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TRUCKEE RIVER
California and Nevada

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HYDROLOGY OFFICE REPORT

TRUCKEE RIVER, CALIFORNIA AND NEVADA

REVISIONS

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TRUCKEE RIVER, CALIFORNIA AND NEVADA

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CHAPTER I - INTRODUCTION

1. Purpose and scope. - This office report has been prepared to present basic hydrologic data and criteria for the Truckee River Basin, California and Nevada. This data is intended for use in feasibility studies for providing additional flood protection to the Truckee Meadows area at and below Reno, Nevada. This report discusses the hydrologic characteristics of the basin, presents an analysis of flow-frequencies, and describes the development of standard project and probable maximum floods resulting from winter type rain storms and summer-fall type cloudbursts. An analysis of spring snowmelt floods is not required for this study since these types of floods are essentially non-damaging in the Truckee Meadows area under existing conditions of upstream regulation.

2. Previous studies. - Several earlier studies of the Truckee River Basin have been conducted by this office. Reports pertaining to hydrologic studies are tabulated below.

a. Office Report, Truckee River Basin, California and Nevada, Standard Project Flood, Truckee River at Reno, Nevada, July 1957.

b. Interim Survey Report for Flood Control, Reno Area, Truckee River and Tributaries, California and Nevada, Appendix A, Hydrology, March 1960.

c. Flood Plain Information, Truckee River, Reno-Sparks-Truckee Meadows, Nevada, October 1970.

d. Master Report on Reservoir Regulation for Flood Control, Truckee River Reservoirs, Nevada and California, December 1971.

e. Flood Plain Information, Steamboat Creek and Tributaries, Steamboat and Pleasant Valleys, Nevada, June 1972.

f. Flood Plain Information, Truckee River and Martis Creek, Truckee, California, June 1974.

CHAPTER II
DESCRIPTIVE HYDROLOGY

3. Description of area. -

a. General. - The Truckee River Basin, shown on chart 1, is located in eastern California and western Nevada. The river drains about 1,070 square miles of mountainous terrain above Reno including about 500 square miles above the Lake Tahoe outlet. Most of the runoff from the basin originates on the eastern slopes of the Sierra Nevada, which rise to over 10,000 feet in this region. Lake Tahoe effectively controls all rainfloods originating above it. The Truckee River begins at the outlet of Lake Tahoe, located on the northwestern shore of the lake, where an outlet structure regulates flow into the river. From the lake, the river flows about 15 miles in a northerly direction to the town of Truckee, California, then northeasterly about 40 miles to the City of Reno, Nevada. Below Reno the river flows about 50 miles easterly and northerly to Pyramid Lake, a remnant of prehistoric Lake Lahontan. The stream basin has no outlet to the sea. The main tributaries below Lake Tahoe are the Little Truckee River, Prosser, Donner, Martis, and Steamboat Creeks. Near Reno the river enters a vast meadow, the western and northern sections of which are occupied by the cities of Reno and Sparks. The eastern portion of the meadow, which is known as Truckee Meadows, is low in elevation and poorly drained. During large runoff periods this area is flooded extensively.

The largest tributary to the Truckee River in the Reno area is Steamboat Creek. This stream originates at the outlet of Washoe Lake, a large flat depression that stores all flood runoff originating above it, drains the southern and eastern part of Truckee Meadows, and enters the Truckee River near Vista. Evans, Dry, Thomas, Whites and Galena Creeks are tributaries to Steamboat Creek and originate on the northeastern slopes of Mt. Rose. Evans and Dry Creek combine below Highway 395 to form Boynton Slough.

North Truckee Drain consists of a natural channel, now largely improved and realigned to provide better drainage of Spanish Springs Valley and the northeasterly sector of Truckee Meadows.

Stream channels in the Truckee River system range from the precipitous tributaries discharging into Lake Tahoe, with slopes of more than 500 feet per mile, to the comparatively flat slopes of less than 10 feet per mile in the lower Truckee River near Pyramid Lake. Streambed profiles of the river system are shown on chart 2.

The major population centers in the basin are located at Reno and around Lake Tahoe. Elsewhere, population is sparse with only a few small towns and settlements. The principal economic activities in the Reno-Truckee Meadows area are the gaming and warehousing industries.

Elsewhere in the basin, tourism, gaming, lumbering, farming, and ranching are the primary economic activities.

b. Geology. - In early geologic times, the Sierra Nevada had a low relief and formed the western shores of lakes which occupied the Great Basin. The present range came into being about the beginning of the Quaternary Period after an era of intense volcanic activity and crustal folding. It is composed largely of granite rock, massive granite batholiths having invaded the folds of the ancestral range during the period of mountain building. Subsequent erosion of the older rock covering has exposed the granites over large areas. Blockfaulted depressed areas filled with gravel and alluvium by the streams which flow through them form the valleys which exist today.

c. Topography. - The Sierra Nevada near the headwaters of the Truckee River tributaries is characterized by rugged rocky peaks, precipitous cliffs, steep canyons, and occasional small meadows and lakes. The lower portion of the basin consists of scattered valleys and dry lakebeds separated by mountain ranges. Elevations within the basin range from 3,900 to over 10,000 feet. About half of the area tributary to the Truckee River between Lake Tahoe and Lawton is above 6,500 feet, but only 10% is above 8,000 feet. Topography and area-elevation curves are shown on charts 3 and 4, respectively.

d. Soils and vegetative cover. - Much of the high mountain area is barren and has little soil cover, although where soil depths and precipitation are adequate, good stands of conifers exist. Below about elevation 5,000 feet, precipitation is sufficient for only sage brush and other desert shrubs. Valleys and meadows watered by running streams produce growths of native grasses. In the lower valleys, the native vegetation has been replaced to a considerable extent by irrigated crops. Most of the soils are alluvial, consisting of materials eroded from the mountainous areas. Some lake sediments laid down by ancient Lake Lahontan, which covered a large portion of the state of Nevada, are found along with the alluvial soils. Soils of the valleys are classified as gravelly or sandy loams on the alluvial slopes, and as silty or clay loams on the bottom lands. They are naturally very fertile, and, in general, are not strongly alkaline, although, without proper drainage, alkali concentrations may reduce their productivity.

4. Flood control and related water resources development. - Flood control and conservation developments in the basin are summarized in the following paragraphs:

a. Projects completed by the Bureau of Reclamation in the Truckee River Basin are the Newlands project, the Truckee River storage project, and the Washoe project. The Newlands project, completed in 1915, consists of the Lake Tahoe outlet control structure; the 290,000 acre-foot Lahontan Reservoir and appurtenant power facilities on the Carson River near Fallon; the Derby Diversion Dam on Truckee River; the Truckee Canal extending from Derby Dam to Lahontan Reservoir; and the facilities for the distribution of irrigation water in the Carson River Basin in the vicinity of Fallon.

The Truckee River storage project, completed in 1939, consists of the 41,100 acre-foot Boca Reservoir on Little Truckee River, together with appurtenant distribution facilities for irrigation. Completed in 1970, the portion of the Washoe project above Reno consists of the 29,800 acre-foot Prosser Creek Reservoir on Prosser Creek and the 226,500 acre-foot Stampede Reservoir on Little Truckee River, about 4 miles upstream from Boca Reservoir. The completed three-reservoir complex of Boca, Stampede, and Prosser Reservoirs provides a total of 50,000 acre-feet of flood control storage and additional flood protection to Reno, Sparks, and the Truckee Meadows area.

b. Developments by the Corps of Engineers include a channel modification project authorized by the Flood Control Act of 1954, consisting mainly of widening and deepening the Truckee River channel through Truckee Meadows for about 7.5 miles, extending from the downstream limits of Reno to a point near Vista; minor channel improvements at Lake Tahoe outlet; and minor channel improvements at intermittent points along the river above and below the Meadows area. This work was completed in 1963. Also, the Flood Control Act of 1962 authorized the 20,400 acre-foot Martis Creek Lake, completed in 1972, for flood control and future water supply.

c. Local interests provided channel improvements along the Truckee River, consisting of riprap and masonry retaining walls for stabilizing both banks through sections of the downtown Reno area. The work was accomplished about 1930 to 1935 by the Works Progress Administration in cooperation with local interests. As a part of the local interest requirements for Martis Creek project, the City of Reno additionally improved the channel to carry a 14,000 cubic feet per second (cfs) flow through Reno. This work was completed in 1972.

d. The Soil Conservation Service has constructed four flood detention reservoirs in the Peavine and East and West Wash watersheds north of Reno. These reservoirs contain a total of about 1,200 acre-feet of storage and provide flood protection to urban areas below the reservoirs.

e. There are other small reservoirs and lakes in the basin that contain very small amounts of storage and have no influence on flood flows on the streams of interest in this study.

5. Climate. - The upper part of the Truckee River Basin is characterized by severe winters and short, mild summers. Precipitation is markedly less than on the western slopes of the Sierra Nevada. The climate of the lower portion of the basin is typical of the Great Basin. The winters are long but with deficient precipitation, and the summers are short with practically no precipitation.

Temperatures vary considerably throughout the basin because of the extreme range in elevation, and diurnal variations are usually large. The minimum and maximum temperatures of record at Tahoe City (elevation 6,230 feet) are -15° F. and 94° F., and at Reno (elevation 4,400 feet) are -16° F. and 104° F., respectively. The monthly distribution of normal temperatures and observed temperature extremes at these two stations as well as at the Truckee Ranger Station and at Boca is illustrated in the following table:

TABLE 1

NORMAL1/ MONTHLY TEMPERATURES (F°)

Month	Tahoe City (El. 6230')	Truckee R.S. (El. 5995')	Boca2/ (El. 5575')	Reno WB AP (El. 4404')
January	26.9	25.6	23.7	30.4
February	28.4	28.0	26.8	35.6
March	32.2	32.7	31.8	41.5
April	38.8	39.7	39.9	48.0
May	45.7	46.6	47.2	53.9
June	53.0	54.1	53.6	60.1
July	60.9	61.9	60.1	67.7
August	60.0	60.4	58.0	65.5
September	54.3	55.3	52.8	58.8
October	45.0	45.6	44.7	49.2
November	35.3	35.0	35.3	38.3
December	30.3	28.5	28.1	31.9
Average Annual	42.6	42.8	41.8	48.4

1/ Normals for all stations are climatological normals based on the period 1931-1960 (as published by USWB).

2/ Boca values are averages for the period of record.

OBSERVED TEMPERATURE EXTREMES

Location	MAXIMUM F°	MAXIMUM Month	MINIMUM F°	MINIMUM Month
Tahoe City	94	August	-15	January
Truckee R.S.	101	August	-28	Jan. & Feb.
Boca	97	July	-45	January
Reno WB AP	104	July	-16	January

Normal annual precipitation over the drainage area between Lake Tahoe and Vista varies from 8 to 70 inches, with a basin mean of 26.5 inches. Precipitation usually falls as snow above elevation 5,000 feet, but some storms produce rain up to the highest elevations of the basin, and snowfall may occur anywhere in the basin.

The areal distribution of normal annual precipitation is shown on chart 5. In the upper part of the basin, about 85% of the annual precipitation falls during the winter months of November through April, but at Reno only 70% of the annual precipitation falls during this period. The normal monthly distribution is shown in the following table.

TABLE 2

NORMAL1/ MONTHLY PRECIPITATION

MONTH	TAHOE CITY (El. 6230')		TRUCKEE R.S. (El. 5995')		BOCA2/ (El. 5575')		RENO WB AP (El. 4404')	
	Inches	Percent	Inches	Percent	Inches	Percent	Inches	Percent
July	0.26	0.8	0.35	1.1	0.32	1.5	0.27	3.8
August	0.14	0.5	0.17	0.6	0.23	1.1	0.17	2.4
September	0.40	1.3	0.37	1.2	0.25	1.2	0.23	3.2
October	1.90	6.1	1.82	5.8	1.01	4.7	0.51	7.1
November	3.15	10.2	3.10	10.0	1.86	8.7	0.57	8.0
December	5.64	18.3	5.66	18.2	3.64	16.9	1.08	15.1
January	6.13	19.8	6.15	19.7	4.92	22.9	1.19	16.6
February	5.32	17.2	5.24	16.8	3.43	16.0	1.02	14.3
March	3.95	12.8	4.02	12.9	3.02	14.1	0.68	9.5
April	2.10	6.8	2.27	7.3	1.33	6.2	0.54	7.5
May	1.35	4.4	1.46	4.7	1.03	4.8	0.52	7.3
June	0.56	1.8	0.56	1.7	.42	1.9	0.37	5.2
ANNUAL	30.90	100	31.14	100	21.46	100	7.15	100
NOV-APR. TOTAL	26.29	85.1	26.44	84.9	18.20	84.8	5.08	71.1

1/ Normals for all stations are climatologic normals based on the period 1930-1960 (published by USWB).

2/ Boca values are averages for the period of record.

Winter snowfall above 5,000 feet elevation normally accumulates until about the first of April, when increasing temperatures mark the beginning of the snowmelt season. Snow falling at lower elevations usually melts within a relatively short time. Basin snowpack data for a wet year (1952), a dry year (1963), a near normal year (1953), and the average for 1 April at representative snow courses are given in Table 3.

6. Runoff. - Most of the runoff from the Truckee River watershed is derived from the snowpack which accumulates over the high mountain

areas during the winter and melts during the late spring and early summer. A large part of the runoff of the Truckee River Basin originates above Farad, with about 31 percent above Lake Tahoe. Because of the regulatory effect of Lake Tahoe, outflows into Truckee River are normally minor except during snowmelt seasons of above-normal runoff. Annual runoff at Farad has varied from 133,000 acre-feet in 1931 to 1,432,000 acre-feet in 1907. Average monthly and annual runoff are illustrated in Table 4.

TABLE 3
1 APRIL SNOW SURVEY DATA
(Truckee River Basin, California and Nevada)

No.	Snow Course	Elev. (Feet)	Snow Depth (Inches)			Water Equivalent (Inches)			Water Equivalent % of Average			Average* (Inches)
			1952	1953	1963	1952	1953	1963	1952	1953	1963	1 April
334	Mt. Rose	9,000	154	79	77	68.1	33.8	28.0	205	102	84	33.8
64	Webber Peak	7,800	184	106	61	86.8	43.5	20.5	197	99	46	44.4
69	Donner Summit	6,900	184	81	25	82.0	39.0	6.1	206	98	15	39.9
90	Sage Hen Cr.	6,500	113	53	24	45.3	21.0	5.0	240	111	26	18.3
92	Truckee #2	6,400	NR	41	21	NR	17.7	4.7	-	105	28	16.2
105	Tahoe City	6,250	89	30	16	38.6	14.6	2.9	327	124	25	11.1
95	Boca #2	5,900	61	7.0	T	25.0	3.8	T	472	72	0	4.8

*The average 1 April water content is for the period 1931-1971, as published in "California Snow Survey Measurement Schedule, 1971."

TABLE 4
Average Monthly Runoff (observed flows)

Month	Truckee River at Tahoe City, CA		Martis Cr. near Truckee, CA		Little Truckee R. above Boca Reservoir, CA		Truckee R. at Farad, CA		Truckee R. at Reno, NV		Steamboat Cr, at Steamboat, NV		Truckee R., below Derby Dam near Wadsworth, NV	
	(1895-96, 1909-78) Ac-ft	%	(1959-1978) Ac-ft	%	(1939-1978) Ac-ft	%	(1909-1978) Ac-ft	%	(1912-19, 30-35, 43-44, 46-78) Ac-ft	%	(1962-78) Ac-ft	%	(1918-78) Ac-ft	%
Oct	13,300	8.1	496	3.0	5,820	4.7	24,100	4.4	16,200	3.6	451	4.6	3,720	1.6
Nov	11,700	7.1	714	4.3	4,580	3.7	23,800	4.4	22,500	5.0	375	3.8	5,760	2.4
Dec	12,500	7.6	1,030	6.1	6,520	5.3	30,400	5.6	31,500	7.0	421	4.3	15,400	6.4
Jan	13,200	8.0	1,650	9.8	5,190	4.2	33,300	6.1	36,200	8.1	787	8.0	20,000	8.3
Feb	14,800	9.0	1,460	8.7	6,330	5.1	33,500	6.1	36,400	8.1	816	8.3	24,000	10.0
Mar	13,700	8.3	2,080	12.4	9,160	7.4	44,700	8.2	45,900	10.2	935	9.6	27,600	11.5
Apr	8,630	5.2	3,460	20.6	22,300	18.0	76,800	14.1	67,200	15.0	857	8.8	40,000	16.7
May	8,120	4.9	3,260	19.4	32,400	26.1	105,000	19.2	86,700	19.4	1,300	13.3	55,900	23.3
Jun	12,900	7.8	1,480	8.8	18,300	14.8	75,000	13.8	58,000	12.9	1,780	18.2	33,700	14.1
Jul	18,000	10.9	436	2.6	6,520	5.3	39,400	7.2	21,000	4.7	972	9.9	6,830	2.8
Aug	20,600	12.5	346	2.1	4,270	3.4	31,700	5.8	13,800	3.1	646	6.6	3,520	1.5
Sep	17,500	10.6	360	2.2	2,540	2.0	27,600	5.1	13,000	2.9	445	4.6	3,260	1.4
Annual (Rounded)	165,000	100.0	16,800	100.0	124,000	100.0	545,000	100.0	448,000	100.0	9,790	100.0	240,000	100.0

7. Streamflow data. - Streamflow records in the Truckee River Basin are available at the locations shown and listed on chart 6.

8. Precipitation data. - Precipitation records at stations in and adjacent to the Truckee River Basin have been published by the U. S. Weather Bureau since 1870. Locations and data pertinent to these stations are shown on chart 5.

9. Storm characteristics. - Precipitation in the headwater areas of the Truckee River Basin usually is associated with general storms which occur during the winter season of November through April. These storms originate over the Pacific Ocean and must cross the continuous barrier of the Sierra Nevada, which averages 8,000 feet in elevation, to reach these areas. The Truckee River headwater area is directly opposite the Donner Pass gap in the barrier, and occasionally air masses carry considerable precipitable moisture over the pass and cause heavy rainfall on the eastern slopes and on the Mt. Rose ridge east and north of Lake Tahoe. Storm periods last from 1 to 4 days. These storms usually produce general snowfall over the headwater areas, but some storms produce rain up to the maximum elevations of the basin.

The major general storms that have occurred over the Truckee River Basin since 1900 are those of February 1904, March 1907, January 1909, January 1914, January 1916, March 1928, December 1937, March 1940, January 1943, February 1945, November 1950, December 1950, December 1955, January-February 1963, and December 1964.

Local cloudbursts occur frequently during the summer. They usually occur in July and August when warm, moist air is more likely to reach this area of Nevada from the Gulf of California. These storms are characterized by high intensities over small areas and can produce large flood flows on the smaller tributary streams but do not have a major impact on flow in the Truckee River.

10. Flood Characteristics. - Floods in the Truckee River Basin can be divided into three distinct types: general rainfloods, cloudburst floods, and snowmelt floods.

General rainfloods, which occur during the period of November through April, result from general rain storms covering a large part of the basin and are characterized by high peak flows and short durations (3 to 6 days). The total volume of runoff from such floods is relatively small. A number of major general rainfloods have been experienced in the Truckee River Basin. Table 5 provides data on some of the larger floods at Reno.

TABLE 5

TRUCKEE RIVER AT RENO - HISTORICAL RAINFLOODS

Date	Peak Flow (cfs)	Max 1-Day Mean Flow (cfs)	Max 3-Day Volume (ac ft)
18 Mar 07	18,500	14,600	68,400
16 Jan 09	10,100	8,540	43,600
26 Mar 28	18,800*	-	66,900*
11 Dec 37	17,000*	-	53,100*
21 Nov 50	19,900	14,100	55,300
4 Dec 50	11,700	6,580	30,600
23 Dec 55	20,800	16,200	67,400
1 Feb 63	18,400	11,500	47,700
23 Dec 64	11,300	9,400	44,600

*Estimated from records at other stations.

Snowmelt floods result from the melting of the snow-pack during the late spring and early summer (April through July) and have relatively large volumes and long durations. The distribution of runoff during the flood period is dependent on the ripeness of the snow and the variation in air temperatures. Generally the highest rates of flow occur in May and June. Snowmelt floods are essentially non-damaging in the Truckee Meadows area under existing conditions of upstream regulation. Data on several snowmelt floods are tabulated below.

TABLE 6

TRUCKEE RIVER AT RENO - HISTORICAL SNOWMELT FLOODS

Date	Peak Flow (cfs)	Max 1-Day Mean Flow (cfs)	Max 3-Day Volume (ac-ft)	April-July Volume (ac-ft)	Annual Volume (ac-ft)
7 May 06	-	6,600*	-	740,000*	-
14 Apr 07	-	7,200*	-	841,000	1,372,500
26 Apr 11	-	6,060	33,300	743,000	1,020,000
15 May 38	-	7,000*	-	652,000*	-
3 May 52	7,950	7,630	42,800	821,000	1,231,000
20 May 58	6,090	5,750	33,700	591,000	794,500
22 May 67	6,800	6,200	33,200	576,200	829,800

*Estimated from records at other stations.

Cloudburst floods are characterized by very high peak flows of short duration and low volume. These floods occur during the summertime, can carry large amounts of debris and sediment, and can cause considerable damage on the smaller tributaries. Data on several cloudburst floods are tabulated below.

TABLE 7

HISTORICAL CLOUDBURST FLOODS

Stream	DA (sq. mi.)	Date	Peak Flow (cfs)	Max 1-Day Mean Flow (cfs)
Galena Creek near Steamboat	8.5	20 Jul 56	4730	---
		15 Aug 65	3670	250
Whites Creek near Steamboat	8.02	15 Aug 65	2280	100

CHAPTER III
STORM AND FLOOD ANALYSIS

11. General. - For purposes of hydrologic analysis the Truckee River Basin has been subdividied as indicated on chart 7. These subdivisions were made at various stream gage locations and at the various lakes and reservoirs to facilitate analysis of past floods. The many small area subdivisions around Reno were made to facilitate possible future studies of this urban area. Because of the large surface area and volume of Lake Tahoe, relative to its drainage area, runoff into the lake during rain-flood periods is completely regulated and releases are negligible. Accordingly, the area above Lake Tahoe was not considered in the analysis. The analysis was made by developing a mathematical model of the basin using the computer program "HEC-1, Flood Hydrograph Package," as modified by the Sacramento District. The analysis includes a determination of base flows, loss rates, unit hydrographs, and flood routing parameters.

12. Floods analyzed. - The December 1955 and January-February 1963 storms and floods represent two of the largest general rain floods in the basin for which adequate flood hydrograph and precipitation data are available. Flood hydrographs and reconstitutions are shown on charts 8 and 9. Several large cloudburst floods have occurred on Galena and Whites Creeks. An analysis of these events was not possible because flood hydrographs and adequate precipitation data are not available.

13. Storm precipitation. - Basin precipitation for the 1955 and 1963 storms was determined from the isohyetal maps shown on charts 10 and 11. These maps were prepared from available precipitation data at the stations indicated on the charts. In areas where precipitation data was missing the isohyetal lines were patterned after the normal annual precipitation isohyetals. Time distribution of precipitation was based on the records at one or more of the recording stations.

14. Snow effects.

a. December 1955. - Available data indicated that a substantial snowpack existed over the upper elevations of the Truckee River Basin prior to the December 1955 storm. Snow depths varied from zero at the 6,000 foot elevation to around 100 inches at the 9-10,000 foot elevation. Potential snowmelt rates were computed for each 1,000 foot elevation band by use of the melt equation for rain-on-snow conditions and partly forested areas given in EM 1110-2-1406. Temperatures were based on the record at the Truckee Ranger Station and a lapse rate of 3° F. per 1,000 feet. Wind data were based on the records at Sacramento since no other data was available. Winds used were those actually observed at Sacramento, reduced by 25 percent to approximate average conditions on the mountain slopes since Sacramento has an open exposure, and adjusted for elevation using figure 5-27 of "Hydrometeorological Report No. 36", dated October 1961.

The influence of the snowpack on runoff was determined using a computational procedure developed by the Bureau of Reclamation and described in Engineering Monograph No. 35, "Effect of Snow Compaction on Runoff From Rain on Snow", dated June 1966. The procedure is basically a water-budget analysis which accounts for the water in the snowpack until it is released in drainage. It uses the concept of "threshold density" and recognizes the compaction (shrinkage) of the snowpack as water is added. "Threshold density," defined as the density of the snowpack at which compaction ceases and drainage from the pack begins, was assumed to be 40 percent. This procedure is similar to that presented in EM 1110-2-1460. The primary difference is that the EM procedure assumes that the initial snowpack is "ripe" (at "threshold density") over the entire basin whereas the USBR procedure allows the adoption of an initial snowpack with densities varying with elevation. The assumption of a "ripe" pack throughout the basin would not be realistic for the Truckee River since pack densities are known to vary with elevation.

Total available water was computed for each 1,000 foot elevation band using the above procedures. The area above 8,000 feet was non-contributing.

b. January-February 1963. - Available data indicates that the snow cover prior to the 1963 flood was substantially less than existed prior to the 1955 flood and that snowmelt apparently did not contribute significant amounts to runoff. Accordingly, a snowmelt analysis was not made. Based on available temperature data it was determined that rain fell up to an elevation of about 9,000 feet. This elevation was used to determine contributing areas for the flood reconstitutions.

15. Baseflow. - Baseflow was separated from the total runoff hydrographs as indicated on charts 8 and 9. Baseflow adopted for standard project and probable maximum general rain flood computations was slightly higher than observed historically to account for wetter antecedent conditions. Baseflow for cloudburst standard project and probable maximum flood computations for the tributary streams around Reno was assumed to equal a normal summertime flow on these streams since these types of storms occur during the summer.

16. Loss rates. - Loss rates developed during this study are based on the initial and constant infiltration loss concept. Higher losses were adopted for cloudburst floods because these events occur during the summertime when ground conditions are dry.

a. General rain floods. - Constant losses obtained from the flood reconstitutions ranged from a low of 0.05 inches per hour to a high of 0.23 inches per hour and averaged 0.15 inches per hour for the 1963 flood and 0.10 inches per hour for the 1955 flood. Based on these results a constant loss rate of 0.10 inches per hour was adopted for standard project and probable maximum flood computations. A slightly higher loss rate of 0.12 inches per hour was adopted for Spanish Springs Valley to account for additional ponding losses in this area. Zero initial losses were adopted for computation of standard project and probable maximum floods since antecedent conditions would be wet prior to the onset of these floods.

b. Cloudburst floods. - As discussed previously, a determination of loss rates using reconstitutions of historical cloudburst floods was not possible due to a lack of hydrograph and precipitation data. A constant loss rate of 0.16 inches per hour and an initial loss of 0.30 inches was adopted. These losses are slightly higher than used for general rain floods since the cloudburst floods occur during the summertime when dryer ground conditions prevail. The adopted losses are consistent with those used in earlier studies.

17. Unit hydrographs. - Unit hydrographs for this study were developed using the modified Los Angeles District S-curve procedure presented in Technical Bulletin No. 5-550-3, "Flood Prediction Techniques," dated February 1957. This procedure utilizes a non-dimensional summation graph (S-curve) in conjunction with a basin factor (n), which relates lag time to basin characteristics, to develop unit hydrographs. Adopted S-curves and lag relationships are shown on charts 12 and 13, respectively. Unit hydrograph parameters and ordinates are listed on tables 8, 9, 10, 11 and 12 (located at the end of text).

In a few cases the n values used for reconstitution of the 1955 and 1963 floods differ slightly. The values used for the 1963 flood were adopted for standard project flood computations since this flood is the largest on record in the basin. Unit hydrographs with higher peaks and shorter lag times than the 1963 unit hydrographs were developed for computation of probable maximum floods to account for the increased hydraulic efficiency of the basins during the occurence of this type of event. These adjustments were accomplished by reducing the n values by 20 percent which produces a corresponding change in peak flows and lag times.

The S-curve used to establish unit hydrographs for the subareas above Lawton was developed from an analysis of the 1963 flood on Martis Creek, Alder Creek, Little Truckee River near Hobart Mills and Little Truckee River near Boca. The S-curves developed from the unit hydrographs for these areas were similar and the Martis Creek S-curve was adopted as being typical for the area.

Unit hydrographs for the subareas below Lawton, except Spanish Springs valley, were developed using either the Truckee Meadows average valley S-curve (length = 743%), the Truckee Meadows average mountain S-curve for general rain events (length = 700%), or the Truckee Meadows average mountain S-curve for cloudburst events (length = 402%). The two mountain curves were developed for the Truckee Meadows Flood Plain Information study (1969). The valley curve is identical to the Los Angeles Valley S-curve used by the Los Angeles District and was used in the Truckee Meadows area for the flat valley areas.

The unit hydrograph developed for Spanish Springs Valley in the Truckee Meadows F.P.I. study used the Clark unit hydrograph technique. The unit hydrograph reflected Clark coefficients of $T_c = 6.0$ hours and $R = 6.0$ hours. A revised unit hydrograph for Spanish Springs Valley was developed for the current study because the drainage area has been revised from that used in the FPI study to account for non-contributing areas. The revised unit hydrograph was developed from an S-curve prepared using the original unit hydrograph from the FPI study. The S-curve is shown on chart 12.

18. <u>Flood routings</u>. - The Truckee River and its tributaries, with the exception of the Truckee Meadows area, are mountainous streams where flows are confined to narrow canyon channels. Channel storage during large floods is small and does not significantly attenuate peak flows. Accordingly, flood routings for the Truckee River basin were accomplished using Muskingum coefficients for most routing reaches supplemented by Modified-Puls routings where storage has a considerable influence on downstream flows. A routing schematic with adopted routing coefficients is shown on chart 14. These coefficients were verified by reconstitution of the 1955 and 1963 floods. Modified-Puls routings and additional refinements are discussed below.

a. Six storage-discharge relationships were developed for Truckee Meadows to represent the differing channel and storage conditions in the Meadows. These relationships were developed using streamflow information at the Vista gage, calculated water surface profiles, historic high water marks in the Meadows and computed storage volumes from available topographic maps. The relationships for 1955 and 1963 conditions are shown on chart 15. The difference between the 1955 and 1963 curves represents the channel enlargement work completed in 1963. Storage-discharge relationships for present (1980) conditions and future (1990) conditions were developed taking into account the effects of the Interstate 80 freeway and the decreased storage in the Meadows due to the present and projected development in the area. Interstate 80 acts as a barrier and prevents significant amounts of water from ponding on the north side of the freeway except during high volume runoff periods. Accordingly, the area north of the freeway was included for general rain flood routings on the Truckee River (high volumes), but was excluded for routing of cloudburst and general rain floods originating in the Steamboat Creek watershed. The standard project flood hydrographs presented in this report represent routings under 1990 conditions. Peak flows for these floods are 4 to 5 percent lower when routed under 1980 conditions.

b. Flows were routed through Independence and Donner Lakes, and Upper Peavine, Lower Peavine, East Wash, and West Wash Reservoirs using storage-discharge relationships furnished by the operating agencies of these facilities or developed by the Sacramento District using available spillway and reservoir capacity data. Storage-discharge relationships are shown on chart 15.

c. Regulated condition routings through Boca, Stampede, Prosser, and Martis Creek Reservoirs reflect the flood control operating criteria for these projects as specified in the "Master Report on Reservoir Regulation for Flood Control-Truckee River Reservoirs", dated December 1971.

d. Storage-discharge relationships were developed for routing of Steamboat Creek flows from index point 40 to the Huffacker Hills damsite. These relationships were developed from water surface profiles prepared for the June 1972 Flood Plain Information Study on Steamboat Creek. Storage-discharge relationships are shown on chart 15.

e. A storage-discharge relationship was developed for routing Dry Creek and Evans Creek from index point 64 to index point 70. This relationship was developed from backwater computations and flooded area maps prepared by Tudor Engineering Company for flood insurance studies. The storage discharge relationship is shown on chart 15.

f. The Truckee River channel and overbank capacities through Reno are limited. When these capacities are exceeded, water leaves the overbank areas and flows in a southeasterly direction, eventually combining with other runoff in the Truckee Meadows area. Division of flow relationships for determining overflows were estimated from water surface profile computations through the Reno area. These relationships are shown on chart 16. Overflows were routed separately using the Muskingum coefficients shown on chart 14.

g. A storage-discharge relationship was developed for the Highway 40 bridge at Wadsworth, since it is somewhat restrictive at the higher flows. This relationship is shown on chart 15.

h. Stream gaging records indicate that channel losses occur between Wadsworth and Nixon when flows at Nixon exceed about 10,000 cfs. In order to simulate these losses the relationship shown on chart 17 was developed and verified by reconstution of the 1963 flood hydrograph and the 1955 peak flow at Nixon. The upper portion of this curve was estimated since historical flows at Nixon have not exceeded about 14,000 cfs (1955 and 1963 floods). This estimate was based on the following reasoning. Channel losses can probably be attributed to losses due to depression storage in overbank areas and to percolation losses to the Dodge Flat ground water basin, located between Wadsworth and Pyramid Lake. Depression losses are satisfied during the initial phases of a flood when channel capacities are exceeded and water can flow to and fill overbank storage areas. Once these areas are filled further losses to this source due to higher flows are greatly reduced. Percolation losses are a function of area flooded and head. Since the Truckee River flood plain between Wadsworth and Nixon is confined to a relatively narrow band the flooded area does not increase significantly with large increases in flow. Accordingly, losses to percolation will not increase by large amounts once the flood plain is covered with water. In view of the above, channel losses at the higher flows were increased only a small amount above those that occur at the lower flows.

CHAPTER IV
LAND USE

19. Land use. - Hydrologic studies in this report were developed for both present land use conditions (yr-1980) and estimated future land use conditions (yr-1990). In the Reno area land use changes may have some impact on runoff. In the other portions of the basin land uses are not expected to change significantly and, accordingly, will have no impact on runoff.

Present and future land use conditions in the Reno area are presented on charts 18 and 19, respectively. These charts were developed from a base map prepared by the Nevada State Highway Department. Land use projections are based on those prepared by the Washoe County Regional Planning Commission (1978 Preliminary General Plan) and have been updated by this office to reflect current conditions and expected future trends.

The effects of the land use changes on runoff were accounted for by lowering loss rates in proportion to the imperviousness of the subareas. The following impervious factors were used for the various land use classifications.

TABLE 13
IMPERVIOUS FACTORS

Land Use	Percent Imperviousness
Forest and grazing areas	5
Agricultural	10
Residential	35
Commerical	60
Industrial	90

Runoff calculations using the above data indicated that land use changes have a negligible effect on peak flows at the points of interest. This results from the fact that the increase in urbanized area, when compared to the total drainage area above the points of interest, is very small. Accordingly, peak flow frequency curves presented in this report are based on 1990 land uses and are considered to represent both existing and future land use conditions.

Rapid development in the Truckee Meadows area has decreased the amount of space available in the Meadows for the storage of flood waters. This was accounted for as discussed in the preceding chapter.

CHAPTER V
FLOW FREQUENCY ANALYSIS

20. General - Rainflood flow-frequency curves required for evaluation of possible flood control projects in the Reno area were developed for the following index points.

TABLE 14

LOCATION OF FLOW-FREQUENCY CURVES

Index Point No.	Description	Drainage Area (sq. mi.)	Curves
3460	Truckee River at Farad (USGS #3460)	426 1/	Peak and Volume
600	Truckee River at Reno (USGS #3480)	561 1/	Peak and Volume
700	Truckee River nr Vista (USGS #3500)	819 2/	Peak and Volume
720	Truckee River below Derby Dam (USGS #3516)	1060 2/	Peak and Volume
740	Truckee River nr Nixon (USGS #3517)	1205 2/	Peak and Volume
30	Steamboat Creek at Steamboat (USGS #3493)	39.3 3/	Peak and Volume
60	Steamboat Creek at Huffacker Hills Damsite	110.4 3/	Peak
84	Steamboat Creek at Mouth	162.3 3/	Peak
20	Galena Creek nr Steamboat (USGS #3489)	8.5	Peak
505	Hunter Creek nr Reno (USGS #3476)	11.5	Peak
44	Whites Creek at Steamboat Ditch	14.6	Peak
66	Evans Creek at Steamboat Ditch	8.4	Peak
622	Dry Creek at Steamboat Ditch	3.6	Peak
64	Dry Creek at Highway 395	14.8	Peak
48	Thomas Creek at Steamboat Ditch	11.4	Peak
70	Boynton Slough	41.0	Peak
620	North Truckee Drain at foothill line	58.9 4/	Peak

1/ Contributing area below Lake Tahoe.
2/ Contributing area below Lake Tahoe and Washoe Lake.
3/ Contributing area below Washoe Lake.
4/ Contributing area.

Two peak flow frequency curves are presented for the Truckee River index points and represent unregulated and regulated conditions of water resource development. Unregulated conditions refers to a runoff regime without Boca, Stampede, Prosser, and Martis Creek Reservoirs but does include the effects of Lake Tahoe, Independence Lake, and Donner Lake. Regulated conditions includes the effects of Boca, Stampede, Prosser, and Martis Creek Reservoirs.

21. Truckee River. -

a. Unregulated conditions. - The period October through March was selected for analysis of rainfloods. Flows below Derby Dam have been impaired by diversions to the Truckee Canal since 1916. Further impairment of flows occurrred when Boca, Prosser, Stampede, and Martis Creek Reservoirs were completed in 1938, 1963, 1969, and 1972, respectively. Accordingly, adjustments to the recorded flows are required to obtain a uniform unregulated flow record. Adjustments to account for Truckee Canal diversions were made by adding the daily diversions to the recorded daily flows at the gages below Derby Dam. Adjustments to account for operation of the various reservoirs were made by routing the daily changes in storage at the reservoirs to the downstream gages and adding the routed changes to the recorded daily flows at the gages. Very few estimates of unregulated condition peak flows are available. Those estimates that are available are based on rainfall-runoff studies. Flows are listed on table 15 (located at the end of text).

The unregulated condition flows at the Truckee River gages were extended by multiple correlation with each other and with the longer record of the Truckee River at the Farad gage. The correlations were made using the HEC "Regional Frequency Computation" computer program. The missing flows estimated by this program include an adjustment for the natural variance in the data. Correlation coefficients are tabulated below.

TABLE 16
CORRELATION COEFFICIENTS - TRUCKEE RIVER

Station	Correlation Coefficients (with Farad gage)				
	1-day	3-day	7-day	15-day	30-day
Truckee River at Reno	.98	.99	.99	.99	.98
Truckee River at Vista	.96	.98	.98	.97	.97
Truckee River below Derby Dam	.94	.95	.96	.96	.96
Truckee River near Nixon	.98	.98	.97	.97	.98

The adopted unregulated condition flow frequency curves are shown on chart 20. Computed and adopted statistics are listed on table 15 (located at the end of text). Adopted means are based on the extended record. Adopted standard deviations and skews have been smoothed considerably to fit the historical data and give consistent volume-duration relationships. The standard deviations and skews based on the extended record were not used because the resulting curves did not fit the longer duration data. The curves include the expected probability adjustment for the indicated number of equivalent years of record.

A statistical analysis of peak flows was not possible because very few unregulated condition peak flow estimates are available. Accordingly, the adopted peak flow-frequency curves are graphical curves. The adopted curves for Farad, Reno, and Vista are identical to those presented in the December 1971 Truckee River "Master Report on Reservoir Regulation for Flood Control." The same curves were adopted for this study because the current analysis does not indicate a significant change from the earlier work. The adopted peak flow-frequency curves for below Derby Dam and Nixon were drawn by keeping the relationship between the peak and 1-day curves approximately the same as at Vista. The adopted peak curves are consistent with the 1-day curves, the historical data, and the computed standard project floods.

b. Regulated conditions. - Frequency curves for regulated conditions were based on records of historical events, appropriately adjusted for the effects of reservoirs completed since the event, and routings of both historic and hypothetical floods. All of the adjustments and routings were made to reflect reservoir operation in accordance with current criteria and regulations.

Historic records were adjusted based on the fact that for any given event, the regulated flow at Reno could be no less than local flows downstream of the reservoirs plus reservoir spill. Since none of the historic events were large enough to cause spill, the regulated flow at Reno would result from the uncontrolled locals. Uncontrolled locals were estimated as a percentage of the corresponding unregulated flow at Reno. Percentages were based on an evaluation of historic events, drainage areas, and normal annual precipitation relationships.

The four largest historical events (Nov-Dec 1950, Dec 1955, Jan-Feb 1963, and Dec 1964) were analyzed in more detail by estimating bi-hourly reservoir inflows and local flows below the reservoirs and routing these flows under regulated conditions. Runoff for the 1955 event was identical with that developed for the storm and flood analysis described in Chapter III. Runoff for the remaining events were developed directly from streamflow records. Reservoir inflows were estimated from outflow and storage records or by correlation with other sites. Outflows from the reservoirs were routed to Reno and subtracted from the observed flows there to obtain the uncontrolled local. Local runoff below Reno was estimated from consideration of observed flows, drainage area, and precipitation patterns.

Regulated condition flows for rare events were determined by routing the standard project flood (SPF) and the 500, 100, and 50 year hypothetical floods through the reservoir system. A 20-day standard project flood series, determined as described in paragraph 27, was used for the routings instead of a single 5-day flood wave because it was found that total inflow volume was critical in determining the regulated condition downstream flows. This is attributed to the limited channel capacities and small reservoir outlet capacities in comparison to inflows. The 500, 100, and 50 year events were patterned after the SPF series. Flows for these floods are consistent with volume-duration relationships at Reno. Some adjustments were required for the one and three day durations to avoid unreasonable distortion of the hydrographs.

