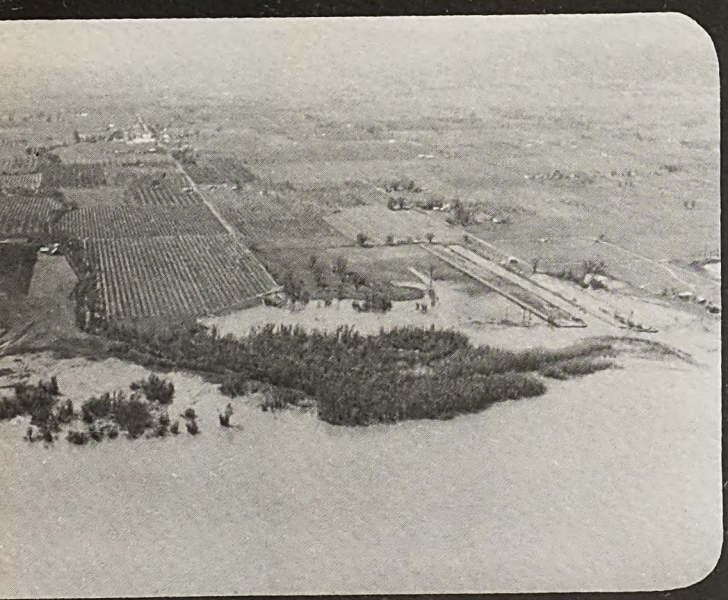
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FLOOD PLAIN INFORMATION

BIG VALLEY STREAMS

(MANNING, ADOBE, KELSEY, AND COLE CREEKS)

KELSEYVILLE, CALIFORNIA

WATER RESOURCES CENTER ARCHIVES
UNIVERSITY OF CALIFORNIA
BERKELEY

PREPARED FOR
LAKE COUNTY
BY THE
DEPARTMENT OF THE ARMY,
SACRAMENTO DISTRICT,
CORPS OF ENGINEERS,
SACRAMENTO, CALIFORNIA

JUNE 1974

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ACTION IS NEEDED

Some areas in the flood plains along the Big Valley streams near Kelseyville are being converted from agricultural to commercial and residential uses.

Greater pressure to utilize these flood prone areas will occur with continued community growth. Flood hazards and flood damage will continue to increase unless some preventive or corrective action is taken.

Effective regulatory measures such as flood plain zoning, subdivision regulations, and building codes can be adopted to prevent or minimize the increase in flood damage. Within the unincorporated areas of Lake County, flood insurance may be obtained to help minimize flood losses. Flood proofing can prevent future damage to existing structures subject to flooding, and flood control works that would modify flood patterns can also be a part of a long-range solution. The adoption of flood plain regulations, which is becoming more and more acceptable as a practical approach to reduction of future flood damage would not prevent the highest and best use of flood prone areas.



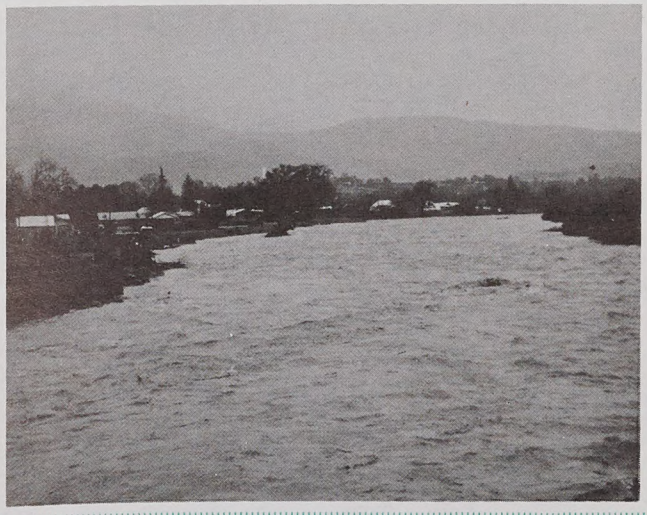
Future flood heights on Cole Creek at Sylar Lane

This folder has been prepared for Lake County by the Sacramento District, U.S. Army Corps of Engineers. It is partially based on data in the report entitled "Flood Plain Information, Big Valley Streams, Kelseyville, California." Copies of the report and this folder are available upon request from the Lake County Flood Control and Water Conservation District.

COVER PHOTOGRAPH

Kelsey Creek flood flows just upstream of Main Street Bridge, January 1965 (Soil Conservation Service Photo).

FLOODS



BIG VALLEY STREAMS

KELSEYVILLE, CALIFORNIA

JUNE 1974

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FLOODS

ON

BIG VALLEY STREAMS

The Big Valley area has suffered damage from large floods in the past. Studies made for a flood plain information (FPI) report on the streams in Big Valley show that floods of similar magnitude can occur on these streams in the future. The FPI report presents facts on the flood potential and flood hazard along Manning, Adobe, Kelsey, and Cole Creeks. It includes maps, drawings, and photographs that illustrate the extent and severity of future floods that have been designated as the Intermediate Regional Flood (IRF) and Standard Project Flood (SPF). An IRF is a large flood that has a 1 percent chance of occurring in any given year. An SPF is an extremely large flood, but one that can reasonably be expected to occur in the future. It would be a much greater flood than an IRF, but still could occur in any particular year.

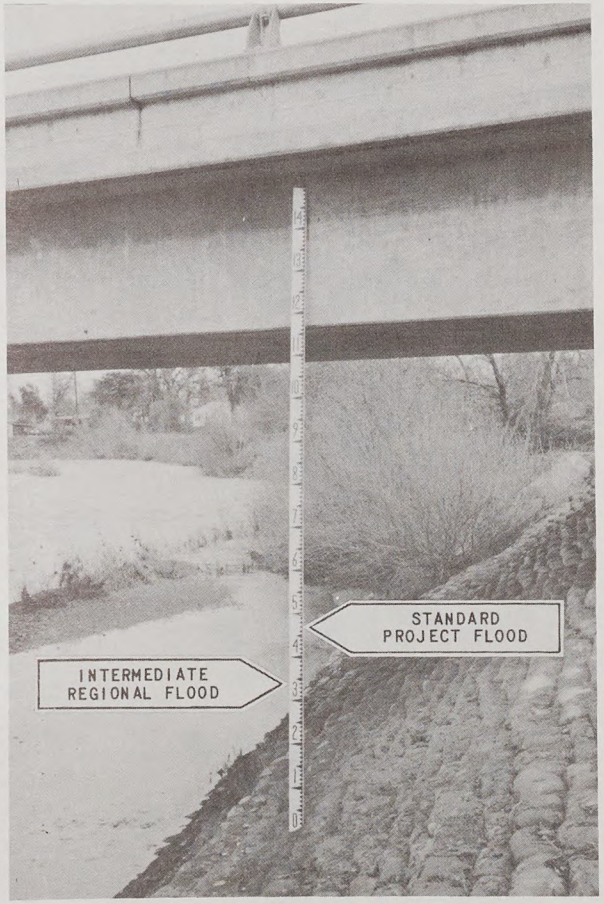
The purpose of FPI reports is to provide a basis for managing the use of flood prone lands in such a way that flood hazards and damage during future floods are minimized or eliminated.



Adobe Creek overflowing its banks just upstream of the Finley Road Bridge, January 1963 (Soil Conservation Service Photo')



Cole Creek flooding at Soda Bay Road, January 1974.

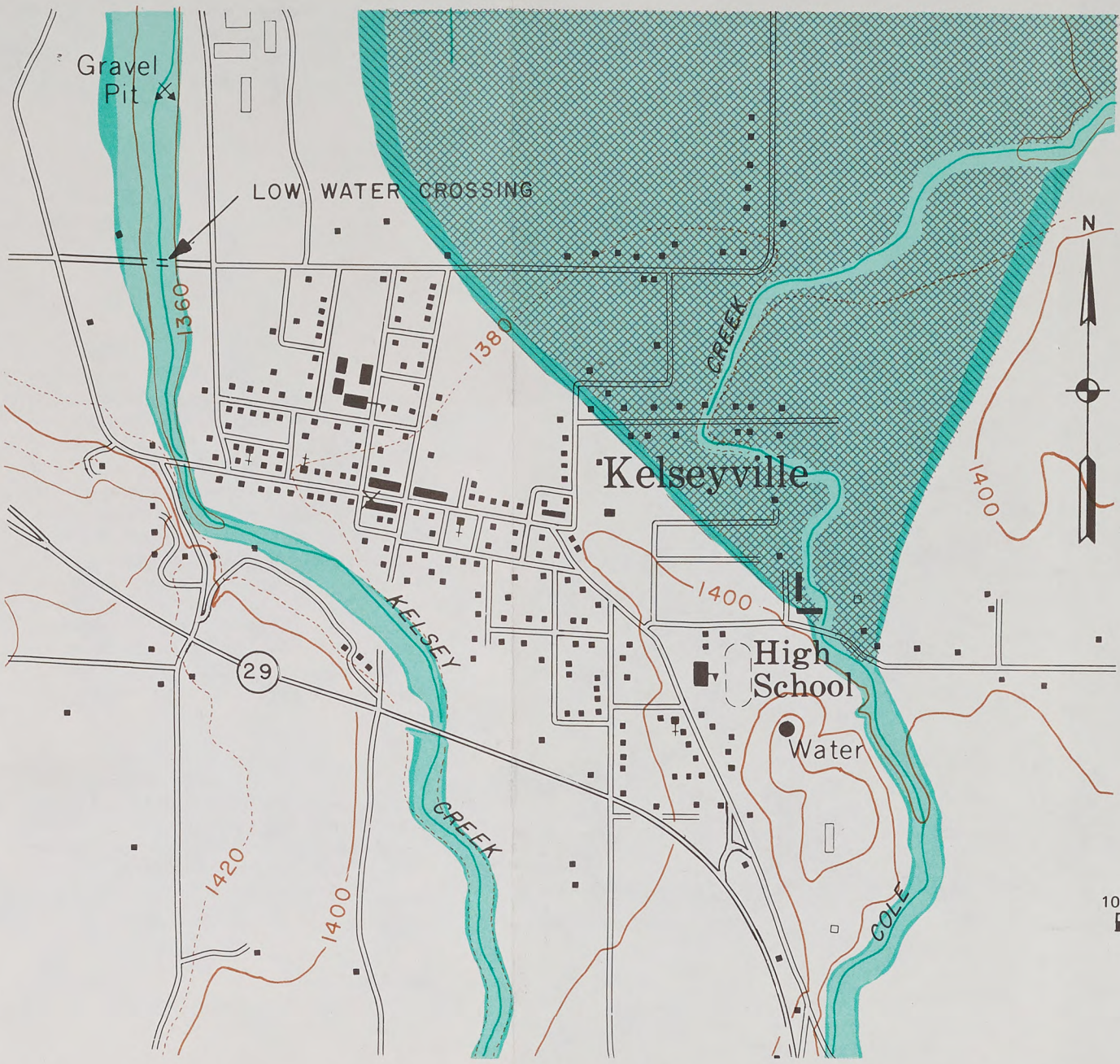


Future flood heights on Kelsey Creek at State Highway 29.



Orientation Folder

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FLOOD PATTERNS

BIG VALLEY STREAMS

KELSEYVILLE, CALIFORNIA

Overflow Limits

Stream Center Line — Intermediate Regional Flood — Standard Project Flood

Area Subject to Sheet Flow

Standard Project Flood Only

Standard Project and Intermediate Regional Floods

(Limits of Flooding are Approximate)

Approximate Scale in Feet

1000 0 1000 2000

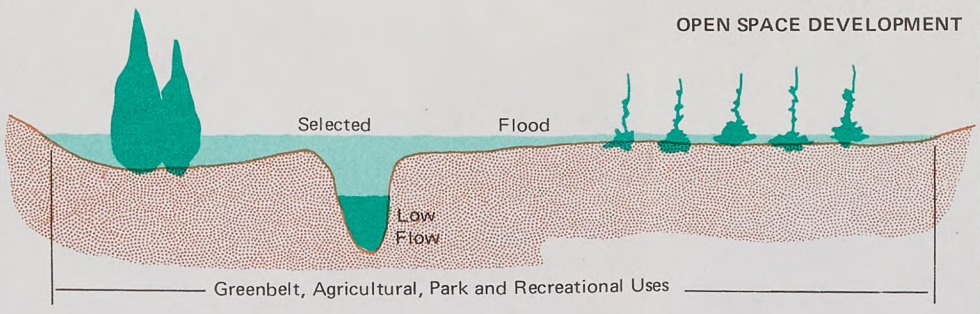
CONTOUR INTERVAL 20'

Maps and other illustrations for the entire study area (lower portion of Big Valley from about the foothill line to Clear Lake) are contained in the FPI Report.

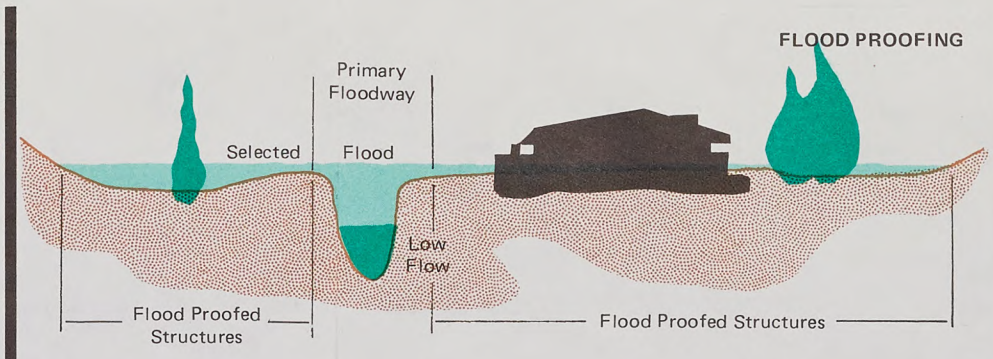
FLOOD PLAIN MANAGEMENT MEASURES USABLE FOR THE REDUCTION OF FLOOD DAMAGE

PREVENTIVE MEASURES

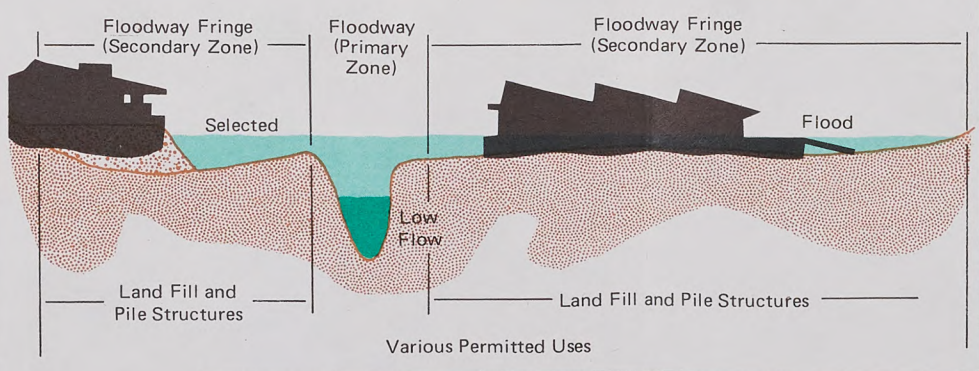
OPEN SPACE DEVELOPMENT



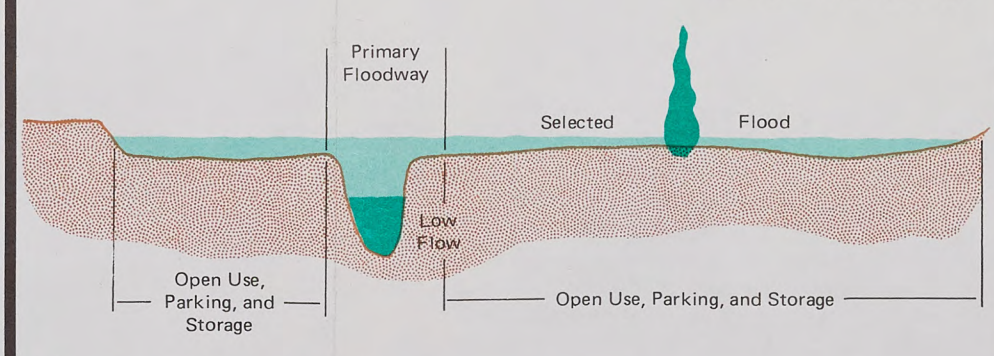
FLOOD PROOFING



ZONING ORDINANCES

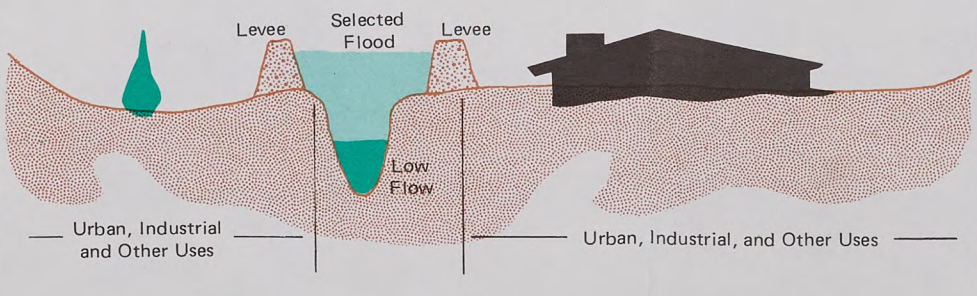


DEVELOPMENT POLICIES

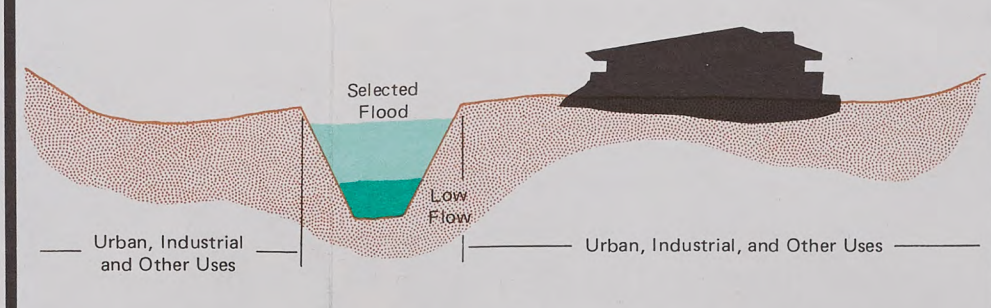


CORRECTIVE MEASURES

LEVEES OR FLOOD WALLS



CHANNEL IMPROVEMENTS



Preventive measures reduce vulnerability to flood damage and provide for greater flexibility in land use management, often at minor cost and with little adverse effect on the environment. Other preventive measures include subdivision regulations, building codes, health regulations, tax adjustments, warning signs, and flood insurance. Corrective measures are often required to alleviate existing flood problems and forestall future problems. Other corrective measures include dams and reservoir, watershed treatment, flood plain evacuation, flood forecasting, and urban redevelopment. Preventive and corrective measures may be used by themselves or in varying combinations to meet the specific needs of a particular flood prone area. Public support is necessary to obtain needed flood damage reduction through flood plain management measures.

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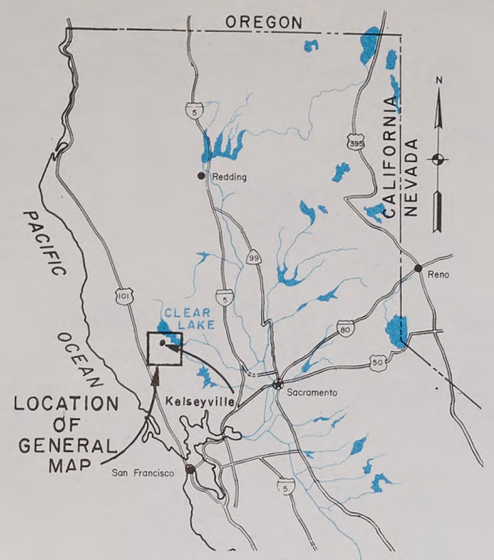
PLATE		
1	General Map	Opposite page *i*
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Cover Photographs: Flood scenes in Big Valley, January and March 1963 and January 1965. The top photograph shows Adobe Creek overflow at Soda Bay Road, January 1963; the center photograph shows high stage along the shore of Clear Lake in March 1963; and the bottom photograph shows flooding along Finley Road, January 1965.

(Photographs courtesy of the West Lake Soil Conservation District, U. S. Soil Conservation Service.)

+ N O T E +

Unless otherwise indicated, all photographs in this report were taken by Corps of Engineers personnel.



VICINITY MAP

SCALE IN MILES

50 0 50 100 150

LEGEND

- Drainage Basin Boundary
- (29) State Highway
- ▲2 Stream Gage (see table 3 for identification)
- ●3 Precipitation Gage (see table 4 for identification)
- Study Area

SCALE IN MILES

1 0 1 2 3 4

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

GENERAL MAP
JUNE 1974

PLATE 1

CLEAR LAKE
LAKEPORT
Rumsey Gage
LAKE CLEAR LAKE STATE PARK
Scotts Creek
Manning Cr.
Slough
SODA BAY RD.
FINLEY
FINLEY RD.
BIG VALLEY RD.
BIG
TRENFRO CROSSING DRIVE
CLARK RD.
KELSEYVILLE
SYLAR LANE
MAIN STREET
KONOCTI RD.
KONOCTI MOUNTAIN
WILKINSON RD.
VALLEY
Gross Cutoff
Highland Creek Dam
Adobe Creek Dam
Thompson Cr.
Adobe Cr.
McGaugh Hill
Bell
HIGHLAND SPRINGS RD.
HOPLAND GRADE
GEORGE RD.
ARGONAUT ROAD
Manning Cr.
Highland Cr.
Kelsey Cr.
McIntire Cr.
Cole Cr.
Sweetwater Cr.
Kelsey Cr.
Bottle Rock Cr.
ADOBE CREEK DR.
WIGHT WAY
KELSEY CREEK DR.
BOTTLE ROCK RD.
ROCK RD.
RED HILL RD.
LOWER SODA BAY RD.
POINT LAKEVIEW RD.
LAKE 29
CLEARLAKE OAKS
CLEARLAKE HIGHLANDS
Cache Creek
Clear Lake Dam
1 Mile
MENDOCINO COUNTY
SONOMA COUNTY
LAKE COUNTY
MAYACAMAS RANGE
PUTAH CREEK BASIN
COBB MOUNTAIN
WHISPERING PINES
▲1
▲2
▲3
●1
●2
●3
●4

PREFACE

The portions of Kelseyville and adjoining areas in Lake County covered by this report are subject to flooding by Manning, Adobe, Kelsey, and Cole Creeks, which are tributaries to Clear Lake. Floodflows from these streams aggravate flood conditions along the lakeshore, which is also subject to flooding from high lake stages resulting from flood runoff of other tributaries. In general, the study area for the report extends along the streams involved from about the foothill line downstream to the lakeshore. For convenience of reference, the watercourses under study have been designated as the "Big Valley Streams." Properties along these streams are primarily agricultural, and have been moderately damaged by floods in the past, especially in 1955, 1958, and 1964-65. Floods larger than those of the past could occur in the future. Accordingly, flooding and flood damages can still be expected.

This report was prepared because knowledge of potential flooding is important in the land-use planning of flood plains. It contain information on past floods, and maps, profiles, and cross sections that indicate the approximate extent and depth of inundation from large floods than can reasonably be expected to occur in the future. For purposes of this report, these floods have been designated as the Intermediate Regional and Standard Project Floods. The report provides Lake County a basis for study and planning for optimum use and development of flood prone areas through zoning and subdivision regulations, construction of flood control projects, or by a combination of these and other approaches to reducing flood hazards and flood damage. Information contained in the report would also be useful in programs dealing with the ecological and environmental aspects of the study area and its land-use role as part of its surroundings. Recommendations or plans for solution of continuing flood problems in the study area are not included in this report. Neither does it extend any Federal authority over zoning or other regulation of flood plain use.

