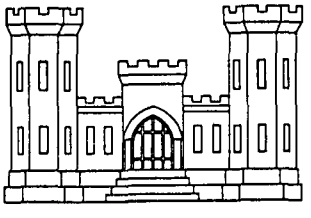
REPORT

ON

FLOODS OF 18 JANUARY 1953

IN

NORTHERN CALIFORNIA COASTAL STREAMS



PREPARED IN THE
OFFICE OF THE DISTRICT ENGINEER
CORPS OF ENGINEERS, U.S.A.
SAN FRANCISCO DISTRICT

JUNE 1953

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I. GENERAL

1. Authority. This report on the floods which occurred in the streams along the north coast of California in the San Francisco District on 18 January 1953 has been prepared in compliance with instructions contained in paragraph 4223.05d pertaining to collection of flood data.

2. Scope. It is intended that this report provide a complete, but brief, account of the January 1953 floods in the San Francisco District, including a general description of the basins, flood characteristics, rainfall associated with the floods, flood emergency activities of the Corps of Engineers, and the hydrologic, hydraulic and damage data collected. Because of the severity of the floods in some of the areas and the extensive damages which they caused, the presentation of the flood data, herein, will be of inestimable value in future flood-control investigations. It is expected that a report on the floods resulting from the January storms in Oregon will be made by the Portland District within whose boundaries that area is located.

3. Description of streams. The storms causing the floods of 18 January 1953 covered about 8,000 square miles of the coastal area of northern California, extending as far south as the lower reaches of the Eel River. The more important of the rivers within this area are Smith River, Klamath River, Redwood Creek, Mad River and Eel River. The locations of these

streams are shown on figure 1, which is a general map of the northern boundaries of the San Francisco District.

4. The above mentioned rivers, and also the minor streams along the north coast of California drain the rugged, mountainous areas of the Coast Range Mountains which rise more than 8,000 feet above the level of the ocean. The streams flow, generally, in deep narrow gorges for most of their course. Occasionally the gorges widen to form valleys of various sizes and importance. Near the mouth, the rivers generally emerge from the mountain regions to meander across relatively flat and wide valleys or debris cones where most of the settlement and other economic developments have taken place. It is these areas, also, which are subject to flooding. Redwood Creek, Mad River and Eel River have drainage basins which are relatively long in comparison to their widths. The Smith River and lower reaches of the Klamath River, have fan-shaped basins which accounts, somewhat, for the greater unit peak flood flows on these two streams than on the other three rivers.

5. Flood characteristics. Because of the steep gradients of the areas of which they drain, the floods on the streams of the Coast Range Mountains in California are characterized by their extremely rapid rise and almost as rapid recession. The time of peaking of the major rivers is about 8 to 18 hours, depending upon the size of the basin, after the start of the initial rise. The time of peaking for the smaller streams is appreciably less than this. Floods are of short duration, with the streams rarely being out of their banks for more than a day. Snow melt is seldom a large contributing factor toward runoff, the flood peaks being the result, primarily, of intense storm rainfall. Because of the rapidity with which flood peaks rise and fall, there is little opportunity

for effecting flood control measures while the flood is in progress. Flood warnings issued by the U. S. Weather Bureau have been effective in keeping the loss of livestock and equipment to a minimum.

6. Existing flood control works. There were no flood control works on any of the rivers included in this report which were constructed by the Corps of Engineers prior to the floods of 18 January 1953. Subsequently, emergency bank-protection measures were accomplished by the San Francisco District along about 2,000 feet of the left bank of Redwood Creek at Orick to protect the approaches to the bridge on Highway U. S. 101 from possible failure. Local interests have from time to time, undertaken measures of limited extent, such as bank-stabilization works and levees, but in most instances the works are widely scattered and have not been effective because of failure or destruction during floods.

II. DESCRIPTION OF FLOODS OF 18 JANUARY 1953

7. Antecedent weather conditions. The month of December 1952 was relatively wet, with a series of four storms occurring over the northern California area. At Crescent City, measurable amounts of precipitation were recorded on 28 days during the month. The total precipitation for the month varied from 130 to 250 percent of the average December amounts at the U. S. Weather Bureau stations. Minor floods occurred on the streams in the area as a result of the rains.

8. Only a small amount of rain fell during the first several days of January 1953. A storm between 6 and 9 January, however, deposited 2.71 inches at Crescent City; 1.90 inches at Eureka; 4.10 inches at Klamath and 3.03 inches at Orleans. This was followed by another storm of 11 to 15 January in which the following amounts were recorded at the U. S. Weather Bureau stations:

a.	Crescent City	5.18 inches
b.	Eureka	2.28 inches
c.	Klamath	5.48 inches
d.	Orleans	3.61 inches

9. Storm associated with floods of 18 January 1953. Following upon the heels of the above earlier storms, was the storm of 16 to 20 January which was responsible for the record floods on the many rivers and tributaries along the coast of northern California. On the morning of 16 January, a low pressure area extended from Montana west to the Aleutian low containing a complex frontal system of waves centered in secondary lows about 25 degrees of longitude apart. The warm front of one of these waves extended into northern California causing rainfall north of Fort Bragg. A high pressure area centered about 700 miles southwest of San Francisco extended into central California. A steep gradient had developed between the center of the high pressure and the secondary low pressure centered off the Washington coast, thereby causing a high velocity flow of moist maritime tropical air in the warm sector. The ridge through central California weakened sufficiently during 17 and 18 January to allow the southwest flow in the warm sectors of these waves to strike the California coastal region north of Fort Bragg and the southwest coastal region of Oregon. This condition remained practically static to 19 January when the ridge of high pressure over the central portion of California began moving north. The isobaric pattern over the Pacific Ocean began shifting so that by 20 January maritime polar air was again flowing over the area. Thus for the period between 16 and 19 January an isobaric pattern existed which approached maximum flood-producing rainfall

conditions.

10. The rainfall which was recorded during the storm, particularly for 17 and 18 January, was quite intense. The heaviest rain fell between about 4 a.m. on 17 January and 7 p.m. on 18 January. The greatest 24-hour amount, 9.82 inches, was recorded at Klamath. The rainfall diminished rapidly to the south, however, with Covelo, in the Eel River basin, recording a 24-hour maximum of 2.38 inches. A summary of the rainfall of 16 to 20 January for selected U. S. Weather Bureau rainfall stations is given in table 1.

Table 1. Rainfall at Selected Stations, Storm of 16-20 January 1953

Station	River Basin	Rainfall in inches on date shown					
		16	17	18	19	20	Total
Brookings, Ore.	Chotco	3.25	6.19	3.36	1.34	1.33	15.47
Kerby, Ore.	Illinois	2.65	2.28	3.34	1.93	1.25	11.45
Crescent City	Coastal	2.00	6.68	4.74	0.76	3.05	17.23
Elk Valley	Smith	3.10	4.64	6.20	1.46	2.71	18.11
Happy Camp Ranger Sta.	Klamath	1.43	3.96	2.82	1.82	0.82	10.85
Klamath	Klamath	4.18	9.82	4.03	2.25	1.00	21.28
Orleans	Klamath	1.22	4.20	3.57	1.22	1.33	11.54
Cecilville Sawyer Ranch	Salmon	0.40	2.98	5.14	0.70	1.50	10.72
Eureka	Coastal	0.92	3.70	1.84	0.38	0.51	7.35
China Flat	Trinity	1.21	3.32	3.83	0.50	0.98	9.84
Mad River Ranger Sta.	Mad	0.10	2.00	4.10	1.09	1.17	8.46
Weaverville Ranger Sta.	Trinity	0	1.71	2.46	0.65	1.05	5.87
Covelo, Eel River Ranger Sta.	Eel	0.11	2.38	0.95	0.21	0.79	4.43

The mass curves of the recording rainfall gages in the area are shown on figure 2. An isohyetal map of the storm is shown on figure 3. The isohyetals are based on rainfall data listed in table 2 which were obtained from a canvass of private records, in addition to the records at the regular U. S. Weather stations.

Table 2. Rainfall Data for Storm of 16-20 January 1953 Obtained from Canvass of Storm Area

Station	Super-vision	Rainfall in inches on date shown					
		16	17	18	19	20	Total
Betts Ranch	S.C.S.			2.00		0.50	2.50
Blue Lake-Guest	Pvt.	0.25	1.81	4.88	1.75	0.81	9.50
Blue Lake- Pon Ranch	Pvt.	1.71	6.20	7.00	1.05	1.47	17.43
Blue Lake- Preston Ranch	Pvt.	1.60	6.90	7.53	1.07	1.25	18.35
Burnt Ranch-Honor Camp #36	DHSC	1.21	3.61	0.80	0.64	0.15	6.41
Burnt Ranch-Kaut	Pvt.	1.32	1.52	1.85	0.87	1.30	6.86
Carlotta-Cummings Cr Camp	Pvt.	1.10	4.95	0.76	0.89	0.28	7.98
Carlotta- Grizzly Camp	Pvt.	1.22	*	6.39	0.72	0.34	8.67
Cold Creek-Sq. Deal Garage	D/ACE		0.88	1.22		0.64	2.74
Crannell Camp	Pvt.		2.61	7.62	*	4.41	14.64
Crannell-Demo	Pvt.	6.35	5.15	0.70	1.38	0.20	13.78
Crescent City-McClendon	Pvt.	2.63	6.16	9.02	1.02	4.19	23.02
Crescent City-Thompson	Pvt.	0.70	4.50	9.00	2.40	4.30	20.90
Ettersburg-Paradise View Ranch	Pvt.		2.30	5.00	1.50	2.30	11.10
Fort Dick-Crosbie	Pvt.	4.05	5.96	2.15	4.08	0.46	16.70
Fort Dick-Randall	Pvt.	*	*	*	*	*	16.02
Gasquet- Patrick Cr.Lodge	Pvt.	4.34	6.50	2.30	4.08	0.90	18.12
Gazelle	Pvt.		*	*	1.26	0.15	1.41
Hamburg-Jackson	Pvt.	*	*	3.94	*	0.94	4.88
Idlewild	DHSC	3.60	6.92	2.30	3.40	0.90	17.12
Korbel Morrison	Pvt.	1.30	5.05	4.18	0.50	0.80	11.83
Oak Knoll R. S.	USFS	0.05	0.84	2.07	0.93	0.88	4.77
Orick- Davison	Pvt.	1.80	4.90	5.10	1.10	1.50	14.40
Orick, near-Dutton	Pvt.	0.30	2.88	6.45	1.91	2.40	13.94
Orleans, near-Gephart	Pvt.	1.98	4.50	4.98	1.14	1.91	14.51
Patricks Point State Park	DPBSC	2.45	6.80	1.35	2.35	0.30	13.25
Potter Valley-Magruder Rn	D/ACE		0.52	1.90	0.69	0.74	3.85
Potter Valley-Near Rn	D/ACE		1.91	0.89	0.22	0.66	3.68
Seiad Valley-Wilkins	Pvt.	0.50	2.00	3.80	0.90	1.60	8.80
Smith River-Hooker	Pvt.	4.74	10.10	1.91	4.41	0.66	21.82
Smith River-Layman	Pvt.	0.80	4.20	8.50	2.20	3.65	19.35
Smith River- Zacher	Pvt.	0.50	4.20	7.80	2.20	4.00	18.70
Trinidad-Big Lagoon Camp	Pvt.	0.25	2.85	6.13	1.46	2.56	13.25
Trinidad-Spruce Cove	Pvt.	0.43	3.04	6.74	1.28	2.35	13.84
Zenia-Burgess	Pvt.	0.20	2.63	1.92	1.50	1.20	7.45

* - Amount included in following measurement
D/ACE - Department of the Army, Corps of Engineers
DHSC - Division of Highways, State of California
DPBSC - Department of Parks and Beaches, State of California
SCS - Soil Conservation Service
USFC - United States Forest Service
Pvt. - Private Individual or Company
Note: Quality of Data Varies

11. Comparison with other storms. There is a scarcity of rainfall data on earlier storms along the north coast area of California. Even for storms of more recent occurrence the records are considered to be inadequate upon which to base a detailed analysis, particularly when the nature of the rugged and varied topography with its orographic effects is recognized. From the data available, however, the storms of February 1915, February 1927, October 1950 and January 1953 were the largest which have occurred in the area since 1900. The two earlier storms were of greater areal extent over the eastern portion of the Coast Range mountains, whereas the October 1950 and January 1953 were of higher intensities in areas adjacent to the coast. The latter two storms are comparable with regards to total storm magnitude. The October 1950 storm covered a somewhat greater area to the south and was of somewhat larger magnitude over inland areas. The January 1953 storm was concentrated more heavily along the coast.

12. Flood magnitudes. As indicated in the previous paragraphs, a series of storms in December 1952 and January 1953 preceded the intense rains responsible for the floods of 18 January. These antecedent storms thoroughly saturated the ground so that resulting conditions were very favorable to runoff. It is believed that loss rates were near the minimum ordinarily adopted for analysis of design floods such as the standard project or maximum probable flood. In an analysis made for the flood on Mad River, loss rates during the critical storm period were estimated to be about 0.02 inch per hour. Rainfall intensities were relatively uniform, averaging about 0.4 inch per hour for an 8-hour period during the peak-producing part of the storm.

13. Discharge hydrographs based on preliminary estimates for the

flood of 18 January 1953 for the Smith, Klamath, Mad, and Van Duzen (tributary to the Eel) Rivers are shown on figure 4. Similar data are not available for Redwood Creek, where only miscellaneous stage and discharges are presently being obtained. The results of the rainfall analysis for Mad River, made in connection with another study, have also been indicated on figure 4. As seen from the hydrographs, the time of peak concentration is very short. Thus the Mad River rose from a flow of about 13,000 cubic feet per second to a peak flow of 75,000 cubic feet per second in a matter of about 14 hours. The rain falling on 18 January resulted in prolonging the high flow in the river. The rapidity with which the streams attain their peaks preclude taking extensive flood control measures for alleviation of damages when the flood is already in progress. Whatever measures are taken have to be accomplished in a relatively short period of time. Data to the extent available on the magnitudes of 18 January 1953 in the north coast of California and comparisons with previous historical floods are summarized in table 3.

Table 3. Summary of Flood Magnitudes

River or Tributary	Location	Drainage Area (sq.mi.)	18 Jan 1953 Discharge (c.f.s.)	18 Jan 1953 Stage (feet)	Previous Historical Flood Discharge (c.f.s.)	Previous Historical Flood Stage (feet)	Previous Historical Flood Date
Smith River	Crescent City (nr.)	613	139,200	38.0	152,000	39.5	29 Oct '50
Klamath River	Klamath (nr.)	12,000	280,000	43.8	197,000	34.0	2 Feb '52
Klamath River	Somesbar	8,480	137,000	49.7	———	50.8	21 Feb '27
Trinity River	Hoopa (nr.)	2,840	98,000	27.3	124,000	31.2	28 Feb '40
S. Fork Trinity River	Salyer (nr.)	920	36,000	27.4	34,700	27.3	2 Feb '52
Salmon River	Somesbar	737	41,000	19.3	29,900	15.8	28 Dec '45
Scott River	Fort Jones (nr.)	656	12,300	15.1	8,320	12.1	2 Feb '52
Redwood Creek	Orick	263	45,000	21.5	37,000	20.0	18 Jan '50
Mad River	Arcata (nr.)	485	75,000	26.2	43,300	19.5	2 Feb '52
Eel River	Fernbridge	———	———	21.0	———	29.8	11 Dec '37
Eel River	Scotia	3,070	156,000	37.0	345,000	55.1	11 Dec '37
Van Duzen River	Bridgeville (nr.)	214	20,500	17.3	20,000	—	28 Oct '50

The discharge data for 1952 and 1953 are based on preliminary estimates by the U. S. Geological Survey.

14. The January 1953 flood on Smith River approached the magnitude of the October 1950 flood, which, according to accounts by local residents, was the highest in their memory. The January 1953 flood, however, resulted in greater damages than that of the flood of earlier date. The estimated runoff above base flow was 512,000 acre feet. The average annual runoff is 2,567,000 acre feet. The increase was due, apparently, to the greater losses sustained by the saw mills, two of which were constructed subsequent to the October 1950 flood.

15. On the Klamath River, the greatest contribution to the flood peaks came from the lower tributaries such as the South Fork of the Trinity River and Salmon River. The estimated runoff above base flow at the gaging station near Klamath was 1,396,000 acre feet. Annual runoff is 12,670,000 acre feet. The incremental peak flow on the main stream between Somesbar and Klamath was 143,000 cubic feet per second for a drainage area of 3,520 square miles as compared with 137,000 cubic feet per second for a drainage area of 8,480 square miles above Somesbar. It is probable that about 20 to 25 percent of this latter peak flow came from the Salmon River, which drains an area 737 square miles, or about 9 percent of the basin above Somesbar. Appreciable inflow from the many small tributaries entering the main channel downstream from the gaging station near Klamath may well have resulted in increasing the peak on the Klamath River at its mouth to more than 300,000 cubic feet per second. Although the peak of the January 1953 flood was exceeded by that of February 1927 at Somesbar, indications are that the downstream inflow was appreciably greater during the more recent flood, thereby

establishing the January 1953 flood on the lower Klamath River as the maximum of recent record.

16. The records on Mad River cover only a relatively few years, 1910 to 1913 and 1950 to date. According to reports of individuals who have resided in the area for many years, the January 1953 flood on Mad River, with its peak of 75,000 cubic feet per second, was undoubtedly the highest in their memory. The runoff above base flow was 223,000 acre feet. The estimated annual runoff, based on correlation with other basins, is 920,000 acre feet. The damage by far exceeded those of any previous known flood, which was partly due to the developments which have taken place in recent years.

17. The flood on Redwood Creek was also the highest at Orick in the the memory of local residents. The estimated peak discharge, based on a miscellaneous measurement made subsequent to the peak flow, was 45,000 cubic feet per second.

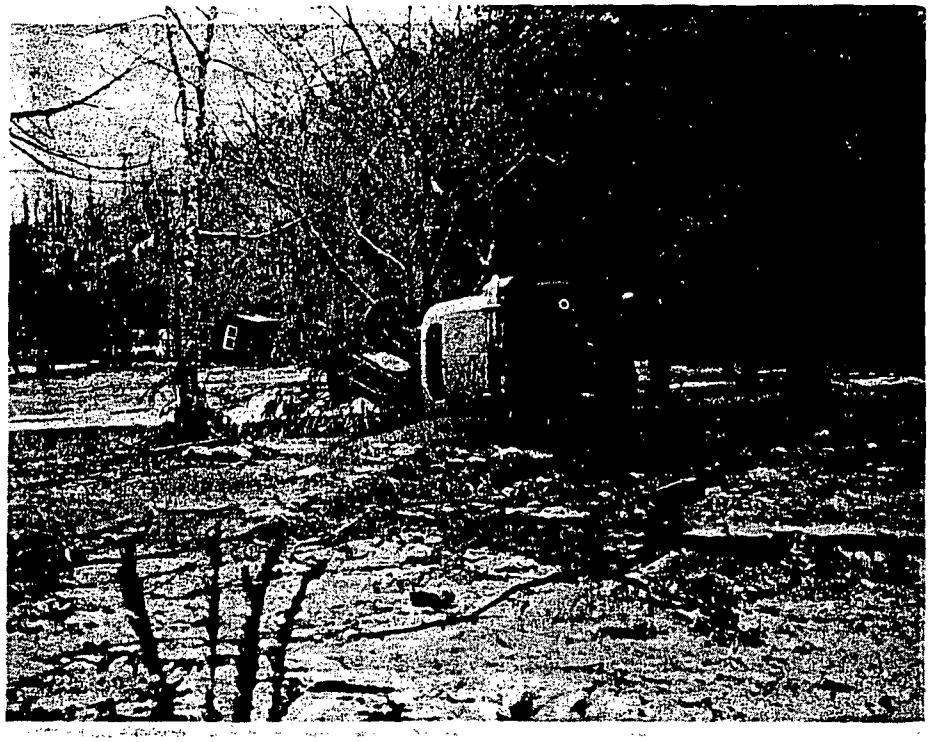
18. Only the northern, or lower, tributaries on the Eel River experienced floods of relatively high magnitudes. To the south, the storm decreased rapidly so that minor rises, only, occurred on the tributaries of the remainder of the Eel River basin. Floods in the lower reaches of Van Duzen River and on its tributaries such as Yager Creek, were exceptionally high. Significant flooding occurred in the vicinity of Fortuna as the result of excessive runoff from two small creeks.