The following conditions and assumptions were used for all regulated condition routings:

a. All reservoirs were assumed to be at the bottom of flood control pool at the beginning of the event.

b. The error of forecasting local was assumed to be +25%.

c. Routing criteria were consistent with the rainfall-runoff models described in Chapter III.

d. Releases from the reservoirs included outlet works discharges when reservoir storage was above gross pool.

e. No channel efficiency contingencies were used since the releases computed by the simulation model during recession resulted in an effective channel flow which varied from 70-80% of channel capacity.

Regulated condition frequency curves were drawn from the adjusted and routed flows with plotting positions at all index points based on the frequency of the corresponding unregulated flow at Reno. The curves are shown on chart 21.

22. Truckee Meadows tributaries. -

a. Gaged locations. - Flow frequency curves for Steamboat Creek, Galena Creek and Hunter Creek at the stream gage locations were prepared from an analysis of the stream flow record. These frequency curves were used as the basis for developing flow-frequency relationships for ungaged streams in the area. This area is subject to both winter general rain floods and summertime cloudburst floods. There is insufficient data to analyze each type event separately; accordingly, an all event analysis was made using the annual maximum flows regardless of their origin.

Computed and adopted statistical parameters at each of the stations are listed in the following table. As indicated, the adopted means are equal to the computed means; the adopted standard deviations are based primarily on the computed standard deviations but have been rounded and smoothed somewhat to give consistent volume-duration relationships; the adopted skews have been substantially rounded and smoothed. The curves are shown on charts 22, 23, and 24 and are consistent with the historical data. The expected probability adjustment is based on the number of years of record at each station.

TABLE 17

STATISTICAL PARAMETERS FOR FLOW
FREQUENCY CURVES - STEAMBOAT, GALENA AND HUNTER CREEKS

		Steamboat Creek at Steamboat Contrib DA = 39.3 square miles (17-Years Record)		Galena Creek nr Steamboat DA = 8.5 square miles (17-Years Record)		Hunter Creek nr Reno DA = 11.5 square miles (12-Years Record)	
Flow Duration	Parameter (Log Units)	Computed	Adopted	Computed	Adopted	Computed	Adopted
Peak	Mean	2.163	2.163	2.057	2.057	1.799	1.799
	Std dev	.434	.46	.517	.46	.454	.46
	Skew	+.564	+.6	+1.724	+.6	+1.728	+.6
1-Day	Mean	1.798	1.798				
	Std dev	.420	.42				
	Skew	+.582	+.6				
3-Day	Mean	1.618	1.618				
	Std dev	.415	.40				
	Skew	+.552	+.5				
7-Day	Mean	1.479	1.479				
	Std dev	.385	.38				
	Skew	+.263	+.4				
15-Day	Mean	1.348	1.348				
	Std dev	.363	.37				
	Skew	+.067	+.3				
30-Day	Mean	1.229	1.229				
	Std dev	.349	.35				
	Skew	+.235	+.2				

b. Ungaged locations. -

(1) Evans, Dry, Thomas, and Whites Creeks. - Peak flow frequency curves were prepared for each of these creeks at Steamboat Ditch and for Dry Creek at Highway 395. All of these streams drain the eastern slopes of Mt. Rose and are similar in size, slopes, location, and exposure to the gaged streams of Hunter, Galena, and Steamboat Creeks. Accordingly, it was assumed that the shape of the peak flow-frequency curves for these ungaged locations would be similar to frequency curves for the gaged streams. The adopted curves, shown on chart 26, were based on ratios of the standard project flood. Ratios used are averages of ratios determined from the Hunter, Galena, and Steamboat Creek curves. Ratios are tabulated below.

Flood	Ratios of SPF
1000 yr	4.31
500 yr	2.06
SPF	1.00
200 yr	.84
100 yr	.45
50 yr	.24
20 yr	.11
10 yr	.06

(2) Steamboat Creek and Boynton Slough. - Peak flow-frequency curves were prepared for Steamboat Creek at Huffacker Hills damsite and at the mouth and for Boynton Slough below Dry Creek. Flows at these locations are effected by routings across Truckee Meadows. Accordingly, the procedures used in subparagraph (1) were not used because the storage effect of the Meadows is not reflected in the frequency curves at the gaged locations.

Both general rain and cloudburst events were analyzed using rainfall-runoff computations and the resulting flow-frequency curves were combined statistically to produce an all events curve. The curves are shown on charts 25 and 27. The general rain curve was prepared using ratios of the standard project flood. Ratios were developed from the 1-day flow frequency curve for the Steamboat Creek near Steamboat gage. The cloudburst curve was prepared using ratios of standard project cloudburst storm precipitation to develop various frequency cloudburst floods. Ratios were obtained from the Reno 3-hour precipitation frequency curve (chart 29). The combined curves were checked by developing a flow-frequency curve for Steamboat Creek at the gage using the above procedure and comparing it to the adopted curve at the gage. This check indicated the combined curves are reasonable.

(3) North Truckee Drain. - The area drained by North Truckee Drain (Spanish Springs Valley) is not typical of Steamboat Creek and its tributaries. Accordingly, the analysis of streamflow records on

Steamboat Creek cannot be applied to North Truckee Drain. The area consists of many small streams that drain the foothill areas surrounding the valley. These streams flow out onto the flat valley floor where there are no defined stream channels other than North Truckee Drain at the lower end of the valley. Flooding from North Truckee Drain does not occur frequently. For example, Tudor Engineering Company reported that a local rancher who has lived in the area for 32 years stated that the drain had overflowed Spanish Springs Road (located at the lower end of Spanish Springs Valley) only twice in that period. Estimates of this flow by Tudor was about 270 cfs.

Recognizing the characteristics of the area, a peak flow-frequency curve for the area was developed using rainfall-runoff computations for the upper end of the curve and the historical experience in the area for the lower end of the curve. The estimated frequency curve is shown on chart 28. The upper end of the curve was drawn using the computed 100-year and 500-year (standard project) general rain floods. Standard project storms and floods are discussed in Chapter VI. The 100-year storm amount was determined using a 3-day precipitation frequency curve for Reno (chart 30). A cloudburst flood was not developed because it was reasoned that this type of event probably would not contribute significant amounts of runoff at the lower end of the valley due to the fact that the low volume in these types of floods would be lost crossing the valley floor. The resulting curve is reasonably consistent with flows developed for flood insurance studies.

This contradicts most other studies.

CHAPTER VI
STANDARD PROJECT FLOODS

23. General. - Standard project floods (SPF) were computed for the Truckee River and for the Truckee Meadows tributaries. Both general rain and cloudburst events were analyzed. The general rain event produces the highest peak flows on the Truckee River while the cloudburst event produces the highest peak flows on the Truckee Meadows tributaries. The general rain event was adopted for standard project flood computation on North Truckee Drain (Spanish Springs Valley) because, as previously stated, the low volume of a cloudburst flood would essentially be lost as it flows across the valley floor.

24. Standard project storm. -

a. General rain. - Standard project storm (SPS) amounts equal to 60 percent of probable maximum precipitation were adopted. Probable maximum precipitation (PMP) amounts were determined using Hydrometeorological Report No. 49, "Probable Maximum Precipitation, Colorado and Great Basin Drainages," dated September 1977. The December storm was used since it produces the highest precipitation over the basin.

(1) Truckee River basin. - The Truckee River storm was centered over the basin above Lawton since this area is the major contributor to runoff at downstream points. Concurrent storms were computed for the areas between Lawton and Vista and between Vista and Nixon. Adopted SPS amounts and a comparison with historical storms are tabulated below.

TABLE 18

GENERAL RAIN STANDARD PROJECT AND HISTORICAL STORM AMOUNTS

Area	Storm Amounts (inches)		
	SPS (72-hr)	21-23 Dec 1955	30 Jan-1 Feb 1963
Above Lawton	11.5	9.8	9.5
Lawton to Vista	6.1	5.0	5.4
Vista to Nixon	4.3	2 ±	1.8

(2) Steamboat Creek and Spanish Springs Valley. - Standard project storms were centered over Steamboat Creek above its mouth and over Spanish Springs Valley above index point 620. Storm amounts (72 hour duration) for the two areas are 7.1 and 6.2 inches, respectively.

b. Cloudburst. - Cloudburst SPS amounts (3-hour duration) were developed using 35 percent of the maximum 3-hour cloudburst probable maximum precipitation. As indicated on chart 29, the SPS has an exceedence frequency of about 0.2 per hundred years. Probable maximum precipitation was determined from Hydrometeorological Report No. 49. Several storm centerings were used to develop standard project floods at the various index points. Centerings and storm amounts are tabulated on table 19.

TABLE 19

CLOUDBURST STANDARD PROJECT STORM AMOUNTS

Location	SPS Centering and Storm Amount (3-Hr Duration)				
	Index Point No.	Specific Over Subarea	SPD (in)	Concurrent Over Subarea	SPS (in)
Galena Creek nr Steamboat	20	201, 20	3.54	No Concurrent	----
Whites Creek at Steamboat Ditch	44	42	3.59	44	3.01
Thomas Creek at Steamboat Ditch	48	48	3.47	No Concurrent	----
Dry Creek at Steamboat Ditch and at Hwy 395	622	621, 622, 623, 624	3.50	64	2.92
Boynton Slough	70	62, 64, 66, 68	3.06	70, 72, 74, 76, 78	2.47
Evans Creek at Steamboat Ditch	66	66	3.54	No Concurrent	----
Steamboat Creek at Steamboat	30	15, 201, 20, 25, 42, 44, 48	2.80	30, 35, 40, 46, 50, 60	1.84
Steamboat Creek at Huffacker Hills Damsite	60	15, 201, 20, 25, 42, 44, 48	2.80	30, 35, 40, 46, 50, 60	1.84
Steamboat Creek at mouth	84	15, 201, 20, 25, 30, 35, 40, 42, 44, 48, 62, 66	2.35	46, 50, 60, 64, 68, 70, 72, 74, 76, 78, 80, 82, 84	1.66 1.36

25. Snow effects. - A snowpack was assumed to exist over the Truckee River Basin prior to the occurrence of the standard project general rain storm because there is normally a snowpack present on the basin in the wintertime. There would be no snowpack prior to a cloudburst storm because these events occur during the summertime.

An initial snowpack over the area above Lawton, varying from zero at the 4,400 foot elevation to about 140 inches at the 9,000 foot elevation, was adopted for standard project general rain flood computations. This pack is similar to that which existed over the basin prior to the December 1955 storm and flood except that the lower edge has been extended to the 4,400 foot elevation. The pack is also similiar to that obtained from the Sacramento Districts' criteria presented in "Standard Project Criteria for General and Local Storms, Sacramento-San Joaquin Valleys, California," dated April 1971 and used in earlier studies of the Truckee River Basin. A snowpack equal to 50 percent of the pack above Lawton was adopted for the area between Lawton and Vista while a pack equal to 25 percent of the pack above Lawton was adopted for the area below Vista. These percentages are based on a comparison of average 1 February snow depth measurements in the basin taken from "Summary of Snow Survey Measurements for Nevada," Soil Conservation Service, 1910-67 and 1968-72. Adopted snowpacks are shown on chart 31.

Potential snowmelt rates were computed for each 1,000 foot elevation band by use of the melt equation for rain-on-snow conditions and partly forested areas given in EM 1110-2-1406. Precipitation distribution, wind, and temperature data for use in this equation were those observed during the January-February 1963 storm. This event was used as a pattern since it is the largest flood of record in the basin. Storm amounts were distributed to the various elevation zones in proportion to the normal annual precipitation of the zones. Precipitation was assumed to fall as rain when temperatures were above 32°F.

The influence of the snowpack on runoff was determined as discussed in paragraph 14a. Table 20 summarizes the rain on snow computations for the Truckee River Standard Project Flood.

Band excess amounts were distributed to the various subareas in proportion to the percentage of each subarea in each elevation zone. The entire area below 9,000 feet was considered to be contributing even though the snowmelt computations indicated that only the area below 8,000 feet would be contributing between Lake Tahoe and Vista. This assumption is conservative and does not introduce a significant increase in runoff since the additional drainage area involved is only about 40 square miles.

26. Standard project floods - unregulated conditions. - Standard project floods for unregulated conditions were computed using the unit hydrograph, loss rate, base flow, flood routing and storm criteria discussed previously. These floods do not include the effects of Boca, Stampede, Prosser, and Martis Creek Reservoirs. Pertinent data on these floods are shown on Tables 21 and 22. Typical hydrographs are shown on charts 32 and 33.

TABLE 20

SUMMARY OF RAIN-ON-SNOW COMPUTATIONS - TRUCKEE RIVER SPF

LAKE TAHOE TO LAWTON

Elevation Band	Band Area (sq mi)	Band Exposure Constant	Antecedent Snow Cover Density (%)	Antecedent Snow Cover Depth (in)	Total Precip (in)	Total Snowmelt (in)	Total Excess Water (in)	Remaining Snow Cover Density (%)	Remaining Snow Cover Depth (in)
4600-5000	7.6	1.0	35.2	15.5	3.6	5.77	9.06	.0	.0
5000-6000	118.0	.8	28.4	27.3	7.9	5.57	12.05	40.0	9.01
6000-7000	234.0	.8	21.6	49.3	11.0	4.95	12.18	40.0	23.66
7000-8000	104.0	.5	16.2	78.4	14.0	1.29	5.46	40.0	53.10
8000-9000	39.6	.5	12.5	116.4	16.9	.0	.0	27.59	114.01
9000-10000	7.9	.5	10.3	157.4	17.8	.0	.0	18.26	186.29
10000-10800	.6	.5	10.0	176.5	19.0	.0	.0	11.17	328.15

LAWTON TO VISTA (areas North of Truckee River)

Elevation Band	Band Area (sq mi)	Band Exposure Constant	Antecedent Snow Cover Density (%)	Antecedent Snow Cover Depth (in)	Total Precip (in)	Total Snowmelt (in)	Total Excess Water (in)	Remaining Snow Cover Density (%)	Remaining Snow Cover Depth (in)
4400-5000	80.6	1.0	37.3	5.5	3.4	2.07	5.45	0.0	0.0
5000-6000	44.7	1.0	28.4	13.5	5.2	4.17	9.03	0.0	0.0
6000-7000	8.8	.5	21.6	24.5	8.2	3.31	9.83	40.0	9.16
7000-8000	3.3	.5	16.2	39.5	12.4	2.93	10.93	40.0	19.67
8000-9000	5.0	.5	12.5	59.0	16.6	.72	4.28	40.0	49.25
9000-10000	1.2	.5	10.3	77.5	19.6	.0	.0	32.61	84.58

TABLE 20 (Cont'd)

LAWTON TO VISTA (Areas South of Truckee River)

Elevation Band	Band Area (sq mi)	Band Exposure Constant	Antecedent Snow Cover Density (%)	Antecedent Snow Cover Depth (in)	Total Precip (in)	Total Snowmelt (in)	Total Excess Water (in)	Remaining Snow Cover Density (%)	Remaining Snow Cover Depth (in)
4400-5000	63.5	1.0	37.3	5.5	3.4	2.07	5.45	.0	.0
5000-6000	97.8	1.0	28.4	13.5	5.2	4.17	9.03	.0	.0
6000-7000	38.8	1.0	21.6	24.5	8.2	5.04	11.72	40.0	4.43
7000-8000	24.1	1.0	16.2	39.5	12.4	4.23	12.54	40.0	15.64
8000-9000	16.1	1.0	12.5	59.0	16.6	1.82	5.37	40.0	46.51
9000-10000	7.3	1.0	10.3	77.5	19.6	.0	.0	33.99	81.15

VISTA TO NIXON

Elevation Band	Band Area (sq mi)	Band Exposure Constant	Antecedent Snow Cover Density (%)	Antecedent Snow Cover Depth (in)	Total Precip (in)	Total Snowmelt (in)	Total Excess Water (in)	Remaining Snow Cover Density (%)	Remaining Snow Cover Depth (in)
3870-4000	7.5	1.0	0	.0	3.4	.0	3.4	.0	.0
4000-5000	201.5	1.0	38	2.0	3.7	.76	4.46	.0	.0
5000-6000	175.2	1.0	28.4	7.0	4.5	2.04	6.49	.0	.0
6000-7000	88.5	1.0	21.6	12.5	5.2	3.25	7.90	.0	.0
7000-8000	6.7	1.0	16.2	19.5	7.0	4.58	10.04	40.0	.3
8000-9000	.0	1.0	12.5	29.5	8.1	2.23	5.85	40.0	14.84

TABLE 21

GENERAL RAIN STANDARD PROJECT FLOODS
UNREGULATED CONDITIONS

Location	Contributing Drainage Area* (sq mi)	Total Drainage Area (sq mi)	Index Point	Peak Flow (cfs)	5-Day Volume (AF)
Truckee River at Farad (USGS #3460)	417.5	932	3460	60,100	148,000
Truckee River at Reno (USGS #3480)	548	1,067	600	71,000	192,200
Truckee River at Vista (USGS #3500)	798	1,429	700	56,500	243,400
Truckee River below Derby Dam (USGS #3516)	1039	1,670	720	56,300	245,800
Truckee River near Nixon (USGS #3517)	1184	1,815	740	53,500	233,100
Steamboat Creek at Huffacker Hills Damsite	103.9	194	60	13,500	27,000
Steamboat Creek at Mouth	155.8	246	84	14,800	38,600
Spanish Springs Valley (North Truckee Drain at foothill line)	58.9	78.5	620	2,500	4,640

* Does not include areas above Lake Tahoe and above Washoe Lake, non-contributing area in Spanish Springs Valley, and areas above 9000 feet elevation.

TABLE 22

CLOUDBURST STANDARD PROJECT FLOODS

Location	Contributing Drainage Area (sq mi)	Total Drainage Area (sq mi)	Index Point	Peak Flow (cfs)	Volume (acre-ft)	Duration (hrs)
Steamboat Creek at Steamboat (USGS #3493)	39.3	123	30	15,200	3,770	24
Steamboat Creek at Huffacker Hills Damsite	110.4	194	60	13,600	9,550	24
Steamboat Creek at Mouth	162.3	246	84	11,100	12,400	36
Galena Creek near Steamboat (USGS #3489)	8.5	8.5	20	6,000	1,310	12
Whites Creek at Steamboat Ditch	14.6	14.6	44	8,700	2,110	12
Evans Creek at Steamboat Ditch	8.4	8.4	66	4,900	1,310	12
Dry Creek at Steamboat Ditch	3.6	3.6	622	2,650	560	12
Dry Creek at Highway 395	14.8	14.8	64	10,900	2,160	12
Thomas Creek at Steamboat Ditch	11.4	11.4	48	5,600	1,730	12
Boynton Slough	41.0	41.0	70	14,000	4,970	12

27. Standard project flood series. - A 20-day standard project flood series for the Truckee River was developed for operation studies involving the upstream reservoirs. This series, as plotted on chart 34, was developed to be consistent with the volume-duration curves for the Truckee River at Reno. The 200-year volume was used for durations between 5 and 20 days. The series consists of four 5-day waves with volumes as indicated on Table 23. Each wave was patterned after the main wave.

28. Standard project floods - regulated conditions. - Regulated condition standard project floods were developed for the Truckee River by routing the unregulated condition SPF's through Boca, Stampede, Prosser, and Martis Creek Reservoirs. Routings through these reservoirs were made in accordance with regulations specified in the "Master Report on Reservoir Regulation for Flood Control - Truckee River Reservoirs," dated December 1971. Flood hydrographs are shown on chart 32. Pertinent data are shown on Table 24.

TABLE 23

TRUCKEE RIVER AT RENO STANDARD PROJECT FLOOD SERIES

Duration (days)	Volume (cfs-days)	Time Order of Occurrence
5	96,900	3rd (main wave)
"	25,000	2nd
"	15,000	4th
"	12,000	1st

TABLE 24

GENERAL RAIN STANDARD PROJECT FLOODS REGULATED CONDITIONS

Location	Index Point	Peak Flow (cfs)	5-Day Volume (AF)
Truckee River at Reno (USGS #3480)	600	40,000	121,000
Truckee River at Vista (USGS #3500)	700	37,000	170,000
Truckee River below Derby Dam (USGS #3516)	720	37,000	172,900
Truckee River near Nixon (USGS #3517)	740	34,300	163,200

CHAPTER VII
PROBABLE MAXIMUM FLOODS

29. General. - General rain and cloudburst probable maximum floods (PMF) were developed for Steamboat Creek at the Huffacker Hills damsite. Both types of floods were considered since it is not known which type of event would be critical for spillway design.

30. Probable maximum precipitation. - Probable maximum precipitation (PMP) for both the general rain (72-hour duration) and cloudburst (6-hour duration) storms was determined using Hydrometeorological Report No. 49, "Probable Maximum Precipitation Estimates, Colorado River and Great Basin Drainages," dated September 1977.

a. General rain. - The December general rain storm was adopted for computation of the general rain PMP since it produces the highest precipitation. General rain PMP for a storm centered over the area above the damsite is 11.9 inches.

b. Cloudburst. - A cloudburst storm centered over the upper areas of the basin was adopted for cloudburst PMF computations. This centering is identical to that used for computation of the standard project flood at the damsite. The storm amount for the upper areas (subareas 15, 201, 20, 25, 42, 44, and 48) is 8.0 inches while the concurrent amount for the lower areas (subareas 30, 35, 40, 46, 50, and 60) is 5.2 inches.

* 31. Snow effects (general rain flood). - A snowpack was assumed to exist over the basin above the Huffacker Hills damsite prior to the occurrence of the general rain PMF because there is normally a snowpack on the basin in the wintertime. Since the PMF would most likely occur durring the December - January period (December adopted for this study - see paragraph 30a) a review of maximum historic snow depths during this period was made to establish a reasonable snowpack. The snowpack on 1 February 1952 was found to be substantially larger than any other historic snowpack. This pack was adopted for PMF computations with the exception that it is somewhat deeper at the lower elevations. Snow densities were assumed to vary from 40 percent at the 5000 foot elevation to 30 percent at the 10,000 foot elevation. These densities are essentially equivalent to the 1952 densities but are somewhat higher than normal snowpack densities for this time of year. The adopted pack is about twice as large and substantially more dense than the pack used for SPF computations. Snow depths and densities are shown on table 25. *

Potential snowmelt rates were computed for each 1,000 foot elevation band by use of the melt equation for rain-on-snow conditions and partly forested areas given in EM 1110-2-1406. Precipitation distribution, wind, and temperature data for use in this equation were based on criteria presented in Hydrometeorological Report No. 36, "Interim Report, Probable Maximum Precipitation in California," dated October 1961. Report No. 36 was used for wind and temperature data because Report No. 49 does not present this information. Use of Report No. 36 was informally discussed with representatives of the Hydrometeorological Branch of the National Weather Service and agreed upon as being applicable to the Steamboat Creek basin. Storm amounts were distributed to the various elevation zones in proportion to the normal annual precipitation of the zones. Precipitation was assumed to fall as rain when temperatures were above 32°F.

* Revised June 1980

The influence of the snowpack on runoff was determined as discussed in paragraph 14a. Table 25 summarizes the rain-on-snow computations. Band excess amounts were distributed to the various sub-areas in proportion to * the percentage of each subarea in each elevation zone. The entire area was considered to be contributing even though the snowmelt computations indicate that the small area above 10,000 feet would be non-contributing. *

32. Probable maximum floods. - Probable maximum floods were computed using the unit hydrograph, loss rate, base flow, flood routing, and storm criteria discussed previously. Hydrographs are shown on chart 35. The cloudburst PMF has a peak flow of 94,000 cfs and a 24-hour volume of 34,100 acre-feet. * The general rain PMF has a peak flow of 35,500 cfs and a 4-day volume of 67,500 AF. *

* Revised June 1980

TABLE 25

SUMMARY OF RAIN-ON-SNOW COMPUTATIONS - STEAMBOAT CREEK PMF

Elevation Band	Band Area (sq mi)	Band Exposure Constant	Antecedent Snow Cover Density (%)	Antecedent Snow Cover Depth (in)	Total Precip (in)	Total Snowmelt (in)	Total Excess Water (in)	Remaining Snow Cover Density (%)	Remaining Snow Cover Depth (in)
4415-5000	29.8	1.0	40	15.5	5.57	6.20	11.77	0	0
5000-6000	39.7	1.0	39	27.3	8.79	10.65	19.44	0	0
6000-7000	16.3	1.0	37	49.3	12.21	10.13	21.94	40	21.29
7000-8000	10.8	1.0	35	78.4	18.50	6.63	23.50	40	56.10
8000-9000	7.3	1.0	33	116.4	23.09	2.53	19.41	35.63	118.14
9000-10000	5.5	1.0	31	157.4	29.31	0	1.37	33.48	229.21
10000-10800	0.9	1.0	29	176.5	31.74	0	0	16.79	493.90

TABLE 8

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
DRAINAGE AREA BELOW 8,000 FEET, MSL, FOR DECEMBER 1955 FLOOD

SUBAREAS	15	20	25	30	35	40	42	44	46	48	50	60	62	64	66
CHARACTERISTICS															
D.A. (Sq. Mi.)	3.4	3.1	8.1	17.8	15.6	2.9	3.4	6.6	1.8	9.1	2.4	22.4	10.2	4.6	7.2
L (Mi.)	4.1	4.7	6.0	6.4	8.4	2.6	4.6	4.2	1.7	7.7	1.6	7.7	4.7	2.5	5.5
Lca (Mi.)	1.8	2.5	2.7	2.1	4.7	1.0	2.3	1.4	1.0	3.7	1.0	2.7	1.5	1.2	3.0
SLOPE (Ft./Mi.)	660.2	516.7	505.0	186.3	337.3	145.0	442.6	384.4	98.8	418.7	171.8	246.4	590.1	129.9	578.2
$LLca/S^{.5}$	0.29	0.51	0.74	0.99	2.13	0.23	0.51	0.29	0.18	1.40	0.12	1.32	0.29	0.27	0.70
$\bar{n}$	.075	.075	.075	.075	.075	.075	.075	.075	.07	.075	.07	.07	.075	.07	.075
LAG (Hours)	1.1	1.4	1.6	1.8	2.4	1.0	1.4	1.1	0.9	2.1	0.8	1.9	1.1	1.0	1.6
S-CURVE	1/	1/	1/	1/	1/	2/	1/	1/	2/	1/	2/	2/	1/	2/	1/

1/ Truckee Meadows average mountain - GR., 2/ Truckee Meadows average valley - GR/CB.

ONE HOUR UNIT HYDROGRAPH ORDINATES
(End of period flow in c.f.s.)

TIME PERIOD *(Hours)*	15	20	25	30	35	40	42	44	46	48	50	60	62	64	66
1	950	636	1363	2478	1240	856	696	1843	670	992	988	1554	2827	1361	1245
2	802	742	1886	3943	2764	608	815	1549	306	1867	345	6105	2376	976	1679
3	266	316	988	2386	2276	183	348	513	100	1298	116	2849	787	294	853
4	108	141	444	1119	1440	94	155	207	50	696	56	1311	318	151	383
5	38	66	241	631	801	56	73	73	28	381	26	784	112	89	204
6	24	28	118	350	502	33	30	46	12	238	5	534	70	54	98
7	19	18	55	181	339	16	20	36	2	139		383	55	26	47
8	13	15	42	97	213	3	16	25		77		283	38	5	36
9		12	35	80	131		13			44		219			30
10		7	29	68	76		8			37		166			26
11			23	58	58					32		121			19
12			5	48	51					28		82			0
13				22	45					25		44			
14					41					19		15			
15					37					6					
16					31										
17					21										
TOTAL	2220	1981	5229	11461	10066	1849	2174	4292	1168	5879	1536	14450	6583	2956	4620

NOTE:
Unit hydrographs for subareas 502-650, 68-84, and 700-760 are shown on Table 10.

TABLE 8

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
DRAINAGE AREAS BELOW 8,000 FEET, MSL, FOR THE DEC 1955 FLOOD

SUBAREAS	3380	3385	50	100	3394	3397	3399	3403	3405	200
CHARACTERISTICS										
Contributing D.A. (Sq. Mi.)	30.1	13.5	15.1	14.1	27.6	24.4	7.4	15.7	2.7	8.3
L (Mi.)	11.2	5.1	7.9	9.0	9.1	10.2	6.2	5.0	3.5	3.8
Lca (Mi.)	5.9	2.6	4.7	3.6	2.9	5.3	3.0	2.2	1.4	1.4
SLOPE (Ft./Mi.)	185.7	405.9	276.0	151.1	139.6	225.5	290.3	237.6	93.7	331.6
$LLca/S^{.5}$	4.85	0.66	1.95	2.64	2.24	3.60	1.10	0.83	0.51	0.30
$\bar{n}$	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06
LAG (Hours)	2.6	1.2	1.9	2.1	3.9	2.4	1.5	1.4	1.1	0.9
S-CURVE	TRUCKEE RIVER BASIN - MARTIS CREEK - MOUNTAIN									
ONE HOUR UNIT HYDROGRAPH ORDINATES (End of period flow in c.f.s.)										
TIME PERIOD (Hours)										
1	5060	3618	2832	2349	2157	3580	1696	3980	797	2865
2	5047	2277	2320	2055	2753	3350	1215	2661	466	1412
3	3791	1240	1549	1433	2268	2432	735	1524	238	620
4	2848	675	1035	1000	1872	1766	445	872	122	272
5	2141	368	691	690	1545	1283	269	500	62	119
6	1609	200	462	486	1275	931	163	286	32	53
7	1207	109	309	339	1053	676	98	164	16	16
8	908	59	206	237	849	491	59	94	8	
9	682	30	137	165	717	356	36	54	1	
10	512		92	115	591	258	22	24		
11	384		61	80	488	188	11			
12	289		41	56	403	136				
13	217		27	39	333	99				
14	163		9	27	275	72				
15	123			19	226	53				
16	92			1	187	38				
17	69				154	26				
18	52				128					
19	37				105					
20					87					
21					71					
22					59					
23					49					
24					40					
25					33					
26					27					
27					23					
28					18					
29					4					
30										
31										
32										
33										
34										
35										
36										
37										
TOTAL	25231	8576	9771	9699	17810	15735	4789	10159	1742	5357

SUBAREAS	3420	3430	3435	3443	3444	3445	300	3460	400	3473	500
CHARACTERISTICS											
Contributing D.A. (Sq. Mi.)	32.4	5.0	10.1	70.5	8.2	25.5	2.3	21.0	29.3	13.6	27.6
L (Mi.)	12.8	5.0	4.3	13.3	5.9	8.2	1.6	11.1	6.7	3.4	9.9
Lca (Mi.)	7.8	2.8	1.6	3.6	3.9	2.5	0.8	5.2	2.4	1.2	3.6
SLOPE (Ft./Mi.)	63.3	540.0	184.0	94.9	104.2	183.4	259.5	165.8	244.0	400.0	239.4
$LLca/S^{.5}$	12.55	0.54	0.52	4.85	1.71	1.50	0.09	4.53	1.32	0.20	2.7
$\bar{n}$	0.08	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.0
LAG (Hours)	5.0	1.2	1.1	2.6	1.8	1.7	0.6	2.6	1.6	0.8	2.0
TIME PERIOD (Hours)											
1	1742	1681	2964	9127	1611	8260	1061	2914	6316	5190	4881
2	2678	1000	1749	9104	1200	4056	314	2864	4731	2228	4131
3	2300	519	896	6839	837	2595	85	2134	2963	860	2820
4	1907	270	460	5138	548	1661	23	1591	1856	332	1927
5	1711	140	236	3862	358	1062	2	1187	1161	128	1315
6	1473	73	121	2902	234	680		885	720	39	898
7	1269	38	62	2178	153	434		659	455		613
8	1092	20	32	1638	100	278		492	285		418
9	941	3	3	1231	65	177		367	178		286
10	810			924	43	114		273	112		195
11	690			693	28	73		204	70		133
12	601			522	18	46		154	26		91
13	517			391	10	5		113			62
14	445			293				84			42
15	384			222				63			7
16	330			166				47			
17	284			125				35			
18	245			94				26			
19	211			67				10			
20	181										
21	156										
22	134										
23	116										
24	100										
25	86										
26	74										
27	63										
28	55										
29	48										
30	40										
31	35										
32	30										
33	26										
34	22										
35	19										
36	16										
37	4										
TOTAL	20931	3744	6517	45516	5286	16441	1485	14102	18883	8777	1781

NOTE:
Unit hydrographs for subareas 502-650, 68-84, and 700-760 are shown on Table 10.

TABLE 9

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES

DRAINAGE AREAS BELOW 9,000 FEET, MSL, FOR THE STANDARD PROJECT GENERAL RAIN AND JAN-FEB 1963 FLOODS

TRUCKEE RIVER BASIN - MARTIS CREEK - MOUNTAIN

SUBAREAS	3380	3385	50	100	3394	3397	3399	3403	3405	200	3420	3430	3435	3443	3444	3445	300	3460	400	3473	500
CHARACTERISTICS																					
Contributing D.A. (Sq. Mi.)	46.0	14.6	17.6	14.1	40.0	27.4	7.4	15.7	2.7	8.3	36.5	7.6	10.8	81.1	10.0	26.0	2.3	49.4	37.6	16.0	32.1
L (Mi.)	11.4	5.5	8.1	9.0	10.2	10.3	6.2	5.8	3.5	3.8	12.8	5.4	4.7	13.3	6.6	8.2	1.6	14.4	9.3	4.1	10.8
Lca (Mi.)	6.3	2.9	4.4	3.6	2.9	6.0	3.0	2.2	1.4	1.4	7.6	2.6	1.7	4.2	4.8	2.8	0.8	4.5	3.1	1.7	2.8
SLOPE (Ft./Mi.)	270.2	449.1	318.5	151.1	179.4	301.0	290.3	237.6	93.7	331.6	139.8	648.2	355.2	155.0	363.2	256.7	259.5	267.2	448.2	621.0	335.8
LLca/S.5	4.37	0.76	2.00	2.64	2.21	3.57	1.10	0.83	0.51	0.30	0.23	0.56	0.43	4.54	1.60	1.27	0.09	4.00	1.35	0.28	1.63
n̄	0.06	0.06	0.06	0.06	0.12	0.06	0.06	0.06	0.06	0.06	0.10	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
LAG (Hours)	2.5	1.3	1.9	2.1	3.9	2.3	1.5	1.4	1.1	0.9	5.4	1.2	1.1	2.6	1.8	1.6	0.6	2.4	1.6	0.9	1.7
S-CURVE																					
ONE HOUR UNIT HYDROGRAPH ORDINATES (End of period flow in c.f.s.)																					
TIME PERIOD (Hours)																					
1	6227	3808	3263	2349	3145	4041	1696	3980	797	2865	1766	2195	3365	10803	1979	5699	1061	6949	8059	5609	6422
2	6073	2484	2687	2055	4002	3772	1215	2661	466	1412	2865	1315	1864	10619	1567	4226	314	6650	6057	2712	5051
3	4510	1394	1801	1433	3295	2736	735	1524	238	620	2496	687	909	7918	1022	2626	85	4889	3814	1169	3278
4	3349	782	1208	1000	2717	1983	445	872	122	272	2160	359	443	5905	667	1632	23	3594	2398	504	2129
5	2489	439	809	698	2241	1439	269	500	62	119	1884	187	216	4406	434	1014	2	2644	1507	217	1381
6	1849	246	542	486	1847	1043	163	286	32	53	1637	98	105	3286	284	630		1943	948	94	897
7	1371	138	364	339	1524	757	98	164	16	16	1423	51	51	2448	185	391		1428	594	22	581
8	1020	78	243	237	1257	549	59	94	8		1236	27	16	1828	120	243		1051	374		377
9	758	43	163	165	1037	398	36	54	1		1074	6		1364	78	151		773	234		244
10	561	11	109	115	854	288	22	24			934			1014	51	94		567	148		159
11	417		73	80	704	209	11				811			756	33	58		417	93		103
12	310		49	56	581	151					705			565	22	16		307	12		67
13	230		33	39	479	110					612			420	10			225			26
14	170		13	27	396	80					532			313				166			
15	127			19	325	58					462			234				122			
16	95			1	268	42					402			175				90			
17	70				221	27					349			131				65			
18	52				183						303			97				32			
19	10				150						264			37							
20					124						229										
21					102						198										
22					85						173										
23					70						150										
24					58						130										
25					48						114										
26					39						98										
27					32						85										
28					26						74										
29					3						64										
30											56										
31											49										
32											42										
33											37										
34											32										
35											28										
36											24										
37											21										
38											19										
39											9										
TOTAL	29688	9423	11357	9099	25813	17683	4749	10159	1742	5357	23554	4925	6969	52319	6452	16780	1485	31912	24278	10327	20715

TABLE 9

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES

AREAS BELOW 9,000 FEET, MSL, FOR STANDARD PROJECT, DEC 1955 AND JAN-FEB 1963 FLOODS

CHARACTERISTICS

510	515	520	522	524	526	528	530	540	550	560	565	570	580	585	590	595	600	602	604	606	610	620	625	630	640	650
1.3	1.9	8.8	4.0	1.9	2.0	2.2	2.3	0.7	2.1	1.2	2.1	0.3	4.0	2.0	2.8	1.4	0.4	2.5	1.8	4.4	10.3	50.9	2.4	8.0	2.3	1.7
1.4	3.0	5.5	4.2	2.4	3.6	4.2	2.7	3.2	3.0	2.1	3.2	1.0	4.0	2.2	2.9	2.6	1.7	3.8	2.4	4.7	7.0	13.5	2.7	5.7	2.6	5.1
0.5	0.9	2.3	2.1	1.1	1.5	1.8	1.4	1.7	2.1	1.0	1.5	0.5	2.0	1.2	1.5	1.3	0.6	2.3	1.5	2.7	3.4	7.7	1.5	3.6	1.8	3.0
735.3	200.5	448.7	731.4	310.6	191.0	179.9	579.9	394.4	323.4	480.2	161.9	111.1	212.1	107.2	229.6	87.1	40.9	107.9	25.3	68.1	189.4	135.5	175.8	120.5	11.6	11.7
0.03	0.17	0.61	0.34	0.16	0.40	0.56	0.16	0.28	0.35	0.10	0.38	0.06	0.55	0.26	0.29	0.38	0.17	0.63	0.70	1.55	1.75	8.93	0.31	1.83	1.35	4.47
0.075	0.06	0.06	0.075	0.06	0.04	0.04	0.06	0.06	0.06	0.06	0.02	0.02	0.06	0.03	0.06	0.03	0.02	0.06	0.02	0.02	0.06	0.17	0.04	0.06	0.04	0.06
0.5	0.8	1.2	1.2	0.7	0.7	0.8	0.7	0.9	1.0	0.6	0.3	0.2	1.2	0.5	0.9	0.5	0.3	1.2	0.4	0.6	1.8	9.4	0.6	1.8	1.1	2.6
2/	2/	2/	2/	1/	1/	1/	2/	1/	2/	2/	1/	1/	2/	1/	1/	1/	1/	1/	1/	1/	2/	3/	1/	1/	1/	1/

ONE HOUR UNIT HYDROGRAPH ORDINATES

(End of period flow in c.f.s.)

510	515	520	522	524	526	528	530	540	550	560	565	570	580	585	590	595	600	602	604	606	610	620	625	630	640	650
665	804	1390	1030	807	678	917	1022	269	713	591	1194	192	1092	1097	839	726	269	534	958	2165	1447	58	1118	665	618	58
118	304	1200	950	251	261	320	350	120	452	140	130	1	946	167	420	134	15	671	142	473	2288	158	219	2464	515	264
37	69	446	331	85	85	110	76	41	134	24	12		318	44	135	42		191	36	150	1377	333	94	1075	151	336
6	21	189	140	40	39	54	25	21	43	12			131	2	68	8		98	1	54	643	871	39	497	78	146
	14	78	52	16	12	25	16	12	18	1			47		39			58		2	363	2113		300	46	84
	2	38	28	1		5		6	14				28		19			39			200	3409		206	29	54
		30	22					1	8				22		4			28			103	4077		145	16	39
		23	17										16					14			56	3685		109	5	30
		7	5										1					5			46	3157		83		24
																					39	2730		61		19
																					34	2361		44		15
																					28	2041		27		13
																					12	1766		13		10
																						1526		2		8
																						1319				7
																						1141				5
																						987				3
																						853				2
																						737				1
																						638				
																						551				
																						475				
																						411				
																						355				
																						307				
																						265				
																						230				
																						198				
																						171				
																						148				
																						128				
																						110				
																						96				
																						83				
																						71				
																						61				
																						52				
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																						30				
																						27				
																						24				
																						21				
																						18				
																						15				
																						11				
826	1214	3459	2575	1200	1265	1439	1497	478	1382	768	1336	193	2601	1310	1574	910	284	1635	1137	2852	6636	38010	1536	5691	1458	1118

- GR/CB.
in - GR.
1.

