-velocity study.

<u>Remarks</u>.- Flood run-off not affected by artificial storage or diversion. Discharge for period of unreliable gage-height record determined from discharge graph based on peak stage, gage readings Dec. 13 and 14, and general shape of recorder graph.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	66	69	317	11	71	10,800	258	21	77	409	372
2	66	71	354	12	89	5,600	252	22	76	379	368
3	65	72	372	13	80	1,900	247	23	74	485	354
4	59	72	334	14	76	1,000	247	24	74	405	344
5	65	71	313	15	77	800	410	25	76	372	334
6	65	71	294	16	76	670	347	26	74	361	340
7	66	71	282	17	86	578	432	27	74	347	334
8	68	71	276	18	96	537	460	28	72	337	344
9	69	84	264	19	82	485	436	29	71	323	497
10	69	5,870	258	20	79	440	413	30	68	320	432
								31		317	413
Mean monthly discharge, in second-feet									73.5	1,077	34
Run-off, in acre-feet									4,380	66,220	21,22

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.73	71	6.50	4,640	3.90	1,590	-	-	-	-
4	-	-	.73	71	8.60	8,600	3.70	1,430	-	-	-	-
6	-	-	.73	71	9.42	10,600	3.52	1,300	-	7,150	-	2,28
8	-	-	.73	71	9.88	11,900	3.70	1,430	-	-	-	-
10	-	-	.73	71	9.50	10,800	5.50	3,210	-	-	-	-
N	.73	71	.73	71	8.10	7,550	7.60	6,570	-	5,300	-	1,80
2	-	-	.73	71	6.55	4,720	14.60	27,900	-	-	-	-
4	-	-	.74	72	5.62	3,370	-	29,400	-	-	-	-
6	-	-	.78	79	5.05	2,660	-	21,900	-	3,680	-	1,50
8	-	-	.85	91	4.85	2,450	-	15,500	-	-	-	-
10	-	-	1.05	134	4.55	2,150	-	11,900	-	-	-	-
M	.73	71	1.50	262	4.20	1,830	-	9,760	-	2,840	-	1,27
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	1,110	-	-	-	-	2.10	600	2.02	564	1.88	502
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	-	994	-	780	-	660	2.05	578	1.94	528	1.82	476
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	917	-	-	-	-	2.01	560	1.90	510	1.77	456
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	860	-	715	-	614	2.05	578	1.92	519	1.84	485
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	1.65	409	-	-	-	-
4	-	-	-	-	-	-	1.73	440	1.80	468	1.67	417
6	1.78	460	1.70	428	1.62	398	1.83	481	-	-	-	-
8	-	-	-	-	-	-	2.10	600	1.72	436	1.58	383
10	-	-	-	-	-	-	2.20	645	-	-	-	-
N	1.73	440	1.66	413	1.57	379	2.08	591	1.61	394	1.52	361
2	-	-	-	-	-	-	1.91	514	-	-	-	-
4	-	-	-	-	-	-	1.79	464	1.53	365	1.48	347
6	1.66	413	1.58	383	1.52	361	1.72	436	-	-	-	-
8	-	-	-	-	-	-	1.70	428	1.52	361	1.47	344
10	-	-	-	-	-	-	1.72	436	-	-	-	-
M	1.74	444	1.65	409	1.59	386	1.79	464	1.59	386	1.55	372

Supplemental records.- Dec. 11, 1 p.m., 11.30 ft., 16,200 sec.-ft.; 3 p.m., 16.00 ft., 33,300 sec.-ft.

North Fork of Kaweah River at Kaweah, Calif.

Location.- Lat. 36°29', long. 118°55', in SE¼ sec. 34, T. 16 S., R. 28 E., 1¼ miles above Mannikin Creek, 1½ miles north of Kaweah, Tulare County, and 3 miles above mouth. Altitude, about 1,080 feet above mean sea level.
Drainage area.- 128 square miles.
Gage-height record.- Water-stage recorder graph. For period Jan. 1-14 recorder graph unreliable, and record was based on shape of recorder graph for Kaweah River near Three Rivers.
Stage-discharge relation.- Defined by current-meter measurements below 3,200 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 8,290 second-feet 3 p.m. Dec. 11 (gage height, 11.0 feet).
1910-November 1937: Discharge, about 7,400 second-feet Jan. 25, 1914 (gage height, 10.2 feet, former site and datum, from floodmarks), from rating curve extended above 2,600 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	9.5	12	88	11	11	2,390	74	21	13	104	122
2	9.5	12	100	12	17	1,100	74	22	14	99	124
3	9.5	12	116	13	14	331	74	23	12	121	119
4	9.5	12	106	14	13	229	74	24	13	104	116
5	9.5	12	100	15	14	189	143	25	14	93	118
6	9.5	12	93	16	14	160	129	26	14	90	118
7	10	12	86	17	16	147	139	27	14	89	119
8	10	12	83	18	16	129	150	28	14	86	126
9	10	18	80	19	15	119	141	29	13	86	171
10	10	1,280	74	20	14	111	129	30	12	86	149
								31		88	149
Mean monthly discharge, in second-feet									12.5	237	112
Run-off, in acre-feet									742	14,570	6,910

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.80	12	5.15	1,120	3.58	299	6.35	2,400	-	-
4	-	-	1.80	12	5.90	1,830	3.46	263	5.91	1,900	3.89	396
6	1.80	12	1.80	12	6.12	2,070	3.37	237	5.41	1,400	-	-
8	-	-	1.80	12	6.40	2,400	3.36	234	5.00	1,060	3.77	349
10	-	-	1.79	12	6.70	2,760	3.85	402	4.80	905	-	-
N	1.80	12	1.79	12	5.95	1,880	5.18	1,140	4.62	779	3.65	307
2	-	-	1.78	11	5.02	1,020	10.00	6,990	4.50	700	-	-
4	-	-	1.78	11	4.48	700	10.50	7,640	4.37	624	3.60	290
6	1.78	11	1.86	15	4.18	551	7.78	4,120	4.26	565	-	-
8	-	-	2.00	23	4.10	515	6.42	2,480	4.19	530	3.56	278
10	-	-	2.16	35	3.93	438	7.03	3,210	4.11	490	-	-
M	1.81	12	2.55	76	3.75	360	7.05	3,230	4.02	449	3.51	263
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.45	246	-	-	-	-	-	-	-	-	-	-
6	-	-	3.28	201	3.12	164	3.05	150	2.95	132	2.89	122
8	3.42	238	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.37	224	3.23	189	3.09	158	3.03	147	2.93	129	2.87	119
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.36	222	-	-	-	-	-	-	-	-	-	-
6	-	-	3.19	180	3.07	154	3.00	141	2.91	126	2.85	116
8	3.31	209	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	206	3.16	173	3.05	150	2.98	138	2.90	124	2.85	116
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	2.77	104	-	-	-	-
4	-	-	-	-	-	-	2.84	114	2.86	118	2.79	106
6	2.84	114	2.79	106	2.75	100	2.90	124	-	-	-	-
8	-	-	-	-	-	-	3.02	145	2.80	108	2.72	96
10	-	-	-	-	-	-	3.09	158	-	-	-	-
N	2.82	111	2.78	105	2.74	99	2.99	139	2.74	99	2.68	90
2	-	-	-	-	-	-	2.88	121	-	-	-	-
4	-	-	-	-	-	-	2.82	111	2.69	92	2.65	86
6	2.80	108	2.76	102	2.71	94	2.80	108	-	-	-	-
8	-	-	-	-	-	-	2.83	113	2.68	90	2.65	86
10	-	-	-	-	-	-	2.90	124	-	-	-	-
M	2.80	108	2.75	100	2.72	96	2.90	124	2.80	108	2.76	102

Supplemental records.- Dec. 10, 1 a.m., 3.70 ft., 340 sec.-ft. Dec. 11, 3 p.m., 11.0 ft., 8,290 sec.-ft.; 9 p.m., 6.27 ft., 2,310 sec.-ft.; 11 p.m., 7.50 ft., 3,780 sec.-ft.

Kings River above North Fork, Calif.

Location.- Lat. 36°52', long. 119°07', in N½ sec. 27, T. 12 S., R. 26 E. (unsurveyed), 1 mile above North Fork of Kings River and 10 miles southeast of Trimmer, Fresno County. Altitude, about 1,020 feet above mean sea level.

Drainage area.- 956 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 11,000 second-feet; extended to peak stage with aid of area-velocity study; verified by logarithmic extension. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 42,000 second-feet 4 p.m. Dec. 11 (gage height, 12.02 feet).

1927-28; 1931-November 1937: Discharge, 13,400 second-feet Feb. 6, 1937 (gage height, 7.86 feet), from rating curve extended above 10,000 second-feet.

Remarks.- Flood run-off very slightly affected by artificial storage. No diversions. Part of basic data furnished by Kings River Water Association and San Joaquin Light & Power Corporation.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	149	147	390	11	153	14,600	300	21	172	560	400
2	149	149	415	12	200	5,990	296	22	167	525	410
3	147	151	430	13	231	2,120	292	23	161	555	381
4	145	143	400	14	207	1,310	292	24	161	485	372
5	143	141	376	15	187	1,020	430	25	163	470	368
6	141	141	354	16	169	871	390	26	161	455	368
7	145	141	354	17	176	780	465	27	159	440	363
8	145	138	340	18	183	698	460	28	155	420	395
9	145	153	322	19	169	638	445	29	149	415	460
10	147	3,340	322	20	172	590	415	30	149	415	410
								31		425	435
Mean monthly discharge, in second-feet									163	1,240	382
Run-off, in acre-feet									9,720	76,220	23,500

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	0.87	140	0.86	138	2.12	539	3.82	1,850	7.01	10,600	4.59	2,980
4	.86	138	.85	136	4.29	2,450	3.62	1,630	6.53	8,750	4.48	2,740
6	.86	138	.85	136	5.24	4,070	3.53	1,540	6.17	7,440	4.37	2,500
8	.85	136	.86	138	5.72	5,310	3.64	1,650	5.89	6,490	4.28	2,320
10	.85	136	.85	136	5.88	5,850	5.07	3,720	5.65	5,730	4.18	2,120
N	.85	136	.85	136	5.62	5,000	7.00	9,920	5.40	5,000	4.11	2,000
2	.85	136	.86	138	5.20	3,980	9.95	25,600	5.25	4,590	4.04	1,870
4	.85	136	.87	140	4.84	3,290	12.02	42,000	5.11	4,230	3.98	1,770
6	.86	138	.95	155	4.68	3,030	11.05	34,200	4.98	3,890	3.93	1,690
8	.86	138	1.09	185	4.53	2,800	9.75	24,900	4.93	3,770	3.92	1,670
10	.86	138	1.21	215	4.25	2,390	8.80	19,200	4.85	3,580	3.91	1,660
M	.86	138	1.49	295	4.02	2,090	7.69	13,600	4.74	3,320	3.91	1,660
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.86	1,580	3.46	1,140	3.23	944	3.06	822	-	-	-	-
4	3.80	1,500	3.43	1,120	3.20	920	3.05	815	2.94	738	2.83	668
6	3.75	1,440	3.39	1,080	3.19	913	3.04	808	-	-	-	-
8	3.67	1,350	3.37	1,060	3.16	892	3.02	794	2.91	717	2.83	668
10	3.62	1,300	3.33	1,030	3.14	878	3.01	787	-	-	-	-
N	3.59	1,270	3.31	1,010	3.11	857	2.99	773	2.89	704	2.79	644
2	3.55	1,230	3.29	992	3.08	836	2.98	766	-	-	-	-
4	3.52	1,200	3.27	976	3.05	815	2.95	745	2.86	686	2.74	614
6	3.49	1,170	3.25	960	3.04	808	2.94	738	-	-	-	-
8	3.48	1,160	3.24	952	3.04	808	2.93	731	2.82	662	2.70	590
10	3.47	1,150	3.24	952	3.05	815	2.92	724	-	-	-	-
M	3.47	1,150	3.23	944	3.06	822	2.93	731	2.81	656	2.74	614
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	2.60	540	2.56	520	2.50	490
4	2.78	638	2.70	590	2.61	545	2.67	575	2.56	520	2.52	500
6	-	-	-	-	-	-	2.72	608	2.55	515	2.53	505
8	2.77	632	2.68	580	2.60	540	2.78	638	2.55	515	2.51	495
10	-	-	-	-	-	-	2.75	620	2.53	505	2.48	480
N	2.70	590	2.63	555	2.58	530	2.68	580	2.50	490	2.45	465
2	-	-	-	-	-	-	2.62	550	2.47	475	2.43	455
4	2.63	555	2.59	535	2.52	500	2.58	530	2.43	455	2.40	440
6	-	-	-	-	-	-	2.56	520	2.40	440	2.38	430
8	2.61	545	2.58	530	2.50	490	2.56	520	2.39	435	2.38	430
10	-	-	-	-	-	-	2.56	520	2.41	445	2.39	435
M	2.66	570	2.59	535	2.55	515	2.57	525	2.46	470	2.43	455

Kings River at Piedra, Calif.

<u>Location</u>.- Lat. 36°49'02", long. 119°23'08", in NW¼ sec. 8, T. 13 S., R. 24 E., half a mile below highway bridge at Piedra, Fresno County, and 12 miles northeast of Sanger. Altitude, about 500 feet above mean sea level.
<u>Drainage area</u>.- 1,694 square miles.
<u>Gage-height record</u>.- Water-stage recorder graph.
<u>Stage-discharge relation</u>.- Defined by current-meter measurements below 26,000 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.
<u>Maxima</u>.- December 1937: Discharge, 80,000 second-feet 4:30 p.m. Dec. 11 (gage height, 19.94 feet).
1895-November 1937: Discharge, about 59,700 second-feet Jan. 25, 1914 (gage height, 21.8 feet, from floodmarks, former site and datum 1,000 feet upstream), from rating curve extended above 15,000 second-feet.
<u>Remarks</u>.- Flood run-off not affected by artificial storage or diversion. Part of basic data furnished by Kings River Water Association.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	183	196	784	11	192	37,800	665	21	220	1,080	916
2	187	192	832	12	213	12,900	645	22	220	964	910
3	187	196	1,040	13	274	4,120	635	23	215	1,040	880
4	183	194	922	14	286	2,680	635	24	215	1,000	820
5	180	190	838	15	253	2,160	1,170	25	220	922	790
6	176	187	790	16	259	1,840	1,080	26	218	880	790
7	178	185	748	17	225	1,600	1,000	27	215	862	790
8	185	185	725	18	235	1,460	1,140	28	208	826	927
9	185	194	695	19	238	1,300	1,110	29	203	802	1,510
10	185	9,190	675	20	223	1,180	1,110	30	199	790	1,080
								31		820	1,000
Mean monthly discharge, in second-feet									212	2,837	892
Run-off, in acre-feet									12,610	174,400	54,850

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.43	185	1.41	180	1.95	328	7.45	6,140	13.50	27,800	7.59	5,540
4	1.42	183	1.40	178	2.28	447	6.94	5,130	12.14	20,700	7.43	5,230
6	1.42	183	1.40	178	2.80	675	6.65	4,620	11.37	17,100	7.22	4,840
8	1.43	185	1.41	180	8.87	9,730	6.95	5,140	10.45	13,400	7.01	4,470
10	1.44	187	1.42	183	10.92	17,300	8.00	7,400	9.80	11,200	6.83	4,170
N	1.44	187	1.43	185	11.57	20,400	16.00	46,800	9.35	9,820	6.67	3,910
2	1.44	187	1.43	185	10.67	16,200	19.87	79,700	8.97	8,760	6.54	3,710
4	1.43	185	1.44	187	9.82	12,900	19.80	79,000	8.59	7,780	6.44	3,560
6	1.43	185	1.50	201	8.96	10,000	19.20	72,500	8.28	7,030	6.32	3,380
8	1.42	183	1.54	211	8.76	9,420	18.75	68,100	8.03	6,470	6.24	3,270
10	1.41	180	1.63	232	8.71	9,280	17.20	54,200	7.88	6,140	6.19	3,200
M	1.41	180	1.77	271	8.12	7,700	15.00	37,500	7.78	5,930	6.18	3,180
	December 14		December 15		December 16		December 17		December 18		December 19	
2	6.20	3,210	5.48	2,300	5.16	1,950	4.87	1,660	4.68	1,490	4.49	1,330
4	6.18	3,180	5.52	2,340	5.16	1,950	4.87	1,660	4.67	1,480	4.47	1,320
6	6.10	3,070	5.52	2,340	5.15	1,940	4.88	1,670	4.67	1,480	4.47	1,320
8	6.00	2,940	5.48	2,300	5.14	1,930	4.89	1,680	4.67	1,480	4.47	1,320
10	5.88	2,780	5.43	2,240	5.11	1,900	4.87	1,660	4.68	1,490	4.48	1,320
N	5.78	2,660	5.37	2,180	5.09	1,880	4.85	1,640	4.67	1,480	4.49	1,330
2	5.70	2,560	5.32	2,120	5.06	1,850	4.82	1,620	4.65	1,460	4.48	1,320
4	5.62	2,460	5.28	2,080	5.02	1,810	4.80	1,600	4.63	1,450	4.45	1,300
6	5.57	2,400	5.25	2,040	4.97	1,760	4.77	1,570	4.61	1,430	4.43	1,280
8	5.53	2,360	5.22	2,010	4.93	1,720	4.74	1,550	4.59	1,410	4.41	1,270
10	5.48	2,300	5.20	1,990	4.90	1,690	4.72	1,530	4.56	1,390	4.36	1,230
M	5.46	2,280	5.17	1,960	4.88	1,670	4.70	1,510	4.53	1,360	4.30	1,180
	December 20		December 21		December 22		December 23		December 24		December 25	
2	4.26	1.150	4.15	1,080	4.09	1,030	3.88	898	4.08	1,030	3.87	892
4	4.25	1,140	4.12	1,050	4.06	1,010	3.83	868	4.07	1,020	3.85	880
6	4.28	1,170	4.14	1,070	3.99	964	3.82	862	4.09	1,030	3.87	892
8	4.32	1,200	4.18	1,100	3.95	940	3.90	910	4.12	1,050	3.93	928
10	4.34	1,210	4.21	1,120	3.96	946	4.14	1,070	4.13	1,060	3.98	958
N	4.35	1,220	4.22	1,120	3.98	958	4.25	1,140	4.12	1,050	3.99	964
2	4.34	1,210	4.21	1,120	3.99	964	4.34	1,210	4.10	1,040	3.98	958
4	4.31	1,190	4.20	1,110	3.98	958	4.39	1,250	4.07	1,020	3.96	946
6	4.27	1,160	4.17	1,090	3.97	952	4.34	1,210	4.03	991	3.92	922
8	4.24	1,140	4.15	1,080	3.96	946	4.25	1,140	3.97	952	3.88	898
10	4.20	1,110	4.14	1,070	3.94	934	4.18	1,100	3.93	928	3.84	874
M	4.17	1,090	4.11	1,050	3.92	922	4.12	1,050	3.91	916	3.80	850

Supplemental records.- Dec. 11, 3:15 p.m., 19.57 ft., 76,700 sec.-ft.; 4:30 p.m., 19.94 ft., 80,000 sec.-ft.; 6:20 p.m., 19.49 ft., 75,500 sec.-ft.

Fresno by-pass, Fresno County, Calif.

Kings River, during flood periods, flows into Tulare Lake but also contributes some water to the San Joaquin River by way of Fresno Slough and Fresno by-pass which joins the San Joaquin River near Mendota. Data furnished by C. L. Kaupke, water master, Kings River Water Association. (See No. 311a on figure 6.)

Daily discharge, in second-feet, December 1937

Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge	Day	Discharge
1	0	6	0	11	0	16	2,805	21	1,100	26	755
2	0	7	0	12	0	17	2,025	22	915	27	680
3	0	8	0	13	920	18	1,650	23	830	28	635
4	0	9	0	14	1,850	19	1,550	24	790	29	610
5	0	10	0	15	3,070	20	1,330	25	760	30	600
										31	595
Mean monthly discharge, in second-feet											757
Run-off, in acre-feet											46,550

North Fork of Kings River near Cliff Camp, Calif.

Location.- Lat. 37°00', long. 118°59', in NW¼ sec. 12, T. 11 S., R. 27 E., at Cliff Camp Bridge, 1 mile northeast of Cliff Camp, Fresno County, and 2.3 miles below Woodchuck Creek. Altitude, about 6,150 feet above mean sea level.

Drainage area.- 174 square miles.

Gage-height record.- Water-stage recorder graph except for period 11 a.m. Dec. 11 to 11 a.m. Jan. 26, when there was no record. Stage graph for Dec. 11 and Jan. 26 determined from partial recorder graph, floodmarks, and stage graphs for Kings River above North Fork and at Piedra. Peak stage obtained from floodmarks.

Stage-discharge relation.- Defined by current-meter measurements below 2,800 second-feet; extended to peak stage with aid of area-velocity study; verified by logarithmic extension.

Maxima.- December 1937: Discharge, 14,000 second-feet about noon Dec. 11 (gage height, 18.0 feet).

1921-November 1937: Discharge, 6,030 second-feet June 4, 1922 (gage height, 10.6 feet, former site and datum), from rating curve extended above 4,200 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Mean discharge for period Dec. 12-31 estimated as 300 second-feet; for period Jan. 1-25 estimated as 85 second-feet. Most of basic data furnished by San Joaquin Light & Power Corporation.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	8	8.5	-	11	9.5	6,620	-	21	13	-	-
2	7.5	9.5	-	12	10	-	-	22	11	-	-
3	7	9	-	13	9.5	-	-	23	11	-	-
4	7	8	-	14	12	-	-	24	13	-	-
5	6.5	7.5	-	15	11	-	-	25	11	-	-
6	7	8	-	16	10	-	-	26	11	-	104
7	8	7.5	-	17	15	-	-	27	10	-	98
8	7.5	7.5	-	18	11	-	-	28	9.5	-	95
9	7.5	39	-	19	10	-	-	29	9	-	97
10	8.5	1,210	-	20	13	-	-	30	8.5	-	97
								31		-	95
Mean monthly discharge, in second-feet									9.75	450	87.5
Run-off, in acre-feet									580	27,640	5,380

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	2.64	7	2.65	7.5	6.46	804	7.50	1,240				
4	2.73	9	2.74	9	7.08	1,060	8.60	1,830				
6	2.74	9	2.78	10	8.25	1,620	12.53	5,450				
8	2.75	9.5	2.79	10	8.75	1,920	14.95	8,820				
10	2.75	9.5	2.80	11	7.98	1,470	16.69	11,700				
N	2.68	8	2.81	11	7.15	1,090	18.00	14,000				
2	2.59	6.5	2.81	11	7.49	1,240	17.30	12,700				
4	2.51	5	2.81	11	8.25	1,620	14.50	8,140				
6	2.58	6	2.90	14	7.50	1,240	12.65	5,600				
8	2.69	8	3.14	24	6.83	952	11.65	4,420				
10	2.67	7.5	4.20	150	6.42	788	11.00	3,720				
M	2.63	7	5.45	440	6.64	876	10.50	3,240				
	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplementary records.- Dec. 9, 9 p.m., 3.26 ft., 33 sec.-ft.

North Fork of Kings River below Rancheria Creek, Calif.

Location.- Lat. 36°56', long. 119°00', in SE¼ sec. 34, T. 11 S., R. 27 E., 1 mile above Balch Diversion Dam and 1 mile below Rancheria Creek, Fresno County. Altitude, about 3,400 feet above mean sea level.
Drainage area.- 225 square miles.
Gage-height record.- Water-stage recorder graph prior to Nov. 30 except for periods Nov. 7-8, 10-15, and parts of Nov. 6, 9, 16, 18, 19, 21, 22, when stage graph was based on partial recorder graph, occasional gage readings, and shape of stage graph for North Fork of Kings River near Cliff Camp. No record for period Dec. 1 to Jan. 31.
Stage-discharge relation.- Defined by current-meter measurements below 4,000 second-feet; extended to peak stage on basis of computation of flow over Balch Forebay Dam plus discharge through sluice gates minus estimated inflow; verified by computation of flow over Balch Afterbay Dam plus discharge through sluice gates minus estimated inflow between gage and dam.
Maxima.- December 1937: Discharge, 21,000 second-feet Dec. 11 (gage height, about 23 feet, from floodmarks).
1927-November 1937: Discharge, 6,510 second-feet May 14, 1937 (gage height, 13.10 feet), from rating curve extended above 3,800 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Mean discharge for period Dec. 12-31 estimated as 450 second-feet; for January, 140 second-feet. Most of basic data furnished by San Joaquin Light & Power Corporation.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	16	16	-	11	19	9,000	-	21	23	-	-
2	16	15	-	12	20	-	-	22	21	-	-
3	16	18	-	13	20	-	-	23	21	-	-
4	16	16	-	14	22	-	-	24	21	-	-
5	15	15	-	15	21	-	-	25	23	-	-
6	16	14	-	16	20	-	-	26	20	-	-
7	16	14	-	17	22	-	-	27	20	-	-
8	16	14	-	18	26	-	-	28	20	-	-
9	16	100	-	19	20	-	-	29	18	-	-
10	17	1,500	-	20	22	-	-	30	17	-	-
								31		-	-
Mean monthly discharge, in second-feet									19.2	636	140
Run-off, in acre-feet									1,140	39,120	8,610

Los Gatos Creek near Coalinga, Calif.

Location.- Lat. 36°13', long. 120°27', in SW$\frac{1}{4}$ sec. 4, T. 20 S., R. 14 E., at mouth of canyon, 3 miles below Diaz Creek, and 7$\frac{1}{2}$ miles northwest of Coalinga, Fresno County. Altitude, about 1,000 feet above mean sea level.

Drainage area.- 105 square miles.

Gage-height record.- Water-stage recorder graph. Affected by variable drawdown of water level in well at high stages.

Stage-discharge relation.- Defined by current-meter measurements below 300 second-feet; extended to peak stage on basis of slope-area determination of flood flow. Shifting-control method used for periods Nov. 1 to Dec. 10, Jan. 16-31. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, about 1,530 second-feet 9:30 a.m. Dec. 11 (gage height, 5.1 feet, from floodmarks on bank; 4.58 feet, inside of well, affected by drawdown).

1931-November 1937: Discharge, about 1,050 second-feet Dec. 28, 1931 (gage height, 4.66 feet, inside of well, present datum), from rating curve extended above 15 second-feet on basis of slope-area determination of flood flow.

January-September 1938: Discharge, about 4,520 second-feet Feb. 11 (gage height, 8.0 feet, from floodmarks on banks; 6.23 feet, inside of well, due to drawdown), from rating curve extended above 300 second-feet on basis of area-velocity study.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	0.3	0.5	11	0.2	349	0.5	21	0.3	0.5	31
2	.2	.3	.6	12	.2	49	.5	22	.3	.5	28
3	.2	.3	.6	13	.2	31	.5	23	.3	.6	24
4	.2	.3	.5	14	.2	14	.5	24	.3	.5	23
5	.2	.3	.5	15	.2	7.5	22	25	.3	.5	21
6	.2	.3	.5	16	.2	3.4	2.9	26	.3	.5	20
7	.2	.3	.5	17	.3	1.6	38	27	.3	.5	20
8	.2	.3	.5	18	.3	1.0	31	28	.3	.5	35
9	.2	.6	.5	19	.3	.6	37	29	.3	.5	53
10	.2	.5	.5	20	.3	.5	45	30	.3	.5	40
								31		.5	135
Mean monthly discharge, in second-feet									0.25	15.1	19.8
Run-off, in acre-feet									15	926	1220

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	December 8 Feet	December 8 Sec.ft.	December 9 Feet	December 9 Sec.ft.	December 10 Feet	December 10 Sec.ft.	December 11 Feet	December 11 Sec.ft.	December 12 Feet	December 12 Sec.ft.	December 13 Feet	December 13 Sec.ft.
2	-	-	-	-	-	-	0.54	0.3	1.69	97		
4	-	-	0.57	0.3	-	-	.55	.5	1.58	74		
6	-	-	-	-	0.56	0.6	.75	4.9	1.51	60		
8	-	-	.57	.3	-	-	1.35	56	1.47	53		
10	-	-	-	-	-	-	4.50	1,460	1.43	45		
N	0.57	0.3	.58	.5	.55	.5	3.57	862	1.41	42		
2	-	-	-	-	-	-	3.67	912	1.39	38		
4	-	-	.64	1.5	-	-	2.90	480	1.36	34		
6	-	-	-	-	.53	.3	2.35	265	1.33	30		
8	-	-	.61	1.0	-	-	2.10	195	1.31	26		
10	-	-	-	-	-	-	1.93	152	1.30	25		
M	.57	.3	.57	.3	.54	.3	1.79	119	1.29	24		

Supplemental records.- Dec. 11, 9 a.m., 2.75 ft., 412 sec.-ft.; 9:30 a.m., 4.58 ft., 1,530 sec.-ft.; 3 p.m., 3.10 ft., 580 sec.-ft.

San Joaquin River above Big Creek, Calif.

Location.- Lat. 37°15'00", long. 119°19'10", in NW¼ sec. 11, T. 8 S., R. 24 E., 3 miles above mouth of Big Creek, Fresno County. Altitude, about 2,500 feet above mean sea level.

Drainage area.- 1,042 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 16,000 second-feet; extended to peak stage with aid of area-velocity study; verified by comparison of peak flow and total run-off of flood with record for San Joaquin River near Friant.

Maxima.- December 1937: Discharge, 52,500 second-feet 3 p.m. Dec. 11 (gage height, 24.05 feet).

1922-November 1937: Discharge, 18,000 second-feet June 5, 1922 (gage height, 17.34 feet).

Remarks.- Flood run-off slightly affected by artificial storage. Most of basic data furnished by Southern California Edison Co., Ltd.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	106	130	427	11	119	31,700	365	21	159	655	534
2	106	126	530	12	140	6,890	358	22	161	602	581
3	104	130	555	13	117	2,440	348	23	144	610	543
4	102	125	506	14	126	1,590	348	24	146	539	498
5	101	121	474	15	142	1,280	678	25	150	502	506
6	99	119	438	16	128	1,090	589	26	144	498	514
7	102	119	427	17	177	985	745	27	144	482	526
8	106	117	408	18	212	885	722	28	136	454	539
9	104	158	379	19	157	790	655	29	134	442	589
10	106	5,500	372	20	157	700	581	30	132	442	560
								31		438	572
Mean monthly discharge, in second-feet									132	1,957	512
Run-off, in acre-feet									7,860	120,300	31,470

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	6.93	117	6.92	116	9.07	878	14.44	7,890	16.62	13,400	12.21	3,210
4	6.95	121	6.95	121	9.99	1,440	15.75	11,800	15.78	10,700	12.01	2,990
6	6.96	123	6.96	123	11.92	3,070	17.50	18,200	15.11	8,750	11.83	2,810
8	6.96	123	6.97	125	12.93	4,480	20.00	29,600	14.56	7,340	11.65	2,630
10	6.95	121	6.96	123	13.68	6,010	22.65	44,100	14.12	6,340	11.49	2,480
N	6.94	119	6.95	121	14.18	7,220	23.30	48,000	13.76	5,620	11.36	2,360
2	6.93	117	6.95	121	14.43	7,870	23.95	52,200	13.44	5,020	11.23	2,250
4	6.92	116	6.94	119	14.40	7,790	23.90	51,800	13.17	4,540	11.12	2,160
6	6.91	114	7.01	132	14.46	7,950	22.90	44,800	12.93	4,160	11.00	2,060
8	6.90	112	7.26	186	14.58	8,270	21.13	34,000	12.74	3,890	10.95	2,020
10	6.90	112	7.68	300	14.32	7,580	19.22	24,100	12.59	3,680	10.93	2,000
M	6.89	110	8.35	547	14.15	7,140	17.78	17,800	12.41	3,440	10.88	1,960
	December 14		December 15		December 16		December 17		December 18		December 19	
2	10.78	1,890	10.10	1,440	9.68	1,190	9.40	1,040	9.19	930	9.03	850
4	10.67	1,810	10.06	1,410	9.65	1,170	9.39	1,030	9.18	925	9.07	870
6	10.55	1,720	10.01	1,380	9.62	1,160	9.37	1,020	9.17	920	9.05	860
8	10.45	1,660	9.95	1,340	9.59	1,140	9.34	1,000	9.16	915	9.00	835
10	10.37	1,610	9.90	1,320	9.55	1,120	9.31	990	9.14	905	8.95	812
N	10.30	1,560	9.86	1,290	9.49	1,080	9.28	975	9.12	895	8.92	799
2	10.25	1,530	9.82	1,270	9.43	1,050	9.25	960	9.09	880	8.86	772
4	10.20	1,500	9.77	1,240	9.40	1,040	9.23	950	9.06	865	8.82	754
6	10.15	1,460	9.74	1,220	9.36	1,020	9.21	940	9.01	840	8.76	727
8	10.10	1,440	9.72	1,210	9.34	1,000	9.18	925	8.98	826	8.73	714
10	10.10	1,440	9.70	1,200	9.34	1,000	9.17	920	8.99	830	8.72	709
M	10.11	1,440	9.70	1,200	9.36	1,020	9.17	920	8.97	822	8.72	709
	December 20		December 21		December 22		December 23		December 24		December 25	
2	8.79	740	8.55	632	8.52	619	8.46	593	8.30	526	8.22	494
4	8.91	794	8.68	691	8.57	642	8.62	664	8.37	555	8.27	514
6	8.90	790	8.77	732	8.62	664	8.72	709	8.44	585	8.33	539
8	8.85	768	8.73	714	8.61	660	8.71	704	8.47	597	8.36	551
10	8.78	736	8.67	686	8.57	642	8.67	686	8.46	593	8.32	534
N	8.71	704	8.62	664	8.52	619	8.63	668	8.40	568	8.27	514
2	8.65	678	8.58	646	8.47	597	8.54	628	8.35	547	8.21	490
4	8.59	650	8.54	628	8.42	576	8.46	593	8.28	518	8.17	474
6	8.54	628	8.51	612	8.37	555	8.40	568	8.24	502	8.15	466
8	8.51	614	8.48	602	8.34	543	8.32	534	8.23	498	8.17	474
10	8.49	606	8.48	602	8.33	539	8.27	514	8.22	494	8.18	478
M	8.51	614	8.49	606	8.37	555	8.26	510	8.21	490	8.20	486

Supplementary records.- Dec. 11, 3 p.m., 24.05 ft., 52,500 sec.-ft.

San Joaquin River below Kerckhoff power house, Calif.

Location.- Lat. 37°05', long. 119°34', in SW¼ sec. 3, T. 10 S., R. 22 E., three-quarters of a mile below Kerckhoff power house, Fresno County, and 2 miles above Big Sandy Creek. Altitude, about 605 feet above mean sea level.
Drainage area.- 1,480 square miles.
Gage-height record.- Water-stage recorder graph prior to noon Dec. 11. Gage house destroyed by flood. Peak stage determined from floodmarks.
Stage-discharge relation.- Defined by current-meter measurements below 14,000 second-feet; extended to peak stage with aid of area-velocity study; verified by peak discharge computed for flow over Kerckhoff Dam, 7 miles upstream, plus computed discharge through sluice gates at Kerckhoff power house.
Maxima.- December 1937: Discharge, 75,000 second-feet about 5 p.m. Dec. 11 (gage height, 46.5 feet).
1936-November 1937: Discharge, 32,000 second-feet Feb. 6, 1937 (gage height, 33.6 feet).
Remarks.- Flood run-off affected by artificial storage in Florence, Huntington, and Shaver Lakes, and in Crane Valley Reservoir. Discharge for period from noon to midnight Dec. 11 based on comparison with records at Friant and Kerckhoff Dam. Discharge not determined for period Dec. 12 to Jan. 31.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	886	713	-	11	986	41,800	-	21	759	-	-
2	1,060	665	-	12	1,060	-	-	22	962	-	-
3	1,120	721	-	13	873	-	-	23	1,120	-	-
4	1,100	620	-	14	691	-	-	24	1,090	-	-
5	1,130	306	-	15	952	-	-	25	603	-	-
6	1,080	907	-	16	689	-	-	26	618	-	-
7	648	1,270	-	17	903	-	-	27	515	-	-
8	668	1,600	-	18	1,180	-	-	28	493	-	-
9	1,110	760	-	19	1,090	-	-	29	597	-	-
10	1,110	5,240	-	20	1,010	-	-	30	646	-	-
								31			
Mean monthly discharge, in second-feet									-	-	-
Run-off, in acre-feet									-	-	-

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	12.80	2,060	7.20	258	11.23	1,320	20.06	7,970				
4	13.50	2,460	10.00	890	10.80	1,160	19.75	7,620				
6	13.50	2,460	9.57	766	10.40	1,020	21.16	9,230				
8	13.88	2,690	8.62	530	10.00	890	25.20	15,000				
10	13.76	2,620	8.02	404	12.00	1,650	34.90	35,400				
N	12.79	2,050	7.60	324	12.00	1,650	44.50	67,000				
2	11.89	1,600	7.54	313	21.65	9,820	-	69,000				
4	10.42	1,030	9.00	620	23.05	11,800	-	74,000				
6	9.10	644	11.13	1,280	22.09	10,400	-	74,000				
8	7.94	388	11.07	1,260	21.50	9,640	-	68,000				
10	7.36	284	11.60	1,470	21.41	9,530	-	54,000				
M	7.33	279	11.72	1,520	20.85	8,860	-	39,000				

Supplemental records.- Dec. 11, about 5 p.m., 46.5 ft., 75,000 sec.-ft.

San Joaquin River near Friant, Calif.

Location.- Lat. 37°00'32", long. 119°41'44", in NE¼ sec. 5, T. 11 S., R. 21 E., 1 mile above Cottonwood Creek and 1½ miles northeast of Friant, Fresno County. Zero of gage is 315.03 feet above mean sea level.

Drainage area.- 1,632 square miles.

Gage-height record.- Water-stage recorder graph except for period Dec. 13 to Jan. 31, when it was based on recorder graphs for stations on river below Friant and on Cottonwood Creek.

Stage-discharge relation.- Defined by current-meter measurements below 25,000 second-feet; extended to peak stage on basis of a drift-velocity measurement of 73,500 second-feet made 2 miles downstream at station below Friant (negligible inflow); verified by area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 77,200 second-feet 7 p.m. Dec. 11 (gage height, 23.8 feet).

1907-November 1937: Discharge, about 60,000 second-feet (revised) Jan. 25, 1914 (gage height, 21.72 feet), from rating curve extended above 13,000 second-feet on basis of rating curve for 1938.

Remarks.- Flood run-off affected by artificial storage in Florence, Huntington, and Shaver Lakes, and in Crane Valley Reservoir. Discharge for period Dec. 13 to Jan. 31 computed from record of discharge for San Joaquin River below Friant, adjusted for flow of Cottonwood Creek. Part of basic data furnished by State of California, Division of Water Resources.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	890	726	988	11	1,030	37,900	1,190	21	830	1,460	1,610
2	1,010	677	957	12	1,010	19,300	1,190	22	874	1,340	1,570
3	1,070	698	1,400	13	1,000	5,100	1,190	23	1,120	1,340	1,390
4	1,120	680	1,380	14	654	1,970	1,230	24	1,060	1,380	1,260
5	1,070	452	1,270	15	877	2,070	2,950	25	778	896	1,430
6	1,100	527	1,330	16	804	1,870	2,400	26	488	978	1,430
7	794	1,360	1,220	17	673	1,530	1,500	27	640	1,310	1,430
8	776	1,820	1,120	18	1,130	1,580	2,040	28	498	1,140	1,460
9	1,060	524	1,040	19	1,120	1,370	1,950	29	526	1,310	1,870
10	1,120	4,430	1,270	20	1,020	1,370	1,900	30	622	1,120	1,560
								31		1,170	1,620
Mean monthly discharge, in second-feet.......................									892	3,206	1,489
Run-off, in acre-feet.......................................									53,090	197,200	91,530

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	5.30	1,050	4.36	594	5.69	1,270	11.33	10,400	19.26	43,000		
4	6.30	1,700	4.03	465	6.00	1,480	11.00	9,540	17.30	31,600		
6	6.42	1,800	3.78	375	6.08	1,540	10.72	8,810	15.60	23,800		
8	6.73	2,070	3.59	313	5.86	1,380	10.56	8,400	14.43	19,400		
10	7.06	2,380	3.53	295	5.78	1,330	11.35	10,400	13.43	16,000		
N	7.10	2,420	4.75	768	6.06	1,520	14.55	20,200	12.68	13,800		
2	7.33	2,650	4.55	678	6.62	1,970	20.88	55,000	12.10	12,100		
4	7.09	2,410	4.27	558	7.05	2,370	23.40	74,000	11.58	10,800		
6	6.57	1,920	4.06	476	11.43	10,700	23.62	75,600	11.18	9,720		
8	6.10	1,550	3.88	411	12.00	12,200	23.70	76,400	10.83	8,880		
10	5.42	1,120	3.80	382	11.75	11,500	23.10	71,200	10.54	8,190		
M	4.83	805	5.48	1,150	11.44	10,700	21.90	61,600	10.42	7,910		
	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplemental records.- Dec. 11, 7 p.m., 23.8 ft., 77,200 sec.-ft.

San Joaquin River below Skaggs Bridge, Calif.

Location.- Lat. 36°50', long. 120°05', in SE¼ sec. 2, T. 13 S., R. 17 E., about 2 miles below Skaggs Bridge and 7 miles west of Herndon, Fresno County. Altitude, about 200 feet above mean sea level.
Drainage area.- 1,760 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements to 26,000 second-feet; extended above. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 55,000 second-feet 7 a.m. Dec. 12 (gage height, 20.90 feet).
Remarks.- Records furnished by State engineer.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	921	653	1,300	11	1,190	5,920	1,300	21	1,160	1,620	1,840
2	930	759	1,030	12	1,110	36,000	1,250	22	948	1,560	1,730
3	1,050	714	1,150	13	1,150	9,450	1,240	23	1,010	1,500	1,600
4	1,160	732	1,490	14	1,030	3,830	1,240	24	1,240	1,460	1,490
5	1,150	705	1,460	15	786	2,520	1,660	25	1,220	1,420	1,390
6	1,160	487	1,370	16	993	2,340	3,420	26	858	1,020	1,610
7	1,150	593	1,430	17	831	2,130	2,160	27	613	1,160	1,550
8	813	1,360	1,310	18	867	1,800	1,900	28	653	1,370	1,500
9	930	1,780	1,180	19	1,240	1,800	2,080	29	553	1,190	1,800
10	1,130	876	1,140	20	1,210	1,500	2,110	30	580	1,370	2,200
								31		1,210	1,820
Mean monthly discharge, in second-feet									988	2,930	1,605
Run-off, in acre-feet									58,780	180,200	98,720

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	3.38	1,590	3.65	1,850	2.61	885	3.22	1,440	13.80	22,800	11.25	15,100
4	3.43	1,640	3.87	2,080	2.52	804	3.30	1,510	19.10	45,500	10.45	13,200
6	3.44	1,650	4.02	2,230	2.50	786	3.57	1,770	20.80	54,000	9.78	11,700
8	3.41	1,620	4.05	2,260	2.52	804	4.50	2,750	20.87	55,000	9.10	10,200
10	3.29	1,500	4.00	2,210	2.55	831	6.00	4,680	20.20	52,000	8.60	9,180
N	3.12	1,340	3.84	2,050	2.52	804	7.07	6,390	19.05	45,000	8.24	8,490
2	2.91	1,160	3.65	1,850	2.46	750	7.98	8,000	18.00	39,500	7.90	7,850
4	2.75	1,010	3.45	1,660	2.42	714	8.45	8,890	16.50	32,700	7.62	7,350
6	2.70	966	3.25	1,460	2.50	786	8.67	9,320	15.00	27,000	7.28	6,740
8	2.82	1,070	3.06	1,290	2.72	984	8.74	9,470	14.00	23,500	6.98	6,230
10	3.08	1,310	2.90	1,150	2.97	1,210	8.90	9,790	13.00	20,300	6.71	5,790
M	3.38	1,590	2.75	1,010	3.13	1,350	10.30	12,900	12.10	17,400	6.57	5,560
	December 14		December 15		December 16		December 17		December 18		December 19	
2	6.47	5,400	4.29	2,520	4.20	2,420	4.00	2,210	3.60	1,800	3.62	1,820
4	6.33	5,180	4.25	2,470	4.18	2,400	3.98	2,190	3.48	1,680	3.52	1,720
6	6.12	4,860	4.22	2,440	4.16	2,380	3.96	2,170	3.40	1,610	3.43	1,640
8	5.80	4,400	4.21	2,430	4.15	2,370	3.95	2,160	3.40	1,610	3.40	1,610
10	5.50	3,980	4.23	2,450	4.15	2,370	3.94	2,150	3.48	1,680	3.43	1,640
N	5.23	3,620	4.30	2,530	4.13	2,340	3.92	2,130	3.57	1,770	3.53	1,730
2	4.97	3,300	4.35	2,580	4.11	2,320	3.91	2,120	3.63	1,830	3.63	1,830
4	4.75	3,040	4.34	2,570	4.10	2,310	3.91	2,120	3.70	1,900	3.70	1,900
6	4.55	2,800	4.34	2,570	4.09	2,300	3.89	2,100	3.74	1,940	3.73	1,930
8	4.42	2,660	4.32	2,550	4.08	2,290	3.87	2,080	3.75	1,950	3.74	1,940
10	4.36	2,590	4.29	2,520	4.05	2,260	3.82	2,020	3.75	1,950	3.72	1,920
M	4.32	2,550	4.25	2,470	4.02	2,230	3.74	1,940	3.72	1,920	3.66	1,860
	December 20		December 21		December 22		December 23		December 24		December 25	
2	3.57	1,770	3.27	1,480	3.37	1,580	3.22	1,440	3.21	1,430	3.19	1,420
4	3.43	1,640	3.23	1,450	3.27	1,480	3.18	1,400	3.15	1,370	3.14	1,370
6	3.27	1,480	3.20	1,420	3.20	1,420	3.17	1,390	3.10	1,330	3.12	1,350
8	3.15	1,370	3.21	1,430	3.18	1,400	3.17	1,390	3.08	1,310	3.12	1,350
10	3.08	1,310	3.28	1,490	3.29	1,500	3.20	1,420	3.14	1,360	3.17	1,400
N	3.09	1,320	3.47	1,670	3.38	1,590	3.28	1,490	3.22	1,440	3.25	1,480
2	3.18	1,400	3.57	1,770	3.45	1,660	3.35	1,560	3.31	1,520	3.31	1,530
4	3.26	1,480	3.62	1,820	3.49	1,690	3.42	1,630	3.37	1,580	3.33	1,550
6	3.32	1,540	3.63	1,830	3.49	1,690	3.45	1,660	3.42	1,630	3.27	1,490
8	3.35	1,560	3.59	1,790	3.43	1,640	3.44	1,650	3.42	1,630	3.17	1,400
10	3.35	1,560	3.53	1,730	3.35	1,560	3.37	1,580	3.34	1,550	3.08	1,320
M	3.32	1,530	3.45	1,660	3.27	1,480	3.29	1,500	3.25	1,460	3.00	1,240

Supplemental records.- D c. 12, 7 a.m., 20.90 ft., 55,000 sec.-ft.

San Joaquin River near Newman, Calif.

Location.- Lat. 37°21'02", long. 120°58'34", in SW¼ sec. 3, T. 7 S., R. 9 E., at highway bridge on Hills Ferry road, 300 feet below mouth of Merced River and 3½ miles northeast of Newman, Stanislaus County. Zero of gage is 51.0 feet (datum of Corps of Engineers, U. S. Army).

Drainage area.- 9,990 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements for entire range of stage.

Maxima.- December 1937: Discharge, 6,050 second-feet morning Dec. 24 (gage height, 11.41 feet).

1912-November 1937: Discharge observed (unregulated), 20,700 second-feet (main channel only) Jan. 27, 1914 (gage height, 18.0 feet), from rating curve extended above 12,400 second-feet.

January-September 1938: Discharge 33,000 second-feet 12:30 a.m. Mar. 7 (gage height, 18.50 feet), from rating curve extended above 32,000 second-feet.

Remarks.- Flood run-off very materially affected by storage in Lake McClure and other storage reservoirs and by natural channel storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	314	466	3,720	11	296	780	3,330	21	450	5,380	5,020
2	304	466	3,640	12	299	960	3,330	22	434	5,750	4,930
3	294	483	3,640	13	294	1,320	3,120	23	466	5,950	4,840
4	289	483	3,560	14	284	2,100	3,050	24	500	6,050	4,660
5	282	434	3,400	15	279	2,700	3,050	25	517	5,850	4,480
6	277	434	3,330	16	274	3,190	3,560	26	517	5,290	4,210
7	277	450	3,260	17	282	3,560	3,880	27	483	4,750	3,960
8	279	466	3,330	18	294	4,040	4,120	28	434	4,390	3,800
9	286	483	3,120	19	327	4,390	4,480	29	434	4,120	3,640
10	289	606	3,190	20	419	4,840	4,840	30	434	3,880	3,720
								31		3,720	3,640
Mean monthly discharge, in second-feet									354	2,832	3,802
Run-off, in acre-feet									21,040	174,100	233,800

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	3.06	556	3.51	724	3.95	900	4.41	1,090
6	-	-	2.83	476	-	-	-	-	-	-	-	-
8	-	-	-	-	3.14	584	3.61	764	4.02	928	4.55	1,160
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.79	463	2.85	483	3.20	606	3.67	788	4.09	956	4.92	1,320
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	3.26	629	3.74	816	4.15	980	5.18	1,450
6	-	-	2.92	507	-	-	-	-	-	-	-	-
8	-	-	-	-	3.32	652	3.81	844	4.20	1,000	5.47	1,600
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.81	469	2.99	531	3.40	682	3.89	876	4.27	1,030	5.77	1,740
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.03	1,880	7.12	2,530	7.84	3,010	-	-	-	-	-	-
6	-	-	-	-	-	-	8.51	3,490	9.04	3,910	9.51	4,310
8	6.27	2,020	7.25	2,610	7.95	3,080	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	6.50	2,160	7.40	2,700	8.08	3,180	8.62	3,580	9.18	4,020	9.65	4,440
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.66	2,260	7.52	2,780	8.19	3,250	-	-	-	-	-	-
6	-	-	-	-	-	-	8.76	3,690	9.30	4,120	9.77	4,540
S	6.81	2,350	7.64	2,870	8.29	3,320	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	6.98	2,450	7.74	2,940	8.37	3,380	8.91	3,810	9.41	4,220	9.90	4,660
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	10.02	4,770	10.57	5,260	11.04	5,690	11.28	5,930	11.41	6,050	11.29	5,940
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	10.14	4,880	10.71	5,390	11.12	5,770	11.31	5,960	11.40	6,050	11.16	5,810
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	10.28	5,000	10.82	5,490	11.20	5,850	11.33	5,980	11.37	6,020	11.01	5,660
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	10.43	5,140	10.95	5,600	11.26	5,910	11.38	6,030	11.34	5,990	10.91	5,570

San Joaquin River near Vernalis, Calif.

Location.- Lat. 37°40'34", long. 121°15'51", in El Pescadero grant, at Durham Ferry highway bridge, 3 miles below Stanislaus River and 3½ miles northeast of Vernalis, San Joaquin County. Altitude, about 10 feet above mean sea level.
Drainage area.- 14,010 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements. Shifting control method used during November.
Maxima.- December 1937: Discharge, 7,960 second-feet 2 to 4 a.m. Dec. 26 (gage height, 14.36 feet).
1922-November 1937: Discharge, 28,700 second-feet Feb. 25, 1936 (gage height, 25.47 feet), from rating curve for 1937.
January-September 1938: Discharge, 51,200 second-feet 1 a.m. Mar. 16 (gage height, 26.64 feet). Peak discharge includes measured flow through levee break on right bank of Stanislaus River, 500 feet upstream from junction with San Joaquin River and about 3 miles upstream from gaging station.
Remarks.- Flood run-off very materially affected by artificial storage in Hetch Hetchy, Don Pedro, and Melones Reservoirs and Lake McClure. Many irrigation diversions above station.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1,720	2,140	6,460	11	1,930	2,420	5,090	21	2,070	7,160	7,160
2	1,720	2,210	6,170	12	1,930	3,260	5,270	22	2,140	7,460	7,460
3	1,860	2,210	5,720	13	1,930	5,360	5,270	23	2,070	7,660	7,360
4	1,900	2,210	5,540	14	1,960	6,460	5,270	24	2,140	7,860	7,160
5	1,900	2,210	5,810	15	1,930	7,060	5,180	25	2,210	7,860	6,960
6	1,900	2,280	5,810	16	1,860	7,060	5,360	26	2,210	7,860	7,360
7	1,930	2,280	5,630	17	1,930	7,160	5,540	27	2,140	7,660	7,360
8	1,930	2,210	5,630	18	1,960	7,260	5,720	28	2,140	7,360	7,260
9	1,860	2,210	5,540	19	1,960	7,260	6,080	29	2,140	7,260	7,060
10	1,930	2,280	5,270	20	2,000	7,260	6,660	30	2,070	6,960	6,860
								31		6,660	7,160
Mean monthly discharge, in second-feet									1,979	5,308	6,199
Run-off, in acre-feet									117,800	326,400	381,200

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	-	-	-	-	8.55	2,740	10.76	4,510
4	-	-	-	-	-	-	8 05	2,380	8.65	2,820	11.06	4,780
6	7.80	2,210	7.80	2,210	7.92	2,290	-	-	8.75	2,900	11.30	5,000
8	-	-	-	-	-	-	8.14	2,450	8.85	2,980	11.51	5,190
10	-	-	-	-	-	-	-	-	9.00	3,100	11.70	5,360
N	7.80	2,210	7.83	2,230	7.95	2,320	8.15	2,460	9.14	3,210	11.85	5,500
2	-	-	-	-	-	-	-	-	9.27	3,320	11.99	5,620
4	-	-	-	-	-	-	8.14	2,450	9.45	3,460	12.10	5,720
6	7.71	2,150	7.76	2,180	7.89	2,270	-	-	9.68	3,640	12.23	5,840
8	-	-	-	-	-	-	8.23	2,510	9.95	3,860	12.33	5,930
10	-	-	-	-	-	-	-	-	10.23	4,080	12.44	6,030
M	7.71	2,150	7.77	2,190	7.94	2,310	8.43	2,650	10.50	4,300	12.53	6,110
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	12.67	6,230	13.45	7,010	-	-	-	-	-	-	-	-
6	-	-	-	-	13.51	7,070	13.60	7,160	13.81	7,370	13.79	7,350
8	12.75	6,310	13.52	7,080	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	12.83	6,390	13.55	7,110	13.40	6,960	13.56	7,120	13.68	7,240	13.65	7,210
2	-	-	-	-	-	-	-	-	-	-	-	-
4	12.96	6,520	13.57	7,130	-	-	-	-	-	-	-	-
6	-	-	-	-	13.41	6,970	13.64	7,200	13.67	7,230	13.63	7,190
8	13.12	6,680	13.60	7,160	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	13.31	6,870	13.60	7,160	13.54	7,100	13.80	7,360	13.79	7,350	13.77	7,330
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	13.83	7,390	13.55	7,110	13.97	7,530	14.15	7,710	14.34	7,900	14.34	7,900
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	13.71	7,270	13.55	7,110	13.91	7,470	14.11	7,670	14.30	7,860	14.34	7,900
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	13.58	7,140	13.67	7,230	13.92	7,480	14.10	7,660	14.27	7,830	14.33	7,890
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	13.55	7,110	13.86	7,420	14.04	7,600	14.25	7,810	14.28	7,840	14.36	7,920

160302 O—39——10

Florence Lake near Big Creek, Calif.

Location.- Lat. 37°17', long. 118°58', in SE¼ sec. 36, T. 7 S., R. 27 E., in gatehouse of Ward Tunnel, upstream from dam on South Fork of San Joaquin River, 16 miles northeast of Big Creek, Fresno County. Zero of gage is at mean sea level.
Drainage area.- 171 square miles.
Gage-height record.- Water-stage recorder graph.
Remarks.- Flood run-off completely controlled in lake. Elevation of top of spillway gates is 7,327.5 feet above mean sea level (capacity, 64,406 acre-feet). See record for South Fork of San Joaquin River at Florence Lake. Records of gage height and contents at midnight furnished by Southern California Edison Co., Ltd. Contents show amount available for release.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	7,315.21	52,915	7,249.38	6,386	7,224.28	162
2	7,315.23	52,934	7,241.12	3,332	7,224.28	162
3	7,315.24	52,943	7,232.98	1,387	7,224.24	159
4	7,315.25	52,952	7,227.77	591	7,224.24	159
5	7,315.27	52,970	7,225.26	306	7,224.21	157
6	7,313.19	51,101	7,224.18	214	7,224.16	154
7	7,312.52	50,504	7,223.77	184	7,224.13	151
8	7,311.34	49,460	7,223.61	116	7,224.09	149
9	7,310.09	48,363	7,224.30	163	7,224.09	149
10	7,308.84	47,276	7,226.88	415	7,224.06	147
11	7,307.27	45,924	7,236.91	2,192	7,224.03	144
12	7,305.67	44,562	7,232.80	1,355	7,224.02	144
13	7,305.10	44,080	7,229.74	850	7,224.01	143
14	7,304.56	43,625	7,228.30	658	7,224.03	144
15	7,303.98	43,138	7,226.95	489	7,224.02	144
16	7,303.43	42,679	7,226.26	410	7,224.20	156
17	7,302.56	41,956	7,225.98	313	7,224.28	162
18	7,300.27	40,071	7,225.82	297	7,224.33	166
19	7,296.65	37,153	7,225.68	284	7,224.28	162
20	7,292.67	34,023	7,225.59	275	7,224.23	158
21	7,288.34	30,707	7,225.28	245	7,224.30	163
22	7,283.82	27,347	7,225.02	219	7,224.26	161
23	7,279.21	24,028	7,224.84	205	7,224.21	157
24	7,276.09	21,846	7,224.80	202	7,224.20	156
25	7,275.19	21,228	7,224.78	200	7,224.18	155
26	7,274.57	20,804	7,224.74	197	7,224.18	155
27	7,271.82	18,954	7,224.72	196	7,224.18	155
28	7,266.79	15,697	7,224.71	195	7,224.13	151
29	7,261.69	12,589	7,224.52	180	7,224.26	161
30	7,256.09	9,501	7,224.38	169	7,224.34	166
			7,224.28	162	7,224.30	163

South Fork of San Joaquin River near Florence Lake, Calif.

Location.- Lat. 37°16'20", long. 118°57'50", in SE¼ sec. 36, T. 7 S., R. 27 E., just below spillway of Florence Lake Dam, Fresno County, and 6 miles above mouth of Bear Creek. Altitude, about 7,200 feet above mean sea level.
Drainage area.- 171 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Flood run-off regulated in Florence Lake.
1921-November 1937: Discharge (unregulated), 3,460 second-feet June 4, 1922 (gage height, 13.75 feet).
Remarks.- Flood run-off regulated in Florence Lake. See record for Florence Lake. Record of adjusted mean daily discharge furnished by Southern California Edison Co., Ltd., has been adjusted for storage in Florence Lake and release into Ward tunnel. Most of basic data furnished by Southern California Edison Co., Ltd.

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.9	0.1	0.9	11	0.2	1.9	0.7	21	0.1	1.5	0.7
2	.9	.1	.9	12	.1	.4	.7	22	.1	1.3	.5
3	.9	.1	.9	13	.1	.2	.7	23	.1	1.3	.4
4	.9	.1	.7	14	.2	.1	.7	24	.1	1.3	.4
5	.9	.1	.7	15	.1	.1	.9	25	.1	1.1	.4
6	.7	.1	.7	16	.2	.1	.9	26	.1	.9	.4
7	.7	.1	.7	17	.3	15	.9	27	.1	.9	.4
8	.5	14	.7	18	.2	2.3	.9	28	.1	.9	.4
9	.2	2.6	.7	19	.2	1.9	.9	29	.1	.9	.4
10	.2	2.6	.7	20	.2	1.7	.7	30	.1	.9	.4
								31		.9	.4
Mean monthly discharge, in second-feet									0.32	1.79	0.66
Run-off, in acre-feet									19	110	40

Adjusted mean daily discharge, December 8-25, 1937

Day	Second-feet	Day	Second-feet	Day	Second-feet
8	14	14	195	20	91
9	60	15	179	21	83
10	302	16	142	22	78
11	1,450	17	108	23	75
12	369	18	110	24	65
13	243	19	98	25	63

Bear Creek near Vermilion Valley, Calif.

Location.- Lat. 37°20', long. 118°58', in SW¼ sec. 12, T. 7 S., R. 27 E., 2 miles above mouth of Vermilion Valley, Fresno County. Altitude, about 7,400 feet above mean sea level.
Drainage area.- 53.5 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Affected by ice for periods Nov. 9-10, Nov. 12 to Dec. 8, Dec. 24 to Jan. 31. Defined by current-meter measurements for range of stage of high water in December.
Maxima.- December 1937: Discharge, 634 second-feet 1 p.m. Dec. 11 (gage height, 5.47 feet).
1921-November 1937: Discharge, 1,600 second-feet (revised) July 21, 1936 (gage height, 6.90 feet), from rating curve extended above 950 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for periods of ice effect computed on basis of weather records, 3 discharge measurements, and records for Mono Creek and Ward tunnel. Most of basic data furnished by Southern California Edison Co., Ltd.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6	6	18	11	4.3	242	14	21	6	28	16
2	6	6	17	12	4.5	79	14	22	6	28	16
3	5.5	6	17	13	4.5	69	14	23	6	23	17
4	5	6	16	14	5	67	14	24	6	22	17
5	4.9	6	16	15	5	52	14	25	6	22	17
6	5	6	16	16	5	42	15	26	6	21	18
7	4.9	6	15	17	5	37	15	27	6	20	18
8	4.3	5	15	18	5	33	15	28	6	20	18
9	4.5	7	15	19	6	33	16	29	6	19	20
10	4.5	61	14	20	6	31	16	30	6	18	20
								31		18	20
Mean monthly discharge, in second-feet									5.36	33.5	16.2
Run-off, in acre-feet									319	2,060	998

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			3.05	5.5	3.43	27	3.60	44	4.00	101	3.74	62
4			3.04	5	3.63	48	3.67	53	3.93	90	3.73	61
6			3.03	4.9	3.81	72	3.80	70	3.87	80	3.73	61
8			3.06	6	4.07	113	4.63	242	3.83	74	3.73	61
10			3.12	8	3.88	82	5.10	440	3.78	67	3.73	61
N			3.11	7.5	3.79	69	5.33	556	3.77	66	3.71	58
2			3.09	6.5	3.78	67	5.40	595	3.80	70	3.89	84
4			3.09	6.5	3.75	64	4.88	338	3.88	82	3.94	91
6			3.12	8	3.72	60	4.54	215	3.86	79	3.90	85
8			3.15	9	3.68	54	4.30	156	3.84	76	3.85	78
10			3.22	12	3.63	48	4.15	127	3.80	70	3.82	73
M			3.30	17	3.60	44	4.06	111	3.76	65	3.80	70
	December 14		December 15		December 16		December 17		December 18		December 19	
2	3.80	70	3.70	57	3.58	42	3.55	38	3.52	35	3.45	28
4	3.81	72	3.68	54	3.57	41	3.54	37	3.49	32	3.47	30
6	3.81	72	3.67	53	3.57	41	3.54	37	3.48	31	3.50	33
8	3.81	72	3.66	52	3.58	42	3.54	37	3.47	30	3.53	36
10	3.81	72	3.65	50	3.59	43	3.55	38	3.48	31	3.56	40
N	3.75	64	3.65	50	3.57	41	3.51	34	3.48	31	3.52	35
2	3.73	61	3.66	52	3.57	41	3.52	35	3.52	35	3.51	34
4	3.76	65	3.67	53	3.60	44	3.55	38	3.53	36	3.53	36
6	3.77	66	3.68	54	3.61	45	3.56	40	3.53	36	3.50	33
8	3.76	65	3.67	53	3.60	44	3.56	40	3.51	34	3.47	30
10	3.74	62	3.64	49	3.58	42	3.55	38	3.47	30	3.46	29
M	3.71	58	3.61	45	3.56	40	3.53	36	3.46	29	3.45	28
	December 20		December 21		December 22		December 23		December 24		December 25	
2	3.45	28	3.43	27	3.39	23	3.29	23				
4	3.45	28	3.44	28	3.40	24	3.39	23				
6	3.47	30	3.45	28	3.43	27	3.37	22				
8	3.49	32	3.47	30	3.45	28	3.38	23				
10	3.53	36	3.49	32	3.47	30	3.38	23				
N	3.51	34	3.48	31	3.50	33	3.39	23				
2	3.50	33	3.45	28	3.45	28	3.40	24				
4	3.49	32	3.46	29	3.46	29	3.37	22				
6	3.47	30	3.44	28	3.46	29	3.38	23				
8	3.45	28	3.42	26	3.43	27	3.37	22				
10	3.43	27	3.40	24	3.40	24	3.37	22				
M	3.43	27	3.40	24	3.39	23	3.37	22				

Supplemental records.- Dec. 11, 1 p.m., 5.47 ft., 634 sec.-ft.

Mono Creek near Vermilion Valley, Calif.

Location.- Lat. 37°22', long. 118°59', in SW¼ sec. 35, T. 6 S., R. 27 E. (unsurveyed), 1 mile below lower end of Vermilion Valley, Fresno County, and 6 miles below mouth of North Fork. Altitude, about 7,400 feet above mean sea level.
Drainage area.- 92.0 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Affected by ice for periods Nov. 9 to Dec. 9, Dec. 24 to Jan. 31. Defined by current-meter measurements for entire range of stage.
Maxima.- December 1937: Discharge, 389 second-feet 5 p.m. Dec. 11 (gage height, 6.26 feet).

1921-November 1937: Discharge, 1,420 second-feet June 16, 1927 (gage height, 8.09 feet), June 22, 1932 (gage height, 8.10 feet), from rating curve defined to 1,400 second-feet.

January-September 1938: Discharge, 1,760 second-feet 10:30 p.m. June 2 (gage height, 8.62 feet) from rating curve extended above 1,500 second-feet with aid of area-velocity study.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for periods of ice effect computed on basis of 2 discharge measurements and flow of Bear Creek and Ward Tunnel.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	19	15	40	11	17	193	34	21	16	57	36
2	19	15	40	12	17	143	33	22	16	60	36
3	18	15	39	13	17	116	33	23	16	50	36
4	17	15	38	14	17	109	33	24	16	48	36
5	17	15	38	15	17	87	35	25	16	47	36
6	18	15	37	16	17	72	36	26	16	46	36
7	17	15	36	17	17	67	36	27	16	45	36
8	16	15	36	18	17	60	36	28	16	44	38
9	16	15	35	19	17	64	36	29	16	43	38
10	16	71	34	20	17	62	36	30	16	42	38
								31		41	38
Mean monthly discharge, in second-feet									16.8	54.9	36.3
Run-off, in acre-feet									998	3,380	2,230

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					4.92	32	5.24	78	5.57	153	5.40	111
4					5.03	45	5.23	76	5.55	148	5.36	102
6					5.12	57	5.25	80	5.51	138	5.34	98
8					5.17	65	5.33	96	5.49	133	5.33	96
10					5.20	70	5.45	123	5.49	133	5.33	96
N					5.32	93	5.88	243	5.51	138	5.39	109
2					5.37	104	6.03	297	5.53	143	5.56	151
4					5.30	89	6.20	365	5.53	143	5.58	156
6					5.24	78	6.20	365	5.54	145	5.45	123
8					5.22	74	5.92	256	5.55	148	5.42	116
10					5.27	83	5.73	197	5.53	143	5.41	113
M					5.27	83	5.63	169	5.50	135	5.37	104
	December 14		December 15		December 16		December 17		December 18		December 19	
2	5.36	102	5.32	93	5.25	80	5.20	70	5.16	64	5.10	54
4	5.35	100	5.30	89	5.15	62	5.19	68	5.15	62	5.06	49
6	5.36	102	5.25	80	5.06	49	5.11	56	5.11	56	5.07	50
8	5.37	104	5.25	80	5.08	51	5.15	62	4.98	39	5.12	57
10	5.39	109	5.27	83	5.14	60	5.17	65	5.00	41	5.16	64
N	5.45	123	5.41	113	5.24	78	5.30	89	5.16	64	5.21	72
2	5.54	145	5.30	89	5.35	100	5.20	70	5.27	83	5.34	98
4	5.41	113	5.28	85	5.32	93	5.17	65	5.18	67	5.29	87
6	5.36	102	5.27	83	5.25	80	5.16	64	5.16	64	5.21	72
8	5.35	100	5.27	83	5.23	76	5.16	64	5.16	64	5.16	64
10	5.36	102	5.27	83	5.22	74	5.17	65	5.20	70	5.10	54
M	5.34	98	5.26	81	5.21	72	5.17	65	5.16	64	5.07	50
	December 20		December 21		December 22		December 23		December 24		December 25	
2	5.04	46	5.07	50	5.04	46	5.06	49				
4	5.03	45	5.06	49	5.06	49	5.03	45				
6	5.06	49	5.06	49	5.06	49	5.01	42				
8	5.10	54	5.06	49	5.08	51	4.99	40				
10	5.12	57	5.09	53	5.11	56	4.99	40				
N	5.16	64	5.14	60	5.13	59	5.02	44				
2	5.30	89	5.26	81	5.29	87	5.12	57				
4	5.30	89	5.26	81	5.28	85	5.11	56				
6	5.21	72	5.17	65	5.22	74	5.10	54				
8	5.18	67	5.11	56	5.17	65	5.10	54				
10	5.15	62	5.10	54	5.13	59	5.11	56				
M	5.11	56	5.03	45	5.12	57	5.11	56				

Supplemental records.- Dec. 11, 5 p.m., 6.26 ft., 389 sec.-ft.

Huntington Lake near Big Creek, Calif.

Location.- Lat. 37°14', long. 119°13', in SW¼ sec. 14, T. 8 S., R. 25 E., at dam on Big Creek, 2 miles northeast of town of Big Creek, Fresno County. Zero of gage is at mean sea level.
Drainage area.- 79 square miles.
Gage-height record.- Water-stage recorder graph.
Remarks.- Flood run-off completely controlled in lake. Elevation of crest of overflow spillway is 6,950 feet above mean sea level (capacity, 88,834 acre-feet). See record for Big Creek below Huntington Lake. Record of contents and gage height at midnight furnished by Southern California Edison Co., Ltd. Contents show amount available for release.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	6,856.48	5,960	6,899.62	30,202	6,906.33	36,300
2	6,852.84	4,897	6,901.88	32,186	6,906.03	36,014
3	6,848.76	3,844	6,903.25	33,425	6,905.44	35,457
4	6,843.75	2,734	6,903.58	33,727	6,904.84	34,893
5	6,839.38	1,915	6,903.47	33,627	6,904.21	34,307
6	6,844.90	2,971	6,902.84	33,052	6,903.56	33,709
7	6,845.30	3,057	6,902.20	32,474	6,902.90	33,106
8	6,844.94	2,980	6,901.59	31,929	6,902.24	32,510
9	6,845.03	2,998	6,901.08	31,475	6,901.73	32,053
10	6,845.03	2,998	6,903.06	33,251	6,901.04	31,440
11	6,846.17	3,246	6,908.72	38,615	6,900.36	30,844
12	6,848.91	3,879	6,911.05	40,941	6,899.64	30,219
13	6,851.19	4,454	6,912.62	42,547	6,898.90	29,583
14	6,853.65	5,124	6,913.67	43,636	6,898.17	28,965
15	6,855.67	5,714	6,914.58	44,591	6,897.62	28,504
16	6,857.27	6,205	6,914.57	44,581	6,897.16	28,120
17	6,858.37	6,556	6,914.32	44,317	6,896.65	27,700
18	6,860.35	7,215	6,914.07	44,054	6,896.15	27,290
19	6,865.53	9,102	6,913.88	43,855	6,895.54	26,797
20	6,870.43	11,154	6,913.46	43,417	6,894.88	26,267
21	6,875.36	13,517	6,912.91	42,845	6,894.22	25,745
22	6,879.73	15,884	6,912.32	42,238	6,893.56	25,229
23	6,883.54	18,175	6,911.78	41,684	6,893.05	24,833
24	6,885.85	19,667	6,911.16	41,053	6,892.42	24,352
25	6,886.26	19,941	6,910.77	40,659	6,891.69	23,800
26	6,885.88	19,687	6,910.41	40,296	6,890.97	23,262
27	6,887.22	20,590	6,909.77	39,655	6,890.25	22,734
28	6,891.07	23,336	6,909.03	38,920	6,889.60	22,262
29	6,894.14	25,682	6,908.25	38,154	6,888.92	21,775
30	6,896.96	27,954	6,907.56	37,483	6,888.36	21,380
			6,906.84	36,788	6,887.80	20,989

Big Creek below Huntington Lake, Calif.

Location.- Lat. 37°13'10", long. 119°12'50", in NW¼ sec. 23, T. 8 S., R. 25 E., 800 feet above Grouse Creek and 1 mile below Huntington Lake, Fresno County. Altitude, about 6,600 feet above mean sea level.

Drainage area.- 80.0 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relations.- Defined by current-meter measurements.

Maxima.- December 1937: Discharge, 28 second-feet 2 p.m. Dec. 11 (gage height, 3.67 feet) represents natural run-off for small area between dam No. 1 and gage; run-off for major part of drainage regulated in Huntington Lake.

1925-November 1937: Discharge, 2,040 second-feet June 23, 1925 (gage height, 10.3 feet); siphon spillways operating at dam No. 1.

Remarks.- Flood run-off regulated in Huntington Lake. See record for Huntington Lake. Record of adjusted mean daily discharge furnished by Southern California Edison Co., Ltd., has been adjusted for Ward tunnel inflow, Huntington Lake storage, and release to Big Creek power house No. 1. Most of basic data furnished by Southern California Edison Co., Ltd.

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.3	0.2	0.5	11	0.3	12	0.4	21	0.3	0.6	0.5
2	.3	.2	.5	12	.3	3.7	.4	22	.3	.6	.5
3	.3	.2	.5	13	.3	1.7	.4	23	.3	.6	.5
4	.3	.2	.5	14	.3	1.3	.4	24	.3	.5	.5
5	.3	.2	.5	15	.3	.9	.5	25	.3	.5	.5
6	.3	.2	.4	16	.3	.8	.4	26	.3	.5	.6
7	.3	.2	.4	17	.4	.8	.7	27	.2	.5	.6
8	.2	.2	.4	18	.3	.7	.6	28	.2	.5	.6
9	.2	.4	.4	19	.3	.6	.6	29	.2	.5	.6
10	.3	6	.4	20	.3	.6	.5	30	.2	.5	.6
								31		.5	.6
Mean monthly discharge, in second-feet (observed)............									0.28	1.19	.50
Run-off, in acre-feet (observed)............................									17	73	31

Adjusted mean daily discharge, in second-feet, Dec. 8-25, 1937

Day	Discharge	Day	Discharge	Day	Discharge
8	15	14	145	20	71
9	123	15	127	21	56
10	639	16	104	22	66
11	1,890	17	95	23	89
12	316	18	79	24	51
13	183	19	70	25	49

Pitman Creek below Tamarack Creek, Calif.

Location.- Lat. 37°12', long. 119°12', in NW¼ sec. 35, T. 8 S., R. 25 E., 500 feet below Tamarack Creek, 3 miles above mouth, and 3 miles southeast of Big Creek, Fresno County. Altitude, about 7,100 feet above mean sea level.

Drainage area.- 22.0 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Affected by ice for period Dec. 13 to Jan. 31. Defined by current-meter measurements below 1,000 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 2,320 second-feet 11:30 a.m. Dec. 11 (gage height, 9.65 feet).

1927-November 1937: Discharge, 885 second-feet May 13, 1937 (gage height, 6.44 feet).

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of ice effect determined on basis of one discharge measurement and record for Huntington-Shaver Conduit at outlet. Most of basic data furnished by Southern California Edison Co., Ltd.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.3	0.5	17	11	0.4	941	14	21	0.7	23	13
2	.3	.5	20	12	.4	143	13	22	.5	21	15
3	.3	.5	19	13	.4	69	13	23	.7	16	14
4	.3	.5	17	14	.4	49	13	24	.5	13	13
5	.3	.5	17	15	.5	43	13	25	.5	17	13
6	.3	.5	16	16	.5	37	16	26	.5	17	14
7	.3	.4	16	17	1.4	35	16	27	.5	17	14
8	.3	.4	14	18	.9	31	15	28	.5	17	14
9	.3	8.5	14	19	.7	27	14	29	.5	16	15
10	.3	139	14	20	.7	24	13	30	.5	17	14
								31		17	13
Mean monthly discharge, in second-feet									0.49	56.2	14.7
Run-off, in acre-feet									29	3,450	904

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.89	0.4	4.02	132	4.20	155	4.47	213		
4	1.88	0.3	1.89	.4	4.25	162	4.94	305	4.32	189		
6	-	-	1.90	.5	4.50	204	6.00	680	4.20	170		
8	1.89	.4	1.90	.5	4.83	278	7.75	1,470	4.10	155		
10	-	-	1.90	.5	4.64	233	9.00	2,030	4.01	143		
N	1.90	.5	1.90	.5	4.26	164	9.44	2,260	3.94	135		
2	-	-	1.90	.5	3.85	114	8.53	1,780	3.90	130		
4	1.89	.4	1.92	.9	3.65	94	6.86	984	3.82	120		
6	-	-	1.98	2.3	3.53	83	6.38	770	3.72	109		
8	1.89	.4	2.42	18	3.52	83	5.40	412	3.61	99		
10	-	-	2.99	45	3.47	79	4.95	302	3.53	92		
M	1.89	.4	3.35	70	3.54	84	4.67	249	3.47	87		

Hour	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Hour	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplemental records.- Dec. 11, 11:30 a.m., 9.65 ft., 2,320 sec.-ft.

Shaver Lake near Big Creek, Calif.

Location.- Lat. 37°09', long. 119°18', in SE¼ sec. 13, T. 9 S., R. 24 E., at dam on Stevenson Creek 6 miles southwest of Big Creek, Fresno County. Zero of gage is at mean sea level.

Gage-height record.- Water-stage recorder graph.

Remarks.- Flood run-off completely controlled in lake. Elevation of crest of spillway is 5,370 feet above mean sea level (capacity, 135,283 acre-feet). Water is received from Huntington Lake and Pitman Creek through Huntington-Shaver Conduit and is released through power house 2A on Big Creek. Record of contents and gage height at midnight furnished by Southern California Edison Co., Ltd. Contents show amount available for release.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	5,322.44	50,098	5,308.47	32,733	5,313.81	38,949
2	5,321.90	49,363	5,308.40	32,655	5,314.02	39,203
3	5,321.35	48,618	5,308.33	32,577	5,313.82	38,961
4	5,320.78	47,848	5,308.34	32,588	5,313.54	38,622
5	5,320.10	46,932	5,308.34	32,588	5,313.25	38,272
6	5,319.32	45,904	5,308.22	32,454	5,312.96	37,922
7	5,318.96	45,432	5,308.11	32,332	5,312.64	37,541
8	5,318.46	44,784	5,308.05	32,265	5,312.47	37,338
9	5,317.93	44,098	5,308.20	32,432	5,312.40	37,255
10	5,317.36	43,368	5,309.48	33,867	5,312.06	36,849
11	5,317.07	42,997	5,312.64	37,541	5,311.62	36,333
12	5,316.51	42,289	5,313.09	38,079	5,311.22	35,864
13	5,315.58	41,123	5,313.28	38,308	5,310.84	35,422
14	5,314.68	40,011	5,313.47	38,538	5,310.59	35,134
15	5,313.73	38,852	5,313.61	38,707	5,310.69	35,249
16	5,312.79	37,720	5,313.68	38,792	5,310.72	35,284
17	5,311.98	36,754	5,313.73	38,852	5,310.52	35,054
18	5,311.56	36,262	5,313.79	38,925	5,310.18	34,662
19	5,311.07	35,688	5,313.85	38,997	5,309.93	34,376
20	5,310.79	35,364	5,313.87	39,021	5,309.60	34,003
21	5,310.68	35,238	5,313.84	38,985	5,309.34	33,708
22	5,310.12	34,593	5,313.87	39,021	5,309.25	33,607
23	5,309.52	33,912	5,313.88	39,033	5,309.27	33,629
24	5,309.00	33,324	5,313.89	39,045	5,308.94	33,257
25	5,309.02	33,346	5,313.95	39,118	5,308.58	32,856
26	5,308.91	33,223	5,313.98	39,154	5,308.33	32,577
27	5,308.83	33,134	5,313.99	39,166	5,307.95	32,154
28	5,308.84	33,145	5,313.96	39,130	5,307.70	31,880
29	5,308.74	33,034	5,313.95	39,118	5,307.55	31,716
30	5,308.61	32,889	5,313.85	38,997	5,307.55	31,716
31			5,313.76	38,888	5,307.26	31,398

North Fork of Willow Creek at Crane Valley Reservoir, Calif.

Location.- Lat. 37°17', long. 119°32', in SW¼ sec. 25, T. 7 S., R. 22 E., at outlet of Crane Valley Reservoir and 4.7 miles north of North Fork, Madera County. Altitude, about 3,250 feet above mean sea level.

Drainage area.- 51.3 square miles.

Remarks.- Flood run-off completely regulated in Crane Valley Reservoir (capacity, about 45,000 acre-feet). In table, observed discharge is water released down creek channel, plus flow in No. 3 ditch, and evaporation. Adjusted discharge has been adjusted for change in storage in reservoir. All data furnished by San Joaquin Light & Power Corporation.

Discharge, in second-feet, and gain or loss in storage, in acre-feet, November 1937 to January 1938

Day	November			December			January		
	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge
1	14	-16	6	20	-16	12	61	-28	47
2	14	0	14	21	-16	13	97	+75	134
3	16	+8	20	68	-94	21	73	+56	102
4	19	0	19	20	-15	13	39	+57	68
5	22	-16	14	21	-8	17	30	+75	68
6	18	-8	14	20	-15	12	34	+57	63
7	20	-8	16	20	-15	13	36	+28	50
8	14	0	14	90	-162	8.5	65	+10	70
9	22	-8	18	90	+77	129	64	-38	45
10	21	-8	17	0	+1,688	851	54	+38	74
11	36	-16	28	0	+4,214	2,120	61	-10	56
12	20	-8	16	0	+707	356	56	-9	52
13	21	0	21	1.6	+277	141	54	-10	49
14	40	-8	36	2.4	+204	105	70	+285	213
15	20	-8	16	2.4	+186	96	60	+496	311
16	18	0	18	13	+205	117	75	+154	152
17	47	+8	51	3.2	+195	102	54	+202	155
18	28	-8	24	3.2	+167	87	32	+241	153
19	38	-24	26	3.2	+149	78	49	+146	123
20	23	0	23	84	-18	75	54	+136	122
21	37	-16	29	33	+83	75	55	+87	99
22	36	-40	16	30	+140	101	53	+98	102
23	24	-24	12	33	+46	56	82	+30	97
24	23	-24	10	30	+84	73	54	+78	93
25	20	-8	16	75	-37	56	74	+20	84
26	20	-8	16	51	+28	65	74	-10	69
27	22	0	22	36	+65	69	55	+98	104
28	22	-16	14	41	+76	79	56	+176	145
29	23	-16	15	51	0	51	48	+137	118
30	22	-15	14	40	-10	35	68	+40	88
31				31	+66	64	40	+456	270

	November	December	January
Mean monthly discharge, in second-feet (observed).........	24.0	30.2	57.3
Gain or loss in storage, in acre-feet.....................	-287	+8,250	+3,170
Mean monthly discharge, in second-feet (adjusted).........	19.2	164	109
Run-off, in acre-feet (adjusted)..........................	1,140	10,110	6,700

Big Sandy Creek near Auberry, Calif.

Location.- Lat. 37°03', long. 119°33', in SE¼ sec. 14, T. 10 S., R. 22 E., 2 miles above mouth and about 5 miles southwest of Auberry, Fresno County. Altitude, about 1,300 feet above mean sea level.
Drainage area.- 34 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 1,850 second-feet 6:30 p.m. Dec. 11 (gage height, 5.4 feet).
Remarks.- Record furnished by State engineer.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	0.3	3	11	0.3	511	5	21	0.3	3.3	23
2	0	.3	14	12	.3	139	6	22	.3	3.0	19
3	0	.3	13	13	.3	30	6	23	.3	12	18
4	.2	.3	7	14	.3	16	11	24	.3	6	15
5	.2	.3	5	15	.3	11	230	25	.3	4.0	15
6	.2	.3	5	16	.3	8	42	26	.3	4.0	14
7	.2	.3	5	17	.3	6	43	27	.3	3.3	14
8	.3	.3	4.0	18	.3	6	27	28	.3	2.8	20
9	.3	.4	4.0	19	.3	5	46	29	.3	2.8	51
10	.3	61	4.0	20	.3	4.0	52	30	.3	2.8	28
								31		2.8	28
Mean monthly discharge, in second-feet									0.26	27.3	25.1
Run-off, in acre-feet									16	1,680	1,540

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			1.08	0.3	1.33	0.9	1.77	27	2.77	289	1.90	40
4			1.08	.3	1.38	1.4	1.80	30	2.55	210	1.87	37
6			1.08	.3	1.44	2.4	1.85	35	2.41	163	1.85	35
8			1.08	.3	1.49	3.6	1.93	45	2.30	130	1.83	33
10			1.08	.3	1.95	48	2.12	83	2.25	117	1.80	30
N			1.08	.3	2.48	187	3.88	808	2.20	104	1.78	28
2			1.08	.3	2.38	154	4.10	903	2.22	109	1.76	26
4			1.09	.3	2.25	117	3.75	737	2.20	104	1.76	26
6			1.12	.3	2.14	88	5.00	1,540	2.13	86	1.75	25
8			1.17	.5	2.05	65	4.30	1,050	2.04	63	1.74	24
10			1.26	.7	1.93	45	3.50	614	2.00	57	1.72	22
M			1.31	.8	1.84	34	3.11	435	1.94	47	1.71	21
	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 20		December 21		December 22		December 23		December 24		December 25	
2							1.57	8				
4							1.59	9				
6							1.60	10				
8							1.62	12				
10							1.67	17				
N							1.69	19				
2							1.68	18				
4							1.65	15				
6							1.63	13				
8							1.61	11				
10							1.60	10				
M							1.59	9				

Fine Gold Creek near Friant, Calif.

Location.- Lat. 37°03', long. 119°39', in NW¼ sec. 14, T. 10 S., R. 21 E., 1,000 feet below Willow Creek, 1½ miles above mouth, and 5½ miles northeast of Friant, Fresno County. Altitude, about 680 feet above mean sea level.
Drainage area.- 89.2 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,100 second-feet; extended on basis of drift-velocity determination of 6,300 second-feet. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 4,900 second-feet 6 p.m. Dec. 11 (gage height, 13.95 feet).
1936-November 1937: Discharge, 6,780 second-feet Feb. 6, 1937 (gage height, 16.45 feet), from rating curve extended above 6,300 second-feet.
January-September 1938: Discharge, 10,300 second-feet about 9 p.m. Mar. 12 (gage height, 20.4 feet, from floodmarks), from rating curve extended above 6,300 second-feet on basis of area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.1	3.7	12	11	3.2	1,610	11	21	3.7	14	81
2	2.3	3.7	14	12	4.3	392	11	22	3.7	14	66
3	2.3	3.7	21	13	3.7	91	11	23	3.7	23	55
4	2.3	3.7	14	14	3.5	44	67	24	3.7	17	49
5	2.1	3.9	13	15	3.5	30	1,030	25	3.7	14	44
6	2.1	3.9	13	16	3.5	24	181	26	3.7	14	41
7	2.3	4.1	12	17	4.1	20	173	27	3.9	13	39
8	2.6	4.1	12	18	4.6	17	104	28	3.9	12	58
9	2.7	5.5	12	19	3.9	16	100	29	3.7	12	205
10	2.7	397	12	20	3.7	15	141	30	3.7	12	92
								31		12	100
Mean monthly discharge, in second-feet									3.30	91.9	90.1
Run-off, in acre-feet									196	5,650	5,540

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.12	4.1	1.75	21	3.05	153	5.86	756	2.97	139
4	-	-	1.12	4.1	2.02	34	2.86	122	5.13	581	2.89	126
6	1.10	3.7	1.12	4.1	2.60	86	2.81	114	4.43	428	2.82	116
8	-	-	1.13	4.3	3.35	212	3.01	146	4.05	352	2.74	105
10	-	-	1.13	4.3	5.30	618	3.85	312	4.05	352	2.69	98
N	1.12	4.1	1.13	4.3	6.98	1,060	11.08	2,900	3.94	330	2.62	89
2	-	-	1.14	4.5	6.10	818	10.80	2,730	3.89	320	2.55	80
4	-	-	1.15	4.6	5.26	609	10.60	2,610	3.80	302	2.50	74
6	1.13	4.3	1.20	5.6	4.75	497	13.95	4,900	3.52	246	2.44	68
8	-	-	1.29	7.5	4.19	380	11.50	3,160	3.35	212	2.39	63
10	-	-	1.46	12	3.80	302	8.95	1,780	3.19	180	2.35	60
M	1.13	4.3	1.59	15	3.35	212	7.25	1,140	3.06	155	2.30	56
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.23	50	-	-	-	-	-	-	-	-	-	-
6	-	-	1.95	32	1.80	25	1.69	21	1.62	18	1.58	16
8	2.17	46	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.13	43	1.90	30	1.76	23	1.67	20	1.61	17	1.56	16
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.09	40	-	-	-	-	-	-	-	-	-	-
6	-	-	1.87	28	1.73	22	1.65	19	1.60	17	1.55	16
8	2.05	38	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.00	35	1.84	27	1.71	21	1.64	19	1.59	17	1.54	15
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.60	17	1.66	19	-	-
6	1.54	15	-	-	-	-	-	-	-	-	1.52	15
8	-	-	-	-	-	-	1.73	22	1.61	17	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.53	15	1.50	14	1.49	14	1.80	25	1.59	17	1.51	14
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.85	28	1.56	16	-	-
6	1.51	14	-	-	-	-	-	-	-	-	1.50	14
8	-	-	-	-	-	-	1.84	27	1.54	15	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.50	14	1.49	14	1.49	14	1.74	23	1.53	15	1.50	14

Cottonwood Creek near Friant, Calif.

Location.- Lat. 37°00', long. 119°43', in SE¼ sec. 6, T. 11 S., R. 21 E., half a mile above mouth and about 1 mile northwest of Friant, Madera County. Altitude, about 360 feet above mean sea level.
Drainage area.- 38 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 180 second-feet at 6 p.m. Dec. 11 (gage height, 2.50 feet).
Remarks.- Record furnished by State engineer.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0.5	11	0	42	0.5	21	0	0.5	13
2	0	0	.9	12	0	8.5	0.5	22	0	0.5	12
3	0	0	.5	13	0	2.4	0.5	23	0	1.4	11
4	0	0	.5	14	0	1.1	3.0	24	0	.9	10
5	0	0	.5	15	0	.6	74	25	0	.5	9
6	0	0	.5	16	0	.5	22	26	0	.5	9
7	0	0	.5	17	0	.5	26	27	0	.5	9
8	0	0	.5	18	0	.5	17	28	0	.5	18
9	0	0	.5	19	0	.5	20	29	0	.5	53
10	0	.2	.5	20	0	.5	20	30	0	.5	23
								31		.5	50
Mean monthly discharge, in second-feet									0	2.1	13.1
Run-off, in acre-feet									0	127	805

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	0.74	0.5	1.32	25		
4					-	0	.73	0.5	1.20	16		
6					-	0	.73	0.5	1.13	12		
8					-	0	.80	1.4	1.07	9.5		
10					-	0	.83	2.0	1.03	8		
N					-	0	.95	5	1.00	7		
2					-	0	1.00	7	.97	6		
4					-	0	1.35	27	.95	5		
6					0.76	.8	2.50	180	.94	4.9		
8					.76	.8	2.36	154	.92	4.3		
10					.75	.6	1.86	83	.90	3.7		
M					.75	.6	1.52	44	.88	3.2		

Little Dry Creek near Friant, Calif.

Location.- Lat. 36°56', long. 119°41', in SW¼ sec. 28, T. 11 S., R. 21 E., about 3.5 miles southeast of Friant, Fresno County, and 4 miles upstream from mouth. Altitude, about 360 feet above mean sea level.
Drainage area.- 58 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 198 second-feet 2 a.m. Dec. 12 (gage height, 2.81 feet).
Remarks.- Record furnished by State engineer.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	6	11	0	39	5.5	21	0	7.5	21
2	0	0	9.5	12	0	85	5	22	0	7	17
3	0	0	13	13	0	21	4.6	23	0	9	14
4	0	0	8	14	0	11	19	24	0	8.5	13
5	0	0	7.5	15	0	9	270	25	0	7.5	11
6	0	0	7.5	16	0	8.5	53	26	0	7	11
7	0	0	7.5	17	0	8	56	27	0	6	10
8	0	0	7	18	0	8.5	32	28	0	6	25
9	0	0	6	19	0	8	35	29	0	6	86
10	0	1.8	6	20	0	7.5	39	30	0	6	31
								31		6	42
Mean monthly discharge, in second-feet									0	9.2	28.3
Run-off, in acre-feet									0	563	1,740

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	1.02	1.9	2.81	198		
4					-	0	1.02	1.9	2.58	140		
6					1.00	1.8	1.05	2.2	2.40	104		
8					1.10	2.5	1.12	2.7	2.28	85		
10					1.10	2.5	1.16	3.0	2.17	69		
N					1.10	2.5	1.20	3.4	2.10	59		
2					1.10	2.5	1.30	5.5	2.05	53		
4					1.08	2.4	1.65	18	2.05	53		
6					1.06	2.3	2.00	47	2.04	52		
8					1.05	2.2	2.50	122	2.04	52		
10					1.03	2.0	2.67	162	1.98	45		
M					1.03	2.0	2.77	187	1.92	38		

Fresno River near Knowles, Calif.

Location.- Lat. 37°14', long. 119°46', in NW¼ sec. 15, T. 8 S., R. 20 E., at Fresno Crossing, 0.1 mile below Bean Gulch and 6 miles northeast of Knowles, Madera County. Altitude, about 1,140 feet above mean sea level.
Drainage area.- 132 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 6,000 second-feet.
Maxima.- December 1937: Discharge, 3,380 second-feet 4 p.m. Dec. 11 (gage height, 5.57 feet).
1911-13, 1915-November 1937: Discharge, 6,880 second-feet Feb. 6, 1937 (gage height, 8.16 feet).
January-September 1938: Discharge, 7,630 second-feet 5 p.m. Mar. 12 (gage height, 8.67 feet), from rating curve extended above 6,000 second-feet.
Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	10	18	26	11	13	1,480	26	21	19	31	118
2	14	18	30	12	19	488	26	22	19	31	101
3	18	18	48	13	19	136	26	23	18	40	90
4	13	17	36	14	19	81	95	24	18	34	81
5	9.5	17	33	15	20	59	846	25	18	30	76
6	9.5	18	31	16	19	50	246	26	18	29	70
7	9.5	18	30	17	20	43	232	27	18	29	66
8	10	17	29	18	34	38	190	28	17	29	94
9	10	19	27	19	25	34	160	29	17	27	43
10	11	517	26	20	20	33	164	30	17	27	122
								31		27	141
Mean monthly discharge, in second-feet									16.7	111	107
Run-off, in acre-feet									995	6,850	6,600

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.29	18	1.27	17	1.46	41	2.34	392	3.25	1,030	1.93	186
4	1.29	18	1.27	17	1.60	70	2.20	315	2.89	743	1.90	172
6	1.28	18	1.27	17	1.72	105	2.16	295	2.65	578	1.87	160
8	1.27	17	1.27	17	2.01	223	2.40	425	2.49	479	1.84	148
10	1.27	17	1.27	17	2.46	461	2.70	610	2.41	431	1.82	140
N	1.26	16	1.28	18	2.81	687	4.00	1,720	2.35	398	1.80	132
2	1.26	16	1.30	19	3.12	926	5.05	2,780	2.26	348	1.78	125
4	1.27	17	1.33	23	3.25	1,030	5.57	3,380	2.20	315	1.76	118
6	1.26	16	1.34	24	3.10	910	5.00	2,720	2.15	290	1.75	115
8	1.27	17	1.35	25	2.90	750	4.70	2,420	2.07	251	1.73	108
10	1.26	16	1.37	27	2.87	729	4.08	1,800	2.01	223	1.72	105
M	1.27	17	1.42	34	2.60	545	3.45	1,200	1.98	209	1.70	98
	December 14		December 15		December 16		December 17		December 18		December 19	
2	1.69	95	1.58	66	1.52	52	-	-	-	-	-	-
4	1.68	92	1.57	63	1.52	52	1.49	46	1.45	40	1.43	36
6	1.67	90	1.56	61	1.52	52	-	-	-	-	-	-
8	1.66	87	1.56	61	1.51	50	1.48	45	1.45	40	1.42	34
10	1.65	84	1.56	61	1.51	50	-	-	-	-	-	-
N	1.64	81	1.55	59	1.51	50	1.47	43	1.44	38	1.42	34
2	1.63	78	1.55	59	1.50	48	-	-	-	-	-	-
4	1.62	76	1.54	57	1.50	48	1.46	41	1.44	38	1.42	34
6	1.61	73	1.54	57	1.50	48	-	-	-	-	-	-
8	1.60	70	1.54	57	1.50	48	1.46	41	1.43	36	1.42	34
10	1.60	70	1.53	55	1.50	48	-	-	-	-	-	-
M	1.59	68	1.52	52	1.49	46	1.46	41	1.43	36	1.41	33
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.41	33	-	-	-	-	1.42	34	1.43	36	1.40	31
6	-	-	-	-	-	-	-	-	-	-	-	-
8	1.41	33	-	-	-	-	1.44	38	1.42	34	1.39	30
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.41	33	1.40	31	1.40	31	1.45	40	1.42	34	1.40	31
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.41	33	-	-	-	-	1.46	41	1.41	33	1.39	30
6	-	-	-	-	-	-	-	-	-	-	-	-
8	1.40	31	-	-	-	-	1.48	45	1.41	33	1.39	30
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.40	31	1.40	31	1.40	31	1.45	40	1.40	31	1.38	29

Fresno River near Daulton, Calif.

Location.- Lat. 37°06', long. 119°54', in NW¼ sec. 3, T. 10 S., R. 19 E., half a mile below mouth of Cottonwood Creek and 5 miles southeast of Daulton, Madera County. Altitude, about 390 feet above mean sea level.
Drainage area.- 258 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements. Shifting-control method used.
Maxima.- December 1937: Discharge, 3,660 second-feet 6 p.m. Dec. 11 (gage height, 5.80 feet).
Remarks.- Record furnished by State engineer.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	-	30	31	11	-	1,400	34	21	-	44	215
2	-	30	33	12	-	993	33	22	-	44	180
3	-	30	49	13	-	271	31	23	-	46	161
4	-	30	49	14	-	143	36	24	-	50	148
5	-	31	39	15	-	111	1,550	25	-	44	132
6	-	33	38	16	-	84	486	26	-	36	129
7	-	30	38	17	-	60	338	27	-	31	129
8	-	34	34	18	-	54	325	28	-	31	129
9	-	33	36	19	-	47	258	29	-	30	457
10	-	260	34	20	-	44	348	30	-	28	271
								31		30	259
Mean monthly discharge, in second-feet										134	195
Run-off, in acre-feet										8,260	11,960

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					1.17	25	3.02	728	4.75	2,380	2.00	348
4					1.17	25	2.98	778	3.97	1,630	1.95	328
6					1.19	28	2.60	525	3.50	1,240	1.92	313
8					1.22	33	2.42	448	3.12	967	1.88	299
10					1.28	42	2.30	405	2.80	759	1.85	285
N					1.36	55	2.24	380	2.63	659	1.80	267
2					1.55	103	2.37	462	2.50	589	1.70	229
4					2.05	253	3.30	1,110	2.43	552	1.65	211
6					2.80	579	5.80	3,660	2.40	536	1.62	197
8					3.12	772	5.72	3,560	2.28	477	1.59	183
10					3.34	900	5.36	3,100	2.15	414	1.57	177
M					3.10	759	5.25	2,980	2.06	376	1.55	169
	December 14		December 15		December 16		December 17		December 18		December 19	
2	1.53	190										
4	1.48	167										
6	1.46	161										
8	1.44	153										
10	1.45	140										
N	1.43	145										
2	1.42	140										
4	1.44	143										
6	1.43	137										
8	1.41	129										
10	1.40	127										
M	1.40	121										

Chowchilla River at Buchanan dam site, Calif.

Location.- Lat. 37°13', long. 120°00', in SW¼ sec. 22, T. 8 S., R. 18 E., 1.4 miles above Raynor Creek and 5 miles west of Raymond, Madera County. Altitude, about 390 feet above mean sea level.
Drainage area.- 238 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,600 second-feet; extended to peak stage. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 7,020 second-feet 4 p.m. Dec. 11 (gage height, 10.74 feet).
1921-23, 1930-November 1937: Discharge, about 12,000 second-feet Feb. 6, 1937 (gage height, 13.0 feet), from rating curve extended above 4,600 second-feet.
January-September 1938: Discharge, about 15,000 second-feet probably Mar. 2, 1938 (gage height, 14.4 feet, from floodmarks), from rating curve extended above 4,600 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	3.1	8	24	11	4.7	2,340	24	21	10	32	252
2	3.2	7	26	12	6	835	24	22	9.5	30	196
3	3.7	7	56	13	8.5	279	24	23	9	35	164
4	3.7	7	45	14	7.5	152	26	24	8.5	47	139
5	3.6	7	33	15	6.5	94	2,840	25	8.5	34	122
6	3.7	7	31	16	6.5	69	705	26	8.5	31	110
7	3.7	7	30	17	8	53	457	27	8.5	28	104
8	3.8	7	29	18	10	43	386	28	9	27	100
9	4.0	11	27	19	15	38	278	29	9	26	175
10	4.3	615	26	20	12	36	386	30	9	26	206
								31		24	172
Mean monthly discharge, in second-feet									7.03	160	233
Run-off, in acre-feet									419	9,840	14,310

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.37	7	1.40	7.5	1.83	21	5.05	724	6.35	1,460	4.16	376
4	1.37	7	1.41	8	1.88	24	4.85	640	5.97	1,190	4.06	350
6	1.37	7	1.42	8	1.95	27	4.62	552	5.66	996	3.96	325
8	1.37	7	1.44	8.5	1.99	29	4.50	508	5.29	795	3.86	303
10	1.37	7	1.46	9	2.05	33	4.75	601	5.10	705	3.77	283
N	1.37	7	1.47	9	4.30	440	5.00	702	4.97	646	3.70	268
2	1.37	7	1.48	9.5	4.90	660	9.50	4,910	4.94	633	3.62	252
4	1.38	7	1.50	10	7.11	2,050	10.74	7,020	4.90	615	3.52	232
6	1.38	7	1.60	12	6.40	1,500	9.06	4,240	4.85	595	3.47	223
8	1.38	7	1.67	15	5.87	1,150	9.02	4,190	4.81	579	3.41	212
10	1.39	7.5	1.72	16	5.50	940	7.75	2,650	4.60	504	3.35	201
M	1.39	7.5	1.78	19	5.25	816	7.15	2,080	4.34	425	3.30	192
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.21	177	2.77	110	2.46	73	-	-	-	-	-	-
6	-	-	-	-	-	-	2.30	56	2.18	45	2.09	38
8	3.13	164	2.71	102	2.44	70	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.05	152	2.65	94	2.42	68	2.27	53	2.15	43	2.08	38
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.97	139	2.59	87	2.38	64	-	-	-	-	-	-
6	-	-	-	-	-	-	2.24	51	2.12	41	2.08	38
8	2.90	128	2.54	81	2.36	62	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.82	117	2.50	77	2.34	60	2.21	48	2.10	39	2.07	37
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.00	32	2.26	52	2.06	36
6	2.06	36	2.01	33	1.97	30	-	-	-	-	-	-
8	-	-	-	-	-	-	2.01	33	2.22	49	2.04	35
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.05	36	2.00	32	1.97	30	2.02	33	2.20	47	2.02	33
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.04	35	2.16	44	2.01	33
6	2.03	34	1.99	31	1.96	30	-	-	-	-	-	-
8	-	-	-	-	-	-	2.06	36	2.13	41	2.00	32
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.02	33	1.98	31	1.97	30	2.25	52	2.10	39	2.00	32

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Bear Creek near Planada, Calif.

Location.- Lat. 37°20', long. 120°19', in SW¼ sec. 10, T. 7 S., R. 15 E., just below mouth of Burns Creek and 3 miles north of Planada, Merced County. Altitude, about 235 feet above mean sea level.
Drainage area.- 161 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements for range of stage occurring in December.
Maxima.- December 1937: Discharge, 6,220 second-feet 6 p.m. Dec. 11 (gage height, 12.37 feet).
Remarks.- Flood run-off not affected by artificial storage or diversion. Basic data furnished by Merced Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	-	0	-	11	-	1,320	-	21	-	10	-
2	-	0	-	12	-	376	-	22	-	9	-
3	-	0	-	13	-	106	-	23	-	10	-
4	-	0	-	14	-	41	-	24	-	11	-
5	-	0	-	15	-	24	-	25	-	14	-
6	-	0	-	16	-	18	-	26	-	12	-
7	-	0	-	17	-	15	-	27	-	10	-
8	-	0	-	18	-	13	-	28	-	10	-
9	-	.1	-	19	-	11	-	29	-	9	-
10	-	.4	-	20	-	10	-	30	-	9	-
								31		9	-
Mean monthly discharge, in second-feet									-	66.0	-
Run-off, in acre-feet									-	4,060	-

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	0	-	-	0.48	0.3	4.15	595	2.58	188
4			-	0	0.48	0.3	.48	.3	3.60	434	2.39	152
6			-	0	-	-	.48	.3	3.15	316	2.25	130
8			-	0	.49	.4	.58	1.7	2.87	251	2.13	113
10			-	0	-	-	.61	2.3	2.72	218	2.03	100
N			-	0	.50	.5	.92	13	2.82	240	1.96	91
2			-	0	-	-	5.90	1,230	2.97	273	1.89	83
4			-	0	.49	.4	9.40	3,340	3.45	393	1.83	76
6			0.47	.2	-	-	12.37	6,220	4.00	550	1.77	70
8			.48	.3	.48	.3	9.00	3,020	3.45	393	1.71	64
10			.49	.4	-	-	6.50	1,500	3.10	304	1.67	60
M			.49	.4	.48	.3	5.00	875	2.80	236	1.62	56
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.52	48	1.21	27	1.08	20	0.98	15	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.41	40	1.17	24	1.04	18	.97	15	0.92	13	0.88	11
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.32	33	1.13	22	1.01	16	.96	14	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.27	30	1.10	21	1.0	16	.95	14	.90	12	.87	11
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	0.86	10	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	0.86	10	0.84	10	0.83	9	0.84	10	.87	11	0.96	14
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	.91	12	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	.84	10	.84	10	.83	9	.84	10	.94	14	.92	13

Mariposa Creek near Le Grand, Calif.

Location.- Lat. 37°16', long. 120°12', in sec. 2, T. 8 S., R. 16 E., about 4 miles northeast of Le Grand, Merced County. Altitude, about 310 feet above mean sea level.

Drainage area.- 111 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements for range of stage occurring in December.

Maxima.- December 1937: Discharge, 3,160 second-feet 2 p.m. Dec. 11 (gage height, 5.17 feet).

Remarks.- Flood run-off not affected by artificial storage or diversion. Basic data furnished by Merced Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	-	0	-	11	-	769	-	21	-	3.4	-
2	-	0	-	12	-	285	-	22	-	3.4	-
3	-	0	-	13	-	96	-	23	-	2.4	-
4	-	0	-	14	-	30	-	24	-	2.8	-
5	-	0	-	15	-	17	-	25	-	5.5	-
6	-	0	-	16	-	13	-	26	-	5.5	-
7	-	0	-	17	-	8	-	27	-	2.8	-
8	-	0	-	18	-	6	-	28	-	2.6	-
9	-	0	-	19	-	5.5	-	29	-	2.8	-
10	-	49	-	20	-	4.2	-	30	-	3.8	-
								31		3.4	-
Mean monthly discharge, in second-feet									-	42.6	-
Run-off, in acre-feet									-	2,620	-

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	0	2.28	250	2.77	554	-	-
4					-	0	2.20	210	2.55	408	2.06	149
6					-	0	2.13	178	2.38	304	-	-
8					-	0	2.10	165	2.27	245	1.93	103
10					-	0	2.26	240	2.17	196	-	-
N					-	0	2.40	315	2.11	170	1.83	76
2					-	0	5.17	3,160	2.13	178	-	-
4					-	0	4.24	1,930	2.12	174	1.77	62
6					-	0	3.59	1,230	2.07	153	-	-
8					-	0	3.23	904	2.31	266	1.71	50
10					2.46	351	3.25	920	2.33	276	-	-
M					2.36	293	3.06	768	2.23	225	1.67	43
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.63	37	1.49	20	-	-	-	-	-	-	-	-
6	-	-	-	-	1.42	15	-	-	-	-	-	-
8	1.60	32	1.46	18	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.57	29	1.45	17	1.40	13	1.32	8	1.28	6	1.26	5.5
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.55	26	1.41	14	-	-	-	-	-	-	-	-
6	-	-	-	-	1.38	12	-	-	-	-	-	-
8	1.53	24	1.45	17	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.50	21	1.42	15	1.36	11	1.30	7	1.27	6	1.25	5
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.21	3.4	1.23	4.2	-	-
6	-	-	-	-	-	-	-	-	-	-	1.22	3.8
8	-	-	-	-	-	-	1.21	3.4	1.23	4.2	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.23	4.2	1.21	3.4	1.20	3.0	1.21	3.4	1.23	4.2	1.30	7
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.19	2.8	1.21	3.4	-	-
6	-	-	-	-	-	-	-	-	-	-	1.29	6.5
8	-	-	-	-	-	-	1.11	1.2	1.07	.7	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.22	3.8	1.21	3.4	1.21	3.4	1.02	.2	1.18	2.6	1.28	6

Supplemental records.- Dec. 10, 9 p.m., 2.49 ft., 369 sec.-ft. Dec. 11, 1 p.m., 2.48 ft., 363 sec.-ft.

Merced River at Happy Isles Bridge, near Yosemite, Calif.

Location.- Lat. 37°43'54", long. 119°33'28", in Yosemite National Park, at Happy Isles Bridge, 0.4 mile below Illilouette Creek and 1½ miles southeast of Yosemite Lodge, Mariposa County. Altitude, about 4,000 feet above mean sea level.
Drainage area.- 181 square miles.
Gage-height record.- Water-stage recorder graph except for period midnight Nov. 16 to 3 p.m. Nov. 19, when there was no record. Stage graph for Nov. 19 based on partial recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,000 second-feet; extended to peak stage on basis of area-velocity study; verified by contracted opening determinations of flood flow at Happy Isles Bridge and at Clark's Bridge, ½ mile below gage. Rating curve changed at peak stage. Shifting-control method used for period Dec. 14 to Jan. 31.
Maxima.- December 1937: Discharge, 10,600 second-feet 1:30 p.m. Dec. 11 (gage height, 10.4 feet).

1915-November 1937: Discharge, 3,800 second-feet May 28, 1919 (gage height, 7.10 feet), from rating curve extended above 2,800 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record determined from comparison with records for Merced River at Pohono Bridge and Tenaya Creek near Yosemite.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4.6	14	84	11	6.5	5,380	64	21	28	149	87
2	4.6	14	92	12	7.5	1,700	66	22	21	128	92
3	4.3	13	87	13	7	644	64	23	20	118	84
4	4.1	12	80	14	8.5	432	68	24	20	102	79
5	4.3	12	78	15	8.5	352	90	25	18	104	79
6	4.6	11	71	16	8.5	288	87	26	17	99	83
7	4.6	11	71	17	16	258	98	27	16	96	86
8	4.9	11	69	18	20	225	96	28	16	90	86
9	4.9	15	66	19	13	193	90	29	15	90	88
10	4.9	960	66	20	17	168	81	30	15	87	80
								31		84	86
Mean monthly discharge, in second-feet									11.5	383	80.6
Run-off, in acre-feet									683	23,520	4,950

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.83	12	2.40	232	5.15	1,790	7.03	3,020	4.52	820
4	0.81	12	.83	12	3.03	442	5.70	2,350	6.58	2,460	4.40	760
6	-	-	.83	12	3.28	547	6.60	3,440	6.35	2,210	4.30	712
8	.78	10	.83	12	4.10	980	6.92	3,860	6.03	1,900	4.20	666
10	-	-	.82	12	4.67	1,380	7.50	4,690	5.68	1,590	4.12	631
N	.72	8	.82	12	4.74	1,430	8.90	7,140	5.45	1,410	4.06	605
2	-	-	.82	12	4.65	1,360	10.25	10,200	5.26	1,270	4.00	580
4	.87	14	.83	12	4.60	1,320	10.10	9,780	5.13	1,180	3.98	572
6	-	-	.87	14	4.50	1,250	9.15	7,230	4.98	1,090	3.96	564
8	.83	12	.95	19	4.27	1,090	8.55	5,810	4.88	1,020	3.94	556
10	-	-	1.05	25	4.20	1,040	8.00	4,660	4.76	951	3.88	532
M	.83	12	1.31	45	4.45	1,220	7.50	3,740	4.63	876	3.81	506
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.68	450	3.46	365	3.27	297	3.19	267	3.10	236	2.99	201
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.58	414	3.40	345	3.22	282	3.15	256	3.05	222	2.93	186
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.55	403	3.38	339	3.20	276	3.13	250	3.02	214	2.93	186
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.53	396	3.35	329	3.22	282	3.12	247	3.04	220	2.94	188
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.87	168	2.82	151	2.60	130	2.58	126	2.38	92	2.41	96
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.83	158	2.81	149	2.56	122	2.47	106	2.38	92	2.42	98
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.85	163	2.80	147	2.61	132	2.51	113	2.53	116	2.50	111
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.87	168	2.79	145	2.64	138	2.52	114	2.48	108	2.50	111

Supplemental records.- Dec. 11, 1:30 p.m., 10.4 ft., 10,600 sec.-ft.

Merced River at Pohono Bridge, near Yosemite, Calif.

Location.- Lat. 37°43'01", long. 119°39'55", 0.4 mile above Artist Creek and 5 miles below Yosemite Lodge, in Yosemite National Park, Mariposa County. Altitude, about 3,870 feet above mean sea level.

Drainage area.- 321 square miles.

Gage-height record.- Water-stage recorder graph except for period 10 a.m. Dec. 11 to 2:30 p.m. Dec. 22, when there was no record. Stage graph for periods Dec. 11-12, 22 based on partial graph, peak stage obtained from floodmarks, and shape of stage graph of Merced River at Happy Isles Bridge.

Stage-discharge relation.- Defined by current-meter measurements below 6,800 second-feet; extended to peak stage on basis of computation of flow over dam about 1 mile below gage; verified by contracted opening determination of flood flow at Pohono Bridge. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 22,000 second-feet about 3 p.m. Dec. 11 (gage height, 19.10 feet).

1916-November 1937: Discharge, 6,370 second-feet June 5, 1922 (gage height, 10.0 feet), from rating curve extended above 5,600 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record, Dec. 13-21, determined from record of Merced River at Happy Isles Bridge.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	21	29	209	11	25	16,000	164	21	46	350	211
2	21	28	229	12	25	6,420	161	22	40	300	227
3	21	27	215	13	25	3,000	158	23	36	271	207
4	21	27	207	14	26	1,200	171	24	36	238	197
5	21	26	199	15	25	900	249	25	34	236	199
6	21	25	185	16	25	700	223	26	32	229	205
7	21	25	180	17	36	600	254	27	31	221	211
8	21	25	178	18	39	500	243	28	30	215	215
9	22	43	169	19	32	450	227	29	30	211	211
10	22	3,030	166	20	30	400	205	30	29	213	195
								31		207	205
Mean monthly discharge, in second-feet									28.1	1,166	202
Run-off, in acre-feet									1,670	71,690	12,450

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			1.09	25	4.30	830	9.35	5,470	12.68	13,600		
4			1.09	25	5.83	1,730	10.43	7,320	11.83	11,400		
6			1.08	25	6.86	2,520	11.77	10,200	11.05	9,480		
8			1.08	25	7.47	3,090	13.99	15,800	10.28	7,800		
10			1.09	25	7.89	3,530	16.25	19,400	9.46	6,230		
N			1.10	26	8.09	3,760	18.02	21,100	8.68	5,000		
2			1.13	28	8.38	4,110	19.06	22,000	8.05	4,160		
4			1.17	31	8.54	4,310	19.07	22,000	7.55	3,540		
6			1.24	36	8.19	3,880	18.40	21,400	7.03	2,970		
8			1.43	53	7.65	3,270	15.80	18,900	6.57	2,520		
10			1.80	93	7.66	3,280	14.71	17,500	6.20	2,200		
M			2.50	214	8.35	4,070	13.76	16,000	5.87	1,940		

Supplemental records.- Dec. 11, about 3 p.m., 19.10 ft., 22,000 sec.-ft.

Merced River at Kittridge, Calif.

Location.- Lat. 37°39', long. 120°11', in sec. 26, T. 3 S., R. 16 E., 0.2 mile below Whites Gulch, a quarter of a mile below Kittridge, Mariposa County, and 3 miles above Horseshoe Bend. Altitude, about 750 feet above mean sea level.

Drainage area.- 935 square miles.

Gage-height record.- Water-stage recorder graph for period 4 p.m. Dec. 16 to Jan. 31. Stage graph for Dec. 16 based on partial recorder graph. Occasional staff gage readings were made Nov. 1 to Dec. 14. Peak stage was determined from floodmarks.

Stage-discharge relation.- Defined by current-meter measurements below 10,000 second-feet; extended to peak stage on basis of computations of change in storage in Lake McClure, adjusted for inflow between gage and lake. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 59,000 second-feet about 3 p.m. Dec. 11 (gage height, 31.0 feet).

1922-November 1937: Discharge, 33,200 second-feet Feb. 6, 1937 (gage height, 22.6 feet, from floodmarks), from rating curve extended above 7,500 second-feet on basis of computations of change in storage in Lake McClure.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period Nov. 1 to Dec. 15 determined from discharge graph based on occasional staff gage readings, floodmarks, and records for Lake McClure, Merced River at Pohono Bridge, and Chowchilla River at Buchanan dam site. Most of basic data furnished by Merced Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	66	98	482	11	75	32,100	397	21	125	798	798
2	66	94	544	12	85	12,800	391	22	115	775	752
3	66	92	685	13	98	4,070	391	23	110	798	708
4	67	92	580	14	105	2,300	391	24	108	685	600
5	67	90	520	15	110	1,710	7,650	25	106	620	552
6	68	90	499	16	105	1,420	2,020	26	105	600	540
7	68	89	457	17	101	1,230	1,660	27	104	580	540
8	69	89	443	18	130	1,080	1,320	28	104	548	532
9	69	89	422	19	150	975	1,060	29	102	502	640
10	70	4,430	409	20	135	870	975	30	100	492	580
								31		492	925
Mean monthly discharge, in second-feet									95.0	2,281	918
Run-off, in acre-feet									5,650	140,200	56,460

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					-	160	-	8,600	-	-		
4					-	235	-	8,650	-	-		
6					-	305	-	9,600	-	15,800		
8					-	375	-	12,000	-	-		
10					-	450	-	27,500	-	-		
N					-	1,600	-	45,400	-	10,500		
2					-	2,750	-	58,500	-	-		
4					-	10,200	-	57,500	-	-		
6					-	10,800	-	55,700	-	7,580		
8					-	11,500	-	46,200	-	-		
10					-	10,300	-	36,800	-	-		
M					-	9,050	-	29,200	-	5,860		

Supplementary records.- Dec. 11, about 3 p.m., 31.0 ft., 59,000 sec.-ft.

Lake McClure at Exchequer, Calif.

Location.- Lat. 37°35', long. 120°16', in SW¼ sec. 13, T. 4 S., R. 15 E., at Exchequer Dam on Merced River 5 miles northeast of Merced Falls. Zero of gage is at mean sea level.
Drainage area.- 1,020 square miles.
Gage-height record.- Gage read to tenths daily at midnight.
Remarks.- Flood run-off completely controlled in reservoir. Crest of spillway is 693.0 feet above mean sea level (capacity, 245,600 acre-feet). See record for Merced River at Exchequer. Basic data furnished by Merced Irrigation District.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	571.1	48,290	575.0	52,000	657.0	167,800
2	571.2	48,380	575.1	52,100	656.3	166,470
3	571.3	48,470	575.2	52,200	655.8	165,520
4	571.3	48,470	575.3	52,300	655.2	164,380
5	571.4	48,560	575.5	52,500	654.4	162,920
6	571.4	48,560	575.6	52,600	653.7	161,660
7	571.5	48,650	575.7	52,700	652.9	160,220
8	571.5	48,650	575.8	52,800	652.1	158,780
9	571.6	48,740	576.0	53,000	651.3	157,340
10	571.6	48,740	584.7	62,070	650.4	155,720
11	571.8	48,920	634.8	129,380	649.6	154,280
12	571.9	49,010	650.0	155,000	648.8	152,840
13	572.0	49,100	654.1	162,380	647.9	151,230
14	572.1	49,190	656.4	166,660	647.1	149,870
15	572.3	49,370	658.1	169,890	656.1	166,090
16	572.4	49,460	659.5	172,550	657.4	168,560
17	572.6	49,640	660.7	174,900	658.0	169,700
18	572.9	49,910	661.7	176,900	658.5	170,650
19	573.1	50,100	662.6	178,700	658.5	170,650
20	573.3	50,300	663.4	180,300	658.4	170,460
21	573.5	50,500	664.0	181,500	658.1	169,890
22	573.6	50,600	663.6	180,700	657.8	169,320
23	573.8	50,800	663.1	179,700	657.4	168,560
24	574.0	51,000	662.6	178,700	656.9	167,610
25	574.2	51,200	662.0	177,500	656.3	166,470
26	574.3	51,300	661.3	176,100	655.8	165,520
27	574.5	51,500	660.6	174,700	655.2	164,380
28	574.6	51,600	660.0	173,500	654.7	163,460
29	574.7	51,700	659.2	171,980	654.3	162,740
30	574.9	51,900	658.5	170,650	655.0	164,000
31			657.7	169,130	657.0	167,800

Merced River at Exchequer, Calif.

Location.- Lat. 37°35', long. 120°17', about on line between secs. 14 and 23, T. 4 S., R. 15 E., at Exchequer, Mariposa County, half a mile below Lake McClure, 0.7 mile below Cotton Creek, and 5 miles northeast of Merced Falls. Altitude, about 400 feet above mean sea level.

Drainage area.- 1,035 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 12,200 second-feet.

Maxima.- December 1937: Discharge (regulated), 1,520 second-feet at intervals during period Dec. 22-25 (gage height, 3.74 feet).

1916-November 1937: Discharge observed (unregulated), about 22,000 second-feet Jan. 17, 1916 (gage height, 20.0 feet, from nonrecording gage, former site and datum), from rating curve extended above 8,600 second-feet.

Remarks.- Flood run-off completely controlled in Lake McClure. Monthly summaries adjusted f changes in storage. See record for Lake McClure at Exchequer. Most of basic data furnished by Merced Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	38	35	1,190	11	36	29	1,170	21	36	49	1,190
2	38	35	1,190	12	36	31	1,160	22	35	1,170	1,190
3	38	35	1,180	13	36	30	1,160	23	35	1,220	1,190
4	39	35	1,180	14	36	29	1,160	24	35	1,210	1,200
5	37	35	1,180	15	36	28	1,200	25	35	1,220	1,200
6	36	35	1,190	16	36	17	1,190	26	35	1,210	1,190
7	36	35	1,190	17	36	14	1,190	27	35	1,210	1,190
8	36	35	1,180	18	36	26	1,190	28	35	1,200	1,190
9	36	35	1,180	19	36	27	1,190	29	35	1,200	1,190
10	36	36	1,170	20	36	27	1,190	30	35	1,200	53
								31		1,200	26
Mean monthly discharge, in second-feet									36.0	410	1,111
Run-off, in acre-feet									2,140	25,190	68,310
Mean monthly discharge, in second-feet (adjusted)									96.6	2,316	1,089
Run-off, in acre-feet (adjusted)									5,750	142,400	66,980

Merced River near Livingston, Calif.

Location.- Lat. 37°23'29", long. 120°47'10", in SE¼ sec. 20, T. 6 S., R. 11 E., 3½ miles west of Livingston, Merced County. Altitude, about 82 feet above mean sea level.
Drainage area.- 1,245 square miles.
Gage-height record.- Water-stage recorder graph except for period noon Dec. 21 to 10:30 a.m. Dec. 24, when there was no record. Stage graph for Dec. 21 based on partial recorder graph.
Stage-discharge relation.- Defined by current-meter measurements for range of stage of high water in December.
Maxima.- December 1937: Discharge, 1,470 second-feet 6 p.m. Dec. 31 (gage height, 5.78 feet).

1922-24, 1926-November 1937: Discharge, 10,900 second-feet (revised) Feb. 24, 1936 (gage height, 19.24 feet), from rating curve for 1938 extended above 8,500 second-feet.

January-September 1938: Discharge, 11,100 second-feet 11 p.m. Feb. 12 (gage height, 19.44 feet) from rating curve extended above 8,500 second-feet.
Remarks.- Flood run-off very materially affected by artificial storage in Lake McClure (capacity, about 250,000 acre-feet). Discharge for period of missing gage-height record determined from range of stage shown on recorder graph, partial recorder graph Dec. 24, and record for Merced River at Exchequer. Most of basic data furnished by Merced Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	114	164	1,260	11	114	153	1,260	21	120	161	1,500
2	117	137	1,260	12	114	232	1,260	22	119	150	1,400
3	117	127	1,260	13	112	364	1,260	23	120	650	1,360
4	112	125	1,260	14	112	245	1,260	24	119	1,000	1,330
5	112	124	1,260	15	116	195	1,440	25	119	1,160	1,330
6	111	122	1,260	16	116	173	2,130	26	122	1,190	1,330
7	111	120	1,260	17	119	209	1,500	27	119	1,190	1,330
8	111	119	1,260	18	124	241	1,470	28	117	1,220	1,330
9	112	119	1,260	19	122	195	1,400	29	119	1,220	1,400
10	112	134	1,260	20	122	175	1,470	30	144	1,220	1,540
								31		1,260	762
Mean monthly discharge, in second-feet									117	448	1,344
Run-off, in acre-feet									6,980	27,560	82,640

Tenaya Creek near Yosemite, Calif.

Location.- Lat. 37°44'33", long. 119°33'25", at bridge in Yosemite National Park, 0.7 mile above junction with Merced River and 1.9 miles east of Yosemite Lodge, Mariposa County. Altitude, about 4,000 feet above mean sea level.
Drainage area.- 47 square miles.
Gage-height record. Water-stage recorder graph except for period 3:30 to 4:30 p.m. Dec. 11, when stage graph was based on floodmarks in the well.
Stage-discharge relation.- Defined by current-meter measurements below 1,400 second-feet; extended to peak stage on basis of area-velocity study; verified by extension of a rating curve for a temporary station upstream. Shifting-control method used for period Nov. 1 to Dec. 9. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 5,550 second-feet 4 p.m. Dec. 11 (gage height, 10.0 feet).
1904-9, 1912-November 1937: Discharge, 1,730 second-feet May 28, 1919 (gage height, 7.05 feet), from rating curve extended above 450 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1.2	1.1	37	11	1.2	3,430	29	21	1.1	65	42
2	1.2	1.1	40	12	1.1	1,240	28	22	1.1	60	43
3	1.2	1.1	38	13	1.0	416	28	23	1.1	56	40
4	1.2	1.1	37	14	1.1	243	28	24	1.2	53	37
5	1.2	1.1	35	15	1.1	177	40	25	1.2	49	37
6	1.1	1.2	34	16	1.1	136	41	26	1.2	48	38
7	1.2	1.2	33	17	1.1	117	48	27	1.1	43	40
8	1.2	1.2	32	18	1.1	98	48	28	1.1	41	39
9	1.2	1.4	30	19	1.0	83	46	29	1.1	40	38
10	1.1	692	30	20	1.0	69	42	30	1.1	40	37
								31		38	37
Mean monthly discharge, in second-feet									1.13	234	37.2
Run-off, in acre-feet									67	14,370	2,280

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.13	82	4.76	871	6.65	2,280	-	-
4	-	-	0.81	1.2	3.21	287	5.38	1,250	6.34	1,910	4.35	509
6	-	-	-	-	3.73	451	6.35	2,100	6.05	1,610	-	-
8	-	-	.81	1.2	4.24	646	6.92	2,760	5.77	1,360	4.18	440
10	-	-	-	-	5.00	995	7.17	3,080	5.53	1,160	-	-
N	0.81	1.2	.82	1.2	5.32	1,200	9.49	5,300	5.30	995	4.05	389
2	-	-	-	-	4.98	984	9.52	5,320	5.13	888	-	-
4	-	-	.85	1.5	4.90	940	10.00	5,550	5.00	815	3.99	367
6	-	-	-	-	4.83	905	9.19	5,130	4.95	788	-	-
8	-	-	.88	1.9	4.61	801	8.39	4,540	4.82	720	3.91	339
10	-	-	-	-	4.40	710	7.50	3,530	4.69	657	-	-
M	.81	1.2	.96	2.9	4.43	723	7.03	2,820	4.56	598	3.77	295
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.68	268	-	-	-	-	-	-	-	-	-	-
6	-	-	3.38	188	3.15	140	3.05	121	2.95	104	2.83	86
8	3.61	249	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.54	229	3.31	172	3.12	134	3.00	112	2.88	93	2.78	79
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.52	224	-	-	-	-	-	-	-	-	-	-
6	-	-	3.28	166	3.10	130	2.99	110	2.88	93	2.80	82
8	3.53	226	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.48	213	3.24	158	3.10	130	2.99	110	2.88	93	2.79	81
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.65	64	2.63	61	-	-	-	-
6	2.72	72	2.65	64	-	-	-	-	2.56	54	2.51	49
8	-	-	-	-	2.61	59	2.54	52	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.67	66	2.65	64	2.57	55	2.50	48	2.50	48	2.49	47
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.62	60	2.55	53	-	-	-	-
6	2.70	69	2.67	66	-	-	-	-	2.57	55	2.54	52
8	-	-	-	-	2.62	65	2.64	62	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.67	66	2.67	66	2.65	64	2.62	60	2.55	53	2.53	51

Orestimba Creek near Newman, Calif.

Location.- Lat. 37°19'09", long. 121°07'14", in NW¼ sec. 20, T. 7 S., R. 8 E., 3 miles below Oso Creek, at highway bridge 5 miles west of Newman, Stanislaus County. Altitude, about 190 feet above mean sea level.
Drainage area.- 129 square miles.
Gage-height record.- Water-stage recorder graph except for periods 5 a.m. Dec. 21 to 1:30 p.m. Dec. 22, 4 a.m. Dec. 24 to 4:30 p.m. Jan. 24, when there was no record.
Stage-discharge relation.- Defined by current-meter measurements below 1,200 second-feet; extended to peak stage on basis of slope-area computations for 1932 peak discharges; verified with aid of area-velocity study. Shifting-control method for period Dec. 11-17.
Maxima.- December 1937: Discharge, 2,040 second-feet 1 p.m. Dec. 11 (gage height, 4.22 feet).
1932-November 1937: Discharge, 3,440 second-feet Feb. 8, 1932 (gage height, 5.15 feet), from rating curve extended above 390 second-feet on basis of slope-area computation of flood flow.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for periods of missing gage-height record based on range in stage indicated on recorder graph and on study of rainfall records.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0	11	0	1,070	0	21	0	0	2
2	0	0	0	12	0	197	0	22	0	0	2
3	0	0	0	13	0	51	0	23	0	0	1
4	0	0	0	14	0	19	0	24	0	0	.4
5	0	0	0	15	0	7.5	1	25	0	0	.1
6	0	0	0	16	0	2.5	1	26	0	0	0
7	0	0	0	17	0	.7	2	27	0	0	0
8	0	0	0	18	0	0	2	28	0	0	.3
9	0	0	0	19	0	0	4	29	0	0	2.5
10	0	0	0	20	0	0	3	30	0	0	5.5
								31		0	54
Mean monthly discharge, in second-feet									0	43.5	2.61
Run-off, in acre-feet									0	2,670	160

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2							-	0	2.46	373	-	-
4							-	0	2.33	305	1.63	73
6							3.90	1,660	2.19	241	-	-
8							4.00	1,780	2.10	205	1.54	59
10							3.83	1,580	2.03	180	-	-
N							4.20	2,040	1.95	154	1.45	46
2							4.15	1,980	1.89	135	-	-
4							3.82	1,560	1.88	132	1.39	40
6							3.43	1,130	1.88	132	-	-
8							3.10	810	1.84	121	1.32	34
10							2.83	601	1.79	106	-	-
M							2.63	473	1.73	92	1.28	30
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-				
4	1.23	26	1.01	9.5	0.86	3.9	0.70	1.1				
6	-	-	-	-	-	-	-	-				
8	1.19	22	.99	9.0	.83	3.0	.68	1.0				
10	-	-	-	-	-	-	-	-				
N	1.15	19	.96	7.5	.80	2.5	.65	.7				
2	-	-	-	-	-	-	-	-				
4	1.11	16	.93	6	.77	2.0	.61	.5				
6	-	-	-	-	-	-	-	-				
8	1.07	13	.90	5	.75	1.7	.55	.2				
10	-	-	-	-	-	-	-	-				
M	1.04	11	.88	4.5	.72	1.3	.42	0				
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplemental records.- Dec. 11, 5:15 a.m., no flow; 5:30 a.m., 3.70 ft., 1,420 sec.-ft.; 1 p.m., 4.22 ft., 2,040 sec.-ft.

Hetch Hetchy Reservoir at Hetch Hetchy, Calif.

Location.- Lat. 37°57', long. 119°47', in sec. 16, T. 1 N., R. 20 E., at O'Shaughnessy Dam on Tuolumne River, Tuolumne County. Zero of gage is at about mean sea level.
Drainage area.- 460 square miles.
Gage-height record.- Gage read to tenths daily at 7 a.m.
Remarks.- Flood run-off completely controlled in reservoir. Elevation of spillway crest is 3,796.0 feet above mean sea level (capacity, 340,830 acre-feet). Some water released during flood period. See record for Tuolumne River near Hetch Hetchy. Basic data furnished by city of San Francisco.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	3,651.3	109,720	3,622.1	78,600	3,670.2	132,970
2	3,650.4	108,670	3,621.1	77,600	3,669.6	132,190
3	3,649.5	107,640	3,620.1	76,600	3,669.0	131,420
4	3,648.5	106,520	3,619.1	75,640	3,668.5	130,780
5	3,647.5	105,400	3,618.1	74,680	3,668.0	130,140
6	3,646.5	104,280	3,617.1	73,720	3,667.4	129,370
7	3,645.4	103,050	3,616.1	72,760	3,666.8	128,600
8	3,644.4	101,930	3,615.1	71,800	3,666.2	127,840
9	3,643.3	100,700	3,614.1	70,840	3,665.5	126,940
10	3,642.2	99,460	3,615.2	71,890	3,664.8	126,040
11	3,641.1	98,230	3,623.0	79,500	3,663.9	124,890
12	3,640.0	97,000	3,668.3	130,520	3,662.9	123,610
13	3,638.8	95,740	3,673.0	136,750	3,661.9	122,330
14	3,637.7	94,580	3,674.9	139,320	3,661.0	121,180
15	3,636.7	93,540	3,676.0	140,800	3.662.1	122,590
16	3,635.7	92,480	3,676.5	141,480	3,661.1	121,310
17	3,634.7	91,440	3,676.8	141,880	3,660.1	120,030
18	3,633.8	90,490	3,676.9	142,020	3,659.9	119,780
19	3,632.8	89,440	3,676.8	141,880	3,659.6	119,430
20	3,631.8	88,390	3,676.7	141,740	3,659.1	118,850
21	3,630.9	87,440	3,676.4	141,340	3,658.5	118,140
22	3,630.2	86,710	3,676.0	140,800	3,658.0	117,560
23	3,629.5	86,000	3,675.6	140,260	3,657.4	116,860
24	3,628.7	85,200	3,675.2	139,720	3,656.7	116,040
25	3,627.7	84,200	3,674.7	139,040	3,656.0	115,220
26	3,626.8	83,300	3,674.0	138,100	3,655.3	114,400
27	3,625.9	82,400	3,673.3	137,160	3,654.6	113,580
28	3,625.0	81,500	3,672.6	136,210	3,653.9	112,760
29	3,624.1	80,600	3,672.0	135,400	3,653.2	111,940
30	3,623.1	79,600	3,671.4	134,590	3,652.5	111,120
31			3,670.8	133,780	3,651.9	110,420

Tuolumne River near Hetch Hetchy, Calif.

Location.- Lat. 37°56', long. 119°48', in SE¼ sec. 17, T. 1 N., R. 20 E., in Yosemite National Park, three-quarters of a mile below O'Shaughnessy Dam and Hetch Hetchy Reservoir, Tuolumne County. Altitude, about 3,450 feet above mean sea level.
Drainage area.- 462 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge (regulated), 715 second-feet 4 p.m. Dec. 24 to 5 p.m. Dec. 27 (gage height, 5.95 feet). Adjusted maximum discharge, about 50,000 second-feet morning Dec. 11, based on record of changes in storage.
1915-November 1937: Discharge, 12,000 second-feet (reservoir full and spilling) June 16, 1929 (gage height, 13.58 feet), from rating curve extended above 7,300 second-feet.
Remarks.- Flood run-off completely regulated in Hetch Hetchy Reservoir (capacity, 340,830 acre-feet). Daily gain or loss in storage computed from contents at midnight determined from graph based on readings at 7 a.m. See record for Hetch Hetchy Reservoir at Hetch Hetchy. Part of basic data furnished by city of San Francisco.