19. High stages occurred on the many small streams and tributaries along the north coast of California north of Eel River as evidenced by the destruction of roads, bridges and other improvements in the path of the flood. Data on stages or discharges for these streams, however, are

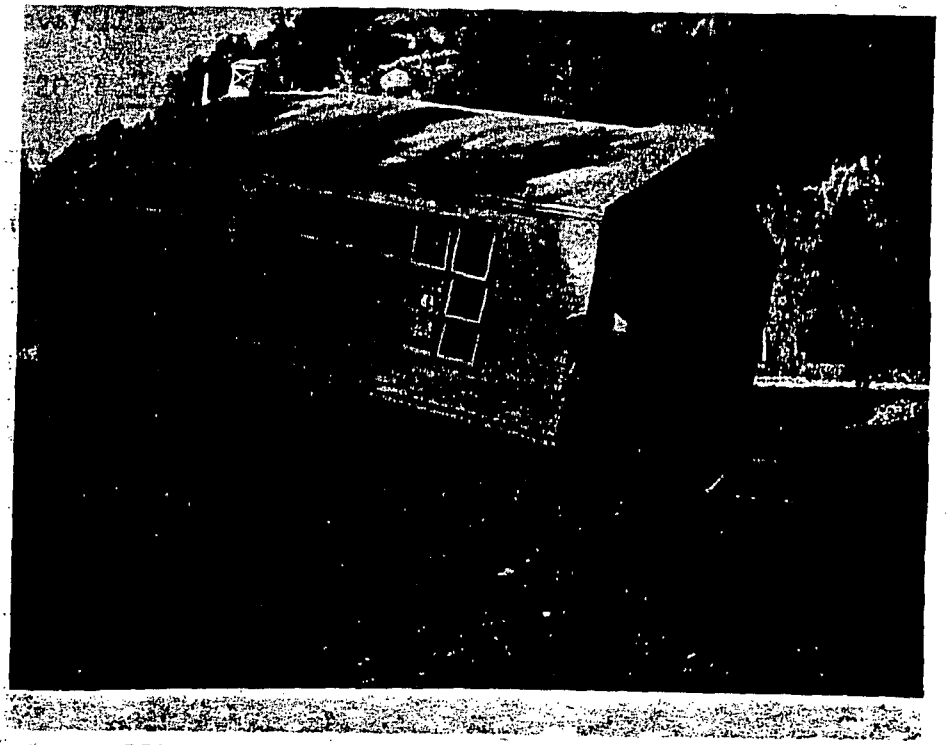
not available.

20. Local conditions created by the floods. The northern California storms of 16 to 20 January 1953, with the attendent floods of high magnitudes, caused widespread destruction to communities, agricultural lands, industrial areas, highways, roads, and bridges. A total of seven persons lost their lives, either directly or indirectly, because of the storm and floods. The resultant damages on many of the streams far exceeded those of any previously known flood. Klamath Glen (estimated population 300) and Klamath (population 1342) on the lower reaches of the Klamath River and Orick (estimated population 800) on Redwood Creek were the communities which were the hardest hit by the floods, being inundated to depths of about 4 feet and more. The destruction of homes, buildings and industrial establishments approached catastrophic proportions. Most of the residents were forced to evacuate during the height of the flood. Water supplies became contaminated and health warnings were issued that all water for human consumption should be boiled. The sanitary disposal systems were rendered inoperative. Other communities which suffered heavy losses due to floods on minor tributaries or streams were Crescent City, Hydesville and Fortuna. Approximately 100 persons were evacuated from the bottomlands of the Van Duzen River at Hydesville, and about 50 persons from the low lying lands of the Mad River at Blue Lake. Because of the short concentration of time of the flood peaks, evacuation had to be accomplished with but little advance warning of impending flood danger. A large number of the evacuees found shelter at numerous logging camps which were made available to them. Others sought refuge with relatives or friends. In general, evacuation was accomplished by the communities themselves without appreciable assistance from outside

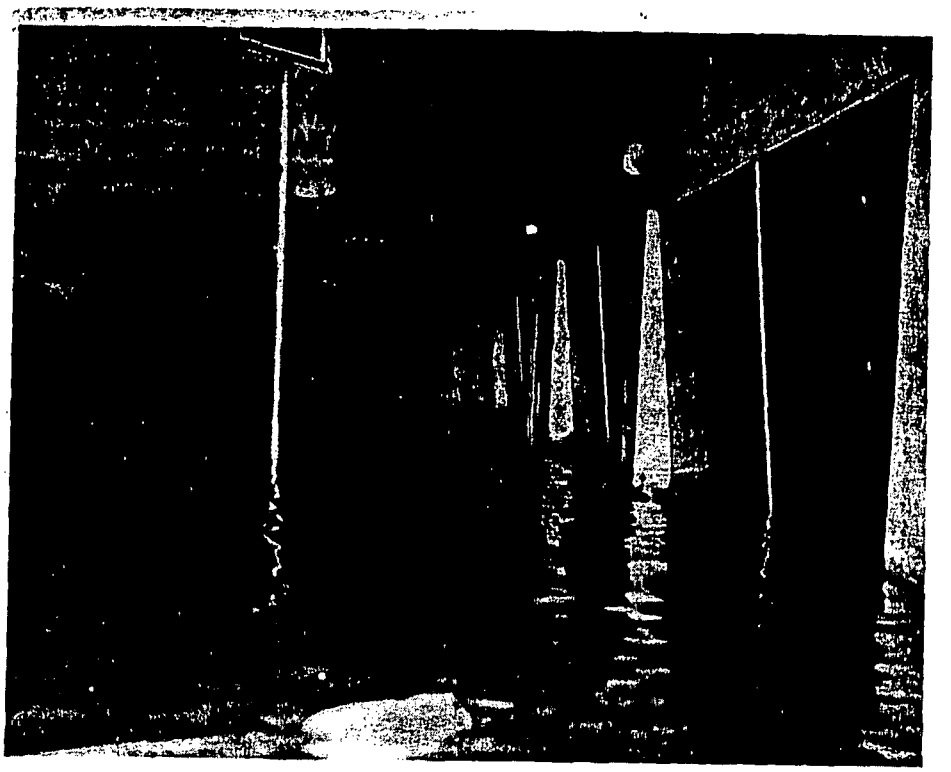
KLAMATH GLEN, CALIFORNIA SHOWING ONE OF SEVERAL HOMES DESTROYED BY OVERFLOW OF KLAMATH RIVER.



KLAMATH GLEN, CALIFORNIA, SHOWING AUTOMOBILES WASHED DOWNSTREAM BY OVERFLOW OF KLAMATH RIVER.



PECWAN SCHOOL, PECWAN, CALIFORNIA, DESTROYED BY OVERFLOW OF PECWAN CREEK.



FORTUNA, CALIFORNIA, SHOWING INUNDATION FROM RHONER CREEK.

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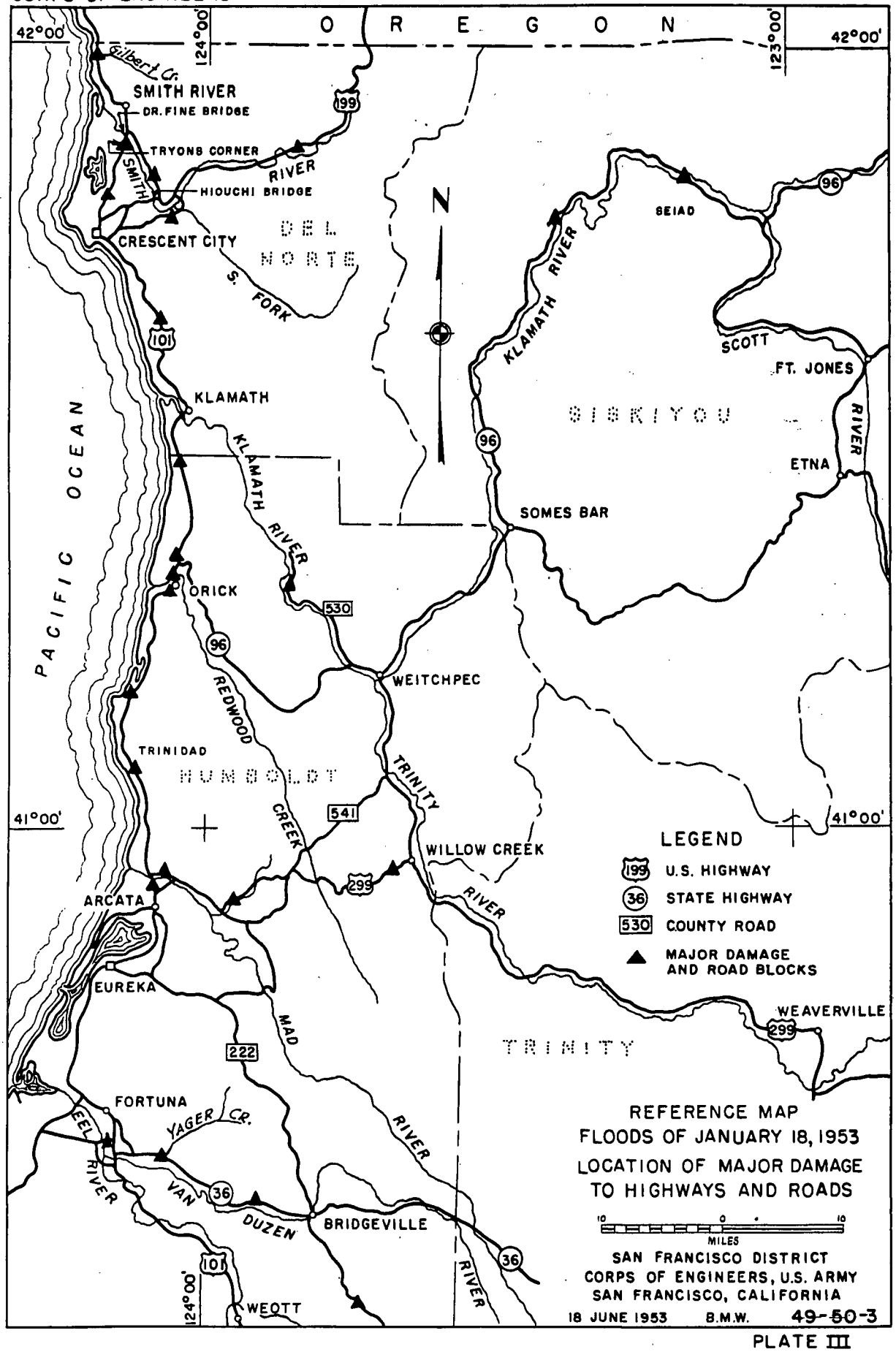


PLATE III

sources. Nearly the entire coastal population north of Eureka was affected, either directly or indirectly, by the storm and floods. A State of Emergency was declared by the Humboldt County Board of Supervisors on 19 January, thus placing the emergency activities in the hands of the Civil Defense Unit.

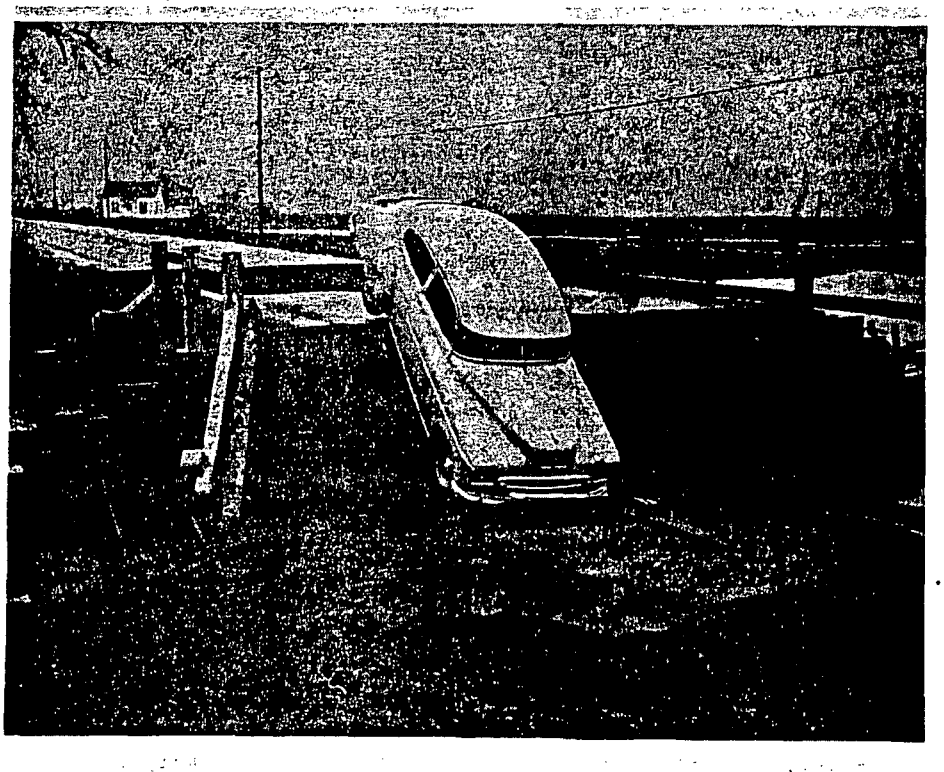
21. Highways 101 and 199 to southern Oregon and U. S. 299 to Sacramento River Valley suffered heavy damages due to slides, washouts and bridge failures. Highway U. S. 101 between Eureka and Crescent City was closed to traffic for about three days and restricted to intermittent light traffic for about five more days. A bridge failure at the Oregon border also crippled traffic for several days. Because of the wet condition of the soil, the highway crews experienced difficulty in repairing the reaches of the highway where slides had occurred. At some sections it was necessary to maintain crews constantly because slides would continue even after the repairs had been made. The south approach to the bridge over Redwood Creek at Orick was in danger of failure due to excessive sloughing of the left bank of Redwood Creek. As an emergency measure, the San Francisco District in cooperation with local interests, stabilized about 2,000 feet of the bank with riprap. The funds were made available under Section 14 of the 1946 Flood Control Act. Secondary roads were closed to traffic and several communities were completely isolated. Logging roads were washed out or closed by slides, paralyzing the important lumber industry of northern California. Service on the Northwestern Pacific Railroad north of Scotia was stopped and communication lines in the area were disrupted. A railroad bridge over Yager Creek near Carlotta collapsed when the pile bents supporting the structure gave way due to the debris jam against the piles.

22. A number of lumber mills were severely damaged and stored cut lumber and logs were lost due to inundation and to collapse of structures through erosion of the river banks. Two of the greatest losses to lumber mills occurred at Klamath and at Blue Lake.

23. The principal damages to agriculture were loss of land due to bank cutting and river meandering, and to deposition of sand, gravel and to debris on cultivated lands. Local flood protection works, such as levees and bank stabilization works, were partially destroyed or failed. Loss of cattle and other livestock was held to a minimum because of timely flood warnings issued by the U. S. Weather Bureau offices at Eureka, California, and Medford, Oregon. Also because of the frequency with which shallow flooding of agricultural lands occurs due to minor rises in the rivers, the farmers have learned to cope with the adverse conditions. At signs of unusual rainfall, they will seek shelter for their cattle either on high ground or in barns or other buildings which have been constructed of sufficient height above the ground so that waters of ordinary floods do not reach the floors of the buildings.

24. Loss of life. Mentioned previously was the fact that the storms and floods were responsible for the direct and indirect loss of life of seven persons. Three members of a railroad crew met their death when the locomotive in which they were riding was hurtled into the swollen flood waters of the Eel River near Scotia by a landslide. Two other men lost their lives when similar slides carried their cars into the ravaging flood waters. One of these tragedies occurred near Klamath Glen on the Klamath River and the other near Blue Lake on the Mad River. Two deaths occurred at Orick. One of these was due to a heart attack believed to have been brought on by over-exertion of loading goods into an automobile

ORICK, CALIFORNIA. SHOWING DESTRUCTION TO HIGHWAY BY OVERFLOW OF REDWOOD CREEK.



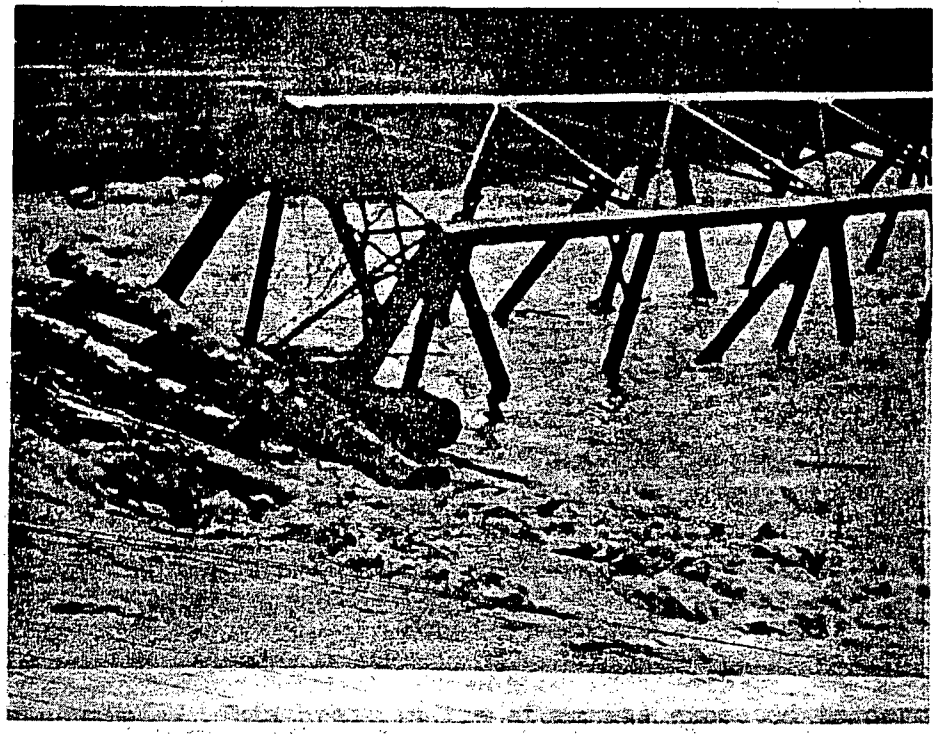
HIGHWAY 101, NORTH OF ARCATA, SHOWING FAILURE OF FILL ON BOTH SIDES OF CULVERT BY OVERFLOW OF MAD RIVER.

GRIZZLY CREEK, CALIFORNIA. STREAM UNDERMINED HUGE REDWOOD TREE WHICH FELL ACROSS BRIDGE DESTROYING RAIL, DECK AND DOWNSTREAM GIRDER.