TABLE 9

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
AREAS BELOW 9,000 FEET, MSL, FOR STANDARD PROJECT, DEC 1955 AND JAN-FEB 1963 FLOODS

SUBAREAS	502	505	510	515	520	522	524	526	528	530	540	550	560	565	570	580	585	590	595	600	602	604	606
CHARACTERISTICS																							
D.A. (Sq. Mi.)	1.6	5.4	1.3	1.9	5.4	4.0	1.9	2.0	2.2	2.3	0.7	2.1	1.2	2.1	0.3	4.0	2.0	2.4	1.4	0.4	2.8	1.8	4.4
L (Mi.)	1.9	5.2	1.4	3.0	5.5	4.2	2.4	3.6	4.2	2.7	3.2	3.0	2.1	3.2	1.0	4.0	2.2	2.9	2.6	1.7	3.8	2.4	4.7
Lca (Mi.)	0.8	2.8	0.5	0.9	2.3	2.1	1.1	1.5	1.8	1.4	1.7	2.1	1.0	1.5	0.5	2.0	1.2	1.5	1.3	0.6	2.3	1.5	2.7
SLOPE (Ft./Mi.)	849.5	564.6	735.3	280.5	440.7	731.4	310.6	191.0	179.9	579.9	394.4	323.4	488.2	161.9	111.1	212.1	107.2	229.6	87.1	40.9	107.9	25.3	68.1
$LLca/S^{.5}$	0.05	0.61	0.03	0.17	0.61	0.34	0.16	0.40	0.56	0.16	0.28	0.35	0.10	0.38	0.06	0.55	0.26	0.29	0.38	0.17	0.43	0.70	1.55
$\bar{n}$	0.075	0.075	0.075	0.06	0.06	0.075	0.06	0.04	0.04	0.06	0.06	0.06	0.06	0.02	0.02	0.06	0.03	0.06	0.03	0.02	0.06	0.02	0.02
LAG (Hours)	0.6	1.5	0.5	0.8	1.2	1.2	0.7	0.7	0.8	0.7	0.9	1.0	0.6	0.3	0.2	1.2	0.5	0.9	0.5	0.3	1.2	0.4	0.6
S-CURVE	1/	2/	2/	2/	2/	2/	1/	1/	1/	2/	1/	2/	2/	1/	1/	2/	1/	1/	1/	1/	1/	1/	1/
ONE HOUR UNIT HYDROGRAPH ORDINATES (End of period flow in c.f.s.)																							
TIME PERIOD (Hours)																							
1	741	1010	665	804	1390	1030	807	878	917	1022	269	713	591	1194	192	1092	1097	839	726	269	534	950	2165
2	175	1289	110	304	1280	950	251	281	328	358	120	452	140	130	1	946	167	420	134	15	671	142	473
3	59	604	37	69	446	331	85	85	110	76	41	134	24	12		310	44	135	42		191	36	150
4	23	270	6	21	189	140	40	39	54	25	21	43	12			131	2	68	8		98	1	54
5	3	136		14	70	52	16	12	25	16	12	18	1			47		39			58		7
6		61		2	30	28	1		5		6	14				28		19			39		
7		33			30	22					1	8				22		4			25		
8		27			23	17										16					14		
9		22			7	5										1					5		
10		18																					
11		6																					
12																							
13																							
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45																							
46																							
47																							
TOTAL	1001	3484	826	1214	3459	2575	1200	1265	1439	1497	478	1302	768	1336	193	2601	1310	1524	910	284	1635	1137	2852

1/ Truckee Meadows average valley - GR/CB.
2/ Truckee Meadows average mountain - GR.
3/ Spanish Springs valley - GR/CB.

TABLE 9

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES

DRAINAGE AREA BELOW 9,000 FEET, MSL, FOR THE STANDARD PROJECT GENERAL RAIN AND JAN-FEB 1963 FLOOD

SUBAREAS	15	20	25	30	35	40	42	44	46	48	50	60	62 3/	64	66	68	70	72	74	76	78
CHARACTERISTICS																					
D.A. (Sq. Mi.)	4.5	5.5	8.4	17.0	15.6	2.9	8.6	6.6	1.8	10.5	2.4	22.8	10.2	4.6	8.4	2.9	3.6	1.9	4.7	2.7	2.1
L (Mi.)	4.7	6.2	6.3	6.4	8.4	2.6	5.8	4.2	1.7	8.4	1.6	7.7	4.7	2.5	6.8	3.0	3.7	2.5	4.3	2.8	4.4
Lca (Mi.)	2.4	2.7	2.9	2.1	4.7	1.0	3.0	1.4	1.0	4.5	1.0	2.7	1.5	1.2	3.0	1.4	1.9	1.2	1.7	1.6	2.8
SLOPE (Ft./Mi.)	783.9	547.0	674.9	186.3	337.3	145.0	566.0	308.4	90.8	503.6	171.8	246.4	590.1	129.9	557.6	215.7	29.9	80.0	327.1	14.1	25.0
$LLca/S^{.5}$	0.4	0.72	0.71	0.99	2.13	0.23	0.69	0.29	0.18	1.67	0.12	1.32	0.29	0.27	1.14	0.20	1.28	0.34	0.41	1.18	2.17
$\bar{n}$	.075	.075	.075	.075	.075	.075	.075	.075	.07	.075	.07	.07	.075	.07	.075	.075	.07	.04	.04	.04	.04
LAG (Hours)	1.3	1.6	1.6	1.8	2.4	1.0	1.6	1.1	0.9	2.2	0.8	1.9	1.1	1.0	1.9	1.1	1.8	0.6	0.7	1.0	1.3
S-CURVE	1/	1/	1/	1/	1/	2/	1/	1/	2/	1/	2/	2/	1/	2/	1/	2/	2/	2/	2/	2/	2/
ONE HOUR UNIT HYDROGRAPH ORDINATES (End of period flow in c.f.s.)																					
TIME PERIOD (Hours)																					
1	1039	943	1441	2478	1240	856	982	1843	670	998	988	1554	2827	1363	1065	752	249	868	2081	809	380
2	1074	1291	1955	3943	2764	608	1318	1549	306	2031	345	6105	2376	976	1816	697	955	228	607	567	602
3	405	668	1000	2386	2276	183	665	513	100	1520	116	2849	787	294	1164	203	435	77	205	171	172
4	178	300	449	1119	1440	94	299	207	50	878	56	1311	318	151	577	104	200	33	95	88	87
5	73	162	240	631	801	56	150	73	28	472	26	784	112	89	319	62	120	7	32	52	53
6	33	79	116	350	502	33	76	46	12	305	5	534	70	54	189	40	82		1	31	35
7	25	37	55	181	339	16	36	36	2	189		383	55	26	103	23	59			15	23
8	21	28	42	97	213	3	28	25		112		283	38	5	53	9	43			3	15
9	14	24	35	80	131		24			63		219			38	1	33				7
10		20	30	68	76		20			43		166			33		25				1
11		15	23	58	58		15			38		121			28		18				
12		2	2	48	51					33		82			25		12				
13				22	45					29		44			19		6				
14					41					27		15			5		2				
15					37					21											
16					31					7											
17					21																
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44																					
45																					
TOTAL	2872	3569	5388	11461	10066	1849	3621	4292	1168	6766	1536	14450	6583	2956	5434	1891	2239	1213	3021	1736	1375

1/ Truckee Meadows average mountain - GR.
2/ Truckee Meadows average valley - GP/CB.
3/ Consists of subareas 621, 622, 623 and 624

TABLE 9

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES

DRAINAGE AREA BELOW 9,000 FEET, MSL, FOR THE STANDARD PROJECT GENERAL RAIN AND JAN-FEB 1963 FLOODS

CHARACTERISTICS

0	35	40	42	44	46	48	50	60	62[3/]	64	66	68	70	72	74	76	78	80	82	84	700	720	730	740	760
.0	13.6	2.9	8.6	6.6	1.8	10.5	2.4	22.4	10.2	4.6	8.4	2.9	3.5	1.9	4.7	2.7	2.1	2.0	2.5	5.6	1.5	241.0	49.0	96.0	93.4
.4	8.4	2.6	5.4	4.2	1.7	8.4	1.6	7.7	4.7	2.5	6.8	3.0	3.7	2.5	4.3	2.8	4.4	3.4	4.2	4.0	1.9	32.5	13.5	10.3	18.8
.1	4.7	1.0	3.0	1.4	1.0	4.5	1.0	2.7	1.5	1.2	3.9	1.8	1.9	1.2	1.7	1.6	2.5	1.7	1.2	3.1	0.5	9.1	6.7	6.9	6.1
.3	337.3	145.0	566.0	384.4	90.0	503.6	171.0	246.4	590.1	129.9	557.5	215.7	29.9	80.0	327.1	14.1	25.0	123.9	4.0	88.7	393.0	92.3	293.6	200.0	151.1
.99	2.13	0.23	0.69	0.29	0.10	1.67	0.12	1.32	0.29	0.27	1.14	0.20	1.28	0.34	0.41	1.18	2.17	0.54	2.21	1.61	0.05	30.77	5.28	8.93	9.33
.075	.075	.075	.075	.075	.07	.075	.07	.07	.075	.07	.075	.075	.07	.04	.04	.04	.04	.07	.07	.07	.07	.07	.07	.07	.07
.0	2.4	1.0	1.6	1.1	0.9	2.2	0.8	1.9	1.1	1.0	1.9	1.1	1.8	0.6	0.7	1.0	1.3	1.3	2.3	2.0	0.6	6.2	3.2	3.9	3.9
	1/	2/	1/	1/	2/	1/	2/	2/	1/	2/	1/	2/	2/	2/	2/	2/	2/	2/	2/	2/	1/	2/	1/	1/	1/

ONE HOUR UNIT HYDROGRAPH ORDINATES

(End of period flow in c.f.s.)

0	35	40	42	44	46	48	50	60	62	64	66
2470	1240	856	982	1843	670	998	988	1554	2827	1361	1065
3943	2764	600	1310	1549	306	2031	345	6105	2376	976	1816
2306	2276	183	665	813	100	1520	116	2049	787	294	1164
1119	1440	94	299	207	50	878	56	1311	318	151	577
631	801	56	150	73	20	472	26	784	112	89	319
350	502	33	76	46	12	305	5	534	70	54	189
181	329	16	34	36	2	189		383	55	26	103
97	213	3	28	25		112		283	38	5	53
80	131		24			63		219			38
68	76		20			43		166			33
53	58		15			38		121			28
40	51					33		82			25
22	45					29		48			19
	41					27		15			5
	37					21					
	31					7					
	21										
11461	10066	1849	3621	4292	1168	6766	1536	14450	6583	2956	5434

68	70	72	74	76	78	80	82	84
752	249	868	2081	809	380	463	110	319
697	955	228	697	567	602	820	508	1426
203	435	77	205	171	172	237	425	791
104	200	33	95	88	87	118	184	357
62	120	7	22	52	53	73	105	209
40	82		1	31	35	48	71	143
23	59			15	23	33	51	104
9	43			3	15	21	39	77
1	33				7	12	30	60
	25				1	4	24	47
	18						19	36
	12						15	27
	6						12	18
	2						9	10
							6	4
							3	
							1	
1891	2239	1213	3021	1736	1375	1829	1612	3628

700	720	730	740	760
753	2933	2271	2988	2812
155	8801	6180	8712	8210
51	14248	6401	10658	10216
15	17184	5071	9804	9487
	16298	3576	7680	7484
	15731	2295	5716	5630
	13380	1523	4012	4007
	11488	1114	2765	2740
	9535	826	2068	2056
	7701	585	1653	1644
	6146	404	1282	1285
	4608	276	966	977
	4006	183	709	719
	3263	140	527	543
	2877	131	374	392
	2462	118	274	281
	2117	108	223	218
	1768	100	215	210
	1490	90	195	192
	1207	87	181	177
	1021	72	169	165
	839	62	159	156
	691	10	144	142
	539		142	136
	458		126	130
	375		106	109
	349		98	95
	345		5	47
	327			
	308			
	293			
	280			
	268			
	260			
	248			
	231			
	224			
	222			
	215			
	190			
	172			
	156			
	154			
	40			
974	155524	31623	61951	60276

624

TABLE 10

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
DRAINAGE AREA BELOW 9,000 FEET, MSL, FOR THE PROBABLE MAXIMUM GENERAL RAIN FLOODS

SUBAREAS	15	20	25	30	35	40	42	44	46	48	50	60
CHARACTERISTICS												
D.A. (Sq. Mi.)	4.5	5.5	8.4	17.8	15.6	2.9	5.6	6.6	1.8	10.5	2.4	22.4
L (Mi.)	4.7	6.2	6.3	6.4	8.4	2.6	5.4	4.2	1.7	8.4	1.6	7.7
Lca (Mi.)	2.4	2.7	2.9	2.1	4.7	1.0	3.0	1.4	1.0	4.5	1.0	2.7
SLOPE (Ft./Mi.)	783.9	547.0	674.9	186.3	337.3	145.0	566.0	384.4	98.8	503.6	171.8	246.5
$LLca/S^{.5}$	0.40	0.72	0.71	0.99	2.13	0.23	0.69	0.29	0.18	1.67	0.12	1.32
$\bar{n}$	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.056	0.06	0.056	0.056
LAG (Hours)	1.0	1.3	1.3	1.4	1.9	0.8	1.3	0.9	0.7	1.8	0.6	1.5
S-CURVE	1/	1/	1/	1/	1/	2/	1/	1/	2/	1/	2/	2/
ONE HOUR UNIT HYDROGRAPH ORDINATES *(End of period flow in c.f.s.)*												
TIME PERIOD *(Hours)*												
1	1400	1304	1990	3536	1919	1120	1354	2377	797	1520	1129	2745
2	973	1335	2013	4278	3335	455	1351	1326	239	2352	273	6675
3	302	504	752	1897	2172	150	499	374	81	1387	92	2141
4	105	221	329	845	1093	74	217	108	38	639	37	1040
5	40	90	133	409	601	39	87	56	14	362	5	642
6	29	41	61	176	361	13	40	41	1	196		426
7	22	31	47	105	198		32	10		98		303
8	3	26	38	86	103		26			56		215
9		18	25	72	71		15			46		145
10				54	61					40		84
11					53					34		32
12					47					27		1
13					37					7		
14					15							
TOTAL	2874	3570	5388	11458	10066	1851	3621	4292	1170	6764	1536	14449

1/ Truckee Meadows average mountain - GR.

2/ Truckee Meadows average valley - GR/CB.

TABLE II

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
DRAINAGE AREAS FOR STANDARD PROJECT CLOUDBURST FLOODS

CHARACTERISTICS

SUBAREAS	15	20	201	25	30	35	40	42	44	46	48	50	60	621
D.A. (Sq. Mi.)	4.6	1.0	7.5	8.4	17.0	15.6	2.9	8.0	6.6	1.0	11.4	2.4	22.4	1.4
L (Mi.)	4.8	2.7	5.5	6.3	6.4	8.4	2.6	5.8	4.2	1.7	8.8	1.6	7.7	2.4
Lca (Mi.)	2.6	1.7	3.1	2.9	2.1	4.7	1.0	3.9	1.4	1.0	5.1	1.0	2.7	1.1
Slope (Ft./Mi.)	850.7	600.7	694.1	478.9	106.3	337.3	145.0	697.4	384.6	90.8	571.1	171.6	246.4	397.9
$LLca/S^{0.5}$	0.83	0.18	0.60	0.71	0.99	2.13	0.23	0.85	0.29	0.18	1.87	0.12	1.32	0.14
n	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.07	0.075	0.07	0.07	0.075
Lag (Hours)	1.3	1.0	1.6	1.6	1.8	2.4	1.0	1.7	1.1	0.9	2.3	0.8	1.9	0.85
S Curve	1/	1/	1/	1/	1/	1/	2/	1/	1/	2/	1/	2/	2/	1/

SUBAREAS	622	623	624	64	66	68	70	72	74	76	78	80	82	84
D.A. (Sq. Mi.)	3.6	3.0	2.2	4.6	8.4	2.9	3.5	1.9	4.7	2.7	2.1	2.8	2.5	5.6
L (Mi.)	4.7	3.4	3.0	2.6	6.8	3.0	3.7	2.5	4.3	2.8	4.4	3.4	4.2	4.4
Lca (Mi.)	2.4	1.7	1.3	1.2	3.9	1.4	1.9	1.2	1.7	1.6	2.5	1.7	1.2	3.1
Slope (Ft./Mi.)	502.6	774.2	550.7	129.9	557.5	215.7	29.9	80.0	327.1	14.1	25.0	123.9	4.0	88.7
$LLca/S^{0.5}$	0.46	0.22	0.17	0.27	1.14	0.20	1.20	0.34	0.41	1.18	2.17	0.54	2.21	1.61
n	0.075	0.075	0.075	0.07	0.075	0.075	0.07	0.04	0.04	0.04	0.04	0.07	0.07	0.07
Lag (Hours)	1.37	1.01	0.92	1.0	1.9	1.0	1.9	0.3	0.4	0.5	0.6	0.4	2.0	1.7
S Curve	1/	1/	1/	2/	1/	2/	2/	2/	2/	2/	2/	2/	2/	2/

1/4-HOUR UNIT HYDROGRAPH ORDINATES
(End of period flow in c.f.s.)

TIME PERIOD (1/4 Hours)	15	20	201	25	30	35	40	42	44
1	340	137	393	425	652	424	187	340	657
2	805	376	1069	1159	1901	969	479	963	1676
3	1345	411	1635	1785	3029	1488	1134	1510	2449
4	1519	420	2007	2209	3934	1988	1673	1910	2460
5	1409	341	2056	2272	4336	2572	1053	2052	2151
6	1219	264	1896	2106	4201	2761	629	1949	1768
7	1035	194	1670	1884	3845	2822	431	1766	1446
8	870	141	1459	1638	3466	2760	319	1576	1106
9	683	105	1255	1409	3007	2533	241	1385	850
10	549	79	1060	1196	2706	2368	196	1201	658
11	437	60	870	994	2349	2199	161	1022	511
12	346	43	723	821	1992	2033	134	856	412
13	286	30	594	678	1682	1784	117	715	322
14	235	19	487	560	1415	1629	100	597	246
15	191	10	413	476	1195	1473	86	503	191
16	151	1	349	395	1018	1313	75	432	130
17	121		300	342	884	1115	66	365	89
18	90		250	289	753	996	59	314	43
19	66		202	236	663	888	52	271	6
20	42		171	198	570	788	46	227	
21	22		133	162	484	675	41	186	
22	1		108	122	398	615	35	161	
23			76	92	352	556	31	120	
24			52	65	285	497	26	90	
25			27	38	220	439	22	76	
26			2	11	175	400	18	53	
27					130	361	14	31	
28					86	321	10	7	
29					39	265	7		
30						246	4		
31						220	1		
32						190			
33						147			
34						127			
35						107			
36						88			
37						59			
38						40			
39						18			
TOTAL	11850	2585	19257	21555	45246	40248	7609	20104	17167

TIME PERIOD (1/4 Hours)	46	48	50	60	621	622	623	624	64
1	131	325	225	404	233	240	355	312	233
2	472	782	887	983	592	675	926	804	758
3	1089	1210	1794	1780	698	979	1248	1016	1794
4	990	1602	1049	3053	584	1152	1174	898	2659
5	508	1977	567	4786	452	1094	970	717	1693
6	323	2167	363	6574	329	959	780	550	1009
7	226	2141	257	7359	227	826	596	394	691
8	148	2050	193	5707	164	698	434	285	513
9	130	1919	153	4015	119	574	327	212	385
10	106	1747	125	3041	87	454	251	159	315
11	89	1589	100	2386	61	363	193	118	258
12	74	1451	84	1950	40	295	147	86	217
13	62	1315	71	1650	23	242	110	57	187
14	52	1184	61	1404	5	196	78	34	160
15	46	1008	51	1164		165	48	1	138
16	40	891	43	1021		134	24		120
17	35	788	35	935		107	5		105
18	30	695	29	808		87			94
19	25	605	23	719		64			84
20	21	521	16	672		46			78
21	18	471	11	595		29			65
22	14	422	6	559		13			57
23	10	376	2	518					49
24	7	336		470					43
25	5	290		431					36
26	2	246		391					30
27		233		368					22
28		201		343					17
29		173		310					12
30		154		291					2
31		130		274					
32		107		255					
33		90		243					
34		68		226					
35		52		210					
36		36		197					
37		18		185					
38				172					
39				159					
40				146					
41				135					
42				125					
43				116					
44				106					
45				97					
46				87					
47				78					
48				65					
49				54					
50				49					
51				39					
52				32					
53				27					
54				19					
55				11					
56				4					
TOTAL	4673	29404	6145	57748	3614	9396	7661	5643	11875

TIME PERIOD (1/4 Hours)	66	68	70	72	74	76	78	80	82	84
1	290	133	68	285	530	138	77	97	35	[illegible]
2	821	405	157	1109	2316	852	198	241	76	[illegible]
3	1303	925	285	1475	3712	1072	460	565	128	[illegible]
4	1702	1546	490	643	1766	1575	786	950	203	[illegible]
5	1913	1231	765	368	980	981	1007	1315	319	[illegible]
6	1987	715	1051	239	634	587	669	951	438	[illegible]
7	1781	483	1139	172	457	403	427	588	567	[illegible]
8	1623	350	866	133	350	297	308	428	720	[illegible]
9	1462	270	612	103	272	225	235	319	612	[illegible]
10	1390	215	468	82	219	183	183	253	453	[illegible]
11	1144	176	364	67	177	151	146	199	351	[illegible]
12	992	149	299	56	149	127	125	171	281	[illegible]
13	846	128	253	46	124	109	108	143	230	[illegible]
14	722	111	214	37	103	93	91	125	193	[illegible]
15	619	96	176	29	84	81	80	103	167	[illegible]
16	523	83	147	22	68	70	70	97	146	[illegible]
17	456	74	143	15	53	61	63	86	126	[illegible]
18	393	64	124	9	37	55	58	76	108	[illegible]
19	338	58	111	4	24	49	50	67	97	[illegible]
20	300	52	102		13	43	45	62	89	[illegible]
21	260	47	92		2	38	40	54	82	[illegible]
22	222	42	86			33	35	50	73	[illegible]
23	189	37	78			28	30	46	64	[illegible]
24	163	32	72			25	27	42	63	[illegible]
25	136	28	66			21	25	38	56	[illegible]
26	108	25	60			17	22	34	53	[illegible]
27	86	21	57			13	20	31	50	[illegible]
28	67	18	52			9	18	28	46	[illegible]
29	48	14	47			7	16	25	43	[illegible]
30	22	11	45			4	14	22	41	[illegible]
31	9	8	42			1	12	20	37	[illegible]
32		5	39				10	18	35	[illegible]
33		2	37				8	15	33	[illegible]
34			33				6	13	31	[illegible]
35			32				5	10	29	[illegible]
36			30				3	8	27	[illegible]
37			28				2	6	26	[illegible]
38			26					4	25	[illegible]
39			24					3	24	[illegible]
40			22					1	22	[illegible]
41			21						21	[illegible]
42			19						20	[illegible]
43			17						19	[illegible]
44			16						18	[illegible]
45			14						17	[illegible]
46			13						16	[illegible]
47			11						15	[illegible]
48			9						14	[illegible]
49			8						13	[illegible]
50			7						12	[illegible]
51			6						12	[illegible]
52			5						11	[illegible]
53			3						11	[illegible]
54			2						10	[illegible]
55									9	[illegible]
56									9	[illegible]
57									8	[illegible]
58									7	[illegible]
59									6	[illegible]
60									5	[illegible]
61									5	[illegible]
62									4	[illegible]
63									3	[illegible]
64									3	[illegible]
65									2	[illegible]
66									1	[illegible]
67									1	[illegible]
TOTAL	21737	7563	8957	4853	12081	6947	5508	7306	6858	[illegible]

1/ Truckee Meadows average mountain Cθ.
2/ Truckee Meadows average valley Cθ.

TABLE 12

UNIT HYDROGRAPH CHARACTERISTICS AND ORDINATES
DRAINAGE AREAS FOR PROBABLE MAXIMUM CLOUDBURST FLOODS

SUBAREAS	15	20	201	25	30	35	40	42	44	46	48	50	60
CHARACTERISTICS													
D.A. (Sq. Mi.)	4.6	1.0	7.5	8.4	17.8	15.6	2.9	8.0	6.6	1.8	11.4	2.4	22.4
L (Mi.)	4.8	2.7	5.5	6.3	6.4	8.4	2.6	5.8	4.2	1.7	8.8	1.6	7.7
Lca (Mi.)	2.6	1.7	3.3	2.9	2.1	4.7	1.0	3.9	1.4	1.0	5.1	1.0	2.7
SLOPE (Ft./Mi.)	854.7	688.7	694.1	674.9	186.3	337.3	145.0	697.4	384.4	98.8	571.1	171.8	246.4
$LLca/S^{.5}$	0.43	0.18	0.68	0.71	0.99	2.13	0.23	0.85	0.29	0.18	1.87	0.12	1.32
$\bar{n}$	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.056	0.06	0.056	0.056
Lag (Hours)	1.1	0.8	1.3	1.3	1.4	1.9	0.8	1.4	0.9	0.7	1.8	0.6	1.5
S-CURVE	1/	1/	1/	1/	1/	1/	2/	1/	1/	2/	1/	2/	2/
1/4 HOUR UNIT HYDROGRAPH ORDINATES (End of period flow in c.f.s.)													
TIME PERIOD (1/4 Hours)													
1	516	213	620	676	1121	530	234	568	937	199	406	354	631
2	1350	527	1558	1709	2929	1483	866	1452	2554	880	1176	1617	1552
3	1862	559	2384	2601	4459	2348	1940	2195	3162	1429	1867	1781	2987
4	1760	437	2579	2849	5322	3072	1442	2561	2726	701	2439	764	5814
5	1493	320	2328	2600	5164	3470	756	2407	2172	389	2710	435	8510
6	1216	215	1994	2220	4616	3409	478	2134	1639	249	2651	288	8713
7	950	145	1602	1893	4049	3278	332	1810	1177	179	2444	209	5557
8	700	103	1346	1520	3474	2996	252	1524	843	137	2212	161	3910
9	628	72	1082	1220	2849	2707	197	1261	624	109	1978	124	2933
10	408	48	825	954	2339	2417	162	995	472	86	1745	98	2268
11	315	29	662	788	1906	2134	132	794	341	70	1523	81	1856
12	246	14	529	613	1545	1862	110	646	247	58	1303	66	1506
13	184	1	430	485	1247	1596	92	527	157	49	1105	53	1260
14	140		352	408	1041	1362	79	430	90	41	934	41	1106
15	91		273	318	876	1160	69	364	24	34	790	32	944
16	58		221	252	738	986	58	292		27	673	22	849
17	24		161	196	585	843	50	229		22	584	13	738
18			117	136	476	740	42	188		16	501	6	680
19			74	98	392	638	35	136		10	438		605
20			38	51	289	564	29	97		6	383		544
21			2	11	209	496	22	64		2	328		486
22					142	428	16	28			273		451
23					75	359	10				235		401
24					6	310	6				199		366
25						260	1				158		340
26						217					124		314
27						172					97		291
28						137					69		267
29						103					42		244
30						70					13		225
31						33							206
32													185
33													167
34													153
35													137
36													123
37													108
38													91
39													74
40													63
41													48
42													38
43													29
44													15
45													4
TOTAL	11850	2683	19257	21552	45844	40268	7410	20699	17165	4471	29400	6145	57797

1/ Truckee Meadows average mountain - CB.
2/ Truckee Meadows average valley - GR/CB.

TABLE 15

UNREGULATED CONDITION FLOWS - TRUCKEE RIVER
(OCTOBER - MARCH)
(Flows in c.f.s.)

WATER YEAR	TRUCKEE RIVER AT FARAD						TRUCKEE RIVER AT RENO					
	PEAK	1 DAY	3 DAY	7 DAY	15 DAY	30 DAY	PEAK	1 DAY	3 DAY	7 DAY	15 DAY	30 DAY
1900												
1901												
1902		1194	874	739	626	515						
1903		3211	2565	1315	827	610						
1904		6730	5050	3812	2613	2591						
1905		1821	1496	1395	1357	1091						
1906		1280										
1907		15900	9260	6420	3897	2236		14600	11493	7062	4816	2726
1908		1395	1329	1298	1284	1130						
1909		8810	7010	4952	3280	2207		8540	7303	5118	3423	2313
1910		3890	3106	2421	2114	1700		3360	3053	2504	2246	1891
1911		2290	2100	1852	1502	1207						
1912		910	894	848	819	616						
1913		810	650	540	490	469		1100	700	536	478	437
1914		2700	2426	2277	1970	1422	7520	3540	3210	2350	2030	1510
1915		927	862	821	702	604		940	887	860	720	560
1916		3540	3123	2667	2328	1966		3870	3420	2850	2450	2040
1917		965	812	783	637	578		1060	899	724	594	536
1918		1620	860	719	629	580		920	853	804	712	622
1919		1040	927	765	641	570		1170	910	746	589	502
1920		595	545	521	514	494						
1921		1930	1640	1377	1184	1017						
1922		582	534	522	515	500						
1923		1200	1116	955	768	636						
1924		767	639	530	493	454						
1925		3430	2116	1352	856	611						
1926		756	720	677	651	529						
1927		2160	1890	1422	1188	992						
1928		12000	9866	5585	2995	1723						
1929		756	551	450	409	340						
1930		1360	1283	1197	867	581						
1931		888	694	579	420	307		759	621	564	412	291
1932		1340	1190	1016	776	506		1240	1200	1040	847	564
1933		226	205	179	162	142		211	199	167	151	128
1934		2500	1839	1301	989	710		1790	1500	1020	790	569
1935		421	320	239	201	177						
1936		1549	1459	1281	1073	823						
1937		792	668	609	563	524						
1938	15500	12300	7833	4642	2362	1408						
1939		1174	1148	1004	816	639						
1940		5440	4660	3747	2195	1426						
1941		1130	937	749	580	529						
1942		1579	1537	1491	1469	1182						
1943		4984	3049	2899	2509	2474		6462	4062	2950	2720	2434
1944		529	489	428	381	359						
1945		1976	1388	957	767	593						
1946		1578	1347	1043	775	551		1110	1028	918	838	793
1947		1388	1236	824	722	679		1239	1205	883	613	483
1948		1179	842	662	478	333		1016	838	664	484	349
1949		453	451	441	418	366		322	313	307	285	238
1950		1104	1042	918	745	627		1349	1072	958	779	663
1951	18000	12000	9412	6662	3894	3450	20500	15662	10555	6491	3883	3581
1952		1825	1821	1805	1748	1693		2734	2632	2170	2052	1923
1953		1358	1351	1341	1324	1244		1726	1424	1421	1402	1315
1954		2548	2084	1372	946	694		2801	2311	1536	1036	750
1955		662	572	518	458	420		530	596	519	461	420
1956	24600	21668	12646	6900	3772	3422	27500	25666	14611	7902	4370	2780
1957		1801	1757	1638	1524	1276		1977	1829	1700	1568	1329
1958		1590	1381	1098	814	640		2501	1935	1426	1012	768
1959		1046	946	775	609	595		742	632	605	592	538
1960		1499	1334	1196	985	843		1825	1311	1167	943	824
1961		589	532	511	481	398		340	354	345	297	269
1962		715	635	492	354	269		789	672	510	355	274
1963	30800	20119	11441	6674	3625	2283	33400	21485	13343	7894	4398	2634
1964		1788	1795	829	674	539		1482	1242	828	680	554

1913		810	680	540	490	469		1100	700	536	474	437
1914		2700	2426	2277	1970	1422	7520	3540	3210	2350	2090	1510
1915		927	862	821	702	604		980	887	860	720	560
1916		3540	3123	2647	2328	1946		3670	3820	2880	2450	2040
1917		948	812	785	637	578		1060	899	724	594	536
1918		1420	840	719	629	580		920	853	804	712	622
1919		1040	927	765	641	570		1170	910	746	589	502
1920		598	545	521	514	494						
1921		1930	1640	1377	1184	1017						
1922		542	534	522	518	500						
1923		1200	1116	955	764	636						
1924		767	639	530	493	484						
1925		3430	2116	1382	856	611						
1926		736	720	677	651	529						
1927		2160	1890	1422	1188	992						
1928		12000	9466	5585	2995	1723						
1929		756	581	450	409	340						
1930		1360	1283	1197	867	581						
1931		888	694	579	420	307		759	621	564	412	291
1932		1340	1190	1016	776	506		1240	1200	1040	847	564
1933		226	205	179	162	142		211	199	167	151	128
1934		2500	1833	1501	989	710		1790	1500	1020	790	569
1935		421	320	239	201	177						
1936		1549	1459	1281	1073	823						
1937		792	668	609	563	524						
1938	15500	12300	7833	4642	2562	1408						
1939		1174	1148	1004	816	639						
1940		5440	4460	3747	2135	1426						
1941		1130	937	749	580	529						
1942		1879	1637	1491	1469	1182						
1943		4984	3049	2899	2509	2474		6462	4062	2960	2720	2434
1944		529	489	426	381	359						
1945		1976	1388	957	767	593						
1946		1575	1347	1043	775	551		1110	1028	918	838	793
1947		1388	1236	824	722	679		1239	1205	883	613	483
1948		1179	842	662	478	333		1016	838	664	484	383
1949		453	451	441	418	366		322	313	307	285	238
1950		1104	1042	918	745	627		1349	1072	958	779	663
1951	18000	11000	9412	6662	3894	3450	20500	15662	10555	6491	3883	3581
1952		1825	1821	1805	1748	1693		2734	2632	2170	2052	1923
1953		1358	1351	1341	1324	1244		1726	1424	1421	1402	1315
1954		2548	2084	1372	946	694		2801	2311	1536	1036	750
1955		662	572	518	458	420		630	596	519	461	420
1956	24400	21668	12644	6900	3772	3422	27800	25666	14611	7902	4370	2780
1957		1801	1737	1638	1524	1276		1973	1829	1700	1568	1329
1958		1590	1381	1098	814	640		2501	1935	1426	1012	765
1959		1044	944	775	609	595		742	632	605	592	538
1960		1499	1334	1196	985	843		1825	1311	1167	943	824
1961		589	532	511	481	398		380	384	345	297	269
1962		715	635	492	354	269		789	672	510	355	274
1963	30500	20119	11441	6674	3825	2283	33400	24485	13343	7894	4398	2634
1964		1788	1255	829	674	539		1482	1242	838	680	584
1965	24000	17237	14120	8533	4767	2819	24300	14556	12938	8714	4731	7802
1966		2095	2085	2065	1827	1271		1931	1928	1917	1730	1201
1967		3834	2952	2312	1769	1190		3886	3563	2841	2140	1391
1968		2173	1875	1684	1364	1071		2336	2174	1871	1449	1132
1969		3857	3346	2732	2321	2100		4307	3683	2957	2505	2222
1970		10221	7850	5918	4523	3393		9255	8314	6881	5075	3816
1971		1330	1256	1125	1040	991		1436	1375	1276	1128	1062
1972		1576	1505	1464	1380	1250		1430	1411	1319	1259	1100
1973		1408	1208	990	713	562		1284	1243	1067	780	583
1974		3679	2771	2317	1921	1626		4220	4000	3095	1944	1701
1975		855	768	662	590	580		1475	1006	797	671	620
1976		979	733	585	479	463		904	664	521	415	361
1977		562	551	583	509	408		557	536	452	394	383

COMPUTED STATISTICS

Years Record	76	75	75	75	75		47	47	47	47	47
Log Mean	3.259	3.183	3.096	3.001	2.907		3.304	3.231	3.137	3.035	2.980
Log Std. Dev.	.424	.397	.361	.322	.299		.477	.450	.411	.376	.375
Skew	.810	.680	.479	.236	.158		.589	.461	.305	.095	.223

EXTENDED STATISTICS BASED ON MULTIPLE CORRELATION

Equiv. Years Record	76.9	77	77	76.9	76.9		76.5	76.8	76.8	76.8	76.5
Log Mean	3.266	3.189	3.100	3.004	2.91		3.276	3.203	3.109	3.008	2.919
Log Std. Dev.	.425	.397	.359	.319	.296		.439	.416	.381	.347	.345
Skew	.767	.651	.448	.213	.133		.595	.485	.339	.178	.313

ADOPTED STATISTICS

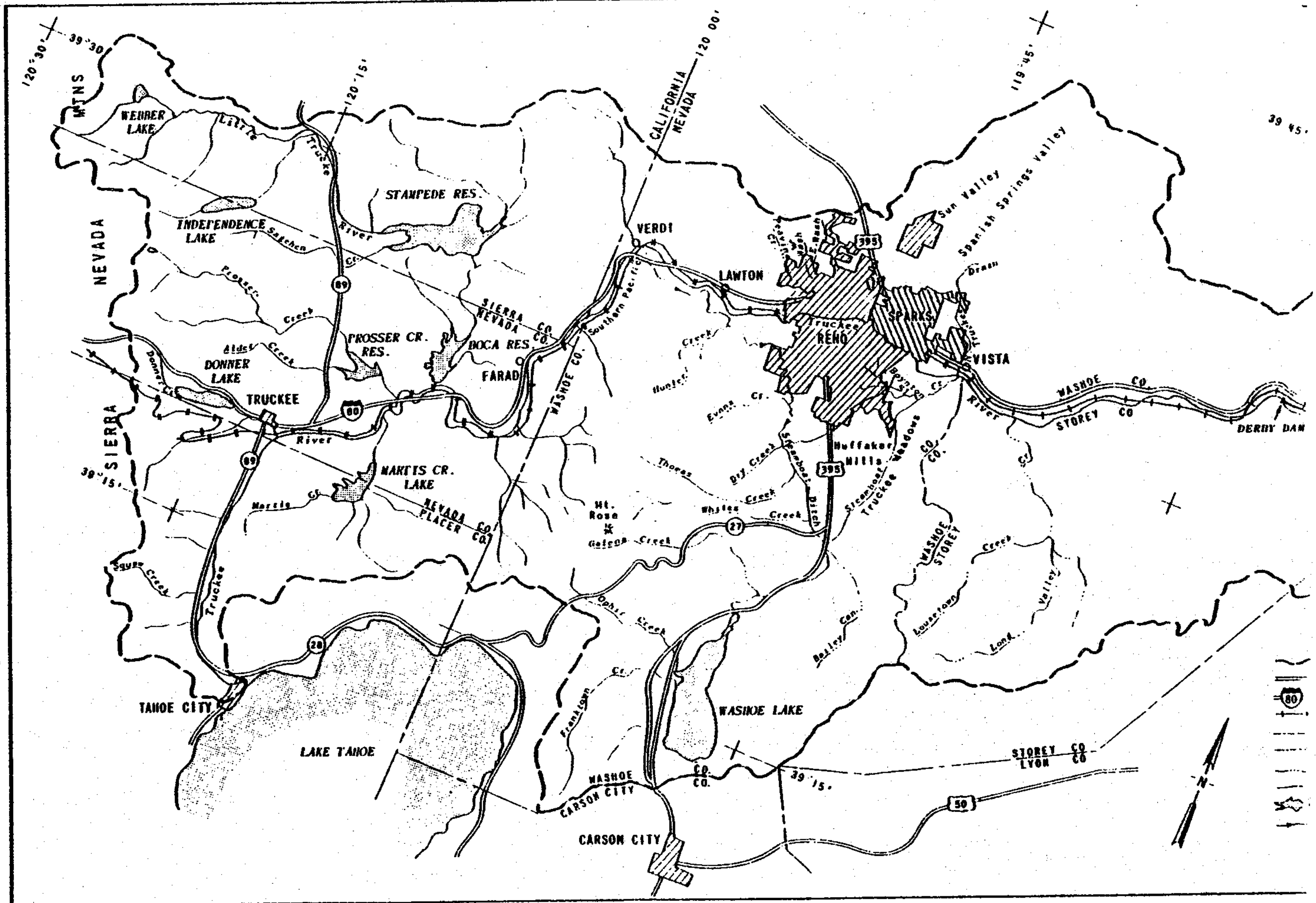
Equiv. Years Record	77	77	77	77	77		77	77	77	77	77
Log Mean	3.266	3.189	3.100	3.004	2.910		3.276	3.203	3.109	3.008	2.919
Log Std. Dev.	.38	.36	.34	.32	.29		.40	.33	.35	.33	.30
Skew	.6	.5	.4	.2	.1		.6	.5	.4	.2	.1

TABLE 15

UNREGULATED CONDITION FLOWS - TRUCKEE RIVER
(OCTOBER - MARCH)
(Flows in c.f.s.)