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This report was prepared at the request of the Lake County Board of Supervisors, with the indorsement of the California Department of Water Resources, under the continuing authority provided the Corps of Engineers in Section 206 of the 1960 Flood Control Act (Public Law 86-645), as amended.

The Sacramento District gratefully acknowledges the assistance and cooperation of Lake County, the California Division of Highways, the West Lake Soil Conservation District (U. S. Soil Conservation Service), and others who aided directly or indirectly in the preparation of this report.

The Lake County Flood Control and Water Conservation District will make the information in this report available to all interested agencies and individuals. Copies of the report and information on its use are available from that agency. The Sacramento District of the Corps of Engineers will, upon request, provide technical assistance to local, State, and Federal agencies in the interpretation and use of data presented herein, and will provide other available data.

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BACKGROUND INFORMATION

SETTLEMENT

From the beginning of permanent occupation of Big Valley during the late 1830's to the present time, its economic base has been agriculture. The earliest occupants, Salvador Vallejo and his brother Juan, herded longhorn cattle for production of hides and tallow. They received a Mexican grant that included Big Valley in 1844, but left the valley and sold most of their cattle to four American settlers in 1847. By the middle 1850's, settlers had occupied the entire valley floor, mostly in large holdings, and dry-farmed wheat had become the most extensive agricultural activity. Dairying also began to assume importance at this time, and barley, oats, and corn were grown to support this industry. Milk was processed into cheese that was sent in large quantities to the mining districts along the Mother Lode. Favorable soils and climate led to cultivation of a variety of fruit prior to 1870, and prunes were extensively planted during the 1880's. Following introduction of the Bartlett pear in 1885, fruit growing rapidly became the dominant economic activity of the region.

The town site of Kelseyville--named for an early settler killed by Indians in 1849--was originally used as a headquarters by the Vallejo brothers. A log house and corral were built in this area, and 10 *vaqueros* and a foreman were stationed there to look after the livestock operations. With the arrival of numbers of American settlers, a general store and a blacksmith-wagon making shop were built in 1857, and two stores and a boarding house were built in 1864. From its beginning, the town has served the commercial needs of surrounding farms and ranches and is now the urban center of a highly productive fruit and nut producing region. The first structure in Finley was a post office established in the late 1880's as a convenience to farmers and ranchers located about equidistant

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from Kelseyville and Lakeport. A general store was established soon after the post office, and a village ultimately developed in the locality.

Clear Lake offers exceptional opportunities for water-oriented recreational activities and, for many years, has attracted very large numbers of vacationists and recreationists. Emphasis on tourism is increasing and summer residences are being built in the Big Valley area. Subdivision type development is taking place, but significant conversion of agricultural lands to urban-suburban uses or lowering of the present level of agricultural activity are not expected.

THE STREAMS AND THEIR VALLEYS

The study area for this report is a locality in west-central Lake County known as Big Valley. It consists of the flood plains and immediately adjacent areas along Manning, Adobe, Kelsey, and Cole Creeks, which are direct tributaries to Clear Lake. The streams under study, all of which are intermittent, are joined by a number of tributaries in the study reaches. (See Plate 1.) In general, the study area extends from the foothill line downstream to the lake. Pertinent data on the streams involved are shown in Table 1.

TABLE 1

THE STREAMS UNDER STUDY

Stream Name	Limits of Study From:	Upstream to:	Approximate Length in Study Reach miles	Approximate Drainage Area[(a)] Sq. mi. At upper limit of study area:	At lower limit of study area:
Manning Creek	Mouth	George Road	3	6	14
Adobe Creek	Mouth	Bell Hill Road	6	25	27
Kelsey Creek	Mouth	Gross Cutoff	6	42	45
Cole Creek	Mouth	Wilkinson Road	5	19	28

(a) Eleven square miles of local contributing area draining directly into Clear Lake are not included in the areas shown.

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Geographically, the study area is part of the Cache Creek Basin, which is divided into upper and lower drainage areas comprising Clear Lake and tributaries, and Cache Creek and tributaries, respectively. Cache Creek flows from the east end of Clear Lake and is a tributary to the Sacramento River. Big Valley is an alluvial plain built largely by Kelsey and Adobe Creeks, which are the two largest tributary streams entering Clear Lake from the south and significantly contribute to increasing the lake stage during flood periods.

With the exception of a small area in Mendocino County, the drainage basins of the streams under study lie entirely in Lake County. The tributary areas are bounded by the eastern slopes of the Mayacamas Range on the west and south, the drainage divide of the Putah Creek Basin on southeast, and the western slope of Mount Konocti on the northeast. Clear Lake, on the north, is the largest natural freshwater lake lying entirely in California.

Elevation in the tributary drainage area varies from about 4,720 feet at Cobb Mountain in the headwater regions of Kelsey Creek to about 1,320 feet along the Clear Lake rim. Vegetation consists of stands of pine and oak in the higher elevations, and brush, scattered stands of pine and oak, and ground cover of hardy native grasses in the foothill areas. On the valley floor, the original vegetation--mostly stands of large valley oak and ground cover of native grasses--has been drastically modified by agricultural operations that involved clearing of almost all of the native trees.

Climate in the Big Valley region is classified as temperate semi-arid and is characterized by dry, rainless summers with high daytime temperature and warm nights, and by wet winters with moderate temperatures. Average annual precipitation ranges from about 25 inches at Clear Lake to about 60 inches on the highest slopes of Cobb Mountain. More than half of the annual precipitation occurs from December through February. Average monthly temperatures vary from the low 40's in January to the low 70's in July, but extremes of 12 degrees in winter and 114 degrees in

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summer have been recorded. Precipitation occurs almost entirely as rain. Light snowfall may occur in Big Valley, but it usually melts as it falls or lasts for only a few days. No significant snowpack accumulates in the high elevations of the tributary area. Killing frosts may occur from November through April and orchardists have made provisions for orchard heating.

The total fall of the Big Valley Streams in the study area is about 100 feet. Stream gradients range from about 20 feet per mile at the foothill line to about 10 feet per mile in the lower reaches, and the shallow gradient characteristic of the lakeshore extends into the lake. In general, stream channels are well defined and range from small and brush choked to large and brush free. However, floods produce high peak flows and large volumes of water that exceed channel capacities and spread overland.

DEVELOPMENTS IN THE STUDY AREA

Lands in the study area are very productive and are used primarily for pear and walnut orchards. Some areas are devoted to vineyards and stock raising, but these activities are less significant than pear and walnut production. In general, irrigated pasture and vineyards are located in the upper portion of the study area, but vineyards are also scattered in the lower portion and some walnut orchards are now being converted to vineyard use. Improvements in rural areas primarily comprise those associated with orcharding and include facilities for irrigation from wells. Numerous wind machines to combat killing frosts have been installed in orchards. Industrial activities associated with agriculture comprise large cooperatively and privately owned fruit packing and walnut drying-shipping plants. Other light industrial and commercial developments include an orchard chemical distributor, a petroleum products distributor, sand and gravel plants, and an asphaltic paving mix plant. Other improvements in the study area include an electrical utility substation, an airport, and lakeshore parks maintained by Lake County and the State of California.

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Kelseyville, a portion of which is in the flood plain of Kelsey Creek, is the only urban center in Big Valley. Single family rural residences, mostly associated with farms and ranches, are scattered throughout the study area. A small cluster of residences and a large fruit packing and walnut drying plant comprise the village of Finley. A previously undeveloped area northerly of Kelseyville has recently been subdivided, but few homes have been built. Subdivision type development is taking place along the lakeshore and is expected to continue because of the recreational potential of Clear Lake and its increasing popularity for the location of summer homes and the permanent dwellings of retirees. The present population of the study area is estimated at 2,000 (1,300 in Kelseyville), and is expected to increase to about 4,200 by the year 2000.(a)

The study area is served by one major highway (State Highway 29) and a network of county roads that afford access to points in the study area and surrounding localities. At present, about 95 percent of the land in the study area is devoted to agricultural use or is undeveloped; about 3 percent is public land; and 2 percent is devoted to residential, commercial, and light industrial uses. In general, land use patterns are not expected to change radically during the next 20-25 years. Additional single family residences will undoubtedly be built and it is expected that some additional land will be devoted to mobile home parks or subdivisions. Kelseyville is expected to expand into adjoining areas, and some commercial development may occur along highway 29. By the year 2000, however, it is estimated that the amount of public land will remain unchanged; land devoted to residential, commercial, and light industrial uses will increase to 4 percent; and the amount of land devoted to agricultural uses or is vacant will decrease to about 93 percent of the total.

(a) Population projections based on California Department of Finance projections for Lake County.

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FLOOD SITUATION

SOURCES OF DATA AND RECORDS

Information relative to past floods was developed from available streamflow records; and from research of newspaper files, review of various published and unpublished reports, and from interviews with local residents. Basic hydrologic data were derived from the records of the gaging stations shown in Table 2.

TABLE 2

STREAM GAGING STATIONS[a]

Station Number[b]	Station Name	Period of Record	Maximum Recorded Peak Flow	
			c.f.s.	date
1	Highland Creek above Highland Creek Dam[c]	Oct 1962 - Present	3,080	Dec 22, 1964
2	Adobe Creek near Kelseyville	Oct 1954 - Present	1,500 1,500	Dec 22, 1964 Jan 23, 1970
3	Kelsey Creek near Kelseyville	Oct 1946 - Present	8,800	Dec 21, 1955

(a) Stream gage data were extracted from U. S. Geological Survey publications.
(b) As shown on Plate 1.
(c) Highland Creek is a tributary to Adobe Creek.

Since streamflow records are not available for two of the streams under study, and the existing stream gages have very short periods of record, basic hydrologic data were developed in part from streamflow data from nearby drainage basins having hydrologic, meteorologic, and physiographic characteristics similar to those of the Big Valley Streams. Stage records for Clear Lake have been maintained since 1874.

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There is only one precipitation station in the drainage area directly tributary to the study reaches. Records from this station and from three selected stations in areas nearby were used in the basic hydrology studies for this report. Information on the stations used and the precipitation recorded during large recent floods are shown in Table 3. Hydrologists made a detailed inspection of the region to define hydrologic characteristics.

TABLE 3

PRECIPITATION STATIONS

Station Number[a]	Station Name	Normal Annual Precipitation inches	Recorded Precipitation inches Dec 19-14 1964	Jan 2-6 1965	Jan 19-24 1970	Jan 12-19 1974
1	Mahnke	47.7	18.09	11.42	10.95	*(b)*
2	The Geysers	54.0	18.36	12.33	13.76	*(b)*
3	Hopland 8 NE	39.7	17.07	6.35	*(c)*	*(b)*
4	Clear Lake Highlands	23.6	4.18	5.08	3.10	3.48

(a) As shown on Plate 1.
(b) Data not available at the time this report was printed.
(c) Station not in operation at time of storm.

The topographic maps prepared for this report to show areas that would be flooded by the Intermediate Regional and Standard Project Floods (Plates 6-11) were based on the U.S. Geological Survey 7.5 minute quadrangle sheets entitled "Highland Springs" (1959), "Kelseyville" (1959), "Lakeport" (1958), and "Lucerne" (1958). Stream profiles and cross sections were developed from these quadrangles and from supplemental topographic data furnished by Lake County, The California Division of Highways, and the U. S. Soil Conservation Service. In total, data for about 400 cross sections were developed for use in preparing the report. Structural dimensions of bridges and culverts were furnished by the California Division of Highways (Bridge Department), or obtained by field investigation during the preparation of this report.

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FLOOD SEASON AND FLOOD CHARACTERISTICS

General rainfloods can occur in the study area anytime during the period from October through May. This type of flood results from prolonged heavy rainfall over the tributary areas and is characterized by high peak flows of moderate duration of three to four days. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions, or when the ground is frozen and infiltration is minimal. Floodflows from the Big Valley Streams contribute to flooding along the lakeshore as well as in riparian areas. It should be noted that shoreline flooding in the study area can occur from high lake stages resulting from flood runoff of tributaries other than those under study, and that shoreline flooding may not necessarily coincide with flooding on the Big Valley Streams.

Cloudburst storms, sometimes lasting as long as three hours, can occur over the drainage basins tributary to the study area anytime from late spring to early fall. The intensity of these storms is quite high and they can produce precipitation resulting in flooding characterized by high peak flow, short duration of floodflow, and small volume of runoff. Due to the small areal extent of cloudburst storms, channel storage effects, and other factors, cloudburst flooding would be less severe than flooding from major flood-producing general rainstorms.

Because of the relatively low elevation of the tributary drainage areas, snow accumulation is rare and does not result in a snowpack that could cause snowmelt flooding in the study area. However, melting snow in the upper reaches of the watersheds could, on rare occasions, augment runoff from general rain.

FACTORS AFFECTING FLOODING AND ITS IMPACT

Obstructions to Floodflows.

Natural obstructions to floodflow include brush and other vegetation growing along the streambanks in floodway areas. During floods, brush growing in floodways impedes floodflows and results in backwater and

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increased flood heights. Brush washed out during floods and carried downstream could collect on bridges or plug culverts, thus creating a damming effect and overbank flow. As floodflow increases, masses of debris may break loose and a wall of water and debris may surge downstream until another obstruction is encountered. In general, obstructions restrict floodflows and cause overbank flows, unpredictable areas of flooding, possible destruction of or damage to bridges and culverts, and increased velocities of flow immediately downstream.

In the study area, there are 33 structures across the various streams. Their number and locations are indicated in the following table.

TABLE 4

STRUCTURES ACROSS THE BIG VALLEY STREAMS

Structure	Manning Creek	Adobe Creek	Kelsey Creek	Cole Creek	Total	Total Obstructive
Bridges	5	7	3	7	22	20
Culverts	1	1	0	0	2	2
Low Water Crossings	0	1	4	0	5	0
Footbridges	0	0	0	1	1	0
Pipeline Crossings	0	0	2	0	2	1
Dams	0	0	1[(a)]	0	1	1
Total	6	9	10	8	33	24

(a) Dumped rock and boulder structure placed to protect the Main Street Bridge footings from erosion. See Figure 5, page 13.

As shown in the table, 24 stream crossings and structures are considered to be obstructive to floodflows. Representative obstructions are shown in Figures 1-7. Pertinent data on all obstructions to floodflow are contained in Table 8, page 33.

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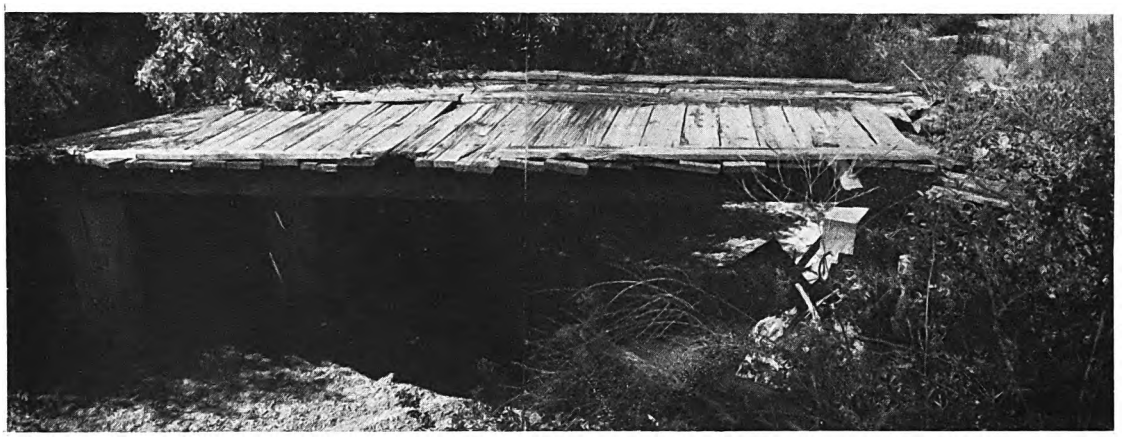


Figure 1 - Abandoned private bridge over Manning Creek between Soda Bay Road and Clear Lake.



Figure 2 - Bridge on George Road at Manning Creek.

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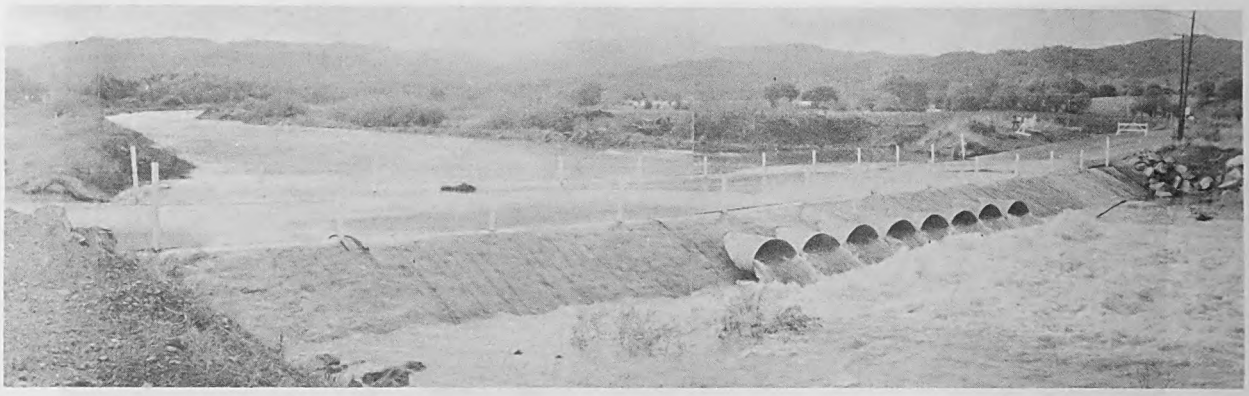


Figure 3 - Culverts on Adobe Creek at Bell Hill Road.



Figure 4 - Pipelines crossing Kelsey Creek just upstream of Soda Bay Road.

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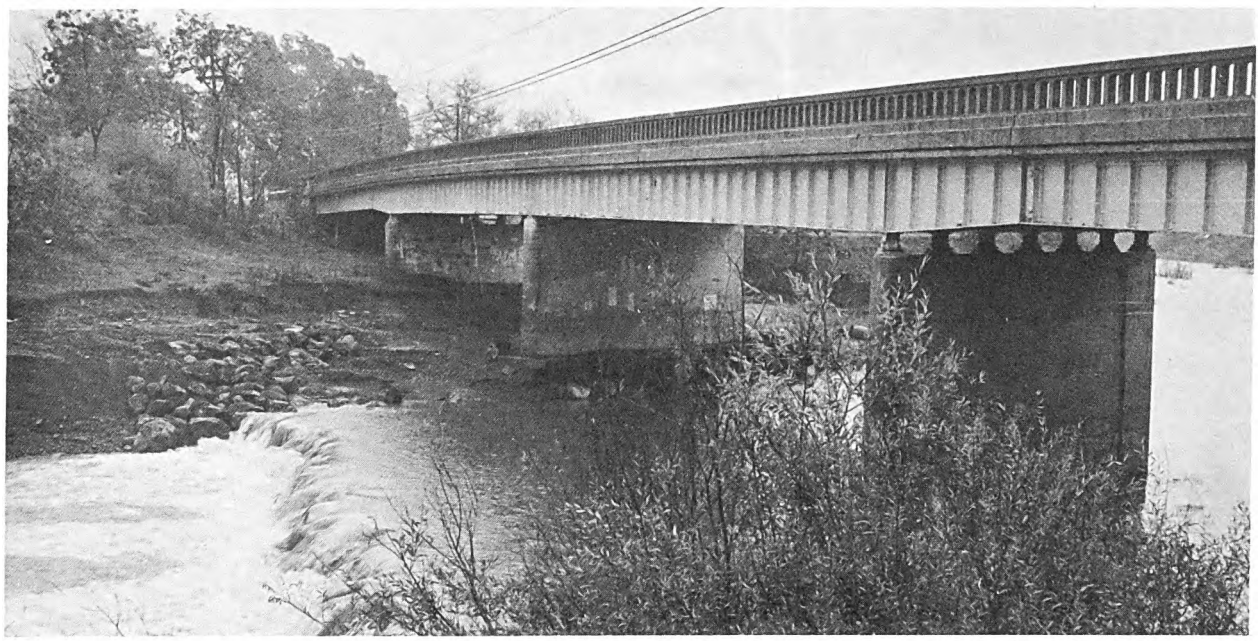


Figure 5 - Bridge and rock dam on Kelsey Creek at Main Street in Kelseyville.

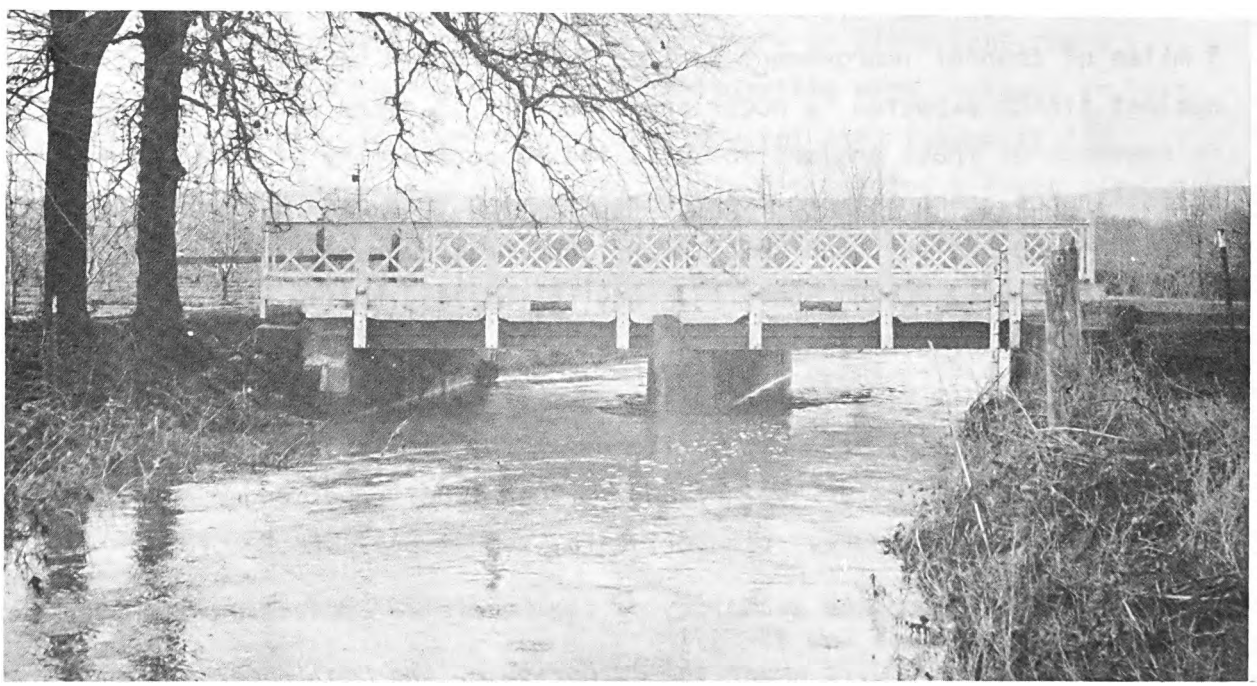


Figure 6 - Bridge on Clark Drive at Cole Creek.

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Figure 7 - Bridge over Cole Creek at Wilkinson Road.

Flood Damage Reduction Measures.