HIGHWAY 101 AT DEL NORTE, HUMBOLDT COUNTY LINE. ROADWAY SUBSEQUENTLY SLIPPED OUT ENTIRELY, CUTTING OFF TRAVEL ON THIS MAIN HIGHWAY BETWEEN EUREKA AND CRESENT CITY.

PLATE V

KLAMATH, CALIFORNIA. EROSION OF BANK SLID MILL AND STORAGE YARD INTO RIVER: NOTE CUT LUMBER FLOATING AWAY



EEL RIVER BASIN. RAILROAD BRIDGE OVER YAGER CREEK WASHED DOWNSTREAM.

SOIL EROSION AT MOUTH OF KLAMATH RIVER

FAILURE OF BANK PROTECTION WORKS SCOTT VALLEY, CALIFORNIA

in an attempt to evacuate from the flood area. The second loss of life occurred when a man was swept away by flood waters while trying to cross the flooded street. The two deaths at Orick may be attributed to the flood. The other deaths are considered to be the result of the storm rather than of the subsequent floods.

25. Activities of the Corps of Engineers. The first evidence that floods in the watershed areas along the north coast of California might develop came with the receipt in the afternoon of 17 January of the quantitative forecast for the 24-hour period ending 8:00 a.m. on 18 January. The predictions were that heavy rains north of Point Arena could be expected during the next 24 hours. Rains averaging 3 inches were forecast during the next 48-hour period. This amount was not considered unusual, and, on the basis of conditions experienced from the previous storms of December and January, it was not expected that floods would reach any exceptionally high peaks. However, personnel of the Hydraulic Division of the Flood Emergency Organization of the District Office were immediately alerted and advised to stand by for further developments. The Chief, Engineering Division and the Executive Officer were then advised of the potential flood conditions, and were kept informed as information was received. Personnel of the South Pacific Division were also contacted and informed of the conditions. Contact was made by late afternoon with the U. S. Weather Bureau offices at San Francisco, Eureka and Medford. The information received was very sketchy, with reports indicating that some of the streams would exceed flood stages. The rainfall was expected to let up for a while and then continue. This break in the storm was expected to permit the streams to drop before the advent of the later rains. Flood warnings

had been issued by the U. S. Weather Bureau for the Smith River. The Smith River and other coastal streams experience frequent minor flooding and thus flood warnings in themselves are not unusual. Thus on two previous occasions during the current flood season the bottomlands in the Eel River Delta had been inundated. Office personnel had been sent to the area for a reconnaissance of conditions resulting from the earlier floods. Also quite large travel distances are involved--about 275 miles from San Francisco to the lower reaches of Eel River and about 375 miles from San Francisco to Smith River over roads which are not always passable during storm conditions. Because of the recent visit to the storm area, it was thought advisable to hold up dispatching observers to the flood scene and taking other emergency measures until more definite information on flood conditions was received. A 24-hour schedule, however, was set up for receiving and furnishing data on the development of flood conditions.

26. Shortly after midnight a message received via short-wave radio was relayed to the District Office that the Klamath River was rising rapidly and was flooding a construction site of a military establishment, with water about 5 feet over the highway. This was the first indication that the current floods might reach high magnitudes of discharge. At 6:00 a.m. the U. S. Weather Bureau at Eureka reported to the Staff Assistant Alternate, Hydraulic Division, that apparently the Eel River was not out of its banks, but that north of Eureka the rivers were at high stages. The rains had not let up as previously predicted but had continued throughout the previous afternoon, with additional heavy rains expected on 18 January. Because of the badly disrupted communications by this time no definite information was immediately available on actual

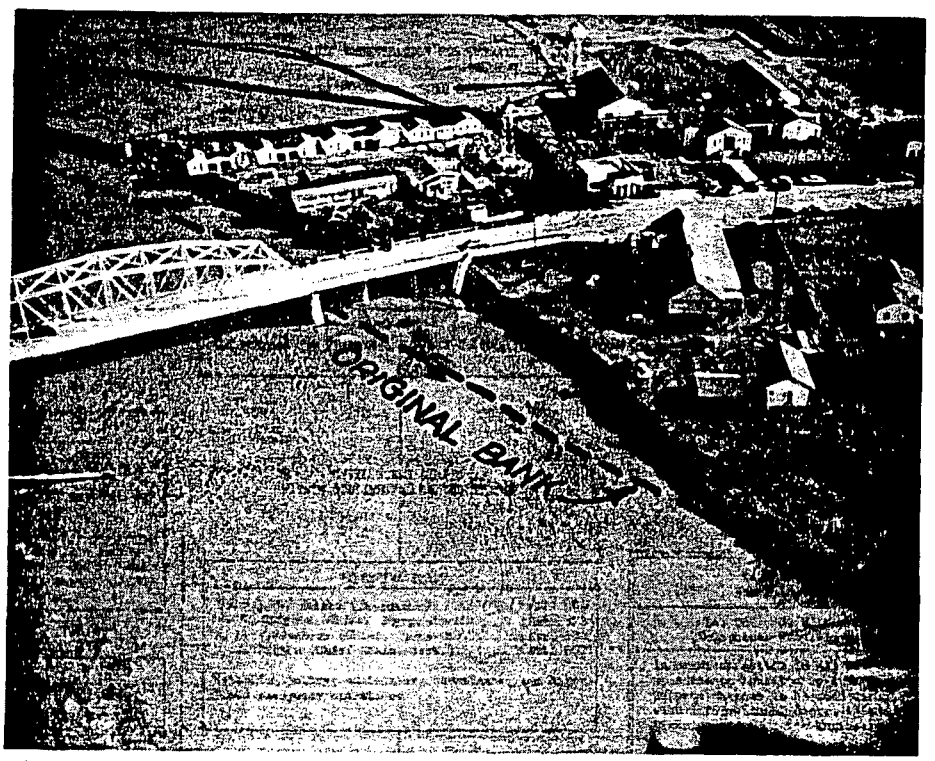
conditions north of Eureka. Immediate steps were then taken to dispatch a party of two engineers to the flood area for purposes of obtaining a first-hand report on conditions. The Flood Fighting Division then went into operation, with key flood fighting and radio communication personnel being dispatched to the critical areas. Mobile radio units were sent to establish communication centers at Fields Landing near Eureka and at Crescent City. In addition a portable short wave radio unit was placed in operation for on-the-scene reporting to the main stations for relaying to the District Office. First contact was made by the units with the office at San Francisco by mid-afternoon of the following day. Radio contact was maintained on a 24-hour schedule during the emergency. The Control Center was activated at about 2 p.m. on 18 January. The Executive Officer, in the absence of the District Engineer, and personnel of the Flood Fighting and Hydraulic Divisions left for Eureka by private plane on the afternoon of 19 January, and immediately upon their arrival contacted local agencies and persons for information relative to the flood conditions. The District Engineer, after a hurried trip, arrived in the stricken area on the afternoon of 20 January, accompanied by the Staff Assistant, Flood Fighting Division, and other District personnel and took immediate personal charge of the field activities of the Corps of Engineers. Parties were dispatched to the several sub-areas into which the stricken area was divided for full report on conditions. Conferences were held with local authorities and agencies, such as the Humboldt County Board of Supervisors and the Regional Civil Defense Coordinator, in an effort to determine the assistance which the Corps of Engineers could give.

27. Two helicopters, which were delayed by bad weather, arrived from Sixth Army by Wednesday 21 January. The helicopters were used to make a

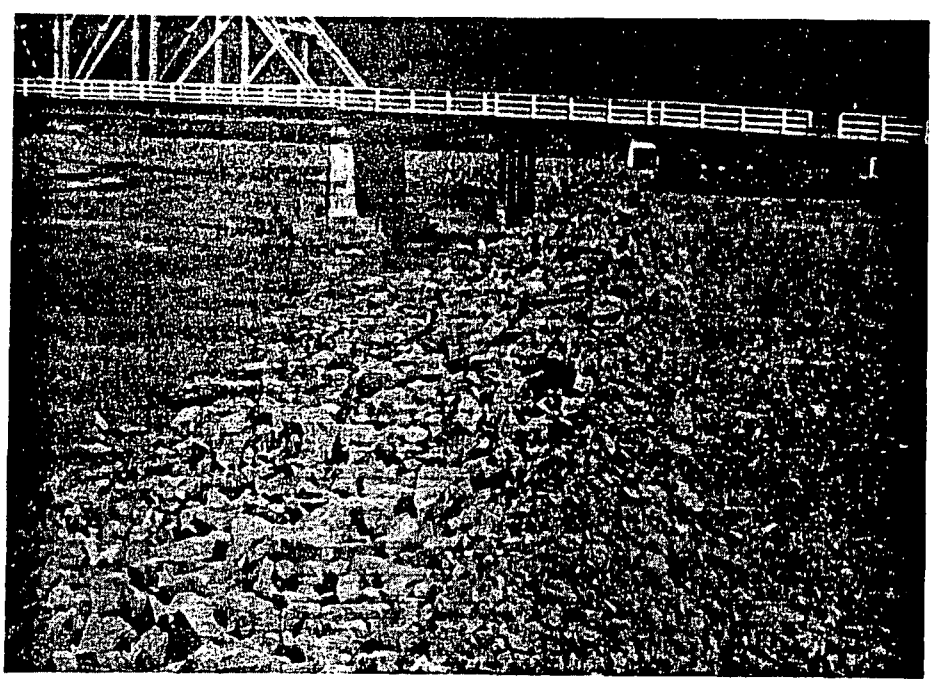
reconnaissance of stricken areas inaccessable by other means of transportation, and to drop food parcels to persons isolated by flood waters or blocked roads. At the request of local interests for assistances a supply of blankets were dispatched from San Francisco to Orick, while a 1500-gallon water tank truck, chemical toilet facilities, two pumps and a quantity of 30-gallon cans for transporting and storing of water were dispatched to Klamath.

28. By Friday much of the preliminary cleaning up and rehabilitation had been accomplished. It was considered that the local people could continue with their own resources. The emergency operations of the San Francisco District were therefore closed down on that day. The crews making preliminary flood damage surveys and one other individual acting as an observer in the event subsequent adverse flood conditions developed, remained in the area. The rest of the District personnel returned to San Francisco. The two helicopters returned to their base by Saturday.

29. Because of the severe erosion which was taking place along the left bank of Redwood Creek at Orick, and which was endangering the bridge on Highway U. S. 101 over the creek, correspondence was dispatched to the Office, Chief of Engineers on 25 January requesting emergency funds under Section 14 of the 1946 Flood Control Act for stabilizing the bank. A teletype was received early on 28 January that the requested funds were authorized. Work was initiated several days later by hired labor forces, with the local interests contributing free of cost to the Federal Government, materials of construction, trucks and several other pieces of equipment. About 2000 feet of the left bank of Redwood Creek in the vicinity of the highway bridge at Orick was protected with riprap,



U.S. HIGHWAY 101 BRIDGE AT ORICK, CALIFORNIA, OVER REDWOOD CREEK, SHOWING BANK EROSION ON LEFT BANK, ENDANGERING THE SOUTH APPROACH.



SAME LOCATION AS ABOVE SHOWING BANK PROTECTION WORK INSTALLED BY CORPS OF ENGINEERS, U.S. ARMY.

BASIC ORGANIZATION FOR OPERATION

DURING FLOOD AND OTHER EMERGENCIES

SAN FRANCISCO DISTRICT

CORPS OF ENGINEERS

U.S.ARMY

DISTRICT ENGINEER

Col. Henry Walsh, C. E.
Telephone: San Francisco EXbrook 2-6820, Ext. 660

CONTROL CENTER

*E.J. Fuller, (Chief, Admin. Asst.) . . . . .)
*J.B. Shaw, (Chief, Management Branch) . . . . .)
*J.E. Deignan, (Chief, Engrg. Div.) . . . .) Ext. 661
R.D. Swift, (Chief, Design Br.) . . . . .) Or 662
L.Q.C. Lamar, Asst. Chief, Supply and ...)
Procurement Division) . . . . .)

Act as instrument of District Engineer for receiving and transmitting orders, requests, and information; compile all flood information; maintain liaison with other flood emergency agencies.

ADVISORS

Legal Advisor (Chief, Legal Br.)
L. C. Burdett . . . . . Ext. 466
Fiscal Advisor (Actg. Deputy Comptroller)
H. W. Kelley . . . . . Ext. 570
Real Estate Advisor (Chief, Real Estate Div.)
H. B. Watkins . . . . . Ext. 356
Supply Advisor (Chief, Supply and Procurement Div.)
T. C. Waale . . . . . Ext. 105**
Chief, Management Branch
*J. B. Shaw . . . . . Ext. 236

CIVIL WORKS LIMITS WITHIN CONTINENTAL UNITED STATES

HONOLULU AREA, TERRITORY OF HAWAII

EXECUTIVE STAFF

Col. G. H. Walker (Executive) . . . . . Ext. 661
*J. E. Deignan (Chief, Engrg. Div.) . . . Ext. 576
P. L. Vredenburg (Chief, Oprns Div.) . . Ext. 382
*E. J. Fuller (Chief Admin. Asst.) . . . . Ext. 662

Establish policy; administer, coordinate, and direct flood emergency operations

AREA ENGINEER
Honolulu, T. H.

Lt. Col., D. M. Matheson
Telephone: Honolulu 5-7941

Independent action in all emergency measures to be taken by Area Engineer. Reports thereon to be made directly, with informational copies to the District and Division Engineers.

SEE VOLUME II
FOR EMERGENCY ORGANIZATION

(P. L. Vredenburg)

FLOOD FIGHTING DIVISION

Staff Assistant (Chief, Construction Div.)
Lt. Col. Sidney Shelley . . . . . Ext. 381
*G. W. Stark (Alternate) . . . . . Ext. 379

Direct flood-fighting operations; procurement; determine flood-fighting needs; maintain and guard flood-control structures; establish radio communications; furnish transportation; provide first-aid.

FLOOD FIGHTING

Director (Chief, Proj. Oprns. Br.)
H. Lyons . . . . . Ext. 378
G. W. Stark (Alternate). . Ext. 379
F. Sandstrom (Alternate). . Ext. 778

FIELD SERVICE AND PROCUREMENT

Director (Chief, Const. Serv. Br.)
C. E. Duckering . . . . . Ext. 350
R. G. Schambeck (Alternate) Ext. 180

FIRST AID

Director (Chief, Safety Br.)
W. W. Fireren Ext. 230
S. E. Little (Alternate) . Ext. 230

J.E.DEIGNAN

HYDRAULIC DIVISION

Staff Assistant (Actg. Chief, Planning & Reports Br.)
R.J.Johnson. . . . . .Ext. 109
I.H.Steinberg(Alternate). . . .Ext. 584

Predict floods; collect and disseminate hydraulic data; make flood-damage surveys; plan operation of District flood-control works; prepare reports to higher authority; prepare plans and cost estimates for repair of damaged flood-control structures.

HYDRAULIC OPERATIONS

Director, (Chief Hydraulics Unit)
V. W. Gates . . . . . Ext. 599
C. Thomsen (Alternate) . . . . Ext. 599

REPORTS

Director, (Member Reports Staff)
W. T. Hodgin . . . . . Ext. 584
O. F. Weymouth (Alternate) . . Ext. 110

REHABILITATION

Director (Chief, Foundations & Materials Branch)
D. S. Cruickshank . . . . . Ext. 697
S. P. Snoek (Alternate) . . . Ext. 697

(E. J. Fuller)

SERVICE DIVISION

Staff Assistant (Chief, Personnel Br.)
E. C. Norman . . . . . Ext. 580
C. R. Holland (Alternate). . . . Ext. 581

Procure personnel; maintain communications and other general office service; issue emergency travel orders; provide photographs.

TELEPHONE AND TELETYPE SERVICE

Supervisor (Chief, General Service Sec.)
*C. E. Palmer . . . . . Ext. 396
E. James (Alternate) . . Ext. 396

PERSONNEL PROCUREMENT

Director (Employee Utilization Sec.)
E. M. O'Toole . . . . . .Ext. 210
I. M. Walton (Alternate). .Ext. 669

OFFICE SERVICE

Director (Chief, Office Service Br.)
L. S. Austin . . . . . Ext. 585
C. E. Palmer (Alternate) . . . Ext. 396

TRAVEL ORDERS

Supervisor (Chief, Gen. Serv. Sec.)
*C. E. Palmer . . . . . Ext. 396
K. Zimmerman (Alternate) . . Ext. 467

PHOTOGRAPHY

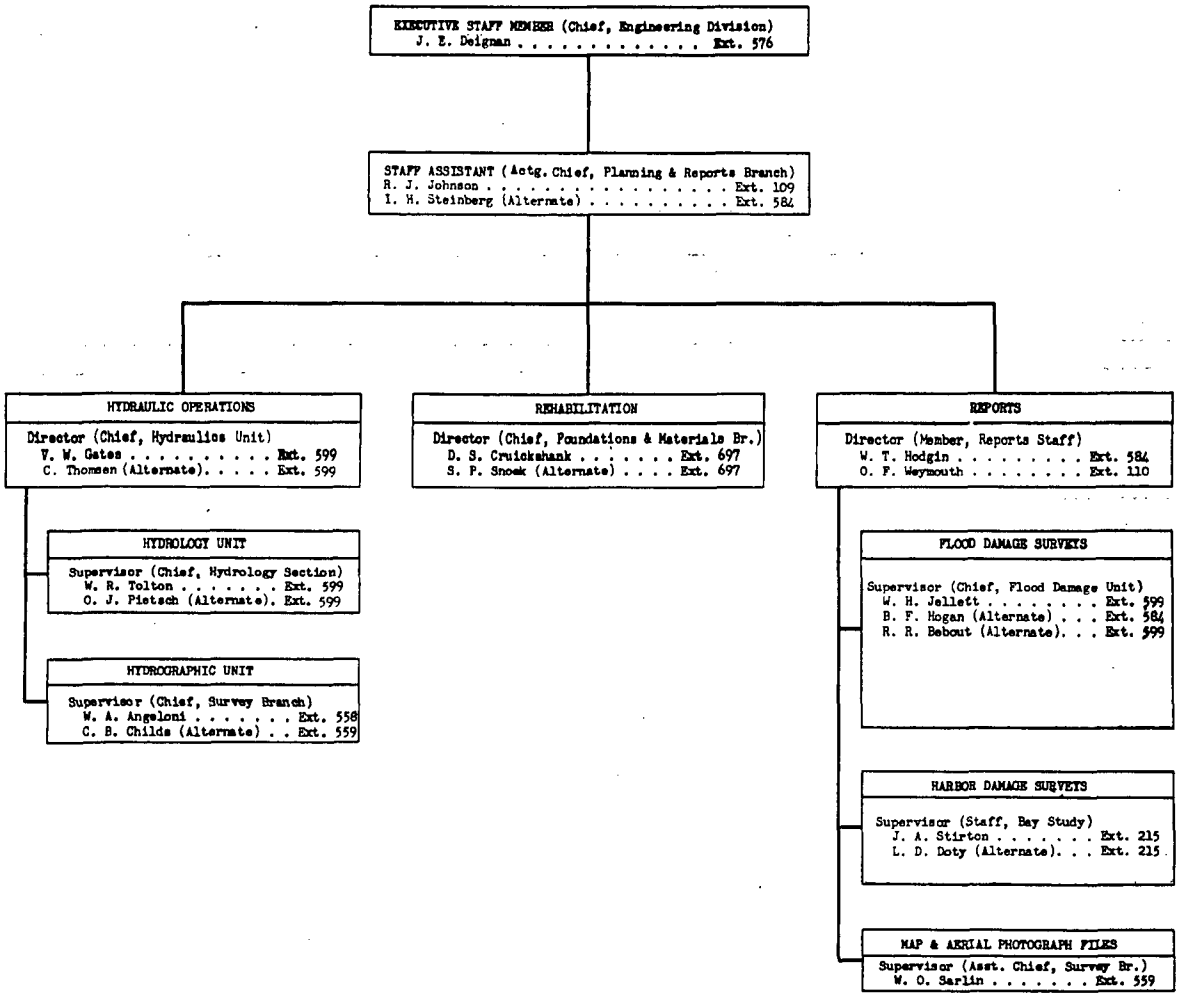
Supervisor (Chief, Reproduction Sec.)
E. M. Carman. . . . . Ext. 60
R. Ambrose (Alternate). . Ext. 59