WATER YEAR	TRUCKEE RIVER NR VISTA						TRUCKEE RIVER BELOW DERBY DAM NEAR WADSWORTH						TRUCKEE RIVER NEAR NIXON					
	PEAK	1 DAY	3 DAY	7 DAY	15 DAY	30 DAY	PEAK	1 DAY	3 DAY	7 DAY	15 DAY	30 DAY	PEAK	1 DAY	3 DAY	7 DAY	15 DAY	30 DAY
1900																		
1901		4210	3980	3170	2640	2090												
1902		1290	1030	855	794	709												
1903		5680	4110	2390	1480	1090												
1904		8280	6410	5120	4290	3460												
1905		2040	1570	1470	1440	1320												
1906		2740	2300	1770	1480	1220												
1907		17000	12800	8240	5260	3310												
1908																		
1909																		
1910																		
1911																		
1912																		
1913																		
1914																		
1915																		
1916																		
1917																		
1918																		
1919								2112	1877	1006	723	620						
1920								1005	783	603	532	492						
1921								2156	1842	1526	1304	1110						
1922								1580	1500	1223	927	767						
1923								1662	1555	1317	1040-	845						
1924								956	844	658	596	522						
1925								3053	2806	1823	1188	827						
1926								829	808	734	706	588						
1927								2430	2035	1927	1584	1337						
1928								12200	11200	8721	4387	2460						
1929								667	553	467	434	388						
1930								1624	1390	1241	846	632						
1931								759	682	990	428	321						
1932								1213	1167	1004	809	560						
1933		250	250	229	203	197		253	248	226	198	191						
1934		1730	1580	1060	836	638		1849	1516	979	763	580						
1935		375	295	253	234	212		309	262	241	226	199						
1936		1620	1520	1370	1160	914		1634	1482	1390	1124	883						
1937		1730	1430	1120	910	710		1868	1628	1086	912	737						
1938		9740	7410	4410	2450	1490		9424	7123	4314	2372	1456						
1939		2031	1531	1188	927	713		1800	1443	1148	904	708						
1940		4920	4424	3713	2210	1499		5418	4049	3671	2161	1492						
1941		1292	1043	874	716	648		1255	1062	874	687	642						
1942		2486	2230	1586	1581	1392		2442	2135	1550	1513	1366						
1943		7852	6001	4251	3493	2958		7909	5998	4388	3545	3019						
1944		655	445	425	412	396		584	441	416	396	379						
1945		2992	2360	1500	1084	815		3085	2298	1580	1113	820						
1946		1110	1051	947	881	809		1346	1226	1025	949	816						
1947		1408	1175	977	778	631		1145	1105	890	537	506						
1948		1106	917	728	544	402		817	735	655	511	392						
1949								368	304	298	269	238						
1950		1528	1303	1020	848	730		1098	1068	935	781	693						
1951		10312	8974	6585	3864	3841		11157	9708	6862	4086	3915						
1952		2844	2792	2460	2211	2026		2981	2843	2576	2374	2177						
1953		2066	1667	1475	1462	1402		2356	2176	2124	2059	1752						
1954		2078	1828	1418	1050	813		2913	2569	1852	1243	901						
1955																		
1956	23200	17332	14434				23000	19809	14703				18100	16196	12398			
1957																		
1958																		
1959		1520	1125	920	651	604												
1960		1945	1545	1172	967	865												
1961		514	470	411	377	384												
1962		896	704	548	401	345												
1963	26800	22299	13847	8317	4554	2697	27000	21403	14606				20800	18179	12866			

1913																		
1914																		
1915																		
1916																		
1917																		
1918																		
1919								2112	1477	1006	723	620						
1920								1006	785	603	532	492						
1921								2156	1842	1826	1304	1110						
1922								1580	1300	1225	927	767						
1923								1662	1555	1317	1080*	848						
1924								966	846	658	595	522						
1925								3083	2806	1823	1188	827						
1926								829	808	734	706	588						
1927								2490	2038	1927	1584	1337						
1928								12200	11200	8721	4387	2460						
1929								667	535	447	438	388						
1930								1624	1390	1241	846	632						
1931								789	682	590	428	321						
1932								1213	1167	1004	809	540						
1933		250	280	229	205	197		253	248	226	198	191						
1934		1730	1540	1060	836	638		1809	1516	979	763	580						
1935		375	298	283	234	212		303	262	241	226	199						
1936		1620	1520	1370	1160	918		1654	1482	1390	1124	889						
1937		1730	1430	1120	910	710		1848	1628	1086	912	737						
1938		9760	7810	4410	2450	1490		9424	7123	4314	2372	1486						
1939		2031	1831	1188	927	713		1800	1443	1148	904	708						
1940		4920	4424	3713	2210	1899		5418	4849	3671	2161	1492						
1941		1292	1043	874	716	648		1258	1062	874	687	642						
1942		2486	2230	1986	1841	1392		2442	2138	1550	1513	1364						
1943		7852	6001	4251	3493	2958		7909	5998	4388	3568	3019						
1944		658	468	425	412	396		584	441	414	396	379						
1945		2992	2560	1900	1084	815		3085	2298	1580	1113	820						
1946		1110	1081	947	881	809		1346	1226	1028	949	816						
1947		1408	1175	977	778	631		1145	1105	890	537	506						
1948		1106	917	728	584	402		817	735	655	511	392						
1949								345	304	298	269	238						
1950		1528	1303	1020	884	750		1098	1068	935	781	693						
1951		10312	8974	6585	3864	3841		11157	9704	6862	4086	3915						
1952		2844	2792	2460	2211	2026		2981	2843	2576	2374	2177						
1953		2066	1667	1475	1462	1402		2356	2176	2124	2059	1752						
1954		2078	1824	1418	1050	813		2913	2569	1852	1243	901						
1955																		
1956	23200	17532	14434				29000	19809	14703				18100	16196	12595			
1957																		
1958																		
1959		1520	1125	820	481	604												
1960		1945	1545	1172	967	865												
1961		514	470	411	377	354												
1962		836	704	548	401	345												
1963	26800	22299	13847	8317	4554	2697	27000	21403	14604				20400	18179	12866			
1964		1782	1514	1096	970	737												
1965		16446	14548	9746	5437	3335												
1966		2001	1998	1979	1795	1281												
1967		5046	4180	3185	2314	1512		5267	4255	3254	2332	1521		4441	3784	3232	2372	1546
1968		2356	2181	1908	1544	1214		2102	2005	1795	1308	820		2437	2222	1962	1574	1225
1969		4297	3486	2960	2518	2255		3897	2974	2522	2198	1975		3653	3216	2681	2331	2128
1970		9820	8831	7841	5565	4104		9631	7787	6828	4906	3729		10327	8460	7093	5414	3974
1971		1526	1480	1389	1221	1145		1618	1531	1484	1303	1221		1536	1472	1436	1268	1188
1972		1550	1515	1411	1343	1184		1507	1473	1401	1338	1154		1520	1493	1437	1378	1225
1973		1493	1438	1258	911	686		1584	1447	1279	943	702		1607	1474	1305	993	762
1974		4850	4494	3445	2005	1783		4848	4995	3620	1941	1739		4774	4874	3849	2034	1858
1975		1755	1214	987	794	722		1971	1908	1017	854	767		1460	1278	1034	885	795
1976		1130	828	689	575	555		982	883	703	577	531		782	768	708	590	557
1977		770	680	556	479	445		700	628	526	472	436		735	654	574	500	462
COMPUTED STATISTICS																		
Years Record		48	49	47	47	47		49	49	47	47	47		13	13	11	11	11
Log Mean		3.392	3.317	3.197	3.098	3.009		3.305	3.238	3.111	3.006	2.919		3.481	3.426	3.287	3.189	3.075
Log Std. Dev.		.439	.430	.389	.349	.322		.435	.421	.360	.322	.305		.464	.430	.326	.297	.271
Skew		.317	.255	.174	.001	.002		.421	.346	.194	.072	.183		.474	.358	.297	.325	.313
EXTENDED STATISTICS BASED ON MULTIPLE CORRELATION																		
Equiv. Years Record		76.6	76.9	76.8	76.7	76.7		75.9	76.8	76.7	76.4	76.4		76.3	76.9	76.9	76.9	76.9
Log Mean		3.383	3.263	3.166	3.072	2.984		3.325	3.259	3.171	3.059	2.970		3.313	3.264	3.194	3.083	2.997
Log Std. Dev.		.402	.397	.371	.350	.300		.418	.404	.378	.334	.310		.388	.377	.360	.308	.281
Skew		.520	.452	.377	.209	.190		.466	.418	.380	.214	.184		.549	.511	.524	.320	.323
ADOPTED STATISTICS																		
Equiv. Years Record		77	77	77	77	77		76	77	77	76	76		76	77	77	77	77
Log Mean		3.383	3.263	3.166	3.072	2.984		3.325	3.259	3.171	3.059	2.970		3.313	3.264	3.194	3.083	2.997
Log Std. Dev.		.39	.39	.37	.34	.32		.39	.38	.36	.34	.32		.38	.36	.34	.32	.30
Skew		.5	.4	.3	.2	.1		.5	.4	.3	.2	.1		.5	.4	.3	.2	.1



WEBBER LAKE
STAMPEDE RES.
INDEPENDENCE LAKE
NEVADA
SIERRA
MTNS
CALIFORNIA
NEVADA
VERDI
LAWTON
RENO
SPARKS
VISTA
Sun Valley
Spanish Springs Valley
SIERRA CO.
NEVADA CO.
PROSSER CR. RES.
BOCA RES.
FARAD
DONNER LAKE
TRUCKEE
Truckee River
WASHOE CO.
STOREY CO.
DERBY DAM
MARTIS CR. LAKE
NEVADA CO.
PLACER CO.
Mt. Rose
Huffaker Hills
Truckee Meadows
Steamboat Ditch
Galena Creek
Ophir Creek
TAHOE CITY
LAKE TAHOE
WASHOE LAKE
WASHOE CO.
CARSON CITY
CARSON CITY
STOREY CO
LYON CO
120°30'
39°30'
120°15'
120°00'
119°45'
39°45'
39°15'

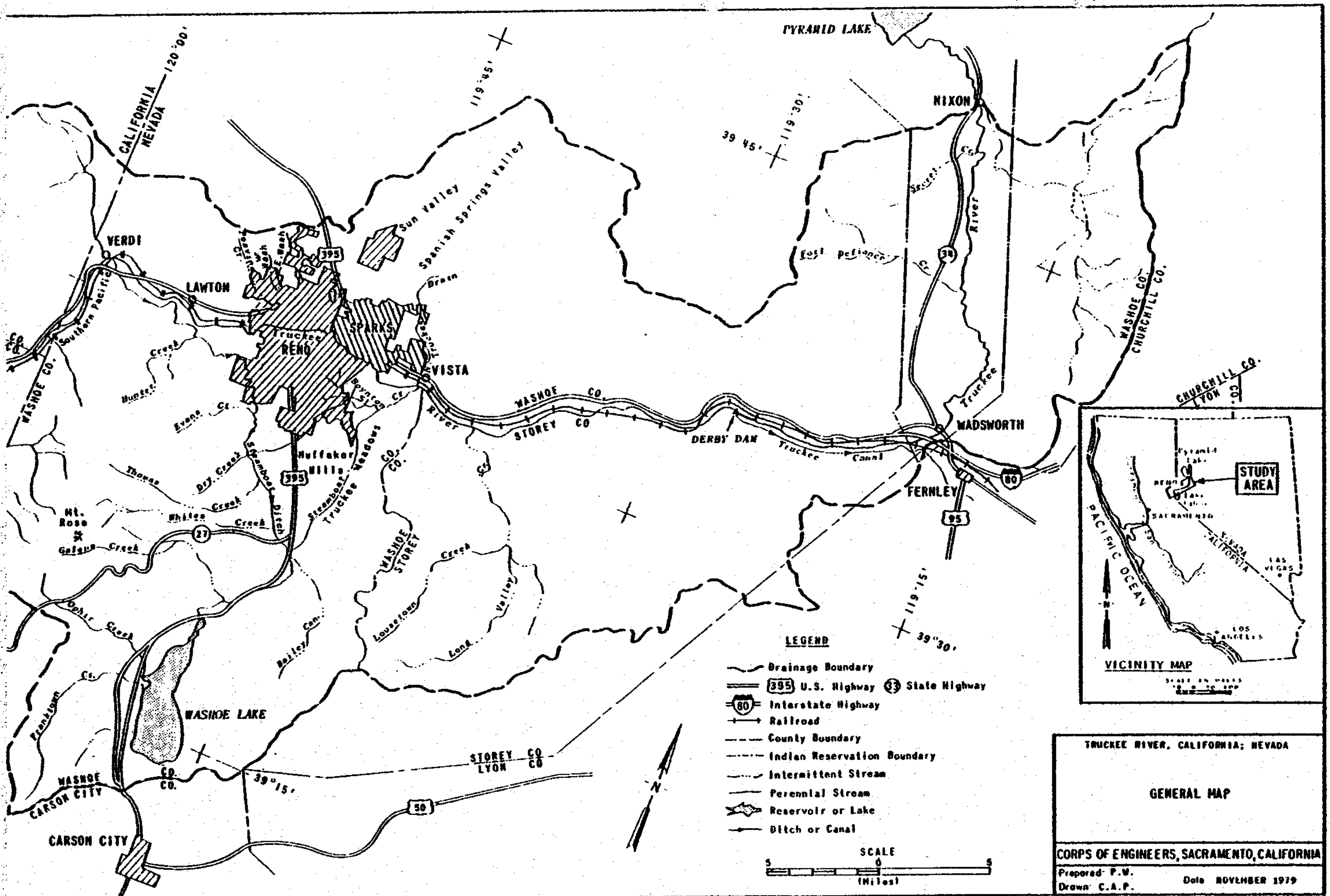
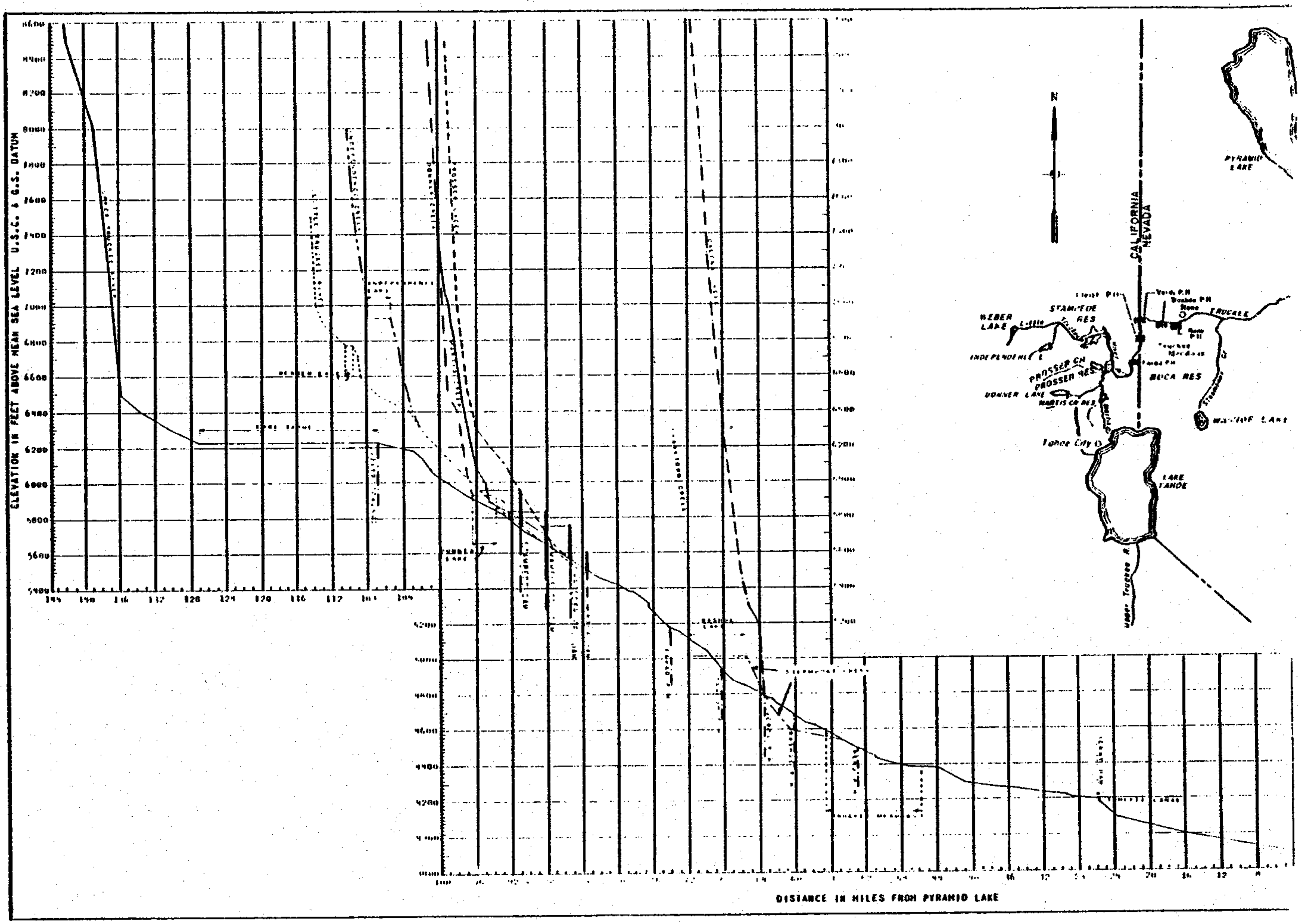
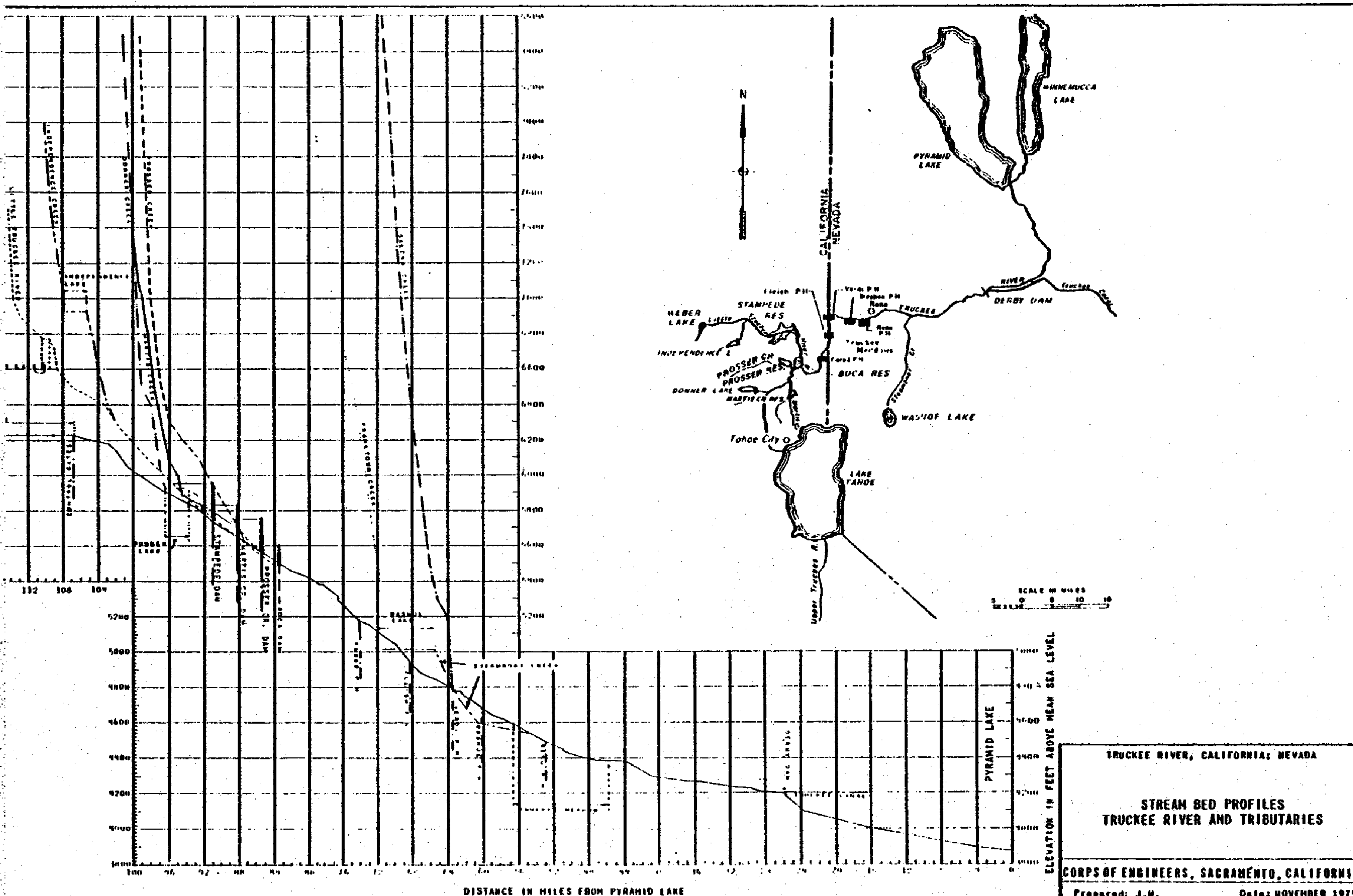

PYRAMID LAKE
NIXON
WADSWORTH
FERNLEY
VISTA
SPARKS
RENO
LAWTON
VERDI
CARSON CITY
WASHOE LAKE
DERBY DAM
Sun Valley
Spanish Springs Valley
Huffaker Hills
Truckee Meadows
Mt. Rose
CALIFORNIA
NEVADA
WASHOE CO.
CHURCHILL CO.
STOREY CO
LYON CO
CARSON CITY
Truckee River
Truckee Canal
Steamboat Ditch
Southern Pacific
LEGEND
Drainage Boundary
395 U.S. Highway
33 State Highway
80 Interstate Highway
Railroad
County Boundary
Indian Reservation Boundary
Intermittent Stream
Perennial Stream
Reservoir or Lake
Ditch or Canal
SCALE
(Miles)
VICINITY MAP
STUDY AREA
PACIFIC OCEAN
SACRAMENTO
LOS ANGELES
LAS VEGAS
TRUCKEE RIVER, CALIFORNIA; NEVADA
GENERAL MAP
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: P.V.
Drawn: C.A.P.
Date NOVEMBER 1979

CHART I



ELEVATION IN FEET ABOVE MEAN SEA LEVEL U.S.C. & G.S. DATUM
DISTANCE IN MILES FROM PYRAMID LAKE
PYRAMID LAKE
CALIFORNIA
NEVADA
N
WEBER LAKE
STAMPEDE RES
INDEPENDENCE L
PROSSER CH
PROSSER RES
DONNER LAKE
MARTIS CR RES
BOCA RES
TRUCKEE
Tahoe City
LAKE TAHOE
Upper Truckee R



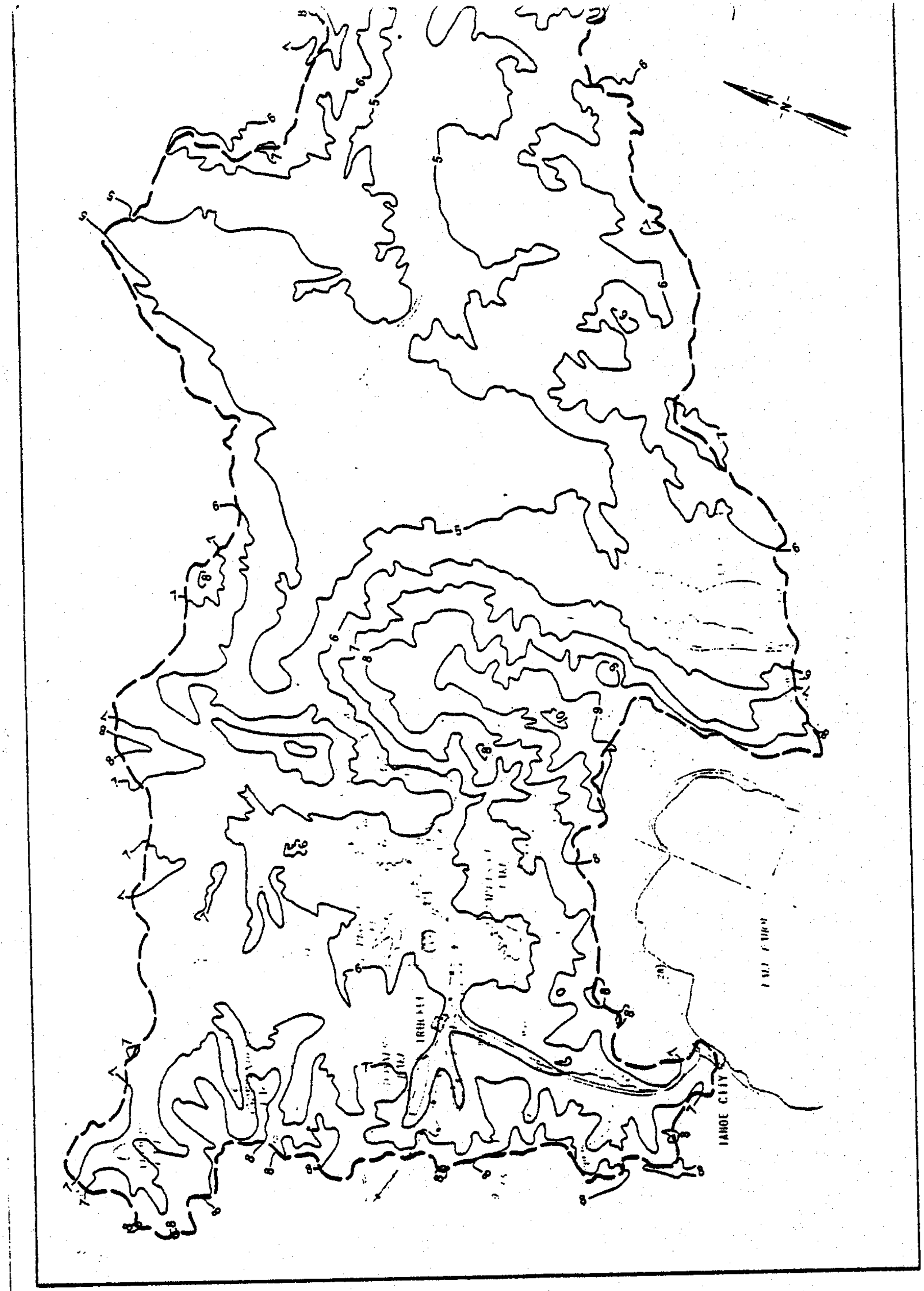
TRUCKEE RIVER, CALIFORNIA; NEVADA

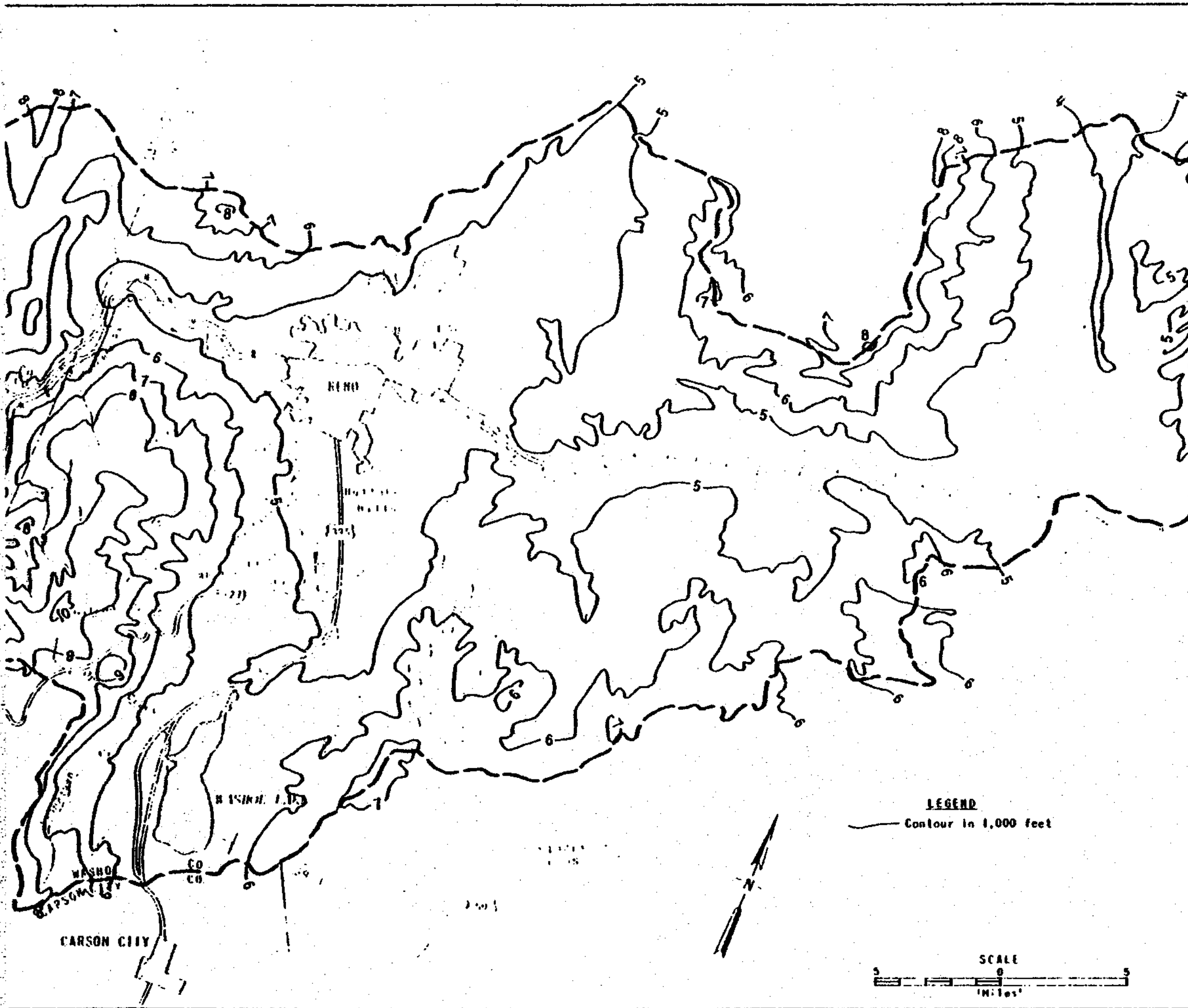
STREAM BED PROFILES
TRUCKEE RIVER AND TRIBUTARIES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J.H. Date: NOVEMBER 1979

CHART 2


N
TAHOE CITY



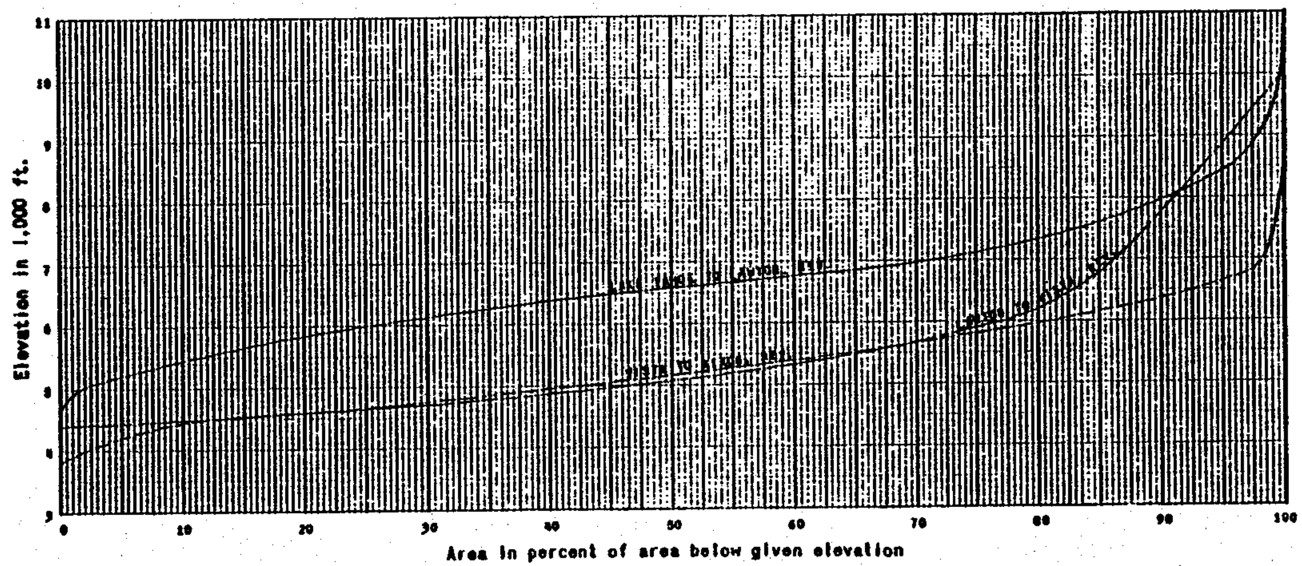
TRUCKEE RIVER, CALIFORNIA; NEVADA

TOPOGRAPHY MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P.
Date NOVEMBER 1979

CHART 3



TRUCKEE RIVER, CALIFORNIA; NEVADA

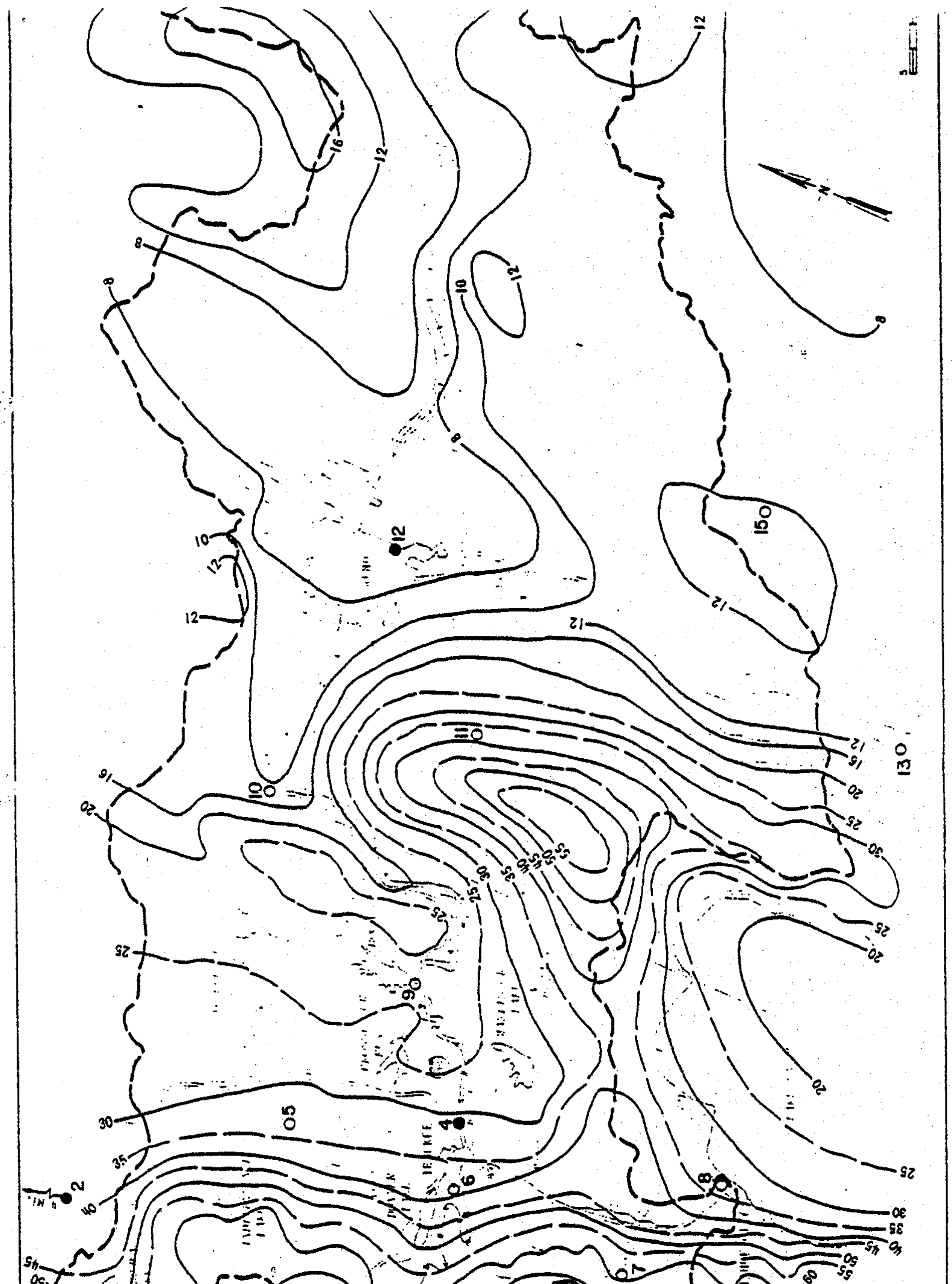
AREA ELEVATION CURVES

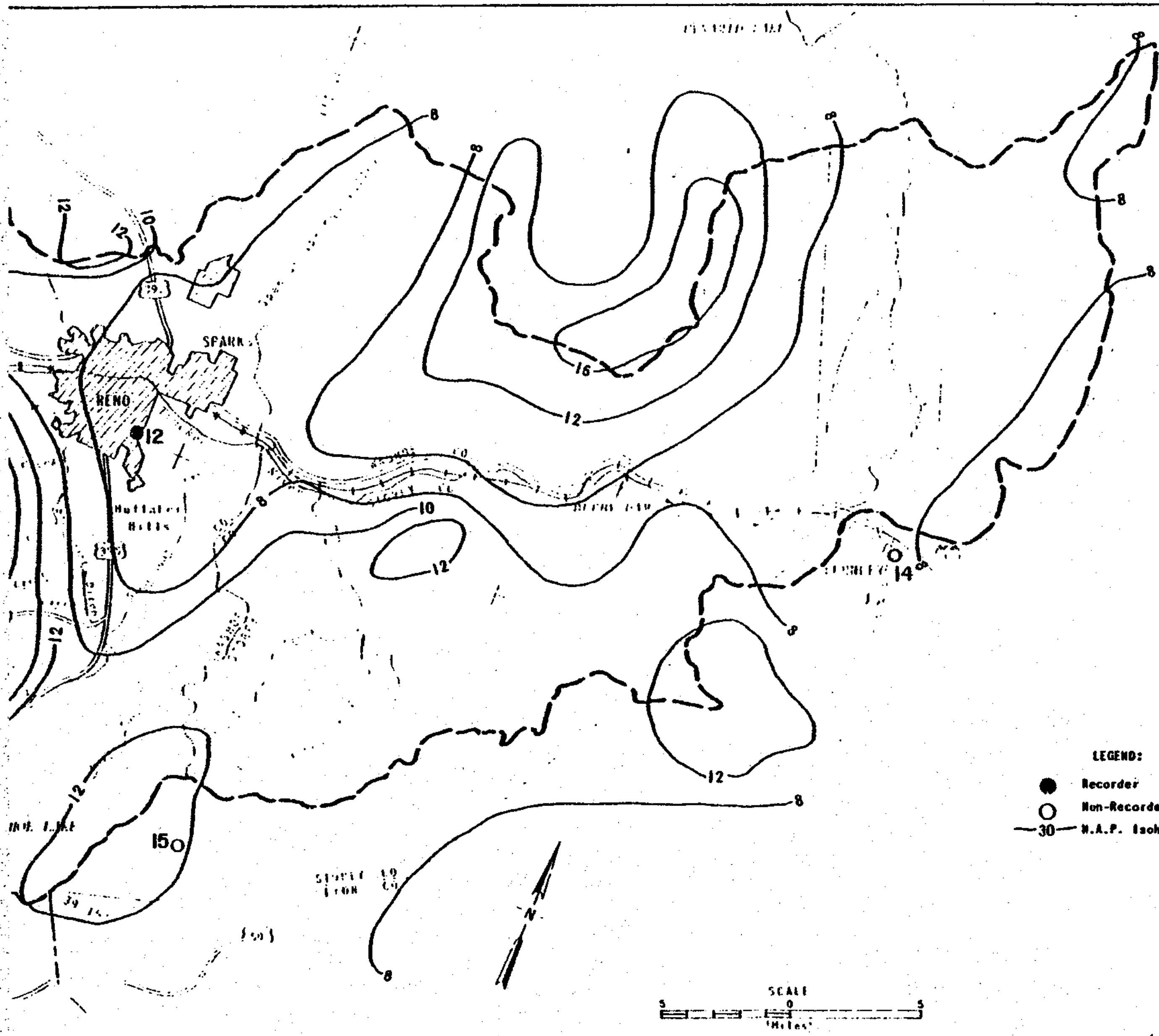
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn. J.N.