Discharge, in second-feet, and gain or loss in storage, in acre-feet, November 1937 to January 1938

Day	November			December			January		
	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge
1	552	-1,050	23	565	-1,000	61	685	-790	287
2	552	-1,040	28	590	-1,000	86	685	-780	292
3	578	-1,090	28	602	-970	113	628	-670	290
4	628	-1,120	63	590	-960	106	628	-640	305
5	615	-1,120	50	565	-960	81	670	-740	297
6	628	-1,200	23	565	-960	81	700	-770	312
7	655	-1,150	75	552	-960	68	730	-760	347
8	640	-1,200	35	552	-960	68	745	-860	311
9	655	-1,240	30	578	+180	669	730	-900	276
10	670	-1,230	50	540	+3,700	2,400	700	-1,070	161
11	685	-1,230	65	590	+50,700	26,200	700	-1,250	70
12	685	-1,250	55	602	+9,700	5,490	700	-1,280	55
13	670	-1,190	70	615	+3,500	2,380	700	-1,180	105
14	615	-1,080	70	640	+1,500	1,400	730	+80	770
15	578	-1,050	47	655	+880	1,100	760	0	760
16	590	-1,050	61	685	+480	927	745	-1,200	140
17	602	-970	113	700	+220	811	745	-550	468
18	615	-1,020	101	700	-60	670	628	-320	467
19	615	-1,050	86	700	-140	629	640	-510	383
20	602	-980	108	685	-320	524	745	-670	407
21	540	-800	137	670	-500	418	745	-620	432
22	520	-710	162	670	-540	398	745	-670	407
23	552	-780	159	670	-540	398	745	-780	352
24	565	-940	91	700	-640	377	745	-820	332
25	565	-930	96	715	-870	276	745	-820	332
26	565	-900	111	715	-940	241	730	-820	317
27	565	-900	111	715	-940	241	730	-820	317
28	540	-900	86	700	-850	271	730	-820	317
29	530	-970	41	685	-810	277	730	-820	317
30	565	-1,000	61	685	-810	277	730	-740	357
31				685	-810	277	745	-610	437

	November	December	January
Mean monthly discharge, in second-feet (observed)..........	598	641	713
Gain or loss in storage, in acre-feet.....................	-31,140	+54,320	-23,200
Mean monthly discharge, in second-feet (adjusted)..........	74.5	1,525	336
Run-off, in acre-feet (adjusted)..........................	4,440	93,750	20,660

Don Pedro Reservoir near La Grange, Calif.

Location.- Lat. 37°42'48", long. 120°24'14", in SW¼ sec. 35, T. 2 S., R. 14 E., at Don Pedro Dam on Tuolumne River, 1 mile below Rogers Creek and 5.5 miles above La Grange, Stanislaus County. Zero of gage is at mean sea level.

Drainage area.- 1,540 square miles.

Gage-height record.- Gage read to tenths daily at 8 a.m.

Remarks.- Flood run-off completely controlled in reservoir. Elevation of crest of spillway is 596.55 feet above mean sea level (capacity, 262,200 acre-feet). Elevation of top of spillway gates is 605.55 feet above mean sea level (capacity, 290,400 acre-feet). See record for Tuolumne River above La Grange Dam. Basic data furnished by Turlock and Modesto Irrigation Districts.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	513.7	69,200	512.4	67,400	583.1	222,200
2	513.3	68,600	512.4	67,400	583.2	222,500
3	513.2	68,500	512.7	67,800	583.8	224,300
4	513.1	68,400	512.8	68,000	584.4	226,000
5	513.0	68,200	512.7	67,800	585.0	227,700
6	512.9	68,100	511.8	66,600	585.5	229,200
7	512.8	68,000	511.7	66,400	585.8	230,100
8	512.4	67,400	511.8	66,600	586.1	231,000
9	512.3	67,300	511.8	66,600	586.5	232,100
10	512.2	67,100	511.9	66,700	586.7	232,800
11	512.1	67,000	534.9	103,200	587.0	233,600
12	512.0	66,900	574.6	198,200	587.3	234,500
13	512.0	66,900	580.4	214,500	587.7	235,600
14	512.1	67,000	582.4	220,200	587.9	236,200
15	511.5	66,200	583.4	223,100	589.8	241,900
16	511.7	66,400	584.1	225,100	594.0	254,500
17	511.9	66,700	584.7	226,900	595.7	259,600
18	511.9	66,700	584.8	227,200	596.8	263,000
19	512.2	67,100	584.9	227,500	597.4	264,800
20	512.3	67,300	584.7	226,900	597.5	265,100
21	512.3	67,300	584.7	226,900	597.3	264,500
22	512.1	67,000	584.6	226,600	597.2	264,200
23	512.3	67,300	584.5	226,300	597.2	264,200
24	512.3	67,300	584.4	226,000	597.0	263,600
25	512.3	67,300	584.3	225,700	597.1	263,900
26	512.3	67,300	584.0	224,800	597.1	263,900
27	512.5	67,500	583.8	224,300	597.2	264,200
28	512.8	68,000	583.7	224,000	597.1	263,900
29	512.6	67,700	583.5	223,400	597.3	264,500
30	512.6	67,700	583.3	222,800	597.3	264,500
31			583.1	222,200	597.2	264,200

Tuolumne River above La Grange Dam, near La Grange, Calif.

Location.- Lat. 37°42'35", long. 120°24'45", in NE¼ sec. 3, T. 3 S., R. 14 E., half a mile below Don Pedro Dam, 3½ miles above La Grange Dam, and 5 miles above La Grange, Stanislaus County. Altitude, about 330 feet above mean sea level.
Drainage area.- 1,540 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Flood run-off completely controlled in Don Pedro Reservoir.
1915-November 1937: Discharge (regulated), 38,100 second-feet Mar. 25, 1928 (gage height, 29.6 feet), from rating curve extended above 17,000 second-feet.
1895-1915: Discharge (unregulated), about 60,300 second-feet Jan. 31, 1911 (gage height, 16.45 feet, from stage graph constructed from frequent gage readings, former site and datum at La Grange Dam), from rating curve extended above 18,000 second-feet.
Remarks.- Flood run-off completely controlled in Don Pedro Reservoir (capacity, 262,200 acre-feet at elevation of crest of spillway). See record for Don Pedro Reservoir near La Grange. Daily and monthly discharges adjusted for changes in storage in Don Pedro Reservoir but not for storage in Hetch Hetchy Reservoir, Lake Eleanor, or for diversions. Contents at midnight in Don Pedro Reservoir determined from graph based on daily readings at 8 a.m. Mean monthly diversion through San Francisco Aqueduct: November, 12 second-feet; December, 3 second-feet; January, 3 second-feet.

Discharge, in second-feet, and gain or loss in storage, in acre-feet, November 1937 to January 1938

Day	November			December			January		
	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge
1	915	-630	597	867	-100	817	839	+200	940
2	913	-270	777	825	+270	961	798	+1,300	1,450
3	923	-100	873	846	+260	977	885	+1,730	1,760
4	919	-160	838	866	-60	836	871	+1,700	1,730
5	933	-140	862	1,030	-870	591	852	+1,570	1,640
6	938	-100	888	882	-530	615	865	+1,100	1,420
7	827	-430	610	898	+60	928	866	+900	1,320
8	948	-270	812	894	+70	929	854	+1,030	1,370
9	954	-160	873	910	+70	945	794	+840	1,220
10	920	-140	849	841	+16,830	9,330	876	+760	1,260
11	828	-100	778	1,110	+99,000	51,000	872	+870	1,310
12	909	-30	894	1,650	+28,400	16,000	859	+1,030	1,380
13	908	+70	943	1,630	+8,100	5,710	872	+770	1,260
14	758	-500	506	1,630	+3,400	3,340	868	+3,300	2,530
15	850	-140	779	1,620	+2,200	2,730	832	+11,300	6,530
16	883	+270	1,020	1,690	+1,700	2,550	812	+7,500	4,590
17	855	+100	905	1,680	+800	2,080	845	+4,000	2,860
18	869	+270	1,010	1,640	+300	1,790	1,270	+2,100	2,330
19	880	+260	1,010	1,590	-300	1,440	2,200	+800	2,600
20	881	+70	916	1,660	-200	1,560	2,320	-300	2,170
21	740	-200	639	1,660	-200	1,560	2,160	-400	1,960
22	872	+100	922	1,650	-300	1,500	2,040	-100	1,990
23	895	+100	945	1,650	-300	1,500	1,760	-400	1,560
24	880	0	880	1,660	-300	1,510	1,600	0	1,600
25	744	0	744	1,560	-700	1,210	1,760	+100	1,810
26	817	+130	883	1,560	-630	1,240	1,800	+200	1,900
27	838	+400	1,040	1,650	-370	1,460	1,840	-100	1,790
28	750	-30	735	1,660	-500	1,410	1,760	+300	1,910
29	855	-100	805	1,650	-600	1,350	2,040	+200	2,140
30	884	-200	783	1,660	-600	1,360	1,800	-200	1,700
31				1,660	-200	1,560	2,200	+3,030	3,730

	November	December	January
Mean monthly discharge, in second-feet (observed)..........	870	1,380	1,323
Gain or loss in storage, in acre-feet......................	-1,930	+154,700	+45,130
Mean monthly discharge, in second-feet (adjusted)..........	837	3,897	2,057
Run-off, in acre-feet (adjusted)...........................	49,810	239,600	126,500

Falls Creek near Hetch Hetchy, Calif.

Location.- Lat. 37°58', long. 119°46', in NE¼ sec. 3, T. 1 N., R. 20 E., in Yosemite National Park, a quarter of a mile above Wampana Falls, 1 mile above mouth, and 2 miles northeast of Hetch Hetchy, Tuolumne County. Altitude, about 5,600 feet above mean sea level.
Drainage area.- 45.2 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,250 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 6,300 second-feet 3 p.m. Dec. 11 (gage height, 8.90 feet).
1915-November 1937: Discharge, 1,740 second-feet Mar. 25, 1928 (gage height, 6.45 feet), from rating curve extended above 1,100 second-feet on basis of 1938 area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	11	38	11	0.1	3,970	27	21	31	78	69
2	.1	10	50	12	.2	1,960	26	22	22	68	74
3	.1	9	54	13	.5	566	25	23	17	68	66
4	.1	9	50	14	1.7	275	30	24	21	68	60
5	.1	8.5	44	15	3.2	191	114	25	18	68	57
6	.1	9	39	16	1.8	148	81	26	15	57	64
7	.1	9	35	17	30	121	102	27	14	52	68
8	.1	9.5	32	18	15	104	86	28	13	44	62
9	.1	41	30	19	11	91	78	29	12	41	62
10	.1	1,300	28	20	25	78	77	30	11	40	59
								31		38	56
Mean monthly discharge, in second-feet									8.79	308	56.2
Run-off, in acre-feet									523	18,930	3,460

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.60	9.5	1.61	10	4.46	672	6.60	1,930	-	-	-	-
4	1.60	9.5	1.61	10	5.15	992	6.88	2,200	7.55	2,930	5.23	738
6	1.60	9.5	1.61	10	5.60	1,240	7.12	2,460	-	-	-	-
8	1.60	9.5	1.62	10	5.84	1,370	7.36	2,760	7.01	2,190	5.02	625
10	1.60	9.5	1.62	10	5.82	1,360	7.62	3,130	-	-	-	-
N	1.60	9.5	1.62	10	5.90	1,410	8.50	5,000	6.50	1,670	4.82	525
2	1.61	10	1.63	11	6.04	1,500	8.80	5,960	-	-	-	-
4	1.61	10	1.68	12	6.06	1,510	8.85	6,130	6.13	1,360	4.69	466
6	1.60	9.5	1.72	14	6.04	1,500	8.70	5,620	-	-	-	-
8	1.60	9.5	2.06	34	6.04	1,500	8.55	5,140	5.80	1,110	4.59	426
10	1.61	10	2.88	162	6.10	1,540	8.30	4,420	-	-	-	-
M	1.61	10	3.68	388	6.33	1,700	8.15	4,070	5.48	892	4.47	380
	December 14		December 15		December 16		December 17		December 18		December 19	
2	4.41	358	-	-	-	-	-	-	-	-	-	-
4	4.34	334	3.91	212	3.69	162	3.54	133	3.42	111	3.35	99
6	4.24	302	-	-	-	-	-	-	-	-	-	-
8	4.15	275	3.85	198	3.63	150	3.52	129	3.41	109	3.32	94
10	4.10	260	-	-	-	-	-	-	-	-	-	-
N	4.08	255	3.80	186	3.59	142	3.48	121	3.38	104	3.28	88
2	4.04	245	-	-	-	-	-	-	-	-	-	-
4	4.01	238	3.77	179	3.55	134	3.45	116	3.35	99	3.26	85
6	4.00	235	-	-	-	-	-	-	-	-	-	-
8	4.00	235	3.74	173	3.53	131	3.44	114	3.32	94	3.26	85
10	3.98	230	-	-	-	-	-	-	-	-	-	-
M	3.96	225	3.72	168	3.54	133	3.43	112	3.34	97	3.30	91
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	3.12	63	3.16	69
4	3.30	91	3.26	85	3.20	75	3.18	72	3.13	64	3.23	80
6	-	-	-	-	-	-	-	-	3.14	66	3.27	86
8	3.26	85	3.24	81	3.18	72	3.17	70	3.20	75	3.29	89
10	-	-	-	-	-	-	-	-	3.26	85	3.28	88
N	3.18	72	3.22	78	3.15	68	3.15	68	3.23	80	3.15	68
2	-	-	-	-	-	-	-	-	3.13	64	3.08	57
4	3.14	66	3.19	74	3.12	63	3.13	64	3.12	63	3.07	56
6	-	-	-	-	-	-	-	-	3.12	63	3.07	56
8	3.17	70	3.17	70	3.10	60	3.12	63	3.12	63	3.07	56
10	-	-	-	-	-	-	-	-	3.11	62	3.06	54
M	3.23	80	3.18	72	3.11	62	3.11	62	3.11	62	3.06	54

Supplemental records.- Dec. 11, 3 p.m., 8.90 ft., 6,300 sec.-ft.

Cherry Creek near Hetch Hetchy, Calif.

Location.- Lat. 38°00', long. 119°54', in SW¼ sec. 28, T. 2 N., R. 19 E., 3 miles northwest of Lake Eleanor Dam, 4 miles above Eleanor Creek, and 7½ miles northwest of Hetch Hetchy, Tuolumne County. Altitude, about 4,800 feet above mean sea level.

Drainage area.- 111 square miles.

Gage-height record.- Water-stage recorder graph except for period 11 a.m. Dec. 10 to 4 p.m. Dec. 18, when there was no record. Peak stage determined from floodmarks inside of cabin.

Stage-discharge relation.- Defined by current-meter measurements below 3,900 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 18,100 second-feet about 2 p.m. Dec. 11 (gage height, 25.1 feet, from floodmarks).

1910-November 1937: Discharge, about 7,750 second-feet June 16, 1929 (gage height, 13.57 feet), from rating curve extended above 3,600 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record based on floodmarks and record for Eleanor Creek near Hetch Hetchy.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	5.5	53	100	11	9	11,600	84	21	144	169	211
2	5.5	48	180	12	20	4,000	84	22	82	147	234
3	5.5	41	180	13	21	1,600	79	23	74	157	195
4	5.5	43	160	14	31	800	220	24	119	166	174
5	5.5	43	134	15	34	600	530	25	74	141	189
6	5	46	115	16	27	500	292	26	68	122	214
7	5	49	104	17	273	400	352	27	66	113	214
8	5.5	44	96	18	76	300	274	28	61	106	180
9	5.5	266	86	19	77	224	227	29	55	100	177
10	5.5	7,800	84	20	248	180	205	30	53	102	157
								31		96	147
Mean monthly discharge, in second-feet									55.5	970	183
Run-off, in acre-feet									3,300	59,620	11,260

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.79	51	1.75	46	9.83	4,520	-	10,400	-	5,200	-	2,400
4	1.82	55	1.75	46	11.75	6,060	-	11,600	-	4,950	-	2,200
6	1.81	53	1.73	44	13.95	7,820	-	13,000	-	4,650	-	2,000
8	1.80	52	1.70	41	15.49	9,140	-	14,200	-	4,500	-	1,750
10	1.77	49	1.67	38	15.86	9,460	-	15,400	-	4,250	-	1,500
N	1.75	46	1.66	37	-	10,000	-	16,600	-	4,000	-	1,350
2	1.71	42	1.65	36	-	9,000	25.1	18,100	-	3,800	-	1,300
4	1.67	38	1.67	38	-	8,000	-	13,600	-	3,600	-	1,250
6	1.64	35	1.77	49	-	8,800	-	7,500	-	3,350	-	1,200
8	1.62	33	2.96	384	-	7,000	-	6,400	-	3,150	-	1,150
10	1.66	37	4.92	1,240	-	8,000	-	5,600	-	2,850	-	1,100
M	1.71	42	7.30	2,720	-	9,200	-	5,500	-	2,600	-	1,050
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	1,000	-	-	-	-	-	-	-	370	2.63	260
4	-	950	-	-	-	-	-	-	-	360	2.60	250
6	-	900	-	-	-	-	-	-	-	350	2.56	237
8	-	850	-	-	-	-	-	-	-	340	2.53	227
10	-	800	-	-	-	-	-	-	-	330	2.50	217
N	-	750	-	*600	-	*500	-	*400	-	280	2.46	205
2	-	730	-	-	-	-	-	-	-	250	2.43	195
4	-	715	-	-	-	-	-	-	2.57	240	2.42	192
6	-	700	-	-	-	-	-	-	2.57	240	2.44	198
8	-	680	-	-	-	-	-	-	2.65	268	2.51	220
10	-	665	-	-	-	-	-	-	2.68	278	2.55	234
M	-	650	-	-	-	-	-	-	2.67	274	2.54	230
	December 20		December 21		December 22		December 23		December 24		December 25	
2	2.52	224	2.46	205	2.35	172	2.36	174	2.40	186	2.30	157
4	2.47	208	2.45	202	2.32	163	2.32	163	2.33	166	2.25	144
6	2.41	189	2.41	189	2.30	157	2.29	154	2.30	157	2.22	136
8	2.35	172	2.35	172	2.27	149	2.26	147	2.30	157	2.22	136
10	2.32	163	2.31	160	2.24	141	2.21	134	2.27	149	2.21	134
N	2.28	152	2.27	149	2.21	134	2.17	124	2.31	160	2.23	139
2	2.26	147	2.25	144	2.18	126	2.17	124	2.28	152	2.19	129
4	2.26	147	2.24	141	2.15	120	2.20	131	2.32	163	2.19	129
6	2.32	163	2.27	149	2.16	122	2.31	160	2.36	174	2.22	136
8	2.38	180	2.32	163	2.22	136	2.42	192	2.37	177	2.25	144
10	2.45	202	2.36	174	2.28	152	2.43	195	2.36	174	2.25	144
M	2.46	205	2.37	177	2.37	177	2.43	195	2.34	169	2.25	144

Supplemental records.- Dec. 9, 7 p.m., 2.17 ft., 117 sec.-ft.; 9 p.m., 4.02 ft., 819 sec.-ft.; 11 p.m., 5.98 ft., 1,840 sec.-ft.

*Mean for the day.

160302 O—39——12

Lake Eleanor near Hetch Hetchy, Calif.

Location.- Lat. 37°58', long. 119°53', in NW¼ sec. 3, T. 1 N., R. 19 E., at dam on Eleanor Creek, 1.7 miles above Miguel Creek and 5½ miles northwest of Hetchy Hetchy, Tuolumne County. Zero of gage is at about mean sea level.
Drainage area.- 79 square miles.
Gage-height record.- Water-stage recorder graph prior to 1 p.m. Dec. 11; elevations at midnight used to determine contents. Staff gage read to tenths daily at 7 a.m. for period Dec. 12 to Jan. 31; elevations at midnight determined from graph based on readings.
Remarks.- Flood run-off controlled partially in reservoir. Elevation of crest of spillway is 4,655 feet above mean sea level (capacity, 23,160 acre-feet). Reservoir began to spill at 7 a.m. Dec. 11. Maximum elevation, 4,663.4 feet 2 p.m. Dec. 11 (contents, 31,010 acre-feet); water flowing over full length of dam. See record for Eleanor Creek near Hetchy Hetchy. Basic data furnished by city of San Francisco.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	4,631.4	4,900	4,631.0	4,680	4,655.2	23,340
2	4,631.0	4,680	4,631.0	4,680	4,655.0	23,160
3	4,630.6	4,450	4,630.9	4,620	4,654.9	23,070
4	4,630.4	4,340	4,630.8	4,560	4,654.8	22,980
5	4,630.2	4,230	4,630.6	4,450	4,654.7	22,890
6	4,630.0	4,110	4,630.3	4,280	4,654.6	22,800
7	4,629.7	3,970	4,630.1	4,170	4,654.4	22,620
8	4,629.5	3,870	4,629.8	4,020	4,654.2	22,440
9	4,629.4	3,820	4,630.2	4,230	4,654.0	22,260
10	4,629.3	3,770	4,647.8	16,760	4,653.8	22,080
11	4,629.3	3,770	4,661.3	29,020	4,653.6	21,900
12	4,629.2	3,730	4,659.5	27,340	4,653.3	21,620
13	4,629.2	3,730	4,658.7	26,600	4,653.2	21,540
14	4,629.1	3,680	4,658.3	26,230	4,653.2	21,540
15	4,629.1	3,680	4,658.0	25,950	4,653.7	21,990
16	4,629.1	3,680	4,657.8	25,760	4,654.3	22,530
17	4,629.8	4,020	4,657.8	25,760	4,654.8	22,980
18	4,630.0	4,110	4,657.7	25,670	4,655.2	23,340
19	4,630.1	4,170	4,657.6	25,580	4,655.6	23,720
20	4,630.4	4,340	4,657.5	25,480	4,656.0	24,090
21	4,630.8	4,560	4,657.5	25,480	4,656.2	24,280
22	4,631.0	4,680	4,657.5	25,480	4,656.5	24,550
23	4,631.0	4,680	4,657.6	25,580	4,656.8	24,830
24	4,631.3	4,850	4,657.6	25,580	4,657.0	25,020
25	4,631.5	4,960	4,657.5	25,480	4,657.2	25,200
26	4,631.4	4,900	4,657.4	25,390	4,657.3	25,300
27	4,631.2	4,790	4,657.3	25,300	4,657.4	25,390
28	4,631.1	4,730	4,657.0	25,020	4,657.6	25,580
29	4,631.0	4,680	4,656.4	24,460	4,657.8	25,760
30	4,631.0	4,680	4,655.8	23,900	4,657.8	25,760
31			4,655.4	23,530	4,657.9	25,860

Eleanor Creek near Hetch Hetchy, Calif.

Location.- Lat. 37°58', long. 119°52', in SW¼ sec. 3, T. 1 N., R. 19 E., in Yosemite National Park, 0.6 mile below Lake Eleanor Dam, 1.1 miles above Miguel Creek, and 5½ miles northwest of Hetch Hetchy, Tuolumne County. Altitude, about 4,600 feet above mean sea level.

Drainage area.- 80 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 1,500 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 10,500 second-feet 3 p.m. Dec. 11 (gage height, 13.95 feet). *Incomplete storage record indicates a higher rate of inflow to Lake Eleanor earlier in the day.*

1910-November 1937: Discharge, 6,400 second-feet Mar. 25, 1928 (gage height, 11.0 feet), from rating curve extended above 1,500 second-feet.

Remarks.- Flood run-off affected by storage in Lake Eleanor (capacity, 23,160 acre-feet). Lake began to spill at 7 a.m. Dec. 11. No diversions. See record for Lake Eleanor near Hetch Hetchy. Monthly summaries adjusted for storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	137	40	190	11	26	4,450	171	21	3.2	107	10
2	137	40	249	12	26	2,910	158	22	16	88	14
3	115	40	152	13	26	1,140	27	23	50	81	30
4	47	50	152	14	26	630	96	24	30	96	34
5	49	84	154	15	9.5	452	65	25	36	92	39
6	49	84	152	16	8.5	337	9	26	71	95	51
7	49	82	152	17	7.5	256	11	27	85	210	65
8	49	84	152	18	3.0	210	10	28	85	152	66
9	35	85	152	19	24	156	10	29	68	362	58
10	26	40	164	20	14	122	9.5	30	41	358	61
								31		351	66
Mean monthly discharge, in second-feet (observed)									45.0	429	88.0
Mean monthly discharge, in second-feet (adjusted)									35.6	735	127
Run-off, in acre-feet (adjusted)									2,120	45,200	7,830

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	2.88	83	2.90	85	3.03	105	2.13	16	9.00	4,490	5.99	1,540
4	2.88	83	2.90	85	3.14	125	2.18	19	8.45	3,880	5.90	1,470
6	2.88	83	2.90	85	3.15	127	2.14	17	8.15	3,580	5.77	1,370
8	2.89	84	2.90	85	2.08	14	2.26	24	7.95	3,380	5.65	1,280
10	2.89	84	2.90	85	1.99	11	6.65	2,040	7.52	2,950	5.54	1,210
N	2.89	84	2.90	85	1.96	9.5	10.60	6,220	7.36	2,790	5.43	1,130
2	2.89	84	2.90	85	1.91	7.5	13.70	10,100	7.00	2,430	5.34	1,070
4	2.89	84	2.90	85	1.83	5.5	13.65	10,000	6.69	2,150	5.22	1,000
6	2.89	84	2.90	85	1.87	6.5	12.70	8,780	6.54	2,020	5.15	960
8	2.89	84	2.91	86	1.91	7.5	11.55	7,380	6.43	1,920	5.05	900
10	2.89	84	2.93	90	2.00	11	10.58	6,230	6.32	1,820	4.97	855
M	2.89	84	2.96	94	2.12	16	9.65	5,200	6.20	1,710	4.88	810
	December 14		December 15		December 16		December 17		December 18		December 19	
2	4.78	760	4.16	494	3.87	390	3.55	278	3.41	235	3.18	173
4	4.72	730	4.13	482	3.84	379	3.53	272	3.39	229	3.17	171
6	4.65	698	4.10	470	3.81	368	3.51	265	3.37	224	3.16	168
8	4.59	670	4.06	456	3.78	358	3.49	259	3.34	215	3.15	166
10	4.53	644	4.13	482	3.76	351	3.47	253	3.32	210	3.14	164
N	4.48	622	4.11	474	3.72	337	3.46	250	3.32	210	3.12	159
2	4.42	598	4.06	456	3.68	323	3.45	247	3.31	207	3.06	146
4	4.37	578	4.02	442	3.65	312	3.43	241	3.30	204	3.06	146
6	4.32	558	3.99	432	3.62	302	3.48	256	3.22	183	3.05	144
8	4.28	542	3.96	421	3.60	295	3.46	250	3.21	181	3.01	135
10	4.24	526	3.93	410	3.58	288	3.44	244	3.20	178	3.01	135
M	4.20	510	3.90	400	3.57	285	3.42	238	3.19	176	3.01	135
	December 20		December 21		December 22		December 23		December 24		December 25	
2	3.00	133	2.88	112	2.80	99	2.66	80	2.67	81	2.89	113
4	2.99	131	2.87	110	2.80	99	2.66	80	2.67	81	2.88	112
6	2.98	129	2.87	110	2.79	98	2.67	81	2.67	81	2.86	109
8	2.98	129	2.86	109	2.79	98	2.67	81	2.67	81	2.85	107
10	2.97	128	2.86	109	2.78	96	2.67	81	2.66	80	2.84	105
N	2.91	117	2.85	107	2.78	96	2.67	81	2.66	80	2.82	102
2	2.90	115	2.84	105	2.77	95	2.67	81	2.90	115	2.81	101
4	2.90	115	2.83	104	2.61	74	2.67	81	2.93	120	2.71	86
6	2.89	113	2.82	102	2.62	75	2.67	81	2.93	120	2.55	68
8	2.89	113	2.82	102	2.62	75	2.67	81	2.92	119	2.55	68
10	2.88	112	2.81	101	2.61	74	2.67	81	2.92	119	2.56	69
M	2.88	112	2.81	101	2.64	78	2.67	81	2.91	117	2.56	69

Supplemental records.- Dec. 11, 3 p.m., 13.95 ft., 10,500 sec.-ft.

South Fork of Tuolumne River near Oakland Recreation Camp, Calif.

Location.- Lat. 37°49', long. 120°00', in SE¼ sec. 29, T. 1 S., R. 18 E., 75 feet below highway bridge on Big Oak Flat road, half a mile southwest of Oakland Recreation Camp, Tuolumne County, and 0.6 mile above junction with Middle Tuolumne River. Altitude, about 2,800 feet above mean sea level

Drainage area.- 87.6 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 1,000 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 6,950 second-feet 4 p.m. Dec. 11 (gage height, 10.0 feet).

1923-November 1937: Discharge, 2,850 second-feet (revised) Apr. 8, 1935 (gage height, 7.07 feet), from rating curve extended above 1,000 second-feet on basis of 1938 area-velocity study.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	12	14	50	11	18	3,130	44	21	18	62	101
2	12	14	76	12	18	542	44	22	17	61	96
3	12	14	72	13	14	218	43	23	16	64	86
4	12	14	60	14	16	148	77	24	19	53	79
5	12	14	56	15	16	117	767	25	17	52	77
6	12	14	52	16	15	99	222	26	16	52	74
7	13	14	50	17	32	87	242	27	16	52	72
8	13	14	47	18	24	79	184	28	15	52	73
9	13	17	46	19	18	71	151	29	15	51	77
10	13	500	45	20	16	65	120	30	15	51	68
								31		50	95
Mean monthly discharge, in second-feet									15.8	187	108
Run-off, in acre-feet									942	11,470	6,640

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.32	14	1.33	14	2.21	59	5.05	1,040	5.06	924	3.57	279
4	1.32	14	1.35	14	2.86	140	5.68	1,480	4.75	750	3.50	262
6	1.33	14	1.33	14	3.28	231	7.18	3,010	4.55	648	3.44	249
8	1.32	14	1.32	14	3.70	360	8.02	4,080	4.43	590	3.37	233
10	1.32	14	1.35	14	3.90	434	8.10	4,190	4.30	530	3.33	225
N	1.35	14	1.36	14	4.13	529	8.85	5,240	4.18	478	3.28	214
2	1.36	14	1.37	15	4.45	682	8.70	5,030	4.05	428	3.22	202
4	1.35	14	1.40	16	4.77	867	10.00	6,950	3.94	390	3.18	194
6	1.35	14	1.45	17	5.11	1,080	7.55	3,260	3.85	360	3.15	189
8	1.34	14	1.57	20	4.67	807	6.29	1,830	3.78	338	3.12	184
10	1.34	14	1.71	26	4.24	578	5.76	1,390	3.71	317	3.09	178
M	1.31	13	1.92	37	4.08	508	5.48	1,200	3.64	297	3.07	175
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.00	162	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.95	154	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.88	143	2.72	117	2.58	98	2.49	87	2.42	79	2.34	71
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.85	138	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.81	132	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.80	130	2.65	107	2.53	92	2.45	82	2.38	75	2.32	69
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	2.23	61	2.47	85	-	-	-	-
4	-	-	2.26	63	2.22	60	2.45	82	2.15	54	2.13	52
6	-	-	-	-	2.22	60	2.40	77	-	-	-	-
8	-	-	2.25	62	2.22	60	2.35	72	2.10	50	2.06	47
10	-	-	-	-	2.21	59	2.30	67	-	-	-	-
N	2.27	64	2.24	62	2.21	59	2.24	62	2.07	48	2.05	46
2	-	-	-	-	2.21	59	2.21	59	-	-	-	-
4	-	-	2.23	61	2.20	58	2.18	56	2.20	58	2.19	57
6	-	-	-	-	2.20	58	2.16	55	-	-	-	-
8	-	-	2.22	60	2.19	57	2.14	53	2.17	56	2.20	58
10	-	-	-	-	2.36	73	2.16	55	-	-	-	-
M	2.27	64	2.23	61	2.45	82	2.18	56	2.18	56	2.21	59

Supplemental records.- Dec. 11, 11 a.m., 8.05 ft., 4,120 sec.-ft.; 3 p.m., 8.75 ft., 5,100 sec.-ft.

Middle Tuolumne River near Buck Meadows, Calif.

Location.- Lat. 37°50', long. 120°00', in NW¼ sec. 28, T. 1 S., R. 18 E., half a mile above junction with South Fork of Tuolumne River and 4 miles east of Buck Meadows, Mariposa County. Altitude, about 2,800 feet above mean sea level.
Drainage area.- 71.0 square miles.
Gage-height record.- Water-stage recorder graph except for period 5 a.m. Dec. 10 to 4:30 p.m. Dec. 12, when there was no record. Stage graph for Dec. 12 based on partial recorder graph. Peak stage determined from floodmarks.
Stage-discharge relation.- Defined by current-meter measurements below 950 second-feet; extended to peak stage with aid of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 2,910 second-feet about 4 p.m. Dec. 11 (gage height, 10.4 feet).
1917-November 1937: Discharge, 1,330 second-feet May 28, 1919 (gage height, 8.15 feet), from rating curve extended above 550 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period Dec. 10-11 determined from discharge graph based on record for South Fork of Tuolumne River near Oakland Recreation Camp.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.2	4.2	45	11	5	1,500	31	21	7.5	49	47
2	2.4	4.2	61	12	6	320	30	22	9	43	50
3	2.5	4.3	50	13	4.3	164	29	23	7	46	42
4	2.5	4.0	43	14	4.6	110	54	24	7	29	38
5	2.5	4.0	39	15	5	90	379	25	7	37	41
6	2.5	4.0	34	16	5	76	94	26	6	40	39
7	2.6	4.0	36	17	7.5	67	96	27	5	42	39
8	2.6	3.8	34	18	10	58	76	28	4.8	41	38
9	2.6	5	32	19	7	50	64	29	4.3	43	39
10	2.6	250	32	20	6	46	48	30	4.2	47	31
								31		45	69
Mean monthly discharge, in second-feet									4.91	104	57.4
Run-off, in acre-feet									292	6,410	3,530

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	1.02	2.2	1.03	2.4	1.56	13	-	510	-	510	-	-
4	1.07	2.8	1.13	3.7	1.88	26	-	900	-	380	3.64	201
6	1.20	4.8	1.26	6	-	100	-	1,220	-	300	-	-
8	1.26	6	1.24	5.5	-	170	-	1,520	-	290	3.50	175
10	1.23	5.5	1.20	4.8	-	235	-	1,600	-	280	-	-
N	1.20	4.8	1.19	4.6	-	310	-	2,120	-	275	3.40	157
2	1.17	4.3	1.19	4.6	-	380	-	2,100	-	270	-	-
4	1.16	4.2	1.19	4.6	-	470	10.4	2,910	-	265	3.32	143
6	1.14	3.5	1.20	4.8	-	525	-	2,000	3.97	264	-	-
8	1.11	3.4	1.29	6.5	-	410	-	1,400	3.91	252	3.27	135
10	1.08	3.0	1.41	9	-	285	-	1,100	3.86	242	-	-
M	1.05	2.6	1.51	12	-	150	-	800	3.80	231	3.30	140
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	2.66	59
4	3.20	124	3.00	96	-	-	-	-	-	-	2.65	58
6	-	-	-	-	2.87	81	2.77	70	2.70	63	2.62	56
8	3.15	116	2.98	94	-	-	-	-	-	-	2.61	55
10	-	-	-	-	-	-	-	-	-	-	2.60	54
N	3.09	108	2.95	90	2.83	76	2.74	67	2.67	60	2.58	52
2	-	-	-	-	-	-	-	-	-	-	2.56	50
4	3.06	104	2.92	86	-	-	-	-	-	-	2.48	43
6	-	-	-	-	2.80	73	2.71	64	2.64	58	2.45	41
8	3.02	99	2.91	85	-	-	-	-	-	-	2.51	46
10	-	-	-	-	-	-	-	-	-	-	2.51	46
M	3.01	97	2.89	83	2.79	72	2.70	63	2.58	52	2.50	45
	December 20		December 21		December 22		December 23		December 24		December 25	
2	2.60	54	2.65	58	2.53	48	2.81	74	2.22	25	2.40	37
4	2.65	58	2.70	63	2.62	56	2.80	73	2.18	23	2.38	36
6	2.61	55	2.63	57	2.60	54	2.75	68	2.14	21	2.36	34
8	2.55	50	2.59	53	2.49	44	2.65	58	2.13	20	2.36	34
10	2.48	43	2.51	46	2.40	37	2.50	45	2.20	24	2.39	36
N	2.41	38	2.44	40	2.37	35	2.40	37	2.26	28	2.32	31
2	2.41	38	2.41	38	2.36	34	2.36	34	2.29	29	2.35	34
4	2.40	37	2.41	38	2.35	34	2.37	35	2.41	38	2.46	42
6	2.37	35	2.40	37	2.30	30	2.36	34	2.44	40	2.46	42
8	2.43	39	2.49	44	2.31	31	2.33	32	2.41	38	2.46	42
10	2.64	58	2.65	58	2.74	67	2.30	30	2.40	37	2.45	41
M	2.59	53	2.55	50	2.80	73	2.25	27	2.40	37	2.45	41

Woods Creek near Jacksonville, Calif.

Location.- Lat. 37°51', long. 120°24', in SW¼ sec. 12, T. 1 S., R. 14 E., 1½ miles above mouth and 1½ miles northwest of Jacksonville, Tuolumne County. Altitude, about 645 feet above mean sea level.
Drainage area.- 98.4 square miles.
Gage-height record.- Water-stage recorder graph except for period 7 a.m. Nov. 30 to 2:30 p.m. Dec. 8, when there was no record. Record for Nov. 30 and Dec. 8 based on partial recorder graph and study of weather records.
Stage-discharge relation.- Defined by current-meter measurements below 1,000 second-feet; extended to peak stage with aid of area-velocity study. Shifting-control method used for period Nov. 8 to Dec. 10. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 5,500 second-feet 11:30 a.m. Dec. 11 (gage height, 7.65 feet).
1925-November 1937: Discharge, 10,600 second-feet Feb. 6, 1937 (gage height, 9.12 feet), from rating curve extended above 1,000 second-feet.
January-September 1938: Discharge, 13,500 second-feet 8 p.m. Feb. 9 (gage height, 10.5 feet), from rating curve extended above 1,000 second-feet with aid of area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record, Dec. 1-7, based on study of rainfall records and stream-flow records for nearby streams.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	7	10	34	11	8	1,770	32	21	9.5	12	68
2	6.5	10	45	12	8	610	29	22	9.5	12	45
3	6	10	64	13	8	120	32	23	10	44	34
4	6	10	59	14	8	70	40	24	11	56	29
5	6	10	54	15	8.5	46	1,490	25	11	80	25
6	6	10	51	16	11	34	176	26	11	45	21
7	6	10	48	17	23	27	213	27	11	35	21
8	6	9.5	44	18	14	22	155	28	10	35	22
9	6	10	39	19	4.5	18	99	29	10	34	130
10	6	72	35	20	6	13	144	30	10	34	68
								31		34	501
Mean monthly discharge, in second-feet									8.78	107	124
Run-off, in acre-feet									523	6,570	7,630

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.67	9.5	1.70	12	1.75	16	2.81	554	1.65	202
4	-	-	1.67	9.5	1.70	12	1.75	16	2.61	484	1.52	171
6	-	-	1.67	9.5	1.75	16	3.35	404	2.34	392	1.42	148
8	-	-	1.67	9.5	1.87	30	6.12	2,880	2.35	395	1.33	130
10	-	-	1.67	9.5	2.35	109	7.34	4,980	3.10	670	1.25	114
N	1.67	9.5	1.67	9.5	3.06	292	7.42	5,140	4.62	1,560	1.18	100
2	-	-	1.67	9.5	2.80	215	6.09	3,070	3.75	975	1.12	90
4	-	-	1.68	10	2.28	96	4.95	1,840	3.05	650	1.07	81
6	-	-	1.69	11	2.05	57	4.12	1,190	2.60	480	1.06	80
8	-	-	1.69	11	1.78	19	3.55	875	2.26	368	1.06	80
10	-	-	1.70	12	1.76	17	3.45	825	2.06	308	1.06	80
M	1.67	9.5	1.70	12	1.75	16	3.04	646	1.84	250	1.05	78
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	0.88	51	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.01	72	.85	46	0.76	34	0.71	27	0.67	22	0.63	18
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	.81	40	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	.93	59	.80	39	.73	30	.68	24	.64	19	.61	15
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	0.57	12	0.72	29	0.93	59	1.13	91
4	-	-	-	-	.57	12	.75	32	.92	57	1.12	90
6	-	-	-	-	.57	12	.77	35	.91	56	1.45	155
8	-	-	-	-	.57	12	.80	39	.90	54	1.28	120
10	-	-	-	-	.57	12	.82	42	.89	52	.98	67
N	0.59	13	0.58	12	.57	12	.85	46	.87	50	.97	65
2	-	-	-	-	.57	12	.88	51	.87	50	.97	65
4	-	-	-	-	.57	12	.90	54	.85	46	.96	64
6	-	-	-	-	.57	12	.92	57	.84	45	.95	62
8	-	-	-	-	.57	12	.93	59	.83	44	.94	60
10	-	-	-	-	.57	12	.93	59	1.12	90	.92	57
M	.58	12	.57	12	.63	18	.93	59	1.14	93	.91	56

Supplemental records.- Dec. 11, 5 a.m., 1.93 ft., 18 sec.-ft.; 11:30 a.m., 7.65 ft., 5,500 sec.-ft.; 9 p.m., 3.62 ft., 910 sec.-ft. Dec. 12, 11 a.m., 4.82 ft., 1,720 sec.-ft. Dec. 24, 9:30 p.m., 0.82 ft., 42 sec.-ft.

Middle Fork of Stanislaus River at Sand Bar Flat, near Avery, Calif.

Location.- Lat. 38°11', long. 120°09', in sec. 19, T. 4 N., R. 17 E., about a mile upstream from diversion dam of Pacific Gas & Electric Co. at Sand Bar Flat and 11 miles southeast of Avery, Calaveras County. Altitude, about 2,450 feet above mean sea level.

Drainage area.- 318 square miles at gaging station; 329 square miles at diversion dam.

Gage-height record.- Water-stage recorder graph except for period 8 a.m. Dec. 4 to Jan. 31, when there was no record. Peak stage obtained from floodmarks on banks.

Stage-discharge relation.- Defined by current-meter measurements below 5,400 second-feet; extended to peak stage on basis of area-velocity study; verified by computation of peak flow over Sand Bar Dam. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 26,500 second-feet about noon Dec. 11 (gage height, 21.0 feet, from floodmarks).

1905-November 1937: Discharge observed, 9,760 second-feet Mar. 19, 1907.

Remarks.- Flood run-off probably affected by artificial storage in Relief Reservoir and other smaller reservoirs for which no records are available. Discharge for period of missing gage-height record computed from discharge graph of flow at Sand Bar Dam based on 4 staff-gage readings daily; verified by comparison with shape of discharge graph for North Fork of Stanislaus River near Avery. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	124	125	310	11	121	18,500	260	21	204	470	360
2	123	124	340	12	120	4,500	270	22	135	430	390
3	121	123	330	13	116	1,800	270	23	115	410	370
4	119	120	310	14	130	1,350	270	24	132	390	350
5	118	120	300	15	109	1,150	530	25	146	370	360
6	116	120	280	16	75	1,000	390	26	138	350	360
7	116	120	280	17	118	860	450	27	132	350	340
8	115	120	270	18	127	660	440	28	132	340	320
9	115	140	270	19	91	550	410	29	128	330	320
10	116	4,900	260	20	115	490	370	30	127	330	330
								31		320	340
Mean monthly discharge, in second-feet									123	1,321	337
Run-off, in acre-feet									7,330	81,250	20,730

Melones Reservoir at Melones Dam, Calif.

Location.- Lat. 37°57'15", long. 120°30'45", near center of sec. 11, T. 1 N., R. 13 E., at Melones Dam on Stanislaus River, Tuolumne County, 0.1 mile below Bear Creek. Zero of gage is at mean sea level.
Drainage area.- 897 square miles.
Gage-height record.- Gage read to tenths daily at 7 a.m.
Remarks.- Flood run-off largely controlled in reservoir (capacity, 91,680 acre-feet at elevation of crest of spillway, 723.0 feet; 112,610 acre-feet at elevation of top of spillway gates, 735.0 feet). Reservoir began to spill about noon Dec. 11. See record for Stanislaus River below Melones power house. Basic data furnished by Pacific Gas & Electric Co.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	631.1	7,422	638.1	9,911	723.5	92,498
2	630.9	7,358	638.0	9,870	723.8	92,985
3	630.8	7,326	637.8	9,794	724.2	93,645
4	631.8	7,646	637.8	9,794	723.7	92,823
5	631.7	7,614	637.7	9,756	723.3	92,173
6	631.6	7,582	638.4	10,032	722.8	91,360
7	631.6	7,582	638.1	9,911	722.3	90,548
8	631.6	7,582	639.1	10,315	722.0	90,060
9	631.7	7,614	640.1	10,722	722.2	90,385
10	631.7	7,614	640.3	10,807	722.5	90,873
11	631.7	7,614	672.7	31,151	722.0	90,060
12	631.8	7,646	723.2	92,010	721.8	89,747
13	632.3	7,812	725.0	94,985	721.5	89,278
14	632.6	7,914	725.0	94,985	721.1	88,652
15	632.5	7,880	725.5	95,823	720.8	88,182
16	632.5	7,880	725.5	95,823	722.5	90,873
17	632.6	7,914	724.8	94,650	723.7	92,823
18	632.8	7,982	724.7	94,483	724.0	93,310
19	633.4	8,186	724.4	93,980	723.7	92,823
20	633.6	8,254	724.3	93,813	723.9	93,148
21	634.1	8,426	724.0	93,310	723.9	93,148
22	635.5	8,930	723.8	92,985	723.8	92,985
23	635.7	9,002	723.7	92,823	724.0	93,310
24	636.0	9,110	723.8	92,985	724.1	93,478
25	636.0	9,110	724.0	93,310	723.6	92,660
26	637.1	9,528	724.1	93,478	723.4	92,335
27	637.2	9,566	724.2	93,645	723.4	92,335
28	637.3	9,604	723.9	93,148	723.3	92,173
29	638.1	9,911	723.5	92,498	723.6	92,660
30	638.1	9,911	723.5	92,498	724.2	93,645
31			723.5	92,498	724.2	93,645

Stanislaus River below Melones power house, Calif.

Location.- Lat. 37°56'50", long. 120°31'45", near line between secs. 10 and 15, T. 1 N., R. 13 E., 300 feet below power house, half a mile above Bear Gulch, and 1 mile below Melones Dam, Tuolumne County. Altitude, about 500 feet above mean sea level.
Drainage area.- 898 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 14,700 second-feet.
Maxima.- December 1937: Discharge, 7,460 second-feet 12:30 p.m. Dec. 12 (gage height, 10.50 feet).
1931-November 1937: Discharge, 19,300 second-feet (revised) Feb. 22, 1936 (gage height, 16.1 feet), from rating curve for 1938 extended above 15,000 second-feet.
Remarks.- Flood run-off largely controlled by Melones Reservoir (capacity, 91,680 acre-feet). Contents at midnight determined from graph based on readings made at 7 a.m. Daily and monthly discharges not adjusted for storage in small reservoirs upstream from Melones Reservoir. See record for Melones Reservoir at Melones Dam. Most of basic data furnished by Pacific Gas & Electric Co.

Discharge, in second-feet, and gain or loss in storage, in acre-feet, November 1937 to January 1938

Day	November			December			January		
	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge
1	149	-64	117	222	-29	207	356	+345	530
2	160	-42	139	220	-66	187	419	+610	727
3	54	+218	164	216	-22	205	1,360	-390	1,160
4	155	+70	190	218	-27	204	1,160	-700	807
5	156	-32	140	15	+185	108	1,020	-766	634
6	155	-9	150	221	-6	218	1,020	-812	611
7	147	0	147	14	+251	141	988	-583	694
8	148	+23	160	2.3	+406	207	660	+88	704
9	148	+9	152	280	+179	370	47	+441	269
10	150	0	150	346	+10,218	5,500	1,020	-434	801
11	144	+23	156	2,560	+65,700	35,700	641	-459	410
12	150	+127	214	6,290	+7,417	10,000	790	-423	577
13	164	+120	224	4,610	+868	5,050	805	-580	513
14	164	+6	167	3,200	+594	3,500	1,020	-516	760
15	166	-10	161	2,910	+244	3,030	685	+1,769	1,580
16	162	+24	174	2,920	-831	2,500	75	+2,166	1,170
17	168	+58	197	2,240	-460	2,010	902	+914	1,360
18	183	+164	266	1,850	-405	1,650	1,530	-203	1,430
19	188	+108	242	988	-265	854	890	+88	934
20	184	+142	256	1,570	-405	1,370	1,030	+95	1,080
21	14	+407	219	1,060	-377	870	902	-115	844
22	210	+198	310	1,110	-210	1,000	768	+182	860
23	215	+97	264	805	+68	839	775	+214	883
24	203	+32	219	634	+277	774	1,300	-530	1,030
25	14	+296	163	634	+214	742	970	-469	734
26	210	+149	285	648	+167	732	845	-95	797
27	212	+38	231	997	-303	844	890	-115	832
28	15	+228	130	1,020	-605	715	632	+298	782
29	208	+90	253	730	-190	634	324	+840	748
30	211	0	211	620	0	620	805	+287	950
31				508	0	508	1,370	+712	1,730

	November	December	January
Mean monthly discharge, in second-feet (observed)	154	1,279	839
Gain or loss in storage, in acre-feet	+2,470	+82,590	+1,860
Mean monthly discharge, in second-feet (adjusted)	195	2,622	869
Run-off, in acre-feet (adjusted)	11,610	161,200	53,440

North Fork of Stanislaus River near Avery, Calif.

Location.- Lat. 38°14', long. 120°17', in sec. 35, T. 5 N., R. 15 E., 700 feet above intake of Utica Mining Co.'s canal, 3½ miles above Beaver Creek, and 5 miles northeast of Avery, Calaveras County. Altitude, about 3,400 feet above mean sea level.
Drainage area.- 163 square miles.
Gage-height record.- Water-stage recorder graph except for period 7 a.m. Dec. 11 to 1:30 p.m. Dec. 12, when stage graph was based on peak stage, 4 gage readings, partial recorder graph, and comparison with stage graphs for nearby stations.
Stage-discharge relation.- Defined by current-meter measurements below 3,400 second-feet; extended to peak stage by $A\sqrt{d}$ method.
Maxima.- December 1937: Discharge, 17,700 second-feet about 9 a.m. Dec. 11 (gage height, about 14.1 feet, from floodmark).
1914-22; 1928-November 1937: Discharge observed, 5,250 second-feet May 11, 1915 (gage height, 8.7 feet), from rating curve extended above 2,400 second-feet.
Remarks.- Flood run-off not materially affected by artificial storage or diversion. Part of basic data furnished by Utica Mining Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	40	60	182	11	57	12,900	148	21	119	261	198
2	40	60	220	12	56	3,620	145	22	70	245	228
3	40	58	232	13	52	1,060	142	23	60	245	224
4	40	57	210	14	58	700	144	24	72	230	200
5	39	56	194	15	53	558	290	25	68	220	200
6	40	54	180	16	49	464	245	26	61	210	214
7	41	53	171	17	103	400	285	27	60	200	228
8	41	53	163	18	81	361	254	28	58	193	222
9	41	57	154	19	59	318	232	29	60	187	218
10	44	3,240	149	20	68	280	216	30	60	183	191
								31		183	204
Mean monthly discharge, in second-feet									57.7	863	203
Run-off, in acre-feet									3,430	53,090	12,460

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.25	51	2.06	133	11.19	10,600	9.55	7,390	-	-
4	-	-	1.25	51	5.40	1,560	12.76	14,200	9.14	6,650	5.09	1,300
6	-	-	1.25	51	7.35	3,830	13.15	15,200	8.70	5,920	-	-
8	-	-	1.25	51	8.32	5,310	13.48	16,000	8.20	5,120	4.90	1,160
10	-	-	1.25	51	7.75	4,420	14.07	17,600	6.95	3,270	-	-
N	1.27	53	1.25	51	6.92	3,230	13.82	16,900	6.12	2,270	4.67	1,000
2	-	-	1.26	52	7.23	3,660	13.25	15,400	5.84	1,980	-	-
4	-	-	1.30	55	7.20	3,620	12.54	13,700	5.70	1,840	4.51	906
6	-	-	1.35	59	6.64	2,870	11.80	12,000	5.62	1,760	-	-
8	-	-	1.44	67	6.40	2,580	10.67	9,540	5.56	1,700	4.43	862
10	-	-	1.60	82	8.14	5,020	9.79	7,820	5.44	1,600	-	-
M	1.25	51	1.80	102	9.09	6,560	9.90	8,020	5.32	1,490	4.34	815
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.26	770	-	-	-	-	-	-	-	-	-	-
6	-	-	3.82	583	3.55	488	3.33	416	3.19	373	3.04	329
8	4.15	722	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.05	678	3.73	550	3.47	460	3.28	400	3.15	361	3.00	318
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.97	643	-	-	-	-	-	-	-	-	-	-
6	-	-	3.68	533	3.40	438	3.23	385	3.10	346	2.93	300
8	3.94	631	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.91	619	3.62	512	3.37	428	3.21	379	3.08	340	2.96	308
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.95	305	2.81	270	2.72	250	2.73	252	2.69	243	2.63	230
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.82	273	2.75	256	2.68	241	2.71	247	2.60	224	2.59	222
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.77	261	2.72	250	2.64	232	2.65	234	2.63	230	2.55	214
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.82	273	2.75	256	2.78	263	2.69	243	2.60	224	2.55	214

Supplemental records.- Dec. 11, 9 a.m., 14.10 ft., 17,700 sec.-ft.

South Fork of Stanislaus River at Strawberry Reservoir, Calif.

Location.- Lat. 38°12', long. 119°59', in W½ sec. 15, T. 4 N., R. 18 E., at dam at Strawberry Reservoir, 1 mile northwest of Pine Crest, Tuolumne County. Altitude, about 5,600 feet above mean sea level.

Drainage area.- 45.5 square miles.

Gage-height record.- One gage reading daily at Strawberry Reservoir and at weir below reservoir.

Remarks.- Flood run-off largely controlled in Strawberry Reservoir. Elevation of crest of spillway is 5,611.5 feet above mean sea level (capacity, 16,550 acre-feet). Reservoir began to spill 5:30 a.m. Dec. 13. Gain or loss in storage computed from contents at midnight determined from graph based on daily readings at 10 a.m. Record of observed daily discharge and other basic data furnished by Pacific Gas & Electric Co.

Contents, gain or loss in storage, and mean daily discharge, December 1937

Day	Strawberry Reservoir		River	
	Contents (acre-feet)	Gain or loss in storage (acre-feet)	Observed discharge (second-feet)	Adjusted discharge (second-feet)
1	5,075	-45	28	6
2	5,045	-30	28	13
3	5,005	-40	28	8.5
4	4,970	-35	28	11
5	4,930	-40	28	8.5
6	4,895	-35	28	11
7	4,860	-35	28	11
8	4,825	-35	28	11
9	5,130	+305	28	182
10	10,050	+4,920	12	2,490
11	15,320	+5,270	0	2,660
12	16,600	+1,280	0	645
13	16,750	+150	92	168
14	16,710	-40	188	167
15	16,600	-110	151	95
16	16,500	-100	127	77
17	16,470	-30	39	24
18	16,460	-10	28	23
19	16,460	0	2.0	2.0
20	16,420	-40	33	13
21	16,300	-120	90	30
22	16,140	-160	107	26
23	15,990	-150	107	31
24	15,840	-150	107	31
25	15,680	-160	107	26
26	15,520	-160	107	26
27	15,350	-170	107	21
28	15,180	-170	107	21
29	15,020	-160	107	26
30	14,850	-170	107	21
31	14,690	-160	107	26

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	53	28	107	11	53	0	107	21	0	90	107
2	53	28	107	12	53	0	107	22	0	107	107
3	53	28	107	13	53	92	107	23	0	107	107
4	53	28	107	14	53	188	107	24	28	107	107
5	53	28	107	15	0	151	107	25	28	107	107
6	53	28	107	16	0	127	107	26	28	107	107
7	53	28	107	17	0	39	107	27	28	107	70
8	53	28	107	18	0	28	107	28	28	107	50
9	53	28	107	19	0	2.0	107	29	28	107	50
10	53	12	107	20	0	33	107	30	28	107	50
								31		107	50
Mean monthly discharge, in second-feet (observed)									31.3	67.2	98.5
Gain or loss in storage, in acre-feet									-1,200	+9,570	-4,120
Mean monthly discharge, in second-feet (adjusted)									11.2	223	31.5
Run-off, in acre-feet (adjusted)									665	13,700	1,930

South Fork of Stanislaus River below Lyons Dam, Calif.

Location.- Lat. 38°05', long. 120°11', in sec. 25, T. 3 N., R. 16 E., about 600 feet below Lyons Dam, Tuolumne County, and 14 miles northeast of Sonora. Altitude, about 4,100 feet above mean sea level.
Drainage area.- 67.2 square miles.
Gage-height record.- Water-stage recorder graph from beginning of record, Nov. 8, 1937.
Stage-discharge relation.- Defined by current-meter measurements below 1,400 second-feet.
Maxima.- December 1937: Discharge (regulated), 342 second-feet 5 p.m. Dec. 12 (gage height, 3.30 feet). Maximum discharge, adjusted for changes in storage in Lyons Reservoir, about 2,800 second-feet morning Dec. 11.
Remarks.- Flood run-off affected by storage in Lyons Reservoir (capacity, 5,500 acre-feet), slightly by diversions into Philadelphia and Tuolumne ditches, and to some extent by storage in Strawberry Reservoir. Daily and monthly discharges adjusted for storage and diversion as shown in table but not for storage in Strawberry Reservoir. Contents at midnight for Lyons Reservoir determined from graph based on daily readings at 10 a.m. Most of basic data furnished by Pacific Gas & Electric Co.

Storage, diversion, and discharge, December 1937

Day	Lyons Reservoir		Philadelphia Canal (sec.-ft.)	Tuolumne Canal (sec.-ft.)	River	
	Contents (acre-feet)	Gain or loss in storage (acre-feet)			Observed discharge (sec.-ft.)	Adjusted discharge (sec.-ft.)
1	394	0	27	7	0	34
2	395	+1	27	7	0	34
3	395	0	26	7	0	33
4	395	0	26	7	0	33
5	395	0	26	7	0	33
6	393	-2	26	6.5	0	32
7	392	-1	26	7	0	32
8	392	0	26	6.5	0	32
9	425	+33	30	7	.1	54
10	1,280	+855	40	7	1.6	480
11	4,350	+3,070	46	10	2.2	1,610
12	4,700	+350	15	9	250	450
13	4,675	-25	18	5	214	224
14	4,675	0	31	4.8	197	233
15	4,669	-6	37	4.7	186	225
16	4,636	-33	38	4.8	126	152
17	4,611	-25	38	5	102	132
18	4,619	+8	38	4.8	79	126
19	4,609	-10	37	4.8	62	99
20	4,590	-19	38	9.5	56	94
21	4,601	+11	37	13	59	115
22	4,628	+27	37	16	84	151
23	4,625	-3	41	20	90	149
24	4,616	-9	44	23	67	129
25	4,606	-10	44	24	65	128
26	4,601	-5	43	24	64	128
27	4,601	0	43	24	63	130
28	4,601	0	43	24	64	131
29	4,601	0	43	24	62	129
30	4,601	0	44	24	62	130
31	4,601	0	45	25	54	124

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	59	11	0	2.2	57	21	0.2	59	90
2	0	0	73	12	0	250	55	22	.2	84	88
3	0	0	69	13	0	214	53	23	.2	90	83
4	0	0	62	14	0	197	63	24	.2	67	77
5	0	0	60	15	.1	186	199	25	.2	65	77
6	0	0	55	16	.1	126	109	26	.2	64	75
7	0	0	52	17	.6	102	136	27	.2	63	68
8	0	0	52	18	.2	79	121	28	.2	64	25
9	0	.1	57	19	.2	62	111	29	.2	62	22
10	0	1.6	58	20	.2	56	96	30	.1	62	18
								31		54	22

	Nov.	Dec.	Jan.
Mean monthly discharge, in second-feet (observed)	0.14	64.8	72.3
Gain or loss in storage, in acre-feet	-235	+4,207	-30
Mean monthly diversion, in second-feet	42.6	46.9	68.9
Mean monthly discharge, in second-feet (adjusted)	39.0	180	141
Run-off, in acre-feet (adjusted)	2,320	11,080	8,660

Calaveras River at Jenny Lind, Calif.

Location.- Lat. 38°05', long. 120°52', in SW¼ sec. 22, T. 3 N., R. 10 E., at highway bridge on Milton road a quarter of a mile south of Jenny Lind, Calaveras County, and 6½ miles below Cosgrove Creek. Altitude, about 220 feet above mean sea level.
Drainage area.- 395 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,400 second-feet. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge (regulated), 3,370 second-feet 4 to 6 p.m. Dec. 11 (gage height, 6.48 feet).
1907-November 1937: Discharge observed (unregulated), about 69,600 second-feet Jan. 31, 1911 (gage height, 14.0 feet), from rating curve extended above 32,500 second-feet.
Remarks.- Flood run-off affected by detention in Hogan flood-control reservoir (capacity, 76,000 acre-feet); not affected by diversions. See following page for storage record and adjusted river discharge. Contents of reservoir at midnight determined from graph based on daily gage readings. Part of basic data furnished by city of Stockton.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	19	56	11	0	2,040	58	21	28	66	342
2	0	18	57	12	0	3,100	56	22	26	62	245
3	0	18	78	13	0	2,020	54	23	26	69	197
4	0	17	95	14	0	544	54	24	25	105	160
5	0	17	83	15	0	211	194	25	26	93	138
6	0	17	76	16	0	138	444	26	24	78	124
7	0	16	73	17	5	107	310	27	21	71	114
8	0	16	69	18	18	89	328	28	20	66	127
9	0	17	68	19	26	78	270	29	20	64	498
10	0	28	62	20	27	71	395	30	20	62	575
								31		57	1,220
Mean monthly discharge, in second-feet									10.4	302	214
Run-off, in acre-feet									619	18,590	13,130

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	-	2.07	19	3.03	223	6.40	3,250	5.99	2,680
4			2.03	16	2.12	23	3.14	270	6.39	3,240	5.91	2,580
6			-	-	2.12	23	3.43	410	6.42	3,280	5.84	2,500
8			-	-	2.13	24	2.74	591	6.38	3,220	5.77	2,420
10			-	-	2.14	25	5.05	1,620	6.40	3,250	5.61	2,240
N			2.03	16	2.14	25	6.24	3,020	6.34	3,160	5.46	2,080
2			-	-	2.14	25	6.44	3,310	6.30	3,100	5.31	1,930
4			-	-	2.14	25	6.48	3,370	6.26	3,040	5.15	1,770
6			-	-	2.15	26	6.48	3,370	6.20	2,960	4.97	1,600
8			2.04	17	2.15	26	6.46	3,340	6.15	2,890	4.80	1,440
10			-	-	2.17	27	6.44	3,310	6.10	2,820	4.57	1,230
M			-	-	2.84	156	6.43	3,300	6.06	2,770	4.35	1,050
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.04	810	3.06	249	2.77	152	2.63	114	2.54	95	2.48	83
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.75	608	3.00	225	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.52	471	2.94	204	2.72	138	2.60	107	2.51	89	2.45	78
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.36	385	2.88	184	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.24	328	2.83	169	2.68	127	2.57	101	2.49	85	2.44	76
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.13	278	2.80	160	-	-	-	-	-	-	-	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.43	74	2.39	68	2.36	63	2.35	62	2.58	103	2.56	99
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.41	71	2.38	66	2.35	62	2.37	64	2.60	107	2.52	91
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.39	68	2.37	64	2.34	60	2.48	83	2.59	105	2.48	82
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-

Calaveras River at Jenny Lind, Calif.--Continued

Gain or loss in storage and mean daily discharge, December 1937

Day	Hogan Reservoir		Calaveras River	
	Contents (acre-feet)	Gain or loss in storage (acre-feet)	Observed discharge (second-feet)	Adjusted discharge (second-feet)
1	902	0	19	19
2	902	0	18	18
3	902	0	18	18
4	902	0	17	17
5	902	0	17	17
6	902	0	17	17
7	902	0	16	16
8	902	0	16	16
9	902	0	17	17
10	1,100	+198	28	128
11	8,100	+7,000	2,040	5,570
12	4,330	-3,770	3,100	1,200
13	1,770	-2,560	2,020	730
14	1,205	-565	544	259
15	1,000	-205	211	108
16	990	-10	138	133
17	990	0	107	107
18	990	0	89	89
19	990	0	78	78
20	990	0	71	71
21	990	0	66	66
22	990	0	62	62
23	990	0	69	69
24	990	0	105	105
25	990	0	93	93
26	990	0	78	78
27	990	0	71	71
28	990	0	66	66
29	990	0	64	64
30	990	0	62	62
31	948	-42	57	36

Mean monthly discharge, in second-feet (observed)........................	302
Gain or loss in storage, in acre-feet....................................	+46
Mean monthly discharge, in second-feet (adjusted)........................	303
Run-off, in acre-feet (adjusted)...	18,640

Cosgrove Creek near Valley Springs, Calif.

Location.- Lat. 38°09', long. 120°50', in SE¼ sec. 35, T. 4 N., R. 10 E., 0.4 mile above mouth and 2.5 miles south of Valley Springs, Calaveras County. Altitude, about 580 feet above mean sea level.
Drainage area.- 20.6 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 800 second-feet. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 288 second-feet 8:15 a.m. Dec. 11 (gage height, 4.05 feet).
1929-November 1937: Discharge, 2,600 second-feet (revised) Feb. 22, 1936 (gage height, 7.80 feet), from rating curve extended above 800 second-feet with aid of area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0.3	11	0	70	0.5	21	0	0.3	8
2	0	0	1.9	12	0	55	.5	22	0	.3	5.5
3	0	0	4.1	13	0	9	.5	23	0	2.5	3.8
4	0	0	1.9	14	0	3.2	.5	24	0	1.7	2.9
5	0	0	1.2	15	0	1.5	47	25	0	.8	2.5
6	0	0	1.0	16	0	.9	12	26	0	.5	2.3
7	0	0	.9	17	0	.6	17	27	0	.5	1.9
8	0	0	.7	18	0	.5	11	28	0	.4	17
9	0	0	.6	19	0	.4	12	29	0	.3	144
10	0	.1	.5	20	0	.3	19	30	0	.3	22
								31		.3	283
Mean monthly discharge, in second-feet									0	4.82	20.2
Run-off, in acre-feet									0	296	1,240

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2							2.09	0.5	2.60	17	-	-
4							2.14	1.0	2.58	16	2.52	13
6							2.87	39	3.05	62	-	-
8							3.96	260	3.74	200	2.47	11
10							3.66	180	3.38	118	-	-
N							3.30	103	3.12	72	2.43	9
2							3.14	75	2.96	50	-	-
4							3.08	66	2.85	36	2.39	7.5
6							2.95	48	2.77	29	-	-
8							2.83	34	2.70	23	2.35	6
10							2.74	26	2.65	20	-	-
M							2.66	21	2.59	16	2.33	5
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.30	4.1	-	-	-	-	-	-	-	-	-	-
6	-	-	2.20	1.7	2.16	1.1	2.11	0.6	2.09	0.5	-	-
8	2.29	3.8	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.27	3.2	2.19	1.5	2.14	.9	2.11	.6	2.09	.5	2.07	0.4
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.25	2.7	-	-	-	-	-	-	-	-	-	-
6	-	-	2.18	1.4	2.13	.8	2.10	.5	2.08	.4	-	-
8	2.24	2.5	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.22	2.1	2.17	1.2	2.12	.7	2.10	.5	2.08	.4	2.06	.3
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.05	0.3	2.15	1.0	-	-	-	-
6	-	-	-	-	-	-	-	-	2.22	2.1	2.14	0.9
8	-	-	-	-	2.05	.3	2.22	2.1	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.06	0.3	2.05	0.3	2.04	.3	2.31	4.4	2.19	1.5	2.13	.8
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.04	.3	2.30	4.1	-	-	-	-
6	-	-	-	-	-	-	-	-	2.17	1.2	2.12	.7
8	-	-	-	-	2.09	.5	2.27	3.2	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.05	.3	2.05	.3	2.10	.5	2.25	2.7	2.15	1.0	2.11	.6

Supplemental records.- Dec. 11, 8:15 a.m., 4.05 ft., 288 sec.-ft.

Salt Springs Reservoir near West Point, Calif.

Location.- Lat. 38°30', long. 120°12', in SE¼ sec. 33, T. 8 N., R. 16 E., at Salt Springs Dam on North Fork of Mokelumne River 2 miles above Cold Creek and 18 miles northeast of West Point, Calaveras County. Zero of gage is at mean sea level.
Drainage area.- 160 square miles.
Gage-height record.- Gage read to tenths daily at 3 p.m. except on Dec. 11, when it was read at 1 p.m.
Remarks.- Flood run-off completely controlled in reservoir (capacity, 129,540 acre-feet at elevation of crest of spillway, 3,947 feet). Small amount of water released during flood period. See record for North Fork of Mokelumne River below Salt Springs Reservoir. Basic data furnished by Pacific Gas & Electric Co.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	3,833.9	43,347	3,800.0	26,119	3,881.5	74,672
2	3,832.2	42,392	3,798.6	25,486	3,880.7	74,080
3	3,830.5	41,448	3,798.3	25,351	3,880.2	73,710
4	3,828.9	40,568	3,797.6	25,038	3,879.1	72,900
5	3,827.1	39,590	3,796.6	24,592	3,878.2	72,241
6	3,826.3	39,158	3,795.5	24,106	3,877.4	71,657
7	3,825.6	38,782	3,794.5	23,668	3,876.4	70,929
8	3,824.4	38,141	3,793.5	23,233	3,875.4	70,204
9	3,823.0	37,399	3,792.5	22,802	3,874.4	69,482
10	3,821.6	36,663	3,808.2	29,948	3,873.4	68,763
11	3,820.8	36,245	3,865.0	62,849	3,872.3	67,976
12	3,819.6	35,623	3,883.8	76,384	3,871.2	67,193
13	3,819.0	35,313	3,887.3	79,020	3,870.1	66,413
14	3,818.4	35,005	3,888.5	79,933	3,869.5	65,990
15	3,817.1	34,340	3,889.6	80,772	3,869.8	66,201
16	3,816.0	33,783	3,890.0	81,078	3,870.0	66,342
17	3,814.9	33,230	3,890.2	81,232	3,870.1	66,413
18	3,814.0	32,780	3,890.2	81,232	3,870.0	66,342
19	3,813.3	32,433	3,890.2	81,232	3,869.8	66,201
20	3,812.0	31,791	3,889.7	80,849	3,869.4	65,919
21	3,811.7	31,644	3,889.2	89,466	3,869.2	65,778
22	3,810.6	31,107	3,888.6	80,009	3,869.1	65,708
23	3,809.2	30,429	3,888.1	79,628	3,869.1	65,708
24	3,807.5	29,614	3,887.4	79,096	3,868.9	65,567
25	3,806.8	29,280	3,886.9	78,717	3,868.5	65,286
26	3,806.0	28,901	3,886.3	78,264	3,868.0	64,935
27	3,804.6	28,243	3,885.6	77,735	3,867.4	64,516
28	3,803.6	27,776	3,884.7	77,059	3,867.0	64,237
29	3,802.3	27,173	3,883.9	76,459	3,866.9	64,167
30	3,801.2	26,667	3,883.0	75,787	3,867.0	64,237
31			3,882.3	75,266	3,866.5	63,889

North Fork of Mokelumne River below Salt Springs Dam, Calif.

Location.- Lat. 38°29', long. 120°13', in SW¼ sec. 33, T. 8 N., R. 16 E., 0.3 mile below Salt Springs Dam and 1.7 miles upstream from Cold Creek, Calaveras County. Altitude, about 3,600 feet above mean sea level.
Drainage area.- 160 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,300 second-feet.
Maxima.- December 1937: Discharge regulated to maximum of 516 second-feet at times Dec. 23 and 24 (gage height, 2.85 feet). Maximum discharge adjusted for changes in storage, about 21,000 second-feet early morning Dec. 11.
1926-37: Discharge (unregulated), 8,740 second-feet Mar. 25, 1928 (gage height, 13.62 feet).
Remarks.- Flood run-off completely regulated in Salt Springs Reservoir (capacity, 129,540 acre-feet). Daily discharge for December and all monthly summaries adjusted for storage and diversion as shown but not for possible storage in small reservoirs upstream. Gain or loss in storage computed from contents at midnight determined from graph based on daily readings at 3 p.m. See record for Salt Springs Reservoir near West Point. Most of basic data furnished by Pacific Gas & Electric Co.

Storage, diversion, and discharge, December 1937

Day	Observed discharge (second-feet)	Gain or loss in storage (acre-feet)	Tiger Creek Conduit diversion (second-feet)	Adjusted discharge (second-feet)
1	2.5	-630	297	
2	2.5	-440	288	
3	2.6	-140	178	
4	2.6	-380	176	
5	2.5	-480	177	*20
6	2.5	-450	266	
7	2.5	-460	245	
8	2.3	-430	250	35
9	2.6	+230	247	366
10	8.5	+21,200	36	10,700
11	26	+27,000	3.8	13,600
12	15	+6,400	130	3,370
13	316	+1,510	183	1,260
14	360	+880	174	978
15	346	+640	178	847
16	401	+230	90	607
17	372	+70	114	521
18	425	0	5.5	430
19	425	-80	5	390
20	230	-450	259	262
21	220	-410	269	282
22	205	-430	281	269
23	318	-410	164	275
24	455	-520	40	233
25	410	-380	17	235
26	410	-490	17	180
27	291	-560	194	203
28	313	-680	195	165
29	318	-610	187	197
30	267	-640	249	193
31	242	-520	207	187

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4.1	2.5	374	11	3.6	26	33	21	2.7	220	4.0
2	4.1	2.5	386	12	3.4	15	31	22	2.7	205	4.0
3	4.0	2.6	124	13	3.2	316	11	23	2.7	318	4.1
4	4.0	2.6	42	14	3.2	360	3.4	24	2.7	455	3.6
5	3.8	2.5	32	15	3.1	346	6	25	2.7	410	17
6	3.8	2.5	46	16	3.1	401	5	26	2.7	410	71
7	3.6	2.5	126	17	3.4	372	5	27	2.7	291	105
8	3.6	2.3	120	18	2.9	425	4.5	28	2.6	313	88
9	3.6	2.6	120	19	2.7	425	4.3	29	2.5	318	102
10	3.6	8.5	62	20	2.9	230	4.1	30	2.5	267	30
								31		242	27

	Nov.	Dec.	Jan.
Mean monthly discharge, in second-feet (observed)............	3.21	206	64.4
Gain or loss in storage, in acre-feet........................	-17,290	+48,570	-11,190
Mean monthly diversion, Tiger Creek Conduit, in second-feet....	325	1,165	289
Mean monthly discharge, in second-feet (adjusted)............	37.3	1,162	172
Run-off, in acre-feet (adjusted)............................	2,221	71,420	10,550

*Mean for the period.

160802 O—39——13

Mokelumne River near Mokelumne Hill, Calif.

Location.- Lat. 38°18'40", long. 120°43'10", in sec. 1, T. 5 N., R. 11 E., at highway bridge 1.2 miles northwest of Mokelumne Hill, Calaveras County, and 8 miles below junction of North and South Forks. Altitude, about 650 feet above mean sea level.
Drainage area.- 538 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 17,000 second-feet. Shifting-control method used for period Nov. 1 to Dec. 10. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 17,700 second-feet 11:20 a.m. Dec. 11 (gage height, 15.25 feet).
1927-November 1937: Discharge, 23,300 second-feet Mar. 25, 1928 (gage height, 16.10 feet), from rating curve extended above 10,200 second-feet on basis of area-velocity study.
Remarks.- Flood run-off affected by artificial storage in Salt Springs and other reservoirs, and to a slight extent by diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	278	367	597	11	386	11,200	639	21	326	732	557
2	398	327	557	12	334	2,770	645	22	398	760	537
3	507	305	760	13	203	1,400	645	23	540	788	405
4	498	246	760	14	181	1,130	517	24	570	732	492
5	462	130	732	15	297	1,060	639	25	402	672	470
6	337	213	678	16	444	1,030	430	26	272	613	547
7	154	270	634	17	531	842	617	27	398	639	645
8	290	315	624	18	507	815	613	28	326	694	678
9	370	297	547	19	394	705	645	29	355	683	678
10	390	2,170	645	20	406	732	624	30	392	661	547
								31		694	787
Mean monthly discharge, in second-feet									378	1,097	609
Run-off, in acre-feet									22,500	67,420	37,470

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	-	2.30	234	5.78	2,580	7.49	5,250		
4			-	-	2.44	278	6.08	2,920	6.74	4,200		
6			-	-	2.59	330	10.51	9,400	6.20	3,480		
8			-	-	3.15	570	13.97	15,400	5.73	2,890		
10			-	-	3.45	731	14.45	16,300	5.58	2,710		
N			-	-	7.46	4,720	14.80	17,000	5.44	2,550		
2			-	-	7.98	5,450	14.54	16,500	4.86	1,950		
4			-	-	7.30	4,500	13.97	15,500	4.40	1,520		
6			-	-	5.80	2,600	12.75	13,400	4.60	1,700		
8			-	-	5.30	2,070	11.46	11,300	4.46	1,570		
10			-	-	5.70	2,490	9.73	8,600	4.44	1,560		
M			2.28	220	5.82	2,620	8.11	6,160	4.20	1,360		
	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplemental records.- Dec. 10, 11 a.m., 7.10 ft., 4,220 sec.-ft.; 1 p.m., 7.53 ft., 4,820 sec.-ft.; 7 p.m., 5.10 ft., 1,890 sec.-ft.; 11 p.m., 6.02 ft., 2,840 sec.-ft. Dec. 11, 5 a.m., 8.00 ft., 5,480 sec.-ft.; 7 a.m., 13.20 ft., 14,100 sec.-ft.; 11:20 a.m., 15.25 ft., 17,700 sec.-ft. Dec. 12, 1 p.m., 5.35 ft., 2,450 sec.-ft.; 3 p.m., 4.30 ft., 1,440 sec.-ft.; 7 p.m., 4.74 ft., 1,830 sec.-ft.

Mokelumne River at Lancha Plana, Calif.

Location.- Lat. 38°13'25", long. 120°53'20", in SW¼ sec. 4, T. 4 N., R. 10 E., 1 mile east of Lancha Plana, Calaveras County, 3 miles downstream from Pardee Dam, and 5 miles above Camanche Creek. Zero of gage is 158.95 feet above mean sea level, from bench mark of East Bay Municipal Utility District.

Drainage area.- 584 square miles.

Gage-height record.- Water-stage recorder graph at both gaging stations and at Pardee Dam.

Stage-discharge relation.- Defined by current-meter measurements for entire range of stage. Shifting-control method used for period Dec. 1-29. Diversion measured by Venturi meter.

Maxima.- December 1937: Discharge (regulated), 2,150 second-feet 7:30 a.m. Dec. 14 (gage height, 5.54 feet).

1926-November 1937: Discharge (unregulated), 27,300 second-feet Mar. 25, 1928 (gage height, 19.65 feet), from rating curve extended above 15,500 second-feet on basis of area-velocity study.

Remarks.- Observed discharge is that passing river gaging station. Diversion is flow into East Bay Municipal Utility District Aqueduct at Pardee Dam. Adjusted discharge is obtained by combining observed discharge, change in storage at Pardee Reservoir computed from readings at midnight, and diversion. Salt Springs and several smaller reservoirs, four hydroelectric plants, and diversions above station.

Storage, diversion, and discharge, December 1937

Day	Pardee Reservoir			Aqueduct diversion (sec.-ft.)	Discharge	
	Elevation (feet)	Contents (acre-feet)	Gain or loss in storage (acre-feet)		Observed (sec.-ft.)	Adjusted (sec.-ft.)
1	546.35	165,640	-572	62	578	352
2	546.01	164,991	-649	62	569	304
3	545.65	164,310	-681	62	569	288
4	545.25	163,552	-758	62	560	240
5	544.78	162,666	-886	62	457	72
6	544.31	161,783	-883	62	574	191
7	543.98	161,164	-619	62	565	315
8	543.63	160,512	-652	62	547	280
9	543.31	159,916	-596	62	556	318
10	545.05	163,174	+3,258	61	574	2,280
11	556.47	185,746	+22,572	63	705	12,100
12	557.24	187,346	+1,600	64	2,000	2,870
13	556.53	185,870	-1,476	64	2,110	1,430
14	555.54	183,826	-2,044	64	2,110	1,140
15	554.44	181,574	-2,252	64	2,110	1,040
16	554.27	181,227	-347	64	1,210	1,100
17	554.41	181,513	+286	64	641	849
18	554.50	181,696	+183	63	661	816
19	554.48	181,656	-40	64	656	700
20	554.48	181,656	0	63	646	709
21	554.48	181,656	0	63	636	699
22	554.57	181,839	+183	63	631	786
23	554.65	182,002	+163	64	631	777
24	554.65	182,002	0	63	641	704
25	554.60	181,900	-102	63	636	648
26	554.50	181,696	-204	64	641	602
27	554.43	181,554	-142	64	641	633
28	554.39	181,472	-82	64	646	669
29	554.37	181,431	-41	64	641	684
30	554.33	181,350	-81	63	641	663
31	554.32	181,329	-21	63	641	693

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	583	578	641	11	487	705	641	21	464	636	631
2	565	569	646	12	574	2,000	641	22	592	631	646
3	560	569	641	13	583	2,110	641	23	602	631	641
4	560	560	646	14	468	2,110	641	24	569	641	646
5	565	457	646	15	578	2,110	651	25	569	636	646
6	543	574	641	16	592	1,210	641	26	556	641	646
7	464	565	641	17	597	641	646	27	560	641	646
8	574	547	641	18	592	661	641	28	464	646	651
9	574	556	641	19	588	656	646	29	551	641	661
10	592	574	641	20	565	646	646	30	574	641	646
								31		641	687
Mean monthly discharge, in second-feet (observed)									557	820	646
Gain or loss in storage, in acre-feet									-13,560	+15,120	-4,820
Mean monthly diversion in aqueduct, in second-feet									46.6	63.0	62.7
Mean monthly discharge, in second-feet (adjusted)									375	1,129	630
Run-off, in acre-feet (adjusted)									22,340	69,430	38,720

Mokelumne River near Clements, Calif.

Location.- Lat. 38°12'25", long. 121°05'20", in NW¼ sec. 15, T. 4 N., R. 8 E., 700 feet above highway bridge, 1 mile north of Clements, San Joaquin County, and 3 miles below Murphy Creek. Altitude, about 80 feet above mean sea level.
Drainage area.- 630 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 2,240 second-feet 2 p.m. Dec. 12 (gage height, 6.82 feet).
1904-November 1937: Discharge (not materially regulated), 25,600 second-feet Mar. 25, 1928 (gage height, 22.45 feet, at station below bridge), from rating curve extended above 4,600 second-feet; verified by comparison of peak discharge and total run-off of flood with record for Mokelumne River at Lancha Plana.
Remarks.- Flood run-off largely controlled by artificial storage in Pardee, Salt Springs, and other reservoirs, and affected by diversion into East Bay Municipal Utility District Aqueduct.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	555	572	642	11	500	820	642	21	492	637	637
2	551	589	659	12	567	1,920	637	22	538	642	642
3	545	576	650	13	576	2,180	637	23	602	646	637
4	545	580	646	14	504	2,220	637	24	602	646	642
5	555	480	642	15	530	2,200	715	25	551	642	646
6	559	538	642	16	593	1,570	655	26	567	637	646
7	472	567	642	17	602	650	682	27	555	642	646
8	525	572	642	18	593	642	664	28	484	646	677
9	563	572	642	19	593	642	664	29	525	637	715
10	589	606	642	20	576	642	616	30	567	637	664
								31		642	971
Mean monthly discharge, in second-feet									553	845	662
Run-off, in acre-feet									32,880	51,950	40,700

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	3.99	664	3.80	580	4.04	687	4.15	738	5.05	1,210	6.75	2,200
4	3.72	546	3.57	484	3.76	563	4.10	715	5.35	1,370	6.75	2,200
6	3.54	472	3.52	464	3.66	521	4.19	757	5.78	1,610	6.75	2,200
8	3.52	464	3.51	460	3.65	517	4.67	998	6.00	1,740	6.75	2,200
10	3.51	460	3.51	460	3.64	513	4.58	950	6.42	1,990	6.75	2,200
N	3.50	456	3.50	456	3.60	496	4.38	850	6.78	2,220	6.72	2,180
2	3.63	509	3.72	546	3.75	559	4.34	830	6.82	2,240	6.64	2,130
4	3.95	646	4.00	668	4.00	668	4.24	781	6.80	2,230	6.69	2,160
6	3.99	664	4.05	692	4.04	687	4.17	748	6.78	2,220	6.70	2,160
8	4.00	668	4.06	696	4.05	692	4.12	724	6.77	2,210	6.70	2,160
10	4.01	673	4.05	692	4.07	701	4.35	835	6.77	2,210	6.71	2,170
M	4.02	677	4.07	701	4.10	715	4.89	1,120	6.76	2,200	6.73	2,180
	December 14		December 15		December 16		December 17		December 18		December 19	
2	6.78	2,220	6.77	2,210	6.76	2,200						
4	6.78	2,220	6.78	2,220	6.77	2,210						
6	6.78	2,220	6.78	2,220	6.78	2,220						
8	6.78	2,220	6.78	2,220	6.78	2,220						
10	6.79	2,220	6.78	2,220	6.78	2,220						
N	6.79	2,220	6.78	2,220	6.76	2,200						
2	6.75	2,200	6.75	2,200	5.48	1,440						
4	6.73	2,180	6.73	2,180	4.30	810						
6	6.75	2,200	6.73	2,180	4.09	710						
8	6.77	2,210	6.73	2,180	4.04	687						
10	6.78	2,210	6.73	2,180	4.01	673						
M	6.76	2,200	6.72	2,180	3.99	664						
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Mokelumne River at Woodbridge, Calif.

Location.- Lat. 38°09'30", long. 121°18'10", in NE¼ sec. 34, T. 4 N., R. 6 E., three-eighths of a mile downstream from dam of Woodbridge Irrigation District at Woodbridge, San Joaquin County. Altitude, about 30 feet above mean sea level.
Drainage area.- 644 square miles.
Gage-height record.- Water-stage recorder graph except for period 5 p.m. Dec. 31 to 10:30 a.m. Jan. 3, when stage graph was based on range of stage indicated on recorder graph and comparison with graph of Mokelumne River near Clements.
Stage-discharge relation.- Defined by current-meter measurements below 2,000 second-feet. Shifting-control method used for period Nov. 1 to Jan. 2.
Maxima.- December 1937: Discharge, 2,010 second-feet 6 p.m. Dec. 16 (gage height, 14.39 feet).
1924-November 1937: Maximum gage height, 26.58 feet Mar. 26, 1928, former site and datum; about 30.6 feet, present datum (discharge not determined).
Remarks.- Flood run-off almost completely controlled by artificial storage in several reservoirs. Many diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	401	591	666	11	493	691	660	21	593	700	641
2	491	590	673	12	439	1,040	658	22	480	683	654
3	485	584	675	13	906	1,700	658	23	601	683	660
4	471	595	669	14	626	1,840	656	24	612	679	656
5	471	578	666	15	507	1,930	684	25	588	675	656
6	458	487	666	16	595	1,970	690	26	595	671	656
7	448	572	664	17	633	1,160	679	27	563	664	654
8	368	586	664	18	628	795	681	28	563	669	660
9	428	584	662	19	622	743	675	29	485	671	698
10	458	614	660	20	608	721	671	30	561	664	688
								31		660	732
Mean monthly discharge, in second-feet									539	832	669
Run-off, in acre-feet									32,090	51,150	41,120

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	8.83	557	8.82	556	8.87	565	8.99	582	9.95	761	13.19	1,620
4	8.98	586	8.98	586	9.09	607	9.19	620	9.93	756	13.28	1,650
6	9.11	610	9.12	612	9.26	639	9.33	646	9.87	743	13.35	1,670
8	9.20	628	9.22	631	9.36	658	9.45	669	9.94	758	13.40	1,690
10	9.24	635	9.25	637	9.40	666	9.51	681	10.22	824	13.43	1,700
N	9.24	635	9.22	631	9.38	662	9.55	688	10.73	952	13.47	1,710
2	9.15	618	9.10	608	9.32	650	9.58	694	11.18	1,070	13.50	1,720
4	9.01	591	8.94	578	9.20	628	9.67	711	11.66	1,200	13.52	1,720
6	8.86	563	8.81	554	9.06	601	9.81	741	12.11	1,320	13.55	1,730
8	8.76	545	8.71	536	8.93	576	9.97	777	12.48	1,430	13.58	1,740
10	8.68	530	8.68	530	8.87	565	10.02	788	12.79	1,520	13.62	1,750
M	8.69	532	8.73	539	8.88	567	10.01	786	13.01	1,580	13.66	1,770
	December 14		December 15		December 16		December 17		December 18		December 19	
2			-	-	14.26	1,970	13.40	1,690	10.37	840		
4			-	-	14.27	1,970	12.76	1,500	10.32	828		
6			-	-	14.28	1,970	12.21	1,340	10.27	816		
8			-	-	14.29	1,980	11.72	1,210	10.22	804		
10			-	-	14.31	1,980	11.37	1,110	10.18	795		
N			-	-	14.33	1,990	11.12	1,040	10.15	788		
2			-	-	14.35	2,000	10.94	996	10.13	784		
4			-	-	14.37	2,000	10.79	957	10.10	777		
6			-	-	14.39	2,010	10.67	926	10.07	770		
8			-	-	14.37	2,000	10.58	903	10.05	765		
10			-	-	14.25	1,960	10.51	885	10.02	758		
M			14.25	1,950	13.90	1,850	10.46	872	10.00	754		
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Cold Creek near Mokelumne Peak, Calif.

Location.- Lat. 38°31', long. 120°13', in sec. 28, T. 8 N., R. 16 E., 1½ miles north of Salt Springs Dam and 6 miles southwest of Mokelumne Peak, Amador County. Altitude, about 6,000 feet above mean sea level.

Drainage area.- 23 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Affected by ice for periods Dec. 1-9, 22-31, Jan. 4-7, 20-31. Defined by current-meter measurements below 900 second-feet; extended to peak stage on basis of area-velocity study.

Maxima.- December 1937: Discharge, 4,100 second-feet 10 a.m. Dec. 11 (gage height, 8.98 feet).

1927-November 1937: Discharge, 3,000 second-feet (revised) Mar. 25, 1928 (gage height, 7.79 feet).

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for periods of ice effect computed on basis of weather records and flow of nearby streams. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	3.5	18	11	0.2	2,440	14	21	19	22	26
2	.2	3.5	21	12	.3	254	14	22	9.5	20	24
3	.2	3.5	19	13	.3	110	14	23	6.5	20	22
4	.2	3	17	14	.3	73	14	24	7	20	20
5	.2	3	16	15	.4	62	21	25	7	20	18
6	.2	3	15	16	.4	49	35	26	6	19	16
7	.2	3	15	17	2.6	43	29	27	6	19	14
8	.2	3	15	18	.8	38	28	28	5.5	19	12
9	.3	3	14	19	.8	30	30	29	5.5	19	12
10	.3	1,610	14	20	31	23	28	30	4.9	18	12
								31		18	12
Mean monthly discharge, in second-feet									3.87	160	18.7
Run-off, in acre-feet									230	9,870	1,150

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	-	5.00	875	6.95	2,290	4.05	412	-	-
4			-	-	6.19	1,690	7.74	2,950	3.79	335	2.79	131
6			-	-	7.13	2,430	8.03	3,210	3.62	293	-	-
8			-	-	7.35	2,610	8.50	3,630	3.49	262	2.66	113
10			-	-	7.19	2,480	8.98	4,100	3.35	231	-	-
N			-	-	6.32	1,790	8.34	3,490	3.26	212	2.57	103
2			-	-	5.82	1,430	7.65	2,860	3.21	202	-	-
4			-	-	5.63	1,300	7.04	2,360	3.20	200	2.55	100
6			-	-	5.44	1,170	6.11	1,640	3.22	204	-	-
8			-	-	5.42	1,150	5.26	1,040	3.15	190	2.52	97
10			-	-	5.68	1,340	4.73	708	3.05	171	-	-
M			1.33	12	6.13	1,650	4.35	520	2.95	154	2.44	88

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.35	79	-	-	-	-	-	-	-	-	-	-
6	-	-	2.20	65	2.04	52	1.94	45	1.88	41	1.74	31
8	2.29	73	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.24	69	2.13	59	1.98	48	1.90	42	1.82	36	1.68	28
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.24	69	-	-	-	-	-	-	-	-	-	-
6	-	-	2.10	57	1.97	47	1.88	41	1.79	34	1.73	31
8	2.29	73	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.28	72	2.10	57	1.97	47	1.90	42	1.79	34	1.70	29

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-								
4	1.63	25	1.60	23								
6	-	-	-	-								
8	1.50	18	1.55	20								
10	-	-	-	-								
N	1.55	20	1.57	22								
2	-	-	-	-								
4	1.62	24	1.60	23								
6	-	-	-	-								
8	1.70	29	1.61	24								
10	-	-	-	-								
M	1.67	27	1.60	23								

Supplemental records.- Dec. 10, 1 a.m., 4.15 ft., 445 sec.-ft.; 7 a.m., 7.47 ft., 2,710 sec.-ft.; 9 a.m., 7.45 ft., 2,690 sec.-ft.

Bear River at Pardoe Camp, Calif.

Location.- Lat. 38°32', long. 120°15', in sec. 18, T. 8 N., R. 16 E., at Pardoe Camp, Amador County, 2 miles below Bear River Reservoir. Altitude, about 5,650 feet above mean sea level.

Drainage area.- 33.0 square miles.

Gage-height record.- Water-stage recorder graph except for periods 8:30 p.m. Dec. 1 to 11:30 a.m. Dec. 8, 5 a.m. to 1 p.m. Dec. 11, when there was no record. Record unreliable for period noon Dec. 12 to 3 p.m. Dec. 13. Stage graph for periods of missing record based on partial recorder graph, range of stage indicated on recorder graph, and floodmark in well.

Stage-discharge relation.- Defined by current-meter measurements below 1,400 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 5,850 second-feet about 9 a.m. Dec. 11 (gage height, 12.0 feet, from floodmarks).

1927-November 1937: Discharge, 4,090 second-feet (revised) Mar. 25, 1928 (gage height, 9.75 feet), from rating curve for 1938.

Remarks.- Flood run-off affected by artificial storage in Bear River Reservoir (capacity, about 6,600 acre-feet). Monthly summaries adjusted for storage. Reservoir began to spill about 10 p.m. Dec. 10. Discharge interpolated for period Dec. 2-7. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.7	8.5	36	11	1.2	3,910	21	21	49	50	41
2	.6	8	49	12	1.3	429	21	22	40	46	53
3	.6	8	48	13	1.4	168	21	23	30	46	50
4	.6	7.5	40	14	4.2	163	22	24	22	44	44
5	.6	7	35	15	6	137	53	25	17	42	44
6	.6	7	30	16	19	108	46	26	15	40	48
7	.7	6.5	27	17	42	94	62	27	12	38	90
8	.8	6.5	26	18	26	82	52	28	10	36	124
9	.8	12	23	19	16	65	49	29	9.5	33	123
10	.8	385	21	20	56	52	43	30	8.5	32	121
								31		33	123
Mean monthly discharge, in second-feet (observed)...........									13.1	197	51.2
Mean monthly discharge, in second-feet (adjusted)...........									13.1	304	51.2
Run-off, in acre-feet (adjusted)...........................									779	18,710	3,150

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.84	6.5	3.40	304	9.32	3,710	4.66	752	2.79	202
4	-	-	.84	6.5	3.73	386	10.53	4,670	4.35	621	2.71	188
6	-	6.5	.83	6.5	4.11	497	11.02	5,070	4.09	529	2.63	173
8	-	-	.83	6.5	3.75	391	11.90	5,770	3.92	474	2.53	155
10	-	-	.83	6.5	3.24	269	11.95	5,810	3.75	424	2.45	142
N	0.84	6.5	.84	6.5	3.48	323	11.34	5,320	3.61	387	2.38	131
2	-	-	.84	6.5	3.25	271	10.50	4,650	3.47	351	2.33	123
4	-	-	.85	6.5	3.10	240	9.47	3,880	3.35	322	2.38	131
6	.85	6.5	.87	7	3.06	232	7.96	2,820	3.22	292	2.66	179
8	-	-	.93	8	3.27	275	6.49	1,800	3.11	268	2.76	197
10	-	-	1.11	12	3.38	300	5.56	1,250	3.00	244	2.76	197
M	.84	6.5	2.78	181	7.50	2,390	5.00	925	2.90	224	2.73	191
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.64	175	2.53	155	-	-	-	-	-	-	1.90	69
6	-	-	-	-	2.27	114	2.15	98	2.09	91	-	-
8	2.56	161	2.46	144	-	-	-	-	-	-	1.77	56
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.50	150	2.39	132	2.19	103	2.10	92	2.00	80	1.75	54
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.51	152	2.36	128	-	-	-	-	-	-	1.84	63
6	-	-	-	-	2.18	102	2.07	88	1.94	73	-	-
8	2.59	156	2.36	128	-	-	-	-	-	-	2.03	84
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.60	168	2.37	129	2.20	104	2.12	94	1.99	79	1.78	57
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-		
4	1.75	54	1.77	56	1.71	51	1.80	59	-	-		
6	-	-	-	-	-	-	-	-	1.62	44		
8	1.69	49	1.72	52	1.67	48	1.69	49	-	-		
10	-	-	-	-	-	-	-	-	-	-		
N	1.65	46	1.67	48	1.61	43	1.61	43	1.61	43		
2	-	-	-	-	-	-	-	-	-	-		
4	1.76	55	1.64	45	1.59	41	1.56	39	-	-		
6	-	-	-	-	-	-	-	-	1.65	46		
8	1.72	52	1.69	49	1.66	47	1.58	40	-	-		
10	-	-	-	-	-	-	-	-	-	-		
M	1.77	56	1.72	52	1.78	57	1.62	44	1.65	46		

Supplemental records.- Dec. 10, 11 p.m., 5.70 ft., 1,230 sec.-ft. Dec. 11, about 9 a.m., 12.0 ft., 5,850 sec.-ft.

Middle Fork of Mokelumne River at West Point, Calif.

Location.- Lat. 38°23'15", long. 120°31'40", in sec. 10 T. 6 N., R. 13 E., 200 feet below highway bridge, 1 mile south of West Point, Calaveras County, and 3½ miles above junction with South Fork. Altitude, about 2,500 feet above mean sea level.
Drainage area.- 67.2 square miles.
Gage-height record.- Water-stage recorder graph except for period 4 a.m. Dec. 19 to 3:45 p.m. Jan. 3, when there was no record and stage graph was based on record for South Fork of Mokelumne River near West Point.
Stage-discharge relation.- Defined by current-meter measurements below 1,000 second-feet; extended to peak stage by paralleling former curve which was extended on basis of slope-area computation of flood flow.
Maxima.- December 1937: Discharge, 1,460 second-feet 9 a.m. Dec. 11 (gage height, 5.97 feet).
1911-November 1937: Discharge observed, 2,550 second-feet Jan. 23, 1914 (gage height, 10.0 feet, former site and datum), from rating curve extended above 490 second-feet.
Remarks.- Flood run-off not affected by artificial storage. Several small diversions above station.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	7	10	22	11	13	837	22	21	17	30	45
2	7	10	30	12	13	294	22	22	13	31	42
3	7	9.5	31	13	10	122	21	23	13	36	39
4	7	9.5	26	14	12	81	21	24	19	29	36
5	7	9.5	25	15	13	63	73	25	14	26	34
6	7	9.5	24	16	11	50	49	26	12	24	33
7	8.5	9	23	17	31	42	59	27	12	23	32
8	7.5	9	23	18	20	38	56	28	11	23	36
9	7.5	11	22	19	14	35	57	29	11	22	48
10	7.5	123	22	20	13	32	51	30	10	22	42
								31	-	22	100
Mean monthly discharge, in second-feet									11.8	67.5	37.6
Run-off, in acre-feet									704	4,150	2,310

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			1.03	9	1.35	28	2.80	268	3.43	427	-	-
4			1.03	9	1.60	51	3.49	443	3.26	382	2.23	147
6			1.03	9	2.08	120	4.47	733	3.26	382	-	-
8			1.03	9	2.27	154	5.80	1,350	3.23	374	2.14	130
10			1.03	9	2.41	182	5.66	1,280	3.04	326	-	-
N			1.03	9	2.35	170	5.42	1,160	2.84	278	2.08	120
2			1.03	9	2.28	156	5.55	1,220	2.70	245	-	-
4			1.03	9	2.20	141	5.18	1,040	2.59	220	2.02	109
6			1.04	9.5	2.12	127	4.80	862	2.51	203	-	-
8			1.07	11	2.14	130	4.32	683	2.44	188	1.97	101
10			1.16	16	2.19	139	3.95	571	2.38	176	-	-
M			1.26	22	2.31	162	3.65	487	2.32	164	1.93	95
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-						
4	-	-	-	-	-	-						
6	1.87	85	1.72	65	1.62	53						
8	-	-	-	-	-	-						
10	-	-	-	-	-	-						
N	1.83	80	1.70	63	1.61	52						
2	-	-	-	-	-	-						
4	-	-	-	-	-	-						
6	1.79	74	1.66	58	1.56	47						
8	-	-	-	-	-	-						
10	-	-	-	-	-	-						
M	1.75	69	1.65	57	1.54	45						
	December 20		December 21		December 22		December 23		December 24		December 25	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												

Supplemental records.- Dec. 11. 9 a.m., 5.97 ft., 1,460 sec.-ft.; 10:50 a.m., 5.75 ft., 1,320 sec.-ft.; 12:20 p.m., 5.34 ft., 1,120 sec.-ft.

South Fork of Mokelumne River near West Point, Calif.

Location.- Lat. 38°22', long. 120°33', in SW¼ sec. 16, T. 6 N., R. 13 E., 600 feet below Sawyer Bridge, 2 miles above junction with Middle Fork, and 2½ miles southwest of West Point, Calaveras County. Altitude, about 2,000 feet above mean sea level.
Drainage area.- 73.8 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements for range of stage of December high water. Shifting control method used for period Dec. 10 to Jan. 31.
Maxima.- December 1937: Discharge, 1,810 second-feet 8 a.m. Dec. 11 (gage height, 7.84 feet).
1933-November 1937: Discharge, 3,600 second-feet Feb. 22, 1936 (gage height, 8.90 feet), from rating curve extended above 710 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	8.5	12	28	11	19	1,010	27	21	20	36	61
2	9	12	36	12	18	304	26	22	16	35	57
3	9	12	41	13	14	128	26	23	15	46	53
4	9	12	35	14	16	87	26	24	18	35	49
5	8.5	12	34	15	17	70	110	25	17	34	47
6	8.5	12	31	16	14	58	66	26	15	32	45
7	9	12	30	17	35	51	80	27	14	32	43
8	9	12	29	18	26	47	75	28	14	30	47
9	9	13	27	19	17	41	78	29	13	29	74
10	9	160	27	20	17	38	73	30	13	29	61
								31		29	170
Mean monthly discharge, in second-feet									14.6	79.9	52.0
Run-off, in acre-feet									866	4,900	3,200

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	-	3.74	37	5.57	440	5.52	427	-	-
4			3.31	12	4.07	68	6.08	689	5.41	380	-	-
6			-	-	4.66	144	7.24	1,370	5.36	359	4.69	146
8			3.31	12	5.01	238	7.84	1,810	5.37	363	-	-
10			-	-	4.98	228	7.46	1,520	5.31	339	-	-
N			3.31	12	4.91	205	7.20	1,350	5.21	301	4.57	125
2			-	-	4.88	196	7.38	1,470	5.12	269	-	-
4			3.31	12	4.80	174	6.88	1,140	5.04	241	-	-
6			3.32	12	4.75	162	6.48	904	4.99	224	4.47	111
8			3.35	14	4.85	188	6.18	740	4.94	208	-	-
10			3.45	19	4.85	188	5.89	592	4.89	194	-	-
M			3.60	28	5.01	238	5.67	486	4.84	179	4.38	100
	December 14		December 15		December 16		December 17		December 18		December 19	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 20		December 21		December 22		December 23		December 24		December 25	
2					3.73	34	4.03	61				
4					-	-	4.01	59				
6					3.73	34	3.95	53				
8					-	-	3.92	50				
10					3.73	34	3.90	48				
N					-	-	3.86	45				
2					3.73	34	3.84	43				
4					-	-	3.83	42				
6					3.72	34	3.82	41				
8					3.73	34	3.80	40				
10					3.81	41	3.78	38				
M					3.98	56	3.78	38				

Supplemental records.- Dec. 11, 12:40 p.m., 7.08 ft., 1,270 sec.-ft.

Sutter Creek near Sutter Creek, Calif.

Location.- Lat. 38°23'30", long. 120°46'50", in sec. 9, T. 6 N., R. 11 E., 1.3 miles east of Sutter Creek, Amador County. Altitude, about 1,150 feet above mean sea level.

Drainage area.- 50.6 square miles.

Gage-height record.- One gage reading daily. Record unreliable and not used for period Dec. 13-25.

Stage-discharge relation.- Defined by current-meter measurements below 1,800 second-feet.

Maxima.- December 1937: Discharge, 575 second-feet probably Dec. 11 (gage height, 7.0 feet, from floodmark).

1922-November 1937: Discharge, 3,900 second-feet Feb. 22, 1936 (gage height, 12.0 feet, from floodmark), from rating curve extended above 1,400 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of unreliable gage-height record determined by comparison with records for nearby stations.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	3.1	5.5	8	11	5.5	316	6.5	21	5	10	25
2	2.6	5	9	12	5.5	192	6.5	22	5.5	16	23
3	2.6	5	9	13	4.4	23	6.5	23	6	15	23
4	2.6	4.7	8.5	14	4.1	22	6.5	24	9	15	22
5	2.6	4.4	8.5	15	3.8	19	55	25	7.5	13	17
6	2.4	4.4	8	16	5	16	20	26	6	12	15
7	2.4	4.7	8	17	9	14	48	27	5.5	10	11
8	2.4	4.7	7.5	18	10	12	25	28	5.5	9	11
9	2.4	5.5	7.5	19	6	11	27	29	5.5	8.5	61
10	2.4	88	7	20	5	11	25	30	5.5	7.5	59
										7.5	204
Mean monthly discharge, in second-feet									4.83	28.8	25.1
Run-off, in acre-feet									287	1,770	1,540

North Fork of Cosumnes River near El Dorado, Calif.

Location.- Lat. 38°36', long. 120°51', in NE$\frac{1}{4}$ sec. 35, T. 9 N., R. 10 E., 1 mile north of Nashville, 2.7 miles above mouth, and 6 miles south of El Dorado, El Dorado County. Altitude, about 910 feet above mean sea level.
Drainage area.- 202 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,900 second-feet. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 3,880 second-feet 3 p.m. Dec. 11 (gage height, 6.70 feet).
1911-November 1937: Discharge, about 7,600 second-feet Mar. 25, 1928 (gage height, 15.2 feet, from floodmarks at former site and datum, 1$\frac{1}{2}$ miles upstream), from rating curve extended above 1,000 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	12	27	74	11	18	2,160	64	21	51	110	148
2	12	26	80	12	37	1,320	62	22	51	102	132
3	12	25	86	13	33	558	60	23	45	145	132
4	12	25	82	14	28	361	59	24	64	107	122
5	13	24	76	15	33	268	161	25	64	100	117
6	13	23	74	16	30	220	145	26	45	91	110
7	13	23	70	17	45	182	158	27	38	86	107
8	12	23	68	18	84	158	228	28	31	82	120
9	13	23	66	19	50	132	189	29	28	80	193
10	13	328	64	20	41	120	182	30	28	76	151
								31		76	413
Mean monthly discharge, in second-feet									32.3	228	122
Run-off, in acre-feet									1,920	14,040	7,520

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	1.39	32	3.04	642	4.97	2,120	3.13	718
4	1.30	23	1.29	22	1.45	40	3.03	636	4.70	1,880	3.07	682
6	-	-	-	-	1.53	51	3.27	777	4.45	1,680	3.00	640
8	1.30	23	1.29	22	1.62	68	3.67	1,040	4.25	1,520	2.95	610
10	-	-	-	-	1.77	100	5.00	2,100	4.12	1,420	2.88	569
N	1.29	22	1.30	23	1.93	141	5.96	3,070	3.94	1,270	2.85	552
2	-	-	-	-	2.86	545	6.64	3,810	3.75	1,140	2.80	525
4	1.30	23	1.31	24	3.10	675	6.59	3,760	3.57	1,010	2.75	498
6	-	-	-	-	3.12	687	6.23	3,360	3.43	911	2.72	481
8	1.30	23	1.32	25	3.09	670	5.73	2,840	3.32	838	2.68	460
10	-	-	-	-	3.00	620	5.48	2,590	3.23	780	2.65	445
M	1.30	23	1.36	29	3.00	620	5.19	2,320	3.18	748	2.62	430
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.56	400	-	-	-	-	-	-	-	-	-	-
6	-	-	2.31	284	2.17	228	2.07	189	1.99	161	1.92	138
8	2.52	380	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.47	356	2.27	268	2.14	216	2.05	182	1.97	154	1.90	132
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.43	338	-	-	-	-	-	-	-	-	-	-
6	-	-	2.24	256	2.12	208	2.03	175	1.96	151	1.89	130
8	2.39	320	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.35	302	2.18	232	2.10	200	2.01	168	1.94	145	1.88	127
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.92	138	-	-	-	-
6	1.87	124	1.82	112	1.78	102	-	-	1.80	107	1.78	102
8	-	-	-	-	-	-	2.04	178	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.85	120	1.81	110	1.77	100	1.98	158	1.80	107	1.78	102
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1.92	138	-	-	-	-
6	1.84	117	1.80	107	1.78	102	-	-	1.79	105	1.77	100
8	-	-	-	-	-	-	1.88	127	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.83	114	1.79	105	1.84	117	1.84	117	1.77	100	1.73	91

Supplemental records.- Dec. 11, 3 p.m., 6.70 ft., 3,880 sec.-ft.

Cosumnes River at Michigan Bar, Calif.

Location.- Lat. 38°30'00", long. 121°02'45", in SE¼ sec. 36, T. 8 N., R. 8 E., at highway bridge at Michigan Bar, Sacramento County, 5½ miles southwest of Latrobe. North and Middle Forks unite 12 miles above station. Altitude, about 190 feet above mean sea level.

Drainage area.- 537 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 9,000 second-feet. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 9,000 second-feet 4 p.m. Dec. 11 (gage height, 7.58 feet).

1907-November 1937: Discharge observed, 23,800 second-feet Feb. 6, 1925 (gage height, 11.2 feet, from nonrecording gage), from rating curve extended above 10,000 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	13	48	156	11	19	4,680	133	21	80	243	360
2	14	45	177	12	37	3,030	128	22	97	226	315
3	15	45	204	13	63	1,260	126	23	82	296	301
4	15	45	183	14	50	808	123	24	89	251	287
5	14	45	168	15	45	599	517	25	116	218	260
6	14	44	159	16	54	480	402	26	89	197	247
7	15	43	151	17	54	396	396	27	72	183	243
8	15	43	148	18	143	345	487	28	63	180	264
9	17	44	143	19	108	305	480	29	53	168	522
10	16	410	138	20	77	273	494	30	49	159	396
								31		156	1,490
Mean monthly discharge, in second-feet........................									52.9	492	310
Run-off, in acre-feet....................................									3,150	30,280	19,040

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.47	53	4.77	1,520	6.35	4,680	-	-
4	-	-	-	-	2.49	56	4.77	1,520	6.18	4,230	4.75	1,500
6	-	-	2.38	42	2.52	60	5.05	1,930	6.05	3,910	-	-
8	-	-	-	-	2.61	74	5.07	1,960	5.87	3,490	4.65	1,370
10	-	-	-	-	2.73	95	5.37	2,490	5.77	3,280	-	-
N	2.39	43	2.39	43	2.74	97	6.75	5,880	5.69	3,110	4.55	1,250
2	-	-	-	-	2.75	98	7.08	7,010	5.54	2,810	-	-
4	-	-	-	-	2.83	114	7.58	9,000	5.40	2,540	4.45	1,140
6	-	-	2.41	45	3.95	645	7.44	8,360	5.25	2,270	-	-
8	-	-	-	-	4.68	1,410	7.10	7,080	5.11	2,030	4.36	1,040
10	-	-	-	-	4.72	1,460	6.80	6,040	4.97	1,800	-	-
M	2.39	43	2.46	52	4.72	1,460	6.57	5,310	4.87	1,660	4.29	970
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.23	910	-	-	-	-	-	-	-	-	-	-
6	-	-	3.92	636	3.73	501	3.59	414	3.49	355	3.41	315
8	4.17	853	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.12	808	3.87	599	3.70	480	3.56	396	3.47	345	3.39	305
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.07	763	-	-	-	-	-	-	-	-	-	-
6	-	-	3.82	564	3.66	456	3.53	378	3.45	335	3.37	296
8	4.01	709	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.97	676	3.77	529	3.63	438	3.50	360	3.43	325	3.35	287
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	3.26	247	3.32	273	-	-
6	3.33	278	3.26	247	-	-	-	-	-	-	3.18	215
8	-	-	-	-	-	-	3.28	256	3.28	256	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.32	273	3.25	243	3.20	222	3.41	315	3.25	243	3.19	218
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	3.50	360	3.24	239	-	-
6	3.29	260	2.32	235	-	-	-	-	-	-	3.19	218
8	-	-	-	-	-	-	3.45	335	3.23	235	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.28	256	3.22	230	3.21	226	3.38	301	3.20	222	3.17	211

Sacramento River at Antler, Calif.

Location.- Lat. 40°53', long. 122°23', in SE¼ sec. 13, T. 35 N., R. 5 W., a quarter of a mile below highway bridge at Antler, Shasta County. Gregory Creek enters 1,000 feet above gage and Pit River 14 miles below. Zero of gage is 934.4 feet above mean sea level.

Drainage area.- 461 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 6,300 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations in Sacramento River Basin.

Maxima.- December 1937: Discharge, 24,900 second-feet 10 p.m. Dec. 10 (gage height, 14.55 feet).

1910-11, 1919-November 1937: Discharge, 34,000 second-feet Mar. 26, 1928 (gage height, 19.4 feet, from floodmarks at former site and datum, a quarter of a mile upstream), from rating curve extended above 11,600 second-feet on basis of area-velocity study.

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	218	1,210	1,060	11	6,590	19,700	848	21	5,700	1,420	2,000
2	215	1,090	1,170	12	1,850	9,660	828	22	5,670	1,330	1,850
3	209	1,020	1,170	13	1,380	5,520	808	23	8,200	1,250	1,700
4	209	950	1,130	14	2,160	3,860	848	24	5,160	1,250	1,510
5	209	880	1,060	15	1,700	3,050	1,210	25	3,470	1,130	1,420
6	209	841	1,020	16	4,820	2,460	1,720	26	2,580	1,130	1,330
7	209	802	985	17	4,660	2,110	4,100	27	2,060	1,130	1,290
8	209	770	950	18	2,460	1,900	2,980	28	1,750	1,090	1,330
9	212	915	880	19	3,530	1,700	2,640	29	1,510	1,060	1,380
10	2,780	13,100	867	20	13,000	1,510	2,340	30	1,330	1,130	1,330
								31		1,130	4,600
Mean monthly discharge, in second-feet									2,809	2,777	1,560
Run-off, in acre-feet									167,100	170,800	95,910

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.80	750	4.74	2,510	13.00	20,300	10.36	13,300	-	-
4	-	-	2.80	750	5.52	3,570	12.55	19,000	9.90	12,200	7.07	6,190
6	2.84	776	2.79	744	6.65	5,430	12.47	18,800	9.53	11,300	-	-
8	-	-	2.78	738	7.87	7,740	12.73	19,500	9.18	10,500	6.88	5,840
10	-	-	2.80	750	9.00	10,100	13.23	20,900	8.86	9,790	-	-
N	2.82	763	2.83	770	10.26	13,000	13.73	22,300	8.59	9,200	6.63	5,390
2	-	-	2.92	828	11.35	15,800	13.58	21,900	8.36	8,720	-	-
4	-	-	3.04	908	12.07	17,700	13.33	21,200	8.13	8,260	6.42	5,220
6	2.81	756	3.23	1,040	13.36	21,300	12.77	19,700	7.92	7,840	-	-
8	-	-	3.46	1,220	14.40	24,300	12.12	17,800	7.73	7,460	6.25	4,740
10	-	-	3.80	1,510	14.55	24,900	11.41	16,000	7.57	7,140	-	-
M	2.80	750	4.18	1,880	14.00	23,100	10.86	14,500	7.41	6,820	6.10	4,500
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.89	4,160	5.26	3,200	4.80	2,580	4.48	2,200	4.23	1,930	4.02	1,720
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.70	3,860	5.14	3,040	4.73	2,500	4.42	2,130	4.18	1,880	3.98	1,680
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.53	3,590	5.00	2,840	4.64	2,390	4.35	2,060	4.12	1,820	3.93	1,630
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.38	3,370	4.90	2,700	4.53	2,280	4.28	1,980	4.07	1,770	3.88	1,580
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.85	1,560	3.71	1,430	3.60	1,330	3.53	1,270	3.48	1,230	3.39	1,160
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.81	1,520	3.68	1,400	3.58	1,310	3.49	1,240	3.55	1,290	3.35	1,130
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.76	1,470	3.65	1,380	3.59	1,320	3.46	1,220	3.50	1,250	3.33	1,110
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.74	1,460	3.63	1,360	3.56	1,300	3.44	1,200	3.42	1,190	3.32	1,110

Sacramento River at Kennett, Calif.

Location.- Lat. 40°44', long. 122°24', in SW¼ sec. 2, T. 33 N., R. 5 W., at highway bridge at Kennett, Shasta County. Zero of gage is 618.26 feet above mean sea level. Gage set to read 2.00 feet more than U. S. Weather Bureau gage at same location.

Drainage area.- 6,600 square miles (not including Goose Lake Basin).

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 66,000 second-feet; extended to peak stage on basis of area-velocity study and A√d method; verified by comparison of peak discharge and total run-off of flood with records for other stations in Sacramento River Basin.

Maxima.- December 1937: Discharge, 132,000 second-feet 1 a.m. Dec. 11 (gage height, 30.6 feet).

1925-November 1937: Discharge, 94,900 second-feet Mar. 26, 1928 (gage height, 25.1 feet), from rating curve extended above 66,000 second-feet.

Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2,910	7,050	7,460	11	13,900	97,200	5,920	21	28,200	11,100	12,600
2	3,020	6,460	7,250	12	7,050	66,400	5,920	22	17,600	9,920	11,400
3	3,020	6,280	7,050	13	5,270	49,800	5,920	23	31,800	9,440	10,900
4	3,130	5,750	7,670	14	9,920	35,100	5,750	24	29,900	9,210	10,600
5	3,130	5,590	7,460	15	7,890	26,500	7,050	25	18,500	8,550	9,680
6	2,650	5,270	7,050	16	13,900	22,000	8,770	26	14,200	8,110	8,990
7	2,500	5,120	6,850	17	17,000	18,200	20,100	27	11,600	8,330	8,330
8	2,650	5,120	6,850	18	11,100	14,700	16,100	28	9,680	7,890	8,770
9	2,860	5,430	6,850	19	10,600	13,100	15,300	29	8,330	7,250	8,990
10	6,210	47,000	5,750	20	51,200	12,400	15,300	30	7,460	7,250	8,550
								31		7,890	16,300
Mean monthly discharge, in second-feet									11,910	17,720	9,403
Run-off, in acre-feet									708.5	1,090	578.1

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.60	4,970	5.00	9,680	30.00	128,000	21.30	76,300	17.80	57,600
4	-	-	2.60	4,970	5.88	11,800	27.20	111,000	20.55	72,100	17.50	56,100
6	2.70	5,120	2.62	5,000	6.90	14,500	24.70	95,800	20.00	69,100	17.15	54,400
8	-	-	2.61	4,980	8.00	17,600	23.30	87,600	19.80	68,000	16.80	52,600
10	-	-	2.62	5,000	10.45	25,600	23.40	88,200	19.60	67,000	16.50	51,200
N	2.66	5,060	2.63	5,020	13.40	37,200	23.30	87,600	19.35	65,700	16.20	49,800
2	-	-	2.72	5,150	16.10	49,300	23.75	90,200	19.10	64,300	15.90	48,300
4	-	-	2.90	5,430	18.70	62,200	24.20	92,900	18.90	63,300	14.60	47,000
6	2.63	5,020	3.07	5,700	21.50	77,400	24.60	95,200	18.70	62,200	15.30	45,600
8	-	-	3.30	6,100	23.50	88,800	24.35	93,800	18.50	61,200	15.00	44,200
10	-	-	3.63	6,710	26.20	105,000	23.60	89,400	18.30	60,200	14.70	42,800
M	2.64	5,030	4.22	7,930	29.70	127,000	22.30	81,900	18.05	58,900	14.40	41,500
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	9.93	23,800	8.75	19,900	7.71	16,700	7.17	15,200
4	13.85	39,100	11.20	28,400	9.70	23,000	8.39	18,800	7.57	16,300	7.10	15,000
6	-	-	-	-	9.60	22,600	8.10	17,900	7.13	15,100	6.73	14,000
8	13.30	36,800	10.95	27,400	9.51	22,300	7.81	17,000	6.82	14,200	6.10	12,400
10	-	-	-	-	9.45	22,100	7.82	17,100	6.70	13,900	5.94	11,900
N	12.80	34,700	10.65	26,300	9.38	21,900	7.90	17,300	6.75	14,000	5.86	11,700
2	-	-	-	-	9.29	21,600	8.05	17,800	6.80	14,200	5.86	11,700
4	12.40	33,000	10.45	25,600	9.18	21,300	8.25	18,400	7.03	14,800	6.10	12,400
6	-	-	-	-	9.25	21,500	8.32	18,600	7.00	14,700	6.47	13,300
8	12.00	31,400	10.27	25,000	9.10	21,000	8.11	17,900	6.94	14,600	6.36	13,000
10	-	-	-	-	9.08	21,000	7.97	17,500	6.87	14,400	6.27	12,800
M	11.55	29,700	9.80	23,300	8.92	20,400	7.85	17,200	6.80	14,200	6.08	12,300
	December 20		December 21		December 22		December 23		December 24		December 25	
2	6.55	13,500	5.90	11,800	5.49	10,900	5.41	10,700	4.94	9,540	5.25	10,300
4	6.60	13,700	6.04	12,200	5.42	10,700	5.45	10,800	5.25	10,300	5.20	10,200
6	6.55	13,500	5.96	12,000	5.10	9,920	5.10	9,920	5.05	9,800	4.90	9,440
8	6.10	12,400	5.65	11,200	4.87	9,370	4.77	9,140	4.86	9,350	4.63	8,840
10	5.70	11,400	5.40	10,600	4.62	8,810	4.49	8,530	4.51	8,570	4.20	7,890
N	5.49	10,900	5.30	10,400	4.70	8,990	4.38	8,290	4.20	7,890	3.92	7,290
2	5.59	11,100	5.06	9,820	4.75	9,100	4.40	8,330	4.12	7,710	3.87	7,190
4	6.00	12,100	5.06	9,820	5.02	9,730	4.48	8,510	4.25	8,000	4.02	7,500
6	6.29	12,900	5.81	11,600	5.47	10,800	4.92	9,490	5.00	9,680	4.19	7,870
8	6.06	12,300	5.59	11,100	5.31	10,400	5.03	9,750	5.20	10,200	4.25	8,000
10	5.95	12,000	5.48	10,800	5.23	10,200	4.99	9,660	5.18	10,100	4.30	8,110
M	5.72	11,400	5.20	10,200	5.13	9,990	4.95	9,560	5.05	9,800	4.30	8,110

Supplemental records.- Dec. 11, 1 a.m., 30.6 ft., 132,000 sec.-ft.; 9 a.m., 23.1 ft., 86,500 sec.-ft.

Sacramento River near Red Bluff, Calif.

Location.- Lat. 40°13'55", long. 122°10'50", in SE¼ sec. 34, T. 28 N., R. 3 W., at lower end of Iron Canyon, half a mile below Sevenmile Creek and 4 miles northeast of Red Bluff, Tehama County. Altitude, about 250 feet above mean sea level.
Drainage area.- 9,300 square miles (not including Goose Lake Basin).
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 125,000 second-feet; extended to peak stage on basis of area-velocity study at gage section; verified by slope-area determination of flood flow and logarithmic extension to peak stage.
Maxima.- December 1937: Discharge, 262,000 second-feet 7:30 a.m. Dec. 11 (gage height, 36.50 feet).
1895-November 1937: Discharge observed, 261,000 second-feet (revised) Feb. 3, 1909 (gage height, 35.2 feet, from nonrecording gage), from rating curve extended above 110,000 second-feet on basis of shape of rating curve for 1937-38.
Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	3,610	10,000	10,900	11	14,300	225,000	8,590	21	76,200	16,700	21,600
2	3,700	9,430	10,900	12	13,400	134,000	8,870	22	30,100	15,000	18,400
3	3,700	8,870	11,200	13	7,780	82,400	8,870	23	37,800	14,300	17,300
4	3,700	8,320	11,200	14	10,500	56,800	8,590	24	51,200	13,700	16,000
5	3,790	7,780	10,900	15	13,400	41,300	11,200	25	31,000	14,300	15,300
6	3,700	7,510	10,600	16	18,100	32,900	11,800	26	22,000	12,400	14,000
7	3,350	7,240	10,300	17	42,800	27,400	43,100	27	17,700	12,100	13,100
8	3,180	6,980	10,000	18	20,100	22,800	32,900	28	14,300	12,100	13,400
9	3,520	7,240	10,000	19	16,000	19,800	27,400	29	12,400	11,200	15,600
10	3,880	66,600	9,150	20	91,100	17,700	28,300	30	10,900	10,600	13,700
								31		11,200	19,800
Mean monthly discharge, in second-feet									19,570	30,440	15,260
Run-off, in acre-feet									1.165	1,872	938.1

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.17	6,980	5.00	15,300	32.6	217,000	28.4	172,000	19.7	94,700
4	2.22	6,980	2.16	6,980	6.80	21,600	34.76	242,000	27.6	164,000	19.3	91,700
6	-	-	2.15	6,980	8.70	29,600	36.2	258,000	26.8	156,000	19.0	89,500
8	-	-	2.15	6,980	10.00	35,000	36.45	261,000	26.05	148,000	18.7	87,400
10	-	-	2.15	6,980	11.40	42,800	35.9	255,000	25.15	141,000	18.35	85,200
N	2.21	6,980	2.16	6,980	12.85	50,100	35.25	246,000	24.14	132,000	18.0	82,400
2	-	-	2.16	6,980	14.50	59,800	34.15	234,000	23.35	125,000	17.7	80,400
4	-	-	2.17	6,980	16.85	74,300	32.8	219,000	22.45	116,000	17.3	77,600
6	-	-	2.24	6,980	19.7	94,700	31.4	203,000	21.75	111,000	16.95	75,600
8	2.16	6,980	2.47	7,780	22.7	119,000	30.45	192,000	21.0	104,000	16.6	73,000
10	-	-	3.00	9,150	27.0	158,000	29.95	188,000	20.6	101,000	16.25	70,300
M	-	-	3.65	10,900	30.0	188,000	29.25	180,000	20.1	97,700	15.90	68,400
	December 14		December 15		December 16		December 17		December 18		December 19	
2	15.55	66,500	12.10	46,300	9.98	35,800	8.73	29,600	-	-	-	-
4	15.22	64,000	11.85	44,800	9.86	35,300	8.66	29,600	7.60	24,800	6.48	20,500
6	14.91	62,200	11.64	43,800	9.73	34,400	8.60	29,200	-	-	-	-
8	14.58	60,400	11.44	42,800	9.59	33,900	8.54	28,700	7.45	24,000	6.44	20,100
10	14.26	58,600	11.26	42,300	9.45	32,900	8.43	28,300	-	-	-	-
N	13.90	56,200	11.02	40,800	9.36	32,900	8.28	27,800	7.22	23,200	6.36	20,100
2	13.62	54,600	10.85	39,800	9.26	32,400	8.07	26,900	-	-	-	-
4	13.36	53,400	10.70	39,300	9.16	32,000	7.84	25,700	6.89	22,000	6.48	20,500
6	13.06	51,800	10.55	38,800	9.03	31,000	7.64	24,800	-	-	-	-
8	12.82	50,100	10.40	37,800	8.98	30,100	7.50	24,400	6.49	20,500	6.00	18,700
10	12.58	49,000	10.26	37,300	8.90	30,500	7.48	24,400	-	-	-	-
M	12.32	47,400	10.12	36,300	8.80	30,100	7.51	24,400	6.41	20,100	5.67	17,700
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.68	17,700	5.43	16,700	4.91	15,000	4.66	14,300	4.22	12,700	4.34	13,100
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.84	18,000	5.54	17,000	5.10	15,600	4.92	15,000	4.48	13,700	4.94	15,000
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.72	17,700	5.36	16,700	4.91	15,000	4.84	14,700	4.56	14,000	4.97	15,300
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.92	18,400	5.41	16,700	4.97	15,300	4.90	15,000	4.60	14,000	4.89	15,000
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.69	17,700	5.28	16,300	4.75	14,700	4.61	14,000	4.60	14,000	4.64	14,000
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.30	16,300	4.98	15,300	4.52	13,700	4.28	13,100	4.36	13,400	4.20	12,700

Supplemental records.- Dec. 11, 7:30 a.m., 36.50 ft., 262,000 sec.-ft.

Sacramento River at Verona, Calif.

Location.- Lat. 38°46'50", long. 121°36'15", in SE¼ sec. 23, T. 11 N., R. 3 E., three-quarters of a mile southeast of Verona, Sutter County, and 1 mile downstream from mouth of Feather River. Gage is set to datum of Corps of Engineers, U. S. Army.
Drainage area.- 21,400 square miles (not including Goose Lake Basin).
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 57,000 second-feet; extended to peak stage. Backwater corrections used for period Dec. 2-Jan. 31.
Maxima.- December 1937: Discharge, 68,400 second-feet 3 a.m. Dec. 14 (gage height, 38.23 feet).
1929-November 1937: Discharge observed, 61,800 second-feet Feb. 25, 1936 (gage height, 36.62 feet), from rating curve extended above 56,000 second-feet.
Remarks.- Flood run-off not materially affected by artificial storage. At discharges above 50,000 second-feet unmeasured flow begins over Fremont weir (1 mile upstream) into Yolo by-pass. Elevation of crest of Fremont weir is 33.5 feet, datum of Corps of Engineers, U. S. Army.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6,260	40,300	27,200	11	6,540	41,600	18,800	21	34,200	54,100	46,300
2	6,260	34,400	25,300	12	6,840	61,600	18,300	22	40,500	52,500	47,600
3	6,260	29,600	24,300	13	10,500	66,700	17,700	23	44,400	50,700	47,600
4	6,540	26,200	23,800	14	14,400	68,100	17,200	24	49,100	48,100	46,000
5	6,400	22,700	23,400	15	13,100	65,600	17,000	25	54,100	45,000	42,900
6	6,540	19,200	22,500	16	13,100	62,500	18,800	26	54,400	41,600	39,500
7	6,680	17,200	21,800	17	15,500	60,200	22,500	27	53,500	38,500	36,100
8	6,540	16,100	21,000	18	22,500	58,300	30,800	28	52,500	35,400	33,400
9	6,260	15,200	20,100	19	29,600	56,900	38,500	29	49,900	32,700	31,300
10	6,260	16,300	19,200	20	31,000	55,200	43,400	30	45,700	30,800	30,100
								31		29,100	28,900
Mean monthly discharge, in second-feet									23,510	41,690	29,070
Run-off, in acre-feet									1,399	2,563	1,788

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	17.25	15,400	23.40	24,600	36.57	60,400	-	-
4	17.84	16,600	17.41	15,700	17.30	15,500	24.95	27,800	36.70	60,900	36.85	64,600
6	-	-	-	-	17.30	15,500	26.35	31,600	36.66	61,100	-	-
8	17.74	16,400	17.32	15,500	17.28	15,400	27.60	34,600	36.60	61,100	37.35	66,000
10	-	-	-	-	17.32	15,400	28.80	37,700	36.52	61,300	-	-
N	17.65	16,200	17.22	15,300	17.35	15,100	30.90	43,900	36.46	61,400	37.74	67,100
2	-	-	-	-	17.40	15,200	32.30	47,600	36.40	61,600	-	-
4	17.55	16,000	17.18	15,200	17.56	15,700	33.20	49,900	36.36	61,600	37.96	67,700
6	-	-	-	-	17.90	16,400	33.85	51,600	36.34	61,900	-	-
8	17.46	15,800	17.14	15,100	18.60	16,700	34.65	54,200	36.32	62,000	38.15	68,200
10	-	-	-	-	19.90	18,500	35.55	57,200	36.34	62,300	-	-
M	17.43	15,700	17.20	15,200	21.60	21,000	36.20	59,300	36.44	62,900	38.22	68,400
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	38.22	68,400	37.58	66,600	36.44	63,400	-	-	-	-	-	-
6	-	-	-	-	-	-	35.45	60,700	34.75	58,700	34.20	57,200
8	38.20	68,400	37.41	66,100	36.26	62,900	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	38.14	68,200	37.20	65,600	36.08	62,400	35.26	60,100	34.59	58,300	34.09	56,900
2	-	-	-	-	-	-	-	-	-	-	-	-
4	38.04	67,900	37.00	65,000	35.94	62,000	-	-	-	-	-	-
6	-	-	-	-	-	-	35.07	59,600	34.46	57,900	33.98	56,500
8	37.91	67,500	36.82	64,500	35.79	61,000	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	37.75	67,100	36.60	63,900	35.65	61,200	34.90	59,100	34.33	57,500	33.85	56,200
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	33.72	55,500	33.23	54,400	32.67	52,900	32.05	51,300	31.16	48,800	29.97	45,700
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	33.59	55,200	33.12	54,100	32.52	52,600	31.86	50,800	30.87	48,000	29.67	44,900
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	33.47	54,800	32.96	53,700	32.37	52,200	31.65	50,300	30.56	47,200	29.38	44,100
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	33.36	54,500	32.84	53,400	32.21	51,700	31.44	49,700	30.27	46,400	29.06	43,300

Supplemental records.- Dec. 14, 3 a.m. 38.23 ft., 68,400 sec.-ft.

Sacramento River at Sacramento and Yolo by-pass at Lisbon, Calif.

Location.- Record for Sacramento River at Sacramento obtained from U. S. Weather Bureau water-stage recorder at I Street bridge. Record for Yolo by-pass obtained from water-stage recorder of California State Department of Public Works at Lisbon sub-station 10 miles southwest of Sacramento.

Remarks.- During extreme high water gates are opened in Sacramento weir (on right bank of river 5 miles northwest of Sacramento and 4 miles upstream from American River) to permit spill into Yolo by-pass. Discharge of Yolo by-pass at Lisbon includes flow over Sacramento weir as well as that of Cache and Putah Creeks and other streams entering Sacramento River from the west. Combined flow of Sacramento River at Sacramento and Yolo by-pass at Lisbon gives practically total run-off from Sacramento Valley to and including Putah Creek. Complete records furnished by State engineer.

Discharge, in second-feet, December 1937

Day	Sacramento River	Yolo by-pass	Total
1	42,000	-	-
2	36,500	-	-
3	29,500	-	-
4	26,000	-	-
5	24,000	-	-
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-
10	25,000	-	-
11	a 70,000	6,000	76,000
12	b 73,000	56,000	129,000
13	66,200	136,000	202,000
14	63,600	c 187,100	251,000
15	62,500	182,000	244,000
16	60,500	142,000	202,000
17	60,000	115,000	175,000
18	59,500	81,700	141,000
19	58,900	66,000	125,000
20	58,000	42,000	100,000
21	56,500	32,000	88,500
22	54,000	22,000	76,000
23	53,000	16,000	69,000
24	50,800	13,000	63,800
25	49,200	11,500	60,700
26	46,000	10,000	56,000
27	41,000	9,000	50,000
28	38,000	7,000	45,000
29	35,000	6,500	41,500
30	32,500	6,000	38,500
31	29,000	5,500	34,500

a 48 gates of Sacramento weir opened about 5 p.m. Dec. 11.
b Peak stage, 27.7 feet 2 a.m. Dec. 11 (discharge, 79,000 second-feet).
c Peak stage, 20.95 feet 8 p.m. Dec. 14 (discharge, 194,000 second-feet).

Miscellaneous discharge measurements made by Corps of Engineers, U. S. Army, during flood of December 1937 at various points on Sacramento River and adjacent channels

Place of measurement	Date	Elevation* (feet)	Discharge (second-feet)
Colusa weir	12	66.08	56,900
Do.	12	66.35	59,200
Do.	13	67.26	30,800
Sutter by-pass at Long Bridge	13	54.05	147,000
Sacramento River at Tisdale weir	14	51.20	16,100
Sutter by-pass at Sutter causeway	12	39.95	13,000
Do.	12-13	42.45	61,100
Do.	13	45.05	106,000
Do.	13	46.75	142,000
Do.	13	47.25	148,000
Sacramento River at Knights Landing	12	38.23	20,700
Do.	13	39.02	20,300
Do.	13	39.69	21,400
Do.	14	40.16	23,100
Knights Landing Ridge cut at highway bridge	15	33.49	2,780
Do.	15-16	34.70	6,560
Do.	16	35.56	11,200
Do.	18	36.38	12,700

*Datum of Corps of Engineers, U. S. Army.

Pit River near Canby, Calif.