*Dual assignment

(Revised October 1952)

PLATE IX

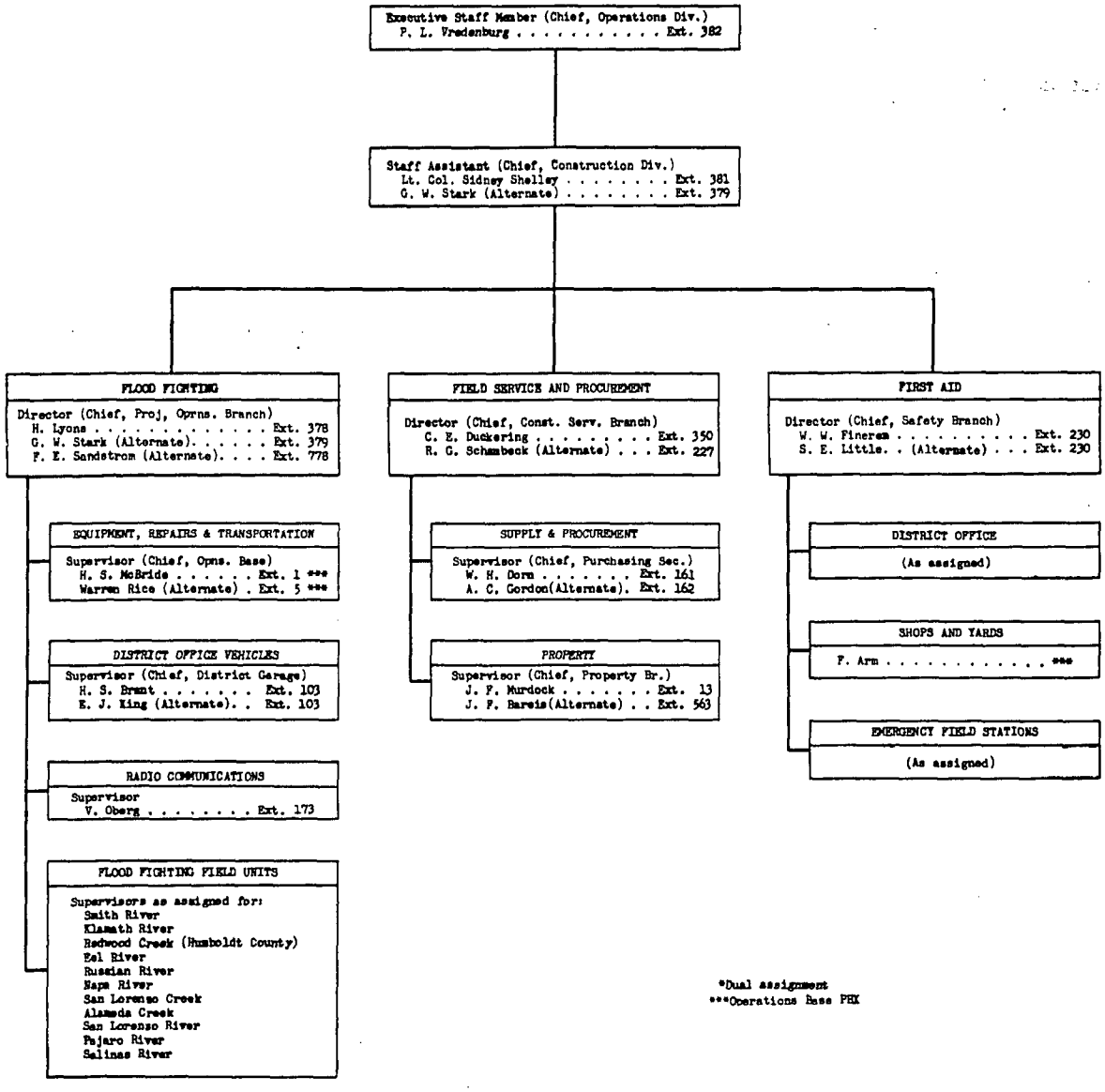
HYDRAULIC DIVISION



(Revised October 1952)

PLATE X

FLOOD FIGHTING DIVISION



*Dual assignment
***Operations Base PHX

(Revised October 1952)

PLATE XI

with a large part of the bank which had been lost by erosion being first rebuilt. The completed work was formally turned over to local interests for their maintenance, in accordance with previous agreements, by letter from the San Francisco District dated 17 April 1953.

III. DAMAGE SURVEYS

30. As previously mentioned, a party was dispatched to the flood area on the morning of 17 January to obtain first-hand information of flood conditions and to make a preliminary appraisal of the flood damages. When it developed that flood conditions were unusually severe another party was dispatched to the area. This latter group, in addition to obtaining information on the extent of flooding and damages also established series of high water marks on the various rivers in the flood-stricken areas.

31. Following this initial survey and preliminary appraisal of flood damages a program was prepared and put into operation for making a detailed survey of damages resulting from the floods of 18 January 1953 on the streams along the north coast of California. By this time, too, many of the highways, particularly secondary roads, were open to traffic so that previously isolated areas could be reached by car. Damages resulting from local conditions, such as slides, washouts, winds and storms, were evaluated as well as those considered as flood damages. Two teams, each consisting of two engineers from the District Office, made the survey. Additional high water marks were established and later tied in to elevation by a survey crew. A canvass was made of private rainfall records in the area to supplement the information being collected at the limited number of U. S. Weather Bureau stations. The assistance of the local newspapers and radio station was solicited, and a large

number of individuals who maintain their own rainfall records responded to the request for the information. The rainfall data obtained from the canvass are tabulated in table 2.

32. Complete coverage was made of urban areas where damages were unusually severe, such as Klamath, Klamath Glen and Orick. Each large mill or industrial establishment was visited and data on damages obtained for the mill proper and to woods operations. State and county agencies were contacted relative to damages to highways, roads and structures, and to traffic delays and rerouting. Officials of public utility companies were interviewed for evaluation of losses to telephone and power facilities. For determining damages to agricultural activities and properties interviews were conducted for each reach covering a representative area of about one-third of the total. The damage for the reach was then estimated by application of the proper factor to the damage for the representative area.

33. Estimate of damages. The total evaluated damages resulting from the storms of mid-January 1953 and the accompanying floods of 18 January, as obtained from the detailed surveys described above, amount to $9,233,700. Of this amount $5,970,700 is attributed to floods which occurred on the major streams and their tributaries. The remaining $3,263,000 has been classified as storm damage. the greatest flood damages were to residential and non-residential properties, totalling some $3,139,100. Agricultural damages exceeded $1,000,000. A summary of the evaluated damages by basins and by types is given in table 4.

Table 4. Summary of Damages, Floods of 18 January 1953

	Flood Damage							Storm	Total
	Eel River	Smith River	Mad River	Redwood Creek	Klamath River	Miscel-laneous Streams	Total All Basins	Storm All Basins	Storm and Flood
Inundation									
Residential									
Direct	$ 18,300		$ 6,500	$ 76,000	$ 253,000		$ 353,800	$ 722,000	$1,075,800
Indirect	1,000						1,000	1,048,000	1,049,000
Nonresidential									
Direct	63,800	$ 26,500	181,100	385,000	589,000	$ 75,000	1,320,400		1,320,400
Indirect	207,700	221,500	250,700	303,000	429,000	52,000	1,463,900		1,463,900
State and County Roads									
Direct	64,000	119,500	205,700	121,000	328,000	191,300	1,029,500	1,003,000	2,032,500
Indirect	40,000	2,500	120,900	60,000	93,000	141,000	457,400	474,000	931,400
Railroads									
Direct	138,500		29,900				168,400		168,400
Indirect	30,000						30,000		30,000
Agriculture									
Direct	133,000	132,000	269,100	93,500	279,000		906,600	16,000	922,600
Bank Cutting	38,400	9,000	48,100	24,000	87,000		206,500		206,500
Bank Prot. Works	25,500		7,700				33,200		33,200
Totals									
Inundation									
Direct	284,600	146,000	423,200	582,000	1,170,000		2,605,800		4,330,800
Indirect	278,700	224,000	371,600	363,000	522,000		1,759,300		3,281,300
Agriculture									
All	196,900	141,000	324,900	117,500	366,000		1,146,300		1,162,300
Grand Total									
Direct	481,500	287,000	748,100	699,500	1,536,000	266,300	4,018,400	1,741,000	5,759,400
Indirect	278,700	224,000	371,600	363,000	522,000	193,000	1,952,300	1,522,000	3,474,300
	$760,200	$511,000	$1,119,700	$1,062,500	$2,058,000	$459,300	$5,970,700	$3,263,000	$9,233,700

34. Brief descriptions of the flood damages, together with drawings of the flood plains and high-water profiles, for each of the major streams and tributaries for which detailed investigations were made are contained in the paragraphs which follow.

IV. SMITH RIVER

35. The Smith River rises in southern Oregon, flows in a southwesterly direction for approximately 50 miles and empties into the Pacific Ocean in the vicinity of the town of Smith River. With the exception of a few small mountain valleys the river flows through rugged mountain canyons until it emerges into the delta area in the vicinity of highway 101 bridge over the river a distance of 7 miles above the mouth. The drainage area is fan-shaped and embraces 613 square miles. The principal tributaries of the Smith River are the South Fork, North Fork and Patrick Creek.

36. The 16-20 January 1953 storm in northern California produced a peak discharge of 139,000 cubic feet per second with a stage of 38.0 feet at the Smith River Gaging Station, on 18 January. The maximum discharge of record (22 years) is 152,000 cubic feet per second with a stage of 39.5 feet on 29 October 1950 at the same location. Discharge measurements are not available for the tributary streams.

37. It is estimated that 7,600 acres of pasture and other agricultural land in the delta area were inundated to an average depth of about 3 feet by the Smith River and its tributaries, Dominie, Rowdy and Morrison Creeks. Flood waters from the Smith River overflowed into Lake Earl Slough and raised the surface of Lake Earl about one foot. Due to the flat slope of the land adjacent to Lake Earl, 3200 acres of land bordering the lake were flooded for a time until relief came

through the opening of the bar between the ocean and Lake Talawa Agricultural damage consisted primarily of scouring of pasture lands, and huge deposits of silt, gravel and timber cuttings. Cattle loss was held to a minimum as a result of flood warnings issued by the United States Weather Bureau Office at Medford, Oregon. Bank cutting occurred on the right and left banks below Highway U. S. 101. State and County highways and roads were damaged considerably by slides and washouts of bridges from flood waters. Commercial, logging, and tourist travel was disrupted or completely stopped at several points for periods of from one to five days. Local residents could not reach places of employment, which was a contributing factor in the partial shutdown of some of the lumber mills in the area.

38. Traffic on Highway U. S. 101 was cut off at Tryons Corner, one-half mile south of the Dr. Fine bridge over Smith River. The old Highway U. S. 101 route north of Dr. Fine bridge to Smith River was cut off. The county North Bank road from Dr. Fine bridge to Hiouchi bridge was closed by inundation and slides at several locations for a period of eight days. Slides closed the county road from Mill Creek State Park to Crescent City for several days. Highway U. S. 101 from Crescent City to Oregon coastal points was cut off due to a bridge washout at Gilbert Creek. State and County road crews working under adverse conditions re-established through traffic by repairing a section of a county road and bridge over Gilbert Creek. Heavy trucking was restricted for several days by the failure of a bridge over Jordan Creek. State Route 199 to Southern Oregon points and Grants Pass was closed for a short period due to several slides. Farm and county roads in the delta area were inundated and considerably

damaged, isolating some farms for a short period.

39. Industrial damage was greatest in the vicinity of the town of Smith River where lumber mills, inundated by Rowdy and Dominie Creeks and isolated by road washouts, necessitated closing of mills for several days with resulting production losses to the mill and income losses to the employees.

40. Public Utility damage was confined to the failure of the local water supply for the town of Smith River, when a small dam and several hundred feet of water pipe washed out on Dominie Creek. Service was discontinued for a period of five days until temporary repairs could be made.

41. There were no lives lost and no serious health problems developed.

42. District Office personnel conducted a flood damage survey, interviewing State, County and local people to evaluate losses due to the storm and flood during the early part of February 1953. Agricultural damage was obtained by interviewing approximately 30 percent of the farms in the flood plain and evaluating the remaining acreage on the ratio of the sampled area to the total acreage in the flood plain. High water marks for the 18 January flood were established and leveled in. The flood plain and water surface profile with locations of high water marks are shown on figure 5.

43. The damages resulting from the 18 January 1953 flood for the Smith River Basin total $511,000. The breakdown for these damages is shown in table 5.

Table 5. Summary of damages 18 January 1953 Flood, Smith River Basin

Type	Main River		Tributaries		Basin Totals	
	Direct	Indirect	Direct	Indirect	Direct	Indirect
Roads and Bridges	$118,000		$ 1,500	$ 2,500	$119,500	$ 2,500
Agricultural	132,000				132,000	
Bank Erosion	9,000				9,000	
Inundation	7,500	12,500	19,000	209,000	26,500	221,500
Total	$266,500	$12,500	$20,500	$211,500	$287,000	$224,000

V. KLAMATH BASIN

44. The Klamath River rises in Lake Ewauna near Klamath Falls, Oregon and flows 263 miles through south central Oregon and northern California to the Pacific Ocean. The drainage area is 15,500 square miles. With the exception of some twenty-five miles in the upper region the river flows through rugged canyons until it reaches the Pacific Ocean. The principal tributaries to the Klamath River are the Shasta, Scott, Salmon and Trinity Rivers.

45. As the result of continued high intensity rains the river reached a peak discharge of 280,000 cubic feet per second with a peak stage of 43.8 feet at the gaging station near Klamath, on the morning of 18 January 1953, inundating the towns of Klamath and Klamath Glen and an estimated 700 acres of surrounding agricultural lands in the delta area.

46. During the late evening and early morning hours of the 17-18 January, it became apparent that the towns of Klamath and parts of Klamath Glen would be inundated. Local people with the assistance of local authorities and air force personnel of an adjacent military establishment, worked to save what personal effects that could be salvaged. By the

afternoon of the 18th flood waters completely covered Klamath and lower Klamath Glen and over 500 people had been evacuated to higher ground some as far away as Crescent City.

47. The lower section of Klamath Glen was particularly hard hit by flood waters. Several homes and a large summer resort were completely swept away by the swirling flood waters. Several other homes were partially destroyed and nearly every home or structure suffered some type of damage. Only the cooperation of local people and local authorities in rescue and evacuation endeavors, prevented serious loss of lives.

Rehabilitation endeavors were hampered at Klamath Glen because of a huge slide on the highway between Klamath and Klamath Glen. One man lost his life and another was rescued when this slide occurred. Two persons spent the night on top of a roof at Klamath Glen where they were trapped while attempting to salvage personal effects from the Klamath Glen Resort, which was totally destroyed. Telephone connections were disrupted north to Crescent City and south to Eureka. Stored food in refrigerators and cold storage boxes became spoiled and had to be thrown away when power was cut off due to inundation. Installation of portable latrines by the District Office alleviated the health menace which was present due to the failure of sanitary systems. Water was obtained from uncontaminated wells on high ground and trucked to the town of Klamath in fire trucks.

48. Nearly every highway and road was cut off at some point either from inundation or slide, hampering evacuation or rehabilitation efforts. Helicopters provided by the 6th Army at the request of the District Engineer brought food and medical supplies to regions in the upper Klamath area inaccessible by road. One lumber mill near the mouth of the Klamath

River was partially destroyed and was out of operation for several months. Restoration of the mill is now in progress. Because of the huge loss of bank, the mill is being constructed on piles placed in the river. The destruction of lumber mills and other places of employment caused inestimable hardship to the economy of the area in wages lost.

49. Scott Valley in the upper Klamath Basin through which the Scott River flows was flooded 18 January 1953, inundating an estimated 6300 acres of agricultural land. The principal damages to this area were to agricultural land, an irrigation system, bank cutting and county roads. Evacuation of residents in the area was not required.

50. The Hoopa Indian Reservation had considerable road damage within the reservation. In the Klamath National Forest floods caused damage to roads, bridges and telephone lines.

51. Immediately after the 18 January flood, personnel of the District Office interviewed local residents and owners or operators of local residential and commercial properties to ascertain their damages. State and County officials provided data to evaluate damages to roads, highways and public buildings. Utility damages were evaluated from interviews with interested officials. High water marks for the 18 January 1953 flood were established and leveled in for the Klamath and Scott Rivers and appear on figures 6 and 7, together with the flood plain and water surface profiles for the Klamath and Scott Rivers.

52. The damages resulting from the 18 January flood in the Klamath River basin amounted to $2,058,000. The breakdown for these damages are tabulated in table 6.

Table 6. Summary of damages 18 January 1953 Flood, Klamath River Basin

Type	Flood Damage: Main River	Flood Damage: Tributaries	Flood Damage: Total Basin	Storm Damage	Total
Agriculture	$ 64,000	$215,000	$ 279,000	$ 1,500	$ 280,500
Bank Erosion	71,000	16,000	87,000		87,000
Inundation					
Nonresidential					
Direct	497,000	92,000	589,000	3,000	592,000
Indirect	390,000	39,000	429,000	57,000	486,000
Residential					
Direct	248,000	5,000	253,000	14,000	267,000
Roads and Bridges					
Direct	215,000	113,000	328,000	147,000	475,000
Indirect	92,000	1,000	93,000	15,000	108,000
Totals					
Direct	1,095,000	441,000	1,536,000	179,000	1,715,000
Indirect	482,000	40,000	522,000	72,000	594,000
Grand Total	$1,577,000	$481,000	$2,058,000	$251,000	$2,309,000

VI. REDWOOD CREEK

53. Redwood Creek drains an area of about 275 square miles of the Coast Range Mountains in Humboldt County. The basin is roughly rectangular in shape, being about 6 miles long. The principal tributary is Prairie Creek which meets the main stream just a short distance upstream from Orick. The watershed lies in an area of heavy precipitation and stream runoff is extremely high, probably exceeding some 50 inches annually on the average. Orick, with an estimated population of 800, is the only important center of population in the basin.

54. The storm of 16-20 January, falling on soil already saturated

by antecedent rains, resulted in a flood on Redwood Creek which was the highest and most destructive in the memory of local residents. The estimated peak discharge was 45,000 cubic feet per second, based on a miscellaneous measurement made by the U. S. Geological Survey just after the peak had passed. The January 1953 flood exceeded the previous recent high water of January 1950 by more than one foot. [illegible] 55. The January 1953 flood caused widespread destruction to urban and industrial developments at Orick, the floodwaters being 4 feet, or more, deep over most of the area. Approximately 1170 acres of agricultural land were inundated. The river rose with such rapidity that salvage attempts were held to a minimum. Residences, stores and other establishments had to be temporarily abandoned to the flood waters. One person lost his life by drowning when he attempted to cross the street which was inundated at the time by the swirling waters. One resident of Orick died of a heart attack apparently brought about by over-exertion in attempting to retrieve his belongings. One other individual narrowly escaped being drowned, but was saved just before being swept away by the flood waters. Residents of Orick were evacuated to higher ground or else found refuge in the second-stories of their homes or buildings. Because of the severe flood conditions, the Board of Supervisors of Humboldt County declared a state of emergency on 19 January.