Date: NOVEMBER 1979

CHART 4





PRECIPITATION STATIONS

NUMBER	STATION		N.A.P. (IN.)	YEARS OF RECORD
1	Blue Canyon AP	R	65.0	39
2	Sierraville R.S.	R	27.0	96
3	Soda Springs I.E.	R	61.4	19
4	Truckee R.S.	R	32.0	96
5	Sagehen	N	32.1E	25
6	Donner Memorial St. Park	N	39.2	25
7	Squaw Valley Lodge	N	59.0E	19
8	Tahoe City	N	34.1	69
9	Boca	N	20.4	69
10	Verdi	N	11.5E	8
11	Mt. Rose Highway Station	N	37.0E	4
12	Reno WBS AP	R	7.2	109
13	Carson City	N	11.5	82
14	Fernley	N	8.7E	20
15	Virginia City	N	12.0E	30

R = RECORDER; N = NON-RECORDER

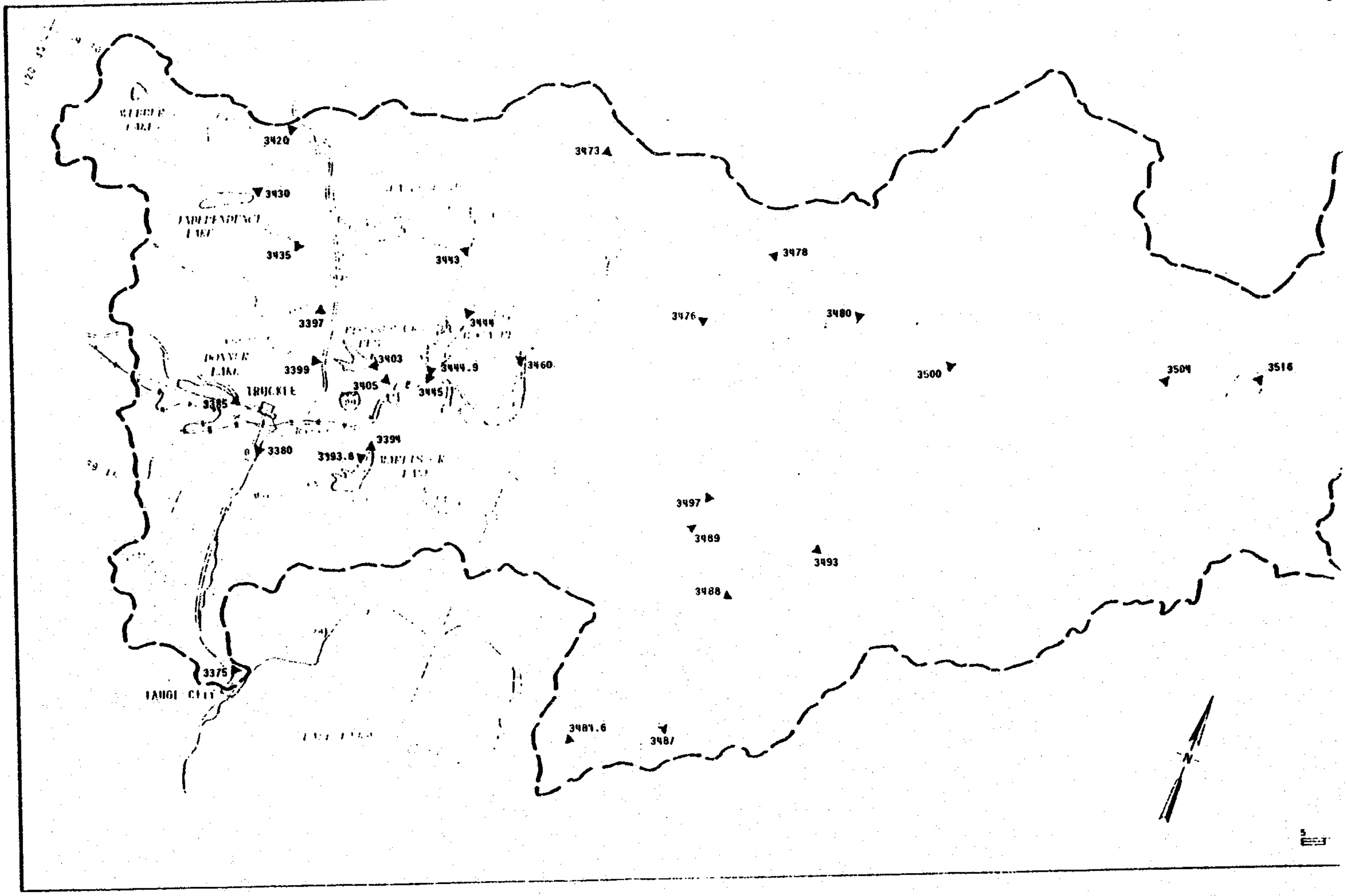
TRUCKEE RIVER, CALIFORNIA; NEVADA

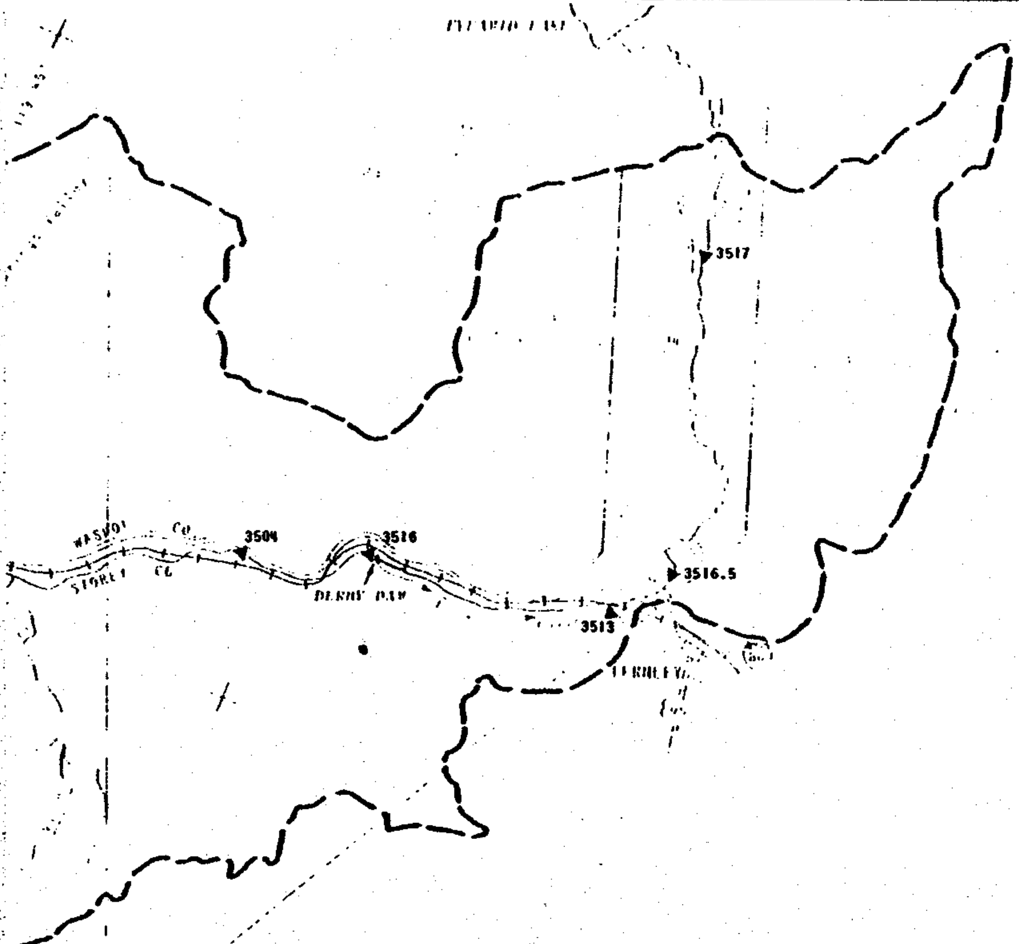
NORMAL ANNUAL PRECIPITATION MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P.
Date NOVEMBER 1979

CHART 5


3420
3473
3430
3435
3443
3478
3397
3444
3476
3480
3399
3403
3444.9
3460
3500
3504
3516
3405
3445
TRUCKEE
3385
3394
3380
3393.6
3497
3489
3493
3488
3375
3484.6
3487
N



STREAM GAGING STATIONS

USGS NO.	NAME OF STATION	DRAINAGE AREA (Sq. Mi.)	ELEVATION GAGE (Ft.)	PERIOD OF RECORD (Water Years) FROM	TO	YEARS
3375	Truckee River at Tahoe City	506	6,216.75	1896, 1901	Present	79
3380	Truckee River near Truckee	552	5,860	1945	1961	17
3385	Donner Creek at Donner Lake near Truckee	14.6	5,930	1910	Present	43*
33938	Martis Creek Lake near Truckee	40.0	5,780.00	1972	Present	6
3394	Martis Creek near Truckee	40.0	5,730	1959	Present	19
3397	Prosser Creek near Hobart Mills	27.4	5,840	1959	1963	8
3399	Alder Creek near Truckee	7.36	5,800	1959	1973	13
3403	Prosser Creek Reservoir near Truckee	50.5	--	1963	Present	16
3405	Prosser Creek near Truckee	53.2	5,602.31	1943	Present	35*
3420	Little Truckee River near Hobart Mills	36.5	6,290	1947	1972	26
3430	Independence Creek near Truckee	7.63	6,940	1969	Present	10
3435	Sagehen Creek near Truckee	10.0	6,320	1954	Present	25
3443	Stampede Reservoir near Boca	136	--	1970	Present	9
3444	Little Truckee River above Boca Reservoir near Boca	146	5,618.67	1940	Present	39
3449	Boca Reservoir near Truckee	172	--	1939	Present	40
3445	Little Truckee River below Boca Dam near Truckee	172	5,500	1940	Present	39
3460	Truckee River at Farad	932	5,153.21	1900	Present	79
3473	Dog Creek near Verdi	16.2	5,660	1957	1961	5
3476	Hunter Creek near Reno	11.5	5,070	1962	1974	12*
3478	Peavine Creek near Reno	2.34	4,990	1963	1974	12
3480	Truckee River at Reno	1,067	4,431.97	1907	Present	52*
34846	Franktown Creek near Carson City	3.24	7,380	1975	Present	4
3487	Washoe Lake near Carson City	83.0	--	1963	Present	16
3488	Little Washoe Lake near Steamboat	83.0	--	1963	Present	16
3489	Galena Creek near Steamboat	8.5	5,592	1962	Present	17
3493	Steamboat Creek at Steamboat	123	4,600	1962	Present	17
3497	Whites Creek near Steamboat	8.02	5,955	1962	1966	5
3500	Truckee River near Vista	1,429	4,368.59	1900	Present	50*
3504	Truckee River below Tracy	1,590	4,238.15	1973	Present	6
3516	Truckee River below Derby Dam	1,670	4,200	1909	Present	60*
35165	Truckee River at Wadsworth	1,719	4,037.90	1966	Present	13
3517	Truckee River near Nixon	1,815	3,940	1958	Present	21
3513	Truckee Canal near Wadsworth	--	4,200	1967	Present	12

*Broken Record

LEGEND:

Drainage Boundary.

▲ Stream Gaging Station- Refer to Table 5. for List of Stations.

SCALE
5 0 5
(Miles)

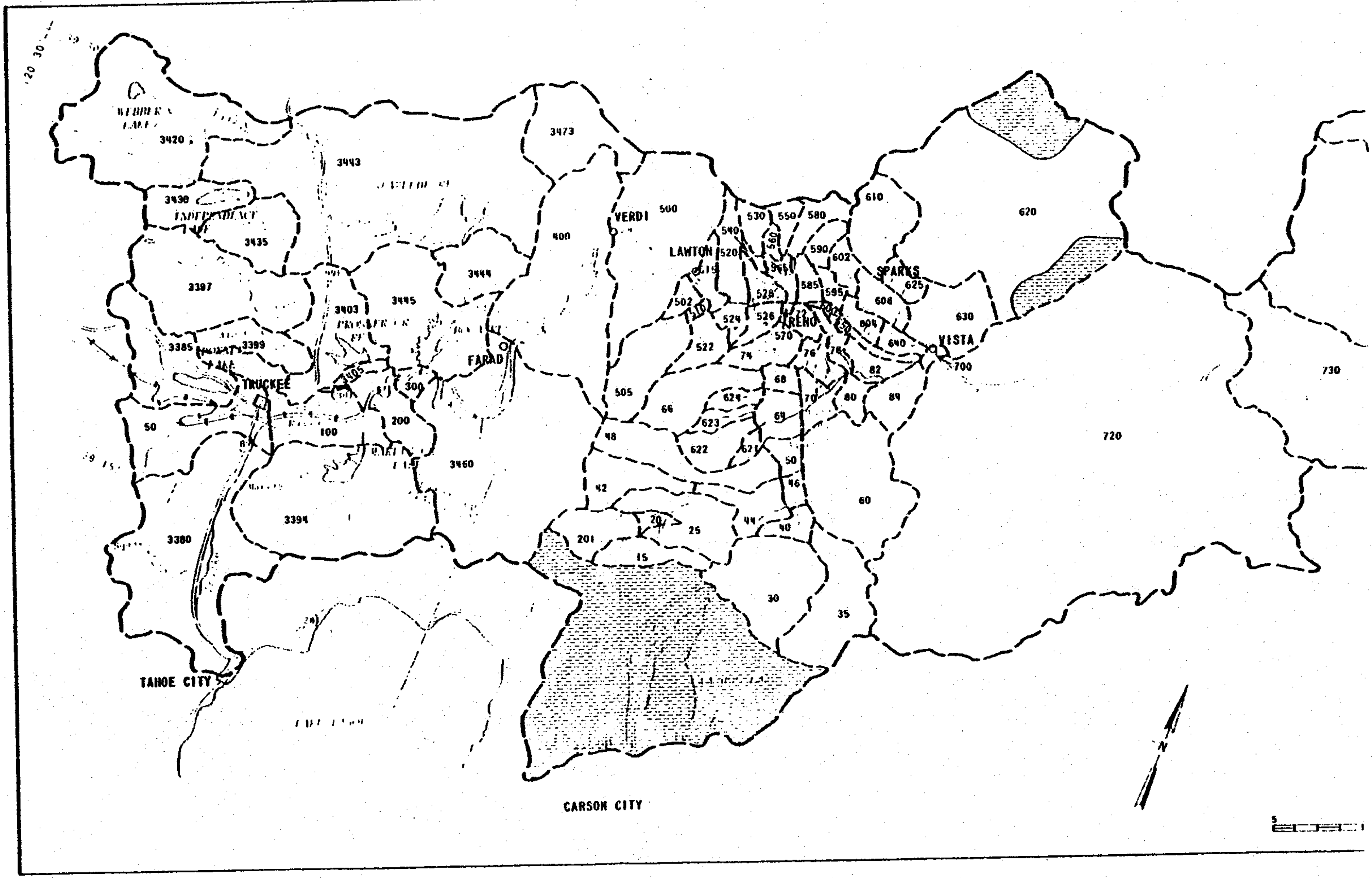
TRUCKEE RIVER, CALIFORNIA; NEVADA

STREAM GAGE
LOCATION MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P.
Date: NOVEMBER 1979

CHART 6



3420
3430
3443
3435
3473
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3445
3403
3397
3385
3399
3380
3394
3460
TRUCKEE
FARAD
VERDI
LAWTON
RENO
SPARKS
VISTA
400
500
505
502
520
522
524
526
528
530
540
550
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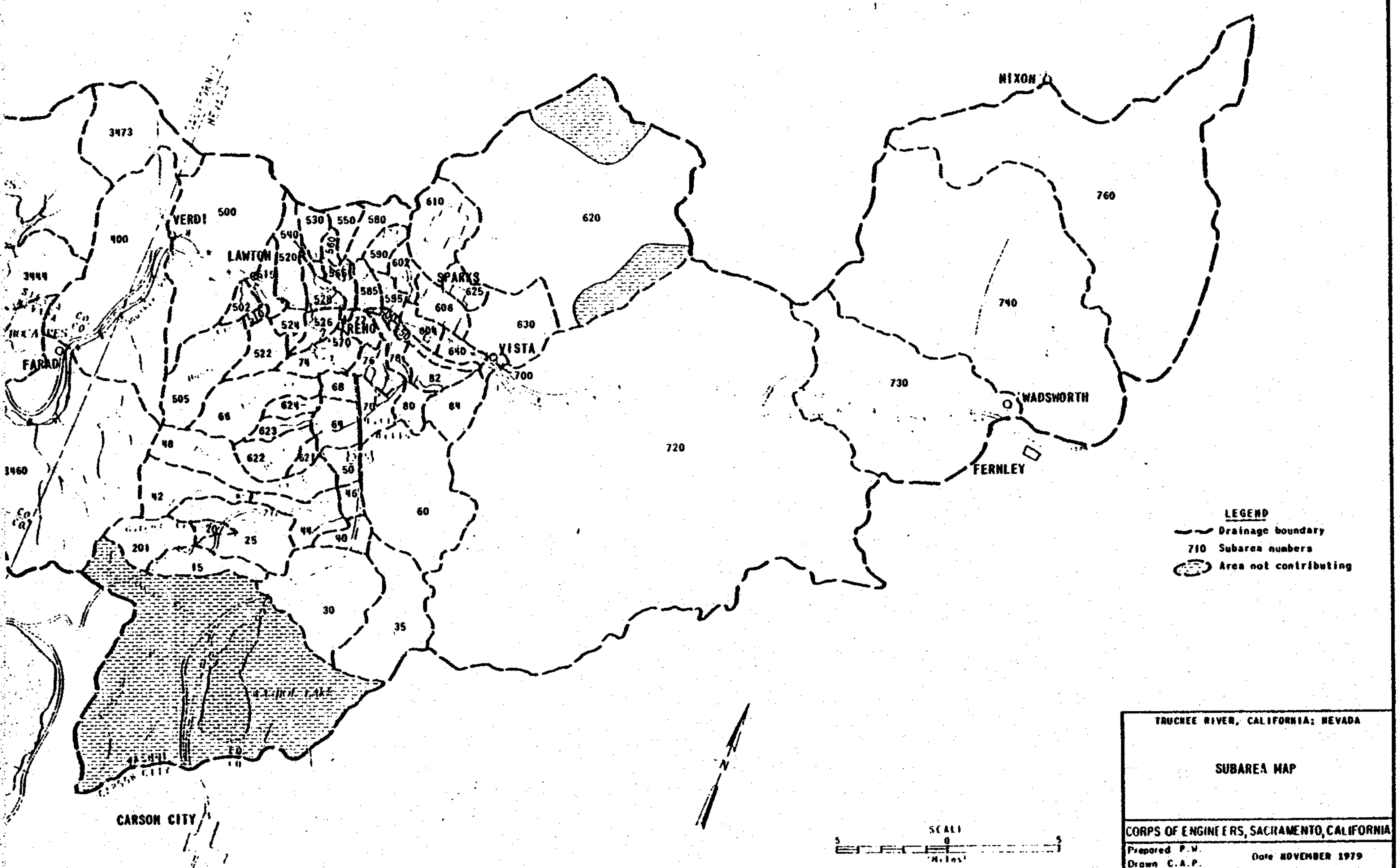
78
80
82
84
TAHOE CITY
CARSON CITY
N



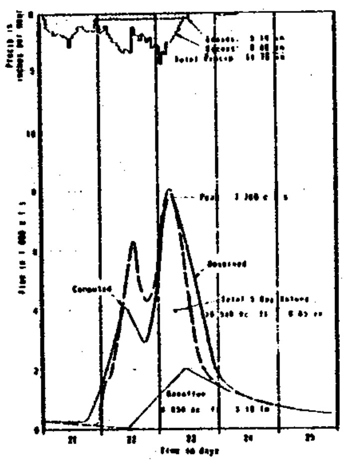
TRUCKEE RIVER, CALIFORNIA; NEVADA

SUBAREA MAP

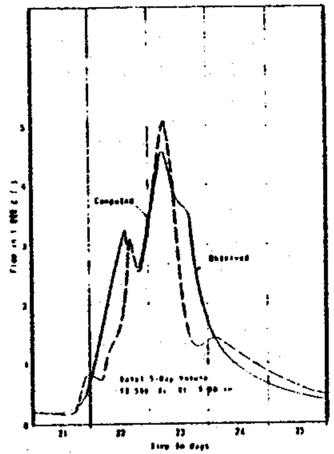
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P.
Date NOVEMBER 1979

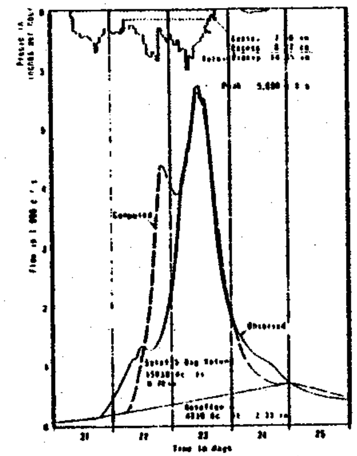
CHART 7



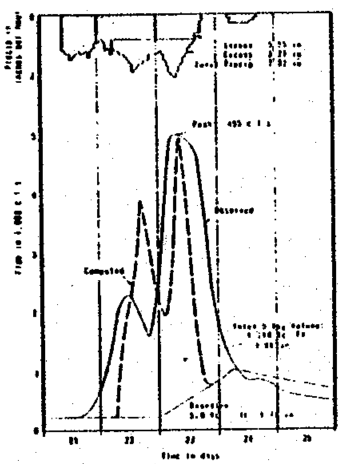
TRUCKEE RIVER NEAR TRUCKEE, CALIFORNIA
U S G S 3200
Contributing drainage area: 20 1 sq mi



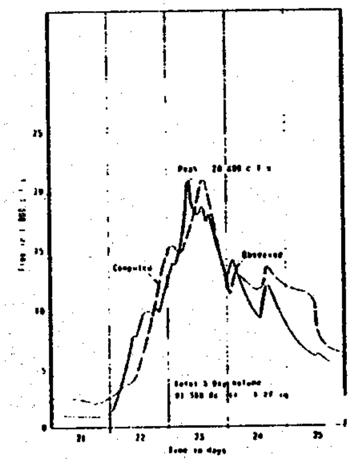
PROSSER CREEK NEAR BOCA, CALIFORNIA
U S G S 3405
Contributing drainage area: 50 2 sq mi



LITTLE TRUCKEE RIVER NEAR HOBART MILLS, CALIFORNIA
U S G S 3420
Contributing drainage area 32 4 sq mi



SAGEHEN CREEK NEAR TRUCKEE CALIFORNIA
U S G S 3435
Contributing drainage area 5 7 sq mi



TRUCKEE RIVER AT RENO NEVADA
Index Point 600
Contributing drainage area 455 0 sq mi

NOTE All precipitation shown is based on a rain on snow analysis

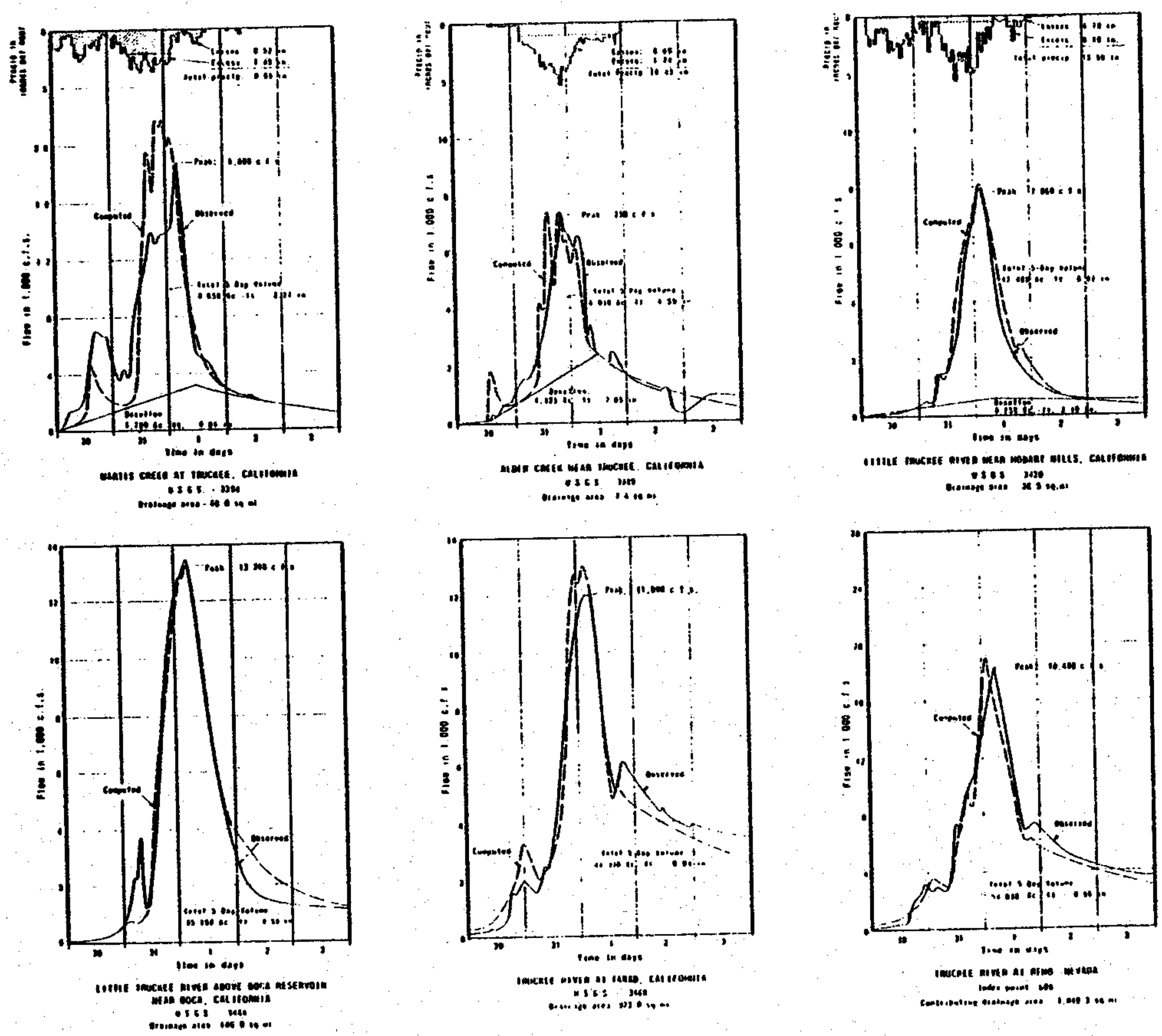
TRUCKEE RIVER, CALIFORNIA, NEVADA

DECEMBER 1955 FLOOD HYDROGRAPHS

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: PW, CAP
Drawn: C.A.P.
Date: NOVEMBER 1979

CHART 8



TRUCKEE RIVER, CALIFORNIA;NEVADA

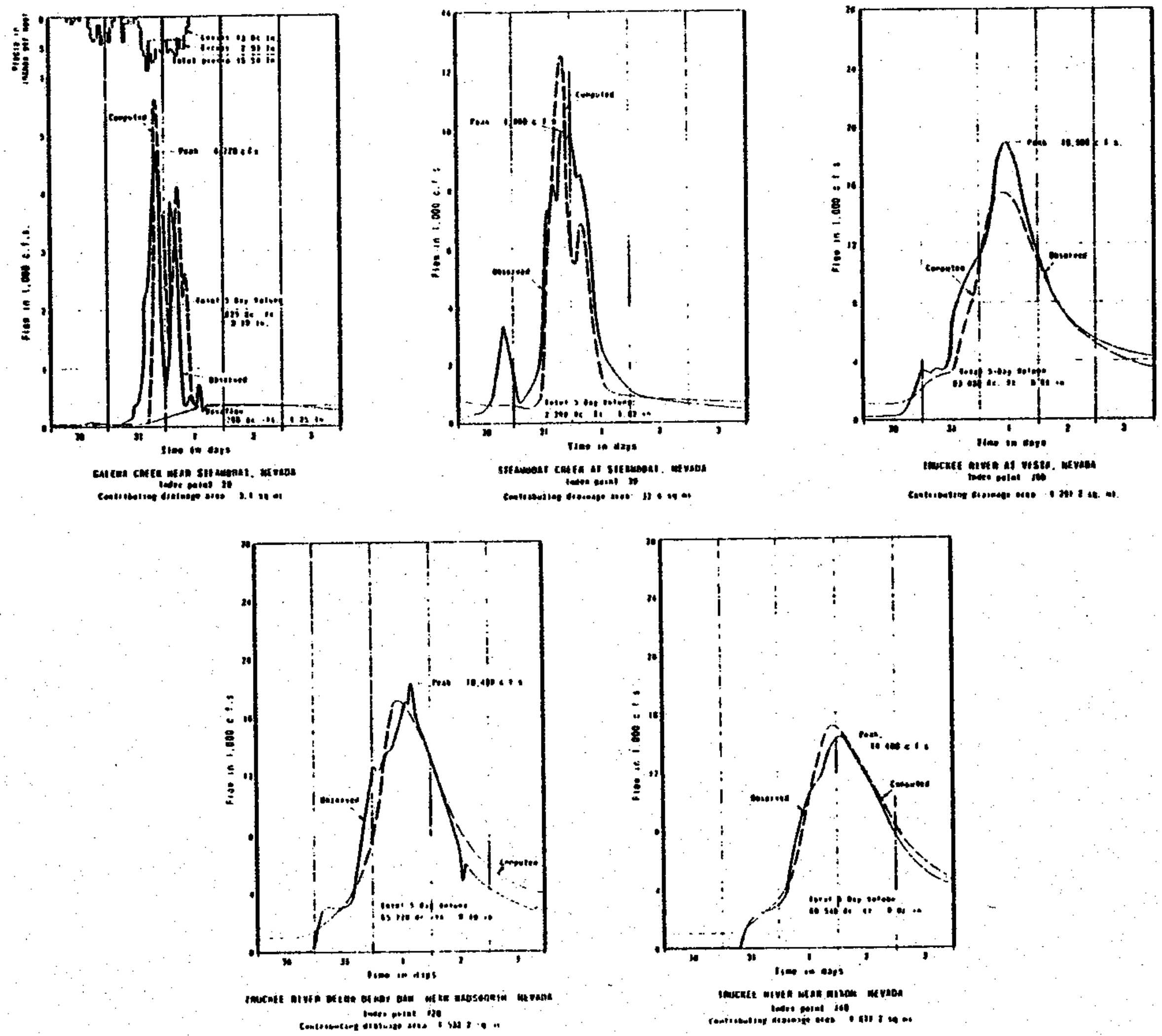
JANUARY-FEBRUARY 1963
FLOOD HYDROGRAPHS

CORPS OF ENGINEERS SACRAMENTO,CALIFORNIA

Prepared P.W.,C.A.P.
Drawn: C.A.P.

Date: NOVEMBER 1979

SHEET 1 OF 2 CHART 9



TRUCKEE RIVER, CALIFORNIA, NEVADA

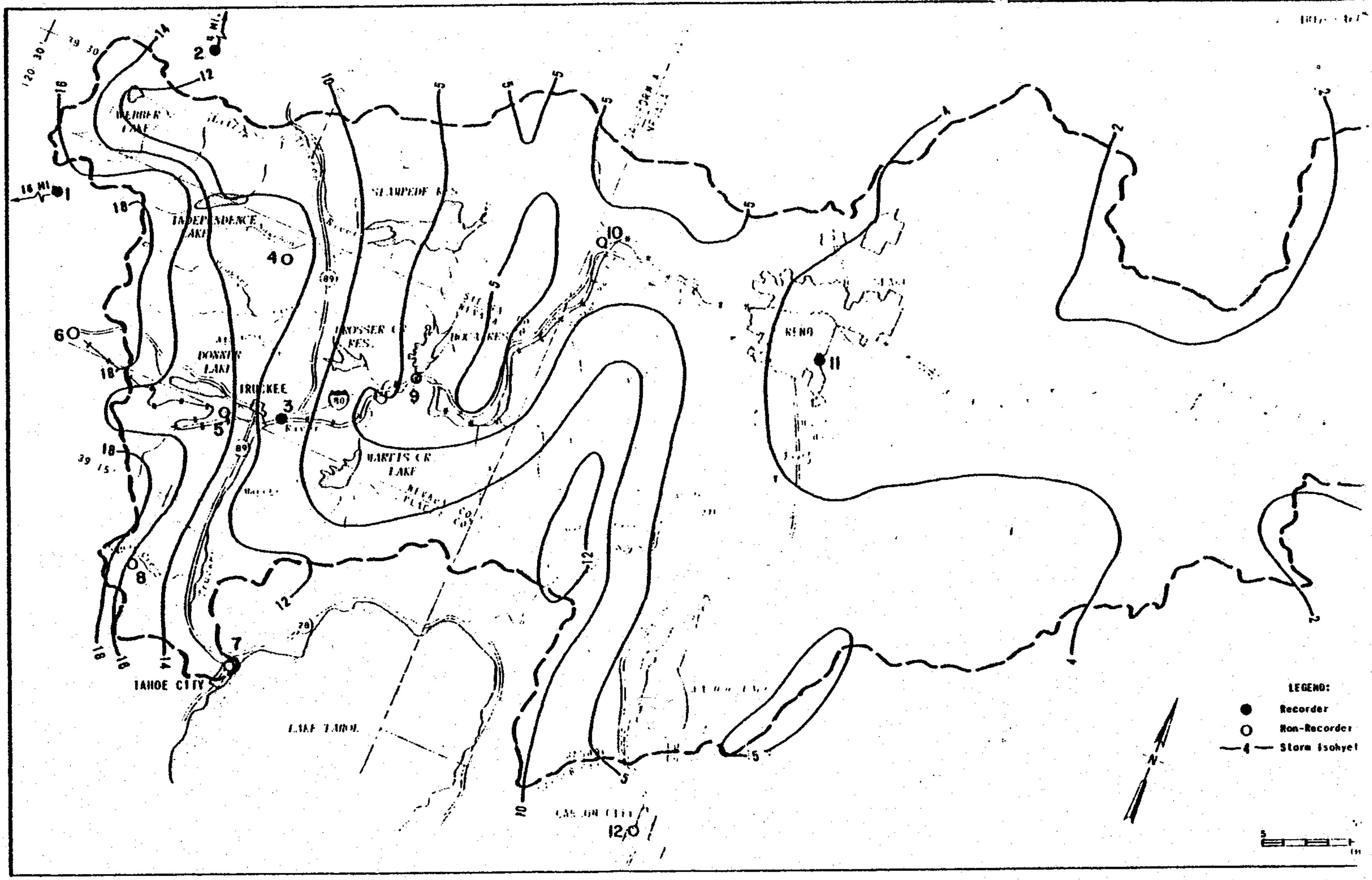
JANUARY-FEBRUARY 1963 FLOOD HYDROGRAPHS

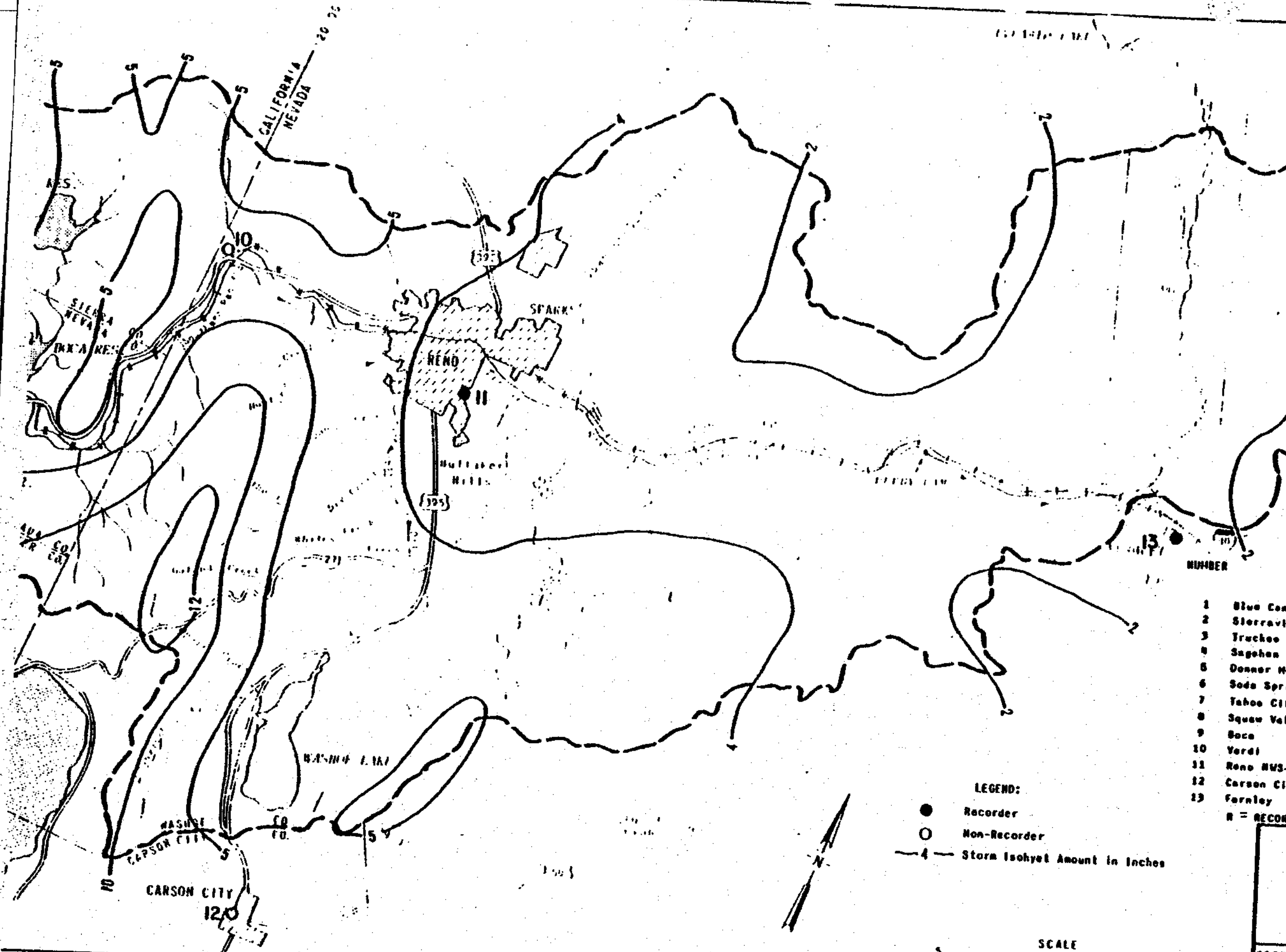
CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: P.W., C.A.P.
Drawn: C.A.P.