Small flood-control reservoirs on Adobe and Highland Creeks, and about 5 miles of channel improvement work on Adobe Creek,[(a)] provide protection against floods expected to occur about once in 10 years on the average. Maintenance of these project works is the responsibility of Lake County. Discontinuous channel improvement work has also been done by local interests along Manning, Kelsey, and Cole Creeks, but provide capacity to carry only minor floodflows. Lake County is studying the feasibility of a storage project[(b)] on Kelsey Creek about 4 miles upstream from Kelseyville. Its primary purpose is water conservation, but it will provide some incidental flood protection. At present, no flood control facilities affecting streamflow in the study area are authorized for construction or under consideration by the Corps of Engineers. Lakeport Lake, a multiple purpose project

(a) Undertaken under the authority of the Watershed Protection and Flood Prevention Act (Public Law 83-566).
(b) Expected to be built under the authority of the Small Reclamation Projects Act of 1956 (Public Law 84-984).

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authorized for construction on Scotts Creek by the Corps of Engineers, will lessen the impact of some but not all floods along the shoreline of Clear Lake. If funds are made available by the Congress, the project should be completed by mid 1978. Clear Lake Dam (which was built across the channel of Cache Creek in 1915 for regulation of irrigation water) and certain court orders[a] issued to stabilize the level of Clear Lake have improved historical flood conditions, but do not prevent damaging stages even during moderate floods.

Extraction of sand and gravel from the channel of Kelsey Creek has increased carrying capacity of the stream in the vicinity of Kelseyville.

A Corps of Engineers study of flood and related water resources problems affecting the upper and lower drainage basins is presently in progress and scheduled for completion in the late fall of 1976. Among other things, the study will include consideration of modifying the existing outlet channel of Clear Lake, which would improve the lakeshore flooding situation and benefit water conservation and recreation.

A rate study for flood insurance for some of the unincorporated area of Lake County has been completed. The periphery of Clear Lake and a portion of Cole Creek in the vicinity of Kelseyville were included in this study. However, official zoning maps have not yet been issued by the Federal Insurance Administration. Lake County has adopted a flood plain zoning ordinance that provides for primary and secondary flood plain zones along watercourses and describes limitations on land uses. The basic intent of the ordinance is to guide development of flood plain lands toward optimum uses commensurate with the flood hazard. Preparation of zone maps and further consideration of implementing the ordinance on the Big Valley Streams is awaiting availability of this report.

Other Factors and Their Impacts.

Flood warning and forecasting. - The National Oceanic and Atmospheric Administration (NOAA), through its National Weather Service (NWS), maintains

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(a) Refer to the paragraph entitled "Orders of the Superior Court," page 18.

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year-round surveillance of weather conditions. NOAA storm forecasts pertinent to the study area are furnished to the NWS office in Sacramento for distribution to agencies responsible for flood protection and, by way of the local news media, to the general public.

Personnel from the NWS office in Sacramento and the California Department of Water Resources are assigned to the Joint Federal-State River Forecast Center, which monitors weather conditions and river stages on a year-round basis. When floods are imminent, the Federal-State Flood Operations Center is activated. It operates on a 24-hour basis in conjunction with the River Forecast Center, and, among other flood emergency activities, advises all interested parties of flood situations as they develop. The Flood Operations Center furnishes flood information and flood warnings to the local news media, law enforcement agencies, and other agencies for their use and dissemination to the public.

Although specific flood forecasts are not prepared for streams in the study area, applicable daily weather forecasts are issued by the NWS office in Sacramento. When weather conditions so warrant, storm and probable flood warnings are issued by that office. The local news media and law enforcement agencies disseminate these warnings to the public.

Thunderstorm activity leading to possible cloudburst situations in a general region can be forecast with a moderate degree of dependability. However, accurate prediction of flood-producing cloudbursts over specific small drainage areas is not possible.

Flood fighting and emergency evacuation plans. - There are no specific formalized plans for flood fighting or emergency evacuation of people and personal property from Kelseyville or other parts of the study area. However, Lake County has a standing emergency plan that covers floods as one of several possible emergency situations. The plan establishes an emergency services organization which directs a variety of actions for pre-emergency, actual emergency, and post emergency operations. The California Department of Water Resources, through the Flood Operations Center, coordinates flood fighting activities throughout the State and is authorized to receive

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requests from local agencies for assistance during floods. The Corps of Engineers responds to requests for flood fighting and rescue work from the Office of Emergency Services (OES) when the emergency is beyond the capabilities of local and State governmental agencies.

Pursuant to the provisions of Section 8589.5, Government Code of California, emergency procedures must be established for the evacuation and control of areas of potential flooding in the event of sudden failure of dams. Portions of Big Valley would be subject to inundation if Adobe Creek and Highland Creek Dams should suddenly fail. Therefore, under the law, the Lake County Flood Control and Water Conservation District must prepare maps showing areas that would be inundated and submit them to the OES. On the basis of the maps, the OES in cooperation with the California Department of Water Resources will designate evacuation areas. The local jurisdiction must then adopt emergency evacuation procedures that include, among other things, specific routes to be used for evacuation; traffic control measures; movement of people without their own transportation; shelter of evacuees; evacuation and care of people from institutions; and perimeter security, interior security, and reoccupation of evacuation areas. The inundation maps were completed in December 1973, and it is expected that development of evacuation procedures will be completed before the end of 1975.

Storage of floatable materials in flood plain areas. - Flood hazards are intensified by floatable materials collecting against bridges or plugging culverts and obstructing the passage of floodflows. The commercial and residential uses of flood plains in the study area do not result in the accumulation of significant amounts of floatable materials. Floatable materials resulting from agricultural operations are primarily prunings from orchards, which are left on the ground or along streambanks and are subject to being picked up and carried away by floodwaters to jam on bridges or plug other restricted channel sections, thus adding to the potential flood hazard

Wind set. - Wind set is a wind caused movement of surface water away from the windward shore of an open body of water. It causes the water

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surface to tilt so that it is below the still-water level along the shoreline from which the wind blows, and above the still-water level along the shoreline toward which the wind blows. Along the lakeshore of the study area, northerly winds during a flood period would increase the depth and extent of flooding inland, and southerly winds would have the opposite effect.

Orders of the Superior Court. - Clear Lake Dam is capable of impounding water in the lake to an elevation of 10.3 feet on the Rumsey Gage,[a] or about 1,329 feet, mean sea level datum. Orders of the Superior Court[b] perpetually enjoin increasing the outlet capacity of Clear Lake or raising the lake level above 7.56 feet on the Rumsey Gage[c] except during storms and floods, for longer than 10 days, and in no event over 9 feet on the gage. It is not physically possible to operate within these limits because outflow is impaired by the Grigsby Riffle, a natural restriction in the outlet channel upstream from the dam. In essence, the effect of the court orders is to prolong flood stages and prevent their rapid reduction.

(a) Located on the city wharf in Lakeport.
(b) The Gopcevic Decree (Mendocino County), October 1920, and the Bemmerly Judgment (No. 8812, Yolo County), December 18, 1940.
(c) The lower limit of shoreline flooding with unfavorable wind set conditions.

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PAST FLOODS

SUMMARY OF HISTORICAL FLOODS

The Big Valley Streams are known to have a long history of flooding, but little definitive data are available for specific floods. Records and other information indicate that flooding occurred in the study area in 1861-62, 1881, 1889-90, and 1895, and that nineteen flood events[(a)] occurred during the 72-year period beginning in 1902. The shoreline of Clear Lake has been subject to flooding throughout its history, and records show that a stage of 7.56 feet on the Rumsey Gage has been exceeded 47 times, and a stage of 9.0 feet has been exceeded 23 times since 1874.



Figure 8 - Adobe Creek flooding just upstream from the Finley Road Bridge, January 1963. (Soil Conservation Service Photo.)

(a) 1902, 06, 07, 09, 11, 13-14, 15, 37, 38, 40, 50, 54, 55, 58, 62, 63, 64-65, 70, and 74.

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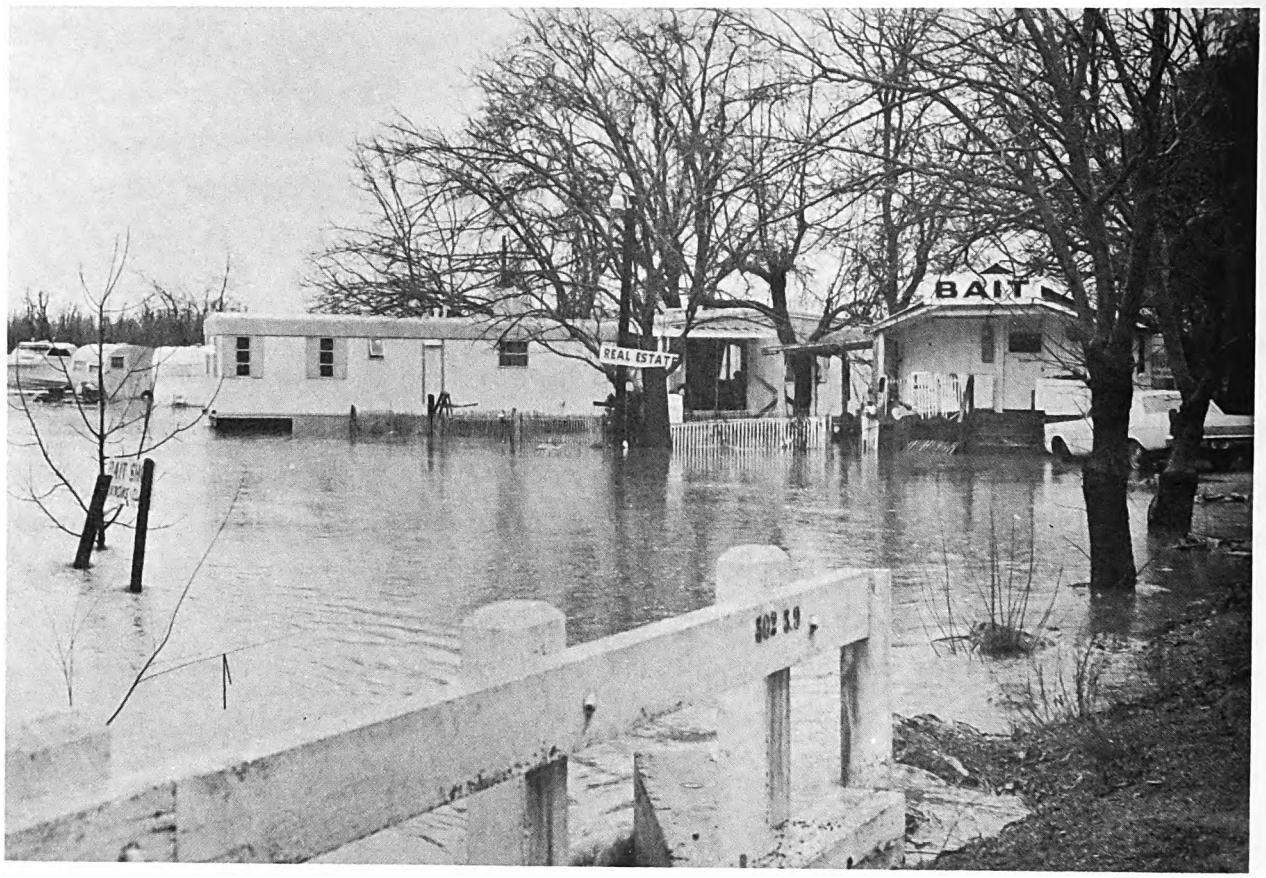


Figure 9 - Cole Creek flooding at Soda Bay Road, January 1974.

FLOOD RECORDS

Information on early historical floods that have occurred in the study area is very limited because neither streamflow records nor eye-witness accounts are available, and contemporary records are practically nonexistent. Definitive data on more recent floods are limited because the rural nature of the flood plains and the isolation of the area from major urban centers usually precluded detailed news media coverage of flood events. Streamflow records extend only from 1954 to the present on Adobe Creek and from 1946 to the present on Kelsey Creek. One hundred years of lake stage records have been made. Some descriptive data are contained in unpublished post flood reports prepared by the Corps of Engineers and in an unpublished Corps of Engineers' study of the Cache Creek Basin. Also, some information on floods in Big Valley has been collected by the Soil Conservation Service.

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Information on floods along Manning and Cole Creeks is essentially non-existent. The largest floodflow on Adobe Creek, 1,500 cubic feet per second, was recorded on both December 22, 1964 and January 23, 1970. A 1,400 cubic foot per second flow occurred on January 16, 1974. The greatest floodflow of record on Kelsey Creek was 8,800 cubic feet per second, which occurred on December 21, 1955. Peak flow on Kelsey Creek in January 1970 was 8,480 cubic feet per second, and an estimated peak flow of 8,500 cubic feet per second occurred in January 1974. The maximum known lake stage, 13.66 feet on the Rumsey Gage, occurred in January 1890. Some of the higher lake stages that have occurred since construction of Clear Lake Dam are as follows:

Date	Stage in Feet (Rumsey Gage)
February 1938	10.25
February 1956	9.53
February 1958	10.88
December 1965	9.10
January 1970	10.47
April 1974	9.12

FLOOD DESCRIPTIONS

With the exception of the knowledge that numerous floods occurred, little information is available on historical floods in the study area. In general, major floodflows on the Big Valley Streams inundate highly developed agricultural lands, urban and suburban property in Kelseyville and Finley village, and create high lake stages and resultant flooding along the lakeshore. Flooding may kill or damage orchards, vineyards, and pasture; destroy livestock; keep land out of production; damage various farm and ranch improvements; seriously erode farmland; overtop and wash out roads, bridges, and flood control improvements; and severely disrupt normal business and agricultural activities and surface transportation. High lake stages result in damage to lakeside dwellings, developed recreation areas, piers, and boats.

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Figure 10 - Adobe Creek floodflows at Bell Hill Road, January 1974.

Available information on the major floods of record follow:

December 1955.

In December 1955, serious and widespread flooding occurred in the Sacramento River Basin. Heavy rains totalling as much as 8-1/2 inches along the eastern slopes of the Coast Ranges during the period 21-23 December resulted in moderately severe flooding along the Big Valley Streams where more than 4,000 acres were inundated. About 500 acres of farmland were flooded along Manning Creek. Adobe Creek flooded about 2,600 acres of orchards and farmland. Sand and silt deposits 4-5 inches thick covered 400 acres and about 100 acres were seriously eroded. Some orchard land was lost through streambank erosion; transmission lines, road surfacing, low water crossing, and a bridge were damaged; and five homes in Finley were flooded. Peak flow on Adobe Creek was 1,250 cubic feet per second. The largest floodflow of record, 8,800 cubic feet per second, occurred on Kelsey Creek and around 1,000 acres of orchards and pastureland were flooded.

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Road surfacing was damaged by inundation, and roadway shoulders, a low water crossing, and a bridge abutment were damaged by erosion.

Most flooding in the area was shallow, but floodwater remained on the land for several days. Clear Lake was very low at the beginning of the flood period and there was no damage along the lakeshore.

January-February 1958.

From January 1 to February 16, 1958, about 25 inches of rain fell on the area tributary to Clear Lake. Peak flows on Kelsey and Adobe Creeks did not approach those of December 1955, but about 2,600 acres of farmland were inundated. Flood losses were minimal and consisted primarily of streambank erosion, deposition of silt and debris near the mouths of the creeks, and damage to roads. Clear Lake exceeded the decree level on February 4 and by February 27 had risen to 10.9 feet, the highest stage recorded since completion of Clear Lake Dam in 1915. In total, lake stage exceeded decree level for about 90 days during the first half of 1958, and the control gates at the dam were kept open during the entire period. Specific information on flood damage along the shoreline portion of Big Valley is not available, but it is known that lakeside homes were damaged, boats were destroyed, and the entire area rendered inactive for recreational uses for about 3 months.

December 1964 and January 1965

Precipitation that caused flooding along the Big Valley Streams in December 1964 and January 1965 occurred in two major storm sequences and totalled 29.5 inches. Peak flows of 1,500 and 7,640 cubic feet per second occurred on Adobe and Kelsey Creeks, respectively, on December 22. Snow fell along the drainage divides to the west and south, but did not augment floodflow. Clear Lake rose from a stage of 4.1 feet on December 22 to 9.1 feet on January 8.

In total, about 185 acres were flooded along Adobe and Kelsey Creeks and damage was estimated at about $140,000. Flood losses included damage to orchards, county roads, and bridges; erosion of farm land and levees;

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damage to farm equipment and fences; damage to a sand and gravel plant; and the costs of flood fighting and cleanup. No information on flooding along Manning and Cole Creeks is available. Damage along the shoreline of Clear Lake was negligible even though the decree level for temporary storage of floodwater was exceeded by 1.54 feet.

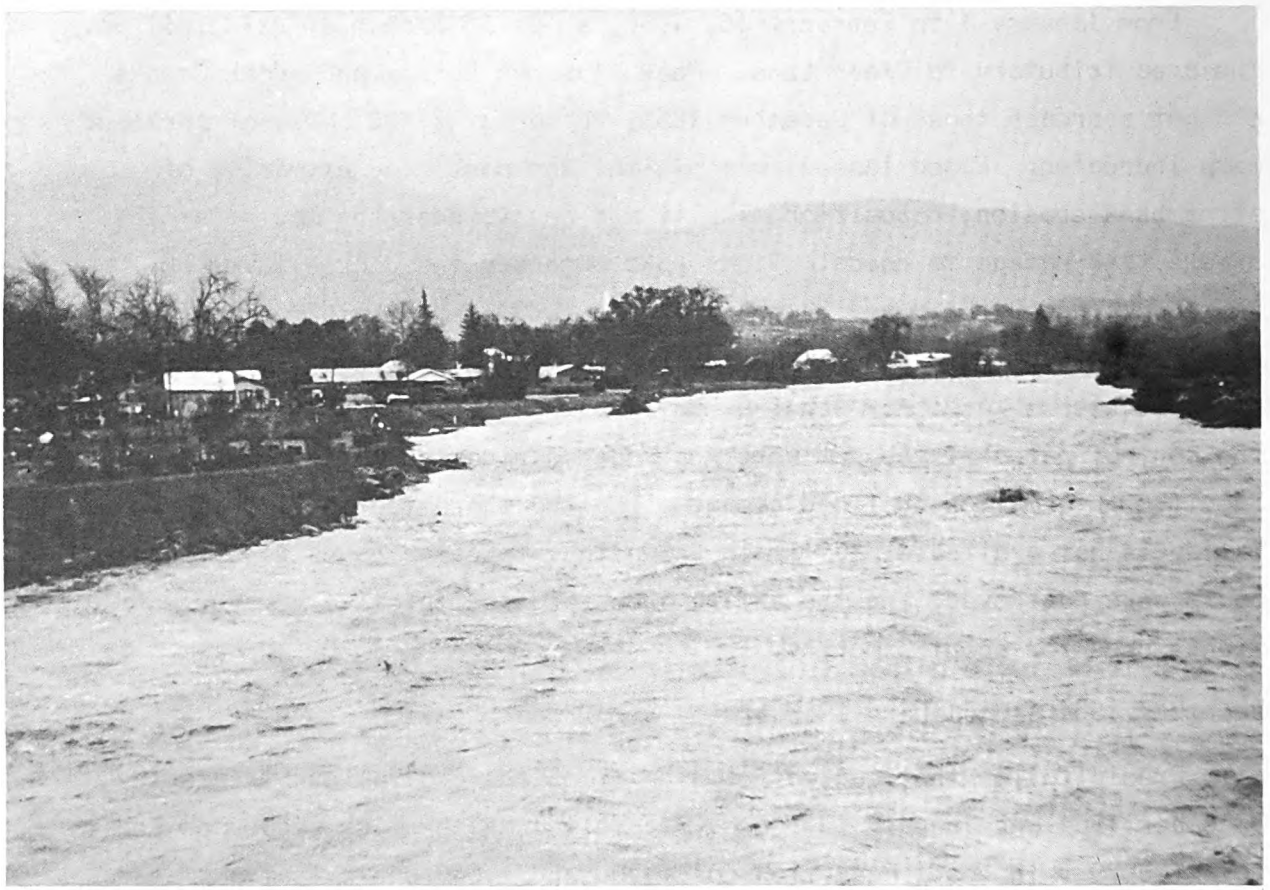


Figure 11 - Kelsey Creek floodflow just upstream from the Main Street Bridge in Kelseyville, January 1965. (Soil Conservation Service photo.)

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FUTURE FLOODS

Although flood-producing storms of the same magnitudes as those that have occurred in the past could recur in the future, discussion of future floods in this report is limited to those that have been designated as the Intermediate Regional and Standard Project Floods. The Standard Project Flood would be larger and would occur less frequently than the Intermediate Regional Flood. A Standard Project Flood would be a rare event, but one that could reasonably be expected to occur. The magnitude of these floods was based on hydrologic computations, which include analysis of available records of past floods, and consideration of pertinent meteorologic and physiographic conditions. Prolonged general rains create the more severe flood conditions in the study area.

During floods, debris collecting against obstructions would cause greater depth of inundation (backwater effect) upstream. Since the occurrence and amount of debris are indeterminate factors, only the physical characteristics of the obstructions were considered in deriving their backwater effect for the maps and other illustrations showing the Intermediate Regional and Standard Project Floods. These maps and illustrations also reflect consideration of vegetation normally existing in floodways.

INTERMEDIATE REGIONAL FLOOD

An Intermediate Regional Flood is one that could be expected to occur once in 100 years on the average, although it may occur, and has a 1 percent probability of occurring, in any given year. Peak flows for the Intermediate Regional Flood were derived from statistical analyses of available streamflow and precipitation records (supplemented by streamflow and precipitation data from adjacent basins having hydrological, meteorological, and runoff characteristics similar to those of the study area).

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Peak flows thus derived, taking into account basin runoff characteristics, ground saturation conditions, and losses from surface pondage and other factors are shown in Table 5. Synthesized stage hydrographs of the Intermediate Regional Flood at selected locations in the study area are shown on Plates 2-4.

STANDARD PROJECT FLOOD

A Standard Project Flood is one that can be expected from the most severe combinations of meteorological and hydrological conditions reasonably characteristic of the geographical region. Peak flows for the Standard Project Flood, which were developed in the same manner as described for the Intermediate Regional Flood, are also shown in Table 5.

TABLE 5

PEAK FLOWS FOR INTERMEDIATE REGIONAL AND STANDARD PROJECT FLOODS[a]

Stream and Location	Intermediate Regional Flood c.f.s.	Standard Project Flood c.f.s.
Manning Creek at George Road	1,300	1,400
Adobe Creek at State Highway 29	5,600	6,400
Kelsey Creek at Renfro Crossing	16,400	19,100
Cole Creek at Konocti Road	7,100	8,200

(a) Only streamway flow is shown.

FREQUENCY

Frequency analyses for the Big Valley Streams were based on records of rainflood flows, available precipitation records, and computed peak flows of floods up to the magnitude of the Standard Project Flood. The analyses, which reflect the judgment of hydrologists familiar with the region, show that the December 1955, December 1964, January 1965, and other selected floods had frequencies of occurrence as summarized in Table 6.

As previously indicated, an Intermediate Regional Flood has a frequency of occurrence of about once in 100 years on the average, and a Standard

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Project Flood would occur less frequently than an Intermediate Regional Flood. Although the Standard Project Flood would be a rare event, it can reasonably be expected to occur in the future. Floods larger than the Standard Project Flood are possible, but their occurrence would be extremely rare.