56. Nearly every home and business establishment in Orick was flooded. Large supplies of stored food stuffs were destroyed and made unfit for human consumption. The lack of transportation facilities hampered ready delivery of stocks to replenish those destroyed by the flood. At the request of local interests for assistance, the San

Francisco District furnished a supply of woolen blankets for use of the flood victims.

57. Floodwaters overflowed state and county roads in the basin and adjacent areas, and traffic was suspended during the height of the flood. The bridge on Highway U. S. 101 over Redwood Creek at Orick was endangered when the left bank of the creek began to erode at a rapid rate, attacking the approach fill. State maintenance crews worked continually during the height of the flood to protect the bridge. As described in previous discussions, about 2000 feet of the bank was subsequently protected with riprap as an emergency measure by the San Francisco District in cooperation with local interests.

58. Several large sawmills were badly damaged and required repairs. The plants were shut down while the repairs were being made. The results of the lay offs of workers necessitated by the temporary closing of the mills will affect the economy of Orick for some indefinite time.

59. As in the other coastal basins, agricultural damages consisted, principally, of scouring and eroding of land, and of deposition of silt, gravel and other debris.

60. Immediately after the 18 January flood personnel of the District Office interviewed local authorities and people to ascertain the damage to their property. Agricultural damage was evaluated by nearly a 100% canvass of the area.

61. High water marks were established and leveled in and appear on figure 8, together with the flood plain and water surface profile for this flood.

62. Damages resulting from the 18 January 1953 flood amounting to $1,062,500 are summarized in table 7.

Table 7. Summary of damages 18 January 1953 Flood
Redwood Creek Basin

	Redwood Creek	Prairie Creek	Basin Total
Roads and Bridges			
Direct	$ 121,000		$ 121,000
Indirect	60,000		60,000
Agricultural			
Direct	83,000	$ 10,500	93,500
Bank Erosion	A/ 23,000	1,000	24,000
Inundation			
Nonresidential			
Direct	372,000	13,000	385,000
Indirect	267,000	36,000	303,000
Residential			
Direct	76,000		76,000
Indirect			
Totals			
Direct	675,000	24,500	699,500
Indirect	327,000	36,000	363,000
Grand Total	$1,002,000	$ 60,500	$1,062,500

A/ $23,000 bank erosion non recurrent emergency bank protection by Corps of Engineers and local people will alleviate future damage.

VII. MAD RIVER

63. The Mad River, with drainage area of 485 square miles, at the gaging station near Arcata, rises in the coastal range and flows through mountain canyons and small valleys for 92 miles until it emerges into the delta area in the vicinity of Blue Lake, 10 miles from the Pacific Ocean.

64. During the 8 January 1953 flood, the Mad River overflowed its banks and flooded 1200 acres of agricultural and industrial land in the vicinity of Blue Lake and Korbel and 4700 acres in the delta area

for a total of 5920 acres.

65. The primary flood damage in this area was to agricultural and industrial properties and improvements. Two large saw mills on the North Fork of the Mad River received extensive damage. Urban developments around the mills also were damaged extensively. Agricultural damage consisted mainly of deposition of large amounts of gravel, sand, silt and refuse from logging operations. Winter vegetables were completely lost at some locations.

66. Bank erosion occurred along the banks at several locations. In the vicinity of Blue Lake it is estimated that 22 acres were eroded by the Mad River during the January flood. If erosion continues at the present rate a very serious condition could develop in which the Mad River would effect a junction with the North Fork a considerable distance upstream from the present mouth of the North Fork. If this condition develops it would lay a large saw mill, agricultural land and eventually some urban development at Blue Lake, open to direct attack of the Mad River.

67. Reports were received that the water level in the reservoir of the Sweesey Dam on Mad River, which serves as the source of water supply for Eureka, was dropping rapidly and that therefore, the dam was in danger of failure. An immediate investigation revealed, however, that the rumor was unfounded. The drop in stage was due merely to recession of flow over the spillway following the peak of the flood.

68. Because of the severity of the damages in the vicinity of Blue Lake, a report, authorized by the Chief of Engineers, is currently under preparation by the San Francisco District to determine the feasibility of undertaking local protection work under Section 212 of

the 1950 Flood Control Act (small projects in which the Federal cost does not exceed $150,000 and which do not require specific approval by Congress for their authorization).

69. During the early part of February District Office personnel made a detailed damage survey of Mad River. Local property owners were interviewed to evaluate damages to their properties; state and county officials provided data on damages to public property, roads and bridges; and officials of appropriate utility companies were contacted to evaluate damage to their property.

70. High water marks were established and leveled in, and are shown on figure 9 together with the flood plain and water surface profiles for the 18 January 1953 flood.

71. The results of the surveys revealed that the total damages caused by the flood of mid-January 1953 in the Mad River amounted to an estimated $1,119,700, as summarized in table 8.

Table 8. Summary of damages 18 January 1953 Flood, Mad River Basin

Type	Main River	Tributaries	Total Basin
Agricultural			
Bank Cutting	$ 48,100		$ 48,100
All Other	261,600	$ 7,500	269,100
Inundation			
Nonresidential			
Direct		181,100	181,100
Indirect		250,700	250,700
Residential			
Direct		6,500	6,500
Roads and Bridges			
Direct	106,000	99,700	205,700
Indirect	95,500	25,400	120,900
Railroad			
Direct		29,900	29,900
Bank Protection Expense		7,700	7,700
Totals			
Direct	415,700	332,400	748,100
Indirect	95,500	276,100	371,600
Grand Total	$511,200	$608,500	$1,119,700

VIII. EEL RIVER

72. Eel River drains an area of approximately 3,630 square miles with the lower portion of the basin lying in Humboldt County. The principal tributaries are the Van Duzen River and three streams known as the North Fork, Middle Fork and South Fork.

73. In the Eel River the storm of 16-20 January 1953 was centered over the lower, or north, part of the basin. The storm decreased rapidly to the south so that only minor rises occurred in the upper

tributaries. The peak stage reached by the Eel River on 18 January was 21.0 feet at Fernbridge, which is not an unusually high stage, the river having risen to 22.5 feet the previous week.

74. Most of the runoff during the 18 January flood originated in the lower reaches of the Van Duzen River and its tributaries. At the gaging station on the Van Duzen near Bridgeville, the flood was of about the same magnitude as that of November 1950. However, the greater runoff from the tributary area downstream from the gaging station during the more recent flood establishes it as the highest of recent record. The maximum flood of record on the Eel River is that of December 1937. In that flood, however, the runoff was from the upper Eel River tributaries, with the Van Duzen contributing a relatively small amount toward the flood peak.

75. The flood on Yager Creek, a tributary of the Van Duzen River, was responsible for the failure of the Northwestern Pacific Railroad bridge at Carlotta, when a log jam caused the piling supporting the bridge structure to give way. The west approach to the highway bridge, on State Highway Route 36, upstream from the railroad bridge also was badly eroded. In general the county roads and bridges suffered major damages from overflow of Yager Creek and Van Duzen River and from slides. The highway between Alton and points beyond Bridgeville was completely closed to traffic for five days because of a bad slide near Bridgeville, and was restricted to light travel for several additional days.

76. Several saw mills and wood camps along Yager Creek and Van Duzen River were badly damaged. Occupants in the low lying community of Pleasant Valley near Hydesville were forced to evacuate because of the high water. Damages on the Van Duzen River were confined primarily

to agricultural lands, bank erosion, county roads and some residences.

77. Overflow from Rhoner Creek in the vicinity of Fortuna inundated Highway U. S. 101 and flooded a commercial district, several homes, a trailer village and a motel to depths of up to about two feet. Damages were confined to personal belongings, stored products, trailers and silt deposition. Overflow from Strongs and Jameson Creeks inundated a saw mill just south of Fortuna.

78. Outlet Creek, in the vicinity of Longvale, caused considerable damage to several saw mills in that area.

79. On the main Eel River, flooding was confined to shallow inundation in the Delta area near the mouth of the river. Of more serious consequence was the continued erosion of the river banks, which during the past several years has been proceeding at an accelerated rate because of the frequent high water. A house at Sandy Prairie had to be moved when threatened to becoming undermined by extensive bank erosion. Continued erosion at Sandy Prairie may endanger a saw mill and the Fortuna sewage disposal plant as well as several ranches in the area. At Dungan Bend the channel shifting due to bank erosion has resulted in loss of a county road. A residence is in danger of becoming undermined. Records since 1938 indicate that the channel at Dungan Bend has shifted about 800 feet. The shift is vividly portrayed on Plate XII, a photograph taken February 1953, upon which has been added the bank line as it existed in 1938.

80. During the first part of February District Office personnel interviewed local people and owners or operators of local residential and commercial properties to evaluate damages to their property. State and county officials provided data to evaluate damages to state and

EEL RIVER DELTA, AT DUNGAN BEND. PHOTOGRAPH TAKEN FEBRUARY 1953.
NOTE INDICATED CHANGE IN CHANNEL ALIGNMENT SINCE 1938.

PLATE XII

county roads and public property. Agricultural damages were evaluated by interviews with owners of approximately 25 percent of the total area inundated. Using the ratio between area sampled and the total areas inundated, agricultural damages were obtained.

81. High water marks were established and leveled in at several points and are shown on figure 10 together with the flood plains and water-surface profiles for the Eel and Van Duzen Rivers.

82. A summary of the damages, resulting from the 18 January 1953 flood, amounting to $760,200 is shown in table 9.

Table 9. Summary of damages 18 January 1953 Flood, Eel River Basin

Type	Eel River	Yager Creek	Van Duzen River	Rhoner Creek	Outlet Creek at Longvale	Round Valley	Little Lake	Totals		
								Eel River	Tributaries	Total
Agriculture	$ 70,000	$ —	$ 13,200	$ —	$ —	$5,500	$44,300	$ 70,000	$ 63,000	$133,000
Bank Erosion	20,000	2,000	12,400	—	—	1,000	3,000	20,000	18,400	38,000
Bank-Protection Works	—	25,000	500	—	—	—	—	—	25,500	25,500
Inundation										
Nonresidential										
Direct	—	55,000	2,500	—	6,300	—	—	—	63,800	63,800
Indirect	—	137,300	58,100	—	12,300	—	—	—	207,700	207,700
Residential										
Direct	—	—	4,400	13,900	—	—	—	—	18,300	18,300
Indirect	—	—	700	300	—	—	—	—	1,000	1,000
State and County Roads										
Direct	48,000	—	16,000	—	—	—	—	48,000	16,000	64,000
Indirect	—	—	—	40,000	—	—	—	—	40,000	40,000
Railroads and Bridges										
Direct	—	138,000	500	—	—	—	—	—	138,500	138,500
Indirect	—	30,000	—	—	—	—	—	—	30,000	30,000
Totals										
Direct	138,000	220,000	49,500	13,900	6,300	6,500	47,300	138,000	343,500	481,500
Indirect	—	167,300	58,800	40,300	12,300	—	—	—	278,700	278,700
Grand Total	$138,000	$387,300	$108,300	$54,200	$ 18,600	$6,500	$47,300	$138,000	$622,200	$760,200

IX. MISCELLANEOUS STREAMS

83. In addition to the flood damage from the major streams and their tributaries, there are several smaller basins, notably Jordan, Gilbert and Elk Creeks in the vicinity of Crescent City that received major damage.

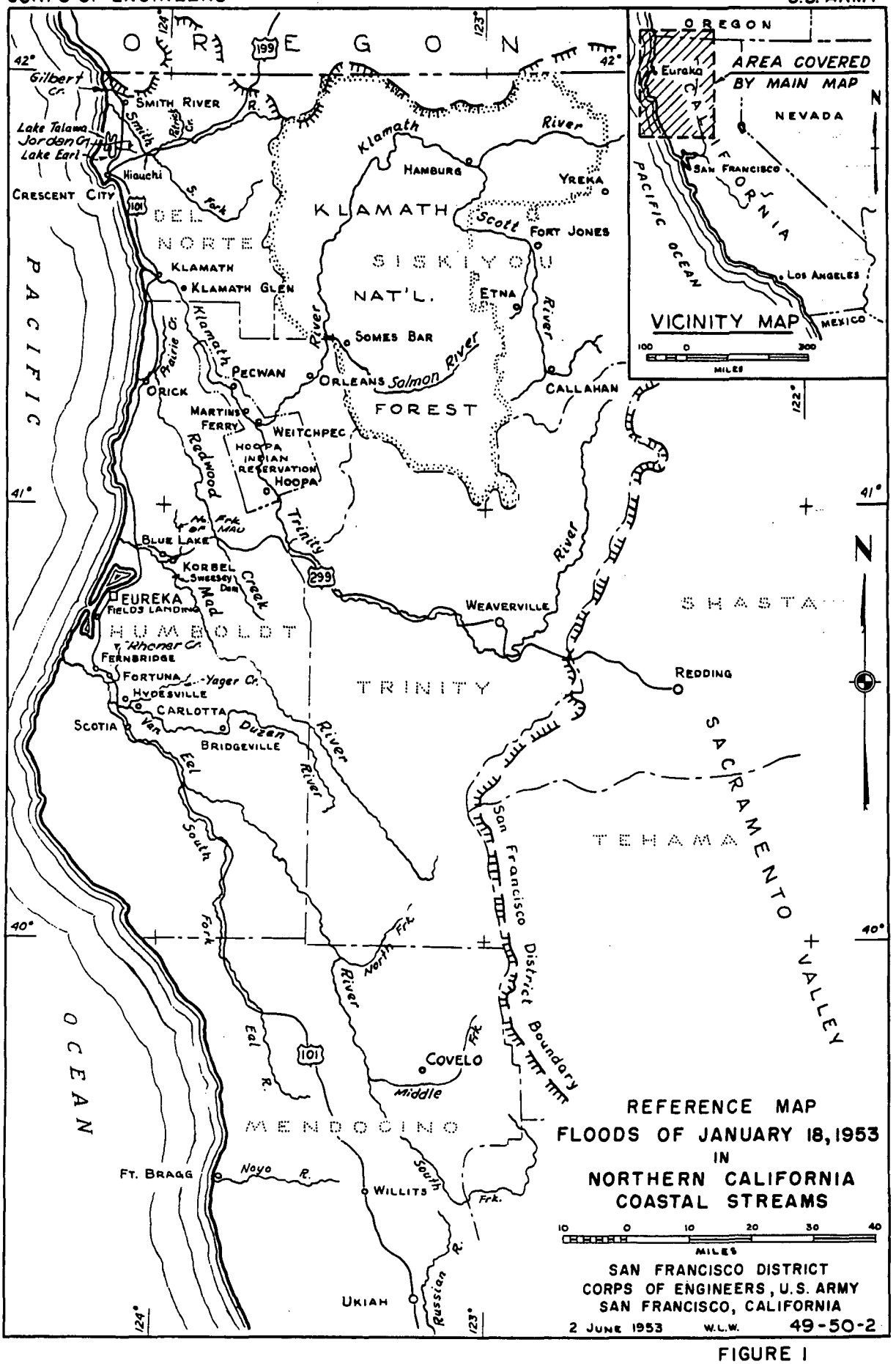
84. Flood damage on these smaller basins was primarily to roads and bridges, as in the case of Gilbert Creek. The failure of Gilbert Creek bridge on Highway U. S. 101 cut off traffic to southern Oregon coastal points until temporary repairs could be made to the county alternate route over Gilbert Creek. At Crescent City, Elk Creek overflowed its banks and inundated Highway U. S. 101 and several stores and industrial establishments in the southern part of the city. Jordan Creek bridge on Highway U. S. 101 was partially destroyed and traffic was held up until temporary repairs were made. The rails and piers on the bridge over Wilson Creek, on Highway U. S. 101, approximately 15 miles south of Crescent City, were severely damaged. Traffic was held up temporarily at this point until emergency repairs could be made.

85. A summary of damages, on the above noted miscellaneous streams, resulting from the 18 January 1953 flood, amounting to $459,300 is shown in table 10.

Table 10. Summary of damages 18 January 1953 Flood, Miscellaneous Streams

Type	Gilbert Creek	Jordan Creek	Elk Creek	Wilson Creek	Total All Streams
Roads and Bridges:					
Direct	$153,000	$31,300	$ 2,000	$5,000	$191,300
Indirect	140,000	1,000			141,000
Inundation					
Direct			75,000		75,000
Indirect			52,000		52,000
Totals					
Direct	153,000	31,300	77,000	5,000	266,300
Indirect	140,000	1,000	52,000		193,000
Total	$293,000	$32,300	$129,000	$5,000	$459,300