Location.- Lat. 41°24', long. 120°55', in SW¼ sec. 10, T. 41 N., R. 9 E., at lower end of Warm Spring Valley, about 4 miles southwest of Canby, Modoc County. Altitude, about 4,300 feet above mean sea level.
Drainage area.- 1,430 square miles (revised), not including Goose Lake Basin.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,600 second-feet; extended to peak stage on basis of area-velocity study.
Maxima.- December 1937: Discharge, 8,210 second-feet 5 p.m. Dec. 11 (gage height, 12.65 feet).
1904-5, 1929-November 1937: Discharge observed, 17,000 second-feet (revised) Mar. 8, 1904 (gage height, 14.0 feet, nonrecording gage, former datum), from rating curve extended above 6,000 second-feet.
Remarks.- Flood run-off slightly affected by artificial storage.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	26	90	241	11	31	6,570	125	21	144	788	166
2	24	90	246	12	33	5,950	122	22	158	668	223
3	23	73	241	13	33	5,950	125	23	260	521	255
4	22	67	232	14	36	4,170	129	24	246	416	305
5	24	63	223	15	50	2,800	140	25	192	335	290
6	38	58	205	16	40	2,060	144	26	171	295	250
7	31	56	184	17	60	1,680	158	27	155	260	232
8	33	52	162	18	60	1,400	184	28	132	246	205
9	29	62	144	19	83	1,140	179	29	116	241	192
10	26	473	125	20	107	932	171	30	98	241	184
								31		241	179
Mean monthly discharge, in second-feet									82.7	1,225	192
Run-off, in acre-feet									4,920	75,330	11,820

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.51	52	7.73	3,390	11.84	7,390	10.37	5,920
4	-	-	-	-	2.52	54	8.49	4,070	11.50	7,050	10.57	6,120
6	2.52	54	2.50	50	2.53	56	9.14	4,690	11.15	6,700	10.69	6,240
8	-	-	-	-	2.55	60	10.00	5,550	10.75	6,300	10.70	6,250
10	-	-	-	-	2.57	65	11.23	6,780	10.42	5,970	10.67	6,220
N	2.51	52	2.50	50	3.10	250	12.12	7,680	10.09	5,640	10.60	6,150
2	-	-	-	-	3.25	325	12.45	8,040	9.78	5,330	10.49	6,040
4	-	-	-	-	3.52	466	12.63	8,210	9.59	5,140	10.35	5,900
6	2.50	50	2.50	50	3.74	587	12.61	8,210	9.56	5,110	10.20	5,750
8	-	-	-	-	4.62	1,120	12.48	8,080	9.66	5,210	10.04	5,590
10	-	-	-	-	5.25	1,540	12.36	7,950	9.84	5,390	9.88	5,430
M	2.51	52	2.51	52	6.45	2,380	12.17	7,740	10.11	5,660	9.69	5,240
	December 14		December 15		December 16		December 17		December 18		December 19	
2	9.51	5,060	-	-	-	-	-	-	-	-	-	-
4	9.32	4,870	7.37	3,100	6.24	2,230	5.62	1,790	5.05	1,400	4.79	1,230
6	9.16	4,710	-	-	-	-	-	-	-	-	-	-
8	8.98	4,530	7.16	2,930	6.09	2,120	5.58	1,770	4.98	1,360	4.71	1,180
10	8.79	4,340	-	-	-	-	-	-	-	-	-	-
N	8.63	4,200	6.98	2,780	5.97	2,040	5.49	1,700	5.01	1,380	4.63	1,130
2	8.45	4,040	-	-	-	-	-	-	-	-	-	-
4	8.30	3,900	6.78	2,620	5.87	1,970	5.37	1,620	5.04	1,400	4.57	1,090
6	8.12	3,740	-	-	-	-	-	-	-	-	-	-
8	7.97	3,600	6.57	2,460	5.79	1,910	5.26	1,540	4.99	1,360	4.52	1,060
10	7.82	3,470	-	-	-	-	-	-	-	-	-	-
M	7.64	3,310	6.39	2,330	5.69	1,840	5.17	1,480	4.89	1,300	4.46	1,020
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.41	986	-	-	-	-	-	-	-	-	-	-
6	-	-	4.12	812	3.91	686	3.64	532	3.43	416	3.29	345
8	4.35	950	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.29	914	4.06	776	3.88	668	3.60	510	3.45	428	3.28	340
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.29	914	-	-	-	-	-	-	-	-	-	-
6	-	-	4.04	764	3.83	638	3.60	510	3.40	400	3.23	315
8	4.25	890	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.20	860	3.97	722	3.76	598	3.49	450	3.31	355	3.20	300

Supplemental records.- Dec. 11, 5 p.m., 12.65 ft., 8,210 sec.-ft.

Pit River at Fall River Mills, Calif.

Location.- Lat. 41°00', long. 121°26', in NE¼ sec. 6, T. 36 N., R. 5 E., 0.8 mile below Fall River and town of Fall River Mills, Shasta County. Altitude, about 3,235 feet above mean sea level.

Drainage area.- 4,150 square miles (not including Goose Lake Basin).

Gage-height record.- Water-stage recorder graph except for period 10 a.m. Dec. 10 to 9 a.m. Dec. 13, when there was no record. Peak stage determined from floodmarks.

Stage-discharge relation.- Defined by current-meter measurements below 8,800 second-feet; extended to peak stage by A$\sqrt{d}$ method; verified by area-velocity study.

Maxima.- December 1937: Discharge, 28,600 second-feet about noon Dec. 12 (gage height, 11.8 feet, inside gage; 12.1 feet, outside gage, from floodmarks).

1921-November 1937: Discharge, 13,000 second-feet (revised) Mar. 28, 1928 (gage height, 7.89 feet), from rating curve for 1938.

Remarks.- Flood run-off slightly affected by artificial storage and diversion. Discharge for period of missing gage-height record, Dec. 10-12, determined from discharge hydrograph based on record for Pit River below Pit No. 4 dam. Discharge for period Dec. 11-12 includes about 800 second-feet from Fall River, which is usually diverted around station through Pit No. 1 power house. Most of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	63	322	618	11	95	10,500	402	21	740	1,730	778
2	62	290	660	12	100	24,500	380	22	653	1,520	882
3	62	266	748	13	96	19,700	365	23	1,380	1,330	1,250
4	60	243	667	14	95	11,300	360	24	1,420	1,120	1,090
5	62	229	618	15	100	8,900	365	25	1,190	850	890
6	63	209	554	16	146	6,200	434	26	930	818	802
7	67	191	518	17	440	4,100	606	27	695	740	732
8	84	179	476	18	250	3,040	906	28	536	653	674
9	71	179	446	19	243	2,480	1,080	29	440	599	640
10	77	750	424	20	680	2,050	842	30	360	573	600
								31		592	570
Mean monthly discharge, in second-feet									375	3,424	657
Run-off, in acre-feet									22,330	210,600	40,420

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	1.12	191	-	2,600	-	18,900	-	24,100
4	-	-	-	-	1.15	200	-	4,000	-	20,300	-	23,300
6	1.08	179	1.08	179	1.24	229	-	6,000	-	22,100	-	22,600
8	-	-	-	-	1.32	258	-	8,200	-	24,300	10.10	21,300
10	-	-	-	-	1.48	326	-	10,300	-	26,800	9.85	20,300
N	1.07	176	1.07	176	-	800	-	12,000	11.80	28,600	9.60	19,300
2	-	-	-	-	-	1,000	-	13,200	-	28,400	9.33	18,200
4	-	-	-	-	-	1,100	-	14,000	-	28,000	9.16	17,500
6	1.09	182	1.07	176	-	1,200	-	14,600	-	27,500	8.94	16,700
8	-	-	-	-	-	1,300	-	15,100	-	26,700	8.73	15,900
10	-	-	-	-	-	1,400	-	16,100	-	25,600	8.54	15,200
M	1.08	179	1.10	185	-	1,800	-	17,400	-	24,800	8.33	14,500
	December 14		December 15		December 16		December 17		December 18		December 19	
2	8.14	13,800	6.84	9,620	6.12	7,500	4.99	4,780	-	-	-	-
4	7.95	13,200	6.80	9,500	6.01	7,220	4.91	4,620	4.21	3,310	3.79	2,620
6	7.79	12,600	6.77	9,410	5.91	6,980	4.85	4,500	-	-	-	-
8	7.64	12,100	6.74	9,320	5.80	6,700	4.79	4,380	4.15	3,200	3.73	2,520
10	7.50	11,600	6.69	9,170	5.69	6,420	4.72	4,240	-	-	-	-
N	7.35	11,200	6.64	9,020	5.58	6,150	4.66	4,120	4.06	3,050	3.67	2,440
2	7.25	10,800	6.59	8,870	5.48	5,900	4.54	3,890	-	-	-	-
4	7.12	10,500	6.53	8,690	5.37	5,630	4.49	3,800	3.98	2,920	3.61	2,340
6	7.03	10,200	6.46	8,480	5.29	5,440	4.45	3,730	-	-	-	-
8	6.97	10,000	6.40	8,300	5.20	5,240	4.40	3,640	3.91	2,810	3.56	2,270
10	6.94	9,920	6.30	8,000	5.12	5,060	4.35	3,550	-	-	-	-
M	6.88	9,740	6.22	7,760	5.05	4,910	4.31	3,480	3.85	2,710	3.52	2,220
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	2.42	948
6	3.45	2,120	3.21	1,800	3.01	1,560	2.84	1,370	2.68	1,200	-	-
8	-	-	-	-	-	-	-	-	-	-	2.31	858
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.39	2,040	3.16	1,740	2.97	1,520	2.80	1,330	2.60	1,120	2.20	770
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	2.17	748
6	3.33	1,960	3.11	1,680	2.93	1,470	2.76	1,290	2.50	1,020	-	-
8	-	-	-	-	-	-	-	-	-	-	2.24	802
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.26	1,870	3.06	1,620	2.89	1,430	2.72	1,240	2.48	1,000	2.39	922

Pit River below Pit No. 4 dam, Calif.

Location.- Lat. 40°59', long. 121°47', in SW¼ sec. 17, T. 36 N., R. 2 E., 1 mile below Pit No. 4 dam, Shasta County, and 3 miles below Screwdriver Creek and Pit No. 3 power house. Altitude, about 2,345 feet above mean sea level.

Drainage area.- 4,860 square miles (not including Goose Lake Basin).

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 7,300 second-feet; extended to peak stage on basis of area-velocity study; verified by computation of flow over Pit No. 3 dam 8 miles above, plus flow through the diversion tunnel from Pit No. 3 dam, plus estimated inflow between the dam and the gage, and by comparison of peak discharge and total run-off of flood with records for other stations on Pit River. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 30,200 second-feet 6 p.m. Dec. 12 (gage height, 17.90 feet).

1927-November 1937: Discharge, 18,400 second-feet (revised) Apr. 8, 1935 (gage height, 14.7 feet), from rating curve extended above 7,300 second-feet on basis of area-velocity study for 1938.

Remarks.- Flood run-off slightly affected by artificial storage and diversion. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1,900	2,300	2,920	11	2,120	12,000	2,480	21	3,590	4,210	3,000
2	1,900	2,240	2,550	12	2,060	26,200	2,480	22	2,770	3,930	3,000
3	1,950	2,120	3,000	13	1,840	25,800	2,410	23	2,910	3,660	3,400
4	2,000	2,000	3,080	14	1,780	16,500	2,340	24	3,750	3,490	3,580
5	1,840	1,950	3,000	15	1,840	12,400	2,410	25	3,750	2,780	3,240
6	1,430	1,950	3,000	16	1,950	10,300	2,550	26	3,670	3,080	2,850
7	1,380	1,950	3,000	17	2,500	8,100	3,000	27	3,130	3,580	2,780
8	1,630	1,950	3,160	18	2,500	6,160	3,400	28	2,630	3,000	2,920
9	1,730	1,950	2,480	19	2,120	5,350	3,580	29	2,240	2,340	3,000
10	1,730	2,680	2,150	20	2,500	4,970	3,490	30	2,240	3,080	2,620
								31		3,000	2,620
Mean monthly discharge, in second-feet									2,313	5,968	2,887
Run-off, in acre-feet									137,600	367,000	177,500

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	7.17	1,920	8.63	3,960	15.18	20,000	17.65	29,200
4	7.17	1,920	7.18	1,930	7.18	1,930	8.60	3,910	15.47	21,000	17.57	28,900
6	-	-	-	-	7.18	1,930	11.90	10,400	16.00	22,900	17.51	28,600
8	7.22	1,970	7.22	1,970	7.19	1,940	10.95	8,180	16.45	24,500	17.40	28,200
10	-	-	-	-	7.73	2,600	11.55	9,520	16.95	26,400	17.25	27,600
N	7.24	1,990	7.23	1,980	7.75	2,630	12.55	12,000	17.37	28,100	17.00	26,600
2	-	-	-	-	7.77	2,660	13.12	13,600	17.65	29,200	16.70	25,400
4	7.18	1,930	7.23	1,980	7.78	2,670	14.50	17,700	17.82	29,900	16.32	24,000
6	-	-	-	-	8.26	3,370	14.25	17,000	17.90	30,200	16.13	23,400
8	7.22	1,970	7.23	1,980	8.50	3,750	14.60	18,000	17.85	30,000	15.90	22,600
10	-	-	-	-	8.58	3,880	14.85	18,900	17.80	29,800	15.62	21,600
M	7.22	1,970	7.17	1,920	8.61	3,930	15.10	19,800	17.73	29,500	15.39	20,800
	December 14		December 15		December 16		December 17		December 18		December 19	
2	15.15	19,900	13.15	13,600	12.21	11,100	10.62	7,260	9.71	5,370	9.19	4,380
4	14.86	18,900	13.03	13,300	12.19	11,100	10.72	7,480	9.78	5,510	9.12	4,250
6	14.65	18,200	12.96	13,100	12.14	10,900	10.91	7,900	9.89	5,730	9.08	4,170
8	14.45	17,600	12.88	12,900	12.07	10,700	11.25	8,700	10.20	6,370	9.32	4,630
10	14.28	17,000	12.82	12,700	12.00	10,600	11.50	9,300	10.29	6,560	9.78	5,510
N	14.10	16,500	12.76	12,500	12.21	11,100	11.40	9,060	10.20	6,370	9.99	5,930
2	13.92	16,000	12.70	12,400	12.10	10,800	11.20	8,580	10.15	6,260	9.86	5,670
4	13.81	15,600	12.40	11,600	12.00	10,600	11.01	8,120	10.10	6,160	9.56	5,080
6	13.60	15,000	12.30	11,300	11.83	10,100	10.91	7,900	10.35	6,680	10.05	6,060
8	13.45	14,600	12.57	12,000	11.38	9,010	10.81	7,680	10.63	7,290	10.19	6,350
10	13.34	14,200	12.29	11,300	11.10	8,340	10.45	6,900	10.45	6,900	10.35	6,680
M	13.24	13,900	12.21	11,100	10.62	7,260	9.95	5,850	9.59	5,140	9.67	5,290
	December 20		December 21		December 22		December 23		December 24		December 25	
2	9.21	4,420	9.04	4,100	8.35	2,920	8.26	2,790	8.02	2,440	8.37	2,960
4	8.94	3,910	8.84	3,730	8.45	3,080	8.22	2,730	7.85	2,220	7.91	2,290
6	9.14	4,290	8.65	3,400	8.50	3,160	8.30	2,850	7.86	2,230	7.78	2,120
8	9.57	5,100	9.19	4,380	8.98	3,980	8.60	3,320	8.50	3,160	7.90	2,280
10	10.10	6,160	9.65	5,260	9.34	4,670	8.98	3,980	8.93	3,890	8.08	2,520
N	9.80	5,550	9.36	4,700	9.17	4,340	9.05	4,120	9.05	4,120	8.22	2,730
2	9.70	5,350	9.12	4,250	9.08	4,170	9.02	4,060	9.05	4,120	8.29	2,840
4	9.42	4,820	8.98	3,980	8.99	4,000	8.95	3,930	9.00	4,020	8.33	2,900
6	9.67	5,290	9.19	4,380	9.36	4,700	9.19	4,380	8.95	3,930	8.35	2,920
8	9.85	5,650	9.33	4,650	9.40	4,780	9.30	4,590	9.35	4,680	8.53	3,210
10	9.75	5,450	8.92	3,880	9.00	4,020	8.94	3,910	9.17	4,340	8.60	3,320
M	9.37	4,720	8.55	3,240	8.52	3,190	8.55	3,240	8.82	3,700	8.52	3,190

Pit River at Big Bend, Calif.

Location.- Lat. 41°01', long. 121°55', in sec. 31, T. 37 N., R. 1 E., at Big Bend, Shasta County. Nelson Creek enters half a mile above and Kosk Creek 1 mile below station. Altitude, about 1,700 feet above mean sea level.
Drainage area.- 4,920 square miles (not including Goose Lake Basin).
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 10,800 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations on Pit River.
Maxima.- December 1937: Discharge, 34,200 second-feet 5 p.m. Dec. 12 (gage height, 16.26 feet).
1910-November 1937: Discharge, 20,400 second-feet (revised) Apr. 8, 1935 (gage height, 13.96 feet), from rating curve for 1938.
Remarks.- Flood run-off slightly affected by artificial storage and diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1,830	2,510	3,170	11	2,290	17,000	2,670	21	6,280	4,730	3,440
2	1,830	2,440	2,750	12	2,220	30,300	2,750	22	4,520	4,210	3,350
3	1,950	2,290	3,350	13	1,950	27,900	2,590	23	4,310	3,910	3,720
4	1,950	2,220	3,350	14	1,950	18,400	2,590	24	5,390	3,820	4,010
5	1,830	2,080	3,260	15	1,950	14,100	2,670	25	4,840	3,000	3,620
6	1,450	2,080	3,170	16	2,220	11,800	2,830	26	4,520	3,440	3,170
7	1,390	2,080	3,260	17	2,830	8,770	3,350	27	3,720	3,910	3,080
8	1,660	2,080	3,350	18	2,830	6,970	3,820	28	3,080	3,260	3,350
9	1,770	2,150	2,830	19	2,440	5,880	4,010	29	2,510	2,590	3,350
10	1,830	4,290	2,360	20	4,840	5,630	3,910	30	2,440	3,350	2,920
								31		3,350	2,920
Mean monthly discharge, in second-feet									2,821	6,792	3,193
Run-off, in acre-feet									167,800	417,600	196,300

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	8.22	2,250	10.81	7,880	14.75	24,600	15.97	32,000
4	8.09	2,070	8.09	2,070	8.28	2,330	11.64	10,500	14.99	26,000	15.83	21,100
6	-	-	-	-	8.38	2,480	12.30	12,900	15.23	27,500	15.65	30,000
8	8.10	2,080	8.10	2,080	8.38	2,480	12.53	13,800	15.53	29,300	15.55	29,400
10	-	-	-	-	8.76	3,100	12.98	15,600	15.77	30,700	15.41	28,600
N	8.15	2,150	8.16	2,160	9.41	4,330	13.40	17,500	15.97	32,000	15.26	22,700
2	-	-	-	-	9.36	4,230	13.75	19,200	16.10	32,800	15.12	26,800
4	8.12	2,110	8.17	2,180	9.59	4,710	14.25	21,800	16.20	33,500	14.96	25,900
6	-	-	-	-	9.92	5,440	14.20	21,500	16.20	33,500	14.85	25,200
8	8.12	2,110	8.20	2,220	10.40	6,690	14.42	22,700	16.13	33,000	14.71	24,400
10	-	-	-	-	10.91	8,180	14.57	23,500	16.12	33,000	14.60	23,700
M	8.13	2,120	8.22	2,250	10.80	7,850	14.65	24,000	16.05	32,500	14.43	22,800
	December 14		December 15		December 16		December 17		December 18		December 19	
2	14.26	21,800	12.89	15,300	12.20	12,600	10.93	8,240	10.14	5,980	9.61	4,750
4	14.09	20,900	12.80	14,900	12.17	12,400	11.03	8,550	10.24	6,250	9.55	4,620
6	13.91	20,000	12.75	14,700	13.13	12,300	11.14	8,900	10.31	6,440	9.58	4,690
8	13.78	19,300	12.70	14,500	12.08	12,100	11.40	9,730	10.62	7,320	9.90	5,390
10	13.63	18,600	12.66	14,300	12.03	11,900	11.57	10,300	10.60	7,260	10.33	6,490
N	13.45	17,700	12.61	14,100	12.21	12,600	11.57	10,300	10.55	7,120	10.42	6,750
2	13.39	17,500	12.58	14,000	12.08	12,100	11.37	9,630	10.50	6,970	10.18	6,090
4	13.29	17,000	12.44	13,500	12.04	12,000	11.30	9,410	10.46	6,860	10.01	5,660
6	13.19	16,600	12.27	12,800	11.91	11,500	11.20	9,090	10.80	7,850	10.15	6,010
8	13.08	16,100	12.54	13,900	11.73	10,900	11.03	8,550	10.86	8,030	10.57	7,170
10	13.01	15,700	12.27	12,800	11.41	9,760	10.58	7,200	10.66	7,430	10.67	7,460
M	12.95	15,500	12.23	12,700	10.90	8,150	10.20	6,140	9.88	5,340	10.27	6,330
	December 20		December 21		December 22		December 23		December 24		December 25	
2	9.78	5,120	9.50	4,520	8.77	3,120	8.66	2,930	8.60	2,830	8.51	2,690
4	9.47	4,460	9.48	4,480	8.92	3,390	8.60	2,830	8.19	2,210	8.15	2,150
6	9.51	4,540	9.11	3,740	8.95	3,440	8.70	3,000	8.21	2,230	8.17	2,180
8	9.95	5,510	9.17	3,850	9.07	3,660	8.83	3,220	8.48	2,640	8.47	2,620
10	10.45	6,830	10.13	5,960	9.81	5,180	9.41	4,330	9.46	4,440	8.66	2,930
N	10.24	6,250	9.84	5,250	9.69	4,920	9.54	4,600	9.57	4,670	8.75	3,080
2	10.12	5,930	9.73	5,010	9.56	4,650	9.49	4,500	9.52	4,560	8.80	3,170
4	9.88	5,340	9.40	4,310	9.48	4,480	9.45	4,420	9.48	4,480	8.83	3,220
6	9.88	5,340	9.53	4,580	9.55	4,620	9.40	4,310	9.42	4,350	8.85	3,260
8	10.26	6,300	9.92	5,440	9.97	5,560	9.86	5,300	9.84	5,250	9.10	3,720
10	10.18	6,090	9.50	4,520	9.54	4,600	9.55	4,620	9.48	4,480	9.11	3,740
M	9.89	5,370	9.12	3,760	9.12	3,760	9.29	4,090	9.14	3,800	8.97	3,480

Supplemental records.- Dec. 12, 5 p.m., 16.26 ft., 34,200 sec.-ft.

Pit River near Ydalpom, Calif.

Location.- Lat. 40°46', long. 122°14', in NW¼ sec. 32, T. 34 N., R. 3 W., at Silverthorne Ferry, 1½ miles southwest of Ydalpom, Shasta County. Squaw Creek enters half a mile above and McCloud River 4 miles below station. Altitude, about 735 feet above mean sea level.

Drainage area.- 5,350 square miles (not including Goose Lake Basin).

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 21,000 second-feet; extended to peak stage on basis of area-velocity study and $A\sqrt{d}$ method; verified by comparison of peak discharge and total run-off of flood with record of Sacramento River near Kennet..

Maxima.- December 1937: Discharge, 65,000 second-feet 11 p.m. Dec. 10 (gage height, 24.20 feet).

1910-November 1937: Discharge, about 47,000 second-feet Dec. 31, 1913 (gage height, about 20.7 feet, from floodmarks, present datum), from rating curve extended above 27,200 second-feet.

Remarks.- Flood run-off slightly affected by artificial storage and diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2,000	3,600	4,610	11	3,520	41,900	3,600	21	11,900	6,710	6,530
2	2,000	3,380	4,130	12	3,100	40,400	3,670	22	7,090	5,990	5,990
3	2,060	3,240	4,210	13	2,520	34,300	3,520	23	10,600	5,630	5,990
4	2,160	3,100	4,610	14	3,970	24,200	3,450	24	12,400	5,630	5,990
5	2,110	2,900	4,450	15	3,670	18,600	4,050	25	8,060	4,950	5,460
6	1,690	2,840	4,290	16	5,220	15,400	4,610	26	6,710	4,780	4,950
7	1,540	2,840	4,290	17	6,170	11,900	9,560	27	5,630	5,120	4,780
8	1,740	2,780	4,370	18	4,610	9,340	7,660	28	4,610	4,610	5,120
9	1,890	3,100	4,210	19	4,610	8,060	7,860	29	3,900	4,210	5,120
10	2,220	24,900	3,240	20	21,300	7,660	7,860	30	3,600	4,450	4,780
								31		4,780	5,990
Mean monthly discharge, in second-feet									5,087	10,360	5,127
Run-off, in acre-feet									302,700	637,300	315,300

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	5.35	2,780	7.50	6,170	21.25	51,500	18.88	41,200	18.30	38,800
4	5.37	2,800	5.35	2,780	8.05	7,180	19.47	43,700	18.98	41,600	18.11	38,000
6	-	-	5.36	2,790	8.67	8,400	18.27	38,600	18.78	40,800	17.92	37,200
8	5.37	2,800	5.35	2,780	9.78	10,900	18.31	38,800	18.58	39,900	17.71	36,300
10	-	-	5.31	2,720	12.20	17,400	17.81	36,700	18.51	39,600	17.50	35,500
N	5.33	2,750	5.34	2,760	14.20	23,500	17.78	36,600	18.60	40,000	17.26	34,500
2	-	-	5.40	2,840	15.72	28,700	18.17	38,200	18.73	40,600	17.01	33,500
4	5.37	2,800	5.52	3,000	16.38	31,100	19.18	42,500	18.77	40,700	16.79	32,700
6	-	-	5.70	3,240	17.00	33,500	19.36	43,200	18.78	40,800	16.54	31,700
8	5.37	2,800	5.89	3,510	17.87	37,000	18.96	41,500	18.73	40,600	16.29	30,800
10	-	-	6.32	4,160	22.85	58,800	18.54	39,800	18.64	40,200	16.04	29,800
M	5.32	2,740	6.91	5,140	23.50	61,800	18.66	40,300	18.48	39,500	15.79	28,900
	December 14		December 15		December 16		December 17		December 18		December 19	
2	15.55	28,100	13.13	20,200	11.88	16,500	10.57	12,900	9.75	10,900	9.43	10,100
4	15.29	27,200	12.99	19,800	11.65	15,800	10.22	12,000	9.25	9,670	9.20	9,560
6	15.08	26,500	12.87	19,400	11.59	15,700	9.77	10,900	8.82	8,720	8.37	7,800
8	14.84	25,700	12.73	19,000	11.55	15,500	9.75	10,900	8.65	8,360	7.92	6,940
10	14.58	24,800	12.63	18,700	11.50	15,400	9.85	11,100	8.74	8,550	7.93	6,960
N	14.37	24,100	12.53	18,400	11.43	15,200	10.04	11,600	8.82	8,720	7.80	6,710
2	14.16	23,400	12.43	18,100	11.33	14,900	10.40	12,400	9.17	9,490	8.02	7,130
4	13.96	22,800	12.34	17,800	11.28	14,800	10.56	12,900	9.15	9,450	8.58	8,220
6	13.75	22,100	12.27	17,600	11.35	15,000	10.38	12,400	9.08	9,300	8.68	8,420
8	13.57	21,500	12.17	17,300	11.33	14,900	10.19	11,900	9.01	9,140	8.52	8,100
10	13.36	20,900	11.80	16,200	11.17	14,500	10.04	11,600	8.95	9,010	8.23	7,530
M	13.23	20,500	11.92	16,600	11.00	14,000	9.89	11,200	9.25	9,670	8.68	8,420
	December 20		December 21		December 22		December 23		December 24		December 25	
2	8.90	8,900	8.40	7,860	7.90	6,900	7.93	6,960	7.76	6,640	7.80	6,710
4	9.00	9,120	8.30	7,660	7.47	6,120	7.49	6,150	7.45	6,080	7.41	6,010
6	8.38	7,820	7.95	7,000	7.11	5,480	7.06	5,390	7.14	5,530	7.06	5,390
8	7.92	6,940	7.59	6,330	6.80	4,950	6.68	4,750	6.60	4,610	6.51	4,470
10	7.61	6,370	7.50	6,170	6.88	5,090	6.55	4,530	6.25	4,050	6.16	3,910
N	7.70	6,530	7.18	5,600	6.93	5,170	6.61	4,630	6.22	4,000	6.11	3,840
2	8.20	7,470	7.29	5,790	7.12	5,490	6.74	4,850	6.46	4,390	6.33	4,180
4	8.72	8,500	8.22	7,510	7.88	6,860	7.33	5,860	7.48	6,130	6.55	4,530
6	8.40	7,860	7.90	6,900	7.70	6,530	7.46	6,100	7.62	6,390	6.64	4,680
8	8.27	7,600	7.76	6,640	7.58	6,310	7.42	6,030	7.58	6,310	6.69	4,760
10	7.98	7,050	7.44	6,060	7.47	6,120	7.35	5,900	7.51	6,190	6.71	4,800
M	8.18	7,430	7.65	6,440	7.67	6,480	7.34	5,880	7.55	6,260	6.73	4,830

Supplemental records.- Dec. 10, 11 p.m., 24.20 ft., 65,000 sec.-ft.

South Fork of Pit River near Likely, Calif.

Location.- Lat. 41°14', long. 120°25', in NE¼ sec. 11, T. 39 N., R. 13 E., 1.3 mile below West Valley Creek and 3.5 miles east of Likely, Modoc County. Altitude, about 4,580 feet above mean sea level.
Drainage area.- 248 square miles (revised).
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Affected by ice for periods Jan. 6-10, 24-26. Defined by current-meter measurements below 600 second-feet; extended to peak stage. Shifting-control method used for period Dec. 12-29.
Maxima.- December 1937: Discharge, 746 second-feet 3 a.m. Dec. 11 (gage height, 4.86 feet).
1928-November 1937: Discharge, 1,060 second-feet Apr. 27, 1932 (gage height, 5.55 feet), from rating curve extended above 550 second-feet.
Remarks.- Flood run-off affected by artificial storage in West Valley Reservoir on West Valley Creek, which stored 7,200 acre-feet during storm period Dec. 10-15. Discharge for periods of ice effect computed on basis of weather records and record for Pit River near Canby.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	14	13	40	11	16	629	31	21	25	53	33
2	14	11	45	12	13	428	30	22	14	46	40
3	14	11	43	13	13	214	30	23	19	47	38
4	14	13	39	14	12	151	31	24	20	46	38
5	13	16	36	15	11	132	34	25	12	40	36
6	14	19	32	16	24	95	33	26	8	44	36
7	14	22	31	17	40	85	37	27	6.5	40	34
8	14	21	31	18	23	74	38	28	8	38	33
9	12	16	31	19	15	61	33	29	12	37	33
10	12	121	31	20	19	55	31	30	14	40	31
								31		39	33
Mean monthly discharge, in second-feet									15.3	85.7	34.6
Run-off, in acre-feet									911	5,270	2,130

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	December 8 Feet	Sec.ft.	December 9 Feet	Sec.ft.	December 10 Feet	Sec.ft.	December 11 Feet	Sec.ft.	December 12 Feet	Sec.ft.	December 13 Feet	Sec.ft.
2	1.90	21	1.82	17	1.84	18	4.84	742	4.29	524	3.51	278
4	1.94	23	1.81	16	1.85	18	4.76	710	4.24	507	3.43	256
6	1.98	26	1.80	16	1.88	20	4.63	659	4.19	490	3.37	240
8	1.95	24	1.80	16	1.88	20	4.38	567	4.15	478	3.31	225
10	1.87	20	1.80	16	1.91	22	4.29	535	4.08	454	3.26	212
N	1.92	22	1.80	16	2.02	29	4.41	578	4.01	432	3.21	199
2	1.86	19	1.80	16	2.12	37	4.62	656	3.94	409	3.16	187
4	1.90	21	1.81	16	2.82	123	4.53	621	3.88	390	3.15	185
6	1.86	19	1.81	16	2.98	153	4.51	614	3.81	368	3.14	182
8	1.82	17	1.82	17	3.50	284	4.41	578	3.75	350	3.15	185
10	1.81	16	1.82	17	3.90	406	4.37	563	3.67	326	3.16	187
M	1.83	18	1.83	18	4.52	618	4.33	549	3.59	302	3.15	185
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.09	171	2.90	132	2.74	106	2.63	89	2.57	81	2.47	69
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.02	155	2.91	134	2.67	95	2.59	84	2.53	76	2.40	61
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.96	143	2.92	135	2.61	86	2.56	80	2.48	70	2.36	57
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.95	141	2.89	130	2.62	88	2.59	84	2.45	66	2.34	55
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.94	139	2.84	122	2.64	90	2.62	88	2.45	66	2.36	57
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.93	137	2.79	114	2.67	95	2.61	86	2.51	74	2.41	62
	December 20		December 21		December 22		December 23		December 24		December 25	
2	2.41	62	2.36	57	2.31	52	2.25	46	2.22	43	2.17	39
4	2.39	60	2.34	55	2.27	48	2.25	46	2.25	46	2.17	39
6	2.38	59	2.32	53	2.24	45	2.26	47	2.28	49	2.21	42
8	2.37	58	2.30	51	2.25	46	2.27	48	2.31	52	2.25	46
10	2.33	54	2.29	50	2.22	43	2.27	48	2.31	52	2.24	45
N	2.28	49	2.32	53	2.21	42	2.26	47	2.23	44	2.18	40
2	2.35	56	2.33	54	2.21	42	2.24	45	2.26	47	2.17	39
4	2.28	49	2.27	48	2.23	44	2.24	45	2.22	43	2.17	39
6	2.28	49	2.27	48	2.24	45	2.23	44	2.20	41	2.18	40
8	2.30	51	2.29	50	2.25	46	2.29	50	2.19	40	2.19	40
10	2.34	55	2.31	52	2.27	48	2.23	44	2.17	39	2.19	40
M	2.36	57	2.31	52	2.27	48	2.23	44	2.17	39	2.19	40

Supplemental records.- Dec. 11, 3 a.m., 4.86 ft., 746 sec.-ft. Dec. 25, 10:30 a.m., 2.17 ft., 39 sec.-ft.

Hat Creek near Hat Creek, Calif.

Location.- Lat. 40°41', long. 121°25', in SE¼ sec. 28, T. 33 N., R. 5 E., 5 miles below Big Springs and 11 miles southeast of Hat Creek, Shasta County. Altitude, about 4,500 feet above mean sea level.

Drainage area.- 155 square miles.

Gage-height record.- Water-stage recorder graph except for period 6 a.m. Jan. 6 to Jan. 31, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 160 second-feet; extended to peak stage on basis of slope-area computation of flood flow. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, about 2,500 second-feet 2 a.m. Dec. 11 (gage height, 7.75 feet).

1926-November 1937: Discharge, 450 second-feet June 16, 1937 (gage height, 4.12 feet).

Remarks.- Flood run-off not appreciably affected by artificial storage or diversion. Discharge for period of missing gage-height record determined from discharge graph based on range of stage shown on recorder graph and record for South Fork of Pit River near Likely.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	85	104	118	11	91	1,340	112	21	186	120	113
2	85	103	120	12	86	331	112	22	135	120	116
3	85	101	118	13	88	206	112	23	188	118	115
4	85	101	118	14	88	176	112	24	135	117	115
5	86	101	117	15	86	163	114	25	121	117	114
6	88	101	115	16	94	151	114	26	115	120	114
7	86	100	114	17	100	145	116	27	110	118	113
8	85	100	113	18	91	135	116	28	107	116	113
9	84	102	112	19	101	130	115	29	105	116	112
10	86	964	112	20	394	123	114	30	104	118	112
								31		117	113
Mean monthly discharge, in second-feet									113	196	114
Run-off, in acre-feet									6,700	12,050	7,030

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.61	115	7.75	2,500	3.83	467	-	-
4	-	-	2.48	101	2.86	147	7.00	2,000	3.66	417	2.90	223
6	2.46	99	-	-	3.30	220	6.52	1,710	3.53	380	-	-
8	-	-	2.47	100	3.85	340	6.05	1,450	3.41	347	2.85	212
10	-	-	-	-	4.27	453	6.10	1,480	3.33	326	-	-
N	2.44	96	2.47	100	4.62	567	5.87	1,350	3.27	310	2.80	202
2	-	-	-	-	5.81	1,100	5.77	1,300	3.22	297	-	-
4	-	-	2.48	101	6.50	1,520	5.46	1,140	3.18	287	2.79	200
6	2.51	104	-	-	7.15	1,980	5.00	918	3.13	275	-	-
8	-	-	2.50	103	7.36	2,150	4.43	675	3.08	263	2.75	192
10	-	-	-	-	7.20	2,020	4.12	561	3.02	250	-	-
M	2.48	101	2.56	110	7.48	2,240	3.98	514	2.97	238	2.72	187
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.69	181	-	-	-	-	-	-	-	-	-	-
6	-	-	2.60	165	2.54	155	2.49	146	2.44	138	2.40	132
8	2.66	176	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.65	174	2.60	165	2.52	151	2.48	145	2.42	135	2.39	130
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.64	172	-	-	-	-	-	-	-	-	-	-
6	-	-	2.58	162	2.51	150	2.47	143	2.42	135	2.37	128
8	2.63	170	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.62	169	2.56	158	2.50	148	2.46	142	2.41	134	2.37	128
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.35	124	2.32	120	-	-	2.30	117	-	-	2.28	114
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.34	123	2.32	120	2.32	120	2.31	118	2.30	117	2.27	113
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.34	123	2.34	123	-	-	2.32	120	-	-	2.32	120
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.32	120	2.32	120	2.32	120	2.31	118	2.29	116	2.30	117

Supplemental records.- Dec. 10, 11 p.m., 6.98 ft., 1,860 sec.-ft. Dec. 11, 1 a.m., 7.40 ft., 2,180 sec.-ft.; 3 a.m., 7.04 ft., 2,020 sec.-ft.

McCloud River near McCloud, Calif.

Location.- Lat. 41°11', long. 122°04', in NE¼ sec. 34, T. 39 N., R. 2 W., half a mile below Angel Creek and 6 miles southeast of McCloud, Siskiyou County. Altitude, about 2,750 feet above mean sea level.

Drainage area.- 388 square miles.

Gage-height record.- Water-stage recorder graph except for period 10 p.m. Dec. 1 to 2 p.m. Dec. 22, when there was no record. Peak stage obtained from floodmark in well.

Stage-discharge relation.- Defined by current-meter measurements below 2,400 second-feet; extended to peak stage by averaging discharges obtained from extensions by area-velocity study and A$\sqrt{d}$ method. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 4,600 second-feet probably Dec. 10 (gage height, 5.4 feet).

1931-November 1937: Discharge, 2,760 second-feet (revised) Feb. 22, 1936 (gage height, 3.62 feet), from rating curve extended above 1,200 second-feet on basis of area-velocity and A$\sqrt{d}$ studies in 1938.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge during period of missing gage-height record determined from discharge hydrograph based on record of McCloud River at Baird.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	587	738	721	11	706	3,500	671	21	1,200	850	677
2	587	730	721	12	651	2,500	665	22	968	825	677
3	587	720	714	13	639	1,700	665	23	1,320	806	677
4	587	700	708	14	682	1,400	671	24	1,360	799	671
5	587	690	702	15	694	1,200	689	25	1,080	773	671
6	587	680	689	16	757	1,100	695	26	954	766	665
7	587	670	689	17	795	1,030	695	27	880	754	665
8	581	660	683	18	757	970	695	28	821	740	671
9	581	680	677	19	744	920	695	29	789	728	671
10	639	2,500	671	20	1,200	880	683	30	763	728	671
								31		728	683
Mean monthly discharge, in second-feet									789	1,047	684
Run-off, in acre-feet									46,950	64,390	42,050

McCloud River at Baird, Calif.

Location.- Lat. 40°47', long. 122°18', in SE¼ sec. 22, T. 34 N., R. 4 W., half a mile below Baird post office, Shasta County, and 1½ miles above junction with Pit River. Altitude, about 700 feet above mean sea level.
Drainage area.- 668 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 9,200 second-feet; extended to peak stage on basis of area-velocity study and comparison with extension of rating for former station 1 mile upstream; verified by comparison of peak discharge and total run-off of flood with records at other stations in upper Sacramento River Basin.
Maxima.- December 1937: Discharge, 32,200 second-feet 11 p.m. Dec. 10 (gage height, 23.35 feet, possibly affected by backwater from Pit River).
1910-November 1937: Discharge observed, 27,600 second-feet Feb. 25, 1917 (gage height, 14.3 feet, from nonrecording gage at former site and datum, 1 mile upstream).
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	750	1,840	1,630	11	2,450	22,100	1,420	21	6,450	2,210	2,790
2	750	1,740	1,700	12	1,570	12,200	1,400	22	4,080	2,130	2,530
3	750	1,630	1,660	13	1,340	7,010	1,400	23	8,960	2,050	2,290
4	750	1,540	1,630	14	2,610	5,020	1,400	24	8,750	1,980	2,130
5	750	1,480	1,600	15	2,050	4,080	1,630	25	5,020	1,910	2,050
6	750	1,420	1,570	16	3,350	3,450	2,050	26	3,550	1,840	1,980
7	750	1,400	1,540	17	3,970	3,060	3,970	27	2,880	1,770	1,910
8	750	1,370	1,510	18	2,610	2,790	3,450	28	2,450	1,740	1,910
9	750	1,420	1,480	19	2,640	2,530	3,350	29	2,210	1,700	1,910
10	1,420	12,200	1,450	20	11,100	2,370	3,150	30	1,980	1,700	1,840
								31		1,660	3,610
Mean monthly discharge, in second-feet									2,940	3,592	2,063
Run-off, in acre-feet									174,900	220,800	126,800

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.80	1,340	4.22	2,310	20.80	27,500	14.66	16,700	9.35	8,380
4	2.86	1,370	2.80	1,340	4.64	2,650	18.30	23,000	13.78	15,200	9.17	8,100
6	-	-	2.79	1,330	5.21	3,160	17.13	20,900	13.11	14,200	8.95	7,780
8	2.85	1,370	2.78	1,330	5.90	3,860	17.15	21,000	12.56	13,300	8.75	7,500
10	-	-	2.79	1,330	7.40	5,670	17.02	20,700	12.03	12,400	8.55	7,220
N	2.84	1,360	2.82	1,350	9.10	8,000	17.26	21,200	11.46	11,500	8.36	6,950
2	-	-	2.88	1,380	11.15	11,100	17.85	22,200	11.00	10,800	8.18	6,700
4	2.82	1,350	2.98	1,440	12.75	13,600	18.08	22,600	10.60	10,200	8.02	6,480
6	-	-	3.11	1,520	16.35	19,600	17.64	21,900	10.30	9,800	7.86	6,270
8	2.81	1,350	3.22	1,580	21.00	27,900	16.86	20,500	10.06	9,440	7.70	6,060
10	-	-	3.40	1,700	22.75	31,000	15.90	18,800	9.80	9,050	7.57	5,890
M	2.80	1,340	3.72	1,920	23.00	31,500	15.20	17,600	9.53	8,640	7.45	5,740
	December 14		December 15		December 16		December 17		December 18		December 19	
2	7.33	5,580	-	-	-	-	-	-	-	-	-	-
4	7.21	5,420	6.29	4,290	5.66	3,610	5.21	3,160	-	-	-	-
6	7.12	5,310	-	-	-	-	-	-	4.83	2,820	4.55	2,570
8	7.04	5,200	6.17	4,160	5.59	3,540	5.15	3,100	-	-	-	-
10	6.95	5,080	-	-	-	-	-	-	-	-	-	-
N	6.89	5,010	6.06	4,040	5.51	3,460	5.09	3,050	4.75	2,740	4.48	2,510
2	6.76	4,850	-	-	-	-	-	-	-	-	-	-
4	6.67	4,740	5.95	3,920	5.43	3,380	5.04	3,010	-	-	-	-
6	6.63	4,700	-	-	-	-	-	-	4.68	2,680	4.43	2,470
8	6.52	4,560	5.86	3,820	5.36	3,310	4.99	2,960	-	-	-	-
10	6.49	4,530	-	-	-	-	-	-	-	-	-	-
M	6.41	4,430	5.75	3,700	5.29	3,240	4.92	2,900	4.62	2,630	4.37	2,430
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	3.77	1,960	-	-
6	4.32	2,390	4.13	2,230	4.00	2,130	3.90	2,050	-	-	3.70	1,910
8	-	-	-	-	-	-	-	-	3.86	2,020	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.27	2,350	4.09	2,200	3.97	2,110	3.86	2,020	3.91	2,060	3.67	1,890
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	3.91	2,060	-	-
6	4.22	2,310	4.04	2,160	3.96	2,100	3.82	1,990	-	-	3.64	1,870
8	-	-	-	-	-	-	-	-	3.80	1,980	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.17	2,270	4.02	2,150	3.94	2,080	3.78	1,970	3.76	1,950	3.62	1,850

Supplemental records.- Dec. 10, 11 p.m., 23.35 ft., 32,200 sec.-ft.

Mill Creek near Los Molinos, Calif.

Location.- Lat. 40°03'20", long. 122°01'15", in N½ sec. 6, T. 25 N., R. 1 W., 5 miles above mouth and 5 miles northeast of Los Molinos, Tehama County. Altitude, about 420 feet above mean sea level.
Drainage area.- 134 square miles (revised).
Gage-height record.- Water-stage recorder graph except for periods midnight Dec. 10 to 4 p.m. Dec. 21, 7 a.m. Dec. 29 to 11:30 a.m. Jan. 21. Stage graph for periods Dec. 11-17, 21, 29, and Jan. 21 based on floodmarks, partial recorder graph, and a few outside staff-gage readings. Peak stage obtained from floodmarks on banks.
Stage-discharge relation.- Defined by current-meter measurements below 3,900 second-feet; extended to peak stage on basis of slope-area computation of flood flow; verified by area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 23,000 second-feet about 2 a.m. Dec. 11 (gage height, 23.4 feet from floodmarks).
1929-November 1937: Discharge, 6,000 second-feet Dec. 15, 1929 (gage-height, 10.05 feet), from rating curve extended above 3,900 second-feet.
Remarks.- Flood flow not affected by artificial storage or diversion. Discharge for periods of missing gage-height record, Dec. 18-20 and Dec. 30 to Jan. 20, determined from range of stage indicated on recorder graph, partial recorder graph, a few outside staff-gage readings, weather records, and comparison with records for nearby streams.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	90	225	250	11	420	12,300	220	21	1,190	324	305
2	89	208	280	12	222	4,050	210	22	593	314	305
3	86	196	300	13	148	1,920	210	23	1,320	314	308
4	85	185	290	14	233	1,020	200	24	1,260	292	279
5	85	172	290	15	231	655	400	25	662	286	264
6	89	167	270	16	928	530	500	26	468	270	255
7	104	165	260	17	1,130	470	900	27	364	258	246
8	91	162	250	18	400	460	600	28	308	246	246
9	91	210	240	19	440	410	500	29	269	246	243
10	103	5,660	220	20	2,640	370	400	30	244	250	236
								31		250	944
Mean monthly discharge, in second-feet									479	1,051	336
Run-off, in acre-feet									28,530	64,630	20,670

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.50	158	3.93	802	23.4	23,000	-	-	-	-
4	-	-	1.50	158	4.00	830	22.0	21,000	-	-	-	-
6	-	-	1.50	158	4.09	866	19.0	16,900	9.0	4,750	6.3	2,240
8	-	-	1.49	156	4.90	1,210	16.4	13,500	-	-	-	-
10	-	-	1.49	156	5.95	1,740	15.2	12,000	-	-	-	-
N	1.52	162	1.49	156	8.10	3,450	14.0	10,400	8.2	3,950	5.8	1,850
2	-		1.50	158	11.85	7,510	12.8	8,960	-	-	-	-
4	-	-	1.56	169	11.85	7,510	12.2	8,240	-	-	-	-
6	-	-	1.65	185	13.50	9,510	11.7	7,650	7.4	3,190	5.4	1,570
8	-	-	1.97	244	14.00	10,200	11.1	6,990	-	-	-	-
10	-	-	2.85	440	17.10	14,200	10.7	6,550	-	-	-	-
M	1.50	158	3.75	732	20.00	18,200	10.2	6,000	6.8	2,650	5.0	1,330
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	4.7	1,170	3.7	700	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.4	1,020	3.6	655	3.3	530	3.15	470	-	*460	-	*410
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	4.1	880	3.5	610	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.9	790	3.4	570	-	-	-	-	-	-	-	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	2.74	321	2.74	321	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	-	*370	-	*324	2.73	318	2.71	311	2.65	292	2.63	286
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	2.72	314	2.67	298	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	2.78	334	2.66	295	2.65	292	2.60	276

Supplemental records.- Dec. 10, 3 p.m., 12.30 ft., 8,050 sec.-ft.
*Mean for the day.

Elder Creek near Henleyville, Calif.

Location.- Lat. 40°02', long. 122°15', in SE$\frac{1}{4}$ sec. 10, T. 25 N., R. 4 W., at bridge on Paskenta-Red Bluff road, 1.2 miles above Spring Branch and 6 miles northeast of Henleyville, Tehama County. Altitude, about 310 feet above mean sea level.
Drainage area.- 147 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,900 second-feet; extended to peak stage on basis of area-velocity study and $A\sqrt{d}$ method.
Maxima.- December 1937: Discharge, 10,700 second-feet 10 p.m. Dec. 10 (gage height, 9.7 feet, from floodmarks on right bank; 10.4 feet, from gage in well at bridge pier in midstream).
1930-November 1937: Discharge, about 6,300 second-feet Jan. 1, 1934 (gage height, 7.26 feet, in well; outside gage height very nearly the same), from rating curve extended above 1,000 second-feet on basis of slope-area determination of flood flow.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	48	70	11	54	4,530	60	21	575	109	132
2	0	44	95	12	32	1,300	58	22	240	104	129
3	0	41	95	13	14	545	58	23	220	98	126
4	0	38	82	14	42	337	58	24	162	95	115
5	0	35	77	15	31	253	90	25	126	90	107
6	0	34	74	16	356	200	172	26	101	84	101
7	0	32	70	17	584	170	1,180	27	82	82	95
8	0	31	67	18	109	146	253	28	70	77	98
9	0	71	62	19	971	129	205	29	62	74	107
10	0	4,080	60	20	4,270	115	158	30	54	72	93
								31		72	1,100
Mean monthly discharge, in second-feet									272	424	169
Run-off, in acre-feet									16,180	26,050	10,410

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.52	31	4.06	1,320	7.10	6,830	-	-	-	-
4	-	-	2.52	31	3.97	1,130	6.60	6,130	4.26	1,750	3.67	656
6	-	-	2.52	31	4.03	1,250	6.45	5,900	-	-	-	-
8	-	-	2.52	31	4.35	1,950	6.55	6,060	4.15	1,510	3.61	586
10	-	-	2.52	31	4.78	2,920	6.00	5,200	-	-	-	-
N	2.52	31	2.53	32	5.00	3,380	5.48	4,310	4.03	1,250	3.55	525
2	-	-	2.56	36	5.70	4,710	5.15	3,680	-	-	-	-
4	-	-	2.59	41	6.30	5,680	4.95	3,280	3.92	1,040	3.51	485
6	-	-	2.62	46	6.60	6,130	4.78	2,920	-	-	-	-
8	-	-	2.68	58	6.75	6,340	4.65	2,630	3.83	881	3.47	448
10	-	-	3.10	190	10.40	10,700	4.50	2,290	-	-	-	-
M	2.52	31	3.72	718	8.00	8,010	4.43	2,130	3.73	732	3.43	412
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-		
4	-	-	-	-	-	-	-	-	-	-		
6	3.37	361	3.24	266	3.14	210	-	-	-	-		
8	-	-	-	-	-	-	-	-	-	-		
10	-	-	-	-	-	-	-	-	-	-		
N	3.33	329	3.22	253	3.12	200	3.05	170	2.99	146		
2	-	-	-	-	-	-	-	-	-	-		
4	-	-	-	-	-	-	-	-	-	-		
6	3.30	305	3.18	230	3.10	190	-	-	-	-		
8	-	-	-	-	-	-	-	-	-	-		
10	-	-	-	-	-	-	-	-	-	-		
M	3.27	286	3.17	225	3.08	182	3.02	158	2.96	136		

Supplemental records.- Dec. 9, 9 p.m., 2.80 ft., 87 sec.-ft.; 11 p.m., 3.35 ft., 345 sec.-ft.

Thomas Creek at Paskenta, Calif.

Location.- Lat. 39°52', long. 122°33', in SE$\frac{1}{4}$ sec. 5, T. 23 N., R. 6 W., half a mile upstream from Paskenta, Tehama County, and 4$\frac{1}{2}$ miles below Mill Creek.
Drainage area.- 188 square miles.
Gage-height record.- Water-stage recorder graph except for period 8 p.m. Dec. 10 to 1 p.m. Dec. 14, when there was no record. Peak stage determined from floodmarks in well and on left bank. Stage graph Dec. 14 based on partial recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 6,900 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 16,500 second-feet about 10 p.m. Dec. 10 (gage height, 16.8 feet).
1921-November 1937: Discharge observed, about 16,600 second-feet Mar. 26, 1928 (gage height, 10.5 feet, from nonrecording gage, former site and datum, half a mile downstream), from rating curve extended above 6,000 second-feet on basis of area-velocity study.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record, Dec. 11-13, determined from discharge graph based on records of Elder Creek near Henleyville and Stony Creek above Stony Gorge Reservoir.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6.5	270	190	11	156	9,700	148	21	1,700	276	330
2	7	248	240	12	113	4,000	140	22	940	256	515
3	7	228	248	13	66	2,000	137	23	1,180	238	560
4	7	212	224	14	204	1,260	137	24	856	230	450
5	6.5	198	212	15	172	880	209	25	674	209	400
6	6.5	188	200	16	990	680	215	26	562	197	375
7	6	178	190	17	1,740	530	642	27	462	190	375
8	6	174	178	18	511	438	530	28	382	176	388
9	6	215	164	19	3,040	362	425	29	332	164	362
10	9.5	8,520	156	20	5,990	310	350	30	296	203	340
								31		210	488
Mean monthly discharge, in second-feet									681	1,063	307
Run-off, in acre-feet									40,530	65,340	18,880

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.01	170	4.30	910	-	13,100	-	-	-	-
4	-	-	2.00	168	5.55	1,740	-	12,000	-	-	-	-
6	-	-	2.00	168	8.35	4,160	-	11,700	-	4,700	-	2,300
8	-	-	2.00	168	10.90	6,660	-	11,800	-	-	-	-
10	-	-	2.01	170	12.60	8,510	-	11,000	-	-	-	-
N	2.02	172	2.07	182	13.75	9,980	-	9,700	-	3,900	-	1,900
2	-	-	2.16	200	15.00	12,100	-	8,800	-	-	-	-
4	-	-	2.24	217	14.85	11,800	-	8,000	-	-	-	-
6	-	-	2.35	241	14.08	10,500	-	7,300	-	3,200	-	1,700
8	-	-	2.52	279	-	12,000	-	6,800	-	-	-	-
10	-	-	2.79	345	16.8	16,500	-	6,300	-	-	-	-
M	2.01	170	2.99	399	-	15,200	-	5,800	-	2,700	-	1,500
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.75	1,400	7.05	955	6.53	712	6.05	545	5.71	452	5.40	375
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	7.55	1,260	6.92	890	6.45	680	5.98	524	5.63	432	5.33	358
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.35	1,130	6.75	808	6.34	639	5.88	495	5.55	412	5.27	344
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	7.18	1,030	6.66	767	6.21	594	5.78	470	5.47	392	5.21	332
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.15	320	4.96	282	4.83	256	4.78	246	4.65	222	4.62	218
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.08	306	4.93	276	4.82	254	4.72	234	4.70	230	4.54	206
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.04	298	4.90	270	4.81	252	4.67	226	4.75	240	4.50	200
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.99	288	4.87	264	4.83	256	4.68	227	4.67	226	4.52	203

Deer Creek near Vina, Calif.

Location.- Lat. 40°01', long. 121°56', in NE¼ sec. 23, T. 25 N., R. 1 W., 0.8 mile above concrete diversion dam and 9 miles northeast of Vina, Tehama County. Altitude, about 480 feet above mean sea level.

Drainage area.- 200 square miles.

Gage-height record.- Water-stage recorder graph prior to 10 p.m. Dec. 10, when station was destroyed. Peak stage determined from floodmarks on banks.

Stage-discharge relation.- Defined by current-meter measurements below 7,000 second-feet; extended to peak stage on basis of area-velocity study.

Maxima.- December 1937: Discharge, 23,800 second-feet about midnight Dec. 10 (gage height, 16.6 feet, from floodmarks).

1911-15, 1920-November 1937: Discharge, 12,200 second-feet Mar. 26, 1928 (gage height, 15.0 feet, from floodmarks, former site and datum, 0.8 mile downstream).

Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	86	202	-	11	282	-	-	21	1,100	-	-
2	82	186	-	12	212	-	-	22	518	-	-
3	80	177	-	13	138	-	-	23	1,190	-	-
4	80	168	-	14	153	-	-	24	1,100	-	-
5	80	157	-	15	212	-	-	25	630	-	-
6	83	149	-	16	504	-	-	26	452	-	-
7	89	144	-	17	1,060	-	-	27	353	-	-
8	89	140	-	18	394	-	-	28	295	-	-
9	86	186	-	19	363	-	-	29	252	-	-
10	95	5,520	-	20	2,550	-	-	30	222	-	-
								31		-	-
Mean monthly discharge, in second-feet									428	-	-
Run-off, in acre-feet									25,450	-	-

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	0.93	140	0.91	136	2.24	547						
4	.93	140	.90	134	2.25	551						
6	.92	138	.90	134	2.33	585						
8	.92	138	.90	134	2.61	715						
10	.92	138	.91	136	3.28	1,060						
N	.92	138	.92	138	5.50	2,600						
2	.93	140	.94	142	9.45	6,860						
4	.94	142	.98	151	9.05	6,320						
6	.94	142	1.08	173	10.95	9,020						
8	.93	140	1.26	215	11.15	9,360						
10	.92	138	1.84	394	14.25	15,900						
M	.92	138	2.16	514	16.60	23,800						

Chico Creek near Chico, Calif.

Location.- Lat. 39°46', long. 121°46', in Arroyo Chico grant, 1 mile above golf clubhouse in Municipal Park and 6 miles northeast of Chico, Butte County. Altitude, about 400 feet above mean sea level.

Drainage area.- 68.3 square miles.

Gage-height record.- Water-stage recorder graph except for period midnight Dec. 10 to noon Dec. 13, when there was no record. Peak stage determined from floodmarks on bank.

Stage-discharge relation.- Defined by current-meter measurements below 4,200 second-feet; extended to peak stage on basis of extension of stage-discharge relation at cable section; verified by area-velocity study and logarithmic extension. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 8,260 second-feet midnight Dec. 10 (gage height, 16.6 feet).

1930-November 1937: Discharge, 4,940 second-feet Feb. 21, 1936 (gage height, 12.70 feet), from rating curve extended above 4,250 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record determined from discharge graph based on records of Butte Creek.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	27	75	83	11	98	5,530	62	21	625	129	259
2	25	67	90	12	84	1,850	61	22	237	123	233
3	24	61	88	13	49	904	60	23	406	123	216
4	24	57	83	14	64	564	59	24	595	113	190
5	24	53	80	15	99	395	136	25	308	110	167
6	24	53	75	16	153	302	134	26	198	103	152
7	27	44	73	17	457	238	656	27	148	96	143
8	27	43	70	18	146	198	428	28	116	92	156
9	25	68	67	19	107	167	382	29	99	88	148
10	27	3,290	64	20	1,340	147	314	30	85	86	133
								31		83	681
Mean monthly discharge, in second-feet......................									189	492	179
Run-off, in acre-feet....................................									11,240	30,250	10,990

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.86	42	3.30	276	-	8,000	-	2,800	-	1,140
4	-	-	1.86	42	3.65	365	-	7,500	-	2,500	-	1,080
6	1.87	43	1.86	42	4.38	574	-	6,900	-	2,200	-	1,020
8	-	-	1.86	42	5.55	952	-	6,300	-	2,000	-	980
10	-	-	1.86	42	6.95	1,510	-	5,800	-	1,820	-	930
N	1.87	43	1.88	44	9.70	2,960	-	5,300	-	1,700	5.38	883
2	-	-	1.89	45	12.60	4,870	-	4,950	-	1,600	5.27	844
4	-	-	1.95	52	12.50	4,800	-	4,550	-	1,500	5.17	810
6	1.87	43	2.12	70	13.10	5,260	-	4,150	-	1,400	5.06	772
8	-	-	2.32	96	14.15	6,100	-	3,750	-	1,320	4.96	739
10	-	-	2.81	174	15.90	7,630	-	3,450	-	1,260	4.87	710
M	1.86	42	3.07	224	16.60	8,260	-	3,100	-	1,200	4.78	682
	December 14		December 15		December 16		December 17		December 18		December 19	
2	4.71	659	-	-	-	-	-	-	-	-	-	-
4	4.63	634	3.97	440	3.54	324	-	-	-	-	-	-
6	4.56	612	-	-	-	-	3.24	252	3.02	204	2.87	174
8	4.49	591	3.88	414	3.49	312	-	-	-	-	-	-
10	4.43	573	-	-	-	-	-	-	-	-	-	-
N	4.37	555	3.81	395	3.45	302	3.19	240	2.99	198	2.84	169
2	4.31	537	-	-	-	-	-	-	-	-	-	-
4	4.25	519	3.74	376	3.39	288	-	-	-	-	-	-
6	4.20	504	-	-	-	-	3.14	229	2.95	190	2.80	161
8	4.15	490	3.67	358	3.35	278	-	-	-	-	-	-
10	4.10	476	-	-	-	-	-	-	-	-	-	-
M	4.05	462	3.60	340	3.30	266	3.08	216	2.91	182	2.77	156
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.65	134	2.52	113	-	-
6	2.74	150	2.64	133	2.58	123	-	-	-	-	2.53	115
8	-	-	-	-	-	-	2.60	126	2.50	110	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.72	147	2.62	129	2.57	121	2.57	121	2.50	110	2.50	110
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.55	118	2.52	113	-	-
6	2.69	141	2.61	128	2.57	121	-	-	-	-	2.47	106
8	-	-	-	-	-	-	2.54	116	2.55	118	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.67	138	2.59	124	2.60	126	2.53	115	2.53	115	2.46	104

Stony Creek above Stony Gorge Reservoir, Calif.

Location.- Lat. 39°30'05", long. 122°31'00", in sec. 15, T. 19 N., R. 6 W., 700 feet downstream from road bridge and 6 miles south of Stony Gorge Dam, Glenn County.

Drainage area.- 266 square miles.

Gage-height record.- Water-stage recorder graph except for period Nov. 20-21, when it was based on records at diversion dam about 10 miles upstream, and at Stony Gorge Reservoir.

Stage-discharge relation.- Defined by current-meter measurements below 2,000 second-feet; extended to peak stage on basis of study of computed flow into and out of Stony Gorge Reservoir; verified by area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 20,800 second-feet 11:30 p.m. Dec. 10 (gage height, 13.1 feet).

1933-November 1937: Discharge, 7,160 second-feet Feb. 21, 1936 (gage height, 8.6 feet), from rating curve extended above 2,200 second-feet.

Remarks.- Flood run-off slightly affected by storage in East Park Reservoir. Monthly summaries adjusted for storage. Part of basic data furnished by Bureau of Reclamation.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	18	154	278	11	151	12,100	247	21	1,060	860	535
2	18	141	414	12	116	5,610	241	22	578	830	530
3	19	136	368	13	64	2,990	235	23	644	800	490
4	19	124	320	14	98	1,920	238	24	590	772	445
5	20	116	292	15	144	1,370	268	25	419	745	414
6	20	109	285	16	484	1,180	388	26	322	734	396
7	20	105	274	17	1,210	1,080	1,770	27	260	728	368
8	20	101	260	18	391	980	830	28	220	706	364
9	21	242	250	19	641	950	772	29	188	690	348
10	24	6,830	250	20	2,950	890	615	30	168	454	328
								31		288	1,110
Mean monthly discharge, in second-feet (observed)									363	1,443	449
Mean monthly discharge, in second-feet (adjusted)									434	1,507	570
Run-off, in acre-feet (adjusted)									25,840	92,660	35,020

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.31	96	4.75	1,560	12.15	17,200	8.80	7,490	-	-
4	-	-	2.31	96	5.40	2,340	11.35	14,400	8.61	7,070	6.74	3,550
6	2.34	103	2.31	96	5.75	2,810	11.00	13,200	8.42	6,670	-	-
8	-	-	2.32	98	6.15	3,380	10.75	12,500	8.22	6,250	6.53	3,240
10	-	-	2.32	98	6.45	3,820	10.55	11,900	8.05	5,910	-	-
N	2.33	101	2.36	107	7.25	5,040	10.50	11,800	7.88	5,570	6.32	2,950
2	-	-	2.40	116	8.65	7,500	10.50	11,800	7.72	5,260	-	-
4	-	-	2.46	131	9.15	8,530	10.35	11,400	7.53	4,900	6.15	2,720
6	2.32	98	2.60	168	9.97	10,400	9.95	10,300	7.35	4,570	-	-
8	-	-	3.05	318	10.20	11,000	9.55	9,240	7.20	4,300	5.98	2,490
10	-	-	4.10	930	11.45	14,700	9.25	8,520	7.08	4,100	-	-
M	2.31	96	4.55	1,340	13.00	20,400	9.00	7,940	6.96	3,900	5.82	2,290
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.68	2,130	5.07	1,470	4.64	1,140	4.64	1,140	-	-	-	-
6	-	-	-	-	-	-	-	-	4.46	1,020	4.34	944
8	5.57	2,000	5.00	1,410	4.58	1,100	4.60	1,110	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.46	1,880	4.93	1,350	4.54	1,070	4.55	1,080	4.42	992	4.33	938
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.34	1,740	4.86	1,300	4.86	1,300	4.53	1,060	-	-	-	-
6	-	-	-	-	-	-	-	-	4.41	986	4.31	926
8	5.25	1,650	4.78	1,240	4.82	1,270	4.50	1,040	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.16	1,560	4.72	1,190	4.74	1,210	4.48	1,030	4.39	974	4.30	920
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.25	890	4.21	866	4.16	836	4.11	806	4.06	778	4.02	756
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.23	878	4.19	854	4.14	824	4.08	789	4.04	767	4.00	745

Supplemental records.- Dec. 10, 11:30 p.m., 13.1 ft., 20,800 sec.-ft.

Stony Gorge Reservoir near Elk Creek, Calif.

Location.- Lat. 39°35', long. 122°32', in NE¼ sec. 16, T. 20 N., R. 6 W., at Stony Gorge Dam on Stony Creek, 1 mile south of Elk Creek, Glenn County. Zero of gage is at mean sea level.
Drainage area.- 301 square miles.
Gage-height record.- Gage read to tenths daily at 7 a.m.
Remarks.- Flood run-off partly regulated in reservoir. Elevation of crest of spillway is 841 feet above mean sea level (capacity, 50,200 acre-feet). Reservoir began to spill about 4 a.m. Dec. 11. Maximum discharge over spillway, about 16,800 second-feet 5:30 a.m. Dec. 11. Basic data furnished by Bureau of Reclamation.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	784.0	5,220	821.2	28,180	834.8	42,460
2	784.1	5,250	821.4	28,360	834.8	42,460
3	784.1	5,250	821.7	28,630	834.9	42,580
4	784.1	5,250	822.0	28,900	834.8	42,460
5	784.2	5,290	822.3	29,200	834.8	42,460
6	784.2	5,290	822.4	29,300	834.7	42,340
7	784.2	5,290	822.6	29,500	834.7	42,340
8	784.2	5,290	822.9	29,800	834.6	42,220
9	784.0	5,220	823.0	29,900	834.6	42,220
10	783.8	5,160	825.0	31,900	834.6	42,220
11	783.9	5,190	841.2	50,460	834.6	42,220
12	785.1	5,590	838.7	47,210	834.6	42,220
13	785.6	5,760	838.3	46,690	834.6	42,220
14	786.0	5,900	838.3	46,690	834.6	42,220
15	786.2	5,970	837.8	46,060	834.6	42,220
16	787.6	6,490	838.5	46,950	834.6	42,220
17	792.6	8,650	837.6	45,820	836.2	44,140
18	795.8	10,220	836.5	44,500	836.3	44,260
19	797.1	10,870	836.0	43,900	835.8	43,660
20	802.8	13,840	835.8	43,660	835.6	43,420
21	811.0	19,600	835.7	43,540	835.4	43,180
22	813.3	21,440	835.6	43,420	835.2	42,940
23	814.7	22,560	835.6	43,420	835.2	42,940
24	816.4	23,990	835.6	43,420	835.1	42,820
25	817.6	25,010	835.5	43,300	835.0	42,700
26	818.6	25,860	835.5	43,300	835.0	42,700
27	819.2	26,380	835.5	43,300	834.9	42,580
28	819.8	26,920	835.5	43,300	834.9	42,580
29	820.4	27,460	835.4	43,180	834.8	42,460
30	820.8	27,820	835.4	43,180	834.8	42,460
31			835.0	42,700	835.2	42,940

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Butte Creek near Chico, Calif.

Location.- Lat. 39°44', long. 121°42', in sec. 25, T. 22 N., R. 2 E., half a mile below junction with Little Butte Creek and 7½ miles east of Chico, Butte County. Altitude, about 350 feet above mean sea level.

Drainage area.- 148 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 8,200 second-feet; extended to peak stage on basis of area-velocity study; verified by logarithmic extensions at cable and gage sections. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 17,000 second-feet 1:30 a.m. Dec. 11 (gage height, 18.9 feet).

1930-November 1937: Discharge, 8,660 second-feet Feb. 21, 1936 (gage height, 13.13 feet), from rating curve extended above 8,200 second-feet.

Remarks.- Flood run-off not materially affected by artificial storage or diversion, but affected by inflow from West Branch Feather River Basin via De Sable and Centerville power plants. Monthly summaries adjusted for inflow.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	121	287	375	11	318	11,200	305	21	1,260	656	556
2	116	267	400	12	264	3,930	305	22	540	534	534
3	110	233	408	13	197	2,260	317	23	1,060	520	508
4	110	262	389	14	234	1,550	302	24	1,160	488	460
5	112	246	364	15	278	1,240	488	25	646	468	460
6	112	227	354	16	326	1,030	432	26	496	436	400
7	117	246	332	17	788	911	1,150	27	414	412	420
8	114	235	332	18	352	758	830	28	335	420	428
9	110	273	338	19	305	660	675	29	329	382	404
10	117	6,210	294	20	2,830	601	630	30	319	375	382
								31		389	758
Mean monthly discharge, in second-feet (observed)............									453	1,216	462
Mean monthly discharge, in second-feet (adjusted)............									397	1,143	387
Run-off, in acre-feet (adjusted)...........................									23,650	70,300	23,800

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	4.55	870	18.55	16,600	9.00	5,700	6.04	2,670
4	3.05	243	3.04	240	5.02	1,170	17.35	15,200	8.50	5,150	5.95	2,620
6	-	-	-	-	5.67	1,640	15.90	13,400	7.95	4,650	5.82	2,490
8	2.96	220	2.92	209	6.34	2,200	15.00	12,300	7.45	4,050	5.67	2,360
10	-	-	-	-	7.15	2,900	14.25	11,400	7.23	3,850	5.56	2,260
N	3.02	235	3.06	246	10.00	5,500	13.80	11,000	7.00	3,650	5.50	2,220
2	-	-	-	-	12.50	8,200	13.20	10,300	6.72	3,350	5.42	2,130
4	3.05	243	3.13	264	12.95	8,800	12.30	9,330	6.48	3,150	5.32	2,040
6	-	-	-	-	13.55	9,600	11.40	8,340	6.48	3,150	5.25	2,000
8	3.05	243	3.32	322	14.72	11,000	10.85	7,680	6.36	3,050	5.16	1,910
10	-	-	-	-	16.60	13,600	10.52	7,350	6.25	2,850	5.07	1,830
M	3.05	243	4.10	622	18.50	16,400	9.65	6,420	6.14	2,760	5.01	1,790
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.90	1,710	4.38	1,310	4.11	1,100	3.87	939	3.63	788	3.42	670
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.78	1,630	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.68	1,550	4.32	1,240	4.01	1,030	3.82	904	3.60	770	3.37	645
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.59	1,470	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.57	1,430	4.24	1,200	3.93	995	3.79	884	3.54	734	3.40	660
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.47	1,350	-	-	-	-	-	-	-	-	-	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.28	601	3.17	552	3.11	524	3.09	516	2.98	472	2.95	460
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.31	615	3.19	560	3.11	524	3.12	529	3.02	488	2.98	472
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.28	601	3.19	560	3.19	560	3.10	520	3.11	524	2.98	472
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-

Supplemental records.- Dec. 11, 1:30 a.m., 18.9 ft., 17,000 sec.-ft.

Lake Almanor near Prattville, Calif.

Location.- Lat. 40°10'30", long. 121°05'25", in NW¼ sec. 28, T. 27 N., R. 8 E., at outlet tower at dam on North Fork of Feather River, 5 miles southeast of Prattville, Plumas County. Zero of gage is at mean sea level.
Drainage area.- 506 square miles.
Gage-height record.- Gage read to hundredths daily at 7 a.m. Elevation and contents at midnight shown in table obtained by interpolation.
Remarks.- Flood run-off completely controlled in lake (capacity, 1,532,800 acre-feet at elevation 4,515 feet). See record for North Fork of Feather River near Prattville. Basic data furnished by Pacific Gas & Electric Co.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	4,459.82	372,863	4,459.31	364.126	4,460.37	382,388
2	4,459.71	370,971	4,459.28	363,615	4,460.36	382,214
3	4,459.59	368,911	4,459.24	362,935	4,460.41	383,085
4	4,459.46	366,686	4,459.20	362,254	4,460.47	384,131
5	4,459.34	364,637	4,459.16	361,575	4,460.52	385,003
6	4,459.22	362,594	4,459.11	360,726	4,460.53	385,178
7	4,459.10	360,556	4,459.04	359,539	4,460.53	385,178
8	4,458.97	358,354	4,458.96	358,185	4,460.55	385,527
9	4,458.82	355,820	4,459.03	359,370	4,460.52	385,003
10	4,458.73	354,304	4,459.83	373,035	4,460.38	382,562
11	4,458.77	354,978	4,461.43	401,028	4,460.26	380,475
12	4,458.75	354,641	4,462.29	416,406	4,460.15	378,566
13	4,458.71	353,967	4,462.60	422,001	4,460.08	377,353
14	4,458.69	353,631	4,462.76	424,900	4,460.06	377,007
15	4,458.63	352,622	4,462.89	427,261	4,460.12	378,046
16	4,458.73	354,304	4,462.93	427,988	4,460.14	378,393
17	4,458.78	355,146	4,462.79	425,444	4,460.18	379,086
18	4,458.78	355,146	4,462.61	422,182	4,460.20	379,433
19	4,458.85	356,326	4,462.43	418,929	4,460.27	380,649
20	4,459.11	360,726	4,462.25	415,686	4,460.34	381,866
21	4,459.23	362,764	4,462.04	411,913	4,460.43	383,433
22	4,459.28	363,615	4,461.86	408,690	4,460.54	385,353
23	4,459.42	366,002	4,461.67	405,298	4,460.62	386,751
24	4,459.49	367,199	4,461.49	402,094	4,460.68	387,801
25	4,459.50	367,370	4,461.29	398,546	4,460.74	388,853
26	4,459.49	367,199	4,461.12	395,539	4,460.80	389,905
27	4,459.45	366,515	4,460.98	393,070	4,460.87	391,135
28	4,459.41	365,832	4,460.71	388,327	4,460.98	393,070
29	4,459.36	364,979	4,460.55	385,527	4,461.07	394,657
30	4,459.34	364,637	4,460.38	382,562	4,461.18	396,599
31			4,460.35	382,040	4,461.40	400,496

North Fork of Feather River near Prattville, Calif.

Location.- Lat. 40°10', long. 121°06', in SW¼ sec. 28, T. 27 N., R. 8 E., half a mile below Almanor Dam, 5 miles southeast of Prattville, Plumas County, and about 9 miles upstream from mouth of Butt Creek. Altitude, about 4,380 feet above mean sea level.
Drainage area.- 507 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge (regulated), 2,620 second-feet 6 a.m. to 4 p.m. Dec. 23 (gage height, 7.20 feet).
1905-November 1937: Discharge (unregulated), about 10,000 second-feet Mar. 19, 1907 (gage height, 16.2 feet, former site and datum), from rating curve extended above 3,700 second-feet.
Remarks.- Flood run-off completely controlled in Lake Almanor. See record for Lake Almanor near Prattville. Daily and monthly discharges adjusted for changes in storage in and diversion from Lake Almanor but not for storage in Mountain Meadows Reservoir. Most of basic data furnished by Pacific Gas & Electric Co.

Discharge, gain or loss in storage, and diversion, December 1937

Day	Observed discharge (second-feet)	Gain or loss in storage (acre-feet)	Tunnel No. 1 diversion (second-feet)	Adjusted discharge (second-feet)
1	2.5	-511	1,020	764
2	21	-511	1,000	763
3	52	-680	990	699
4	25	-681	992	674
5	72	-679	992	722
6	121	-849	993	686
7	80	-1,187	993	475
8	343	-1,354	993	653
9	155	+1,185	999	1,750
10	30	+13,665	1,120	8,040
11	31	+27,993	850	15,000
12	190	+15,378	305	8,250
13	1,560	+5,595	43	4,420
14	1,930	+2,899	55	3,450
15	1,960	+2,361	38	3,190
16	2,240	+727	310	2,920
17	2,280	-2,544	1,110	2,110
18	2,280	-3,262	1,100	1,740
19	2,350	-3,253	1,100	1,810
20	2,520	-3,243	1,120	2,000
21	2,520	-3,773	1,120	1,740
22	2,490	-3,223	1,110	1,980
23	2,560	-3,392	1,120	1,970
24	2,520	-3,204	1,120	2,020
25	2,520	-3,548	1,120	1,850
26	2,520	-3,007	1,130	2,130
27	2,490	-2,469	1,140	2,380
28	2,490	-4,743	930	1,030
29	2,490	-2,800	30	1,110
30	2,070	-2,965	21	596
31	1,040	-522	23	800

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	543	2.5	552	11	31	31	552	21	2.5	2,520	43
2	543	21	552	12	31	190	552	22	2.5	2,490	44
3	543	52	552	13	31	1,560	234	23	3.0	2,560	44
4	538	25	552	14	31	1,930	43	24	2.8	2,520	44
5	538	72	552	15	31	1,960	43	25	2.5	2,520	44
6	538	121	552	16	30	2,240	43	26	2.5	2,520	44
7	534	80	552	17	13	2,280	43	27	2.5	2,490	44
8	534	343	552	18	2.5	2,280	43	28	2.5	2,490	44
9	534	155	552	19	2.5	2,350	43	29	2.5	2,490	44
10	450	30	552	20	4.4	2,520	43	30	2.5	2,070	44
								31		1,040	44

	Nov.	Dec.	Jan.
Mean monthly discharge, in second-feet (observed)...........	184	1,418	247
Gain or loss in storage, in acre-feet......................	-10,120	+17,400	+18,460
Mean monthly diversion Tunnel No. 1, in second-feet..........	1,016	806	387
Mean monthly discharge, in second-feet (adjusted)............	1,030	2,507	934
Run-off, in acre-feet (adjusted)...........................	61,320	154,200	57,410

Feather River near Oroville, Calif.

Location.- Lat. 39°32', long. 121°29', in NE¼ sec. 2, T. 19 N., R. 4 E., 2 miles below junction of North and Middle Forks and 3 miles northeast of Oroville, Butte County. Zero of gage is 182.02 feet above mean sea level (general adjustment of 1929).

Drainage area.- 3,611 square miles.

Gage-height record.- Water-stage recorder graph except for period 3 p.m. Dec. 10 to 3 p.m. Dec. 15, when stage graph was based on floodmarks, occasional staff gage readings, and graphs at other stations on Feather River.

Stage-discharge relation.- Defined by current-meter measurements below 62,000 second-feet; extended to peak stage on basis of area-velocity study and A√d method; verified by slope-area computations of flood flow. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 185,000 second-feet about 6 a.m. Dec. 11 (gage height, 73.6 feet).

1902-November 1937: Discharge, about 230,000 second-feet (revised) Mar. 19, 1907 (gage height, 28.2 feet, *former site and datum at Oroville*).

Remarks.- Flood run-off affected by storage in Lake Almanor and Bucks, Butt Valley, and other storage reservoirs.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2,190	3,930	5,180	11	2,860	145,000	3,800	21	14,700	9,970	6,190
2	2,490	3,690	5,500	12	2,980	63,400	3,680	22	7,010	9,700	5,770
3	2,440	3,510	5,640	13	2,390	35,200	3,680	23	11,100	9,160	5,640
4	2,440	3,330	4,980	14	2,700	24,400	3,200	24	11,400	8,720	5,310
5	2,440	3,150	4,790	15	3,620	17,100	5,050	25	7,290	8,400	4,860
6	2,340	3,210	4,600	16	3,030	14,800	4,860	26	5,610	8,080	4,660
7	2,190	3,210	4,460	17	10,300	13,300	10,200	27	5,070	7,840	4,530
8	2,290	3,150	4,280	18	5,570	12,100	9,340	28	4,050	7,680	4,720
9	2,390	3,570	3,860	19	4,400	11,000	8,080	29	3,930	7,440	4,460
10	2,440	77,800	3,920	20	20,600	10,200	7,200	30	4,110	7,280	4,100
								31		6,190	5,950
Mean monthly discharge, in second-feet									5,212	17,600	5,242
Run-off, in acre-feet									310.2	1,082	322.3

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	9.61	3,220	10.00	3,450	15.00	6,520	65.00	134,000	56.50	93,000	40.70	42,100
4	9.16	2,960	10.00	3,450	17.45	8,360	70.20	164,000	54.10	83,400	40.10	40,800
6	8.66	2,690	10.00	3,450	25.60	16,300	73.60	185,000	51.90	74,800	39.30	39,100
8	8.36	2,520	10.00	3,450	33.40	27,400	72.00	175,000	50.40	69,600	38.70	37,700
10	8.36	2,520	9.60	3,210	40.40	41,500	70.30	165,000	49.00	65,000	38.00	36,200
N	9.98	3,440	10.00	3,450	47.45	60,200	68.50	154,000	47.50	60,300	37.30	34,700
2	9.98	3,440	10.00	3,450	57.00	95,000	67.00	145,000	46.30	56,700	36.60	33,300
4	9.98	3,440	10.05	3,480	64.00	128,000	65.00	134,000	44.80	52,400	36.20	32,500
6	9.98	3,440	10.25	3,600	68.00	151,000	63.80	128,000	43.50	48,900	35.50	31,200
8	9.96	3,430	10.40	3,690	71.50	172,000	62.30	120,000	42.60	46,600	35.15	30,500
10	9.96	3,430	10.80	3,930	69.50	160,000	61.00	114,000	41.90	45,000	34.70	29,700
M	9.95	3,420	12.35	4,860	66.60	143,000	59.00	104,000	41.20	43,300	34.40	29,100
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	19,000	25.08	15,700	22.30	12,800	22.00	12,500	20.60	11,100
4	-	27,100	-	18,300	24.75	15,300	23.15	13,600	21.32	11,800	20.70	11,200
6	-	-	-	17,800	24.65	15,200	23.18	13,700	21.65	12,200	20.75	11,300
8	-	25,700	-	17,200	24.30	14,800	23.05	13,600	21.75	12,200	20.70	11,200
10	-	-	-	16,700	24.40	14,900	23.75	14,200	21.95	12,400	20.65	11,200
N	-	24,400	-	16,200	23.58	14,100	22.45	13,000	22.15	12,600	20.60	11,100
2	-	-	-	16,300	23.85	14,400	22.90	13,400	20.90	11,400	20.55	11,100
4	-	22,700	25.75	16,500	23.88	14,400	22.20	12,700	21.15	11,600	20.40	11,000
6	-	-	25.80	16,600	23.98	14,500	22.95	13,400	21.35	11,800	21.25	11,800
8	-	21,100	26.10	16,900	23.75	14,200	22.92	13,400	22.00	12,500	20.40	11,000
10	-	-	25.00	15,600	23.72	14,200	22.10	12,600	21.20	11,700	20.05	10,600
M	-	19,900	25.30	16,000	23.70	14,200	22.42	12,900	20.45	11,000	19.65	10,300
	December 20		December 21		December 22		December 23		December 24		December 25	
2	19.40	10,100	19.27	9,940	19.05	9,740	18.30	9,070	17.80	8,640	18.50	9,250
4	19.45	10,100	19.27	9,940	19.10	9,790	18.75	9,480	17.87	8,700	17.20	8,160
6	19.70	10,300	19.15	9,840	19.15	9,840	18.42	9,180	17.82	8,660	17.60	8,480
8	19.80	10,400	19.20	9,880	19.20	9,880	18.42	9,180	17.82	8,660	17.60	8,480
10	20.40	11,000	19.80	10,400	19.25	9,920	18.42	9,180	18.02	8,820	17.75	8,440
N	19.55	10,200	19.80	10,400	19.65	10,300	19.75	10,400	18.90	9,610	17.40	8,320
2	19.00	9,700	19.68	10,300	18.65	9,380	18.30	9,070	17.85	8,680	17.30	8,240
4	19.80	10,400	19.55	10,200	18.90	9,610	17.85	8,860	18.30	9,070	17.30	8,240
6	19.50	10,200	19.40	10,100	18.65	9,380	18.00	8,800	17.00	8,000	17.10	8,080
8	20.75	11,300	19.25	9,920	18.95	9,660	18.80	9,520	17.75	8,600	17.40	8,320
10	19.40	10,100	19.15	9,840	20.05	10,600	18.10	8,890	17.45	8,360	17.25	8,200
M	18.15	8,940	19.00	9,700	18.40	9,160	18.00	8,800	17.90	8,720	17.20	8,160

Supplemental records.- Dec. 16, 9:30 a.m., 24.75 ft., 15,300 sec.-ft. Dec. 18, 3 a.m., 22.15 ft., 12,600 sec.-ft; 7 p.m., 22.60 ft., 13,100 sec.-ft; 9 p.m., 20.90 ft., 11,400 sec.-ft. Dec. 23, 1 a.m., 17.85 ft., 8,680 sec.-ft. Dec. 24, 7 p.m., 16.45 ft., 7,560 sec.-ft. Dec. 25, 1 a.m., 18.55 ft., 9,300 sec.-ft.

Indian Creek near Crescent Mills, Calif.

Location.- Lat. 40°05', long. 120°56', in SW¼ sec. 25, T. 26 N., R. 9 E., 0.8 mile above mouth of Dixie Creek and about 1½ miles below Crescent Mills, Plumas County. Altitude, about 3,500 feet above mean sea level.

Drainage area.- 746 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 5,500 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 11,500 second-feet 3 a.m. Dec. 12 (gage height, 15.00 feet).

1906-9, 1911-18, 1930-November 1937: Discharge, about 11,700 second-feet Mar. 19, 1907 (gage height, 20.2 feet, from floodmark, former site and datum, 500 feet upstream), from rating curve extended above 3,200 second-feet.

Remarks.- Flood run-off not affected by artificial storage or irrigation diversions in Indian and Genesee Valleys.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	33	195	330	11	64	6,970	243	21	980	600	502
2	33	180	344	12	82	10,600	241	22	860	520	468
3	33	169	379	13	66	6,450	245	23	752	502	468
4	33	160	367	14	76	3,170	245	24	860	434	415
5	34	148	338	15	81	2,060	379	25	729	418	397
6	34	140	304	16	114	1,560	418	26	530	391	388
7	36	134	276	17	357	1,240	520	27	382	367	376
8	36	131	259	18	354	1,030	720	28	300	350	373
9	35	139	256	19	258	855	670	29	254	327	367
10	34	789	252	20	454	695	580	30	215	322	350
								31		330	418
Mean monthly discharge, in second-feet									270	1,335	383
Run-off, in acre-feet									16,080	82,070	23,580

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	3.53	267	7.12	2,130	14.98	11,500	12.63	8,420
4	-	-	2.80	129	3.69	302	7.97	2,720	14.98	11,500	12.30	8,010
6	2.82	132	-	-	3.85	341	9.00	3,580	14.93	11,400	11.95	7,590
8	-	-	2.80	129	4.02	388	10.37	4,960	14.81	11,300	11.62	7,190
10	-	-	-	-	4.25	465	11.33	6,130	14.68	11,100	11.29	6,800
N	2.81	131	2.80	129	4.51	575	12.24	7,340	14.51	10,900	10.96	6,400
2	-	-	-	-	4.96	808	13.11	8,560	14.31	10,600	10.63	6,010
4	-	-	2.82	132	5.38	1,060	13.73	9,500	14.07	10,300	10.30	5,610
6	2.81	131	-	-	5.74	1,270	14.22	10,300	13.81	9,950	9.97	5,240
8	-	-	2.97	157	6.02	1,440	14.64	10,900	13.52	9,580	9.65	4,880
10	-	-	-	-	6.29	1,600	14.87	11,300	13.25	9,220	9.35	4,560
M	2.80	129	3.31	221	6.57	1,770	14.96	11,400	12.95	8,840	9.09	4,270
	December 14		December 15		December 16		December 17		December 18		December 19	
2	8.82	3,990	-	-	-	-	-	-	-	-	-	-
4	8.60	3,770	7.03	2,290	6.29	1,690	5.79	1,340	-	-	-	-
6	8.40	3,570	-	-	-	-	-	-	5.36	1,070	5.06	888
8	8.23	3,400	6.85	2,140	6.19	1,620	5.72	1,290	-	-	-	-
10	8.08	3,250	-	-	-	-	-	-	-	-	-	-
N	7.93	3,100	6.71	2,030	6.11	1,570	5.65	1,240	5.28	1,020	4.99	850
2	7.79	2,970	-	-	-	-	-	-	-	-	-	-
4	7.68	2,870	6.60	1,940	6.03	1,510	5.56	1,190	-	-	-	-
6	7.57	2,770	-	-	-	-	-	-	5.21	976	4.92	811
8	7.46	2,670	6.49	1,850	5.96	1,460	5.50	1,150	-	-	-	-
10	7.34	2,570	-	-	-	-	-	-	-	-	-	-
M	7.24	2,480	6.39	1,770	5.88	1,410	5.44	1,110	5.14	934	4.84	767
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	4.77	730	4.52	609	4.32	528	4.27	510	4.10	450	4.00	418
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.72	705	4.48	592	4.28	513	4.26	506	4.07	440	4.00	418
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	4.66	675	4.45	580	4.28	513	4.22	492	4.02	424	4.01	421
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.59	640	4.38	552	4.30	520	4.15	468	4.00	418	3.96	406

Supplemental records.- Dec. 12, 3 a.m., 15.00 ft., 11,500 sec.-ft.

Spanish Creek at Keddie, Calif.

Location.- Lat. 40°00'05", long. 120°57'20", in NE¼ sec. 27, T. 25 N., R. 9 E., 200 feet above Blackhawk Creek and 0.9 mile southeast of Keddie, Plumas County. Altitude, about 3,250 feet above mean sea level.
Drainage area.- 184 square miles.
Gage-height record.- Water-stage recorder graph except for period Nov. 1 to 3:30 p.m. Nov. 17, when it was based on occasional gage readings, range of stage indicated on recorder graph, and stage-graph for Indian Creek near Crescent Mills.
Stage-discharge relation.- Defined by current-meter measurements below 4,500 second-feet; extended to peak stage by $A\sqrt{d}$ method; verified by area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 11,500 second-feet 11 a.m. Dec. 11 (gage height, 12.43 feet).
1911-November 1937: Discharge, about 11,000 second-feet Mar. 26, 1928 (gage height, 15.5 feet, from floodmarks, former site and datum, 1.2 miles downstream), from rating curve extended above 900 second-feet.
Remarks.- Flood run-off not appreciably affected by artificial storage or diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	40	140	176	11	80	9,610	146	21	845	255	337
2	40	129	205	12	88	3,370	144	22	330	255	341
3	40	121	208	13	80	1,460	142	23	609	266	341
4	40	117	187	14	75	865	142	24	736	238	289
5	40	111	176	15	80	649	374	25	414	228	266
6	42	106	168	16	140	505	305	26	291	208	248
7	42	102	158	17	545	420	813	27	234	193	241
8	40	99	153	18	237	361	757	28	193	190	245
9	40	108	149	19	173	321	532	29	168	181	234
10	40	4,600	146	20	1,190	281	401	30	151	181	214
								31		181	440
Mean monthly discharge, in second-feet									235	834	280
Run-off, in acre-feet									14,010	51,270	17,210

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.24	101	3.02	322	11.42	10,000	7.84	5,010	5.18	1,970
4	-	-	2.24	101	3.44	512	11.39	9,980	7.44	4,490	5.04	1,830
6	-	-	2.23	99	3.87	776	11.64	10,400	7.05	4,020	4.89	1,680
8	-	-	2.23	99	4.40	1,160	12.12	11,100	6.76	3,670	4.77	1,570
10	-	-	2.22	97	4.85	1,540	12.36	11,400	6.50	3,370	4.64	1,460
N	2.22	97	2.22	97	5.45	2,120	12.37	11,500	6.31	3,160	4.55	1,380
2	-	-	2.23	99	7.20	4,140	11.97	10,900	6.13	2,960	4.49	1,320
4	-	-	2.24	101	9.14	6,700	11.41	10,000	5.95	2,760	4.43	1,270
6	-	-	2.26	104	11.67	10,400	10.57	8,760	5.78	2,580	4.38	1,220
8	-	-	2.34	119	12.19	11,200	9.75	7,590	5.55	2,340	4.33	1,180
10	-	-	2.47	146	11.87	10,700	8.87	6,360	5.46	2,250	4.27	1,120
M	2.24	101	2.70	208	11.52	10,200	8.29	5,600	5.32	2,110	4.20	1,060
	December 14		December 15		December 16		December 17		December 18		December 19	
2	4.14	1,010	-	-	-	-	-	-	-	-	-	-
4	4.11	984	3.71	692	-	-	-	-	-	-	-	-
6	4.07	951	-	-	3.42	521	3.25	435	3.12	374	3.00	325
8	4.03	919	3.67	667	-	-	-	-	-	-	-	-
10	3.99	888	-	-	-	-	-	-	-	-	-	-
N	3.95	858	3.64	649	3.38	500	3.21	415	3.09	361	2.97	313
2	3.92	835	-	-	-	-	-	-	-	-	-	-
4	3.90	820	3.59	619	-	-	-	-	-	-	-	-
6	3.86	792	-	-	3.34	480	3.17	396	3.06	349	2.96	309
8	3.83	771	3.54	589	-	-	-	-	-	-	-	-
10	3.79	744	-	-	-	-	-	-	-	-	-	-
M	3.76	724	3.49	560	3.29	455	3.15	388	3.04	341	2.94	301
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.81	252	-	-	-	-	-	-
6	2.91	289	-	-	-	-	2.87	274	-	-	-	-
8	-	-	-	-	2.79	245	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.89	281	2.81	252	2.77	238	2.83	259	2.76	234	2.73	224
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.81	252	-	-	-	-	-	-
6	2.88	278	-	-	-	-	2.83	259	-	-	-	-
8	-	-	-	-	2.91	289	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.86	270	2.82	255	2.95	305	2.81	252	2.75	231	2.72	221

Supplemental records.- Dec. 11, 11 a.m., 12.43 ft., 11,500 sec.-ft.

Bucks Creek storage reservoir near Bucks ranch, Calif.

Location.- Lat. 39°54', long. 121°12', in NW¼ sec. 33, T. 24 N., R. 7 E., at dam on Bucks Creek 2 miles northwest of former Bucks ranch and 15 miles west of Quincy, Plumas County. Zero of gage is at mean sea level.

Drainage area.- 28 square miles.

Gage-height record.- Water-stage recorder graph. Elevations at midnight used to determine contents.

Remarks.- Flood run-off completely controlled in reservoir (capacity, 101,650 acre-feet at elevation of crest of spillway, 5,154.85 feet). See record for Bucks Creek at Bucks Creek storage reservoir. Basic data furnished by Pacific Gas & Electric Co.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	5,138.00	72,621	5,138.9	74,089	5,147.55	88,665
2	5,137.75	72,216	5,138.85	74,008	5,147.4	88,406
3	5,137.45	71,730	5,138.95	74,170	5,147.25	88,145
4	5,137.15	71,244	5,139.0	74,252	5,147.1	87,885
5	5,136.95	70,920	5,139.1	74,416	5,146.95	87,626
6	5,136.65	70,437	5,139.0	74,252	5,146.85	87,454
7	5,136.35	69,955	5,139.0	74,252	5,146.7	87,195
8	5,136.0	69,392	5,138.9	74,089	5,146.45	86,764
9	5,135.65	68,833	5,138.8	73,926	5,146.15	86,248
10	5,135.5	68,594	5,140.6	76,886	5,145.75	85,561
11	5,135.4	68,434	5,145.4	84,962	5,145.35	84,876
12	5,135.15	68,035	5,147.45	88,492	5,145.05	84,362
13	5,135.0	67,795	5,148.75	90,755	5,144.95	84,192
14	5,135.2	68,114	5,149.45	91,983	5,145.15	84,533
15	5,135.3	68,274	5,149.5	92,071	5,145.3	84,791
16	5,135.4	68,434	5,149.45	91,983	5,145.55	85,218
17	5,135.55	68,674	5,149.35	91,807	5,145.85	85,733
18	5,135.7	68,913	5,149.15	91,450	5,145.9	85,818
19	5,136.15	69,633	5,149.05	91,280	5,146.15	86,247
20	5,137.0	71,001	5,149.0	91,192	5,146.35	86,592
21	5,137.3	71,487	5,148.8	90,843	5,146.45	86,764
22	5,137.6	71,973	5,148.6	90,494	5,146.55	86,937
23	5,137.9	72,459	5,148.55	90,406	5,146.7	87,195
24	5,138.2	72,947	5,148.45	90,231	5,146.8	87,367
25	5,138.4	73,273	5,148.35	90,057	5,146.75	87,281
26	5,138.6	73,600	5,148.35	90,057	5,146.6	87,023
27	5,138.7	73,763	5,148.3	89,970	5,146.6	87,023
28	5,138.7	73,763	5,148.1	89,621	5,146.75	87,281
29	5,138.7	73,763	5,147.95	89,360	5,146.8	87,367
30	5,138.7	73,763	5,147.85	89,186	5,146.85	87,454
31			5,147.75	89,008	5,146.95	87,626

Bucks Creek at Bucks Creek storage reservoir, Calif.

Location.- Lat. 39°54', long. 121°12', in NW¼ sec. 33, T. 24 N., R. 7 E., at dam on Bucks Creek 2 miles northwest of former Bucks Ranch and 15 miles west of Quincy, Plumas County. Altitude, about 5,000 feet above mean sea level.
Drainage area.- 28 square miles.
Maxima.- December 1937: Discharge regulated to maximum of 238 second-feet. Maximum discharge adjusted for changes in storage, about 5,500 second-feet 3 to 6 a.m. Dec. 11.
Remarks.- Flood run-off completely regulated in Bucks Creek storage reservoir (capacity, 101,650 acre-feet). Daily records of storage and release (observed discharge) furnished by Pacific Gas & Electric Co. Daily and monthly discharges adjusted for changes in storage. See record for Bucks Creek storage reservoir.

Discharge and gain or loss in storage, December 1937

Day	Observed discharge (sec.-ft.)	Gain or loss in storage (acre-feet)	Adjusted discharge (sec.-ft.)	Day	Observed discharge (sec.-ft.)	Gain or loss in storage (acre-feet)	Adjusted discharge (sec.-ft.)
1	0	+326		16	238	-88	194
2	0	-81		17	238	-176	149
3	0	+162		18	238	-357	58
4	0	+82		19	238	-170	152
5	0	+164	*41	20	238	-88	194
6	0	-164		21	238	-349	62
7	0	0		22	238	-349	62
8	166	-163		23	238	-88	194
9	238	-163	156	24	238	-175	150
10	76	+2,960	1,570	26	238	-174	150
11	0	+8,076	4,070	26	238	0	238
12	0	+3,530	1,780	27	238	-87	194
13	0	+2,263	1,140	28	238	-349	62
14	0	+1,228	619	29	238	-261	106
15	154	+88	198	30	238	-174	150
				31	238	-178	148

	November	December	January
Mean monthly discharge, in second-feet (observed)..........	114	143	106
Gain or loss in storage, in acre-feet......................	+408	+15,240	-1,380
Mean monthly discharge, in second-feet (adjusted)..........	121	391	83.1
Run-off, in acre-feet (adjusted)...........................	7,200	24,060	5,110

*Mean for the period.

Grizzly Creek near Storrie, Calif.

Location.- Lat. 39°52', long. 121°14', in SW¼ sec. 5, T. 23 N., R. 7 E., about 2,000 feet above outlet of tunnel from Bucks Creek and 6 miles southeast of Storrie, Plumas County. Altitude, about 4,900 feet above mean sea level.

Drainage area.- 6.2 square miles.

Gage-height record.- Water-stage recorder graph except for period 8 a.m. Jan. 2 to 9 a.m. Jan. 5, when there was no record. Stage graph for Jan. 2 and 5 based on partial recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 150 second-feet; extended to peak stage on basis of area-velocity study; verified by extension of rating curve for discontinued station below Bucks Creek Tunnel, which is well defined to 600 second-feet. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 1,570 second-feet 11 a.m. Dec. 10 (gage height, 7.20 feet).

1929-1932, 1934-November 1937: Discharge, about 1,000 second-feet Dec. 12, 1929 (gage height, 4.85 feet, from floodmark in well), and Feb. 21, 1936 (gage height, 4.86 feet), from rating curve extended above 150 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record, Jan. 3-4, interpolated. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1.8	17	7.5	11	12	569	7.5	21	81	14	19
2	1.6	15	14	12	8	167	8	22	48	12	24
3	1.5	14	12	13	5	84	8.5	23	140	13	25
4	1.4	14	11	14	31	58	10	24	68	15	21
5	1.3	13	10	15	20	45	46	25	43	12	20
6	1.4	13	9.5	16	90	37	22	26	33	12	20
7	1.6	12	9	17	126	30	41	27	26	9.5	20
8	1.5	12	8	18	38	24	34	28	22	9	20
9	1.5	106	8	19	106	16	25	29	20	8.5	19
10	1.7	1,090	8	20	275	14	21	30	18	8.5	19
								31		8	19
Mean monthly discharge, in second-feet									40.8	79.7	17.6
Run-off, in acre-feet									2,430	4,900	1,080

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.57	12	5.91	1,020	5.68	933	3.25	240	-	-
4	-	-	1.57	12	6.48	1,250	5.20	766	3.16	222	2.43	98
6	-	-	1.57	12	6.52	1,270	5.36	821	3.08	206	-	-
8	-	-	1.57	12	6.13	1,110	5.48	863	3.00	190	2.37	90
10	-	-	1.58	12	6.80	1,390	5.28	793	2.91	174	-	-
N	1.57	12	1.68	18	6.23	1,150	4.12	443	2.85	163	2.32	84
2	-	-	1.97	40	6.10	1,100	3.93	394	2.78	151	-	-
4	-	-	2.48	95	5.37	824	3.66	328	2.71	140	2.26	77
6	-	-	2.96	175	6.10	1,100	3.61	316	2.65	130	-	-
8	-	-	3.43	273	5.70	940	3.60	314	2.60	122	2.22	72
10	-	-	3.55	300	6.03	1,070	3.53	299	2.56	116	-	-
M	1.57	12	4.70	606	5.90	1,020	3.38	266	2.51	109	2.18	68
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.15	64	-	-	-	-	-	-	-	-	-	-
6	-	-	2.00	48	1.90	38	1.83	32	1.76	26	-	-
8	2.12	60	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.09	57	1.97	45	1.88	36	1.81	30	1.74	24	1.62	16
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.06	54	-	-	-	-	-	-	-	-	-	-
6	-	-	1.94	42	1.86	34	1.79	28	1.73	23	-	-
8	2.04	52	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.02	50	1.93	41	1.84	33	1.77	27	-	-	1.59	14
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	1.60	15
6	-	-	-	-	-	-	-	-	1.53	12	-	-
8	-	-	-	-	-	-	-	-	-	-	1.55	12
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.59	14	1.58	14	1.55	12	1.56	13	1.60	15	1.55	12
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	1.55	12
6	-	-	-	-	-	-	-	-	1.65	18	-	-
8	-	-	-	-	-	-	-	-	-	-	1.55	12
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.57	14	1.56	13	1.56	13	1.55	12	1.66	19	1.54	12

Supplemental records.- Dec. 10, 11 a.m., 7.20 ft., 1,570 sec.-ft.

West Branch of Feather River near Yankee Hill, Calif.

Location.- Lat. 39°42', long. 121°34', in SW¼ sec. 5, T. 21 N., R. 4 E., at highway bridge 1.4 miles below Concow Creek and 2 miles west of Yankee Hill, Butte County. Altitude, about 1,100 feet above mean sea level.

Drainage area.- 145 square miles.

Gage-height record.- Water-stage recorder graph except for periods 8 p.m. Dec. 10 to 9:30 a.m. Dec. 14, 6 p.m. Dec. 21 to about 2 p.m. Jan. 2, when there was no record. Gage read at 4 p.m. Dec. 12 and 7 a.m. Dec. 14. Peak stage obtained from floodmark. Stage graph for Dec. 14 based on staff gage reading and partial recorder record.

Stage-discharge relation.- Defined by current-meter measurements below 14,300 second-feet; extended to peak stage; verified by area-velocity study and comparison of peak discharge and total run-off of flood with records on Butte, Chico and Concow Creeks. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 21,400 second-feet about 2 a.m. Dec. 11 (gage height, 30.3 feet).

1930-November 1937: Discharge, 14,400 second-feet Feb. 21, 1936 (gage height, 23.6 feet), from rating curve defined to 14,300 second-feet.

Remarks.- Flood run-off probably not materially affected by artificial storage or diversion. Discharge for periods of missing gage-height record determined from discharge graph based on records for Butte and Concow Creeks.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	11	230	250	11	192	14,500	165	21	1,380	522	538
2	8.5	203	270	12	160	4,460	156	22	550	490	490
3	7.5	186	290	13	52	2,120	146	23	1,790	470	474
4	7	170	254	14	111	1,450	146	24	1,260	430	388
5	7	154	234	15	288	1,090	461	25	696	400	340
6	7	144	224	16	368	930	403	26	536	360	309
7	8	143	210	17	1,310	815	1,250	27	412	325	293
8	8	128	196	18	379	528	815	28	336	320	293
9	7.5	157	178	19	385	640	510	29	288	280	282
10	8	11,400	176	20	4,120	570	658	30	254	250	251
								31		250	629
Mean monthly discharge, in second-feet									498	1,423	364
Run-off, in acre-feet									29,650	87,500	22,370

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	3.38	136	3.38	136	8.00	1,420	30.3	21,400	-	6,600	-	2,560
4	3.34	131	3.37	134	10.80	2,960	-	21,000	-	6,000	-	2,420
6	3.32	128	3.36	133	13.30	4,840	-	19,000	-	5,400	-	2,320
8	3.30	126	3.36	133	14.70	5,960	-	17,000	-	4,900	-	2,220
10	3.30	126	3.35	132	17.35	8,320	-	15,200	-	4,520	-	2,160
N	3.29	125	3.35	132	23.50	14,300	-	13,800	-	4,180	-	2,080
2	3.28	124	3.35	132	26.40	17,200	-	12,600	-	3,840	-	2,000
4	3.27	122	3.40	138	25.20	16,000	-	11,500	12.48	3,560	-	1,950
6	3.26	121	3.60	164	25.00	15,800	-	10,400	-	3,380	-	1,900
8	3.37	134	3.75	185	27.90	18,800	-	9,400	-	3,160	-	1,850
10	3.39	137	4.25	262	29.0	20,000	-	8,400	-	2,940	-	1,800
M	3.39	137	5.30	484	30.0	21,100	-	7,400	-	2,720	-	1,750
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.30	1,600	8.41	1,170	7.96	994	7.58	843	7.33	556	7.10	675
6	-	-	-	-	-	-	-	-	-	-	-	-
8	9.15	1,520	8.32	1,140	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	8.98	1,440	8.25	1,110	7.81	934	7.50	815	7.25	528	7.03	650
2	-	-	-	-	-	-	-	-	-	-	-	-
4	8.83	1,360	8.17	1,080	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.62	1,260	8.11	1,050	7.68	882	7.42	587	7.17	700	6.88	598
10	-	-	-	-	-	-	-	-	-	-	-	-
M	8.50	1,210	8.02	1,020	-	-	-	-	-	-	-	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-								
4	6.83	580	6.70	538								
6	-	-	-	-								
8	-	-	-	-								
10	-	-	-	-								
N	6.78	564	6.67	528								
2	-	-	-	-								
4	-	-	-	-								
6	-	-	-	-								
8	6.75	551	-	500								
10	-	-	-	-								
M	-	-	-	-								

Supplemental records.- Dec. 9, 11 p.m., 4.55 ft., 316 sec.-ft.

Concow Creek near Yankee Hill, Calif.

Location.- Lat. 39°46', long. 121°32', in NE¼ sec. 16, T. 22 N., R. 4 E., at diversion dam for Spring Valley Ditch, 300 feet below Lake Wilenor Dam and 4 miles north of Yankee Hill post office, Butte County. Altitude, about 1,850 feet above mean sea level.

Drainage area.- 14.7 square miles.

Gage-height record.- Water-stage recorder graph except for period midnight Dec. 10 to 10 a.m. Dec. 11, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 500 second-feet; extended to peak stage on basis of rating for spillway of Lake Wilenor Dam.

Maxima.- December 1937: Discharge, 770 second-feet 10 a.m. Dec. 11 (gage height, 2.44 feet).

1927-November 1937: Discharge, 1,840 second-feet Mar. 26, 1928 (gage height, 5.9 feet), from rating curve extended above 300 second-feet on basis of computation of peak discharge over Lake Wilenor Dam.

Remarks.- Flood run-off affected by storage in Lake Wilenor. Elevation of crest of spillway is 1,967.0 feet above mean sea level (capacity, 7,300 acre-feet). Lake started to spill about 2 a.m. Dec. 11. Discharge for period of missing gage-height record obtained from discharge graph based on changes in storage in Lake Wilenor and comparison with records for nearby streams. Discharge adjusted for storage and diversion. Elevation at midnight and corresponding contents in Lake Wilenor determined from graph based on daily readings at about 10 a.m. Part of basic data furnished by Table Mountain and Thermalito Irrigation Districts.

Storage, diversion, and discharge, December 1937

Day	Lake Wilenor			Spring Valley Ditch diversion (sec.-ft.)	Discharge	
	Elevation (feet)	Contents (acre-feet)	Gain or loss (acre-feet)		Observed (sec.-ft.)	Adjusted (sec.-ft.)
1	1,952.7	3,840	+20	0.2	0	
2	1,952.8	3,860	+20	.2	0	
3	1,952.9	3,880	+20	.2	0	
4	1,953.0	3,900	+20	.2	0	
5	1,953.1	3,920	+20	.2	0	*7.5
6	1,953.1	3,920	0	.2	0	
7	1,953.2	3,940	+20	.2	0	
8	1,953.2	3,940	0	.2	0	
9	1,954.0	4,100	+160	.4	0	81
10	1,964.8	6,650	+2,550	2.1	0	1,290
11	1,968.0	7,600	+950	2.0	491	972
12	1,967.5	7,450	-150	.5	223	148
13	1,967.3	7,390	-60	.4	102	72
14	1,967.2	7,360	-30	.4	62	47
15	1,967.2	7,360	0	.4	45	45
16	1,967.2	7,360	0	.4	35	35
17	1,967.1	7,330	-30	.4	29	14
18	1,967.1	7,330	0	.4	25	25
19	1,967.1	7,330	0	.4	19	19
20	1,967.0	7,300	-30	.4	19	43
21	1,967.0	7,300	0	.4	14	14
22	1,967.0	7,300	0	.4	15	15
23	1,967.1	7,330	+30	.4	17	32
24	1,967.1	7,330	0	.4	19	19
25	1,967.1	7,330	0	.4	19	19
26	1,967.1	7,330	0	.4	17	17
27	1,967.0	7,300	-30	.4	16	1.3
28	1,967.0	7,300	0	.4	17	17
29	1,967.0	7,300	0	.4	16	16
30	1,967.0	7,300	0	.4	16	16
31	1,967.0	7,300	0	.4	15	15

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	14	11	0	491	0	21	0	14	51
2	0	0	16	12	0	223	0	22	0	15	43
3	0	0	16	13	0	102	0	23	0	17	35
4	0	0	15	14	0	62	0	24	0	19	29
5	0	0	14	15	0	45	8	25	0	19	24
6	0	0	15	16	0	35	24	26	0	17	17
7	0	0	14	17	0	29	209	27	0	16	15
8	0	0	4.7	18	0	25	87	28	0	17	14
9	0	0	.2	19	0	19	77	29	0	16	14
10	0	0	0	20	0	19	70	30	0	16	13
										15	81
Mean monthly discharge, in second-feet (observed)									0	39.7	29.7
Gain or loss in storage, in acre-feet									+1,840	+3,480	+210
Mean monthly diversion in Spring Valley Ditch, in second-feet									10.4	.46	8.67
Mean monthly discharge, in second-feet (adjusted)									41.3	96.8	41.6
Run-off, in acre-feet (adjusted)									2,460	5,950	2,560

*Mean for the period.

Middle Fork of Feather River near Clio, Calif.

Location.- Lat. 39°45', long. 120°36', in E½ sec. 23, T. 22 N., R. 12 E., 0.3 mile above Frazier Creek and 1½ miles northwest of Clio, Plumas County. Altitude, about 4,350 feet above mean sea level.
Drainage area.- 699 square miles.
Gage-height record.- Water-stage recorder graph for period Nov. 1-27. No record Nov. 28 to Jan. 31. Peak stage determined from floodmark.
Stage-discharge relation.- Defined by current-meter measurements below 2,600 second-feet; extended to peak stage on basis of area-velocity study.
Maxima.- December 1937: Discharge, 5,320 second-feet probably Dec. 11 (gage height, 10.4 feet).
1925-November 1937: Discharge, 11,000 second-feet Mar. 26, 1928 (gage height, 12.0 feet), from rating curve extended above 4,750 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. The following mean discharges for periods of missing gage-height record were determined from floodmark and discharge graph based on records for Spanish Creek at Keddie and Indian Creek near Crescent Mills: Dec. 1-9, 80 sec.-ft.; Dec. 10-15, 1,700 sec.-ft.; Dec. 16-31, 170 sec.-ft.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	23	-	-	11	38	-	-	21	351	-	-
2	23	-	-	12	41	-	-	22	158	-	-
3	23	-	-	13	31	-	-	23	153	-	-
4	23	-	-	14	51	-	-	24	199	-	-
5	23	-	-	15	38	-	-	25	136	-	-
6	24	-	-	16	43	-	-	26	114	-	-
7	24	-	-	17	211	-	-	27	107	-	-
8	23	-	-	18	86	-	-	28	105	-	-
9	23	-	-	19	68	-	-	29	102	-	-
10	23	-	-	20	291	-	-	30	100	-	-
								31		-	-
Mean monthly discharge, in second-feet									88.5	440	150
Run-off, in acre-feet									5,270	27,050	9,220

Supplemental records.- Dec. 11, 10.4 ft., 5,320 sec.-ft.

Middle Fork of Feather River at Bidwell Bar, Calif.

Location.- Lat. 39°33', long. 121°26', in NW¼ sec. 32, T. 20 N., R. 5 E., at highway bridge at Bidwell Bar, 2 miles above junction with North Fork and 7 miles northeast of Oroville, Butte County. Altitude, about 290 feet above mean sea level.

Drainage area.- 1,353 square miles.

Gage-height record.- Water-stage recorder graph except for periods 3 a.m. Dec. 11 to 1 p.m. Dec. 12, 4 p.m. Dec. 24 to 7:30 a.m. Jan. 11, when it was based on peak stage, range of stage indicated on recorder graph, and stage graphs for nearby stations. Peak stage obtained from floodmarks.

Stage-discharge relation.- Defined by current-meter measurements below 20,000 second-feet; extended to peak stage; verified by area-velocity study and $A\sqrt{d}$ method. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 93,000 second-feet about 6 a.m. Dec. 11 (gage height, 24.0 feet, from floodmarks).

1911-November 1937: Discharge, about 90,000 second-feet Mar. 26, 1928 (gage height, 22.8 feet, from floodmarks), from rating curve extended above 10,500 second-feet on basis of slope-area computation of flood flow.

Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	233	975	1,540	11	462	72,000	1,340	21	4,890	2,280	2,460
2	247	895	1,570	12	634	22,500	1,280	22	2,290	2,190	2,320
3	249	846	1,600	13	450	12,200	1,280	23	3,440	2,140	2,320
4	247	798	1,500	14	625	7,920	1,250	24	3,610	2,020	2,100
5	244	774	1,460	15	948	5,620	2,020	25	2,340	1,900	1,980
6	244	726	1,430	16	822	4,520	1,900	26	1,760	1,860	1,860
7	252	703	1,400	17	3,680	3,690	4,160	27	1,440	1,820	1,820
8	249	680	1,370	18	1,810	3,250	3,580	28	1,270	1,740	1,980
9	247	717	1,370	19	1,210	2,840	3,040	29	1,150	1,710	1,860
10	244	36,700	1,340	20	6,610	2,500	2,740	30	1,060	1,640	1,740
								31		1,570	2,550
Mean monthly discharge, in second-feet									1,432	6,507	1,941
Run-off, in acre-feet									85,200	400,100	119,300

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	3.38	671	5.55	2,140	21.70	74,500	-	33,500	12.75	14,500
4	-	-	3.37	666	6.72	3,510	-	86,500	-	30,000	12.64	14,100
6	3.41	685	3.36	662	9.90	8,960	24.0	93,000	-	27,500	12.51	13,600
8	-	-	3.36	662	12.05	15,000	-	89,500	-	24,500	12.35	13,100
10	-	-	3.36	662	13.05	18,800	-	81,000	-	22,500	12.22	12,600
N	3.40	680	3.36	662	14.42	25,200	-	75,500	-	20,500	12.09	12,200
2	-	-	3.37	666	16.65	38,200	-	70,500	13.97	19,300	11.92	11,700
4	-	-	3.42	689	20.60	65,800	-	68,000	13.64	18,000	11.79	11,300
6	3.39	675	3.50	726	21.65	74,200	-	63,500	13.37	16,900	11.65	10,800
8	-	-	3.60	774	21.38	72,000	-	55,000	13.11	15,800	11.50	10,400
10	-	-	3.82	880	22.07	77,600	-	46,500	12.92	15,100	11.35	10,000
M	3.38	671	4.45	1,240	22.25	79,000	-	39,500	12.83	14,800	11.19	9,630
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	10.92	9,000	9.48	6,230	8.51	4,790	7.82	3,940	7.34	3,400	6.88	2,920
6	-	-	-	-	-	-	-	-	-	-	-	-
8	10.63	8,380	9.30	5,940	8.37	4,600	7.73	3,840	7.28	3,340	6.82	2,860
10	-	-	-	-	-	-	-	-	-	-	-	-
N	10.38	7,880	9.15	5,700	8.26	4,470	7.64	3,730	7.17	3,220	6.78	2,820
2	-	-	-	-	-	-	-	-	-	-	-	-
4	10.14	7,400	8.97	5,440	8.14	4,330	7.56	3,650	7.08	3,120	6.71	2,750
6	-	-	-	-	-	-	-	-	-	-	-	-
8	9.90	6,960	8.82	5,230	8.03	4,200	7.49	3,570	7.01	3,050	6.64	2,680
10	-	-	-	-	-	-	-	-	-	-	-	-
M	9.68	6,560	8.66	5,000	7.92	4,060	7.42	3,490	6.94	2,980	6.59	2,630
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	6.18	2,260	5.84	1,970	-	-
6	6.54	2,590	6.24	2,320	6.04	2,140	-	-	-	-	-	1,930
8	-	-	-	-	-	-	6.08	2,170	5.84	1,970	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	6.47	2,520	6.21	2,290	6.02	2,120	6.01	2,110	5.96	2,070	-	1,920
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	5.95	2,060	5.96	2,070	-	-
6	6.37	2,430	6.10	2,190	6.15	2,240	-	-	-	-	-	1,910
8	-	-	-	-	-	-	5.90	2,020	-	2,030	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	6.30	2,370	6.05	2,140	6.31	2,380	5.88	2,000	-	1,950	-	1,900

Supplemental records.- Dec. 10, 11 p.m., 22.4 ft., 80,200 sec.-ft.

South Fork of Feather River at Enterprise, Calif.

Location.- Lat. 39°32', long. 121°21', in SW¼ sec. 6, T. 19 N., R. 6 E., 0.8 mile above McCabe Creek and 1 mile above highway bridge at Enterprise, Butte County. Altitude, about 550 feet above mean sea level.
Drainage area.- 134 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,500 second-feet; extended to peak stage; verified by area-velocity study and A$\sqrt{d}$ method. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 17,300 second-feet 5 p.m. Dec. 10 (gage height, 20.4 feet).
1911-November 1937: Discharge (regulated), about 15,200 second-feet Mar. 26, 1928 (gage height, 16.0 feet, from floodmarks at former site and datum, half a mile downstream), from rating curve extended above 2,000 second-feet on basis of computed flow over Palermo Canal diversion dam about 1 mile above station.
Remarks.- Flood run-off affected by artificial storage in Lost Creek Reservoir (capacity, about 5,700 acre-feet) and by diversions into Forbestown ditch and Palermo canal. Monthly summaries adjusted for storage and diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	11	147	276	11	70	12,900	223	21	760	392	418
2	29	137	306	12	72	3,760	220	22	372	392	405
3	28	130	316	13	57	1,900	217	23	614	392	405
4	28	124	286	14	104	1,300	213	24	622	369	369
5	28	117	276	15	138	940	380	25	424	347	358
6	28	110	267	16	118	740	347	26	314	326	336
7	30	99	258	17	768	610	890	27	260	306	336
8	29	93	240	18	283	545	628	28	217	306	358
9	28	114	232	19	184	470	530	29	191	306	347
10	28	8,360	229	20	1,310	430	470	30	167	286	326
								31		286	628
Mean monthly discharge, in second-feet (observed)									244	1,185	358
Mean monthly discharge, in second-feet (adjusted)									343	1,200	368
Run-off, in acre-feet (adjusted)									20,430	73,800	22,610

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	3.22	91	5.50	558	18.50	14,000	13.00	5,500	9.95	2,360
4	-	-	3.22	91	6.95	1,110	19.70	16,000	12.50	4,880	9.80	2,240
6	3.25	94	3.23	92	10.00	3,000	20.30	17,100	12.20	4,520	9.65	2,120
8	-	-	3.24	93	11.30	4,180	19.60	15,900	11.85	4,140	9.50	2,000
10	-	-	3.25	94	12.10	5,060	19.00	14,800	11.60	3,860	9.40	1,930
N	3.24	93	3.26	95	13.50	6,790	18.90	14,700	11.30	3,560	9.30	1,860
2	-	-	3.27	96	17.40	12,300	18.60	14,200	11.05	3,310	9.20	1,790
4	-	-	3.34	103	20.10	16,800	17.70	12,600	10.80	3,080	9.10	1,720
6	3.23	92	3.48	120	19.90	16,400	16.30	10,300	10.60	2,900	9.00	1,650
8	-	-	3.60	134	18.50	14,000	14.90	8,150	10.45	2,760	8.90	1,580
10	-	-	3.90	177	18.10	13,300	14.20	7,130	10.30	2,640	8.85	1,540
M	3.22	91	4.50	292	18.20	13,500	13.60	6,290	10.10	2,480	8.80	1,510
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	8.65	1,420	7.95	1,020	7.45	780	7.10	645	6.85	560	6.63	494
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.85	1,360	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	8.40	1,270	7.77	925	7.32	728	7.02	617	6.77	536	6.57	476
2	-	-	-	-	-	-	-	-	-	-	-	-
4	8.30	1,210	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.18	1,140	7.60	845	7.22	688	6.92	582	6.70	515	6.50	455
10	-	-	-	-	-	-	-	-	-	-	-	-
M	8.05	1,060	-	-	-	-	-	-	-	-	-	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.46	445	6.30	405	6.20	380	6.35	418	6.08	354	6.05	347
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	6.40	430	6.27	398	6.17	373	6.20	380	6.18	376	6.03	343
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	6.34	415	6.23	388	6.39	428	6.13	365	6.18	376	6.02	340
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-

Supplemental records.- Dec. 10, 5 p.m., 20.40 ft., 17,300 sec.-ft.

Lost Creek near Clipper Mills, Calif.

Location.- Lat. 39°34', long. 121°09', in sec. 24, T. 20 N., R. 7 E., 1,000 feet below Lost Creek Dam and 2 miles north of Clipper Mills, Butte County. Altitude, about 3,050 feet above mean sea level.

Drainage area.- 30.1 square miles.

Gage-height record.- Water-stage recorder graph except for period 10:30 a.m. Dec. 23 to 10:30 a.m. Jan. 20, when there was no record. Stage graph for Dec. 23 and Jan. 20 based on partial recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 450 second-feet; extended to peak stage on basis of computed flow over Lost Creek Dam. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 3,380 second-feet 4 p.m. Dec. 10 (gage height, 6.80 feet).
1927-November 1937: Discharge, 2,900 second-feet Mar. 26, 1928 (gage height, 6.10 feet).

Remarks.- Discharge for period of missing gage-height record, Dec. 24 to Jan. 19, determined from staff-gage readings at and corresponding flow over Lost Creek Dam. Flood run-off affected by artificial storage in Lost Creek Reservoir (capacity, about 5,700 acre-feet) and by diversion into Forbestown ditch. Reservoir began to spill about 6 a.m. Dec. 8. Monthly summaries adjusted for storage and diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	0.2	90	11	0.4	2,040	80	21	0.4	117	100
2	.2	.2	100	12	.2	738	80	22	.2	120	103
3	.2	.2	100	13	.2	426	80	23	.6	117	100
4	.2	.2	90	14	.4	310	80	24	.5	110	91
5	.2	.2	95	15	.2	246	170	25	.3	105	84
6	.2	.2	95	16	.7	202	110	26	.2	100	81
7	.2	.2	90	17	1.1	175	300	27	.2	90	84
8	.2	2.7	90	18	.2	155	210	28	.2	90	103
9	.2	40	85	19	.2	137	170	29	.2	90	96
10	.2	1,490	85	20	2.5	124	110	30	.2	85	82
								31		85	144
Mean monthly discharge, in second-feet (observed)									0.37	232	109
Mean monthly discharge, in second-feet (adjusted)									83.5	247	119
Run-off, in acre-feet (adjusted)									4,970	15,210	7,310

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	0.08	0.2	1.40	7.5	3.15	375	5.54	1,980	4.41	1,030	-	-
4	.08	.2	1.42	9	3.70	610	6.08	2,560	4.29	943	3.50	478
6	.10	.2	1.43	10	4.06	806	6.37	2,880	4.20	880	-	-
8	.22	.2	1.43	10	4.33	971	6.14	2,620	4.10	815	3.42	443
10	.58	.3	1.44	10	4.65	1,200	5.98	2,450	4.00	750	-	-
N	1.06	1.3	1.47	13	5.00	1,470	5.98	2,350	3.94	713	3.36	418
2	1.22	2.8	1.49	14	5.80	2,250	5.78	2,230	3.85	659	-	-
4	1.30	4.2	1.60	24	6.80	3,380	5.55	1,990	3.77	614	3.30	394
6	1.34	5.5	1.74	39	5.80	2,250	5.22	1,670	3.72	587	-	-
8	1.37	6.5	1.95	68	5.40	1,840	4.90	1,390	3.66	556	3.25	375
10	1.39	7.2	2.35	143	5.30	1,740	4.77	1,290	3.60	526	-	-
M	1.40	7.5	2.80	252	5.40	1,840	4.62	1,170	3.57	512	3.21	360
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.16	342	2.92	259	2.77	211	2.67	181	2.59	157	2.52	139
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.11	324	2.89	249	2.76	208	2.66	178	2.58	155	2.51	137
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.07	310	2.87	242	2.72	196	2.64	172	2.56	150	2.51	137
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.03	296	2.84	233	2.72	196	2.63	169	2.55	147	2.50	134
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.99	283	2.82	226	2.70	190	2.62	166	2.54	144	2.49	132
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.96	272	2.79	217	2.69	187	2.61	163	2.52	139	2.49	132
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-						
4	3.18	127	2.43	117	2.41	112						
6	-	-	-	-	-	-						
8	2.46	124	2.43	117	2.40	110						
10	-	-	-	-	-	-						
N	2.46	124	2.42	115	2.40	110						
2	-	-	-	-	-	-						
4	2.45	122	2.43	117	2.47	127						
6	-	-	-	-	-	-						
8	2.45	122	2.42	115	2.52	139						
10	-	-	-	-	-	-						
M	2.44	120	2.41	112	2.50	134						

Middle Fork of Yuba River at Milton, Calif.

Location.- Lat. 39°31'22", long. 120°35'01", in SW¼ sec. 12, T. 19 N., R. 12 E., at diversion dam of Nevada Irrigation District at old town site of Milton, Sierra County, 8 miles above South Fork of Middle Fork of Yuba River. Altitude, about 5,700 feet above mean sea level.
Drainage area.- 41 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,500 second-feet; extended to peak stage on basis of computed flow over diversion dam.
Maxima.- December 1937: Discharge, 6,800 second-feet 10 a.m. Dec. 11 (gage height, 4.18 feet).
1925-November 1937: Discharge (regulated), 4,070 second-feet Mar. 25, 1928 (gage height, 9.45 feet, former site and datum, 0.2 mile downstream).
Remarks.- Flood run-off slightly affected by storage in diversion reservoir and diversion through Milton-Bowman tunnel. Monthly summaries adjusted for diversion. Most of basic data furnished by Nevada Irrigation District.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	0	0	11	0	4,010	0	21	0	0	0
2	0	0	0	12	0	450	0	22	0	0	0
3	0	0	0	13	0	126	0	23	0	0	0
4	0	0	0	14	0	19	0	24	0	0	0
5	0	0	0	15	0	0	0	25	0	0	0
6	0	0	0	16	0	0	0	26	0	0	0
7	0	0	0	17	0	0	0	27	0	0	0
8	0	0	0	18	0	0	0	28	0	0	0
9	0	0	0	19	0	.1	0	29	0	0	0
10	0	2,240	0	20	0	0	0	30	0	0	0
								31		0	0
Mean monthly discharge, in second-feet (observed)............									0	221	0
Mean monthly discharge, in second-feet (adjusted)............									20.2	313	47.2
Run-off, in acre-feet (adjusted)............................									1,200	19,220	2,900

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					0.00	0	2.67	3,260	1.14	798	0.49	201
4					.06	2.4	3.67	5,490	1.01	651	.46	181
6					1.56	1,360	3.75	5,680	.90	535	.42	156
8					2.10	2,210	3.87	5,980	.81	450	.40	143
10					2.22	2,420	4.18	6,800	.75	397	.38	132
N					2.20	2,380	3.79	5,780	.75	397	.35	116
2					2.61	3,140	3.40	4,840	.72	371	.34	110
4					2.86	3,650	2.79	3,500	.69	346	.33	104
6					2.69	3,300	2.10	2,210	.66	323	.31	94
8					2.64	3,200	1.69	1,560	.62	292	.29	83
10					2.68	3,280	1.47	1,230	.57	256	.26	68
M					2.58	3,080	1.29	987	.53	228	.24	58
	December 14		December 15		December 16		December 17		December 18		December 19	
2	0.22	50										
4	.20	42										
6	.18	34										
8	.16	26										
10	.13	16										
N	.12	13										
2	.11	11										
4	.09	7										
6	.07	3.7										
8	.04	1.0										
10	.02	.4										
M	.00	0										

Supplemental records.- Dec. 10, 5 a.m., 1.08 ft., 728 sec.-ft. Dec. 11, 5 a.m., 3.84 ft., 5,900 sec.-ft.

160302 O—39——16

Middle Fork of Yuba River near North San Juan, Calif.

Location.- Lat. 39°23', long. 121°06', in NE¼ sec. 32, T. 18 N., R. 8 E., 1 mile below Oregon Creek and 1 mile north of North San Juan, Nevada County. Zero of gage is 1,400.62 feet above mean sea level (general adjustment of 1929).

Drainage area.- 207 square miles.

Gage-height record.- Water-stage recorder graph. Affected by drawdown of water level in well.

Stage-discharge relation.- Defined by current-meter measurements below 23,000 second-feet. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 24,000 second-feet 7:30 a.m. Dec. 11 (gage height, 13.7 feet, from floodmarks on bank; 13.3 feet, in well, affected by drawdown).

1911-November 1937: Discharge, about 26,000 second-feet Mar. 25, 1928 (gage height, 15.3 feet, from floodmarks at former site and datum, 0.4 mile upstream), from rating curve extended above 1,200 second-feet on basis of slope-area determination of flood flow.

Remarks.- Flood run-off not materially affected by artificial storage. Milton-Bowman tunnel diverts water above station. Monthly summaries adjusted for diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	41	107	190	11	92	16,100	144	21	488	258	398
2	40	100	209	12	97	3,840	141	22	220	258	385
3	39	94	220	13	67	1,600	139	23	400	264	377
4	39	89	201	14	150	953	136	24	522	246	333
5	39	84	192	15	132	688	298	25	295	234	305
6	39	81	181	16	149	541	261	26	212	218	288
7	39	78	171	17	639	445	1,180	27	167	206	280
8	39	75	166	18	244	377	748	28	144	206	291
9	39	84	156	19	148	325	585	29	126	201	288
10	39	7,300	151	20	429	284	475	30	115	195	267
								31		192	501
Mean monthly discharge, in second-feet (observed)									174	1,152	312
Mean monthly discharge, in second-feet (adjusted)									194	1,244	359
Run-off, in acre-feet (adjusted)									11,570	76,500	22,050

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	2.79	77	2.77	74	3.98	396	9.60	10,500	7.70	6,080	5.87	2,120
4	2.79	77	2.77	74	5.55	1,500	10.28	12,700	7.44	5,400	5.77	1,970
6	2.78	75	2.77	74	7.42	4,440	12.28	20,100	7.23	4,870	5.69	1,860
8	2.78	75	2.76	72	8.17	6,260	13.20	24,000	7.07	4,490	5.61	1,750
10	2.78	75	2.75	71	8.63	7,520	12.49	22,700	6.85	3,970	5.53	1,660
N	2.78	75	2.76	72	9.12	8,960	12.30	21,900	6.66	3,550	5.45	1,560
2	2.78	75	2.77	74	9.31	9,530	12.25	21,800	6.47	3,160	5.38	1,490
4	2.78	75	2.81	80	9.88	11,400	11.25	18,000	6.34	2,910	5.30	1,400
6	2.78	75	2.85	86	10.07	12,000	10.10	13,800	6.25	2,740	5.24	1,340
8	2.78	75	2.93	99	9.80	11,100	9.23	10,800	6.16	2,580	5.19	1,290
10	2.77	74	3.03	115	9.51	10,200	8.53	8,460	6.08	2,450	5.13	1,240
M	2.77	74	3.30	172	9.47	10,000	8.01	6,930	5.97	2,270	5.08	1,190
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.98	1,100	4.48	748	4.19	580	3.98	470	3.82	394	3.68	337
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.87	1,020	4.42	712	4.15	558	3.95	455	3.80	385	3.66	329
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.78	946	4.37	682	4.11	536	3.93	445	3.78	377	3.65	325
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.70	890	4.32	652	4.08	520	3.90	430	3.76	369	3.62	313
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.61	827	4.27	624	4.04	500	3.87	416	3.72	353	3.61	309
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.54	784	4.23	602	4.01	485	3.84	403	3.71	349	3.59	302
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	3.42	246	3.63	317	-	-	-	-
4	3.57	294	3.48	264	3.42	246	3.59	302	3.39	237	3.40	240
6	-	-	-	-	3.42	246	3.55	288	-	-	-	-
8	3.56	291	3.47	261	3.41	243	3.51	274	3.38	234	3.37	232
10	-	-	-	-	3.41	243	3.48	264	-	-	-	-
N	3.54	284	3.46	258	3.40	240	3.46	258	3.41	243	3.36	229
2	-	-	-	-	3.42	246	3.44	252	-	-	-	-
4	3.52	277	3.45	255	3.45	255	3.42	246	3.45	255	3.35	226
6	-	-	-	-	3.48	264	3.41	243	-	-	-	-
8	3.51	274	3.44	252	3.51	274	3.40	240	3.45	255	3.35	226
10	-	-	-	-	3.57	294	3.40	240	-	-	-	-
M	3.50	270	3.43	249	3.61	309	3.40	240	3.44	252	3.35	226

Supplemental records.- Dec. 11, 7:30 a.m., 13.3 ft., 24,000 sec.-ft.

Yuba River at Smartville, Calif.

Location.- Lat. 39°13', long. 121°18', in SW¼ sec. 22, T. 16 N., R. 6 E., at Narrows, 1 mile below Deer Creek and 1 mile north of Smartville, Yuba County. Zero of gage is 264.17 feet above mean sea level.

Drainage area.- 1,201 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 30,000 second-feet; extended to peak stage on basis of area-velocity study; verified by $A\sqrt{d}$ method. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 95,000 second-feet 9 a.m. Dec. 11 (gage height, 26.0 feet).

1903-November 1937: Discharge, about 120,000 second-feet Mar. 26, 1928 (gage height, 31.2 feet, present datum, from floodmarks), from rating curve extended above 6,500 second-feet on basis of slope-area computation of flood flow. Maximum gage height, 29.2 feet Mar. 19, 1907, former datum; equal to 34.4 feet present datum.

Remarks.- Flood run-off affected somewhat by artificial storage and diversions. Lake Spaulding (capacity, 70,500 acre-feet), Bowman Lake (capacity, 67,400 acre-feet), and Fordyce Lake (capacity, 42,000 acre-feet).