TABLE 6

FREQUENCY DATA[a]

Flood or Condition	Peak Flow or Lake Stage c.f.s.	Peak Flow or Lake Stage ft[b]	Frequency years
ADOBE CREEK			
December 1955	1,250		4
December 1964-January 1965	1,500		8
January 1970			
January 1974	1,400[c]		6
KELSEY CREEK			
December 1955	8,800		6
December 1964-January 1965	8,750		6
January 1970	8,480		5
January 1974	8,500[c]		5
CLEAR LAKE			
Permitted stage for temporary storage of floodwater:			
Lower Limit		7.56	2
Upper Limit		9.00	7
January-February 1958		10.88	40
December 1964-January 1965		9.10	7
January 1970		10.47	25
April 1974		9.12	7

(a) Frequency data are not given for Manning and Cole Creeks due to lack of flow data.
(b) Rumsey gage.
(c) Preliminary estimate.

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HAZARDS OF LARGE FLOODS

The amount and extent of damage, and the attendant hazard, from any flood depends on the depth and duration of flooding, velocity of flow, rate of rise, and developments in the flood plain. An occurrence of an Intermediate Regional or Standard Project Flood on streams in the study area, with existing flood control facilities and under present conditions of development, would result in extensive inundation of agricultural lands and rural residences. Finley and portions of Kelseyville would also be subject to flooding, and many miles of roads would be overtopped and rendered impassable for varying periods.

Floodwater flowing at high velocity and carrying floating debris would create conditions hazardous to persons attempting to cross flooded areas on foot or in vehicles. In general, floodwater 3 or more feet deep and flowing at a velocity of 3 or more feet per second could easily sweep a person off his feet, thus creating definite danger of injury or drowning. Rapidly rising and swiftly flowing floodwater may trap persons in homes that are ultimately isolated or in vehicles that could be stranded. Sewage, garbage, and other organic materials carried or deposited by floodwater could create health hazards, and isolation of areas by floodwater could create short-term medical, fire, and law enforcement emergencies. Wells can be inundated, thus creating the possibility of damage to pumping equipment and contaminated domestic water supply. Flooding also creates hazards to livestock and wildlife, and may result in ecological damage.

A special flood hazard in the Big Valley area comprises the presence of many hundreds of smudge pots used for orchard heating. When smudge pots are inundated or tipped over by floodwaters, the smudging oil floats out onto the surface of the floodwater. It will kill low growing vegetation such as irrigated pasture, lawns, and gardens; endanger fish and waterfowl if carried into Clear Lake, and materially increase costs of post flood cleanup.

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FLOODED AREAS AND FLOOD DAMAGES

The approximate limits of flooding that would result from a Standard Project Flood in Big Valley are shown on Plate 5, which is also an index to more detailed maps showing areas that would be inundated by the Intermediate Regional and Standard Project Floods (Plates 6-11).[a] As shown on those plates, the Intermediate Regional and Standard Project Floods would inundate extensive areas and there will be intermingling of floodwaters from various sources.[b] Flooding in the study area is the result of high lake stages and stream overflow. Flooding from the lake would extend inland more than 1/2 mile on the average from the normal shoreline, and would inundate several small subdivisions along the lake perimeter as well as the State and county parks. With the exception of some "islands" and areas of high ground near the foothills, most of the study area between Clear Lake and Highway 29 would be inundated by stream overflow. The community of Finley and portions of Kelseyville as well as rural residences and large agricultural areas could be inundated. In the upper portion of the study area, Adobe Creek floodwater would divide into bands extending north on both sides of the creek. The floodwater on the east would inundate areas along McGaugh Slough and pond on the upstream side of Highway 29. The band of floodwater on the west would join overflow from Manning Creek in a common flood area on the upstream side of the highway. As indicated on the maps, most flooding from stream overflow would be sheet flow in nature. The area that would be inundated by an Intermediate Regional Flood totals about 7,210 acres, of which 6,640 acres are open or agricultural lands, 460 acres are streamway, and 110 acres are urban and rural subdivisions.

Flood damage would be mainly agricultural in nature except in the more densely populated rural residential areas readily accessible from main roads.

(a) Flooding along small tributary streamways with drainage areas of less than 4 square miles is not shown on Plates 6-11 because it is considered to be a problem of local drainage and not a problem of stream overflow.
(b) It should be noted that all of the flooded areas shown on Plates 6-11 may not be inundated at the same point in time because high lake stages and flood producing storms over the various drainage basins would not necessarily occur concurrently.

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Agricultural losses would consist of land erosion and deposition of debris and mud in orchards and pastures; loss of productivity; possible loss of livestock; inundation of farm supplies and implements; increased weed problems; and damage to farm improvements such as irrigation systems, fences, and buildings. Roadbeds, bridges and abutments, streambanks, and communication and power distribution systems would also be damaged. Residential losses would include damage to foundations, floors, walls, furnishings, lawns, swimming pools, septic tanks, wells, cars, gardens, and costs of temporary housing. Commercial losses would include structural and equipment damage, temporary loss of business, replacement of inventory, and costs of cleanup and repair. Access to various areas could be delayed several hours.

Due to the wider sheet flow areas and greater depth of flooding during a Standard Project Flood, damage would be somewhat more extensive than during an Intermediate Regional Flood. Plates 12-17 show water surface profiles of the Intermediate Regional and Standard Project Floods. Depth of flow in channels can be estimated from these illustrations. Typical cross sections of flood plains at selected locations in the study area, together with the water surface elevation and lateral extent of the Intermediate Regional and Standard Project Floods are shown on Plates 18-21.

The impact of flooding is not limited to areas actually flooded. For examples, floodwaters may interrupt surface transportation and result in inconvenience to the traveling public. Interruption of utility services may affect areas other than those actually flooded and result in personal discomfort and inconvenience, or cessation of business and industrial activities--and attendant loss of business and worker income. Emergency situations could be very difficult to deal with due to flooded roads and lack of communications. Meeting the costs of emergency flood relief, flood fighting, other flood emergency activities, cleanup, and the repair and restoration of public facilities damaged or destroyed by floods has an impact that far transcends the flooded areas as County, State, and Federal tax revenues must be used for these activities, thus reducing revenues available

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for other services, especially at the local level. Communities such as Kelseyville and Finley could suffer loss of business activity when agricultural areas upon which these communities depend are flooded and crops are lost, damaged, or significantly reduced below normal levels. In the Big Valley area, oil from smudge pots carried by floodwaters into Clear Lake could contaminate lakeshore areas quite far removed from the areas actually flooded.

VELOCITIES OF FLOW

During an Intermediate Regional Flood, average velocity of flow in the main channels of the streams would be as shown in Table 7.

TABLE 7

AVERAGE VELOCITIES OF FLOW,
INTERMEDIATE REGIONAL FLOOD

Stream	Velocity feet per second
Manning Creek	4-7
Adobe Creek	6-8
Kelsey Creek	6-9
Cole Creek	3-9

In the range of values shown, the lower value is the average velocity in the lower reach of the particular stream and the higher value is the average velocity in the upper portion of the reach under study. Overland flow consists of sheet flow and ponding areas. In sheet flow areas, velocity of flow would range from 2 to 4 feet per second. Due to limited topographic data and (upon field inspection) the apparent flatness of terrain, not all of the high ground within the sheet flow areas is readily identifiable.

Water flow at a rate of 7 feet per second or greater will cause severe erosion of streambanks and is capable of transporting large rocks. Velocities in the range of 5 to 7 feet per second could erode fill around bridge abutments. Water flowing at about 2 feet per second or less will deposit

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debris and silt. It is expected that velocity of flow during a Standard Project Flood would be slightly higher than during an Intermediate Regional Flood.

OBSTRUCTIONS

As previously noted, 24 of the 33 structures in the study area are obstructive to floodflow. Pertinent data on obstructions are contained in Table 8. As may be seen from Plates 12-17, the effect of obstructions is to raise the water surface elevations upstream. Obstructive bridges are especially susceptible to structural damage from the forces of floodwater and floating debris.

RATES OF RISE AND DURATION OF FLOODING

Intense rainfall from general storms centered over the upper basins of the Big Valley Streams rapidly collects as runoff that reaches the study area soon after the beginning of storms. The stream channels in the study area are generally well defined and range from small to moderate in cross section area. Consequently, flows from flood-producing storms are contained in some stream reaches. However, there are streamways where channel capacity is exceeded and floodwater spreads overland. General rainstorms can last for several days. Therefore, the total volume of runoff is large and overbank flow can continue for many hours. Table 9, page 34, which was developed from synthesized stage hydrographs (including those shown on Plates 2-4), gives the maximum rate of rise, height of rise, time of rise, and duration above flood stage for the Intermediate Regional and Standard Project Floods at selected locations in the study area. Manning Creek is not included in the table because flooding is mostly overland flow that combines with Adobe Creek floodwater in a common flood plain, and a realistic hydrograph cannot be constructed. During floods, Clear Lake would rise very slowly, but high stages would continue for long periods. As previously noted, decree level was exceeded for about 90 days during the 1958 flood.

In general, the water surface of the Standard Project Flood along the streamways would be about 1 foot higher than the Intermediate Regional Flood. It would be less than 1 foot higher in sheet flow areas, and more than one foot in areas subject to lake flooding.

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TABLE 8

OBSTRUCTIVE BRIDGES, CULVERTS, AND OTHER STREAM CROSSINGS

Identification	Location (a)	Approximate Elevation ft., msl datum: Stream-bed	Top of Under-clearance (b)	Road-way (b)	Inter-mediate Regional Flood	Standard Project Flood
MANNING CREEK						
Abandoned Private Bridge	1.20	1332	1337	1338	1339	1339
State Highway 29 (c)	2.04	1343	1351	1353	1352	1352
Ackley Road	2.77	1366	1376	1377	1374	1374
George Road	3.06	1372	1380	1382	1380	1380
ADOBE CREEK						
Soda Bay Road	1.13	1330	1340	1342	1339	1339
Finley Road	1.98	1341	1351	1353	1350	1351
Big Valley Road	2.24	1344	1355	1358	1354	1354
Private Road	2.57	1349	1361	1363	1360	1361
Argonaut Road	2.81	1351	1365	1367	1363	1364
State Highway 29	2.84	1351	1365	1367	1364	1365
Bell Hill Road (c)	5.67	1401	1404	1405	1410	1411
KELSEY CREEK						
Soda Bay Road	1.52	1329	1347	1351	1344	1344
Pipeline Crossing	1.70	1330	1350	1351 (d)	1346	1347
Rock Dam	4.05	1359 (e)	-(f)	1363 (g)	1374	1375
Main Street	4.07	1359	1381	1386	1374	1375
State Highway 29	4.63	1369	1390	1394	1381	1383
COLE CREEK						
Clear Lake State Park Road	0.20	1322	1330	1332	1331	1333
Soda Bay Road	1.03	1327	1334	1336	1337	1337
Private Road	1.28	1329	1334	1336	1337	1337
Clark Drive	1.81	1334	1340	1342	1341	1341
Private Road	3.11	1354	1360	1361	1361	1361
Sylar Lane	3.91	1378	1384	1386	1386	1386
Konocti Road	4.32	1391	1398	1400	1403	1404
Wilkinson Road	4.95	1415	1426	1428	1430	1431

(a) Distance upstream from mouth in miles.
(b) Average elevation.
(c) Culvert.
(d) Top of pipeline.
(e) Base of Dam.
(f) Not applicable.
(g) Top of Dam.

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TABLE 9

RATES OF RISE AND DURATION OF FLOODING

Flood	Maximum Rate of Rise ft./hr.	Height of Rise[a] ft.	Time of Rise[b] hrs.	Duration above Flood Stage hrs.
ADOBE CREEK AT HIGHWAY 29				
Intermediate Regional	1.0	2.4	4	16
Standard Project	1.0	3.4	6	22
KELSEY CREEK AT RENFRO CROSSING				
Intermediate Regional	1.0	3.4	4	13
Standard Project	1.0	4.6	6	17
COLE CREEK AT KONOCTI ROAD				
Intermediate Regional	0.4	4.8	28	48
Standard Project	0.4	5.2	31	52

(a) Flood stage level (beginning of overbank flow) to maximum floodflow level.
(b) Time period corresponding to height of rise.

PHOTOGRAPHS, FUTURE FLOOD HEIGHTS

The levels that the Intermediate Regional and Standard Project Floods are expected to reach at various locations in the study area are indicated in the following photographs.

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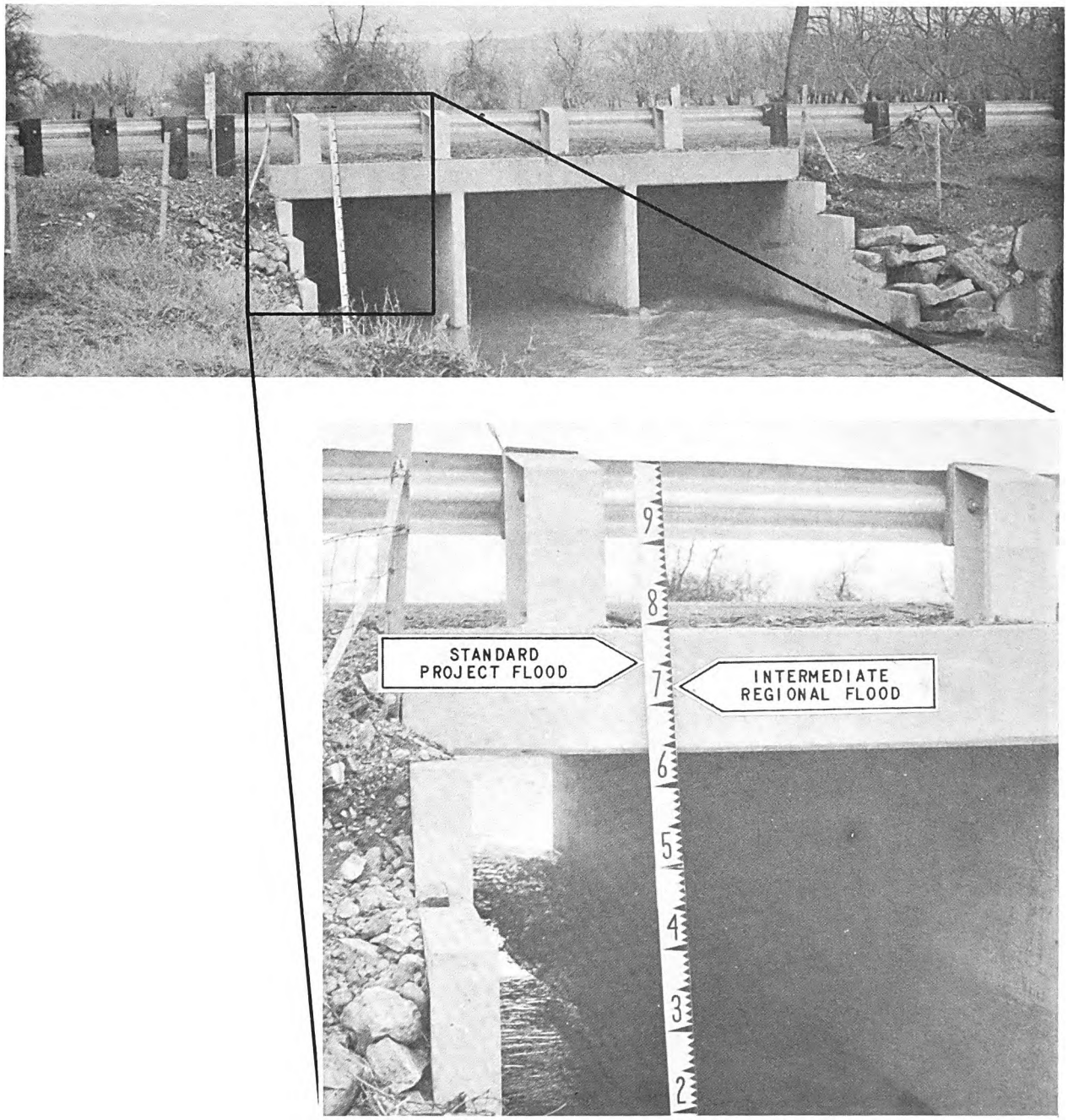


Figure 12 - Future flood heights on Manning Creek at State Highway 29.

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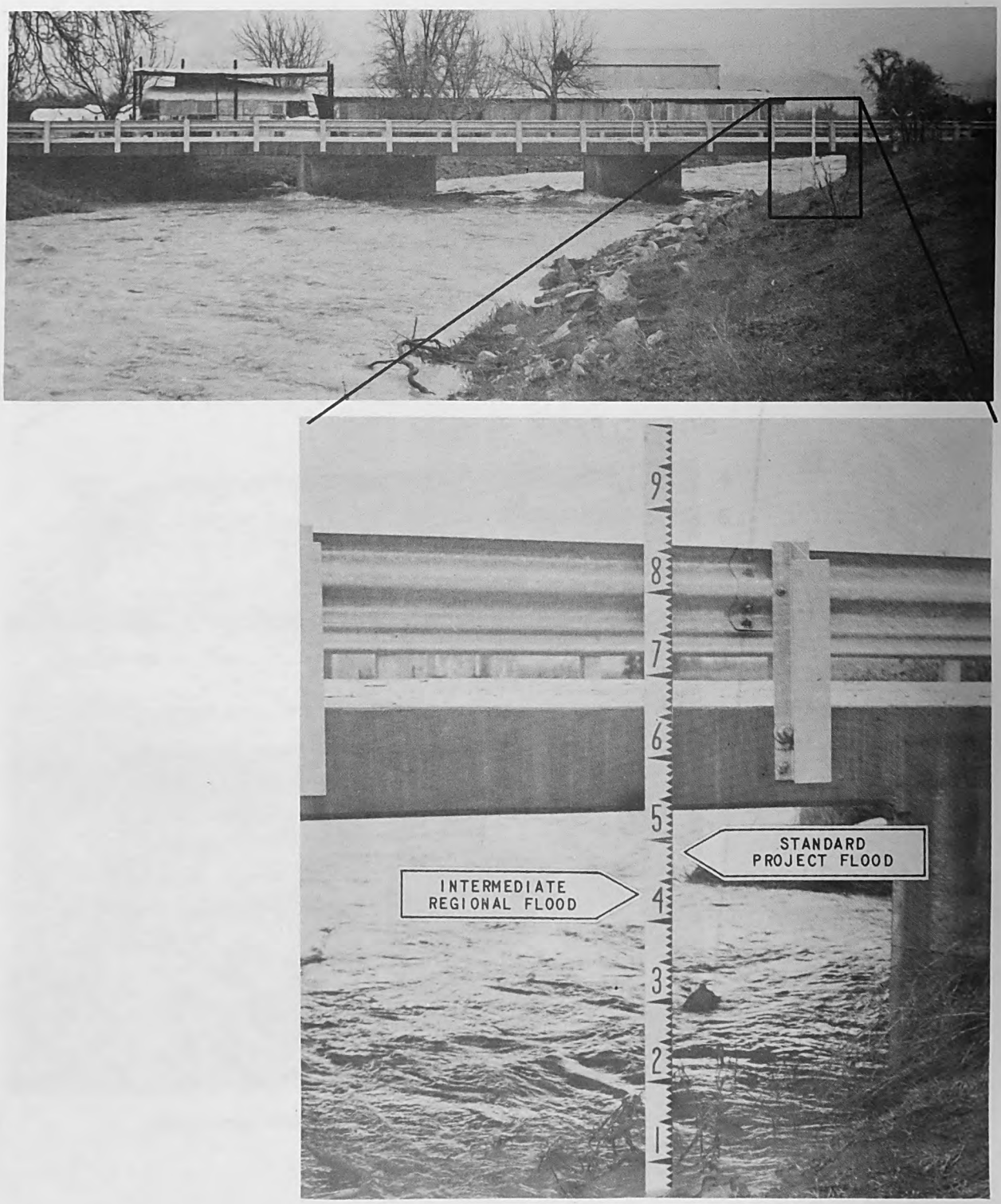


Figure 13 - Future flood heights on Adobe Creek at Finley Road.

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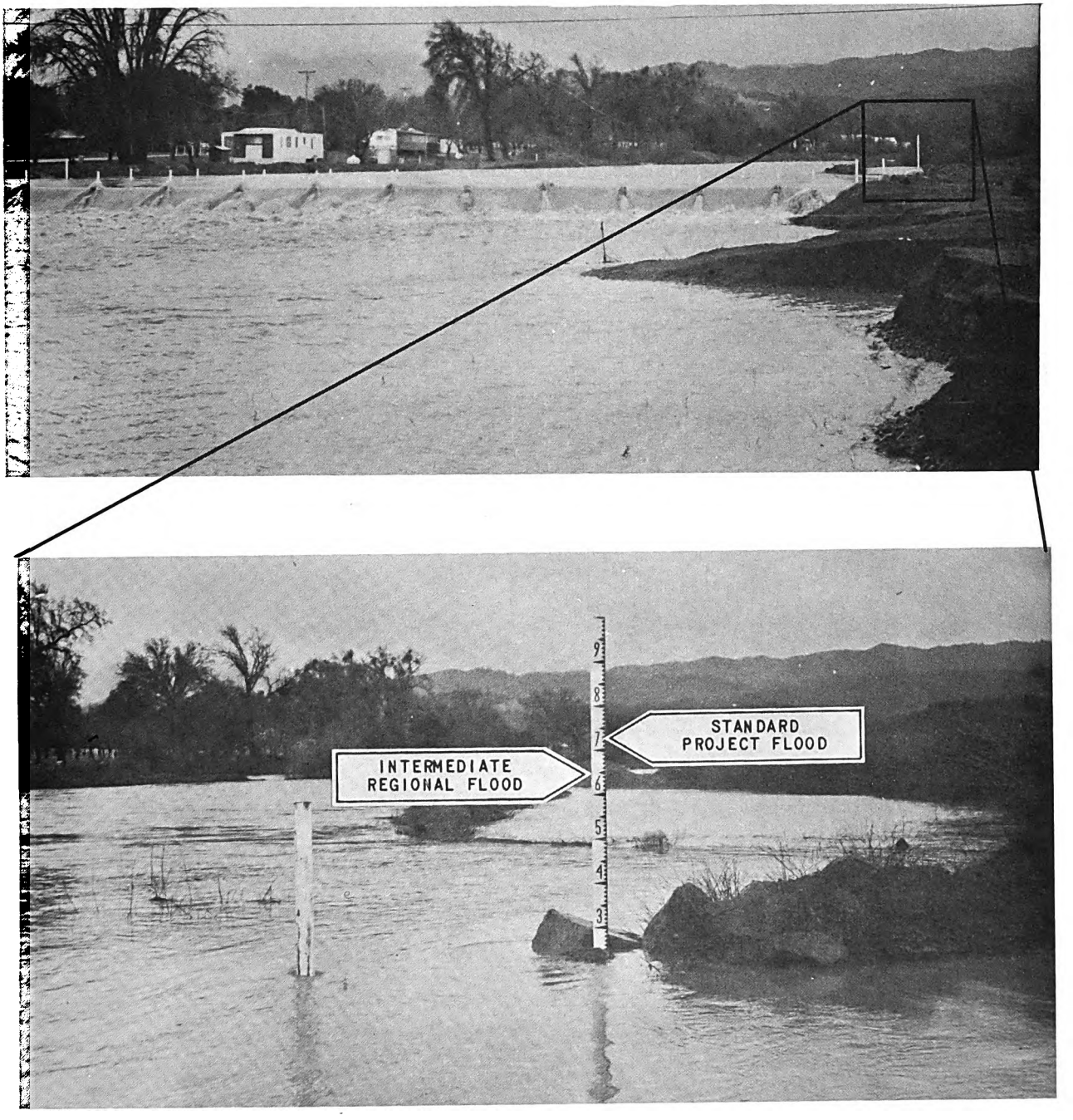


Figure 14 - Future flood heights on Adobe Creek at Bell Hill Road.