Date: NOVEMBER 1979

SHEET 2 OF 2 CHART 9


LEGEND:
Recorder
Non-Recorder
Storm Isohyet
TAHOE CITY
LAKE TAHOE
TRUCKEE
RENO
DONNER LAKE
INDEPENDENCE LAKE
WEBBER LAKE
STAMPEDE RES.
PROSSER CR. RES.
BOCA LAKE
MARTIS CR. LAKE
CARSON CITY
N



PRECIPITATION STATIONS

NUMBER	STATION		RAINFALL AMOUNT (Inches)	YEARS OF RECORD
1	Blue Canyon AP	R	19.20	39
2	Sierraville R.S.	R	10.06	96
3	Truckee R.S.	R	11.76	96
4	Sagehen	N	12.70	26
5	Donner Memorial St. Park	N	15.80	25
6	Soda Springs	N	18.50	19
7	Tahoe City	N	12.08	69
8	Squaw Valley Lodge	N	14.30	19
9	Boca	N	6.80	89
10	Verdi	N	4.25	5
11	Reno NWS-AP	R	3.77	109
12	Carson City	N	7.80	82
13	Fernley	R	1.79	20

R = RECORDER; N = NON-RECORDER

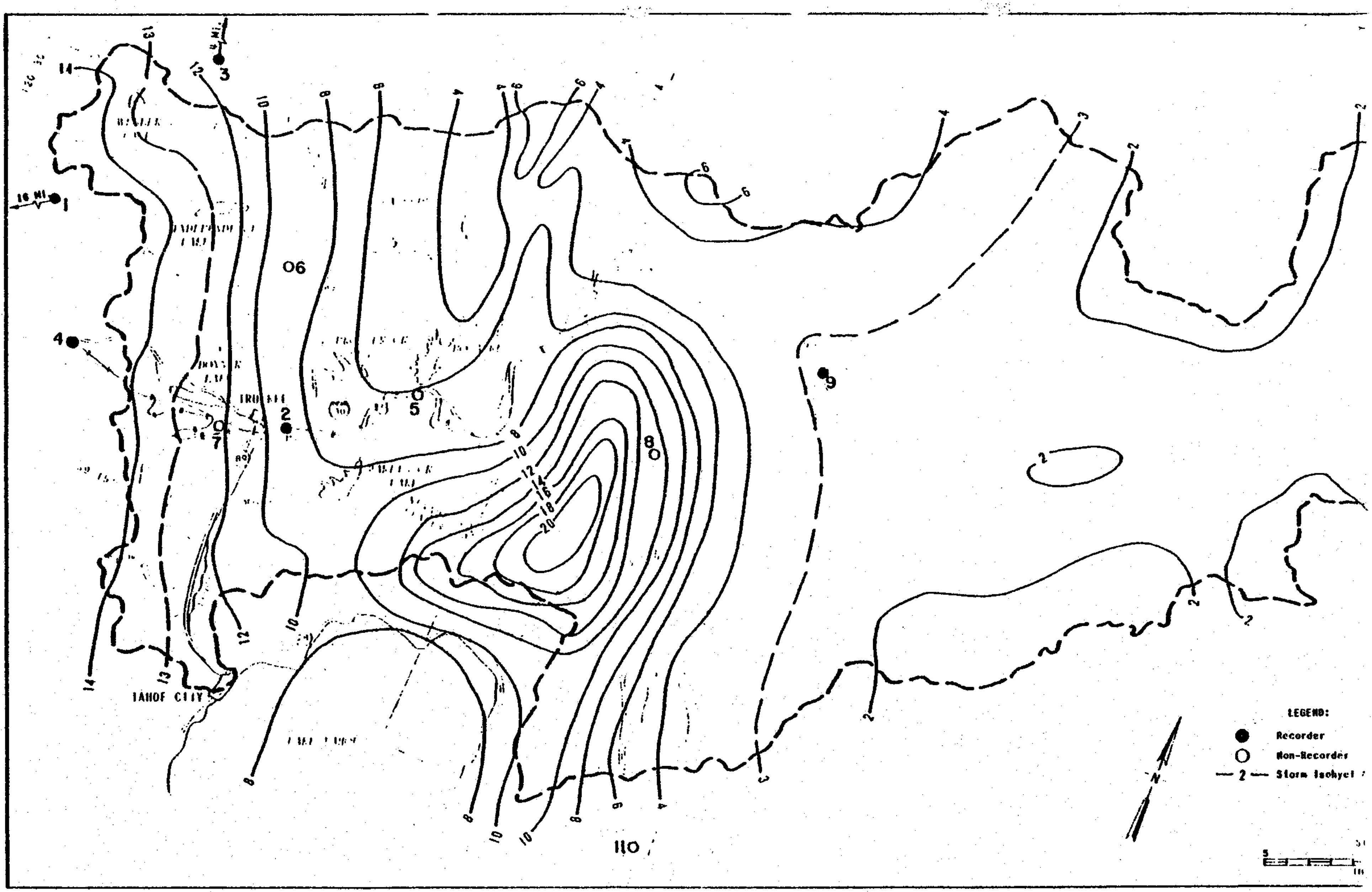
TRUCKEE RIVER, CALIFORNIA; NEVADA

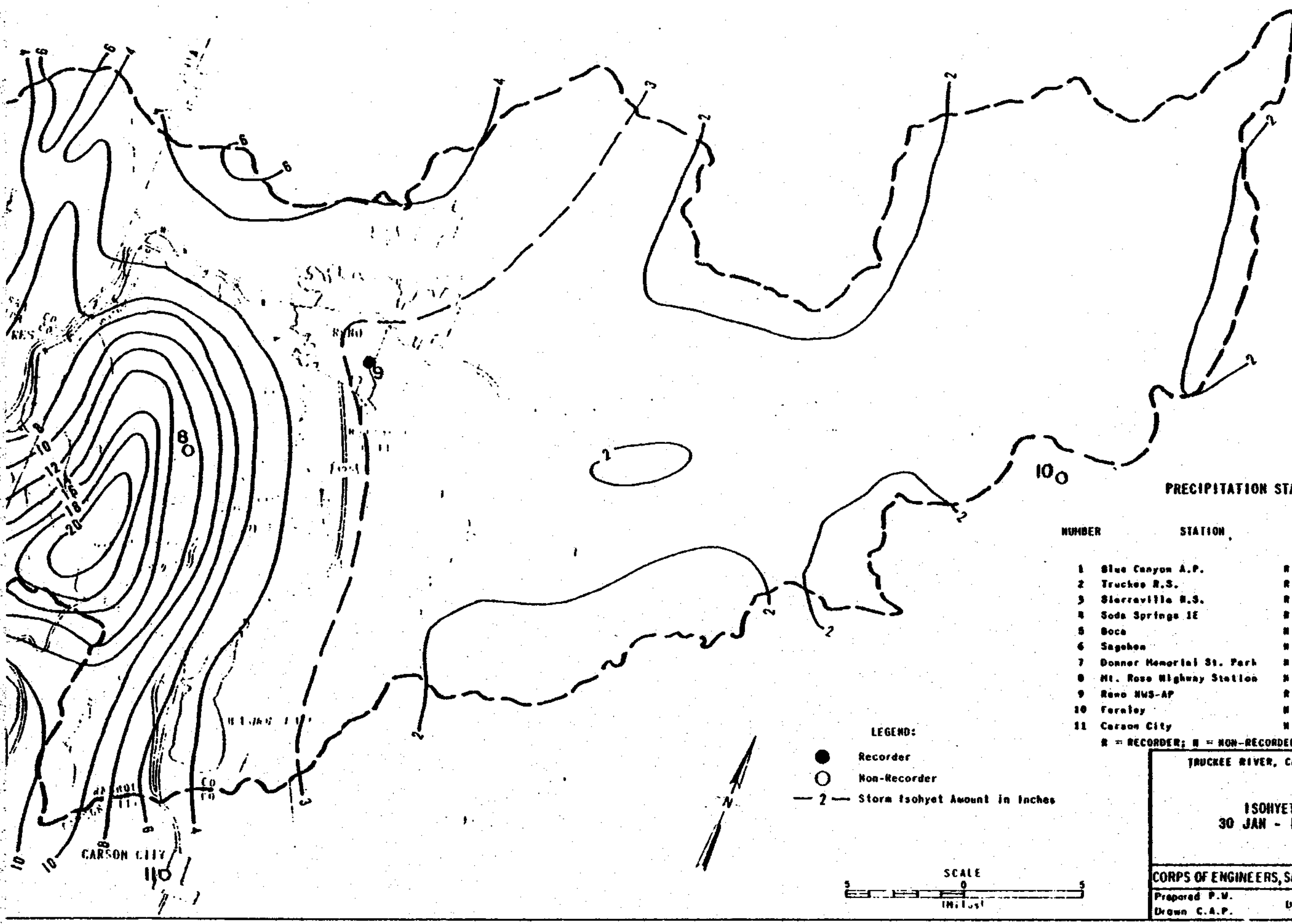
ISOHYETAL MAP
21-25 DECEMBER 1955

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P. Date NOVEMBER 1979

CHART 10


LEGEND:
Recorder
Non-Recorder
2 — Storm Isohyet
TAHOE CITY
16 MI.
4 MI.
N



PRECIPITATION STATIONS

NUMBER	STATION		RAINFALL AMOUNT (Inches)	YEARS OF RECORD
1	Blue Canyon A.P.	R	16.01	39
2	Truckee R.S.	R	8.84	96
3	Sierraville R.S.	R	8.73	96
4	Soda Springs 1E	R	14.80	19
5	Boca	N	6.22	89
6	Sagehen	N	9.25	25
7	Donner Memorial St. Park	N	12.05	25
8	Mt. Rose Highway Station	N	13.88	4
9	Reno NWS-AP	R	2.59	109
10	Fernley	N	1.01	20
11	Carson City	N	7.14	82

R = RECORDER; N = NON-RECORDER

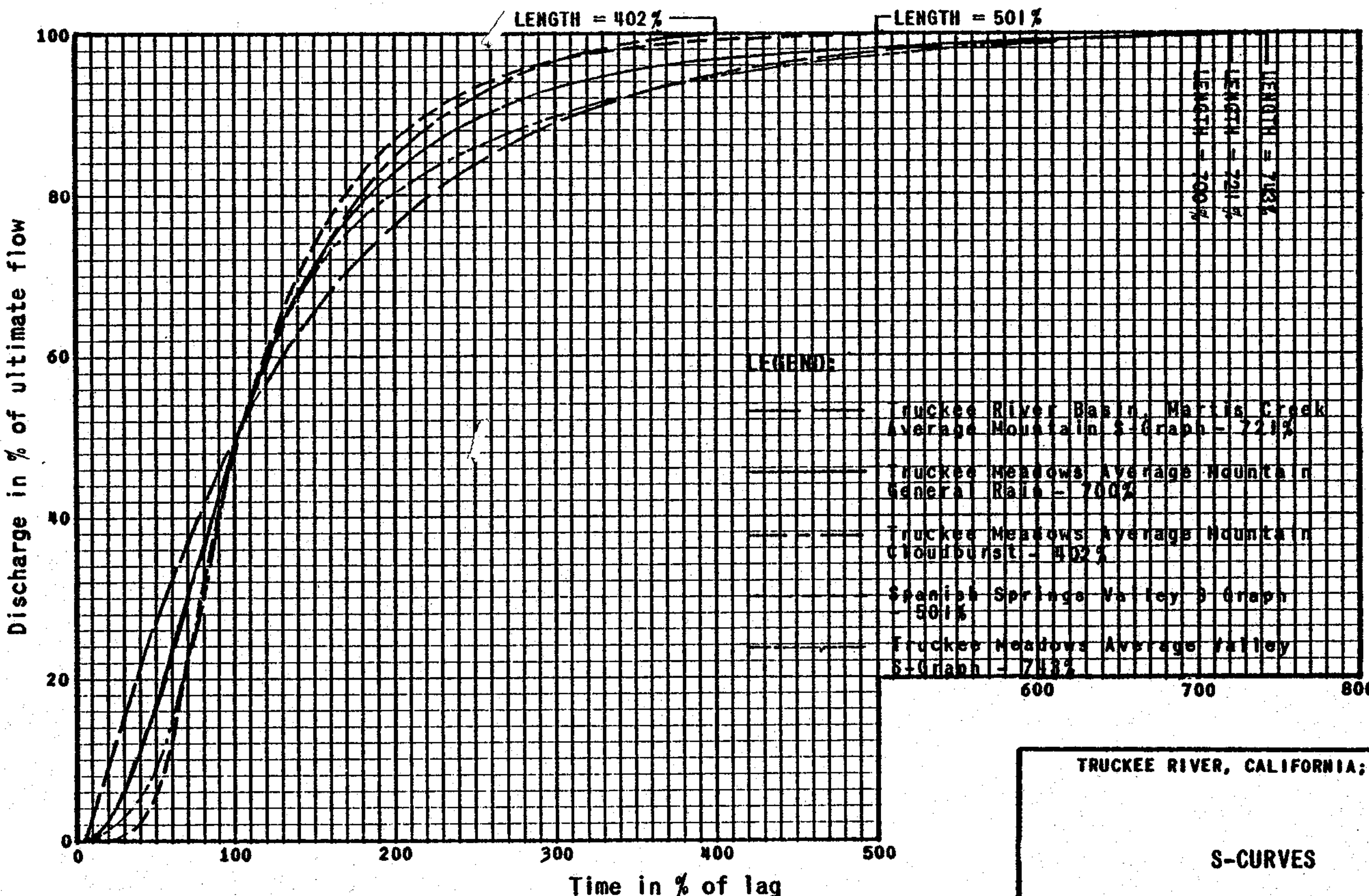
TRUCKEE RIVER, CALIFORNIA; NEVADA

ISOHYETAL MAP
30 JAN - 1 FEB 1963

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared P.W.
Drawn C.A.P.
Date NOVEMBER 1979

CHART 11



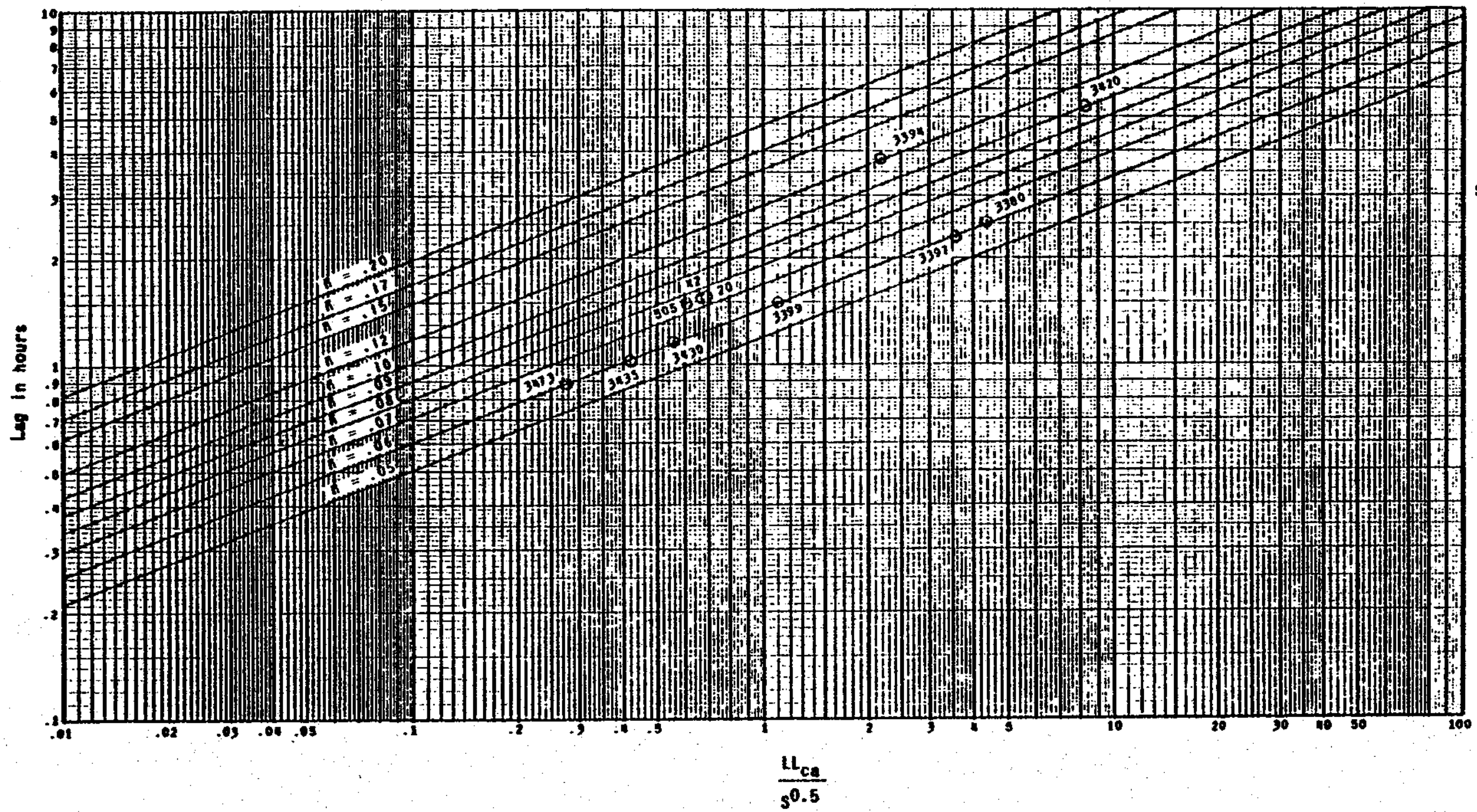
TRUCKEE RIVER, CALIFORNIA; NEVADA

S-CURVES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.
Date: NOVEMBER 1979

CHART 12



USGS GAGING

SUBAREAS	
20	Galena Creek near
42	Whites Creek near
505	Hunter Creek near
3380	Truckee River near
3394	Martis Creek near
3397	Prosser Creek near
3399	Alder Creek near
3420	Little Truckee Ri
3430	Independence Creek
3435	Sagehen Creek near
3473	Dog Creek near Ve

TERMINOLOGY

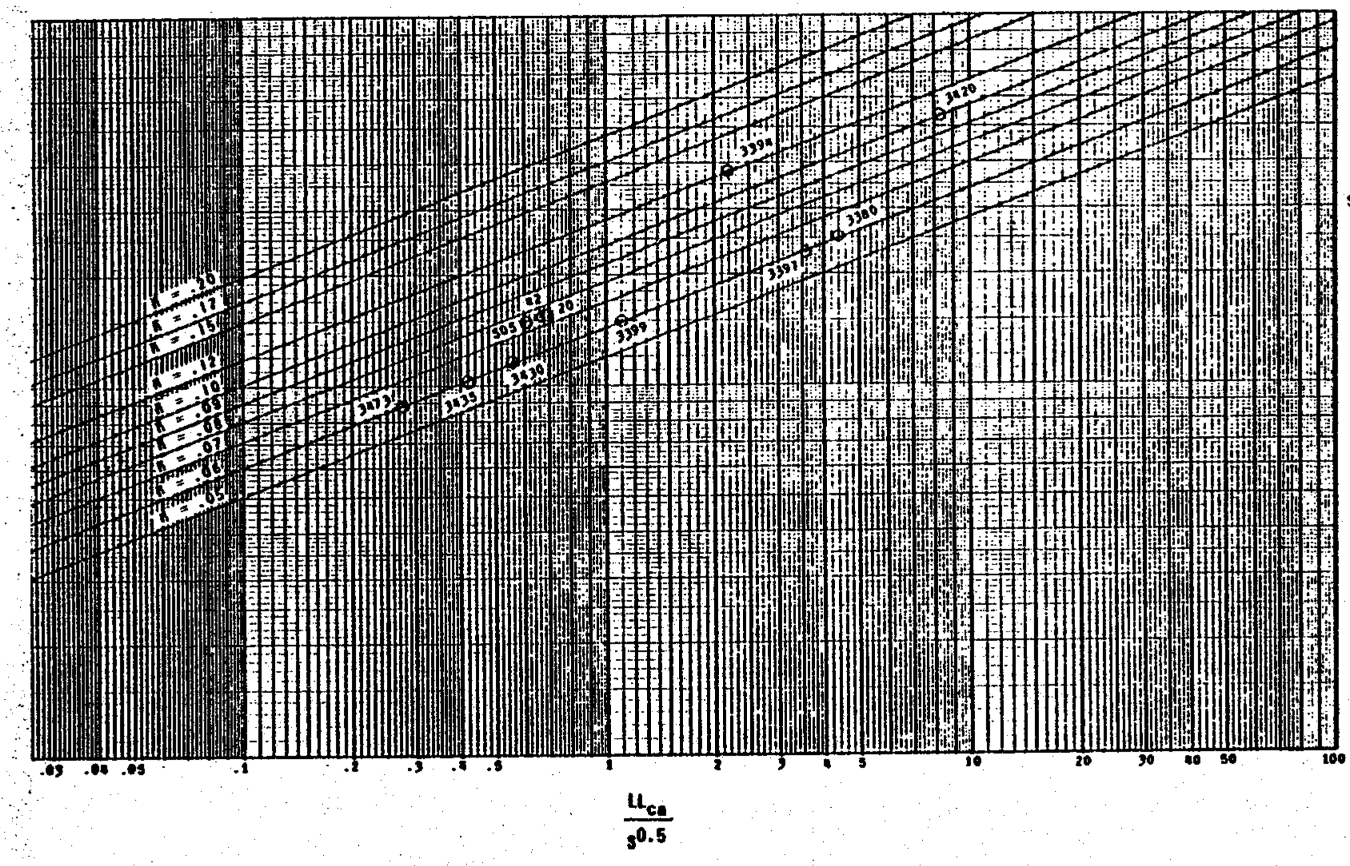
L - Length of longest watercourse.

L_{ca} - Length along longest watercourse, measured upstream to point opposite center of area.

S - Overall slope of longest watercourse between headwater and collection point.

Lag - Elapsed time from beginning of unit precipitation to instant that summation hydrograph reaches 50% of ultimate discharge.

$\bar{n}$ - Basin factor representing basin shape, drainage pattern, and roughness of the stream beds.



USGS GAGING STATIONS

SUBAREAS	LOCATION
20	Galena Creek near Steamboat, Nev. - USGS-3489
42	Whites Creek near Steamboat, Nev. - USGS-3497
505	Hunter Creek near Reno, Nev. - USGS-3476
3380	Truckee River near Truckee, Cal.
3394	Martis Creek near Truckee, Cal.
3397	Prosser Creek near Hobart Mills, Cal.
3399	Alder Creek near Truckee, Cal.
3420	Little Truckee River near Hobart Mills, Cal.
3430	Independence Creek near Truckee, Cal.
3435	Sagehen Creek near Truckee, Cal.
3473	Dog Creek near Verdi, Nev.

TERMINOLOGY

- L - Length of longest watercourse.
- L_{ca} - Length along longest watercourse, measured upstream to point opposite center of area.
- S - Overall slope of longest watercourse between headwater and collection point.
- Lag - Elapsed time from beginning of unit precipitation to instant that summation hydrograph reaches 50% of ultimate discharge.
- $\bar{n}$ - Basin factor representing basin shape, drainage pattern, and roughness of the stream beds.

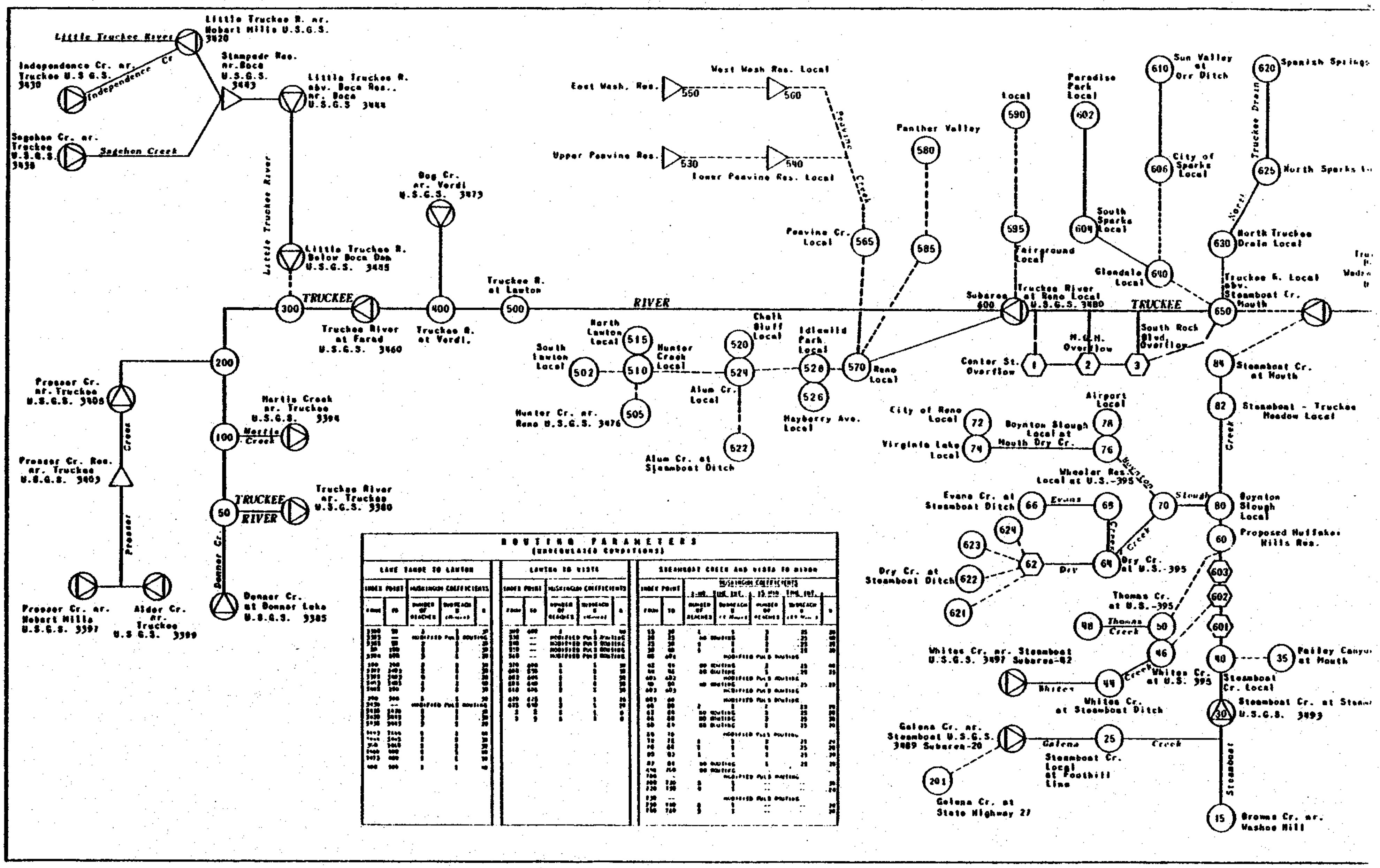
TRUCKEE RIVER, CALIFORNIA; NEVADA

LAG RELATIONSHIPS

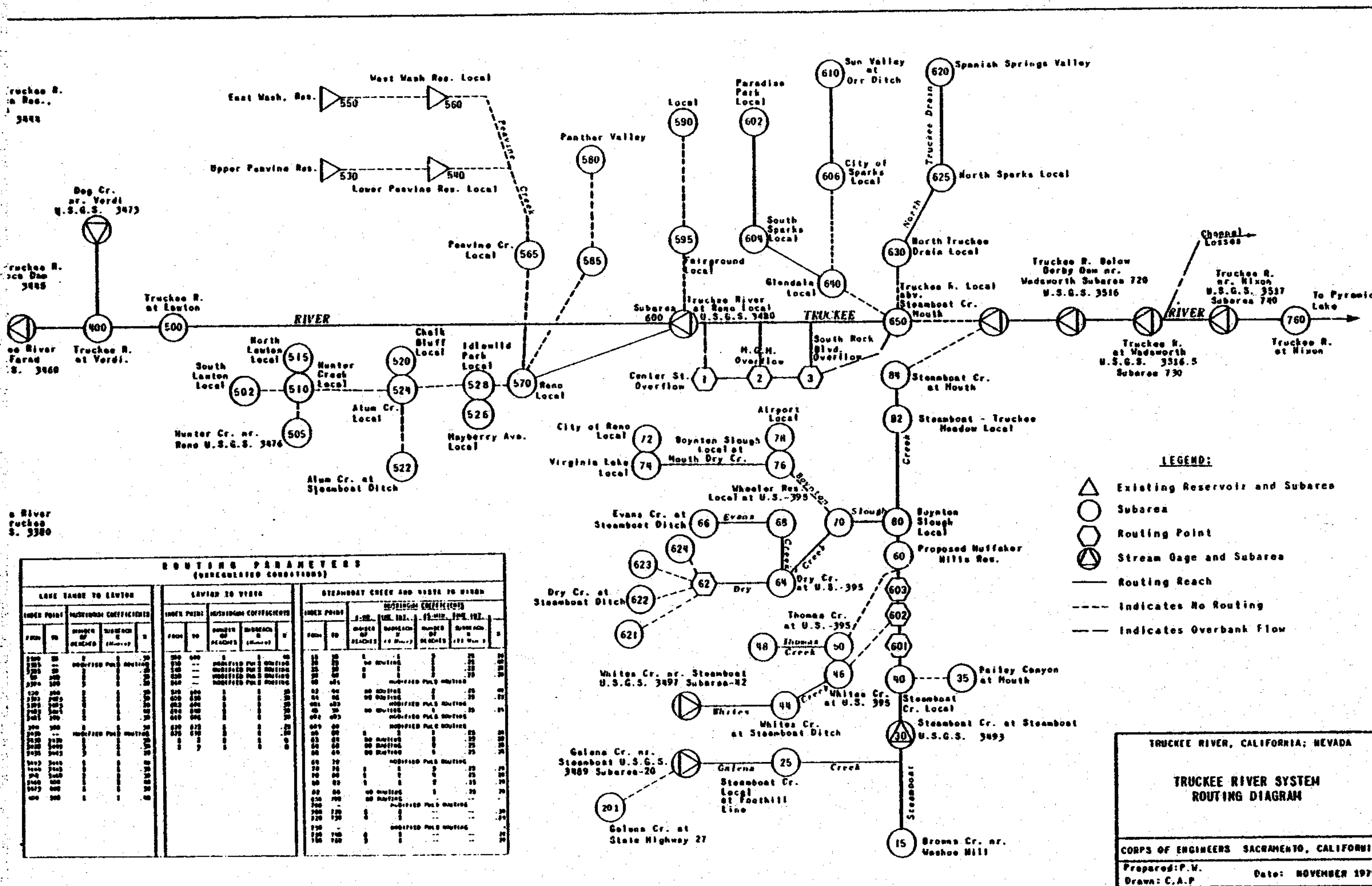
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W. Drawn: C.A.P. Date: NOVEMBER 1979

CHART 13



Little Truckee River
Little Truckee R. nr. Hobart Mills U.S.G.S. 3420
Independence Cr. nr. Truckee U.S.G.S. 3430
Independence Cr
Stampede Res. nr. Boca U.S.G.S. 3443
Little Truckee R. abv. Boca Res., nr. Boca U.S.G.S 3444
Sagehen Cr. nr. Truckee U.S.G.S. 3438
Sagehen Creek
Little Truckee River
Little Truckee R. Below Boca Dam U.S.G.S. 3445
Dog Cr. nr. Verdi U.S.G.S. 3479
Truckee R. at Lawton
TRUCKEE
RIVER
Truckee River at Farad U.S.G.S. 3460
Truckee R. at Verdi.
Prosser Cr. nr. Truckee U.S.G.S. 3408
Prosser Cr. Res. nr. Truckee U.S.G.S. 3409
Prosser
Creek
Prosser Cr. nr. Hobart Mills U.S.G.S. 3397
Alder Cr. nr. Truckee U.S.G.S. 3399
Martis Creek nr. Truckee U.S.G.S. 3394
Martis Creek
Truckee River nr. Truckee U.S.G.S. 3380
Donner Cr.
Donner Cr. at Donner Lake U.S.G.S. 3385
East Wash. Res.
West Wash Res. Local
Upper Peavine Res.
Lower Peavine Res. Local
Peavine Creek
Panther Valley
Peavine Cr. Local
North Lawton Local
South Lawton Local
Hunter Creek Local
Hunter Cr. nr. Reno U.S.G.S. 3476
Chalk Bluff Local
Alum Cr. Local
Alum Cr. at Steamboat Ditch
Idlewild Park Local
Mayberry Ave. Local
Reno Local
Local
Fairground Local
Paradise Park Local
South Sparks Local
Glendale Local
Sun Valley at Orr Ditch
City of Sparks Local
Spanish Springs
Truckee Drain
North Sparks
North Truckee Drain Local
Subareo 600
Truckee River at Reno Local U.S.G.S. 3480
Truckee & Local abv. Steamboat Cr. Mouth
Center St. Overflow
M.G.N. Overflow
South Rock Blvd. Overflow
Steamboat Cr. at Mouth
Steamboat - Truckee Meadow Local
City of Reno Local
Virginia Lake Local
Airport Local
Boynton Slough Local at Mouth Dry Cr.
Boynton Slough
Wheeler Res. Local at U.S.-395
Evans Cr. at Steamboat Ditch
Evans
Creek
Dry
Dry Cr. at Steamboat Ditch
Dry Cr. at U.S.-395
Boynton Slough Local
Proposed Huffaker Hills Res.
Thomas Cr. at U.S.-395
Thomas Creek
Whites Cr. nr. Steamboat U.S.G.S. 3497 Subarea-42
Whites
Whites Cr. at U.S. 395
Whites Cr. at Steamboat Ditch
Steamboat Cr. Local
Bailey Canyon at Mouth
Steamboat Cr. at Steamboat U.S.G.S. 3493
Galena Cr. nr. Steamboat U.S.G.S. 3489 Subarea-20
Galena
Steamboat Cr. Local at Foothill Line
Galena Cr. at State Highway 27
Steamboat
Browns Cr. nr. Washoe Hill
ROUTING PARAMETERS
(UNREGULATED CONDITIONS)
LAKE TAHOE TO LAWTON
LAWTON TO VISTA
STEAMBOAT CREEK AND VISTA TO DIXON
INDEX POINT
MUSKINGUM COEFFICIENTS
FROM
TO
NUMBER OF REACHES
MODIFIED PULS ROUTING



ROUTING PARAMETERS
(UNREGULATED CONDITIONS)

LAKE TAHOE TO LAWTON

Index Point From	Index Point To	Muskingum Coefficients: Number of Reaches	Subreach K (Hours)	X
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LAWTON TO VISTA

Index Point From	Index Point To	Muskingum Coefficients: Number of Reaches	Subreach K (Hours)	X
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

STEAMBOAT CREEK AND VISTA TO NIXON

Index Point From	Index Point To	1-Hr. Time Int.: Number of Reaches	1-Hr. Time Int.: Subreach K (1 Hour)	15-Min. Time Int.: Number of Reaches	15-Min. Time Int.: Subreach K	X
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

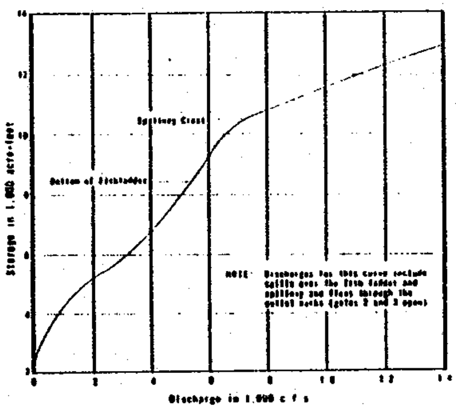
TRUCKEE RIVER, CALIFORNIA; NEVADA

TRUCKEE RIVER SYSTEM
ROUTING DIAGRAM

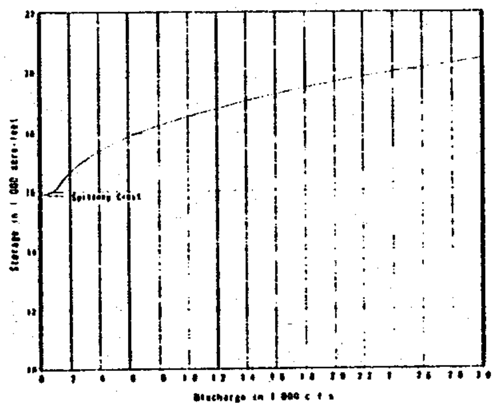
CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.
Date: NOVEMBER 1979

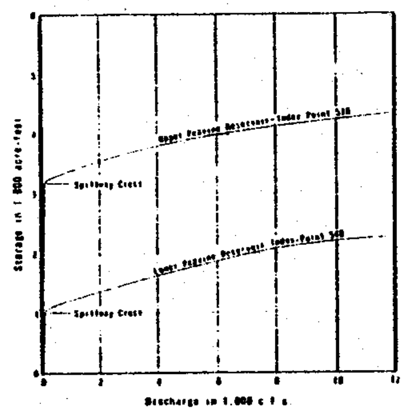
CHART 14



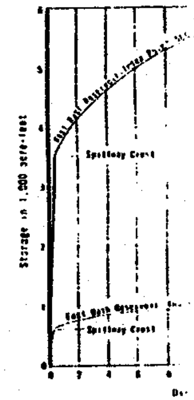
DONNER LAKE
Index Point 338½
Donner Creek

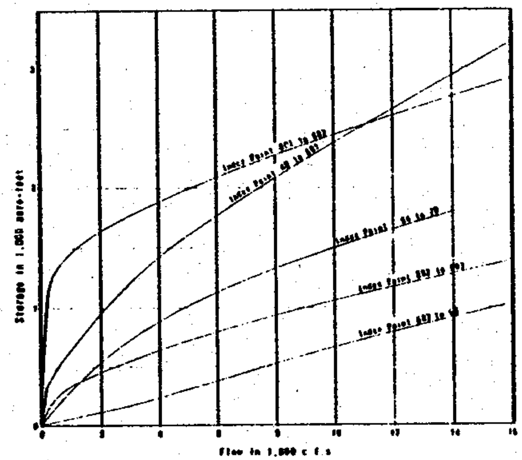


INDEPENDENCE LAKE
Index Point 343D
Independence Creek

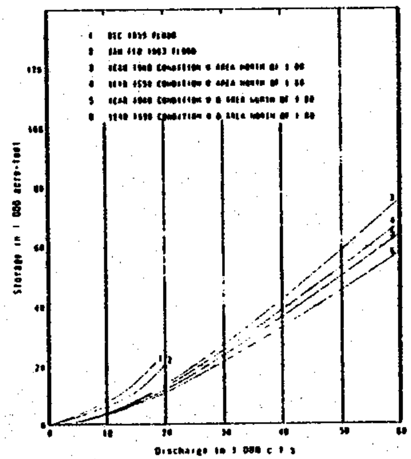


UPPER & LOWER PEAVINE RESERVOIRS
Peavine Creek

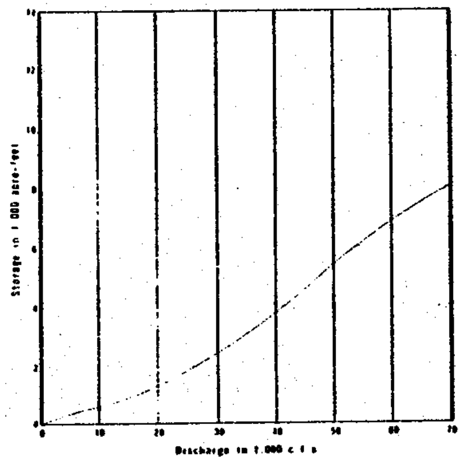




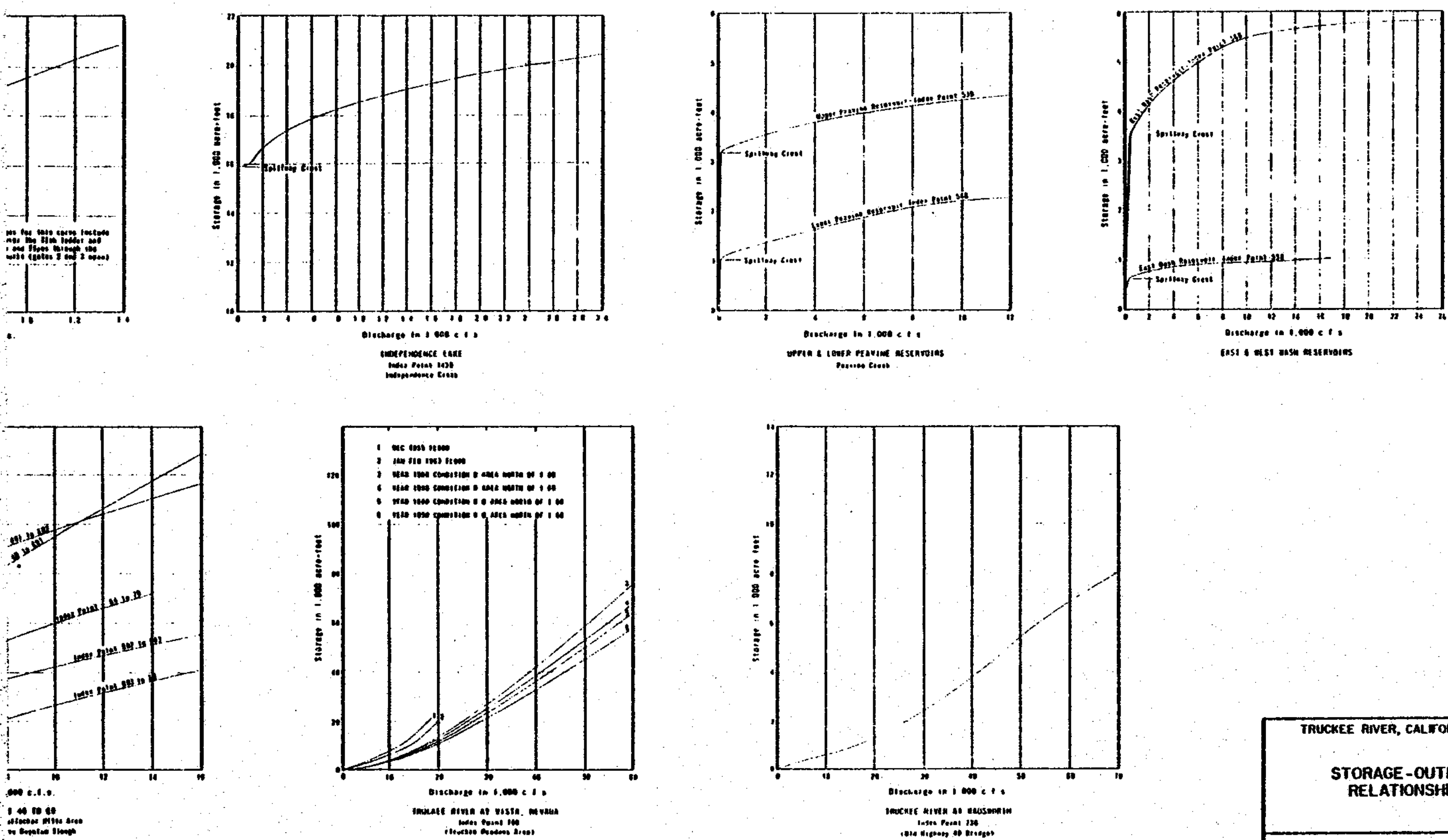
INDEX POINT 40 TO 60
Steamboat Creek - Huffaker Hills Area
and Dry Creek above Boynton Slough



TRUCKEE RIVER AT VISTA NEVADA
Index Point 700
(Truckee Meadows Area)



TRUCKEE RIVER AT WADSWORTH
Index Point 770
(Old Highway 40 Bridge)



TRUCKEE RIVER, CALIFORNIA;NEVADA

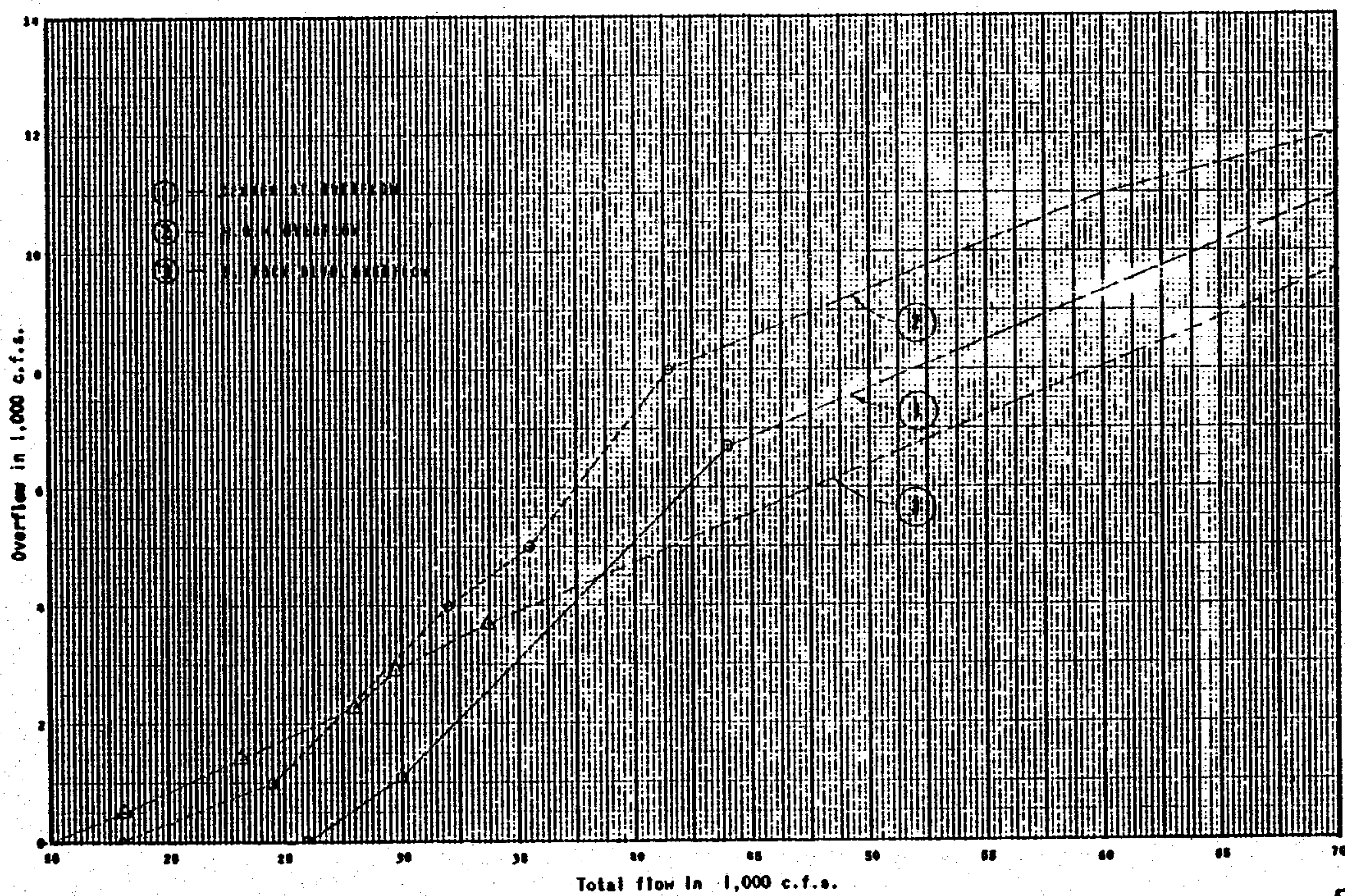
STORAGE-OUTFLOW RELATIONSHIPS

CORPS OF ENGINEERS SACRAMENTO,CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.