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	318	842	1,290	11	530	74,200	862	21	5,970	2,340	2,560
2	297	808	1,310	12	630	24,900	817	22	2,520	2,270	2,340
3	297	819	1,470	13	518	11,900	781	23	2,980	2,340	2,270
4	304	808	1,320	14	705	7,460	772	24	4,210	2,130	2,060
5	304	753	1,220	15	855	5,720	1,860	25	2,650	2,060	1,860
6	311	786	1,180	16	755	4,460	1,800	26	1,890	1,930	1,670
7	270	786	1,080	17	2,480	3,730	6,200	27	1,500	1,800	1,670
8	285	808	1,030	18	1,670	3,240	5,960	28	1,240	1,740	1,800
9	304	878	980	19	1,320	2,860	4,170	29	1,070	1,660	1,930
10	318	34,900	910	20	3,350	2,560	3,240	30	938	1,580	1,640
								31		1,400	3,240
Mean monthly discharge, in second-feet									1,360	6,596	1,977
Run-off, in acre-feet									80,900	405,600	121,600

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	4.7	2,270	20.6	56,900	17.14	36,700	12.04	15,100
4	-	-	3.49	819	6.0	3,950	21.8	64,700	16.37	32,800	11.81	14,300
6	3.44	764	-	-	7.5	6,000	23.4	75,800	15.80	30,100	11.63	13,700
8	-	-	3.49	819	9.4	9,090	24.6	84,500	15.27	27,700	11.47	13,200
10	-	-	-	-	12.3	15,600	25.9	94,200	14.76	25,400	11.26	12,400
N	3.47	797	3.47	797	16.2	31,000	25.8	93,500	14.31	23,500	10.90	11,300
2	-	-	-	-	18.3	42,300	25.3	89,800	13.76	21,300	10.83	11,000
4	-	-	3.51	842	20.0	53,000	24.8	86,000	13.36	19,800	10.77	10,800
6	3.50	830	-	-	22.8	71,600	24.0	80,000	13.01	18,500	10.56	10,200
8	-	-	3.61	962	24.6	84,500	21.5	62,800	12.53	16,800	10.28	9,340
10	-	-	-	-	22.5	69,500	19.6	50,600	12.43	16,400	10.30	9,400
M	3.50	830	3.80	1,190	21.0	59,500	18.3	43,000	12.24	15,800	10.25	9,260
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	10.06	8,730	9.19	6,420	-	-	-	-	-	-	-	-
6	-	-	-	-	8.40	4,660	7.97	3,850	7.63	3,290	7.40	2,930
8	9.84	8,110	9.02	6,010	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	9.54	7,300	8.89	5,700	8.30	4,460	7.90	3,730	7.56	3,180	7.36	2,870
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.42	6,990	8.76	5,410	-	-	-	-	-	-	-	-
6	-	-	-	-	8.18	4,220	7.81	3,580	7.52	3,110	7.31	2,800
8	9.19	6,420	8.64	5,150	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	9.10	6,200	8.53	4,920	8.04	3,970	7.80	3,560	7.46	3,020	7.27	2,740
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.20	2,630	7.06	2,420	6.91	2,210	7.14	2,540	6.81	2,070	6.89	2,190
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	7.16	2,570	7.02	2,370	6.90	2,200	7.00	2,340	6.83	2,100	6.80	2,060
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.12	2,510	7.00	2,340	6.91	2,210	6.91	2,210	6.96	2,280	6.78	2,030
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	7.09	2,470	6.96	2,280	7.08	2,450	6.86	2,140	6.98	2,310	6.76	2,010

Supplemental records.- Dec. 11, 9 a.m., 26.0 ft., 95,000 sec.-ft.

Oregon Creek near North San Juan, Calif.

Location.- Lat. 39°24', long. 121°05', in SW¼ sec. 22, T. 18 N., R. 8 E., 1 mile above mouth and 3 miles northeast of North San Juan, Nevada County. Altitude, about 1,500 feet above mean sea level.

Drainage area.- 35.1 square miles.

Gage-height record.- Water-stage recorder graph except for period 6:30 a.m. Jan. 22 to Jan. 31, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 2,100 second-feet; extended to peak stage.

Maxima.- December 1937: Discharge, 2,750 second-feet 6 a.m. Dec. 11 (gage height, 9.25 feet).

1911-November 1937: Discharge observed, about 4,000 second-feet (revised) Mar. 25, 1928 (gage height, 9.5 feet, from nonrecording gage, former site and datum), from rating curve extended above 250 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record determined from discharge graph based on record for Middle Fork of Yuba River near North San Juan.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4.8	16	35	11	14	1,540	28	21	76	46	125
2	4.5	14	42	12	15	560	27	22	34	47	115
3	4.3	13	46	13	8.5	268	27	23	90	49	110
4	4.3	12	42	14	25	179	26	24	110	46	105
5	4.3	11	40	15	20	130	72	25	54	42	90
6	4.1	10	37	16	27	102	65	26	37	39	82
7	4.1	9.5	35	17	112	81	571	27	29	37	76
8	3.8	9	33	18	36	68	289	28	24	36	76
9	3.8	15	31	19	23	58	194	29	20	36	74
10	3.8	832	30	20	107	52	149	30	18	34	72
								31		35	160
Mean monthly discharge, in second-feet									30.7	143	93.7
Run-off, in acre-feet									1,830	8,780	5,760

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.82	9	4.30	220	6.19	810	6.08	761	-	-
4	-	-	1.82	9	6.30	860	7.95	1,820	6.01	730	4.75	311
6	1.82	9	1.82	9	6.88	1,150	9.25	2,750	5.93	694	-	-
8	-	-	1.82	9	6.88	1,150	8.24	2,020	5.82	648	4.62	282
10	-	-	1.82	9	6.40	910	7.94	1,810	5.66	584	-	-
N	1.83	9.5	1.82	9	6.41	915	8.30	2,060	5.56	541	4.51	260
2	-	-	1.84	10	6.70	1,060	8.15	1,960	5.44	500	-	-
4	-	-	1.88	11	6.41	915	7.64	1,600	5.34	467	4.41	240
6	1.82	9	1.95	14	6.33	875	7.18	1,330	5.23	433	-	-
8	-	-	2.09	19	6.20	815	6.75	1,080	5.12	402	4.35	229
10	-	-	2.35	30	6.06	752	6.42	920	5.00	370	-	-
M	1.82	9	3.10	74	6.04	743	6.20	815	4.89	344	4.26	214
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.18	201	3.75	142	-	-	-	-	-	-	-	-
6	-	-	-	-	3.45	108	3.23	86	3.07	72	2.92	60
8	4.10	189	3.70	136	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.02	178	3.65	130	3.39	101	3.19	82	3.03	68	2.89	58
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.95	168	3.60	124	-	-	-	-	-	-	-	-
6	-	-	-	-	3.34	96	3.15	78	2.99	65	2.86	57
8	3.87	157	3.55	118	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.81	149	3.50	113	3.27	89	3.11	75	2.95	62	2.83	55
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.64	44	2.85	56	2.62	43	-	-
6	2.80	53	2.70	47	-	-	-	-	-	-	2.62	43
8	-	-	-	-	2.63	44	2.75	50	2.61	42	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.78	52	2.69	46	2.63	44	2.70	47	2.65	44	2.58	41
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	2.70	47	2.66	45	2.72	48	-	-
6	2.75	50	2.67	46	-	-	-	-	-	-	2.57	40
8	-	-	-	-	2.80	53	2.64	44	2.71	48	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.73	49	2.65	44	2.94	62	2.63	44	2.66	45	2.57	40

Supplemental records.- Dec. 11, 3 a.m., 6.64 ft., 1,030 sec.-ft.

North Fork of Yuba River near Sierra City, Calif.

Location.- Lat. 39°34', long. 120°40', in NW¼ sec. 32, T. 20 N., R. 12 E., 1½ miles west of Sierra City, Sierra County, and 2½ miles below South Fork of North Fork of Yuba River. Altitude, about 4,100 feet above mean sea level.

Drainage area.- 91.3 square miles.

Gage-height record.- Water-stage recorder graph except for period 7:30 a.m. Dec. 26 to 3 p.m. Dec. 28, when it was based on range of stage indicated on recorder graph. Gage heights shown are gage heights inside of well. At high stages gage inside of well usually reads lower than gage outside of well because of effect of drawdown, but near peak stage water entered well through ventilators, causing outside and inside gages to read about the same.

Stage-discharge relation.- Defined by current-meter measurements below 2,500 second-feet; extended to peak stage by averaging discharges determined on basis of area-velocity study and $A\sqrt{d}$ method; verified by logarithmic extension. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 9,800 second-feet about 4 a.m. Dec. 11 (gage height, about 10.0 feet).

1911-13, 1923-November 1937: Discharge, 5,920 second-feet Mar. 25, 1928 (gage height, 8.50 feet), from rating curve extended above 600 second-feet on basis of area-velocity study.

Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	46	87	148	11	57	5,300	124	21	218	211	133
2	45	85	153	12	50	1,300	122	22	136	200	138
3	45	82	148	13	54	810	122	23	160	191	133
4	44	79	142	14	70	565	122	24	148	188	127
5	44	76	138	15	61	448	135	25	127	183	130
6	45	74	132	16	97	374	128	26	114	166	128
7	45	73	132	17	191	322	155	27	107	162	128
8	45	73	128	18	105	286	148	28	100	157	130
9	45	136	127	19	103	250	140	29	94	153	128
10	45	4,310	125	20	304	227	135	30	90	151	125
								31		149	135
Mean monthly discharge, in second-feet									94.5	544	134
Run-off, in acre-feet									5,620	33,460	8,210

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.83	72	4.60	1,560	7.96	7,470	4.20	1,760	-	-
4	-	-	1.83	72	5.53	2,840	10.00	9,800	4.02	1,560	3.30	950
6	1.84	73	1.83	72	5.83	3,320	8.16	8,120	3.90	1,440	-	-
8	-	-	1.83	72	6.08	3,750	7.71	7,280	3.81	1,360	3.18	866
10	-	-	1.83	72	6.30	4,130	7.16	6,290	3.76	1,310	-	-
N	1.84	73	1.84	73	7.02	5,480	6.66	5,390	3.70	1,260	3.09	804
2	-	-	1.87	76	7.30	6,050	5.50	3,500	3.69	1,250	-	-
4	-	-	1.96	87	6.90	5,240	5.52	3,530	3.67	1,240	3.02	762
6	1.84	73	2.15	110	6.85	5,140	5.25	3,130	3.61	1,190	-	-
8	-	-	2.47	159	6.96	5,360	4.90	2,640	3.52	1,120	2.91	696
10	-	-	2.83	254	6.95	5,340	4.66	2,310	3.47	1,080	-	-
M	1.84	73	4.04	966	7.25	5,940	4.45	2,060	3.42	1,040	2.83	652
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.75	608	-	-	-	-	-	-	-	-	-	-
6	-	-	2.47	466	2.29	386	2.15	330	2.05	292	1.95	258
8	2.70	580	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.65	555	2.42	444	2.25	370	2.12	318	2.02	282	1.93	250
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.63	545	-	-	-	-	-	-	-	-	-	-
6	-	-	2.39	430	2.23	362	2.12	318	2.02	282	1.93	250
8	2.57	515	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.52	490	2.33	404	2.19	346	2.09	306	1.98	268	1.89	237
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.85	224	1.80	208	1.77	200	1.74	191	1.74	191	1.71	183
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.84	221	1.80	208	1.77	200	1.76	197	1.74	191	1.71	183
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.87	230	1.84	221	1.81	211	1.78	202	1.72	186	1.71	183
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.83	218	1.81	211	1.70	180	1.74	191	1.72	186	1.68	175

Lake Spaulding near Emigrant Gap, Calif.

Location.- Lat. 39°20', long. 120°38', in sec. 20, T. 17 N., R. 12 E., at dam on South Fork of Yuba River 2½ miles northeast of Emigrant Gap, Placer County. Zero of gage is 4,621 feet above mean sea level.
Drainage area.- 118 square miles.
Gage-height record.- Gage read to tenths daily at 5 p.m.
Remarks.- Flood run-off largely controlled in lake (capacity, 71,000 acre-feet at elevation of crest of spillway, 4,821 feet). Reservoir spilled for period 8 a.m. Dec. 11 to 11 a.m. Dec. 15. See record for South Fork of Yuba River at Lake Spaulding. Basic data furnished by Pacific Gas & Electric Co.

Gage height and contents, November 1937 to January 1938

Day	November		December		January	
	Gage height (feet)	Contents (acre-feet)	Gage height (feet)	Contents (acre-feet)	Gage height (feet)	Contents (acre-feet)
1	166.4	50,116	157.8	45,363	177.8	56,788
2	165.5	49,603	156.7	44,780	177.6	56,667
3	164.6	49,090	155.8	44,304	177.6	56,667
4	163.6	48,528	154.7	43,721	177.5	56,607
5	162.6	47,978	153.6	43,138	177.3	56,487
6	161.7	47,483	152.8	42,714	177.0	56,306
7	161.1	47,153	151.9	32,237	176.3	55,885
8	160.1	46,603	150.6	41,548	176.0	55,704
9	159.3	46,163	149.5	40,965	175.5	55,403
10	158.1	45,521	175.0	55,102	175.0	55,102
11	157.4	45,151	205.2	74,626	174.5	54,801
12	156.7	44,780	201.7	72,197	174.0	54,500
13	156.1	44,462	201.2	71,850	173.3	54,094
14	156.1	44,462	200.7	71,503	172.9	53,861
15	156.1	44,462	199.7	70,809	173.5	54,210
16	156.0	44,409	199.0	70,323	173.7	54,326
17	157.1	44,992	198.0	69,678	174.0	54,500
18	157.0	44,939	196.8	68,905	174.0	54,500
19	156.6	44,727	195.5	68,067	173.9	54,442
20	157.4	45,151	194.0	67,100	173.8	54,384
21	158.0	45,468	192.9	66,396	173.4	54,152
22	159.7	46,383	191.5	65,500	173.2	54,036
23	160.1	46,603	190.0	64,540	173.6	54,268
24	161.1	47,153	188.2	63,372	174.1	54,560
25	161.9	47,593	187.0	62,580	173.8	54,384
26	162.2	47,758	185.5	61,590	173.7	54,326
27	161.4	47,318	183.7	60,415	173.2	54,036
28	160.4	46,768	182.1	59,426	172.9	53,861
29	159.3	46,163	180.2	58,252	172.8	53,803
30	158.6	45,876	178.8	57,390	172.7	53,745
31			178.0	56,908	172.6	53,687

South Fork of Yuba River at Lake Spaulding, Calif.

Location.- Lat. 39°20', long. 120°38', in sec. 20, T. 17 N., R. 12 E., at Lake Spaulding Dam, Nevada County.

Drainage area.- 118 square miles.

Gage-height record.- Water-stage recorder graph (lake and spillway record) for period 8 a.m. Dec. 11 to 11 a.m. Dec. 15. Staff gage on lake read daily at 5 p.m. Water-stage recorder graph for Bowman-Spaulding canal. Record of daily discharge furnished for spill and release.

Maxima.- December 1937: Greatest outflow, 19,600 second-feet about 12:15 p.m. Dec. 11, computed from records of spill and release. Maximum inflow to reservoir probably occurred earlier, while it was rising rapidly.

Remarks.- Computed river discharge has been adjusted for items shown in table but not for storage in Lake Fordyce or other upstream reservoirs. Gain or loss in storage computed from contents at midnight determined from graph based on daily readings at 5 p.m. See record for Lake Spaulding near Emigrant Gap. Most of basic data furnished by Pacific Gas & Electric Co.

Storage, release, inflow, and discharge, December 1-20, 1937

Day	Lake Spaulding				Inflow from Bowman-Spaulding canal (sec.-ft.)	Computed river discharge (sec.-ft.)
	Contents (acre-feet)	Gain or loss in storage (acre-feet)	Spill (sec.-ft.)	Release (sec.-ft.)		
1	45,193	-470	0	550	229	
2	44,641	-552	0	550	229	
3	44,134	-507	0	549	229	
4	43,551	-583	0	550	229	
5	43,014	-537	0	535	229	*49
6	42,575	-439	0	551	229	
7	42,036	-539	0	551	229	
8	41,378	-658	0	550	229	
9	41,900	+522	0	537	206	594
10	59,500	+17,600	0	359	39	9,190
11	73,200	+13,700	4,830	626	.2	12,400
12	72,130	-1,070	1,580	797	26	1,810
13	71,800	-330	507	696	106	931
14	71,295	-505	255	781	130	651
15	70,667	-628	30	894	135	472
16	70,135	-532	0	902	126	508
17	69,453	-682	0	924	106	474
18	68,661	-792	0	944	112	433
19	67,785	-876	0	944	111	391
20	66,895	-890	0	944	111	384

*Mean for the period.

Bowman Lake near Graniteville, Calif.

Location.- Lat. 39°27', long. 120°39', in SW¼ sec. 5, T. 18 N., R. 12 E., at Bowman Dam, on Canyon Creek, 4 miles east of Graniteville, Nevada County. Zero of gage is at mean sea level.

Drainage area.- 30 square miles.

Gage-height record.- Gage read to tenths daily at 4:30 p.m. except on days for which no record is shown.

Remarks.- Flood run-off completely controlled in lake (capacity, 62,400 acre-feet at elevation of crest of spillway of concrete dam, 5555.75 feet). Elevation of top of rock-fill dam is 5,567 feet. Water is brought into the lake from Middle Fork of Yuba River through Milton-Bowman tunnel and is released through Bowman-Spaulding canal. See record for Canyon Creek below Bowman Lake. Basic data furnished by Nevada Irrigation District.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	5,509.9	29,940	5,493.9	20,850	5,521.4	36,840
2	5,509.1	29,460	5,493.3	20,550	-	-
3	5,508.3	28,980	5,492.9	20,350	-	-
4	5,507.4	28,440	-	-	5,520.8	36,480
5	5,506.6	27,960	-	-	5,520.6	36,360
6	5,505.8	27,480	5,491.2	19,500	5,520.3	36,180
7	5,505.0	27,000	5,490.5	19,150	-	-
8	5,504.1	26,460	5,489.8	18,800	-	-
9	5,503.2	25,920	5,489.1	18,450	-	-
10	5,502.4	25,440	5,493.7	20,750	5,518.9	35,340
11	5,501.6	24,960	5,511.2	30,720	5,518.4	35,040
12	5,500.8	24,480	5,516.0	33,600	5,518.0	34,800
13	5,500.0	24,000	-	-	5,517.5	34,500
14	5,499.2	23,520	5,518.0	34,800	5,517.0	34,200
15	5,498.5	23,150	5,518.9	35,340	5,516.8	34,080
16	5,497.9	22,850	5,519.8	35,880	5,516.4	33,840
17	5,498.1	22,950	5,520.4	36,240	5,516.2	33,720
18	5,497.9	23,850	-	-	5,515.9	33,540
19	5,497.5	22,650	-	-	5,515.7	33,420
20	5,497.4	22,600	5,521.1	36,660	-	-
21	5,497.5	22,650	-	-	5,414.8	32,880
22	5,497.2	22,500	5,521.6	36,960	5,514.4	32,640
23	5,497.1	22,450	5,521.7	37,020	-	-
24	5,497.0	22,400	5,521.8	37,080	5,513.6	32,160
25	5,496.7	22,250	5,521.9	37,140	5,513.1	31,860
26	5,496.4	22,100	5,522.0	37,200	5,512.7	31,620
27	5,495.9	21,850	5,522.0	37,200	5,512.3	31,380
28	5,495.4	21,600	5,522.0	37,200	5,511.9	31,140
29	5,495.0	21,400	5,521.9	37,140	5,511.5	30,900
30	5,494.5	21,150	5,521.8	37,080	5,511.0	30,600
31			5,521.6	36,960	5,510.5	30,300

Canyon Creek below Bowman Lake, Calif.

Location.- Lat. 39°26', long. 120°40', in SE$\frac{1}{4}$ sec. 7, T. 18 N., R. 12 E., 1 mile below Bowman Lake, Nevada County, and 3 miles upstream from mouth of Texas Creek. Altitude, about 5,100 feet above mean sea level.

Drainage area.- 31.7 square miles.

Gage-height record.- Water-stage recorder graph except for period Dec. 3 to 11, when record was furnished by Nevada Irrigation District.

Stage-discharge relation.- Defined by current-meter measurements for range of stage occurring in December.

Maxima.- December 1937: Discharge (regulated), 88 second-feet 9:30 a.m. Dec. 11 (gage height, 2.20 feet). Maximum discharge computed from increase in storage, about 5,200 second-feet early morning Dec. 11.

1927-November 1937: Discharge (reservoir spilling), 1,460 second-feet June 6, 1936 (gage height, 5.98 feet), from rating curve extended above 700 second-feet.

Remarks.- Flood run-off completely regulated by storage in Bowman Lake (capacity, 62,400 acre-feet). Daily discharge for December and all monthly discharges adjusted for storage, inflow, and diversion as shown, but not for possible storage in small reservoirs upstream. Gain or loss in storage computed from contents at midnight determined from graph based on daily readings at 4:30 p.m. See record for Bowman Lake near Graniteville. Most of basic data furnished by Nevada Irrigation District.

Discharge, gain or loss in storage, inflow, and diversions, December 1937

Day	Observed discharge (second-feet)	Gain or loss in storage (acre-feet)	Milton-Bowman Tunnel inflow (second-feet)	Bowman-Spaulding Canal diversion (second-feet)	Adjusted discharge (second-feet)
1	0.8	-290	17	229	67
2	.8	-280	16	229	73
3	.8	-200	15	229	114
4	.8	-280	15	229	74
5	.8	-300	14	229	65
6	.8	-310	13	229	61
7	.8	-370	12	229	31
8	.8	-350	13	229	41
9	5	-70	14	206	162
10	40	+5,600	120	39	2,780
11	65	+8,000	200	.2	3,900
12	32	+1,600	276	26	589
13	.4	+600	232	106	176
14	.2	+570	227	130	190
15	1.4	+550	211	135	202
16	1.4	+520	200	126	189
17	1.3	+230	121	106	102
18	1.2	+140	88	112	96
19	1.0	+140	103	111	80
20	.9	+170	100	111	98
21	.9	+160	96	142	128
22	.8	+100	91	155	115
23	.9	+60	81	154	104
24	.9	+60	79	152	104
25	.9	+60	77	152	106
26	.9	+40	74	152	99
27	.9	0	76	159	84
28	.9	-20	72	174	93
29	1.0	-60	67	195	99
30	1.0	-70	62	204	108
31	1.0	-130	61	207	81

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.5	0.8	1.0	11	1.4	65	0.9	21	3.5	0.9	1.6
2	.5	.8	1.9	12	1.2	32	.8	22	2.0	.8	2.4
3	.5	.8	1.6	13	.8	.4	.8	23	4.1	.9	2.4
4	.4	.8	1.2	14	4.3	.2	.8	24	3.5	.9	1.8
5	.4	.8	1.0	15	2.5	1.4	1.6	25	2.5	.9	1.6
6	.4	.8	1.0	16	12	1.4	1.2	26	2.0	.9	1.8
7	.4	.8	.9	17	19	1.3	3.1	27	1.8	.9	1.8
8	.4	.8	.9	18	2.9	1.2	2.0	28	1.4	.9	1.8
9	.5	5	.9	19	3.1	1.0	1.6	29	1.3	1.0	1.8
10	.5	40	.9	20	11	.9	1.4	30	1.0	1.0	1.8
										1.0	2.0
Mean monthly discharge, in second-feet (observed)............									2.86	5.36	1.49
Gain or loss in storage, in acre-feet........................									-9,220	+15,870	-6,720
Mean monthly discharge, in second-feet (adjusted)............									46.7	329	62.6
Run-off, in acre-feet (adjusted).............................									2,780	20,250	3,850

Deer Creek near Smartville, Calif.

Location.- Lat. 39°13'20", long. 121°16'00", in sec. 23, T. 16 N., R. 6 E., 1 mile above mouth and 2 miles northeast of Smartville, Yuba County. Altitude, about 500 feet above mean sea level.

Drainage area.- 83.5 square miles.

Gage-height record.- One gage reading daily. A stage graph was drawn for period Dec. 8 to 14 based on gage readings, floodmark, and comparison with stage graphs at nearby stations.

Stage-discharge relation.- Defined by current-meter measurements below 3,500 second-feet; extended to peak stage by $A\sqrt{d}$ method; verified by area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 10,800 second-feet about 9 a.m. Dec. 11 (gage height, 13.2 feet, from floodmark).

1935-November 1937: Discharge, 7,520 second-feet Feb. 4, 1937 (gage height, 11.5 feet), from rating curve extended above 3,500 second-feet on basis of area-velocity study and $A\sqrt{d}$ method.

Remarks.- Flood run-off probably not materially affected by diversion or artificial storage in Deer Creek Reservoir.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	33	36	70	11	88	6,620	55	21	715	70	138
2	45	65	72	12	88	1,930	53	22	1,290	94	130
3	31	15	68	13	88	455	53	23	500	101	122
4	55	45	66	14	76	170	51	24	198	68	115
5	65	40	63	15	76	138	272	25	162	72	108
6	65	40	59	16	76	138	154	26	115	82	88
7	76	36	53	17	500	101	1,100	27	36	75	94
8	76	35	57	18	67	88	420	28	28	70	138
9	82	88	57	19	41	82	285	29	19	72	130
10	82	2,420	55	20	460	66	248	30	14	68	130
								31		77	990
Mean monthly discharge, in second-feet									175	434	177
Run-off, in acre-feet									10,410	26,690	10,900

Bear River near Wheatland, Calif.

Location.- Lat. 39°00', long. 121°25', in sec. 3, T. 13 N., R. 5 E., 1 mile southeast of Wheatland, Yuba County, 6½ miles below Rock Creek, and 12 miles above mouth. Altitude, about 85 feet above mean sea level.
Drainage area.- 295 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 11,000 second-feet 2:30 p.m. Dec. 11 (gage height, 11.32 feet).
1928-November 1937: Discharge, 21,600 second-feet Apr. 8, 1935 (gage height, 15.15 feet), from rating curve extended above 16,100 second-feet.
1904-28: Discharge, about 29,600 second-feet Jan. 14, 1909 (gage height, 18.9 feet, from nonrecording gage, former site and datum, 8 miles upstream; drainage area, 263 square miles), from rating curve extended above 1,900 second-feet.
Remarks.- Flood run-off slightly affected by artificial storage and many diversions into and out of drainage basin. Camp Far West Reservoir (capacity, 5,000 acre-feet) and Combie Reservoir (capacity, 9,000 acre-feet).

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	33	168	518	11	56	8,180	248	21	542	601	619
2	36	176	513	12	81	3,390	212	22	464	595	571
3	36	176	491	13	60	1,570	191	23	908	613	589
4	34	180	452	14	88	962	194	24	870	589	530
5	36	180	385	15	88	746	573	25	613	601	502
6	36	153	252	16	74	674	442	26	516	589	486
7	38	143	272	17	426	649	827	27	398	571	469
8	36	102	345	18	234	631	799	28	234	571	464
9	38	100	268	19	284	625	714	29	197	559	486
10	39	2,460	244	20	446	613	720	30	184	547	447
								31		541	876
Mean monthly discharge, in second-feet									238	911	474
Run-off, in acre-feet									14,130	56,040	29,160

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	1.25	168	5.22	3,160	7.00	5,080	3.93	1,960
4	-	-	1.02	94	1.32	197	6.12	4,110	6.39	4,410	3.84	1,880
6	1.05	102	-	-	1.70	410	8.36	6,680	5.97	3,950	3.76	1,800
8	-	-	1.02	94	4.05	2,080	9.47	8,160	5.94	3,910	3.66	1,710
10	-	-	-	-	4.85	2,790	10.65	9,940	5.58	3,520	3.56	1,620
N	1.05	102	1.01	91	5.26	3,200	11.14	10,800	5.32	3,260	3.45	1,520
2	-	-	-	-	5.34	3,280	11.30	11,000	5.00	2,940	3.33	1,420
4	-	-	1.02	94	5.88	3,850	11.28	11,000	4.73	2,680	3.24	1,350
6	1.05	102	-	-	6.42	4,440	11.03	10,600	4.53	2,500	3.20	1,320
8	-	-	1.05	102	6.13	4,120	10.42	9,570	4.25	2,240	3.16	1,290
10	-	-	-	-	5.50	3,440	9.26	7,860	4.05	2,060	3.09	1,230
M	1.04	100	1.19	146	5.22	3,160	7.99	6,240	4.02	2,040	3.03	1,180
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.90	1,080	2.50	785	-	-	-	-	-	-	-	-
6	-	-	-	-	2.35	688	2.30	655	2.27	637	2.26	631
8	2.81	1,010	2.47	766	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.73	948	2.43	740	2.32	668	2.29	649	2.26	631	2.25	625
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.66	897	2.41	726	-	-	-	-	-	-	-	-
6	-	-	-	-	2.31	662	2.28	643	2.25	625	2.24	619
8	2.61	862	2.39	714	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.55	820	2.37	700	2.31	662	2.28	643	2.26	631	2.24	619
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.23	613	2.21	601	2.20	595	2.25	625	2.20	595	2.21	601
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.22	607	2.21	601	2.20	595	2.25	625	2.19	589	2.22	607
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.22	607	2.20	595	2.20	595	2.22	607	2.19	589	2.21	601
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.22	607	2.20	595	2.20	595	2.21	601	2.19	589	2.20	595

Supplemental records.- Dec. 11, 2:30 p.m., 11.32 ft., 11,000 sec.-ft.

North Fork of American River near Colfax, Calif.

Location.- Lat. 39°02', long. 120°54', in NW¼ sec. 30, T. 14 N., R. 10 E., 50 feet downstream from bridge on Colfax-Forest Hill road, 200 feet below mouth of Shirttail Canyon Creek, and 5 miles southeast of Colfax, Placer County. Zero of gage is 897.29 feet above mean sea level (general adjustment of 1929).

Drainage area.- 308 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 20,300 second-feet; extended to peak stage by $A\sqrt{d}$ method; verified by area-velocity study and by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 26,700 second-feet 11:30 a.m. Dec. 11 (gage height, 18.2 feet, inside gage; 19.4 feet, outside gage, determined from drawdown relation curve).

1911-November 1937: Discharge, about 37,000 second-feet (revised) Mar. 25, 1928 (gage height, 25.2 feet, from floodmarks, present datum), from rating curve extended above 2,650 second-feet on basis of slope-area determination of flood flow.

Remarks.- Flood run-off slightly affected by artificial storage and diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	57	198	415	11	100	16,500	287	21	751	649	715
2	57	186	450	12	133	4,980	274	22	357	627	721
3	55	177	470	13	85	2,550	269	23	369	676	704
4	54	163	425	14	160	1,740	260	24	710	616	616
5	54	155	390	15	157	1,340	506	25	441	594	578
6	54	155	364	16	128	1,160	470	26	341	495	566
7	54	149	346	17	907	1,020	960	27	290	512	561
8	54	146	332	18	468	895	1,060	28	255	490	566
9	52	157	310	19	248	799	895	29	234	440	583
10	51	9,710	296	20	437	715	799	30	214	425	522
								31		425	853
Mean monthly discharge, in second-feet									244	1,576	534
Run-off, in acre-feet									14,530	96,880	32,850

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.94	144	3.07	575	11.89	12,400	8.90	7,100	6.10	3,190
4	1.96	149	1.94	144	4.65	1,540	13.23	15,100	8.53	6,510	5.95	3,020
6	-	-	1.94	144	10.12	9,100	15.07	19,200	8.19	5,980	5.81	2,870
8	1.95	146	1.93	141	11.00	10,700	15.58	20,400	7.88	5,520	5.67	2,720
10	-	-	1.93	141	11.53	11,700	16.80	23,300	7.58	5,090	5.56	2,610
N	1.95	146	1.93	141	11.09	10,800	17.48	25,000	7.29	4,690	5.44	2,490
2	-	-	1.93	141	12.20	13,000	16.07	21,600	7.06	4,380	5.32	2,370
4	1.95	146	1.94	144	13.26	15,200	14.56	18,000	6.82	4,070	5.23	2,280
6	-	-	1.98	155	12.87	14,300	12.79	14,200	6.67	3,870	5.15	2,200
8	1.94	144	2.03	169	11.83	12,300	11.13	10,900	6.56	3,730	5.06	2,110
10	-	-	2.15	204	11.17	11,000	10.10	9,060	6.40	3,540	5.00	2,060
M	1.94	144	2.46	311	11.18	11,000	9.35	7,820	6.24	3,350	4.97	2,030
	December 14		December 15		December 16		December 17		December 18		December 19	
2	4.90	1,970	-	-	-	-	-	-	-	-	-	-
4	4.85	1,920	4.30	1,460	3.94	1,190	3.75	1,060	3.56	936	3.38	823
6	4.78	1,860	-	-	-	-	-	-	-	-	-	-
8	4.72	1,810	4.22	1,400	3.96	1,200	3.71	1,030	3.54	921	3.35	805
10	4.67	1,760	-	-	-	-	-	-	-	-	-	-
N	4.62	1,720	4.16	1,350	3.91	1,170	3.68	1,010	3.52	908	3.34	799
2	4.58	1,680	-	-	-	-	-	-	-	-	-	-
4	4.53	1,640	4.10	1,300	3.87	1,140	3.66	999	3.50	895	3.32	787
6	4.48	1,600	-	-	-	-	-	-	-	-	-	-
8	4.43	1,560	4.03	1,250	3.82	1,100	3.62	973	3.46	871	3.29	769
10	4.38	1,520	-	-	-	-	-	-	-	-	-	-
M	4.35	1,500	3.97	1,210	3.78	1,080	3.58	947	3.41	841	3.26	751
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	3.04	627	3.32	787	3.02	616	3.01	610
4	3.24	739	3.10	660	3.03	622	3.32	787	3.02	616	2.99	600
6	-	-	-	-	3.02	616	3.29	769	3.02	616	2.99	600
8	3.23	733	3.09	654	3.02	616	3.21	721	3.01	610	2.97	588
10	-	-	-	-	3.01	610	3.14	682	3.00	605	2.97	588
N	3.21	721	3.09	654	3.01	610	3.08	649	2.99	600	2.96	583
2	-	-	-	-	3.00	606	3.05	632	2.99	600	2.95	578
4	3.16	693	3.06	638	3.00	605	3.04	627	3.00	605	2.95	578
6	-	-	-	-	3.00	605	3.03	622	3.03	622	2.94	572
8	3.14	682	3.05	632	3.07	644	3.02	616	3.04	627	2.94	572
10	-	-	-	-	3.15	688	3.02	616	3.04	627	2.94	572
M	3.11	666	3.04	627	3.25	745	3.02	616	3.03	622	2.94	572

Supplemental records.- Dec. 11, 11:30 a.m., 18.20 ft., 26,700 sec.-ft.

American River at Fair Oaks, Calif.

Location.- Lat. 38°38'15", long. 121°15'55", just above highway bridge at Fair Oaks, Sacramento County, and 10 miles below South Fork. Altitude, about 72 feet above mean sea level.
Drainage area.- 1,921 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 102,000 second-feet; extended to peak stage; verified by area-velocity study and by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin. Shifting-control method used for period Dec. 12-20.
Maxima.- December 1937: Discharge, 114,000 second-feet 6 p.m. Dec. 11 (gage height, 29.06 feet).
1904-November 1937: Discharge, 140,000 second-feet (revised) Mar. 19, 1907, and Mar. 25, 1928 (gage height, 31.4 feet, present datum), from rating curve extended above 75,000 second-feet.
Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	585	1,040	1,870	11	658	81,100	1,470	21	2,730	2,720	3,000
2	604	970	1,940	12	835	37,000	1,470	22	2,150	2,540	2,720
3	560	970	2,010	13	880	13,600	1,440	23	1,600	2,900	2,810
4	585	925	2,010	14	858	8,240	1,380	24	2,220	2,540	2,630
5	585	902	1,800	15	995	5,820	2,010	25	2,080	2,460	2,380
6	595	880	1,800	16	970	4,920	2,540	26	1,500	2,300	2,300
7	595	880	1,600	17	1,430	4,300	3,100	27	1,290	2,010	2,220
8	590	880	1,570	18	2,810	3,760	4,920	28	1,200	2,010	2,300
9	600	858	1,630	19	1,630	3,410	3,890	29	1,100	1,940	2,810
10	604	24,300	1,470	20	1,290	3,000	3,760	30	1,070	1,870	2,630
								31		1,800	3,200
Mean monthly discharge, in second-feet									1,173	7,189	2,345
Run-off, in acre-feet									69,820	442,000	144,200

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	3.03	985	20.96	59,800	22.60	69,900	12.12	17,400
4	2.82	889	2.78	871	3.18	1,060	19.94	53,900	20.10	54,800	11.85	16,400
6	-	-	-	-	3.26	1,100	19.47	51,200	18.33	45,000	11.62	15,700
8	2.69	830	2.79	876	3.50	1,230	20.00	54,200	17.08	38,500	11.38	14,900
10	-	-	-	-	3.69	1,340	22.21	67,400	16.19	34,300	11.16	14,200
N	2.83	894	2.81	884	7.43	4,970	25.02	85,600	15.40	30,800	10.96	13,500
2	-	-	-	-	13.87	24,300	27.00	99,000	14.75	28,000	10.73	12,900
4	2.88	916	2.71	840	17.59	41,100	28.24	108,000	14.15	25,400	10.60	12,400
6	-	-	-	-	20.00	54,200	29.06	114,000	13.57	23,100	10.44	11,900
8	2.60	790	2.76	862	21.30	61,800	28.54	110,000	13.17	21,600	10.27	11,400
10	-	-	-	-	22.23	67,500	27.28	101,000	12.77	20,100	10.10	10,900
M	2.85	902	2.93	938	21.92	65,500	25.05	85,800	12.44	18,900	9.95	10,500
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.66	9,160	8.64	6,300	7.98	5,400	7.42	4,630	6.90	4,020	6.55	3,640
6	-	-	-	-	-	-	-	-	-	-	-	-
8	9.45	8,610	8.49	6,000	7.86	6,190	7.29	4,430	6.78	3,860	6.42	3,490
10	-	-	-	-	-	-	-	-	-	-	-	-
N	9.25	8,120	8.35	5,720	7.72	4,950	7.11	4,170	6.66	3,710	6.29	3,340
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.16	7,900	8.32	5,660	7.67	4,870	7.06	4,100	6.64	3,690	6.23	3,280
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.99	7,500	8.22	5,480	7.58	4,730	6.99	4,010	6.60	3,640	6.18	3,230
10	-	-	-	-	-	-	-	-	-	-	-	-
M	8.79	7,040	8.13	5,310	7.55	4,680	7.04	4,080	6.66	3,710	6.20	3,250
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.10	3,200	5.76	2,860	5.47	2,600	5.58	2,700	5.55	2,680	5.39	2,530
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.93	3,030	5.56	2,680	5.33	2,480	5.75	2,860	5.36	2,510	5.33	2,430
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.89	2,990	5.50	2,630	5.34	2,490	6.11	3,210	5.35	2,500	5.46	2,590
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.84	2,940	5.44	2,580	5.31	2,470	6.02	3,120	5.24	2,410	5.41	2,550
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.79	2,890	5.45	2,580	5.30	2,460	5.30	2,900	5.21	2,390	5.22	2,400
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.80	2,900	5.51	2,640	5.36	2,510	5.69	2,800	5.23	2,400	5.16	2,350

Middle Fork of American River near Auburn, Calif.

Location.- Lat. 38°55', long. 121°00', in NW¼ sec. 5, T. 12 N., R. 9 E., at Mountain Quarry Co.'s plant 1.7 miles above junction with North Fork of American River and 3½ miles northeast of Auburn, Placer County. Altitude, about 580 feet above mean sea level.
Drainage area.- 619 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 28,800 second-feet; extended to peak stage on basis of area-velocity study and by $A\sqrt{d}$ method; verified by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 47,900 second-feet 2 p.m. Dec. 11 (gage height, 27.3 feet).
1911-November 1937: Discharge, 62,000 second-feet (revised) Mar. 25, 1928 (gage height, 35.6 feet, former site and datum, from floodmarks), from rating curve extended above 4,000 second-feet on basis of slope-area determination of flood flow.
Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	82	238	581	11	112	37,700	404	21	1,510	846	975
2	82	224	640	12	169	12,700	394	22	650	804	952
3	79	213	700	13	149	4,710	384	23	462	909	1,060
4	79	204	640	14	172	2,920	384	24	800	783	930
5	78	195	581	15	219	2,250	660	25	580	783	846
6	76	188	539	16	195	1,800	700	26	416	720	804
7	78	185	502	17	743	1,540	1,200	27	347	680	804
8	79	185	481	18	840	1,340	1,590	28	308	660	846
9	79	190	452	19	388	1,110	1,290	29	273	620	975
10	80	18,100	418	20	360	975	1,160	30	254	581	888
								31		581	1,290
Mean monthly discharge, in second-feet									325	3,062	776
Run-off, in acre-feet									19,320	188,300	47,740

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.29	186	2.83	293	19.79	25,800	18.56	22,600	11.00	6,100
4	2.28	185	2.30	188	3.25	402	20.00	26,400	17.30	19,300	10.80	5,820
6	-	-	2.30	188	4.20	720	21.80	31,400	16.20	16,700	10.60	5,540
8	2.28	185	2.30	188	6.90	2,010	24.00	38,000	15.30	14,500	10.31	5,190
10	-	-	2.30	188	17.40	19,600	25.11	41,300	14.45	12,600	9.95	4,760
N	2.28	185	2.30	188	19.65	25,400	26.40	45,200	13.70	11,000	9.68	4,460
2	-	-	2.30	188	20.65	28,200	27.30	47,900	13.10	9,800	9.52	4,300
4	2.28	185	2.30	188	21.60	30,900	26.99	47,000	12.60	8,800	9.33	4,110
6	-	-	2.31	190	22.25	32,800	26.40	45,200	12.10	7,880	9.16	3,940
8	2.28	185	2.36	199	21.96	31,900	24.90	40,700	11.78	7,310	8.98	3,760
10	-	-	2.45	215	20.88	28,900	22.45	33,400	11.50	6,860	8.84	3,640
M	2.28	185	2.54	232	20.00	26,400	20.35	27,400	11.20	6,380	8.68	3,490
	December 14		December 15		December 16		December 17		December 18		December 19	
2	8.55	3,380	-	-	-	-	-	-	-	-	-	-
4	8.42	3,260	-	-	-	-	-	-	5.38	1,380	4.91	1,160
6	8.33	3,180	7.20	2,370	6.38	1,900	5.74	1,560	-	-	-	-
8	8.22	3,100	-	-	-	-	-	-	5.31	1,340	4.88	1,150
10	8.10	3,000	-	-	-	-	-	-	-	-	-	-
N	8.03	2,940	7.00	2,250	6.25	1,830	5.67	1,520	5.27	1,320	4.77	1,100
2	7.92	2,860	-	-	-	-	-	-	-	-	-	-
4	7.80	2,770	-	-	-	-	-	-	5.19	1,290	4.74	1,080
6	7.70	2,700	6.80	2,130	6.10	1,740	5.56	1,470	-	-	-	-
8	7.60	2,630	-	-	-	-	-	-	5.16	1,270	4.70	1,060
10	7.50	2,560	-	-	-	-	-	-	-	-	-	-
M	7.40	2,490	6.57	2,000	5.93	1,660	5.46	1,420	5.10	1,240	4.60	1,020
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.56	1,000	4.24	863	4.13	817	4.57	1,010	3.94	737	4.13	817
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.52	984	4.20	846	4.08	796	4.60	1,020	4.04	779	4.10	804
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.50	975	4.11	808	4.07	791	4.44	948	4.06	787	4.06	787
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.44	948	4.14	821	4.10	804	4.30	888	4.06	787	4.02	770
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.40	930	4.13	817	4.20	846	4.06	787	4.06	787	3.98	754
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.30	888	4.16	829	4.37	917	3.93	733	4.11	808	3.96	745

Supplemental records.- Dec. 10, 6:30 a.m., 22.37 ft., 32,300 sec.-ft.; 1:00 p.m., 20.95 ft., 29,100 sec.-ft.

South Fork of American River near Kyburz, Calif.

Location.- Lat. 38°46', long. 120°19', in S½ sec. 29, T. 11 N., R. 15 E., beside Lincoln Highway, 0.5 mile below Silver Fork of South Fork of American River, and 2 miles west of Kyburz, Eldorado County. Altitude, about 4,030 feet above mean sea level.
Drainage area.- 196 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 3,900 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin.
Maxima.- December 1937: Discharge, 9,700 second-feet 6 a.m. Dec. 11 (gage height, 8.55 feet).
1922-November 1937: Discharge, 5,020 second-feet Mar. 25, 1928 (gage height, 7.60 feet), from rating curve extended above 2,200 second-feet.
Remarks.- Flood run-off not materially affected by artificial storage. Monthly summaries adjusted for diversion into Eldorado canal. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.1	3.0	112	11	3.4	6,470	67	21	51	165	78
2	2.2	3.0	121	12	2.6	1,960	64	22	2.4	154	88
3	2.1	2.5	110	13	2.1	904	63	23	2.4	136	83
4	2.0	2.2	104	14	4.2	538	64	24	2.5	144	74
5	2.5	2.0	98	15	1.7	416	92	25	2.0	136	75
6	2.4	4.2	89	16	2.6	322	78	26	1.5	130	79
7	2.2	2.4	79	17	53	275	101	27	1.5	128	82
8	3.1	1.7	76	18	7	238	89	28	2.2	117	82
9	2.2	3.7	71	19	2.5	207	85	29	2.2	114	79
10	2.1	2,850	68	20	78	174	74	30	2.2	110	67
								31		109	75
Mean monthly discharge, in second-feet (observed)									8.33	510	82.8
Mean monthly discharge, in second-feet (adjusted)									110	596	174
Run-off, in acre-feet (adjusted)									6,550	36,620	10,720

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.09	.9	3.90	506	7.72	6,420	5.93	2,820	4.78	1,230
4	1.28	2.7	1.08	.8	5.33	1,580	8.35	8,680	5.80	2,600	4.70	1,150
6	-	-	1.08	.8	6.10	2,590	8.55	9,700	5.65	2,360	4.64	1,090
8	1.29	2.9	1.08	.8	6.70	3,700	8.00	7,920	5.52	2,160	4.57	1,020
10	-	-	1.08	.8	6.65	3,600	7.91	7,670	5.40	1,990	4.50	960
N	1.20	1.7	1.08	.8	6.40	3,100	7.76	7,250	5.30	1,850	4.45	920
2	-	-	1.08	.8	6.73	3,770	7.51	6,550	5.22	1,750	4.31	808
4	1.12	1.1	1.08	.8	6.75	3,810	7.50	6,520	5.18	1,690	4.27	779
6	-	-	1.10	.9	6.60	3,490	7.15	5,550	5.11	1,600	4.23	751
8	1.10	.9	1.16	1.4	6.40	3,100	6.71	4,450	5.00	1,470	4.19	724
10	-	-	1.65	13	6.70	3,700	6.38	3,730	4.94	1,400	4.13	688
M	1.09	.9	2.15	46	6.83	3,990	6.11	2,160	4.85	1,300	4.07	652
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.98	599	3.71	453	3.46	345	-	-	-	-	-	-
6	-	-	-	-	-	-	3.29	282	3.19	249	3.06	212
8	3.90	555	3.65	425	3.42	330	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.84	522	3.60	402	3.38	315	3.25	268	3.13	232	3.02	201
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.81	506	3.56	385	3.35	304	-	-	-	-	-	-
6	-	-	-	-	-	-	3.23	262	3.12	229	3.01	199
8	3.80	500	3.54	377	3.33	296	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.77	484	3.51	364	3.33	296	3.22	259	3.10	223	3.00	196
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.93	179	2.90	172	2.85	161	2.76	142	2.69	128	2.71	132
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.85	161	2.87	165	2.81	152	2.64	119	2.71	132	2.65	121
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.86	163	2.85	161	2.78	146	2.67	125	2.81	152	2.74	138
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.93	179	2.85	161	2.80	150	2.74	138	2.91	174	2.83	157
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.95	184	2.88	168	2.85	161	2.80	150	2.86	163	2.79	148
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.95	184	2.88	168	2.91	174	2.72	134	2.78	146	2.70	130

Supplemental records.- Dec. 10, 1 a.m., 2.35 ft., 66 sec.-ft.

South Fork of American River near Camino, Calif.

Location.- Lat. 38°46', long. 120°42', in SW$\frac{1}{4}$ sec. 25, T. 11 N., R. 11 E., 300 feet above mouth of Iowa Canyon Creek, 1 mile below intake of American River flume, and 3 miles northwest of Camino, Eldorado County. Altitude, about 1,640 feet above mean sea level.

Drainage area.- 497 square miles.

Gage-height record.- Water-stage recorder graph except for period 11:40 a.m. Dec. 3 to 12:40 p.m. Dec. 12. Stage graph for period 11:40 a.m. Dec. 3 to 7 a.m. Dec. 10 based on several daily readings taken from the recorder graph before it was destroyed. Stage graph for period 7 a.m. Dec. 10 to 12:40 p.m. Dec. 12 based on floodmarks, occasional readings at a dam 1 mile above gage, and comparison with stage graphs for South Fork of American River at Coloma and Silver Creek near Placerville.

Stage-discharge relation.- Defined by current-meter measurements below 8,000 second-feet extended to peak stage on basis of area-velocity study; verified by $A\sqrt{d}$ method, computed flow over a dam 1 mile above gage, and comparison of peak discharge and total run-off of flood with records for other stations in American River Basin. Rating curve changed Dec. 10.

Maxima.- December 1937: Discharge, 25,800 second-feet about noon Dec. 11 (gage height, 25.5 feet, from floodmark).
1922-November 1937: Discharge, 24,100 second-feet (revised) Mar. 25, 1928 (gage height, 24.4 feet, from floodmark).

Remarks.- Flood run-off not materially affected by artificial storage. American River flume diverts above station. Monthly summaries adjusted for diversion. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	18	100	341	11	164	18,500	252	21	454	488	422
2	78	142	352	12	202	6,580	256	22	309	461	435
3	94	112	386	13	162	2,640	248	23	252	461	448
4	119	112	341	14	184	1,650	248	24	338	398	386
5	112	95	319	15	192	1,260	386	25	272	410	398
6	118	112	308	16	171	1,020	352	26	242	374	374
7	114	125	300	17	364	802	564	27	218	363	386
8	124	98	304	18	356	702	630	28	160	374	398
9	124	132	252	19	205	630	532	29	121	352	410
10	114	7,340	268	20	200	502	448	30	125	352	374
								31		341	532
Mean monthly discharge, in second-feet (observed)									190	1,517	376
Mean monthly discharge, in second-feet (adjusted)									223	1,610	476
Run-off, in acre-feet (adjusted)									13,280	98,990	29,240

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.26	107	3.50	308	13.8	8,790	16.0	11,800	9.20	3,460
4	2.40	123	2.32	113	6.00	1,230	16.5	12,500	14.8	10,100	8.93	3,220
6	-	-	2.36	118	10.50	4,730	19.4	16,600	13.6	8,530	8.70	3,040
8	2.16	96	2.40	123	14.1	9,180	22.5	21,200	12.6	7,230	8.46	2,850
10	-	-	2.40	123	15.9	11,700	25.3	25,400	11.7	6,100	8.27	2,700
N	2.09	89	2.40	123	16.0	11,800	25.5	25,800	11.0	5,280	8.07	2,550
2	-	-	2.40	123	15.5	11,100	25.0	25,000	10.70	4,950	7.90	2,430
4	2.01	82	2.40	123	14.8	10,100	23.2	22,300	10.35	4,570	7.72	2,300
6	-	-	2.48	133	14.0	9,050	21.4	19,600	10.10	4,320	7.56	2,190
8	2.04	85	2.67	160	13.3	8,140	19.8	17,200	9.90	4,120	7.46	2,120
10	-	-	2.89	194	12.8	7,490	18.6	15,400	9.67	3,890	7.26	1,990
M	2.20	100	3.10	230	12.4	6,970	17.3	13,600	9.45	3,680	7.16	1,930
	December 14		December 15		December 16		December 17		December 18		December 19	
2	7.05	1,860	6.17	1,330	5.70	1,070	5.07	768	4.79	662	4.84	680
4	7.06	1,870	6.16	1,330	5.73	1,080	5.05	760	4.77	655	4.84	680
6	6.99	1,820	6.11	1,300	5.70	1,070	5.03	752	4.76	652	4.83	677
8	6.88	1,760	6.06	1,270	5.70	1,070	5.00	740	4.91	706	4.83	677
10	6.85	1,740	6.30	1,410	5.73	1,080	5.35	895	5.14	798	4.92	710
N	6.82	1,720	6.27	1,390	5.71	1,080	5.35	895	5.15	802	4.84	680
2	6.49	1,520	5.89	1,160	5.67	1,060	5.20	824	6.13	793	4.81	670
4	6.60	1,590	6.09	1,280	5.64	1,040	5.18	815	6.00	740	4.56	583
6	6.69	1,580	5.89	1,160	5.57	1,000	5.15	802	4.50	564	4.55	680
8	6.51	1,640	6.00	1,230	5.60	970	5.17	811	4.89	698	4.76	652
10	6.49	1,520	5.95	1,200	5.17	811	5.04	756	4.84	680	4.60	596
M	6.17	1,330	5.52	980		780	4.89	698	4.84	680	4.23	482
	December 20		December 21		December 22		December 23		December 24		December 25	
2	4.21	477	3.97	416	3.84	384	4.08	443	3.58	326	4.33	511
4	4.20	474	4.00	422	3.84	384	4.08	443	3.59	328	3.87	391
6	4.20	474	4.29	499	3.84	384	4.09	445	3.63	337	3.82	379
8	4.35	517	4.30	602	3.88	393	4.24	485	3.63	337	3.77	367
10	4.62	570	4.32	508	4.30	502	4.32	508	3.76	365	3.75	363
N	4.64	610	4.54	577	4.41	535	4.42	538	4.15	461	3.80	374
2	4.25	488	4.15	461	4.17	466	4.14	458	4.11	451	3.77	367
4	4.35	517	4.29	499	4.18	469	4.19	471	3.85	386	3.70	352
6	4.30	502	4.30	502	4.25	488	3.99	420	3.89	396	3.68	348
8	4.47	554	4.43	542	4.42	538	4.11	451	4.29	499	4.12	453
10	4.05	435	4.42	538	4.36	520	3.94	408	4.39	429	4.25	488
M	3.91	400	3.86	388	4.07	449	3.67	346	4.43	642	4.31	605

South Fork of American River at Coloma, Calif.

Location.- Lat. 38°48', long. 120°53', in SW¼ sec. 17, T. 11 N., R. 10 E., at highway bridge at Coloma, Eldorado County, 0.6 mile below Irish Creek. Altitude, about 740 feet above mean sea level.

Drainage area.- 635 square miles.

Gage-height record.- Water-stage recorder graph except for period Dec. 29-30, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 13,200 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 27,000 second-feet 2 p.m. Dec. 11 (gage height, 20.5 feet).

1929-November 1937: Discharge, 13,300 second-feet Apr. 8, 1935 (gage height, 16.85 feet), from rating curve extended above 9,400 second-feet.

Remarks.- Flood run-off not materially affected by artificial storage or diversion. Discharge for period of missing gage-height record determined from record of South Fork of American River near Camino.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	138	214	524	11	203	18,100	428	21	565	688	662
2	114	250	551	12	282	7,030	432	22	416	662	688
3	148	235	569	13	212	3,000	420	23	328	741	688
4	146	229	533	14	235	1,900	424	24	436	602	622
5	148	235	512	15	268	1,500	647	25	360	632	602
6	143	214	491	16	229	1,220	612	26	285	593	588
7	146	235	465	17	440	1,010	884	27	264	560	593
8	151	232	478	18	508	916	981	28	268	564	622
9	156	235	436	19	313	824	854	29	217	560	714
10	148	7,280	444	20	282	741	768	30	241	540	652
								31		529	1,030
Mean monthly discharge, in second-feet									260	1,686	610
Run-off, in acre-feet									15,450	103,700	37,520

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	7.63	296	7.36	209	7.60	285	14.95	9,080	15.60	11,200	12.03	4,020
4	7.62	292	7.40	220	7.63	296	15.45	10,300	15.05	9,840	11.85	3,760
6	7.59	282	7.40	220	8.20	530	16.45	13,100	14.60	8,760	11.68	3,530
8	7.49	247	7.40	220	8.32	590	18.00	17,800	14.20	7,880	11.52	3,330
10	7.42	226	7.40	220	14.25	7,540	18.98	21,200	13.83	7,110	11.37	3,140
N	7.35	206	7.44	232	15.95	11,700	20.10	25,400	13.50	6,470	11.23	2,980
2	7.32	198	7.47	241	16.68	13,700	20.50	27,000	13.12	5,780	11.11	2,830
4	7.37	212	7.50	250	16.45	13,100	20.00	25,100	12.86	5,330	10.95	2,660
6	7.36	209	7.53	260	16.17	12,300	19.15	22,000	12.63	4,950	10.82	2,510
8	7.35	206	7.55	268	16.05	11,900	18.35	19,300	12.45	4,660	10.72	2,410
10	7.36	209	7.57	274	15.62	10,800	17.35	16,200	12.31	4,440	10.65	2,340
M	7.38	214	7.59	282	15.25	9,810	16.32	13,100	12.15	4,200	10.50	2,190
	December 14		December 15		December 16		December 17		December 18		December 19	
2	10.43	2,120	9.82	1,560	9.47	1,280	9.15	1,050	9.00	948	8.95	916
4	10.36	2,050	9.73	1,480	9.36	1,190	9.05	981	8.95	916	8.74	790
6	10.35	2,040	9.72	1,480	9.34	1,180	9.03	968	8.85	854	8.70	768
8	10.32	2,010	9.71	1,470	9.32	1,160	9.02	961	8.84	848	8.68	757
10	10.25	1,940	9.68	1,440	9.29	1,140	9.01	955	8.84	848	8.67	752
N	10.17	1,870	9.66	1,430	9.27	1,130	9.00	948	8.93	903	8.66	746
2	10.18	1,880	9.82	1,560	9.45	1,260	9.20	1,080	9.07	994	8.80	824
4	10.12	1,830	9.77	1,520	9.44	1,250	9.21	1,090	9.08	1,000	8.92	897
6	10.03	1,750	9.67	1,440	9.42	1,240	9.13	1,030	9.06	988	8.89	878
8	10.03	1,750	9.69	1,450	9.38	1,210	9.11	1,020	9.02	961	8.74	790
10	9.98	1,700	9.64	1,410	9.35	1,180	9.10	1,010	8.96	922	8.72	779
M	9.95	1,680	9.64	1,410	9.30	1,150	9.10	1,010	9.00	948	8.85	854
	December 20		December 21		December 22		December 23		December 24		December 25	
2	8.77	807	8.55	688	8.64	736	8.85	854	8.50	662	8.65	741
4	8.56	693	8.40	612	8.50	662	8.65	741	8.36	593	8.68	757
6	8.54	683	8.37	598	8.33	578	8.68	757	8.23	533	8.68	757
8	8.53	678	8.40	612	8.33	578	8.65	741	8.24	538	8.42	622
10	8.53	678	8.50	662	8.33	578	8.63	730	8.27	551	8.38	602
N	8.54	683	8.57	698	8.34	583	8.60	714	8.28	555	8.35	588
2	8.65	741	8.57	698	8.45	637	8.66	746	8.25	542	8.33	579
4	8.77	807	8.70	768	8.64	736	8.75	796	8.54	683	8.32	574
6	8.63	730	8.60	714	8.62	725	8.67	752	8.54	683	8.37	598
8	8.58	704	8.55	688	8.65	741	8.58	704	8.40	612	8.30	564
10	8.59	709	8.57	698	8.67	752	8.50	662	8.39	607	8.26	546
M	8.66	746	8.65	741	8.84	848	8.53	678	8.50	662	8.35	588

Supplemental records.- Dec. 10, 9 a.m., 8.45 ft., 658 sec.-ft.

160302 O—39——17

Medley Lakes outlet near Vade, Calif.

Location.- Lat. 38°51', long. 120°08', in SW¼ sec. 29, T. 12 N., R. 17 E., 1 mile below main dam at Medley Lakes and 5 miles northwest of Phillips, Vade post office, Eldorado County. Altitude, about 8,100 feet above mean sea level.

Drainage area.- 6.2 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Affected by ice for period Dec. 23 to Jan. 31. Defined by current-meter measurements below 120 second-feet; extended to peak stage.

Maxima.- December 1937: Discharge, 166 second-feet 9 a.m. Dec. 10 (gage height, 3.06 feet).

1922-November 1937: Discharge, 202 second-feet June 15, 16, 1929 (gage height, 3.42 feet).

Remarks.- Flood run-off materially affected by storage in Medley Lakes during storm period in December but little, if any, net retention for period Nov. 1 to Jan. 31. No record of storage. Discharge for period of ice effect computed on basis of weather records. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	15	12	-	11	14	100	-	21	13	32	-
2	15	12	-	12	12	30	-	22	13	32	-
3	14	11	-	13	11	25	-	23	13	31	-
4	14	10	-	14	12	24	-	24	13	31	-
5	14	9	-	15	11	24	-	25	13	31	-
6	14	7.5	-	16	11	28	-	26	13	30	-
7	13	7	-	17	13	34	-	27	13	30	-
8	13	6.5	-	18	12	34	-	28	13	30	-
9	13	7	-	19	13	33	-	29	13	29	-
10	12	102	-	20	14	32	-	30	12	29	-
								31		29	-
Mean monthly discharge, in second-feet									13.0	28.5	25
Run-off, in acre-feet									772	1,750	1,540

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.73	6	1.53	37	2.30	94	-	-	-	-
4	-	-	.72	6	2.06	74	2.42	105	1.45	32	-	-
6	-	-	.72	6	2.85	145	2.49	111	-	-	-	-
8	-	-	.72	6	2.99	159	2.64	125	1.39	30	-	-
10	-	-	.72	6	3.00	160	2.84	144	-	-	-	-
N	0.74	6.5	.72	6	2.69	129	2.83	143	1.35	28	1.30	25
2	-	-	.72	6	2.52	114	2.63	124	-	-	-	-
4	-	-	.74	6.5	2.36	99	2.41	104	1.34	27	-	-
6	-	-	.77	7	2.24	89	2.10	77	-	-	-	-
8	-	-	.84	8.5	2.18	83	1.86	58	1.32	26	-	-
10	-	-	.95	12	2.17	83	1.70	47	-	-	-	-
M	.73	6.0	1.14	18	2.20	85	1.59	40	1.31	26	1.29	24
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	1.28	24	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	1.28	24	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.29	24	1.28	24	1.29	24	1.47	34	1.47	34	1.46	33
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	1.44	32	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	1.46	33	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.29	24	1.28	24	1.47	34	1.47	34	1.46	33	1.45	32
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-								
4	-	-	-	-								
6	-	-	-	-								
8	-	-	-	-								
10	-	-	-	-								
N	1.45	32	1.45	32								
2	-	-	-	-								
4	-	-	-	-								
6	-	-	-	-								
8	-	-	-	-								
10	-	-	-	-								
M	1.45	32	1.45	32								

Supplemental records.- Dec. 10, 9 a.m., 3.06 ft., 166 sec.-ft.

Silver Lake outlet near Kirkwood, Calif.

Location.- Lat. 38°40', long. 120°08', in SW¼ sec. 32, T. 10 N., R. 17 E., 1,000 feet below Silver Lake Dam and 3 miles southwest of Kirkwood, Amador County. Altitude, about 7,200 feet above mean sea level.

Drainage area.- 14.9 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 200 second-feet; extended to peak stage on basis of area-velocity study.

Maxima.- December 1937: Discharge (regulated), 504 second-feet 3 p.m. Dec. 11 (gage height, 5.10 feet).

1922-November 1937: Discharge, 374 second-feet July 1, 1932 (gage height, 4.28 feet).

Remarks.- Flood run-off affected by storage in Silver Lake (capacity, about 4,700 acre-feet, without flashboards; 8,700 acre-feet, with flashboards). Discharge over spillway (without flashboards) began about 5 a.m. Dec. 11. Probably very little storage in lake before Dec. 9. Peak stage and run-off of about 4,500 acre-feet must have occurred between Dec. 9 and 5 a.m. Dec. 11. Storage record for Silver Lake (incomplete) shows 261 acre-feet Nov. 29 and 5,231 acre-feet Dec. 14.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6.5	3.9	34	11	1.8	349	27	21	4.8	46	26
2	5.5	3.3	34	12	2.0	376	27	22	4.8	43	26
3	5	3.0	34	13	2.0	255	26	23	4.8	40	26
4	4.5	2.4	33	14	2.0	156	26	24	5	40	25
5	3.9	2.0	32	15	2.0	110	26	25	5	39	25
6	3.0	2.4	31	16	2.2	83	26	26	5	38	25
7	2.6	2.4	31	17	3.6	64	26	27	4.8	38	25
8	2.2	2.2	30	18	3.6	55	26	28	4.5	37	25
9	1.8	2.8	28	19	3.6	53	26	29	4.5	36	25
10	1.4	40	28	20	4.2	50	26	30	4.2	36	25
								31		35	25
Mean monthly discharge, in second-feet									3.69	65.9	27.6
Run-off, in acre-feet									220	4,050	1,700

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	0.90	9.5	1.80	74	4.70	440	-	-
4	-	-	0.66	2.2	1.02	15	1.84	78	4.61	426	3.72	293
6	-	-	-	-	1.22	26	2.70	162	4.52	411	-	-
8	-	-	.66	2.2	1.30	32	3.88	315	4.47	403	3.57	272
10	-	-	-	-	1.40	40	4.52	411	4.39	390	-	-
N	0.66	2.2	.66	2.2	1.49	47	4.82	459	4.30	376	3.44	254
2	-	-	-	-	1.55	52	5.00	488	4.22	363	-	-
4	-	-	.68	2.6	1.56	53	5.09	502	4.14	352	3.27	230
6	-	-	-	-	1.58	54	5.03	493	4.07	342	-	-
8	-	-	.73	3.9	1.62	58	4.96	482	4.00	332	3.14	213
10	-	-	-	-	1.65	68	4.87	467	3.92	321	-	-
M	.66	2.2	.80	6	1.73		4.80	456	3.86	312	3.00	196
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.87	181	2.32	122	1.98	90	-	-	-	-	-	-
6	-	-	-	-	-	-	1.73	68	1.60	56	1.57	54
8	2.75	168	2.25	115	1.93	86	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.65	156	2.19	109	1.88	81	1.69	64	1.59	55	1.56	53
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.57	148	2.14	105	1.85	78	-	-	-	-	-	-
6	-	-	-	-	-	-	1.65	60	1.57	54	1.54	51
8	2.48	138	2.08	99	1.81	75	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.40	130	2.03	95	1.78	72	1.62	58	1.57	54	1.53	50
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.53	50	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.52	50	1.48	46	1.43	42	1.40	40	1.40	40	1.39	39
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.50	48	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.48	46	1.46	45	1.42	42	1.40	40	1.40	40	1.39	39

Supplemental records.- Dec. 11, 3 p.m., 5.10 ft., 504 sec.-ft.

Silver Fork of South Fork of American River near Kyburz, Calif.

Location.- Lat. 38°45', long. 120°17', in NE¼ sec. 34, T. 11 N., R. 15 E., 2 miles above mouth and 2 miles southeast of Kyburz, Eldorado County. Altitude, about 4,850 feet above mean sea level.
Drainage area.- 108 square miles.
Gage-height record.- Water-stage recorder graph except for period Dec. 29 to Jan. 2, when there was no record.
Stage-discharge relation.- Defined by current-meter measurements below 2,250 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin.
Maxima.- December 1937: Discharge, 5,450 second-feet 10:30 a.m. Dec. 11 (gage height, 8.30 feet).
1924-November 1937: Discharge, 3,620 second-feet Mar. 25, 1928 (gage height, 6.54 feet), from rating curve extended above 950 second-feet.
Remarks.- Flood run-off affected by storage in Twin Lakes and Silver Lake (combined capacity, 26,000 acre-feet). Monthly summaries adjusted for storage. Discharge for period of missing gage-height record based on comparison with record for South Fork of American River near Kyburz. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	73	82	115	11	92	3,840	78	21	91	156	89
2	78	81	112	12	86	1,470	75	22	47	149	93
3	79	79	109	13	78	701	75	23	41	135	92
4	78	81	103	14	85	393	74	24	48	147	86
5	78	81	99	15	70	310	88	25	43	142	89
6	78	91	93	16	70	250	85	26	51	138	91
7	78	92	88	17	108	214	96	27	62	136	93
8	84	89	86	18	69	194	92	28	62	130	95
9	84	74	81	19	61	176	92	29	61	126	93
10	84	1,330	79	20	105	161	86	30	74	122	88
								31		118	84
Mean monthly discharge, in second-feet (observed)...........									73.3	364	90.3
Mean monthly discharge, in second-feet (adjusted)...........									24.9	497	82.5
Run-off, in acre-feet (adjusted)...........................									1,480	30,570	5,070

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.05	85	3.33	381	5.95	2,640	5.45	2,110	4.18	934
4	-	-	2.03	82	4.11	878	6.74	3,540	5.23	1,890	4.11	878
6	2.09	91	1.98	75	4.50	1,200	6.70	3,490	5.05	1,710	4.05	830
8	-	-	1.91	66	4.90	1,560	6.94	3,780	4.95	1,610	3.96	760
10	-	-	1.91	66	5.08	1,740	8.28	5,420	4.85	1,520	3.90	715
N	2.09	91	1.90	65	4.53	1,230	8.22	5,350	4.73	1,410	3.84	673
2	-	-	1.90	65	4.87	1,530	8.01	5,070	4.64	1,330	3.77	624
4	-	-	1.98	75	5.20	1,860	7.77	4,770	4.55	1,240	3.74	603
6	2.09	91	1.97	74	5.10	1,760	7.02	3,870	4.50	1,200	3.71	582
8	-	-	1.97	74	4.83	1,500	6.40	3,130	4.41	1,120	3.66	550
10	-	-	2.01	79	4.80	1,470	6.00	2,690	4.34	1,060	3.61	518
M	2.03	82	2.19	105	5.14	1,800	5.72	2,380	4.25	990	3.55	485
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.46	439	3.22	339	3.00	270	-	-	-	-	-	-
6	-	-	-	-	-	-	2.83	224	2.72	198	2.64	182
8	3.40	410	3.18	326	2.96	259	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.35	389	3.13	310	2.93	250	2.79	214	2.70	194	2.61	176
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.31	372	3.09	297	2.90	242	-	-	-	-	-	-
6	-	-	-	-	-	-	2.76	207	2.67	188	2.59	172
8	3.30	368	3.07	291	2.88	237	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.27	357	3.04	282	2.86	232	2.75	205	2.66	186	2.59	172
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.43	143	2.36	132	2.38	135
6	2.55	165	2.51	158	2.48	152	-	-	-	-	-	-
8	-	-	-	-	-	-	2.35	130	2.40	138	2.36	132
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.50	156	2.48	152	2.45	147	2.35	130	2.49	154	2.45	147
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	2.38	135	2.55	165	2.46	149
6	2.49	154	2.48	152	2.43	143	-	-	-	-	-	-
8	-	-	-	-	-	-	2.39	136	2.48	152	2.42	142
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.56	167	2.49	154	2.50	.56	2.36	132	2.42	142	2.38	135

Supplemental records.- Dec. 11, 10:30 a.m., 8.30 ft., 5,450 sec.-ft.

Twin Lakes outlet near Kirkwood, Calif.

Location.- Lat. 38°42', long. 120°03', in SW¼ sec. 18, T. 10 N., R. 18 E., 500 feet below main dam and outlet gate of Twin Lakes and 1 mile east of Kirkwood, Amador County. Altitude, about 7,900 feet above mean sea level.

Drainage area.- 12.4 square miles.

Gage-height record.- Defined by current-meter measurements for stages reached during period November to January (completely regulated).

Maxima.- December 1937: Outlet gates closed 8:45 a.m. Dec. 10 and flood flow completely regulated. Maximum discharge computed from increase in storage, about 2,200 second-feet early morning Dec. 11.

1922-November 1937: Discharge (regulated), 176 second-feet May 25-28, 1928 (gage height, 1.95 feet).

Remarks.- Flood run-off completely controlled in Twin Lakes (capacity, 21,200 acre-feet). No flow over Twin Lakes spillway for period Nov. 1 to Jan. 31. Gain or loss in storage computed from contents at midnight determined from graph based on daily readings at 4 p.m. Most of basic data furnished by Pacific Gas & Electric Co.

Discharge, in second-feet, and gain or loss in storage, in acre-feet, November 1937 to January 1938

Day	November			December			January		
	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge	Observed discharge	Gain or loss in storage	Adjusted discharge
1	61	-115		68	-123		1.4	+9	6
2	66	-125		67	-123		1.5	+28	16
3	66	-115		69	-129		1.5	+19	11
4	66	-141		71	-145		1.5	+9	6
5	66	-158		74	-153	*3.0	1.5	+29	16
6	66	-157	*1.3	76	-169		1.5	+19	11
7	70	-139		76	-151		1.5	+9	6
8	72	-113		66	-132		1.5	+19	11
9	71	-137		52	-50		1.5	0	1.5
10	71	-137		22	+1,600	829	1.5	+9	6
11	71	-112		2.2	+2,510	1,270	1.5	+19	11
12	70	-128	5.5	1.0	+440	223	1.5	0	1.5
13	66	-118	6.5	1.4	+225	115	1.5	+10	6.5
14	58	-101	7	1.4	+138	71	1.5	+47	25
15	54	-102	2.6	1.4	+100	52	1.5	+56	30
16	55	-84	13	1.4	+83	43	1.5	+29	16
17	45	-50	20	1.5	+74	39	1.5	+66	35
18	40	-59	10	1.4	+56	30	1.5	+76	21
19	40	-67	6	1.4	+46	25	1.5	+38	25
20	40	-49	15	1.5	+27	15	1.5	+19	11
21	25	-41	4.3	1.5	+28	16	1.5	+9	6
22	17	-25	4.4	1.5	+47	25	1.5	+19	11
23	17	-17	8.5	1.5	+65	34	1.5	+9	6
24	17	-17	8.5	1.4	+27	15	1.5	+19	11
25	26	-50		1.4	+28	16	1.5	+10	6.5
26	40	-58		1.4	+28	16	1.5	+19	11
27	45	-82	*2.1	1.4	+28	16	1.5	+10	6.5
28	45	-100		1.1	+27	15	1.5	+19	11
29	50	-106		1.0	+28	15	1.5	0	1.5
30	68	-123		1.1	+28	15	1.5	+29	16
31				1.2	+19	11	1.5	+105	54

	November	December	January
Mean monthly discharge, in second-feet (observed)..........	52.1	21.6	1.50
Gain or loss in storage, in acre-feet......................	-2,830	+4,480	+728
Mean monthly discharge, in second-feet (adjusted)..........	4.64	94.5	13.3
Run-off, in acre-feet (adjusted)...........................	276	5,810	820

*Mean for the period.

Alder Creek near Whitehall, Calif.

Location.- Lat. 38°45', long. 120°22', in SW¼ sec. 36, T. 11 N., R. 14 E., three-quarters of a mile above mouth and 2 miles southeast of Whitehall, Eldorado County. Altitude, about 4,000 feet above mean sea level.

Drainage area.- 22.8 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 250 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations in American River Basin.

Maxima.- December 1937: Discharge, 710 second-feet 9:30 a.m. Dec. 11 (gage height, 4.50 feet).

1922-November 1937: Discharge, about 2,060 second-feet Mar. 25, 1928 (gage height, 7.1 feet, from floodmark).

Remarks.- Flood run-off not affected by artificial storage. Alder Creek feeder flume diverts immediately above station. Monthly summaries adjusted for diversion. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.3	0.5	14	11	0.6	509	9	21	6	26	17
2	.3	.5	15	12	.8	262	8	22	.8	23	18
3	.3	.5	16	13	.5	152	7.5	23	.6	21	18
4	.3	.5	14	14	1.8	110	8	24	2.2	20	15
5	.3	.5	13	15	1.5	81	14	25	.7	18	15
6	.3	.5	13	16	.6	63	11	26	.2	18	16
7	.3	.5	11	17	13	51	22	27	.1	15	17
8	.1	.5	11	18	5	41	20	28	.1	15	18
9	.1	.9	10	19	.3	34	20	29	.1	14	18
10	.1	196	9.5	20	1.6	29	17	30	.3	14	15
								31		13	13
Mean monthly discharge, in second-feet (observed)									1.31	55.8	14.3
Mean monthly discharge, in second-feet (adjusted)									3.01	61.5	21.3
Run-off, in acre feet (adjusted)									179	3,780	1,310

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	1.57	27	3.31	377	3.20	348	-	-
4	-	-	1.03	0.4	2.35	154	3.50	426	3.08	319	2.45	174
6	1.04	0.5	-	-	2.80	252	3.81	509	2.98	295	-	-
8	-	-	1.03	.4	2.87	269	4.30	650	2.90	276	2.37	158
10	-	-	-	-	2.70	228	4.42	686	2.83	259	-	-
N	1.04	.5	1.03	.4	2.56	197	4.15	605	2.78	247	2.32	148
2	-	-	-	-	2.68	224	4.04	573	2.74	238	-	-
4	-	-	1.04	.5	2.69	226	3.97	554	2.70	228	2.27	138
6	1.04	.5	-	-	2.63	213	3.80	506	2.65	217	-	-
8	-	-	1.05	.6	2.64	215	3.74	489	2.60	206	2.24	132
10	-	-	-	-	2.64	215	3.53	434	2.56	197	-	-
M	1.04	.5	1.35	11	2.87	269	3.35	387	2.52	188	2.20	124
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.15	115	2.00	88	1.87	66	1.79	54	1.72	44	1.66	37
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.11	108	1.96	81	1.85	63	1.77	51	1.70	41	1.65	36
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.08	102	1.93	76	1.83	60	1.76	49	1.69	40	1.63	33
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.04	95	1.90	71	1.81	57	1.74	47	1.67	38	1.61	31
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.60	30	1.56	26	1.53	24	1.50	21	1.41	15	1.39	13
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.59	29	1.55	26	1.51	22	1.51	22	1.55	26	1.45	18
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	1.58	28	1.55	26	1.51	22	1.50	21	1.50	21	1.49	20
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.57	27	1.54	25	1.55	26	1.46	18	1.48	20	1.45	18

Supplemental records.- Dec. 11, 9:30 a.m., 4.50 ft., 710 sec.-ft.

Plum Creek near Riverton, Calif.

Location.- Lat. 38°45', long. 120°26', in SE¼ sec. 32, T. 11 N., R. 14 E., 1½ miles above mouth and 2 miles southeast of Riverton, Eldorado County. Altitude, about 4,100 feet above mean sea level.
Drainage area.- 6.8 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 120 second-feet; extended to peak stage; verified by comparison of peak discharge with that of Alder Creek and by area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 315 second-feet 7 a.m. Dec. 11 (gage height, 3.10 feet).
1922-November 1937: Discharge, 635 second-feet Mar. 25, 1928 (gage height, 4.10 feet), from rating curve extended above 75 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.8	1.2	2.7	11	4.0	195	2.1	21	3.0	3.4	10
2	.9	1.2	3.4	12	2.1	75	2.1	22	2.4	3.2	10
3	1.0	1.2	3.7	13	1.5	30	2.1	23	2.2	3.2	11
4	1.0	1.2	3.2	14	2.1	16	2.0	24	3.8	3.0	9
5	1.0	1.1	3.0	15	2.1	12	5	25	3.0	2.8	8
6	1.0	1.0	2.8	16	2.1	8.5	4.5	26	2.4	2.8	7.5
7	1.0	1.0	2.7	17	6.5	6.5	20	27	2.0	2.8	6.5
8	1.0	1.0	2.6	18	3.6	5	20	28	1.7	2.8	6.5
9	1.0	1.4	2.4	19	2.2	4.3	15	29	1.4	2.7	6
10	1.1	54	2.2	20	2.8	3.7	12	30	1.3	2.7	5.5
								31		2.7	9
Mean monthly discharge, in second-feet									2.07	14.6	6.53
Run-off, in acre-feet									123	897	402

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	0.56	1.0	1.20	18	2.15	118	2.12	114	-	-
4	-	-	.56	1.0	1.75	66	2.40	160	2.02	100	1.45	37
6	-	-	.56	1.0	2.14	117	3.04	300	1.99	96	-	-
8	-	-	.56	1.0	1.92	86	3.08	310	1.90	83	1.38	32
10	-	-	.56	1.0	1.73	63	2.81	244	1.85	77	-	-
N	0.56	1.0	.56	1.0	1.64	53	2.63	205	1.79	70	1.33	28
2	-	-	.56	1.0	1.61	50	2.67	213	1.74	64	-	-
4	-	-	.57	1.1	1.54	43	2.51	180	1.69	59	1.26	24
6	-	-	.61	1.5	1.47	36	2.48	174	1.64	54	-	-
8	-	-	.66	2.2	1.47	36	2.54	186	1.62	52	1.24	22
10	-	-	.78	4.4	1.54	43	2.34	149	1.55	46	-	-
M	.56	1.0	.92	7.5	1.84	76	2.20	126	1.51	42	1.19	20
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.16	18	1.02	13	0.93	9.5	0.87	7.5	0.81	5.5	0.77	4.5
6	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.10	16	.99	12	.90	8	.85	6.5	.79	5	.76	4.3
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	1.06	14	.96	10	.88	7.5	.83	6	.78	4.8	.75	4.1
10	-	-	-	-	-	-	-	-	-	-	-	-
M	-	-	-	-	-	-	-	-	-	-	-	-

Supplemental records.- Dec. 11, 7 a.m., 3.10 ft., 315 sec.-ft.

Silver Creek at Union Valley, Calif.

Location.- Lat. 38°52', long. 120°26', in SE$\frac{1}{4}$ sec. 20, T. 12 N., R. 14 E., 1 mile below junction of North and Middle Forks of Silver Creek, near lower end of Union Valley, El Dorado County. Altitude, about 4,530 feet above mean sea level.

Drainage area.- 82.7 square miles.

Gage-height record.- Water-stage recorder graph except for period 8 a.m. Dec. 30 to Jan. 31, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 3,000 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 8,560 second-feet 10 a.m. Dec. 11 (gage height, 15.28 feet).

1924-November 1937: Discharge, 8,050 second-feet (revised) Mar. 25, 1928 (gage height, 14.7 feet, from floodmark).

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record based on range of stage indicated on recorder graph and record for Silver Creek near Placerville.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	6.5	38	-	11	17	5,560	-	21	121	128	-
2	6.5	36	-	12	20	1,070	-	22	63	121	-
3	6.5	32	-	13	15	487	-	23	63	104	-
4	6.5	32	-	14	33	331	-	24	75	131	-
5	6.5	32	-	15	25	285	-	25	55	121	-
6	6.5	35	-	16	29	236	-	26	48	114	-
7	6.5	36	-	17	121	206	-	27	44	111	-
8	7	38	-	18	63	183	-	28	41	106	-
9	7	51	-	19	42	158	-	29	40	104	-
10	7	3,840	-	20	109	134	-	30	40	114	-
								31		110	-
Mean monthly discharge, in second-feet									37.7	454	100
Run-off, in acre-feet									2,240	27,940	6,150

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	1.10	38	5.40	1,260	10.85	4,880	6.18	1,680	4.01	638
4	1.10	38	1.08	36	8.27	2,990	12.16	5,930	5.70	1,420	3.87	590
6	-	-	1.07	36	10.31	4,450	13.29	6,850	5.46	1,290	3.75	550
8	1.08	36	1.06	35	12.11	5,890	14.62	7,980	5.17	1,140	3.64	515
10	-	-	1.06	35	12.15	5,920	15.28	8,560	4.90	1,010	3.55	487
N	1.10	38	1.06	35	11.28	5,220	14.30	7,700	4.74	933	3.47	464
2	-	-	1.06	35	10.49	4,590	13.12	6,700	4.62	879	3.41	447
4	1.07	36	1.08	36	9.72	4,000	12.03	5,820	4.54	843	3.36	433
6	-	-	1.19	45	8.91	3,440	10.00	4,200	4.51	830	3.33	424
8	1.13	40	1.42	66	8.24	2,970	8.32	3,020	4.41	789	3.28	411
10	-	-	1.71	101	8.15	2,900	7.36	2,380	4.28	737	3.22	395
M	1.10	38	2.40	216	9.26	3,680	6.77	2,020	4.14	685	3.16	380
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.05	354	2.86	311	-	-	-	-	-	-	-	-
6	-	-	-	-	2.56	248	2.38	212	2.29	194	2.11	162
8	2.96	333	2.78	294	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.89	318	2.72	280	2.48	232	2.34	204	2.23	183	2.07	155
2	-	-	-	-	-	-	-	-	-	-	-	-
4	2.86	311	2.66	268	-	-	-	-	-	-	-	-
6	-	-	-	-	2.43	222	2.31	198	2.19	176	2.07	155
8	2.90	320	2.63	262	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	2.92	324	2.62	260	2.42	220	2.31	198	2.15	169	2.02	147
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.96	138	1.92	131	1.87	124	1.70	100	1.92	131	1.83	118
6	-	-	-	-	-	-	-	-	-	-	-	-
8	1.89	127	1.88	125	1.82	117	1.65	94	1.96	138	1.83	118
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.87	124	1.85	121	1.75	107	1.65	94	1.93	133	1.85	121
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.95	136	1.90	128	1.83	118	1.71	101	1.93	133	1.88	125
6	-	-	-	-	-	-	-	-	-	-	-	-
8	2.00	144	1.89	127	1.92	131	1.85	121	1.90	128	1.87	124
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.96	138	1.88	125	1.83	118	1.90	128	1.86	122	1.82	117

Silver Creek near Placerville, Calif.

Location.- Lat. 38°47', long. 120°35', in SW¼ sec. 13, T. 11 N., R. 12 E., a quarter of a mile above mouth and 12 miles northeast of Placerville, Eldorado County. Altitude, about 2,250 feet above mean sea level.
Drainage area.- 176 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 4,000 second-feet; extended to peak stage with aid of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records at other stations in American River Basin.
Maxima.- December 1937: Discharge, 14,600 second-feet 12:30 p.m. Dec. 11 (gage height, 13.8 feet).
1921-November 1937: Discharge, 12,400 second-feet (revised) Mar. 25, 1928 (gage height, 12.8 feet, present site and datum, from floodmarks; 18.0 feet, former site and datum, from gage-height comparison).
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	34	90	208	11	53	9,500	172	21	287	280	288
2	35	93	233	12	74	2,730	172	22	151	268	299
3	35	84	236	13	52	1,160	172	23	134	246	329
4	34	83	213	14	76	770	170	24	202	241	266
5	33	82	198	15	80	632	254	25	152	246	280
6	33	79	174	16	64	526	233	26	118	220	271
7	32	82	176	17	237	450	407	27	109	218	274
8	32	87	174	18	172	407	400	28	100	215	288
9	32	94	170	19	101	352	352	29	98	206	285
10	32	5,220	174	20	118	305	299	30	94	210	241
								31		206	308
Mean monthly discharge, in second-feet									93.5	819	249
Run-off, in acre-feet									5,560	50,340	15,300

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	3.32	332	9.40	6,050	8.40	4,510	5.66	1,520
4	2.15	83	2.17	86	6.16	1,840	10.30	7,590	7.95	3,880	5.50	1,410
6	-	-	-	-	8.60	4,810	11.02	8,890	7.60	3,420	5.40	1,340
8	2.24	96	2.21	91	9.85	6,800	11.70	10,200	7.30	3,060	5.27	1,260
10	-	-	-	-	10.45	7,860	12.35	11,500	6.90	2,620	5.15	1,190
N	2.23	94	2.18	87	10.60	8,130	13.70	14,300	6.62	2,340	5.05	1,130
2	-	-	-	-	10.30	7,590	13.45	13,800	6.40	2,130	5.00	1,100
4	2.16	84	2.18	87	9.95	6,960	12.60	12,000	6.25	2,000	4.90	1,040
6	-	-	-	-	9.52	6,240	11.70	10,200	6.11	1,870	4.82	992
8	2.17	86	2.26	98	9.10	5,570	10.75	8,400	6.03	1,800	4.78	969
10	-	-	-	-	8.25	5,040	9.65	6,460	5.94	1,730	4.75	952
M	2.17	86	2.56	149	8.80	5,110	8.95	5,340	5.80	1,620	4.69	920
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.60	870	-	-	-	-	-	-	-	-	-	-
6	-	-	4.20	676	3.90	550	3.67	461	3.55	418	3.39	363
8	4.48	810	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	4.38	760	4.10	632	3.83	522	3.65	454	3.53	411	3.35	349
2	-	-	-	-	-	-	-	-	-	-	-	-
4	4.30	720	-	-	-	-	-	-	-	-	-	-
6	-	-	4.00	590	3.76	495	3.60	436	3.47	390	3.31	335
8	4.21	680	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.19	672	3.94	566	3.70	472	3.56	422	3.43	376	3.28	326
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.26	320	3.17	294	3.10	274	3.19	299	2.96	236	3.05	260
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.19	299	3.13	282	3.07	266	2.96	236	2.95	233	2.96	236
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	3.12	280	3.09	271	3.00	246	2.87	213	3.04	257	2.90	220
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.15	288	3.10	274	3.19	299	2.90	220	3.09	271	3.02	252

Supplemental records.- Dec. 11, 12:30 p.m., 13.8 ft., 14,600 sec.-ft.

South Fork of Silver Creek near Ice House, Calif.

Location.- Lat. 38°49', long. 120°22', in SW¼ sec. 1, T. 11 N., R. 14 E., 1½ miles northeast of Ice House, Eldorado County, and 8 miles northeast of Riverton. Altitude, about 5,300 feet above mean sea level.
Drainage area.- 28.4 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Affected by ice for periods Nov. 29 to Dec. 8, Dec. 24 to Jan. 3, Jan. 6-9, 15-31. Defined by current-meter measurements below 550 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other streams in American River Basin. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 2,200 second-feet 12:30 p.m. Dec. 11 (gage height, 5.80 feet).
1924-November 1937: Discharge, 1,620 second-feet Mar. 26, 1928 (gage height, 5.35 feet), from rating curve extended above 550 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for periods of ice effect computed on basis of weather records and flow of nearby streams.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1.8	9	20	11	3.2	1,620	18	21	30	31	16
2	1.8	9	20	12	2.6	442	18	22	22	30	16
3	1.8	8	20	13	3.5	149	17	23	21	26	16
4	1.8	8	20	14	8	87	17	24	21	27	16
5	1.8	8	20	15	7.5	70	17	25	18	25	16
6	1.8	9	19	16	8	54	17	26	16	24	15
7	1.8	9	19	17	24	47	17	27	14	23	15
8	1.8	9	19	18	15	43	17	28	12	22	15
9	1.8	12	19	19	12	38	17	29	11	21	15
10	1.8	900	19	20	20	33	17	30	10	20	15
								31		20	15
Mean monthly discharge, in second-feet									9.89	124	17.3
Run-off, in acre-feet									589	7,600	1,070

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			-	-	1.00	33	4.45	1,140	3.73	775	2.12	203
4			0.66	12	1.30	59	4.58	1,230	3.53	684	2.06	189
6			-	-	2.30	212	4.90	1,450	3.25	564	1.98	172
8			.65	12	3.50	625	5.22	1,710	3.05	485	1.92	160
10			-	-	4.20	990	5.60	2,020	2.90	430	1.88	152
N			.65	12	4.88	1,440	5.78	2,180	2.78	389	1.82	142
2			-	-	5.12	1,630	5.74	2,150	2.63	340	1.77	133
4			.65	12	4.93	1,470	5.59	2,010	2.51	303	1.73	126
6			-	-	4.74	1,340	5.45	1,900	2.43	280	1.70	121
8			.70	14	4.64	1,270	5.02	1,560	2.36	262	1.68	118
10			-	-	4.46	1,150	4.45	1,180	2.29	244	1.65	113
M			.85	23	4.38	1,100	4.05	942	2.21	224	1.63	110
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.57	100	-	-	-	-	-	-	-	-	-	-
6	-	-	1.40	76	1.25	58	1.16	48	1.12	44	1.06	39
8	1.51	92	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	1.46	84	1.35	70	1.21	53	1.15	47	1.11	43	1.05	38
2	-	-	-	-	-	-	-	-	-	-	-	-
4	1.42	79	-	-	-	-	-	-	-	-	-	-
6	-	-	1.30	63	1.19	51	1.13	45	1.09	41	1.03	36
8	1.40	76	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.41	77	1.29	62	1.18	50	1.13	45	1.08	40	1.03	36
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-				
4	-	-	-	-	-	-	-	-				
6	1.01	35	0.97	32	0.95	30	0.87	25				
8	-	-	-	-	-	-	-	-				
10	-	-	-	-	-	-	-	-				
N	.96	31	.96	31	.90	27	.81	21				
2	-	-	-	-	-	-	-	-				
4	-	-	-	-	-	-	-	-				
6	.97	32	.95	30	.93	29	.85	24				
8	-	-	-	-	-	-	-	-				
10	-	-	-	-	-	-	-	-				
M	.98	33	.96	31	.96	31	.98	33				

Supplemental records.- Dec. 11, 12:30 p.m., 5.80 ft., 2,200 sec.-ft.

Clear Lake at Lakeport, Calif.

Location.- Lat. 39°03', long. 122°55', in SE¼ sec. 24, T. 14 N., R. 10 W., at municipal wharf on north side of Third Street in Lakeport, Lake County. Zero of gage is 1,318.59 feet above mean sea level (general adjustment of 1929).
Drainage area.- 420 square miles including water surface of lake (65 square miles).
Gage-height record.- Staff gage read once daily to hundredths.
Maxima.- December 1937: Gage height, 5.67 feet Dec. 16.
1913-November 1937: Gage height, 11.12 feet Jan. 28, 1914.
January-September 1938: Gage height, 10.25 feet Feb. 15-16.
Remarks.- Flood run-off largely controlled in lake. Basic data furnished by Clear Lake Water Co.

Gage height, in feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1.10	2.35	4.97	11	1.10	3.40	5.17	21	1.97	5.45	5.80
2	1.10	2.35	4.97	12	1.17	5.35	5.20	22	2.00	5.45	5.87
3	1.10	2.35	5.07	13	1.17	5.52	5.20	23	2.07	5.45	5.92
4	1.10	2.35	5.07	14	1.20	5.65	5.20	24	2.17	5.40	5.92
5	1.10	2.35	5.07	15	1.22	5.65	5.20	25	2.20	5.35	6.00
6	1.10	2.35	5.07	16	1.40	5.67	5.27	26	2.25	5.25	6.00
7	1.10	2.35	5.10	17	1.45	5.65	5.37	27	2.27	5.17	6.00
8	1.10	2.35	5.10	18	1.47	5.62	5.50	28	2.30	5.10	6.05
9	1.10	2.35	5.10	19	1.50	5.60	5.65	29	2.30	5.00	6.10
10	1.10	2.80	5.15	20	1.70	5.50	5.72	30	2.32	5.00	6.20
								31		4.97	6.30

Cache Creek at Yolo, Calif.

Location.- Lat. 38°43'30", long. 121°48'25", in Rio Jesus Maria grant, 800 feet above highway bridge and half a mile south of Yolo, Yolo County. Altitude, about 60 feet above mean sea level.

Drainage area.- 1,150 square miles (revised).

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 15,200 second-feet; extended to peak stage; verified by area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 19,300 second-feet 4 p.m. Dec. 11 (gage height, 29.10 feet).

1903-November 1937: Discharge observed, 21,100 second-feet Feb. 2, 1915 (gage height, 29.8 feet, present datum, from nonrecording gage), from rating curve extended above 12,300 second-feet.

Remarks.- Flood run-off materially affected by storage in Clear Lake.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	57	376	11	0	17,300	138	21	2,000	1,820	740
2	0	46	336	12	0	9,760	135	22	525	1,820	586
3	0	41	316	13	0	3,760	132	23	237	1,770	510
4	0	36	300	14	0	3,200	130	24	262	1,770	444
5	0	33	279	15	0	2,680	130	25	304	1,720	396
6	0	32	251	16	0	2,500	138	26	200	1,720	360
7	0	30	223	17	10	2,320	465	27	150	1,660	332
8	0	28	195	18	374	2,160	1,140	28	115	1,600	328
9	0	29	171	19	121	1,990	890	29	91	1,600	328
10	0	1,030	144	20	65	1,880	1,060	30	73	1,550	308
								31		975	996
Mean monthly discharge, in second-feet									151	2,159	396
Run-off, in acre-feet									8,980	132,700	24,350

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.05	44	18.00	10,100	26.00	16,700	10.55	4,720
4	-	-	1.82	27	2.11	49	25.69	16,400	24.25	15,200	10.05	4,390
6	1.84	28	-	-	2.19	56	27.78	18,200	22.50	13,700	9.66	4,160
8	-	-	1.81	27	2.18	55	27.99	18,400	20.00	11,700	9.36	3,980
10	-	-	-	-	2.25	62	27.93	18,300	17.50	9,700	9.09	3,810
N	1.83	28	1.81	27	2.37	76	28.26	18,600	15.40	8,110	8.84	3,660
2	-	-	-	-	3.03	209	28.90	19,200	14.11	7,140	8.60	3,520
4	-	-	1.86	30	5.00	1,190	29.10	19,300	13.27	6,550	8.40	3,400
6	1.82	27	-	-	6.50	2,090	29.05	19,300	12.51	6,020	8.21	3,290
8	-	-	1.88	31	7.63	2,770	28.84	19,100	12.00	5,660	8.06	3,200
10	-	-	-	-	8.88	3,520	28.36	18,700	11.44	5,300	7.87	3,080
M	1.82	27	2.05	44	10.85	4,800	27.45	17,900	11.00	5,010	7.71	2,990
	December 14		December 15		December 16		December 17		December 18		December 19	
2	7.85	3,070	-	-	-	-	-	-	-	-	-	-
4	8.80	3,640	7.33	2,760	-	-	-	-	-	-	-	-
6	9.35	3,970	-	-	6.99	2,550	6.71	2,390	6.40	2,210	6.06	2,020
8	8.48	3,450	7.22	2,690	-	-	-	-	-	-	-	-
10	8.12	3,230	-	-	-	-	-	-	-	-	-	-
N	7.98	3,150	7.11	2,630	6.94	2,520	6.64	2,340	6.30	2,160	5.99	1,980
2	7.88	3,090	-	-	-	-	-	-	-	-	-	-
4	7.78	3,030	7.05	2,590	-	-	-	-	-	-	-	-
6	7.68	2,970	-	-	6.86	2,480	6.57	2,300	6.22	2,110	5.92	1,950
8	7.61	2,930	7.04	2,580	-	-	-	-	-	-	-	-
10	7.55	2,890	-	-	-	-	-	-	-	-	-	-
M	7.46	2,840	7.04	2,580	6.79	2,430	6.51	2,270	6.14	2,070	5.84	1,900
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.79	1,870	5.75	1,850	5.69	1,820	5.61	1,780	5.59	1,760	5.53	1,730
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.78	1,870	5.74	1,850	5.68	1,810	5.61	1,780	5.56	1,750	5.52	1,730
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.77	1,860	5.73	1,840	5.66	1,800	5.60	1,770	5.55	1,740	5.51	1,720
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.77	1,860	5.71	1,830	5.64	1,790	5.60	1,770	5.53	1,730	5.50	1,720

North Fork of Cache Creek near Lower Lake, Calif.

Location.- Lat. 39°01', long. 122°33', in NE¼ sec. 31, T. 14 N., R. 6 W., 500 feet above Sweet Hollow Creek, 3 miles above mouth, and 7 miles northeast of Lower Lake, Lake County. Altitude, about 1,050 feet above mean sea level.

Drainage area.- 214 square miles.

Gage-height record.- Water-stage recorder graph except for period 2 a.m. Nov. 23 to 8 a.m. Dec. 16, when there was no record. Stage graph for period midnight Dec. 15 to 8 a.m. Dec. 16 based on shape of stage graph for Putah Creek near Guenoc.

Stage-discharge relation.- Defined by current-meter measurements below 7,300 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 16,000 second-feet about 3 a.m. Dec. 11 (gage height, 12.98 feet).

1930-November 1937: Discharge, about 11,000 second-feet Dec. 26, 1931 (gage height, 9.65 feet).

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record estimated from record for Putah Creek near Guenoc.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0.2	120	120	11	0.4	8,000	86	21	644	256	472
2	.2	110	170	12	29	3,000	86	22	318	240	418
3	.2	100	174	13	11	2,000	86	23	700	222	365
4	.2	95	145	14	40	1,100	88	24	600	205	326
5	.2	90	132	15	136	750	114	25	400	198	294
6	.2	85	120	16	301	534	106	26	300	179	269
7	.2	80	114	17	901	439	838	27	250	163	253
8	.2	75	106	18	209	378	576	28	200	150	256
9	.2	150	96	19	149	323	628	29	160	141	243
10	.3	9,500	92	20	2,210	280	580	30	130	134	222
								31		126	1,060
Mean monthly discharge, in second-feet									256	943	279
Run-off, in acre-feet									15,250	57,960	17,130

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2												
4												
6												
8												
10												
N												
2												
4												
6												
8												
10												
M												
	December 14		December 15		December 16		December 17		December 18		December 19	
2					-	-	-	-	-	-	-	-
4					-	574	-	-	-	-	-	-
6					-	-	2.58	457	2.39	391	2.20	332
8					2.82	550	-	-	-	-	-	-
10					-	-	-	-	-	-	-	-
N					2.78	534	2.53	439	2.35	378	2.17	323
2					-	-	-	-	-	-	-	-
4					2.74	518	-	-	-	-	-	-
6					-	-	2.49	425	2.29	359	2.13	311
8					2.68	494	-	-	-	-	-	-
10					-	-	-	-	-	-	-	-
M					2.65	483	2.44	408	2.24	344	2.08	296
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.05	288	1.94	258	1.88	243	1.83	230	1.74	208	1.73	205
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	2.02	280	1.93	256	1.87	240	1.80	222	1.74	208	1.71	200
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	2.00	274	1.91	251	1.86	238	1.78	217	1.75	210	1.69	196
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	1.96	264	1.89	245	1.85	235	1.76	212	1.75	210	1.66	188

Supplemental records.- Dec. 11, about 3 a.m. 12.98 ft., 16,000 sec.-ft.

Putah Creek near Guenoc, Calif.

Location.- Lat. 38°46', long. 122°31', in sec. 22, T. 11 N., R. 6 W., just above dam site and 3½ miles downstream from highway bridge at Guenoc, Lake County. Altitude, about 925 feet above mean sea level.

Drainage area.- 112 square miles.

Gage-height record.- Water-stage recorder graph except for periods 6:30 p.m. Dec. 10 to 4:30 p.m. Dec. 11, Dec. 20 to Jan. 13, when there was no record. Stage graph for periods 6:30 p.m. Dec. 10 to 4:30 p.m. Dec. 11, Jan. 13 based on floodmarks, range of stage indicated on recorder graph, and shape of stage graph for Putah Creek near Winters.

Stage-discharge relation.- Defined by current-meter measurements below 7,000 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 24,100 second-feet about 3 a.m. Dec. 11 (gage height, 22.7 feet).

1904-6, 1930-November 1937: Discharge observed, 24,600 second-feet Mar. 10, 1904 (gage height, 20.1 feet, former datum), from rating curve extended above 14,500 second-feet.

Remarks.- Flood run-off not affected by artificial storage or diversion. Discharge for period of missing gage-height record, Dec. 21 to Jan. 12, determined from discharge graph based on range of stage from recorder graph and record for Putah Creek near Winters.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	2.7	94	90	11	61	11,600	75	21	811	180	461
2	2.7	86	180	12	46	2,420	75	22	376	160	361
3	2.8	79	180	13	13	1,160	72	23	890	150	292
4	2.8	74	130	14	82	770	72	24	750	140	242
5	2.7	68	90	15	97	558	90	25	366	130	212
6	2.7	65	85	16	120	432	142	26	246	120	190
7	2.7	61	85	17	705	344	2,400	27	184	110	176
8	2.8	58	80	18	148	287	910	28	146	100	198
9	2.9	210	80	19	138	240	950	29	122	90	194
10	3.4	13,600	75	20	3,780	207	662	30	107	90	171
								31		80	2,160
Mean monthly discharge, in second-feet									307	1,089	361
Run-off, in acre-feet									18,280	66,970	22,180

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	2.19	57	11.05	5,560	22.00	22,800	9.23	3,480	6.59	1,430
4	-	-	2.18	56	13.30	8,420	21.25	21,400	8.95	3,200	6.47	1,360
6	2.20	58	2.18	56	14.90	10,800	18.70	17,000	8.68	2,950	6.34	1,300
8	-	-	2.19	57	15.49	11,700	17.00	14,100	8.50	2,790	6.25	1,260
10	-	-	2.20	58	15.18	11,200	15.40	11,500	8.22	2,560	6.14	1,200
N	2.20	58	2.23	61	15.14	11,100	14.20	9,700	7.94	2,330	6.04	1,150
2	-	-	2.26	65	18.07	15,900	13.20	8,280	7.67	2,130	5.95	1,110
4	-	-	2.30	69	21.90	22,600	12.45	7,280	7.42	1,950	5.85	1,060
6	2.19	57	2.36	76	20.75	20,600	11.70	6,340	7.22	1,810	5.77	1,030
8	-	-	2.85	148	19.70	18,700	10.95	5,440	7.04	1,700	5.68	986
10	-	-	4.35	491	19.25	17,900	10.22	4,560	6.87	1,600	5.60	950
M	2.19	57	8.40	2,700	19.45	18,300	9.60	3,860	6.73	1,520	5.53	922
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.39	866	4.70	610	4.25	461	3.90	366	3.63	303	3.40	252
6	-	-	-	-	-	-	-	-	-	-	-	-
8	5.27	818	4.60	575	4.18	440	3.85	354	3.59	294	3.37	246
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.15	770	4.53	550	4.12	424	3.81	344	3.56	287	3.34	240
2	-	-	-	-	-	-	-	-	-	-	-	-
4	5.03	726	4.45	523	4.06	408	3.77	332	3.52	278	3.31	234
6	-	-	-	-	-	-	-	-	-	-	-	-
8	4.89	676	4.37	497	4.01	395	3.72	323	3.47	267	3.28	228
10	-	-	-	-	-	-	-	-	-	-	-	-
M	4.80	645	4.30	476	3.95	379	3.68	314	3.44	261	3.24	220
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-										
4	-	-										
6	3.21	214										
8	-	-										
10	-	-										
N	3.17	207										
2	-	-										
4	-	-										
6	3.14	201										
8	-	-										
10	-	-										
M	3.10	194										

Supplemental records.- Dec. 11, about 3 a.m., 22.7 ft., 24,100 sec.-ft.

Putah Creek near Winters, Calif.

Location.- Lat. 38°31', long. 122°05', in NE¼ sec. 28, T. 8 N., R. 2 W., 6 miles west of Winters, Yolo County, and 8 miles below Capell Creek. Altitude, about 160 feet above mean sea level.
Drainage area.- 614 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 16,700 second-feet; extended to peak stage of 1937 on basis of area-velocity study. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 39,200 second-feet 8:30 a.m. Dec. 11 (gage height, 24.8 feet).
1930-November 1937: Discharge, 41,100 second-feet Feb. 4, 1937 (gage height, 25.4 feet).
1905-30: Discharge, about 60,000 second-feet Dec. 31, 1913 (gage height, about 39.0 feet, from floodmarks, former site and datum, 6 miles downstream), from rating curve extended above 20,000 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	7	146	174	11	11	29,300	132	21	3,340	348	1,100
2	7	132	196	12	12	7,120	129	22	800	312	820
3	7	118	276	13	10	2,730	125	23	593	296	664
4	7	108	218	14	10	1,560	124	24	1,130	276	529
5	7.5	100	188	15	10	1,100	137	25	760	271	456
6	7.5	94	174	16	15	840	163	26	445	252	400
7	7	89	164	17	223	664	3,560	27	322	228	361
8	7	84	157	18	460	560	1,970	28	244	212	428
9	7.5	88	147	19	188	470	2,260	29	199	198	544
10	7	20,000	137	20	3,160	400	1,890	30	168	188	428
								31		180	4,550
Mean monthly discharge, in second-feet									406	2,209	729
Run-off, in acre-feet									24,140	135,800	44,830

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	4.30	116	22.45	32,000	15.05	11,300	10.84	3,640
4	-	-	3.97	81	4.43	132	21.95	30,400	14.41	9,900	10.64	3,410
6	4.01	85	-	-	7.65	1,100	23.70	35,700	13.88	8,760	10.44	3,190
8	-	-	3.97	81	17.00	16,200	24.75	39,000	13.35	7,700	10.24	2,970
10	-	-	-	-	19.95	24,400	24.40	37,900	13.00	7,000	10.08	2,810
N	4.00	84	4.00	84	20.91	27,300	23.53	35,200	12.73	6,510	9.92	2,650
2	-	-	-	-	20.82	27,100	22.25	31,400	12.47	6,050	9.78	2,510
4	-	-	4.06	90	20.57	26,300	20.80	27,000	12.17	5,570	9.63	2,380
6	3.99	83	-	-	21.00	27,600	19.64	23,500	11.90	5,140	9.50	2,260
8	-	-	4.10	94	23.25	34,400	18.40	19,900	11.65	4,740	9.38	2,150
10	-	-	-	-	23.95	36,400	17.12	16,500	11.36	4,290	9.26	2,060
M	3.97	81	4.21	106	23.50	35,100	15.95	13,500	11.10	3,950	9.16	1,980
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	8.99	1,840	8.03	1,220	7.38	912	6.90	720	6.53	586	6.21	487
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.78	1,690	7.90	1,150	7.29	876	6.83	693	6.47	566	6.18	478
10	-	-	-	-	-	-	-	-	-	-	-	-
N	8.61	1,570	7.79	1,100	7.20	840	6.77	671	6.42	550	6.13	464
2	-	-	-	-	-	-	-	-	-	-	-	-
4	8.44	1,450	7.67	1,040	7.11	804	6.70	646	6.36	532	6.09	453
6	-	-	-	-	-	-	-	-	-	-	-	-
8	8.30	1,370	7.58	1,000	7.05	780	6.64	624	6.31	517	6.04	439
10	-	-	-	-	-	-	-	-	-	-	-	-
M	8.16	1,290	7.48	956	6.96	744	6.59	607	6.26	502	6.00	428
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.95	414	5.73	356	5.60	324	5.51	302	5.40	278	5.36	269
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.88	395	5.69	346	5.57	317	5.49	298	5.39	276	5.37	271
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.82	379	5.65	336	5.55	312	5.46	291	5.38	274	5.38	274
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.78	369	5.62	329	5.53	307	5.44	287	5.37	271	5.35	267

Supplemental records.- Dec. 11, 8:30 a.m., 24.8 ft., 39,200 sec.-ft.

NAPA RIVER BASIN

Conn Creek near St. Helena, Calif.

Location.- Lat. 38°29', long. 122°24', in NW$\frac{1}{4}$ sec. 3, T. 7 N., R. 5 W., a quarter of a mile upstream from highway bridge, 4 miles southeast of St. Helena, Napa County, and 6 miles above mouth. Altitude, about 180 feet above mean sea level.
Drainage area.- 52.0 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 1,350 second-feet; extended to peak stage. Rating curve changed on Dec. 10, 1937.
Maxima.- December 1937: Discharge, about 2,660 second-feet 4:30 a.m. Dec. 11 (gage height, 7.90 feet).
1930-November 1937: Discharge, about 4,600 second-feet Feb. 4, 1937 (gage height, 10.3 feet), from rating curve extended above 2,200 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	0	1.8	8	11	0	1,270	6.5	21	27	12	57
2	0	1.8	14	12	0	276	6.5	22	9	12	42
3	0	1.5	12	13	0	100	6.5	23	8.5	12	34
4	0	1.5	10	14	0	61	7	24	12	12	28
5	0	1.5	9.5	15	0	42	10	25	8.5	12	25
6	0	1.5	9	16	0	31	8	26	6	10	22
7	0	1.8	8.5	17	0	26	84	27	3.9	9.5	21
8	0	1.5	8.5	18	0	21	50	28	3.3	8.5	37
9	0	3.8	7.5	19	0	18	168	29	2.7	8	34
10	0	975	7	20	53	14	88	30	2.7	7.5	25
								31		7.5	678
Mean monthly discharge, in second-feet									4.55	95.5	49.4
Run-off, in acre-feet									271	5,870	3,040

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	3.05	1.3	3.07	1.8	4.89	520	6.39	1,430	4.56	367	3.86	129
4	3.05	1.3	3.07	1.8	6.01	1,170	7.49	2,290	4.49	336	3.82	120
6	3.05	1.3	3.07	1.8	7.45	2,260	7.38	2,200	4.38	292	3.78	111
8	3.05	1.3	3.07	1.8	6.40	1,440	7.58	2,370	4.61	390	3.75	106
10	3.06	1.5	3.07	1.8	5.81	1,040	6.66	1,630	4.61	390	3.74	104
N	3.06	1.5	3.08	2.2	6.17	1,280	6.20	1,300	4.41	304	3.72	100
2	3.06	1.5	3.09	2.7	5.63	928	5.66	946	4.27	252	3.70	96
4	3.07	1.8	3.10	3.3	5.32	746	5.35	762	4.16	214	3.67	91
6	3.07	1.8	3.11	3.9	5.11	630	5.10	625	4.08	188	3.63	85
8	3.07	1.8	3.13	5.5	5.22	691	4.99	570	4.01	167	3.61	82
10	3.07	1.8	3.17	8.5	5.30	735	4.77	462	3.95	151	3.58	77
M	3.07	1.8	3.24	16	5.49	844	4.60	385	3.91	141	3.56	74
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.52	67	3.36	45	3.26	33	3.19	26	3.15	23	3.08	18
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.50	64	3.34	42	3.24	31	3.19	26	3.13	21	3.08	18
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.48	61	3.35	44	3.25	32	3.20	27	3.13	21	3.09	18
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.46	58	3.32	40	3.24	31	3.19	26	3.13	21	3.08	18
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.42	53	3.29	36	3.22	29	3.16	24	3.10	19	3.07	17
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.39	49	3.27	34	3.21	28	3.16	24	3.09	18	3.06	16
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.05	16	3.00	12	-	-	-	-	2.96	10	3.02	14
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.04	15	3.00	12	-	-	-	-	2.96	10	3.01	13
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.03	14	3.01	13	2.98	12	2.98	12	2.96	10	3.00	12
2	-	-	-	-	-	-	-	-	-	-	-	-
4	3.03	14	3.01	13	-	-	-	-	3.00	12	2.97	11
6	-	-	-	-	-	-	-	-	-	-	-	-
8	3.01	13	2.99	12	-	-	-	-	3.00	12	2.97	11
10	-	-	-	-	-	-	-	-	-	-		
M	3.00	12	2.99	12	2.97	11	2.97	11	3.01	13		

Supplemental records.- Dec. 11, 4:30 a.m., 7.90 ft., 2,660 sec.-ft.

Lake Pillsbury at Hullville, Calif.

Location.- Lat. 39°24', long. 122°57', on line between sec. 14 and 23, T. 18 N., R. 10 W., at Scott Dam on Eel River at Hullville, Lake County, 0.3 mile below Rice Fork. Zero of gage is at mean sea level.
Drainage area.- 288 square miles.
Gage-height record.- Gage read to tenths daily at 4 p.m. except on days for which no record is shown.
Remarks.- Flood run-off partly controlled in reservoir (capacity, 72,040 acre-feet at elevation of crest of spillway, 1,900 feet; capacity increased by slide and radial gates to 93,720 acre-feet at elevation 1,910 feet). Reservoir was at spillway level at beginning of flood. Maximum elevation, 1,911.8 feet 12:30 a.m. Dec. 11 (contents, 97,980 acre-feet). See record for Eel River at Hullville. Basic data furnished by Pacific Gas & Electric Co.

Elevation and contents, November 1937 to January 1938

Day	November		December		January	
	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Elevation (feet)	Contents (acre-feet)
1	1,885.4	46,140	1,900.5	73,050	1,900.3	72,650
2	-	-	-	-	1,900.7	73,460
3	1,884.8	45,220	-	-	1,900.7	73,460
4	1,884.7	45,070	-	-	1,900.7	73,460
5	-	-	-	-	1,900.6	73,260
6	-	-	-	-	1,900.5	73,050
7	-	-	-	-	1,900.4	72,850
8	-	-	-	-	1,900.3	72,650
9	1,884.6	44,920	1,900.2	72,450	1,900.3	72,650
10	1,884.4	44,610	1,908.8	90,950	1,900.3	72,650
11	1,886.3	47,550	1,908.9	91,180	1,900.3	72,650
12	1,887.1	48,820	1,904.5	81,390	1,900.2	72,450
13	1,887.2	48,980	1,902.9	77,990	1,900.2	72,450
14	1,888.0	50,270	1,902.1	76,320	1,900.2	72,450
15	-	-	1,901.7	75,500	1,900.4	72,850
16	1,888.5	51,090	1,901.4	74,880	1,900.7	73,460
17	-	-	1,901.2	74,470	1,902.7	77,570
18	-	-	1,901.0	74,060	1,902.1	76,320
19	1,899.0	70,060	1,900.9	73,860	1,901.8	75,700
20	1,905.6	83,770	1,900.7	73,460	1,901.5	75,090
21	1,903.7	79,680	1,900.6	73,260	1,901.3	74,680
22	-	-	1,900.6	73,260	1,901.3	74,680
23	1,902.6	77,360	1,900.7	73,460	1,901.2	74,470
24	-	-	1,900.7	73,460	1,901.1	74,270
25	-	-	1,900.6	73,260	1,900.9	73,860
26	-	-	1,900.5	73,050	1,900.8	73,660
27	-	-	1,900.4	72,850	1,900.8	73,660
28	-	-	1,900.4	72,850	1,900.8	73,660
29	-	-	1,900.4	72,850	1,900.8	73,660
30	-	-	1,900.4	72,850	1,900.8	73,660
31			1,900.3	72,650	1,901.7	75,500

Eel River at Hullville, Calif.

Location.- Lat. 39°24', long. 122°58', in NE$\frac{1}{4}$ sec. 22, T. 18 N., R. 10 W., half a mile below Scott Dam, half a mile above Soda Creek, and half a mile west of Hullville, Lake County. Altitude, about 1,800 feet above mean sea level.

Drainage area.- 289 square miles.

Gage-height record.- Water-stage recorder graph except for periods 1:20 p.m. Dec. 1 to 4:30 p.m. Dec. 14, 9 a.m. Dec. 17 to 10:15 a.m. Dec. 20, 4:15 p.m. Dec. 20 to 2:30 p.m. Dec. 29, and 3 p.m. Dec. 30 to 1:00 p.m. Jan. 1, when there was no record. Stage graph for Dec. 1, 14, 17, 20, 29, 30 based on partial recorder graph and gage readings. Peak stage obtained from floodmarks on left bank.

Stage-discharge relation.- Defined by current-meter measurements below 2,900 second-feet; extended to peak stage on basis of computed flows over Scott Dam. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, about 38,000 second-feet about 12:30 a.m. Dec. 11 (gage height, 22.9 feet, from floodmarks).

1922-November 1937: Discharge, about 32,600 second-feet Mar. 26, 1928 (gage height, 21.0 feet, from floodmarks, present datum), from rating curve extended above 3,700 second-feet on basis of computed flow over Scott Dam.

Remarks.- Flood run-off only slightly affected by storage in Lake Pillsbury at Scott Dam. See record for Lake Pillsbury. Discharge for periods Dec. 2-13, 18-19, 21-28, and 31 determined from discharge graph based on partial stage graph, gage readings, peak stage, and record for Eel River at Van Arsdale Dam, near Potter Valley. Monthly summaries adjusted for storage. Most of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	174	393	459	11	46	29,000	354	21	4,500	630	1,730
2	178	350	679	12	31	12,000	341	22	2,480	560	1,620
3	178	320	820	13	29	5,800	325	23	2,390	590	1,530
4	161	300	711	14	38	3,450	325	24	2,230	640	1,380
5	66	280	572	15	34	2,280	462	25	1,610	640	1,230
6	31	260	516	16	40	1,700	674	26	1,210	570	1,110
7	29	240	480	17	39	1,380	3,660	27	920	553	1,040
8	29	220	438	18	35	1,180	3,330	28	708	500	1,040
9	55	280	401	19	91	1,020	2,580	29	572	462	1,060
10	84	12,800	377	20	5,390	842	2,140	30	466	452	1,010
								31		456	1,950
Mean monthly discharge, in second-feet (observed)									795	2,585	1,108
Mean monthly discharge, in second-feet (adjusted)									1,238	2,583	1,154
Run-off, in acre-feet (adjusted)									73,690	158,800	70,970

Eel River at Van Arsdale Dam, near Potter Valley, Calif.

Location.- Lat. 39°23', long. 123°07', in NE¼ sec. 30, T. 18 N., R. 11 W., 500 feet below Van Arsdale Dam and 5 miles north of Potter Valley, Mendocino County. Altitude, about 1,400 feet above mean sea level.

Drainage area.- 347 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 16,100 second-feet; extended to peak stage on basis of computed flow over Van Arsdale Dam. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 39,300 second-feet 2 a.m. Dec. 11 (gage height, 30.9 feet).

1910-November 1937: Discharge, about 40,000 second-feet Mar. 26, 1928 (gage height, 27.0 feet, from floodmarks), from rating curve extended above 1,100 second-feet on basis of computed flow over Van Arsdale Dam.

Remarks.- Flood run-off affected by storage in Lake Pillsbury and Van Arsdale Reservoir, and by diversion to Potter Valley power house. Monthly summaries adjusted for diversion only. Part of basic data furnished by Pacific Gas & Electric Co.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1.0	270	264	11	3.4	31,100	276	21	5,880	692	1,830
2	1.1	379	494	12	2.3	13,300	256	22	2,930	616	1,620
3	1.6	200	692	13	2.2	6,610	246	23	2,930	580	1,500
4	2.6	166	580	14	2.6	4,020	248	24	2,670	461	1,220
5	2.6	153	494	15	4.6	2,730	379	25	1,930	580	1,020
6	80	97	427	16	378	2,060	639	26	1,320	511	882
7	34	81	388	17	710	1,560	3,880	27	952	494	752
8	30	66	355	18	204	1,220	3,500	28	728	324	752
9	17	109	262	19	547	997	2,730	29	520	325	794
10	2.4	13,300	295	20	7,100	816	2,380	30	273	370	712
								31		373	1,920
Mean monthly discharge, in second-feet (observed)									975	2,728	1,025
Mean monthly discharge, in second-feet (adjusted)									1,106	2,889	1,187
Run-off, in acre-feet (adjusted)									65,840	177,600	72,960

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	4.24	59	7.83	1,200	30.90	39,300	21.03	18,100	15.11	8,310
4	-	-	4.23	57	9.15	1,960	30.58	38,500	20.39	16,900	14.79	7,870
6	4.30	67	4.22	56	10.61	3,120	30.30	37,800	19.82	15,900	14.50	7,460
8	-	-	4.21	54	12.24	4,720	29.46	35,900	19.22	14,800	14.18	7,010
10	-	-	4.24	59	13.65	6,340	28.63	33,900	18.63	13,800	13.91	6,630
N	4.29	66	4.23	57	16.78	10,800	27.80	32,100	18.09	12,900	13.70	6,380
2	-	-	4.24	59	19.10	14,600	26.82	29,900	17.49	11,900	13.49	6,130
4	-	-	4.36	77	20.75	17,600	25.85	27,800	16.95	11,100	13.30	5,900
6	4.28	64	4.46	94	22.90	21,700	24.83	25,600	16.48	10,300	13.10	5,600
8	-	-	4.71	144	25.90	27,900	23.70	23,300	16.08	9,690	12.93	5,460
10	-	-	5.19	259	28.95	34,700	22.79	21,500	15.77	9,240	12.74	5,230
M	4.24	59	6.39	652	30.12	37,400	21.85	19,600	15.45	8,790	12.58	5,040
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	12.24	4,630	10.72	3,020	9.82	2,240	-	-	-	-	-	-
6	-	-	-	-	-	-	9.04	1,650	8.44	1,300	7.96	1,050
8	11.94	4,280	10.57	2,880	9.67	2,120	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	11.68	4,000	10.40	2,730	9.55	2,020	8.89	1,550	8.30	1,220	7.85	997
2	-	-	-	-	-	-	-	-	-	-	-	-
4	11.35	3,650	10.24	2,590	9.43	1,920	-	-	-	-	-	-
6	-	-	-	-	-	-	8.74	1,460	8.20	1,170	7.76	956
8	11.14	3,440	10.09	2,450	9.30	1,830	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	10.94	3,240	9.94	2,330	9.20	1,760	8.59	1,380	8.08	1,110	7.65	905
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	6.79	559	-	-
4	-	-	-	-	-	-	-	-	6.80	562	6.97	623
6	7.53	851	7.23	724	6.99	630	6.86	584	6.80	562	-	-
8	-	-	-	-	-	-	-	-	6.80	562	6.90	598
10	-	-	-	-	-	-	-	-	6.80	562	-	-
N	7.44	812	7.16	696	6.98	627	6.84	576	6.81	566	6.84	576
2	-	-	-	-	-	-	-	-	6.81	566	-	-
4	-	-	-	-	-	-	-	-	6.25	385	6.76	548
6	7.37	781	7.10	672	6.96	620	6.80	562	5.66	220	-	-
8	-	-	-	-	-	-	-	-	5.67	222	6.70	528
10	-	-	-	-	-	-	-	-	5.70	230	-	-
M	7.30	752	7.05	653	6.91	602	6.79	559	6.89	594	6.65	511

Eel River at Scotia, Calif.

Location.- Lat. 40°29', long. 124°06', in sec. 7, T. 1 N., R. 1 E., at Wildwood Bridge, half a mile north of Scotia, Humboldt County. Altitude, about 50 feet above mean sea level.

Drainage area.- 3,070 square miles.

Gage-height record.- Two gage readings daily; occasional extra readings during high stages. Graph constructed from gage readings for periods Nov. 16-27, Dec. 10-16.

Stage-discharge relation.- Defined by current-meter measurements below 49,000 second-feet; extended to peak stage on basis of area-velocity study.

Maxima.- December 1937: Discharge, 257,000 second-feet 10:45 a.m. Dec. 11 (gage height, 55.1 feet, from gage reading).

1911-15; 1916-November 1937: Discharge observed, about 290,000 second-feet Feb. 2, 1915 (gage height, 55.5 feet, from nonrecording gage), from rating curve extended above 114,000 second-feet.

Remarks.- Flood run-off not materially affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	194	8,340	6,940	11	4,900	240,000	4,200	21	91,100	8,060	26,300
2	203	7,220	8,060	12	11,500	152,000	3,980	22	41,000	7,220	22,800
3	240	6,420	11,200	13	6,420	72,100	3,760	23	42,900	6,680	23,500
4	234	5,640	9,460	14	9,180	41,500	3,760	24	49,800	6,420	15,700
5	234	5,140	7,500	15	14,700	27,900	8,060	25	35,600	6,680	14,100
6	212	4,900	6,680	16	12,500	20,900	14,700	26	25,100	6,940	12,800
7	223	4,660	6,420	17	56,200	16,000	35,600	27	17,700	6,680	10,900
8	212	4,420	5,640	18	36,500	13,100	41,000	28	13,700	6,680	10,300
9	316	3,980	5,140	19	43,400	10,900	34,700	29	11,200	6,680	14,700
10	574	50,800	4,660	20	163,000	9,180	36,000	30	9,460	6,420	12,500
								31		7,220	17,000
Mean monthly discharge, in second-feet									23,280	25,190	14,130
Run-off, in acre-feet									1,385	1,549	868.9

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					12.65	4,310	49.0	208,000	48.7	206,000	32.7	95,500
4					12.75	4,540	51.4	227,000	47.1	194,000	31.7	89,400
6					13.0	5,140	53.5	244,000	45.4	181,000	30.65	83,100
8					13.3	5,900	54.8	255,000	44.1	172,000	29.65	77,100
10					14.5	9,180	55.1	257,000	42.7	162,000	29.0	73,300
N					17.0	17,000	55.1	257,000	41.2	151,000	28.3	69,200
2					21.3	33,800	55.1	257,000	39.6	140,000	27.6	65,300
4					26.7	60,300	54.8	255,000	38.3	132,000	27.2	63,000
6					33.25	99,000	54.3	251,000	37.0	123,000	26.7	60,300
8					37.9	129,000	53.1	241,000	35.9	116,000	26.25	57,800
10					42.5	160,000	51.7	230,000	34.8	109,000	25.8	55,500
M					46.1	186,000	50.2	218,000	33.7	102,000	25.45	53,600
	December 14		December 15		December 16		December 17		December 18		December 19	
2	25.0	51,300	-	-	-	-						
4	24.65	49,600	20.6	30,800	18.55	22,600						
6	24.2	47,300	-	-	-	-						
8	23.85	45,600	20.45	30,100	18.3	21,600						
10	23.4	43,400	-	-	-	-						
N	22.85	40,800	19.9	27,900	18.0	20,500						
2	22.5	39,200	-	-	-	-						
4	22.05	37,100	19.5	26,300	17.7	19,400						
6	21.7	35,600	-	-	-	-						
8	21.5	34,700	19.15	24,900	17.6	19,100						
10	21.2	33,400	-	-	-	-						
M	21.0	32,500	18.8	23,500	17.5	18,700						

Supplemental records.- Dec. 11, 10:45 a.m., 55.10 ft., 257,000 sec.-ft.

Klamath River at Somesbar, Calif.

Location.- Lat. 41°23', long. 123°29', in NE¼ sec. 4, T. 11 N., R. 6 E., 300 feet below mouth of Salmon River and 1 mile west of Somesbar post office, Siskiyou County. Altitude, about 450 feet above mean sea level.

Drainage area.- 8,480 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 49,000 second-feet; extended to peak stage on basis of area-velocity study. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 73,700 second-feet 3:30 p.m. Dec. 11 (gage height, 32.3 feet).

1927-November 1937: Discharge, 60,300 second-feet Mar. 26, 1928 (gage height, 27.9 feet), from rating curve extended above 49,000 second-feet on basis of area-velocity study. Maximum stage known, about 50.8 feet Feb. 21, 1927, from floodmarks (discharge not determined).

Remarks.- Flood run-off somewhat affected by artificial storage and diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	1,900	8,160	10,300	11	10,000	68,600	6,560	21	28,900	8,570	14,300
2	2,740	7,600	9,130	12	6,150	57,000	6,820	22	18,500	8,290	20,700
3	2,780	7,190	8,850	13	6,020	33,700	6,560	23	25,300	8,010	21,000
4	2,780	6,670	9,130	14	11,300	25,600	10,000	24	21,300	8,010	16,600
5	2,780	5,300	8,850	15	7,880	21,000	15,800	25	16,700	7,470	15,500
6	2,780	5,080	8,290	16	8,720	16,300	14,000	26	14,600	6,430	14,900
7	2,560	5,780	7,730	17	12,800	13,100	14,000	27	12,600	6,820	13,400
8	1,780	5,540	7,470	18	11,800	11,300	18,300	28	10,800	8,010	13,400
9	2,360	5,540	6,820	19	35,500	9,410	16,600	29	9,520	7,730	13,400
10	6,090	27,000	6,070	20	56,800	8,570	14,900	30	8,720	13,700	11,900
								31		12,500	11,900
Mean monthly discharge, in second-feet									12,080	14,320	12,040
Run-off, in acre-feet									718,900	880,600	740,200

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	7.75	5,660	7.68	5,490	7.96	6,180	29.10	64,100	30.00	66,800	20.90	40,700
4	7.61	5,320	7.58	5,260	8.15	6,670	29.40	65,000	29.70	65,900	20.30	39,000
6	7.50	5,080	7.47	5,010	8.55	7,740	29.75	66,000	29.40	65,000	19.65	37,200
8	7.41	4,880	7.37	4,790	9.65	10,700	30.00	66,800	28.70	62,900	19.15	35,800
10	7.33	4,710	7.30	4,640	11.40	15,100	30.30	67,700	27.88	60,400	18.60	34,300
N	7.29	4,620	7.50	5,080	14.40	22,900	31.30	70,700	27.10	58,100	18.05	32,700
2	7.83	5,850	7.86	5,920	16.60	28,800	32.10	73,100	26.10	55,300	17.60	31,500
4	7.87	5,950	7.85	5,900	18.90	35,100	32.28	73,600	25.25	52,900	17.30	30,600
6	7.92	6,070	7.96	6,180	21.90	43,500	31.65	71,800	24.25	50,100	16.95	29,700
8	7.95	6,150	8.00	6,280	25.00	52,200	30.95	69,600	23.20	47,200	16.55	28,500
10	7.86	5,920	7.94	6,120	27.40	59,000	30.48	68,200	22.30	44,600	16.10	27,300
M	7.76	5,680	7.90	6,020	28.83	63,300	30.30	67,700	21.60	42,700	15.75	26,300
	December 14		December 15		December 16		December 17		December 18		December 19	
2	15.35	25,200	14.00	21,500	12.50	17,400	11.03	13,200	10.40	11,300	9.98	9,950
4	15.92	26,800	13.75	20,800	12.35	17,000	10.90	12,800	10.25	10,800	9.86	9,590
6	16.15	27,400	14.10	21,800	12.30	16,900	11.35	14,200	10.20	10,600	9.80	9,410
8	16.00	27,000	14.25	22,200	12.75	18,100	11.35	14,200	10.40	11,300	9.76	9,300
10	15.75	26,300	14.05	21,600	12.50	17,400	11.25	13,800	10.50	11,600	9.74	9,240
N	15.73	26,200	14.10	21,800	12.35	17,000	11.18	13,600	10.50	11,600	9.71	9,160
2	15.62	25,900	13.98	21,400	11.87	15,700	11.05	13,200	10.59	11,900	9.68	9,070
4	15.45	25,500	13.85	21,100	11.82	15,500	11.00	13,100	10.58	11,800	9.63	8,930
6	15.20	24,800	13.65	20,600	11.66	15,100	10.90	12,800	10.40	11,300	9.86	9,590
8	14.95	24,100	13.40	19,900	11.55	14,700	10.75	12,400	10.38	11,200	9.98	9,950
10	14.50	22,800	13.15	19,200	11.35	14,200	10.56	11,800	10.25	10,800	9.83	9,500
M	14.20	22,000	12.75	18,100	11.15	13,600	10.45	11,400	10.15	10,500	9.71	9,160
	December 20		December 21		December 22		December 23		December 24		December 25	
2	9.64	8,960	9.43	8,370	9.23	7,810	9.26	7,900	9.10	7,470	9.18	7,680
4	9.56	8,740	9.34	8,120	9.14	7,570	9.10	7,470	8.98	7,160	9.03	7,290
6	9.51	8,600	9.27	7,930	9.07	7,390	9.00	7,210	8.93	7,030	8.88	6,900
8	9.48	8,510	9.23	7,810	9.03	7,290	8.93	7,030	8.92	7,000	8.82	6,740
10	9.45	8,430	9.68	9,070	9.48	8,510	9.48	8,510	9.45	8,430	9.28	7,950
N	9.42	8,320	9.66	9,020	9.53	8,650	9.46	8,460	9.50	8,570	9.27	7,930
2	9.39	8,260	9.68	9,070	9.58	8,790	9.50	8,570	9.56	8,740	9.20	7,730
4	9.37	8,210	9.72	9,190	9.70	9,130	9.53	8,650	9.63	8,930	9.24	7,840
6	9.34	8,120	9.72	9,190	9.68	9,070	9.50	8,570	9.61	8,880	9.30	8,010
8	9.45	8,430	9.65	8,990	9.60	8,850	9.40	8,290	9.55	8,710	9.25	7,870
10	9.62	8,900	9.53	8,650	9.50	8,570	9.33	8,090	9.46	8,460	9.15	7,600
M	9.55	8,710	9.38	8,230	9.40	8,290	9.23	7,810	9.33	8,090	9.05	7,340

Supplemental records.- Dec. 11, 3:30 p.m., 32.3 ft., 73,700 sec.-ft.

Shasta River near Yreka, Calif.

Location.- Lat. 41°49', long. 122°35', in NE¼ sec. 24, T. 46 N., R. 7 W., 0.6 mile above mouth and 6 miles north of Yreka, Siskiyou County. Altitude, about 2,000 feet above mean sea level.

Drainage area.- 804 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements below 570 second-feet; extended to peak stage on basis of area-velocity study; verified by slope-area computation of flood flow. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 1,860 second-feet 4 p.m. Dec. 11 (gage height, 6.17 feet).

1933-November 1937: Discharge, 1,000 second-feet Jan. 15, 1936 (gage height, 4.80 feet), from rating curve extended above 240 second-feet on basis of slope-area computation of flood flow.

January-September 1938: Discharge, 1,940 second-feet 5:30 p.m. Mar. 23 (gage height, 6.24 feet).