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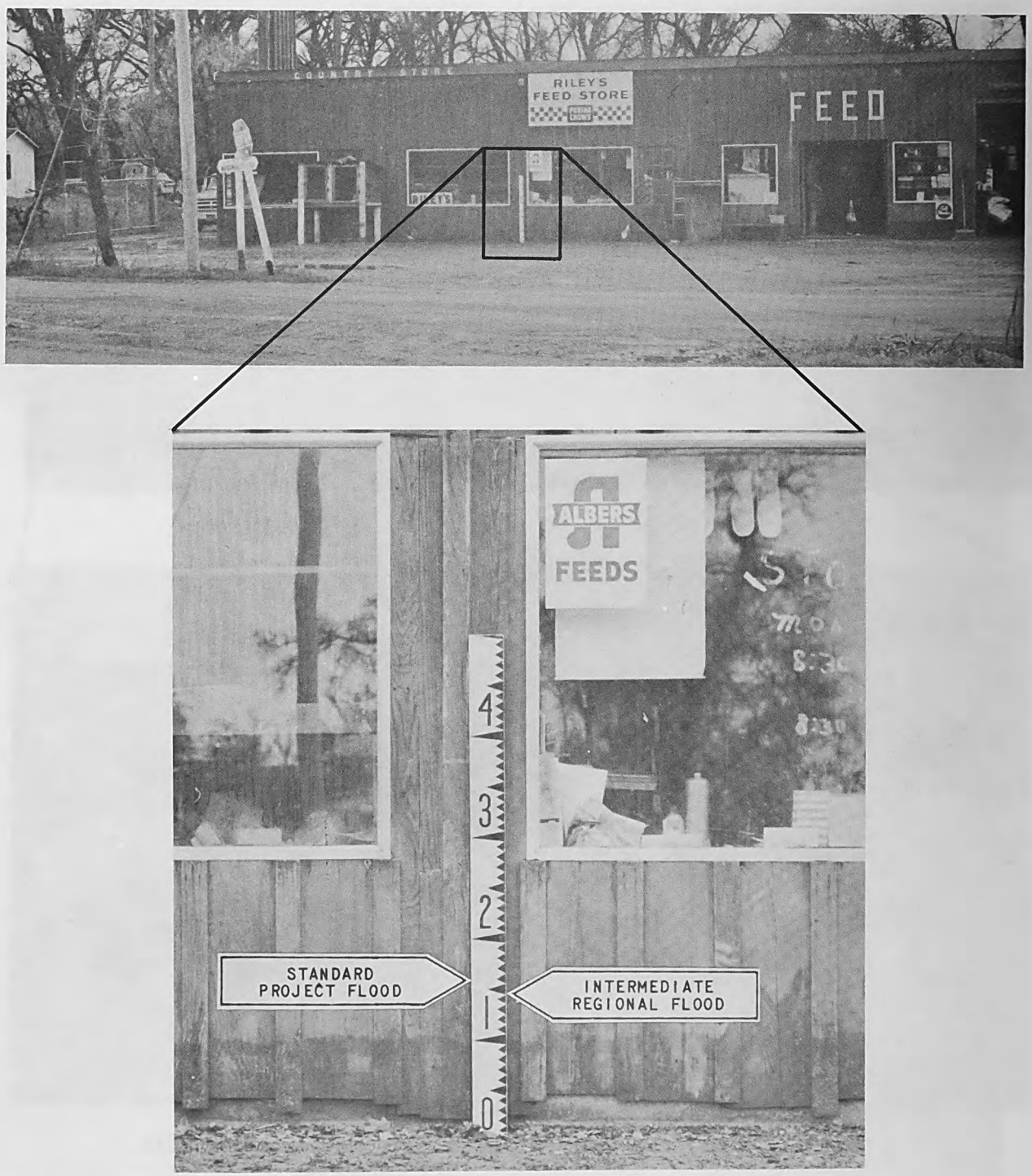


Figure 15 - Future flood heights at Big Valley and Argonaut Roads.

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Figure 16 - Future flood heights on Kelsey Creek at State Highway 29.

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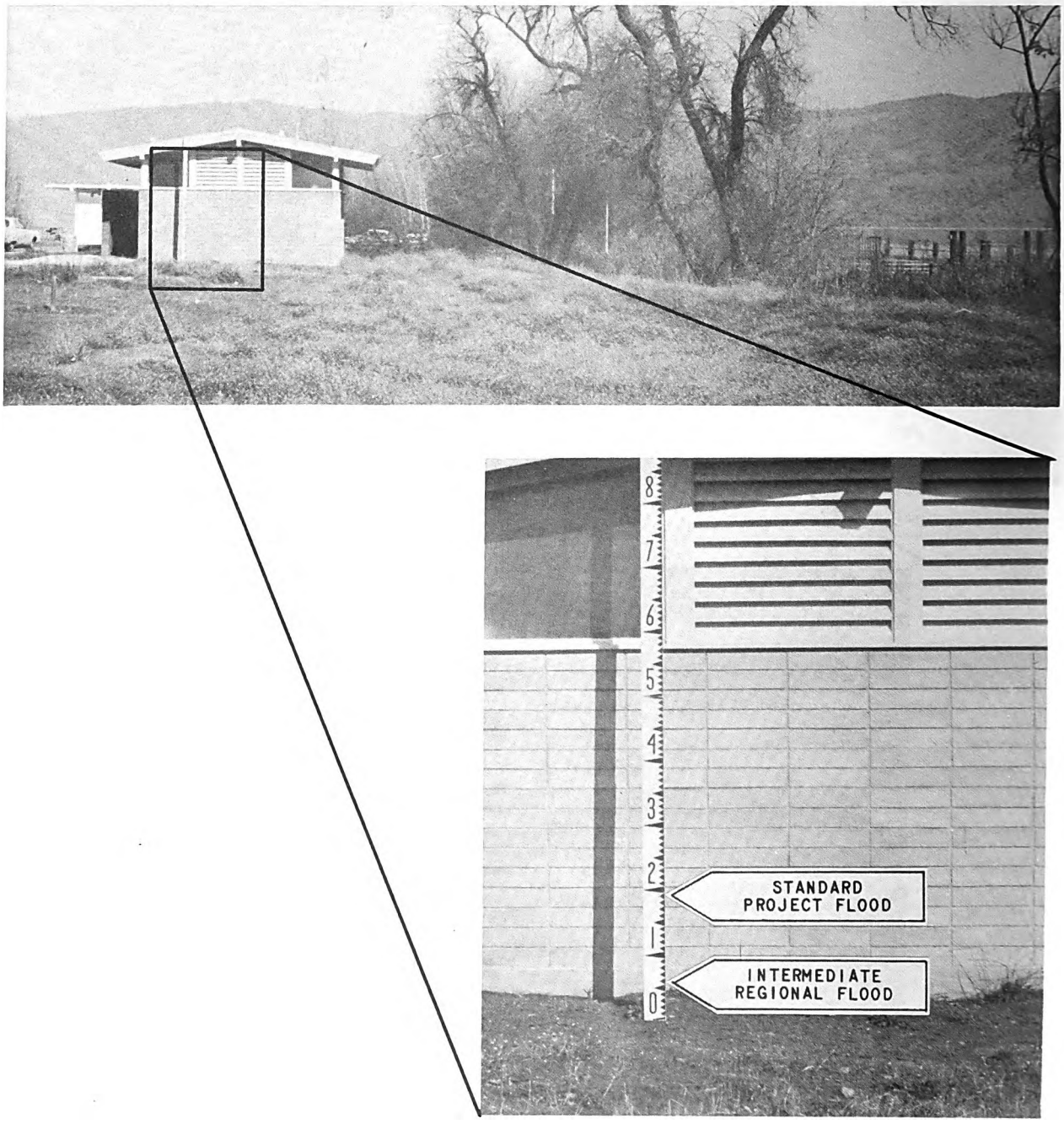


Figure 17 - Future flood heights at a structure in Clear Lake State Park.

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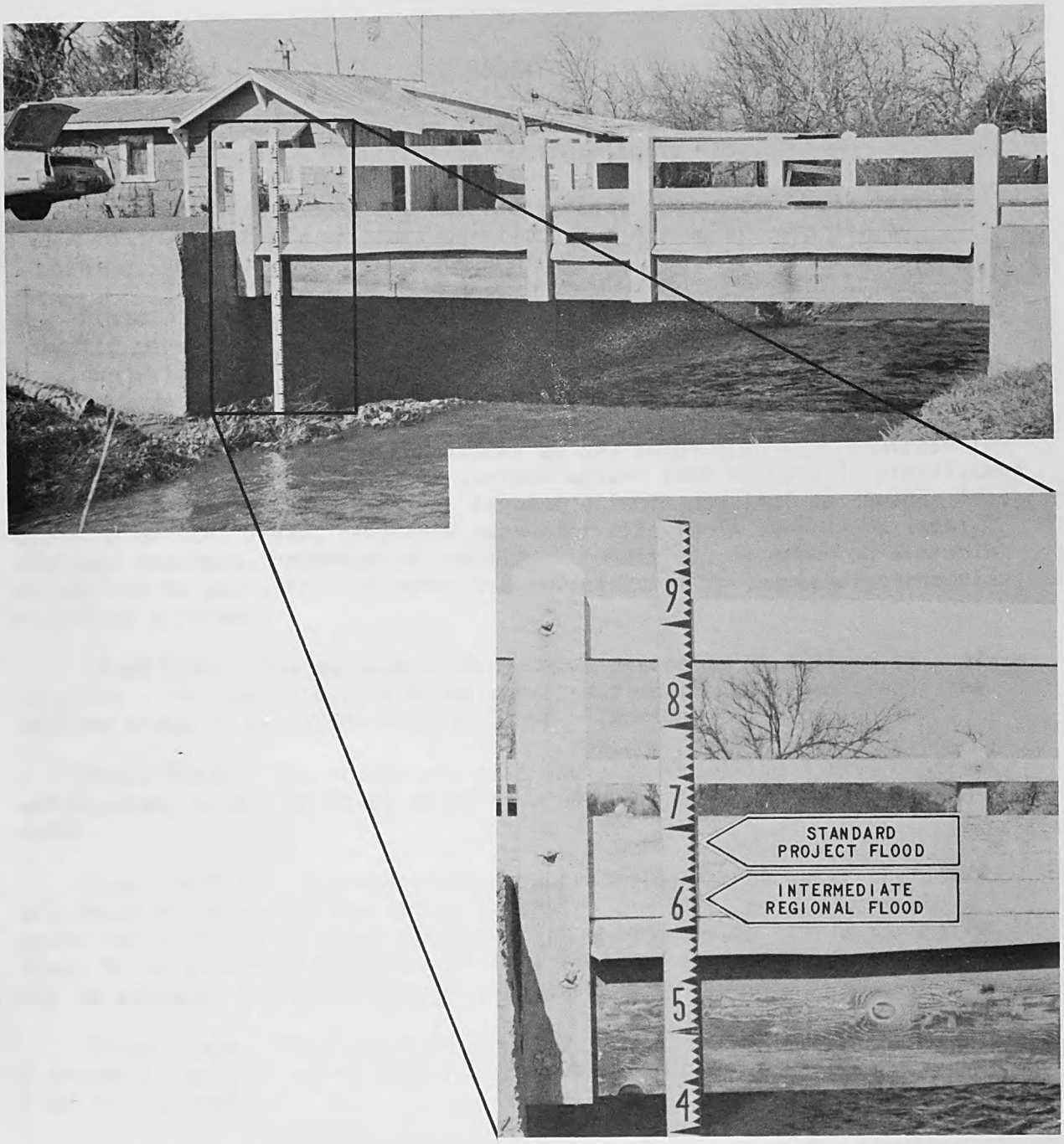


Figure 18 - Future flood heights on Cole Creek at Sylar Lane.

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GLOSSARY

Backwater Effect. The rise in surface elevation of flowing water upstream from and as a result of an obstruction to flow.

Cloudburst. A sudden and extremely heavy downpour of rain that is small in areal extent; of short duration; and may be accompanied by lightning, thunder, and strong gusts of wind.

Flood. An overflow of water onto lands used or usable by man and not normally covered by water. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river, stream, lake, or ocean.

Normally, a "flood" is considered as any temporary rise in streamflow or stage (but not the ponding of surface water) that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials coincident with increased streamflow, and other problems.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest, the maximum stage or elevation reached by the floodflow.

Flood Plain. The relatively flat lowlands adjoining a river, stream, watercourse, ocean, or lake, which have been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Hydrograph. A graph of time *vs* flow or stage at a given location along a stream.

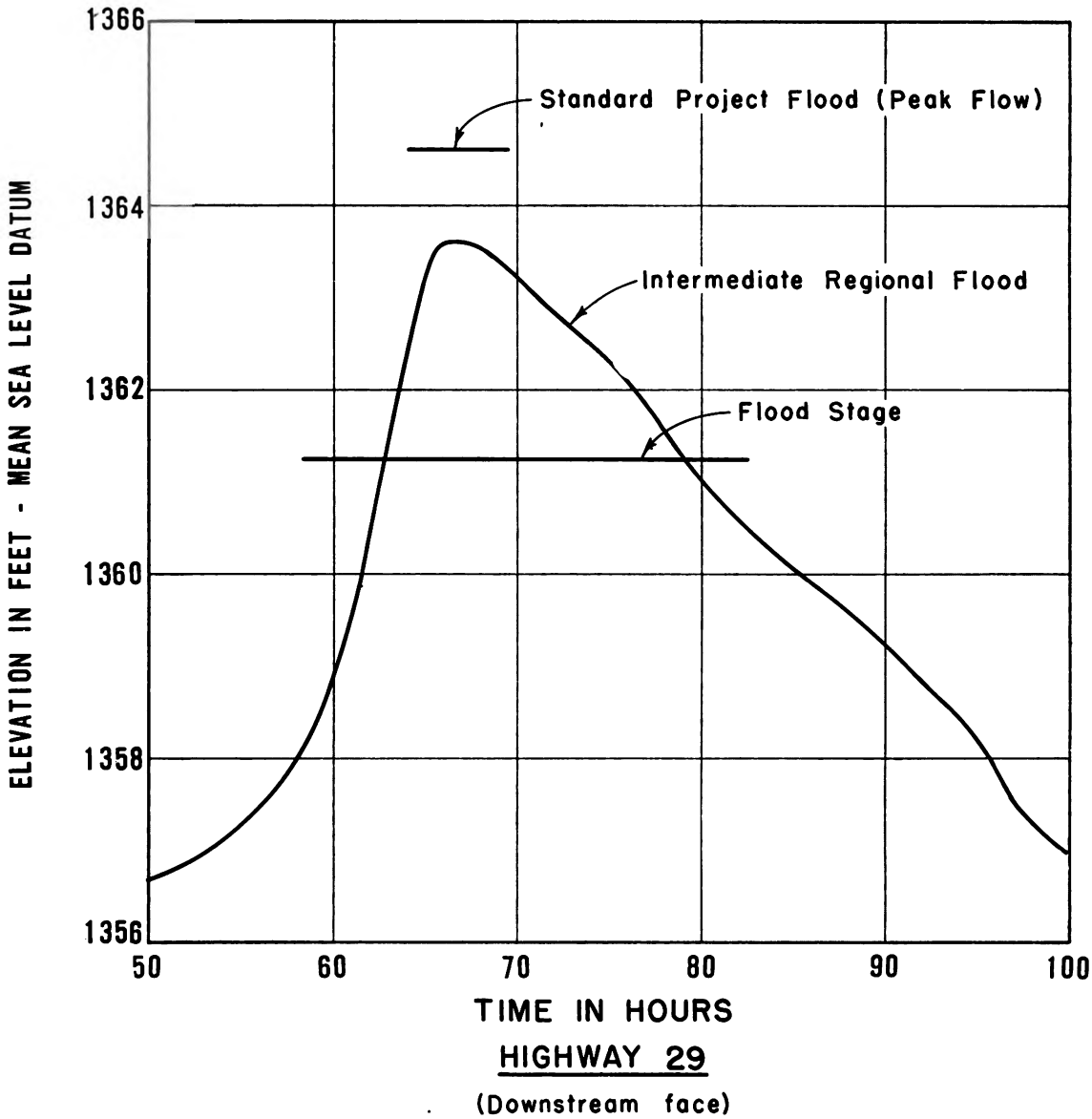
Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year.

Sheetflow. Broad, shallow overland floodflows generally varying from a few inches to not more than 2 feet deep on the average.

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Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations.

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HIGHWAY 29

(Downstream face)

NOTES

The hydrograph is based on computed data.

The flow for the Flood Stage at Highway 29 is based on the channel capacity just above Big Valley Road.

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

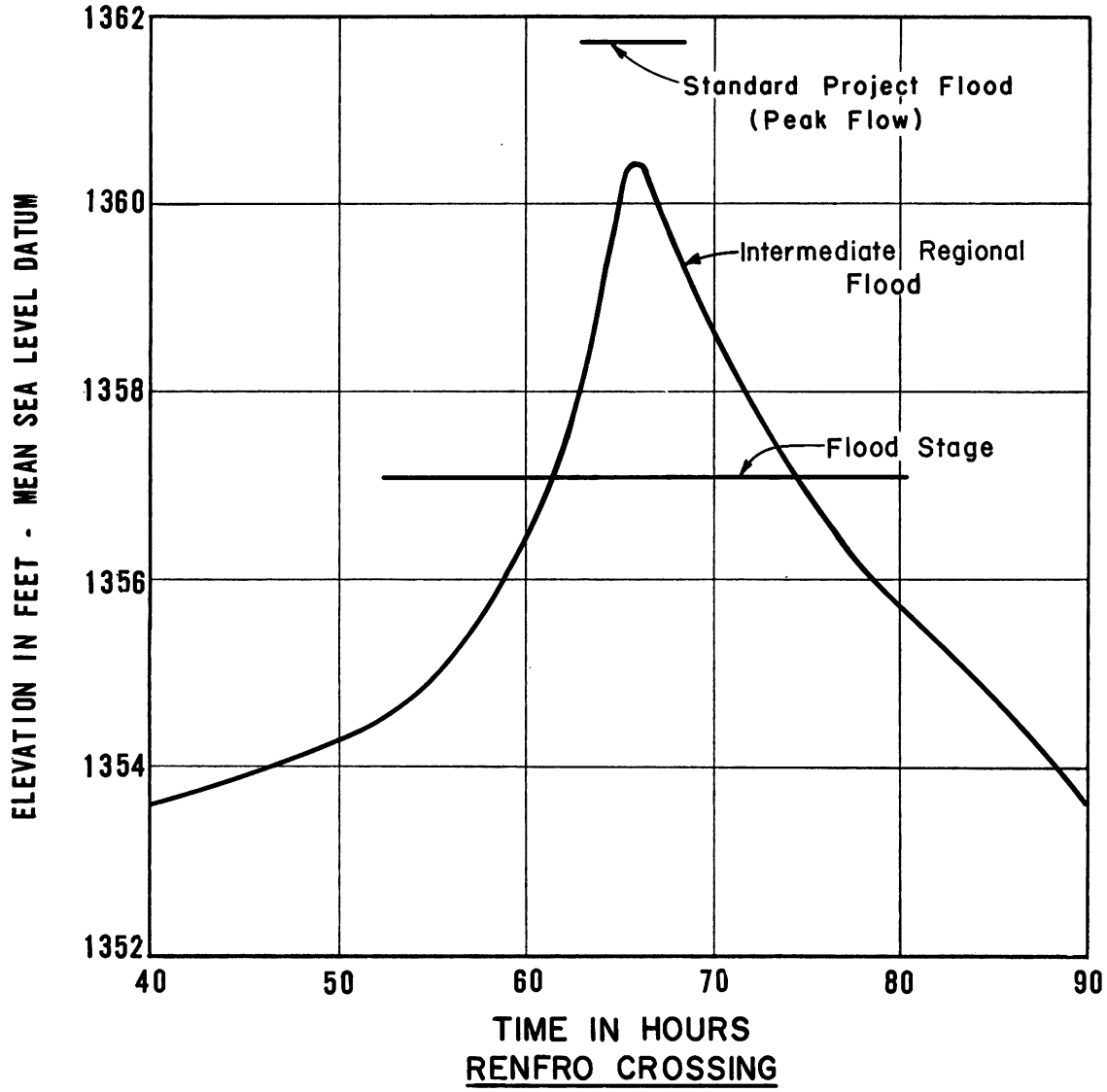
STAGE HYDROGRAPH

ADOBE CREEK
JUNE 1974

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PLATE 2

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NOTES

The hydrograph is based on computed data.

The Flow for the Flood Stage at the Renfro Crossing is based on the channel capacity at Mile 2.3.

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KELSEYVILLE, CALIFORNIA

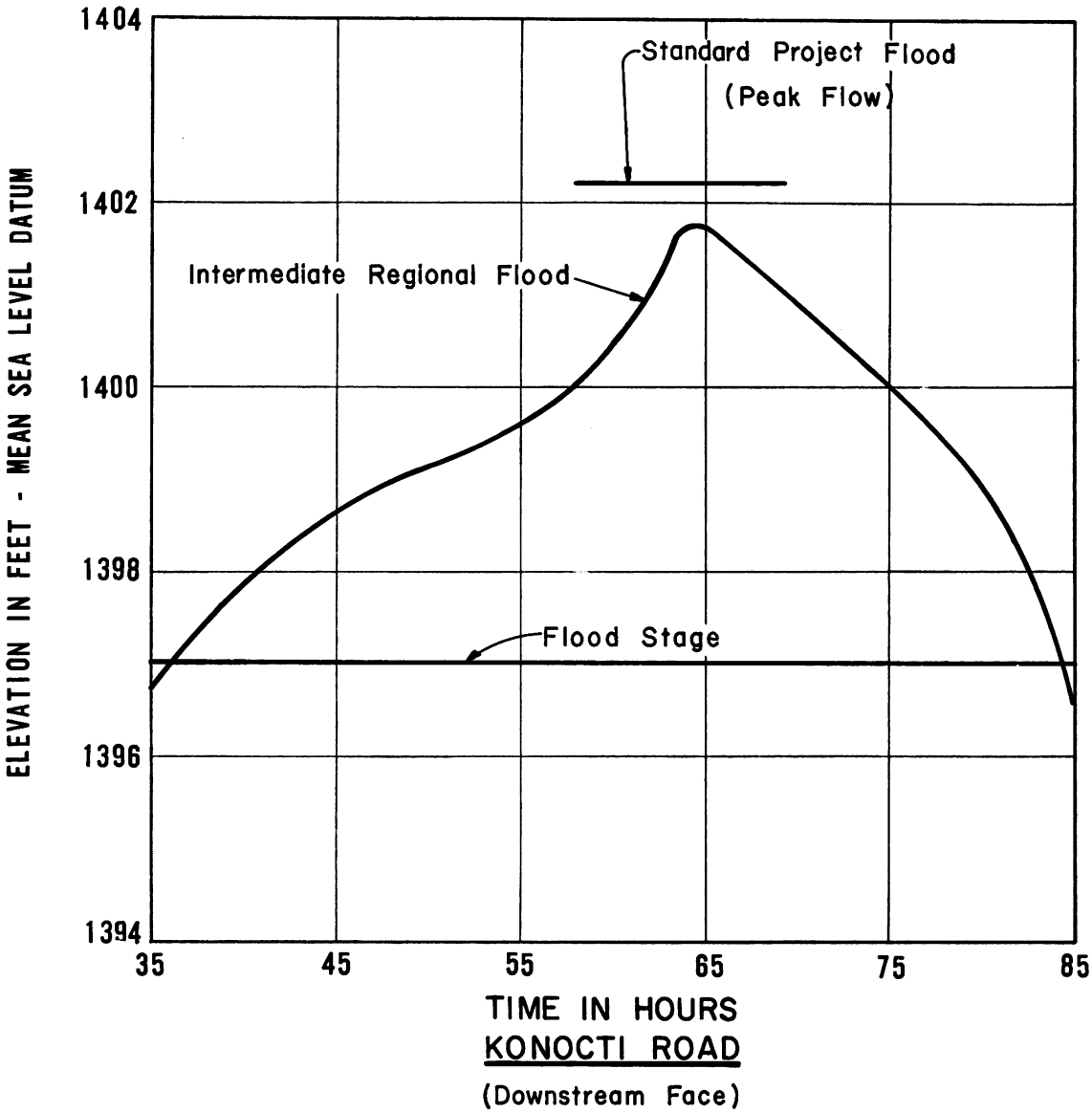
STAGE HYDROGRAPH

KELSEY CREEK
JUNE 1974

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PLATE 3

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NOTES

The hydrograph is based on computed data.