CORPS OF ENGINEERS U.S. ARMY

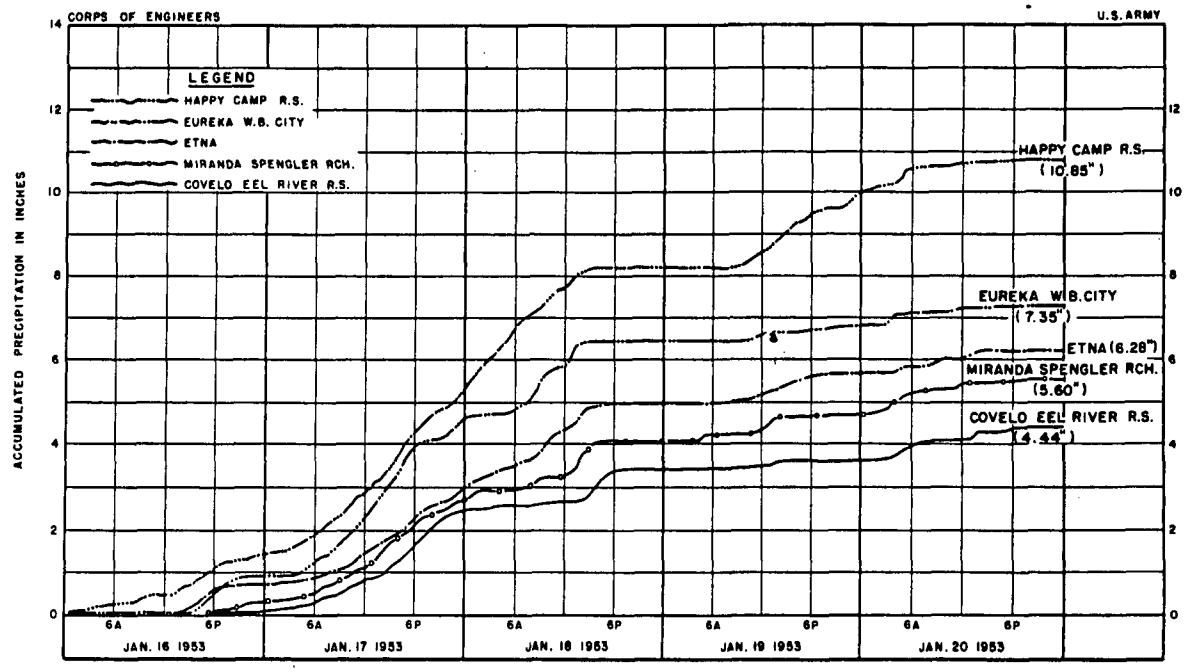


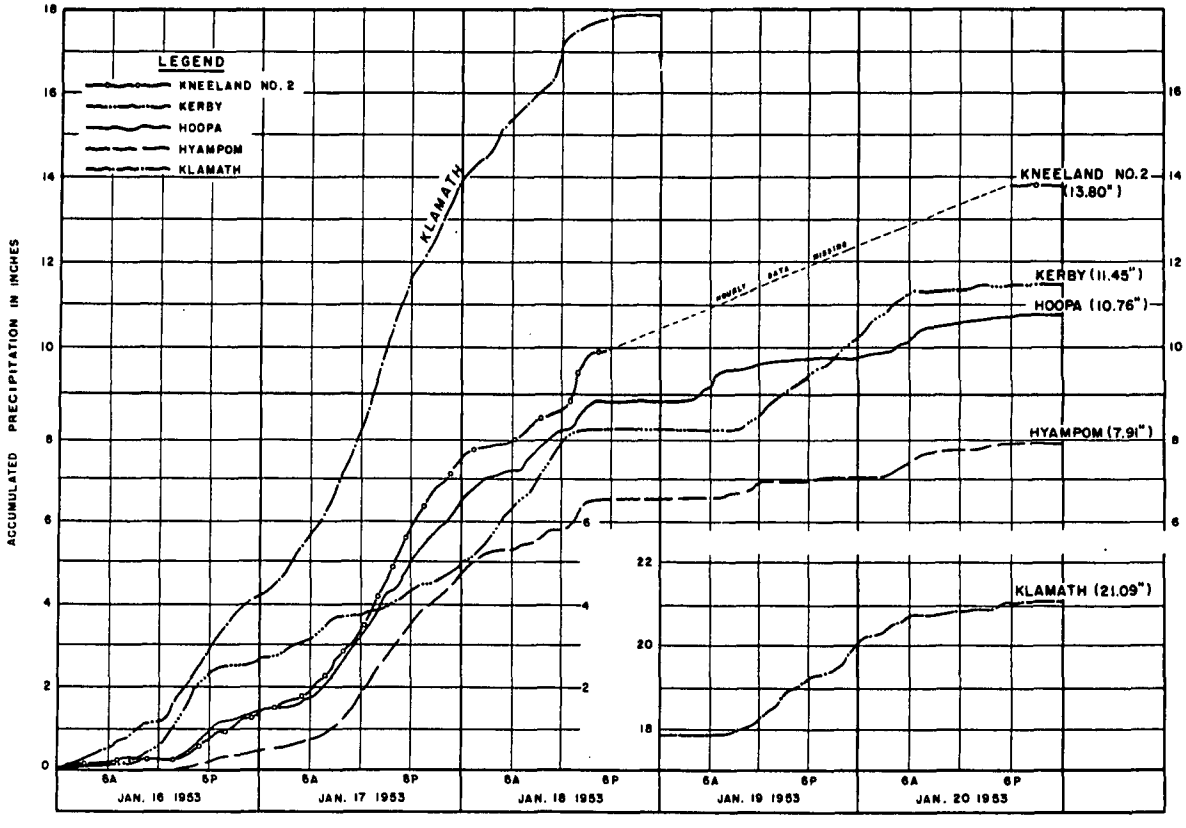
REFERENCE MAP
FLOODS OF JANUARY 18, 1953
IN
NORTHERN CALIFORNIA
COASTAL STREAMS

SAN FRANCISCO DISTRICT
CORPS OF ENGINEERS, U.S. ARMY
SAN FRANCISCO, CALIFORNIA
2 JUNE 1953 W.L.W. 49-50-2

FIGURE 1

CORPS OF ENGINEERS U.S. ARMY





REPORT ON
FLOOD OF JANUARY 1953
NORTHERN CALIFORNIA COASTAL STREAMS

MASS RAINFALL CURVES

STORM OF 16-20 JAN. 1953

IN 3 SHEETS SHEET NO. 1

CORPS OF ENGINEERS, U.S. ARMY, SAN FRANCISCO, CALIF.

DRAWN: R.R.B.
TRACED: J.D.K.
CHECKED: W.R.T.

DATE: 5 JUNE 1953
FILE No. 49-46-1

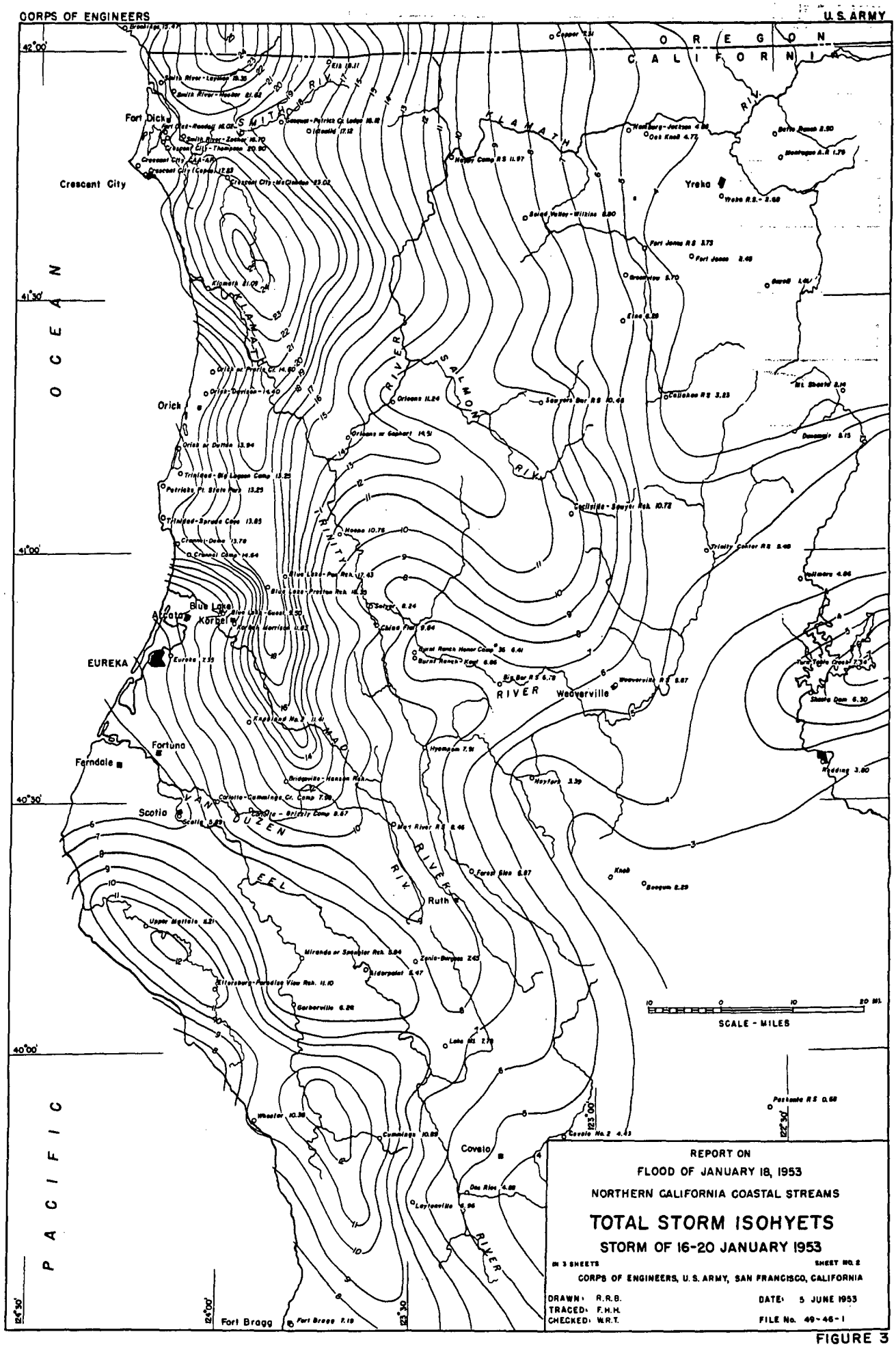
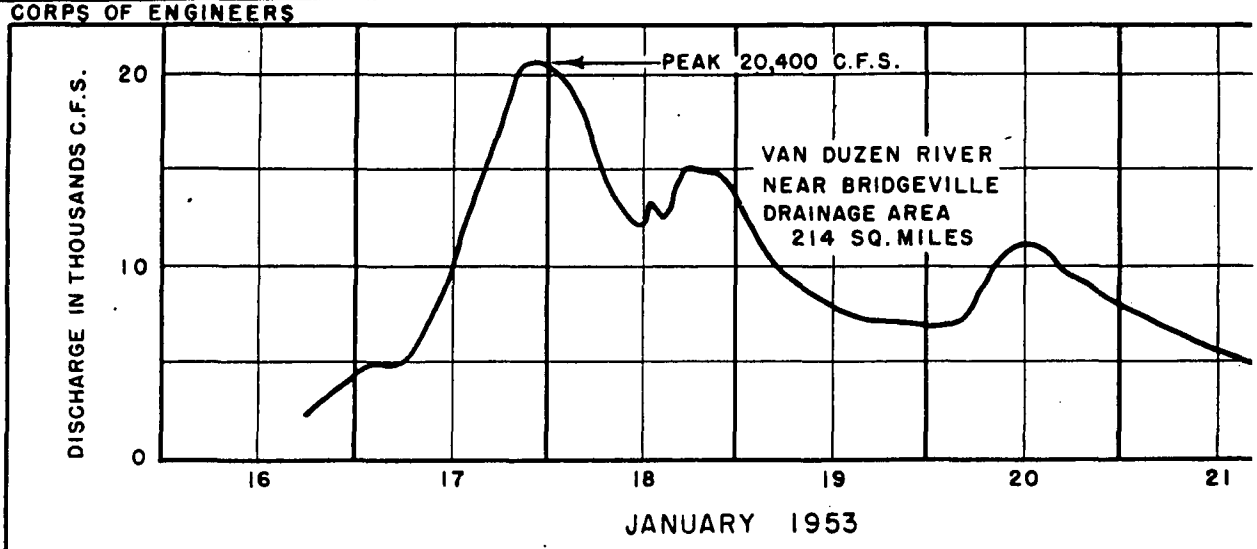
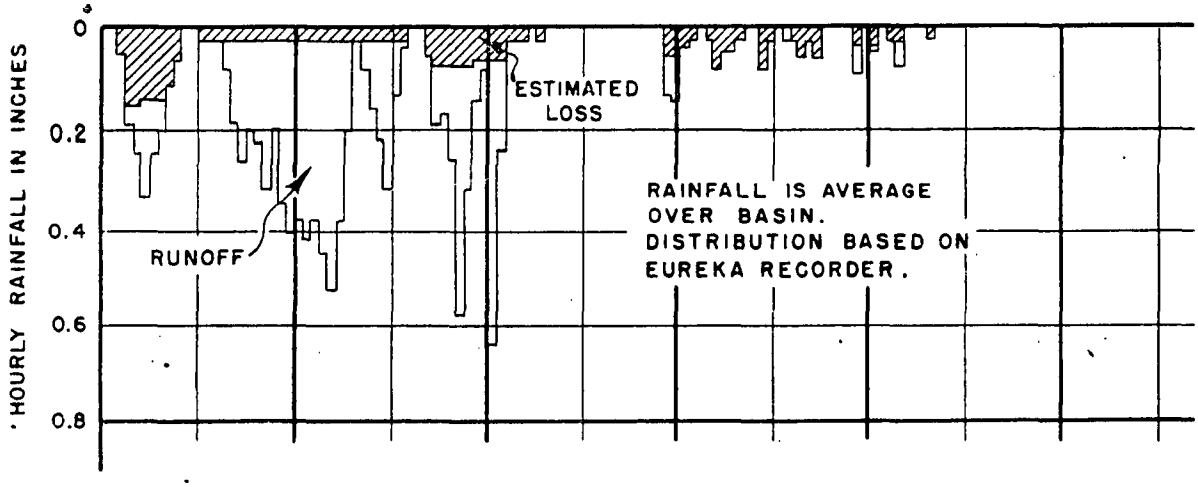
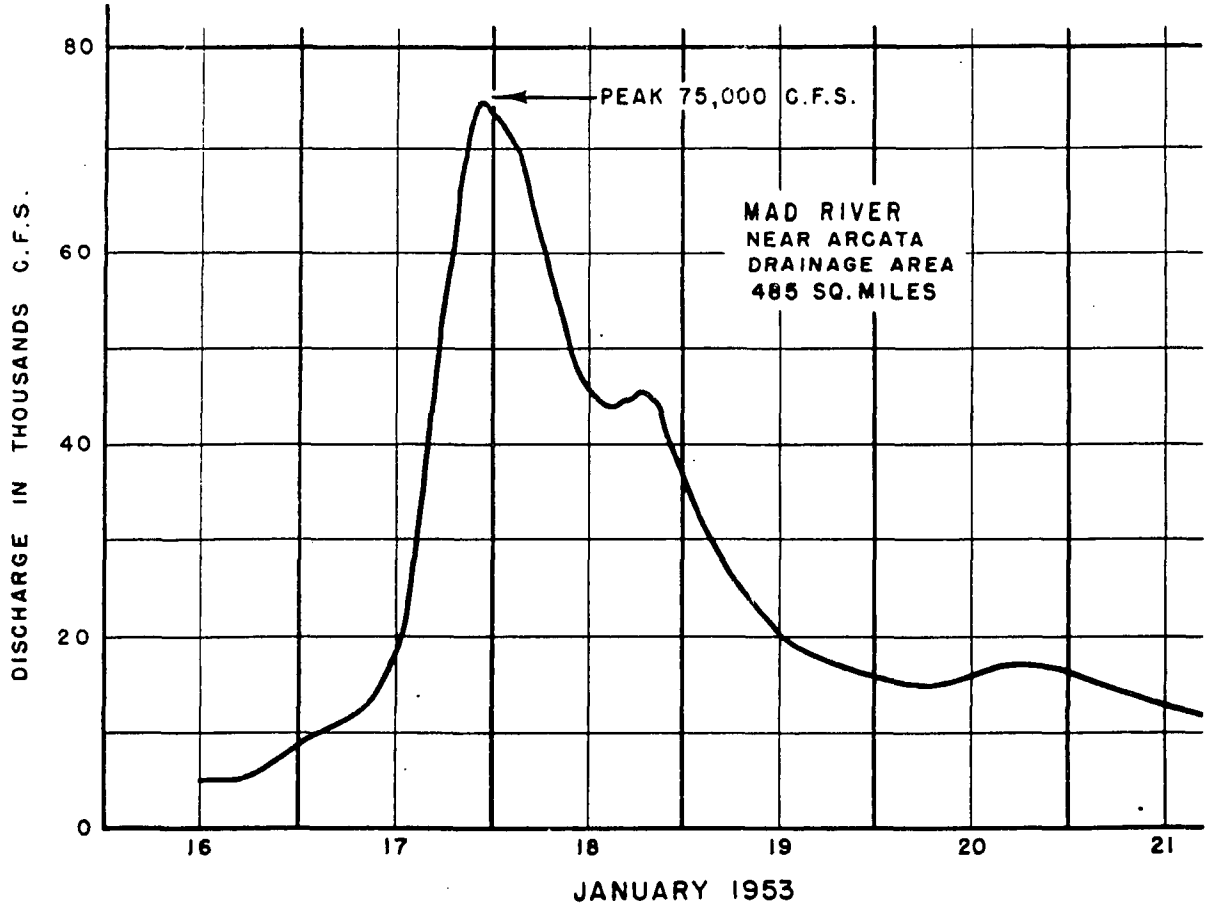

CORPS OF ENGINEERS
U.S. ARMY
OREGON
CALIFORNIA
PACIFIC OCEAN
Crescent City
Fort Dick
Orick
Blue Lake
Arcata
Korbel
EUREKA
Fortuna
Ferndale
Scotia
Weaverville
Yreka
Ruth
Covelo
Fort Bragg
Redding
SCALE - MILES
REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL STREAMS
TOTAL STORM ISOHYETS
STORM OF 16-20 JANUARY 1953
CORPS OF ENGINEERS, U.S. ARMY, SAN FRANCISCO, CALIFORNIA
DRAWN: R.R.B.
TRACED: F.H.H.
CHECKED: W.R.T.
DATE: 5 JUNE 1953
FILE No. 49-46-1