Remarks.- Flood run-off somewhat affected by artificial storage in Shasta River Reservoir (capacity, 72,000 acre-feet). Many irrigation diversions above station.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	135	169	209	11	150	1,400	221	21	231	218	304
2	126	166	311	12	172	1,460	218	22	201	215	317
3	126	163	311	13	172	800	218	23	338	212	355
4	126	160	295	14	169	488	240	24	298	215	311
5	126	160	279	15	160	372	334	25	234	218	298
6	126	160	263	16	180	348	321	26	204	231	288
7	126	160	250	17	210	295	450	27	189	276	298
8	124	160	234	18	186	266	411	28	177	247	311
9	124	160	224	19	177	244	358	29	174	221	301
10	126	407	221	20	219	228	324	30	172	215	282
								31		215	285
Mean monthly discharge, in second-feet									176	331	292
Run-off, in acre-feet									10,470	20,330	17,930

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	2.85	166	4.89	971	6.15	1,860	-	-
4	-	-	-	-	2.88	174	4.81	927	6.05	1,780	4.85	940
6	-	-	-	-	2.90	180	5.00	1,030	5.88	1,640	-	-
8	-	-	-	-	2.90	180	5.32	1,230	5.74	1,530	4.69	850
10	-	-	-	-	2.95	195	5.40	1,290	5.65	1,460	-	-
N	2.83	160	2.83	160	3.07	231	5.56	1,400	5.64	1,460	4.58	790
2	-	-	-	-	3.21	275	6.03	1,760	5.60	1,430	-	-
4	-	-	-	-	3.55	389	6.17	1,860	5.52	1,370	4.44	720
6	-	-	-	-	4.20	638	6.11	1,830	5.42	1,300	-	-
8	-	-	-	-	4.79	917	5.94	1,690	5.31	1,230	4.33	668
10	-	-	-	-	4.97	1,010	5.75	1,540	5.20	1,150	-	-
M	2.83	160	2.84	163	4.85	949	5.87	1,640	5.06	1,070	4.21	614
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	3.46	334	-	-	-	-	-	-
4	4.10	570	3.64	396	3.45	331	3.36	301	-	-	-	-
6	-	-	-	-	3.43	324	-	-	-	-	-	-
8	3.99	526	3.59	379	3.42	321	3.35	298	-	-	-	-
10	-	-	-	-	3.41	317	-	-	-	-	-	-
N	3.89	488	3.56	368	3.40	314	3.34	295	3.25	266	3.17	240
2	-	-	-	-	3.52	355	-	-	-	-	-	-
4	3.79	450	3.54	362	3.79	450	3.34	295	-	-	-	-
6	-	-	-	-	3.61	386	-	-	-	-	-	-
8	3.72	425	3.52	355	3.49	345	3.35	298	-	-	-	-
10	-	-	-	-	3.42	321	-	-	-	-	-	-
M	3.68	411	3.48	341	3.40	314	3.29	279	3.22	256	3.15	234
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	3.08	212	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	3.13	228	3.10	218	3.09	215	3.07	209	3.09	215	3.10	218
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	3.10	218	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	3.11	221	3.09	215	3.09	215	3.09	215	3.08	212	3.12	224

Salmon River at Somesbar, Calif.

Location.- Lat. 41°23', long. 123°28', in NW$\frac{1}{4}$ sec. 2, T. 11 N., R. 6 E., half a mile east of Somesbar post office, Siskiyou County, and 1$\frac{1}{2}$ miles above mouth. Altitude, about 500 feet above mean sea level.
Drainage area.- 737 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 7,000 second-feet; extended to peak stage on basis of area-velocity study.
Maxima.- December 1937: Discharge, 27,000 second-feet 1:30 a.m. Dec. 11 (gage height, 14.80 feet).

1927-November 1937: Discharge, 21,600 second-feet Jan. 14, 1936 (gage height, 13.0 feet), from rating curve extended above 9,200 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversions.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	255	1,770	2,490	11	1,760	25,200	1,460	21	7,750	2,100	3,480
2	235	1,590	2,420	12	1,070	13,900	1,420	22	5,440	1,970	6,520
3	225	1,460	2,240	13	965	8,250	1,390	23	8,250	1,800	6,520
4	215	1,320	2,100	14	2,200	6,040	2,430	24	5,920	1,820	5,080
5	210	1,240	1,990	15	1,620	4,840	3,590	25	4,500	1,680	4,260
6	215	1,180	1,880	16	2,170	4,040	3,050	26	4,040	1,590	3,700
7	215	1,140	1,780	17	3,700	3,480	3,590	27	3,160	1,560	3,480
8	215	1,070	1,680	18	2,810	2,950	4,150	28	2,630	1,490	3,370
9	215	1,040	1,600	19	9,880	2,620	3,920	29	2,250	1,450	3,160
10	441	9,890	1,530	20	17,000	2,320	3,480	30	1,970	3,480	2,850
								31		2,950	3,050
Mean monthly discharge, in second-feet									3,051	3,782	3,021
Run-off, in acre-feet									181,500	232,500	185,800

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	4.50	1,260	14.76	26,800	11.65	18,200	-	-
4	-	-	4.31	1,030	4.65	1,460	14.60	26,400	11.20	17,000	8.17	9,180
6	-	-	-	-	5.06	2,090	14.71	26,700	10.78	15,900	-	-
8	-	-	4.30	1,020	6.00	3,920	14.43	25,900	10.42	15,000	7.95	8,620
10	-	-	-	-	6.59	5,300	14.24	25,400	10.08	14,100	-	-
N	4.34	1,070	4.30	1,020	7.45	7,380	14.46	26,000	9.81	13,400	7.71	8,020
2	-	-	-	-	8.55	10,100	14.66	26,600	9.52	12,600	-	-
4	-	-	4.31	1,030	9.49	12,500	14.58	26,300	9.26	11,900	7.52	7,550
6	-	-	-	-	10.86	16,100	14.12	25,000	9.06	11,400	-	-
8	-	-	4.34	1,070	12.65	20,900	13.45	23,200	8.90	11,000	7.38	7,200
10	-	-	-	-	14.16	25,100	12.88	21,600	8.69	10,500	-	-
M	4.32	1,040	4.41	1,150	14.75	26,800	12.24	19,800	8.50	10,000	7.23	6,830
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	7.09	6,500	6.51	5,100	-	-	-	-	-	-	-	-
6	-	-	-	-	6.13	4,220	5.84	3,570	5.60	3,050	5.41	2,690
8	6.97	6,210	6.48	5,030	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	6.85	5,920	6.41	4,860	6.05	4,040	5.78	3,440	5.55	2,950	5.37	2,620
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.76	5,700	6.35	4,720	-	-	-	-	-	-	-	-
6	-	-	-	-	5.99	3,900	5.72	3,300	5.50	2,850	5.33	2,540
8	6.66	5,460	6.28	4,560	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	6.58	5,270	6.22	4,430	5.91	3,720	5.66	3,180	5.46	2,780	5.28	2,460
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.23	2,370	5.10	2,150	-	-	-	-	4.88	1,800	4.83	1,720
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	5.20	2,320	5.07	2,100	4.99	1,970	4.88	1,800	4.93	1,880	4.79	1,660
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	5.16	2,250	5.04	2,050	-	-	-	-	4.92	1,860	4.76	1,620
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	5.13	2,200	5.02	2,020	4.96	1,930	4.84	1,740	4.86	1,770	4.75	1,600

Supplemental record.- Dec. 11, 1:30 a.m., 14.80 ft., 27,000 sec.-ft.

Trinity River at Lewiston, Calif.

Location.- Lat. 40°42', long. 122°48', in NE¼ sec. 19, T. 33 N., R. 8 W., at highway bridge at Lewiston, Trinity County, 0.8 mile below Deadwood Creek. Zero of gage is 1,794.72 feet above mean sea level (general adjustment of 1929).
Drainage area.- 724 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 12,400 second-feet; extended to peak stage on basis of area-velocity study; verified by comparison of peak discharge and total run-off of flood with records for other stations on Trinity River. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 37,000 second-feet 1:30 a.m. Dec. 11 (gage height, 19.90 feet).
1911-November 1937: Discharge, about 31,900 second-feet Nov. 30, 1926 (gage height, 18.3 feet, from floodmark), from rating curve extended above 6,100 second-feet on basis of slope-area computation of 28,700 second-feet for flood of March 1928.
Remarks.- Flood run-off not appreciably affected by artificial storage or by diversions above stations for irrigation, power, and mining.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	239	1,430	1,440	11	2,700	32,400	1,170	21	7,610	1,930	2,140
2	219	1,310	1,620	12	1,440	15,500	1,140	22	5,030	1,790	2,470
3	210	1,200	1,630	13	1,000	7,560	1,130	23	10,400	1,680	2,630
4	207	1,120	1,530	14	1,280	5,240	1,290	24	5,400	1,630	2,320
5	204	1,050	1,470	15	1,160	4,280	1,950	25	3,560	1,530	2,160
6	198	996	1,390	16	2,120	3,550	2,000	26	2,880	1,440	2,020
7	198	962	1,350	17	2,800	3,040	3,120	27	2,330	1,380	1,990
8	195	930	1,290	18	1,850	2,630	3,120	28	2,000	1,330	2,110
9	195	978	1,230	19	4,250	2,320	2,790	29	1,750	1,270	2,060
10	806	14,400	1,200	20	20,000	2,110	2,470	30	1,550	1,560	1,950
								31		1,540	2,470
Mean monthly discharge, in second-feet									2,793	3,874	1,892
Run-off, in acre-feet									166,200	238,200	116,300

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	5.81	898	6.62	1,620	19.89	37,000	15.77	22,400	11.43	9,400
4	-	-	5.81	898	6.92	1,920	19.40	35,200	15.20	20,500	11.26	8,960
6	-	-	5.81	898	7.42	2,470	18.82	33,200	14.61	18,600	11.08	8,490
8	-	-	5.80	890	8.56	4,020	18.58	32,300	14.15	17,200	10.94	8,140
10	-	-	5.81	898	10.43	7,370	18.63	32,500	13.68	15,700	10.80	7,800
N	5.85	930	5.81	898	12.00	11,200	18.78	33,000	13.24	14,400	10.68	7,510
2	-	-	5.83	914	13.63	15,600	18.82	33,200	12.92	13,500	10.55	7,200
4	-	-	5.85	930	15.00	19,800	18.66	32,600	12.60	12,600	10.44	6,940
6	-	-	5.94	1,000	16.65	25,500	18.38	31,600	12.32	11,800	10.34	6,710
8	-	-	6.05	1,100	17.90	29,800	17.96	30,100	12.06	11,100	10.25	6,510
10	-	-	6.19	1,220	19.11	34,200	17.30	27,800	11.85	10,500	10.15	6,290
M	5.82	906	6.40	1,410	19.65	36,100	16.55	25,100	11.64	9,940	10.07	6,110
	December 14		December 15		December 16		December 17		December 18		December 19	
2	9.98	5,920	-	-	-	-	-	-	-	-	-	-
4	9.90	5,740	9.28	4,520	8.86	3,750	8.53	3,170	8.28	2,760	8.07	2,420
6	9.83	5,600	-	-	-	-	-	-	-	-	-	-
8	9.76	5,460	9.23	4,430	8.79	3,620	8.48	3,090	8.24	2,690	8.03	2,360
10	9.69	5,320	-	-	-	-	-	-	-	-	-	-
N	9.64	5,220	9.17	4,310	8.72	3,500	8.43	3,000	8.20	2,630	8.01	2,340
2	9.58	5,100	-	-	-	-	-	-	-	-	-	-
4	9.53	5,000	9.10	4,180	8.67	3,410	8.39	2,930	8.16	2,570	8.00	2,320
6	9.48	4,900	-	-	-	-	-	-	-	-	-	-
8	9.43	4,800	9.02	4,040	8.62	3,320	8.35	2,870	8.13	2,520	7.96	2,260
10	9.40	4,750	-	-	-	-	-	-	-	-	-	-
M	9.35	4,640	8.93	3,870	8.57	3,240	8.32	2,820	8.10	2,470	7.93	2,220
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	7.90	2,170	-	-	-	-	-	-	-	-	-	-
6	-	-	7.75	1,960	7.65	1,820	7.58	1,720	7.49	1,610	7.45	1,560
8	7.87	2,130	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	7.86	2,110	7.73	1,930	7.63	1,790	7.55	1,680	7.55	1,680	7.43	1,530
2	-	-	-	-	-	-	-	-	-	-	-	-
4	7.83	2,070	-	-	-	-	-	-	-	-	-	-
6	-	-	7.70	1,890	7.62	1,780	7.51	1,630	7.53	1,660	7.40	1,490
8	7.80	2,030	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	7.77	1,990	7.67	1,850	7.60	1,750	7.48	1,590	7.46	1,570	7.38	1,470

Supplemental records.- Dec. 11, 1:30 a.m., 19.90 ft., 37,000 sec.-ft.

Trinity River near Burnt Ranch, Calif.

Location.- Lat. 40°47', long. 123°25', in sec. 29, T. 5 N., R. 7 E., 2 miles above highway bridge at Cedar Flat and 7 miles above Burnt Ranch, Trinity County. Zero of gage is 1,007.98 feet above mean sea level (general adjustment of 1929).

Drainage area.- 1,429 square miles (revised).

Gage-height record.- Water-stage recorder graph except for period noon Dec. 11 to 4 p.m. Dec. 19, when there was no record.

Stage-discharge relation.- Defined by current-meter measurements below 23,800 second-feet; extended to peak stage on basis of area-velocity study; verified by $A\sqrt{d}$ method and comparison of peak discharge and total run-off of flood with records for other stations on Trinity River. Rating curve changed at peak stage.

Maxima.- December 1937: Discharge, 71,800 second-feet about 2 p.m. Dec. 11 (gage height, 31.4 feet, from floodmarks on bank).

1931-November 1937: Discharge, 31,000 second-feet Jan. 15, 1936 (gage height, 19.27 feet), from rating curve extended above 7,000 second-feet on basis of area-velocity study.

Remarks.- Flood run-off not affected by artificial storage; perhaps slightly affected by regulation and di ersions above station. Discharge for period of missing gage-height record obtained from discharge graph based on peak stage, partial recorder graph, and record for Trinity River near Hoopa.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	354	2,650	2,720	11	2,720	50,400	2,120	21	21,300	3,340	4,760
2	367	2,420	2,840	12	3,420	33,000	2,020	22	8,830	3,080	5,720
3	347	2,200	3,080	13	1,800	19,000	1,970	23	13,200	2,900	6,400
4	334	2,000	2,900	14	1,950	12,000	2,120	24	11,700	2,780	5,560
5	328	1,850	2,780	15	2,150	8,500	3,210	25	7,480	2,660	4,920
6	325	1,760	2,660	16	2,360	6,800	3,470	26	5,900	2,490	4,460
7	316	1,660	2,540	17	6,240	5,500	5,560	27	4,920	2,380	4,310
8	316	1,620	2,380	18	4,450	4,700	6,740	28	4,000	2,320	4,310
9	313	1,530	2,270	19	6,560	4,000	6,230	29	3,420	2,220	4,310
10	620	4,120	2,170	20	27,800	3,600	5,560	30	2,960	2,720	4,020
								31		3,020	4,310
Mean monthly discharge, in second-feet									4,893	6,426	3,820
Run-off, in acre-feet									291,100	395,100	234,900

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	-	-	-	-	5.47	1,590	18.00	27,500				
4	-	-	-	-	5.48	1,600	20.70	35,500				
6	5.49	1,610	5.41	1,540	5.55	1,660	22.70	41,700				
8	-	-	-	-	5.64	1,750	24.00	46,000				
10	-	-	-	-	5.75	1,850	25.76	52,000				
N	5.47	1,590	5.39	1,520	5.91	2,010	-	59,600				
2	-	-	-	-	6.17	2,280	-	71,800				
4	-	-	-	-	6.75	2,960	-	66,800				
6	5.44	1,570	5.38	1,510	8.45	5,480	-	60,900				
8	-	-	-	-	9.60	7,480	-	55,900				
10	-	-	-	-	11.30	10,900	-	51,400				
M	5.45	1,580	5.47	1,590	15.15	20,000	-	47,700				
	December 14		December 15		December 16		December 17		December 18		December 19	
2											-	-
4											-	-
6											-	-
8											-	-
10											-	-
N											-	*4,000
2											-	
4											7.55	-
6											-	-
8											7.50	-
10											-	-
M											7.41	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.36	3,680	7.12	3,370	6.91	3,090	6.76	2,910	6.61	2,730	6.63	2,760
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	7.31	3,610	7.07	3,300	6.91	3,090	6.76	2,910	6.65	2,780	6.51	2,610
2	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
6	7.29	3,590	7.02	3,240	6.89	3,070	6.69	2,830	6.69	2,830	6.46	2,560
8	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
M	7.18	3,440	6.97	3,170	6.85	3,020	6.65	2,780	6.70	2,840	6.44	2,530

*Mean for the day.

Trinity River near Hoopa, Calif.

Location.- Lat. 41°02', long. 123°39', in SE$\frac{1}{4}$ sec. 31, T. 8 N., R. 5 E., on Hoopa Indian Reservation, half a mile below Campbell Creek and 2 miles southeast of Hoopa, Humboldt County. Altitude, about 315 feet above mean sea level.
Drainage area.- 2,840 square miles (revised).
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 32,800 second-feet; extended to peak stage on basis of area-velocity study; verified by $A\sqrt{d}$ method and by comparison of peak discharge and total run-off of flood with records for other stations on Trinity River. Rating curve changed at peak stage.
Maxima.- December 1937: Discharge, 105,000 second-feet 2 p.m. Dec. 11 (gage height, 28.70 feet).
1911-14, 1916-18, 1931-November 1937: Discharge observed, about 89,000 second-feet Dec. 31, 1913 (gage height, 28.1 feet, from nonrecording gage, former site and datum, 2 miles downstream), from rating curve extended above 12,000 second-feet.
Remarks.- Flood run-off not affected by artificial storage or diversion.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	641	5,530	6,300	11	3,760	93,400	4,850	21	35,900	7,180	11,900
2	646	4,980	6,740	12	6,080	69,300	4,580	22	18,500	6,740	15,100
3	632	4,480	6,960	13	3,720	39,500	4,490	23	22,200	6,300	17,900
4	596	4,120	6,520	14	4,380	28,800	4,670	24	22,200	6,100	14,400
5	582	3,870	6,300	15	5,420	21,400	6,740	25	15,200	5,900	12,200
6	574	3,640	6,100	16	5,310	16,500	7,400	26	11,900	5,500	10,700
7	564	3,430	5,700	17	14,900	12,800	13,100	27	9,820	5,500	9,900
8	560	3,290	5,500	18	10,600	10,500	18,700	28	8,300	5,300	9,900
9	560	3,220	5,210	19	16,900	9,120	16,500	29	7,050	5,120	9,640
10	765	15,100	5,030	20	53,100	8,120	14,100	30	6,320	6,520	8,860
								31		6,960	9,900
Mean monthly discharge, in second-feet									9,589	13,810	9,222
Run-off, in acre-feet									570,600	849,400	567,100

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	7.26	3,370	7.16	3,230	7.27	3,390	24.75	78,000	26.57	90,500	19.35	46,800
4	7.26	3,370	7.15	3,220	7.40	3,570	25.46	82,700	26.05	86,900	18.95	44,800
6	7.25	3,360	7.15	3,220	7.57	3,820	26.03	86,600	25.40	82,600	18.65	43,200
8	7.23	3,330	7.14	3,210	7.79	4,180	26.52	90,000	24.75	78,400	18.35	41,800
10	7.21	3,300	7.13	3,190	7.98	4,530	27.25	95,200	23.85	72,700	18.10	40,500
N	7.20	3,290	7.12	3,180	8.35	5,310	28.05	101,000	23.05	67,700	17.85	39,300
2	7.20	3,290	7.12	3,180	9.11	7,080	28.70	105,000	22.35	63,500	17.60	38,100
4	7.19	3,280	7.12	3,180	11.05	12,000	28.40	103,000	21.75	60,000	17.40	37,100
6	7.18	3,260	7.14	3,210	13.88	20,600	28.25	102,000	21.15	56,500	17.20	36,200
8	7.17	3,250	7.16	3,230	16.93	33,700	27.89	99,600	20.65	53,700	16.95	35,000
10	7.16	3,230	7.18	3,260	20.05	49,500	27.45	96,600	20.15	51,000	16.80	34,300
M	7.16	3,230	7.21	3,300	22.86	65,800	27.05	93,800	19.75	48,900	16.65	33,600
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	16.30	32,000	14.42	23,600	13.03	18,000	11.82	13,800	10.88	11,000	10.33	9,460
6	-	-	-	-	-	-	-	-	-	-	-	-
8	15.93	30,300	14.15	22,400	12.80	17,200	11.66	13,300	10.75	10,600	10.25	9,250
10	-	-	-	-	-	-	-	-	-	-	-	-
N	15.60	28,800	13.89	21,400	12.59	16,400	11.48	12,700	10.66	10,400	10.16	9,020
2	-	-	-	-	-	-	-	-	-	-	-	-
4	15.31	27,500	13.67	20,500	12.42	15,800	11.31	12,200	10.57	10,100	10.10	8,860
6	-	-	-	-	-	-	-	-	-	-	-	-
8	14.98	26,000	13.44	19,600	12.23	15,200	11.16	11,800	10.52	9,960	10.02	8,650
10	-	-	-	-	-	-	-	-	-	-	-	-
M	14.70	24,800	13.24	18,800	12.01	14,400	10.97	11,200	10.45	9,770	9.96	8,500
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.88	8,310	9.54	7,500	9.21	6,760	9.05	6,410	8.84	5,980	8.91	6,120
6	-	-	-	-	-	-	-	-	-	-	-	-
8	9.78	8,070	9.46	7,310	9.17	6,670	9.01	6,320	8.87	6,040	8.87	6,040
10	-	-	-	-	-	-	-	-	-	-	-	-
N	9.75	8,000	9.40	7,180	9.14	6,610	8.96	6,220	8.88	6,060	8.81	5,920
2	-	-	-	-	-	-	-	-	-	-	-	-
4	9.72	7,930	9.36	7,090	9.13	6,590	8.93	6,160	8.90	6,100	8.75	5,800
6	-	-	-	-	-	-	-	-	-	-	-	-
8	9.66	7,780	9.30	6,960	9.11	6,540	8.91	6,120	8.97	6,240	8.71	5,720
10	-	-	-	-	-	-	-	-	-	-	-	-
M	9.61	7,660	9.24	6,830	9.09	6,500	8.85	6,000	8.94	6,180	8.67	5,640

Owens River near Round Valley, Calif.

Location.- Lat. 37°26'25", long. 118°33'20", in SE$\frac{1}{4}$ sec. 10, T. 6 S., R. 31 E., below Sheep Bridge, 700 feet above mouth of Rock Creek and 2 miles north of Round Valley, Inyo County. Altitude, about 4,450 feet above mean sea level.
Drainage area.- About 450 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements below 883 second-feet; extended to peak stage.
Maxima.- December 1937: Discharge, 1,560 second-feet 8 p.m. Dec. 11 (gage height, 4.87 feet).
1903-23, 1927-November 1937: Discharge, 1,190 second-feet June 30, 1907 (gage height, 4.0 feet).
Remarks.- Discharge at indicated time is the mean for the two-hour interval prior to the indicated hour. Record furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	146	142	176	11	156	734	162	21	160	185	150
2	146	144	182	12	166	901	162	22	160	181	164
3	146	146	178	13	166	491	152	23	160	176	154
4	146	146	176	14	168	285	156	24	162	160	150
5	148	146	172	15	160	257	164	25	160	155	150
6	150	146	162	16	160	241	152	26	156	157	156
7	148	146	160	17	166	227	166	27	154	155	156
8	148	150	160	18	154	215	166	28	152	157	156
9	152	152	158	19	160	213	166	29	150	150	154
10	152	340	164	20	160	185	150	30	144	160	150
								31		167	158
Mean monthly discharge, in second-feet									155	233	161
Run-off, in acre-feet									9,230	14,300	9,880

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2					2.18	166	3.20	491	4.50	1,250	3.68	728
4					2.19	168	3.05	426	4.20	1,040	3.60	683
6					2.20	170	2.95	386	4.07	949	3.50	627
8					2.22	174	2.92	375	4.15	1,000	3.40	571
10					2.35	204	2.93	379	4.10	970	3.30	515
N					2.40	216	3.00	405	4.00	900	3.22	471
2					2.70	300	3.25	512	3.92	855	3.18	456
4					3.05	426	3.65	704	3.82	799	3.08	419
6					3.30	534	3.95	872	3.78	777	3.07	415
8					3.40	577	4.65	1,370	3.76	766	3.02	396
10					3.43	590	4.82	1,520	3.76	766	2.98	381
M					3.35	556	4.65	1,370	3.71	738	2.97	378
	December 14		December 15		December 16		December 17		December 18		December 19	
2	2.85	365										
4	2.80	346										
6	2.73	319										
8	2.67	297										
10	2.63	281										
N	2.60	270										
2	2.52	239										
4	2.55	251										
6	2.50	232										
8	2.57	256										
10	2.63	281										
M	2.64	285										

Rock Creek at Sherwin Hill, near Bishop, Calif.

Location.- Lat. 37°28'45", long. 118°36'05", in SW¼ sec. 29, T. 5 S., R. 31 E., at Sherwin Hill, 3 miles above Pine Creek and 14 miles northwest of Bishop, Inyo County. Altitude, about 4,900 feet above mean sea level.
Drainage area.- 51.7 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Standard rating for 6-foot improved venturi (Parshall) flume.
Maxima.- December 1937: Discharge, 115 second-feet 6 p.m. Dec. 11 (gage height, 2.60 feet).
1922-November 1937: Discharge, 162 second-feet June 17, 1927 (gage height, 3.04 feet, at former site).
Remarks.- Discharge at indicated time is the mean for the two-hour interval prior to the indicated hour. Record furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	11	12	17	11	11	*60	15	21	14	19	15
2	11	13	16	12	10	36	15	22	13	18	16
3	11	13	16	13	12	29	15	23	13	16	13
4	10	13	15	14	12	24	15	24	13	11	11
5	10	13	15	15	12	24	15	25	13	12	14
6	10	13	14	16	12	24	14	26	13	12	14
7	10	13	14	17	13	23	16	27	13	13	14
8	10	12	14	18	13	22	15	28	13	13	15
9	11	12	15	19	14	20	12	29	12	14	15
10	10	*44	15	20	14	17	10	30	12	16	10
								31		17	16
Mean monthly discharge, in second-feet									11.9	19.3	14.4
Run-off, in acre-feet									706	1,190	885

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			0.67	13	0.80	17	1.15	30	1.35	39	1.18	31
4			.67	13	.90	20	1.10	28	1.35	39	1.16	30
6			.67	13	1.35	39	1.07	31	1.40	41	1.14	30
8			.65	12	1.60	51	1.10	28	1.41	42	1.13	29
10			.65	12	1.75	59	1.35	39	1.36	39	1.11	28
N			.65	12	1.90	67	1.70	56	1.27	40	1.08	27
2			.65	12	1.80	61	1.90	67	1.23	33	1.00	24
4			.65	12	1.60	51	2.50	104	1.23	33	.98	23
6			.65	12	1.50	46	2.60	115	1.22	33	1.28	36
8			.66	12	1.40	41	2.50	104	1.22	33	1.09	28
10			.67	13	1.30	36	2.05	75	1.20	32	1.08	27
M			.72	14	1.25	34	1.60	52	1.20	32	1.07	27
	December 14		December 15		December 16		December 17		December 18		December 19	
2	1.05	26										
4	1.03	25										
6	1.00	24										
8	.87	19										
10	.83	18										
N	.77	16										
2	.80	17										
4	1.05	26										
6	1.47	44										
8	1.15	30										
10	1.04	26										
M	1.02	25										

*Computed from bi-hourly discharge.

Pine Creek at division box, near Bishop, Calif.

Location.- Lat. 37°24'55", long. 118°37'10", in NW¼ sec. 19, T. 6 S., R. 31 E., a quarter of a mile above division box and forks of creek, 4 miles west of Round Valley, and 13 miles northwest of Bishop, Inyo County. Altitude, about 5,250 feet above mean sea level.

Drainage area.- 37.9 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Defined by current-meter measurements.

Maxima.- December 1937: Discharge, 207 second-feet 3 p.m. Dec. 11 (gage height, 2.88 feet).

1922-November 1937: Discharge, 350 second-feet July 21, 1936 (gage height, 3.58 feet).

Remarks.- Discharge at indicated time is the mean for the two-hour interval prior to the indicated hour. Record furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	17	15	22	11	16	*97	19	21	16	20	18
2	17	15	22	12	16	46	19	22	16	19	18
3	17	15	20	13	16	34	19	23	16	19	18
4	16	15	20	14	16	30	18	24	16	17	18
5	16	15	19	15	16	30	19	25	16	17	18
6	16	15	19	16	16	26	18	26	16	16	18
7	16	16	19	17	16	25	19	27	16	16	18
8	16	15	19	18	16	22	19	28	16	16	19
9	16	17	19	19	16	20	18	29	15	16	19
10	16	*68	19	20	16	20	18	30	15	19	18
								31		22	19
Mean monthly discharge, in second-feet									16.0	24.3	18.9
Run-off, in acre-feet									954	1,490	1,160

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			1.09	16	1.86	62	1.48	39	1.77	56	-	-
4			1.09	15	1.99	70	1.51	41	1.68	51	1.43	36
6			1.09	15	2.04	73	1.60	46	1.64	49	-	-
8			1.09	15	2.76	180	1.93	66	1.58	45	1.41	35
10			1.09	15	2.30	76	2.65	155	1.56	44	-	-
N			1.09	15	2.08	75	2.70	166	1.53	42	1.40	34
2			1.09	15	1.83	60	2.70	166	1.53	42	-	-
4			1.09	15	1.74	56	2.78	184	1.52	41	1.39	34
6			1.10	16	1.68	51	2.30	88	1.50	40	-	-
8			1.13	18	1.58	45	2.30	88	1.48	39	1.37	32
10			1.18	21	1.53	42	2.00	76	1.47	38	-	-
M			1.26	25	1.48	39	1.89	64	1.45	37	1.37	32

Big Pine Creek below Little Pine Creek, near Big Pine, Calif.

Location.- Lat. 37°09', long. 118°19', N½ sec. 25, T. 9 S., R. 33 E., below Big Pine Creek power house and 2¼ miles southwest of Big Pine, Inyo County. Altitude, about 4,400 feet above mean sea level.
Drainage area.- 39.5 square miles.
Gage-height record.- Water-stage recorder graph.
Stage-discharge relation.- Defined by current-meter measurements.
Maxima.- December 1937: Discharge, 79 second-feet 2:30 p.m. Dec. 11 (gage height, 1.52 feet).
1904-5, 1907-10: Mean daily discharge, 268 second-feet July 10-12, 1905.
Remarks.- Discharge at indicated time is the mean for the two-hour interval prior to the indicated hour. Records furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	16	3.9	14	11	8.5	*43	12	21	6	14	12
2	17	4.1	14	12	8.5	26	12	22	6	14	11
3	16	4.3	13	13	7	21	12	23	5.5	14	10
4	16	4.5	14	14	5	19	12	24	5.5	15	9
5	16	4.7	13	15	4.8	18	12	25	4.9	14	10
6	16	4.9	13	16	4.8	16	12	26	4.9	13	10
7	12	5	13	17	6	15	12	27	3.9	14	10
8	14	5.5	13	18	6	15	12	28	3.9	14	10
9	9.5	*6.5	12	19	6	14	12	29	3.4	14	11
10	7.5	23	12	20	6	14	11	30	3.9	14	8.5
								31		14	11
Mean monthly discharge, in second-feet									8.35	13.6	11.7
Run-off, in acre-feet									497	836	719

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			0.31	6	0.42	10	0.68	21	0.95	30	0.70	22
4			.31	6	.45	12	.67	21	.90	31	.69	21
6			.31	6	.87	29	.69	22	.85	29	.68	21
8			.31	6	.95	33	.85	28	.82	27	.75	24
10			.31	6	1.00	35	1.10	40	.80	26	.67	21
N			.31	6	.90	31	1.50	78	.78	25	.82	27
2			.31	6	.78	25	1.50	78	.77	25	.70	22
4			.31	6	.77	25	1.45	73	.81	27	.70	22
6			.31	6	.75	24	1.20	50	.75	24	.67	21
8			.35	7	.75	24	1.10	40	.75	24	.70	22
10			.38	9	.72	23	1.05	35	.73	23	.60	17
M			.37	8	.69	22	1.00	32	.72	23	.61	18
	December 14		December 15		December 16		December 17		December 18		December 19	
2	0.61	18										
4	.63	19										
6	.67	21										
8	.67	21										
10	.60	17										
N	.60	17										
2	.60	17										
4	.69	21										
6	.69	21										
8	.68	21										
10	.67	21										
M	.67	21										

Supplemental records.- Dec. 11, 2:30 p.m., 1.52 ft., 79 sec.-ft.
*Computed from bi-hourly discharge.

Independence Creek at Independence, Calif.*

Location.- Lat. 36°48', long. 118°12', in SE¼ NW¼ sec. 19, T. 13 S., R. 35 E., above intake for town water supply, half a mile southwest of Independence, Inyo County. Altitude, about 4,200 feet above mean sea level.
Drainage area.- 17.6 square miles.
Gage-height record.- Water-stage recorder graph at combination weir and submerged orifice.
Stage-discharge relation.- Based on formulas for weir and submerged orifice.
Maxima.- December 1937: Discharge, 31 second-feet 6 p. m., Dec. 11 (gage height, 1.96 feet).
1905-11: Daily discharge (estimated), 226 second-feet in June 1906.
Remarks.- In the second table gage height and discharge given are the mean for the two-hour interval preceding the indicated hour. Record furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	3.8	3.3	4.5	11	3.6	†15	4.1	21	3.6	4.8	4.1
2	3.8	3.3	4.5	12	3.6	10	3.9	22	3.6	4.8	3.8
3	3.8	3.1	4.3	13	3.6	8	3.9	23	3.6	5	3.6
4	3.8	3.1	4.3	14	3.6	7	3.9	24	3.4	4.8	3.8
5	3.8	3.1	4.3	15	3.6	6.5	3.9	25	3.4	5.5	3.9
6	3.6	3.1	4.3	16	3.6	6	3.9	26	3.4	8	3.9
7	3.4	3.1	4.1	17	3.6	5.5	3.9	27	3.4	4.8	3.8
8	3.4	3.1	4.1	18	3.6	5.5	3.9	28	3.3	4.6	3.6
9	3.6	3.1	4.1	19	3.6	5.5	3.9	29	3.3	4.6	3.6
10	3.6	†14	4.1	20	3.6	5	4.1	30	3.3	4.6	3.4
								31		4.6	3.6
Mean monthly discharge, in second-feet									3.56	5.56	3.97
Run-off, in acre-feet									212	342	244

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			3.83	3.0	3.43	11	3.60	7	3.20	16	3.52	9
4			3.83	3.0	3.00	18	3.62	6.5	3.30	14	3.53	8.5
6			3.83	3.0	2.80	20	3.62	6.5	3.40	12	3.53	8.5
8			3.83	3.0	2.50	23	3.63	6.5	3.45	10	3.54	8.5
10			3.83	3.0	2.15	26	3.58	7.5	3.47	10	3.55	8
N			3.83	3.0	3.00	18	3.55	8	3.48	10	3.55	8
2			3.83	3.0	3.30	14	3.00	18	3.49	9.5	3.56	8
4			3.83	3.0	3.42	11	2.00	29	3.50	9.5	3.56	8
6			3.82	3.1	3.50	9.5	1.96	31	3.51	9	3.57	8
8			3.81	3.3	3.54	8.5	2.50	23	3.52	9	3.57	8
10			3.77	3.9	3.57	8	2.82	20	3.53	8.5	3.57	8
M			3.62	6.5	3.58	7.5	3.00	18	3.54	8.5	3.58	7.5

*Published as Independence Creek near Independence, 1905-9, and as Little Pine Creek near Independence, 1910-11.
†Computed from bi-hourly discharge.

Tuttle Creek at Canyon Road, near Lone Pine, Calif.

Location.- Lat. 36°35', long. 118°05', in NE¼ SE¼ sec. 32, T. 15 S., R. 36 E., above division box, at base of Alabama Hills, about 1½ miles southwest of Lone Pine, Inyo County. Altitude, about 4,000 feet above mean sea level.

Drainage area.- 8.5 square miles.

Gage-height record.- Water-stage recorder graph.

Stage-discharge relation.- Standard rating for 3 foot improved venturi (Parshall) flume.

Maxima.- December 1937: Discharge, 41 second-feet about 4 p.m. Dec. 11 (gage height, 2.20 feet).

Remarks.- Discharge at indicated time is the mean for the two-hour interval prior to the indicated hour. Record furnished by city of Los Angeles.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	5	4.7	5.5	11	5	21	5	21	5	6	4.7
2	5	4.7	5.5	12	5	8	5	22	4.8	6	4.7
3	5	4.7	5.5	13	5	6.5	4.8	23	4.7	6	4.6
4	5	4.7	5	14	5	6.5	4.8	24	4.4	6	4.6
5	5	4.7	5	15	4.8	6.5	4.8	25	4.4	6	4.6
6	5	4.6	5	16	4.8	6	4.8	26	4.4	6	4.7
7	4.8	4.6	5	17	4.8	6	4.8	27	4.6	5.5	4.6
8	5	4.6	5	18	4.7	6	4.8	28	4.6	5.5	4.6
9	5	4.8	5	19	4.8	6	4.7	29	4.7	5.5	4.6
10	5	15	5	20	5	6	4.6	30	4.7	5.5	4.7
								31		5.5	4.6
Mean monthly discharge, in second-feet									4.83	6.42	4.86
Run-off, in acre-feet									288	395	299

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2			0.55	4.7	0.80	8.5	1.21	16	1.12	14		
4			.55	4.7	1.00	12	1.21	16	.90	10		
6			.55	4.7	1.35	19	1.21	16	.73	7.5		
8			.55	4.7	1.31	18	1.21	16	.72	7		
10			.55	4.7	1.42	21	1.21	16	.71	7		
N			.56	4.8	1.22	16	1.21	16	.71	7		
2			.56	4.8	1.20	16	1.40	20	.71	7		
4			.55	4.7	1.20	16	2.20	41	.70	7		
6			.55	4.7	1.20	16	2.00	36	.70	7		
8			.56	4.7	1.21	16	1.70	28	.70	7		
10			.56	4.8	1.21	16	1.40	20	.71	7		
M			.64	6	1.21	16	1.20	16	.71	7		

Bridgeport Reservoir near Bridgeport, Calif.

Location.- Lat. 38°19'30", long. 119°12'50", in SE¼ sec. 34, T. 6 N., R. 25 E., at dam on East Walker River, 4½ miles north of Bridgeport, Mono County. Altitude, about 6,500 feet above mean sea level.
Gage-height record.- Gage read once daily.
Remarks.- Flood run-off completely controlled in reservoir (capacity, 42,500 acre-feet). Gage-height record and capacity table furnished by Walker River Irrigation District.

Contents, in acre-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	15,470	18,350	30,120	11	16,500	19,330	32,080	21	17,060	27,200	33,860
2	15,630	18,520	30,360	12	16,500	19,610	32,330	22	17,230	27,780	34,110
3	15,710	18,700	30,610	13	16,580	19,880	32,460	23	17,580	28,010	34,240
4	15,790	18,780	30,850	14	16,580	20,250	32,590	24	17,750	28,240	34,380
5	15,870	18,780	30,970	15	16,660	21,600	32,840	25	17,920	28,470	34,510
6	15,950	18,870	31,210	16	16,740	22,790	32,960	26	18,000	28,820	34,640
7	16,030	18,960	31,330	17	16,740	24,040	33,090	27	18,000	29,160	34,740
8	16,180	18,960	31,570	18	16,820	25,100	33,220	28	18,090	29,400	35,040
9	16,260	19,050	31,700	19	16,820	25,980	33,480	29	18,090	29,520	35,170
10	16,420	19,150	31,950	20	16,900	26,530	33,600	30	18,180	29,640	35,440
								31		29,880	35,570

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HUMBOLDT-CARSON SINK BASIN

Carson River at Lahontan Reservoir, Nev.

Location.- Lat. 39°28', long. 119°04', in SE¼ sec. 33, T. 19 N., R. 26 E., at Lahontan Dam, Lyon County, Nevada.
Drainage area.- About 1,200 square miles.
Remarks.- Flood run-off completely regulated in Lahontan Reservoir. Elevation of spillway crest is 4,162.0 feet above mean sea level (capacity, 273,600 acre-feet). Daily change in storage adjusted for release and inflow to show natural run-off. All data furnished by Truckee-Carson Irrigation District.

Storage, release, inflow, and discharge, December 1937

Day	Lahontan Reservoir			Inflow from Truckee Canal (second-feet)	Computed natural run-off (second-feet)
	Contents (acre-feet)	Gain or loss in storage (acre-feet)	Release (second-feet)		
1	136,422	+469	85	222	99
2	136,830	+408	87	232	61
3	137,136	+306	41	192	3
4	137,493	+357	5	151	34
5	137,901	+408	5	142	69
6	138,360	+459	5	136	100
7	138,717	+357	5	120	65
8	139,074	+357	5	115	70
9	139,431	+357	5	122	63
10	139,992	+561	5	216	72
11	140,920	+928	5	445	28
12	142,342	+1,422	5	505	217
13	145,600	+3,258	5	480	1,170
14	151,000	+5,400	5	442	2,290
15	160,818	+9,818	5	445	4,510
16	165,733	+4,915	5	109	2,370
17	168,133	+2,400	5	41	1,170
18	170,072	+1,939	5	68	915
19	171,864	+1,792	5	51	857
20	173,336	+1,472	5	59	688
21	174,808	+1,472	5	136	611
22	176,564	+1,756	5	141	749
23	177,856	+1,292	5	134	522
24	179,216	+1,360	5	131	560
25	180,304	+1,088	5	136	418
26	181,525	+1,221	5	122	499
27	182,525	+1,000	5	128	381
28	183,620	+1,095	5	121	436
29	184,600	+980	5	138	361
30	185,720	+1,120	5	143	427
31	186,700	+980	3.5	152	346

Gain or loss in storage, in acre-feet	+50,747
Release, in acre-feet	698
Inflow from Truckee Canal, in acre-feet	11,450
Computed mean monthly run-off, in second-feet	650
Computed run-off, in acre-feet	39,990

Lake Tahoe at Tahoe, Calif.

Location.- Lat. 39°05'55", long. 120°08'25", in NW¼ sec. 7, T. 15 N., R. 17 E., near outlet of lake at Tahoe, Placer County. Zero of gage is 6,219.01 feet above mean sea level (general adjustment of 1929).

Drainage area.- 519 square miles (including water surface of lake, which is 193 square miles).

Gage-height record.- Gage read to hundredths daily about 7 a.m.

Maxima.- December 1937: Gage height, 4.81 feet Dec. 19.
1900-November 1937: Gage height, 11.26 feet July 14, 15, 17, 18, 1907.

Remarks.- Flood run-off completely controlled in lake. See record for Truckee River at Tahoe. Records furnished by Truckee-Carson Irrigation District and H. C. Dukes, Federal water master.

Gage height, in feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4.12	4.01	4.72	11	4.01	4.46	4.65	21	4.08	4.77	4.71
2	4.11	4.01	4.72	12	4.02	4.72	4.65	22	4.07	4.77	4.71
3	4.10	4.00	4.71	13	4.01	4.75	4.64	23	4.04	4.79	4.70
4	4.10	3.99	4.70	14	4.00	4.77	4.63	24	4.07	4.78	4.70
5	4.09	3.97	4.70	15	3.99	4.78	4.67	25	4.06	4.77	4.69
6	4.08	3.97	4.70	16	3.97	4.80	4.80	26	4.05	4.76	4.69
7	4.06	3.96	4.70	17	4.03	4.80	4.70	27	4.04	4.74	4.69
8	4.04	3.95	4.68	18	4.04	4.80	4.71	28	4.03	4.73	4.70
9	4.02	3.95	4.66	19	4.04	4.81	4.71	29	4.02	4.72	4.70
10	3.99	4.13	4.66	20	4.05	4.79	4.72	30	4.02	4.72	4.69
								31		4.72	4.74

Truckee River at Tahoe, Calif.

Location.- Lat. 39°09'55", long. 120°08'45", in NW¼ sec. 7, T. 15 N., R. 17 E., at Tahoe, just below dam at outlet of Lake Tahoe, Placer County. Altitude, about 6,200 feet above mean sea level.
Drainage area.- 519 square miles.
Gage-height record.- Water-stage recorder graph.
Maxima.- December 1937: Flood run-off completely controlled in Lake Tahoe.
1895-96, 1900-December 1937: Discharge observed, 1,340 second-feet July 13-20, 1907.
Remarks.- Flood run-off completely controlled in Lake Tahoe. See record for Lake Tahoe. Record of daily discharge furnished by Truckee-Carson Irrigation District. Discharge records not adjusted for storage because of uncertain, but relatively large effect of evaporation.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	115	96	159	11	96	0	206	21	108	0	128
2	113	96	159	12	97	0	186	22	106	0	128
3	111	94	176	13	96	0	186	23	101	93	128
4	111	93	186	14	94	0	170	24	106	159	128
5	109	90	186	15	93	0	161	25	104	159	128
6	108	90	186	16	90	0	161	26	103	159	128
7	104	88	186	17	99	0	150	27	101	159	128
8	101	87	186	18	101	0	128	28	99	159	128
9	97	87	212	19	101	0	128	29	97	159	128
10	93	42	234	20	103	0	128	30	97	159	128
								31		159	128
Mean monthly discharge, in second-feet									102	71.9	157
Run-off, in acre-feet									6,060	4,420	9,680

Truckee River at Iceland, Calif.

Location.- Lat. 39°22'35", long. 120°01'35", in SW¼ sec. 31, T. 18 N., R. 18 E., above dam of National Ice Co. at Iceland, Nevada County. Altitude, about 5,420 feet above mean sea level.

Drainage area.- 937 square miles.

Gage-height record.- Water-stage recorder graph at regular station site prior to Jan. 6; at Farad Camp 3½ miles downstream for period Jan. 7-31. Gage heights not used to determine discharge for period Dec. 12 to Jan. 6.

Stage-discharge relation.- Defined by current-meter measurements below 4,000 second-feet; extended to peak stage by formula for flow over Iceland Dam at Iceland station; defined by current-meter measurements below 5,000 second-feet and extended to peak stage at Farad Camp station.

Maxima.- December 1937: Discharge, 15,500 second-feet 4 p.m. Dec. 11 (gage height, 11.59 feet), by averaging results from extensions of rating curves for stations at Iceland and Farad Camp; verified by slope-area determination of flood flow.
1899-November 1937: Discharge observed, 15,300 second-feet Mar. 18, 1907 (gage height, 11.5 feet, from nonrecording gage).

Remarks.- Flood run-off reduced by flow from 519 square miles stored at Lake Tahoe. Daily discharge estimated for period Dec. 12 to Jan. 6. Basic data furnished by Truckee-Carson Irrigation District and H. C. Dukes, Federal watermaster.

Mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	176	176	430	11	183	12,300	464	21	483	650	427
2	172	187	430	12	179	7,200	464	22	320	550	421
3	168	179	430	13	172	4,000	444	23	285	500	382
4	168	176	430	14	191	2,400	444	24	290	430	370
5	168	172	400	15	183	1,500	452	25	253	430	382
6	164	172	370	16	183	1,100	433	26	226	430	340
7	157	168	326	17	352	950	480	27	217	430	333
8	160	172	390	18	275	800	429	28	204	430	340
9	160	176	394	19	253	750	413	29	196	430	329
10	157	4,000	437	20	424	700	386	30	179	430	296
								31		430	329
Mean monthly discharge, in second-feet									223	1,368	400
Run-off, in acre-feet									13,290	84,130	24,590

Gage height, in feet, and discharge, in second-feet, at indicated time, 1937

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	December 8		December 9		December 10		December 11		December 12		December 13	
2	3.13	160	3.16	172	3.80	495	8.80	7,440	9.87	-	8.22	-
4	3.14	164	3.15	168	4.80	1,220	9.25	8,610	9.56	-	8.13	-
6	3.15	168	3.12	157	5.90	2,350	9.90	10,400	9.38	-	8.05	-
8	3.13	160	3.10	149	6.50	3,060	10.35	11,600	9.16	-	7.99	-
10	3.12	157	3.10	149	7.00	3,740	10.80	13,000	9.05	-	7.94	-
N	3.11	153	3.18	179	7.30	4,200	11.17	14,100	8.90	*7,200	7.87	*4,000
2	3.15	168	3.16	172	7.60	4,760	11.54	15,300	8.77	-	7.82	-
4	3.25	208	3.16	172	7.90	5,380	11.59	15,500	8.68	-	7.78	-
6	3.20	187	3.16	172	8.15	5,930	11.55	15,300	8.57	-	7.75	-
8	3.17	176	3.20	187	8.35	6,370	11.10	13,900	8.48	-	7.72	-
10	3.17	176	3.29	226	8.45	6,600	10.73	12,800	8.38	-	7.68	-
M	3.16	172	3.42	285	8.50	6,720	10.25	11,400	8.30	-	7.64	-
	December 14		December 15		December 16		December 17		December 18		December 19	
2	-	-	7.30	-	-	-	-	-	-	-	-	-
4	7.55	-	7.28	-	6.66	-	6.45	-	6.30	-	6.57	-
6	-	-	7.27	-	-	-	-	-	-	-	-	-
8	7.45	-	7.27	-	6.61	-	6.40	-	6.29	-	6.49	-
10	-	-	7.26	-	-	-	-	-	-	-	-	-
N	7.40	*2,400	7.24	*1,500	6.58	*1,100	6.36	*950	6.28	*800	6.41	*750
2	-	-	7.22	-	-	-	-	-	-	-	-	-
4	7.36	-	7.21	-	6.54	-	6.33	-	6.27	-	6.40	-
6	-	-	7.20	-	-	-	-	-	-	-	-	-
8	7.35	-	7.12	-	6.52	-	6.34	-	6.21	-	6.40	-
10	-	-	6.85	-	-	-	-	-	6.26	-	-	-
M	7.32	-	6.73	-	6.50	-	6.33	-	6.57	-	6.35	-
	December 20		December 21		December 22		December 23		December 24		December 25	
2	-	-	-	-	-	-	-	-	5.65	-	-	-
4	6.26	-	6.03	-	5.95	-	5.62	-	5.83	-	5.84	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	6.18	-	5.90	-	5.85	-	5.83	-	5.90	-	5.78	-
10	-	-	-	-	-	-	-	-	-	-	-	-
N	6.11	*700	5.89	*650	5.88	*550	5.50	*500	6.05	*430	5.87	*430
2	-	-	-	-	-	-	-	-	-	-	-	-
4	6.20	-	5.96	-	5.93	-	5.50	-	6.10	-	6.02	-
6	-	-	-	-	-	-	-	-	-	-	-	-
8	6.17	-	6.05	-	5.93	-	5.56	-	6.05	-	5.97	-
10	-	-	-	-	5.85	-	-	-	-	-	-	-
M	6.13	-	6.02	-	5.78	-	5.52	-	5.95	-	5.90	-

*Mean for the day.

Donner Creek near Truckee, Calif.

Location.- Lat. 39°19'15", long. 120°12'10", in SE¼ sec. 16, T. 17 N., R. 16 E., 1 mile below Cold Creek, 1½ miles southwest of Truckee, Nevada County, and 2 miles below Donner Lake. Altitude, about 5,800 feet above mean sea level.

Drainage area.- 29.2 square miles.

Gage-height record.- Water-stage recorder graph.

Maxima.- December 1937: Discharge, 1,800 second-feet 2 p.m. Dec. 11 (gage height, 5.40 feet, inside gage; 6.2 feet, outside gage, from floodmarks), determined by slope-area computation.

1902-15, 1928-November 1937: Discharge observed, 980 second-feet Mar. 18, 1907 (gage height, 5.5 feet, former datum, from nonrecording gage).

Remarks.- Flood run-off partly controlled by outlet gates at Donner Lake. Record of changes in storage in lake for period Dec. 1-11 shown below. No record subsequent to 8 a.m. Dec. 11; recorder destroyed. Daily discharge for period Dec. 1-11 adjusted for changes in storage in Donner Lake. Most of basic data furnished by Truckee-Carson Irrigation District and H. C. Dukes, Federal water master.

Observed mean daily discharge, in second-feet, November 1937 to January 1938

Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.	Day	Nov.	Dec.	Jan.
1	4	7	31	11	4	1,600	13	21	17	55	54
2	4	7	32	12	4	980	12	22	12	43	54
3	4	6	32	13	4	715	12	23	9	40	52
4	4	6	31	14	5	628	16	24	9	40	52
5	4	6	28	15	5	505	24	25	8	38	40
6	4	7	20	16	5	243	31	26	7	34	15
7	4	8	14	17	7	166	32	27	7	33	13
8	4	7	15	18	6	130	31	28	7	32	11
9	5	6	13	19	5	101	31	29	6	30	11
10	5	366	13	20	9	78	41	30	6	30	12
								31		31	18
Mean monthly discharge, in second-feet (observed)...........									6.1	193	25.9
Run-off, in acre-feet (observed)...........................									365	11,850	1,590

Contents of lake, gain or loss in storage, and daily discharge, Dec. 1-11, 1937

Day	Donner Lake		Donner Creek	
	Contents (acre-feet)	Gain or loss (acre-feet)	Observed discharge (second-feet)	Adjusted discharge (second-feet)
1	4,317	+8	7	11
2	4,325	+8	7	11
3	4,334	+9	6	11
4	4,342	+8	6	10
5	4,342	0	6	6
6	4,350	+8	7	11
7	4,359	+9	8	13
8	4,359	0	7	7
9	4,565	+206	6	110
10	6,278	+1,713	366	1,230
11	6,870	+592	1,600	1,900

SUMMARY OF FLOOD DISCHARGES

In table 4 of this report are assembled the results of the determinations of maximum flood flows at existing river-measurement stations and at a few other places on streams in the basins of northern California. Table 4 gives the following information:

1. Map reference number, applicable to figures 4 to 12 on pages 13-21, to aid the reader in locating the place where the discharge was determined.

2. Name of stream and place of determination of discharge.

3. Drainage area, in square miles, tributary to the stream at the place of determination of discharge.

4. Period of record. In general, this information is given only for existing river-measurement stations and the initial year is the first calendar year for which high water records are available.

5. The date of the maximum discharge previously known and its magnitude in second-feet.

6. The average discharge for the 24 consecutive hours of maximum flow, total and per square mile.

7. The day, time of day, and the rate in second-feet, total and per square mile, of the maximum momentary peak discharge associated with the floods of December 1937. A notation as to the method of determination is also included.

For existing river-measurement stations the method of determination is designated "Stage-discharge relation" and is described in greater detail in the records for the respective stations.

Where the maximum discharge was not measured at a regular station, a brief reference is made to the method of determination and a discussion of each method will be found in the section of this report entitled "Determination of flood discharges."

The reader should consult the section "Records of previous floods" for possible additional references to notable floods not included in the summary table.

The basic data and computations for the determinations of discharge are filed in the San Francisco district office of the Geological Survey and may be examined there.

Figure 43 shows the maximum peak discharges of the floods of December 1937 in second-feet per square mile, as given in table 4, plotted against the corresponding drainage area.

Table 4.--Summary of flood discharges in northern California

No. on fig. 4-6	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	Salinas River Basin										
101	Salinas River near Santa Margarita	150	1932-1937	Feb. 6, 1937	7,260	1,840	12.3	Dec. 11, 9:30 pm	3,550	23.7	a
102	Salinas River near Spreckels	4,180	1930-1937	Dec. 29, 1931	42,100	10,800	2.58	Dec. 12, 10 pm	13,400	3.21	a
103	San Antonio River at Pleyto	282	1930-1937	Dec. 28, 1931	7,460	3,720	13.2	Dec. 11, 4:30 pm	6,100	21.6	a
104	Arroyo Seco near Soledad	238	1930-1937	Feb. 21, 1917	22,000	6,990	29.4	Dec. 11, 8 am	13,400	56.3	a
	Pajaro River Basin										
105	Uvas Creek near Morgan Hill	30.2	1930-1937	Dec. 27, 1931	4,340	4,630	153	Dec. 11, 1 am	8,630	286	a
	San Lorenzo River Basin										
106	San Lorenzo River at Big Trees	110	1937	Feb. 14, 1937	8,700	3,480	31.6	Dec. 11, 3 am	5,590	50.8	a
	San Francisquito Creek Basin										
201	San Francisquito Creek at Stanford University	37.7	1931-1937	Feb. 4, 1937	b2,620	b587	-	Dec. 11, 11 am	b940	-	a
202	San Francisquito Creek at Palo Alto	38.6	1931-1937	Feb. 4, 1937	b2,550	b550	-	Dec. 11, 1:30 pm	b840	-	a
203	Los Trancos Creek at Stanford University	7.5	1931-1937	Mar. 21, 1937	c399	c38	5.07	Dec. 11, 8:30 am	c120	16.0	a
	Stevens Creek Basin										
204	Stevens Creek near Cupertino	18.1	1930-1937	Dec. 27, 1931	709	b	-	Dec. 11, 12:30 am	b55	-	a
	Guadalupe Creek Basin										
205	Guadalupe Creek at Guadalupe	12.6	1930-1937	Dec. 28, 1931	1,160	b312	-	Dec. 11, 1 am	b826	-	a
206	Guadalupe Creek at San Jose	131	1930-1937	Dec. 27, 1931	6,700	b4,020	-	Dec. 11, 4 am	b6,660	-	a
207	Alamitos Creek near Edenvale	35.0	1930-1937	Dec. 27, 1931	2,670	b1,340	-	Dec. 11, 1:30 am	b2,280	-	a
208	Los Gatos Creek at Los Gatos	40.0	1930-1937	Feb. 13, 1937	5,500	2,640	66.0	Dec. 11, 2 am	4,800	120	a
209	Campbell Creek at Saratoga	8.8	1933-1937	Feb. 13, 1937	910	301	34.2	Dec. 11, 1 am	534	60.7	a
	Coyote Creek Basin										
210	Coyote Creek near Madrone	193	1902-1912	Mar. 7, 1911	25,000	b1,250	-	Dec. 11, 4 am	b2,750	-	a

211	Coyote Creek near Edenvale	229	1917-1937	Feb. 10, 1922	10,000	b1,460	-	Dec. 11, 8 am	b3,060	-	a
	Alameda Creek Basin										
212	Alameda Creek near Niles	633	1917-1937	Feb. 10, 1922	13,900	c3,560	-	Dec. 11, 9 pm	c5,180	-	a
	Kern River Basin										
301	Kern River near Kernville	845	1912-1937	Jan. 17, 1916	9,690	c3,280	3.88	Dec. 11, 8 pm	c6,800	8.05	a,d
302	Kern River above Kern Canyon power house	2,310	1929-1937	Feb. 7, 1937	c19,200	c4,420	1.91	Dec. 12, 5:30 am	c7,900	3.42	d
303	Kern River near Bakersfield	e2,420	1893-1937	Feb. 7, 1937	20,000	-	-	Dec. 12, 11:30 am	6,859	2.83	a
304	South Fork of Kern River near Onyx	531	1911-1914 1919-1937	Feb. 6, 1937	3,130	1,020	1.92	Dec. 12, 8 am	1,260	2.37	a
305	South Fork of Kern River at Isabella	985	1929-1937	Feb. 7, 1937	4,100	952	.966	Dec. 13, 2 am	1,140	1.16	a
	Tulare Lake Basin										
306	Tule River near Porterville	266	1901-1937	Feb. 13, 1936	e12,500	3,880	14.6	Dec. 11, 6 pm	11,300	42.5	a,f
307	South Fork of Tule River near Success	106	1930-1937	Feb. 6, 1937	3,370	452	4.26	Dec. 11, 7 pm	1,060	10.0	a
308	Kaweah River near Three Rivers	520	1903-1937	Feb. 6, 1937	18,900	13,300	25.6	Dec. 11, 3 pm	33,300	64.0	a
309	North Fork of Kaweah River at Kaweah	128	1910-1937	Jan. 25, 1914	7,400	3,040	23.8	Dec. 11, 3 pm	8,290	64.8	a
310	Kings River above North Fork	956	1927-1928 1931-1937	Feb. 6, 1937	13,400	17,400	18.2	Dec. 11, 4 pm	42,000	43.9	a
311	Kings River at Piedra	1,694	1895-1937	Jan. 25, 1914	59,700	44,000	26.0	Dec. 11, 4:30 pm	80,000	47.2	a
312	North Fork of Kings River near Cliff Camp	174	1921-1937	June 4, 1922	6,030	g	-	Dec. 11, noon	14,000	80.5	a
313	North Fork of Kings River below Rancheria Creek	225	1927-1937	May 14, 1937	6,510	g	-	Dec. 11	21,000	93.3	d
314	Los Gatos Creek near Coalinga	105	1931-1937	Dec. 28, 1931	1,050	394	3.75	Dec. 11, 9:30 am	1,530	14.6	f
	San Joaquin River Basin										
315	San Joaquin River above Big Creek	1,042	1922-1937	June 5, 1922	b18,000	b32,500	31.2	Dec. 11, 3 pm	b52,500	50.4	a
316	San Joaquin River below Kerckhoff power house	1,480	1936-1937	Feb. 6, 1937	b32,000	g	-	Dec. 11, pm	b75,000	50.7	a
317	San Joaquin River near Friant	1,632	1907-1937	Jan. 25, 1914	be60,000	b47,300	29.0	Dec. 11, 7 pm	b77,200	47.3	a

a Stage-discharge relation.
b Regulated; not adjusted for storage.
c Not adjusted for diversions.
d Flow over dam.
e Revised.
f Slope-area computation.
g No record.

Table 4.--Summary of flood discharges in northern California--Continued

No. on fig. 6-7	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	San Joaquin River Basin--Continued										
318	San Joaquin River below Skaggs Bridge	1,760	-	-	-	36,200	20.6	Dec. 12, 7 am	55,000	31.2	a
319	San Joaquin River near Newman	9,990	1912-1937	Jan. 27, 1914	20,700	b	-	Dec. 24, 6-8 am	h6,050	-	a
320	San Joaquin River near Vernalis	14,010	1922-1937	Feb. 25, 1936	h28,700	b	-	Dec. 26, 2-4 am	h7,960	-	a
322	South Fork of San Joaquin River near Florence Lake	171	1921-1937	June 4, 1922	3,460	b	-	-	b	-	-
323	Bear Creek near Vermilion Valley	53.5	1921-1937	July 21, 1936	e1,600	257	4.80	Dec. 11, 1 pm	634	11.9	a
324	Mono Creek near Vermilion Valley	92.0	1921-1937	June 16, 1927 June 22, 1932	1,420 1,420	217	2.36	Dec. 11, 5 pm	389	4.23	a
326	Big Creek below Huntington Lake	80.0	1925-1937	June 23, 1925	b2,040	b	-	-	b	-	-
327	Pitman Creek below Tamarack Creek	22.0	1927-1937	May 13, 1937	885	953	43.3	Dec. 11,11:30 am	2,320	105	a
329	North Fork of Willow Creek at Crane Valley Reservoir	51.3	-	-	-	b	-	-	b	-	-
330	Big Sandy Creek near Auberry	34	-	-	-	583	17.1	Dec. 11, 6:30 pm	1,850	54.4	a
331	Fine Gold Creek near Friant	89.2	1936-1937	Feb. 6, 1937	6,780	1,800	20.2	Dec. 11, 6 pm	4,900	54.9	a
332	Cottonwood Creek near Friant	38	-	-	-	48	1.26	Dec. 11, 6 pm	180	4.74	a
333	Little Dry Creek near Friant	58	-	-	-	107	1.84	Dec. 12, 2 am	198	3.41	a
	Fresno River Basin										
334	Fresno River near Knowles	132	1911-1913 1915-1937	Feb. 6, 1937	6,880	1,620	12.3	Dec. 11, 4 pm	3,380	25.6	a
335	Fresno River near Daulton	258	-	-	-	1,890	7.33	Dec. 11, 6 pm	3,660	14.2	a
	Chowchilla River Basin										
336	Chowchilla River at Buchanan dam site	238	1921-1923 1930-1937	Feb. 6, 1937	12,000	2,580	10.8	Dec. 11, 4 pm	7,020	29.5	a
	Bear Creek Basin										
337	Bear Creek near Planada	161	-	-	-	1,520	9.44	Dec. 11, 6 pm	6,220	38.6	a

338	Mariposa Creek near Le Grand	111	-	-	-	915	8.24	Dec. 11, 2 pm	3,160	28.5	a
	Merced River Basin										
339	Merced River at Happy Isles Bridge, near Yosemite	181	1915-1937	May 28, 1919	3,800	5,500	30.4	Dec. 11, 1:30 pm	10,600	58.6	a,i
340	Merced River at Pohono Bridge, near Yosemite	321	1916-1937	June 5, 1922	6,370	17,400	54.2	Dec. 11, 3 pm	22,000	68.5	d,i
341	Merced River at Kittridge	935	1922-1937	Feb. 6, 1937	33,200	36,000	38.5	Dec. 11, 3 pm	59,000	63.1	j
343	Merced River at Exchequer	1,035	1915-1937	Jan. 17, 1916	22,000	b	-	-	b	-	-
344	Merced River near Livingston	1,245	1922-1924 1926-1937	Feb. 24, 1936	he10,900	b	-	Dec. 31, 6 pm	h1,470	-	a
345	Tenaya Creek near Yosemite	47	1904-1909 1912-1937	May 28, 1919	1,730	3,690	78.5	Dec. 11, 4 pm	5,550	118	a
	Orestimba Creek Basin										
346	Orestimba Creek near Newman	129	1932-1937	Feb. 8, 1932	3,440	1,190	9.22	Dec. 11, 1 pm	2,040	15.8	a,f
	Tuolumne River Basin										
348	Tuolumne River near Hetch Hetchy	462	1915-1937	June 16, 1929	b12,000	b	-	Dec. 11, am	k50,000	108	a
350	Tuolumne River above La Grange Dam, near La Grange	1,540	1915-1937	Mar. 25, 1928	b38,100	b	-	-	b	-	a
351	Falls Creek near Hetch Hetchy	45.2	1915-1937	Mar. 25, 1928	1,740	4,260	94.3	Dec. 11, 3 pm	6,300	139	a
352	Cherry Creek near Hetch Hetchy	111	1910-1937	June 16, 1929	7,750	12,200	110	Dec. 11, 2 pm	18,100	163	a
354	Eleanor Creek near Hetch Hetchy	e80	1910-1937	Mar. 25, 1928	b6,400	b6,020	75.2	Dec. 11, 3 pm	b10,500	131	a
355	South Fork of Tuolumne River near Oakland Recreation Camp	87.6	1923-1937	Apr. 8, 1935	e2,850	3,220	36.7	Dec. 11, 4 pm	6,950	79.4	a
356	Middle Tuolumne River near Buck Meadows	71.0	1917-1937	May 28, 1919	1,330	1,520	21.4	Dec. 11, 4 pm	2,910	41.0	a
357	Woods Creek near Jacksonville	98.4	1925-1937	Feb. 6, 1937	10,600	1,910	19.4	Dec. 11, 11:30 am	5,500	55.9	a
	Stanislaus River Basin										
358	Middle Fork of Stanislaus River at Sand Bar Flat, near Avery	e318	1905-1937	Mar. 19, 1907	9,760	b	-	Dec. 11 noon	b26,500	83.3	a,d

a Stage-discharge relation.
b Regulated; not adjusted for storage.
d Flow over dam.
e Revised.
f Slope-area computation.
g No record.
h Not adjusted for storage or diversions.
i Contracted-opening computation.
j Computed from changes in storage in reservoir downstream.
k Computed from record of storage and outflow.

Table 4.--Summary of flood discharges in northern California--Continued

No. on fig. 7-9	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	Stanislaus River Basin--Continued										
360	Stanislaus River below Melones power house	898	1931-1937	Feb. 22, 1936	be18,700	b6,240	-	Dec. 12,12:30 pm	b7,340	-	a
361	North Fork of Stanislaus River near Avery	163	1914-1922 1928-1937	May 11, 1915	5,250	b13,100	80.4	Dec. 11, 9 am	b17,700	109	d
362	South Fork of Stanislaus River at Strawberry Reservoir	45.5	-	-	-	b	-	-	b	-	-
363	South Fork of Stanislaus River below Lyons Dam	67.2	1937	-	-	b	-	Dec. 11, am	k2,800	-	a
	Calaveras River Basin										
364	Calaveras River at Jenny Lind	395	1907-1937	Jan. 31, 1911	69,600	b3,280	-	Dec. 11, 4-6 pm	b3,370	-	a
365	Cosgrove Creek near Valley Springs	20.6	1929-1937	Feb. 22, 1936	e2,600	76	3.69	Dec. 11, 8:15 am	288	14.0	a
	Mokelumne River Basin										
367	North Fork of Mokelumne River below Salt Springs Dam	160	1926-1937	Mar. 25, 1928	8,740	b	-	Dec. 11, am	k21,000	131	-
368	Mokelumne River near Mokelumne Hill	538	1927-1937	Mar. 25, 1928	23,300	b11,600	-	Dec. 11,11:20 am	b17,700	-	a
369	Mokelumne River at Lancha Plana	584	1926-1937	Mar. 25, 1928	27,300	b	-	-	b	-	-
370	Mokelumne River near Clements	630	1904-1937	Mar. 25, 1928	25,600	b	-	-	b	-	-
371	Mokelumne River at Woodbridge	644	1924-1937	Mar. 26, 1928	m	b	-	-	b	-	-
372	Cold Creek near Mokelumne Peak	23	1927-1937	Mar. 25, 1928	e3,000	2,560	111	Dec. 11, 10 am	4,100	178	a
373	Bear River at Pardoe Camp	e33.0	1927-1937	Mar. 25, 1928	be4,090	b3,930	119	Dec. 11, 9 am	b5,850	177	a
374	Middle Fork of Mokelumne River at West Point	67.2	1911-1937	Jan. 23, 1914	2,550	855	12.7	Dec. 11, 9 am	1,460	21.7	a
375	South Fork of Mokelumne River near West Point	73.8	1933-1937	Feb. 22, 1936	3,600	1,040	14.1	Dec. 11, 8 am	1,810	24.5	a
376	Sutter Creek near Sutter Creek	50.6	1922-1937	Feb. 22, 1936	3,900	n	-	Dec. 11	575	11.4	a
377	North Fork of Cosumnes River near Eldorado	202	1911-1937	Mar. 25, 1928	7,600	2,590	12.8	Dec. 11, 3 pm	3,880	19.2	a
378	Cosumnes River at Michigan Bar	537	1907-1937	Feb. 6, 1925	23,800	5,690	10.6	Dec. 11, 4 pm	9,000	16.8	a

	Sacramento River Basin										
401	Sacramento River at Antler	461	1910-1911 1919-1937	Mar. 26, 1928	34,000	21,500	46.6	Dec. 10, 10 pm	24,900	54.0	a
402	Sacramento River at Kennett	6,600	1925-1937	Mar. 26, 1928	94,900	100,000	15.2	Dec. 11, 1 am	132,000	20.0	a
403	Sacramento River at Redding	6,700	-	-	-	-	-	Dec. 11	136,000	20.3	f
404	Sacramento River near Red Bluff	9,300	1895-1937	Feb. 3, 1909	e251,000	225,000	24.2	Dec. 11, 7:30 am	262,000	28.2	a,f
405	Sacramento River at Verona	21,400	1929-1937	Feb. 25, 1936	p61,800	p68,200	-	Dec. 14, 3 am	p68,400	-	a
	Pit River Basin										
406	Pit River near Canby	e1,430	1904-1905 1929-1937	Mar. 8, 1904	e17,000	7,510	5.25	Dec. 11, 5 pm	8,210	5.74	a
407	Pit River at Fall River Mills	e4,150	1921-1937	Mar. 28, 1928	e13,000	25,900	6.24	Dec. 12, noon	28,600	6.89	a
408	Pit River below Pit No. 4 dam	4,860	1927-1937	Apr. 8, 1935	e18,400	29,100	5.99	Dec. 12, 6 pm	30,200	6.21	a
409	Pit River at Big Bend	4,920	1910-1937	Apr. 8, 1935	e20,400	32,000	6.50	Dec. 12, 5 pm	34,200	6.95	a
410	Pit River near Ydalpom	5,350	1910-1937	Dec. 31, 1913	47,000	44,400	8.30	Dec. 10, 11 pm	65,000	12.1	a
411	South Fork of Pit River near Likely	e248	1928-1937	Apr. 27, 1932	1,060	620	2.50	Dec. 11, 3 am	746	3.01	a
412	Hat Creek near Hat Creek	155	1926-1937	June 16, 1937	450	1,810	11.7	Dec. 11, 2 am	2,500	16.1	f
413	McCloud River near McCloud	388	1931-1937	Feb. 22, 1936	e2,760	g	-	Dec. 10	4,600	11.9	a
414	McCloud River at Baird	668	1910-1937	Feb. 25, 1917	27,600	24,300	36.4	Dec. 10, 11 pm	32,200	48.2	a
	Cow Creek Basin										
415	Cow Creek near Redding	443	-	-	-	-	-	Dec. 11, 12:30 am	53,000	120	f
	Battle Creek Basin										
416	Battle Creek near Cottonwood	351	-	-	-	-	-	Dec. 11, 12:30 am	35,000	99.7	f
	Mill Creek Basin										
417	Mill Creek near Los Molinos	e134	1929-1937	Dec. 15, 1929	6,000	13,600	103	Dec. 11, 2 am	23,000	172	a,f
	Elder Creek Basin										
418	Elder Creek near Henleyville	147	1930-1937	Jan. 1, 1934	6,300	6,330	43.1	Dec. 10, 10 pm	10,700	72.8	a

a Stage-discharge relation
b Regulated; not adjusted for storage.
d Flow over dam.
e Revised.
f Slope-area computation.
g No record.
k Computed from record of storage and outflow.
m Not determined.
n Staff gage reading only.
p Not including flow in by-pass.

Table 4.--Summary of flood discharges in northern California--Continued

No. on fig. 9	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	Thomas Creek Basin										
419	Thomas Creek at Paskenta	188	1921-1937	Mar. 26, 1928	16,600	12,300	65.4	Dec. 10, 10 pm	16,500	87.8	a
	Deer Creek Basin										
420	Deer Creek near Vina	200	1911-1915 1920-1937	Mar. 26, 1928	12,200	g	-	Dec. 10, midnight	23,800	119	a
	Chico Creek Basin										
421	Chico Creek near Chico	68.3	1930-1937	Feb. 21, 1936	4,940	6,400	93.7	Dec. 10, midnight	8,260	121	a
	Stony Creek Basin										
422	Stony Creek above Stony Gorge Reservoir	266	1933-1937	Feb. 21, 1936	b7,160	b13,400	50.4	Dec. 10, 11:30 pm	b20,800	78.2	j
	Butte Creek Basin										
424	Butte Creek near Chico	148	1930-1937	Feb. 21, 1936	c8,660	c12,500	84.5	Dec. 11, 1:30 am	c17,000	115	a
	Feather River Basin										
426	North Fork of Feather River near Prattville	507	1905-1937	Mar. 19, 1907	10,000	b	-	Dec. 23,6 am-4 pm	b2,620		a
427	North Fork of Feather River at Big Bar	1,934	-	-	-	-	-	Dec. 11	83,000	42.9	f
428	Feather River near Oroville	3,611	1902-1937	Mar. 19, 1907	e230,000	157,000	43.5	Dec. 11, 6 am	185,000	51.2	a,f
429	Indian Creek near Crescent Mills	746	1906-1909 1911-1918 1930-1937	Mar. 19, 1907	q11,700	11,000	14.7	Dec. 12, 3 am	11,500	15.4	a
430	Spanish Creek at Keddie	184	1911-1919 1921-1937	Mar. 26, 1928	11,000	10,600	57.6	Dec. 11, 11 am	11,500	62.5	a
432	Bucks Creek at Bucks Creek storage reservoir, near Bucks ranch	28	-	-	-	b	-	Dec. 11, 3-6 am	k5,500	196	-
433	Grizzly Creek near Storrie	6.2	1929-1932 1934-1937	Dec. 12, 1929 Feb. 21, 1936	1,000 1,000	1,100	177	Dec. 10, 11 am	1,570	253	a
434	West Branch of Feather River near Yankee Hill	145	1930-1937	Feb. 21, 1936	b14,400	b18,100	125	Dec. 11, 2 am	b21,400	148	a
435	Concow Creek near Yankee Hill	14.7	1927-1937	Mar. 26, 1928	1,840	b	-	Dec. 11, 10 am	b770	52.4	d

436	Middle Fork of Feather River near Clio	699	1925-1937	Mar. 26, 1928	11,000	g	-	Dec. 11	5,320	7.61	a
437	Middle Fork of Feather River at Bidwell Bar	1,353	1911-1937	Mar. 26, 1928	90,000	78,400	57.9	Dec. 11, 6 am	93,000	68.8	a
438	South Fork of Feather River at Enterprise	134	1911-1937	Mar. 26, 1928	b15,200	b15,100	113	Dec. 10, 5 pm	b17,300	129	a
439	Lost Creek near Clipper Mills	30.1	1927-1937	Mar. 26, 1928	h2,900	h2,340	77.7	Dec. 10, 4 pm	h3,380	112	d
440	Middle Fork of Yuba River at Milton	41	1925-1934 1935-1937	Mar. 25, 1928	4,070	c4,530	110	Dec. 11, 10 am	c6,800	166	d
441	Middle Fork of Yuba River near North San Juan	207	1911-1937	Mar. 25, 1928	26,000	c16,400	79.2	Dec. 11, 7:30 am	c24,000	116	a
442	Yuba River at Smartville	1,201	1903-1937	Mar. 26, 1928	120,000	78,200	65.1	Dec. 11, 9 am	95,000	79.1	f
443	Oregon Creek near North San Juan	35.1	1911-1937	Mar. 25, 1928	4,000	1,580	45.0	Dec. 11, 6 am	2,750	78.3	a
444	North Fork of Yuba River near Sierra City	91.3	1911-1913 1923-1937	Mar. 25, 1928	5,920	6,460	70.8	Dec. 11, 4 am	9,800	107	a
445	North Fork of Yuba River below Goodyears Bar	244	1930-1937	Feb. 21, 1936	9,080	g	-	Dec. 11 am	26,000	107	a
447	South Fork of Yuba River at Lake Spaulding	118	-	-	-	b	-	Dec. 11, 12:15 pm	k19,600	166	-
449	Canyon Creek below Bowman Lake	31.7	1927-1937	June 6, 1936	h1,460	b	-	Dec. 11 am	r5,200	164	-
450	Deer Creek near Smartville	83.5	1935-1937	Feb. 4, 1937	b7,520	n	-	Dec. 11, 9 am	b10,800	129	a
451	Bear River near Wheatland	295	1928-1937	Apr. 8, 1935	b21,600	b8,440	28.6	Dec. 11, 2:30 pm	b11,000	37.3	a
	American River Basin										
452	North Fork of American River near Colfax	308	1911-1937	Mar. 25, 1928	55,000	17,000	55.2	Dec. 11, 11:30 am	26,700	86.7	a
453	North Fork of American River at Rattlesnake Bridge	999	1930-1937	Apr. 8, 1935	41,500	g	-	Dec. 11	78,000	78.1	a
454	American River at Fair Oaks	1,921	1904-1937	Mar. 25, 1928 Mar. 19, 1907	e140,000	83,400	43.4	Dec. 11, 6 pm	114,000	59.3	a
455	Middle Fork of American River near Auburn	619	1911-1937	Mar. 25, 1928	100,000	37,500	60.6	Dec. 11, 2 pm	47,900	77.4	a
456	South Fork of American River near Kyburz	196	1922-1937	Mar. 25, 1928	5,020	c6,540	33.4	Dec. 11, 6 am	c9,700	49.5	a
457	South Fork of American River near Camino	497	1922-1937	Mar. 25, 1928	e24,100	c18,900	38.0	Dec. 11, noon	c25,800	51.9	a,d
458	South Fork of American River at Coloma	635	1929-1937	Apr. 8, 1935	13,300	18,500	29.1	Dec. 11, 2 pm	27,000	42.5	a
459	Medley Lakes outlet near Vade	6.2	1922-1937	June 15-16,1929	b202	b112	18.1	Dec. 10, 9 am	b166	26.8	a

a Stage-discharge relation.
b Regulated; not adjusted for storage.
c Not adjusted for diversions.
d Flow over dam.
e Revised.
f Slope-area computation.
g No record.
h Not adjusted for storage or diversions.
j Computed from changes in storage in reservoir downstream.
k Computed from record of storage and outflow.
n Staff gage reading only.
q Probably low.
r Adjusted for storage.

Table 4.—Summary of flood discharges in northern California—Continued

No. on fig. 8-12	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	American River Basin—Continued										
460	Silver Lake outlet near Kirkwood	14.9	1922-1937	July 1, 1932	b374	b453	30.4	Dec. 11, 3 pm	b504	33.8	a
461	Silver Fork of South Fork of American River near Kyburz	108	1924-1937	Mar. 25, 1928	b3,620	b3,840	35.6	Dec. 11, 10:30 am	b5,450	50.5	a
462	Twin Lakes outlet near Kirkwood	12.4	1922-1937	May 25-28, 1928	b176	b	-	Dec. 11 am	k2,200	177	-
463	Alder Creek near Whitehall	22.8	1922-1937	Mar. 25, 1928	2,060	516	22.6	Dec. 11, 9:30 am	710	31.1	a
464	Plum Creek near Riverton	6.8	1922-1937	Mar. 25, 1928	635	197	29.0	Dec. 11, 7 am	315	46.3	a
465	Silver Creek at Union Valley	82.7	1924-1937	Mar. 25, 1928	e8,050	5,680	68.7	Dec. 11, 10 am	8,560	104	a
466	Silver Creek near Placerville	176	1921-1937	Mar. 25, 1928	e12,400	9,560	54.3	Dec. 11, 12:30 pm	14,600	83.0	a
467	South Fork of Silver Creek near Ice House	28.4	1924-1937	Mar. 26, 1928	1,620	1,640	57.7	Dec. 11, 12:30 pm	2,200	77.5	a
	Cache Creek Basin										
468	Clear Lake at Lakeport	420	1913-1937	Jan. 28, 1914	s11.12	-	-	Dec. 16	s5.67	-	-
469	Cache Creek at Yolo	e1,150	1903-1937	Feb. 2, 1915	b21,100	b18,300	15.9	Dec. 11, 4 pm	b19,300	16.8	a
470	North Fork of Cache Creek near Lower Lake	214	1930-1937	Dec. 26, 1931	e11,000	g	-	Dec. 11, 3 am	16,000	74.8	a
	Putah Creek Basin										
471	Putah Creek near Guenoc	112	1904-1906 1930-1937	Mar. 10, 1904	24,600	17,700	158	Dec. 11, 3 am	24,100	215	a
472	Putah Creek near Winters	614	1930-1937	Feb. 4, 1937	41,100	33,500	54.6	Dec. 11, 8:30 am	39,200	63.9	a
	Napa River Basin										
501	Conn Creek near St. Helena	52.0	1930-1937	Feb. 4, 1937	4,600	1,320	25.4	Dec. 11, 4:30 am	2,660	51.2	a
	Russian River Basin										
502	Russian River at Healdsburg	777	-	-	-	-	-	Dec. 11	74,000	95.2	f
	Eel River Basin										
504	Eel River at Hullville	289	1922-1937	Mar. 26, 1928	32,600	g	-	Dec. 11, 12:30 am	b38,000	131	d

505	Eel River at Van Arsdale Dam near Potter Valley	347	1910-1937	Mar. 26, 1928	40,000	b33,400	96.3	Dec. 11, 2 am	b39,300	113	d
506	Eel River at Scotia	3,070	1911-1915 1916-1937	Feb. 2, 1915	290,000	242,000	78.8	Dec. 11, 10:45 am	257,000	83.7	a
	Klamath River Basin										
507	Klamath River at Somesbar	8,480	1927-1937	Mar. 26, 1928	60,300	69,000	8.14	Dec. 11, 3:30 pm	73,700	8.69	a
508	Shasta River near Yreka	804	1933-1937	Jan. 15, 1936	1,000	1,670	2.08	Dec. 11, 4 pm	1,860	2.31	e
509	Salmon River at Somesbar	737	1927-1937	Jan. 14, 1936	21,600	25,800	35.0	Dec. 11, 1:30 am	27,000	36.6	a
510	Trinity River at Lewiston	724	1911-1937	Nov. 30, 1926	31,900	33,400	46.1	Dec. 11, 1:30 am	37,000	51.1	a
511	Trinity River near Burnt Ranch	e1,429	1931-1937	Jan. 15, 1936	31,000	g	-	Dec. 11, 2 pm	71,800	50.2	a
512	Trinity River near Hoopa	e2,840	1911-1914 1916-1918 1931-1937	Dec. 31, 1913	89,000	95,800	33.7	Dec. 11, 2 pm	105,000	37.0	a
	Smith River Basin										
513	Smith River near Crescent City	613	1931-1937	Apr. 13, 1937	70,100	g	-	Dec. 11	78,900	129	a
	The Great Basin										
	Owens Lake Basin										
601	Owens River near Round Valley	450	1903-1923 1927-1937	June 30, 1907	1,190	1,070	2.38	Dec. 11, 8 pm	1,560	3.47	a
602	Rock Creek at Sherwin Hill, near Bishop	51.7	1922-1937	June 17, 1927	c162	64	1.24	Dec. 11, 6 pm	115	2.23	a
603	Pine Creek at division box, near Bishop	37.9	1922-1937	July 21, 1936	350	101	2.67	Dec. 11, 3 pm	207	5.46	a
604	Big Pine Creek below Little Pine Creek near Big Pine	39.5	1904-1905 1907-1910	July 10-12,1905	268	45	1.14	Dec. 11, 2:30 pm	79	2.00	a
605	Independence Creek at Independence	17.6	1905-1911	June - 1906	t226	18	1.02	Dec. 11, 6 pm	31	1.76	u
606	Tuttle Creek at Canyon Road, near Lone Pine	8.5	1906-1911	-	-	21	2.47	Dec. 11, 4 pm	41	4.82	a
	Walker Lake Basin										
608	West Walker River at Chris Flat, above Coleville	187	-	-	-	-	-	Dec. 11	5,800	31.0	f
609	West Walker River near Coleville	245	1903-1910 1915-1937	July 3, 1907	4,170	-	-	Dec. 11	6,500	26.5	f

a Stage-discharge relation.
b Regulated; not adjusted for storage.
c Not adjusted for diversions.
d Flow over dam.
e Revised.
f Slope-area computation.
g No record.
k Computed from record of storage and outflow.
s Maximum gage height in feet.
t Estimated mean daily discharge.
u Combination weir and orifice.

Table 4.--Summary of flood discharges in northern California--Continued

No. on fig. 9, 12	Stream and place of determination	Drainage area (sq. mi.)	Period of record	Maximum discharge previously known		Maximum discharge during floods of December 1937					
						Maximum 24-hour average		Momentary peak			
				Date	Second-feet	Second-feet	Sec.-ft. per sq. mi.	Time	Second-feet	Sec.-ft. per sq. mi.	Method of determining
	Humboldt-Carson Sink Basin										
610	East Fork of Carson River near Markleeville	214	1911-1931	June 17, 1911	2,380	-	-	Dec. 11	8,400	39.3	f
612	Markleeville Creek at Markleeville	53.1	1911-1931	June 15, 1911	915	-	-	Dec. 11	3,500	65.9	f
613	West Fork of Carson River at Woodfords	e69.0	1900-1920	May 9,10, 1906	1,570	-	-	Dec. 11	3,500	50.7	d,f
	Pyramid and Winnemucca Lakes Basin										
614	Lake Tahoe at Tahoe	519	1900-1937	July 14, 15, 17, 18, 1907	s11.26	-	-	Dec. 19	s4.81	-	-
615	Truckee River at Tahoe	519	1895-1896 1900-1937	July 13-20, 1907	b	b	-	-	b	-	-
616	Truckee River at Iceland	937	1899-1937	Mar. 18, 1907	b15,300	b	-	Dec. 11, 4 pm	b15,500	16.5	a,d,f
617	Donner Creek near Truckee	e29.2	1902-1915 1928-1937	Mar. 18, 1907	980	b	-	Dec. 11, 2 pm	b1,800	61.6	a
618	Little Truckee River near Boca	150	1911-1915	Apr. 15, 1914	2,360	-	-	Dec. 11	6,200	41.3	f

a Stage-discharge relation.
b Regulated; not adjusted for storage.
d Flow over dam.
e Revised.
f Slope-area computation.
s Maximum gage height in feet.

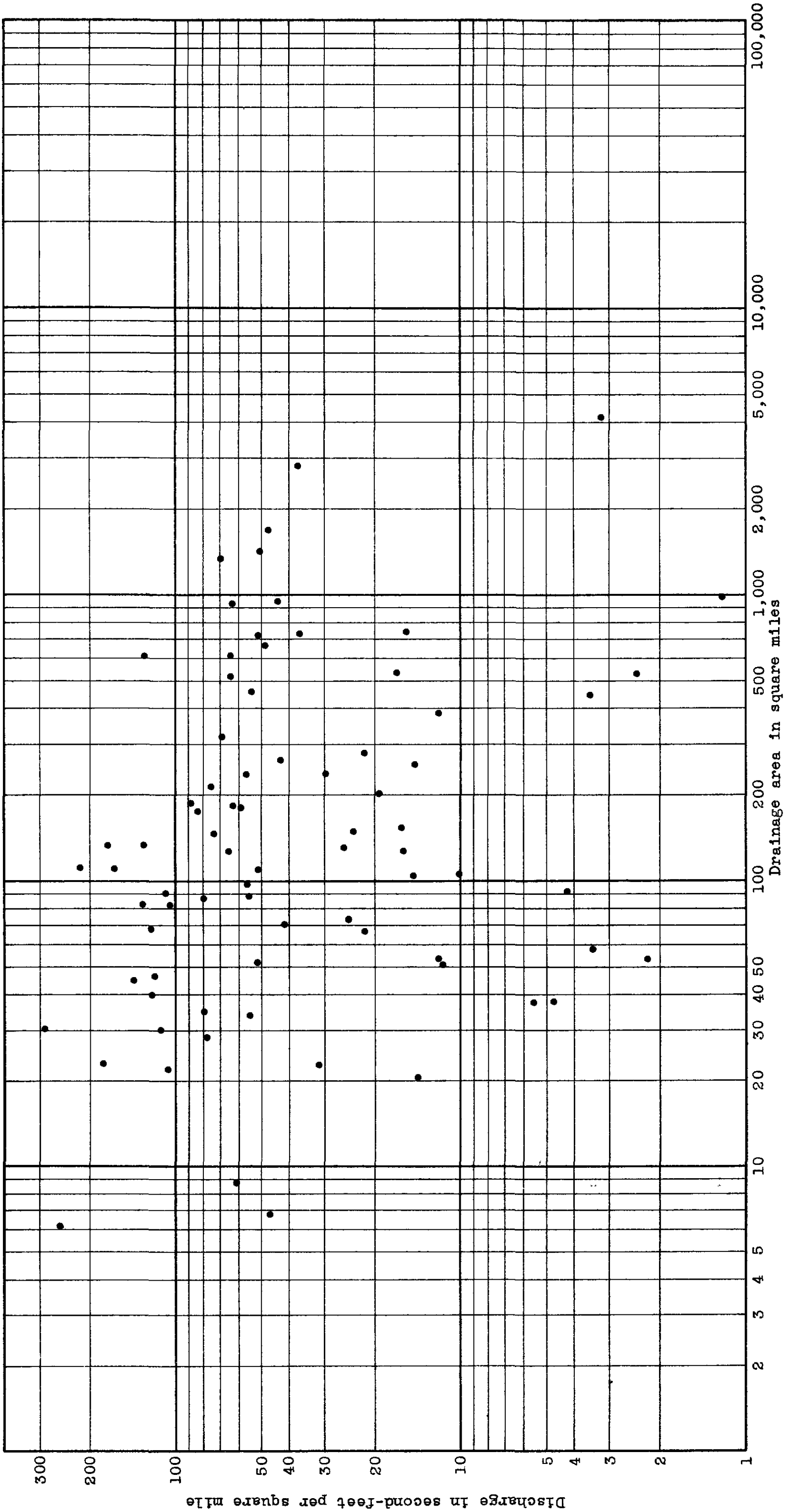

Figure 43.--Chart showing the maximum momentary discharge, in second-feet per square mile, for unregulated streams in California, December 1937, as given in table 4.

STORAGE

Run-off of many California streams is affected by storage. The effect in terms of inches in depth over various drainage areas is discussed in the section on "Rainfall and run-off studies". Basic data for practically all important storage reservoirs in northern California are given in the section on "Stages and discharges at river-measurement stations". Table 5 lists the total available storage capacity of reservoirs in northern California. (Footnotes to table 7 in the section on "Rainfall and run-off studies" explain adjustments for storage.)

Table 5.--Total available storage capacity of reservoirs in northern California, by drainage basins

Basin and stream	Available storage capacity (acre-feet)
San Joaquin Basin	
Kern River	a205,000
Kaweah River	1,150
Kings River	4,720
San Joaquin River (above Friant)	339,100
Merced River	289,600
Tuolumne River	684,700
Stanislaus River	170,800
Calaveras River	89,700
Mokelumne River	385,600
Cosumnes River	1,200
Sacramento Basin	
Pit River	232,000
Stony Creek	101,200
Feather River (including Yuba and Bear)	1,792,300
Cache Creek (Clear Lake)	375,000
Putah Creek	1,700
American River	57,400
Miscellaneous	14,500
North Pacific Basins	
Eel River	74,600
Shasta River	72,000
Trinity River	1,200
The Great Basin	
Truckee River (including Lake Tahoe)	759,000
Carson River	7,900
Walker River	51,000
Owens River	99,300

a Buena Vista Reservoir, former natural terminus of river.

Storage reservoirs in California regulate surface run-off for many purposes, including municipal use, irrigation, hydro-electric power, flood control, navigation, replenishment of underground reservoirs at a controlled rate, assistance in salinity control near tide water, and various combinations of these uses. Some of the uses may be harmoniously combined, others are in conflict, but whatever the use some advantage generally accrues for flood control. Even if a reservoir is full at the time of a flood peak there will generally be some reduction in momentary maximum owing to increased channel storage in the section of the river channel occupied by the reservoir.

Daily gage height (or elevation) and daily contents for the three-month period November 1, 1937, to January 31, 1938, are presented in this report for the following reservoirs:

San Joaquin River Basin.--Florence Lake on South Fork of San Joaquin River; Huntington Lake on Big Creek; Shaver Lake on Stevenson Creek; Lake McClure on Merced River; Hetch Hetchy Reservoir on Tuolumne River; Don Pedro Reservoir on Tuolumne River; Lake Eleanor on Eleanor Creek; Melones Reservoir on Stanislaus River; Salt Springs Reservoir on North Fork of Mokelumne River.

Sacramento River Basin.--Stony Gorge on Stony Creek; Lake Almanor on North Fork of Feather River; Bucks Creek Storage Reservoir on Bucks Creek; Bowman Lake on Canyon Creek; Lake Spaulding on South Fork of Yuba River.

Eel River Basin.--Lake Pillsbury on Eel River.

Less complete data are given for the following reservoirs not listed above: Clear Lake on Cache Creek; Lake Tahoe on Truckee River; Bridgeport Reservoir on East Walker River.

Data for the foregoing two groups are presented under the names of the respective reservoirs in the same order as the river-measurement stations. Some reservoir information for the flood period is also given in connection with following stream-flow records:

San Joaquin River Basin.--North Fork of Willow Creek near Crane Valley Reservoir (Crane Valley Reservoir); South Fork of Stanislaus River at Strawberry Reservoir (Strawberry Reservoir); South Fork of Stanislaus River below Lyons Dam (Lyons Reservoir); Calaveras River at Jenny Lind (Hogan Reservoir); Mokelumne River at Lancha Plana (Pardee Reservoir).

Sacramento River Basin.--Concow Creek near Yankee Hill (Lake Wilenor); Twin Lakes Outlet near Kirkwood (Twin Lakes Reservoir); Silver Lake Outlet near Kirkwood (Silver Lake).

San Francisco Bay.--Alameda Creek near Niles (Calaveras Reservoir).

The Great Basin.--Carson River at Lahontan Reservoir (Lahontan Reservoir); Donner Creek near Truckee (Donner Lake).

Examples of effect of storage

San Joaquin River

The most notable effect of storage during the flood of December 1937 was on the lower San Joaquin River. At the river-measurement station on the San Joaquin River near Friant, there was on December 11 a momentary peak of 77,200 second-feet, by far the highest during the past 30 years of record. Friant gaging station is at the edge of the foothills, 278 miles by river upstream from Collinsville at the junction of the Sacramento and San Joaquin Rivers.

At the gaging station near Vernalis, just upstream from the effect of tide and 202 miles by river downstream from Friant, there was practically no immediate effect from the upstream flood and a very moderate and flattened peak of only 7,960 second-feet on December 26. Between the two stations the San Joaquin is joined by many tributaries, including three large streams, the Merced, Stanislaus, and Tuolumne Rivers. The remarkable reduction of the momentary peak discharge from 77,300 second-feet to 7,960 second-feet was associated with a similar falling-off in flood volume. The reduction was caused by a combination of natural and artificial storage. Four large reservoirs on three main tributaries were practically empty on December 9, as were many miles of channels and sloughs and many square miles of lowlands between Friant and Vernalis, hence they supplied a large volume of storage capacity to hold the flood waters.

Lake McClure on the Merced River has a capacity of 282,000 acre-feet; Melones Reservoir on the Stanislaus River, 113,000 acre-feet; Hetch Hetchy Reservoir on the Tuolumne River, 360,000 acre-feet; Don Pedro Reservoir on the Tuolumne River, 290,000 acre-feet. None of these filled during the December storm but they showed a gain in storage of 446,000 acre-feet. Many smaller reservoirs stored their proportional part of the flood.

Although the peak at Friant was by far the largest for the 30 years of record, it also was reduced by storage. Florence Lake, Huntington Lake, Shaver Lake, and Crane Valley Reservoir, in the headwaters of the San Joaquin, gained a total of 30,000 acre-feet during the flood period.

The eight largest reservoirs upstream from Vernalis therefore detained 476,000 acre-feet of water. It appears, therefore, that very material contribution to flood control was furnished by the eight large reservoirs in San Joaquin River Basin, although they were built primarily for power and irrigation use and not for flood control.

The total available artificial storage in reservoirs upstream from Vernalis is about 1,500,000 acre-feet. The natural storage available in channels, sloughs, and overflow areas, plus seepage loss to underground basins, is unknown in amount but without doubt was very large and was a major factor in avoiding a serious flood on the lower San Joaquin. The flow past Vernalis during the period December 8 to 25 was only 208,000 acre-feet.

Past records show that most major storms come later in the season than the storm of December 9-13, 1937, and it is reasonable to assume that at times of floods these reservoirs would ordinarily be at least partly full and so contribute less toward reducing the flood damage in the San Joaquin Valley.

It is now a matter of record, that the lower San Joaquin River did receive the highest water in many years during March and again in June, 1938. Many reservoirs were filled by the middle of March, most of them were overflowing by June, and the San Joaquin River then resembled a lake for the 244 miles from Skaggs Bridge to mouth.

Another example of effect of storage worthy of mention was at Hogan Reservoir on the Calaveras River, which has a capacity of 76,000 acre-feet. This is one of very few reservoirs in California constructed primarily for flood control, and open ports were built into the dam. Its effect is shown by the record at the river-measurement station on the Calaveras River at Jenny Lind. While neighboring streams were experiencing high and sharp flood peaks on December 11, the maximum at Jenny Lind was only 3,370 second-feet. The peak would have been even lower except for unregulated inflow along several miles of channel between the reservoir and Jenny Lind. The mean discharge for December 11 was 2,040 second-feet, and for December 12, 3,100 second-feet. After adjusting for storage effect the respective mean discharges are 5,570 and 1,200 second-feet. The peak discharge, adjusted for storage, is problematical. Before construction of the reservoir there was a peak flow of 36,800 second-feet on February 6, 1925, and 17,300 second-feet was recorded on March 25, 1928. A discharge of about 69,600 second-feet was reported for January 31, 1911.

Reservoirs on the Mokelumne River prevented a flood of considerable size, although they were built for purposes other than flood control. Salt Springs Reservoir (capacity, 130,000 acre-feet) and Pardee Reservoir (capacity, 210,000 acre-feet) did not spill. Together, they detained 85,000 acre-feet during the flood period. Smaller reservoirs in the Mokelumne Basin stored some additional water. Consequently, peak discharge at the river-measurement station on the Mokelumne River near Lancha Plana was only the 2,150 second-feet released at Pardee Dam.

Sacramento River

In contrast with the fortunate situation on the lower San Joaquin River, serious flood conditions prevailed during December 1937 throughout the length of the Sacramento River. The ratio of available storage to volume of run-off is much lower in the Sacramento Basin than in the San Joaquin. In addition, the antecedent period had been very wet in the northern part of the Sacramento Valley, but relatively dry in the San Joaquin.

Lake Almanor on the North Fork of Feather River gained 69,800 acre-feet during the storm period; Lake Spaulding on the South Fork of Yuba River, 31,000 acre-feet from 5 p.m. December 9 to 8 a.m. December 11, when it started to spill, and Bucks Creek storage reservoir on Bucks Creek, 18,100 acre-feet. These were the only instances of comparatively large storage detention. Many small reservoirs, especially in the Feather River Basin, filled and spilled during the flood period.

The total capacity of all reservoirs in the Sacramento Basin is about 2,600,000 acre-feet, but far less than this amount was actually available, for three reasons. Many reservoirs were partly filled at the beginning of the December storm. Some of the "hold over" or cyclic reservoirs are never filled by any one flood. Several reservoirs, in Pit River Basin particularly, are in areas that seldom contribute surface run-off to the Basin's main stream.

The effect of storage on each of the principal tributaries of the Sacramento River is summarized as follows.

On the Pit River there are 83 reservoirs with combined capacity of 232,000 acre-feet. However, it is estimated that only about 93,000 acre-feet of flood waters had been detained at the end of the flood period, and consequently storage had relatively little effect on either the flood peak or the total flood run-off of the Pit River.

The Feather River, upstream from the Yuba River, has 31 reservoirs with a combined capacity of 1,522,000 acre-feet. This includes Lake Almanor with a capacity of 1,308,000 acre-feet, which has never been fully utilized. It is estimated that about 80,000 acre-feet were detained above Oroville between December 9 and 20. The effect on the peak discharge of the Feather River was very slight.

The Yuba River has 39 storage reservoirs with a capacity of about 256,000 acre-feet and the Bear River, five with 15,000 acre-feet. It is estimated that 82,500 acre-feet was detained on the Yuba and 7,000 on the Bear during the December storm. Storage upstream from the gaging station on Yuba River at Smartville was proportionately larger than on some of the other Sacramento tributaries and probably reduced the peak by an appreciable amount.

In Cache Creek Basin, Clear Lake with a capacity of about 375,000 acre-feet at a gage height of 9 feet, held 131,000 acre-feet more on December 20 than on December 10 and therefore materially affected the flow at the gaging station on Cache Creek at Yolo.

The American River has 16 reservoirs, including minor ones, with a combined capacity of about 57,000 acre-feet. It is estimated that they detained 28,000 to 30,000 acre-feet during the high water period.

The Sacramento River upstream from the Pit River has practically no storage.

Minor basins from the Pit down to the Feather have storage amounting to 114,000 acre-feet. Minor basins from the Feather to the American have reservoirs with capacities of about 1,800 acre-feet, and Putah Creek Basin about 1,700 acre-feet. The amount detained in these is problematical but was certainly small in comparison with the total flood run-off.

On December 20 there was possibly 480,000 acre-feet more in storage in artificial reservoirs in the Sacramento River Basin, than on December 10.

Run-off past Sacramento in the main channel of the Sacramento River, plus flow in Yolo by-pass December 10 to 20, was 3,100,000 acre-feet. Therefore, artificial storage was only about 15 per cent and played a small part in the results in the lower Sacramento Valley.

Areas outside the Central Valley

In Santa Clara Valley, storage on streams tributary to San Francisco Bay played an important part. During 1935 and 1936 the Santa Clara Valley Water Conservation District constructed reservoirs on Coyote, Guadalupe, Stevens, Los Gatos, and Almaden Creeks, and Calero Reservoir, holding foothill storage supplied by a canal from Almaden Reservoir. These reservoirs were built to detain storm waters and release them at a rate slow enough to replenish natural underground storage. None of these reservoirs filled during the December flood and therefore the run-off of none of the streams named approached previous flood peaks at gaging stations downstream from the reservoirs. At the end of the flood period they contained 19,200 acre-feet more than at the beginning.

In the North Pacific area, flood discharge at gaging stations was not appreciably affected by storage.

In the Great Basin area, Lake Tahoe is the outstanding storage reservoir. The gates in the dam at the outlet of the Lake were closed throughout the December storm period. Without this regulation of the run-off from 519 square miles of the Upper Truckee Basin, the flood would have been much more serious at Iceland and points farther downstream.

RAINFALL AND RUN-OFF STUDIES

General discussion

In connection with the outstanding floods of March 1936 in northeastern United States and of January 1937 in the Ohio and Mississippi Rivers, detailed analyses were made in order to develop some of the significant features of the relation between rainfall and run-off.

The results of these studies are published in Water Supply Papers 798, 799, 800, and 838. A second objective, probably of equal importance, was to use the results of the analyses, so far as practicable, in checking the accuracy or reasonableness of the basic data published in the reports and in furnishing a background of information that is useful in consideration of the deficiencies in the basic meteorologic and hydrologic data and of measures to supply them. The analyses herein, relating to the storm and floods of December 1937 in northern California, have been carried on with the same objectives in view.

As it is evident that altitude, especially along the western face of the Sierra Nevada, was a factor of major importance in affecting the magnitude of the precipitation and its occurrence as rain or snow, the drainage basins have been broken down into altitude zones and the areas in each zone determined approximately. Table 6 shows for each basin the approximate number of square miles lying above an altitude of 9,000 feet, between 7,000 and 9,000 feet, between 5,000 and 7,000 feet, and below 5,000 feet. These determinations are useful in explaining rainfall and run-off characteristics and may be of value in future studies relating to the run-off and flood potentialities of the Sierra Nevada. For detail studies in any individual basin, large scale topographic maps should be used, as the areas given in table 6 are only approximate.

Table 6.--Drainage areas, in square miles, between selected altitudes along western slope of the Sierra Nevada

No. on fig. 5-7	Stream and point of measurement	Total area*	Partial area*: Above 9,000 feet	7,000 to 9,000 feet	5,000 to 7,000 feet	Below 5,000 feet
	Kern River Basin					
301	Kern River near Kernville	845	361	252	185	47
302	Kern River above Kern Canyon power house	2,310	455	590	661	604
303	Kern River near Bakersfield	2,420	455	590	666	709
304	South Fork of Kern River near Onyx	531	92	260	160	19
305	South Fork of Kern River at Isabella	985	92	288	338	267
	Tulare Lake Basin					
306	Tule River near Porterville	266	4	40	71	151
307	South Fork Tule River near Success	106	0	12	32	62
308	Kaweah River near Three Rivers	520	65	126	129	200
309	North Fork Kaweah River at Kaweah	128	2	30	37	59
310	Kings River above North Fork	956	424	258	172	102
311	Kings River at Piedra	1,694	547	397	262	488
312	North Fork of Kings River near Cliff Camp	174	98	70	6	0
313	North Fork of Kings River below Rancheria Creek	225	102	87	19	17
	San Joaquin River Basin					
315	San Joaquin River above Big Creek	1,042	440	300	219	83
317	San Joaquin River near Friant	1,632	463	401	338	430
318	San Joaquin River below Skaggs Bridge	1,760	463	401	338	558
322	South Fork San Joaquin River near Florence Lake	171	140	31	0	0
323	Bear Creek near Vermilion Valley	54	43	11	0	0
324	Mono Creek near Vermilion Valley	92	70	22	0	0
326	Big Creek below Huntington Lake	80	23	53	4	0
327	Pitman Creek below Tamarack Creek	22	1	21	0	0
329	North Fork of Willow Creek at Crane Valley Reservoir	51	0	9	19	23
330	Big Sandy Creek near Auberry	34	0	0	0	34
331	Fine Gold Creek near Friant	89	0	0	0	89
332	Cottonwood Creek near Friant	38	0	0	0	38
333	Little Dry Creek near Friant	58	0	0	0	58
	Fresno River Basin					
334	Fresno River near Knowles	132	0	0	14	118
335	Fresno River near Daulton	258	0	0	14	244
	Chowchilla River Basin					
336	Chowchilla River at Buchanan dam site	238	0	0	5	233
	Bear Creek Basin					
337	Bear Creek near Planada	161	0	0	0	161
338	Mariposa Creek near Le Grand	111	0	0	0	111
	Merced River Basin					
339	Merced River at Happy Isles Bridge, near Yosemite	181	96	69	16	0
340	Merced River at Pohono Bridge, near Yosemite	321	117	168	27	9
341	Merced River at Kittridge	935	124	262	166	383
343	Merced River at Exchequer	1,035	124	262	166	483
344	Merced River near Livingston	1,245	124	262	166	693
345	Tenaya Creek near Yosemite	47	6	36	4	1
	Tuolumne River Basin					
348	Tuolumne River near Hetch Hetchy	462	220	165	55	22
350	Tuolumne River above La Grange Dam, near La Grange	1,540	254	340	313	633
351	Falls Creek near Hetch Hetchy	45	19	20	6	0
352	Cherry Creek near Hetch Hetchy	111	22	59	23	7
354	Eleanor Creek near Hetch Hetchy	80	7	42	26	5
355	South Fork of Tuolumne River near Oakland Recreation Camp	88	0	17	44	27
356	Middle Tuolumne River near Buck Meadows	71	0	26	19	26
357	Woods Creek near Jacksonville	98	0	0	0	98

* Area given to the nearest square mile.

Table 6.--Drainage areas in square miles between selected altitudes along western slope of the Sierra Nevada--Continued

No. on fig. 7-9	Stream and point of measurement	Total area*	Partial area*			
			Above 9,000 feet	7,000 to 9,000 feet	5,000 to 7,000 feet	Below 5,000 feet
	San Joaquin River Basin--Continued					
	Stanislaus River Basin					
358	Middle Fork of Stanislaus River at Sand Bar Flat, near Avery	318	57	130	101	30
360	Stanislaus River below Melones power house	898	63	239	214	382
361	North Fork of Stanislaus River near Avery	163	0	76	67	20
362	South Fork of Stanislaus River at Strawberry Reservoir	46	5	30	11	0
363	South Fork of Stanislaus River below Lyons Dam	67	5	30	19	13
	Calaveras River Basin					
364	Calaveras River at Jenny Lind	395	0	0	0	395
365	Cosgrove Creek near Valley Springs	21	0	0	0	21
	Mokelumne River Basin					
367	North Fork of Mokelumne River below Salt Springs Dam	160	0	119	35	6
368	Mokelumne River near Mokelumne Hill	538	0	154	137	247
369	Mokelumne River at Lancha Plana	584	0	154	137	293
370	Mokelumne River near Clements	630	0	154	137	339
371	Mokelumne River at Woodbridge	644	0	154	137	353
372	Cold Creek near Mokelumne Peak	23	0	14	9	0
373	Bear River at Pardoe Camp	33	0	19	14	0
374	Middle Fork of Mokelumne River at West Point	67	0	0	20	47
375	South Fork of Mokelumne River near West Point	74	0	0	20	54
376	Sutter Creek near Sutter Creek	51	0	0	0	51
377	North Fork of Cosumnes River near El Dorado	202	0	4	46	152
378	Cosumnes River at Michigan Bar	537	0	9	79	449
	Sacramento River Basin					
401	Sacramento River at Antler	461	4	7	107	343
402	Sacramento River at Kennett	6,600	9	103	2,308	4,180
404	Sacramento River near Red Bluff	9,300	9	121	2,374	6,796
	Pit River Basin					
406	Pit River near Canby	1,430	0	77	932	421
407	Pit River at Fall River Mills	4,150	0	77	1,908	2,165
408	Pit River below Pit No. 4 dam	4,860	0	83	2,082	2,695
409	Pit River at Big Bend	4,920	0	83	2,082	2,755
410	Pit River near Ydalpom	5,350	0	83	2,082	3,185
411	South Fork of Pit River near Likely	248	0	42	206	0
412	Hat Creek near Hat Creek	155	0	17	101	37
413	McCloud River near McCloud	388	2	6	106	274
414	McCloud River at Baird	668	5	13	119	531
	Mill Creek Basin					
417	Mill Creek near Los Molinos	134	0	14	24	96
	Deer Creek Basin					
420	Deer Creek near Vina	200	0	0	44	156
	Chico Creek Basin					
421	Chico Creek near Chico	68	0	0	4	64
	Butte Creek Basin					
424	Butte Creek near Chico	148	0	0	47	101
	Feather River Basin					
426	North Fork of Feather River near Prattville	507	0	9	307	191
428	Feather River near Oroville	3,611	0	23	1,907	1,681
429	Indian Creek near Crescent Mills	746	0	0	577	169
430	Spanish Creek at Keddie	184	0	0	51	133
432	Bucks Creek at Bucks Creek storage reservoir	28	0	0	28	0
433	Grizzly Creek near Storrie	6	0	0	6	0
434	West Branch of Feather River near Yankee Hill	145	0	0	46	99

* Area given to the nearest square mile.

Table 6.--Drainage areas, in square miles, between selected altitudes along western slope of the Sierra Nevada--Continued

No. on fig. 9-12	Stream and point of measurement	Total area*	Partial area*			
			Above 9,000 feet	7,000 to 9,000 feet	5,000 to 7,000 feet	Below 5,000 feet
	Sacramento River Basin--Continued					
	Feather River Basin--Continued					
435	Concow Creek near Yankee Hill	15	0	0	0	15
436	Middle Fork of Feather River near Clio	699	0	10	492	197
437	Middle Fork of Feather River at Bidwell Bar	1,353	0	10	769	574
438	South Fork of Feather River at Enterprise	134	0	0	61	73
439	Lost Creek near Clipper Mills	30	0	0	5	25
	Yuba River Basin					
440	Middle Fork of Yuba River at Milton	41	0	14	27	0
441	Middle Fork of Yuba River near North San Juan	207	0	14	79	114
442	Yuba River at Smartville	1,201	0	80	435	686
443	Oregon Creek near North San Juan	35	0	0	3	32
444	North Fork of Yuba River near Sierra City	91	0	16	70	5
445	North Fork of Yuba River below Goodyears Bar	244	0	16	150	78
447	South Fork of Yuba River at Lake Spaulding	118	0	50	68	0
449	Canyon Creek below Bowman Lake	32	0	4	28	0
450	Deer Creek near Smartville	84	0	0	0	84
451	Bear River near Wheatland	295	0	0	2	293
	American River Basin					
452	North Fork of American River near Colfax	308	0	20	114	174
454	American River at Fair Oaks	1,921	0	242	545	1,134
455	Middle Fork of American River near Auburn	619	0	76	242	301
456	South Fork of American River near Kyburz	196	0	114	76	6
457	South Fork of American River near Camino	497	5	146	189	157
458	South Fork of American River at Coloma	635	0	146	189	300
459	Medley Lakes outlet near Vade	6	0	6	0	0
460	Silver Lake outlet near Kirkwood	15	0	15	0	0
461	Silver Fork of South Fork of American River near Kyburz	108	4	58	43	3
462	Twin Lakes outlet near Kirkwood	12	3	9	0	0
463	Alder Creek near Whitehall	23	0	0	21	2
464	Plum Creek near Riverton	7	0	0	5	2
465	Silver Creek at Union Valley	83	0	21	49	13
466	Silver Creek near Placerville	176	1	32	91	52
467	South Fork of Silver Creek near Ice House	28	1	10	17	0
	The Great Basin †					
	Owens River Basin					
601	Owens River near Round Valley	450	96	264	89	1
602	Rock Creek at Sherwin Hill, near Bishop	52	36	8	8	0
603	Pine Creek at division box, near Bishop	38	30	6	2	0
604	Big Pine Creek below Little Pine Creek, near Big Pine	40	26	8	5	1
605	Independence Creek at Independence	18	10	3	3	2
606	Tuttle Creek at Canyon Road, near Lone Pine	9	4	1	2	2

* Area given to the nearest square mile.
† Eastern slope of Sierra Nevada.

In certain respects the characteristics of the storm of December 1937 and resulting flood run-off were simple. The storm period was short and relatively isolated from antecedent and subsequent storm periods, making it possible to determine definitely the precipitation associated with the flood. There had been little precipitation for 15 days prior to December 9, and the stream discharges at the beginning of the storm consisted largely of outflow from ground water. The rise in stages was pronounced, and the recession limbs of the hydrographs were not influenced by precipitation that fell after the storm period and were influenced only in the higher Sierra Nevada by run-off from melting snow, which may have been on the ground on December 12. All the direct run-off, not artificially stored, had passed out of the basins either into the ocean or into the broad flat reaches of the Central Valley by December 20, eight days after the end of the storm.

The determination of the direct run-off resulting from the storm was, therefore, not complicated either by a large ground-water flow at the beginning of the flood rise or by run-off from subsequent precipitation.

The method used in arriving at an estimate of the average precipitation in each basin is described under "Meteorologic and hydrologic conditions". (See table 7 and figs. 13-21 for results of the determinations.) No attempt has been made to present in tabular form any estimates of the water content of the snow that may have been on the ground at the beginning of the storm and that may have contributed to the flood run-off. Comments about possible contributions from melting snow are, however, included in the discussion by drainage basins.

The records of mean daily discharge as presented in the section entitled "Stages and discharges at river-measurement stations" have been used as a basis for the determination of the direct run-off resulting from the storm.

A discharge hydrograph was constructed for the record at each river-measurement station for the period November 15 to December 31, 1937. The hydrograph for the Middle Fork of Feather River at Bidwell Bar (fig. 44) shows the general shape of the hydrographs at most of the river-measurement stations.

Table 7.--Rainfall and run-off of flood of December 1937
(Mean depth, in inches, over drainage basin)

No. on fig. 4-5	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	Salinas River Basin					
101	Salinas River near Santa Margarita	150	3.3	0.5	0.5	2.8
102	Salinas River near Spreckels	4,180	4.8	.25	.25	4.55
103	San Antonio River at Pleyto	282	7.7	.9	.9	6.8
104	Arroyo Seco near Soledad	238	10.6	1.75	1.75	8.85
	Pajaro River Basin					
105	Uvas Creek near Morgan Hill	30.2	18.0	8.9	8.9	9.1
	San Lorenzo River Basin					
106	San Lorenzo River at Big Trees	110	17.1	2.25	2.25	14.85
	San Francisquito Creek Basin					
201	San Francisquito Creek at Stanford University	37.7	6.7	.9	a1.3	5.4
202	San Francisquito Creek at Palo Alto	38.6	6.6	.8	a1.2	5.4
203	Los Trancos Creek at Stanford University	7.5	6.8	.2	b.6	6.2
	Stevens Creek Basin					
204	Stevens Creek near Cupertino	18.1	11.2	.3	c1.3	9.9
	Guadalupe Creek Basin					
205	Guadalupe Creek at Guadalupe	12.6	12.1	1.3	d4.35	7.75
206	Guadalupe Creek at San Jose	131	10.9	1.55	e2.45	8.45
207	Alamitos Creek near Edenvale	35	11.9	1.9	f4.0	7.9
208	Los Gatos Creek at Los Gatos	40	14.5	4.15	4.15	10.35
209	Campbell Creek at Saratoga	8.8	14.9	2.35	2.35	12.55
	Coyote Creek Basin					
210	Coyote Creek near Madrone	193	7.2	.3	g1.45	5.75
211	Coyote Creek near Edenvale	229	7.4	.35	g1.3	6.1
	Alameda Creek Basin					
212	Alameda Creek near Niles	633	5.2	.4	h.75	4.45
	Kern River Basin					
301	Kern River near Kernville	845	7.8	.4	i.65	7.15
302	Kern River above Kern Canyon power house	2,310	5.3	.15	j.25	5.05
303	Kern River near Bakersfield	2,420	5.1	.25	.25	4.85
304	South Fork of Kern River near Onyx	531	4.3	.15	.15	4.15
305	South Fork of Kern River at Isabella	985	3.7	.1	.1	3.6
	Tulare Lake Basin					
306	Tule River near Porterville	266	9.4	1.1	1.1	8.3
307	South Fork of Tule River near Success	106	6.7	.35	.35	6.35
308	Kaweah River near Three Rivers	520	11.9	1.85	1.85	10.05
309	North Fork of Kaweah River at Kaweah	128	12.4	1.6	1.6	10.80
310	Kings River above North Fork	956	8.1	1.1	1.1	7.0

a Adjusted for storage in Searsville Lake plus diversions into Los Trancos and Lagunita canals.
b Adjusted for diversion into Los Trancos canal.
c Adjusted for storage in Stevens Creek Reservoir.
d Adjusted for storage in Guadalupe Creek Reservoir.
e Adjusted for storage in Calero, Almaden, Vasona, and Guadalupe Reservoirs.
f Adjusted for storage in Calero and Almaden Reservoirs.
g Adjusted for storage in Coyote Reservoir.
h Adjusted for storage in Calaveras Reservoir plus diversions for San Francisco water supply.
i Adjusted for flow through Kern River No. 3 canal.
j Adjusted for flow through Kern Canyon power house.

Table 7.--Rainfall and run-off of flood of December 1937--Continued
(Mean depth, in inches, over drainage basin)

No. on fig. 5-7	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	Tulare Lake Basin--Continued					
311	Kings River at Piedra	1,694	9.7	1.5	1.5	8.2
312	North Fork of Kings River near Cliff Camp	174	13.4	-	-	-
313	North Fork of Kings River below Rancheria Creek	225	13.2	-	-	-
314	Los Gatos Creek near Coalinga	105	4.2	.15	.15	4.05
	San Joaquin River Basin					
315	San Joaquin River above Big Creek	1,042	8.8	1.85	k2.05	6.75
317	San Joaquin River near Friant	1,632	9.3	1.6	m1.85	7.45
318	San Joaquin River below Skaggs Bridge	1,760	9.0	1.15	m1.45	7.55
322	South Fork of San Joaquin River near Florence Lake	171	8.4	0	n1.15	7.25
323	Bear Creek near Vermillion Valley	54	6.4	.45	.45	5.95
324	Mono Creek near Vermillion Valley	92	6.0	.4	.4	5.6
326	Big Creek below Huntington Lake	80	9.9	0	o3.05	6.85
327	Pitman Creek below Tamarack Creek	22	12.7	2.35	2.35	10.35
329	North Fork of Willow Creek at Crane Valley Reservoir	51	15.5	-	p3.0	12.5
330	Big Sandy Creek near Auberry	34	8.7	.85	.85	7.85
331	Fine Gold Creek near Friant	89	8.4	1.05	1.05	7.35
332	Cottonwood Creek near Friant	38	4.4	.05	.05	4.35
333	Little Dry Creek near Friant	58	6.3	.1	.1	6.2
	Fresno River Basin					
334	Fresno River near Knowles	132	11.0	.75	.75	10.25
335	Fresno River near Daulton	258	8.7	.45	.45	8.25
	Chowchilla River Basin					
336	Chowchilla River at Buchanan dam site	238	7.7	0.65	0.65	7.05
	Bear Creek Basin					
337	Bear Creek near Planada	161	3.8	.45	.45	3.35
338	Mariposa Creek near Le Grand	111	5.5	.4	.4	5.1
	Merced River Basin					
339	Merced River at Happy Isles Bridge	181	12.1	2.0	2.0	10.1
340	Merced River at Pohono Bridge, near Yosemite	321	12.2	3.55	3.55	8.65
341	Merced River at Kittridge	935	11.7	2.25	2.25	9.45
345	Tenaya Creek near Yosemite	47	12.7	4.95	4.95	7.75
	Orestimba Creek Basin					
346	Orestimba Creek near Newman	129	4.7	.4	.4	4.3
	Tuolumne River Basin					
348	Tuolumne River near Hetch Hetchy	462	10.0	.45	q3.3	6.7
350	Tuolumne River above La Grange Dam, near La Grange	1,540	9.5	.4	r3.4	6.1
351	Falls Creek near Hetch Hetchy	45.2	11.4	6.75	6.75	4.65
352	Cherry Creek near Hetch Hetchy	111	11.8	9.05	9.05	2.75
354	Eleanor Creek near Hetch Hetchy	80	12.9	4.6	s9.6	3.3

k Adjusted for storage in Florence Lake Reservoir and flow of Ward tunnel at outlet.

m Adjusted for storage in Florence Lake, Shaver Lake, Huntington Lake, and Crane Valley Reservoir.

n Adjusted for storage in Florence Lake Reservoir plus diversion to Ward tunnel at intake.

o Adjusted for storage in Huntington Lake and for diversions.

p Adjusted for storage in Crane Valley Reservoir and for diversions.

q Adjusted for storage in Hetch Hetchy Reservoir.

r Adjusted for storage in Don Pedro, Hetch Hetchy, and Eleanor Reservoirs, but not for some negligible diversions.

s Adjusted for storage in Lake Eleanor.

Table 7.--Rainfall and run-off of flood of December 1937--Continued
(Mean depth, in inches, over drainage basin)

No. on fig. 7	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	San Joaquin River Basin--Continued					
	Tuolumne River Basin--Continued					
355	South Fork of Tuolumne River near Oakland Recreation Camp	88	11.1	1.9	1.9	9.2
356	Middle Tuolumne River near Buck Meadows	71	10.9	1.3	1.3	9.6
357	Woods Creek near Jacksonville	98	6.4	1.0	1.0	5.4
	Stanislaus River Basin					
358	Middle Fork of Stanislaus River at Sand Bar Flat, near Avery	318	9.3	3.8	t4.3	5.0
360	Stanislaus River below Melones power house	898	9.4	1.0	u3.4	6.0
361	North Fork of Stanislaus River near Avery	163	9.8	5.05	v6.0	3.8
362	South Fork of Stanislaus River at Strawberry Reservoir	45.5	11.4	-	w5.25	6.15
363	South Fork of Stanislaus River below Lyons Dam	67	11.1	.45	x5.65	5.45
	Calaveras River Basin					
364	Calaveras River at Jenny Lind	395	6.0	.75	y.75	5.25
365	Cosgrove Creek near Valley Springs	20.6	3.6	.25	.25	3.35
	Mokelumne River Basin					
367	North Fork of Mokelumne River below Salt Springs Dam	160	7.9	0.6	z9.35	-1.45
368	Mokelumne River near Mokelumne Hill	538	8.6	1.25	aa3.85	4.75
369	Mokelumne River at Lancha Plana	584	8.2	.5	ab3.65	4.55
370	Mokelumne River near Clements	630	7.8	.5	ab3.35	4.45
371	Mokelumne River at Woodbridge	644	7.7	.45	ac3.25	4.45
372	Cold Creek near Mokelumne Peak	23	9.2	7.35	7.35	1.85
373	Bear River at Pardoe Camp	33	9.4	5.9	ad9.65	-0.25
374	Middle Fork of Mokelumne River at West Point	67	9.1	.8	.8	8.3
375	South Fork of Mokelumne River near West Point	74	10.0	.85	.85	9.15
376	Sutter Creek near Sutter Creek	51	5.5	.45	.45	5.05
377	North Fork of Cosumnes River near El Dorado	202	8.3	.9	.9	7.4
378	Cosumnes River at Michigan Bar	537	7.0	.8	.8	6.2

t Adjusted for storage in Relief Reservoir on basis of an estimate that 60 percent of reservoir capacity was filled during period Dec. 9-20. Not adjusted for small inflow in Philadelphia ditch.

u Adjusted for storage in Melones Reservoir plus 60 percent of combined capacities of Relief, North Fork, Big Dam, Upper Strawberry, Strawberry Lake, Herring Creek, and Lyons Reservoirs.

v Adjusted on basis of an estimated change in storage amounting to 60 percent of the capacities of Union, Silver Valley, Spicer Meadow, and Hunters Reservoirs. Utica Reservoir was full at the beginning of the storm.

w Computed from change in storage in Strawberry Reservoir for period Dec. 8-19.

x Adjusted for diversions in Tuolumne and Philadelphia ditches and observed storage in Lyons and Strawberry Lake Reservoirs plus 60 percent of capacity of Big Dam, Upper Strawberry, and Herring Creek Reservoirs.

y Hogan Reservoir detained some run-off and reduced peak but did not change total run-off.

z Adjusted for observed storage in Salt Springs Reservoir, estimated storage in Blue Lake, Lower Blue, Meadow, and Twin Lake Reservoirs, and diversion to Tiger Creek power house conduit.

aa Adjusted for observed storage in Salt Springs Reservoir, estimated storage in 4 small reservoirs, and total capacity of Bear River Reservoir.

ab Adjusted for observed storage in Salt Springs and Pardee Reservoirs, diversions to East Bay Municipal Utility District aqueduct, estimated storage in 4 small reservoirs, and capacity of Bear River Reservoir.

ac Same as ab. Flow in Woodbridge canal negligible for this period.

ad Adjusted for storage capacity of Bear River Reservoir.

Table 7.--Rainfall and run-off of flood of December 1937--Continued
(Mean depth, in inches, over drainage basin)

No. on fig. 8-9	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	Sacramento River Basin					
401	Sacramento River at Antler	461	8.3	4.45	4.45	3.85
402	Sacramento River at Kennett	6,600	6.3	1.9	ae2.15	4.15
404	Sacramento River near Red Bluff	9,300	6.7	2.5	af2.7	4.0
	Pit River Basin					
406	Pit River near Canby	1,430	4.6	.9	ag1.9	2.7
407	Pit River at Fall River Mills	4,150	4.9	.8	ah1.2	3.7
408	Pit River below Pit No. 4 dam	4,860	5.1	.8	ai1.15	3.95
409	Pit River at Big Bend	4,920	5.1	.95	ai1.3	3.8
410	Pit River near Ydalpom	5,350	5.7	1.4	ai1.70	4.0
411	South Fork of Pit River near Likely	248	3.4	.25	aj2.35	1.05
412	Hat Creek near Hat Creek	155	6.8	.65	.65	6.15
413	McCloud River near McCloud	388	7.0	1.0	1.0	6.0
414	McCloud River at Baird	668	8.3	3.15	3.15	5.15
	Mill Creek Basin					
417	Mill Creek near Los Molinos	134	13.5	6.8	6.8	6.7
	Elder Creek Basin					
418	Elder Creek near Henleyville	147	4.8	2.75	2.75	2.05
	Thomas Creek Basin					
419	Thomas Creek at Paskenta	188	5.8	5.05	5.05	.75
	Deer Creek Basin					
420	Deer Creek near Vina	200	14.2	-	-	-
	Chico Creek Basin					
421	Chico Creek near Chico	68	14.2	6.75	6.75	7.45
	Stony Creek Basin					
422	Stony Creek above Stony Gorge Reservoir	266	7.0	4.2	ak4.8	2.2
	Butte Creek Basin					
424	Butte Creek near Chico	148	15.0	6.3	am6.05	8.95
	Feather River Basin					
426	North Fork of Feather River near Prattville	507	7.1	-	an3.1	4.0
428	Feather River near Oroville	3,611	9.8	3.55	ao3.95	5.85
429	Indian Creek near Crescent Mills	746	5.9	1.65	1.65	4.25
430	Spanish Creek at Keddie	184	11.2	4.1	4.1	7.1
432	Bucks Creek at Bucks Creek storage reservoir	28	18.2	-	ap12.6	5.6
433	Grizzly Creek near Storrie	6.2	19.5	12.5	12.5	7.0
434	West Branch of Feather River near Yankee Hill	145	15.0	8.7	aq9.7	5.3

ae Adjusted for an estimated storage of 92,880 acre-feet in Pit River Basin.
af Adjusted for estimated storage of 100,000 acre-feet, including 2 reservoirs on Battle Creek.
ag Adjusted on basis of fragmentary records and estimated storage in West Valley and Big Sage Reservoirs, Tule Lake, and other reservoirs for a total of 78,500 acre-feet.
ah Same as ag plus 10,000 acre-feet additional storage.
ai Same as ah plus storage in Lake Britton.
aj Adjusted for estimated storage in West Valley Reservoir and Tule Lake.
ak Adjusted for storage in East Park Reservoir.
am Adjusted for diversion from West Branch of Feather River.
an Adjusted for storage in Lake Almanor.
ao Adjusted for storage in Lake Almanor, Butt Valley and Bucks Creek Reservoirs, and Lake Wilenor.
ap Computed from changes in storage in Bucks Creek Reservoirs.
aq Adjusted for storage in Lake Wilenor, estimated storage in 3 small reservoirs, and for diversions in Spring Valley ditch and Miocene canal.

Table 7.--Rainfall and run-off of flood of December 1937--Continued
(Mean depth, in inches, over drainage basin)

No. on fig. 9	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	Sacramento River Basin--Continued					
	Feather River Basin--Continued					
435	Concow Creek near Yankee Hill	14.7	11.0	2.4	ar6.65	4.35
436	Middle Fork of Feather River near Clio	699	6.6	-	-	-
437	Middle Fork of Feather River at Bidwell Bar	1,353	10.8	4.35	as4.35	6.45
438	South Fork of Feather River at Enterprise	134	18.2	7.85	7.85	10.35
439	Lost Creek near Clipper Mills	30.1	19.1	6.2	6.2	12.9
	Yuba River Basin					
440	Middle Fork of Yuba River at Milton	41	13.0	6.2	at7.65	5.35
441	Middle Fork of Yuba River near North San Juan	207	11.5	5.25	at5.6	5.9
442	Yuba River at Smartville	1,201	12.4	4.75	au6.0	6.4
443	Oregon Creek near North San Juan	35.1	10.4	3.75	3.75	6.65
444	North Fork of Yuba River near Sierra City	91	13.3	5.0	5.0	8.3
447	South Fork of Yuba River at Lake Spaulding	118	12.8	-	av12.2	.6
449	Canyon Creek below Bowman Lake	31.7	13.5	-	aw11.9	1.6
450	Deer Creek near Smartville	84	9.8	7.1	7.1	2.7
451	Bear River near Wheatland	295	8.8	1.9	ax2.35	6.45
	American River Basin					
452	North Fork of American River near Colfax	308	10.3	4.3	ay4.55	5.75
454	American River at Fair Oaks	1,921	9.0	3.2	az3.5	5.5
455	Middle Fork of American River near Auburn	619	10.3	4.7	ba4.8	5.5
456	South Fork of American River near Kyburz	196	9.5	2.5	bb3.6	5.9
457	South Fork of American River near Camino	497	9.7	2.85	bc3.35	6.35
458	South Fork of American River at Coloma	635	9.2	2.2	bd2.6	6.6
459	Medley Lakes outlet near Vade	6.2	-	-	-	-
460	Silver Lake outlet near Kirkwood	14.9	8.8	3.2	be8.85	-.05
461	Silver Fork of South Fork of American River near Kyburz	108	9.5	2.65	bf4.65	4.85
462	Twin Lakes outlet near Kirkwood	12.4	8.2	-	bg7.9	.3
463	Alder Creek near Whitehall	22.8	10.4	2.25	2.25	8.15
464	Plum Creek near Riverton	6.8	10.1	2.0	2.0	8.1
465	Silver Creek at Union Valley	83	10.3	5.1	5.1	5.2
466	Silver Creek near Placerville	176	10.0	4.15	4.15	5.85
467	South Fork of Silver Creek near Ice House	28.4	10.1	4.25	4.25	5.85

ar Adjusted for storage in Lake Wilenor.

as Adjusted for estimated storage in 13 small reservoirs amounting to 10,400 acre-feet.

at Adjusted for diversion to Milton-Bowman tunnel.

au Adjusted for storageiin Lake Spaulding, Bowman Lake, and Bullards Bar Reservoir, and for estimated storage in French Lake and Lake Fordyce.

av Computed from storage, inflow, and release at Lake Spaulding.

aw Computed from storage in Bowman Lake minus diversion in Milton-Bowman tunnel plus diversion in Bowman-Spaulding canal minus run-off from 6 square miles above French Lake, which did not overflow.

ax Adjusted for storage estimated as 50 percent of the capacity of Combie and Camp Far West Reservoirs, amounting to 14,000 acre-feet.

ay Adjusted for storage estimated as 50 percent of the capacity of Lake Valley and two smaller reservoirs.

az Adjusted for storage estimated as 50 percent of the capacity of 14 small reservoirs, including Twin Lakes.

ba Adjusted for storage estimated as 50 percent of the capacity of Loon Lake.

bb Adjusted for storage, partly estimated, in Twin and Silver Lakes plus diversion in Eldorado canal.

bc Adjusted for storage, partly estimated, in Twin and Silver Lakes plus 30 percent (estimated) of the capacity of Medley Lakes plus diversion in American River flume.

bd Same as bc plus 1,000 acre-feet (estimated) between Camino and Coloma.

be Adjusted for storage in Silver Lake.

bf Adjusted for estimated storage in Twin and Silver Lakes.

bg Computed from storage in Twin Lakes.

Table 7.--Rainfall and run-off of flood of December 1937--Continued
(Mean depth, in inches, over drainage basin)

No. on fig. 9-12	Stream and point of measurement	Drainage area (square miles)	Precipitation Dec. 9-12	Direct run-off associated with total storm period		Col. 3 minus col. 5
				Observed	Adjusted for storage	
	1	2	3	4	5	6
	Sacramento River Basin--Continued					
	Cache Creek Basin					
469	Cache Creek at Yolo	1,150	7.3	1.45	bh3.6	3.3
470	North Fork of Cache Creek near Lower Lake	214	7.3	4.15	4.15	3.15
	Putah Creek Basin					
471	Putah Creek near Guenoc	112	14.1	9.7	9.7	4.4
472	Putah Creek near Winters	614	8.4	3.7	3.7	4.7
	Napa Creek Basin					
501	Conn Creek near St. Helena	52	8.1	1.95	1.95	6.15
	Eel River Basin					
504	Eel River at Hullville	289	11.8	8.65	bi8.7	3.1
505	Eel River at Van Arsdale Dam	347	11.6	7.8	bj8.05	3.55
506	Eel River at Scotia	3,070	9.9	7.3	bj7.35	2.55
	Klamath River Basin					
507	Klamath River at Somesbar	8,480	-	1.05	bk -	-
508	Shasta River near Yreka	804	4.4	.2	bm0.35	4.05
509	Salmon River at Somesbar	737	5.8	3.55	3.55	2.25
510	Trinity River at Lewiston	724	6.4	4.15	4.15	2.25
511	Trinity River near Burnt Ranch	1,429	6.3	3.65	3.65	2.65
512	Trinity River near Hoopa	2,840	6.6	3.75	3.75	2.85
	The Great Basin					
	Owens Lake Basin					
601	Owens River near Round Valley	450	4.0	.2	.2	3.8
602	Rock Creek at Sherwin Hill, near Bishop	51.7	4.6	.15	.15	4.45
603	Pine Creek at division box, near Bishop	37.9	5.5	.25	.25	5.25
604	Big Pine Creek below Little Pine Creek, near Big Pine	39.5	5.4	.1	.1	5.3
605	Independence Creek near Big Pine	17.6	5.0	.1	.1	4.9
606	Tuttle Creek at Canyon Road	8.5	3.1	.15	.15	2.95
	Carson River Basin					
611	Carson River at Lahonton Reservoir	1,200	-	-	bn.45	-
	Pyramid and Winemucca Lake Basins					
613	Truckee River at Tahoe	519	6.8	-	-	-
616	Truckee River at Iceland	937	7.2	1.25	-	-
617	Donner Creek near Truckee	30	10.5	6.7	-	-

bh Adjusted for storage (estimated) in Clear Lake.
bi Adjusted for storage in Lake Pillsbury.
bj Adjusted for storage in Lake Pillsbury and for diversion to Potter Valley power house.
bk No attempt made to determine natural run-off.
bm Adjusted for storage in Lake Dwinnell.
bn Adjusted for storage in Lahonton Reservoir.