Date: NOVEMBER 1979

CHART 15



NOTE:
Plotted points based on computed water surface profiles. Upper portion of curves estimated.

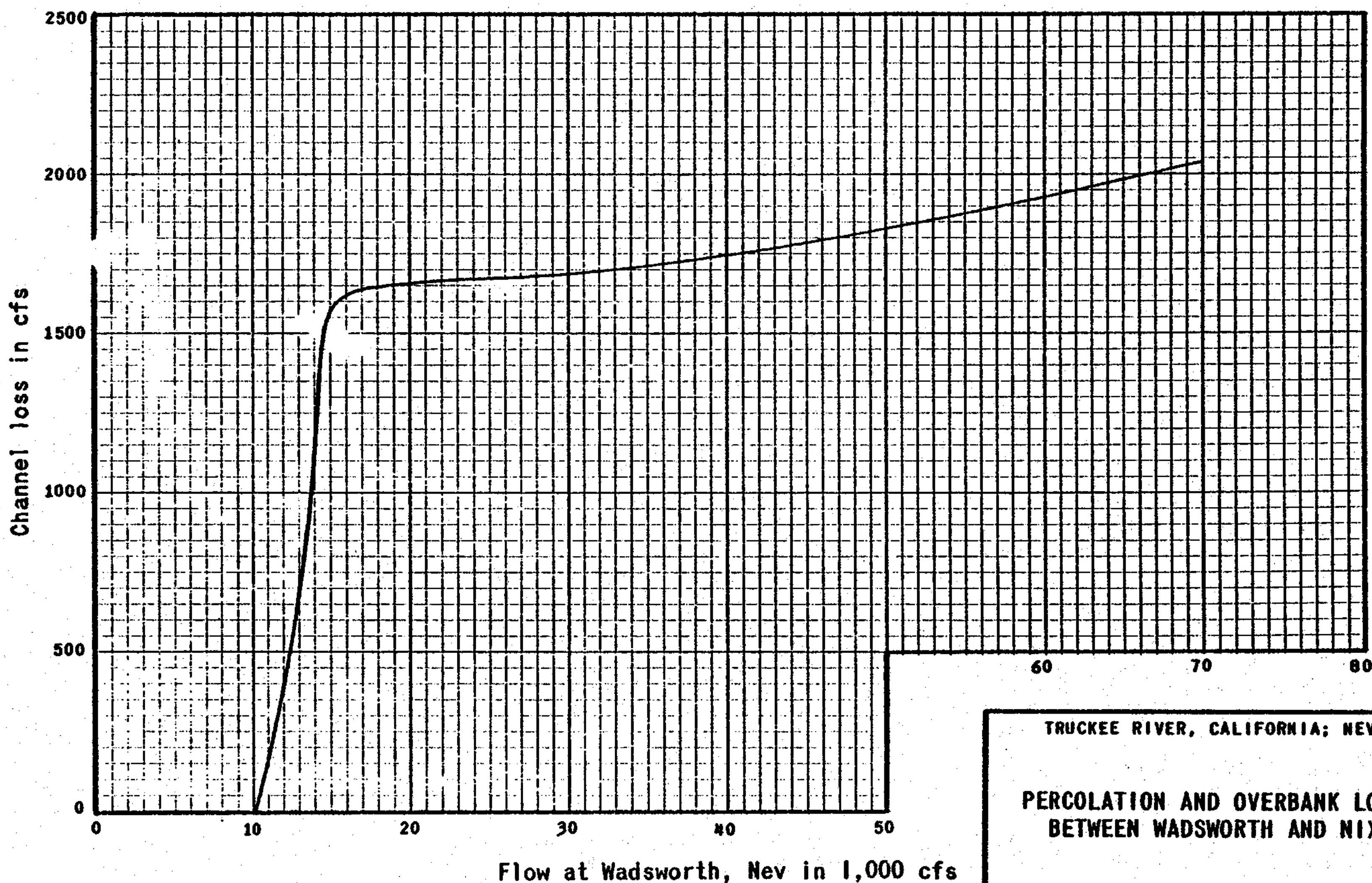
TRUCKEE RIVER, CALIFORNIA; NEVADA

TOTAL FLOW TO OVERFLOW RELATIONSHIPS

TRUCKEE RIVER AT RENO

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: P.W. Date: NOVEMBER 1979
Drawn: J.H.

CHART 1c



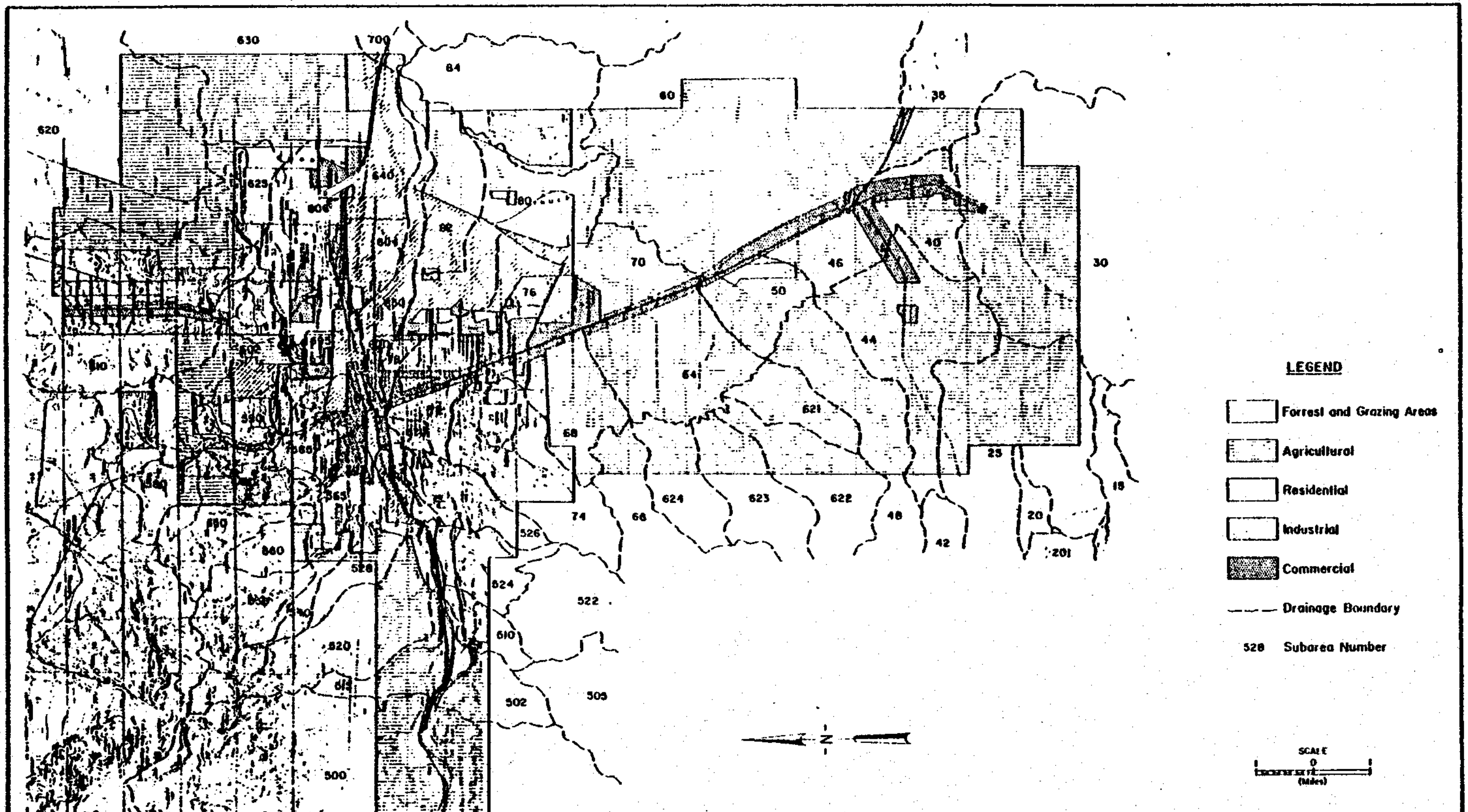
TRUCKEE RIVER, CALIFORNIA; NEVADA

PERCOLATION AND OVERBANK LOSSES BETWEEN WADSWORTH AND NIXON

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: J.H.

Date: NOVEMBER 1979



TRUCKEE RIVER, CALIFORNIA;NEVADA

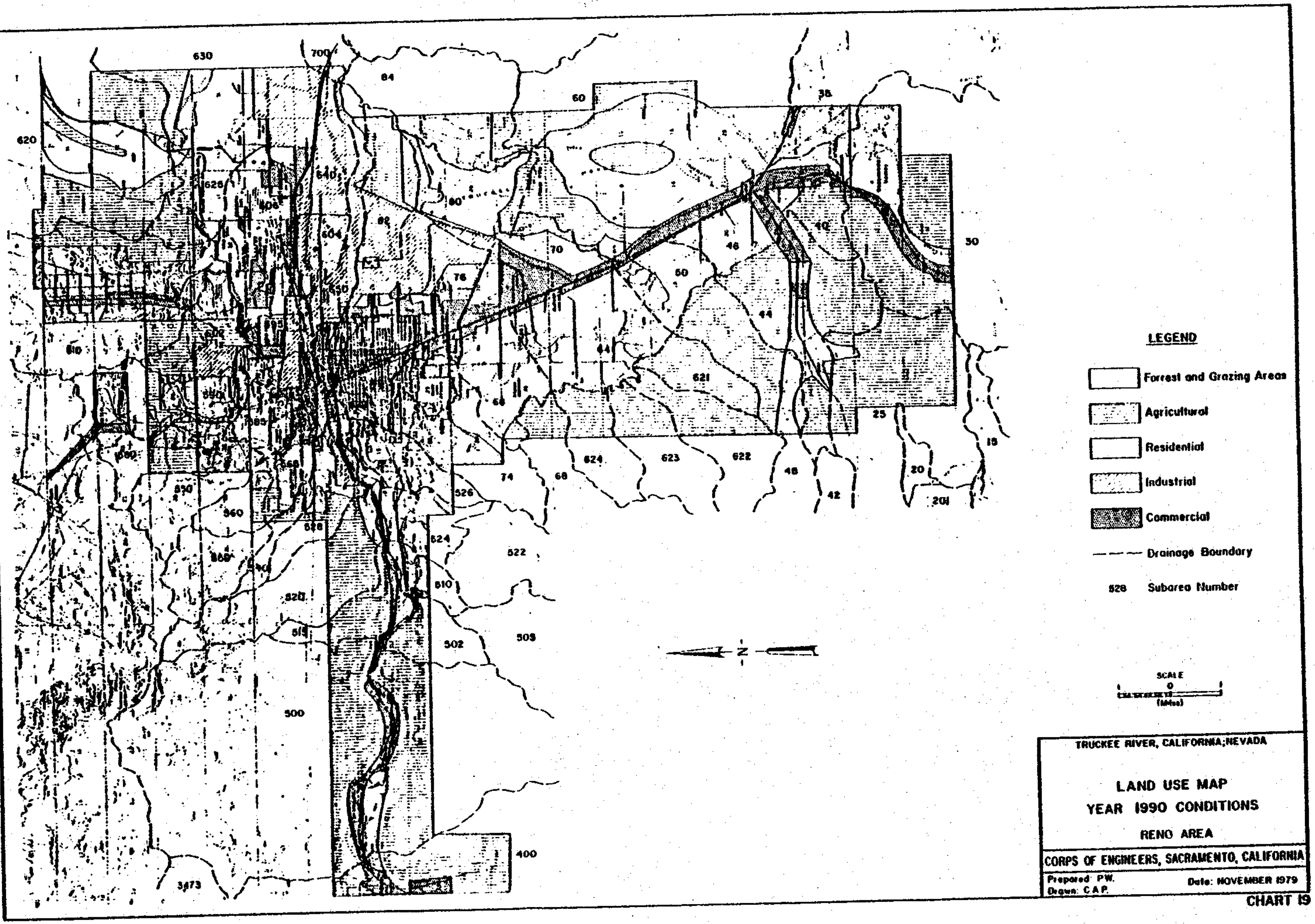
LAND USE MAP
YEAR 1980 CONDITIONS
RENO AREA

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P

Date NOVEMBER 1979

CHART 18



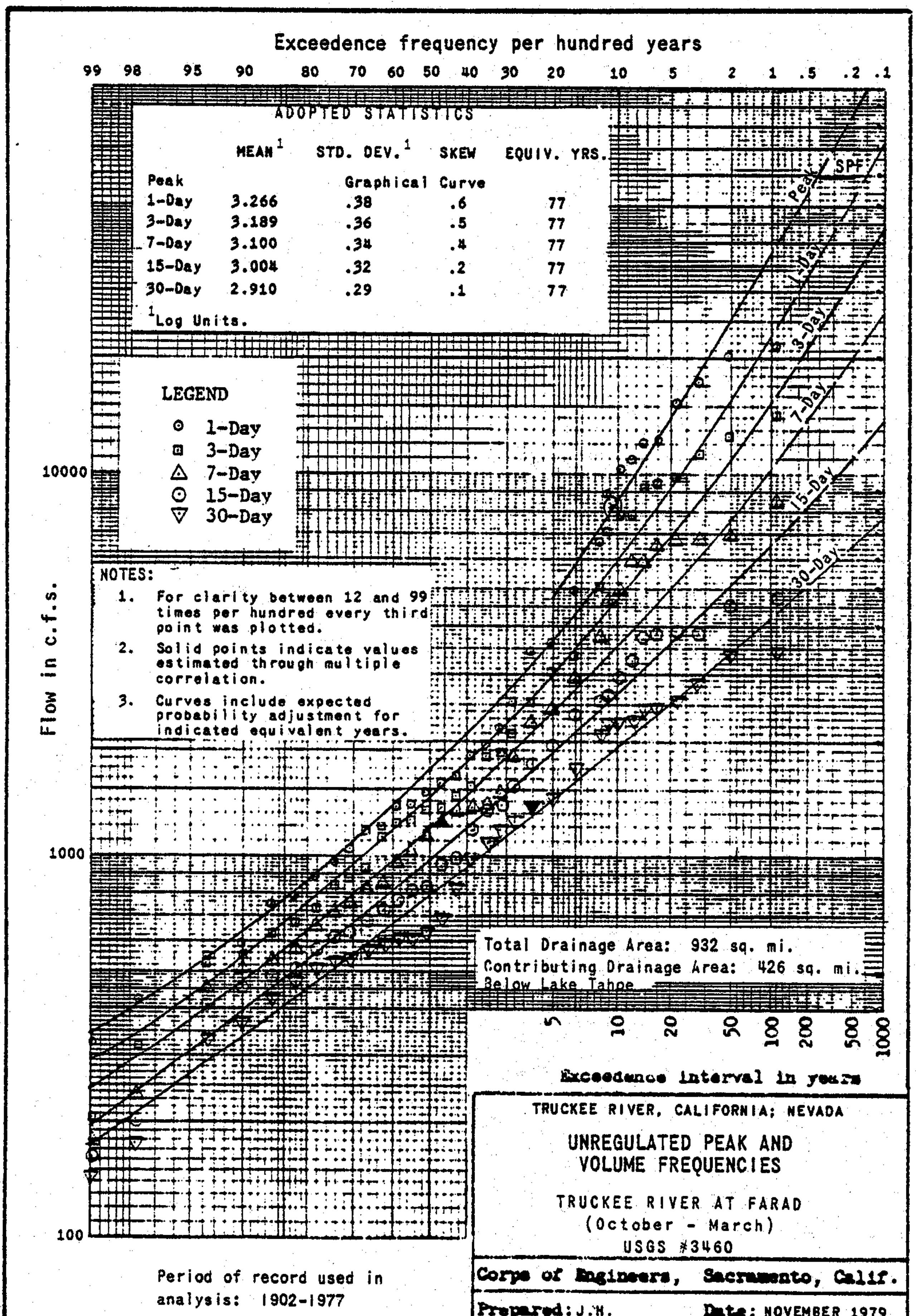
TRUCKEE RIVER, CALIFORNIA;NEVADA

LAND USE MAP
YEAR 1990 CONDITIONS
RENO AREA

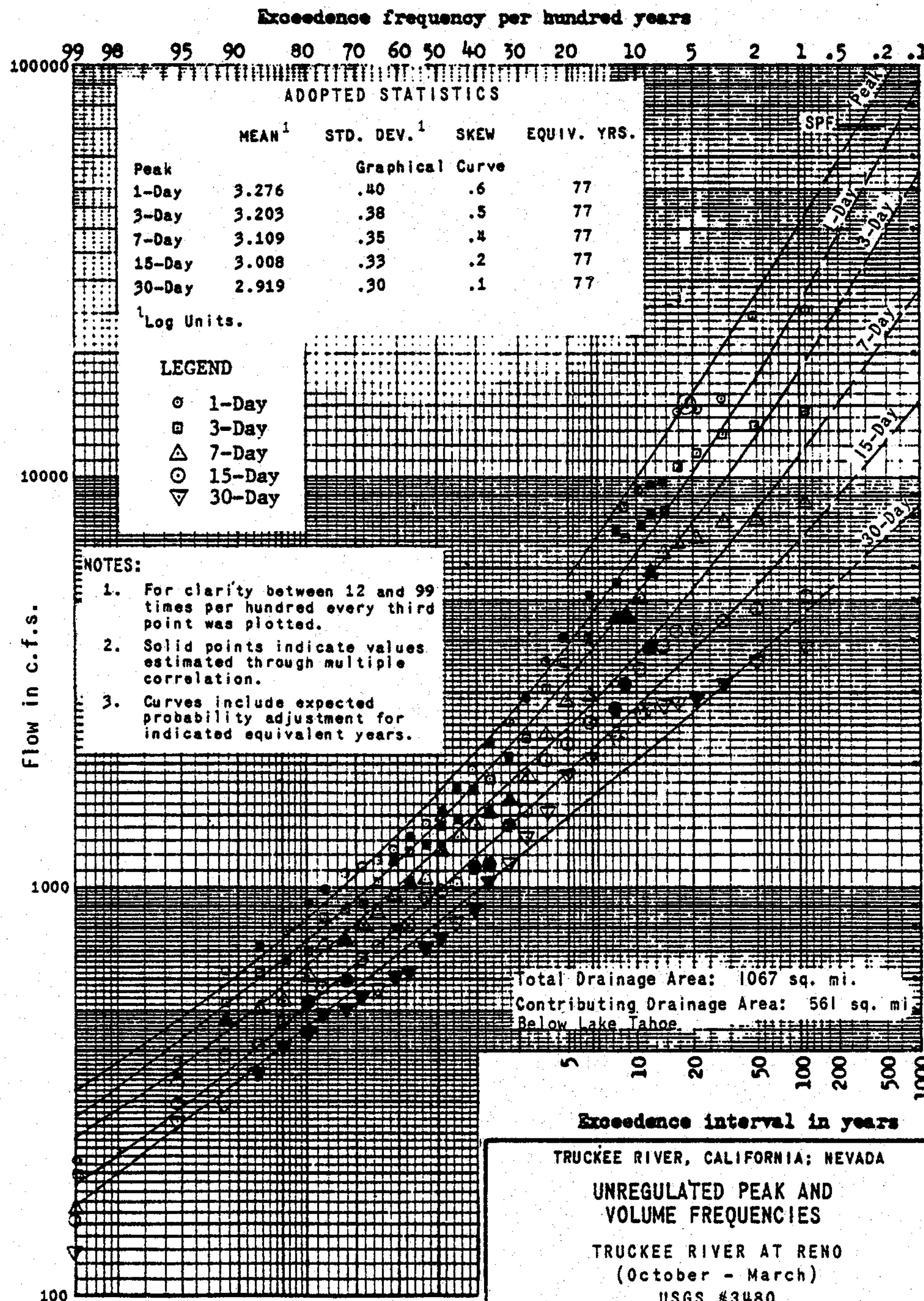
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.
Date: NOVEMBER 1979

CHART 19



SHEET 1 OF 5 CHART 20



ADOPTED STATISTICS

	MEAN[1]	STD. DEV.[1]	SKEW	EQUIV. YRS.
Peak		Graphical	Curve	
1-Day	3.276	.40	.6	77
3-Day	3.203	.38	.5	77
7-Day	3.109	.35	.4	77
15-Day	3.008	.33	.2	77
30-Day	2.919	.30	.1	77

[1] Log Units.

NOTES:

1. For clarity between 12 and 99 times per hundred every third point was plotted.
2. Solid points indicate values estimated through multiple correlation.
3. Curves include expected probability adjustment for indicated equivalent years.

Period of record used in analysis: 1907, 09-10, 13-19, 31-34, 43, 46-77.

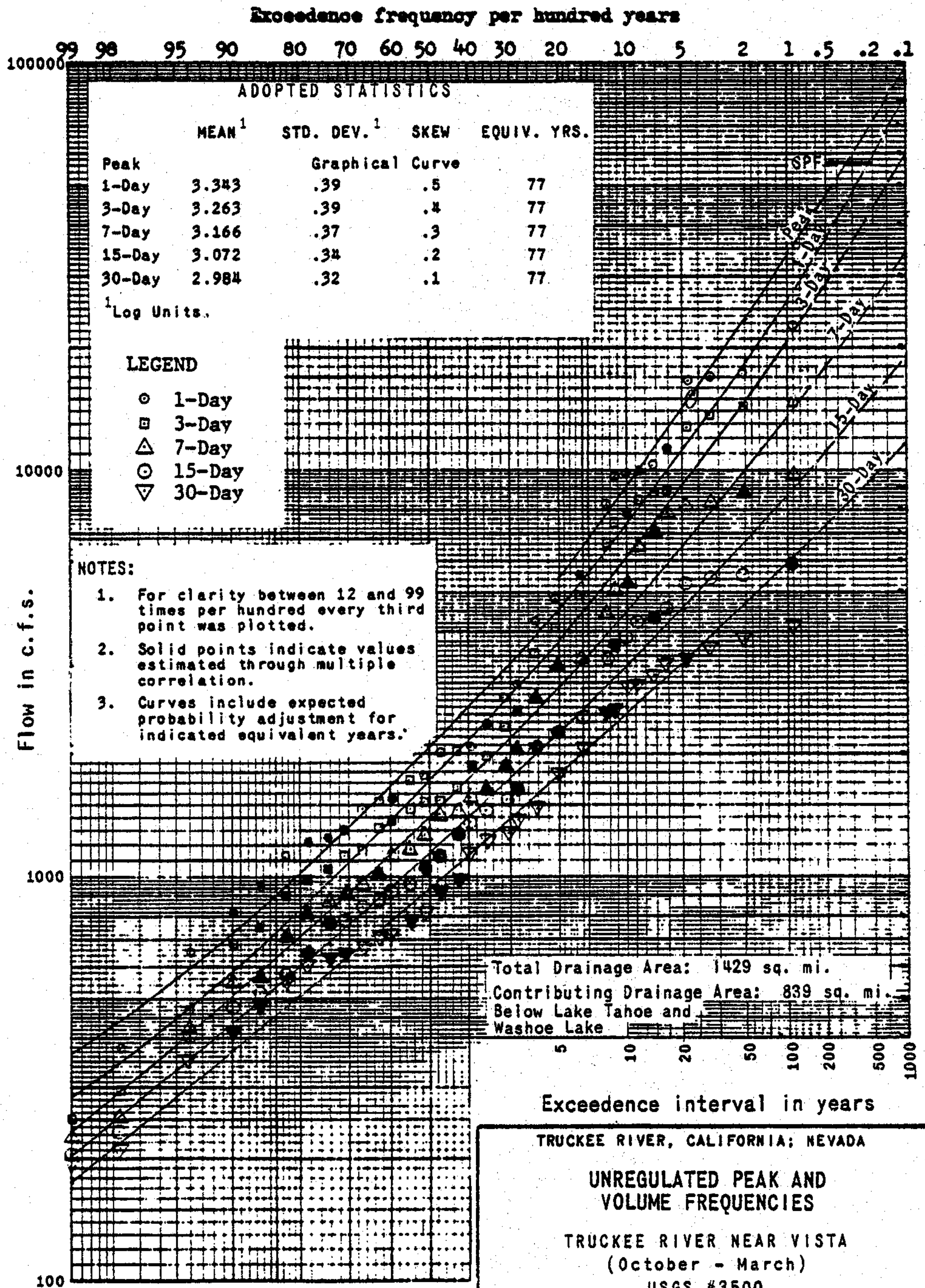
TRUCKEE RIVER, CALIFORNIA; NEVADA

UNREGULATED PEAK AND VOLUME FREQUENCIES

TRUCKEE RIVER AT RENO
(October - March)
USGS #3480

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. **Date:** NOVEMBER 1979



ADOPTED STATISTICS

	MEAN[1]	STD. DEV.[1]	SKEW	EQUIV. YRS.
Peak		Graphical	Curve	
1-Day	3.343	.39	.5	77
3-Day	3.263	.39	.4	77
7-Day	3.166	.37	.3	77
15-Day	3.072	.34	.2	77
30-Day	2.984	.32	.1	77

[1] Log Units.

LEGEND

- ⊙ 1-Day
- ⊡ 3-Day
- △ 7-Day
- ○ 15-Day
- ▽ 30-Day

NOTES:

1. For clarity between 12 and 99 times per hundred every third point was plotted.
2. Solid points indicate values estimated through multiple correlation.
3. Curves include expected probability adjustment for indicated equivalent years.

Period of record used in analysis: 1901-07, 33-48, 50-54, 59-77.

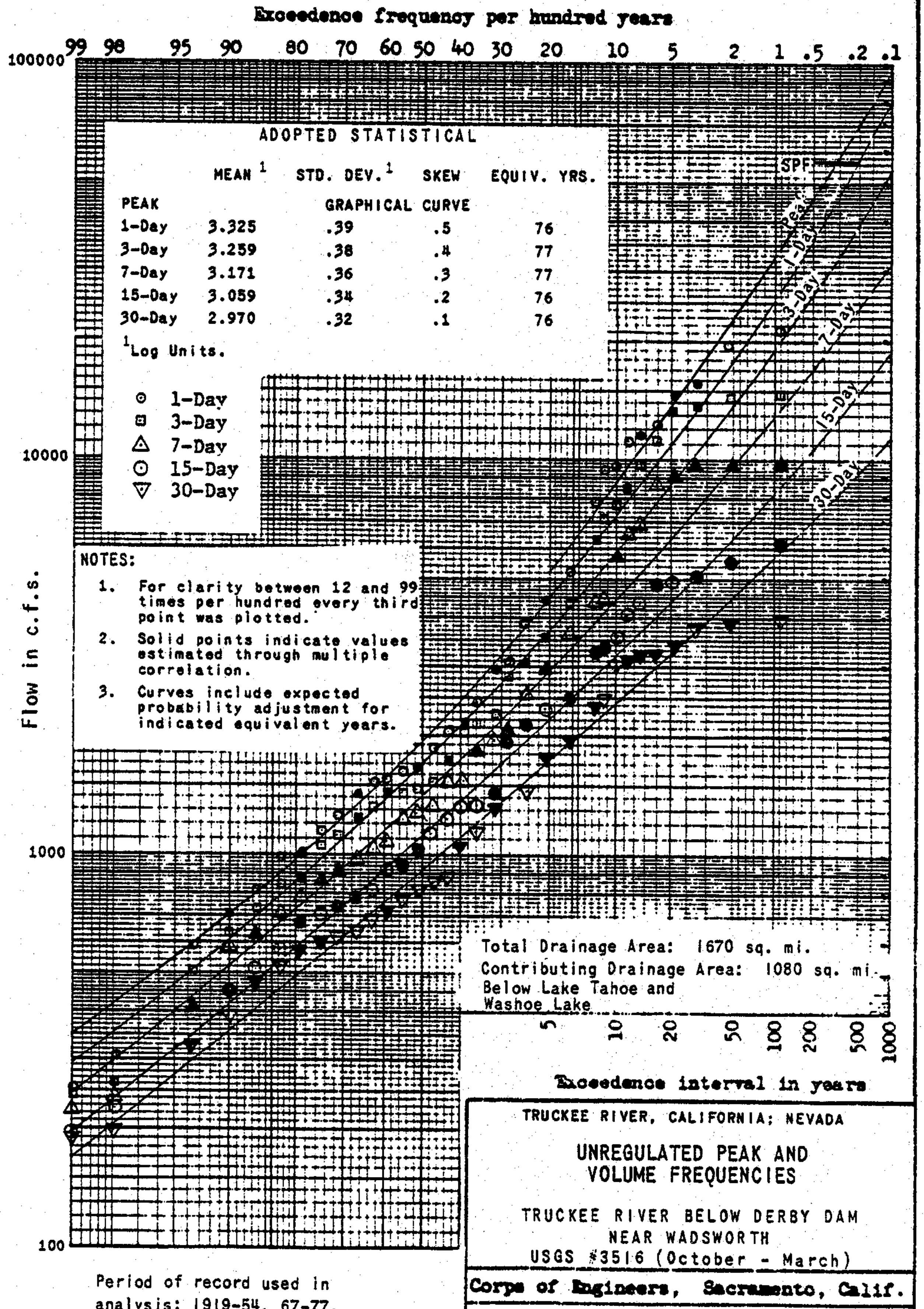
TRUCKEE RIVER, CALIFORNIA; NEVADA

UNREGULATED PEAK AND VOLUME FREQUENCIES

TRUCKEE RIVER NEAR VISTA
(October - March)
USGS #3500

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. **Date** NOVEMBER 1979



ADOPTED STATISTICAL

	MEAN [1]	STD. DEV. [1]	SKEW	EQUIV. YRS.
PEAK		GRAPHICAL CURVE		
1-Day	3.325	.39	.5	76
3-Day	3.259	.38	.4	77
7-Day	3.171	.36	.3	77
15-Day	3.059	.34	.2	76
30-Day	2.970	.32	.1	76

[1] Log Units.

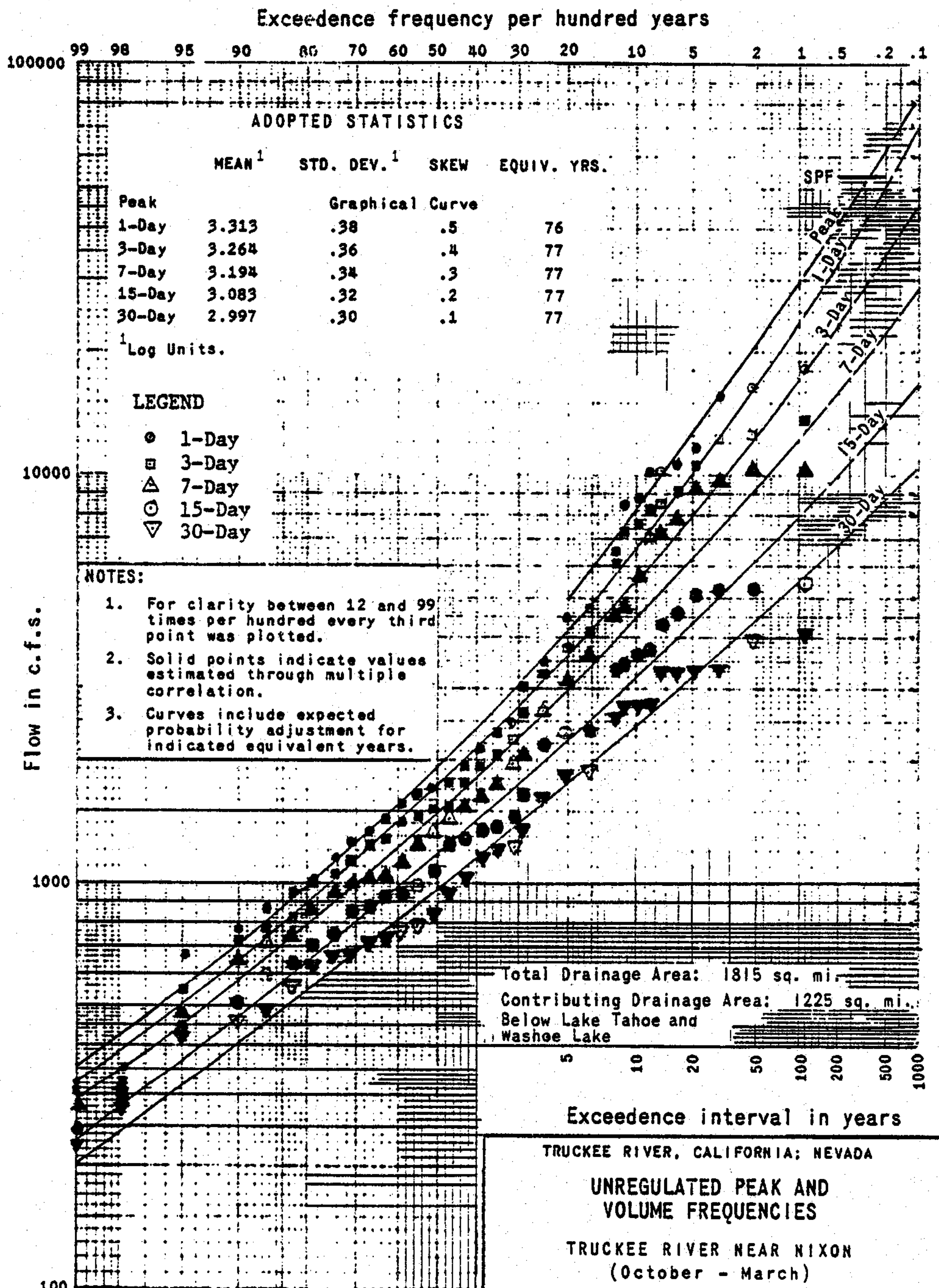
TRUCKEE RIVER, CALIFORNIA; NEVADA

UNREGULATED PEAK AND VOLUME FREQUENCIES

TRUCKEE RIVER BELOW DERBY DAM NEAR WADSWORTH
USGS #3516 (October - March)

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. **Date:** NOVEMBER 1979



ADOPTED STATISTICS

	MEAN[1]	STD. DEV.[1]	SKEW	EQUIV. YRS.
Peak		Graphical	Curve	
1-Day	3.313	.38	.5	76
3-Day	3.264	.36	.4	77
7-Day	3.194	.34	.3	77
15-Day	3.083	.32	.2	77
30-Day	2.997	.30	.1	77

[1] Log Units.

NOTES:

1. For clarity between 12 and 99 times per hundred every third point was plotted.
2. Solid points indicate values estimated through multiple correlation.
3. Curves include expected probability adjustment for indicated equivalent years.

Total Drainage Area: 1815 sq. mi.
Contributing Drainage Area: 1225 sq. mi.
Below Lake Tahoe and Washoe Lake

TRUCKEE RIVER, CALIFORNIA; NEVADA

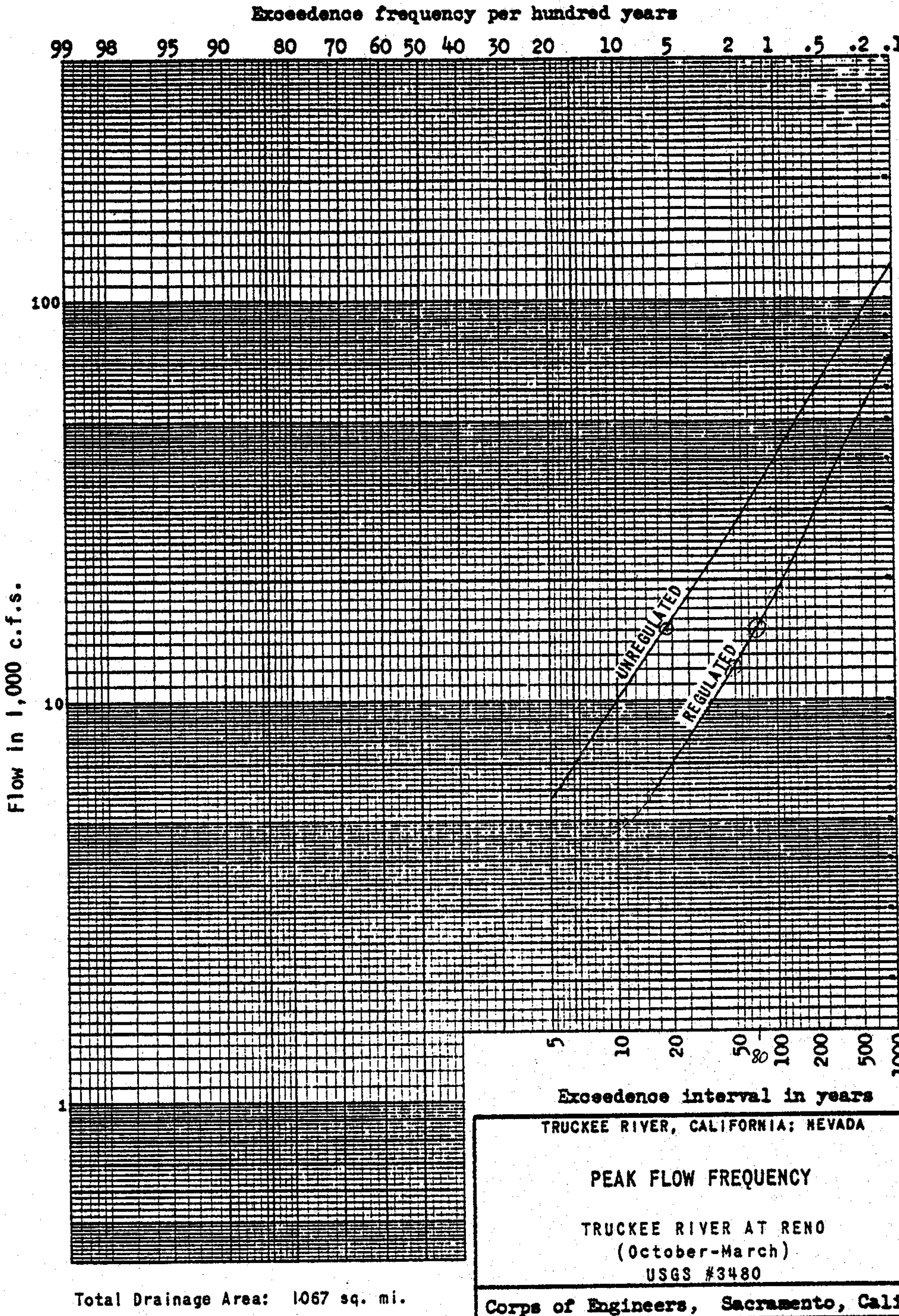
UNREGULATED PEAK AND VOLUME FREQUENCIES

TRUCKEE RIVER NEAR NIXON
(October - March)
USGS #3517

Period of record used in analysis: 1967-77

Corps of Engineers, Sacramento, Calif.