FIGURE 3

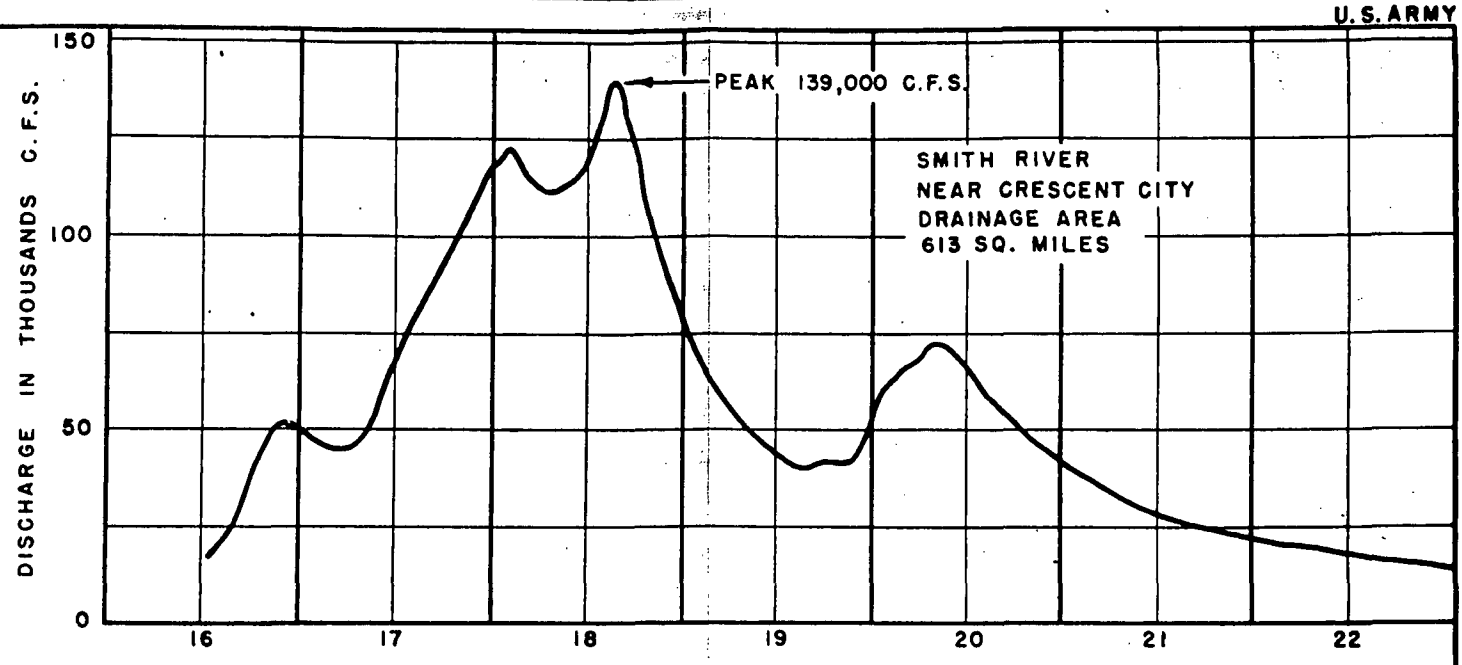
CORPS OF ENGINEERS

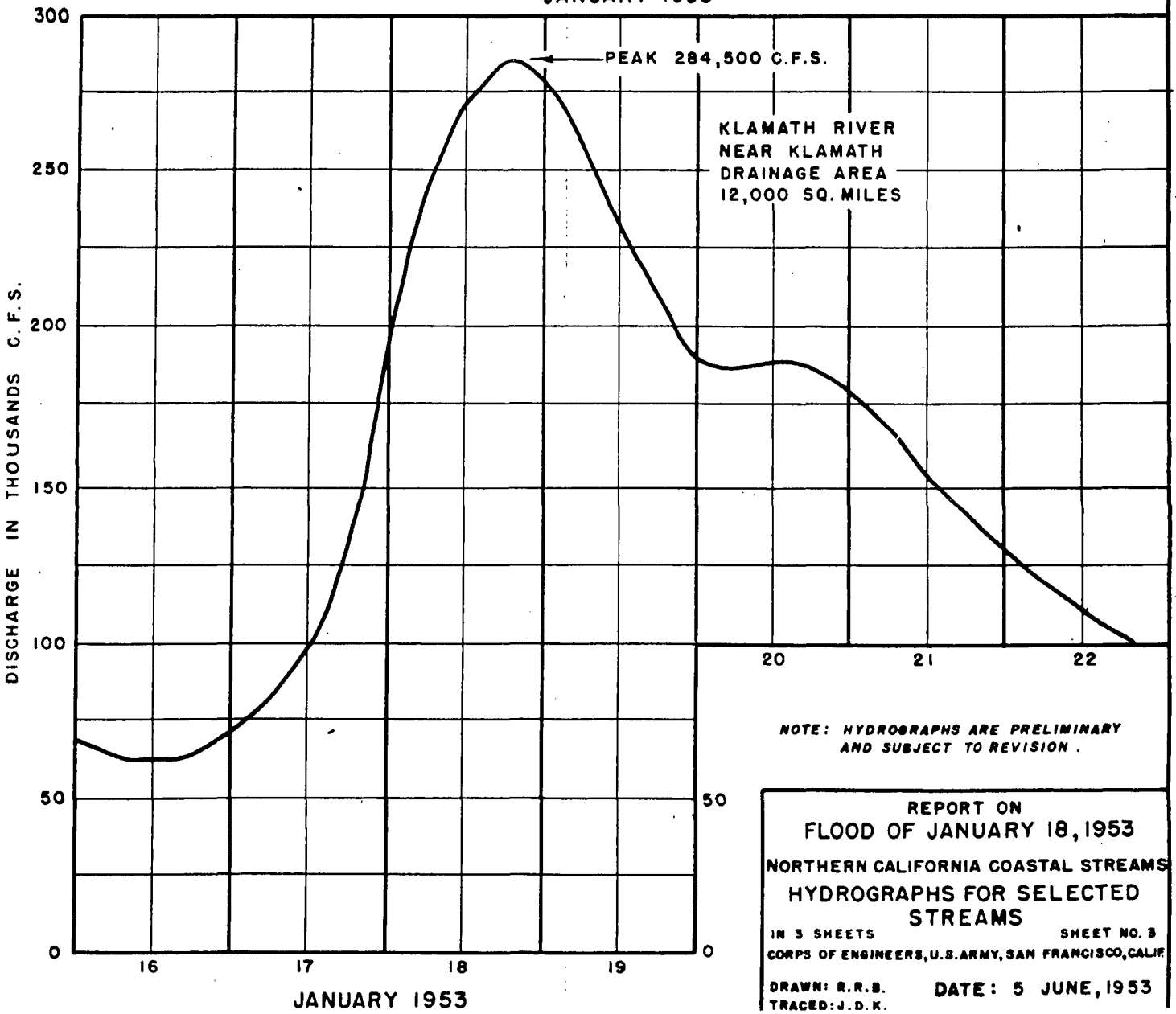






U.S. ARMY

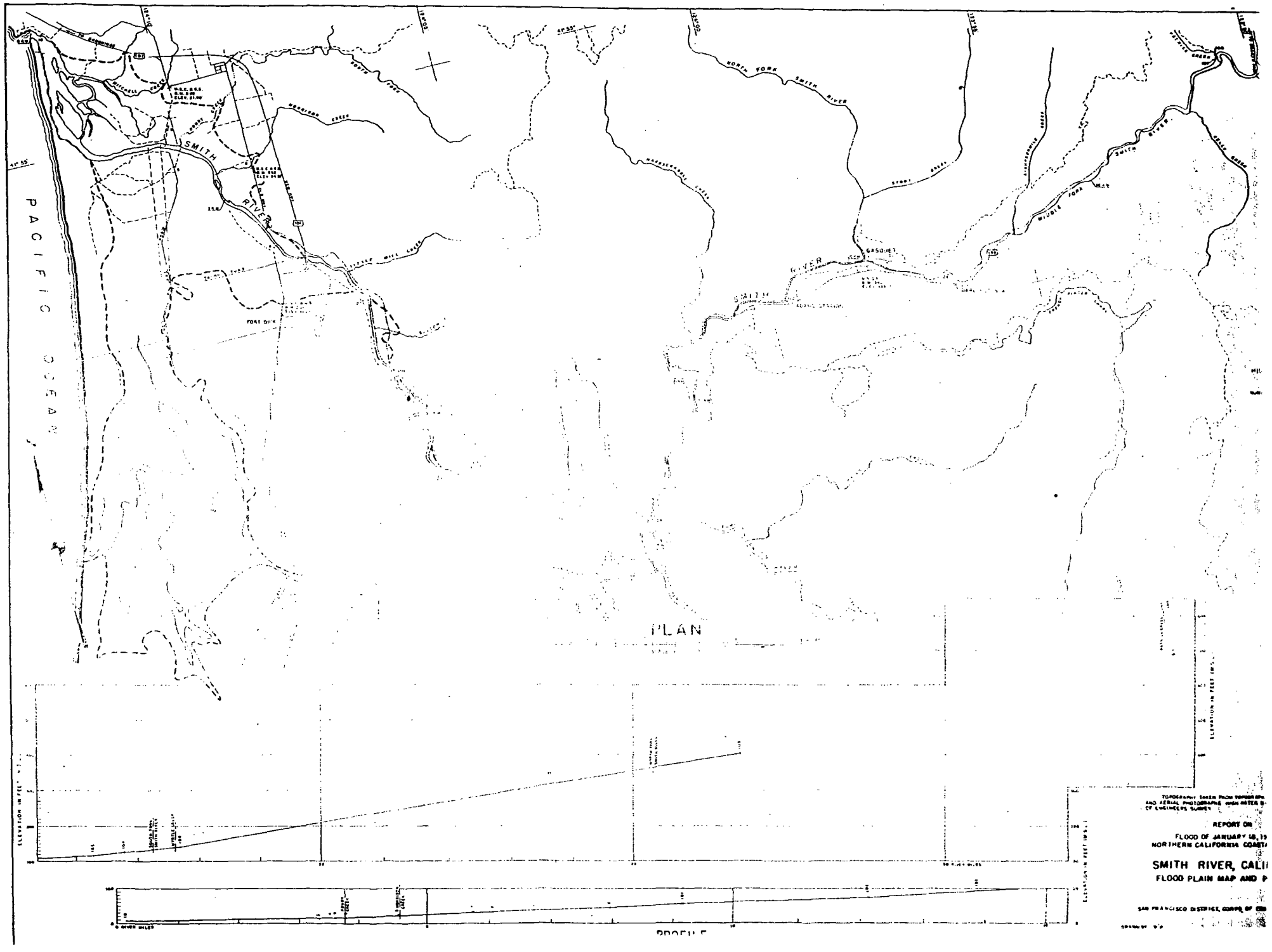




NOTE: HYDROGRAPHS ARE PRELIMINARY AND SUBJECT TO REVISION.

REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL STREAMS
HYDROGRAPHS FOR SELECTED STREAMS
IN 3 SHEETS SHEET NO. 3
CORPS OF ENGINEERS, U.S. ARMY, SAN FRANCISCO, CALIF.
DRAWN: R.R.B.
TRACED: J.D.K.
DATE: 5 JUNE, 1953

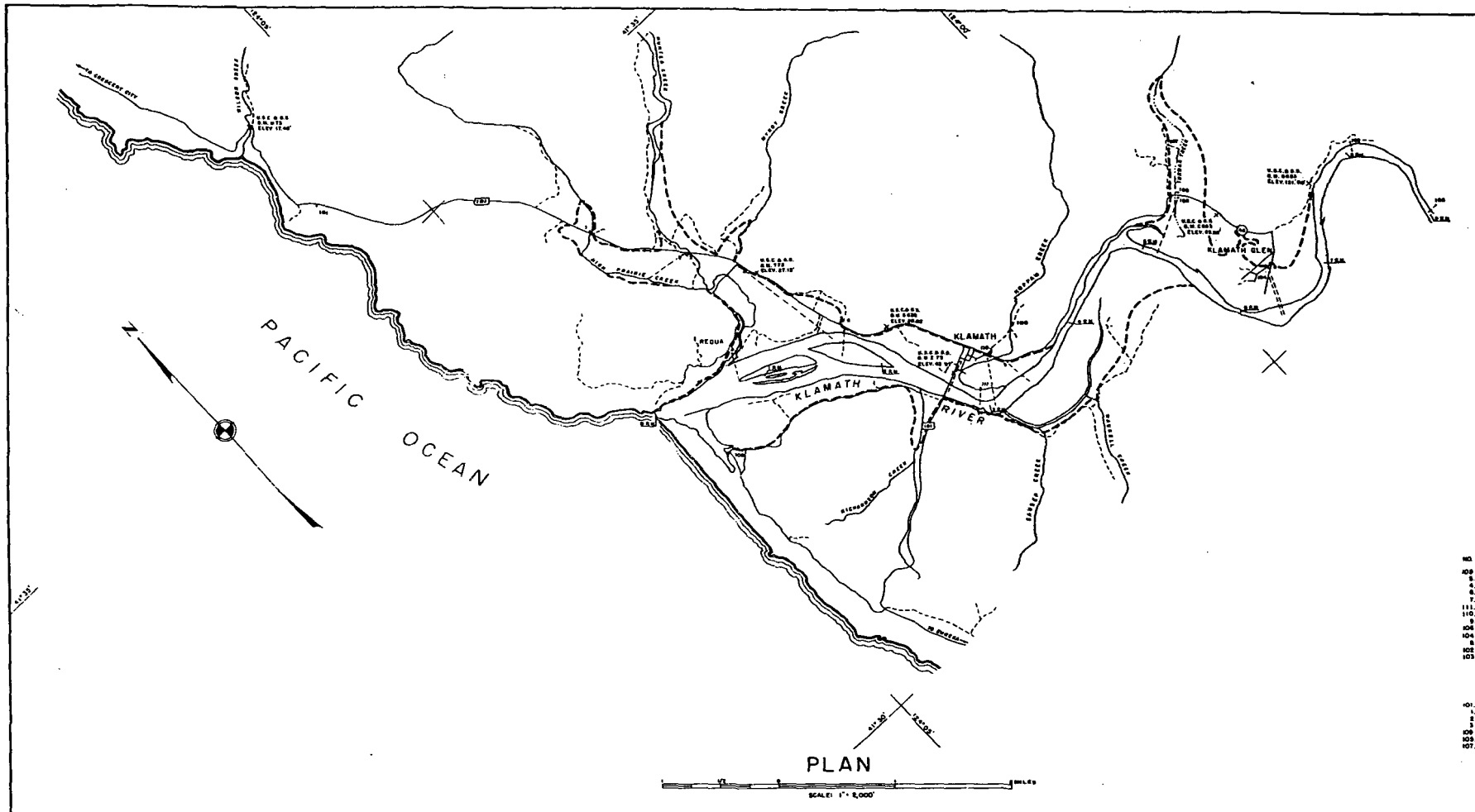
CORPS OF ENGINEERS



SMITH RIVER, CALI

FLOOD PLAIN MAP AND P

CORPS OF ENGINEERS

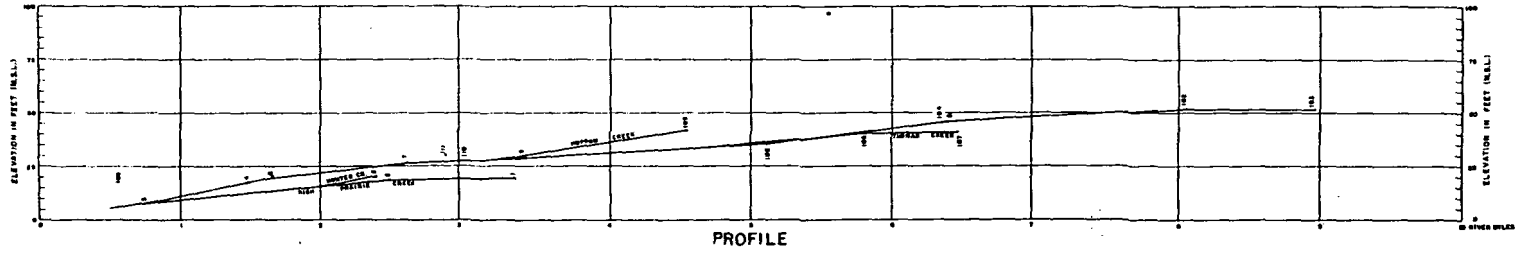


HIGH WATER MARKS

KLAMATH RIVER

NO.	ELEV.	ELEV. TOP BANK AT H.W.M.	
109	32.1'	-	
9	8.3'	-	
8	17.4'	-	
8	20.8'	28.0	
7	16.5'	-	
111	29.7'	29.8	
110	27.5'	-	
5	29.9'	-	
304	33.1'	-	
104	45.8'	-	
4	46.1'	-	
305	38.0'	-	
103	51.8'	-	

101	14.1'	-	(CRESCENT PLYWOOD CO
1	18.8'	-	(HIGH PRAIRIE CREEK)
2	17.5'	-	(PRAIRIE CREEK)
3	20.2'	-	(HUNTER CREEK)
309	41.2'	40.2	(HOPPING CREEK)
105	40.2'	-	(TURWAR CREEK)
107	40.9'	-	(TURWAR CREEK)



TOPOGRAPHY TAKEN FROM TOPOGRAPHIC QUADRANGL AND AERIAL PHOTOGRAPHS. HIGH WATER MARKS BY THE OF ENGINEERS SURVEY.

REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL STREA

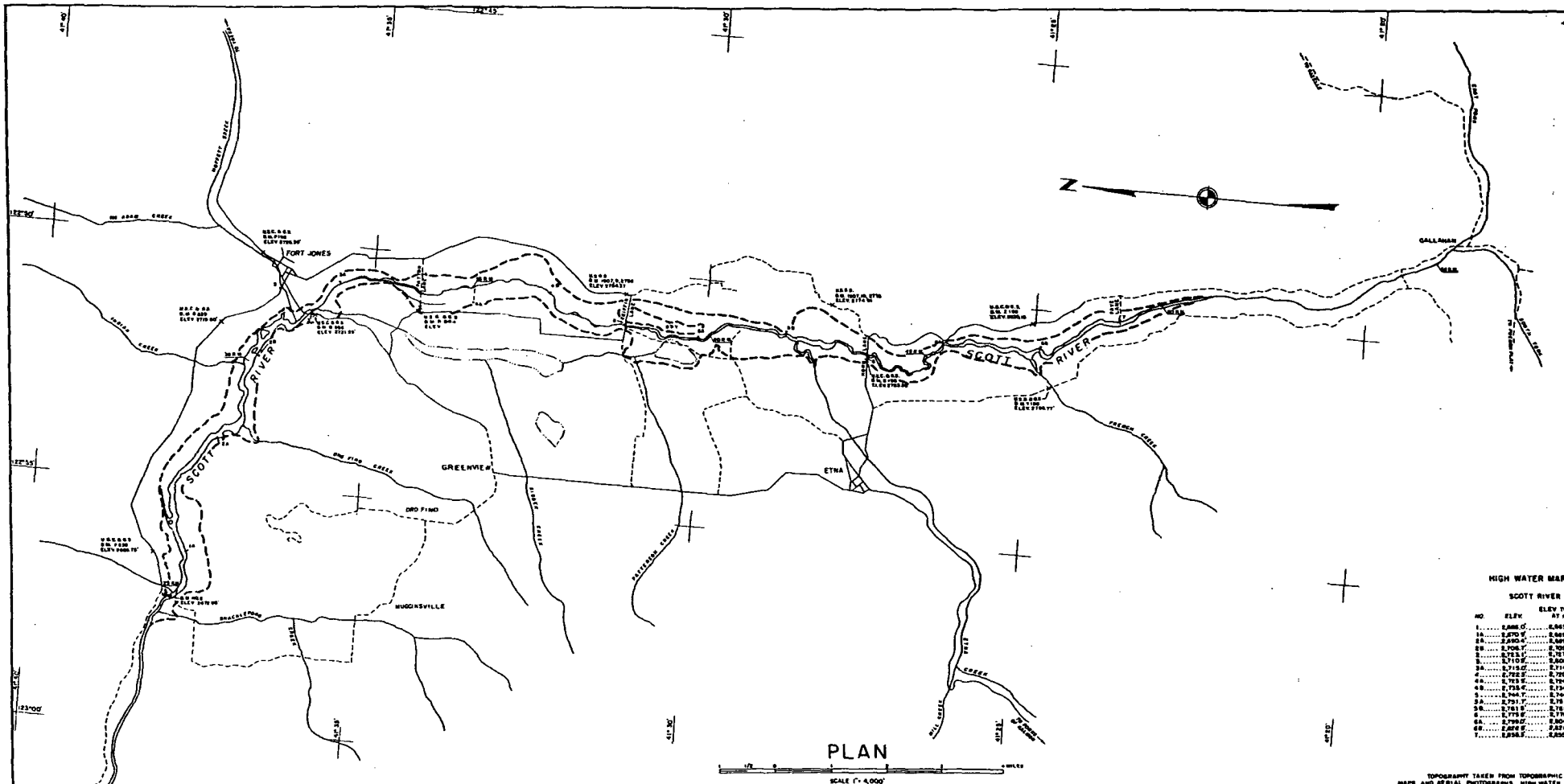
KLAMATH RIVER, CALIFORN
FLOOD PLAIN MAP AND PROFILE

SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS, U

DRAWN BY: S.S. DATE:
TRACED BY: S.S.
CHECKED BY: W.H.J., S.S.A.