Stream flow on December 8 (point A, fig. 44) was low and, because there had been little or no antecedent precipitation since November 24, consisted largely of outflow from ground water. On December 9, the water-stage recorder indicated increases in stage and discharge culminating in a peak (B) occurring generally between 10 a.m. December 10 and 4 p.m. December 11. The peak was followed by a decline in stage

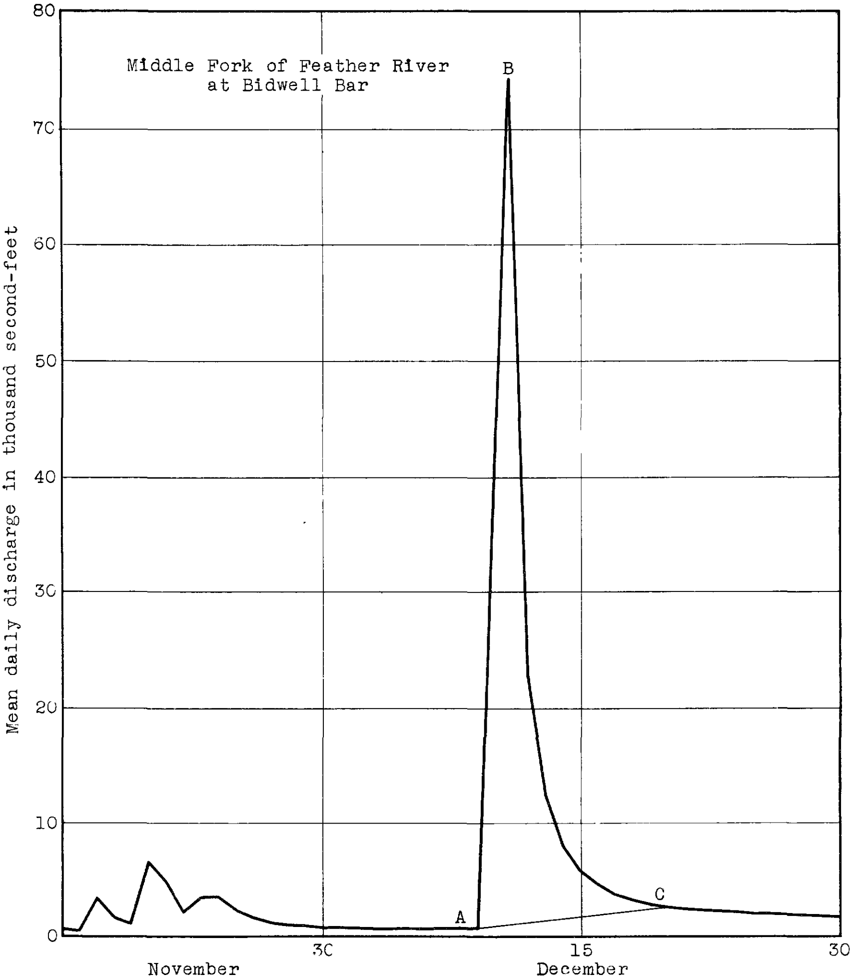

Figure 44.--Method of analysis used in determining direct run-off associated with the storm period December 8-13, 1937.

which continued without interruption until about December 20, when practically all of the direct run-off associated with the flood had passed the gaging station. The flow represented by that portion of the hydrograph from (B) to (C) represents, to a very considerable extent, water draining out of the channel system as a result of the large direct inflow into the channel systems, lasting from about noon December 9 to noon December 11.

The total area under the hydrograph represents the direct run-off resulting from the storm precipitation plus the stream flow that would have been maintained from antecedent sources had there been no increment of direct run-off after point (A).

The increase in stream flow directly attributable to the rain and melting snow has been estimated by making an approximation of the position (A-C) of the graph of ground-water flow plus surface run-off from antecedent precipitation, which in this example is negligible, and by assuming that the area above that line represents the increment in stream flow resulting from the direct run-off associated with the precipitation that occurred after December 8. The area above line A-C is believed to include essentially all the surface run-off resulting from the storm precipitation, and may include some ground water originating from the current storm and discharged into stream channels with a promptness that approached that of the surface run-off. The results of these analyses, expressed in inches of depth over the drainage basins, are shown in table 7 and in figure 45. It is evident that these estimates of direct run-off are somewhat less than the total measured flow by reason of the exclusion of the flow maintained from antecedent sources, an amount generally less than 10 percent of the total run-off. Other investigators, of course, might estimate such maintained flow differently. Such differences in judgment, however, would result in differences that would be relatively small in relation to the magnitude of the flood run-off as a whole.

For river basins where there was artificial storage or diversion, the run-off records were adjusted for the effect of the storage or diversions, and the adjusted run-off as well as the observed run-off was expressed in inches of depth over the drainage area and are listed in table 7. The difference between these two represents the total net storage or diversions during the flood period December 9 to 20. In many of the smaller basins, where the quantity of water stored or diverted was a large part of and in some instances equal to the entire flow, the adjusted run-off estimates may not represent the natural run-off as closely as the data given for those basins where there were no complications due to storage or diversion.

At those river-measurement stations where the observed stream flow represents essentially natural-flow conditions unaffected by artificial storage, there were determined (a) the direct run-off expressed in inches over the area for the maximum 24-hour average discharge; (b) the

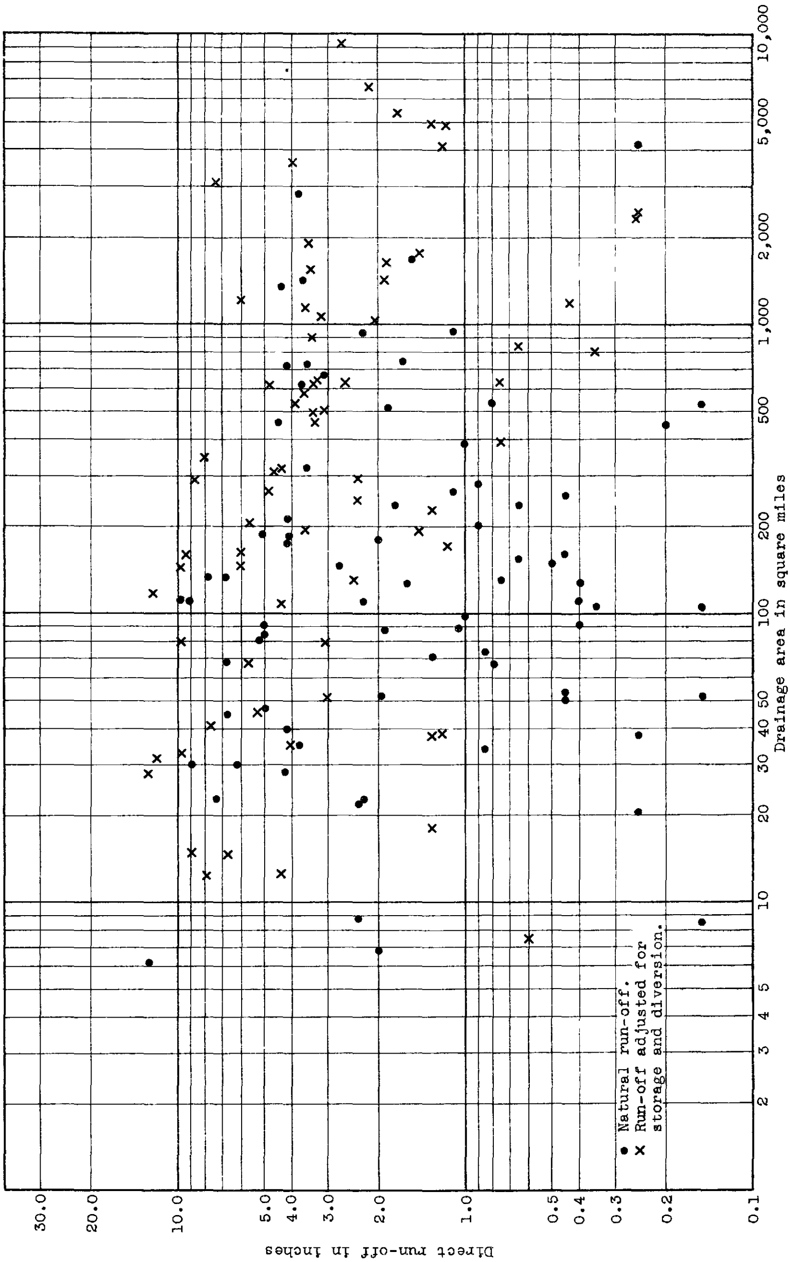

Figure 45.--Chart showing direct run-off, in inches, determined for various drainage areas in northern California during flood of December 1937, as given in table 7.

ratio in percentage between the direct run-off during the 24 hours of greatest flow and the total direct run-off for the flood period; (c) the date and time of occurrence of the momentary peak discharge, the time being generally to the nearest hour, but in a few instances, to the nearest 15 minutes; and (d) the ratio in percentage between the momentary peak discharge and the maximum 24-hour average discharge. The results of these determinations are shown in table 8.

The data relating to rainfall and run-off and the flood characteristics as summarized in tables 7 and 8 are essentially basic in that they are all directly derived from observations of rainfall and run-off. Engineers and hydrologists will readily appreciate, however, the approximations that may have been necessary with respect to some of the individual items. Moreover, the analyses of the records are complicated by conditions which, although present in other areas where similar studies have been made, were not so pronounced as those that exist in that part of California embraced within this flood study. These conditions relate largely to the lack of uniformity in the topographic, edaphic, and biologic characteristics of the various drainage basins. For example, a typical basin on the west slope of the Sierra Nevada is tilted steeply from headwater to the valley floor and may include a range in altitude of 10,000 or 12,000 feet. It crosses a series of zones differing in precipitation, temperature, cover, and soil. To a considerable extent similar conditions apply to most of the river basins discussed herein. These conditions may materially affect the interpretation of the results. Although the basic data are necessarily collected by basins, the basins themselves may or may not be natural divisions for the study of precipitation, run-off, or residuals, and basins grouped herein on the basis of similar run-off characteristics may not necessarily have similar inherent characteristics in other important respects.

Because of large differences in altitude and topography, the rainfall, snowfall, and temperature data are applicable to relatively restricted areas near the places of observation. The restricted application of the observed data affects the accuracy of the isohyetal maps from which the precipitation values given in table 7 were obtained and also makes uncertain the delineation of the line of demarcation between areas where the precipitation took the form of rain or snow.

Table 8.--Run-off characteristics

No. on fig. 4-6	Stream and point of measurement	Total direct run-off (inches)		Ratio of col. 3 to col. 2 (percent)	Date and hour of peak discharge	Ratio of momentary peak discharge to maximum 24-hour discharge (percent)
		Flood period	Maximum 24-hour			
	1	2	3	4	5	6
	Salinas River Basin					
101	Salinas River near Santa Margarita	0.5	0.45	90	Dec. 11 9:30 pm	192
102	Salinas River near Spreckels	.25	.1	40	Dec. 12 10 pm	124
103	San Antonio River at Pleyto	.9	.5	56	Dec. 11 4:30 pm	164
104	Arroyo Seco near Soledad	1.75	1.1	63	Dec. 11 8 am	192
	Pajaro River Basin					
105	Uvas Creek near Morgan Hill	8.9	5.7	64	Dec. 11 1 am	186
	San Lorenzo River Basin					
106	San Lorenzo River at Big Trees	2.25	1.15	51	Dec. 11 3 am	161
	Guadalupe Creek Basin					
208	Los Gatos Creek at Los Gatos	4.15	2.45	59	Dec. 11 2 am	182
209	Campbell Creek at Saratoga	2.35	1.25	53	Dec. 11 1 am	177
	Kern River Basin					
304	South Fork of Kern River near Onyx	.15	.05	33	Dec. 12 8 am	124
	Tulare River Basin					
306	Tule River near Porterville	1.1	.55	50	Dec. 11 6 pm	291
307	South Fork of Tule River near Success	.35	.15	43	Dec. 11 7 pm	235
308	Kaweah River near Three Rivers	1.85	.95	51	Dec. 11 3 pm	250
309	North Fork of Kaweah River at Kaweah	1.6	.9	56	Dec. 11 3 pm	273
310	Kings River above North Fork	1.1	.65	59	Dec. 11 4 pm	241
311	Kings River at Piedra	1.5	.95	63	Dec. 11 4:30 pm	182
314	Los Gatos Creek near Coalinga	.15	.15	100	Dec. 11 9:30 am	388
	San Joaquin River Basin					
323	Bear Creek near Vermillion Valley	.45	.15	33	Dec. 11 1 pm	247
324	Mono Creek near Vermillion Valley	.4	.1	25	Dec. 11 5 pm	180
327	Pitman Creek below Tamarack Creek	2.35	1.6	68	Dec. 11 11:30 am	243
330	Big Sandy Creek near Auberry	.85	.65	76	Dec. 11 6:30 pm	317
331	Fine Gold Creek near Friant	1.05	.75	71	Dec. 11 6 am	272
332	Cottonwood Creek near Friant	.05	.05	100	Dec. 11 6 pm	375
333	Little Dry Creek near Friant	.1	.05	50	Dec. 12 2 am	185
	Fresno River Basin					
334	Fresno River near Knowles	.75	.45	60	Dec. 11 4 pm	208
335	Fresno River near Daulton	.45	.25	56	Dec. 11 6 pm	194
	Chowchilla River Basin					
336	Chowchilla River at Buchanan dam site	.65	.4	62	Dec. 11 4 pm	272

Table 8.--Run-off characteristics--Continued

No. on fig. 6-8	Stream and point of measurement	Total direct run-off (inches)		Ratio of col. 3 to col. 2 (percent)	Date and hour of peak discharge	Ratio of momentary peak discharge to maximum 24-hour discharge (percent)
		Flood period	Maximum 24-hour			
	1	2	3	4	5	6
	San Joaquin River Basin--Continued					
	Bear Creek Basin					
337	Bear Creek near Planada	0.45	0.35	78	Dec. 11 6 pm	409
338	Mariposa Creek near Le Grand	.4	.3	75	Dec. 11 2 pm	345
	Merced River Basin					
339	Merced River at Happy Isles Bridge	2.0	1.1	55	Dec. 11 1:30 pm	193
340	Merced River at Pohono Bridge, near Yosemite	3.55	2.0	56	Dec. 11 3 pm	126
341	Merced River at Kittridge	2.25	1.4	62	Dec. 11 3 pm	164
345	Tenaya Creek near Yosemite	4.95	2.9	59	Dec. 11 4 pm	150
	Orestimba Creek Basin					
346	Orestimba Creek near Newman	.4	.35	88	Dec. 11 1 pm	171
	Tuolumne River Basin					
351	Falls Creek near Hetch Hetchy	6.75	3.5	52	Dec. 11 3 pm	148
352	Cherry Creek near Hetch Hetchy	9.05	4.05	45	Dec. 11 2 pm	149
355	South Fork of Tuolumne River near Oakland Recreation Camp	1.9	1.35	71	Dec. 11 4 pm	216
356	Middle Tuolumne River near Buck Meadows	1.3	.8	62	Dec. 11 4 pm	191
357	Woods Creek near Jacksonville	1.0	.7	70	Dec. 11 11:30 am	288
	Calaveras River Basin					
365	Cosgrove Creek near Valley Springs	.25	.15	60	Dec. 11 8:15 am	379
	Mokelumne River Basin					
372	Cold Creek near Mokelumne Peak	7.35	4.1	56	Dec. 11 10 am	160
374	Middle Fork of Mokelumne River at West Point	.8	.45	56	Dec. 11 9 am	171
375	South Fork of Mokelumne River near West Point	.85	.5	59	Dec. 11 8 am	174
376	Sutter Creek near Sutter Creek	.45	.25	56	Dec. 11	182
377	North Fork of Cosumnes River near El Dorado	.9	.45	50	Dec. 11 3 pm	150
378	Cosumnes River at Michigan Bar	.8	.4	50	Dec. 11 4 pm	158
	Sacramento River Basin					
401	Sacramento River at Antler	4.45	1.65	37	Dec. 10 10 pm	116
	Pit River Basin					
412	Hat Creek near Hat Creek	.65	.4	62	Dec. 11 2 am	138
413	McCloud River near McCloud	1.0	.25	25	Dec. 10	131
414	McCloud River at Baird	3.15	1.25	40	Dec. 10 11 pm	132
	Mill Creek Basin					
417	Mill Creek near Los Molinos	6.8	3.8	56	Dec. 11 2 am	167
	Elder Creek Basin					
418	Elder Creek near Henleyville	2.75	1.6	58	Dec. 10 10 pm	169

Table 8.--Run-off characteristics--Continued

No. on fig. 8-11	Stream and point of measurement	Total direct run-off (inches)		Ratio of col. 3 to col. 2 (percent)	Date and hour of peak discharge	Ratio of momentary peak discharge to maximum 24-hour discharge (percent)
		Flood period	Maximum 24-hour			
	1	2	3	4	5	6
	Sacramento River Basin--Continued					
	Thomas Creek Basin					
419	Thomas Creek at Paskenta	5.05	2.4	48	Dec. 10 10 pm	134
	Chico Creek Basin					
421	Chico Creek near Chico	6.75	3.45	51	Dec. 10 12 pm	129
	Feather River Basin					
429	Indian Creek near Crescent Mills	1.65	.55	33	Dec. 12 3 am	105
430	Spanish Creek at Keddie	4.1	2.1	51	Dec. 11 11 am	108
433	Grizzly Creek near Storrie	12.5	6.5	52	Dec. 10 11 am	143
437	Middle Fork of Feather River at Bidwell Bar	4.35	2.1	48	Dec. 11 6 am	119
438	South Fork of Feather River at Enterprise	7.85	4.15	53	Dec. 10 5 pm	115
439	Lost Creek near Clipper Mills	6.2	2.85	46	Dec. 10 4 pm	144
	Yuba River Basin					
433	Oregon Creek near North San Juan	3.75	1.65	44	Dec. 11 6 am	174
444	North Fork of Yuba River near Sierra City	5.0	2.6	52	Dec. 11 4 am	152
450	Deer Creek near Smartville	4.95	2.9	59	Dec. 11 9 am	163
	American River Basin					
463	Alder Creek near Whitehall	2.25	.8	36	Dec. 11 9:30 am	138
464	Plum Creek near Riverton	2.0	1.05	53	Dec. 11 7 am	160
465	Silver Creek at Union Valley	5.1	2.5	49	Dec. 11 10 am	151
466	Silver Creek near Placerville	4.15	2.0	48	Dec. 11 12:30 pm	153
467	South Fork of Silver Creek near Ice House	4.25	2.1	49	Dec. 11 12:30 pm	134
	Cache Creek Basin					
470	North Fork of Cache Creek near Lower Lake	4.15	1.6	39	Dec. 11 3 am	168
	Putah Creek Basin					
471	Putah Creek near Guenoc	9.7	5.8	60	Dec. 11 3 am	136
472	Putah Creek near Winters	3.7	2.0	54	Dec. 11 8:30 am	117
	Napa River Basin					
501	Conn Creek near St. Helena	1.95	.95	49	Dec. 11 4:30 am	201
	Klamath River Basin					
509	Salmon River at Somesbar	3.55	1.25	35	Dec. 11 1:30 am	105
510	Trinity River at Lewiston	4.15	1.65	40	Dec. 11 1:30 am	111
511	Trinity River near Burnt Ranch	3.65	----	--	Dec. 11 2 pm	---
512	Trinity River near Hoopa	3.75	1.2	32	Dec. 11 2 pm	111

Table 8.--Run-off characteristics--Continued

No. on fig. 12	Stream and point of measurement	Total direct run-off (inches)		Ratio of col. 3 to col. 2 (percent)	Date and hour of peak discharge	Ratio of momentary peak discharge to maximum 24-hour discharge (percent)
		Flood period	Maximum 24-hour			
	1	2	3	4	5	6
	The Great Basin					
	Owens Lake Basin					
601	Owens River near Round Valley	0.2	0.1	50	Dec. 11 8 pm	146
602	Rock Creek at Sherwin Hill, near Bishop	.15	.05	33	Dec. 11 6 pm	180
603	Pine Creek at division box, near Bishop	.25	.1	40	Dec. 11 3 pm	205
604	Big Pine Creek below Little Pine Creek, near Big Pine	.1	.05	50	Dec. 11 2:30 pm	176
605	Independence Creek near Big Pine	.1	.05	50	Dec. 11 6 pm	172
606	Tuttle Creek at Canyon Road	.15	.05	33	Dec. 11 4 pm	195

The run-off values in tables 7 and 8, being expressed in inches over the drainage basins, are significant for comparison only if the entire basin contributed direct run-off. The analyses of the run-off records indicate that there was little contribution to the stream flow in those parts of basins lying at altitudes of about 9,000 feet or more, or from those parts of the basins where the total storm precipitation was less than about 5 inches and in some areas about 8 inches. In basins where either or both of these conditions exist, the run-off values in table 7 are not satisfactorily comparable unless adjusted to the areas lying below the 9,000 foot contour or having at least 5 inches of precipitation. To a limited extent, these adjustments have been included in the descriptive text relating to each basin. For many basins, inconsistencies in the run-off values disappear when the run-off is expressed in depth in inches over the approximate net contributing area. For reasons given, similar adjustments are necessary in the residuals or differences between rainfall and direct run-off. The interpretation of the data is also complicated by the fact that, in a very considerable part of the area, the indicated differences between rainfall and run-off are so large that they become insensitive as an index of possible discrepancies in the basic data. Considerable error might exist in either the rainfall or the run-off values without a negative residual being shown. Such a negative residual would be an indication of error, unless run-off was affected by melting snow from previous storms. In some of the basins, the adjustments for artificial storage and diversion greatly exceed the measured stream flow, and therefore errors in the stage-capacity tables of storage reservoirs or in the estimates of storage where no records are available may affect the run-off figures in table 7. Many of the basic rainfall and run-off data in table 7, which appear inconsistent, may reflect actual basin characteristics rather than errors in observations. To a limited extent the apparent inconsistencies are discussed by individual basins.

Direct run-off

The run-off in table 7 is the total direct run-off during the flood period December 9 to 20 expressed in inches over the drainage areas. The hydrographs given in the section "Stages and discharges at river-measurement stations" (figs. 31 to 41) show, for selected river-measurement stations, the distribution of the run-off with respect to time after it had reached the river channels. For consideration of problems relating to the retention and storage of water, either in reservoirs or through the medium of land use practices, a knowledge of the total flood run-off is of major importance. The effect of run-off in building up channel storage in the lower reaches of principal river systems and in overflowing and submerging natural flood plains is also of direct interest in flood-control studies. The degree to which the flood run-off is concentrated with respect to time is of paramount importance in studies relating to the capacities of spillways, by-passes, bridge openings, or channels designed to carry momentary peak discharges, and is a measure of the dynamic destructive force of stream flow. When the observed run-off is adjusted for channel storage and thus synchronized more clearly with the precipitation, it furnishes information of immediate value in problems relating to direct surface run-off before it reaches stream channels.

As is to be expected, the areas from which there was high run-off coincide with the areas in which the precipitation was the greatest. The adjusted total direct flood run-off was generally in excess of 8 inches, and was in excess of 12 inches from three basins where the storm rainfall averaged from 12 to 18 inches, and where there were maxima in excess of 20 inches at individual places.

Analyses of the run-off of major floods in the United States (including the floods of March 1913, which were extreme on the Miami River in Ohio; the floods of March 1936, which embraced all of the northeastern United States from Virginia to Maine; the great Ohio and Mississippi River floods of January 1937; and certain other floods caused by intense local storms) indicate that, over a considerable part of the country, the direct run-off during a flood period has ranged between 8 and 10 inches. The character of the storms associated with these floods has varied greatly, between short intense storms for small drainage basins and widely extended general rainfall covering many days and marked by several comparatively intense storm periods. Similarly, the flood rises varied from sharp peaks for small basins to relatively flat rises extending over many days for the largest basins. By comparison, therefore, with standards elsewhere in the country, extreme flood conditions seemingly prevailed during December 1937 in those basins in California where the total direct run-off was 8 inches or more.

The areas in which the adjusted total direct flood run-off exceeded 10 inches (see table 7) include the drainage basins of Bucks Creek and Grizzly Creek in the Feather River Basin, and the South Fork of the Yuba

River and Canyon Creek in the Yuba River Basin. Drainage basins in which the adjusted direct run-off was between 8 and 10 inches include those of Uvas Creek, Upper Putah Creek, and the Eel River above Hullville and above Van Arsdale Dam, draining parts of the Coast Ranges, Eleanor Creek and Cherry Creek in the Tuolumne River Basin, the North Fork of the Mokelumne River, the West Branch of the Feather River, the Bear River above Pardoe Camp, and Silver Lake, draining parts of the Sierras. In parts of the Pit River Basin downstream from Big Bend, including Squaw Creek and possibly the area tributary to the lower McCloud River, the direct run-off also apparently exceeded 8 inches. The run-off in parts of the drainage basins immediately adjacent to the basins just mentioned probably also exceeded 8 inches. In addition, drainage basins in which river-measurement stations were inoperative or were not being maintained during the flood period, such as the basins of the Russian River, the Smith River, Grindstone Creek, the North Fork of the Kings River, and possibly others, may have experienced flood run-off of more than 8 inches.

Areas in which the adjusted total direct flood run-off was between 6 and 8 inches include those upstream from river-measurement stations on Falls Creek in the Tuolumne River Basin; the North Fork of the Stanislaus River; Cold Creek in the Mokelumne River Basin; Concow Creek, Lost Creek, and the South Fork of the Feather River in the Feather River Basin; the Middle Fork of the Yuba River at Milton, and Deer Creek near Smartville in the Yuba River Basin; Twin Lakes outlet in the American River Basin; Mill Creek; Chico Creek; Butte Creek; and the Eel River at Scotia.

It seems evident that in all the basins mentioned above the water available for run-off exceeded the capacity of the basins to retain or absorb water by an amount sufficient to produce flood run-off comparable with the run-off during great floods elsewhere in the United States. Many other basins from which the flood run-off was less than 6 inches appear to fall into three more or less well defined groups.

One group includes basins where the storm rainfall and the direct run-off were relatively low, yet where momentary peak discharges reached on December 10 or 11 have not been equalled or exceeded during the period of record which in many cases exceeds 20 years. The storm precipitation in December 1937 averaged less than 7 inches over the basin, the total adjusted direct run-off was generally less than 2 inches, and yet the momentary peak discharge on December 10 or 11 was considerably more than has been recorded since the river-measurement stations have been in operation at the following places: Pit River at Fall River Mills, Pit River below Pit No. 4 dam, Pit River at Ydalpom, and Hat Creek near Hat Creek. The basins upstream from these points of measurement are underlain in part by lava, drainage at many places is poorly defined, and some of the areas have no visible outlets to stream channels. The Upper Pit River country is normally an area of low rainfall. By comparison with the floods of other regions, neither the total run-off nor the momentary peak discharge during December 1937 can be considered as either a medium or a large flood. However, on the basis of the flood history of these streams as disclosed by the stream-flow records, the records of December 1937 are a measure of large floods for these particular basins.

The second group of basins includes those in which the storm precipitation was greater than that which took place over some basins where the run-off was in excess of 6 inches and no snow was involved, yet by reason of a high retentive and absorptive capacity during the storm period the run-off was relatively small. In the basins of the following rivers the average storm precipitation was 10 inches or more but the adjusted total direct run-off was generally less than 3 inches: San Lorenzo River, Guadalupe Creek (at San Jose), Campbell Creek, Stevens Creek, Fresno River, Arroyo Seco, South Fork of Mokelumne River, Plum Creek, and Alder Creek. Other peak discharges of record in these basins have materially exceeded the peak discharge during December 1937, and the other maxima on San Lorenzo Creek, Campbell Creek, Arroyo Seco, and the Fresno River resulted from storms of less intensity than that of December 1937. (See table 9 on pp. 337-339.) Brief analysis seems to indicate that the large residual shown for many of these basins during December 1937 does not necessarily reflect a high retentive and absorptive capacity during all storms.

The third group of basins includes those where by reason of high altitudes and low temperature some of the precipitation fell as snow that did not contribute immediately to the flood run-off, and also those basins in which there was snow on the ground at the beginning of the storm period that did not melt materially and perhaps actually retained some of the rainfall. The net effect was that direct surface run-off took place in only a part of these drainage areas. Consequently, for basins in this group, a high storm precipitation is indicated, but the run-off expressed in inches over their areas as a whole is low and not indicative of run-off contributions from those parts of basins where no snow was involved. Typical basins of this type include the upper Merced, Kings, and Kaweah Rivers. In parts of these basins, although the total run-off was low, it was concentrated with respect to time and momentary peaks greatly exceeded prior peaks of record. The unusually high peak discharge in these basins as compared to all other peaks of record would seem to be a measure of the unusual character of the storm of December 1937 with respect to rain at high altitudes.

On the other hand, some of the smaller basins like Bear and Mono Creeks near Vermilion Valley are at such high altitudes that neither their total run-off nor the momentary peak discharges approached those for floods from melting snow in the spring and early summer.

Based on observations of run-off, precipitation, snow, and the relation between these factors and altitude, a generalized map (fig. 46) has been prepared showing areas from which the direct run-off during the flood period in December was greater than 8 inches, between 4 and 8 inches, between half an inch and 4 inches, and less than half an inch. In preparing this generalized map an attempt was made to balance areas above and below lines of equal run-off so that mean run-off for a given basin equals the measured run-off. In areas where the run-off was not measured, the lines of equal run-off are based to a large extent on precipitation and on general relations between rainfall and run-off observed in adjacent areas. There is also shown in figure 46 the approximate location of the 9,000-foot contour which for the December storm and flood represents approximately the upper limit of the area in much of the Sierra Nevada that contributed materially to the flood run-off. As indicated in this figure, areas in which there were 8 inches or more of direct run-off include most of the headwater basins of the Eel River and Putah Creek and parts of the Russian River Basin in the northern Coast Ranges; Uvas Creek Basin in the Santa Cruz Mountains area; Squaw Creek and adjacent areas tributary to the lower Pit River and headwater areas of Mill, Deer, Chico and Butte Creeks; the West Branch, South Fork, and lower parts of the North and Middle Forks of the Feather River; the South Fork of the Yuba River; parts of the North and South Forks of the American River; and parts of the headwater areas in the Mokelumne, Stanislaus and Tuolumne River Basins. Areas in which there was less than about half an inch of direct run-off include all the San Joaquin Valley floor and adjacent foothill areas, the western half of the central Sacramento and all of the lower Sacramento Valley, much of the area immediately tributary to San Francisco Bay, and most of the drainage areas on the eastern

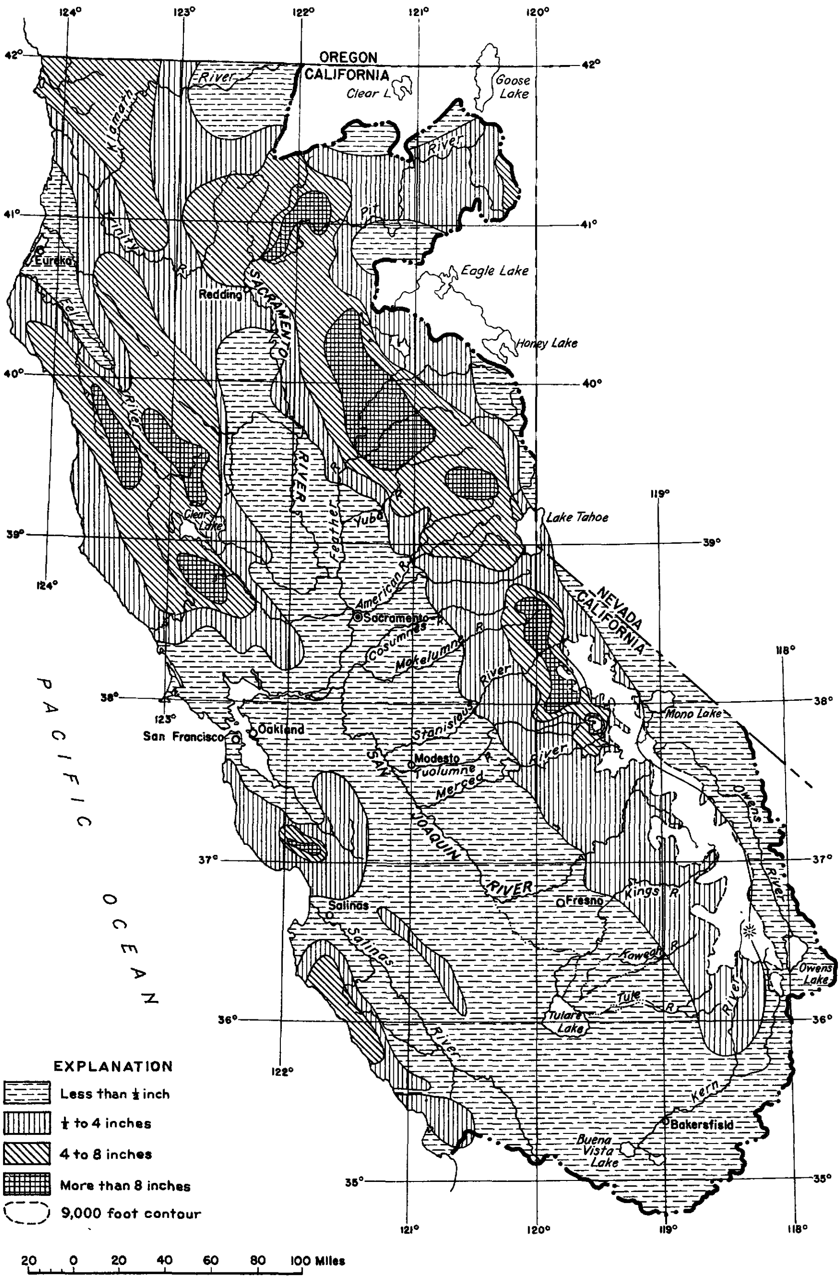

Figure 46.--Map showing areas of equal run-off in northern California during floods of December 1937.

slopes of the Sierra Nevada. The storm covered about 109,000 square miles. The areal extent of the run-off was approximately as follows:

Run-off (inches)	Tributary area (square miles)
Little or none	1/ 3,900
Less than 1/2	56,400
1/2 to 4	28,300
4 to 8	16,400
More than 8	3,800

1/ It is assumed that above an altitude of 9,000 feet there was little if any run-off.

Of the 56,400 square miles where the direct run-off was less than half an inch, about 35,000 square miles are located in the Central Valley and foothill area tributary to the San Joaquin and Sacramento Rivers and Tulare and Buena Vista Lakes. The question arises: to what extent may this great area be considered as one that will rarely, if ever, contribute large amounts of flood run-off to the San Joaquin and Sacramento Rivers? Local areas may be subject to the cloudburst type of storm with resultant intense run-off from relatively small areas. However, the area would seem to be so located with respect to the Pacific Ocean and mountain ranges as to be more immune to widespread occurrence of heavy rainfall than much of the area in the Coast Ranges and the Sierra Nevada. Moreover, the topographic and edaphic conditions in much of the area are conducive to a relatively high absorptive capacity, at least at the beginning of the rainy season. On the other hand, storms such as those in February 1936 and February 1937 did occur in foothill areas with resultant large flood run-off.

During the flood of December 1937, there were 44,700 square miles from which the run-off was between half an inch and 8 inches; of this area, 28,300 square miles had less than 4 inches and 16,400 square miles had between 4 and 8 inches. How subject are these areas to flood run-off greater than took place during December 1937? Consideration should be given especially to the flood-producing potentialities of the areas in which the run-off during the flood of December 1937 was between 4 and 8 inches with a view to determining whether, by reason of their altitude and topography, these areas may be subject to storm precipitation of a magnitude that would produce run-off considerably in excess of that during December 1937. Relatively little is known about the absorptive capacity of much of these areas under different storm conditions, but in general their absorptive capacity under normal conditions is probably less than that of the valley floor, which is composed largely of alluvium. In the absence of specific information to the contrary, it would appear that much of the 16,400 square miles from which there was between 8 and 4 inches run-off during the December storm must be regarded as subject to run-off considerably in excess of the peaks of 1937. During the flood of December 1937, the 9,000-foot contour was about the upper limit of appreciable run-off, but there is considerable evidence that the heavy rain extended above the 9,000-foot altitude in the headwaters of the Tuolumne River, notably in Cherry, Eleanor, and Fall Creek Basins. Matthes [6] states:

> Owing to low air temperatures all the year round . . . but a small proportion of the snowpack in the Alpine zone is transformed into melt-water. . . . . Above altitudes of 11,000 to 12,000 feet, according to latitude, melt-water is so scanty that it forms no channel-making streams or streamlets. Above 13,000 feet the snow-fields yield but small trickles that do not reach the valley below.

It would appear that the area between altitudes of 9,000 and 11,000 feet may at times contribute flood run-off to some extent. On the other hand, as discussed herein, the abnormally high temperatures prevailing during the storm of December 1937 had the effect of raising the altitude of the rainfall limit to only about 9,000 feet.

The flood-producing potentialities of the high Sierra Nevada offer a field for an interesting study of snow in relation to flood run-off. Because of their high altitudes, many of the snow fields in the Sierra Nevada, especially in the southern part, are apparently not subject to unusually high winter temperatures and to the accompanying warm winds of the Chinook type, which occur in the Pacific northwest and which result in the release of large volumes of water in sharp and violent floods similar to those from rain storms of high intensity. However, the run-off from the higher snow fields of the Sierra Nevada is influenced by the seasonal trends of temperature. The higher spring temperatures, either with or without rain, release large amounts of water which may or may not produce major flood stages in tributaries of the San Joaquin River, depending upon the abnormality of the temperature, but which may accumulate, as during May and June, 1938, in the channel of the lower San Joaquin and result in major flood stages and long continued occupancy of the natural flood plains.

6/ Matthes, F. E., Evaporation and runoff from snow in the Alpine zone of our western mountains, Am. Geophys. Union Trans., pt. 3, August 1938, p. 662.

If rain falls on snow there is a tendency for some retention, the amount depending on the associated temperatures and the depth of the snow and its water content. However, an analysis of winter and spring floods in the San Joaquin River Basin may show that during long continued periods of rain associated with high temperatures, snow cover, even at the higher altitudes, may constitute a distinct flood hazard. In the basins draining the northern parts of the Sierra Nevada there is relatively less area of high altitude than in the southern basins. Therefore, snow fields on the western slopes tributary to the Sacramento River are subject to higher temperatures and more precipitation in the form of rain, and hence constitute a greater flood hazard than snow fields on higher slopes tributary to the San Joaquin River.

Although the rains of December 1937 produced widespread floods of high intensity, a brief analysis indicates that, in many basins, the run-off of some prior floods which were associated with melting snow exceeded the run-off during the December flood, even though the degree of concentration and the momentary peak discharge may have been less. The floods of March 1928 in parts of the Sacramento River basin are an example of this type of flood. The direct run-off in some of the basins, especially of the American and Feather Rivers, was larger than the direct run-off during the flood of December 1937. The flood period in March 1928 was generally longer than that in 1937, and run-off was less concentrated with respect to time.

Residuals

If the run-off and the precipitation records are correct and there was no snow on the ground at the beginning of the storm period, the differences between the run-off and precipitation, herein called residuals, represent the amount of water that was retained in the basin in the form of snow or as surface storage and absorption, or was transpired and evaporated during the flood period. Negative residuals are clearly indicative of errors in basic data. Unusually large or unusually small residuals represent either unusual basin characteristics or possibilities of error in basic data. Generally, the residuals, if properly interpreted, should represent relative measures of the absorptive capacity of the various drainage basins during the December storm.

Analysis of the rainfall and run-off values in table 7 discloses only three drainage basins - the North Fork of the Mokelumne River (above

Salt Springs Dam), the Bear River (above Pardoe Camp in the Mokelumne River Basin), and Silver Lake outlet (near Kirkwood in the American River Basin) - where negative residuals are indicated. All these basins are at an altitude above 5,000 feet, and the flood run-off may have been augmented by snow on the ground at the beginning of the flood period or affected by inaccuracies in the large storage adjustments that were made to determine the natural run-off. In six other basins - upstream from river-measurement stations on Cold Creek near Mokelumne Peak, the South Fork of the Pit River near Likely, Thomas Creek near Paskenta, the South Fork of the Yuba River at Lake Spaulding, Canyon Creek below Bowman Dam, and Twin Lakes outlet near Kirkwood - the residuals are less than 2 inches and possible sources of discrepancies in results are indicated as follows. In three of the basins, large storage adjustments were necessary, and in all basins except Thomas Creek near Paskenta snow melt may have contributed to the flood run-off. Thomas Creek Basin lies on the eastern slopes of the northern Coast Ranges where there is a decided sparsity of rain gages and where it appears that the isohyetals indicate less storm rainfall than actually occurred.

On the other extreme, residuals in four areas upstream from river-measurement stations on San Lorenzo River at Big Trees, Campbell Creek at Saratoga, North Fork of Willow Creek at Crane Valley Reservoir, and Lost Creek near Clipper Mills, exceed 12 inches; and the residual in San Lorenzo Creek Basin is nearly 15 inches. The Lost Creek Basin is small and lies mostly below an altitude of 5,000 feet in the Feather River Basin, and there is a possibility that less rain fell in the basin than is indicated by the isohyetals as drawn. For the basin of the North Fork of Willow Creek there was a large adjustment for storage and diversions. The other two basins are on the slopes of the southern Coast Ranges, where it is believed that the positions of the isohyetals are well fixed by supplemental precipitation records. Los Gatos Creek Basin (Santa Clara County), also draining a part of the Coast Ranges, has a high residual of 10.35 inches. It is believed that the direct run-off from these basins has been determined with reasonable accuracy. These high values may be due in part to the highly shattered condition of the underlying bed rock, and to some extent may be indicative of a tendency of areas in the southern Coast Ranges, as well as in much of the semi-desert and foothill areas of the southern Central Valley, to absorb large quantities of water, at least during the first period of heavy rains in the early winter. This view seems to be supported in part by the fact that residuals in excess of 8 inches are indicated in the basins, in addition to those already named, upstream from gaging stations on Uvas Creek near Morgan Hill, Stevens Creek near Cupertino, Guadalupe Creek at San Jose, and Arroyo Seco near Soledad, all in the Coast Ranges, and for parts of the Tule, Mokelumne, Kaweah, and Fresno River Basins, tributary to the southern part of the Central Valley. In all these areas, the precipitation was generally in excess of 10 inches, and the residual values indicated in table 7 may approach the maximum capacity of these areas to absorb water under conditions similar to those prevailing during the storm of December 1937. During the period December 9 to 12 the residuals were more a measure of total rainfall than of infiltration capacity in parts of the Salinas, San Francisquito, Guadalupe, Coyote, Alameda, Lower Kern, Los Gatos (near Coalinga), lower San Joaquin, Chowchilla, Bear, Orestimba, Lower Tuolumne, Stanislaus, Calaveras, and lower Mokelumne Basins.

Considering the basins in the northern part of the Central Valley and in the northern Coast Range, it is evident that during the December storm, at least, their absorptive capacity was materially less than that in the southern basins described.

In the upper Sacramento, Pit, McCloud, Putah, Elder, Stony, Cache, Eel, Shasta, and Trinity Basins, the residuals are consistently less than 5.0 inches. It has been pointed out in the discussion of antecedent rainfall that during November 1937, there was generally in relation to normal an excess of rain in the northern part of the area and a deficiency in the southern part. To antecedent conditions may therefore be ascribed some and perhaps a major part of the differences in the absorptive capacities as measured by the residuals, except in basins where lava formations are a major influence.

Interpretation of the residuals for basins in the higher parts of the Sierra Nevada is uncertain because of snow and relatively sparse rainfall data. In parts of the upper Kings, San Joaquin, Tuolumne, Feather, Yuba, and American River Basins residuals of 6 to 8 inches are indicated. However, as shown in table 7 the residuals for the larger number of basins range between 4 and 6 inches. In the absence of other information, it may be concluded that the average retention in much of the higher Sierra country was between 4 and 6 inches during the flood period in December, and that, other things being equal, residuals of less than 4 to 6 inches may indicate contributions to run-off from snow on the ground at the beginning of the storm period, and higher residuals may indicate either an over-estimate of the rainfall or retention of water in the form of snow on the ground at the end of the period studied.

It may be of interest to point out that during the storm of March 9 to 22, 1936, residuals of less than 3 inches were indicated for nearly all river basins in Virginia, Maryland, Pennsylvania, New York, and New England. For the storm of December 1937 in California residuals as small as 3 inches are the exception, not the rule.

Comparison of rainfall and run-off conditions during floods of record

A study has been made of the rainfall and run-off conditions during the highest floods of record for those basins in which there is no large artificial storage, for the purpose of comparison with conditions prior to and during the December flood. The study is of preliminary character and largely qualitative rather than quantitative. Instead of preparing a detailed rainfall map for each of the storms which have resulted in the major floods herein considered, the precipitation data concerning major floods were assembled for all available rainfall stations and ratios were determined between the precipitation during the storm of December 1937, used as a standard, and the previous or subsequent large storms. The results of these comparisons are shown in table 9, which includes symbols and explanatory footnotes to classify the characteristics of the precipitation. A more detailed explanation of some of the symbols than appears in the table follows.

When the precipitation was within 10 percent of that which occurred during the storm of December 1937 the symbol (c) is used. When the precipitation was within 10 to 25 percent, plus or minus, of that of December 1937 the symbol (b) is used to signify that the difference was plus and (d) to signify that the difference was minus. In a similar manner the symbol (a) indicates that the precipitation was more than 25 percent greater than that which occurred during the December storm, and (e) that the precipitation was more than 25 percent smaller. The symbol (k) is used to indicate that there was substantial contribution of melting snow to the flood run-off, and symbol (l) to indicate small contributions. When there was an accumulation of snow during the storm period the symbol (n) indicates light accumulation and symbol (o) heavy accumulation. Most of the storms analyzed were apparently of longer duration than the storm of December 1937. When the duration was

Table 9.--Comparison of floods of December 1937 with other floods, for unregulated streams

Stream and point of measurement	Date of other flood	Momentary peak discharge (second-feet)		Direct run-off for storm period (inches)		Remarks*
		Flood of December 1937	Other flood	Flood of December 1937	Other flood	
Salinas River Basin						
Salinas River near Santa Margarita	Feb.11,1938	3,550	11,000	0.5	2.5	ch
Salinas River near Spreckels	Feb.12,1938	13,400	75,000	.25	1.8	bh
San Antonio River at Pleyto	Feb.11,1938	6,100	10,700	.9	3.0	bh
Arroyo Seco near Soledad	Feb.21,1917	13,400	22,000	1.75	4.0	dh
Pajaro River Basin						
Uvas Creek near Morgan Hill	Dec.27,1931	8,630	4,340	8.9	5.9	eg
San Lorenzo River Basin						
San Lorenzo River at Big Trees	Jan.31,1938	5,590	12,000	2.25	5.25	eh
Guadalupe Creek Basin						
Los Gatos Creek at Los Gatos	Feb.13,1937	4,800	5,500	4.15	2.6	eh
Campbell Creek at Saratoga	Feb.13,1937	534	910	2.35	1.7	eh
Kern River Basin						
South Fork of Kern River near Onyx	Mar.2,1938	1,260	3,450	.15	.3	eh,oi
South Fork of Kern River at Isabella	Feb.7,1937	1,140	4,100	.1	.2	eh,k
Tulare Lake Basin						
Tule River near Porterville	Feb.13,1936	11,300	12,500	1.1	1.3	ch,l
South Fork of Tule River near Success	Feb.6,1937	1,060	3,370	.35	1.2	eh,k
Kaweah River near Three Rivers	Feb.6,1937	33,300	18,900	1.85	1.6	eh,ki
North Fork of Kaweah River at Kaweah	Jan.25,1914	8,290	7,400	1.6	2.9	ch,oi
Kings River above North Fork	Feb.6,1937	42,000	13,400	1.1	.6	eh,oi
Kings River at Piedra	Jan.25,1914	80,000	59,700	1.5	1.45	bh,oi
Los Gatos Creek near Coalinga	Feb.11,1938	1,530	4,520	.15	.6	ch,m
San Joaquin River Basin						
Bear Creek near Vermilion Valley	July 21,1936	634	1,600	.45	.7	eh,k
Mono Creek near Vermilion Valley	June 2,1938	389	1,760	.4	4.8	h,ki
Pitman Creek below Tamarack Creek	May 13,1937	2,320	885	2.35	.25	hl
Fine Gold Creek near Friant	Mar.12,1938	4,900	10,300	1.05	2.4	eh,li
Fresno River Basin						
Fresno River near Knowles	Mar.12,1938	3,380	7,630	.75	2.3	eh,li
Chowchilla River Basin						
Chowchilla River at Buchanan dam site	Mar.2,1938	7,020	15,000	.65		dh,li
Merced River Basin						
Merced River at Happy Isles Bridge, near Yosemite	May 28,1919	10,600	3,800	2.0	3.6	eh,ki
Merced River at Pohono Bridge, near Yosemite	June 5,1922	22,000	6,370	3.55	4.45	h,ki
Merced River at Kittridge	Feb.6,1937	59,000	33,200	2.25	1.65	dh,ki
Tenaya Creek near Yosemite	May 28,1919	5,550	1,730	4.95	2.05	eh,ki

* Remarks refer to amount of water available for run-off during other flood as compared with amount available during flood of December 1937. Key letters explained below:

a Much more precipitation.
b Slightly more precipitation.
c Precipitation about same.
d Slightly less precipitation.
e Much less precipitation.
f Short storm.
g Prolonged storm.
h Large amount of antecedent precipitation.
i At high altitudes.
j At low altitudes.
k Large snow contribution.
l Small snow contribution.
m No snow contribution.
n Light snow accumulation.
o Heavy snow accumulation.

Table 9.--Comparison of floods of December 1937 with other floods, for unregulated streams--Continued

Stream and point of measurement	Date of other flood	Momentary peak discharge (second-feet)		Direct run-off for storm period (inches)		Remarks*
		Flood of December 1937	Other flood	Flood of December 1937	Other flood	
San Joaquin River Basin--Con.						
Orestimba Creek Basin						
Orestimba Creek near Newman	Feb.8,1932	2,040	3,440	0.4	1.0	eh,li
Tuolumne River Basin						
Falls Creek near Hetch Hetchy	Mar.25,1928	6,300	1,740	6.75	3.65	ch,ni
Cherry Creek near Hetch Hetchy	June 16,1937	18,100	7,750	9.05	2.95	e,li
South Fork of Tuolumne River near Oakland Recreation Camp	Apr.8,1935	6,950	2,850	1.9	1.1	ejh,ni
Middle Tuolumne River near Buck Meadows	May 28,1919	2,910	1,330	1.3	.45	e,li
Woods Creek near Jacksonville	Feb.9,1938	5,500	13,500	1.0	5.65	ah
Calaveras River Basin						
Cosgrove Creek near Valley Springs	Feb.22,1936	288	2,600	.25	3.6	agh,m
Mokelumne River Basin						
Cold Creek near Mokelumne Peak	Mar.25,1928	4,100	3,000	7.35	6.45	aj,oi
Middle Fork of Mokelumne River at West Point	Jan.23,1914	1,460	2,550	.8	4.05	ah,li
South Fork of Mokelumne River near West Point	Feb.22,1936	1,810	3,600	.85	3.0	agh,ni
Sutter Creek near Sutter Creek	Feb.22,1936	575	3,900	.45	3.25	agh,m
North Fork of Cosumnes River near El Dorado	Mar.25,1928	3,880	7,600	.9	4.15	aj,ki
Cosumnes River at Michigan Bar	Feb.6,1925	9,000	23,800	.8	2.1	ch,ki
Sacramento River Basin						
Sacramento River at Antler	Mar.26,1928	24,900	34,000	4.45	4.25	e,li
Pit River Basin						
Hat Creek near Hat Creek	June 16,1937	2,500	450	.65	.05	e,li
McCloud River near McCloud	Feb.22,1936	4,600	2,760	1.0	.4	cg,oi
McCloud River at Baird	Feb.25,1917	32,200	27,600	3.15	2.75	c,lj,ni
Mill Creek Basin						
Mill Creek near Los Molinos	Dec.15,1929	23,000	6,000	6.8	3.2	ai
Elder Creek Basin						
Elder Creek near Henleyville	Jan.1,1934	10,700	6,300	2.75	.7	cj,oi
Thomas Creek Basin						
Thomas Creek at Paskenta	Mar.26,1928	16,500	16,600	5.05	4.4	e,li
Chico Creek Basin						
Chico Creek near Chico	Feb.21,1936	8,260	4,940	6.75	3.6	cg,oi
Feather River Basin						
Indian Creek near Clipper Mills	Mar.19,1907	11,500	11,700	1.65	2.6	ag,k
Spanish Creek at Keddie	Mar.26,1928	11,500	11,000	4.1	3.85	c
Grizzly Creek near Storrie	Feb.21,1936	1,570	1,000	12.5	4.95	cg,oi
Middle Fork of Feather River at Bidwell Bar	Mar.26,1928	93,000	90,000	4.35	5.8	c,ki
South Fork of Feather River at Enterprise	Mar.26,1928	17,300	15,200	7.85	11.05	a,ki
Lost Creek near Clipper Mills	Mar.26,1928	3,380	2,900	6.2	9.4	ai,lj
Oregon Creek near North Juan	Mar.25,1928	2,750	4,000	3.75	10.65	a,li
North Fork of Yuba River near Sierra City	Mar.25,1928	9,800	5,920	5.0	5.55	aj,li
Deer Creek near Smartville	Feb.4,1937	10,800	7,520	4.95	4.45	d,kj

* Remarks refer to amount of water available for run-off during other flood as compared with amount available during flood of December 1937. Key letters explained below:

a Much more precipitation.
b Slightly more precipitation.
c Precipitation about same.
d Slightly less precipitation.
e Much less precipitation.
f Short storm.
g Prolonged storm.
h Large amount of antecedent precipitation.
i At high altitudes.
j At low altitudes.
k Large snow contribution.
l Small snow contribution.
m No snow contribution.
n Light snow accumulation.
o Heavy snow accumulation.

Table 9.--Comparison of floods of December 1937 with other floods, for unregulated streams--Continued

Stream and point of measurement	Date of other flood	Momentary peak discharge (second-feet)		Direct run-off for storm period (inches)		Remarks*
		Flood of December 1937	Other flood	Flood of December 1937	Other flood	
Sacramento River Basin--Con.						
American River Basin						
Alder Creek near Whitehall	Mar.25,1928	710	2,060	2.25	-	aj,oi
Plum Creek near Riverton	Mar.25,1928	315	635	2.0	7.15	aj,k
Silver Creek at Union Valley	Mar.25,1928	8,560	8,050	5.1	-	aj,oi
Silver Creek near Placerville	Mar.25,1928	14,600	12,400	4.15	-	aj,oi
South Fork of Silver Creek near Ice House	Mar.26,1928	2,200	1,620	4.25	4.55	aj,ni
Cache Creek Basin						
North Fork of Cache Creek near Lower Lake	Dec.26,1931	16,000	11,000	4.15	2.35	e,li
Putah Creek Basin						
Putah Creek near Guenoc	Mar.10,1904	24,100	24,600	9.7	8.85	-
Putah Creek near Winters	Feb.4,1937	39,200	41,100	3.7	2.0	d
Napa River Basin						
Conn Creek near St. Helena	Feb.4,1937	2,660	4,600	1.95	1.5	d
Klamath River Basin						
Salmon River at Somesbar	Jan.14,1936	27,000	21,600	3.55	3.55	ag,oi
Trinity River at Lewiston	Nov.30,1926	37,000	31,900	4.15	4.55	ag,m
Trinity River near Burnt Ranch	Jan.15,1936	71,800	31,000	3.65	1.75	ag,oi
Trinity River near Hoopa	Dec.31,1913	105,000	89,000	3.75	4.55	ag,l
Smith River Basin						
Smith River near Crescent City	Apr.13,1937	78,900	70,100	-	9.1	d
The Great Basin						
Owens Lake Basin						
Owens River near Round Valley	June 30,1907	1,560	1,190	.2	.3	ki
Rock Creek at Sherwin Hill, near Bishop	June 17,1927	115	162	.15	.5	e,ki
Pine Creek at division box, near Bishop	July 21,1936	207	350	.25	.45	e,ki

* Remarks refer to amount of water available for run-off during other flood as compared with amount available during flood of December 1937. Key letters explained below:

a Much more precipitation.
b Slightly more precipitation.
c Precipitation about same.
d Slightly less precipitation.
e Much less precipitation.
f Short storm.
g Prolonged storm.
h Large amount of antecedent precipitation.
i At high altitudes.
j At low altitudes.
k Large snow contribution.
l Small snow contribution.
m No snow contribution.
n Light snow accumulation.
o Heavy snow accumulation.

much longer the symbol (g) is used, and where shorter the symbol (f). If no indicating time length is given it may be inferred that the duration was somewhat longer than for the storm of December 1937.

The amount of antecedent rainfall seems to be a very influential factor in California floods. The great majority of floods which exceeded that of December 1937 were preceded by more precipitation, although the actual flood-producing precipitation may have been less.

Some of the earlier maxima are not based on recording-gage records and the accuracy of the momentary peaks may not approach that of the more recent records.

Analysis indicates that, in six basins where apparently no snow was involved, storms of less rainfall produced larger peaks than were recorded during December 1937. These basins drain parts of the Coast Ranges and are upstream from gaging stations located on Arroyo Seco near Soledad, the San Lorenzo River at Big Trees, Los Gatos Creek at Los Gatos, Campbell Creek at Saratoga, Putah Creek near Winters, and Conn Creek near St. Helena. All the highest peaks occurred later in the rainy season than the flood of December 1937 and were preceded by much more precipitation. On Arroyo Seco and the San Lorenzo River the maximum peaks were accompanied also by a greater total direct run-off than occurred during December 1937. At the other four gaging stations the total direct run-off associated with the storm of February 1937 was less than in December 1937.

If floods are considered in basins where snow was involved, storms of less rainfall produced higher peaks than in December 1937 in 19 basins, and produced more direct run-off in 12 basins. In nearly all of these floods there was more antecedent precipitation and the storm period was longer than in December 1937.

In general it may be said that, with the exception of a few floods due wholly or primarily to melting snow, the floods that exceeded those of December 1937 were associated with storms that were more prolonged or that had more antecedent precipitation.

In comparison with floods of the eastern part of the United States, it seems evident that in semi-arid regions the available absorptive capacity of the basin at the time of the flood may be a major determining influence, whereas in more humid regions the available absorptive capacity is likely to be subject to less variation due to regularly recurring rainfalls and the maximum floods are associated very commonly with maximum storm precipitation.

Run-off characteristics

In the area covered by this report there are approximately 250 river-measurement stations at which continuous records of stage and discharge are obtained. However, as a result of artificial storage for irrigation, power, municipal water supplies, and flood prevention, and of diversions of water upstream from some of the gaging stations, the observed discharge represents natural flow conditions at only about 81 river-measurement stations.

The hydrographs of the flow at these 81 stations have been analyzed to show the characteristics of the natural run-off during the floods of December 1937. Where groups of basins had similar run-off characteristics, it has been assumed that some general deductions could be drawn.

An important characteristic of flood run-off is the degree to which it is concentrated with respect to time. For basin-wide storms not associated with snow, Sherman [7/] presented the idea that surface run-off from rainfalls occurring within the same time interval will produce similar hydrographs whose ordinates will very with the volume of surface run-off. The studies by Bernard, [8/] Hoyt, [9/] Snyder, [10/] the Corps of Engineers, U. S. Army, and others, have substantiated the general idea. It would appear that if, during an isolated storm such as occurred during December 1937, the storm characteristics were similar over the affected area, the degree to which the run-off was concentrated with respect to time may be related largely to inherent basin characteristics, except in those basins where snow was involved. Concentration is usually evaluated in the form of a ratio between discharge for a short interval of time and discharge for a relatively long interval of time. Some investigators have chosen the ratio between the average discharge for the calendar day of greatest flow and the average discharge for the period of flood run-off (both computed above a base representing contribution from ground water and surface run-off from antecedent precipitation). Others have used the ratio between momentary peak discharge and discharge for the highest calendar day (with or without

7/ Sherman, L. K., Stream flow from rainfall by the unit graph method: Eng. News-Record, vol. 108, pp. 500-501, 1932.

8/ Bernard, M. M., An approach to determinate stream flow: Am. Soc. Civil Eng. Trans., vol. 100, pp. 347-362, 1935.

9/ Hoyt, W. G. and others, Studies of relations of rainfall and run-off in the United States: U. S. Geol. Survey Water-Supply Paper 772, 1936.

10/ Snyder, F. F., Synthetic unit-graphs: Am. Geophys. Union Trans., pp. 447-454, 1938.

correction for ground-water contribution). It may be readily appreciated that any ratio involving the calendar day is not desirable because it is only by accident that the average discharge for the highest calendar day will coincide with that for the maximum 24-hour discharge.

In this report two separate measures of the concentration are used. The first is the ratio between the run-off during the 24 hours of greatest discharge and the total direct run-off during the storm period. This ratio is listed in table 8, column 4.

The second ratio computed is that between the momentary peak discharge and the maximum 24-hour discharge. This ratio is listed in table 8, column 6.

For the 81 unregulated streams listed in table 8 for which complete data are available, the ratio between the run-off during the 24 hours of greatest discharge and the total direct run-off during the storm period will be discussed first. It is realized that, because of the relatively small size of many of the basins and the extreme flashiness of the run-off, the 24-hour period is too long for any except very general comparisons.

As indicated in table 8, column 4, in 12 of the basins less than 40 percent of the total run-off occurred during the 24 hours of greatest discharge. In 14 other basins the ratios of concentration were between 40 and 49 percent. In 33 basins, the largest number for any one group, between 50 and 59 percent of the total run-off occurred during a 24-hour interval. In 11 basins, ratios were between 60 and 69 percent, and in only 10 basins were the ratios 70 percent or more.

An examination of the grouping of the stations with respect to the degree of concentration of the flood run-off indicates that in general those basins in which less than 50 percent of the total direct run-off occurred during 24 hours fall into two groups. One group, including the upper Kern River, Bear, Mono, Indian, Cherry, and Silver Creeks, and the Middle Feather River drains parts of the high Sierras where melting snow may have contributed to the run-off. The other group includes some streams in the Klamath and upper Sacramento River Basins where there was but little contribution to the run-off from melting snow.

Basins in which there was an unusually high concentration of flood run-off with respect to time - that is, in which 70 percent or more of the total run-off occurred during a 24-hour period - are located principally in the semi-arid and lower foothill areas where the stream flow is not well sustained and the flood run-off takes place following periods of high rainfall intensity as a sudden and flashy peak of relatively small volume but with a high maximum rate. Such basins include the areas upstream from the river-measurement stations on Orestimba Creek, Los Gatos Creek near Coalinga, the Salinas River near Santa Margarita, Woods Creek, Fine Gold Creek, Cottonwood Creek, Big Sandy Creek, Bear Creek near Planada, Mariposa Creek, and the South Fork of the Tuolumne River. The basins seem to group between these limits with some degree of consistency. Those that drain the upper foothills, including the Fresno, Chowchilla, lower Kings, Middle Tuolumne, and others, had concentration ratios of 60 to 69 percent. The largest group includes basins situated largely on the higher slopes of the Sierra Nevada where between 50 and 59 percent of the total run-off occurred during a 24-hour period. In many of these basins there may have been snow on the ground, but the effect was apparently not such as to produce a low concentration ratio.

Salinas River near Santa Margarita, Los Gatos Creek near Coalinga, Cottonwood Creek near Friant, and Orestimba Creek near Newman show particularly high concentration ratios.

In view of the large number of basins where natural run-off characteristics could not be determined because of regulation, the relations indicated in table 8, column 4, are subject to modification on a basis of detailed studies of other floods and through the use of time intervals shorter than 24 hours.

In the area studied, most of the basins with natural flow conditions are small and have relatively little channel storage. Flood run-off appears at the river-measurement stations soon after the time when rainfall intensity exceeds the infiltration capacity, and crest stages occur almost simultaneously over the individual basins. This is in contrast to many large river systems where wide channels and overflow areas provide channel storage which retards and reduces the flood crest.

In 68 of the 81 basins in table 8 the momentary peak stages were on December 11, and their times were about equally divided between forenoon and afternoon. In nine basins, the peaks were on December 10, seven being late in the afternoon or at night. On four streams, the peaks were on December 12. During the late afternoon and night of December 10, there were peak stages in the northern part of the Sacramento River Basin. During the morning of December 11, there were peak stages throughout the northern Sierra Nevadas and areas near San Francisco Bay. In the southern Sierra Nevadas, in general, peak stages were reached during the afternoon and evening of December 11. The times of occurrence of the crest stages may be indicative of the progress of the most intense part of the storm, when allowance is made for the elapsed time between the falling of the rain and its observed appearance as run-off. It should not be overlooked that because of antecedent precipitation, there would be a tendency for the run-off to be earlier in the northern part of the area than in the southern part, and this may be reflected in the later occurrence of peak stages in much of the San Joaquin River Basin. At many of the stations there were two peaks, but generally the second peak reached the higher stage. With time of occurrence of the maximum peak stages so nearly simultaneous, no correlation with basin characteristics has been attempted.

Characteristics of peak discharge

In connection with the study of the magnitude and frequency of floods in the United States, the Advisory Committee on Flood Protection Data, appointed by the American Society of Civil Engineers, suggested that significant and valuable information would be developed by investigating the magnitude of the maximum 24-hour flows, independent of coincidence with the calendar day, and by determining the relation between the maximum 24-hour flow and the momentary peak discharge. In that study 11/ 690 flood events were tabulated, but the data did not respond to general analysis. Nevertheless, it was suggested that "not only the seasonal influence but also the wide variety of soil moisture, directions of storm movement, duration and distribution of rainfall on a given river system, influence of thaws, and shape of drainage basin may be reflected in the relative values". 12/

The influences upon the shape of the flood crest, as outlined above, may be classified as follows: first, those that relate to the particular meteorologic and hydrologic conditions attending a specific storm, and second, those that are peculiar to each basin.

In table 4 (see pp. 288-298) there are given in second-feet the momentary peak discharge and the maximum 24-hour average discharge, independent of the calendar day. In table 8, column 6, (see pp. 321-324) is shown the ratio between momentary peak discharge and the maximum 24-hour average discharge for 81 unregulated streams. These ratios range

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11/ Jarvis, C. S., and others, Floods in the United States magnitude and frequency: U. S. Geol. Survey Water-Supply Paper 771, 1936.

12/ Idem, p. 94.

all the way from 105 percent for Indian Creek at Crescent Mills, in the Feather River Basin, influenced by channel storage, to 409 percent for Bear Creek near Planada with little, if any, channel storage. Ten basins had ratios of less than 125 percent, and 20 basins had ratios exceeding 200 percent. The largest grouping had ratios between 125 and 200 percent. As between basins where the discharge for the 24 hours of greatest flow was only slightly less than the momentary peak discharge and basins where the momentary peak discharge was between two and three times greater than the maximum 24-hour average discharge, differences in basin characteristics are, in general, pronounced. Among the large number of basins where the momentary peak was from 125 to 200 percent of the maximum 24-hour average discharge, correlation with basin characteristics is difficult. Snow was involved in many of the basins that fall in this grouping, and delayed run-off therefrom probably had an effect on the ratio. In general, low ratios prevail in those basins in which there were known to be large amounts of channel storage, and storage in swamps and lakes, or where lava is present as in the Feather, Klamath, and Pit River Basins. High ratios are indicated in much of the semi-arid and foothill areas where flash floods of short duration follow closely periods of heavy rainfall intensity, with little flow prior to the beginning of the sharp flood rise and rapid recession following the peak.

The range in amount of total direct run-off from unregulated streams is from 0.05 inch on Cottonwood Creek to 12.5 inches on Grizzly Creek. Cottonwood Creek is a small tributary of the San Joaquin River lying wholly in the low foothill area where precipitation was light, the antecedent period was dry, and the absorptive capacity of a large part of the basin was probably not reached. Grizzly Creek is a high Sierra basin in a region where the rainfall was heavy, the antecedent period was wet, and the run-off was augmented by the melting of snow which was already on the ground at the beginning of the storm.

The total direct run-off for each of the river-measurement stations listed in table 7 (see pp. 311-316) has been plotted, as shown in figure 45 (see p. 319), and the scattered points are evidence of the great variety of conditions that were in effect on the different stream basins. Cottonwood Creek and Grizzly Creek, cited in the preceding paragraph, represent opposite extremes. It should also be kept in mind that Cottonwood Creek and Grizzly Creek Basins are sufficiently small and compact to be subject to practically uniform conditions over their

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respective areas. On the contrary, most of the basins, as mentioned elsewhere in this report, are subject to great variations in altitude, precipitation, temperature, cover, gradient, and soil, so that run-off is the resultant of many variable influences.

As also stated previously, analyses of the run-off of major floods in the central and eastern parts of the United States indicate that the direct run-off of such floods has rarely exceeded 10 inches, and has generally been between 8 and 10 inches. Figure 45 seems to indicate that for the floods here studied many of the results conform more or less closely to these limits.

The method of plotting results used in figure 45 disregards basin differences and, like some other studies in this report, produces results that have a composite character. The method has the advantage of showing actual and natural behavior of stream flow. It may be that detailed analysis of the long-time rainfall and run-off records by large and small basins will show run-off characteristics more comprehensively, and perhaps more accurately for extensive areas, than can be shown by the synthetic development of rainfall-run-off experiences on relatively small experimental areas.

Basin characteristics

In this section neighboring stream basins have been grouped for convenience in description and in discussion of rainfall and run-off. The grouping, and the order of discussion, are not exactly the same as used in the annual water-supply papers of the Geological Survey but are most suitable to a study of the hydrology associated with the storm of December 1937.

The word "basin" is used at many places in this report to refer to the area upstream from the gaging station at which the run-off is measured. Therefore, under this usage the reference is to the entire basin of any given stream only when the gaging station is located near the mouth. Few basins in California are subject to uniform conditions over their whole areas. On the contrary, most basins possess widely varying altitudes and stream gradients, and cross different zones of precipitation, temperature, cover, and soil, so that the run-off is the resultant of the action of many variable influences.

Key maps (figs. 47 to 70) show the relative location of each group of basins. A brief description is included for each basin for which complete run-off data are available in order to give the reader a general idea of the shape, size, altitude, slope, and geologic formation. Basins for which run-off data are incomplete are not described. It is recognized that the nature and extent of forest and other vegetative cover is one factor in the relation between rainfall and run-off. As the stream basins show great variation in this feature it is considered beyond the scope of this report to describe cover conditions [13] in the individual basins or to make a study of the probable effect upon run-off.

Streams in the area covered by this report may be classified approximately into four groups in accordance with different hydrologic characteristics. Such a classification can be of only the most general nature because, as explained previously, most California streams and their drainage basins are subject to great variations in climate, topography, and geology. The examples given are considered typical. Many streams contain characteristics of two or more groups and no attempt has been made to put every stream arbitrarily into some group.

High Sierra type

A stream may be said to have characteristics of a "typical High Sierra stream" when it has its source in long-lived or perpetual snow banks, or glaciers, near the crest of the Sierra Nevada, and when a large proportion of the precipitation over its basin accumulates in the form of snow. As a result it will be a perennial stream even though its lower reaches may be in foothill or valley areas that receive no rain from May to October. Its run-off will depend to a large extent upon the depth and water content of the snow pack and upon the rapidity with which the snow melts.

The discharge hydrograph will be characterized by a diurnal fluctuation that will make periodic appearances in March and will usually become continuous in April. The diurnal variation will increase in amplitude until the peak of the snow run-off is reached in late May or June. At that time the discharge corresponding to the warmest part of the day may be two or three times the discharge at the low point corresponding to the night period when the least melting occurs. After that time the fluctuation gradually decreases.

A typical High Sierra stream may be subject to flood run-off at any time from November to June, owing to storms such as those of March 1928 or December 1937. Occasionally summer thunder storms, which are

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13/ See Atlas of American Agriculture: U. S. Dept. Agr., 1936.

common to the High Sierra from June to August, will cover sufficient area and be of long enough duration to cause a very large peak discharge on one or more tributaries. In discussing and comparing discharge and run-off from High Sierra streams it is important to know the distribution of the drainage area upstream from the river-measurement station with respect to altitude. A tributary that has a basin wholly above 7,000 feet will obviously have a different type of discharge than the main stream which is normally measured at the base of the foothills. The maximum 24-hour average discharge for the tributary would occur during the time of greatest snow run-off. That for the main stream would more likely be due to heavy rainfall plus snow melt at lower altitudes.

When rivers such as the San Joaquin are classified as High Sierra streams it is understood that they are considered from a point upstream from man-made works that may change their nature.

Rivers that may be considered to belong to the High Sierra group are the Kaweah, Kings, San Joaquin, Merced, Tuolumne, Stanislaus, Mokelumne, American, and probably the Feather and Yuba. The Kern River at the extreme south end of the Sierras has distinctive characteristics but is also one of this group. On the east side of the Sierra Nevada, the group includes such rivers as the Truckee, Carson, Walker, and Owens, although they are in a region of much less precipitation than the rivers on the west side. Headwater tributaries of all the streams named would also belong to the group.

Midslope type

Streams of this type are those that head moderately high in the Sierra Nevada, but whose basins have relatively small percentages of their areas at high altitudes and therefore do not accumulate a snow pack that lasts until summer. They may show very large daily fluctuations during April and May when the snow at lower elevations is melting fast.

Streams in this group would ordinarily have both their highest momentary peaks and maximum 24-hour average discharge caused by heavy rain storms augmented by some melting snow. Their summer flow may be very low and may even become zero in the lower reaches during a dry season.

Streams that may be considered to belong to this group are the Tule, South Fork of the Tule, Fresno, Cosumnes, North Fork of the Cosumnes, West Branch of the Feather, and Bear Rivers, also Plum, Alder, and Spanish Creeks. Mill Creek and Deer Creek (near Vina) come nearer to this type than to any other, although they are at the north end of the Sierra Nevada and their summer flow is relatively large owing to perennial springs and underground storage in lava fields.

Foothill type

In this group are streams that are usually torrential in character and intermittent and that depend almost entirely on rain for their run-off. Their basins are in semi-arid regions on which no rain may fall from May to October, or even for longer periods, and the streams may have no surface flow for many months in some years. The slopes of the basins are flatter than those in the preceding groups, and run-off is largely dependent upon the absorptive condition of the soil of the basin, which in turn may be determined largely by the amount of recent antecedent rainfall.

Streams of this type are: the Salinas River and its tributaries, Uvas Creek, Los Gatos Creek (near Coalinga), Fine Gold Creek, the Chowchilla River, Orestimba Creek, Woods Creek, Cosgrove Creek, Sutter Creek, Elder Creek, North Fork of Cache Creek, Putah Creek, and Conn Creek.

Miscellaneous group

The fourth group, denoted the miscellaneous group, is not marked by common characteristics, to any great extent, but constitutes a classification for streams that fall outside the preceding three groups. It includes streams that originate around Mount Shasta or in the Siskiyou and Klamath mountains and in the Coast Ranges between the Smith River on the north and San Francisco Bay on the south. The Trinity and Salmon Rivers, in that area, have many characteristics of the High Sierra type but are in a region of considerably greater rainfall.

The fourth group also includes the short coastal streams south of San Francisco Bay, originating on the westernmost slope of the Coast Ranges. San Lorenzo River (Santa Cruz County) is the only one in that area discussed in this report.

Southern Pacific basins

Topographically the Salinas Basin is a long narrow valley (fig. 47), walled in by steep mountain slopes which have been greatly eroded and dissected by stream action. There is a broad mesa or elevated plain along the southeast side. The crests of the encircling mountains range in altitude from 2,500 to 4,000 feet above sea level.

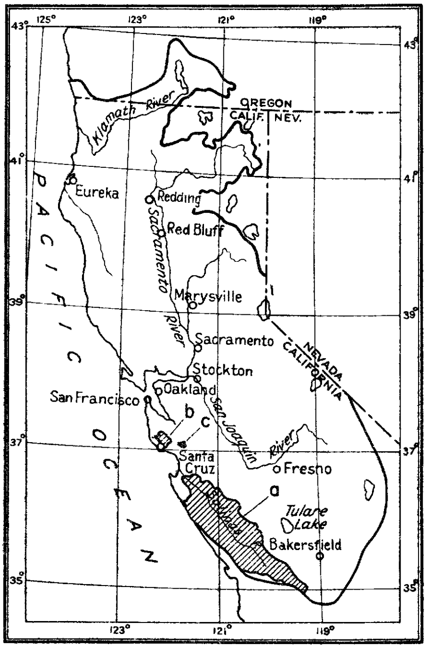

Figure 47.--Key map showing location of southern Pacific basins: (a) Salinas River, (b) San Lorenzo River, (c) Uvas Creek.

The Salinas River flows about 150 miles northwestward and for most of the distance is in a broad, flat, alluvial valley. Most of the water comes from the Arroyo Seco and the San Antonio and Nacimiento Rivers, on the west. San Lorenzo Creek and the Estrella River, on the east, are intermittent streams that carry extremely heavy loads of sediments during flashy floods. Soda Lake Basin does not drain into the Salinas River. The base gaging station is near Spreckels, a few miles upstream from the mouth, at an altitude of about 50 feet above sea level.

The Salinas River is of the foothill type of stream, as described in the introduction to this section.

The basin is composed of a wide variety of granitic and sedimentary rocks. Except in the headwater area the bed of the valley is alluvium.

Uvas Creek, in the Pajaro Basin, rises on the south side of Loma Prieta Mountain (altitude, 3,800 feet), flows southeastward, and drops in about 10 miles to an altitude of 390 feet at the gaging station. The basin is about one and a half times as long as it is wide and is underlain largely by sandstone, chert, limestone, and serpentine. Uvas Creek is a foothill type of stream.

The San Lorenzo River drains a coastal basin about 16 miles long by 8 miles wide, has several large tributaries, is bounded on the west and east by ranges about 2,000 feet high, and flows in a southerly direction through a steep canyon. The basin is underlain by a mixture of greatly shattered sedimentary and granitic formations. The river flows parallel to a fault line. The gaging station is at an altitude of 150 feet. This stream is classified in the miscellaneous group. It is a perennial stream and is in a region of heavier precipitation than the foothill type. Precipitation is always in the form of rain and is at times torrential.

Twenty-nine rainfall stations in the Salinas, San Lorenzo, and Pajaro River Basins and about an equal number in adjacent territory define the lines of equal rainfall with a fair degree of accuracy. The precipitation stations are largely in the valleys, only a few being maintained in the hills where rainfall during the December storm was heaviest. There was no snow on the ground before the storm and no snow fell during it.

The observed run-off from all the basins is essentially natural. Except at the Salinas River near Spreckels, above which there are considerable channel storage, flat slopes, and high absorptive capacity, meteorologic conditions were soon reflected at the gaging stations. The direct run-off, in inches, above the various gaging stations was (table 7, see pp. 311-316) 2.25 for the San Lorenzo River, 8.9 for Uvas Creek, 0.5 for the Salinas River near Santa Margarita, 0.9 for the San Antonio River, 1.75 for Arroyo Seco, and 0.25 for the Salinas River near Spreckels. The run-off was generally less than 0.5 inch over the greater part of the Salinas River Basin.

San Lorenzo River and Uvas Creek Basins received excessive amounts of rain, but from only the Uvas Creek Basin was the flood run-off unusually high.

Indicated residuals between rainfall and run-off range from 2.8 inches in the upper Salinas River Basin to 14.85 inches in the San Lorenzo River Basin. It is probable that in the lower part of the Salinas River Basin there was insufficient rain to utilize or exceed the absorptive capacity of the basin. The ability of the San Lorenzo River Basin to absorb rain during the December storm was apparently very great, as indicated by the large residual.

There are no recording precipitation stations in the southern Pacific area. However, the river and creek gage-height graphs show that the storm traveled generally in a southeast direction. The water-stage recorder graphs for Uvas Creek and San Lorenzo River show an initial peak about 6 a.m. on December 10 and the highest peak about 2 a.m. on December 11. The Arroyo Seco had a large inflow into the stream channel on December 10 and the highest peak at 8 a.m. on December 11. The San Antonio River at Pleytc began to flow about noon on December 10 and reached the peak about 4 p.m. on the following day. The Salinas River near Santa Margarita did not begin to rise until 8 a.m. on December 11 and reached its peak about 10 p.m. on the same day. The peak did not pass Spreckels until 10 p.m. on December 12.

The ratios of the momentary peak flow to the mean during the 24 hours of highest flow were generally high and ranged from 161 to 192 percent on the smaller basins. On the 4,180 square miles of the Salinas Basin above Spreckels this ratio was only 124 percent. The ratios between the run-off during the 24 hours of highest flow and the total storm run-off ranged from 40 percent for the Salinas Basin as a whole to 90 percent for the 150 square miles upstream from the gaging station near Santa Margarita.

The momentary peak discharge and the total direct flood run-off of Uvas Creek greatly exceeded those for the previous maximum flood of record on December 27, 1931. Peaks at other river-measurement stations in the southern Pacific area did not approach record discharges, although the precipitation during the storm of December 1937 was generally as great as or greater than that which occurred during the storms that produced previous maximum peaks of record. However, the previous peaks occurred later in the season when the absorptive capacities were probably much less than at the beginning of the rainy period in December 1937. It appears that if the storm of December 1937 had occurred later in the rainy season, the run-off would have been considerably greater.

The precipitation in the storms in January, February, and March 1938 fell upon ground more fully moistened than in December 1937 and, as a consequence, new records for peak discharge and for total direct flood run-off were established for the river-measurement stations on the Salinas River near Santa Margarita and at Spreckels, on the San Antonio River at Pleyto, and on the San Lorenzo River at Big Trees.

Los Gatos Creek Basin (near Coalinga) and Orestimba Creek Basin

Los Gatos and Orestimba Creeks are short, torrential, intermittent streams which drain the eastern slopes of the Coast Ranges and flow out onto alluvial fans on the western side of the San Joaquin Valley. Most of the run-off sinks into these fans. These streams are examples of the foothill type. (See fig. 48 for location.)

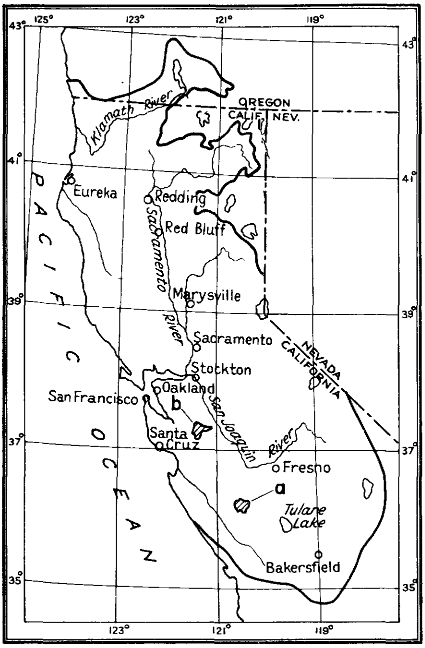

Figure 48.--Key map showing location of (a) Los Gatos Creek Basin (near Coalinga) and (b) Orestimba Creek Basin.

Los Gatos Creek drains an approximately square area and has three main tributaries that originate on the south slopes of San Benito Mountain. The mountain rises to an altitude of more than 5,000 feet and is composed of serpentine and other intrusive rocks. The three main tributaries of Los Gatos Creek flow through formations of marine sediment for most of the 14 miles above the gaging station, and drop from altitudes of 3,000, 4,000, and 5,000 feet, respectively, down to an altitude of 1,000 feet at the gaging station.

Orestimba Creek drains a triangular area which is about 18 miles long and which has a watershed line that follows the crest of the Diablo Range for about 15 miles. The tributary from the north rises at an altitude of about 3,000 feet and the main tributary from the south rises at an altitude of about 2,000 feet, whereas the gaging station is at an altitude of 190 feet. The headwater area is underlain by sedimentary and metamorphic rocks, the midsection lies in marine sediments, and just upstream from the gaging station the channel is cut in alluvium.

There are no rainfall stations in either basin and the lines representing equal rainfall in these areas are not well defined.

There was no snow on either drainage basin before the storm and none fell during the storm. The observed flow from both streams is not affected by artificial storage.

The run-off for both streams (see table 7, pp. 311-316) was very small, being only 0.4 inch for Orestimba Creek and 0.15 inch for Los Gatos Creek. These basins are in an area of low precipitation, and the precipitation during the storm was comparatively light. The differences between rainfall and direct run-off were slightly greater than 4 inches in each basin and probably do not reflect their greatest absorptive capacities. The ratios between the momentary peak flow and the average for the 24 hours of highest flow were very high, reaching 388 percent for Los Gatos Creek, indicating a type of flashy run-off perhaps to be expected from small semi-arid basins where there is no sustained flow. In Orestimba Creek basin the ratio was 171 percent. The ratios between the run-off during the 24 hours of highest flow and the total run-off for the storm were also very high, being 88 and 100 percent on Orestimba and Los Gatos Creeks, respectively. These ratios were 89 and 87 percent, respectively, before the component figures of the ratios were rounded off to the nearest half-tenth of an inch. Run-off began on both creeks on the morning of December 11 and the peaks were reached about noon on the same day.

The momentary peak discharge on Los Gatos Creek exceeded the previous peak of record but was itself greatly exceeded when the rains of the storm of February 11, 1938, fell upon ground previously moistened.

The highest records on Orestimba Creek both for momentary peak and total direct run-off occurred in connection with the storm of February 8, 1932. Although the storm of 1932 apparently produced less rainfall than that of 1937, the rainfall from the former fell upon more moist ground and possibly was augmented by melting snow in the higher parts of the basin.

Kern River Basin

The Kern River Basin, the largest stream basin in the Sierra tributary to the San Joaquin Valley, occupies the southeast end of that valley and differs from any of the other tributary basins in that its main axis lies north and south instead of east and west. The basin, which is long and comparatively narrow, lies west of the main Sierra divide, but is east of the secondary parallel crest, called the Great Western Divide, which separates this basin from the basins of the Kaweah and Tule Rivers and the southern foothill streams on the west. (See figure 49.) It is separated from the Kings River Basin on the north by a cross range about 15 miles in length, known as the Kings-Kern Divide. The Kern River and its main tributary, the South Fork, rise in numerous small glacial lakes at the north end of the basin among very high peaks and flow southward for many miles. About 70 percent of the basin upstream from Bakersfield is at an altitude of more than 5,000 feet. It is a High Sierra river, although in a region of less precipitation than the High Sierra rivers to the north.

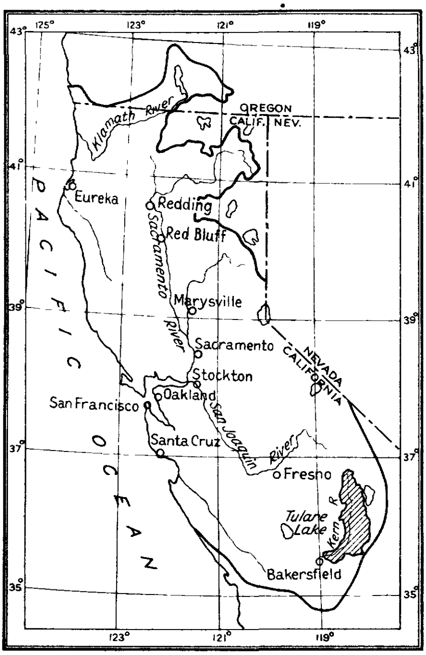

Figure 49.--Key map showing location of Kern River Basin.

The basin of the South Fork of the Kern River upstream from the gaging station near Onyx is about 50 miles long and increases in width southward, from about 6 miles in the headwater area to about 18 miles near the mouth. The headwaters are at an altitude of about 10,500 feet and the gaging station is at 2,900 feet. The basin is characterized by low, flat, and irregular hills, separated by meadows. Granitic rocks are predominant, but there are also limestones, slates, and schists in the basin. Between the upper and lower gaging stations, near Onyx and at Isabella, the river flows for 18 miles on alluvium at flat slopes. In this reach the floods are much affected by channel or ground-water storage. This intermediate area drains granitic rocks but the rainfall is normally low and the contribution to the flow of the river is small. The run-off of the South Fork is much less than that of the main branch, and the peak of the snowmelt normally comes earlier than from the Sierra streams to the north. The part of the basin of the Kern River upstream from the gaging station near Kernville is about 55 miles long and averages about 18 miles in width. From the headwaters in the north, at an altitude of about 13,000 feet, the river flows in an almost straight line southward through a deep canyon, with a steep slope to the gaging station at an altitude of about 3,550 feet. The upper part of the basin is characterized by high glaciated peaks and ridges and by deep canyons. Below this part the basin is underlain by granitic and metamorphic rocks, but the river flows on alluvium for about 10 miles above and below the junction with the South Fork at Isabella. Downstream from Isabella the river again flows through a canyon over granitic rocks, then through marine sediments along the edge of the foothills, and finally through alluvium for the last few miles above the gaging station near Bakersfield, which is at an altitude of about 470 feet.

Lines of equal precipitation in the Kern River Basin have been based on five records in the southern part of the basin and on scattered records in adjoining basins to the east and west, which may not be closely indicative of the precipitation in the headwater areas. As indicated by the isohyetals (see fig. 14, p. 46), the precipitation during the storm period, December 9 to 13, is assumed to have decreased from a total of 12 inches along the upper portions of the higher mountain areas lying between the headwaters of the upper Kern and Kaweah River Basins to about 4 inches along the eastern boundary and to less than 2 inches along the southern part of the basin. There was probably some snow on the ground on December 9 in the headwater areas, but the small total run-off indicates that there was little contribution from melting snow to the flood run-off.

An analysis of the direct run-off, as measured at five places within the basin, indicates that practically all of the stream flow at the gaging station on the Kern River near Bakersfield originated in the area above Kernville and in the South Fork of the Kern River above Onyx. These basins have a combined area of nearly 1,400 square miles, of which 95 percent lies above an altitude of 5,000 feet, 70 percent above 7,000 feet, and 33 percent above 9,000 feet. Based on the isohyetals as drawn, the storm precipitation over the drainage area above Kernville averaged 7.8 inches and above Onyx 4.3 inches. The total direct run-off was 0.65 and 0.15 inch, respectively. If it is assumed that the area above 9,000 feet did not contribute direct run-off to the stream channels because the precipitation had the form of snow, the total direct run-off from the contributing areas below 9,000 feet was 1.15 inches above Kernville and 0.2 inch above Onyx. In the absence of exact information as to the precipitation and run-off for the higher altitudes, it seems reasonable to assume that the representative run-off from the area which actually contributed may lie somewhere between 0.65 and 1.15 inches for the basin above Kernville and 0.15 and 0.2 inch for the basin above Onyx. From a study of differences in the measured stream flow, there was apparently little run-off from areas where the total storm precipitation was 5 inches

The maximum 24-hour direct run-off from the South Fork of the Kern River above Onyx was 0.05 inch, or 33 percent of the total direct run-off. This relatively low ratio may indicate some run-off from melting snow. The ratio between the momentary peak flow and the mean for the 24 hours of highest flow was 124 percent.

The determinations of the magnitude of the precipitation seem consistent insofar as rainfall is concerned. There may have been more precipitation in the headwater areas than is shown by the isohyetals, but if so, it apparently was in the form of snow and did not contribute materially to the flood run-off.

The heavy rainfall began to be reflected in the stage of the South Fork of the Kern River near Onyx on the morning of December 10 and high flows continued during all of that day and the next. The first of two small peaks came about midnight of December 11, and the second and higher one came about 8 a.m. on December 12.

None of the momentary peak discharges at the river-measurement stations on the South Fork of the Kern River and on the Kern River near Kernville approached the highest peaks on record. However, on March 2, 1938, a new peak of record was established on the South Fork of the Kern River near Onyx. All the peaks of record probably resulted from less total precipitation than in December 1937, but they occurred later in the rainy season after absorptive capacity of the ground had been considerably utilized. Also run-off from melting snow may have been a large factor associated with some of the storms that brought the record peaks. In these basins, as in many others, the storm of December 1937 undoubtedly would have produced greater peaks and more total run-off if there had been preceding rains to moisten the soil.

Tule and Kaweah River Basins

The Tule River rises at an altitude of about 9,300 feet above sea level near the top of the Great Western Divide, which is a secondary crest roughly paralleling the crest of the Sierra Nevada. The river flows westward and southwestward, and during flood periods reaches Tulare Lake. (See fig. 50.)

The eastern two-thirds of the basin is an eroded mountain region whose rather steep slopes have been carved by the action of primary and secondary stream systems. The western third is a region of rounded foothills. Granitic and metamorphic rocks predominate in the basin.

The basin upstream from the gaging station (altitude, 580 feet) is approximately triangular in shape, is about 24 miles long, and its watershed line follows the Sierra crest for 18 miles. About 43 percent of the basin is above an altitude of 5,000 feet. It is classed as a midslope stream.

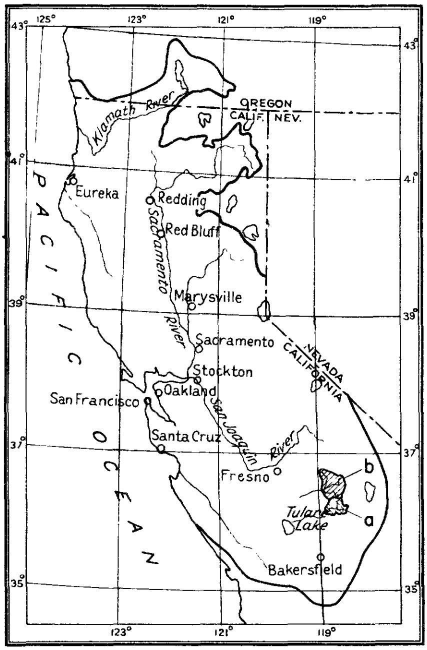

Figure 50.--Key map showing location of (a) Tule and (b) Kaweah River Basins.

The South Fork of the Tule River is not included in the basin upstream from the gaging station on the main river. The South Fork originates at an altitude of about 8,000 feet and flows generally westward. The gaging station, at an altitude of 750 feet, is about 16 miles from the source and about 5 miles upstream from the junction with the Tule River. About 40 percent of the basin upstream from the gaging station is at an altitude of more than 5,000 feet. Both granitic and metamorphic rocks are found in its basin. It is of the midslope type of Sierra Nevada stream.

The Kaweah River rises in Lion Lake, at altitude of 10,900 feet above sea level, and follows a general southwestward course. During flood periods it reaches Tulare Lake through various channels across its ancient delta. The upper parts of the basin are very rugged and contain many domes and ridges, interspersed between upland meadows and small glacial lakes. Granitic rocks predominate in the headwater areas, and there are some limestone and schist in the lower portions. The river and main tributaries have fairly well developed canyons and moderately steep slopes. The basin upstream from the gaging station near Three Rivers (altitude, 620 feet) is about 22 miles long and borders the crest of the Great Western Divide for about 20 miles. The average altitude of the basin is much higher than that of the Tule River Basin, 62 percent of its area being above an altitude of 5,000 feet. The Kaweah River is a typical High Sierra river.

The lines of equal precipitation are fairly well defined by observations in the Tule River Basin, excluding the South Fork, and in the Kaweah River Basin, excluding the North Fork. In the higher parts of the basins the isohyetals are based largely on observations near Springville (14.68 inches; altitude, 4,050 feet), Giant Forest (16.28 inches; altitude, 6,360 feet), and General Grant National Park (15.10 inches; altitude, 6,775 feet). The isohyetals have been constructed on the assumption that these observations indicate the precipitations that may have occurred over relatively small areas and that there was a reduction in the amount of rainfall at higher altitudes.

The observed run-off at all four gaging stations is not affected by artificial storage. The total storm precipitation was in excess of 11 inches in the Kaweah River Basin and it is probable that nearly all of the drainage area contributed direct run-off during the storm period. The lower parts of the Tule River Basin and the South Fork of the Tule River Basin had less than 5 inches of rainfall and probably contributed but little to the flood run-off. The direct run-off (table 7, pp. 311-316) from the four areas was 0.35 inch for the South Fork of the Tule, 1.1 inches for the Tule, 1.85 inches for the Kaweah, and 1.6 inches for the North Fork of the Kaweah River Basins.

On the assumption that there was no direct run-off from the areas above an altitude of 9,000 feet and that there was negligible contribution from those areas in the Tule and South Fork of the Tule River Basins where the precipitation was less than 5 inches, the adjusted direct run-off would be 0.35 inch for the South Fork of the Tule, 1.15 inches for the Tule, 2.15 inches for the Kaweah, and 1.6 inches for the North Fork of the Kaweah River Basins. The differences for those basins between adjusted rainfall and adjusted run-off are 7.45 inches, 9.95 inches, 9.95 inches, and 10.8 inches respectively.

The total direct run-off during the 24 hours of greatest flow ranged from 0.15 inch in the South Fork of the Tule River Basin to 0.95 inch in the Kaweah River Basin and the degree of concentration of run-off, as expressed by the ratio between the maximum 24-hour run-off and the total run-off during the flood period ranged from 43 percent to 56 percent. The momentary peak discharge was from 2.35 to nearly 3 times greater than the average discharge for the 24 hours of greatest flow. The recording rain gage at Fresno indicated heavy rain during the afternoon of December 9 and a few hours of lighter rain in the forenoon of December 10. Then there was a heavy rain in the forenoon of December 11 with a maximum intensity about 7 a.m., and a short sharp peak of great intensity between 4 and 5 p.m. on the same day. These periods of high rainfall were reflected in high flow during the whole forenoon of December 10, followed by a recession during the afternoon of that day and the early morning hours of the next day. Then there was a second and higher peak between 4 and 7 p.m. on December 11 at all four stations.

Momentary peak discharges on the Kaweah River near Three Rivers and the North Fork of the Kaweah River at Kaweah in December 1937 exceeded the previous peaks of record on those streams, whereas the momentary peaks on the Tule River near Porterville and on the South Fork of the Tule River near Success did not exceed the highest peaks on record. The total direct run-off for the storm reached a new record only at the gaging station on the Kaweah River.

Kings River Basin

The Kings River has its source in many small glacial lakes at altitudes of 12,000 feet and more, near the crest of the Sierra Nevada. (See figure 51 for location of the basin.) The topography is very rough and irregular, being characterized by sharp peaks and ridges, precipitous canyons, and granite domes. Many small lakes and meadows are scattered through the upper part of the basin. The middle portion is the most rugged area in the entire Sierra Nevada. The canyon of the main river below the junction of the Middle and South Forks is more than 5,000 feet deep, and thus is one of the deepest canyons in the continental United States. Nearly all the tributaries also run in deep canyons cut through solid granite, and those on the South Fork and the Middle Fork (Tehipite Valley) are noted for their resemblance to Yosemite Valley. The basin is largely underlain by granitic rocks, but a broad belt of metamorphic rocks traverses the area from northwest to southeast, crossing in the vicinity of the junction of the Middle and South Forks. The Kings River is a typical High Sierra river. During flood periods the river reaches Tulare Lake. The basin upstream from Piedra has a radial distance of about 40 miles to the north and 60 miles to the east. The altitude at this gaging station is about 500 feet, but 71 percent of the basin is above 5,000 feet.

The portion of the basin upstream from the gaging station located on the main stream just above the mouth of the North Fork, is fan-shaped with a radial distance of 32 to 40 miles. The gaging station is at an altitude of 1,020 feet, and 89 percent of the basin is above 5,000 fee

The highest precipitation stations within the Kings River Basin and also the places where the greatest precipitation was recorded are Cliff Camp (altitude, 6,150 feet) and General Grant National Park (altitude, 6,775 feet) where the total precipitation was 12.19 inches and 15.10 inches, respectively. Half of the Kings River Basin upstream from Piedra lies at an altitude above 7,000 feet and 30 percent lies at an altitude above 9,000 feet. In this large high area between Cliff Camp, General Grant National Park, and the eastern boundary of the basin, there is little, if any, basic information that will definitely locate the isohyetals, and the computed precipitation may not be indicative of actual conditions.

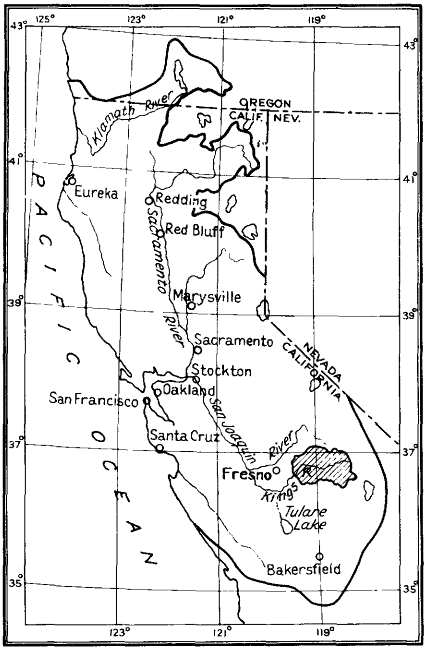

Figure 51.--Key map showing location of Kings River Basin

No complete record showing the distribution of the precipitation with respect to time is available within the basin. At the experimental station of the United States Forest Service in the Big Creek area near Trimmer, where the total storm precipitation was somewhat more than 12 inches, partial failure of recording apparatus made it impossible to determine accurately the maximum intensities. The partial precipitation record and also the recording graphs of river stages indicate that there were two periods of great rainfall intensity about 12 hours apart, and that probably the period of maximum intensity was during the last storm period, during the morning of December 11. The peak discharge on the Kings River at Piedra was reached between 4 and 4:30 p.m.

River-measurement stations of the San Joaquin Light & Power Corporation on the North Fork of the Kings River at Cliff Camp and below Rancheria Creek, and on Dinkey Creek did not operate during the entire flood period as a result of failure of the water-stage recorders caused by over-topping or other difficulties.

In these areas the storm precipitation may have exceeded the 12 to 14 inches indicated by the isohyetals. As indicated by differences in the flow of the Kings River above the North Fork and at Piedra, the total direct run-off in inches from the intermediate areas of the North Fork, Dinkey Creek, and a small foothill area was about twice that of the Kings River above the mouth of the North Fork.

There is very little artificial storage within the basin and the observed records represent natural flow. The direct run-off (table 7, pp. 311-316) for the Kings River Basin above the North Fork was 1.1 inches; for the Kings River above Piedra, 1.5 inches; and for the intermediate area, about 2 inches. If it is assumed that there was a negligible contribution to the run-off from areas lying above 9,000 feet, the direct run-off below 9,000 feet would be 1.95 inches for the area above the North Fork and 2.25 inches for the entire basin above Piedra.

The differences between rainfall and direct run-off are 7.0 inches and 8.2 inches for the Kings River above the North Fork and at Piedra, respectively. These differences do not indicate that there was any material contribution to the run-off from snow on the ground prior to the storm. In fact, the low run-off values, expressed in inches over the area, may indicate an over-estimation of the area that actually contributed flood run-off, and the high residuals may indicate that some of the precipitation fell as snow that did not melt. Assuming no run-off above 9,000 feet, the adjusted average precipitation would be 11.1 and 11.4 inches, the adjusted run-off would be 1.95 and 2.25 inches, and thus the adjusted residual would be 9.15 inches in each instance for the areas on the Kings River above the North Fork and above Piedra. Somewhat more than 60 percent of the total run-off passed the river-measurement stations during the 24-hour period of greatest flow. This high ratio signifies that there may have been but little run-off from melting snow during the flood period. The peak discharge of the Kings River above the mouth of the North Fork was 2.41 times the maximum 24-hour average and at Piedra 1.82 times the maximum 24-hour average.

Momentary peak discharge and total direct run-off from the Kings River above the North Fork and the Kings River at Piedra exceeded the previous record. At Piedra there was slightly more precipitation in the storm of January 1914 than in December 1937 and it fell on ground previously moistened. However, there was heavy snow at an altitude of about 6,000 feet at the beginning of the storm of 1914, and the snow line lowered about 2,000 feet in altitude during the storm, making the amount of precipitation available in the form of water approximately equal to that in 1937.

Upper San Joaquin River Basin

The San Joaquin River rises in the High Sierra south of Yosemite National Park and flows southwestward to the trough of the San Joaquin Valley, whence it takes a northwestward course to its mouth. (See figure 52.) Near the headwaters numerous small glacial lakes and smooth bare domes and ridges bear testimony to the former presence of great glaciers, and near the highest peaks small glaciers still exist. The region between the crest and the edge of the valley is cut into canyons by many long perennial streams. About 68 percent of the area upstream from Skaggs Bridge is above an altitude of 5,000 feet. Downstream from Skaggs Bridge the river becomes a winding stream of flat gradient. Much of the area in the lower valley is subject to overflow.

The South Fork of the San Joaquin River, Bear Creek, and Mono Creek all rise in glacial lakelets along the crest of the Sierra Nevada at altitudes of 11,000 to 12,000 feet and flow in a general westerly direction. They are typical High Sierra streams. The gaging stations are at altitudes of 7,200, 7,400 and 7,400 feet, respectively. Florence Lake reservoir is on the South Fork, just upstream from the gaging station.

There are metamorphic formations in each basin, but granitic rocks are predominant. Each basin has several small tributaries, but the South Fork has two main branches which unite half-way from the source to the gaging station.

Big Creek and Pitman Creek rise at altitudes between 9,000 and 10,000 feet, and flow in a general westerly direction among granitic rocks. The gaging stations are at altitudes of 6,600 and 7,100 feet, respectively. They are small High Sierra streams. Huntington Lake reservoir is in the Big Creek Basin.

The basin of the North Fork of Willow Creek, upstream from the gaging station below Crane Valley Reservoir, is approximately rectangular in shape and extends about 12 miles north and south and about 5 miles east and west. Granitic rocks predominate in the basin, but quartzite, limestone, slate, and schist are found around Crane Valley Reservoir. The longer of the two main branches rises at an altitude of about 8,000 feet. The run-off is measured at an altitude of about 2,900 feet.

The two upper branches of Fine Gold Creek rise at an altitude of about 4,000 feet and flow in a general southerly direction. The gaging station is at an altitude of about 680 feet. It is a typical foothill stream. Formations are similar to those in the Willow Creek Basin and granite predominates.

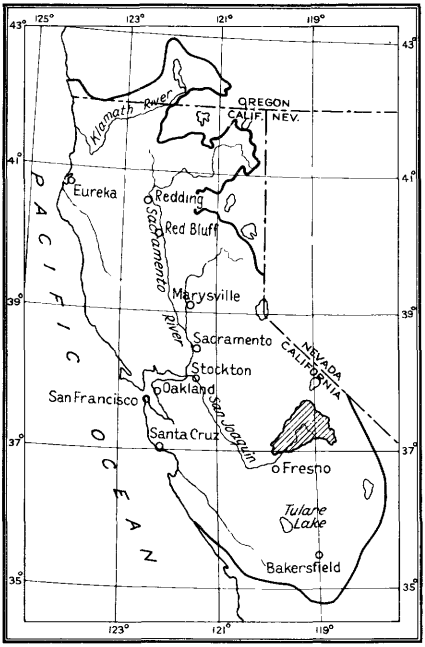

Figure 52.--Key map showing location of upper San Joaquin River Basin.

Big Sandy, Cottonwood, and Little Dry Creeks have small basins tributary to the San Joaquin River in the vicinity of Friant. They may be considered foothill streams. Cottonwood and Little Dry Creeks rise at altitudes between 1,000 and 2,000 feet, and each drops to about 360 feet at the gaging stations, whereas Big Sandy Creek rises at about 4,000 feet and drops to 1,300 feet at the gaging station. Granite predominates in all three basins.

The San Joaquin River Basin upstream from the gaging station near Friant, which contains all the previously mentioned basins, is shaped approximately like an equilateral triangle, about 55 miles on a side, with one side following the crest of the Sierra Nevada. The intermediate area not included in previously mentioned basins is underlain by granitic and volcanic rocks. The gaging station near Friant is at an altitude of 315 feet. Four large reservoirs - Florence, Huntington, and Shaver Lakes, and Crane Valley Reservoir - are in the basin upstream from Friant. Between the gaging stations near Friant and at Skaggs Bridge the San Joaquin River flows over sedimentary rock formations for about 10 miles and over alluvium on the valley floor for about 20 miles.

The San Joaquin River, considered as a whole from any point upstream from Skaggs Bridge, clearly falls into the class of High Sierra rivers. Downstream from that point its nature is changed by works of man.

There are 15 precipitation records in the San Joaquin Basin upstream from Friant. Most of these are concentrated in the southwest third of the area, and here the lines of equal rainfall are well defined. The only precipitation stations at notably high altitudes are those at Florence Lake (altitude, 7,400 feet) and Huntington Lake (altitude, 7,000 feet). There are also records at an altitude of about 5,400 feet at Shaver Lake and Central Camp. There are no precipitation data in areas with altitudes above 9,000 feet. Such areas comprise 42 percent of the drainage area of the San Joaquin River above Big Creek and about 80 percent of the drainage area above the river-measurement stations on Bear Creek, Mono Creek, and the South Fork of the San Joaquin River near Florence Lake. Records at Bishop Creek, Lake Sabrina, South Lake, Gem Lake, and Ellery Lake are of considerable aid, although they are on the eastern slope of the Sierra Nevada. In the high altitudes and in the northwest two-thirds of the basin the lines of equal rainfall are poorly defined.

Prior to the storm in December there was no snow on the ground at Huntington Lake or Florence Lake, but there was 12 inches of snow at Kaiser Pass (altitude, 9,300 feet) on November 30, some of which probably disappeared by December 9. At the beginning of the storm there was no snow on the eastern slope of the Sierra Nevada at South Lake (altitude, 9,620 feet), Lake Sabrina (altitude, 9,100 feet), Bishop Creek (altitude, 8,390 feet), and Gem Lake (altitude, 9,120 feet). As nearly as can be determined, all the precipitation was in the form of rain on December 9, 10, and 11 up to an altitude of 8,500 feet, a mixture of rain and snow between altitudes of 8,500 and 9,000 feet, and mostly snow above an altitude of 9,000 feet. On December 12, the last day of the storm, an inch of snow fell at Huntington Lake, and 5½ inches of wet snow fell at Florence Lake. There was probably an accumulation of snow at Kaiser Pass during the storm, as 19 inches remained on December 19. On the eastern slope of the Sierra Nevada, at South Lake 6 inches of snow fell on December 10, 5 inches on the 11th, and 5 inches on the 12th; at Lake Sabrina half an inch fell on the 9th, 2 inches on the 11th, and 6 inches on the 12th; at Bishop Creek, 2 inches fell on the 11th, and 1 inch on the 12th; at Gem Lake, 7 inches were on the ground on December 12. All this snow was very wet.

The observed run-off of Bear, Mono, Pitman, and Fine Gold Creeks is unregulated. The run-off of the South Fork of the San Joaquin River near Florence Lake and the San Joaquin above Big Creek is affected by artificial storage in Florence Lake and by diversion to Ward tunnel. This storage and diversion amounted during the flood period to 1.15

inches over the basin of the South Fork of the San Joaquin above the gaging station near Florence Lake and 0.2 inch over the basin of San Joaquin above Big Creek. The run-off of Big Creek below Huntington Lake was affected by storage in Huntington Lake and diversion into and out of the basin. The net total of this storage and diversion amounted to 3.05 inches. The run-off of the North Fork of Willow Creek at Crane Valley Reservoir was affected by storage in the reservoir and by some diversions, all of which amounted to 3.0 inches. The run-off of the San Joaquin River near Friant was affected by storage in Florence Lake, Shaver Lake, Huntington Lake, and Crane Valley Reservoir, amounting to 0.25 inch over the drainage area. The observed run-off from the above-mentioned basins has been adjusted on the basis of changes of storage in the reservoirs to show natural run-off. (See table 7, cols. 4, 5.)

The adjusted total run-off, in inches, from the drainage areas upstream from the gaging stations on the San Joaquin River above Big Creek, Mono Creek, Bear Creek, and the South Fork of the San Joaquin River near Florence Lake were 2.05, 0.40, 0.45, and 1.15 inches, respectively. If it is assumed that the area above an altitude of 9,000 feet did not contribute to the stream flow, the run-off, in inches, from the areas below 9,000 feet would be 3.55, 1.6, 2.35 and 6.45 inches, respectively. These latter figures are more consistent and are believed to represent more nearly the conditions existing during the storm.

The differences between rainfall and run-off range from 5.6 and 5.95 inches on Mono and Bear Creeks to 10.35 and 12.5 inches on Pitman Creek and the North Fork of Willow Creek. On the assumption that there was no run-off above 9,000 feet, the residuals for Mono and Bear Creeks are about 5.0 and 4.2 inches respectively. The residuals for the North Fork of Willow Creek and for Pitman Creek appear to be large. However, there was a residual of 7.35 inches for the Fine Gold Creek Basin where the precipitation was less than that in either the Willow or the Pitman Creek Basin by more than 4 inches.

There are four recording rain gages in the basin above Friant - one each at O'Neals and at Bass Lake and two at North Fork. All of them indicated (fig. 27, p. 62) continous rainfall of high intensity during the afternoon and evening of December 9 and the morning of the 10th. There was one peak in the rainfall rates just before midnight, and another about 4 a.m. on the 10th. This heavy rain produced moderate rises on the San Joaquin River above Big Creek and on Fine Gold Creek. Bear, Mono, and Pitman Creeks rose only slightly. There was another rainfall of short duration but of the highest recorded intensity between 2 and 3 p.m. on the 11th. Pitman Creek reached its highest stage at noon on the 11th, and the San Joaquin River above Big Creek and Fine Gold Creek reached their maximum stages at 4 and 6 p.m., respectively, on December 11. Bear and Mono Creeks were highest in the afternoon of December 11, but they did not reach extreme stages. The snow cover at these high altitudes was apparently heavy enough so that it absorbed most of the precipitation that fell as rain. The ratios between the run-off during the 24 hours of highest flow and the total run-off for the storm are 33, 25, 68, and 71 percent for Bear, Mono, Pitman, and Fine Gold Creeks, respectively. The low ratios for Bear and Mono Creeks probably indicate the influence of snow in the basins. Ratios between the rates of flow at the momentary peak and for the 24 hours of highest flow are 247, 180, 243, and 272 percent, respectively, for the same streams.

The momentary peak and total direct run-off for Pitman Creek greatly exceeded the previous records, but subsequent highest peaks of record were established on Fine Gold Creek and Mono Creek in 1938. The peak on Pitman Creek on May 13, 1937, and the peaks on Mono Creek in 1927 and 1938 resulted from melting snow and not from direct precipitation.

Fresno and Chowchilla River, Mariposa and Bear Creek Basins

The Fresno and the Chowchilla Rivers and Mariposa and Bear Creeks all rise among foothills or low mountains, part way up the western slope of the Sierra Nevada, and flow southwestward. (See fig. 53.) The Fresno River belongs to the midslope type of Sierra streams. The others belong to the foothill group.

One branch of the Fresno River rises at an altitude of about 8,000 feet and the other at about 6,000 feet. Both flow in a general southwesterly direction half-way to the gaging station, then unite and flow southward. The gaging station near Knowles is at an altitude of about 1,140 feet. Only a few square miles of the drainage area are at an altitude of more than 5,000 feet. The basin is about 18 miles long, 12 miles wide in the middle, and 6 miles wide at the upper and lower ends. Granitic rocks predominate, but limestone, slate, and schist are in the area. The drainage area between the gaging stations near Knowles and near Daulton is about 20 miles long and 6 miles wide, although the air-lines distance between the stations is only about 12 miles. The altitude of the lower gaging station is about 390 feet. The rocks in this

The five branches of the Chowchilla River rise at altitudes ranging from 2,000 to 4,000 feet, and the gaging station is at an altitude of about 390 feet. The length of the basin is about 24 miles to the gaging station, and the width is 10 to 12 miles. The geologic formations are similar to those in the Fresno River Basin, but the lower end of the stream above the station flows through slate formations.

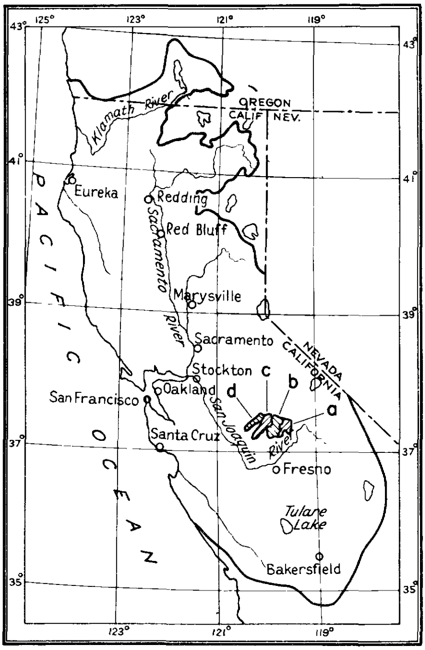

Figure 53.-- Key map showing location of (a) Fresno River, (b) Chowchilla River, (c) Mariposa Creek, and (d) Bear Creek Basins.

Mariposa and Bear Creeks rise at an altitude of about 2,000 feet and flow in a general southwesterly direction. The gaging stations are on the floor of the San Joaquin Valley. Mariposa Creek Basin, upstream from the gaging station, is about 24 miles long and 2 to 8 miles wide, whereas Bear Creek Basin is about 20 miles long and 10 miles wide. Both basins contain granitic rocks and a variety of metamorphic rocks, but Mariposa Creek flows among non-marine sediments for several miles upstream from the gaging station, whereas for the lower 5 miles Bear Creek flows over alluvium.

Although there are no precipitation stations in the Fresno or Chowchilla River Basins and only one each in the Mariposa and Bear Creek Basins, it is believed that precipitation records in adjacent basins may be fairly indicative of precipitation within the four basins mentioned. There was no snow in these drainage areas during the storm period.

The total precipitation over the areas ranged from 2.5 to 14 inches. The precipitation record at the San Joaquin Experimental Station of the United States Forest Service near O'Neals (fig. 27, p. 62) should be fairly indicative of the distribution of the storm rainfall with respect to time in the headwater areas. At O'Neals the precipitation fell in two principal storms, lasting from noon December 9 to about 7 a.m. December 10 and from 6 p.m. December 10 to 8 p.m. December 11, with maximum intensities during the afternoon of December 11. The maximum stage was recorded on December 11 at 2 p.m. at the Mariposa Creek gaging station, at 4 p.m. at the Fresno and Chowchilla Rivers gaging stations, and at 6 p.m. at the Bear Creek gaging station.

The total direct surface run-off from these basins was very small in comparison with other basins herein considered, being 0.75 inch from the Fresno River near Knowles, 0.65 from the Chowchilla River, 0.4 inch from Mariposa Creek, and 0.45 inch from Bear Creek. The difference between rainfall and run-off, assuming that all of the drainage area was contributing, was 10.25 inches in the Fresno and 7.05 inches in the Chowchilla River Basins, 5.1 inches in the Mariposa and 3.35 inches in the Bear Creek Basins. The low residual in the Chowchilla River, Mariposa Creek, and Bear Creek Basins probably indicates that there was an amount of rain insufficient to utilize all their absorptive capacity. Assuming that there was run-off only from areas having total storm precipitation of more than 5 inches, the mean precipitation on such areas would be 8.35 inches for the Chowchilla River, 7.1 inches on Mariposa Creek, and 5.95 inches on Bear Creek. The run-off adjusted for corresponding areas would be 0.8, 0.75, and 2.3 inches, and the corresponding residuals would be 7.55, 6.35, and 3.65 inches, respectively. Examination of these figures suggests that the indicated precipitation on Bear Creek Basin may be lower than the actual and that the area above the 5-inch isohyetal should be larger.

There is no material storage in these basins and the observed flow at the river-measurement stations represents natural run-off. The maximum run-off during a 24-hour period was 0.45 inch for the Fresno and 0.4 inch for the Chowchilla River, 0.3 inch for Mariposa and 0.35 inch for Bear Creek. These run-offs represent about 61 percent of the total run-off from the Fresno and Chowchilla River Basins and about 76 percent of the total run-off from Mariposa and Bear Creek Basins. Ratios between the momentary peak discharge and the maximum 24-hour averages are 208, 272, 345, and 409 percent for the Fresno and Chowchilla Rivers, and Mariposa and Bear Creeks, respectively.

The momentary peak discharges of the Fresno and Chowchilla Rivers did not equal the previous peaks of record, but new maxima were established on each in March 1938.

There was much less rain during the storm of March 12, 1938, on the Fresno Basin and slightly less rain during the storm of March 2, 1938, on the Chowchilla Basin than during the storm of December 1937. However, the storm of March 1938 occurred toward the end of the rainy season and there was apparently much less capacity for absorption than during December 1937.

Merced River Basin

The Merced River drains a part of the western slope of the Sierra, but touches the crest of the Sierra only at Mount Lyell (altitude, 13,090 feet) which is common to the upper San Joaquin Basin on the south, the Tuolumne Basin on the north, and the Great Basin on the east. The river has its sources in numerous small glacial lakes at altitudes of 10,000 feet and above. It flows in a general southwesterly course and joins the lower San Joaquin River on the floor of the Great Valley. The mountainous portion of the basin is about 65 miles long and 20 to 25 miles wide. (See fig. 54.)

The outstanding topographic feature is Yosemite Valley, less than a mile wide and about 7 miles long. The almost flat valley floor (altitude, about 3,900 feet) is margined by cliffs that rise almost vertically 2,000 to 3,000 feet. In the upper basin are other smaller valleys, but the surrounding topography is very rough and broken and is characterized by jagged peaks, precipitous walls, and bare granite domes. In parts of the basin there are large areas of massive, ice-smoothed granite. Although the percentage of rainfall that runs off from such areas must be high, there is a compensating effect in the talus slopes, mountain meadows, and lakes found nearby.

Of the part of the basin upstream from the gaging station at Exchequer, 53 percent is above an altitude of 5,000 feet. The Merced River and its headwater tributaries are typical High Sierra streams.

The basin upstream from Yosemite Valley is underlain almost entirely by granitic rocks. The floor of Yosemite Valley consists of glacial deposits and alluvium. Downstream there is a mixture of granitic, metamorphic, and sedimentary rocks.

Lake McClure, an artificial storage reservoir, occupies the channel of the Merced River for most of the distance between the gaging stations at Kittridge and at Exchequer.

Lines of equal rainfall in the Merced River Basin (fig. 16) are based on observations at Yosemite (altitude, 3,983 feet) with some weight given to the observations at Ellery Lake (altitude, 9,600 feet) and Gem Lake (altitude, 9,120 feet) lying in Mono Lake Basin east of the divide.

In view of the scarcity of the observations, computed areal rainfall may be considerably in error. In the absence of snow observations, it is assumed that above an altitude of 9,000 feet all of the precipitation took the form of snow, and that between 7,500 and 9,000 feet there was snow on the ground prior to the storm period. Some or all of the snow at the lower altitudes probably melted during the flood. The precipitation was partly as snow on December 9 and 12, but largely as rain on December 10 and 11. About 90 percent of the Merced drainage basin above Yosemite lies at an altitude above 7,000 feet, and 10 percent of the area lies above 9,000 feet.

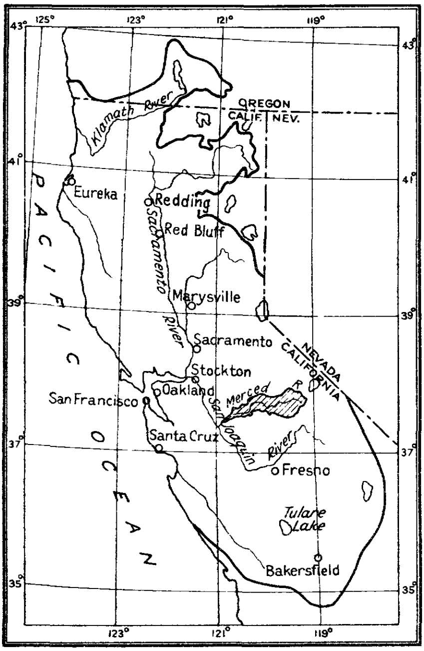

Figure 54.--Key map showing location of Merced River Basin.

The observed flow at the river-measurement stations upstream from Kittridge was essentially natural. Practically all of the direct run-off was impounded in Lake McClure, downstream from Kittridge.

Probably somewhat more than 12 inches of precipitation fell over each of the headwater basins. There was, however, considerable variation in the total direct run-off during the flood period expressed in inches over the drainage basins. The indicated amounts (table 7, see pp. 311-316) were 2.0 inches for the Merced River above Happy Isles, 4.95 for Tenaya Creek, 3.55 inches for the Merced River above Pohono Bridge, and about 5.95 inches for the area between Happy Isles Bridge and Pohono Bridge. If it is assumed that the area above an altitude of 9,000 feet was essentially non-contributing, the total direct run-off in inches for the parts of the basins below 9,000 feet would be 4.2 inches for the Merced River above Happy Isles Bridge, 5.55 inches for Tenaya Creek Basin, and 5.2 inches for the Merced River above Pohono Bridge. These run-off values are more consistent, although considerably less, than the higher run-off values indicated in the upper Tuolumne River Basin.

Using these adjusted run-off values and revised precipitation over the contributing area, the difference between rainfall and run-off would be about 9.3, 7.6, and 8.3 inches for basins above the Happy Isles Bridge, Pohono Bridge, and Tenaya Creek gaging stations, respectively. These relatively high residuals indicate that there was apparently little contribution to run-off from snow, which may have been on the ground prior to the storm period, and suggests the possibility that part of the indicated precipitation had the form of snow and remained on the ground. Based on differences betweem the stream flow at Pohono Bridge and that at Kittridge, the direct run-off for the intervening area was 1.6 inches and the residual 9.85 inches, the results being comparable with those for the adjacent basins of the South and Middle Forks of the Tuolumne River. The maximum peak stages in the headwater areas were between 1:30 and 4:00 p.m. on December 11. On an average, 60 percent of the total run-off was during the 24-hour period of maximum flow. The instantaneous peak discharge was 50 to 90 percent greater than the mean of the 24-hour maximum discharge, except at Pohono Bridge, where it was only 26 percent greater. The latter figure probably reflects the effect of the channel and overflow storage in Yosemite Valley, where about half the valley floor was inundated.

The momentary peak discharges for the flood of December 1937 greatly exceeded the previous maxima for the Merced River at Happy Isles Bridge, the Merced River at Pohono Bridge, and Tenaya Creek near Yosemite. (See table 9, p. 337.) The total direct run-off for the storm was also greater for the flood in December 1937 than for the previous largest flood on the Merced River at Kittridge and on Tenaya Creek near Yosemite. The total direct run-off for the flood of December 1937 was less than that for the previous high flood for the Merced River at Happy Isles Bridge and Pohono Bridge, but the previous floods at these gaging stations were due mostly to melting snow in May and June.

Tuolumne River Basin

The Tuolumne River has its source in Lyell, Maclure, and other glaciers and in extensive snow fields and snow drifts on the upper portions of the Sierra Nevada. It flows westward through upland meadows and then through a deep canyon nearly 80 miles long cut in solid granite. The upper part of this canyon, 3,000 to 4,000 feet deep, is one of the notable topographic features of the State and is known as the Grand

Canyon of the Tuolumne. At the lower end of the Grand Canyon is Hetch Hetchy Valley, which is smaller than Yosemite Valley but in every other way greatly resembles it. Hetch Hetchy Reservoir now occupies the floor of the valley. Finally the river passes through the lower canyon, through Don Pedro Reservoir, and into the San Joaquin Valley, which it enters near La Grange. (See fig. 55.)

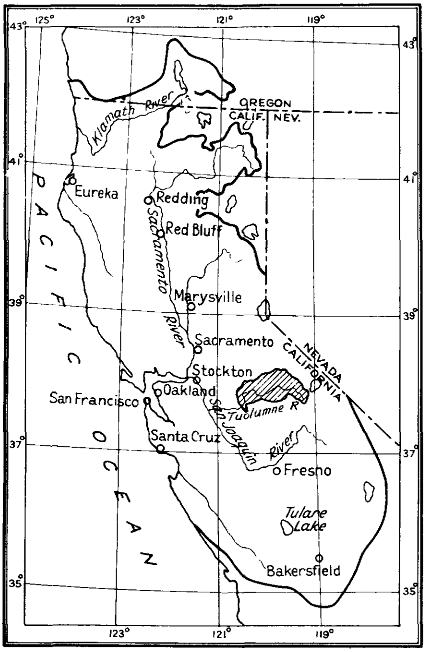

Figure 55.--Key map showing location of Tuolumne River Basin.

Typical features of the basin are large areas of bare glaciated granite and rugged domes and cliffs. The granite formation typical of this and many other Sierra basins does not necessarily mean that they are lacking in absorptive capacity. Meadows, lakes, and glacial deposits are numerous. The granite contains many cracks, and many of the cliffs have extensive talus slopes at their feet. Limestone is present in the lower part of the basin.

The Tuolumne River Basin, considered as a whole upstream from the base river-measurement station near La Grange (altitude, 330 feet), is roughly trapezoidal in shape and lies on the western slope of the Sierra Nevada. It has a width of more than 40 miles along the crest and a length of about 70 miles from the crest to La Grange. About 59 percent of the area upstream from La Grange is above an altitude of 5,000 feet. The Tuolumne River and its headwater tributaries are typical High Sierra streams.

Cherry Creek and its tributary, Eleanor Creek, are alike in many respects. The Cherry Creek gaging station is upstream from the junction with Eleanor Creek and measures the flow from a basin about 20 miles long, ranging in altitude from 9,500 to 4,800 feet. The Eleanor Creek gaging station is just downstream from Lake Eleanor, and the basin above it is also about 20 miles long and ranges in altitude from 10,000 to

4,600 feet. The geology of these basins is practically the same as that of the upper Tuolumne River Basin.

The basins of the Middle Tuolumne River and the South Fork of the Tuolumne River, upstream from their respective gaging stations, are about 25 and 20 miles long, and 5 to 6 miles wide at the widest parts. Each stream rises at an altitude of about 8,000 feet and flows westward without important tributaries. Each gaging station is 2,800 feet above sea level. The basins are almost exclusively underlain by granitic rock, but the South Fork flows over metamorphic formations for a few miles upstream from the gaging station. These two streams do not originate at the Sierra crest. They are of the midslope type of Sierra streams. About two-thirds of the basin areas are over 5,000 feet in altitude and a very small portion is over 7,000 feet.

Woods Creek is a characteristically foothill type of stream with three principal branches. It flows in a generally southerly direction among various formations that include granite and metamorphic rocks. It heads at an altitude of about 2,000 feet and the gaging station is at 645 feet.

The only precipitation observations in the headwater areas are those at Hetch Hetchy (altitude, 3,530 feet) and Lake Eleanor (altitude, 4,600 feet). From 60 to 84 percent of the Tuolumne River, and of Falls, Cherry, and Eleanor Creek Basins upstream from Hetch Hetchy are above an altitude of 7,000 feet, and from 10 to 50 percent of these basins lie above 9,000 feet.

In view of the scarcity of observations, the lines of equal rainfall in the headwater areas are subject to error.

There was no snow on the ground at Lake Eleanor and at Hetch Hetchy prior to the storm period, and all of the precipitation had the form of rain. It is assumed that precipitation fell as snow above an altitude of 9,000 feet, and as rain and snow between 7,500 and 9,000 feet altitude.

During the flood period the observed discharge of Falls Creek, Cherry Creek, the Middle and South Forks of the Tuolumne River, and Woods Creek was essentially natural. The flow of the Tuolumne River at Hetch Hetchy was materially modified by storage in Hetch Hetchy Reservoir, amounting to 2.85 inches over the area; of Eleanor Creek by storage in Lake Eleanor, amounting to 5.05 inches; and of the Tuolumne River near La Grange by storage in Don Pedro Reservoir, in addition to that in Hetch Hetchy Reservoir and Lake Eleanor, amounting to a total equivalent to 3.0 inches over the drainage area. The natural run-off for the flood period has been determined by adjusting the observed run-off for changes in storage in the above-mentioned reservoirs.

The adjusted total direct run-off expressed in inches over the drainage areas is (table 7, pp. 311-316) 3.3, 6.75, 9.05, and 9.6 inches for the basins of the Tuolumne River near Hetch Hetchy, Falls Creek, Cherry Creek, and Eleanor Creek upstream from the river-measurement stations. If it is assumed that the run-off from the area above 9,000 feet did not contribute greatly to the stream flow, the flood run-off expressed in inches over the area below 9,000 feet would be 6.3, 10.7, 12.0, and 10.6, respectively.

The indicated differences between rainfall and run-off for the four upper stations, assuming the entire area was contributing, range from 2.75 to 6.7 inches. On the assumption that there was no material contribution to the stream flow from areas above 9,000 feet, the differences range from about 0.3 to 2.3 inches for the basins of Falls, Eleanor, and Cherry Creeks, to 4.8 inches for the upper Tuolumne River Basin. These values would indicate that there was either a substantial contribution from melt of antecedent snow or more rain than is indicated by the isohyetals. Although some of the headwater areas of the South and Middle Forks are at an altitude of more than 7,000 feet and the lines of equal rainfall (fig. 16, p. 48) show about the same total precipitation as for other headwater areas, the total direct run-off is only 1.9 inches for the South Fork of the Tuolumne River and 1.3 inches for the Middle Tuolumne River, with indicated differences between rainfall and run-off of 9.2 and 9.6 inches, respectively. These differences compare favorably with those for adjacent drainage areas to the south and indicate considerably less run-off and considerably more difference between rainfall and run-off than for the higher Sierra areas. In Woods Creek Basin there was probably little direct run-off. In the lower part of the basin, where the precipitation was less than 5 inches, the indicated total direct run-off of 1.0 inch is probably somewhat less than the actual amount from the contributing areas.

There were no recording precipitation stations within the basin, but the graphs of river stages indicate that the precipitation was marked by two storm peaks about 12 hours apart, the period of maximum intensity being probably during the morning of December 11. In the basins at high altitudes the maximum stages were between 2 and 4 p.m.

In the Woods Creek area the maximum stage was at 11:30 a.m. In the high basins the maximum peak discharge was about 50 percent greater than the average for the 24 hours of maximum run-off; in the South Fork and Middle Tuolumne, twice as large; and in the Woods Creek area three times as large. The ratio for Woods Creek is typical of that for the lower foothill areas where the precipitation rate materially exceeded the infiltration rate for only a short time, causing high intensity of run-off for a portion of the 24-hour period of maximum run-off and a relatively low flow for the remainder of that period. From 45 to 71 percent of the total direct run-off was during a 24-hour period.

The momentary peak discharges and total direct storm run-off for Falls Creek, Cherry Creek, the South Fork of the Tuolumne River, and the Middle Tuolumne River greatly exceeded the previous record.

The momentary peak on Woods Creek was only about half the previous peak of record. A new record peak was subsequently established on February 9, 1938, when direct run-off was also much greater and resulted from much more precipitation on wetter ground.

Stanislaus River Basin

The Stanislaus River drains a basin on the western slope of the Sierra Nevada, which ranges in width from about 20 miles along the crest of the Sierra to 10 miles near the lower end, and is about 55 miles long from the crest to the base gaging station below Melones power house. The river has its source in small glacial lakes at altitudes close to 9,000 feet, in rough and broken country. The three main branches flow southwestward in well developed canyons from 500 to 2,000 feet deep. They are typical High Sierra streams. About 57 percent of the area upstream from the base gaging station (altitude, about 500 feet) is at an altitude of more than 5,000 feet. (See fig. 56.)

The three main branches, referred to gaging stations, are the North Fork of the Stanislaus River near Avery, the Middle Fork of the Stanislaus River at Sand Bar Flat near Avery, and the South Fork of the Stanislaus River below Lyons Dam. The flow of the South Fork was measured also at the dam for Strawberry Reservoir, about 12 miles upstream from Lyons Dam. Granitic rocks and andesite are prevalent in the upper basins, but volcanic formations are also found. The downstream portion of the basin includes similar rocks, and also a variety of metamorphic rocks.

Lines of equal rainfall (fig. 16, p. 48) are fairly well defined by precipitation observations in the Stanislaus River Basin except in the headwater areas where the isohyetals are based on observations only at Lake Alpine (altitude, 7,500 feet), Strawberry (altitude, 5,720 feet), Spring Gap (altitude, 4,875 feet), and Sand Bar Flat (altitude, 4,875 feet). About 10 percent of the area upstream from Melones is above an altitude of 9,000 feet and 35 percent is above 7,000 feet. Up to an altitude of 5,600 feet there was no snow on the ground at the beginning of the storm, and all of the precipitation on December 9, 10, and 11 had the form of rain, but snow was associated with the rain on December 12.

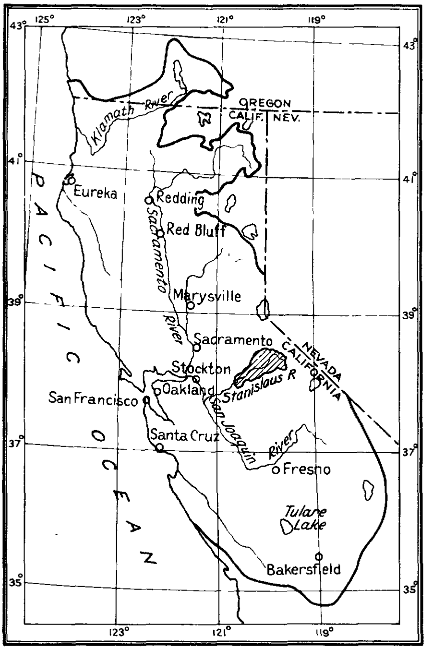

Figure 56.--Key map showing location of Stanislaus River Basin.

Above an altitude of 7,500 feet there was considerable snow on the ground, as indicated by the record at Lake Alpine of 13 inches on the ground on November 30. At these altitudes a portion of the precipitation on December 9 and 12 had the form of snow, although it appears that most of the precipitation on December 10 and 11 was rain.