Flood Stage is the beginning of overbank flow.

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

STAGE HYDROGRAPH
COLE CREEK
JUNE 1974

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PLATE 4

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LAKEPORT.

CLEAR LAKE

RIGGS ROAD

CITY LIMITS

TODD ROAD

29

20

Clear Lake State Park

Manning Creek

Rumsey Slough

SODA BAY ROAD

STONE DRIVE

PARK DRIVE

Cole Creek

Kelsey Creek

FINLEY ROAD

FINLEY

MATHEWS RD.

Thompson Creek

Adobe Creek

Slough

ROAD

LOASA ROAD

GADDY ROAD

Manning Cr.

ARGONAUT RD.

DAVIS ROAD

DR.

KELSEYVILLE

MERRITT ROAD

SPRINGS

McGaugh Hill

RENFRO ROAD

BELL HILL ROAD

KONOCTI ROAD

HIGHLAND

HILL ROAD

BELL

PLUNKETT LANE

Creek

OAK DRIVE

LIVE

WILKINSON ROAD

DRIVE

COLE CREEK

6

7

8

9

10

11

N

SCALE IN MILES

0 2

Highland Creek Dam

Adobe Creek Dam

ADOBE CREEK DRIVE

WIGHT WAY

KELSEY CREEK

Kelsey Creek

McIntire Cr. Creek

HIGHLAND SPRINGS ROAD

Highland Creek

LEGEND

6 Plate Number

29 State Highway

Standard Project Flood

Study Limits

Foothill Line

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS

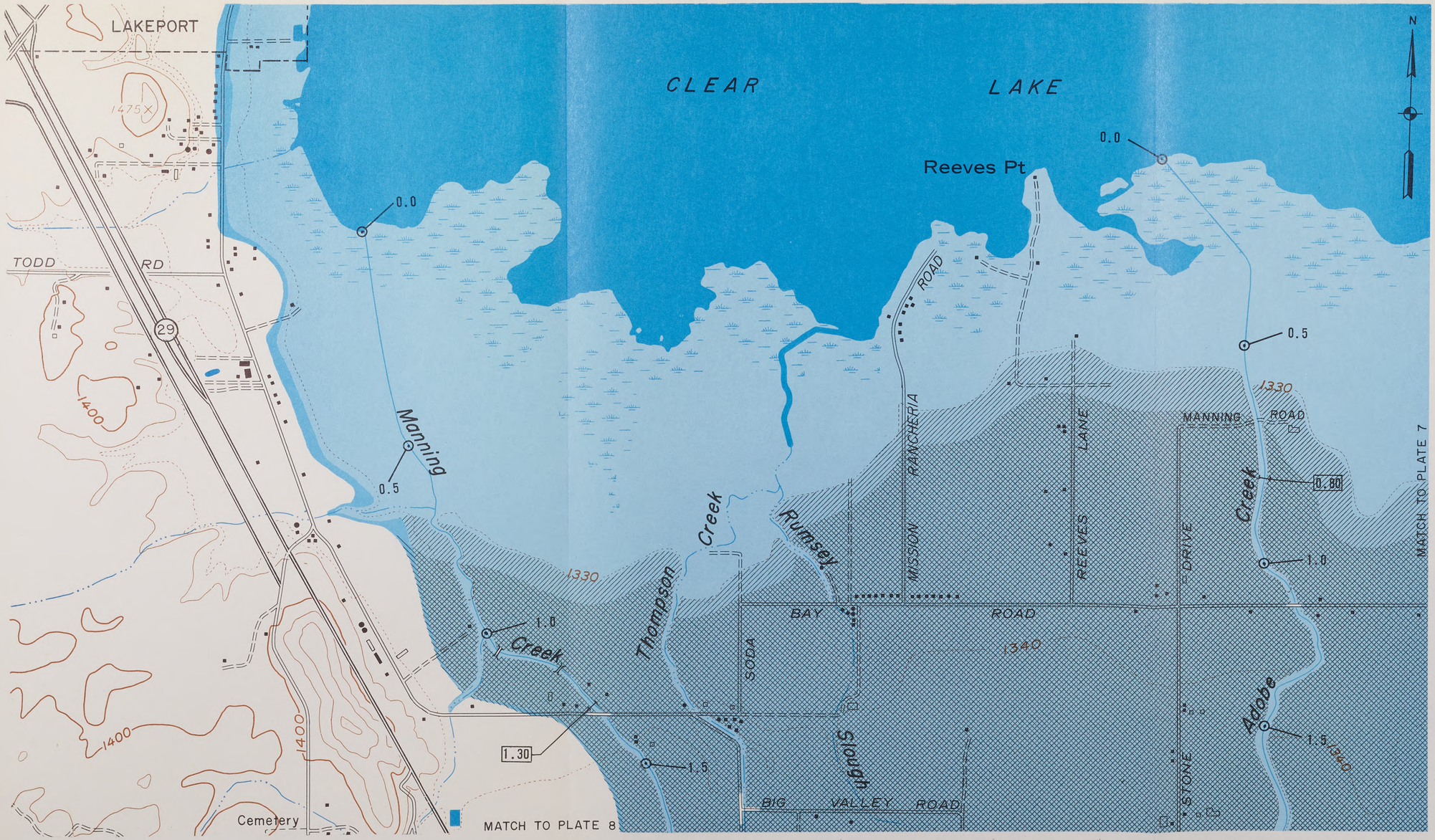
KELSEYVILLE, CALIFORNIA

INDEX MAP-FLOODED AREAS
JUNE 1974

PLATE 5

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LEGEND

Overflow Limits

Low Water Channel

Intermediate Regional Flood

Standard Project Flood

Area Subject to Sheet Flow

Standard Project Flood Only

Standard Project and Intermediate Regional Floods

Intermediate Regional Flood Only

(Limits of Flooding are Approximate)

29 State Highway

0.5 Distance in miles upstream from month.

0.80 Cross Section

NOTES

Map based on U.S.G.S. 7.5-min. quadrangle sheets, Lakeport 1958, and Lucerne 1958. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

Limits of overflow indicated may vary from actual locations on the ground because of accuracy of available topography.

Areas outside the overflow limits shown may be subject to flooding from local runoff.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 10' AND 40'

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOODED AREAS
JUNE 1974

PLATE 6

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LEGEND

Overflow Limits

Low Water Channel

Intermediate Regional Flood

Standard Project Flood

Area Subject to Sheet Flow

Standard Project Flood Only

Standard Project and Intermiate Regional Floods.

Intermediate Regional Flood Only

(Limits of Flooding are Approximate)

0.5 Distance in miles upstream from month.

1.50 Cross Section

NOTES

Map based on U.S.G.S. 7.5-min quadrangle sheet, Lucerne 1958. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

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SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 10' AND 40'

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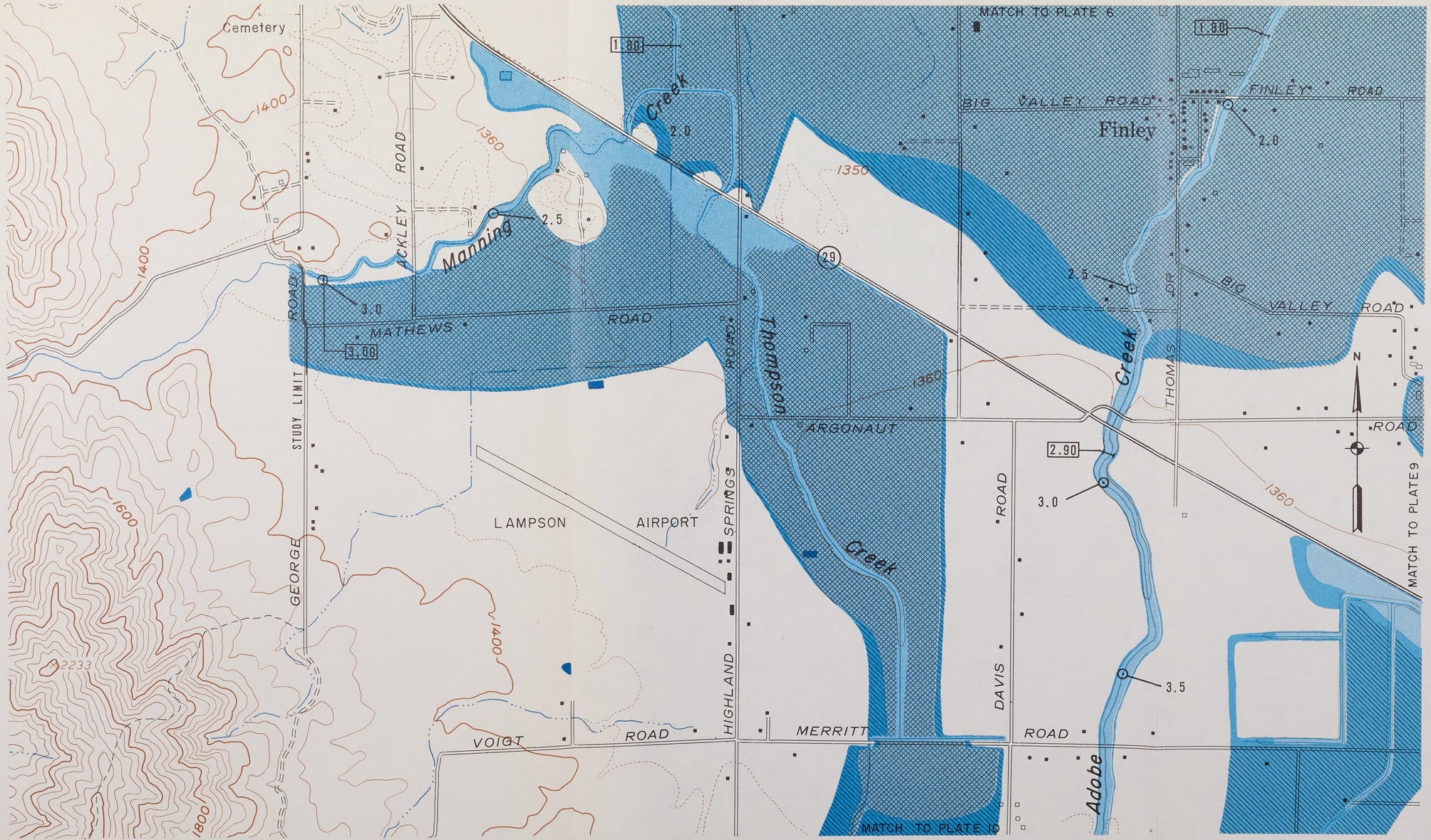
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOODED AREAS
JUNE 1974

PLATE 7

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LEGEND

Overflow Limits

- Low Water Channel
- Intermediate Regional Flood
- Standard Project Flood

Area Subject to Sheet Flow

- Standard Project Flood Only
- Standard Project and Intermediate Regional Floods
- Intermediate Regional Flood

(Limits of Flooding are Approximate)

- (29) State Highway
- 2.0 Distance in miles upstream from mouth.
- 1.80 Cross Section

NOTES

Map based on U.S.G.S. 7.5-min. quadrangle sheets, Lakeport 1958, Lucerne 1958, Highland Springs 1959, and Kelseyville 1959. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

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Areas outside the overflow limits shown may be subject to flooding from local runoff.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 10', 20' AND 40'

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

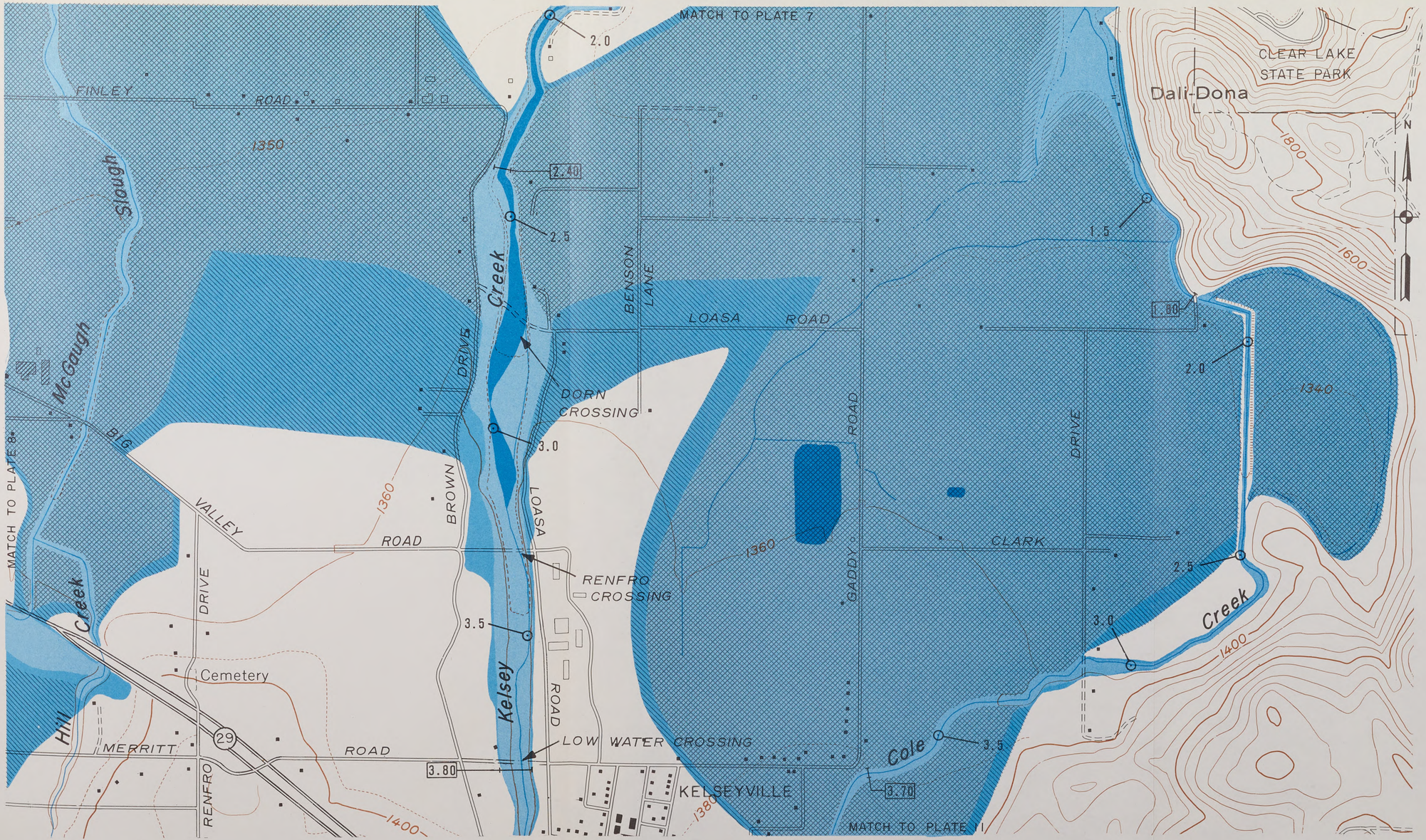
FLOODED AREAS

JUNE 1974

PLATE 8

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LEGEND

Overflow Limits

Low Water Channel

Intermediate Regional Flood

Standard Project Flood

Area Subject to Sheet Flow

Standard Project Flood Only

Standard Project and Intermediate Regional Floods

Intermediate Regional Flood Only

(Limits of Flooding are Approximate)

29 State Highway

2.0 Distance in miles upstream from mouth.

1.80 Cross Section

Levee

NOTES

Map based on U.S.G.S. 7.5-min quadrangle sheets, Lucerne 1958, and Kelseyville 1959. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

Limits of overflow indicated may vary from actual locations on the ground because of accuracy of available topography.

Areas outside the overflow limits shown may be subject to flooding from local runoff.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 10', 20' AND 40'

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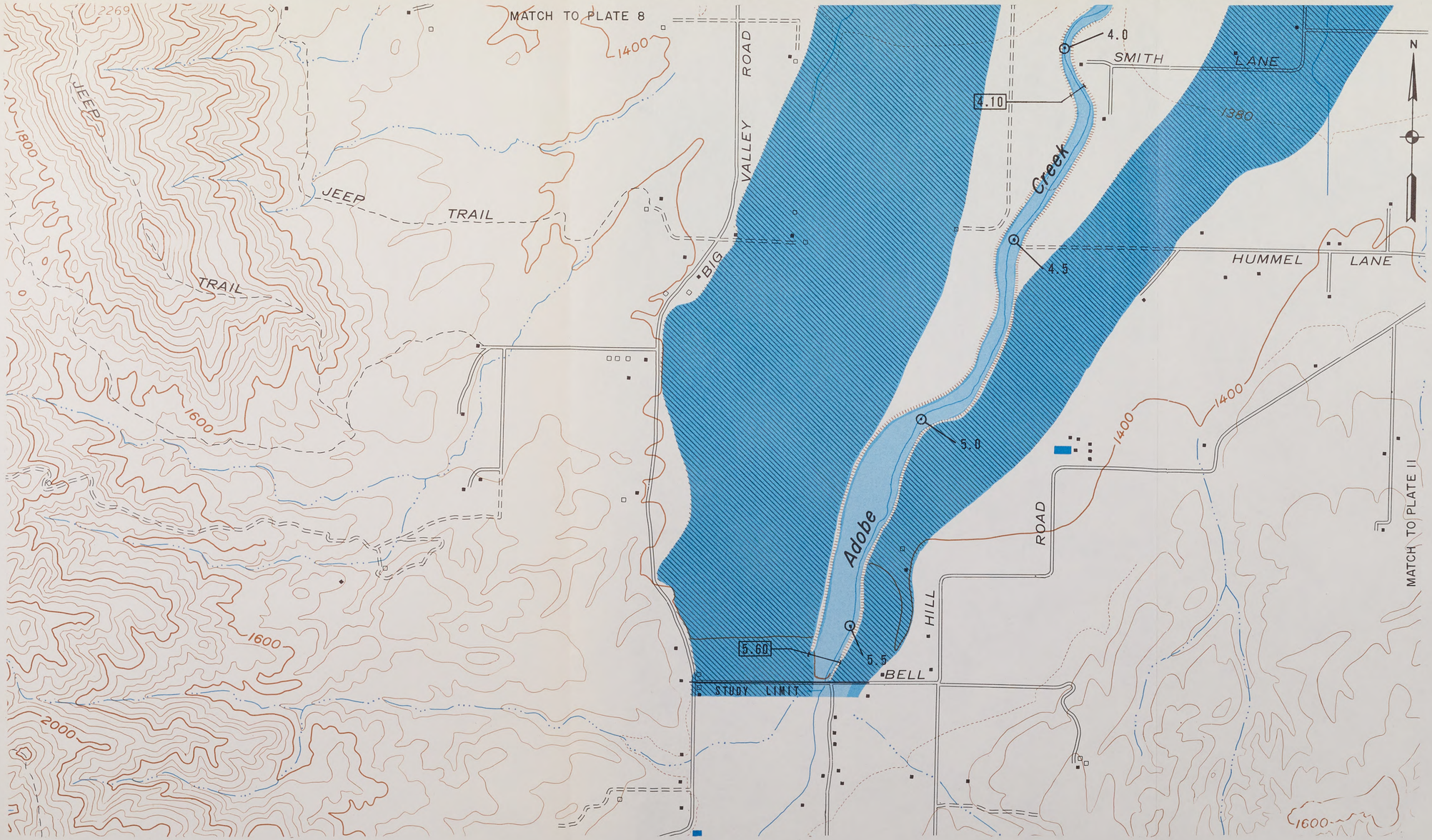
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOODED AREAS
JUNE 1974

PLATE 9

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LEGEND

Overflow Limits

Low Water Channel | Intermediate Regional Flood | Standard Project Flood

Area Subject to Sheet Flow — Standard Project Flood Only

(Limits of Flooding are Approximate)

4.0 — Distance in miles upstream from mouth.

4.10 — Cross Section

Levee

NOTES

Map based on U.S.G.S. 7.5-min. quadrangle sheets, Highland Springs 1959, and Kelseyville 1959. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

Limits of overflow indicated may vary from actual locations on the ground because of accuracy of available topography.

Areas outside the overflow limits shown may be subject to flooding from local runoff.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 20' AND 40'

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

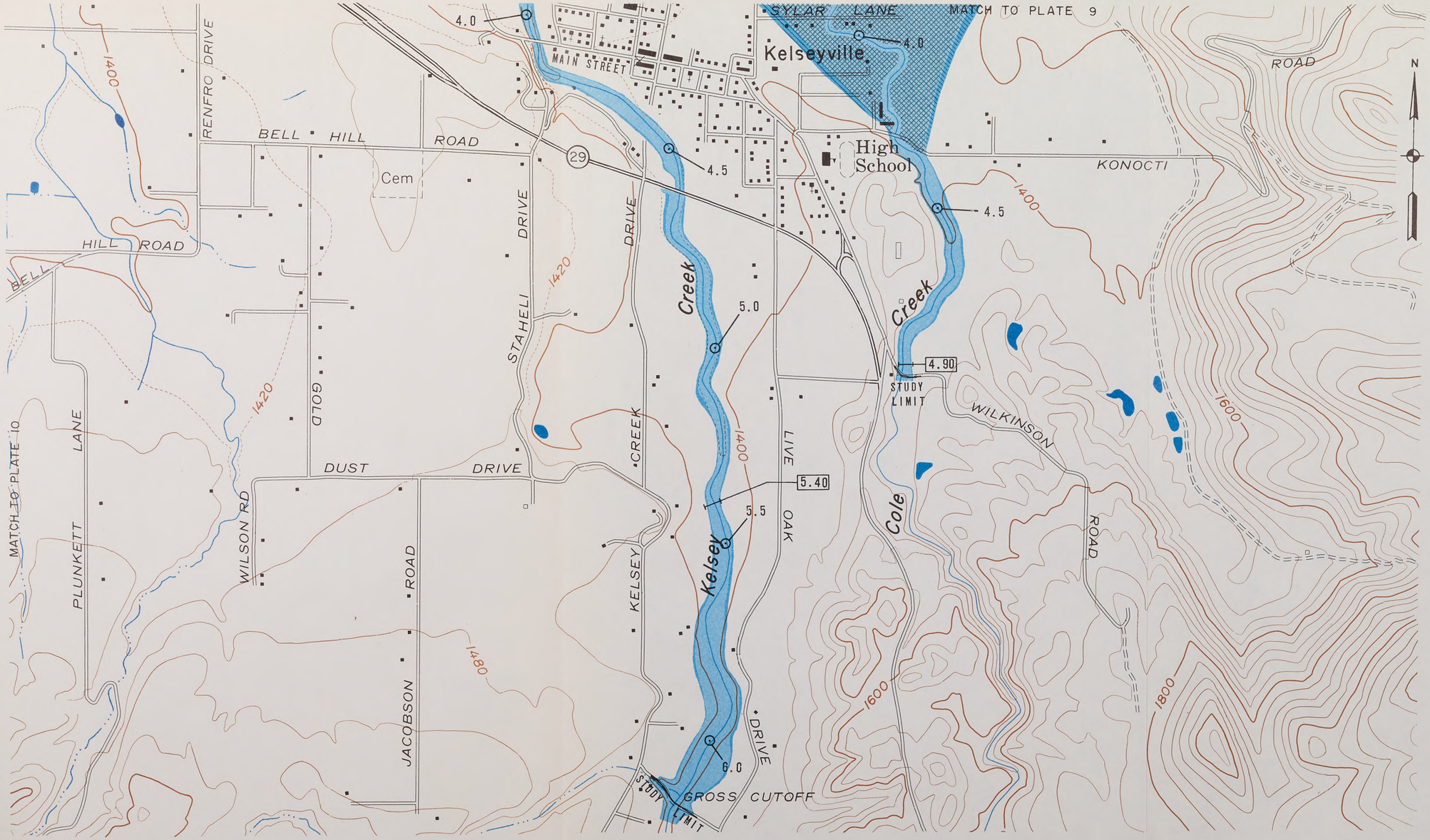
FLOODED AREAS

JUNE 1974

PLATE 10

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LEGEND

Overflow Limits

Low Water Channel
Intermediate Regional Flood
Standard Project Flood

Areas Subject to Sheet Flow

Standard Project Flood Only
Standard Project and Intermediate Regional Floods

(Limits of Flooding are Approximate)

29 State Highway

⊙—4.0 Distance in miles upstream from month.