FILE NO. 59-5

CORPS OF ENGINEERS



PLAN

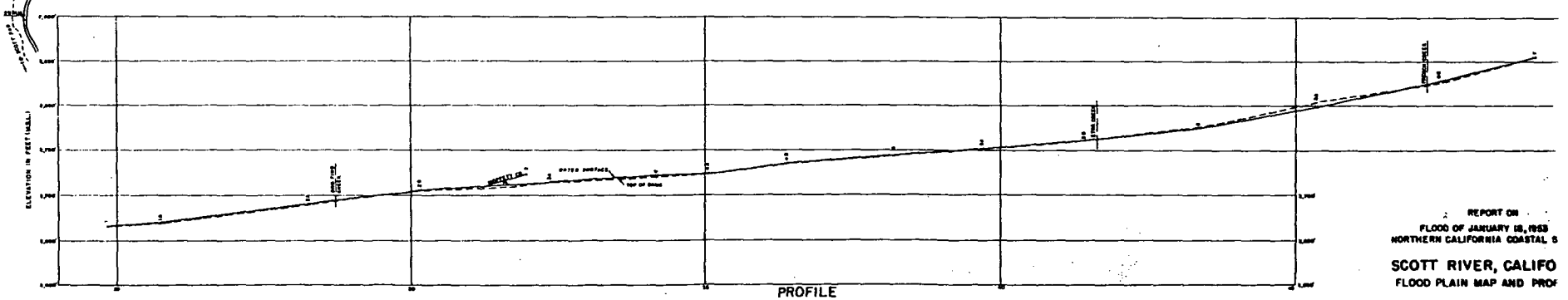
SCALE 1" = 4,000'

HIGH WATER MARKS

SCOTT RIVER

NO.	ELEV.	ELEV TOP BA AT RWM
1	2,666.0'	2,665.1' RI
1A	2,670.1'	2,669.8' RI
2A	2,690.4'	2,689.8' LI
2B	2,706.1'	2,705.1' LI
3	2,713.1'	2,712.1' RI
3A	2,710.0'	2,709.1' LI
3A	2,715.0'	2,714.0' RI
4	2,722.5'	2,720.7' RI
4A	2,723.5'	2,722.4' LI
4B	2,735.6'	2,734.3' RI
5	2,744.1'	2,742.2' RI
5A	2,751.7'	2,749.8' RI
5B	2,761.9'	2,761.6' RI
6	2,775.0'	2,774.0' LI
6A	2,790.0'	2,804.5' RI
6B	2,824.5'	2,823.0' RI
7	2,854.1'	2,853.4' RI

TOPOGRAPHY TAKEN FROM TOPOGRAPHIC QUAD MAPS AND AERIAL PHOTOGRAPHS. HIGH WATER MARK THE CORPS OF ENGINEERS SURVEY.



PROFILE

REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL S

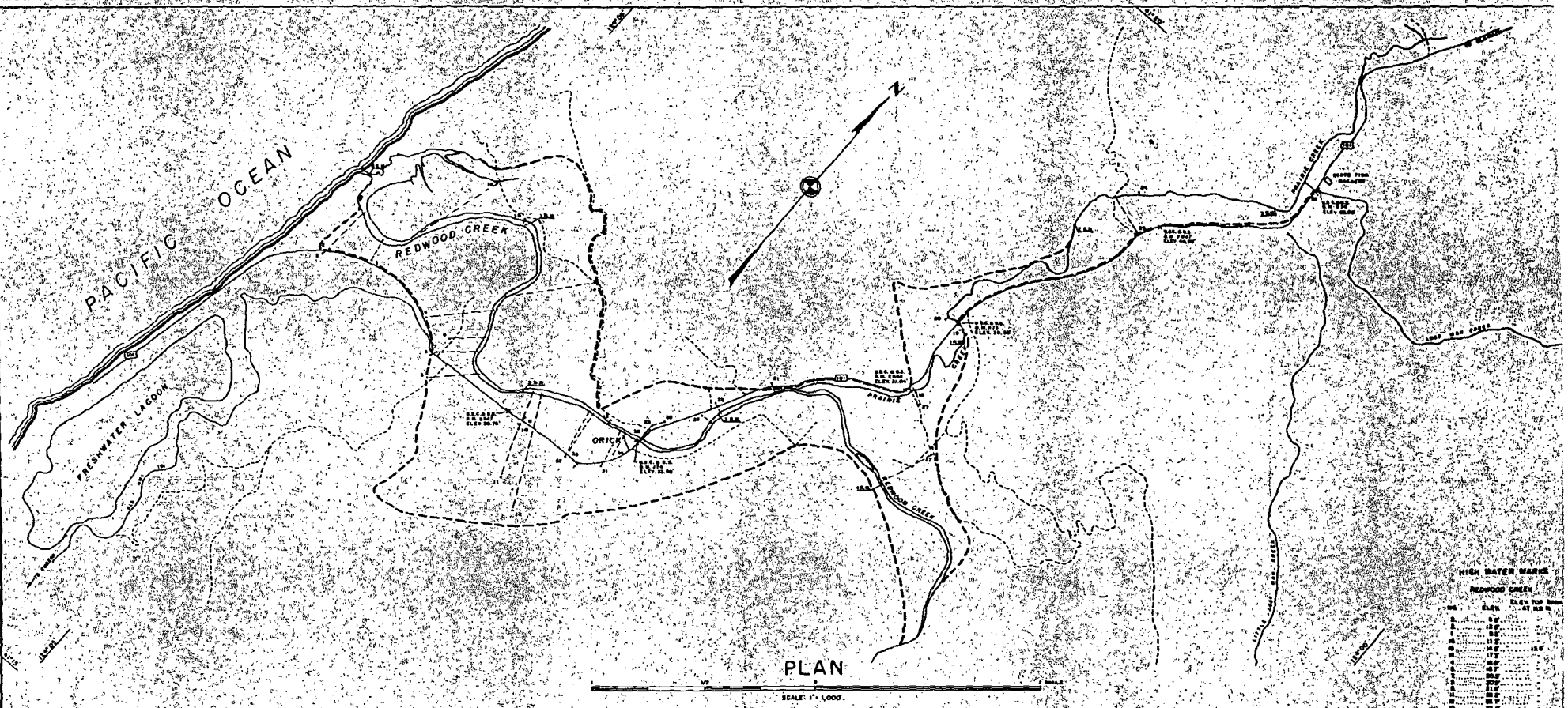
SCOTT RIVER, CALIFO
FLOOD PLAIN MAP AND PROF

SAN FRANCISCO DISTRICT, CORPS OF ENGINEE

DRAWN BY: R.S.
TRACED BY: G.S.
CHECKED BY: R.H.J., H.M.S.

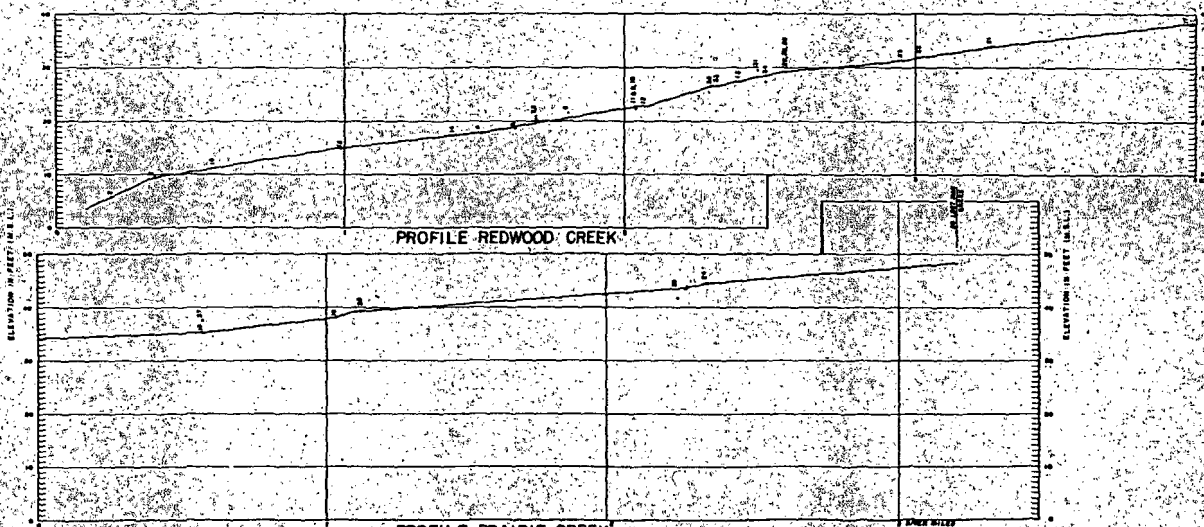
FILE NO. 5

CORPS OF ENGINEERS



PLAN

SCALE: 1" = 1,000'



TOPOGRAPHY TAKEN FROM TOPOGRAPHIC QUADRANGLES AND AERIAL PHOTOGRAPHS, HIGH WATER MARKS BY THE CORPS OF ENGINEERS SURVEY

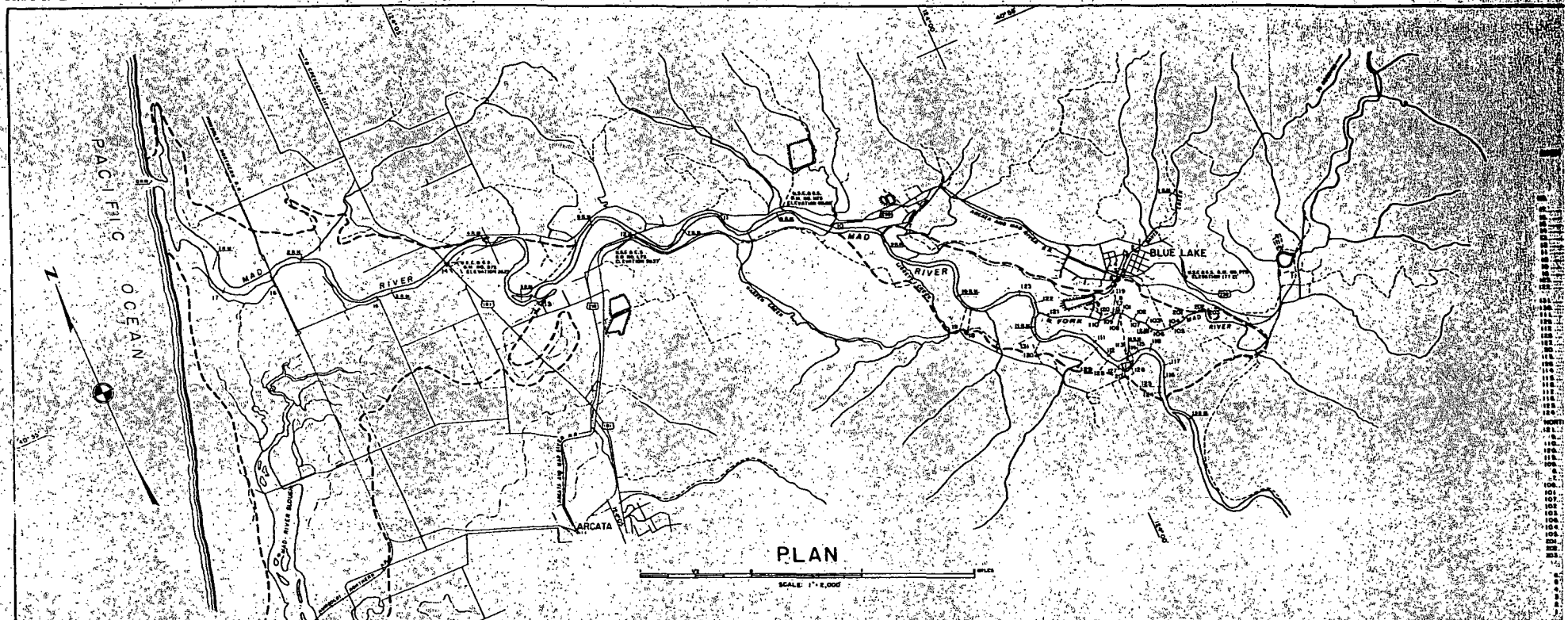
REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL STRE
HUMBOLDT COUNTY
REDWOOD CREEK, CALIFOR
FLOOD PLAIN MAP AND PROFIL

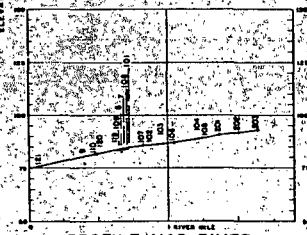
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS

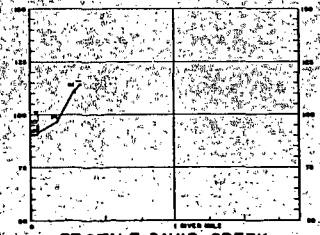
DRAWN BY U.S.
TRACED BY U.S.
CHECKED BY U.S.A., U.S.N.

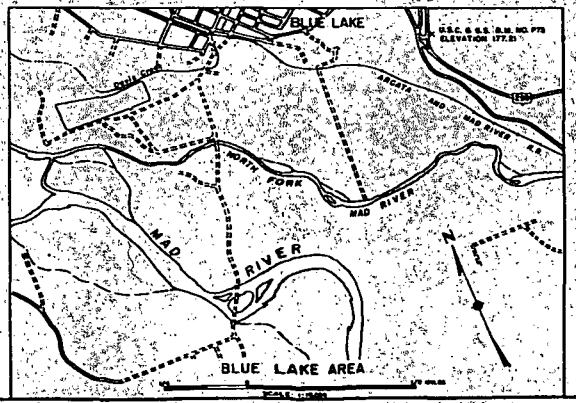
File No. 65-

CORPS OF ENGINEERS









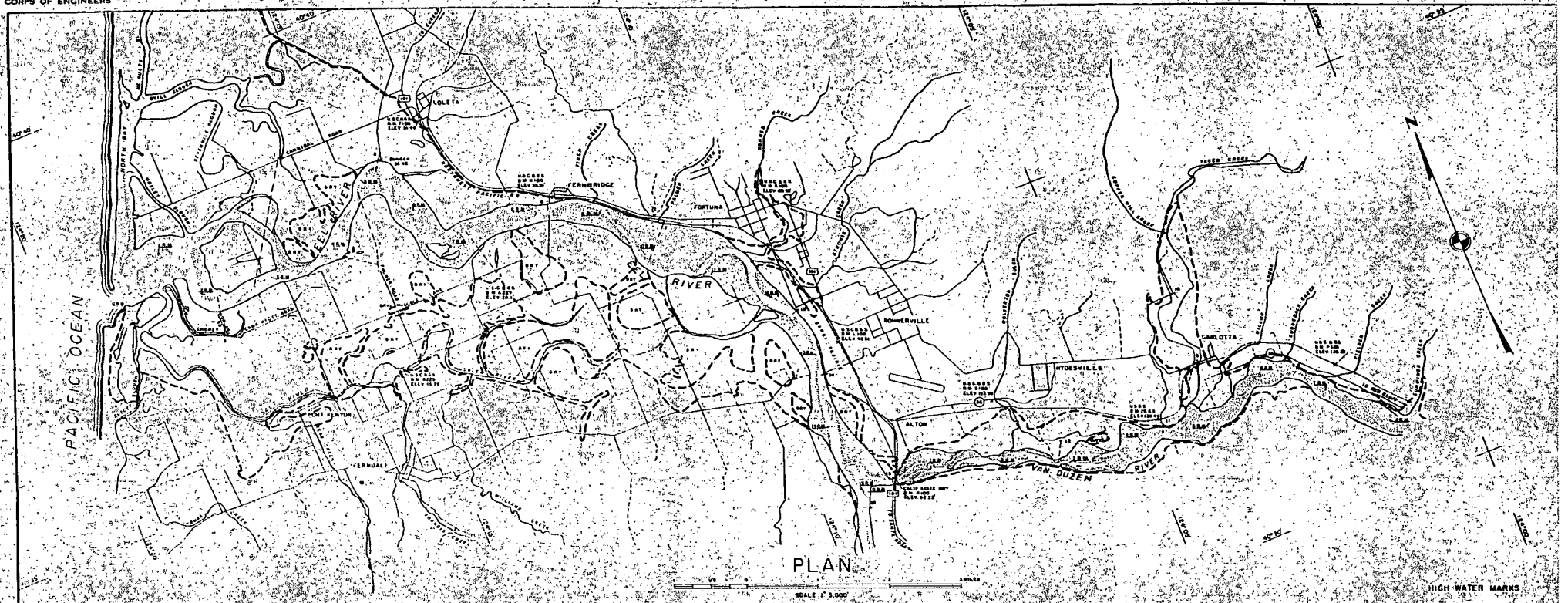
REPORT ON
FLOOD OF JANUARY 18, 1953
NORTHERN CALIFORNIA COASTAL S

MAD RIVER, CALIFOR

FLOOD PLAIN MAP AND PRO

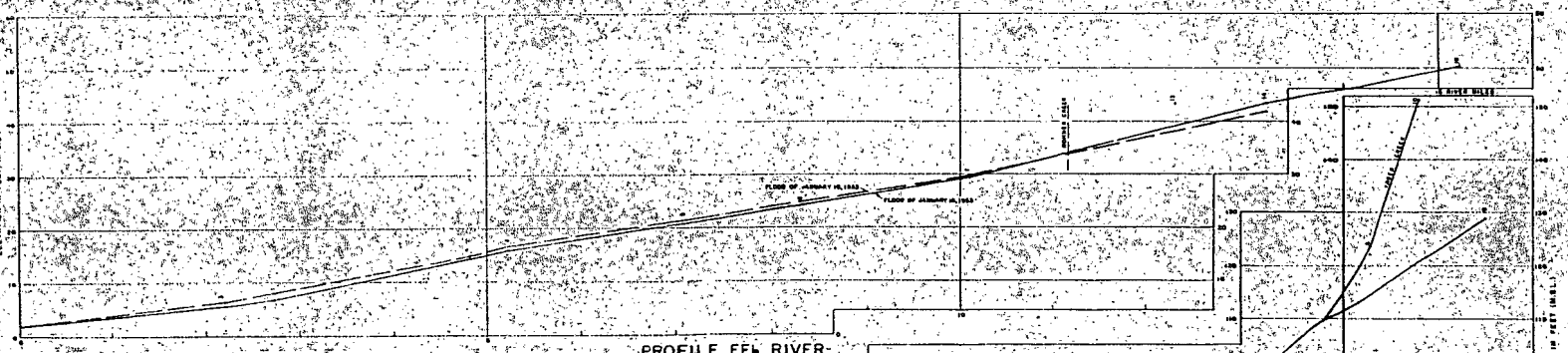
SAN FRANCISCO DISTRICT, CORPS OF ENGINE

CORPS OF ENGINEERS

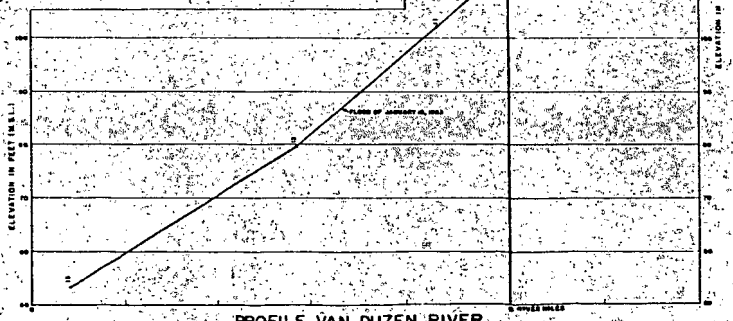


PLAN

SCALE 1" = 3,000'



PROFILE EEL RIVER



PROFILE VAN DUZEN RIVER

HIGH WATER MARKS

EEL RIVER

NUMBER	JAN 18 ELEV	JAN 19 ELEV	ELEV. TOP BANK AT H.W.M.
	8.5	7.0	
	14.0		
5	15.5	13.5	14.5
6	21.5	18.5	
8		24.0	
10	28.9	25.5	
14		43.5	48.0
16	41.9	43.3	53.1
18		50.3	56.0

VAN DUZEN RIVER

15		84.4	
16		96.4	
17		108.4	
18	120.0	120.5	121.0 (TIMBER)
19		120.5	(TIMBER)
20		120.5	

TOPOGRAPHY TAKEN FROM TOPOGRAPHIC QUADRANGLE MAPS AND AERIAL PHOTOGRAPHS. HIGH WATER MARKS BY THE CORPS OF ENGINEERS SURVEY.

REPORT ON

FLOOD OF JANUARY 18, 1953

NORTHERN CALIFORNIA COASTAL STREAMS

EEL AND VAN DUZEN RIVERS, CALIF.

FLOOD PLAIN MAP AND PROFILES

SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS, U.S.

DRAWN BY: B.W. DATE: 8

TRACED BY: B.W.

CHECKED BY: W.H.H., H.M.B.

FILE NO. 60-53-

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