The flow at all the river-measurement stations in the Stanislaus River Basin is modified by storage; that in the Middle Fork Basin by storage in Relief Reservoir, amounting to 0.5 inch over the drainage area; in the North Fork Basin by storage in Union, Silver Valley, Spicer Meadows, and Utica Reservoirs, amounting to 0.95 inch; in the South Fork by Lyons and Strawberry Reservoirs, amounting to 5.2 inches over the area above the lower station; and in the main stream by additional storage in Melones Reservoir for a total retained storage amounting to 2.4 inches over the drainage area. These estimates of storage have been based on observations at the larger reservoirs, Melones, Lyons, and Strawberry, and on estimated values for Relief Reservoir and all the smaller reservoirs, the total capacity of which comprises but a small part of the total.

The adjusted direct run-off (table 7, see pp. 311-316) for the Middle Fork of the Stanislaus River Basin above Sand Bar Flat was 4.3 inches, compared to almost 6 inches for the North and South Forks. It is possible that the differences result from inadequate adjustments for storage.

Melting snow may have contributed to the run-off of the Middle and North Forks of the Stanislaus River. The indicated differences between rainfall and run-off of 5.0 inches and 3.8 inches, respectively, would be increased somewhat if the total amount of water available for run-off (rainfall plus water content of the snow cover) were taken into account, making them more in conformity with the 5.45 inches for the South Fork and 6.0 inches for the Stanislaus River Basin as a whole.

Because of the necessary large adjustments for storage, no attempt was made to determine the natural maximum run-off during a 24-hour period or to determine the degree to which the natural run-off was concentrated with respect to time.

Calaveras River Basin

The basin of the Calaveras River upstream from the gaging station at Jenny Lind is about 36 miles long and 16 miles wide at the middle. (See fig. 57.) Only a very small part of the basin is above an altitude of 4,000 feet. There are six branches that rise at altitudes ranging from 3,000 to 5,000 feet along the lower western slope of the Sierra Nevada. The gaging station is at an altitude of about 220 feet. The geologic formations include granitic rocks, andesite, and metamorphic rocks in the headwater regions, and a variety of metamorphic rocks in the lower region. As the headwaters of the Calaveras River do not reach the higher slopes of the Sierra Nevada and as most of the basin is below an altitude of 4,000 feet, snowfall is an unimportant factor and the stream has the hydrologic characteristics of foothill streams.

Cosgrove Creek Basin is a very small area among low foothills and is a part of the Calaveras Basin. The headwaters originate at an altitude of about 1,200 feet and the gaging station is about 580 feet above sea level. The flow of the stream is very flashy, in common with all foothill streams. The geologic formations are extremely varied and include most of those listed for the Calaveras River, and also some sedimentary rocks.

All of the Calaveras River drainage basin is at an altitude of less than 5,000 feet. There was apparently no snow on the ground prior to the storm period and all of the precipitation during the storm period had the form of rain. The total precipitation ranged from 9 to 14 inches. As indicated by the recording precipitation gage at Fricot City, the precipitation was nearly continuous from 1 a.m. December 9 to 8 p.m. December 11 followed by showers between 4 a.m. and 8 a.m. December 12. Maximum intensities during the storm were reached early on the morning of December 11.

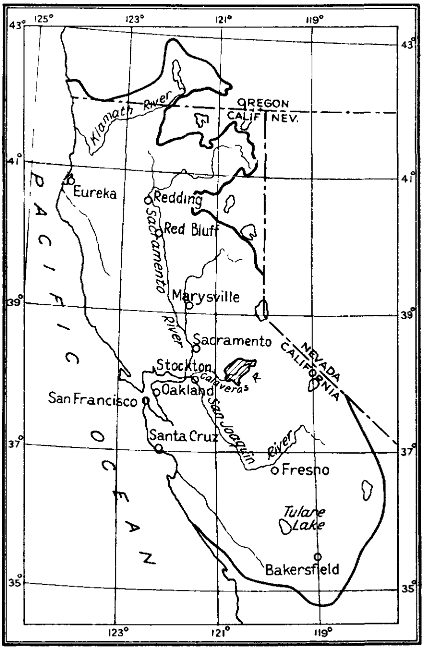

Figure 57.--Key map showing location of Calaveras River Basin.

At Cosgrove Creek near Valley Springs, where the flow was unaffected by storage but upstream from which the total rainfall was less than 4 inches, there was no appreciable run-off until morning of December 11 when the creek rose rapidly to its peak stage at 8:15 a.m., about 2 hours after the maximum rain intensity of 0.84 inch per hour at Fricot City and of 0.36 inch per hour at Fiddletown. The flow of the Calaveras River at Jenny Lind was materially modified by storage in Hogan Reservoir. Instead of a major peak stage and a large concentration of flow on December 11, the discharge was spread comparatively uniformly over a period of three days. Little storage was retained in Hogan Reservoir at the end of the flood period, and the total observed direct run-off approximates natural-flow conditions. In Cosgrove Creek Basin, where the flow was not affected by storage, 60 percent of the total direct run-off was during a 24-hour period and the instantaneous peak was 3.79 times the maximum discharge in a 24-hour period.

The indicated difference between rainfall and run-off was 3.35 inches for the Cosgrove Creek Basin and 5.25 inches for the Calaveras River Basin as a whole. It is evident that, except for a short period during the morning of December 11, the greater part of the precipitation in Cosgrove Creek Basin fell at intensities very little more than the capacity of the basin to absorb it. A similar condition probably existed in the lower portions of the Calaveras River Basin where the precipitation was less than 5 inches. Assuming no run-off below the 5-inch isohyetal, the precipitation for the net area in the Calaveras River Basin would be 7.55 inches, the adjusted run-off 1.4 inches, and the residual 6.15 inches.

The momentary peak and the total direct run-off for the storm for Cosgrove Creek near Valley Springs did not approach the record for the storm of February 22, 1936. The storm in 1936 produced much greater precipitation in this locality than the storm of December 1937, was more prolonged, and occurred later in the rainy season after other storms had partly utilized the absorptive capacity of the ground. There was no snow in either storm.

Cosumnes River and Sutter Creek Basins

The headwaters of the Cosumnes River rise at altitudes of about 7,000 feet on the western slope of the Sierra Nevada and flow in a westerly direction. The basin upstream from the gaging station (altitude, 190 feet) is about 45 miles long. (See fig. 58.) Only about a sixth of the Cosumnes Basin is above 5,000 feet, and the basin is separated from the crest of the Sierra by the American and Mokelumne Rivers. It is of the midslope type of Sierra Nevada rivers. The basin contains granitic rock, andesite, quartzite, limestone, slate, and shale.

The North Fork of the Cosumnes River Basin is similar to that just described. The basin upstream from the gaging station (altitude, 910 feet) is about 33 miles long.

Sutter Creek is essentailly a single stream that rises at an altitude of about 4,000 feet and flows southwestward. The basin upstream from the gaging station (altitude, 1,100 feet) is about 18 miles long, and has the characteristics of a foothill creek. The upper basin contains andesite, and the lower portion is underlain by quartzite, limestone, slate, and shale.

In these two basins, which are a part of the Mokelumne River Basin, precipitation for the storm is fairly well defined up to 8 or 9 inches by observations within and adjacent to the basins. The nearest recording precipitation gages are at Sacramento and Fiddletown (fig. 26) where the storm period extended from about 6 p.m. December 9 to 7 p.m. December 11, the period of maximum intensity being between 4 and 5 a.m.

December 11. All of the Sutter Creek drainage basin and 84 percent of the Cosumnes River basin above Michigan Bar are below an altitude of 5,000 feet and 98 percent of the area is below 7,000 feet. Observations indicate that there was probably no snow on the ground prior to the storm period and that practically all of the flood-producing precipitation had the form of rain.

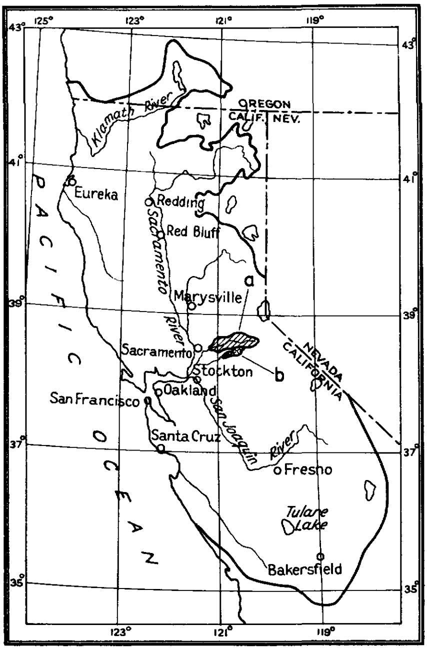

Figure 58.--Key map showing location of (a) Cosumnes River and (b) Sutter Creek Basins.

As there is no storage or diversion, the observed streamflow records represent natural flow conditions. Continuous records show pronounced increases in the river stage at noon December 10 and noon December 11 and crest stages between 3 and 4 p.m. December 11, thus reflecting two periods of high intensity in precipitation.

The direct run-off during the flood period was 0.9 inch over the basin of the North Fork of Cosumnes River above El Dorado, 0.7 inch over the area between El Dorado and Michigan Bar, and 0.8 inch from all the drainage basin above Michigan Bar. The average precipitation over the basin was about 7.0 inches, leaving a difference between rainfall and run-off of 6.2 inches. Of the total direct run-off about 50 percent flowed past Michigan Bar during the 24-hour period of greatest flow, ending at noon on December 12. The instantaneous peak discharge was about 50 percent greater than the average for the 24 hours of greatest flow. In the Sutter Creek Basin the storm precipitation averaged only about 5.5 inches and the storm run-off was but 0.45 inch.

In all probability there was little direct run-off in the lower part of the basin where the total storm precipitation was less than 5 inches and the actual run-off from the contributing area was probably somewhat greater than is indicated by the rate of 0.45 inch for the areas as a whole. On this assumption, the precipitation for the area within the 5-inch isohyetal would be 7.9 inches, the adjusted run-off for the corresponding area, 1.05 inches, and the residual, 6.85 inches.

Neither the momentary peak discharges nor the total direct run-off for the flood of December 1937 approached those resulting from previous floods of record on Sutter Creek, the North Fork of the Cosumnes River, and the Cosumnes River. This was as expected, inasmuch as the larger floods were the result either of very much more rain, or of about the same amount of rain augmented by melting snow or falling upon ground that had already received sufficient recent precipitation to utilize the absorptive capacity to a considerable degree.

Mokelumne River Basin

The Mokelumne River Basin, on the western slopes of the Sierra Nevada, is about 85 miles long from the crest of the Sierra to the downstream gaging station at Woodbridge (altitude, 30 feet). It has a width of about 20 miles along the crest and of only 2 to 5 miles in the lower half. (See fig. 59.) The source of the river is in glacial lakelets at altitudes between 8,000 and 9,000 feet, and the course is generally in a southwesterly direction. The main branch, the North Fork, has cut a deep canyon, a part of which is now occupied by Salt Springs Reservoir. The upper part of the basin is marked by parallel ridges separated by canyons, and the lower part is a rolling, hilly region. Nearly half of the area upstream from the gaging station at Woodbridge is above an altitude of 5,000 feet, and 54 percent of the basin upstream from the gaging station near Mokelumne Hill is above an altitude of 5,000 feet.

The river channel for most of the distance between the gaging stations near Mokelumne Hill and at Lancha Plana is filled by Pardee Reservoir.

The North Fork of the Mokelumne River is clearly a High Sierra river. The Mokelumne River as a whole is in the same classification as far downstream as the gaging station near Mokelumne Hill. Below that point its character is affected by control and diversions.

Granitic rocks and andesite predominate in the upstream areas. Limestone, shale, and slate are found in the lower portions, and alluvium containing gravel, sand, silt, and clay mark the area downstream from Clements.

Bear River and Cold Creek rise at altitudes of about 9,000 to 10,000 feet and flow in a southwesterly direction. The gaging stations, at altitudes of 5,650 and 6,000 feet respectively, are 10 and 8 miles downstream from the headwaters. The high altitude of these small basins causes snowfall to be the prevailing form of precipitation and gives them hydrologic characteristics different from the nearby South and Middle Forks of the Mokelumne River.

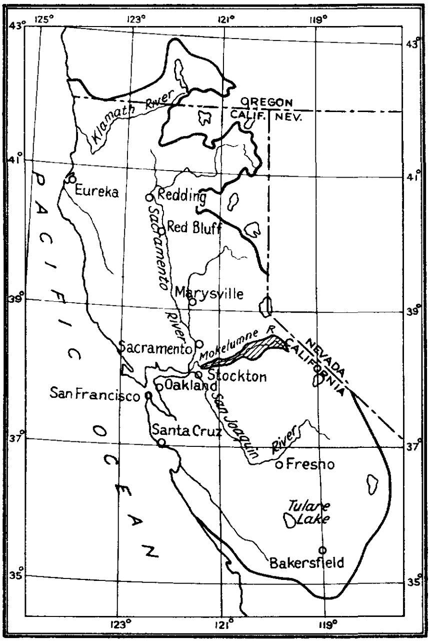

Figure 59.--Key map showing location of Mokelumne River Basin.

The South and Middle Fork Basins upstream from the gaging stations are each about 20 miles long and 6 miles wide at the widest place. Each of these streams has two main branches, rises at an altitude of around 7,000 feet, and flows in a westerly direction. The gaging stations are at altitude of 2,500 and 2,000 feet respectively. The streams are relatively much smaller than the North Fork and may be classed with the midslope type streams, but have some characteristics of foothill creeks.

The isohyetals for the Mokelumne River Basin (fig. 16, p. 48) seem fairly well defined by observations. The high precipitation indicated in the headwaters of the Middle and South Forks of the Mokelumne River Basin is predicated on the high precipitation recorded at Big Trees (altitude, 4,700 feet). The indicated precipitation in the other high headwater areas is based largely on observations at Salt Springs (altitude, 3,600 feet), Lake Alpine (altitude, 7,500 feet), and Twin Lakes (altitude, 7,920 feet).

It would appear that these three stations should indicate the precipitation in the upper basins with a fair degree of accuracy. Somewhat more than 290 square miles of the Mokelumne River Basin lies above an altitude of 7,000 feet and 150 square miles lies above 9,000 feet.

On the basis of observations at Lake Alpine and Twin Lakes there was possibly 5 to 8 inches of snow prior to the storm over a considerable part of the drainage basins of the North Fork of the Mokelumne River upstream from the gaging station below Salt Springs, Cold Creek, and the Bear River and some of the precipitation on December 9, 11, and 12 may have had the form of snow. Recording precipitation records at Fiddletown and Fricot City (figs. 26 and 27, see pp. 61, 62) should show the distribution of the precipitation within these basins. The tendency for the precipitation to be marked by two periods of heavy intensity is indicated by decided increases in river stage early in the mornings of December 10 and 11. There was some decrease in stage after the first period of heavy intensity and before the second.

At only three of the river-measurement stations is the flow essentailly unaffected by artificial storage - those on Cold Creek and on the Middle and South Forks of the Mokelumne River. The flow at the other gaging stations is modified by storage in several reservoirs, at the largest of which (Salt Springs and Pardee) records of storage are available. At the smaller reservoirs, Blue Lake, Lower Blue Lake, Meadow Lake, Twin Lake, and Bear, the total capacity of which is but a small part of the total, no records of storage are available. The storage retained above or diverted around the gaging stations amounted to 8.75 inches for the North Fork of the Mokelumne River below Salt Springs Dam, 2.6 inches for the Mokelumne River near Mokelumne Hill, 3.15 inches for Lancha Plana, 2.85 inches for Clements, 2.8 inches for Woodbridge, and 3.75 inches for the Bear River at Pardoe Camp.

The rainfall and run-off relations seem fairly consistent in areas where there was no snow. The total residuals (table 7, see pp. 311-316) were 7.75 inches, 8.3 inches, and 9.15 inches respectively in the areas between Salt Springs Dam and Mokelumne Hill, and in the Middle and South Fork Basins.

In the North Fork of the Mokelumne River Basin upstream from the gaging station below Salt Springs Dam and in the Bear River Basin the indicated direct run-off is somewhat more than the computed rainfall. In both of these areas large storage adjustments were made, and the direct run-off values shown in table 7 may be in error.

In Cold Creek Basin, where the observed run-off represents natural flow conditions, the indicated direct run-off is 7.35 inches as compared to adjusted values of over 9 inches in adjacent basins. The indicated differences between rainfall and run-off was nearly 2 inches in Cold Creek Basin, and there may have been a contribution to the flood run-off of 1 to 2 inches resulting from melting snow. Based on the total amount of water available for run-off the indicated residual would be between 3 and 4 inches.

In basins where natural flow conditions prevailed, the peak stages were reached December 11 between 8 and 10 a.m. about 2 hours after the period of heaviest rainfall intensity at Fricot City and about 6 hours before the end of the storm period. Between 56 and 59 percent of the total direct run-off was during a 24-hour period and the peak discharge was between 60 and 74 percent greater than the mean for the 24 hours of greatest discharge.

The momentary peak discharge and the total direct run-off for the flood exceeded all previous records on Cold Creek, but did not approach previous records on the Middle and South Forks of Mokelumne River. These results are in keeping with the characteristics of the storm of December 1937, notable for extremely heavy rainfall at altitudes of 3,000 to 7,000 feet and above, and relatively light rainfall in the lower areas. The gaging station on Cold Creek is at an altitude of about 6,000 feet.

The larger former floods on the Middle and South Forks of the Mokelumne River were caused by heavier rainfall following preliminary storms which had lessened the absorptive capacity of the basins.

Upper Sacramento River and McCloud River Basins

The upper Sacramento River Basin as treated herein includes the area that drains into the Sacramento River upstream from the base gaging station near Red Bluff except the Pit River Basin. (See fig. 60.) The part of the basin upstream from the junction with the Pit River is very much smaller in area and in volumne of stream flow than the Pit River Basin. The McCloud River flows into the Pit River downstream from Ydalpom and a few miles upstream from the confluence with the Sacramento and is similar to the Pit River in many respects. A large area in the upper McCloud River Basin is occupied by volcanic formations that regulate the water supply. The McCloud is probably the least flashy of the large rivers in California. The summer flow is particularly well sustained.

The basin of the McCloud River upstream from the gaging station near McCloud (altitude, 2,750 feet) is roughly a square which is about 20 miles long on each side and the northwest corner of which occupies the slope of Mount Shasta (altitude, 14,161 feet). Springs in the lava formation southeast of Mount Shasta are large and steady contributors, and additional flow comes from the southern and eastern slopes of the mountain through Cold and Ash Creeks. Almost the entire basin upstream from McCloud is underlain by volcanic rocks. Mud and Squaw Valley Creeks also rise on the southern slope of the mountain in similar volcanic formations and flow southward to contribute to the main river downstream from the gaging station near McCloud and upstream from the gaging station at Baird (altitude, 700 feet). The area between these gaging stations is about 45 miles long and has a maximum width of 12 miles in the middle. During the summer, mud flows associated with the recession of glaciers come from the slopes of Mount Shasta. The lower part of the basin is underlain by marine sediments and to a lesser extent by volcanic and granitic formations. About 30 percent of the area upstream from the upper gaging station is above an altitude of 5,000 feet whereas only a few square miles of the intermediate area is above 5,000 feet.

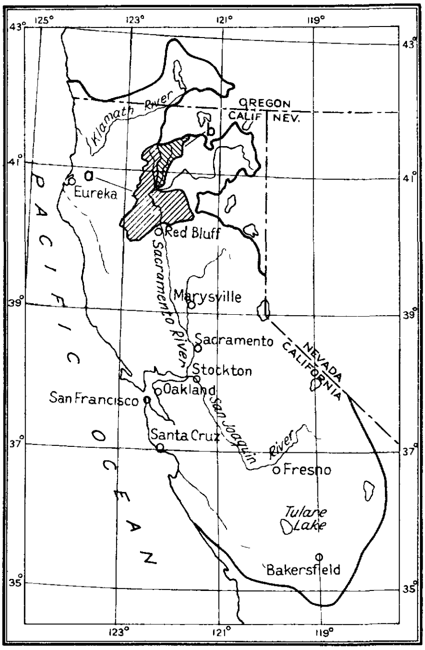

Figure 60.--Key map showing location of (a) upper Sacramento River and (b) McCloud River Basins.

The basin of the Sacramento River upstream from the gaging station at Antler (altitude, 934 feet) is about 35 miles long and 15 miles wide. One corner drains the southwestern slopes of Mount Shasta and is underlain by formations similar to those of the upper McCloud Basin. About 25 percent of the area is above an altitude of 5,000 feet. The lower part of the basin is underlain by metamorphic formations and granite. The small intermediate area downstream from the gaging stations on the Pit River near Ydalpom, the McCloud River at Baird, and the Sacramento River at Antler and upstream from the gaging station at Kennett (altitude, 618 feet) is underlain by a wide variety of formations.

The large drainage area between the gaging station at Kennett and the one near Red Bluff (altitude, 250 feet) is 70 to 80 miles from east to west and 25 to 35 miles from north to south. This area is notable for its large contribution to the run-off of the Sacramento River during periods of winter rain. Cow, Battle, and Cottonwood Creeks are the most important tributaries in this reach. Battle Creek drains the western slope of Lassen Peak and Cow Creek rises at an altitude of about 6,000 feet, but most of this area is in the foothills or in the valley. Although there are some volcanic materials in the headwaters of Cow and Battle Creeks, various sedimentary formations occupy most of the area. Alluvium is very prominent along the branches of Cow Creek and along the Sacramento River between Redding and the mouth of Cottonwood Creek.

The upper Sacramento, McCloud, and Pit River Basins have peculiarities, as described, that put them into the miscellaneous group of streams.

The precipitation map is comparatively well defined for the Sacramento River Basin above Antler and Kennett by rainfall stations at Mount Shasta City, Dunsmuir, Vollmer's ranch, Bayles, and Kennett. Isohyetals in the McCloud River Basin are based on one record at McCloud and those in adjacent basins. Twenty to twenty-five percent of the area upstream from Baird and Antler is above an altitude of 5,000 feet and without precipitation records. Lines of equal rainfall are not well defined in the McCloud River Basin upstream from McCloud.

Except on small areas on Mount Shasta and Lassen Peak, there was no snow on the ground at the beginning of the storm and no snow fell during the storm. There was about 8 feet of snow at Lake Helen (altitude, 8,300 feet) on the slopes of Lassen Peak at the end of November, and this was reported to have been reduced to about 5 feet of slush during the rains in December. Probably the snow absorbed the rain above altitudes of about 8,500 to 9,000 feet and there was little run-off above these altitudes. There probably was snow ranging from a few inches to a few feet in depth between altitudes of 6,500 and 8,000 feet which melted and ran off during the December storm. The area between these altitude limits, however, amounts to only a few square miles around Lassen Peak and was even smaller around Mount Shasta.

The observed discharge during the flood period was essentially natural on the Sacramento River at Antler, the McCloud River near McCloud, and the McCloud River at Baird. The run-off at the river-measurement station on the Sacramento River at Kennett was adjusted for a considerable amount of storage on the Pit River, and the run-off for the Sacramento near Red Bluff was adjusted for additional storage in reservoirs on Battle Creek. The total adjustment for storage amounted to 0.25 inch above Kennett and 0.20 inch above Red Bluff.

The adjusted total direct run-off expressed in inches over the drainage areas is (table 7, see pp. 311-316) 4.45, 2.15, 2.7, 1.0, and 3.15 for the areas above Antler, Kennett, Red Bluff, McCloud, and Baird, respectively. The low run-off on the upper McCloud River Basin was probably due to a combination of large absorption in very porous lava beds and slightly lower precipitation than occurred over the other headwater areas. The intermediate area between the Sacramento River gaging stations at Kennett and Red Bluff produced a run-off of about 4.0 inches.

The residuals seem consistent in these basins. In the upper McCloud River Basin, which is composed of large areas underlain by lava beds, the residual was 6.0 inches. Other residuals were 5.15 for the McCloud River at Baird, 3.85 for the Sacramento River at Antler, 4.15 for the Sacramento River at Kennett, 4.0 for the Sacramento near Red Bluff, and about 3.7 for the area between Kennett and Red Bluff. The precipitation in these areas during November 1937 was much larger than that in the southern part of the Central Valley.

Recording-gage precipitation records at Mount Shasta City and Vollmer's ranch in the basin above Antler (fig. 26, p. 61) indicate continuous rainfall from about 9 a.m. December 9 to 4 p.m. December 11, high intensities being recorded in the forenoon and afternoon of December 10 and the forenoon of December 11. The McCloud River at Baird and the Sacramento River at Antler show peak run-off about four hours after the peak precipitation of the afternoon of December 10, and neither shows any appreciable rise until midnight December 9 following 15 to 16 hours of continuous rain. Most of the precipitation of December 9 apparently was absorbed. Peak stages were reached at 10 p. m. on December 10 at Antler, and at 11 p.m. on December 10 at Baird, and a second peak of considerable magnitude was recorded in the afternoon of December 11, following a period of high rainfall intensity at about 10 a.m.

The ratios between the run-off during the 24 hours of greatest flow and the total storm run-off are 37 percent for Antler, 25 percent for the McCloud River near McCloud, and 40 percent for the McCloud River at Baird. Corresponding ratios between the maximum momentary discharge and the maximum 24-hour average discharge are 116, 131, and 132 percent, respectively.

At the three river-measurement stations in this area where the flow is not regulated, the Sacramento River at Antler, and the McCloud River near McCloud and at Baird, the total direct run-off for the flood was higher, and, except at the Antler station, the momentary peak discharge was higher than for previously recorded floods. At Antler the momentary peak of March 26, 1928, remains as the maximum of record. Melting snow contributed to that flood.

Pit River Basin

The Pit River upstream from the base gaging station near Ydalpom drains an area of 5,350 square miles, not including the Goose Lake Basin which does not now drain into the Pit River. (See fig. 61.) The Pit River rises near the eastern border of California in the Warner Mountains, which reach an altitude of 9,900 feet, and flows generally westward to the gaging station which is near Ydalpom at about an altitude of 735 feet. Two-fifths of the area is at an altitude of more than 5,000 feet; for the most part it is underlain by lava beds in the north and consists of numerous meadow valleys, flat and marshy, in the south. The area also contains many volcanic buttes and peaks, of which Lassen Peak is the most conspicuous.

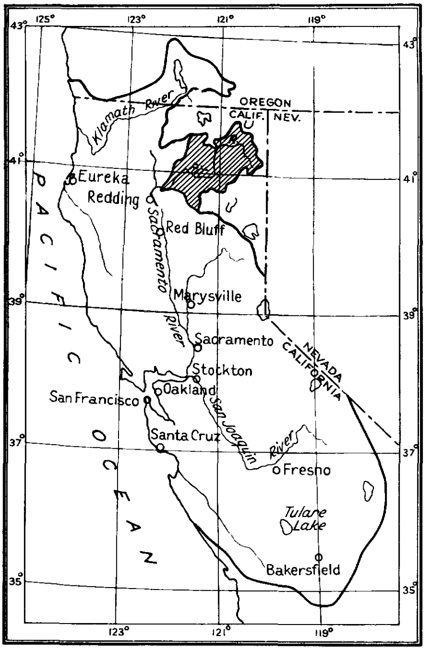

Figure 61.--Key map showing location of Pit River Basin.

The Pit River Basin is noted for its large springs[14] and for the marked regulating effect of the volcanic formations upon stream flow. The lava fields act as great underground storage basins that reduce flood flows and increase dry season flows. Because of the uncertainly in locating watershed lines, discharges expressed in second-feet per square mile may have little significance. The vagueness of drainage boundaries and the large time lag between rainfall and its appearance as run-off caused by underground storage, render it difficult or impracticable to formulate relations between precipitation and run-off. It is probable that storage in lava beds holds over from season to season and that the effect of either an extremely dry or an extremely wet season may extend over several years.

14/ Meinzer, O. E., Large springs of the United States: U. S. Geol. Survey Water-Supply Paper 557, pp. 55-62, 1927.

The North and South Forks of the Pit River head in the Warner Mountains. The gaging station on the South Fork near Likely is about 4,580 feet above sea level, and the gaging station near Canby below the junction of the Forks is about 4,300 feet. This whole area is underlain by volcanic rocks, but andesite is more common in the Warner Mountains and basalt and other types in the large, relatively flat plain the center of which is near Alturas.

Most of the large area between the gaging stations near Canby and Fall River Mills (altitude, 3,235 feet) is very flat, and the drainage boundaries on the sides of the basin are very indefinite. Volcanic andesite and basalt are predominant, but there are large areas of alluvium around Bieber and Fall River Mills.

The area between the gaging stations at Fall River Mills and below Pit No. 4 dam (altitude, 2,345 feet), which includes the area upstream from the Hat Creek gaging station (altitude, 4,500 feet), also contains volcanic plateaus, although the river flows in a canyon in this reach. Headwater areas of Hat Creek around Lassen Peak contain volcanic ash and porous lava, but most of the area is underlain by other volcanic material such as andesite, rhyolite, and basalt. Drainage areas are not well defined in parts of this region.

The small area between the gaging stations below Pit No. 4 dam and at Big Bend (altitude, 1,700 feet) is chiefly underlain by volcanic rocks, but there is a small amount of marine sediments along the river near Big Bend. This reach of the river is in a deep canyon.

The intermediate area below the Big Bend gaging station and above the Ydalpom station forms a crude triangle about 25 or 30 miles on a side. Part of this area is above an altitude of 5,000 feet, and the surface is very rough and irregular. In general, the part of the drainage area to the southeast of the river is underlain principally by volcanic rocks and to a lesser extent by marine sediments and granite, whereas the main river and Squaw Creek, the important tributary from the west, flow through areas of more dense metamorphic rocks. The Pit River is in the miscellaneous group of streams. (See p. 349.)

The precipitation map of the Pit River Basin is defined by nine rainfall stations in the basin and by a few stations in adjacent basins. About 40 percent of the entire basin lies above an altitude of 5,000 feet. The percentage increases toward the headwaters to 65 percent near Canby and 100 percent for the South Fork of the Pit River basin above Likely. A small percentage lies above 7,000 feet.

With the exception of the heavy snow cover around Mount Lassen in the headwaters of Hat Creek, there was very little snow on the ground below an altitude of 5,000 feet at the beginning of the December storm and apparently only a few inches over most of the area above an altitude of 6,000 feet. Indications are that nearly all of this snow melted and ran off during the early part of the storm. A slight amount of snow fell at the higher altitudes during the last hours of the storm. The lower fringe of the snow pack around Lassen Peak may have melted and run off, but the general effect was probably for the deep snow blanket on the peak to absorb the rain without producing run-off.

In the Pit River Basin only the gaging station on Hat Creek shows natural run-off. Observed run-off at the other river-measurement stations was adjusted for estimated and observed storage in the reservoirs as follows: The South Fork of the Pit River near Likely for storage in West Valley and Tule Lake reservoirs; the Pit River near Canby for Big Sage Reservoir and other small reservoirs in addition to those on the South Fork; the Pit River at Fall River Mills for 10,000 acre-feet in addition to that above Canby; the Pit River below Pit No. 4 dam for Lake Britton in addition to that above Fall River Mills; and the Pit River at Big Bend and year Ydalpom for the same storage as at Pit No. 4 dam.

The results of adjusted direct run-off in inches (table 7, see pp. 311-316) from the drainage areas above the stations near Likely, Canby, Fall River Mills, Pit No. 4 dam, Big Bend, and Ydalpom are 2.35, 1.9, 1.2, 1.15, 1.3, and 1.7, respectively, of which it is estimated that 2.1, 1.0, 0.4, 0.35, 0.35, and 0.3 inches, respectively, were held in the storage reservoirs during the flood period. The decrease in run-off downstream as far as Pit No. 4 dam is probably due mostly to large areas contributing relatively little or no flow, the percentage of such area being especially high upstream from the Fall River Mills gaging station. Natural run-off for Hat Creek has the low value of 0.65 inch. The surface drainage in the Hat Creek Basin is poorly defined, the lava is exceptionally porous, and it is probable that comparatively little of the area contributes to the surface run-off. Therefore the result stated has little significance.

There was a storm center of considerable magnitude below Big Bend, as indicated by the precipitation record of 14.77 inches at Montgomery Creek and by the large inflow into Pit River between Big Bend and Ydalpom. For this intermediate area the average storm rainfall was about

12.0 inches, the direct run-off 8.4 inches, and the residual 3.6 inches. The residuals in the basin range from 1.05 inches for the gaging station near likely to 4.0 inches for the station near Ydalpom.

A recording precipitation gage at Redding shows almost continuous rain from 9 a.m. December 9 to 1 p.m. December 11, greatest intensities being reached between 9 and 10 a.m. and between 5 and 6 p.m. December 10. (See fig. 26, p. 61.) These latter periods apparently correspond to discharge peaks on Hat Creek at 7 p.m. December 10 and 2 a.m. December 11. The flow of Hat Creek showed no rise for about 16 hours after the storm began. The ratio of the run-off during the 24-hours of highest flow to the total run-off for the storm is 62 percent, and the ratio between the maximum peak flow and the maximum 24-hour average flow is 138 percent.

Hat Creek is notable for its relatively steady, spring-fed flow, and from the beginning of record in 1926 until December 1937 there had been no record of a flood on the stream. For reasons stated in the basin description, the peak run-off per square mile or the total direct flood run-off in inches has little significance in this area. The momentary peak discharge of 2,500 second-feet on December 11, 1937, is considered remarkably high when the past record of this stream and the characteristics of its basin are considered.

Mill, Deer, Chico, and Butte Creek, and Bear River Basins

Mill, Deer, Chico, and Butte Creeks and the Bear River all have long narrow basins that head at fairly high altitudes on the western side of the Sierra Nevada and flow in a southwesterly direction to the Sacramento Valley. (See fig. 62.) The first four streams, in their relatively sudden approach to the floor of the valley, have the common characteristics of deep canyons cut down through old lava flows.

Mill and Deer Creeks are very similar, although Mill Creek rises on the slopes of Lassen Peak (altitude, 10,453 feet) and Deer Creek originates at an altitude of about 5,000 feet in the broad Deer Creek Meadows which are fed from an adjacent drainage area having altitudes as high as 7,000 feet. The gaging station on Mill Creek is at an altitude of about 420 feet and that on Deer Creek about 480 feet. Mill Creek Basin upstream from the gaging station is about 40 miles long and has a width of about 4 miles at its upper end, whereas Deer Creek Basin is only 35 miles long but is about 8 miles wide at the upper end. The upper part of each basin is underlain by volcanic materials such as rhyolite and andesite, whereas the lower parts are underlain by sedimentary materials.

Chico and Butte Creek Basins are very much alike. Butte Creek Basin upstream from the gaging station is a little over 30 miles long and Chico Creek Basin a little less, but each is only 2 to 5 miles wide. Butte Creek rises at an altitude of about 6,000 feet and Chico Creek at about 5,000 feet. The gaging stations are about 350 and 400 feet, respectively, above sea level. Both streams originate in volcanic material, and flow on marine sediments through most of their length.

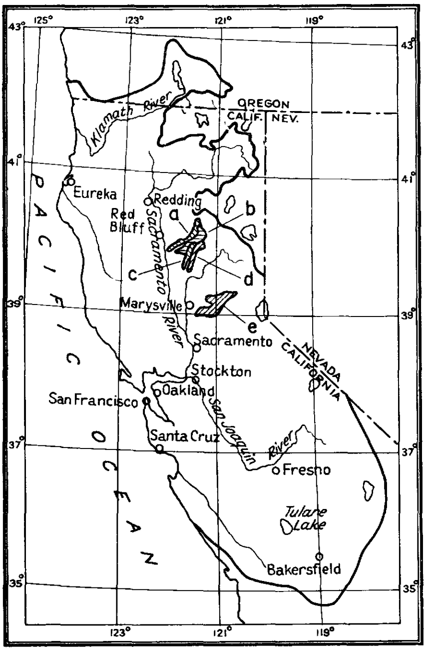

Figure 62.--Key map showing location of (a) Mill Creek, (b) Deer Creek, (c) Chico Creek, (d) Butte Creek, and (e) Bear River Basins.

The Bear River Basin has characteristics quite different from the four basins just described. The Bear River originates at an altitude of only a little more than 5,000 feet, and nearly all of the drainage area is below 5,000 feet. The gaging station is on the main valley floor at an altitude of about 85 feet. The basin is about 45 miles long and 10 miles wide in the middle, and narrows at the ends. The basin materials vary greatly, but metamorphic rocks are most common. In the lower reaches the bed is filled with debris resulting from hydraulic mining in the headwaters. The Bear River is called a beheaded stream, the South Fork of Yuba River having stolen its ancient headwaters. It belongs to the midslope type of streams. (See p. 348.)

There are only three rainfall stations in these minor basins, all located on the east side of the Sacramento Valley, but there are enough stations in adjacent basins to define the precipitation map comparatively well.

There was no snow on the ground at the beginning of the storm and none fell during the storm, except on 6 square miles in the headwaters of Mill Creek on the slopes of Lassen Peak. In this small area there was heavy snow above an altitude of about 8,000 feet, which probably absorbed all the rain. A narrow fringe of snow between 7,000 and 6,000

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feet probably contributed some direct run-off.

The observed discharge on Mill Creek and Chico Creek is natural. The record on Deer Creek is incomplete, as the gaging station was destroyed by the flood. The run-off on Bear River was adjusted on the assumption that storage in Combie and Camp Far West Reservoirs occupied 50 percent of their capacity. Such storage amounted to 0.45 inch over the area. The run-off of Butte Creek was adjusted for diversions received from the Feather River Basin.

The adjusted total direct run-off in inches over these basins (table 7, see pp. 311-316) is 6.8, 6.75, and 2.35 for Mill Creek, Chico Creek, and the Bear River, respectively. The run-off for the Bear River is low because a considerable part of its drainage area is on the valley floor in a region that received comparatively little rainfall. The direct run-off from headwater areas of Deer, Butte, Battle, Antelope, and Cow Creeks probably equalled or exceeded the observed run-off from Mill and Chico Creeks.

Residuals for Mills Creek, Chico Creek, and the Bear River are fairly consistent at 6.7, 7.45, and 6.45 inches, respectively.

The rain gage at Redding recorded almost continuous precipitation from 9 a.m. December 9 to noon December 11, and there were periods of especially high intensity about 9 a.m. and 5 p.m. December 10. These peaks were reflected in a rapid increase in the stages of Mill and Chico Creeks at about 2 p.m. December 10 and peaks at midnight on December 10 for Chico Creek and 2 a.m. on December 11 for Mill Creek. Neither Mill Creek nor Chico Creek showed any appreciable rise in stage until 8 p.m. December 9 after it had been raining at Redding for about 10 hours at an average rate of about 0.2 inch per hour. The ratio between the peak flow and the maximum 24-hour flow is 167 percent for Mill Creek and 129 percent for Chico Creek. Mill Creek also had a greater concentration of run-off in the 24 hours of greatest flow in relation to the run-off of the entire storm, the ratio being 56 percent compared with 51 percent for Chico Creek.

Mill and Chico Creeks are the only streams of this group with complete records of the flood run-off unaffected by storage or diversions. Both the momentary peak discharges and the total direct run-offs for the flood period greatly exceeded previous records.

It appears probable that the storm of December 1929 brought much more precipitation to the Mill Creek area, over a seven-day period, than the storm of December 1937. However, the period preceding the storm in

1929 was much drier than the corresponding period in 1937. This appears to be one more confirmation of the probability, previously mentioned, that antecedent conditions are very important and may be more influential than basin characteristics.

Elder, Thomas, Stony, Cache, and Putah Creek Basins

Elder, Thomas, Stony, Cache, and Putah Creeks all rise on the eastern slope of the Coast Ranges at altitudes of 4,000 to 8,000 feet and flow in a general easterly direction. (See fig. 63.) The gaging stations are on the west side of the Sacramento Valley. Unless artificially regulated, these streams go wholly or nearly dry in the summer and fall, and are subject to flashy floods in the winter and spring.

One of the two main branches of Elder Creek rises at an altitude of about 7,000 feet. The main stream generally flows in a easterly direction. The gaging station on the floor of the valley is at an altitude of about 310 feet. The basin is about 27 miles long above the station and 8 miles wide near the upper end, and narrows near the gaging station. Most of the basin is at relatively low altitude. It is a very flashy stream of the foothill type. (See p. 349.)

Thomas Creek rises at a similar elevation, but a much larger proportion of the drainage area is at comparatively high altitudes and the gaging station is at a little higher altitude on the edge of the foothills. The basin is about 25 miles long and 12 miles wide near the middle. At times snowfall is a factor in the stream's behavior. Geological conditions at the headwaters of both Thomas and Elder Creeks are unmapped, but the region contains sedimentary rocks and both streams cross bands of sedimentary material of various kinds.

The four upper branches of Stony Creek rise at altitudes ranging from 4,000 to 6,000 feet near the crest of the Coast Ranges, and flow eastward out of the hills and then northward through a broad valley. The basin upstream from the gaging station is roughly a square of about 16 miles on each side, and is only a small part of Stony Creek Basin. The formations are chiefly sedimentary but there is granitic rock in some of the headwater area.

The three main branches of the North Fork of Cache Creek rise at altitudes of about 4,000 to 5,000 feet and flow eastward and southward. The gaging station is at an altitude of about 1,050 feet. The basin is roughly diamond-shaped, its major axis being 25 miles in length and its minor axis 15 miles. Almost the entire basin is underlain by sedimentary formations. It is a foothill type of creek.

Clear Lake, which is surrounded by hills, is the principal topographic feature of upper Cache Creek. The area in Cache Creek Basin upstream from the gaging station at Yolo includes, in addition to the North Fork Basin, a 40-mile strip along the divide on the west, 2,000 to 3,000 feet high, a flat district around the margin of Clear Lake, and a 40-mile strip of low valley land. The whole basin upstream from Yolo is about 80 miles long and about 35 miles wide near the upper end. The basin is underlain by sedimentary formations, alluvium, and limited amounts of volcanic material.

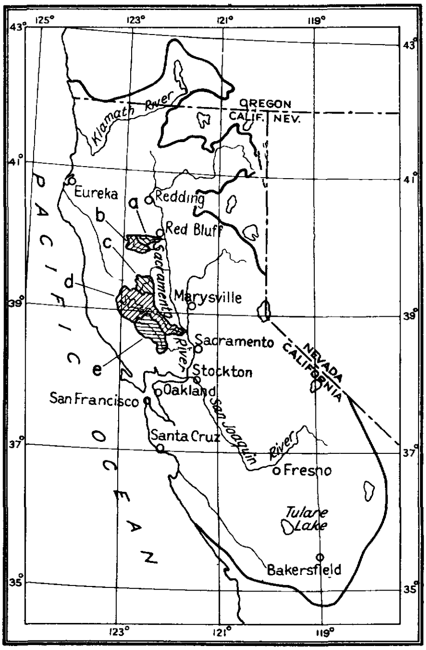

Figure 63.--Key map showing location of (a) Elder Creek, (b) Thomas Creek, (c) Stony Creek, (d) Cache Creek,and (e) Putah Creek Basins.

Putah Creek Basin is long and narrow. Several branches rise along the east side of the Coast Ranges at altitudes of 3,000 to 5,000 feet and converge a few miles west of the gaging station near Guenoc which is at an altitude of about 925 feet. The basin upstream from Guenoc,which is only about 16 miles long and 10 miles wide, is in an area that has heavy precipitation. It is underlain mostly by sedimentary rocks, but there is volcanic material in the mountains and alluvium in the downstream valleys. Some of the intermediate drainage area downstream from Guenoc and upstream from the gaging station near Winters (altitude, about 160 feet) is as high as 2,000 feet, but a large part is under 1,000 feet in the valleys near Pope Valley and Monticello. Various kinds of sedimentary formations predominate. Putah Creek is a foothill type of stream. (See p. 349.)

There are no precipitation stations in Elder, Thomas, or the North Fork of Cache Creek Basins and the lines of equal rainfall are therefore poorly defined by stations in adjacent basins. Two precipitation stations in Stony Creek Basin above Stony Gorge Reservoir tend to fix the position of the isohyetals, but the locations are indefinite in the higher altitudes. A systematic search was made for supplemental precipitation data in the Putah Creek Basin, and the rainfall map is considered well defined in that basin and for Cache Creek Basin, except for the North Fork.

There were probably patches of snow in small areas lying above 6,500 feet in the Coast Ranges, but in general there was little, if any, contribution from snow melt.

The run-off is natural for Elder and Thomas Creeks and North Fork of Cache Creek and at the two gaging stations on Putah Creek. The run-off of Cache Creek at Yolo is materially affected by storage in Clear Lake, amounting to about 2.15 inches over the drainage area; and on Stony Creek above Stony Gorge Reservoir by storage in East Park Reservoir, amounting to 0.6 inch over the drainage area. The observed run-offs at the latter two gaging stations were adjusted to show natural run-off. The adjusted total run-off in inches from the drainage basins (see table 7, pp. 311-316) is 2.75 for Elder Creek, 5.05 for Thomas Creek, 4.8 for Stony Creek, 4.15 for North Fork of Cache Creek, 3.6 for Cache Creek at Yolo, 9.7 for Putah Creek near Guenoc, and 3.7 for Putah Creek near Winters. The lower parts of Elder and Putah Creek Basins received less than 5 inches of rainfall, and the run-off from the contributing areas in these basins was in excess of the indicated rates for their entire areas.

The area upstream from Putah Creek near Guenoc had much heavier rainfall and run-off than did neighboring areas.

The difference between rainfall and run-off, in inches, is 2.05 for Elder Creek, 0.75 for Thomas Creek, 2.2 for Stony Creek, 3.15 for North Fork of Cache Creek, 3.3 for Cache Creek at Yolo, 4.4 for Putah Creek near Guenoc, and 4.7 for Putah Creek near Winters. The low residuals for Thomas Creek, Elder Creek, and Stony Creek probably indicate that there was more rain in these areas than is shown by the lines of equal rainfall.

There are no recording gages in these basins, but the one at Redding may be fairly indicative of conditions on Elder and Thomas Creeks and the one at Sacramento may be indicative of the rainfall distribution in Cache and Putah Creek Basins. The rain fell at maximum intensity between 5 and 6 p.m. December 10 at Redding and maximum peaks were reached on Elder and Thomas Creeks at 10 p.m. on that date. At Sacramento, as is generally true for much of the southern storm area, there were two periods of heavy rainfall intensity, one in the forenoon of December 10 and the other during the early hours of December 11. (See fig. 36, p. 61.) These periods were followed by double peaks of almost equal magnitude on Cache and Putah Creeks.

The ratios between the momentary peak discharge and the discharge during the 24 hours of greatest flow range from 117 percent for Putah Creek near Winters to about 168 percent for Elder Creek and North Fork of Cache Creek. The lower ratio at Winters probably reflects the smoothing of the peak by channel storage. Ratios between the run-off during the 24 hours of greatest flow and the total run-off for the storm range from 40 to 60 percent.

The momentary peak discharges and total direct run-off for the storm period were the highest on record for Elder Creek and the North Fork of Cache Creek. Previous momentary peaks were slightly higher than those for December 1937 on Thomas Creek, Putah Creek near Guenoc, and Putah Creek near Winters. However, the total direct run-off for the storm in 1937 was probably a maximum of record at all three measuring points.

Feather River Basin

The Feather River Basin upstream from the base gaging station near Oroville is a large fan-shaped area having a radial distance of 70 to 80 miles from the gaging station to the north and east perimeter along the crest of the Sierra. The distance around the perimeter is about 110 miles. (See fig. 64.) The crest of the Sierra in this region is lower and not as well defined as it is to the south, and the North and Middle Forks of the Feather River flow through high and relatively flat valleys in their upper reaches before they enter deep canyons in the middle reaches. About 53 percent of the basin upstream from Oroville is above an altitude of 5,000 feet. There is a rather sharp line of demarcation running near Doyle, Susanville, Westwood, Almanor, Caribou, Sterling City, and Oroville between the greatly varied granites, andesites, and metamorphic rocks to the south and the more recent volcanics, andesite, rhyolite, and sediments to the north.

There are two significant characteristics of the Feather River Basin. One is the regulating action upon stream flow of the volcanic formations in the northern part of the basin. In this respect it resembles the Pit River Basin where areas of lava act as huge underground reservoirs, reducing flood flows and augmenting dry season discharge. The other characteristic is the sharp distinction between the relatively low water-yield of the upper areas such as the Sierra, Indian, and

Genesee Valleys, and the high yield of the intermediate areas further downstream. There are two reasons for the marked difference: the reduced precipitation in the upper valleys, which are east of the high ridges through which the Feather River and its branches have cut deep canyons; and the increased seepage, evaporation, and other losses where streams flow through flat alluvial valleys. Although the Feather River has its own peculiar characteristics, it resembles the High Sierra type of streams in many respects.

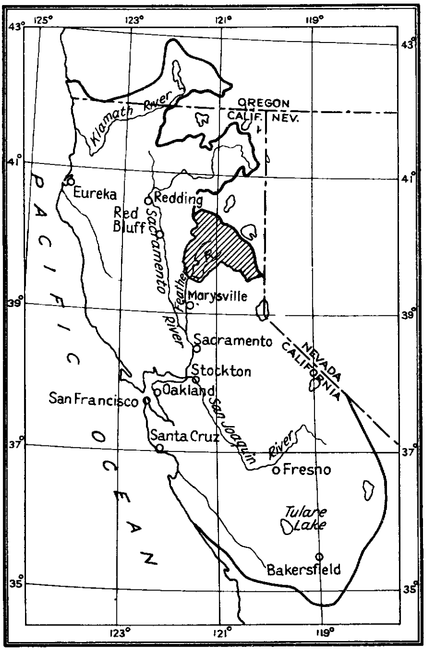

Figure 64.--Key map showing location of Feather River Basin.

The South Fork of the Feather River rises at an altitude of about 7,000 feet and flows about 30 miles through a narrow basin. The gaging station is at an altitude of about 550 feet. Lost Creek is tributary to South Fork, and has a narrow basin about 11 miles long which descends from an altitude of more than 5,000 feet at the head to 3,050 feet at the gaging station. The geologic formations are rather varied in this area. Granite is most prominent, particularly in the Lost Creek Basin, but there are also volcanic materials.

About half of the area of the Middle Fork is at altitudes between 5,000 and 7,000 feet, and the rest ranges from 5,000 feet down to 290 feet at the gaging station. A prominent feature is the large amount of comparatively flat terrain just below 5,000 feet in the Sierra Valley, a mountain meadow. The Sierra Valley and the surrounding country are very dry in summer. The western part of the basin is a crescent-shaped area about 50 miles long and 6 to 15 miles wide, and the river flows in a canyon. Granitic rocks and andesite volcanics are more prevalent than metamorphic rocks. Indian Creek Basin, which is about 40 miles long and 25 miles across, ranges in altitude from about 8,000 feet along the divide on the north and east to 3,500 feet at the gaging station. A large part of the area is relatively high and flat, three-quarters being over 5,000 feet. The stream has a flat gradient, especially in the swampy Indian Valley. Granite and andesite are most prevalent in the headwater areas, but there are large patches of metamorphic rocks and auriferous gravels as well as numerous small areas of various formations in the western end, and the stream flows over alluvium for several miles in Indian and Genesee Valleys.

Spanish Creek Basin also is relatively flat; it ranges in altitude from about 7,000 feet on some of the surrounding hills to 3,250 feet at the gaging station, and two-thirds of the area is below 5,000 feet. The two main branches flow 12 and 15 miles from the east and west, respectively, unite, and flow northward a few miles to the gaging station. The stream may be considered as of the midslope type. (See p. 348.) Metamorphic rocks occupy most of the area, but the stream flows through several large patches of alluvium.

The North Fork of the Feather River Basin upstream from the gaging station near Prattville has altitudes of about 5,500 to 10,453 feet (Mount Lassen) along the north side and of 4,380 feet at the gaging station. There are many perennial springs in the headwater area, which also contains the large Lake Almanor and Mount Meadows Reservoirs. For the greater part of its course the North Fork flows through a deep canyon, and most of the tributaries are short streams that drain precipitous slopes. Most of the area is underlain by more recent volcanic andesite, rhyolite, and basalt, but there is alluvium around Mount Meadows Reservoir. There are several fault lines north of Lake Almanor.

Grizzly and Bucks Creek Basins are two small areas lying between altitudes of 7,000 and 5,000 feet. The Bucks Creek Basin, a large portion of which is occupied by Bucks Creek storage reservoir, is underlain almost entirely by granite, whereas Grizzly Creek Basin contains mostly metamorphic rocks and only a minor amount of granite.

The basin of the West Branch of the Feather River upstream from the gaging station is about 27 miles long and 3 to 7 miles wide. It ranges in altitude from about 6,000 feet at the headwaters to 1,100 feet at the gaging station. Basalt and metamorphic rocks are most common. It is a midslope type stream. Concow Creek flows into West Branch of Feather River and has a very small drainage area which ranges in altitude from about 4,000 feet in the upper part to 1,850 feet at the gaging station. Granite and metamorphic rocks are most common.

The intermediate area in the basin of the North Fork of Feather River between all these tributary basins and the base gaging station near Oroville is about 50 miles long from north to south and 10 to 20 miles wide. The altitude ranges from about 7,000 feet at the peaks to 182 feet at the gaging station. Granite and metamorphic rocks are most common.

The lines of equal rainfall (fig. 17, p. 49) in Feather River Basin are well defined by 22 rainfall stations above Oroville and by some in adjacent basins. About half the basin is above an altitude of 5,000 feet. However, only two of the rainfall stations are above an altitude of 5,000 feet, which may cause some inaccuracies in the location of the isohyetals in headwater areas.

Snow data in the basin are meagre. There was heavy snow on a few square miles around Mount Lassen in the drainage of the North Fork of the Feather River near Prattville; the lower fringe of this snow melted. The heavier snow at highest altitudes probably absorbed all the rain that fell. A small part of the area upstream from the Middle Fork of the Feather River near Clio is above 7,000 feet, and it is presumed that in this and adjacent areas snow conditions were similar to those at Soda Springs (altitude, 6,752 feet), where there was 13 inches of snow on the ground on December 8, 13 inches on the 9th, 10 inches on the 10th, a trace on the 11th, 8 inches on the 12th, and 7 inches on December 13. At Soda Springs, 13 inches of snow melted and ran off during the storm, and 8 inches of new snow fell during the last phases of the storm. At the beginning of the storm the snow generally ranged in depth from a trace to about 1 foot at altitudes of 6,000 to 7,000 feet. A considerable part of the North Fork of the Feather River Basin above Prattville and small parts of the drainage areas of Spanish Creek, Indian Creek, and the Middle Fork of the Feather River near Clio are within these limits, and there was probably contribution to the flood run-off from melting snow.

The observed discharge is essentially unregulated at the river-measurement stations on Indian Creek, Spanish Creek, Grizzly Creek, Lost Creek, the Middle Fork of the Feather River at Bidwell Bar, and the South Fork of the Feather River near Enterprise. The flow on the North Fork of the Feather River near Prattville is controlled at Almanor Dam. The record for Bucks Creek is derived from storage records in Bucks Creek storage and diversion reservoirs. Flow on the West Branch of the Feather River near Yankee Hill was materially modified by storage in Lake Wilenor and in smaller reservoirs and by diversions into Spring Valley ditch and Miocene canal, amounting to 2.0 inches during the storm. The flow of Concow Creek was modified by storage in Lake Wilenor, amounting to 4.25 inches; and that of the Feather River near Oroville, by storage in five large reservoirs having a total retention during the storm equivalent to 0.40 inch over the area. The observed run-off has been adjusted to give natural run-off. Changes in storage on Lost Creek and in the South Fork of the Feather River Basin above Enterprise were so small that run-off was assumed to be natural. No detailed run-off data for the flood period are available for the station on the Middle Fork of the Feather River near Clio.

At the gaging station on the Feather River near Oroville the water-stage recorder was overtopped at the peak, and the record is therefore incomplete.

The indicated direct run-off in inches (see table 3, pp. 311-316) was 1.65 for Indian Creek, 4.1 for Spanish Creek, 12.5 for Grizzly Creek, 6.2 for Lost Creek, 7.85 for the South Fork of the Feather River near Enterprise, and 4.35 for the Middle Fork of the Feather River at Bidwell Bar. The run-off adjusted for storage is 12.6 inches for Bucks Creek, 9.7 for the West Branch of the Feather River, 6.65 for Concow Creek, 3.1 for the North Fork of the Feather River near Prattville, and 3.95 for the Feather River near Oroville. There was probably a limited contribution from melting snow in the basin above Prattville and in some of the others. The result for Indian Creek reflects the comparatively low rainfall of less than 6 inches. The indicated run-offs for Grizzly and Bucks Creeks exceed those for any drainage basin for which complete records of these floods are available. Lack of information to determine accurately the drainage area for Grizzly Creek casts some doubt upon the run-off values expressed in inches over the area. The adjusted values for Bucks Creek, however, support the high value for Grizzly Creek.

Differences between rainfall and run-off range from 4.0 inches for the North Fork of the Feather River near Prattville to 12.9 inches for Lost Creek. All but Lost Creek and South Fork of Feather River near Enterprise show less than 7.1 inches.

There are no recording rainfall gages in or near the Feather River Basin. The gage-height graphs of the natural flow stations seem to indicate that the precipitation was generally continuous throughout the storm period. With the exception of those on Indian Creek, all the peak stages occurred between noon December 10 and noon December 11. The ratios between the rate of flow at the peak and the maximum 24-hour average flow are very low for Indian Creek, Spanish Creek, Middle Fork of the Feather River, and South Fork of the Feather River, ranging from 105 percent to 119 percent. The small drainage areas on Grizzly Creek and Lost Creek show ratios of 143 and 144 percent, respectively. The ratios between the run-off during the 24 hours of greatest flow and the total storm run-off were close to 50 percent, except that for Indian Creek which was 33 percent. The flow of Indian Creek responded comparatively slowly to the storm rainfall, the crest stage not being reached until 2 p.m. December 12, whereas the crest stages on most of the other streams occurred on December 11. The delayed run-off and lower ratios for Indian Creek are probably related to the flat meadows above the point of measurement, which act as natural detention reservoirs that smooth the peaks and delay the run-off.

The momentary peak discharges during December 1937 exceeded previous high peaks at all gaging stations in the Feather River Basin except those with records going back to the flood of March 1907. There seems little doubt that the flood of 1907 was the largest in the Feather River Basin thus far in this century.

Yuba River Basin

The basin of the Yuba River upstream from the base gaging station at Smartville is fan-shaped, and has a radial distance of 45 to 52 miles from Smartville and an outer periphery of about 50 miles, 30 miles of which is along the 7,000 to 8,000-foot crest of the Sierra Nevada. (See fig. 65.) The topography is rugged and mountainous, and about 43 percent of the area is above an altitude of 5,000 feet. The tributaries have cut deep canyons, which head well up in the mountains. There are perennial springs in parts of the basin and many small glacial lakes at higher altitudes. In the lower reaches of the river the stream bed is filled with debris from hydraulic mining washed down from upper parts of the basin.

The headwaters of the South Fork of the Yuba River are measured at gaging stations on the South Fork at Lake Spaulding, and on Canyon Creek below Bowman Dam. The former stream rises at an altitude of about 8,000 feet on the crest of the Sierra Nevada and drops to around 5,200 feet at the gaging station; the latter rises at about 7,000 feet and drops to about 5,100 feet at the gaging station. Glacial deposits, andesites, granite, granodiorite, metamorphic rocks, and lesser amounts of basalt, limestone, slate, and shale are some of the varied formations in the areas.

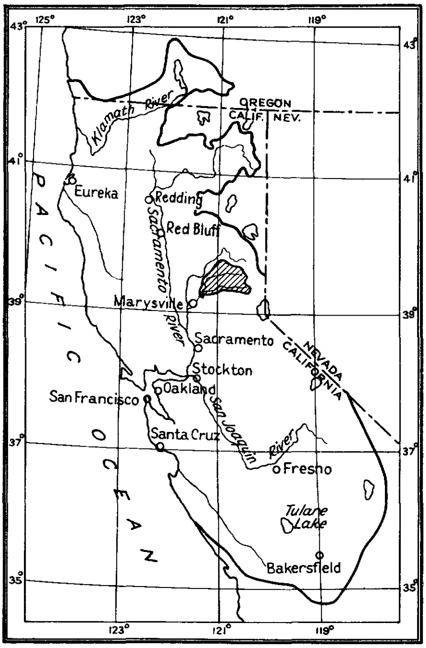

Figure 65.--Key map showing location of Yuba River Basin.

The Middle Fork of the Yuba River heads along the crest of the Sierra Nevada at an altitude of a little more than 7,000 feet and drops to about 5,700 feet at the gaging station near Milton. Glacial deposits, andesite, and metamorphic rocks are among the varied formations. Oregon Creek, which has a basin 15 miles long and 2 miles wide, is also tributary to the Middle Fork. This stream rises at an altitude of about 5,000 feet and drops to about 1,500 feet at the gaging station. The exposed formations include andesite, metamorphic rocks, serpentine, and some granodiorite. The basin of the Middle Fork upstream from the gaging station near North San Juan, which includes the two areas just mentioned, is about 35 miles long and 4 to 7 miles wide. The altitude at the gage is about 1,400 feet. Geologic formations include all the types found in the upper basins.

The North Fork of the Yuba River rises at about 7,000 feet and, in about 14 miles, drops to an altitude of about 4,100 feet at the gaging station near Sierra City. Most of the basin is underlain by granodiorite, glacial deposits, and andesite. The Yuba River and its higher tributaries have the characteristics of a High Sierra stream. (See p. 347.)

Deer Creek drains a basin about 28 miles long and 3 to 5 miles wide which heads at an altitude of about 4,000 feet and drops to about 500 feet at the gaging station near Smartville. It can be classed as a foothill stream, although snowfall may be a factor at times.

The drainage area between the previously mentioned gaging stations and the base gaging station at Smartville is V-shaped, has legs 35 to

45 miles long, and reaches altitudes as high as 7,000 feet. Formations include all of the types enumerated for the tributary basins, except glacial deposits.

There are ten precipitation stations in the Yuba River Basin. Three of these, including the important station at Soda Springs (altitude, 6,752 feet) are above an altitude of 5,000 feet. The greater part of the area above Smartville is below an altitude of 5,000 feet, 36 percent is between 5,000 and 7,000 feet, and 7 percent is above 7,000 feet. The topography is more complex than that of the basins to the north, and the lines of equal rainfall are probably not as well defined as in areas where the conditions are more uniform.

The snow depth at Soda Springs was 13 inches on December 8, 13 inches on December 9, 10 inches on December 10, a trace on December 11, 8 inches on December 12, and 7 inches on December 13. There was no snow on the ground on December 9 at Lake Spaulding (altitude, 5,075 feet), and only a trace at Bowman Dam (altitude, 5,347 feet). There was, however, an inch of snow at each place after the storm on December 12. From these and other data it is assumed that all precipitation in this basin was in the form of rain during the early days of the storm and turned to snow at altitudes above 5,000 feet during the last part of the storm period. It is concluded that there was snow on the ground at the beginning of the storm, ranging in depth from a trace at an altitude of about 5,500 feet to a few inches at 6,000 feet, and about a foot at 7,000 feet. Much of this snow probably melted during December 9 and 10, and contributed to the run-off.

The observed discharge at the river-measurement stations on Deer Creek near Smartville, Oregon Creek near North San Juan, and the North Fork of the Yuba River near Sierra City is essentially natural. The observed direct run-off at the following stations was adjusted for artificial storage and diversions: at the Middle Fork of the Yuba River near North San Juan and near Milton for diversions to Milton-Bowman tunnel, amounting to 1.55 inches on the area above Milton and 0.35 inch on the area above North San Juan; the South Fork of the Yuba River at Lake Spaulding for storage in Lake Spaulding, Fordyce Reservoir, and other reservoirs; Canyon Creek below Bowman Dam for storage in Bowman Lake, minus inflow from Milton-Bowman tunnel, plus diversions into Bowman-Spaulding canal, and for some storage in French Lake; and the Yuba River near Smartville for storage at Bullards Bar Reservoir, Fordyce Lake, French Lake, Lake Spaulding, and Bowman Lake, amounting to 1.3 inches over the drainage area.

The total direct run-off, in inches, for the flood periods (see table 7, pp. 311-316) is 5.0 inches for the area upstream from the gaging station on the North Fork of the Yuba River near Sierra City, 11.9 inches for Canyon Creek, 12.2 inches for the South Fork of the Yuba River at Lake Spaulding, 3.75 inches for Oregon Creek, 5.6 inches for the Middle Fork of the Yuba River near North San Juan, 7.1 inches for Deer Creek near Smartville, 7.65 inches for the Middle Fork of the Yuba River at Milton, and 6.0 inches for the Yuba River at Smartville. The high run-off for Canyon Creek and the South Fork of the Yuba River at Lake Spaulding are probably partly due to snow melt.

The residuals range from 8.3 inches for the area of the North Fork upstream from Sierra City to 1.6 for Canyon Creek and 0.6 for the area of the South Fork above Lake Spaulding. The latter two figures are obviously low and it is probable that the rainfall map in this area would show more rain if there were additional data in the higher altitudes. However, the reason may be found in contribution from melting snow, as previously mentioned.

There are no recording precipitation gages in the basins where the run-off was essentially natural, but Oregon Creek shows a first peak in rainfall at 7 a.m. December 10, the main peak at 6 a.m. December 11, and a third peak at noon December 11. The North Fork of the Yuba River near Sierra City shows the first peak at noon December 10, and the main peak at 4 a.m. December 11. Precipitation that caused the third peak on Oregon Creek may have fallen as snow above Sierra City. The run-off during the 24 hours of greatest flow was 44 percent of the total run-off for Oregon Creek and 52 percent for the area of the North Fork above Sierra City. Near Sierra City the flow during the main peak was about 50 percent greater than the maximum 24-hour average flow and on Oregon Creek about 75 percent greater.

Of the three basins where the run-off is natural, two, the North Fork of Yuba River near Sierra City and Deer Creek near Smartville, had highest momentary peak discharges for their periods of record. On the third, Oregon Creek, the storm in 1937 seemed considerably less severe than the storm in 1928 and the peak in 1928 is still the maximum. It is possible that in that basin melting snow was a larger factor in 1928 than in 1937.

American River Basin

The American River Basin, upstream from the base gaging station at Fair Oaks, is triangular in shape, is about 65 miles long, and has a maximum width of 50 miles along the crest of the Sierra Nevada. (See fig. 66.) The American River is formed by the union of the South, Middle, and North Forks, which flow in deep canyons down the western slope of the Sierra. A few miles upstream from Fair Oaks the river emerges from its canyon and flows over cobble bars. In the lower reaches the river bed is practically filled with debris that was started downstream by early hydraulic mining operations.

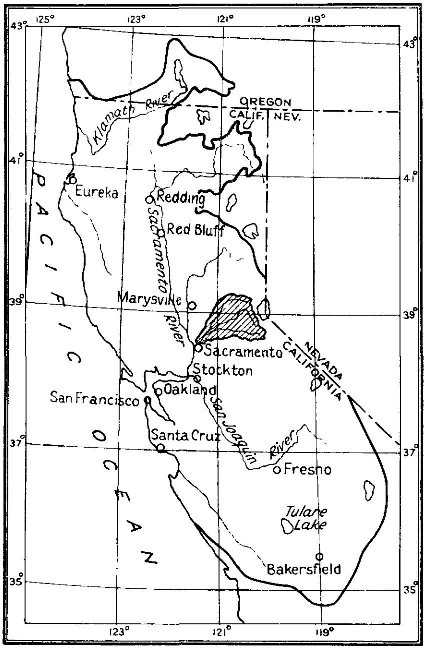

Figure 66.--Key map showing location of American River Basin.

About 41 percent of the basin is above an altitude of 5,000 feet and 13 percent is over 7,000 feet. The river is classed with the High Sierra streams. Generally speaking, the American River Basin will have a greater depth of snowpack, at like elevations, than the Sierra basins near the southern end of the Sierras.

Granite and andesite predominate in the upstream portion of the basin. Quartzite, limestone, shale, slate, and glacial deposits are common in the lower areas.

The American River Basin contains many subdivisions, but the area upstream from each gaging station is not described in detail. A brief description of the outstanding features of some of the smaller basins follows.

Silver Creek, a tributary of the South Fork of the American River, rises at an altitude of about 9,000 feet and flows westward. The basin upstream from the gaging station (altitude, 2,250 feet) near Placerville is about 22 miles long and 10 miles wide, and 18 percent of it is above an altitude of 7,000 feet. Of the basin upstream from South Fork of Silver Creek near Ice House, 39 percent is above 7,000 feet.

Plum and Alder Creeks are in two small basins tributary to the South Fork of the American River but at lower altitudes than Silver Creek. Both basins lie between altitudes of 4,000 and 7,000 feet. They flow northwestward between steep ridges that shut out a part of the sunlight and some of the rain from the southwest. They belong to the mid-slope type of streams. (See p. 348.)

There are 11 precipitation stations in the American River Basin, but only one, Twin Lakes (altitude, 7,920 feet), is above 5,000 feet, and the stations are otherwise poorly distributed. There may be considerable inaccuracy in the lines of equal rainfall at high altitudes.

The snow on the ground at Twin Lakes was reported as 8 inches on December 8 and 8 inches on December 12, but the original 8 inches melted and ran off on December 9 and 10 and was replaced during the closing hours of the storm. Reports indicate that there was about 2 feet of snow on Echo Summit at the beginning of the storm and not more than 2 feet at Desolation Valley (altitude, 8,200 feet). Any snow cover greater than about 2 feet would probably have had a tendency to absorb rain rather than to contribute to the run-off. Estimates of the United States Weather Bureau place the snow cover at 12 inches between altitudes of 6,500 and 7,500 feet. The melting of the snow would contribute about 2 or 3 inches to the run-off. There must have been some snow on the area between altitudes of 5,500 and 6,500 feet. It is assumed that all precipitation in this area was rain on December 9 and 10, except that there were a few hours of snow during the last hours of the storm at the higher elevations.

Alder Creek, Plum Creek, and the three stations on Silver Creek show natural discharge. The flow at the other river-measurement stations was materially modified by storage in reservoirs as follows: the flow on the North Fork of the American near Colfax by the contents of three reservoirs amounting to 0.25 inch over the drainage area; the Middle Fork of the American River by storage estimated as 50 percent of the capacity of Loon Lake, amounting to 0.1 inch over the area; the Silver Fork of the South Fork of the American River by storage in Twin Lakes and Silver Lake amounting to 1.7 inches; the South Fork of the American River near Kyburz by the last items and by diversions to El Dorado canal, the total adjustment amounting to 1.1 inches; the South Fork of the American River near Camino by the last items plus diversion to the American River flume, totaling 0.5 inch; the South Fork of the American River at Coloma by the last items plus some small storage, amounting to 0.2 inch; and the American River at Fair Oaks by 14 reservoirs with a net retention during the flood period amounting to 0.3 inch over the drainage area. The discharge at Silver Lake outlet and Twin Lakes outlet is controlled and the observed run-off has been adjusted to give natural run-off based on observations of changes of storage in the lakes.

The adjusted total direct run-off expressed in inches over the drainage areas (see table 7) varied from 8.85 and 7.9 above Silver Lake outlet and Twin Lakes outlet to 2.25 and 2.0 on Alder Creek and Plum Creek. The two higher figures include some run-off from snow. The low run-off on Alder and Plum Creeks is explained by the basin characteristics previously cited and by the probability that rainfall in those local areas was less than indicated by the general isohyetals.

Differences between rainfall and run-off range from 8.15 to 8.1 inches on Alder and Plum Creeks to 0.30 and 0.05 inches above Twin and Silver Lake outlets. The difference is largely explained by the drainage basin characteristics, but the negative value for Silver Lake outlet indicates an error probably either in the adjustment for storage or in drawing the isohyetals. All the other run-offs and residuals in the American River drainage appear reasonably consistent.

There are recording rainfall gages at Georgetown in this basin and at Fiddletown just to the south. Both of these records show high rainfall intensities in the early morning hours of December 10 and also on December 11, although Georgetown had the highest peak on December 10 and Fiddletown on December 11. These high intensities seem to correspond to the peaks about noon on December 10 and on December 11 in the gage-height graphs at the three gaging stations on Silver Creek. Peaks on the short drainage areas on Alder and Plum Creeks occurred three or four hours after the highest rainfall intensities. The second peak was the higher on all five of the streams where the run-off is unaffected by storage. The ratios between the greater of the peak flows and the maximum 24-hour average flow range from 134 percent on the South Fork of Silver Creek to 160 percent on Plum Creek. The ratios between the run-off during the 24 hours of greatest flow and the total run-off for the storm are very nearly 50 percent for all the streams having natural flow, except that for Alder Creek, which is 36 percent.

Of the five basins with unregulated flow in this area, the momentary peak discharges in two, Alder Creek and Plum Creek, were much lower than the peaks of March 1928. At the three gaging stations on Silver Creek the peaks in December 1937 were moderately higher than those of March 1928.

The storm in 1928 was unusually heavy in the lower altitudes of some of the Sierra basins, such as Plum and Alder Creek Basins, and was accompanied by considerable contribution from melting snow at low and intermediate altitudes. The storm in 1937 was relatively less severe at the lower altitudes and probably was not augmented by melting snow in basins such as those of Plum and Alder Creeks.

Northern Pacific basins

The northern Pacific basins for which data are given in this report are those of the Russian, Eel, Klamath, and Smith Rivers, and three tributaries of the Klamath, the Shasta, Salmon, and Trinity Rivers. (See fig. 67.) They belong to the miscellaneous group of streams. (See p. 349.)

The Klamath River heads far to the northeast, in southern Oregon. The others drain parts of the California Coast Ranges, a region subject to heavy precipitation. The northern Pacific basins, including those not mentioned herein, yield more than one-third of all the run-off in the State.

The three main branches of the Eel River rise at altitudes of about 5,000 to 6,000 feet, 15 to 20 miles to the north, south, and east of the gaging station at Hullville, just downstream from Lake Pillsbury (altitude, about 1,800 feet). The intermediate drainage area between the gaging stations at Hullville and below Van Arsdale Dam is very small. The river drops about 400 feet in the intervening 8 miles. The tributary drainage area downstream from the Van Arsdale gaging station and upstream from the gaging station at Scotia is about 90 miles long, is 50 miles wide in the middle, and narrows as it approaches Scotia. Most of the water comes from tributaries draining mountains 5,000 to 6,000 feet high along the Coast Ranges, and the river flows generally northwestward. The gaging station at Scotia is at an altitude of about 50 feet. The rocks of this region are nearly all sedimentary.

The Shasta River Basin is roughly 25 miles square. The river rises on the north slopes of Mount Shasta and moderately high mountains to the east, and flows northward through the broad alluvial Shasta Valley and then through several miles of canyon to the junction with the Klamath River. The gaging station is at an altitude of about 2,000 feet. The rocks on the east side of the river are mostly volcanic; those on the south are chiefly volcanic, granitic, and metamorphic; and those on the west are largely limestone. Large springs are found in the volcanic areas. There may be corresponding losses at other places. Discharge expressed in second-feet per square mile has little meaning in the Shasta Basin because of undefined limits of surface drainage and lava beds.

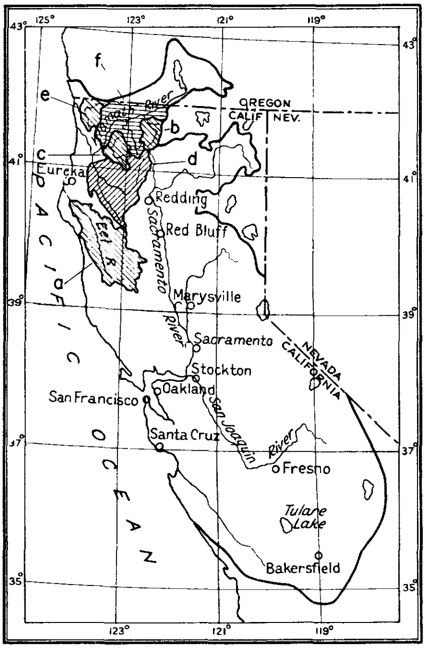

Figure 67.--Key map showing location of northern Pacific basins: (a) Eel River, (b) Shasta River, (c) Salmon River, (d) Trinity River, (e) Smith River, (f) Klamath River between Copco and Somesbar.

The Salmon River and its main branches rise along one of the crests of the Coast Range at about 6,000 feet and flow in a westerly direction. The gaging station near the mouth is at an altitude of about 500 feet. Salmon River flows into the Klamath just upstream from the gaging station on the Klamath. It drains a mountain area that is subject to heavy snowfall in winter, and it has many characteristics of a High Sierra river. This region is mostly unmapped geologically, but it probably contains a great variety of formations.

The Trinity River Basin includes some of the roughest and least populated mountain areas in California. Some of the mountain peaks are more than 8,000 feet above sea level. The river rises at an altitude of about 7,000 feet about 20 miles west of Mount Shasta, and flows southwestward for about 60 miles and then generally northwestward for about 70 miles to its junction with the Klamath River. There are three gaging stations on the river, one at Lewiston (altitude, about 1,800 feet), one near Burnt Ranch (altitude, 1,010 feet), and one near Hoopa (altitude, 315 feet). The geological formations vary widely and include granite, metamorphic and sedimentary rocks, and alluvium.

Branches of the Smith River rise at altitudes of about 5,000 feet along 40 miles of the crest of the westernmost Coast Range, and converge a short distance upstream from the gaging station, which is at an altitude of a few hundred feet. This is a region of very heavy rainfall and little snow, and the river is extremely responsive to storms. It may have the highest average discharge per square mile of any basin in California.

On the Russian River the only information available is the momentary peak discharge. A description of the basin is therefore not given.

The flow of the Klamath River at Somesbar is controlled to such an extent by upper Klamath Lake, by other storage reservoirs, and by power plants that no attempt has been made to adjust the observed run-off. A description of the basin is not given.

There are about 30 precipitation records in the northern Pacific and adjacent basins. However, these records are very unequally distributed among the basins, and there are no available records in the upstream portion of the Eel, Salmon and Trinity Basins. In general there are no records at high altitudes along the crests of the Coast Ranges. Therefore the isohyetal lines as drawn are subject to error.

Snow data are scarce, but the information available in records of the United States Forest Service indicates that there were patches of snow on the shaded slopes on the comparatively small areas above an altitude of 6,500 feet. This small amount undoubtedly melted on December 9 and 10, but added very little to the run-off.

The observed run-off at the three river-measurement stations on the Trinity River and at the Salmon River station is natural. Flow at some of the other stations is materially affected by storage in reservoirs and diversion: the Eel River at Hullville by retained storage in Lake Pillsbury, amounting to 0.05 inch over the drainage area; the Eel River at Van Arsdale Dam and at Scotia by storage in Lake Pillsbury and Van Arsdale Reservoir and by diversions to the Potter Valley power house, amounting to 0.25 inch on the upper area and 0.05 inch on the whole area above Scotia; and the Shasta River near Yreka by storage in Shasta Reservoir, amounting to 1.65 inches over the area. The run-off at these stations has been adjusted to show natural run-off.

Indicated direct run-off in inches of the natural flow streams (see table 7, pp. 311-316) was 3.55 for the Salmon River, and 4.15, 3.65, and 3.75 for the Trinity River at Lewiston, Burnt Ranch, and near Hoopa, respectively.

The record of stage on the Smith River is incomplete, owing to stopping of the water-stage recorder. The momentary peak run-off was 129 second-feet per square mile, although the only nearby rainfall records indicated not to exceed 4 or 5 inches of rain.

The run-off adjusted for storage amounts to 8.7, 8.05, and 7.35 inches for the Eel River at Hullville, below Van Arsdale Dam, and at Scotia, respectively, and 0.35 inch on the Shasta River near Yreka. The storm was evidently not so heavy in the northern end of the State, generally, although the Smith River had a very high momentary peak.

Differences between rainfall and run-off range from 2.25 for the Trinity River at Lewiston and the Salmon River to 4.05 inches for the Shasta River near Yreka.

A recording rainfall gage at Eureka registered high intensities about noon December 10, noon December 11, and about 8 p.m. December 11. Gage-height graphs at stations on the Salmon River at Somesbar and the Trinity River at Lewiston showed peaks about midnight December 10, but high stages continued during December 11. The peak occurred at noon December 11 at the lower gaging station on the Trinity River.

The ratios between the momentary peak discharge and maximum 24-hour average flow are very low, averaging about 110 percent. Ratios between the run-off during the 24 hours of highest flow and the total run-off for the storm range from 32 to 40 percent. At all of the four river-measurement stations where flow is unregulated the momentary peak discharges were the highest on record.

San Francisco Bay basins

The San Francisco Bay basins as discussed here include those of San Francisquito, Stevens, Guadalupe, Campbell, Coyote, and Alameda Creeks, and also of Conn Creek in Napa River Basin. (See fig. 68.) They resemble the foothill type of streams. (See p. 349.)

Alameda Creek is the largest stream draining into the southern part of San Francisco Bay, and has a basin about 50 miles long and 10 to 20 miles wide. The long lateral tributaries from the south, which drain from sedimentary formations at altitudes of 3,000 to 4,000 feet, are the most important. Most of the laterals from the north flow through a broad sedimentary valley, but there are some volcanic rocks interbedded with the sediments. The gaging station is at an altitude of about 100 feet.

Calaveras Reservoir is on Calaveras Creek, a tributary of Alameda Creek.

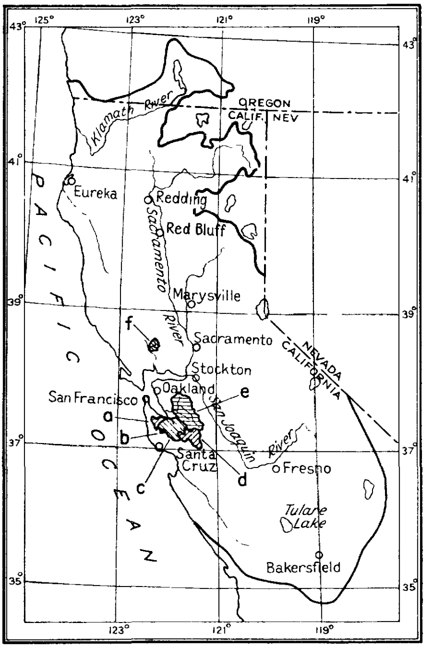

Figure 68.--Key map showing location of San Francisco Bay basins: (a) San Francisquito Creek, (b) Stevens Creek, (c) Guadalupe Creek, (d) Coyote Creek, (e) Alameda Creek, (f) Conn Creek.

Coyote Creek and its tributaries rise on the southern slope of Mount Hamilton and flow southward for about 15 miles, draining sedimentary formations at altitudes of 3,000 to 4,000 feet. There the creek turns northwestward and flows in a canyon along the Hayward fault line until it passes out of the hills near the upper gaging station near Madrone into the flat Santa Clara Valley. It then flows in a comparatively flat channel between hills on the east and an alluvial valley on the west, and finally through a flat delta to the bay. The downstream gaging station near Edenvale is 190 feet above sea level.

Alamitos, Guadalupe, and Los Gatos Creeks rise on the north slopes of Loma Prieta Mountain at altitudes of more than 3,000 feet, and flow generally northward 4 to 10 miles through sedimentary formations. The gaging stations are at the edge of the hills at altitudes between 200 and 360 feet. From here the streams flow through channels cut in alluvium. Guadalupe and Los Gatos Creeks unite immediately upstream from the gaging station in San Jose.

Campbell and Stevens Creeks drain sedimentary and serpentine rock formations as they drop from altitudes between 2,000 and 3,000 feet to sea level. The gaging stations are at altitudes of 400 or 500 feet at the edge of the hills, 5 to 6 miles from the headwaters.

San Francisquito Creek and its tributary, Los Trancos Creek, rise on a 2,000-foot ridge southwest of Stanford University, and drop nearly to sea level in a few miles. The gaging stations are a few miles from the source at altitudes of 120 and 160 feet. The upper basins contain a variety of sedimentary formations, which are probably badly shattered, and the stream courses seem to have a relation to the San Andreas fault. San Francisquito Creek flows for about 4 miles between the upstream and downstream gaging stations in a channel cut in alluvium higher than the bordering areas.

Conn Creek, in Napa County on the north side of San Francisco Bay, originates in hills some 2,000 feet above sea level. It takes a general southeasterly course and, in times of flood, unites with Napa River (tributary to San Pablo Bay, an arm of San Francisco Bay). The gaging station is at the edge of the foothills and is about 180 feet above sea level. The basin contains a variety of sedimentary, intrusive, and volcanic formations.

Rainfall data are more plentiful around San Francisco Bay than in any other locality in northern California. There are 23 rainfall stations within this drainage area and numerous other stations in adjacent territory. A great majority of these gages are unofficial, being maintained by private individuals or quasi-public institutions. Most of the records collected are at points in the valleys, and few data are available at the higher altitudes where the precipitation was generally heavy. Lines of equal rainfall are believed to be fairly well defined, however, in spite of the steep gradients of variation in precipitation.

There was no snow on the ground at the beginning of the storm, and none fell during the storm.

Basins in which the run-off is natural are those of Conn Creek, Los Gatos Creek, and Campbell Creek. The observed run-off from the other basins has been adjusted for storage. The flow of Los Trancos Creek was adjusted for diversions to Los Trancos canal, such adjustment amounting to 0.4 inch over the drainage area. San Francisquito Creek at Stanford and at Palo Alto were adjusted for storage in Searsville Lake and for diversions to Los Trancos and Lagunita canals, amounting to 0.4 inch for each station. Stevens and Guadalupe Creeks were adjusted for Stevens and Guadalupe Reservoirs, amounting to 1.0 and 3.05 inches, respectively. Alamitos Creek was adjusted for storage in Calero and Almaden Reservoirs, totaling 2.1 inches. Guadalupe Creek at San Jose was adjusted for storage in Calero, Almaden, Vasona, and Guadlupe Reservoirs, totaling 0.9 inch. Coyote Creek near Madrone and at Edenvale was adjusted for storage in Coyote Reservoir, amounting to 1.15 inches on the upper drainage area and 0.95 inch on the lower. Alameda Creek was adjusted for storage in Calaveras Reservoir and diversions for San Francisco water supply amounting to 0.35 inch over the drainage area.

The adjusted run-off in inches (see table 7, pp. 311-316) ranges from 0.6 and 0.75 on Los Trancos and Alameda Creeks to 4.15 and 4.35 on Los Gatos and Guadalupe Creeks at Guadalupe, respectively. The precipitation was definitely lighter on the northern basins in this group and exceeded their absorptive capacity by comparatively small amounts. There were centers of heavy precipitation along the divide between the coast and the bay drainage area from Saratoga Gap to and south of Loma Prieta, a large mountain on which lie the headwater areas of Los Gatos, Guadalupe, Alamitos, and Uvas Creeks. The rainfall was much lighter on the second range of hills, which is drained by Alameda and Coyote Creeks.

The differences between rainfall and run-off are generally high. This is particularly true of Stevens, Campbell, and Los Gatos Creek Basins in which residuals of between 10 and 12 inches are indicated. These values are partially substantiated by the extremely high value of 14.85 inches for San Lorenzo River, just over the ridge, and 9.1 inches for Uvas Creek, to the south.

The recording rain gage (see fig. 27, p. 62) at San Francisco may be indicative of the distribution of the storm precipitation in the San Francisco Bay and Santa Cruz Mountain areas, although the total amount recorded is much less than that in much of the area. The precipitation of greatest intensity, about 10 a.m. December 9, is not reflected in discharge peaks at any of the stream-measurement stations. Later periods of high intensity at about 2 p.m. on the 10th and the early morning of the 11th seem to be reflected in peaks on Conn and Los Gatos Creeks at 6 a.m. on the 10th and in the morning of the 11th. A short, sharp storm about 6 a.m. on December 12 must have been local to San Francisco, there being no effect on the run-off of Los Gatos Creek and only a slight effect on Conn Creek.

The ratios between the flow at the momentary peaks and the maximum 24-hour average flows are high, as is to be expected on short creeks with high gradients and draining steep hills, like Los Gatos, Campbell, and Conn; these ratios were 182, 177, and 201 percent, respectively. The ratios between the highest 24-hour run-off and the total run-off for the storm range from 49 to 59 percent.

Maximum momentary peaks on Los Gatos, Campbell, and Conn Creeks were considerably lower than the peaks of February 1937. However, total direct run-off during the storm of December 1937 exceeded the total direct run-off of the February storm. This behavior is apparently accounted for by the double peak and the broader hydrograph of the flood of December 1937.

Owens Lake basins

The streams in Owens Lake Basin discussed in this report are Owens River and Rock, Pine, Big Pine, Independence, and Tuttle Creeks. (See fig. 69.)

The Owens River rises along the crest of the Sierra Nevada immediately east of the headwaters of the San Joaquin River around Mount Lyell, and the smaller streams on the west side of Owens Valley rise along this crest between Mount Lyell and Mount Whitney. The sources are small glaciers or snow banks that lie on the shady side of the peaks and crests. The streams emerge from the mouths of the canyons at the eastern base of the Sierra upon talus slopes and detrital cones, and cross a broad alluvial plain. In this belt of debris the streams lose a large amount of water, part of which reappears in springs in the valley.

The large underground water storage in Owens Valley is directly related to the small surface run-off and to the porous surface that characterizes both the detrital cones and the lava fields. Parts of the Owens Basin are non-contributing to surface run-off, owing to their volcanic (lava) formation. This region is semi-arid, desert in parts, on the lower western slopes of the Sierra Nevada and Coast ranges. The streams in Owens Valley, to an even greater extent than streams on the west side of the Sierra Nevada, depend upon melting of winter snows for run-off. It therefore is evident that these streams do not show and can not be expected to show either a large surface discharge per square mile or a large total run-off for a given storm. As in the Pit River Basin, discharge per square mile has little significance.

The Owens River upstream from the gaging station near Round Valley has a basin roughly 25 miles long and 18 miles wide, in which the two main tributaries rise at altitudes of 8,000 to 12,000 feet, flow eastward to unite in Long Valley at about 6,800 feet, and then flow southward through a comparatively flat valley. The gaging station is at an altitude of 4,450 feet. Almost the whole basin is at an altitude of more than 5,000 feet. The headwater areas on the escarpment of the Sierra Nevada contain chiefly metamorphic rocks and granite overlain locally by volcanic deposits. The middle and lower parts of the basin are alluvium and an old lake bed. The upper part of Owens Valley and the volcanic rock fields at its head are traversed by a network of small faults. There are numerous hot springs in the region west of Long Valley.

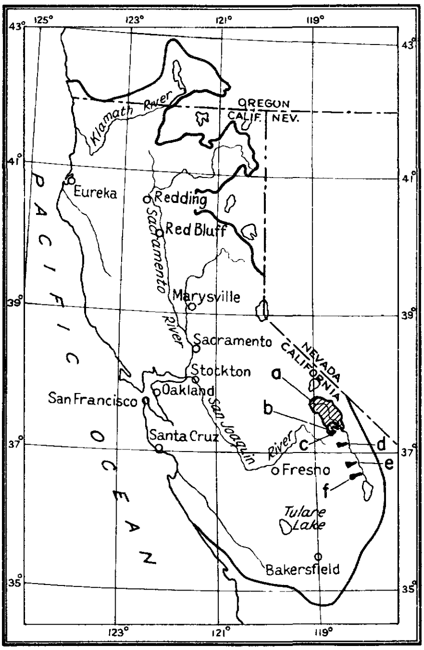

Figure 69.--Key map showing location of Owens Lake basins: (a) Owens River upstream from Round Valley, (b) Rock Creek, (c) Pine Creek, (d) Big Pine Creek, (e) Independence Creek, (f) Tuttle Creek.

Rock Creek and Pine Creek rise at very high altitudes of about 11,000 to 12,000 feet on the granitic escarpment of the Sierra Nevada, and drop sharply for a few miles in a northeasterly direction, Rock Creek among glacial deposits, and Pine Creek among metamorphic rocks, moraines, and terrace deposits. Pine Creek has a particularly high proportion of its area at high altitudes, and is associated with a fault line in its middle course. The gaging station on Rock Creek is at an altitude of about 4,900 feet, and the station on Pine Creek is at about 5,250 feet.

Big Pine Creek heads in a row of small glaciers, of which Palisade Glacier is the largest, at an altitude of about 12,500 feet, and drops sharply eastward through glacial and terrace deposits. The gaging station is at an altitude of about 4,200 feet. The length from source to gaging station is only about 10 miles.

Independence and Tuttle Creeks also rise at very high altitudes on the granitic escarpment and plunge eastward for a few miles before reaching comparatively gentle slopes on terrace deposits. The gaging stations are at altitudes of about 4,000 feet.

The only rainfall records available in the Owens Basin are those at Big Pine Creek power house No. 3, and the only ones available in Big Pine Creek Basin are those at Crooked Creek. However, there are about 12 nearby rainfall stations that help to define the lines of equal rainfall in the drainage areas of Owens River and Rock, Pine, Big Pine, Independence and Tuttle Creeks with a fair degree of accuracy. The extremely steep slopes of these basins add to the difficulties of definition of the rainfall. The records at Ellery Lake (altitude, 9,600 feet), Gem Lake (altitude, 9,120 feet), Bishop Creek (altitude, 9,390 feet), Lake Sabrina (altitude, 9,100 feet), and South Lake (altitude, 9,620 feet) were very useful in defining the precipitation at high altitudes. Most of the other rainfall stations are located along the Owens River.

With the exception of 1 inch at Gem Lake, there was practically no snow at any of the five high precipitation stations at the beginning of the storm on December 9. The following new snow was reported: at Ellery Lake, 2 inches on December 9, 17 inches on the 10th, 4 inches on the 11th, and 3 inches on the 12th, the accumulation on the 12th being 20 inches; at Gem Lake, an accumulation of 7 inches on December 12; at Bishop Creek, 2 inches on the 11th, and one inch on the 12th; at Lake Sabrina, 1/2 inch on December 9, 2 inches on the 11th, and 6 inches on the 12th, the accumulation on the 12th being 7 inches; at South Lake, a trace on December 9, 6 inches on the 10th, 5 inches on the 11th, and 5 inches on the 12th, the accumulation on December 12 being 12 inches. The water content of the snow added up to 6.43 inches at Ellery Lake, 0.92 inch at Lake Sabrina, and 5.95 inches at South Lake. As the total precipitation during the storm was reported to be 6.84 inches at Ellery Lake, 4.66 at Gem Lake, 6.75 at Bishop Creek, 8.72 at Lake Sabrina, and 5.40 at South Lake, it is obvious that almost all of the precipitation was snow above an altitude of 9,500 feet, and partly snow and partly rain at 9,000 feet, at which altitude there was no run-off. At Lundy Lake (altitude, 7,760 feet), 2 inches of snow was reported on December 12, but this was gone on December 14. From this record and that at Bishop Creek, it would seem that at an altitude of 8,500 feet the precipitation fell as rain during December 9 and 10 and changed to snow on the last days of the storm, and that practically all the precipitation was rain below about 7,500 feet.

Run-off was unregulated at all the six stream-measurement stations in this area, and amounted to 0.2 inch over the drainage area on the Owens River, 0.15 inch on Rock Creek, 0.25 inch on Pine Creek, 0.1 inch on Big Pine Creek, 0.1 inch on Independence Creek, and 0.15 inch on Tuttle Creek. Assuming that only the area below 9,000 feet contributed, these figures would be 0.25, 0.45, 1.1, 0.25, 0.15, and 0.25 respectively. The Pine Creek Basin has a particularly high percentage of its area above an altitude of 9,000 feet.

The differences between precipitation and run-off were 3.8 inches for the Owens River, 4.45 for Rock Creek, 5.25 for Pine Creek, 5.3 for Big Pine Creek, 4.9 for Independence Creek, and 2.95 for Tuttle Creek. These values seem consistent. Assuming that only the area below 9,000 feet contributed and using the precipitation for this area, the respective residuals would be 3.55, 3.35, 4.1, 4.55, 4.25, and 2.35 inches.

Ratios between the run-off during the 24 hours of highest flow and for the entire storm range from 25 to 53 percent. Ratios between the momentary peak discharge and the maximum 24-hour average discharge range from 146 percent on Owens River to 205 percent on Pine Creek. Both sets of ratios are consistent.

There are no recording rainfall records available in this region, but all the stream-stage records show rises beginning in the early morning of December 10, and all the streams except the Owens River near Round Valley reached low peaks in the forenoon of the same day. The Owens River reached the first peak just before midnight. After a 12 to 14-hour recession, a second rise started, and the five smaller streams reached a higher peak in the afternoon of December 11. The Owens River reached its higher peak at 10 p.m. the same evening.

The momentary peak of 1,560 second feet on the Owens River exceeded the previous peak of 1,190 second feet on June 30, 1907. The momentary peaks of 115 and 207 second feet on Rock and Pine Creeks did not exceed the previous record peaks of 162 and 350 second feet on June 17, 1927, and July 21, 1936, respectively.

Truckee River Basin

Truckee River has its source in Lake Tahoe, the dominating feature of the basin. The lake, which has a surface area of about 193 square miles, occupies part of an elongated valley between the steep east front of the Sierra Nevada and the west front of the Carson Range. Glacial lakes occupy small valleys along the east front of the Sierra, at altitudes of more than 9,000 feet, and are drained by small streams entering Lake Tahoe. The gaging station on the upper Truckee River is immediately downstream from the lake outlet, at an altitude of about 6,200 feet above sea level. (See fig. 70.)

The Sierra Nevada and Carson Ranges are made up chiefly of granitic rocks, and the Sierra has been extensively glaciated. Volcanic rocks, alluvium, and glacial deposits occupy the valley tract.

The tributaries of Donner Creek rise at about 7,000 feet near Donner Summit, in granite, and flow eastward through glacial Donner Lake. The gaging station is not far from the confluence of the creek with Truckee River and is at an altitude of about 5,800 feet.

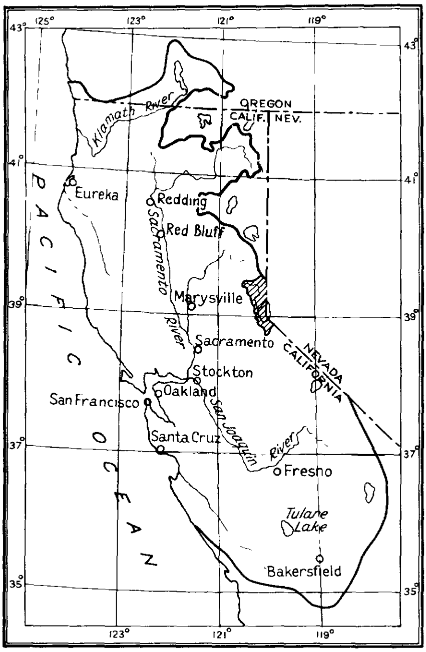

Figure 70.--Key map showing location of Truckee River Basin (California part.)

The intermediate drainage area between the Truckee River gaging stations at Tahoe and Iceland is about 22 miles long from north to south and 18 miles wide from east to west. The mountains are composed mostly of volcanic material, and there are considerable amounts of glacial deposits in the valleys. After leaving Lake Tahoe, the Truckee River flows northward to the junction with Donner Creek, then northeastward past the Iceland gaging station, at an altitude of about 5,420 feet, and finally northward and northwestward and discharges into Pyramid and Winnemucca lakes.

There are four rainfall stations in the Truckee River basin upstream from Iceland, and some in adjacent territory, but the lines of equal rainfall are poorly defined. The steep rainfall gradient and the rapid change in altitude add to this uncertainty.

A considerable part of the drainage area along the western side of the basin is above 7,000 feet. Snow conditions at Soda Springs were probably typical of the high area. At Soda Springs (altitude, 6,752 feet) there were 13 inches of snow on the ground on December 8, 13 inches on the 9th, 10 inches on the 10th, a trace on the 11th, 8 inches on the 12th, and 7 inches on December 13th. The original 13 inches of snow melted and ran off during the early days of the storm and was followed by a lighter cover during the closing hours of the storm. There was probably some snow at all altitudes above 6,000 feet at the beginning of the storm.

Run-off at all three gaging stations is controlled by large lake storage upstream: the two Truckee River stations by Lake Tahoe, and Donner Creek by Donner Lake. Storage quantities in these lakes were relatively so large and uncertain that no attempt has been made to adjust the observed flow for storage in order to compute the total flood run-off.

FLOOD CRESTS

Various agencies of the Federal and State governments, together with public-service and other companies, obtained records of the crest stages reached by the San Joaquin and Sacramento Rivers during December 1937. Some of the records were obtained at regular river-measurement stations for which additional data appear in this report. Other records are at places for which only the crest stage is available. All these records of crest stages for the two rivers have been assembled in table 10, which shows both the gage height in feet and the altitude above mean sea level.

The profile of crest stages on the San Joaquin River is shown graphically in figure 71 and for the Sacramento River in figure 72. For comparison, the profile of crest stages in the San Joaquin River during the flood of March 1938 is shown in figure 74 on page 492.

It should be noted that the table and graphs show the absence, rather than the presence, of a peak on the lower San Joaquin River in December 1937. The "peak" that reached the Geological Survey gaging station near Newman on December 24, 1937, was only 6,050 second-feet, and the small rise that appeared at the Vernalis gaging station on December 26 had little relation to the record peak that passed the Friant gaging station on December 11.

Table 10.--Flood-crest stages

Stream and gaging station	Miles above mouth	Day and hour	Gage height in feet	Altitude in feet a/
San Joaquin River				
Friant, U. S. Geological Survey gage, 1 mile upstream from Cottonwood Creek	278.4	Dec. 11 7 pm	23.8	333.8
Skaggs Bridge, Southern California Edison Co. gage, 2 miles downstream from bridge, near Herndon	244.5	Dec. 12 7 am	20.9	218.0
Gravelly Ford, Miller & Lux gage, 150 feet downstream from intake of Gravelly Ford canal	241.2	Dec. 12 9 am	12.2	205.8
Whitehouse, Miller & Lux gage, 400 feet upstream from head of Lone Willow Slough	227.8	Dec. 13 1 am	10.8	177.8
Mendota Dam, Miller & Lux gage, 25 feet upstream from dam	216.6	Dec. 14 5 am	15.0	162.0
Firebaugh, Miller & Lux gage, highway bridge	205.1	Dec. 15	147.2	147.2
Temple Slough, Miller & Lux gage, headgate of slough	192.4	Dec. 15 1 pm	131.8	131.8
Santa Rita Bridge, Miller & Lux gage	184.1	Dec. 16 6:30 am	13.2	120.1
Lucerne, Miller & Lux gage, 1½ miles east of Lucerne farm	180.7	bDec. 17 4 pm	113.7	113.7
Chamberlain Slough, State Division of Water Resources gage, 6½ miles west of El Nido	178.3	Dec. 16	9.95	110.5
Turner Island Bridge, State Division of Water Resources gage, 1 mile downstream from Turner ranch	166.8	Dec. 16	8.55	95.2
Fremont Road bridge, State Division of Water Resources gage, 5 miles northeast of Gustine	135.6	Dec. 22 4 pm	-	64.8
Newman, U. S. Geological Survey gage, 300 feet downstream from mouth of Merced River	128.3	Dec. 24 8 am	11.41	58.8
Grayson, city of San Francisco gage, Laird Slough, 1½ miles east of Grayson	96.3	Dec. 25 3 pm to midnight	-	34.4
Tuolumne River, city of San Francisco gage, on Tuolumne River, 2,000 feet upstream from junction with San Joaquin River	91.1	Dec. 25 midnight	-	29.4
Vernalis, U. S. Geological Survey gage, 3 miles downstream from mouth of Stanislaus River	76.7	Dec. 26 2 am	14.36	19.2
Lathrop, U. S. Weather Bureau gage	59.1	Dec. 23 3 pm	c5.2	c7.1
Sacramento River				
Antler, U. S. Geological Survey gage, right bank, 0.2 mile downstream from highway bridge	337.5	Dec. 10 10 pm	14.55	949.0
Kennett, U. S. Geological Survey gage, highway bridge	319.0	Dec. 11 1 am	30.6	648.9
Keswick, U. S. Geological Survey gage, left bank, 0.5 mile downstream from Spring Creek	307.3	Dec. 11	37.0	537.0
Red Bluff, U. S. Geological Survey gage, left bank, 4 miles upstream from Red Bluff	254.2	Dec. 11 7:30 am	36.5	289.1
Red Bluff, U. S. Weather Bureau gage, bridge	249.6	Dec. 11 8:35 am	31.95	268.8
Hamilton City, U. S. Weather Bureau gage, Gianelli Bridge	204.5	Dec. 11 5 pm	22.8	147.1
Ord's Ferry, State Division of Water Resources gage, right bank, ferry crossing	185.6	Dec. 11 5 pm	120.9	118.1
Butte City, U. S. Geological Survey gage, left bank, 0.2 mile downstream from highway bridge	170.6	Dec. 12 7 am	95.4	92.6
Moulton Break, State Division of Water Resources gage, right bank, Gordon's pump house	158.5	Dec. 12 11 am	83.4	80.6
Colusa, State Division of Water Resources gage, weir	146.2	Dec. 13 7 pm	67.4	64.6
Colusa, U. S. Geological Survey gage, right bank, highway bridge	144.7	Dec. 12 2 pm	67.2	64.4
Meridian, Sacramento Northern Ry. gage, bridge	134.8	Dec. 13 6 pm	61.5	58.6
Tisdale weir, State Division of Water Resources gage, pumping plant, 1,000 feet downstream from weir	119.6	Dec. 14 6 am	51.1	d48.2
Wilkins Slough, U. S. Geological Survey gage, right bank, 1,500 feet downstream from pumping plant of reclamation district No. 108	118.9	Dec. 14 6 am	50.7	47.8
Knights Landing, U. S. Geological Survey gage, left bank, just above Southern Pacific Co. bridge	89.4	Dec. 14 4 am	40.4	37.4
Fremont weir, Corps of Engineers, U. S. Army, gage, upstream end	83.4	Dec. 14 4 am	38.4	e35.5
Fremont weir, Corps of Engineers, U. S. Army, gage, downstream end	81.7	Dec. 14 4 am	37.8	e34.9

a Above mean sea level.
b Gage height practically unchanged, Dec. 16 and 17.
c Probably affected by tide.
d Elevation of crest of weir, 39.4 feet.
e Elevation of crest of weir, 30.6 feet.

Table 10.--Flood-crest stages--Continued

Stream and gaging station	Miles above mouth	Day and hour	Gage height in feet	Altitude in feet a/
Sacramento River--Continued				
Verona, U. S. Geological Survey gage, Garden Highway bridge, left bank, 1 mile downstream from mouth of Feather River	78.7	Dec. 14 3 am	38.23	35.3
Sacramento weir, State Division of Water Resources gage, upstream end	63.5	Dec. 12 3 am	31.4	f28.4
Sacramento, U. S. Weather Bureau gage, I Street bridge	59.4	Dec. 12 2 am	27.7	27.8
Freeport Bridge, Corps of Engineers, U. S. Army, gage	46.6	Dec. 12 3 am	23.3	20.3
Clarksburg, State Division of Water Resources gage	42.2	Dec. 12 3 am	21.2	18.2
Greens Landing, Corps of Engineers, U. S. Army, gage, near Courtland	34.5	Dec. 12 3 am	18.8	15.8
Walnut Grove, State Division of Water Resources gage	26.6	-	12.7	9.7
Rio Vista, Corps of Engineers, U. S. Army, gage	12.5	Dec. 16 1 pm	8.8	5.8

a Above mean sea level.
f Elevation of crest of weir, 22.0 feet.

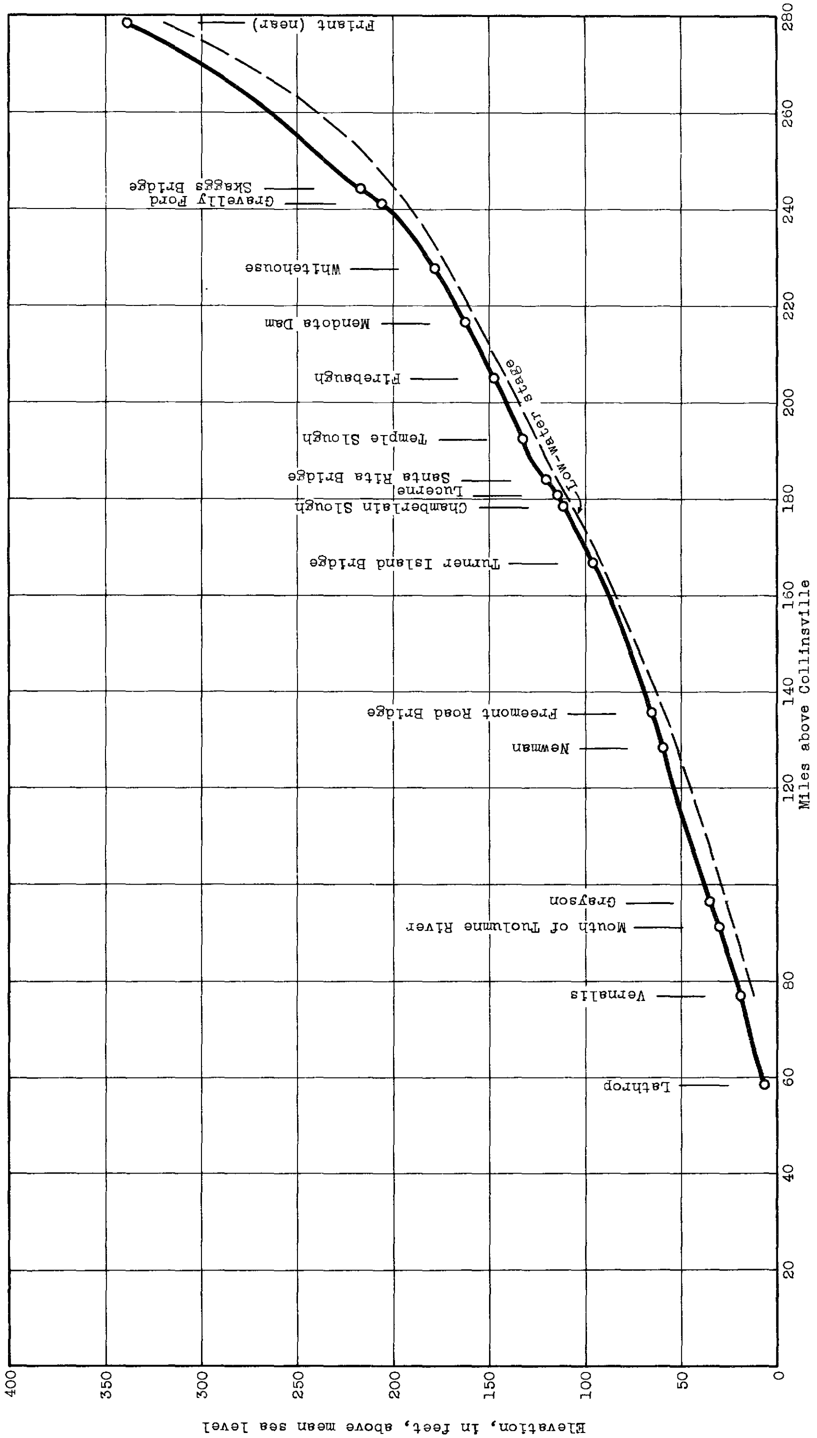

Figure 71.--Profile of crest stages on the San Joaquin River during the flood of December 1937.

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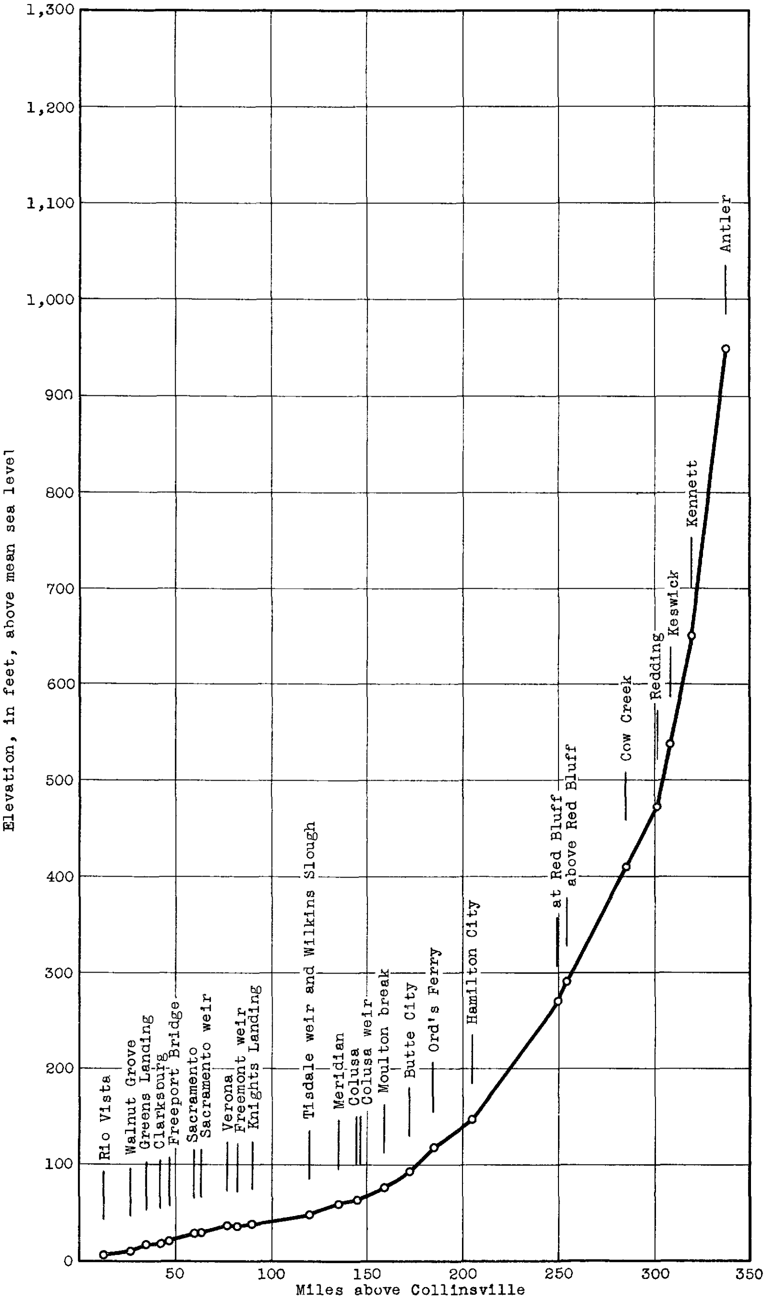

Figure 72.--Profile of crest stages on the Sacramento River during the flood of December 1937.

Information is very meager about floods in northern California prior to about 1850, when extensive settlement of the State began. There were several great floods in the region between 1850 and about 1890, the time when systematic records of stream flow began. With regard to those floods, authentic data are available on the rainfall conditions and crest stages in some localities. The data are supplemented by accounts in local histories and newspapers, which give much general information on the duration and areal extent of the largest floods. From 1890 to 1907 flood data on the larger rivers have been published in water-supply papers of the Geological Survey, and since 1907 the published records have continuously increased in comprehensiveness and accuracy.

Comprehensive and reliable comparisons of the magnitude of early floods cannot be made, because of complicated and variable artificial conditions and the lack of complete data. Mining, reclamation, flood protection, and other works have greatly altered the regimen of the rivers and at some places to such an extent that the crest stages of recent minor floods were higher than those of early major floods.[15] Comparisons of available flood data for some streams are shown in tables 11 to 17.

Further on in this chapter detailed information about floods is given for each major stream basin, or group of basins.

Sources of information

Some of the principal sources of published information about previous floods are the newspapers, the county histories and other historical writings, and the Federal, State, and private reports describing floods or flood control problems. Of these sources the newspapers generally have the most detailed descriptive accounts of the early floods and the special reports generally have the most specific data. In addition, it is possible in many cases to obtain eye-witness accounts of previous floods from local residents, sometimes supplemented by well-authenticated high-water marks. Many of these eye-witness accounts are not specific as to dates but may be verified by newspaper reports.

15/ Discussions of changes in conditions of several California streams due to artificial causes are published in U. S. Geol. Survey Prof. Paper 105, Water-Supply and Irrigation Papers 17, 18, and 19, several reports of the Corps of Engineers, U. S. Army, and reports and publications of the State of California.

It is not practicable to give in this report detailed references to all sources of information of former floods. More specific data about sources than are here supplied are available in the files of the San Francisco district office of the Geological Survey.

Newspapers

There is given below a partial list of the newspapers consulted to obtain descriptions of the floods that are discussed in this report. These are grouped according to the basins to which the local news was related, although the State-wide accounts found in newspapers of the principal cities were the only news sources consulted for some localities and floods. The papers are listed, alphabetically by cities, with the latest names and places of publication. Many of them have had various names, and a few were published at other places in the earlier years. The cities are in California unless otherwise designated.

San Francisco Bay basins.--Napa Daily Register, Napa; San Francisco Chronicle, San Francisco.

Kern River Basin.--Bakersfield Californian, Bakersfield.

Tulare Lake Basin.--Fresno Expositor, Fresno; Fresno Morning Republican, Fresno; Visalia Delta, Visalia.

San Joaquin River Basin.--Mariposa Gazette, Mariposa; Stockton Morning Independent, Stockton.

Sacramento River Basin.--Folsom Telegraph, Folsom; Marysville Appeal-Democrat, Marysville; Red Bluff Beacon, Red Bluff; Red Bluff Sentinel, Red Bluff; Tehama County People's Cause, Red Bluff; Sacramento Bee, Sacramento; Daily Sacramento Placer Times, Sacramento; Sacramento Daily Union, Sacramento.

Northern Pacific basins.--Del Norte Record, Crescent City; Humboldt Standard, Eureka; Humboldt Times, Eureka; Healdsburg Enterprise, Healdsburg; Russian River Flag, Healdsburg; Sonoma County Tribune, Healdsburg; Trinity Journal, Weaverville.

Great Basin.- Esmeralda Union, Aurora, Nevada; Carson City Appeal-News, Carson City, Nevada; Gold Hill Daily News, Gold Hill, Nevada; Inyo Independent, Independence.

In addition to accounts in these newspapers, a collection of miscellaneous news clippings was reviewed at the Bancroft Library, University of California, Berkeley. This collection is assembled in a volume called "California Floods", and covers the period 1861-1879. Another collection of news clippings at this library is assembled in a volume called "Sacramento River Floods of 1878 and 1881".

Detailed information about the issues available and the locations of these and other newspapers is given in "American Newspapers 1821-1936, A Union List of Files Available in the United States and Canada", edited by Winifred Gregory and published by the H. W. Wilson Co., New York, 1937. The most complete files in Northern California are those of the California State Library, Sacramento, and of the Bancroft Library, University of California, Berkeley. Some newspapers are available only in local collections such as those of the publisher's, or of the city and county libraries.

Histories

The following list of histories includes those that were found to be most complete and apparently most accurate in their accounts of early floods. Although county histories were found not to be a very satisfactory source of flood information, they furnished some valuable fragmentary data that were not obtainable elsewhere.

History of Fresno County, Calif., Lilbourne Alsip Winchell, under the editorial supervision of Ben R. Walker, published by A. H. Cawston, Fresno, 1933.

History of Kern County, Calif., by Wallace M. Morgan and others, published by Historic Record Co., Los Angeles, 1914.

History of Sacramento County, Calif., Thompson & West, Oakland, Calif., 1879.

History of Siskiyou County, Calif., D. J. Stewart & Co., Oakland, Calif., 1881.

History of Stanislaus County, Calif., by L. C. Branch and others, published by Wallace W. Elliott & Co., San Francisco, Calif., 1881.

Illustrated atlas and history of Yolo County, published by De Pue & Co., San Francisco, Calif., 1879.

Miscellaneous reports

The following list records some of the miscellaneous reports that were consulted, with a brief statement of the flood information obtained.

Annual Report of the Surveyor-General of California for the year 1862.
Contains special reports from several county surveyors, listing flood heights above low water in 1862 at a few places in the Central Valley.

Engineers Report on the Northern Boundary of Swamp Land District No. 2; B. F. Leet, Engineer, and George H. Goddard, Consulting Engineer; Sacramento, Calif., May 13, 1862. (Part of this report is published in the Sacramento Union of May 16, 1862.)
Contains high-water elevations and areas of cross-sections for the flood of January 10, 1862, at several points on the American River from Folsom to Sacramento.

Report of the State Engineer to the Legislature of the State of California - Session of 1880. Part III; Sacramento, Calif., 1880.
Presents high-water elevations for 1878-79 at a number of points in the Yuba River Basin and for 1861-62 on the South Fork of Yuba River at Edwards Bridge. Detailed descriptions of the channel conditions are given.

Report of the Chief of Engineers, U. S. Army, 1882. Appendix MM.
Contains miscellaneous high-water elevations of the floods of 1879-80, and comparisons with the flood of 1861-62 on the Cosumnes, Calaveras, Stanislaus, and Tuolumne Rivers. Compares the floods of 1861-62 and 1881 on the Feather River at and near Oroville.

Physical Data and Statistics of California; compiled in the State Engineering Department of California. Wm. Ham. Hall, C. E., State Engineer; Sacramento, Calif., 1886.
Presents many early meteorological records, and monthly and yearly stream flow data for the period 1878-84.

Report of the Chief of Engineers, U. S. Army, 1891. Appendix VV.
Lists data on the high water of 1861-62, for the South Fork of Yuba River at Edwards Bridge. Maximum and minimum gage heights for the Feather and Yuba Rivers near Marysville are given for the years 1881-89, and gage heights are listed for several days during the high-water period March-May 1890. The peak stages of April 1853 and December 1889 for the Feather River at Nicolaus are referred to the low-water plane. Damages in the lower Sacramento Basin caused by the floods of 1889-90 are discussed. Detailed descriptions of channel conditions are given for the Feather, Yuba, Bear, and American Rivers, and for the large tributaries of the lower San Joaquin River.

Report of the Commissioner of Public Works to the Governor of California; Sacramento, Calif., 1895.
Contains graphs of rainfall at Red Bluff, October 1877 to June 1887, and October 1887 to June 1894; and at Sacramento, October 1861 to June 1862; October 1877 to June 1887; and October 1887 to June 1894. Stage-graphs for the Sacramento River at Red Bluff are given for most of the winter months during the period December 1878 to August 1894, excepting the seasons of 1888-89 and 1889-90. Stage-graphs for the Sacramento River at Sacramento are given for the periods September 1849 to August 1862; and September 1874 to November 1894. Miscellaneous high-water elevations are listed for points in the Sacramento River Basin and on the lower San Joaquin River, especially for the years 1878 and 1879. References are given to sources of information about the channel dimensions and water surface elevations of many rivers of the Central Valley.

Report of the Commissioner of Public Works to the Governor of California, 1895-1896; Sacramento, Calif., 1896.
Contains a list of maximum and minimum gage heights on the San Joaquin River near Lathrop, for the years 1879-94 and the high-water gage height of 1895. The flood profile of the Sacramento River from Cache Slough to Collinsville is given for 1896, and is compared with flood profiles for 1878 and 1879.

Summary of outstanding floods

The following summary of the most outstanding and wide-spread floods for the period 1861 to 1907 affords a brief general description of their magnitude and areal extent. Unless otherwise stated, the observations refer to foothill localities on streams tributary to the great Central Valley and to places near the mouths of the coastal streams.

Floods of 1861-62

The winter season of 1861-62 was remarkable for the exceptionally high stages reached on nearly every stream, for the repeated occurrence of large floods, and for the prolonged and widespread inundation in the San Joaquin and Sacramento Valleys. During the period December 7-9, 1861, exceptionally high or record-breaking stages were observed in the Klamath River Basin, and large floods were reported throughout the Sacramento River Basin. During the latter part of December 1861, moderate or large floods occurred from the Kern River to the upper Sacramento River Basin, and on some of the coastal streams.

In the period January 10-11, 1862, extremely high or record-breaking stages were observed on the larger streams in the San Joaquin and Sacramento Valleys, on coastal streams from the Salinas to Eel River, and on streams in the Great Basin from the Walker to the Truckee River.

In the period January 12-18, floods occurred several times on foothill streams in the San Joaquin Valley and, about January 18, in the Kern and Tulare Lake Basins, and probably in the South Pacific Basins. There was another important flood period, January 22-24, in the Sacramento and lower San Joaquin River Basins. The peak discharges of the lower San Joaquin and Sacramento Rivers in January 1862 appear to have been the greatest since early in the nineteenth century.

Floods of 1867-68

The floods of 1867-68 were especially severe on streams in the Sierra Nevada in the southern part of the Central Valley. Peak stages in this region in the period December 24-26 were generally the highest of record. There were floods of great magnitude also on the main tributaries of the lower San Joaquin and Sacramento Rivers, where the crest stages at many points approached or equalled those of 1861-62. Floods also occurred in the Great Basin from the Truckee River south to the Walker River, and possibly as far as the Owens River. Apparently at some points in the Walker and Carson River Basins the floods were the greatest of which there is knowledge. High stages were observed several times during December 1867 on the foothill streams of the Sierra Nevada, and moderate or large floods occurred during the latter part of this month on streams in the upper Sacramento River Basin and on some of the coastal streams.

Floods of 1881

The floods in 1881 were outstanding in the upper part of the Sacramento River Valley. The Sacramento River upstream from Cow Creek reached early in February the highest stage of which there is record. Floods of considerable magnitude occurred throughout the Sacramento River Basin from January 30 to February 4. Peak stages along the lower Feather and Sacramento Rivers equalled or exceeded those of 1861-62, but the maximum discharges probably were less. There were notable floods at some points in the San Joaquin River Basin and on coastal streams from San Francisco Bay north to the Smith River. The peak stage of 1881 on the Klamath River at Weitchpec, although considerably below that of 1861, was one of the highest known.

Floods of 1889-90

The winter season of 1889-90 was remarkable for the exceptionally heavy and widespread precipitation which produced floods of considerable importance throughout northern California in January and February 1890, and moderate floods at other times from December 1889 to May 1890. The floods of January and February were especially heavy on coastal streams from the Salinas River north to the Smith River. Several of these rivers were reported to have been, during the first part of February, the highest since 1861-62. The crests near the mouths of the Klamath and Smith Rivers were about the same as the record peaks of 1861-62. The peak discharges from streams of the Sierra Nevada were, in general, not very great. In this region the season was unusual because of exceptionally low temperatures and heavy snowfall at high altitudes resulting in very high stages owing to ice and snow gorges at some places.

Floods of 1907

The flood season of 1907 was one of the most outstanding for which fairly adequate stream-flow data are available. During the period March 18-21, major floods occurred on the main tributaries of the lower San Joaquin River, in the Sacramento River Basin, on many of the coastal streams, and on the Truckee River in the Great Basin. The peak stages on some of the larger tributaries of the lower San Joaquin and Sacramento Rivers were possibly the highest since 1867-68, but in general were lower than the record peaks of 1861-62. Exceptionally high stages on the Trinity, Eel, and Russian Rivers were reported, and moderate floods occurred in the basins tributary to San Francisco Bay, and southward to the Salinas River Basin.

Southern Pacific basins

Floods of 1861-62.--A flood of major proportions occurred on Salinas River during the winter season of 1861-62. According to Juan Arajo, resident near Paso Robles since 1855, the channel, which prior to 1862 was narrow and meandering, was widened considerably in places by this flood. From statements of Charles Bardin, a witness of the flood of 1862 near Salinas, the height of the flood referred to the datum of the gage at the present river-measurement station near Spreckels was recently determined as about 31 feet, or about 5 feet higher than the stage of any other known flood at this point. The river overflowed beyond the channel and practically covered the site of the present town of Salinas.

In 1861-62 the Pajaro River at the present railroad crossing upstream from Watsonville reached a stage about 15 feet above the peak stage of 1937, 32 feet above the high water of 1932, and 26.5 feet above the high water of 1900. The stages for 1862, 1900, and 1932 were reported at a public hearing conducted by the Corps of Engineers, U. S. Army. It was also brought out at this hearing that the Pajaro River channel was wider in 1870 than in 1862. The date of the maximum of 1862 was probably January 11, but major floods also occurred between January 17 and 24.

There were major floods on Soquel Creek and the San Lorenzo River on January 11, 1862. The overflow from Soquel Creek destroyed several buildings in the town of Soquel, and the flood on the San Lorenzo River destroyed buildings at Santa Cruz. It was noted that the great quantity of rain kept the San Lorenzo River at high stage for two weeks after January 11. There was another major rise on streams in this vicinity during the latter part of this period.

Floods of 1867 and subsequent floods.--It appears from newspaper accounts and statements of residents that notable floods occurred on the Salinas River in the periods 1867-68, 1878, 1879, 1880, 1881, 1884, 1889-90, 1907, 1911, and 1913-14. Residents near Santa Margarita in the upper part of the basin mention the floods of 1881, 1889-90, and 1911 as especially large. At Paso Robles the flood of 1913-14 was described by residents as the highest observed in recent years until 1938. It washed out the highway bridge at Paso Robles and the railroad bridge 12 miles downstream.

At the gaging station at Spreckels on the lower river the peak of 1911 reached a stage of 26.1 feet as compared with stages of 25.2 in 1914 and 25.0 in 1938. Mr. Charles L. Pioda, who has studied these floods in the lower Salinas Basin, found that the flood of 1914 was higher than that of 1911 at many places. The magnitude of these and earlier floods cannot be closely compared from the relation of the stages at this point, as it is probable that channel changes have tended to lower the flood profiles.

In the Pajaro River Basin stages resulting in overflow occurred near Watsonville in the years 1890, 1894, 1907, 1909, 1911, 1914, 1915, 1916, 1922, 1927, 1931, 1933, and 1937. This record, furnished by the City Engineer, probably included some minor floods. Outstanding floods occurred in the period 1913-14, when five inundations were noted at Watsonville, and possibly in 1911 when very high stages were recorded in adjacent basins. Uvas Creek flooded the city of Gilroy in 1913-14.

Newspaper accounts mention floods of considerable size on the San Lorenzo River in 1869, 1890, 1895, and 1907, and floods probably occurred in other years when there were major floods in the San Francisco Bay and Pajaro River Basins. The San Lorenzo River at Santa Cruz was said to have been the highest since 1862 on February 10, 1869. Another major flood was that of January 25, 1890, called "the highest ever known" in a newspaper dispatch from Santa Cruz. Again in January 1895 there was a flood of such magnitude that railroad tracks were washed out at points between Santa Cruz and Boulder Creek. The San Lorenzo River was at flood stages several times between March 19 and 25, 1907, causing damage to or loss of bridges along its channel, and damage to buildings in Santa Cruz.

San Francisco Bay basins

Early floods.--Severe storms near San Francisco during the period 1787-1820 are listed in a history of California by Theodore E. Hittell. Heavy rains in January and February 1819 caused floods that changed the courses of many streams. Another series of storms, which probably caused floods, was that of December 1798 and January 1799, which was reported to have lasted for 28 days.

Floods of 1849-50.--Reference to the flood season of 1849-50 was made in a history of Santa Clara County published in 1881. Julius Martin of Gilroy, a pioneer of 1843, was cited as authority for the statement that there were heavy rains from November 1849 to April 1850, which culminated in an inundation in Santa Clara Valley that remained for weeks. Another account stated that there was an extensive flood in Napa Valley during this season.

Flood of 1852-53.--During the flood of 1852-53 a bridge on the Napa River at Napa was washed out. The river overflowed into the town, and flooded all lowlands in Napa County.

Floods of 1861-62.--Part of the town of Napa was flooded on December 8, 1861, and several houses were washed away. Again on December 28 part of the town was flooded. Exceptionally severe floods occurred throughout the San Francisco Bay basins on January 11, 1862. The towns of Alvarado, San Leandro, Napa, and Pacheco were flooded. The floods of January 1862 destroyed many bridges and mills in San Mateo and Santa Clara Counties.

Flood of 1867.--Heavy rains occurred throughout this drainage area in December 1867. It is said that on December 31 Petaluma Creek at Petaluma was the highest since the town was settled. Railroad tracks and buildings were flooded.

Flood of 1869.--It is recorded in a history of Santa Clara County that Los Gatos and Guadalupe Creeks overflowed in San Jose and caused the greatest flood known since settlement of the town by Americans. Newspaper accounts state that water covered the valley in every direction from San Jose, February 9-10. Floods of considerable proportions also occurred at this time in the Napa Valley, where railroad tracks were washed out below Calistoga and below Napa.

Floods of 1871.--There was also a flood in San Jose from overflow of Los Gatos and Guadalupe Creeks in December 1871. It is noted in the historical account that widening and improvement of the channels has lessened the flood hazard since that date.

Floods of 1874 and 1878.--A history of Sonoma County records that there were floods in November 1874 caused by excessive rains. January 1878 was also listed as a period of unusual and damaging floods.

Floods of 1879.--Floods on the Napa River at Napa, about March 5-8, 1879, were called the greatest since 1862, and possibly approached or exceeded the floods of that year. Parts of the town were flooded and several houses washed away.

Floods of 1881.--The floods on the Napa River and Petaluma Creek on January 31, 1881, were said to have exceeded any other known. A stone bridge was destroyed and the railroad bridge at Napa was damaged.

Floods of 1889-90.--Precipitation for the winter season 1889-90 was the greatest of record at many points in the San Francisco Bay region. There were floods on January 24-25, apparently nearly as high as any known. The Napa River at Napa was reported to have been on January 24 only a foot below the record height of 1881, and the flood in the Santa Clara Valley near San Jose was said to have been the greatest since 1862. An observer of the flood of 1890 at Mountain View near San Jose stated recently that it has not since been equalled. Bridges were destroyed at several points in the San Francisco Bay region, railroad tracks were washed out, towns and farms were flooded, and at least two persons were drowned.

Floods of 1892 to 1906.--Stream-flow records on Alameda Creek began in 1891. There was a flood of great magnitude on November 30, 1892, which possibly has not been exceeded since. Mean daily discharge at Niles Dam for this date is listed as 16,200 second-feet, the highest for the period of record at this station, and higher than any daily discharge recorded at nearby comparable stations since 1900. Moderate floods occurred in January and February 1894, November 1900, March 1903, and January 1906; and an outstanding flood, January 18, 1895, indicated by a mean daily discharge of 10,900 second-feet at Niles Dam. On the Napa River at Napa there was a flood of considerable magnitude on January 21-22, 1895, noted as the second within 3 weeks at that point. The stream-flow record for Coyote Creek near Madrone, started in 1902, shows a high peak discharge of 15,000 second-feet on March 31, 1903, exceeded only in March 1911 for the periods of record 1902-12, and 1916-38. Moderate peaks were recorded in January and December 1906.

Flood of 1907.--There were floods on streams in the Santa Clara Valley on March 19 and 23, 1907, those of March 19 on Los Gatos Creek and adjacent streams apparently were especially severe. Railroad bridges were washed out and farm lands were damaged in that region. There was a moderate peak on Coyote Creek near Madrone on March 19, and floods on Alameda Creek, March 19 and 23, of the same magnitude as those of 1895. Country adjacent to San Jose was flooded on both days, especially from overflow of Guadalupe Creek.

Floods of 1909.--There were floods on Alameda and Coyote Creeks on January 21, 1909, of the same magnitude as those of 1907.

Flood of 1911.--There was another flood on Alameda Creek March 7, 1911, which was about the same magnitude as that of 1892. The maximum recorded discharge at the gaging station on Coyote Creek near Madrone was in 1911, probably on March 7. This gaging station has been operated since 1902, except for the period 1913-15.

Floods of 1914 and subsequent floods.--Several floods have occurred on streams in Santa Clara Valley since 1911. Alameda Creek reached high stages on January 25, 1914, February 25, 1917, February 10, 1919, and February 10, 1922. Storage on this creek has affected the flood discharges since 1916. There were moderate floods on Coyote Creek near Madrone on February 21, 1917, February 10, 1919, February 10, 1922, February 13, 1927, and December 28, 1931. Since 1934 some flood waters have been impounded in a reservoir.

Kern River Basin

Floods of 1861 and 1862.--There was a notable flood on the Kern River about December 25, 1861, which resulted in a change in the channel at the site of the present city of Bakersfield, and flooded all but the higher knolls in that vicinity. A prolonged flood period followed the initial rise. Definite information is lacking as to the stage the river reached in its foothill channel, or the dates of the peak stages, but it is probable that there were other floods about the middle of January 1862, when the rivers in Tulare Lake Basin and in southern California reached their peak stages.

Flood of 1867.--The greatest flood on the Kern River of which there is knowledge lasted from about December 25, 1867, to January 1, 1868. Cedar logs believed to have been deposited by this flood were recently found by the Corps of Engineer, U. S. Army, in the rocky canyon two miles downstream from Fairview (13 miles upstream from Kernville). These logs and other evidences of the early flood were about 13 feet above the highest of recent flood marks, which were about 10 feet above low water and which probably were left by the flood of February 1937. The river at Kernville was reported to have been at an extremely high stage for a period of three days in December 1867, and at its peak to have covered practically the entire site of the present town of Kernville. The South Fork of the Kern River overflowed the lowlands in South Fork Valley between Onyx and Isabella, keeping ranchers from their homes for four days. According to information from the Corps of Engineers, U. S. Army, drift logs were found at a height of about 40 feet above the high-water line of February 1937 on the Kern River, in a narrow rock canyon two miles downstream from the South Fork of Kern River. Drift marks of this early flood still exist at several places in this canyon. At the same place the peak of February 1937 was about 30 feet above present low water. Near Borel power house, about 9 miles downstream from the South Fork of the Kern River, several drift logs and fragments were found about 25 feet above the high-water line of February 1937, which was about 23 feet above low water. Many of the logs and pieces of wood were of cedar and redwood, and must have been carried down from the high mountains. Local residents believe that these floodmarks in Kern Canyon were undoubtedly left by the flood of 1867. As reported to the Corps of Engineers, U. S. Army, by an eye witness of the flood of 1867 on the Kern River at Rio Bravo ranch, 3/4 mile below Cottonwood Creek, the flood stage in 1867 was 6.4 feet above that of February 1937. The peak stage of 1937 was about 16 feet above low water at this ranch. The flood profile in 1937 may have been modified by the present bridge, the floor of which was submerged in 1937. In 1867 the Kern River overflowed beyond its channel for a considerable distance, near the present site of Bakersfield, and was reported to have covered knolls not flooded in 1861-62. A remarkable feature of the flood of 1867 was the large quantities of logs carried down from the mountains and deposited on the overflowed lands near Kernville and Bakersfield. Saw mills were established at Kernville and Bakersfield to cut these logs into lumber. Trees along the channel near Kernville were said to have been entirely washed away by the flood of 1867, from which fact it was inferred that the flood was the greatest for a long period. The flood of 1867 on the Kern River was certainly much greater than any that have occurred since that time.