4.90 Cross Section

NOTES

Map based on U.S.G.S. 7.5-min quadrangle sheet, Kelseyville 1959. Minor additions and adjustments made by Corps of Engineers.

Elevations shown are based on Mean Sea Level Datum.

Limits of overflow indicated may vary from actual locations on the ground because of accuracy of available topography.

Areas outside the overflow limits shown may be subject to flooding from local runoff.

SCALE IN FEET

1000 0 1000 2000

CONTOUR INTERVAL 20' AND 40'

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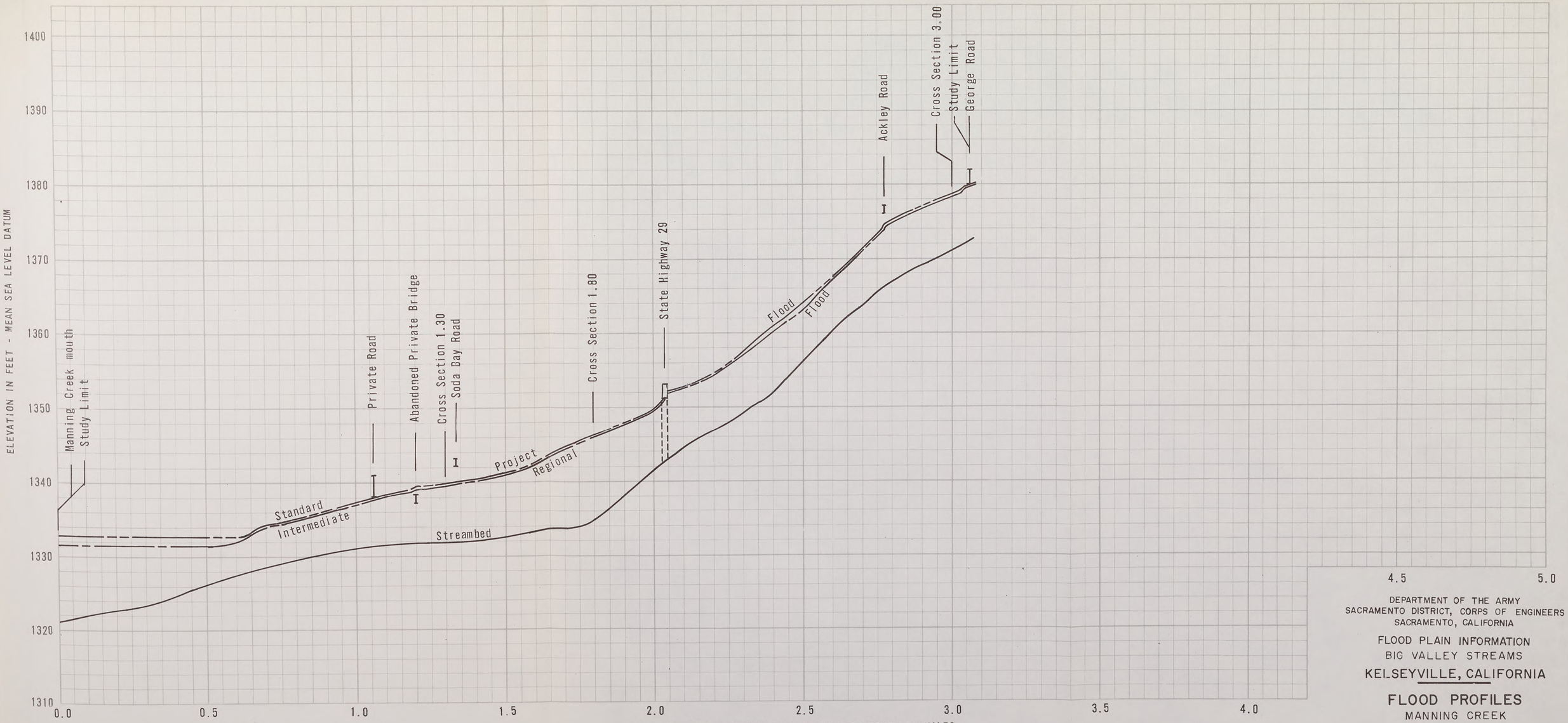
FLOOD PLAIN INFORMATION
ADOBE, KELSEY, AND COLE CREEKS
KELSEYVILLE, CALIFORNIA

FLOODED AREAS
JUNE 1974

PLATE 11

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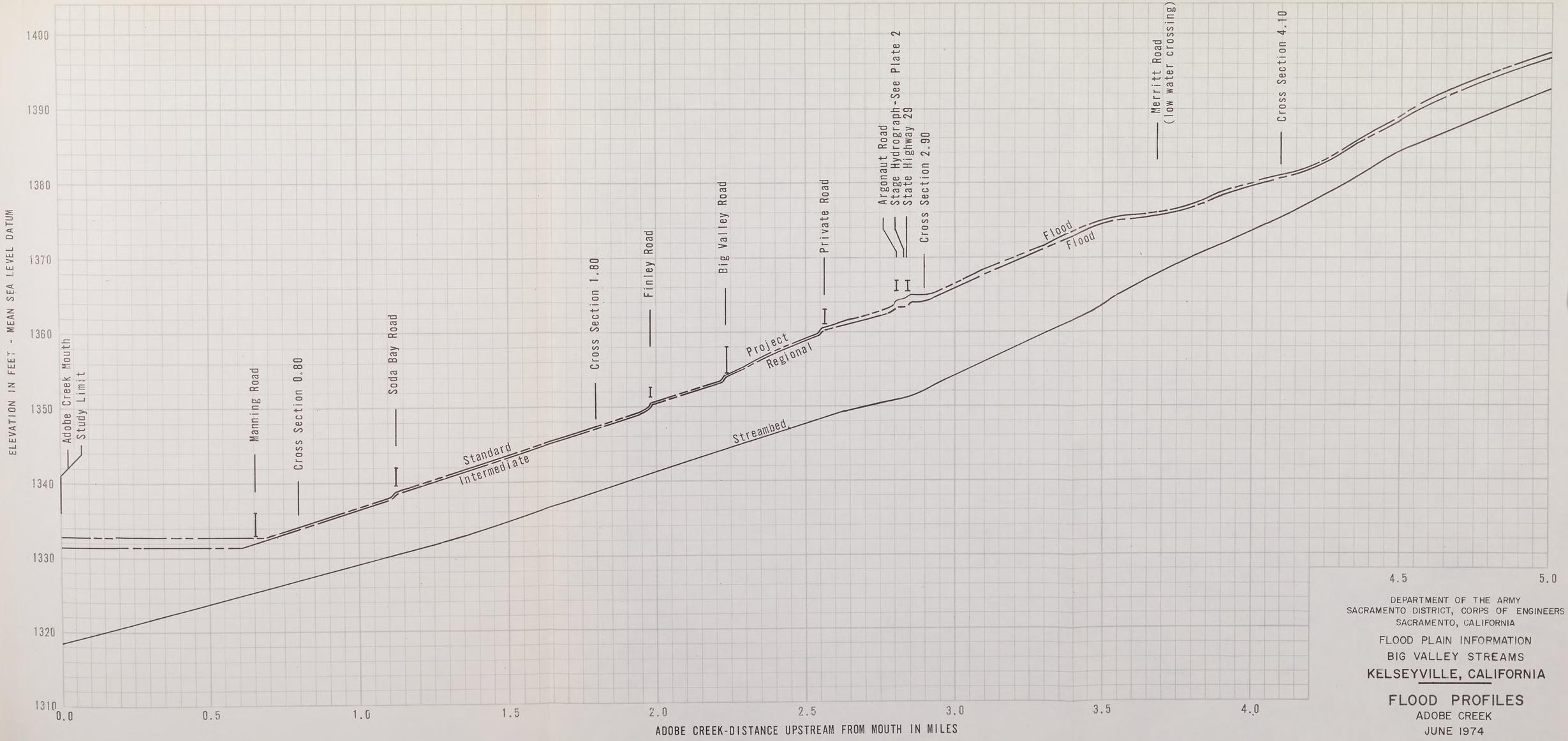
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOOD PROFILES
MANNING CREEK
JUNE 1974

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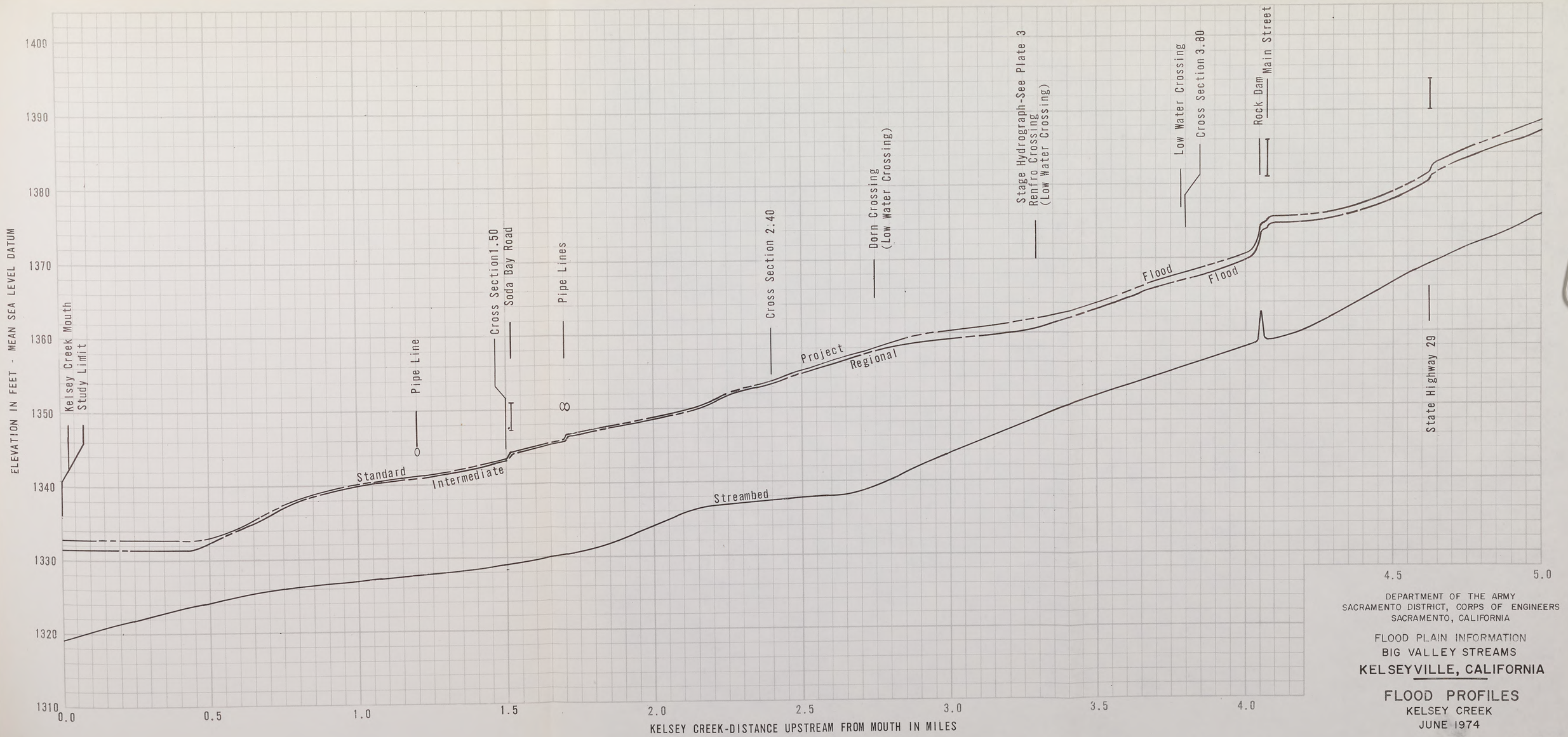
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOOD PROFILES
ADOBE CREEK
JUNE 1974

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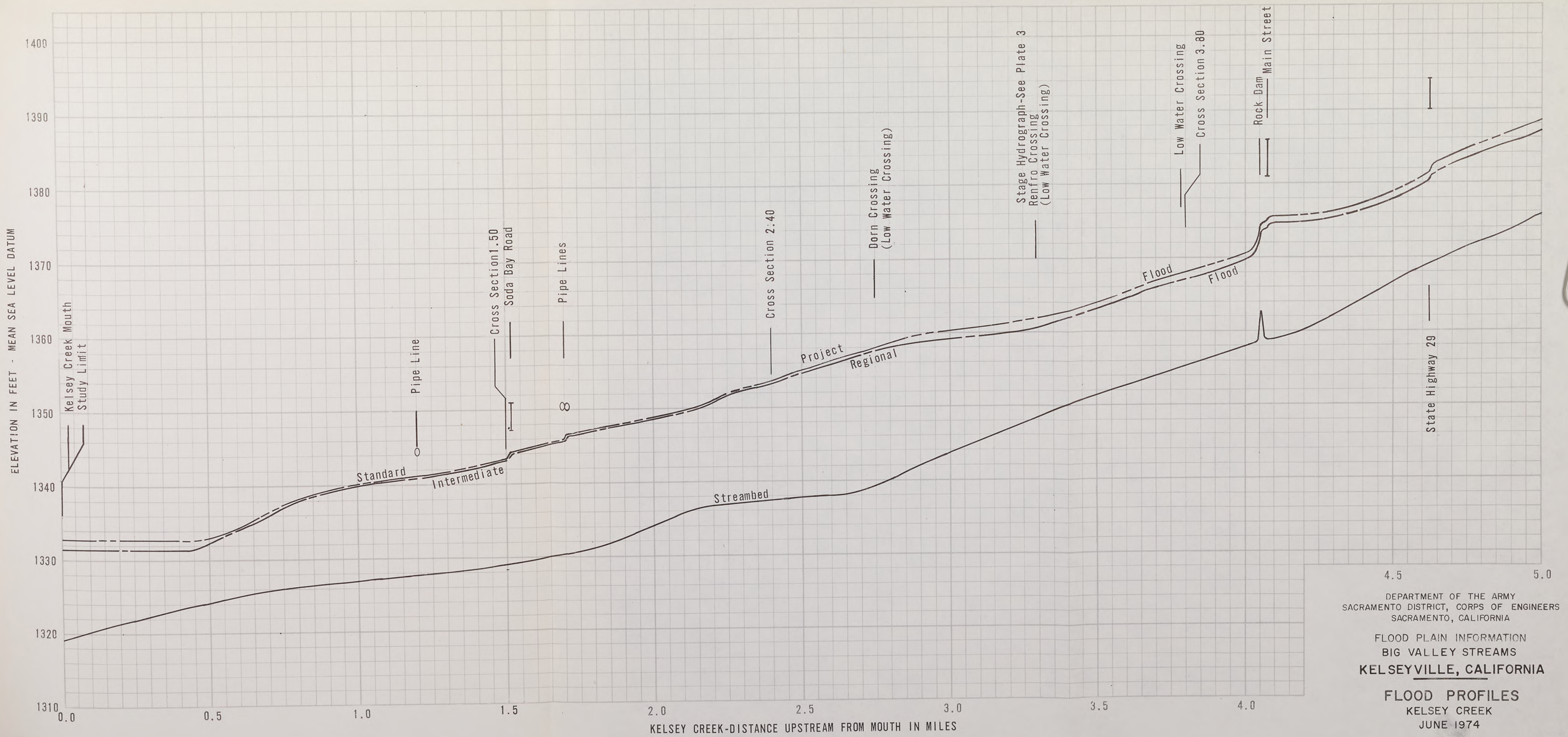
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOOD PROFILES
KELSEY CREEK
JUNE 1974

PLATE 15

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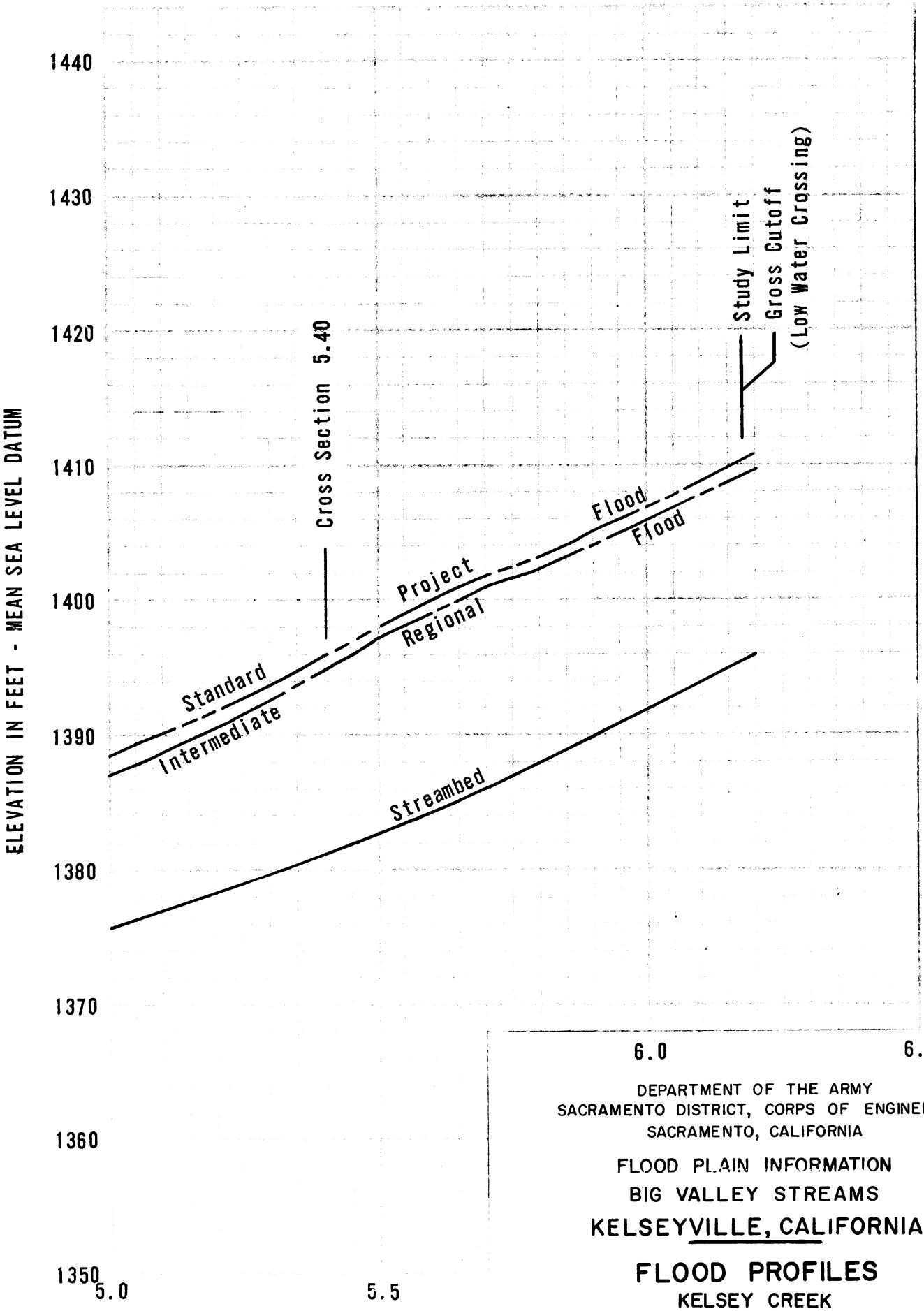
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