Flood of 1890.--The Kern River near Bakersfield was reported to have been the highest on January 26, 1890, since 1867-68. The flood apparently was not of major importance, although structures were damaged on the river at Kernville and near Bakersfield.

Flood of 1893.--There was a flood on the Kern River at Bakersfield on February 10, 1893, which, according to a Bakersfield newspaper, was the first of importance since the flood season of 1867-68. According to this account, the flood of 1893 did not quite reach a place in Bakersfield which had been flooded to a depth of 2 feet in 1867-68. Residents along the Kern River downstream from Kernville, who witnessed the flood of 1893, describe it as having been several feet below the floodmarks of the early flood, but much higher than the floods of 1916 and 1937. From the best information available the flood stage in 1893 at the mouth of the South Fork of the Kern River was about 4 feet above the peak of February 1937, which was about 11.5 feet above low water. The flood of 1893 was of comparatively brief duration, but it caused extensive flooding of farm lands along the lower Kern River and washed out railroad tracks near Bakersfield. In general, the flood of 1893 on the Kern River was not as great as that of 1867, but appears to have exceeded any other since 1867.

Floods of 1909 and subsequent floods.--Floods occurred on the Kern River in January 1909, January 1914, January 1916, and February 1937. The flood of 1909 was of minor proportions and resulted in comparatively little damage, although it was relatively high on the upper river. The floods of January 1914, January 1916, and February 1937 were about the same magnitude, and all caused considerable property damage along the lower river. Highways, farm lands, and homes were flooded by the overflow from the river. (See table 11 for a comparison of floods in Kern River and Tulare Lake Basins from 1867 to 1938.)

Tulare Lake Basin

Floods of 1861 and 1862.--The first heavy storm of the season occurred on December 23-25, 1861. It was reported that there was a flood on the White River and a damaging flood on the Tule River which overflowed farms to a depth of several feet. The Kaweah and Kings Rivers apparently did not reach exceptionally high stages.

Then on January 11, 1862, there was an exceptionally great flood, which probably has since been equalled or exceeded only in December 1867. The flood followed a general storm, which resulted in record-breaking stages on tributaries of the lower San Joaquin and Sacramento Rivers. The town of Visalia, an early settlement in the lower Kaweah River Basin, was flooded on Main Street to a depth of about 2 feet on January 11. The town was again flooded to about the same depth on January 17-18, and the water again rose on January 20 to a stage slightly greater than on either of the previous dates. This information serves chiefly to establish the dates of the larger floods, but because of the probable variable influence of extensive overflow below the foothills, it indicates only very roughly their magnitude. The lowlands along the tributaries of Tulare Lake were probably flooded continuously from January 11 until about the end of the month. It is not clear, from the contemporary accounts, when the maximum stages occurred in the foothills. It is probable, however,

Table 11.--Maximum stage and discharge of recorded floods at indicated places in Kern River and Tulare Lake Basins

Date	Kern River Basin	Tulare Lake Basin					
	Kern River near Bakersfield	Tule River near Porterville a/		Kaweah River near Three Rivers b/		Kings River at Piedra c/	
	Discharge (second-feet)	Gage height (feet)	Discharge (second-feet)	Gage height (feet)	Discharge (second-feet)	Gage height (feet)	Discharge (second-feet)
1867, December	-	-	-	d20±	-	-	-
1899, Mar. 25	-	-	-	-	-	e13.8	24,000
1900, Nov. 21	-	-	-	-	-	e12.4	17,800
1901, Jan. 7	-	-	-	-	-	e15.8	33,200
1902, Apr. 7	-	e7.2	3,400	-	-	e13.1	20,800
1903, Jan. 28	-	e7.6	3,800	-	-	-	-
1904, Mar. 23	-	e6.15	2,440	e8.4	3,900	12.8	19,500
1906, Jan. 19	-	-	-	-	-	e13.8	24,000
1906, Mar. 15	-	-	-	e10.3	8,520	e14.1	25,400
1906, Mar. 16	-	e8.5	4,760	-	-	e13.0	20,400
1909, Jan. 14	11,870	e8.4	4,650	e10.3	8,520	15.1	32,800
1909, Jan. 21	-	e9.1	5,070	e10.6	9,210	12.9	19,800
1909, Dec. 8	-	e9.5	5,430	-	-	-	-
1909, Dec. 9	-	-	-	-	-	16.5	44,800
1914, Jan. 25	-	10.8	6,600	13.0	13,300	21.8	59,700
1914, Jan. 26	18,287	-	-	-	-	-	-
1916, Jan. 17	-	11.0	6,780	13.5	14,700	19.0	45,400
1916, Jan. 18	17,962	-	-	-	-	-	-
1916, Mar. 21	11,830	-	-	-	-	-	-
1927, Feb. 18	-	10.0	5,260	11.8	10,100	14.28	19,200
1935, Apr. 8	-	8.9	4,360	11.76	8,900	11.65	20,100
1936, Feb. 13	-	10.55	12,500	7.86	8,000	-	-
1936, Feb. 22	-	-	-	-	-	12.38	24,600
1937, Feb. 6	-	9.60	12,000	12.65	18,900	13.9	34,800
1937, Feb. 7	20,000	-	-	-	-	-	-
1937, Dec. 11	-	9.5	11,300	16.0	33,300	19.94	80,000
1938, Mar. 3	14,582	-	-	-	-	-	-

a Tule River gage moved 75 feet upstream Jan. 21, 1931; new datum.
b Kaweah River gage moved 2 miles downstream February 1, 1936; new datum.
c Kings River gage moved 1,000 feet downstream Feb. 7, 1931; new datum.
d From floodmarks referred to present datum.
e Maximum recorded; may not be the peak.

Note.--Discharge records prior to Jan. 15, 1909, for Tule, Kaweah, and Kings Rivers have been revised from previously published figures.

that the Kings River reached its greatest stage on January 11, the day when the highest stage was observed on the adjacent San Joaquin River. The White River and Poso Creek, in the southeastern part of Tulare Lake Basin, were reported to have been at their highest on January 18. During these floods, the Tule River changed its channel for a considerable distance downstream from the foothills. From the number of large trees washed down from the mountains by the floods on the Kings, Kaweah, Tule, and White Rivers it was inferred by the settlers that this was the greatest flood for many years.

Flood of 1867.--Following an exceptionally heavy rain in the period December 21-25, 1867, which extended throughout northern California, there were major floods on all the main tributaries of Tulare Lake. The town of Visalia was partly flooded by water from the Kaweah River on December 23, and by December 24 the flood stage in the town had exceeded the record of 1862 by 4 inches. After receding about 2 feet, the water again rose to about the same stage on December 26. The stage of the Kaweah River in its channel downstream from the foothills was reported to have exceeded the stage in 1862 by 2 feet. As determined by the position of the redwood and cedar logs deposited by this flood, the maximum stage on the Kaweah River near Three Rivers referred to the datum of the present gage was about 20.0 feet. So far as known, this stage has not since been approached, except in December 1937 when the peak stage was 16.0 feet.

Descriptions of the flood of 1867 on Kings River do not given a definite comparison with the flood of 1862. A settlement known as Scottsburg on the Kings River, near the present town of Centerville, was flooded in 1862. The town, rebuilt at a new site, was destroyed by the flood of 1867. From this fact it appears that the later flood was at least as severe as that of 1862, and probably reached a greater height. From reliable accounts by an eye-witness of the flood of 1867, the Kings River reached a stage about 3 feet greater than in 1937 at a point one mile downstream from Piedra. At Pine Flat dam site on Kings River, about three miles upstream from Piedra, it was recently determined from the position of cedar and other drift logs deposited along the channel that a previous flood had exceeded that of 1937 by at least 7 feet. The rise in December 1937 was about 18 feet above low water. From statements of ranchers who settled in this vicinity about 1875 it is believed that these logs were deposited either in 1862 or in 1867. An outstanding characteristic of the flood of 1867 on the Kings and Kaweah Rivers, as well as on the Kern and upper San Joaquin Rivers, was the tremendous quantity of timber brought down from the Sierra and deposited on the plains. That there were exceptionally heavy storms in the Sierra Nevada in December 1867 is indicated by the record precipitation of 12.19 inches measured at Camp Independence in Owens Valley, east of the headwaters of the Kaweah River. From the meagre reports available it is probable that the Tule and White Rivers and Deer and Poso Creeks reached exceptionally high stages in December 1867. Newspaper accounts stated that the Tule River was higher than in 1862. Downstream from the foothills it flooded farm lands and, as in 1862, cut a new channel for a portion of its course. The low lands between the Tule and Kern Rivers were described as having been almost completely flooded.

In general, the flood of 1867 in Tulare Lake Basin was the greatest of which there is knowledge. In 1868 Tulare Lake reached about the same height as in 1862-63 when it overflowed to the north into the San Joaquin River.

Floods of 1875 and subsequent floods.--Floods occurred in the Tulare Lake Basin in the years 1875, 1879, 1884, 1893, 1906, 1914, and 1916.

Historical writings mention high water at Visalia in 1875 and 1879 as having flooded parts of the city. The floods were undoubtedly of minor proportions in Tulare Lake Basin. The State Engineer in 1886 lists the high water of 1879 on Kings River near Kingsburg as only 6.7 feet above the low water of 1878, as compared with the height of 17.3 feet in 1867-68 at the same place.

In 1884 there was a prolonged season of high water that caused much damage to the farms in the lowlands. There is no information available as to peak stages of the rivers during this period. The State records of stream flow for this season, listed in Water-Supply Paper 299, show very high snow run-off on the Kings, Kaweah, and Tule Rivers.

There were floods in the northern part of the Tulare Lake Basin on January 25-27, 1886. Judging from later comparisons, the Kings River did not reach an extremely high stage at this time, although there was an extensive inundation in the city of Fresno from streams in that vicinity.

There were floods of considerable proportions in the Kaweah and Kings River Basins in January 1890. Overflow from the Kaweah River caused damage in Visalia where it was reported that boats were used on Main Street. Railroad tracks were washed out in the vicinity of Visalia. About January 25, 1890, the Kings River reached a stage reported to have been the highest since 1867-68, although it may have been exceeded in

1914 and 1937 at foothill points. The crest at the railroad bridge near Kingsburg was reported in a Fresno newspaper as 16 feet above low water, exceeding by 2.5 feet any since construction of the bridge. This stage possibly is comparable with the peak stage of 1867-68 which was 17.3 feet above low-water of 1878 as mentioned above. The stage of 1890 probably was referred to the same gage datum used by the State Engineer at this railroad bridge, from 1878 to 1884, as described in Water-Supply Paper 299. The relative heights of the crests at this point, however, do not necessarily indicate, even roughly, the relative heights of the crests in the foothill channel.

A flood occurred on the Kaweah and Tule Rivers on February 9, 1893. Bridges and roads were washed out or damaged in the Kaweah River Basin and it was reported that the Kaweah River was higher than it had been for 20 years. Evidently the rainfall was especially heavy in the southern part of Tulare Lake Basin, where the Tule River was said to have been as high as in 1867. Highway and railroad bridges were washed out, and parts of the city of Porterville were flooded. The height of this flood on Tule River is not known at a point that would be comparable with recent recorded peak stages. The flood of 1893 was of brief duration and in general does not rank as a major one throughout the Tulare Lake Basin. The gage height on the Kings River at Kingsburg on February 10, 1893, was 11.5 feet, not an exceptionally high stage.

Visalia was flooded by the Kaweah River in March 1906 and again in June 1906. The flood in June followed unusually high flows from melting snow. At the height of this flood the water in the town was about 1 foot deep on Main Street, apparently 1 or 2 feet below the height of 1867. The floods on streams in the Tulare Lake Basin were of minor proportions. For a comparison of this flood with later peak stages in this basin see table 11.

On January 25, 1914, stages were recorded on the Kings River at Piedra and on the Kaweah River near Three Rivers that were considerably higher than any others that have occurred since the establishment of the river-measurement stations. A resident on the Kings River at Trimmer reported in 1914 that the flood of that year had exceeded by 3 feet any others that had occurred since the season of 1867-68, when the Kings River at that point was 6 feet higher than in 1914. The flood of 1914 caused considerable damage to roads and farm lands along the Kings River. An exceptional feature of this flood was the high precipitation in the Sierra Nevada. A total precipitation of 22 inches was reported for the storm period at Hume Lake in the upper Kings River Basin. In the southern part of Tulare Lake Basin the floods were not of major proportions.

A flood similar to that of 1914 occurred on January 17, 1916, in the Tulare Lake Basin. The stages were higher than in 1914 on the Kaweah River near Three Rivers and on the Tule River near Porterville, but were not exceptional. On the Kings River at Piedra the peak in 1916, although lower than in 1914, was among the highest recorded at that station.

See table 11 for a comparison of floods in Kern River and Tulare Lake Basins during the period 1867 to 1938.

San Joaquin River Basin

Floods of 1847 and 1852.--The earliest flood mentioned in historical accounts of the settlement of the San Joaquin River Basin is that of January 1847. It was reported that the Stanislaus River, at a point about 1½ miles upstream from its mouth, overflowed the country for miles beyond its channel, and that the San Joaquin River near the mouth of the Stanislaus River was about 3 miles wide at the crest of the flood. Apparently this flood did not attract much attention at other places in the basin and was probably of minor magnitude. As in the Sacramento River Basin, the extent of overflow in the lower reaches of these rivers in the early days scarcely gives any indication of the discharge, as the minor floods would have spread, in many places, beyond the normal channels almost as far as the major ones. Brief mention is made of a flood in 1852 that inundated parts of Stockton and was considered the highest known flood in the lower San Joaquin River Basin until 1862. Rainfall and run-off in the foothills of the Sierra Nevada were reported to have been excessive.

Floods of 1861-62.--At the time of the first flood of the winter season of 1861-62 in the Sacramento River Basin on December 9, the San Joaquin River and its lower tributaries, with the possible exception of the Cosumnes River, did not rise to extremely high stages.

The first exceptionally high run-off from the tributary basins of the lower San Joaquin River occurred on December 26, 1861, when according to reports, the Mokelumne River slightly exceeded its previous record of 1852 and the Merced River was at about the flood stages of 1849 and 1852-53. The storm that caused the flood of December 26 was general from the Kern River to the upper Sacramento River. During this storm, snow fell continuously in the upper basin of the Stanislaus River, so it is probable that the heaviest run-off was from comparatively low altitudes in the Sierra Nevada. Foothill creeks were extremely high, and frequent rains during the latter part of December 1861 prolonged the flood conditions in the lower San Joaquin Valley. Stockton was first flooded on December 26, and by December 28 the surrounding country was inundated for many miles.

The upper San Joaquin River and all of its important tributaries reached record-breaking stages on January 11, 1862. The heavy rainstorm that caused this flood was general throughout northern California, as was also the preceding snowfall on January 5. It was reported that in the upper Mokelumne River Basin, at an altitude of about 9,000 feet, there was 18 feet of snow on the ground preceding the storm. Rain fell from January 9 to 11 and the snow settled to a depth of 15 feet. At Big Trees in the Stanislaus River Basin (altitude, about 5,000 feet) the snow, which was reported to have been 3½ feet deep preceding the storm, all melted. The flood of January 11 on the upper San Joaquin River at old Millertown, upstream from Friant, was determined by the Fresno County Surveyor to have been 26 feet above low water. This rise was several feet higher than ever known before, but it was exceeded by several feet in 1867. At this same place on December 11, 1937, the river reached a stage about 21 feet above low water.

According to the Mariposa Gazette, the Merced River near Kittridge on January 11, 1862, exceeded the record height of December 1861 by about 10 feet. Mariposa Creek was reported as being very high for two weeks before and after January 11, but apparently the highest stage was reached about that date. It was said that the whole country about lower Mariposa Creek and the Fresno and Chowchilla Rivers, as seen from the foothills, was one vast sheet of water. Reports about the Merced River were too vague to permit the determination of the stage of the 1862 flood at most locations that would afford a comparison with recent flood stages. Reported stages reached in 1862 at points upstream and downstream from Kittridge are in general much greater than the stage of the flood of 1937 at Kittridge. It is believed that the flood of 1862 was higher than that of 1937 at Kittridge, but probably was not as high as the flood of 1937 in the Yosemite Valley. The Merced River, downstream from the mouth of its canyon, flooded the town of Snelling on January 11, 1862, and the channel was widened and changed considerably by the flood.

On the Tuolumne River at Branch's Ferry, about 4 miles below La Grange, the crest stage on January 10, 1862, was about 30 feet above low water and about 7 feet above the previous record in 1852. Near the La Grange dam site on the Tuolumne River above La Grange, high-water marks of the flood of 1862 were found by Wagoner.16/ From the flood profile thus determined he computed the peak discharge of 1862 as 130,000 second-feet. Most of the flood water of the Tuolumne River in December 1937 was impounded in reservoirs upstream from La Grange, so a comparison with the flood of 1862 cannot readily be made.

The Stanislaus River at Knights Ferry, after flooding part of the town on January 10, 1862, and washing away buildings and the bridge, rose to its greatest height on January 11 and washed away almost the entire business part of the town, which was later rebuilt on higher ground. This flood was said to have been 12 feet higher than any previously known. Its crest was recently determined by the Corps of Engineers, U. S. Army, as 33 feet gage height, referred to the datum of the former gaging station at Knights Ferry, compared with a peak stage of 27 feet on March 19, 1907, and 26 feet on January 31, 1911. In December 1937 reservoirs impounded most of the flood water.

In 1862 the Mokelumne River near Mokelumne Hill reached a maximum stage corresponding to about 23.4 feet at the present river-measurement station, as determined from a mark pointed out by Mr. C. F. Kelton, whose grandfather observed the flood. The crest stage of 1907, possibly the greatest since 1867, was observed by Mr. Kelton at a point that corresponds to a gage height of 20.3 feet. The maximum stage since the establishment of the gaging station in 1927 was 16.1 feet on March 25, 1928. The discharge corresponding to the latter stage was 23,300 second-feet.

After the peak stage of January 11, 1862, there were frequent storms that resulted in almost incredible amounts of rain in the period January 12-23 in parts of the Sierra Nevada tributary to the San Joaquin Basin. A total of 21 inches of rain was reported to have fallen from January 12 to 23 at Mariposa, and 30 inches from January 14 to 23 at Sonora.

Newspapers of Stockton and Mariposa stated that the Stanislaus River equalled its flood of January 11 during this period, and that the Tuolumne and Merced Rivers exceeded the records of January 10 and

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16/ Wagoner, Luther, Flood of March, 1907, in California rivers: Am. Soc. Civil Eng. Trans., vol. 61, p. 353, 1908.

11. The earlier floods of the season destroyed nearly all of the bridges, mills, and other structures along the channels. On January 17 the water rose in Stockton about half a foot above its previous record of January 11; on January 23 it slightly exceeded this mark; and on January 24 it established a record for the season. The flood height of January 24, 1862, was determined by the San Joaquin County Surveyor to have been 12.1 feet above low tide of December 3, 1862, at Stockton, and 3.5 feet above the flood of 1852. He reported that the San Joaquin River west of Lathrop, on January 24, 1862, was 12 feet above the summer low tides and 5 feet above the highest water of 1852.

The magnitude of the flood of 1862 on the upper San Joaquin River has probably been exceeded only in 1867. The floods in 1862 on the main tributaries, including the Merced, Tuolumne, Stanislaus, and Mokelumne Rivers, were undoubtedly major floods and were equalled, if at all, only in 1867. An outstanding feature of the floods of 1861-62 on these tributaries was that record-breaking stages were reached two or three times during the season. The flood period of 1861-62 in the lower San Joaquin River Basin was probably the greatest of which there is definite knowledge.

Floods of 1867 and 1868.--On December 11, 1867, the Merced River at Snelling reached its highest stage since 1862, owing to heavy rains during the previous week. On the same day the Mokelumne River overflowed its banks near Woodbridge and reached a stage described as 2 feet below the record of 1862.

In the period December 21-25, 1867, an extremely severe storm, which was general throughout northern California, caused the upper San Joaquin River to reach a record-breaking stage on December 24, 1867. Near Temperance Flat, about 12 miles upstream from Friant, the stage as recently determined from floodmarks was about 19 feet higher than that of December 1937, which was about 33 feet above low water. At Millerton, then the county seat, the water rose to a point on the court-house, identified by eye witnesses, 12 feet above the floodmark of 1937, which was about 21 feet above low water. News accounts stated that the flood of 1867 exceeded that of 1862 by 10 feet in Millerton, and that many buildings were destroyed. On the San Joaquin River about 15 miles downstream from the present town of Friant, the flood of 1867 was reported to have been 6 feet higher than in 1862. On January 2, 1868, the flood stage on the San Joaquin River near Newman, as observed in a building still standing, was 21.7 feet (datum of present gage). The highest stage noted since 1868 was 19.8 feet in 1886. At very high stages the river overflows beyond the channel for a considerable distance. The known stages at Newman are tabulated in table 12.

The Merced River in its foothill channel reached a peak on December 24, 1867, said to have been higher than ever seen before. The Merced River did not again flood the town of Snelling, as in 1862, although according to the local newspaper the river was 2 feet higher than in 1862. The Tuolumne and Stanislaus River were reported to have slightly exceeded their record stages of 1862 on December 26, 1867. Houses were washed away at Knights Ferry on the Stanislaus River. The Mokelumne River was reported variously to have been within 4 inches of the stage of 1862, or to have exceeded it, on December 26, 1867. These accounts presumably refer to the lower Mokelumne River. The maximum in 1867 at Mokelumne Hill was reported to have been 3 feet lower than in 1862 and roughly at the same height as was reached in 1907.

The San Joaquin at Kasson's Landing, downstream from the present gaging station near Vernalis, was said to have risen on December 24, 1867, to within 1.5 feet of the stage of 1862. On December 26, the Tuolumne, Stanislaus, and Mokelumne Rivers reached their peaks, and on January 2, 1868, the San Joaquin River near Newman reached its maximum stage. On January 11, 1868, the San Joaquin River was falling rapidly and, upstream from the Stanislaus River, was within its banks. A map published by the State Engineer in 1886 lists the high water of 1867-68 at Durham's Ferry on the San Joaquin River as 1.8 feet lower than in 1862.

The flood of 1867-68 was one of major importance throughout the San Joaquin River Basin. In the foothills the flood on the main river exceeded considerably any other known flood, and was probably higher than any known flood at all points upstream from the mouth of the Merced River. The San Joaquin River downstream from the mouth of the Stanislaus River was not as high in 1867-68 as in 1861-62. Flood stages of the lower river for this early period cannot be compared with those of recent floods, because of extensive changes in the channel. It is probable, however, that the peak discharge of the lower San Joaquin River has not been equalled since 1868.

Floods from 1869 to 1878.--A flood of considerable proportions occurred in the lower part of the San Joaquin Basin about February 10-11, 1869, at the time of the large floods in the San Francisco Bay area. The city of Stockton was partly flooded, mainly from the Calaveras

River, which was said to have been the highest known to that date.

Historical writings mention a flood on the Mokelumne, Stanislaus, and Tuolumne Rivers in the winter of 1871-72. The accounts state that there was comparatively little damage.

A disastrous flood occurred on Sutter and Jackson Creeks on February 16 or 17, 1878. It was said that several persons were drowned in Jackson, and that buildings and bridges were destroyed. The streets of Woodbridge were flooded by the Mokelumne River. Streams had been high for several weeks preceding the flood of 1878 in the lower San Joaquin Basin, and the peak resulted from an intense, brief rainfall in the foothills. Important floods also occurred in Woodbridge in 1862, 1868, and 1872.

Flood of 1881.--The flood of 1881 was apparently not disastrous in the San Joaquin Valley, although major floods occurred in the northern part of the State in January and February 1881. The State records of stream-flow show that there may have been an exceptionally high peak in January 1881 on the San Joaquin River near the present town of Friant. News accounts state that the heaviest rainfall since 1867 occurred at Mariposa about the end of January 1881, and that mining equipment was damaged by the flood on the Merced River that resulted from this storm. Other accounts state that bridges, dams, and levees in Stanislaus County in the lower San Joaquin Basin were not damaged by the flood in 1881. An extensive flood was observed in the country adjacent to the lower Mokelumne River, and may have been caused by overflow from the Sacramento River. Historical writings, however, do not mention the flood in 1881 as outstanding in the San Joaquin Valley, and in general it probably was not of great importance.

Floods of 1884 to 1904.--Floods occurred in March 1884, January-February 1886, and during the seasons 1889-90 and 1892-93. There is little definite information, but it appears that exceptionally high stages on the Sierra Nevada streams were reached at various times during this period. Outstanding peaks observed on the lower San Joaquin River at the railway crossing near Lathrop, March 11, 1884, January 27, 1886, and May 30, 1890, were roughly 16 feet above low water, about the same height as on February 6, 1881. This stage was exceeded during several years after 1890, indicating that channel changes probably had an increasing effect on the flood profiles.

The town of Hill's Ferry on the San Joaquin River near the present town of Newman was flooded to a considerable depth in February 1886. As determined from a floodmark pointed out by an eye witness, this flood was 1.9 feet lower than the record flood of 1867. According to the person who observed the flood of 1886, it has not been equalled since. Tributaries of the lower San Joaquin River from the Stanislaus to the Cosumnes River were reported to have been at exceptionally high stages about the end of January 1886.

Large floods occurred throughout the San Joaquin River Basin during the latter part of January 1890. The upper San Joaquin River possibly reached an extremely high stage. The Merced, Stanislaus, Tuolumne, and Mokelumne Rivers were at dangerously high stages, and some of the foothill tributaries of these rivers were said to have been the highest known. Several towns were flooded and railroad and highway structures washed out. The maximum stage of the season, however, was reached, at least on the lower San Joaquin, during the snow run-off period in May 1890.

The few stream flow records available indicate that there were no extremely high floods from 1895 to 1907. Farm lands adjacent to lower Mokelumne River were reported to have been flooded in 1904 to the greatest extent since 1881. The flood, however, was attributed to a rush of water from overflow of the Sacramento River. The records for tributaries of the lower San Joaquin River indicate that only moderately high flows occurred in February and March 1904.

Flood of 1907.--The flood of March 1907 was outstanding in the San Joaquin River Basin. Only a moderate rise on the upper river was observed during this flood, but there were exceptionally high stages on the large tributaries in the lower part of the basin. From the Merced to the Mokelumne River the peak stages occurred on March 19 and were followed by high stages for several days. The San Joaquin River downstream from Mendota was at or above flood stage from March 19 to about the end of the month. A description of the flood of 1907 is given in the transactions of the American Society of Civil Engineers (vol. 61, p. 281, 1908), and there is a brief discussion of this flood and attendant weather conditions in Bulletin 43 of the United States Weather Bureau.

Floods of 1909.--There were moderate rises on the upper San Joaquin River and its tributaries from the Merced to the Mokelumne Rivers on January 14 and 15, 1909, and again on January 21. The peak stages were not exceptionally high except on the Calaveras River which, on January 21, overflowed near Bellota and flooded parts of Stockton and adjacent lands. The lower San Joaquin River reached a stage of 19 feet at Lathrop on January 23 and 24, which was about the same stage as occurred in 1907.

The flood of 1909 is discussed in Bulletin 43 of the United States Weather Bureau.

Flood of 1911.--The flood of 1911 was the greatest that has occurred in the lower San Joaquin Valley in recent times. During this flood the upper San Joaquin River near Friant reached high stages on January 30 and 31. (See table 12.) The flood was relatively higher downstream, and near Newman at the mouth of the Merced River the peak stage of 1911 has not been equalled since. High stages were reached on January 30 and 31 on the Calaveras, Mokelumne, Stanislaus, Tuolumne, and Merced Rivers. The floods on these tributaries combined to raise the San Joaquin River at Lathrop to a record-breaking stage of 22 feet on February 1. It was estimated that 75,000 acres of land were flooded from the overflow of the San Joaquin, Mokelumne, and Calaveras Rivers. Extensive reclamation works and other improvements affecting the capacity of the channel make it impossible to estimate from the flood heights the relative magnitude of the flood flows in the lower San Joaquin Basin. For a discussion of the flood of 1911 and attendant weather conditions see the report entitled "Flood problems of Calaveras River", published by the Department of Engineering, State of California, and Bulletin 43 of the United States Weather Bureau.

Floods of 1914 and subsequent floods.--The San Joaquin River near Friant attained a peak on January 25, 1914, which was not exceeded until December 1937. On the upper river this flood was probably the greatest for a long period prior to 1914 but was much lower than the record-breaking flood of 1867. The Tuolumne River nearly equalled its record of 1911, but the Stanislaus and Calaveras Rivers reached only moderately high peaks. The San Joaquin River near Newman reached a peak on January 27, 1914, which was not exceeded until 1938, but which was considerably lower than the reported peaks of 1868, 1886, and 1911. In 1914 the lower San Joaquin River at Lathrop reached its crest on January 27 at a stage that was about the same as the peaks of 1907 and 1909, but considerably below the record stage of 1911.

See table 12 for a comparison of floods at certain localities in the San Joaquin River Basin during the period 1867 to 1938.

Table 12.--Maximum stage and discharge of recorded floods at indicated places on San Joaquin and Tuolumne Rivers

Date	San Joaquin River--				Tuolumne River--	
	near Friant a/		near Newman		above La Grange Dam near La Grange b/	
	Gage height (feet)	Discharge (sec.-ft.)	Gage height (feet)	Discharge (sec.-ft.)	Gage height (feet)	Discharge (sec.-ft.)
1867-8	-	-	c21.7	-	-	-
1886, February	-	-	c19.8	-	-	-
1899, Mar. 25	-	-	-	-	d12.5	e26,800
1901, Feb. 19	-	-	-	-	d11.7	e22,500
1906, Mar. 24	-	-	-	-	d12.45	e26,200
1907, Mar. 19	-	-	-	-	d15.75	e50,400
1909, Jan. 14	d15.0	26,800	-	-	d9.5	26,500
1909, Dec. 9	-	-	-	-	d8.1	20,900
1909, Dec. 31	d15.3	27,900	-	-	-	-
1911, Jan. 31	d18.0	38,800	-	-	d16.45	60,300
1911	-	-	c19±	-	-	-
1914, Jan. 25	21.72	54,000	-	-	16.0	57,900
1914, Jan. 27	-	-	d18.0	20,700	-	-
1916, Feb. 6	-	-	d17.0	18,200	-	-
1917, Feb. 21	-	-	-	-	27.6	e33,800
1918, Mar. 7	-	-	-	-	22.47	23,300
1928, Mar. 25	12.35	13,100	-	-	-	-
1928, Mar. 31	-	-	d8.95	4,500	-	-
1935, Apr. 8	13.16	15,700	-	-	-	-
1935, Apr. 18	-	-	14.02	8,820	-	-
1936, Feb. 22	15.7	25,000	-	-	-	-
1936, Feb. 26	-	-	16.80	14,400	-	-
1937, Feb. 6	18.2	36,400	-	-	-	-
1937, Feb. 20	-	-	15.96	12,800	-	-
1937. Dec. 11	23.8	77,200	-	-	-	-
1938, Mar. 2	18.95	41,400	-	-	-	-
1938, Mar. 7	-	-	18.50	f33,000	-	-

a Record prior to Nov. 9. 1913, obtained at former site, 2 miles upstream.
b Record prior to Apr. 1, 1908, obtained at gage at bridge below La Grange Dam; record from Apr. 1, 1908, to Mar. 18, 1915, obtained at La Grange Dam; record subsequent to Mar. 18, 1915, obtained at present site, 3½ miles upstream from La Grange Dam. Storage on Tuolumne River began in Lake Eleanor in June 1918, in Don Pedro Reservoir in November 1922, and in Hetch Hetchy Reservoir in May 1923.
c Observed in a building 500 feet upstream and referred to gage datum.
d Maximum recorded; may not be the peak.
e Supersedes previously published discharge. Prior to 1909, discharge records also include diversions not previously included, to make all entries comparable.
f Adjusted for measured flow in by-pass channels around gage; discharge records for previous years were not adjusted.

Sacramento River Basin

Floods from 1825 to 1847.--County histories and journals of pioneers mention floods in the lower Sacramento River Basin during the seasons 1825-26, 1839-40, and in the year 1847. The flood of 1839-40 was experienced by the pioneer settler John A. Sutter, who described the country as a vast expanse of water. His small boat was delayed for several weeks in making the trip between his fort at the site of the present city of Sacramento and the base of supplies at Yerba Buena, now San Francisco. This flood was evidently of considerable duration, but the widespread flooding of the lowlands does not necessarily indicate that it was of extreme magnitude. Until levees were constructed even minor floods would have spread far beyond the channel of the lower Sacramento River. Histories of the early settlements state that the Indians recalled the flood of 1825-26 as an outstanding one, and that they had knowledge of a great flood, supposed to have occurred about the beginning of the nineteenth century, which caused thousands of deaths.

Floods of 1850.--The first flood on the lower Sacramento River of which there are fairly accurate descriptions is that of January 1850. The city of Sacramento was flooded on January 10 for a distance of a mile back from the Embarcadero. Newspaper accounts state that most of the houses were flooded, and that many were washed from their foundations. Some loss of life was caused by this flood, and there was great damage to provisions and other property. Lowlands west of the Sacramento River were flooded, but without great damage. The maximum stage at Sacramento on January 10 has been determined as 20.2 feet, referred to a datum that is at about mean sea level. Subsequent reference to the stage of the Sacramento River at Sacramento refer to this same datum. (See list of flood stages at Sacramento on page 469.)

An eye witness[17] of the flood of 1850 wrote as follows under date of January 10, 1850:

> This morning I went upon the foretop of a store-ship anchored near our steamer, to take a survey of an entire city under water. I could not discover a single speck of land in sight, except a little spot of a few feet on the levee near our boat. The boatmen were navigating the streets in whale boats in every direction.

Further on he stated:

> --- the valley, for the width of several miles, and in length for more than a hundred miles, was an unbroken sea of waters.

17/ Taylor, William, California life illustrated, p. 114, 116, 1858.

On February 23, 1850, a Sacramento newspaper stated that there were accounts from all quarters of tremendous floods and continued rains. Again in April there was another flood at Sacramento "within a foot of the great inundation".

The few available precipitation records support the conclusion that the season of 1849-50 must have been one of heavy run-off. However, the floods of 1850 were exceeded at Sacramento in 1852, and greatly exceeded in 1862.

Floods of 1852 and 1853.--The flood of 1852 on the Sacramento River is described in a Red Bluff newspaper of 1861 as the highest known to the oldest residents prior to December 1861. As reported in this account, the crest stage of 1852 was only slightly exceeded on December 8, 1861.

The lower Sacramento River and its tributary, the American River, reached high stages after a prolonged rain that began on March 5, 1852. The city of Sacramento was flooded during the period March 7-11, chiefly from overflow of the American River east of the city. The Sacramento River at Sacramento was not extremely high during this flood, reaching a gage-height of only 18 feet.

On December 31, 1852, after a short, sharp rise of the American River that flooded the city on December 19, the Sacramento River reached a gage-height of 21.7 at Sacramento, higher than any previously observed. The city was reported to have been completely flooded on January 1, 1853, but rapid recession followed the peak. The brief duration of the flood in Sacramento suggests that it was due mainly to overflow from the American River which remains at flood stages for relatively brief periods. The lowlands of the Sacramento River downstream from Colusa were flooded, and it was reported that all places along the right bank of the river were under water except the Indian mounds, and that thousands of cattle were drowned. The flood had subsided by the end of January 1853.

There was a flood at the junction of the Yuba and Feather Rivers on March 28, 1853, which was said to have been 8 inches higher than that of the preceding January. It was noted that this was the fourth and last flood of the season at that place. The Sacramento River at Sacramento rose from a low stage on March 25 to 19.4 feet on April 3.

Floods of 1861 and 1862.--A series of floods occurred in December 1861 and January 1862, which months constitute the greatest flood period in the history of California. At Red Bluff the first flood on the Sacramento River occurred on December 8, 1861, when, it was reported, there was a rapid rise from a comparatively low stage to a height probably of about 28 feet, as determined by comparison with the record flood of January 1862. The tributary creeks in the vicinity of Red Bluff were not notably high, the greatest rise being in the mountain regions in the northern part of the basin. On December 23, 1861, after a two-day storm, the river at Red Bluff was at bank-full stage, and on December 28 and 29, 1861, another hard rain caused tributaries upstream from Red Bluff to rise to very high stages. Cottonwood Creek was reported to have been higher than ever before known. The Sacramento River at Red Bluff apparently did not reach exceptionally high stages during either of these storms. On January 10, 1862, after a rainstorm that had been preceded on January 5 by a snowfall of 8 inches at Red Bluff, the Sacramento River had the second notable flood of the season, described as being within 1.5 feet of the flood of December 8, 1861. Cottonwood Creek was reported to have exceeded its previous record by 3 feet. Again on January 15 and 17 there were snowstorms at Red Bluff, followed by a heavy rain that began on January 19. After a gradual rise of several days the river reached on January 23 a record height of 29 feet, which according to Bulletin 43 of the United States Weather Bureau was the highest stage at Red Bluff until February 4, 1881.

The storm that caused the flood of December 8, 1861, on the upper Sacramento River was general throughout the Sacramento River Basin. The lower Sacramento River and its tributaries, the Feather, Yuba, Bear, and American Rivers, rose from high stages on December 7 to flood crests on December 9. The American River at Folsom was described as having exceeded the flood of 1852 by 8 feet on the latter date, and it is probable that the other tributaries were correspondingly high. Overflow from the American River, east of Sacramento, flooded that city on December 9, causing loss of life and much destruction of property. The lower Sacramento River continued to rise until December 14, flooding considerable areas in the lowlands downstream from Colusa. After the river gradually subsided from a gage height of 22.0 feet on December 13 to 18.8 feet on December 23, there was a second rise to about 22.2 feet at Sacramento on December 25, and after another subsidence there was a rise to 22.6 feet on December 27 and 31. A notable feature of this flood period in the lower Sacramento Valley was the prolonged high stages that existed from December 13, 1861, to about the first of February 1862. During this period there was an outstanding storm, general throughout central California, beginning on January 8, that caused record floods on several of the rivers in the Sierra Nevada on January 10 and 11. The American River at Folsom attained a stage considerably greater than any other known, except possibly that of 1867. At all of the lower points on the Feather, Yuba, Bear, and American Rivers, the flood stages were much greater than had been previously observed.

The Sacramento River at Sacramento reached a stage of 24.0 feet on January 11, 1862, which was the highest of record to that time, and caused additional loss of life and destruction of property. Many of the reports published during this period describe the lower Sacramento Valley as one vast sea of water. Thousands of cattle were drowned or died from starvation in the overflowed regions, and many ranch buildings were destroyed.

Throughout the month of January the lower Sacramento River was at flood stage, ranging in height from about 21 to 24 feet. There was a fourth notable rise of the tributaries in the Sierra Nevada on January 22, although the floods of the Yuba River at Marysville and probably also of the American River at Folsom were lower than the floods of December 9, 1861, and of January 11, 1862. The lower Sacramento River did not reach its former record, and by the end of January it was receding gradually. Another minor rise occurred about the end of February on the American River, causing another flood in Sacramento. The Sacramento River at Sacramento reached a height of about 21 feet on March 2, 1862.

The known stages for the floods of 1861-62 in the Sacramento River Basin are given in tables 13-15 and in the list on page 469.

Floods of 1867 and 1868.--In December 1867 the storms that resulted in the record-breaking floods in the San Joaquin River Basin also caused floods in the lower Sacramento Valley. Streams of the Sacramento River Basin upstream from Red Bluff probably did not reach exceptionally high stages, although floods on the Sacramento River upstream from the Pit River and on Cow Creek were reported. An outstanding feature of this flood period in the lower Sacramento River Basin was the extremely heavy precipitation reported for December 1867. At Nevada City, in the Yuba River Basin, 41.95 inches of rain was measured in that month. Heavy storms occurred in the periods December 8-9, 17-18, and 21-25, 1867, and from December 29, 1867, to January 2, 1868, and were followed by excessive run-off from the foothills. Foothill tributaries of the Yuba and American Rivers were reported to have reached record stages on December 22, 23, and 25. The American River near Sacramento was higher on December 24, 1867, than during the flood of January 10, 1862, and by December 26 it was at its crest, reported variously to have been 2 to

Table 13.--Maximum stage and discharge of recorded floods at indicated places on Sacramento and Pit Rivers

Date	Sacramento River--					Pit River--	
	at Kennett		near Red Bluff		at Red Bluff	near Ydalpom a/	
	Gage height b/ (feet)	Discharge (sec.-ft.)	Gage height (feet)	Discharge (sec.-ft.)	Gage height c/ (feet)	Gage height (feet)	Discharge (sec.-ft.)
1862, Jan. 23	-	-	-	-	29	-	-
1881, Feb. 4	-	-	-	-	29.5	d28±	-
1896, Jan. 27	-	-	-	-	e24.1	-	-
1900, Jan. 3	-	-	-	-	e24.7	-	-
1902, Feb. 10	-	-	e23.6	140,000	e24.7	-	-
1902, Feb. 24	-	-	e24.8	151,000	e24.7	-	-
1902, Nov. 10	-	-	e21.4	118,000	e23.3	-	-
1903, Jan. 25	-	-	e22.8	131,000	e24.4	-	-
1903, Nov. 22	-	-	e21.5	119,000	e24.5	-	-
1904, Feb. 16	-	-	e31.0	f207,000	e28.2	-	-
1905, Jan. 23	-	-	e20.3	108,000	e24.5	-	-
1906, Mar. 31	-	-	e23.4	137,000	e25.5	-	-
1906, Apr. 1	-	-	-	-	e25.5	-	-
1907, Feb. 2	e23.2	-	-	-	-	-	-
1907, Feb. 4	-	-	e23.1	134,000	e24.4	-	-
1907, Mar. 20	35.2	-	e29.4	f191,000	e26.8	-	-
1909, Jan. 16	e34.5	-	e28.4	181,000	e27.9	-	-
1909, Jan. 21	e32.0	-	e27.1	f168,000	e26.0	-	-
1909, Feb. 3	e34.5	-	e35.2	f252,000	e30.5		
1911, Mar. 7	e19.0	-	e22.7	130,000	e25.5	e13.3	20,600
1913, Dec. 31	e28.6	-	-	-	e28.0	e20.7	47,000
1914, Jan. 1	-	-	e27.6	f173,000	e29.0	-	-
1914, Jan. 2	e27.0	-	-	-	-	-	-
1915, Feb. 2	e31.5	-	e34.0	f239,000	e30.4	e17.1	33,900
1916, Feb. 10	e23.0	-	-	-	-	e18.9	40,300
1916, Feb. 11	-	-	e19.4	101,000	e24.0	-	-
1926, Feb. 4	19.5	66,000	-	-	-	14.75	26,000
1926, Feb. 5	-	-	20.5	110,000	e23.5	-	-
1927, Feb. 21	24.66	92,800	26.0	f152,000	e26.5	20.8	45,700
1928, Mar. 26	25.1	94,900	-	-	-	18.5	37,800
1928, Mar. 27	-	-	26.1	f153,000	e26.9	-	-
1935, Apr. 7	15.65	47,000	-	-	-	-	-
1935, Apr. 8	-	-	-	-	e23.6	16.00	29,400
1936, Jan. 15	-	-	-	-	-	18.5	37,900
1936, Feb. 21	23.3	85,500	-	-	-	-	-
1936, Feb. 22	-	-	24.5	133,000	-	-	-
1937, Dec. 10	-	-	-	-	-	24.2	65,000
1937, Dec. 11	30.6	132,000	36.5	262,000	32.0	-	-

a Records prior to 1924 from staff gage, 400 feet downstream from present gage; gage heights prior to 1924 adjusted to present datum by adding 2.50 feet to staff-gage readings.
b Records prior to 1926 furnished by U. S. Weather Bureau and adjusted to datum of present U. S. Geological Survey, which is 2.00 feet lower.
c Records furnished by U. S. Weather Bureau.
d From floodmark referred to present datum.
e Maximum recorded; may not be the peak.
f Supersedes discharge previously published.

Table 14.—Maximum stage, in feet, of recorded floods in Sacramento River Basin

Stream and location	1861-62	1867-68	1879	1881	1904	1907	1909	1915	1928	1937
Sacramento River:										
Cow Creek, half a mile upstream from mouth of	-	-	-	a26±	-	-	-	-	-	a25±
Bloody Island, 28 miles upstream from Red Bluff	-	-	-	b34.0	-	-	b33.3	b33.3	-	b34.0
Jelley's Ferry, former U. S. Geological Survey gage	-	-	-	45±	-	-	45±	44.5±	-	47±
Bend Bridge, County gage, 12¼ miles upstream from Red Bluff	-	-	-	-	-	-	c36.2	-	-	39.4
Red Bluff, U. S. Weather Bureau gage d/	29	-	-	29.5	-	-	e30.5	e30.4	-	32.0
North Fork of Feather River:										
Pulga, half a mile upstream from f/	a43	-	-	a45	-	a33	-	-	-	a25
Middle Fork of Feather River:										
Bidwell Bar, U. S. Geological Survey gage f/	31.2	-	-	(g)	-	-	28.0	-	22.8	24.0
South Fork of Yuba River:										
Edwards Bridge, 14.5 miles upstream from mouth h/	a30.9	(j)	a21.8	-	a25.0	a24.0	a24.0	-	a20.5	a18.5

a Stage above normal low water of 1937-38.
b Stage above estimated normal low water of 1937-38.
c From information furnished by W. H. Luning, former County surveyor.
d Record furnished by U. S. Weather Bureau.
e Maximum recorded; may not be the peak.
f Records prior to 1913 from information in Report to State Reclamation Board, Dec. 12, 1913, by A. Givan.
g Reported to have been at least 8 feet lower than peak stage of 1861-62.
h Records prior to 1937 from information furnished by W. W. Waggoner, former County surveyor.
j Reported to have been at least 8 feet higher than peak stage of 1861-62.

Table 15.--Maximum stage and discharge of recorded floods at indicated places on Feather, Yuba, and American Rivers

Date	Feather River--		Yuba River--	American River--		
	at Oroville		at Smartville	at Folsom	at Fair Oaks	
	Gage height a/ (feet)	Discharge (sec.-ft.)	Discharge (sec.-ft.)	Gage height b/ (feet)	Gage height c/ (feet)	Discharge (sec.-ft.)
1862, Jan. 10	-	-	-	d42	e39±	-
1879, Feb. 12	f11.7	-	-	f24.0	-	-
1881, Jan. 30	-	-	-	f23.5	-	-
1881, February	f25	-	-	-	-	-
1883, Mar. 29	-	-	-	f19.7	-	-
1884, Mar. 9	f13.0	-	-	f26.0	-	-
1884, Dec. 23	f13.8	-	-	-	-	-
1885, Dec. 25	f15.7	-	-	f23.8	-	-
1886, Jan. 24	f15.1	-	-	f29.0	-	-
1904, Feb. 22	-	-	59,800	-	-	-
1904, Feb. 24	f19.5	106,000	59,900	-	-	-
1907, Mar. 19	28.2	g230,000	100,000	f26.8	f31.4	g140,000
1909, Jan. 14	-	-	-	f24.5	f27.7	101,000
1909, Jan. 15	-	-	111,000	-	-	-
1909, Jan. 16	f26.0	g180,000	-	-	-	-
1911, Jan. 31	-	-	39,000	-	f22.9	82,000
1913, Dec. 31	20.5	g122,000	61,200	-	-	-
1914, Jan. 1	-	-	-	-	f21.7	74,100
1914, Jan. 25	-	-	-	f18.8	-	-
1915, May 11	16.3	g81,400	-	-	-	-
1915, May 12	-	-	46,500	-	-	-
1917, Feb. 25	16.15	g80,400	45,800	f15.4	-	-
1919, Feb. 11	-	-	29,400	f17.2	20.4	67,500
1925, Feb. 6	-	-	43,800	-	f26.0	99,500
1927, Feb. 21	18.34	g94,000	49,000	-	-	-
1928, Mar. 25	-	-	-	f26.8	31.45	g140,000
1928, Mar. 26	h26.5	g185,000	120,000	-	-	-
1935, Apr. 8	-	j58,600	41,200	f18.8	20.73	60,900
1936, Feb. 22	-	-	44,500	-	20.7	58,300
1937, Dec. 11	h26.4	j185,000	95,000	23.9	29.06	114,000

a Referred to datum of U. S. Weather Bureau gage.
b Record furnished by U. S. Weather Bureau. Prior to 1907 gage was located 1,000 feet upstream from present gage (high-water gage heights not comparable with subsequent records).
c Datum lowered 1.00 foot in 1930; all gage heights adjusted to present datum.
d Recent investigation indicates that flood crest of 1862 was about 33 feet at present site.
e From reported floodmark; verified by comparison with flood crests of 1862 and 1907 at other points.
f Maximum recorded; may not be the peak.
g Supersedes discharge previously published.
h Gage height outside of well.
j At station 5 miles upstream.

5 feet above the record of 1862 at different places near Sacramento. The flood profile of the American River at Sacramento was undoubtedly raised by channel constrictions made after 1862. The levees protecting Sacramento were raised after the flood of 1862 and the city has not been seriously flooded since that time. The American River at Folsom on December 26 was reported in news accounts from Folsom to have been as high as, or slightly higher than, the record peak of 1862. It was also reported that on the same date the South Fork of the American River near its mouth rose to within a few inches of the peak of 1862. The North and South Forks of the Yuba River were reported to have exceeded the stage of 1862. The Feather River at Oroville was considerably below the flood crest of 1862 but, according to varying reports, downstream from the mouth of the Yuba River it equalled or exceeded the crest of 1862. The flood profiles of the lower Feather and Yuba Rivers had probably been raised somewhat by the deposition of mining debris in the channels since 1862. Cache and Putah Creeks, tributaries of the Sacramento River from the Coast Ranges, were reported to have been at unusual stages on December 22, 1867. Either on this date or about December 31, Cache Creek reached the highest stage since 1853, and Putah Creek was higher than ever before known. On December 26, 1867, the Sacramento River at Sacramento rose to a stage of 24.1 feet, which was about the same as its previous crest of January 1862.

The tributaries of the lower Sacramento River again rose to high stages on December 31, 1867, or on January 1, 1868, but did not equal the flood stages of December 26. The Yuba River at Marysville was reported to have risen on January 1 to within a few inches of its peak of December 26. The American River at Folsom on December 31, 1867, it was said, lacked 6.5 feet of reaching its previous peak. The American River at Brighton, near Sacramento, was reported to have attained on January 1, 1868, a height some 2 feet below its previous record. Cache Creek near Yolo was again at overflow stage. The Sacramento River at Sacramento rose to 23.4 feet on January 1, 1868. It was reported that during the flood of 1867-68 the peak at Maine Prairie, in the flood basin below Sacramento, was very close to that of 1862.

<u>Floods of 1878</u>.--The Sacramento River at Red Bluff reached a flood height of about 26 feet above low water on January 17, 1878, the highest stage since January 1862. Rainfall for the period January 14 to 16 was 9.40 inches at Red Bluff. Tributaries in the vicinity of Red Bluff, including Read, Grasshopper, Dibble, and Cottonwood Creeks, were at very

high stages, and washed out or damaged railway trestles and highway bridges. Cache and Putah Creeks reached notably high stages. Continued rains resulted in prolonged inundation of the lowlands on the west side of the river from Colusa to Knights Landing.

On January 28, 1878, after minor rises on January 22 and 25 to stages of about 20.5 feet above low water, the Sacramento River at Red Bluff reached a stage of 25.5 feet. Elder, Thomas, and Stony Creeks were at extremely high stages and flooded the lowlands for miles beyond their channels. The relative magnitudes of the floods on these creeks cannot be determined from the information available, but the actual magnitudes were apparently great.

The Sacramento River at Sacramento on February 1, 1878, reached a gage height of 25.2 feet, the highest stage known at that point up to that time, but at Maine Prairie the stage was about 2 feet lower than in 1862. As a result of a break in the levee below Sacramento, the south part of the city and adjacent lands were flooded. Lowlands upstream from Knights Landing and at other places along the lower river were inundated during the entire month of February. On February 19, Knights Landing was partially flooded when the levees protecting the town were overtopped. On February 20 the Sacramento River at Sacramento again exceeded the previous record, rising to 26.0 feet. As previously mentioned, continued levee building tended to raise the flood profile at Sacramento. Several breaks in the levees above and below the city caused flooding of the lowlands west of the river. Cache and Putah Creeks were again at exceptionally high stages, causing extensive overflow and damage to railroad structures, but streams in the upper Sacramento River Basin were not at exceptionally high stages.

Floods of 1881.--The Sacramento River at Red Bluff reached on January 14-15, 1881, a stage of about 24 feet. This rise was followed by high stages on the lower Sacramento River, and it was reported that there were numerous breaks in the levees.

On January 30, after a three-day storm that extended throughout the Sacramento River Basin, the river attained a stage of about 25 feet at Red Bluff. The storm that caused this rise was followed almost immediately by another general storm. The Sacramento River at Red Bluff, already at a high stage on January 31, continued to rise and reached a peak of 29.5 feet (present datum of the gage of the United States Weather Bureau) on February 4, the highest known to that date. An exceptional feature of this flood was the prolonged period of high stages preceding the peak. At the present river-measurement station on the Pit River near Ydalpom the floodmark of 1881, as pointed out by an eye witness, was found to be about 4 feet above the peak of 1937. This witness said that the flood of 1881 had been described to him as the greatest for at least 30 years prior to and including that year. He stated also that the flood in 1937 was the highest since 1881. The Sacramento River immediately upstream from the mouth of Cow Creek attained in 1881 a stage that is considered by local residents to have been the highest since the settlement of this region in about 1850. A cedar drift log, which is a high-water mark of the flood of 1881 at this point, was reached but not disturbed by the flood of 1937. Cow Creek was at a notably high stage in 1881 and washed out bridges and roads, but the flood of that year was considerably exceeded by the one in 1937, when the creek was at the highest stage known to local residents. Cottonwood Creek was reported not to have been exceptionally high in 1881. On the Sacramento River at Bloody Island, near the junction with Cottonwood and Battle Creeks, the floods of 1881 and 1937 were at about the same stage; at Jelley's Ferry the stage of 1881 was exceeded in 1937; and at Red Bluff the stage of 1881 was exceeded by 2.5 feet in 1937.

There were notable floods on the Feather, Yuba, and American Rivers in the period January 30-31, 1881. The Feather and Yuba Rivers near Marysville were reported to have risen higher than ever before known, although the Feather River at Oroville did not exceed its previous record stage until February 4. The relatively high stages along the lower channels of these rivers were undoubtedly due in part to changed channel conditions that resulted from mining activities and reclamation work. The American River at Folsom was reported to have reached a stage of 23.5 feet on January 30, not an exceptionally high stage. The Sacramento River at Sacramento reached a flood stage of about 26 feet on January 31.

Beginning on February 2 the Feather and Yuba Rivers rose gradually to the highest stages of the year on February 4. The Feather River at Oroville exceeded the record stage of 1862 by about half a foot, but it was reported that at Longs Bar, upstream from Oroville, the crest was several feet below that of 1862. The relatively high stage at Oroville was attributed to deposition of mining debris in the channel since 1862. On the Middle Fork of the Feather River at Bidwell Bar, where flood stages are more nearly comparable, the stage of 1881 was reported to have been 8 feet below the record stage of 1862. On the North Fork of the Feather River near Pulga the crest in 1881 was about 2 feet higher than that in 1862, both floods being considerably higher than any other floods observed at that place. The American River apparently did not attain a second notably high stage.

The Sacramento River at Sacramento, which was at high stages since January 31, established a new record stage of 26.5 feet on February 4. Several breaks occurred in the levees on both sides of the river downstream from Sacramento during this period. Railroad tracks in the lower Sacramento River Basin were submerged and washed out at several places. At Maine Prairie the peak stage was the same as that in 1862.

Floods of 1886.--There were moderate floods in this basin in January 1886. Maximum stages on the tributaries of the lower Sacramento River, occurring about January 24, probably were the highest during the period 1882-88. On some of these tributaries, notably the American River and Cache Creek, the floods apparently were of considerable proportions, and resulted in overflow of farm lands and railroad tracks. The maximum reached on the Sacramento River at Sacramento was 25.6 feet on January 28, the highest between 1882 and 1888.

Floods of 1889-90.--The winter of 1889-90 was notable for the prolonged rainy season, which produced damaging floods in the Sacramento River Basin in December 1889 and in January, February, and March 1890. The Sacramento River reached flood stages from Tehama to Sacramento on December 12, 1889. The peak stages at Colusa and Sacramento on this date were the highest yet observed. The storm was evidently very general throughout the lower Sacramento River Basin, but caused only a minor rise on the main river at Red Bluff. The crests at Colusa and Sacramento were higher than they would have been if no reclamation work had been done along the rivers. There were many breaks in the levees from Colusa downstream, and considerable damage was done to grain lands. A large break on the right bank below Sacramento about December 12 probably helped to reduce subsequent flood stages at Sacramento. By December 21 the river downstream from Sacramento was rapidly receding.

On January 25, 1890, tributaries of the Sacramento River were again at high stages. The American River at Folsom was reported to have reached on this date a gage-height of 30 feet, possibly not the crest. This stage probably is comparable with the readings at the former Weather Bureau gage site given in table 15. Stony, Cache, and Putah Creeks were at extremely high stages on January 24 or 25. Stony and Putah Creeks were said to have been at the highest stages known to local residents, and there was a considerable overflow from Cache Creek near Yolo, which flooded farms and caused washouts along the railroad. The lower Sacramento River reached only a moderately high crest about January 31.

In February 1890 there was a flood on the upper Sacramento River that resulted in the greatest rise of the season at Red Bluff, the river reaching a stage of about 26.5 feet on February 4. The Sacramento River at Redding washed out part of a highway bridge constructed about 1885. The lower Sacramento River, at a fairly high stage since January, reached another moderate crest about February 11. The stage at Sacramento was above 21 feet for most of the period from February to June. Again in March 1890 there was a prolonged period of high water on the upper Sacramento River, although the peak stages at Red Bluff were not exceptionally high. Stony Creek and possibly other tributaries from the Coast Ranges were at flood stage on March 5, 1890. The lower Feather River on about March 7 apparently reached its highest stage of the season. The crest on the Sacramento River at Sacramento on March 11 was about 2.5 feet below the maximum of December 12. The peak of 1889 at Sacramento exceeded that of 1881, chiefly because of changed channel conditions, but the maximum at Maine Prairie during 1889-90 was roughly 3 feet lower than the record heights of 1881 and 1861-62.

The season of 1889-90 was featured by an exceptionally heavy snowfall in the mountains, and the snow run-off period was one of the heaviest and longest of record. Lowlands in the lower Sacramento River Basin were flooded for many weeks.

Floods of 1891 to 1903.--There were no outstanding general floods in the Sacramento River Basin from 1891 until 1904, although the Sacramento River at Sacramento reached high stages in 1891, 1892, 1893, 1895, 1896, 1900, 1901, 1902, and 1903. The maximum during this period occurred on December 27, 1892, when there was a crest at Sacramento higher than in December 1889. The crest in the flood basin at Maine Prairie for the season of 1892-93, however, was about 2 feet lower than that in 1889-90. At Red Bluff the Sacramento River was at or above a stage of 25 feet from about December 24 to 27, 1892. This flood in the Sacramento Valley followed a heavy rainfall, December 22-25, which evidently extended to the eastern slope of the Sierra, causing a flood in the Carson River Basin. The flood of January 1895, which was particularly severe on some of the coastal streams, also appears to have been of major proportions on Cache Creek, January 22-23. The crest at Rumsey was stated to have been 2 feet higher, and that at Capay, 10 inches higher than ever known. In the lower part of the basin there was an extensive inundation of farm lands, destruction of bridges, and damage to railroad rights of way.

Floods of 1904.--The Sacramento River at Kennett was reported in a newspaper dispatch to have reached on February 15, 1904, a peak stage of 23 feet, the highest yet observed at that comparatively recent settlement. Cottonwood and Clear Creeks, tributaries between Kennett and Red Bluff, were said to have been higher than ever before known, and on February 16 the river at Red Bluff reached a stage of 28.2 feet, which was reported to have been the highest since February 1881. From February 15 to the end of March the flood period was almost continuous in the lower Sacramento River Basin. During this time there were several rises on the Sacramento River near Red Bluff. There was a severe flood on the Pit River at Alturas about March 10, when it was reported that boats were rowed through the main part of the town.

For a discussion of the flood of 1904 reference is made to Water-Supply Paper 147. In general, it was considered to have been the most destructive flood in the history of the lower Sacramento Valley up to that time, but it was believed that the peak discharge of the lower Sacramento River had been much greater in 1862. Exceptionally high stages were reached only on tributaries of the upper Sacramento River.

Flood of 1907.--In March 1907 there was a very destructive flood in the Sacramento River Basin.[18] The flood was caused by a severe rain in the period March 16-20, and was preceded and followed by a period of comparatively high run-off.

Exceptionally high stages were reached on streams throughout the basin. On the Feather River at Oroville the flood height was the greatest ever observed, although it was believed that the flood profile at that place had been raised since 1862 by deposition of mining debris. On the American River at Folsom and Fair Oaks the peak of March 19 was exceeded in 1862 and possibly also in 1867. A report by A. Givan and C. E. Grunsky to the State Reclamation Board lists the flood profile of 1862 as about 7.5 feet above the high water of 1907 at Fair Oaks, and 4.0 feet above the high water of 1907 near Mills, where the river has a

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18/ The flood of 1907 is discussed in the following publications: Clapp, W. B., Murphy, E. C., and Martin, W. F., The flood of March, 1907, in the Sacramento and San Joaquin River Basins, California: Am. Soc. Civil Eng. Trans., vol. 61, p. 281, 1908. Taylor, N. R., The rivers and floods of the Sacramento and San Joaquin watersheds: Bull. 43, U. S. Weather Bur. 1913.

wide overflow. From investigations near Folsom it seems probable that the peak of 1907 at the present gage at Folsom was about 6 feet below that of 1862.

Flood of 1909.--In the period January 14-27, 1909, there were floods at several places in the Sacramento River Valley from Red Bluff to the mouth of the Sacramento River. The flood of 1909, in general, was believed to have been as great as that of 1907. The Sacramento River had reached high stages at Red Bluff by the period January 7-10. Again on January 17 the river was at a very high stage, and on February 3 it reached the highest stage theretofore observed at Red Bluff, which has since been exceeded only by the record-breaking stage of December 11, 1937.

The lower river at Sacramento reached the maximum stage of record on January 17, and exceptionally high stages were recorded between January 14 and 19 on nearly all of the main tributaries of the river. Flood conditions prevailed until January 27 in the lower basin, and were followed again by damaging floods during the first part of February.

The floods of 1909 are discussed in Bulletin 43 of the United States Weather Bureau. They are the most disastrous of any of which there is an authentic account, although it is believed that the flood discharge from the Sacramento River Basin in 1862 was probably far in excess of that in the floods of either 1907 or 1909.

Flood of 1911.--A minor flood occurred in the Sacramento Valley in March 1911. Sacramento River near Red Bluff reached a high stage on March 7, and Stony, Cache, and Putah Creeks had high peak stages on March 6 or 7, 1911. The Feather, American, and lower Sacramento Rivers did not reach exceptionally high stages. Damaging floods were confined mainly to the lowlands on the west side of the Sacramento River downstream from Colusa, and were the result of heavy run-off from the foothills of the Coast Ranges.

Flood of 1913-14.--On December 31, 1913, and during the first week of January 1914, high stages were recorded on some of the tributaries of the upper Sacramento River. The Sacramento River at Red Bluff, although not rising to the flood crests of 1881 and 1909, was at a very high stage for three days after December 31, and there was an outstanding peak of 29 feet on January 1, 1914. Putah Creek at Winters attained a record-breaking peak on December 31, 1913. The main tributaries of the lower Sacramento River did not reach exceptionally high stages during this period, and the flood was of little importance in the lower basin.

During the latter part of January 1914 there was a prolonged period of high water on the Sacramento River near Red Bluff and on nearly all of its downstream tributaries. High stages were recorded on the Feather and American Rivers on January 25, at the time that notable floods were observed in the San Joaquin River and Tulare Lake Basins. The floods on the main tributaries of the Sacramento River were of small magnitude but, occurring at a time of prolonged high water, caused the Sacramento River at Sacramento to rise to a stage of 27.8 feet on January 27, the highest since 1909.

Flood of 1915.--On February 2, 1915, the upper Sacramento River reached a height at Kennett of 29.5 feet (datum of United States Weather Bureau) which, although not as high as the floods of 1907 and 1909, has not been exceeded since. The crest stage at Red Bluff almost equalled that of 1909. The discharge of Cache Creek at Yolo on February 2, 1915, was the greatest of record, and that of Putah Creek at Winters was exceptionally high, although considerably less than the record flood of 1913. The Feather and American Rivers did not reach notably high stages and the flood was of little importance on the lower Sacramento River.

Flood of 1928.--High stages were recorded on several streams of the Sacramento Basin in 1916, 1917, 1919, 1925, 1926, and 1927, but few of these were exceptionally high, and no general or outstanding floods occurred. In March 1928 there was a severe flood in the Feather and American River Basins and moderate floods throughout the Sacramento River Basin. A notable feature of the flood of 1928 was that it occurred during a relatively dry season and was preceded and followed by comparatively low stages, whereas most of the important floods in this basin have occurred during seasons of heavy precipitation. The flood of 1928 occurred during a period (March 22-28) of heavy precipitation in the Sierra Nevada. Temperatures were unusually high and the rainfall was especially heavy in the period March 24-25 at altitudes up to 7,000 feet. On March 25 the American River at Fair Oaks equalled its maximum recorded discharge of March 19, 1907, and the Feather River at Oroville was exceptionally high. The Sacramento River at Sacramento on March 26 nearly reached its record stage of 1909, mainly as a result of the run-off from the American River. The greatest damage during the flood of 1928 was from overflow of the American River near Sacramento. Several thousand acres, including the town of North Sacramento, were flooded.

For a record of stage associated with the flood of 1928 reference is made to a publication of the State of California, Department of Public Works, entitled "Stream flow data for flood season of 1928".

Table 13 on page 457 gives a comparison of floods at two points on the Sacramento River and on Pit River near Ydalpom from 1862 to 1937.

Table 14 on page 458 furnishes a comparison of floods at several points on the Sacramento River during the period 1861 to 1937. Similar information is given, for the Feather, Yuba, and American Rivers, in table 15 on page 459.

Table 16 shows a comparison of floods on Stony, Cache, and Putah Creeks for the period 1904 to 1937.

Table 16.--Maximum stage and discharge of recorded floods at indicated places on Stony, Cache, and Putah Creeks

Date	Stony Creek at St. John[a]	Cache Creek at Yolo		Putah Creek near Winters[b]	
	Gage height (feet)	Gage height[c] (feet)	Discharge (sec.-ft.)	Gage height (feet)	Discharge (sec.-ft.)
1904, Mar. 10	-	30.2	-	-	-
1907, Mar. 19	13.2	-	-	29.0	37,000
1909, Jan. 8	-	-	-	27.5	33,400
1909, Jan. 26	d11.0	-	-	-	-
1909, Feb. 3	-	29.8	20,800	-	-
1909, Feb. 4	12.6	-	-	-	-
1911, Mar. 7	-	29.8	20,800	-	-
1913, Dec. 31	-	29.4	20,500	39.0	60,000
1914, Jan. 1	10.0	-	-	-	-
1914, Feb. 21	d10.3	-	-	-	-
1915, Feb. 2	d11.5	29.8	21,100	30.0	40,400
1916, Jan. 3		28.9	20,300	35.0	53,300
1917, Feb. 24	-	-	-	29.0	37,300
1917, Feb. 25	d10.0	27.1	18,800	-	-
1921, Jan. 30	-	26.3	18,000	29.2	33,500
1925, Feb. 11	-	-	-	35.1	53,600
1925, Feb. 12	-	25.7	18,400	-	-
1927, Feb. 18	-	24.8	17,200	-	-
1927, Apr. 2	-	-	-	29.2	31,300
1928, Mar. 27	d7.6	22.3	15,100	31.0	34,700
1931, Dec. 27	-	-	-	21.8	30,000
1935, Mar. 6	-	-	-	23.2	34,200
1936, Feb. 21	-	-	-	22.85	33,000
1937, Feb. 4	-	-	-	25.4	41,100
1937, Dec. 10	12.0	-	-	-	-
1937, Dec. 11	-	29.1	19,300	24.8	39,200

a Record furnished by U. S. Weather Bureau.
b Records prior to June 1930 are for former Geological Survey gage at Winters, 6 miles downstream.
c Gage datum lowered 2.0 feet in 1930; gage heights prior to 1930 adjusted to present datum.
d Maximum recorded; may not be the peak.

Table 17 is a list of maximum annual stages observed on Sacramento River at Sacramento from 1849 to 1938. The record for periods 1849-79 and 1888-91, was taken from Commissioner of Public Works Report, State of California, 1894-95; the entire record from 1849 to 1929 was compiled and furnished by Department of Public Works, State of California. Record for the period 1930-38 was furnished by United States Weather Bureau.

The zero of present Weather Bureau gage is 0.12 foot above mean sea level. All stages given in the table are presumably referred to the present Weather Bureau gage datum.

These data are to be used with caution. The stage is often not a true indication of discharge or the magnitude of a flood since it has been affected by building of levees, bypasses, and overflow channels. The data should not be used or quoted except with proper qualification.

Table 17.--Maximum annual stage, in feet, on the Sacramento River at Sacramento from 1849 to 1938

Date	Stage	Date	Stage
1849	18.8	1899, Apr. 1-2	24.2
1850, Jan. 10	20.2	1900, Jan. 9	27.0
1851, Apr. 7	9.8	1901, Feb. 25	28.2
1852, Dec. 31	21.7	1902, Mar. 1	28.2
1853, Apr. 3	19.4	1903, Apr. 4	27.6
1854, Mar. 23	20.2	1904, Feb. 26	27.9
1855, Mar. 14	20.3	1905, Feb. 6	22.0
1856, May 8	12.4	1906, Feb. 2	27.4
1857, Feb. 18	18.2	1907, Feb. 7, Mar. 20	27.2
1858, Feb. 26	18.9	1908, Feb. 13	20.4
1859, May 27	19.0	1909, Jan. 17	29.6
1860, Apr. 21	15.2	1910, Mar. 24-25	22.8
1861, Apr. 11	21.8	1911, Feb. 2	26.9
1862, Jan. 11	24.0	1912, May 31	16.7
1867, Dec. 26	24.1	1913, Apr. 27	17.9
1874, Nov. 27	19.1	1914, Jan. 27	27.8
1875, Jan. 27	22.2	1915, May 11	26.8
1876, Mar. 9	24.7	1916, Mar. 21	25.9
1877, Mar. 19	18.1	1917, Feb. 25	26.4
1878, Feb. 20	26.0	1918, Apr. 2	20.6
1879, Mar. 16	23.7	1919, Feb. 11	28.6
1880, Apr. 22	24.4	1920, Nov. 23	23.8
1881, Feb. 4	26.5	1921, Jan. 20	26.3
1882, Apr. 11-12	21.2	1922, Dec. 14	25.4
1883, May 24	20.7	1923, Apr. 11	21.3
1884, Dec. 27	24.6	1924, Feb. 11	18.4
1885, Dec. 30-31	23.9	1925, Feb. 6	28.0
1886, Jan. 28	25.6	1926, Apr. 9	24.8
1887, Mar. 29, Apr. 11	20.5	1927, Feb. 19	27.4
1888, Feb. 16	20.0	1928, Mar. 26	29.5
1889, Dec. 12	27.0	1929, Dec. 17	23.2
1890	24.6	1930, Mar. 6	24.4
1891, Mar. 5	26.9	1931, Dec. 29	22.9
1892, Dec. 27	28.6	1932, Jan. 1	22.6
1893, Mar. 22	26.5	1933, Apr. 1	14.0
1894, Apr. 12	22.6	1934, Jan. 4	21.2
1895, Jan. 27	26.6	1935, Apr. 8	28.6
1896, Jan. 29	26.7	1936, Feb. 22	28.7
1897, Feb. 9-10	24.2	1937, Dec. 12	27.7
1898, Mar. 1-4	16.7	1938, Feb. 11	27.7

Russian River Basin

Floods of 1861-62.--The Russian River near Guerneville, after rising to flood stages in December 1861, reached a stage in January 1862 which, so far as known, has not been equalled since.

Floods from 1867 to 1881.--Floods occurred on the lower Russian River in 1867, 1871, 1878, 1879, and 1881. During January and February 1878 the river between Ukiah and Healdsburg reached flood stages several times, the highest being near Healdsburg on February 21, 1878. There was an outstanding flood during the first part of March 1879, reported to have been the highest at Ukiah for eleven years. Disastrous floods occurred on coastal streams west of the Russian River, which were, at some points, the highest known to old inhabitants. Another flood on January 30, 1881, was noted at Guerneville as the third in three years in that city. The peak stage was reported in a news account as 41 feet 8 inches above low-water. This flood probably was somewhat lower than those of 1878 and 1879.

Flood of 1890.--A major flood occurred on January 24-25, 1890, which evidently was nearly the highest known at many points along the river. The crest at Ukiah was said to have been the highest for 20 years, and that at Cloversdale, the highest for 40 years. The river changed its course upstream from Geyserville, destroying a portion of the railroad. In Alexander Valley, upstream from Healdsburg, the water was reported to have overtopped the highway bridge by 5 feet, and apparently it was about 6 feet above the floodmark of 1878 at that place. The river at Healdsburg in the period January 24-25 was described in the Healdsburg Enterprise as the highest for 25 years. It was stated that a resident who had kept a record of the height of the river for that period had found the 1890 peak to be 2½ feet higher than any other. Another account stated that the river at Healdsburg was higher than ever before known, even surpassing the peak of 1862. Downstream at Guerneville the crest on February 25 was reported to have been within 9 inches of the flood of 1879, and higher than any between 1880 and 1889.

Floods from 1893 to 1937.--Floods of considerable magnitude have been recorded by residents along the river at different times subsequent to 1890. Outstanding floods were reported for the years 1893, 1895, 1907, 1914, 1915, and 1937, and it is possible that floods of similar magnitude have also occurred in other years. An observer of the flood of 1895 at Guerneville stated that it was the highest flood of which he had knowledge during the period 1885-1939. Newspaper accounts, January 23-24, 1895, describe this flood at Healdsburg and at Guerneville as the greatest for a long period prior to 1895 - evidently it was considered higher than the flood of 1890 at these points. For a comparison of maximum stages on the Russian River near Guerneville see table 18. Several of the listed stages are so nearly the same that it would be misleading to make exact comparisons, especially as channel changes may have affected the flood profiles.

Eel River Basin

Flood of 1852.--The flood of 1852 on the lower Eel River was apparently one of the greatest known. At the time of the flood of 1890 residents mentioned that of 1852 as having been outstanding.

Floods of 1861-62.--Floods occurred on the lower Eel River during the latter part of November and the first part of December, on December 22, 1861, and on January 11, 1862. Residents along the lower Eel River stated at the time of the January flood that the crest was a foot higher than ever known, and about eighteen inches higher than the previous record of the season. At the time of the great flood of 1915 old residents at Metropolitan, on the river 4 miles below Scotia, recalled that of 1862 as having been higher.

Floods of 1877, 1878, and 1879.--There were floods during the season of 1877-78, and a major flood on the lower Eel River about March 6, 1879. Accounts indicate that the crest heights in 1879 from Scotia to the mouth were the highest for at least about 12 years, and probably were nearly as high as any known. Major floods occurred at upper points in the Eel River Basin, on the Van Duzen River, and on the Mad River, north of the Eel River Basin.

Floods of 1881.--An outstanding flood occurred on the Eel River, January 12-15, 1881, as described in the Humboldt Times of January 14 and 15. The crests on the lower river, on its tributary, the Van Duzen, and on the adjacent Mad River apparently were somewhat higher than those in 1879. It is probable that other floods occurred on the Eel River later in January and in February, when the rivers to the north and south reached their highest crests.

Floods of 1890.--There was a flood on the Eel River on February 3, 1890, and another about the first of March 1890. From newspaper accounts it appears that the two floods had about the same stage and that the stage was somewhat lower than that of 1881.

Table 18.- Maximum stage, in feet, of recorded floods at indicated places in northern Pacific basins

Stream and location	1861-2	1881	1890	1904	1907	1913	1914	1915	1916	1917	1926	1927	1928	1936	1937
<u>Russian River Basin</u>															
Russian River:															
Summer Home Park, 4 miles upstream from Guerneville	a50±	-	-	-	b45±	-	a42.5	a44	-	-	-	-	-	-	a42.5
<u>Eel River Basin</u>															
Eel River:															
Scotia, U. S. Geological Survey gage	-	-	-	-	-	-	c52.5	d55.5	-	d51.2	d42.2	d45.2	d46.3	d44.7	55.1
<u>Klamath River Basin</u>															
Klamath River:															
Happy Camp, former U. S. Geological Survey gage near	30.0	-	27.0	21.2	-	-	-	-	-	-	-	-	-	-	-
Somesbar, U. S. Geological Survey gage	-	-	-	-	-	-	-	-	-	-	-	50.8	27.9	27.8	32.3
Orleans, at hotel	-	-	a38.8	-	-	-	-	-	-	-	-	a27.3	-	-	a18.2
Weitchpec, at mouth of Trinity River	a100.5	a87	a96.5	-	-	-	-	e70±	-	-	-	a79.0	-	-	a58.7
Martins Ferry, 4 miles downstream from Weitchpec	a102.4	-	a97.6	-	-	-	-	-	-	-	-	a81.5	-	-	a62.8
Requa, former U. S. Geological Survey gage near	60.0	-	63.0	-	-	-	d27.0	d33.3	d21.5	-	-	53.0	-	-	35.0
Trinity River:															
Lewiston, U. S. Geological Survey gage	21.6	20.4	-	-	-	-	16.7	15.2	15.4	10.1	18.3	-	17.2	13.0	19.90
Hoopa, U. S. Geological Survey gage near	-	-	-	-	-	-	-	-	-	-	-	-	-	24.60	28.7
Hoopa, at bridge at Hoopa Indian Reservation	-	-	f49.4	-	g47	h28.1	-	-	-	h24.6	a39.5	-	-	-	a28.1
<u>Smith River Basin</u>															
Smith River:															
Crescent City, U. S. Geological Survey gage	-	-	-	-	-	-	-	-	-	-	-	41.4	-	25.1	29.4
Tryons Corners, at highway bridge	a21.5±	-	a20.5±	-	-	-	-	-	-	-	-	a20.5	-	-	a15.9

a Stage above normal low water of 1937-38.
b Stage above normal low water of 1937-38; reported to have occurred also about March 1879 and either in 1890 or 1895.
c Maximum recorded; reported to have occurred in 1907 also.
d Maximum recorded; may not be the peak.
e Stage above low water reported by the Humboldt Standard of Feb. 5, 1915.
f Stage above normal low water of 1937-38; from floodmark. May have occurred in 1886.
g Stage above normal low water of 1937-38; from floodmark. May have occurred in 1909.
h Maximum recorded at former U. S. Geological Survey gage at Hoopa.

Flood of 1907.--It was reported that on March 18, 1907, the Eel River at places downstream from Scotia was the highest known for 30 years. The peak stage at Scotia was roughly established by comparisons with the flood of 1914 at Scotia, Rio Dell, and Rohnerville, where the two floods were reported to have reached about the same stage. (See table 18.)

Flood of 1913-14.--A flood that reached its highest stages on December 31, 1913, and January 1, 1914, followed a period of several days of warm rainfall. For comparison with later floods see table 18.

Flood of 1915.--On February 2, 1915, the Eel River from Scotia to Loleta rose to its highest recorded stage, possibly exceeded only in 1862. At Shively, 10 miles upstream from Scotia, the peak of 1915 was described as 14 inches above that of 1907. It was 3 feet higher than the peak of 1914 at Scotia, and was reported as 18 inches higher at Fortuna, 12 miles downstream. Homes and ranch buildings along the lower river were flooded.

The peak of 1915 at Scotia has not been exceeded since, but was nearly equalled in December 1937. The latter flood was variously described as from 8 inches lower to 3 feet higher than that of 1915 at other points along the river. The two floods may be classified as approximately of the same magnitude.

Floods of 1917-37.--An outstanding flood occurred at Scotia on February 25, 1917, and minor floods were recorded in 1926, 1927, 1928, and 1936.

For a comparison of floods on Eel River from 1861 to 1937 see table 18.

Klamath River Basin

Floods of 1852-53.--The first large floods in the Klamath River Basin after the settlement of the country are mentioned in a history of Siskiyou County. During the season of 1852-53 there were four floods, which washed out the few bridges that had been built and caused damage in the settlements of Scotts Bar, on the Scott River, and in Yreka, on Yreka Creek.

Floods of 1861-62.--A flood of great magnitude occurred about December 8, 1861. Rainfall had been heavy throughout November, and the rains at the end of that month were extremely heavy. On November 30 the Shasta and Scott Rivers flooded large tracts of land. On December 7 and 8, these rivers and their tributaries were at flood stages that evidently were higher than the previous rises. Buildings were washed away or damaged at Yreka, Etna, and Fort Jones. Along the Salmon and Trinity Rivers, the water washed out bridges, mills, and mining equipment. The main Klamath River from Happy Camp downstream to the Trinity River reached stages that have not been equalled since. A suspension bridge across the river near Martins Ferry, downstream from the mouth of the Trinity River, described as 98 feet above the river, was washed out. The peak of 1861 at Martins Ferry was recently determined to have been about 102 feet above the low water of 1937-38.

There was a third flood on December 22 which, according to a history of Siskiyou County, was the final one of the season of 1861-62. This third flood was apparently of lesser magnitude at least in the upper part of the basin. Based upon the history of this flood season in other basins, it is possible that there were floods again in January 1862 on the lower Klamath River.

Flood of 1864.--A flood described as "nearly as great as that of 1861" occurred in the Scott River Basin on December 26, 1864. Precipitation in the Scott River Valley for the month of December exceeded the large amount measured during December 1861. The flood was probably of little importance on the main Klamath River.

Flood of 1867.--Floods occurred in the Shasta and Scott River Basins in December 1867. The Klamath River near the junctions with these tributaries was described as approaching the record flood of 1861. The flood of 1867 on other tributaries and on the lower Klamath River evidently was of much less magnitude.

Floods of 1881.--After a heavy rainfall, the Klamath River near the Shasta and Scott Rivers was at a stage on January 14, 1881, that was described in a historical account as equalling that of 1861. The tributaries washed out bridges and caused extensive damage to farms and roads.

During the first part of February these rivers were again at flood stages, described as even higher than in January. The upper Trinity River at Lewiston nearly equalled its peak of 1861. The Klamath River downstream from the Trinity River was reported to have been highest in February since 1861, but was considerably below that record peak.

Floods of 1890.--On February 3-4, 1890, the Klamath River from Happy Camp to below Weitchpec reached stages nearly as high as those in 1861, and the river from Blue Creek to its mouth reached record-breaking stages, which were somewhat above those in the flood of 1861. On the upper Trinity River at Lewiston the flood did not attract attention. The season of 1889-90 was notable for the quantities of snow deposited in the mountains of northern California, and for the exceptionally heavy rainfall at lower altitudes.

Floods of 1904.--Floods in the Shasta and Scott River Basins on February 22, 1904, were described as the greatest since 1861. The Scott River washed out a bridge at Scotts Bar and flooded Fort Jones. As in the Sacramento River Basin, these floods evidently were relatively high on the smaller streams of the basin. The Klamath River at Happy Camp reached only a moderately high stage, as compared with those of 1890 and 1861. Its peak of February 22 was slightly exceeded again on March 8, 1904.

Floods of 1914 and subsequent years.--The lower Klamath River was reported to have been on January 1, 1914, at the highest stage for a number of years, but the flood apparently did not do much damage.

In February 1915 the Klamath River at Weitchpec probably exceeded the rise of 1914 and possibly was at its highest since 1890. Mining structures along the lower river were damaged.

The Klamath River near Requa reached an exceptionally high stage on February 19-20, 1927. The flood was fairly high at Weitchpec and higher at Somes Bar than at any time since. It was apparently of much less magnitude in the upper part of the Klamath Basin. On the upper Trinity River at Lewiston it was lower than a previous rise in the same season.

Floods occurred on the Klamath River in 1928, 1936, and 1937. These were moderate floods, except at upper points in the basin. For a comparison of floods during the period 1861 to 1937 see table 18.

Smith River Basin

Flood of 1861.--The flood of December 1861 damaged farms in the Smith River Valley and carried down great quantities of timber. There is little definite information but, so far as known, this flood has not been equalled since.

Flood of 1881.--The Smith River reached an exceptionally high stage in February 1881.

Flood of 1890.--A flood on the Smith River below the mouth of the Middle Fork on February 3, 1890, almost equalled the flood of 1861, as determined by the depth of water in a ranch house. An account of this flood period in Crescent City mentioned the occurrence of rain throughout January and of heavy snows in the mountains, followed by general rains from January 29 to February 3. It was believed that the snowfall in this basin during the winter of 1889-90 was the heaviest since settlement of the country. As in the Klamath River Basin, the flood run-off in 1890 probably came chiefly from the lower altitudes.

Flood of 1927.--A flood of great magnitude occurred on the lower Smith River in the period February 19-20, 1927, and resulted in considerable overflow of the lowlands. This flood was of about the same magnitude as those in 1890 and 1861, and was much greater than the recent floods of 1936 and 1937.

For a comparison of floods during the period 1861 to 1937, see table 18.

Major streams from the Sierra Nevada tributary to the Great Basin

Floods of 1861-62.--Pioneer accounts furnish information about floods of the winter season of 1861-62 on the Owens River and other major streams of the Sierra Nevada tributary to the Great Basin. It is stated that there was rain or snowfall on each of 54 consecutive days after December 24, 1861. Creeks became impassable and the Owens River at overflow stages was from one-fourth to one mile wide in places. The level of Owens Lake was reported to have been raised 12 feet by the flood waters.

In the Walker Lake Basin there was a rainstorm that combined with melting snow to cause heavy run-off during the period January 8-11, 1862. At Aurora, Nevada, in the Bodie Creek Basin tributary to the East Walker River, several buildings were destroyed by the flood of January 11, and there was reported loss of life on nearby Bodie Creek.

There were floods in the Carson River Basin in December 1861 at the time of the first large floods of this season in the lower Sacramento River Basin. The greatest run-off, however, evidently took place from January 9 to 12, 1862, as a result of the general warm rainfall. There was a disastrous flood on the Carson River at the towns of Empire and Dayton, Nevada, where several persons were reported to have been drowned, and a number of buildings were washed away. Water in Empire was said to have been from 6 to 8 feet deep. The flood at Dayton and on the river downstream was called the greatest known to that time.

Severe floods also occurred north of the Carson River Basin in January 1862. Washoe Lake was described as appearing to be twice its usual size. There was an extensive inundation in the Steamboat Creak Basin, tributary to the Truckee River.

Floods of 1867-68.--Floods similar to those of 1861-62 occurred in December 1867. At Independence, in the Owens River Basin, precipitation during this month was greater than the total for any of the 50 seasons after 1867-68 for which complete records have been obtained.

In the Walker Lake Basin there were storms on December 8 and 9, and almost continuously from December 16 to 31. The East Walker River was said to have been higher than ever before known, and it washed out or destroyed farm buildings along its channel. There were also damaging floods on the West Walker River and in the upper Carson River Basin.

The Carson River flooded the towns of Empire and Dayton on December 24, 1867, and was at flood stage for several days, reaching a height at Empire on December 26 reported to have been within 2 feet of the maximum stage of 1861-62. Floods on local tributaries occurred on December 23, 25, and 31.

The Truckee River was reported to have overflowed beyond its channel for miles on December 26, 1867, flooding many ranches. This account presumably refers to places near present Reno, Nevada, in Truckee Meadows, which were described on January 1, 1868, as having been flooded for the 10 days preceding. Bridges on the main river and on its tributaries were washed out.

Flood of 1886.--A notable flood occurred in the Truckee River Basin near Reno during January 23-24, 1886, as the result of heavy rainfall. Railroad tracks were washed out at several points.

Floods of 1889-90.--The season of 1889-90 was featured by the great amount of snow deposited in the Sierra Nevada and throughout the Walker, Carson, and Truckee River Basins. At many points in this region the precipitation was probably the greatest since 1867-68.

The rainstorm of January 25, which caused floods in central California, extended into the Great Basin, and although the run-off evidently was not extremely heavy, there were exceptionally high stages as a result of ice gorges at several points. Damaging floods were noted especially on the Owens River at Lone Pine and near Independence, on the East Fork of the Carson River, and on the Carson River near Genoa, Nevada. The floods in the Carson River Basin at this time resulted chiefly from ice gorges, and were followed during the first part of February 1890 by floods on the lower Carson River after a period of warm weather that caused release of the ice dams and melting of snow. The lower part of Empire was flooded on February 6, and mills along the river were put out of operation by the high water.

There were floods again during the first part of May 1890, caused by heavy snows in the Walker, Carson, and Truckee River Basins. The Truckee River near Reno was reported to have been higher about May 8 than for many years, and its overflow covered a number of ranches. Stream-flow records for the Truckee River near Boca, California, show that the mean discharge for May 1890, which was 5,275 second-feet, was greater than the maximum daily discharge for most of the seasons during the period of record, 1899-1937, at comparable stations downstream. The maximum daily discharge during May 1890 was 7,172 second-feet. Corresponding records for May 1890 show somewhat greater mean and maximum discharges at Vista, Nevada, below Truckee Meadows.

Flood of 1892.--On the East Fork of the Carson River near Gardnerville there was on December 25, 1892 a peak discharge estimated as 5,540 second-feet, which is the maximum recorded for the periods of record: 1890-93, 1900-06, 1908-10, 1917, 1924-29, and 1935-37; but which was considerably exceeded in December 1937 by an estimated peak discharge of 11,000 second-feet.

Flood of 1907.--The flood of March 18-19, 1907, was one of the greatest, from the Owens to the Truckee River Basin, for which quantitative information is available. There were moderate floods on the Owens River near Big Pine, California, on the East Walker River near Yerington, Nevada, and on the Carson River near Empire, Nevada, and a major flood on the Truckee River.

The mean daily discharge of the Truckee River at Iceland, California, about 4 miles downstream from Boca, on March 18, 1907, was 15,300 second-feet, which, for the period of record 1899-1938, was relatively closely approached only in March 1928 and December 1937. There were extensive washouts of the railroad along the Truckee River near Floriston, California, and Verdi, Nevada. The flood of 1907 was called in a news dispatch from Reno the highest in Nevada for 37 years. The peak discharge of the Truckee River at Iceland in 1907 apparently was considerably more than that of 1890, and probably was somewhat higher than those in 1928 and 1937.

Floods of 1914.--There were floods of considerable magnitude from the Owens to the Truckee River Basin during January 23-27, 1914, notably at lower points on the rivers. The Owens River near Big Pine reached a peak discharge of about 3,220 second-feet on January 26, the highest for the period of record, 1906-38. The Carson River near Empire had on

January 23, 1914, a maximum recorded discharge of 5,160 second-feet, the highest for the period, 1900-22. This flow was nearly equalled again during January 26-27, 1914. The Carson River near Fort Churchill, Nevada, reached a peak discharge of 6,150 second-feet on January 26, 1914, the highest for the period of record, 1911-37. Heavy run-off caused extensive washouts on several of the railroad lines at lower points in the basins, but run-off from the high mountains was comparatively small. The peak discharge of the Truckee River at Reno during this season was 7,520 second-feet on December 31, 1913, apparently considerably higher than that during the January flood.

Flood of 1928.--In March 1928 there was an outstanding flood on Truckee River at Iceland, with a mean discharge of 12,000 second-feet on March 25, and of 11,000 second-feet on March 26. This is comparable with the mean discharge of 12,300 second-feet on December 11, 1937, when there was a peak discharge of 15,500 second-feet. There were moderate floods in thé Carson River Basin during March 1928, and only minor rises on streams in the Walker and Owens River Basins.

RECORDS OF FLOODS IN 1938

The floods of December 1937 in northern California were forerunners of other notable floods in California, especially those of March 1938 in southern California on which a separate report (Water-Supply Paper 844, Floods of March 1938 in southern California) has been made.

A series of storms passed over northern California during January, February, and March 1938. During those months momentary peak discharges higher than those of December 1937, and in fact the highest on record, occurred at 14 river-measurement stations. Three were in the Salinas River Basin, one in a coastal basin, one in the Kern, eight in the San Joaquin, and one in the Klamath River Basin. Later, during the period of snow run-off early in June 1938, Mono Creek (San Joaquin River Basin) reached the highest peak discharge on record. Of the 15 maxima of record, only two, those on the South Fork of the Kern River near Onyx and on the Chowchilla River, were associated with the storm of March 2, 1938, which caused major floods in southern California.

For 11 of the 15 streams that experienced maximum peak discharge, gage heights and discharge for bi-hourly periods during the flood, and also mean daily discharge for a 25-day period including the flood, are given in this chapter. The 11 are: Salinas River near Santa Margarita, Salinas River near Spreckels, San Antonio River at Pleyto, San Lorenzo

River at Big Trees, South Fork of Kern River near Onyx, Los Gatos Creek near Coalinga, Mono Creek near Vermilion Valley, Fresno River near Knowles, Merced River near Livingston, Woods Creek near Jacksonville, and Shasta River near Yreka.

At three of the 15 river-measurement stations - San Joaquin River near Newman, San Joaquin River near Vernalis, Fine Cold Creek near Friant - mean daily discharge only for the month of March 1938 is given herein. The floods at the first two stations of this group rose and fell so gradually and were so prolonged that bi-hourly records do not add information of special significance. On Fine Gold Creek bi-hourly data are not given because the water-stage records are incomplete.

At the fifteenth gaging station, Chowchilla River at Buchanan dam site, there is no record for the period March 2-31, and neither bi-hourly or daily discharge data are given. The peak gage height, probably on March 2, was determined from floodmarks, and the corresponding discharge was computed as 15,000 second-feet (gage height, 14.4 feet). The mean monthly discharge for March 1938 was estimated to be 2,000 second-feet.

During February and March 1938, and also during June 1938, serious flood conditions prevailed on the lower San Joaquin River and considerable damage was done to farm lands and homes.

This is in strong contrast to the situation during December 1937 when there was no flood on the San Joaquin downstream from the Merced River, because of storage in reservoirs on the principal tributaries and storage in the natural channels and overflow areas downstream from Mendota. The reservoirs upstream from Vernalis, which stored large volumes of water during the flood of December 1937, were Hetch Hetchy and Don Pedro on the Tuolumne River, Lake McClure on the Merced River, and Melones on the Stanislaus River. By February 11 these reservoirs were filled sufficiently so that large volumes of water were passing down the three rivers, and the natural channels and lower overflow areas of the San Joaquin were also filled. The San Joaquin River also received some flood flow from the Kings River through Fresno by-pass (Fresno Slough). The record of discharge of Fresno by-pass for the period January 1 to July 31, 1938, is included in this section.

On figure 73 are shown the graphs of stage at various river-stage stations on the San Joaquin River for the period March 1-20, 1938. This may be compared with figure 42 on page 96 which shows similar data for December 1937.

A. NORTHEAST END OF TULARE LAKE.

B. AGRICULTURAL LANDS NEAR LATON ON FRESNO-HANFORD HIGHWAY FLOODED BY OVERFLOW FROM KINGS RIVER.

HIGH WATER OF JUNE 1938 IN TULARE LAKE BASIN.

On figure 74 is shown a profile of crest stages on the San Joaquin River during the flood of March 1938. See figure 71 for a similar graph for the flood of December 1937.

Tulare Lake rose substantially during the floods of December 1937, but was affected to a greater extent by the floods of February and March 1938 and experienced very serious overflow conditions in the period of the summer snow melt. Daily gage heights for Tulare Lake for the period, May 1937 to September 1938, are given in this section.

Views of high water of June 1938 in Tulare Lake Basin are shown on plate 13.

Salinas River near Santa Margarita, Calif.

Location.- See page 97.
Maxima.- February 1938: Discharge, about 11,000 second-feet 10 a.m. Feb. 11 (gage height, 17.0 feet).
1932-January 1938: Discharge, 7,260 second-feet Feb. 6, 1937 (gage height, 14.35 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	485	6	154	11	7,190	16	536	21	241
2	329	7	99	12	1,730	17	408	22	215
3	1,670	8	75	13	569	18	571	23	197
4	732	9	315	14	1,700	19	476	24	184
5	312	10	881	15	815	20	288	25	172

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 8		February 9		February 10		February 11		February 12		February 13	
2	4.60	82	4.58	80	6.40	585	12.55	5,700	9.22	2,940	5.97	775
4	4.58	80	4.65	89	6.36	569	12.95	6,140	8.60	2,440	5.84	713
6	4.57	78	4.95	140	6.26	529	13.30	6,560	8.25	2,200	5.74	668
8	4.56	77	5.46	259	6.10	465	14.90	8,480	8.05	2,060	5.63	618
10	4.55	76	5.40	242	5.95	412	17.00	11,000	7.74	1,840	5.56	487
N	4.54	75	5.35	229	5.88	388	16.56	10,500	7.39	1,590	5.46	544
2	4.52	72	5.50	270	5.78	354	15.90	9,740	7.05	1,380	5.43	532
4	4.52	72	5.95	412	5.81	364	14.45	8,140	6.82	1,240	5.35	500
6	4.51	71	6.50	625	6.25	525	13.05	6,600	6.59	1,100	5.29	476
8	4.51	71	6.38	577	7.65	1,210	11.72	5,240	6.38	980	5.25	460
10	4.51	71	6.28	537	9.80	2,890	10.80	4,320	6.22	900	5.22	448
M	4.52	72	6.33	557	11.13	4,190	9.95	3,560	6.10	840	5.31	484

Salinas River near Spreckels, Calif.

Location.- See page 98.
Maxima.- February 1938: Discharge, about 75,000 second-feet 6:30 a.m. Feb. 12 (gage height, 25.0 feet).
1930-January 1938: Discharge, about 42,100 second-feet Dec. 29, 1931 (gage height, 20.40 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	1,730	6	8,520	11	44,800	16	11,900	21	6,700
2	7,180	7	5,740	12	69,900	17	8,780	22	5,500
3	6,700	8	4,310	13	31,500	18	7,310	23	4,620
4	16,600	9	3,700	14	17,200	19	7,100	24	3,680
5	14,900	10	7,720	15	20,700	20	8,990	25	2,960

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 9		February 10		February 11		February 12		February 13		February 14	
2	8.57	3,770	8.80	4,080	15.60	21,100	24.28	70,000	19.90	48,700	11.98	18,700
4	8.47	3,670	9.70	5,210	16.54	25,300	23.74	73,200	18.56	42,700	11.64	17,900
6	8.50	3,700	10.35	6,200	17.18	28,400	24.99	74,900	17.45	37,900	11.36	17,100
8	8.45	3,650	10.77	6,910	17.70	31,000	24.97	74,800	16.60	34,500	11.22	16,800
10	8.45	3,650	10.92	7,160	18.60	35,500	24.90	74,500	15.83	31,600	11.16	16,600
N	8.51	3,710	11.00	7,300	20.52	46,100	24.72	73,500	15.16	29,100	11.18	16,700
2	8.50	3,700	11.05	7,400	21.90	54,400	24.52	72,400	14.54	26,900	11.20	16,700
4	8.49	3,690	11.19	7,680	23.05	61,800	24.33	71,400	14.07	25,200	11.23	16,800
6	8.45	3,650	11.60	8,500	23.56	65,100	23.86	68,800	13.60	23,700	11.24	16,800
8	8.36	3,560	12.20	9,800	23.72	66,200	23.07	64,600	13.00	21,700	11.25	16,800
10	8.35	3,550	13.20	12,400	23.69	66,000	22.10	59,500	12.55	20,400	11.32	17,000
M	8.38	3,580	14.40	16,300	23.83	66,900	21.15	54,800	12.25	19,500	11.64	17,900

San Antonio River at Pleyto, Calif.

Location.- See page 99.

Maxima.- February 1938: Discharge, 10,700 second-feet 7 a.m. Feb. 11 (gage height, 5.10 feet).
1930-January 1937: Discharge, 7,460 second-feet Dec. 28, 1931 (gage height, 4.55 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	922	6	778	11	9,200	16	1,460	21	824
2	667	7	612	12	3,740	17	1,110	22	749
3	3,130	8	524	13	1,980	18	1,170	23	678
4	1,830	9	1,330	14	4,650	19	1,290	24	585
5	1,040	10	5,670	15	2,200	20	920	25	515

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 9		February 10		February 11		February 12		February 13		February 14	
2	1.94	524	3.50	2,750	4.88	9,380	4.18	5,500	3.30	2,200		
4	2.00	560	3.38	2,400	5.03	10,300	4.08	5,010	3.26	2,100		
6	2.05	592	3.36	2,350	4.94	9,740	3.98	4,560	3.21	1,980		
8	2.06	599	3.55	2,900	5.00	10,100	3.90	4,200	3.17	1,900		
10	2.15	660	4.00	4,650	4.91	9,560	3.80	3,800	3.12	1,800		
N	2.42	868	4.45	6,920	4.92	9,620	3.72	3,480	3.11	1,780		
2	2.55	990	4.48	7,090	4.95	9,800	3.65	3,220	3.10	1,760		
4	2.63	1,070	4.70	8,300	4.85	9,200	3.56	2,930	3.11	1,780		
6	2.79	1,260	4.60	7,750	4.84	9,140	3.50	2,750	3.15	1,860		
8	3.45	2,600	4.66	8,080	4.66	8,080	3.45	2,600	3.24	2,060		
10	3.90	4,200	4.79	8,840	4.55	7,480	3.40	2,450	3.30	2,200		
M	3.74	3,560	4.71	8,360	4.35	6,380	3.35	2,320	3.45	2,600		

San Lorenzo River at Big Trees, Calif.

Location.- See page 102.

Maxima.- January 1938: Discharge, 12,000 second-feet 3 p.m. Jan. 31 (gage height, 16.8 feet, from drift marks outside of well; 16.3 feet inside of well, affected by drawdown).
1936-December 1937: Discharge, 8,700 second-feet Feb. 14, 1937 (gage height, 14.1 feet, from floodmarks).

Mean daily discharge, in second-feet, 1938

Day	January	Day	January	Day	February	Day	February	Day	February
22	96	27	69	1	2,590	6	1,100	11	2,320
23	87	28	104	2	1,520	7	748	12	1,550
24	79	29	140	3	2,320	8	574	13	2,720
25	74	30	116	4	1,950	9	1,090	14	2,970
26	71	31	4,850	5	1,280	10	1,650	15	1,350

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	January 31		February 1		February 2		February 3		February 4		February 5	
2	2.30	106	9.72	4,120	6.05	1,330	9.00	3,440	7.25	1,980	5.90	1,260
4	2.37	116	9.38	3,780	5.90	1,260	8.55	3,040	7.80	2,400	5.80	1,220
6	2.71	168	9.15	3,580	5.78	1,210	8.10	2,640	8.15	2,680	5.65	1,150
8	5.60	1,040	8.54	3,030	5.60	1,120	7.88	2,460	7.90	2,480	5.55	1,100
10	10.00	3,800	8.18	2,700	5.45	1,060	7.62	2,260	7.62	2,260	5.50	1,080
N	13.32	7,610	7.70	2,320	5.35	1,020	7.65	2,280	7.32	2,030	5.50	1,080
2	16.00	11,550	7.32	2,030	5.38	1,030	7.50	2,160	7.08	1,880	5.75	1,190
4	16.15	11,800	7.06	1,870	5.70	1,170	7.30	2,020	6.85	1,740	6.17	1,380
6	13.53	8,340	6.86	1,750	6.50	1,550	7.10	1,890	6.60	1,600	6.35	1,480
8	11.90	6,390	6.61	1,600	7.35	2,060	6.85	1,740	6.36	1,480	6.55	1,580
10	10.90	5,300	6.36	1,480	8.40	2,900	6.58	1,590	6.25	1,420	6.50	1,550
M	10.10	4,500	6.18	1,390	9.55	3,950	6.80	1,710	6.07	1,340	6.35	1,480

South Fork of Kern River near Onyx, Calif.

Location.- See page 119.

Maxima.- March 1938: Discharge, 3,450 second-feet 6 p.m. Mar. 2 (gage height, 6.69 feet).
1911-14, 1919-February 1938: Discharge, 3,130 second-feet Feb. 6, 1937 (gage height, 6.50 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	March	Day	March	Day	March
19	67	24	112	1	430	6	331	11	226
20	77	25	107	2	1,710	7	289	12	540
21	82	26	103	3	1,100	8	266	13	531
22	94	27	110	4	580	9	232	14	373
23	105	28	176	5	407	10	217	15	334

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 28		March 1		March 2		March 3		March 4		March 5	
2	2.20	114	3.28	423	3.12	365	5.03	1,610	3.76	710	3.25	470
4	2.23	120	3.64	585	3.25	412	4.79	1,390	3.68	670	3.21	452
6	2.28	130	3.58	555	3.51	520	4.67	1,300	3.63	645	3.16	432
8	2.34	143	3.55	540	3.98	764	4.52	1,180	3.56	610	3.13	419
10	2.42	161	3.45	492	4.63	1,140	4.39	1,090	3.50	580	3.08	399
N	2.54	190	3.31	434	5.05	1,480	4.27	1,010	3.45	558	3.04	384
2	2.52	185	3.20	393	6.28	2,880	4.20	965	3.42	544	3.04	384
4	2.54	190	3.14	372	6.65	3,380	4.16	939	3.38	526	3.03	380
6	2.57	198	3.15	376	6.69	3,450	4.07	882	3.37	522	3.02	377
8	2.67	225	3.14	372	6.30	2,940	3.99	834	3.35	513	3.01	373
10	2.76	250	3.13	368	5.78	2,360	3.91	790	3.32	500	3.00	369
M	2.91	294	3.11	362	5.39	1,950	3.83	746	3.28	482	2.98	362

Los Gatos Creek near Coalinga, Calif.

Location.- See page 131.

Maxima.- February 1938: Discharge, about 4,520 second-feet 3 a.m. Feb. 11, (gage height, 8.0 feet, from floodmarks on banks; 6.23 feet, inside of well, affected by drawdown).
1931-January 1938: Discharge, about 1,530 second-feet Dec. 11, 1937 (gage height, 5.1 feet, from floodmarks on bank; 4.58 feet, inside of well, affected by drawdown).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	220	6	80	11	1,170	16	95	21	48
2	88	7	53	12	219	17	75	22	43
3	296	8	38	13	127	18	77	23	40
4	194	9	227	14	206	19	72	24	38
5	117	10	386	15	131	20	54	25	35

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 9		February 10		February 11		February 12		February 13		February 14	
2	0.95	37	1.95	274	3.55	840	2.10	280	1.62	154		
4	.96	38	1.74	214	5.95	3,890	2.01	253	1.58	145		
6	1.20	84	1.64	188	5.80	3,590	1.96	239	1.56	140		
8	1.81	233	1.55	165	4.20	1,390	1.94	233	1.54	136		
10	1.82	236	1.51	155	3.25	748	1.94	233	1.51	129		
N	1.80	230	1.54	162	2.23	320	1.94	233	1.48	123		
2	1.77	220	1.68	198	2.43	390	1.87	214	1.46	119		
4	1.92	265	1.95	274	2.65	470	1.81	199	1.45	116		
6	2.30	404	3.51	816	2.65	470	1.76	186	1.44	114		
8	2.28	394	3.55	840	2.58	443	1.72	177	1.44	114		
10	2.23	374	3.55	840	2.42	387	1.69	170	1.44	114		
M	2.12	332	3.28	679	2.23	320	1.65	160	1.48	123		

Tulare Lake in Kings County, Calif.

Location.- Staff gage, lat. 36°05', long. 119°44', at SW corner sec. 31, T. 21 S., R. 21 E., 12 miles southeast of Stratford.

Records available.- May 1937 to September 1938. March 1906 to September 1920 (incomplete) at several other sites.

Extremes.- Maximum stage recorded during period May 1937 to September 1938, 195.5 feet June 5, 1938. Maximum amount in storage, about 1,160,000 acre-feet, June 30, 1938.

1906-38: Maximum stage probably occurred June 21, 1907 (gage height, 14.0 feet, former site and datum); lake dry or practically so for parts of 1906, 1914, 1916, 1919, 1920-22, 1924-36, and 1937.

Remarks.- Tulare Lake receives water from Kings, Kaweah, and Tule Rivers during high-water periods and occasionally from Kern River, Deer Creek, and several small intermittent streams. Its boundaries have been greatly altered in recent years by the construction of levees and other reclamation work. Water reached lake from tributaries about Feb. 10, 1937, for first time since April 1923, and lake attained a stage of 192.3 feet June 16, 1937 (contents about 420,000 acre-feet). It then receded until Dec. 14, 1937, when it began to receive flow from flood of Dec. 11. It continued to rise slowly through March 1938, with occasional periods of falling stage due to breaking of levees. The spring rise began about Apr. 15, 1938, and continued to the peak stage of June 5, 1938.

The amount of water in storage continued to increase, due to more levee breaks, until June 30, 1938. Gage-height record furnished by Tulare Lake reclamation district No. 749.

Gage height, in feet, 1937-38

1937

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1	-	190.4	191.8	189.5	186.9	16	187.1	192.3	190.9	188.2	186.3
2	-	190.7	191.8	189.4	186.8	17	187.4	192.2	190.8	188.1	186.3
3	-	191.0	191.7	189.3	186.8	18	187.8	192.2	190.7	188.0	186.2
4	-	191.2	191.7	189.2	186.7	19	188.4	192.2	190.7	187.9	186.2
5	-	191.3	191.6	189.2	186.7	20	189.0	192.2	190.6	187.8	186.2
6	-	191.4	191.6	189.1	186.6	21	189.2	192.2	190.6	187.7	186.1
7	-	191.6	191.5	189.0	186.6	22	189.4	192.2	190.5	187.6	186.1
8	-	191.8	191.5	188.9	186.5	23	189.6	192.1	190.4	187.5	186.1
9	-	191.8	191.4	188.8	186.5	24	189.8	192.1	190.3	187.5	186.0
10	186.0	192.0	191.3	188.7	186.4	25	190.0	192.1	190.2	187.4	186.0
11	186.1	192.1	191.2	188.6	186.4	26	190.2	192.1	190.1	187.3	186.1
12	186.4	192.2	191.2	188.5	186.4	27	190.6	192.0	190.0	187.2	186.1
13	186.5	192.2	191.1	188.4	186.4	28	190.9	192.0	190.0	187.2	186.1
14	186.6	192.2	191.0	188.4	186.4	29	191.0	191.9	189.8	187.1	186.1
15	186.8	192.2	191.0	188.3	186.3	30	191.2	191.9	189.7	187.0	186.2
						31	190.4	-	189.6	187.0	-

1937-38

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	-	-	186.0	186.9	-	188.3	193.4	192.6	195.1	193.0	192.2	191.4
2	186.2	186.2	-	-	-	188.3	193.1	192.3	195.2	193.0	192.2	191.4
3	-	186.2	-	186.9	-	188.5	192.9	192.1	195.3	193.0	192.2	191.3
4	186.2	186.2	-	186.9	-	188.6	192.7	192.1	195.4	193.0	192.2	191.3
5	186.2	-	-	186.9	-	188.9	192.6	192.2	*195.5	193.0	192.1	191.3
6	186.2	-	-	186.9	187.4	189.2	192.5	192.2	195.3	193.0	192.1	191.2
7	186.2	186.2	-	186.9	-	189.6	192.5	192.2	*195.1	193.0	192.1	191.2
8	-	186.1	185.9	186.9	187.5	190.0	192.6	192.3	194.6	193.0	192.0	191.2
9	-	186.1	-	-	-	190.3	192.6	192.4	*194.2	192.9	192.0	191.2
10	186.2	186.1	186.0	186.9	187.7	190.5	192.6	192.4	193.7	192.9	192.0	191.2
11	186.3	186.1	186.0	187.0	187.8	190.7	192.6	192.5	193.3	192.9	192.0	191.1
12	-	186.1	-	187.0	187.9	190.9	192.6	192.5	*193.1	192.9	191.9	191.1
13	-	186.1	186.0	187.0	*187.9	191.0	192.6	192.5	193.0	192.8	191.9	191.1
14	186.3	186.1	186.2	187.0	188.2	191.2	192.6	192.6	192.8	192.8	191.9	191.1
15	186.4	186.1	186.4	187.1	188.3	191.5	192.6	192.8	192.8	192.8	191.8	191.1
16	-	186.1	186.6	187.1	188.5	191.8	192.7	192.9	192.7	192.8	191.8	191.1
17	186.4	186.0	186.7	187.1	188.6	192.1	192.7	193.0	192.8	192.7	191.8	191.0
18	186.4	186.0	186.8	187.1	188.7	192.3	192.7	193.2	192.8	192.7	191.8	191.0
19	-	186.0	-	187.1	188.5	192.8	192.8	193.4	192.8	192.7	191.8	191.0
20	186.4	186.0	186.8	187.1	188.4	192.9	192.8	193.6	192.9	192.7	191.7	191.0
21	186.3	186.0	186.9	187.1	188.4	193.1	192.8	193.8	192.9	192.7	191.7	191.0
22	186.3	186.0	186.9	187.1	-	193.3	192.8	194.0	192.9	192.6	191.7	191.0
23	186.3	186.0	186.9	187.1	188.2	193.5	192.9	194.2	192.9	192.6	191.6	191.0
24	-	186.0	186.9	187.1	188.2	193.6	*193.0	194.4	192.9	192.6	191.6	191.0
25	186.3	186.0	-	187.1	188.2	193.7	193.0	194.5	193.0	192.5	191.6	191.0
26	186.3	186.0	186.9	187.1	188.2	*193.8	192.9	194.5	193.0	192.5	191.5	190.9
27	186.3	186.0	186.9	187.1	188.2	193.7	192.8	*194.6	193.0	192.4	191.5	190.9
28	186.2	186.0	186.9	-	188.2	193.7	192.9	194.7	193.0	192.4	191.5	190.9
29	-	186.0	186.9	-	-	193.8	*193.0	194.8	193.0	192.4	191.5	190.9
30	-	186.0	186.9	-	-	*193.9	192.9	194.9	193.0	192.3	191.4	190.9
31	186.2	-	186.9	-	-	193.7	-	195.0	-	192.3	191.4	-

*Levees broke, flooding additional areas.

Fresno by-pass, Fresno County, Calif.

Kings River, during flood periods, flows into Tulare Lake but also contributes some water to the San Joaquin River by way of Fresno Slough and Fresno by-pass which joins the San Joaquin River near Mendota. Data furnished by C. L. Kaupke, water master, Kings River Water Association. (See No. 311a on figure 6 and p. 128.)

Daily discharge, in second-feet, January to July 1938

Day	January	February	March	April	May	June	July
1	590	280	1,345	2,170	2,700	4,230	2,655
2	570	210	1,380	2,085	2,730	4,190	1,600
3	455	410	1,750	1,960	2,590	4,400	1,470
4	445	960	2,380	1,815	2,310	4,710	1,580
5	510	1,080	3,380	1,630	2,100	4,940	1,650
6	505	1,470	3,930	1,595	1,670	5,100	1,430
7	360	1,680	3,730	1,695	1,535	5,230	1,005
8	355	1,490	3,250	1,820	1,565	5,120	265
9	345	1,235	2,940	1,635	1,615	4,830	385
10	290	1,045	2,790	1,410	1,710	4,480	530
11	270	1,025	2,750	1,275	1,820	4,300	540
12	220	1,600	2,600	1,225	1,950	4,250	315
13	180	1,880	2,500	1,075	2,190	4,120	105
14	145	2,455	2,540	965	2,660	3,950	45
15	130	2,860	3,170	1,275	2,990	3,500	0
16	145	2,540	3,630	1,310	3,450	3,065	0
17	145	2,410	3,380	1,050	4,150	2,920	0
18	410	2,295	3,050	980	4,680	3,110	0
19	465	2,100	2,935	1,035	4,700	3,350	0
20	480	1,900	2,880	1,310	4,280	3,490	0
21	485	1,950	2,770	1,740	4,010	3,290	0
22	490	2,310	2,680	2,090	3,720	2,880	0
23	400	2,235	2,650	2,410	3,335	2,330	0
24	310	1,905	2,610	2,580	2,975	1,900	0
25	265	1,710	2,535	2,740	2,890	2,020	0
26	185	1,550	2,490	2,840	3,110	2,435	0
27	75	1,470	2,580	2,940	3,600	2,850	0
28	45	1,380	2,500	2,980	3,900	3,050	0
29	40	-	2,375	2,810	4,210	3,080	0
30	40	-	2,300	2,710	4,360	3,040	0
31	145	-	2,235	-	4,360	-	0

Monthly discharge, January to July 1938

Month	Mean (second-feet)	Run-off in acre-feet
January	306	18,800
February	1,623	89,961
March	2,711	166,390
April	1,838	109,207
May	3,028	185,853
June	3,672	218,117
July	438	26,878

San Joaquin River near Newman, Calif.

Location.- See page 136.

Maxima.- March 1938: Discharge, 33,000 second-feet 12:30 a.m. Mar. 7 (gage height, 18.50 feet).

1912-February 1938: Discharge observed (unregulated), 20,700 second-feet (main channel only) Jan. 27, 1914 (gage height, 18.0 feet).

Mean daily discharge, in second-feet, February to April 1938

Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.
1	5,560	10,800	15,000	11	11,300	27,100	10,300	21	20,800	25,200	10,800
2	4,840	11,300	14,100	12	14,100	27,100	10,500	22	19,500	24,400	11,100
3	4,930	13,300	13,000	13	20,100	26,100	10,300	23	17,800	23,600	10,800
4	5,380	16,800	12,300	14	23,600	25,200	10,100	24	15,400	22,100	10,800
5	6,550	22,100	11,600	15	23,600	25,200	10,100	25	14,100	20,800	11,300
6	7,420	31,700	11,300	16	24,400	27,100	9,880	26	13,000	20,100	11,900
7	8,080	33,000	11,600	17	24,400	29,200	9,880	27	11,900	20,100	13,000
8	8,450	31,700	11,100	18	24,400	28,100	9,690	28	11,300	20,100	13,700
9	9,010	30,400	11,100	19	22,800	28,100	9,510	29		19,500	14,500
10	9,690	28,100	10,500	20	21,400	27,100	10,100	30		17,300	14,500
								31		15,800	
Mean monthly discharge, in second-feet									14,350	23,500	11,480
Run-off, in thousands of acre-feet									797	1,445	683

San Joaquin River near Vernalis, Calif.

Location.- See page 137.

Maxima.- March 1938: Discharge, 51,200 second-feet 1 a.m. Mar. 16 (gage height, 26.64 feet).

1922-February 1938: Discharge, 28,700 second-feet Feb. 25, 1936 (gage height, 25.57 feet).

Mean daily discharge, in second-feet, February to April 1938

Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.
1	7,560	19,800	24,200	11	17,300	39,300	20,500	21	28,200	35,900	22,200
2	10,400	20,500	22,600	12	28,000	36,700	20,500	22	27,100	35,900	23,400
3	12,400	21,800	21,400	13	34,000	35,900	20,800	23	26,000	34,300	24,200
4	13,800	26,500	20,800	14	40,000	40,200	21,400	24	25,500	32,900	24,200
5	16,200	33,600	20,200	15	39,300	50,000	21,800	25	24,200	30,800	24,600
6	17,700	35,100	20,500	16	36,700	50,000	21,800	26	22,600	30,100	25,100
7	16,300	36,700	21,800	17	35,100	43,200	21,400	27	20,800	28,800	25,500
8	14,400	38,400	21,800	18	33,600	41,200	21,100	28	20,200	27,600	26,500
9	13,500	38,400	21,400	19	31,500	39,300	21,100	29		27,100	25,100
10	14,100	39,300	20,500	20	29,400	37,500	21,400	30		26,500	25,500
								31		25,500	
Mean monthly discharge, in second-feet									23,420	34,150	22,410
Run-off, in thousands of acre-feet									1,301	2,100	1,333

Mono Creek near Vermilion Valley, Calif.

Location.- See page 141.

Maxima.- June 1938: Discharge, 1,760 second-feet 10:30 p.m. June 2 (gage height, 8.62 feet).
1921-May 1938: Discharge, 1,420 second-feet June 16, 1927 (gage height, 8.09 feet), June 22, 1932 (gage height, 8.10 feet).

Mean daily discharge, in second-feet, 1938

Day	May	Day	May	Day	June	Day	June	Day	June
22	446	27	1,030	1	1,410	6	1,380	11	1,270
23	570	28	1,030	2	1,520	7	1,380	12	1,030
24	712	29	970	3	1,550	8	1,340	13	800
25	828	30	1,060	4	1,520	9	1,410	14	828
26	910	31	1,210	5	1,410	10	1,340	15	1,000

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	June 1		June 2		June 3		June 4		June 5		June 6	
2	8.16	1,450	8.51	1,700	8.55	1,720	8.42	1,630				
4	8.11	1,420	8.39	1,610	8.44	1,650	8.34	1,580				
6	8.02	1,350	8.27	1,530	8.33	1,570	8.26	1,520				
8	7.95	1,300	8.15	1,440	8.22	1,490	8.16	1,450				
10	7.85	1,240	8.04	1,370	8.11	1,420	8.07	1,390				
N	7.77	1,190	7.94	1,300	8.00	1,340	7.98	1,330				
2	7.74	1,170	7.92	1,280	8.01	1,350	7.98	1,330				
4	7.85	1,240	8.05	1,380	8.11	1,420	8.18	1,470				
6	8.15	1,440	8.30	1,550	8.27	1,530	8.34	1,580				
8	8.44	1,650	8.49	1,680	8.41	1,630	8.40	1,620				
10	8.56	1,730	8.61	1,760	8.47	1,670	8.41	1,630				
M	8.59	1,750	8.60	1,760	8.47	1,670	8.38	1,610				

Fine Gold Creek near Friant, Calif.

Location.- See page 148.

Maxima.- March 1938: Discharge, 10,300 second-feet about 9 p.m. Mar. 12 (gage height, 20.4 feet, from floodmarks).
1936-February 1938: Discharge, 6,780 second-feet Feb. 6, 1937 (gage height, 16.45 feet).

Mean daily discharge, in second-feet, 1938

Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.	Day	Feb.	Mar.	Apr.
1	524	1,100	142	11	3,950	405	133	21	282	385	109
2	274	3,200	137	12	1,320	2,460	134	22	237	240	107
3	738	3,000	131	13	616	3,200	194	23	201	206	103
4	808	1,510	133	14	1,140	1,200	164	24	192	447	107
5	452	780	306	15	603	800	143	25	174	255	186
6	237	603	174	16	428	650	137	26	170	185	133
7	174	500	152	17	306	615	131	27	157	170	117
8	154	1,040	138	18	350	430	121	28	210	177	109
9	440	590	133	19	792	305	118	29		170	109
10	270	452	133	20	361	567	114	30		154	114
								31		149	
Mean monthly discharge, in second-feet									556	837	139
Run-off, in acre-feet									30,860	51,460	8,260

Fresno River near Knowles, Calif.

Location.- See page 151.

Maxima.- March 1938: Discharge, 7,630 second-feet 5 p.m. Mar. 12 (gage height, 8.67 feet).
1911-13, 1915-February 1938: Discharge, 6,880 second-feet Feb. 6, 1937 (gage height, 8.16 feet).

Mean daily discharge, in second-feet, 1938

Day	March	Day	March	Day	March	Day	March	Day	March
1	1,270	6	814	11	638	16	1,090	21	736
2	3,280	7	694	12	2,890	17	1,020	22	604
3	2,670	8	1,140	13	4,020	18	766	23	552
4	1,590	9	743	14	1,570	19	680	24	1,050
5	1,050	10	617	15	1,140	20	998	25	687

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	March 11		March 12		March 13		March 14		March 15		March 16	
2	2.66	584	3.41	1,170	6.33	4,270	4.25	1,970				
4	2.65	578	3.54	1,290	7.67	6,120	4.11	1,830				
6	2.64	571	3.65	1,380	8.00	6,580	4.02	1,740				
8	2.63	564	3.77	1,490	7.15	5,390	3.95	1,670				
10	2.62	558	3.87	1,590	6.15	4,040	3.87	1,590				
N	2.62	558	3.98	1,700	5.80	3,620	3.82	1,540				
2	2.62	558	4.16	1,880	5.82	3,640	3.75	1,480				
4	2.70	610	5.00	2,720	5.50	3,270	3.70	1,430				
6	2.78	666	6.82	4,930	5.19	2,930	3.67	1,400				
8	2.90	750	7.10	5,320	4.90	2,620	3.65	1,380				
10	3.13	934	7.70	6,160	4.65	2,370	3.62	1,360				
M	3.29	1,060	6.90	5,040	4.41	2,130	3.60	1,340				

Merced River near Livingston, Calif.

Location.- See page 161.

Maxima.- February 1938: Discharge, 11,100 second-feet 11 p.m. Feb. 12 (gage height, 19.44 feet).
1922-24, 1926-January 1938: Discharge, 10,900 second-feet (revised) Feb. 24, 1936 (gage height, 19.24 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	2,020	6	1,760	11	3,830	16	7,080	21	5,370
2	1,720	7	1,610	12	8,950	17	6,450	22	4,060
3	846	8	1,540	13	9,570	18	5,890	23	2,530
4	1,760	9	1,610	14	7,650	19	5,510	24	2,130
5	2,140	10	2,420	15	8,150	20	5,440	25	2,000

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 9		February 10		February 11		February 12		February 13		February 14	
2	5.18	1,250	7.10	1,950	8.14	2,360	15.10	6,540	19.33	11,000	16.69	8,040
4	5.40	1,330	7.94	2,280	8.85	2,640	15.40	6,810	19.12	10,800	16.55	7,900
6	5.80	1,470	8.54	2,520	9.58	2,960	15.85	7,220	18.85	10,500	16.43	7,780
8	6.14	1,590	8.81	2,620	10.21	3,270	16.30	7,650	18.56	10,100	16.34	7,690
10	6.38	1,680	8.84	2,640	10.60	3,480	17.00	8,350	18.26	9,760	16.20	7,550
N	6.54	1,740	8.80	2,620	10.85	3,620	17.72	9,140	17.97	9,420	16.09	7,440
2	6.62	1,770	8.81	2,620	11.16	3,800	18.35	9,870	17.72	9,140	15.99	7,340
4	6.68	1,790	8.79	2,620	11.79	4,170	18.83	10,400	17.50	8,900	15.95	7,300
6	6.68	1,790	8.66	2,560	12.62	4,700	19.14	10,800	17.30	8,680	15.99	7,340
8	6.54	1,740	8.37	2,450	13.38	5,220	19.33	11,000	17.13	8,490	16.10	7,450
10	6.33	1,660	8.02	2,310	14.14	5,760	19.43	11,100	16.96	8,310	16.26	7,610
M	6.46	1,710	7.85	2,240	14.69	6,200	19.43	11,100	16.82	8,170	16.45	7,800

Woods Creek near Jacksonville, Calif.

Location.- See page 174.

Maxima.- February 1938: Discharge, 13,500 second-feet 8 p.m. Feb. 9 (gage height, 10.5 feet).

1925-January 1938: Discharge, 10,600 second-feet Feb. 6, 1937 (gage height, 9.12 feet).

Mean daily discharge, in second-feet, 1938

Day	February	Day	February	Day	February	Day	February	Day	February
1	1,460	6	248	11	5,440	16	366	21	192
2	414	7	178	12	1,220	17	279	22	190
3	2,280	8	142	13	530	18	252	23	180
4	1,190	9	3,160	14	1,180	19	418	24	170
5	476	10	5,250	15	566	20	232	25	160

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	February 8		February 9		February 10		February 11		February 12		February 13	
2	1.44	153	1.51	168	5.21	2,800	7.00	5,300	4.45	2,000	2.59	686
4	1.41	146	1.60	190	4.48	2,030	7.13	5,560	4.18	1,740	2.46	634
6	1.41	146	1.82	245	4.59	2,140	6.90	5,150	3.91	1,510	2.34	586
8	1.40	144	2.35	395	6.37	4,360	7.57	6,440	3.61	1,270	2.24	546
10	1.39	142	2.88	582	7.62	6,540	8.09	7,480	3.35	1,090	2.18	522
N	1.38	140	3.05	650	8.19	7,680	8.02	7,340	3.18	988	2.08	482
2	1.37	138	2.80	550	7.93	7,160	8.13	7,560	3.12	952	2.04	466
4	1.36	136	3.76	980	8.59	8,580	7.82	6,940	3.16	976	2.00	450
6	1.36	136	9.61	10,500	8.40	8,100	6.59	4,680	3.17	982	1.96	436
8	1.36	136	10.50	13,500	7.38	6,060	5.69	3,380	3.15	970	1.95	432
10	1.41	146	8.22	7,740	6.34	4,310	5.13	2,710	2.94	860	2.03	462
M	1.47	159	6.65	4,780	6.04	3,870	4.75	2,300	2.76	770	2.58	682

Shasta River near Yreka, Calif.

Location.- See page 270.

Maxima.- March 1938: Discharge, 1,940 second-feet 5:30 p.m. Mar. 23 (gage height, 6.24 feet).

1933-February 1938: Discharge, 1,860 second-feet 4 p.m. Dec. 11, 1937 (gage height, 6.17 feet).

Mean daily discharge, in second-feet, 1938

Day	March	Day	March	Day	March	Day	March	Day	March
7	477	12	382	17	511	22	530	27	750
8	447	13	443	18	496	23	1,470	28	725
9	422	14	454	19	500	24	1,260	29	655
10	400	15	432	20	570	25	970	30	610
11	382	16	500	21	550	26	800	31	570

Gage height, in feet, and discharge, in second-feet, at indicated time, 1938

Hour	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.	Feet	Sec.ft.
	March 22		March 23		March 24		March 25		March 26		March 27	
2	3.95	511	4.45	725	5.66	1,470	5.09	1,080				
4	3.95	511	4.70	855	5.54	1,390	5.03	1,050				
6	3.95	511	5.08	1,080	5.45	1,320	4.99	1,020				
8	3.95	511	5.54	1,390	5.37	1,270	4.94	994				
10	3.95	511	5.84	1,610	5.32	1,230	4.88	958				
N	3.95	511	5.95	1,700	5.28	1,210	4.85	940				
2	3.96	515	6.08	1,800	5.29	1,210	4.81	916				
4	3.97	519	6.18	1,880	5.31	1,230	4.78	899				
6	4.08	562	6.22	1,920	5.30	1,220	4.76	888				
8	4.11	574	6.13	1,840	5.27	1,200	4.74	877				
10	4.13	582	5.98	1,720	5.22	1,160	4.72	866				
M	4.24	628	5.82	1,600	5.16	1,130	4.71	860				

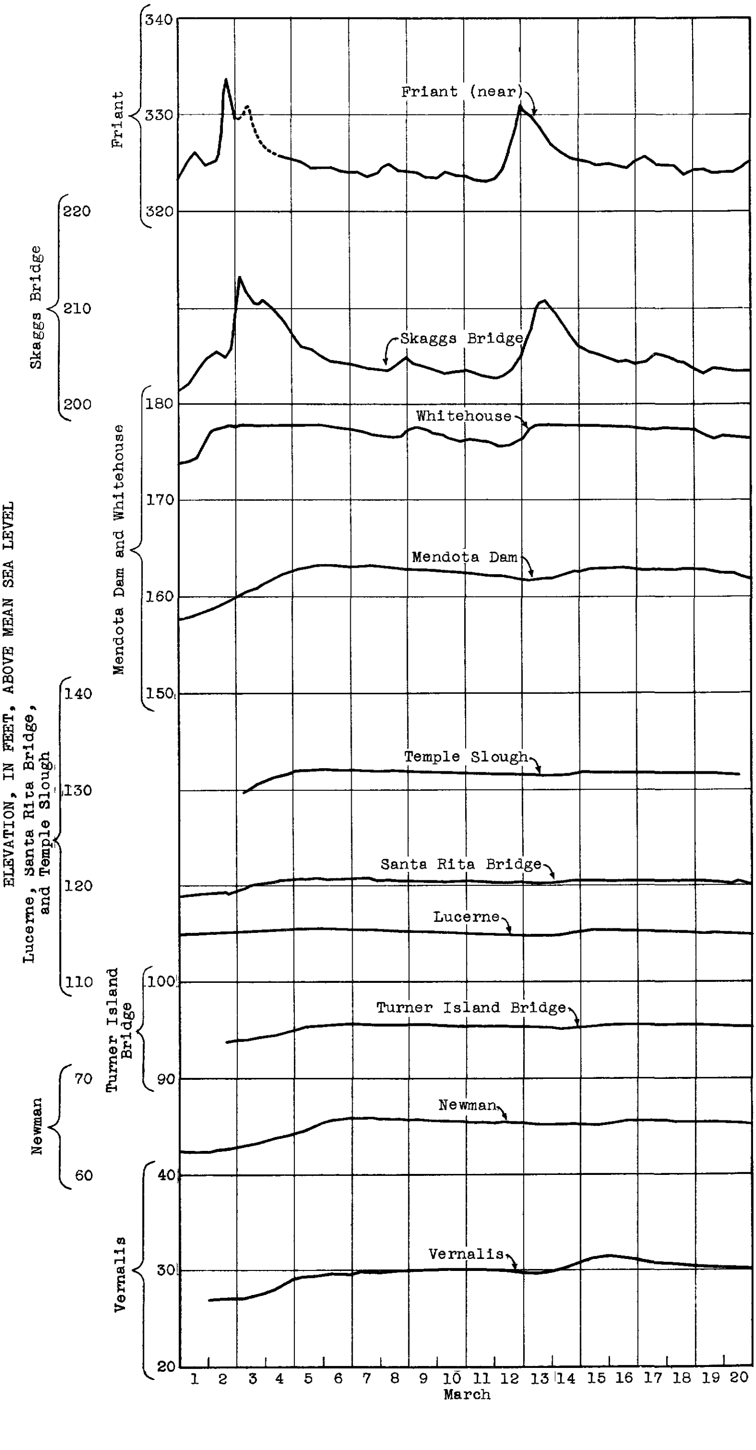

Figure 73.--Graphs of stage at various river-stage stations on the San Joaquin River March 1-20, 1938.

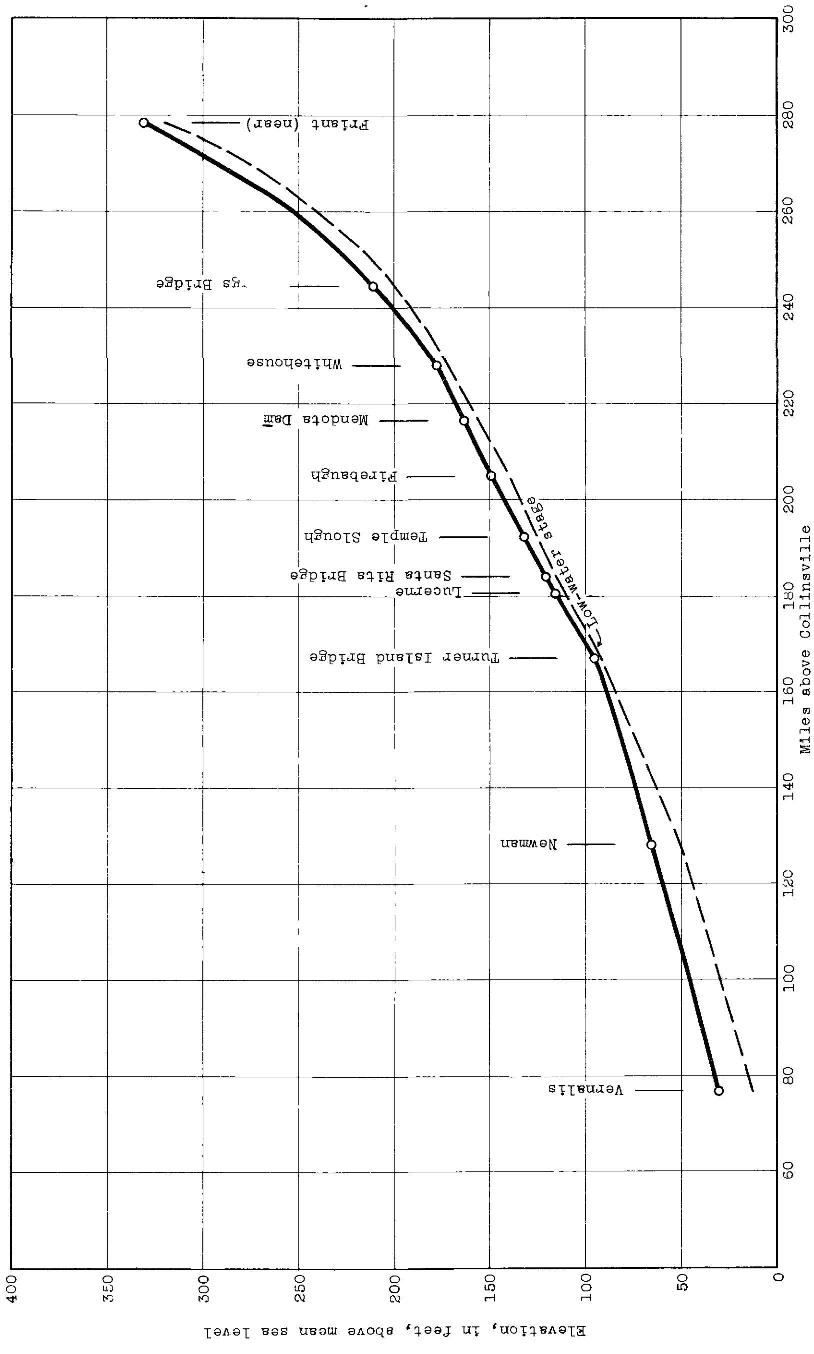

Figure 74.--Profile of crest stages on the San Joaquin River during the flood of March 1938.

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