FLOOD PROFILES
KELSEY CREEK
JUNE 1974

PLATE 15

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

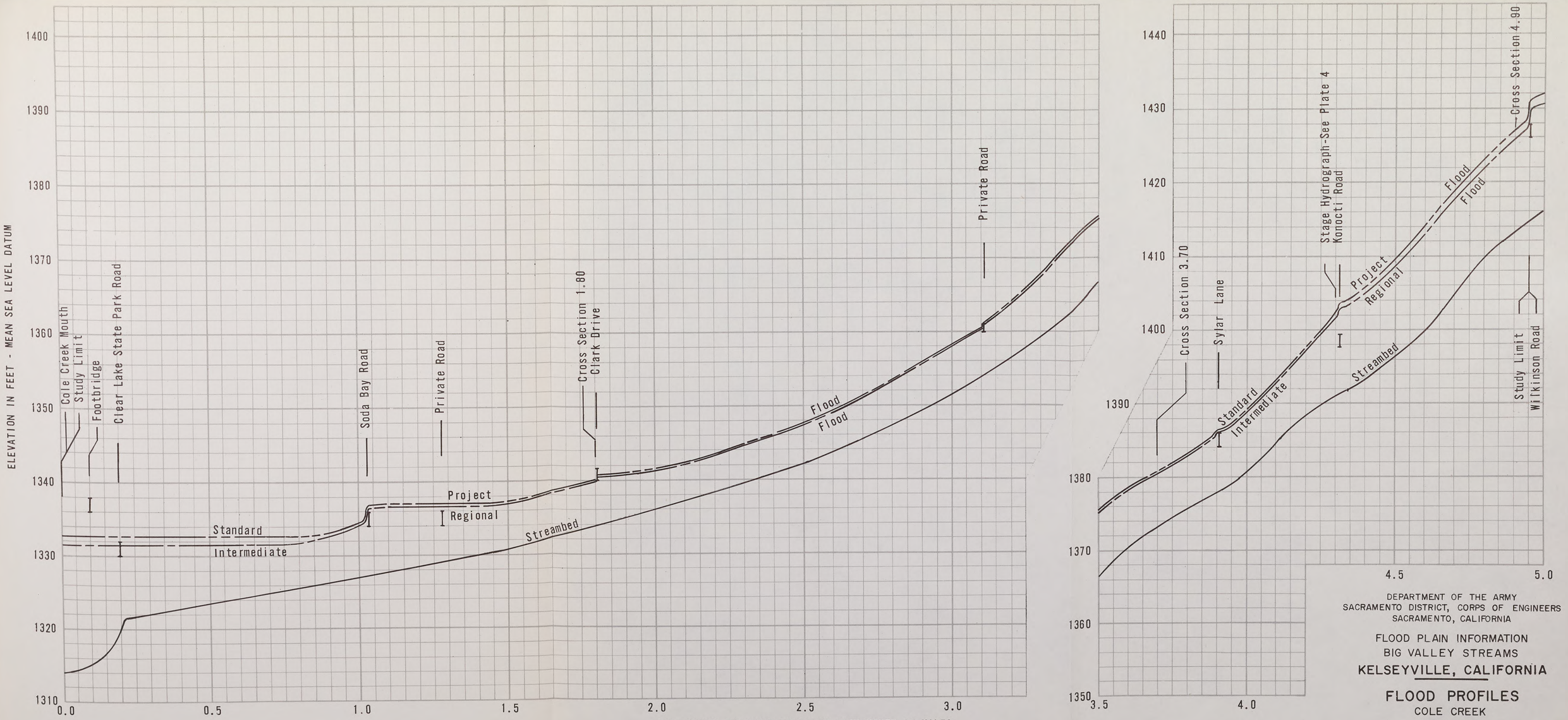
FLOOD PROFILES

KELSEY CREEK
JUNE 1974

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SACRAMENTO, CALIFORNIA

FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

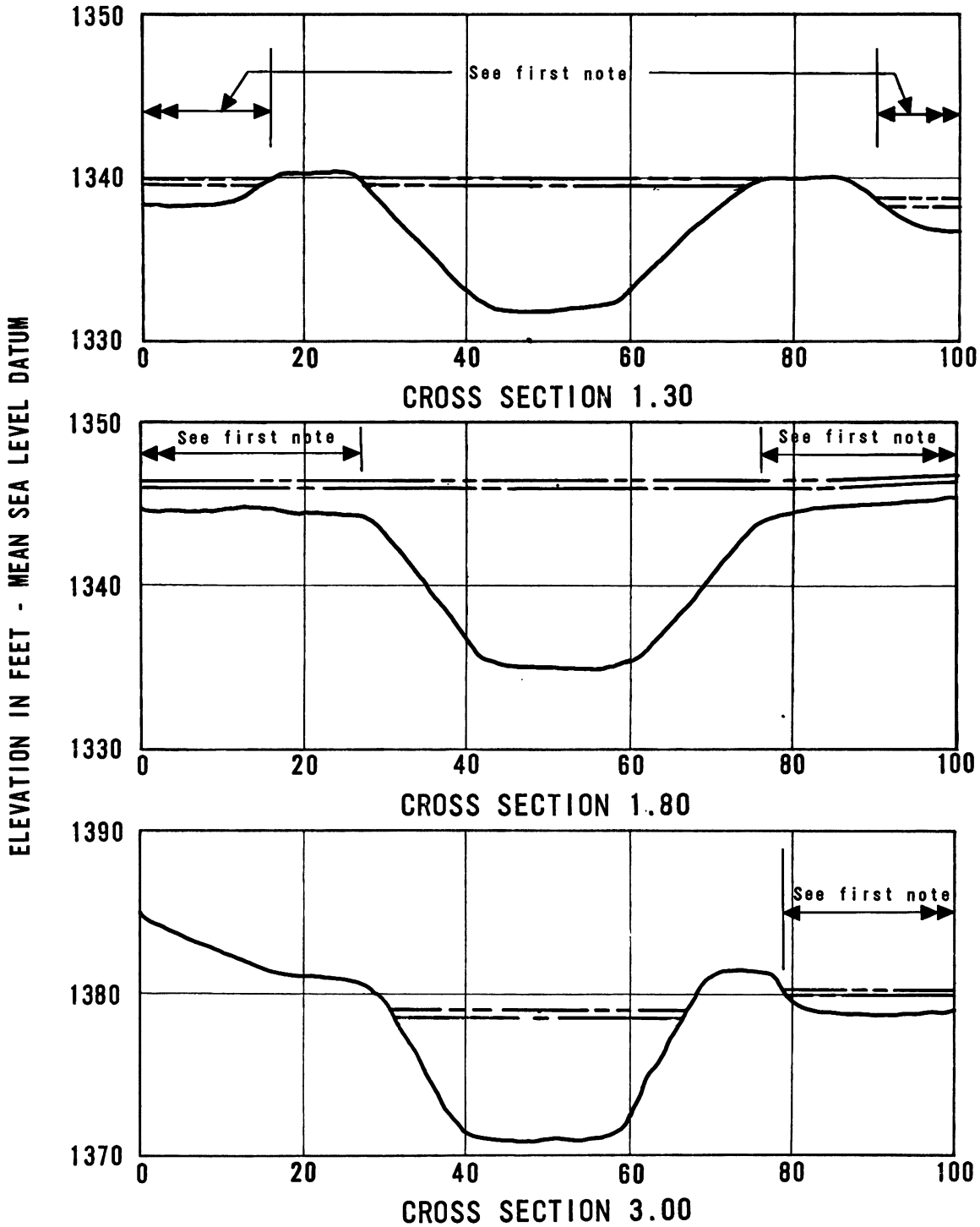
FLOOD PROFILES

COLE CREEK
JUNE 1974

PLATE 17

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LEGEND

Standard Project Flood

Intermediate Regional Flood

Approximate Ground Line

NOTES

Cross sections through sheet flow areas do not extend to the full width of the flooded areas. See the Flooded Areas plates 6 and 8 for the sheet flow area limits.

Cross sections are viewed in the direction of flow.

All horizontal distances are in feet.

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS

KELSEYVILLE, CALIFORNIA

CROSS SECTIONS

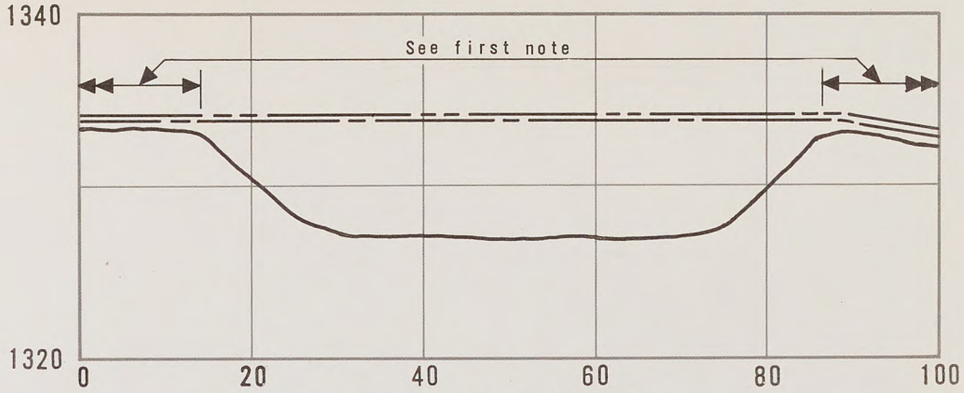
MANNING CREEK

JUNE 1974

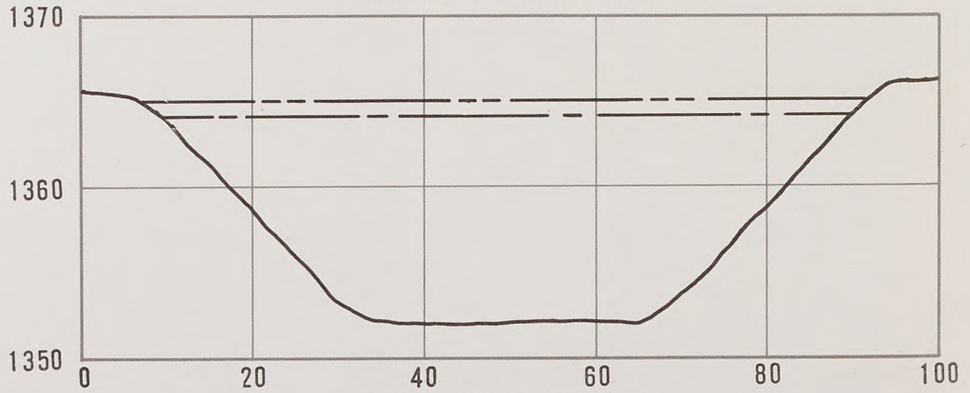
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PLATE 18

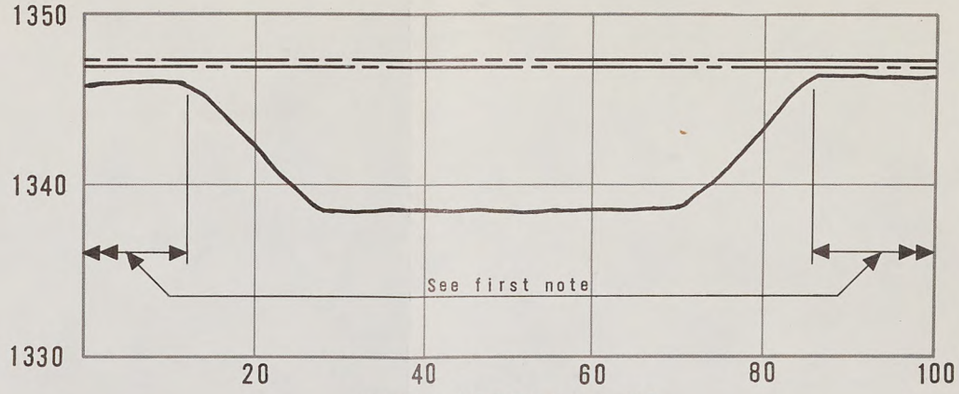
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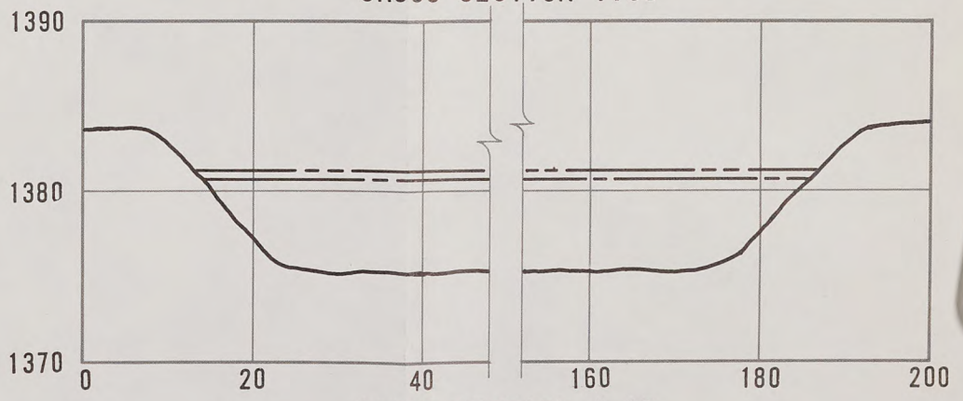
CROSS SECTION 0.80



CROSS SECTION 2.90

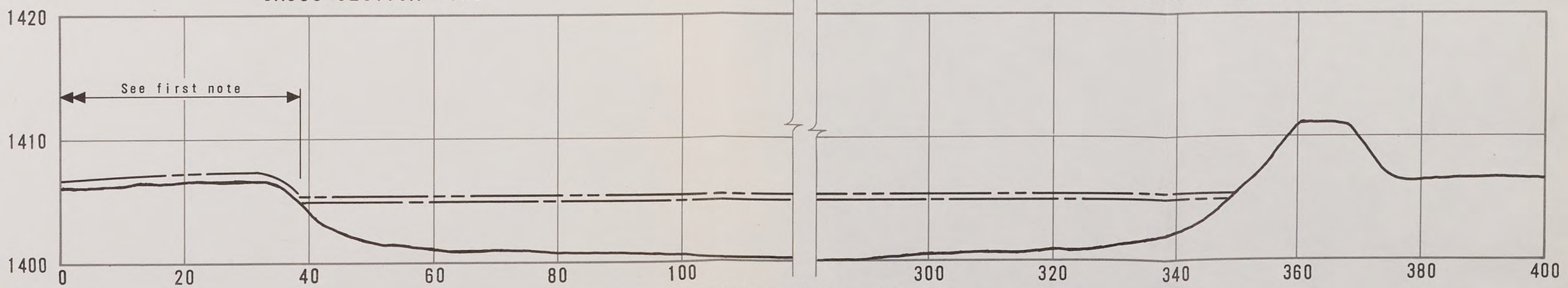


CROSS SECTION 1.80



CROSS SECTION 4.10

ELEVATION IN FEET - MEAN SEA LEVEL DATUM



CROSS SECTION 5.60

LEGEND

- Standard Project Flood
- Intermediate Regional Flood
- Approximate Ground Line

NOTES

Cross sections through sheet flow areas do not extend to the full width of the flooded areas. See the Flooded Areas plates 6, 8, and 10 for the sheet flow area limits.

Cross sections are viewed in the direction of flow.

All horizontal distances are in feet.

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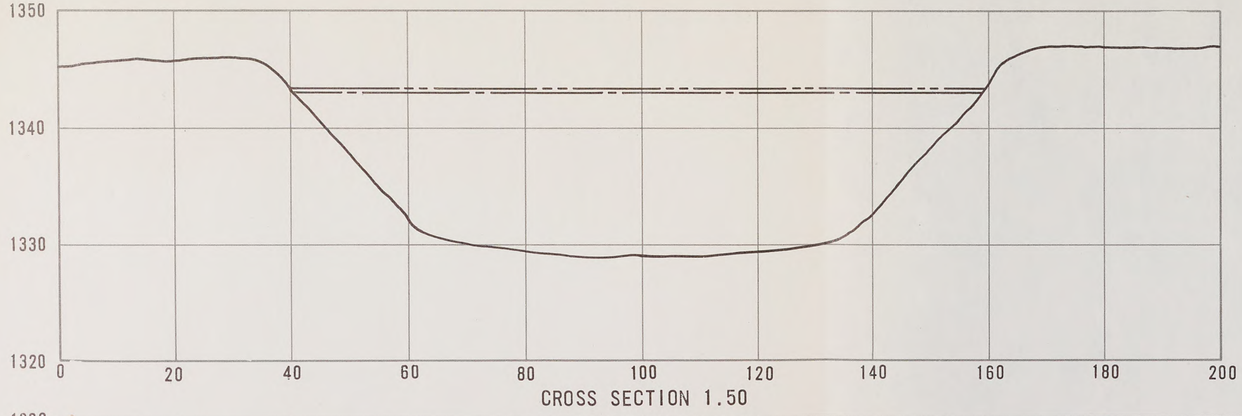
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

CROSS SECTIONS
ADOBE CREEK
JUNE 1974

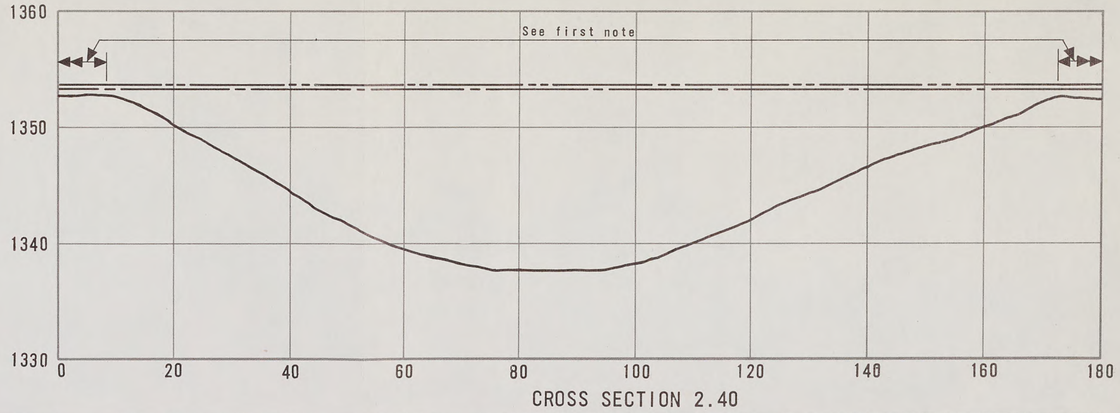
PLATE 19

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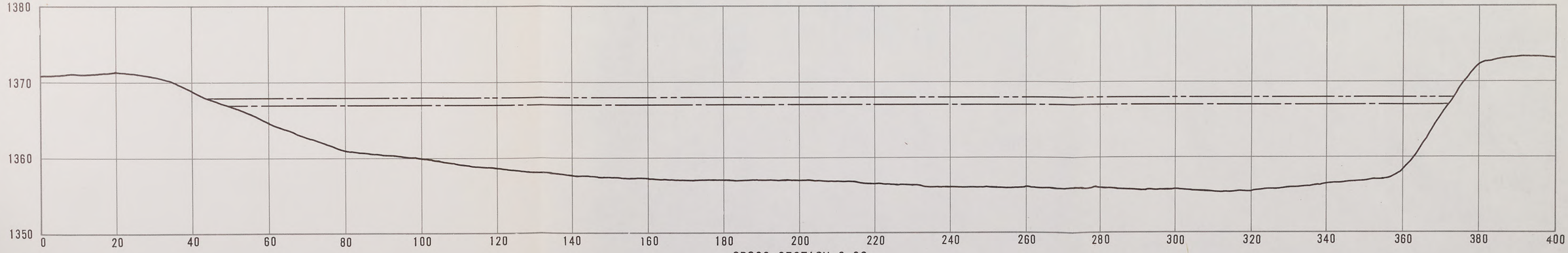


CROSS SECTION 1.50

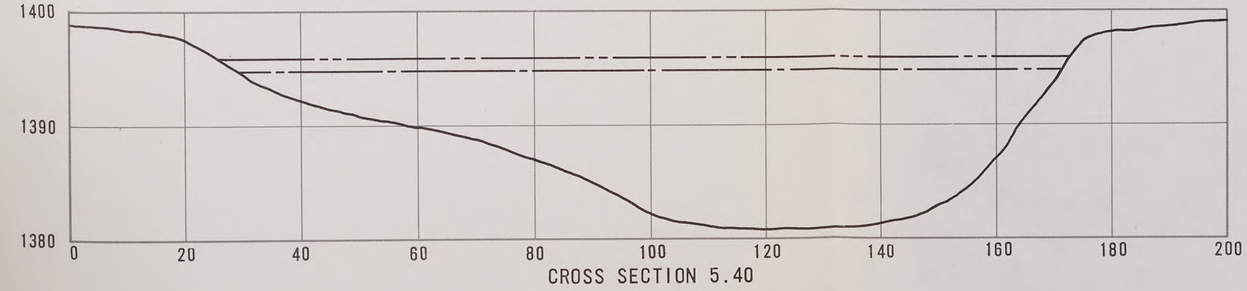


CROSS SECTION 2.40

ELEVATION IN FEET - MEAN SEA LEVEL DATUM



CROSS SECTION 3.80



CROSS SECTION 5.40

LEGEND

- Standard Project Flood
- Intermediate Regional Flood
- Approximate Ground Line

NOTES

Cross sections through sheet flow areas do not extend to the full width of the flooded areas. See the Flooded Areas plate 9 for the Sheet flow area limits.

Cross sections are viewed in the direction of flow.

All horizontal distances are in feet.

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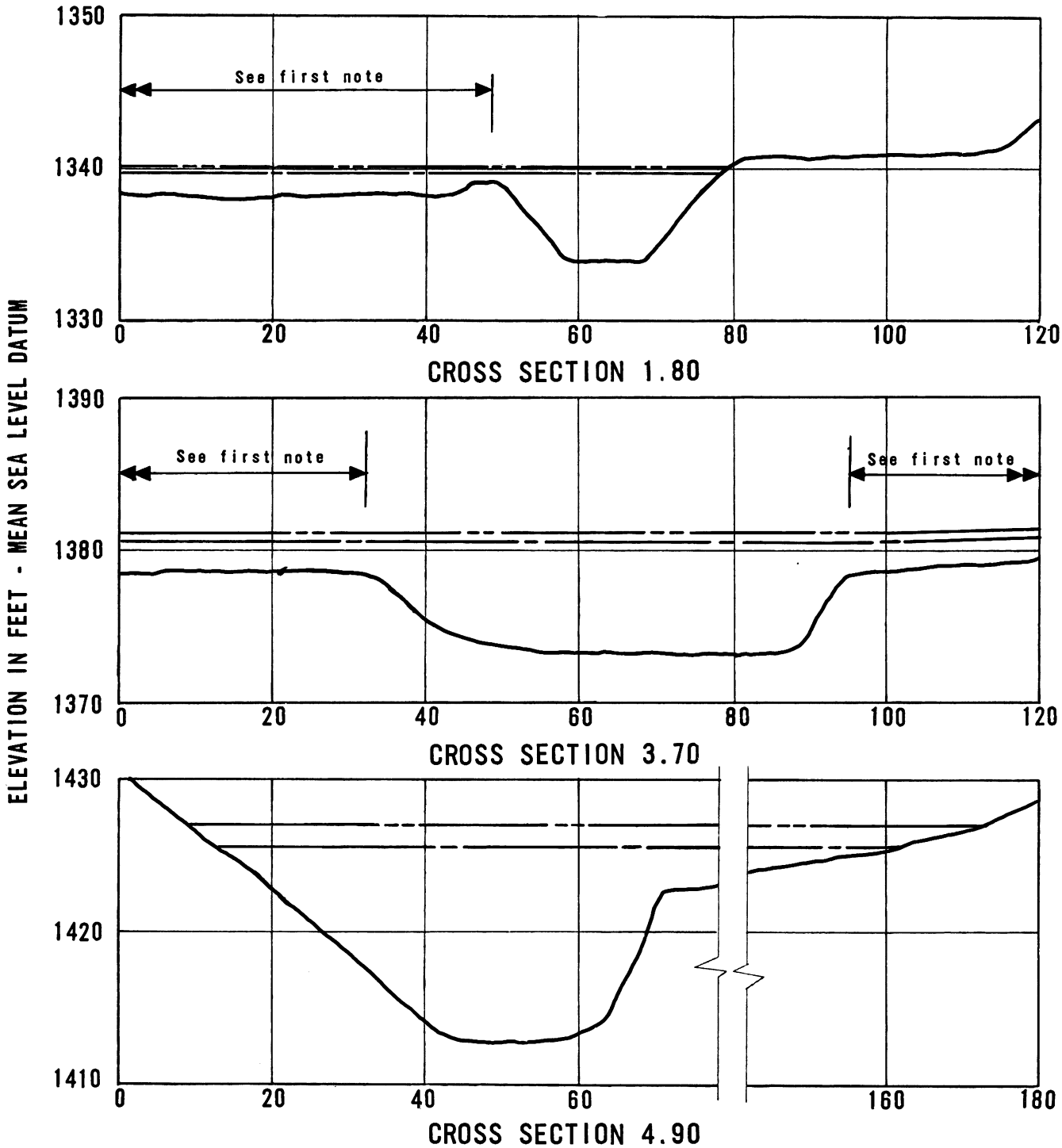
FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

CROSS SECTIONS
KELSEY CREEK
JUNE 1974

PLATE 20

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LEGEND

——— Standard Project Flood

——— Intermediate Regional Flood

——— Approximate Ground Line

NOTES

Cross sections through sheet flow areas do not extend to the full width of the flooded areas. See the Flooded Areas plates 9 and 11 for the sheet flow area limits.

Cross sections are viewed in the direction of flow.

All horzontal distances are in feet.

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FLOOD PLAIN INFORMATION
BIG VALLEY STREAMS
KELSEYVILLE, CALIFORNIA

CROSS SECTIONS

COLE CREEK
JUNE 1974

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PLATE 21

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