Prepared. J.H. Date. NOVEMBER 1979



TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK FLOW FREQUENCY

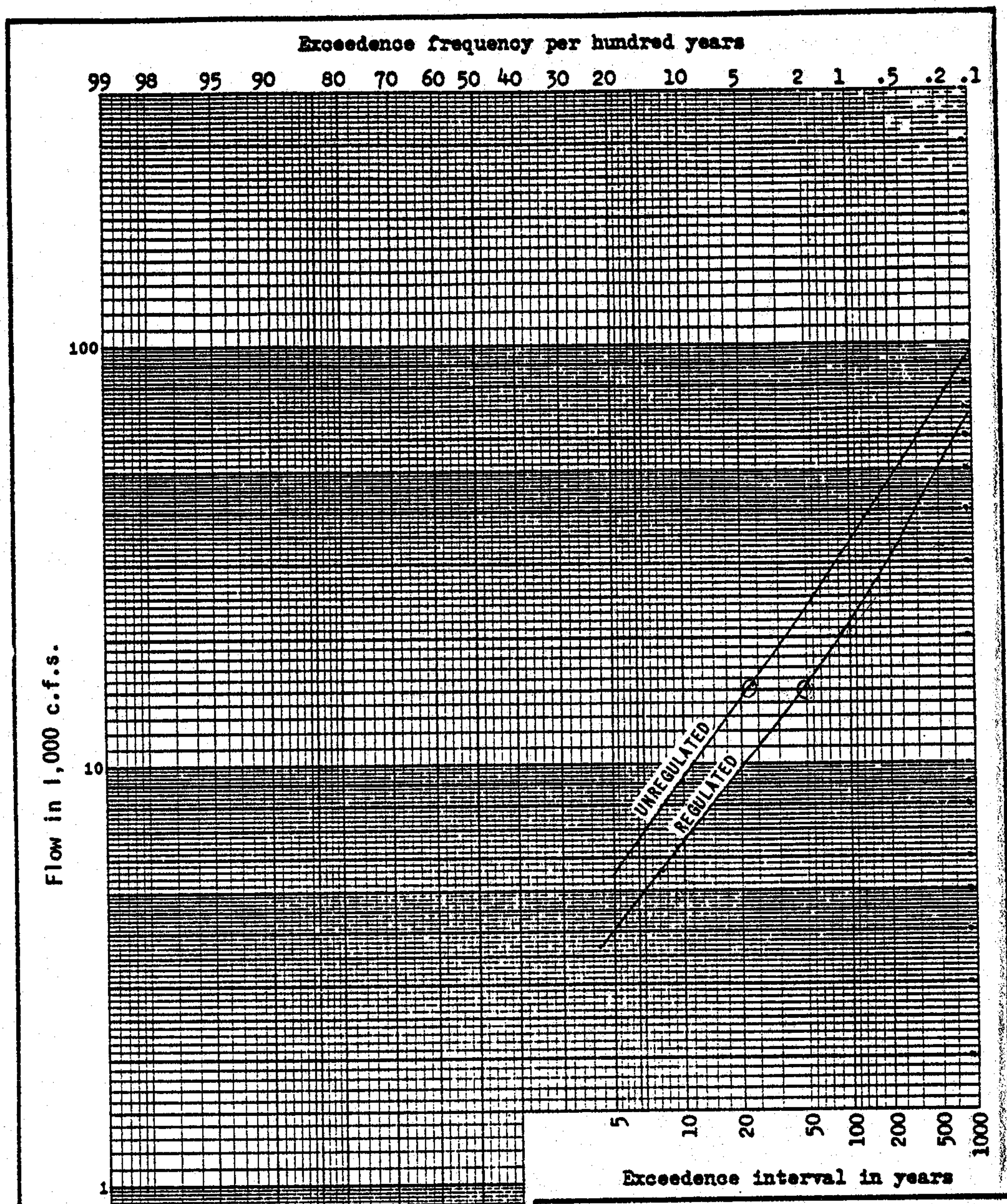
TRUCKEE RIVER AT RENO
(October-March)
USGS #3480

Total Drainage Area: 1067 sq. mi.
Contributing Drainage Area: 561 sq. mi. Below Lake Tahoe

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. Date: NOVEMBER 1979

SHEET 1 OF 4 CHART 21



TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK FLOW FREQUENCY

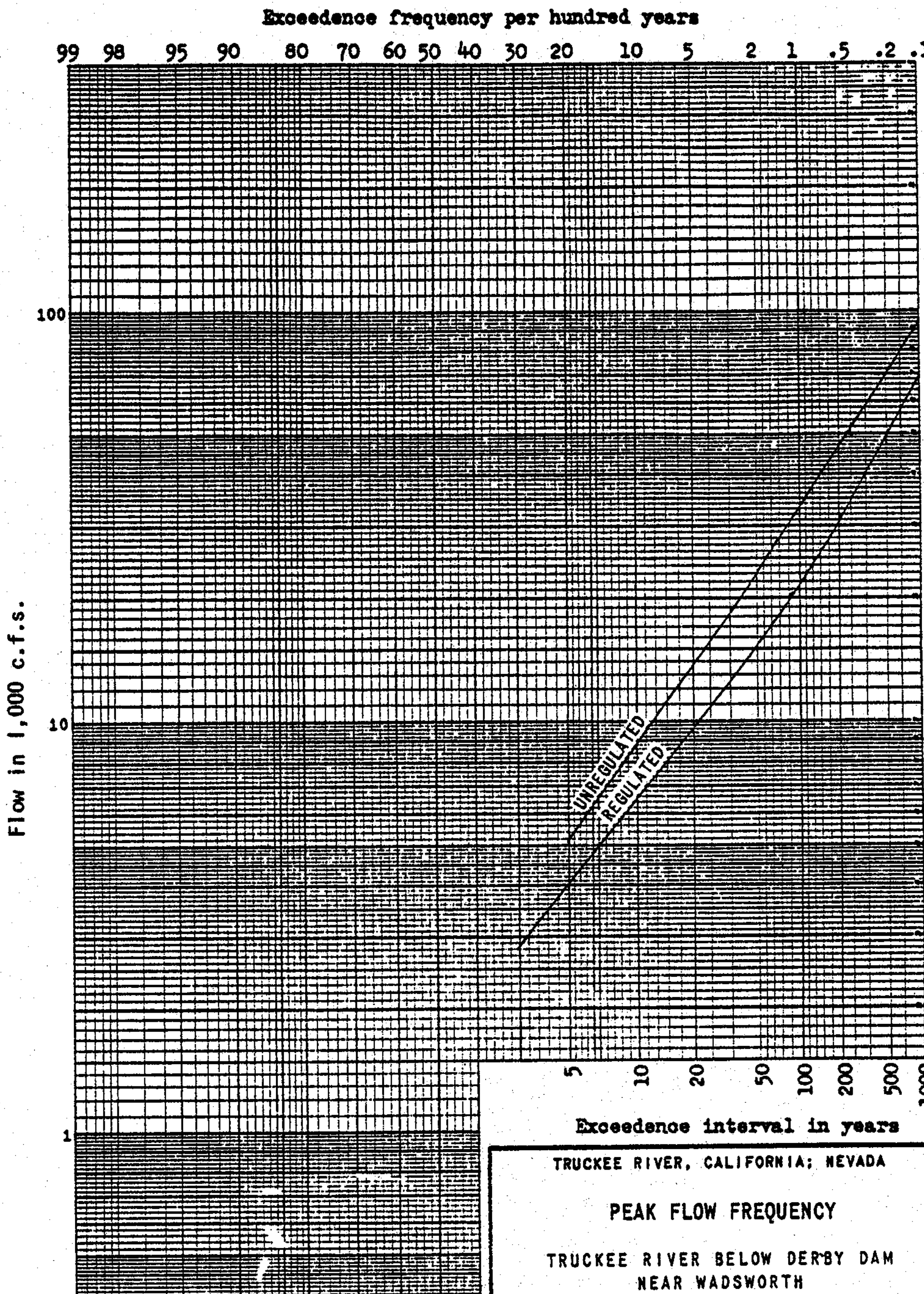
TRUCKEE RIVER NEAR VISTA
(October-March)
USGS #3500

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. Date: NOVEMBER 1979

Total Drainage Area: 1429 sq. mi.

Contributing Drainage Area: 839 sq. mi.
Below Lake Tahoe and
Washoe Lake



TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK FLOW FREQUENCY

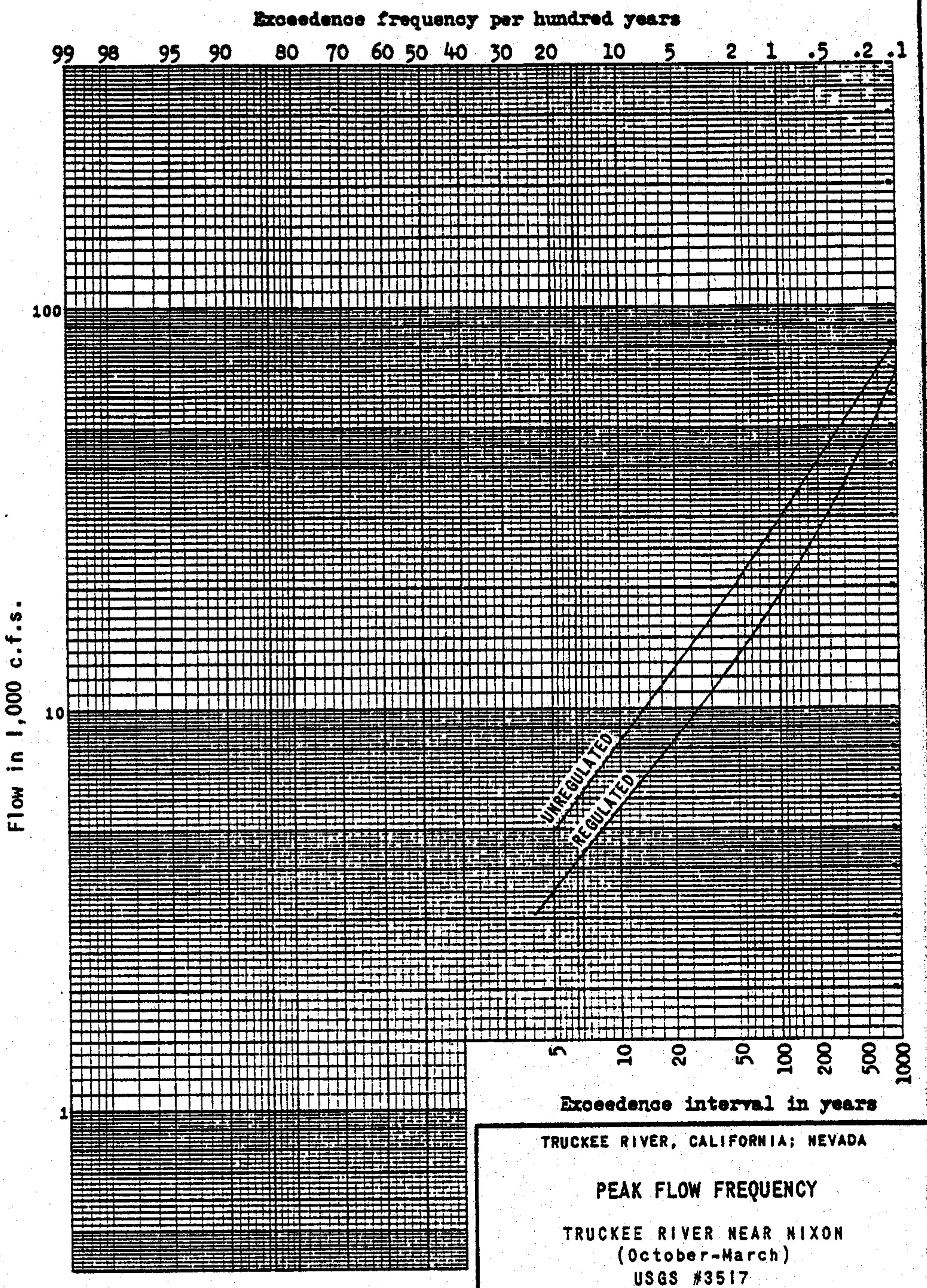
TRUCKEE RIVER BELOW DERBY DAM
NEAR WADSWORTH
USGS #3516 (October-March)

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. Date: NOVEMBER 1979

Total Drainage Area: 1670 sq. mi.

Contributing Drainage Area: 1080 sq. mi.
Below Lake Tahoe and
Washoe Lake



TRUCKEE RIVER, CALIFORNIA; NEVADA

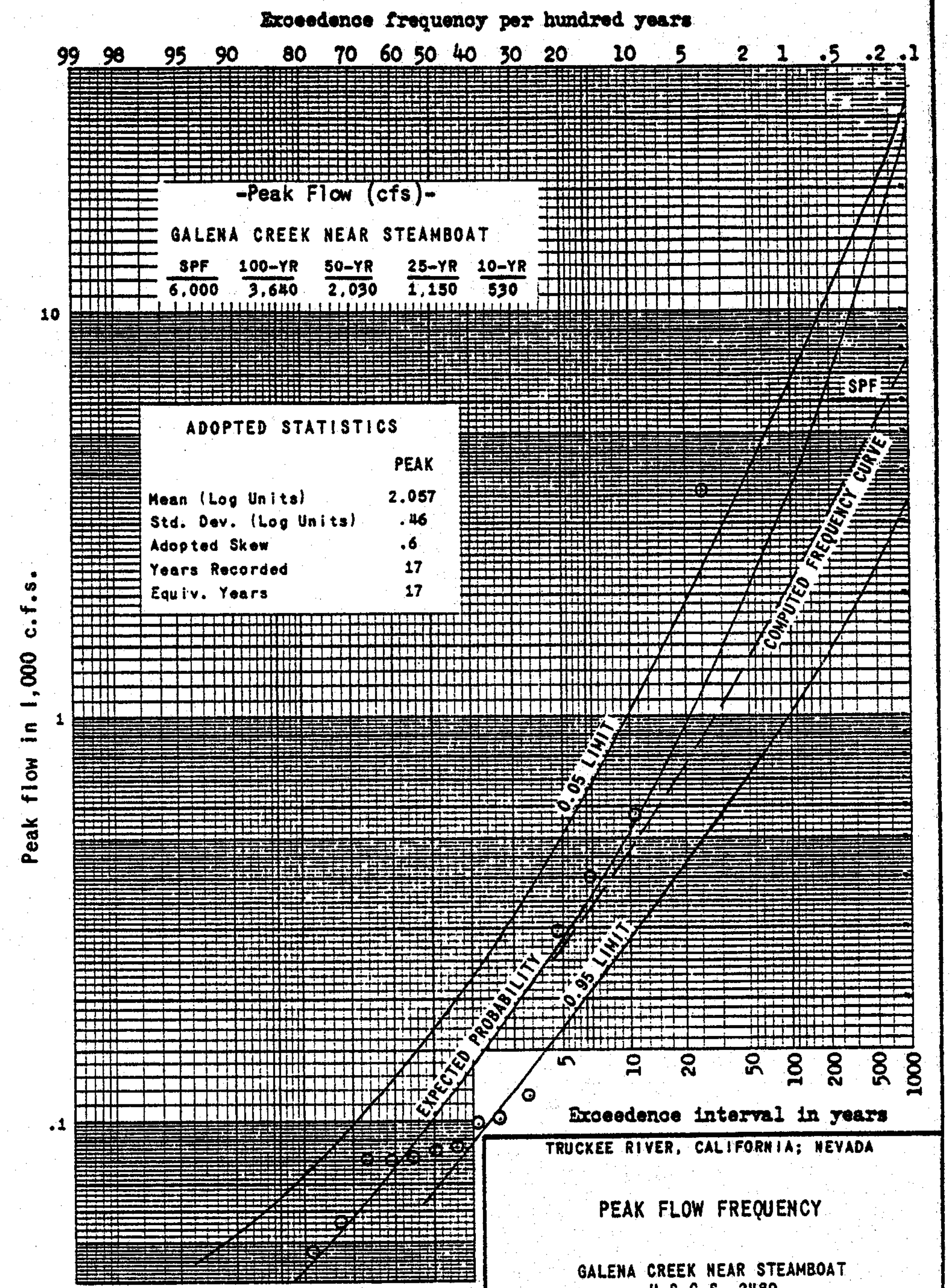
PEAK FLOW FREQUENCY

TRUCKEE RIVER NEAR NIXON
(October-March)
USGS #3517

Total Drainage Area: 1815 sq. mi.
Contributing Drainage Area: 1225 sq. mi.
Below Lake Tahoe and
Washoe Lake

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. **Date:** NOVEMBER 1979



-Peak Flow (cfs)-

GALENA CREEK NEAR STEAMBOAT

SPF	100-YR	50-YR	25-YR	10-YR
6,000	3,640	2,030	1,150	530

ADOPTED STATISTICS

	PEAK
Mean (Log Units)	2.057
Std. Dev. (Log Units)	.46
Adopted Skew	.6
Years Recorded	17
Equiv. Years	17

Period of Record: 1962-1978
Total Drainage Area: 8.5 sq. mi.

TRUCKEE RIVER, CALIFORNIA; NEVADA

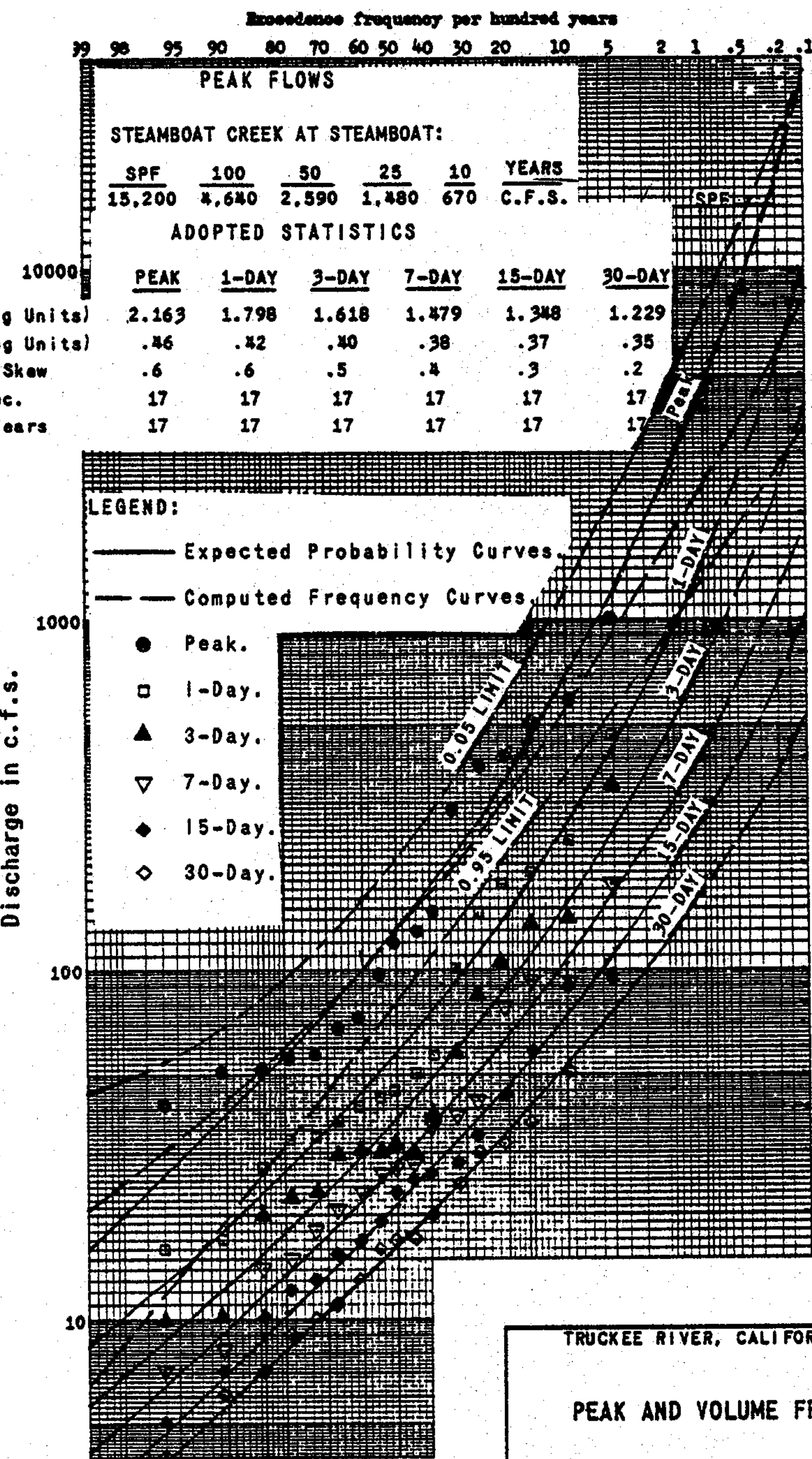
PEAK FLOW FREQUENCY

GALENA CREEK NEAR STEAMBOAT
U.S.G.S. 3489

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. Date: NOVEMBER 1979

CHART 22



PEAK FLOWS

STEAMBOAT CREEK AT STEAMBOAT:

SPF	100	50	25	10	YEARS
15,200	4,640	2,590	1,480	670	C.F.S.

ADOPTED STATISTICS

	PEAK	1-DAY	3-DAY	7-DAY	15-DAY	30-DAY
Mean (Log Units)	2.163	1.798	1.618	1.479	1.348	1.229
S.D. (Log Units)	.46	.42	.40	.38	.37	.35
Adopted Skew	.6	.6	.5	.4	.3	.2
Years Rec.	17	17	17	17	17	17
Equiv. Years	17	17	17	17	17	17

TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK AND VOLUME FREQUENCIES

STEAMBOAT CREEK AT STEAMBOAT (30)
USGS NO. 3493

Period of Record: 1962-1978

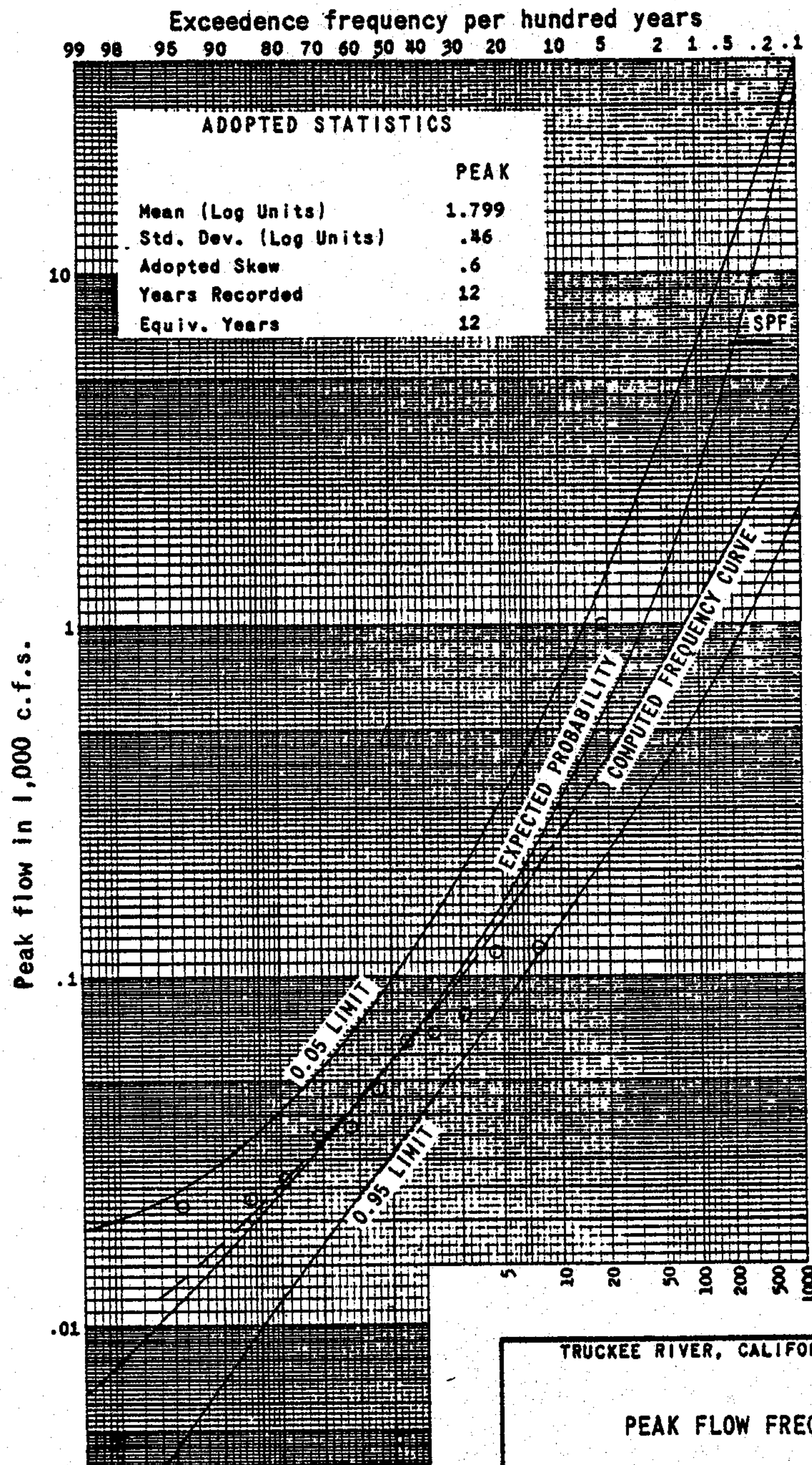
Total Drainage Area: 123.0 sq. mi.

Contributing Drainage Area: 39.3 sq. mi.
Below Washoe Lake

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.
Date: NOVEMBER 1979

CHART 23



Period of Record: 1962-1971, 1973-1974
Total Drainage Area: 11.5 sq. mi.

TRUCKEE RIVER, CALIFORNIA; NEVADA

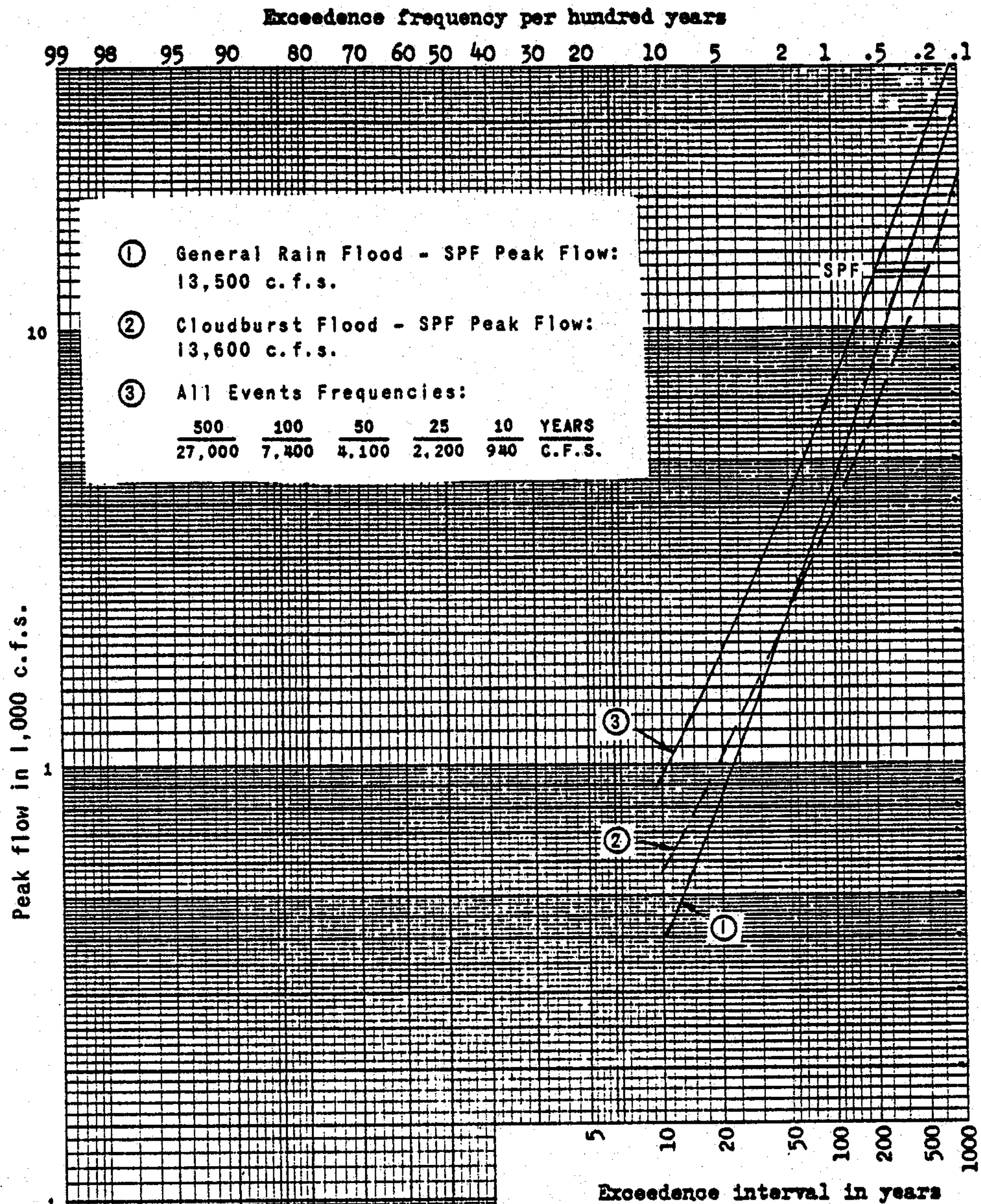
PEAK FLOW FREQUENCY

HUNTER CREEK NEAR RENO
USGS #3476

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: J.H.
Drawn: C.A.P.
Date: NOVEMBER 1979

CHART 24



TRUCKEE RIVER, CALIFORNIA; NEVADA

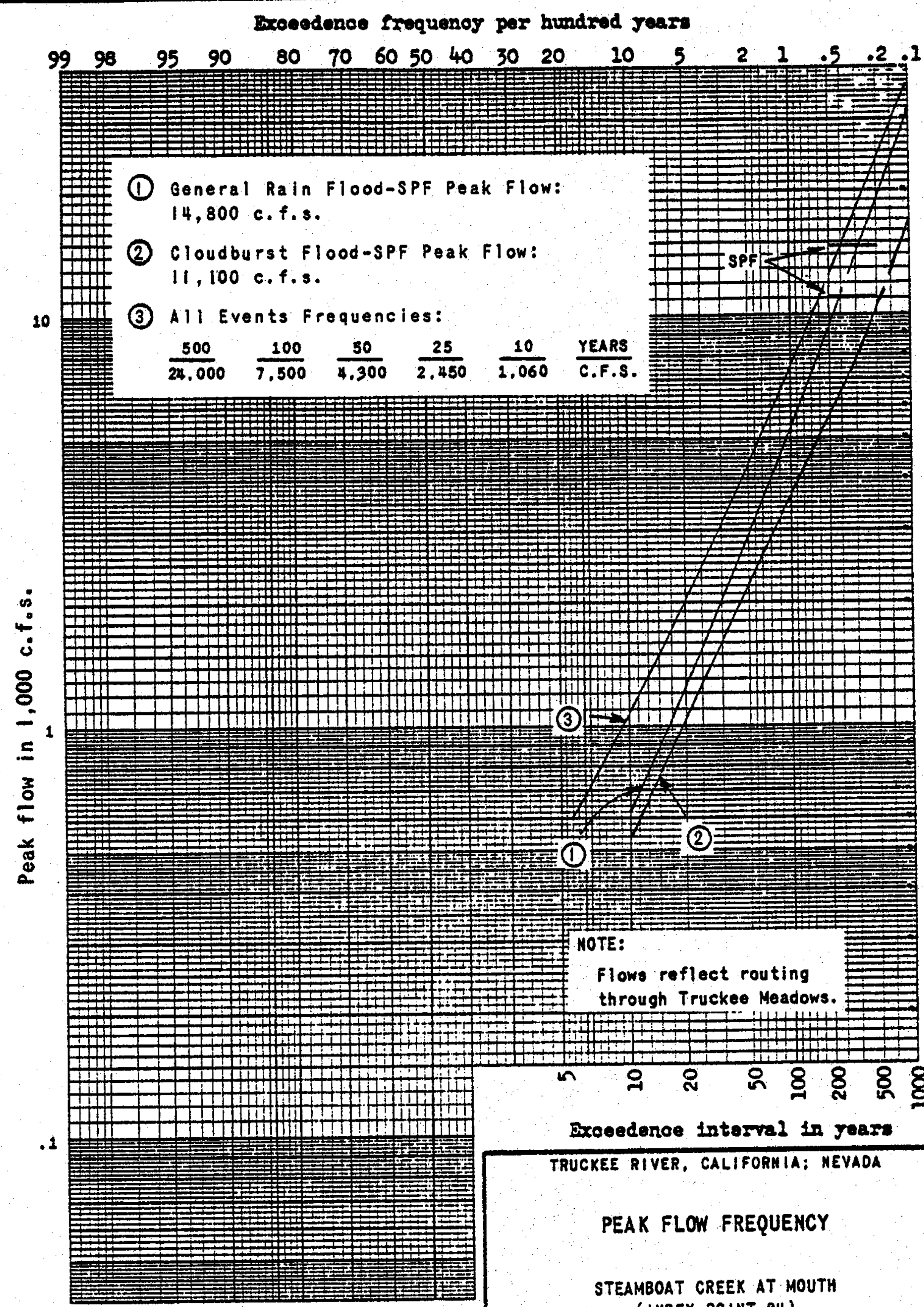
PEAK FLOW FREQUENCY

STEAMBOAT CREEK AT HUFFACKER HILLS
(INDEX POINT 60)

Total Drainage Area: 194.0 sq. mi.
Contributing Drainage Area: 110.4 sq. mi.

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. **Date:** NOVEMBER 1979



TRUCKEE RIVER, CALIFORNIA; NEVADA

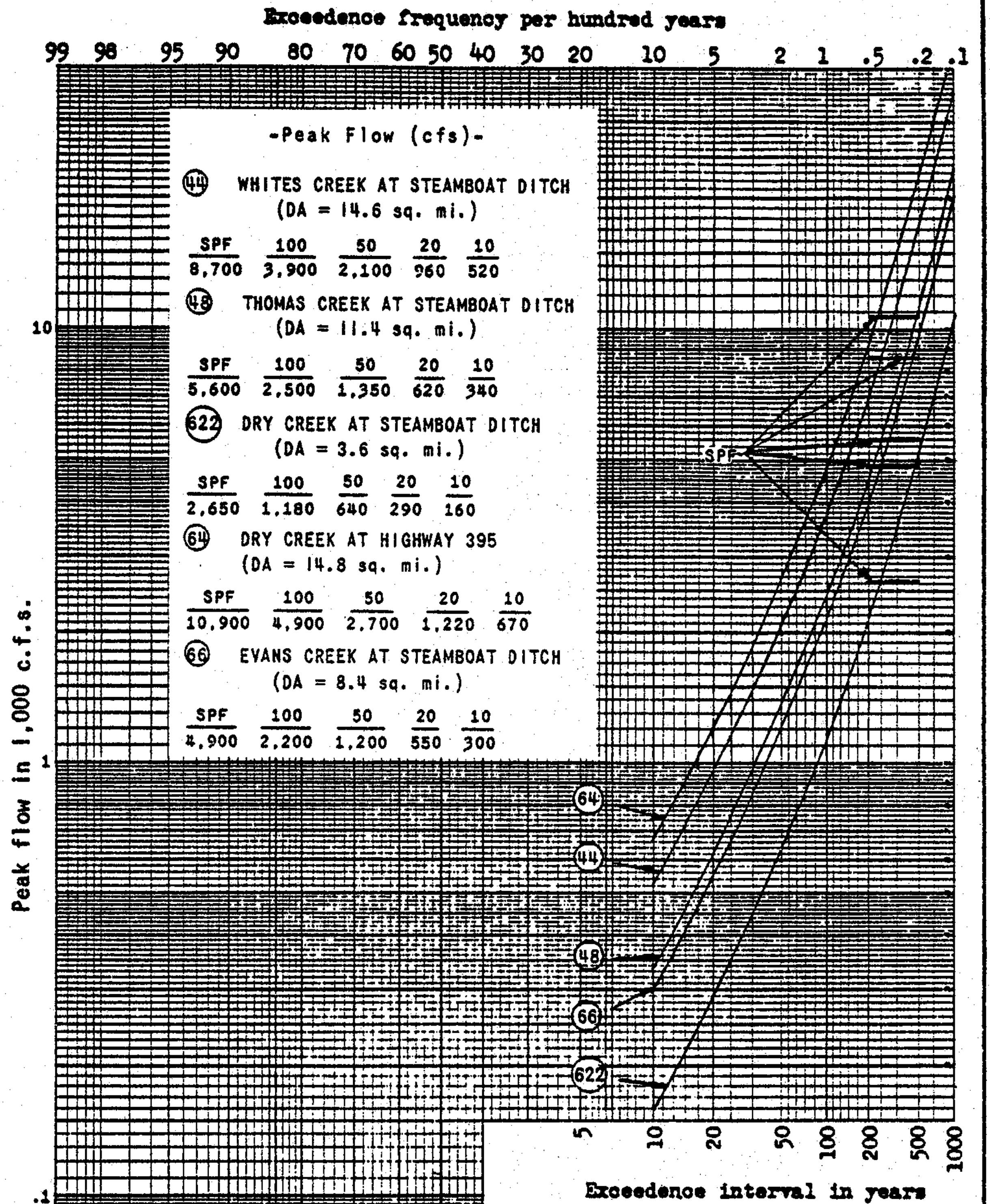
PEAK FLOW FREQUENCY

STEAMBOAT CREEK AT MOUTH
(INDEX POINT 84)

Corps of Engineers, Sacramento, Calif.

Prepared: J.H. Date: NOVEMBER 1979

Total Drainage Area: 246.0 sq. mi.
Contributing Drainage Area: 162.3 sq. mi.



TRUCKEE RIVER, CALIFORNIA; NEVADA

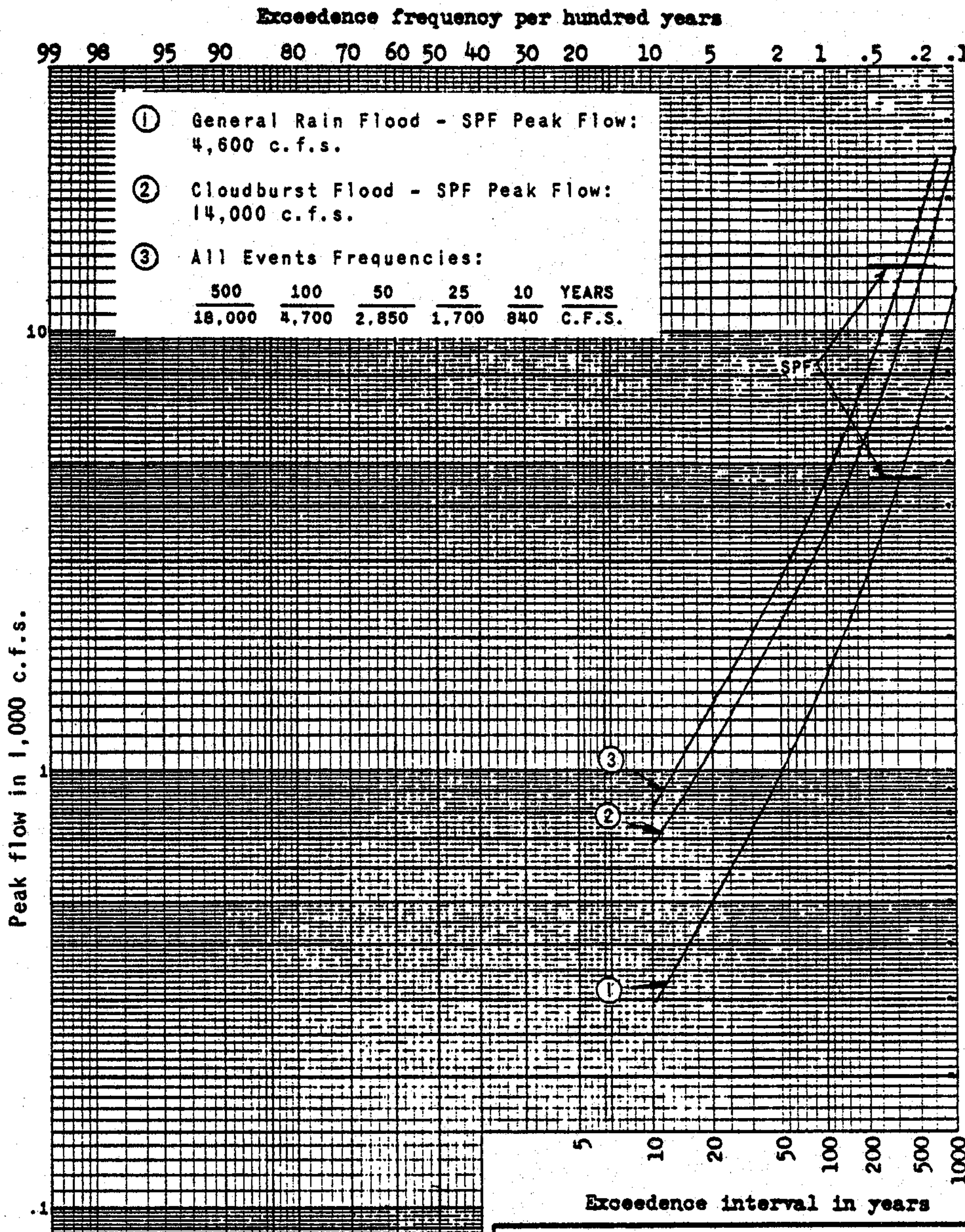
PEAK FLOW FREQUENCY

DRY, EVANS, WHITES, THOMAS CREEKS
AT STEAMBOAT DITCH AND DRY CREEK
AT HIGHWAY 395

Corps of Engineers, Sacramento, Calif.

Prepared: R.C.K. **Date:** NOVEMBER 1979

CHART 26



Total Drainage Area: 41 sq. mi.

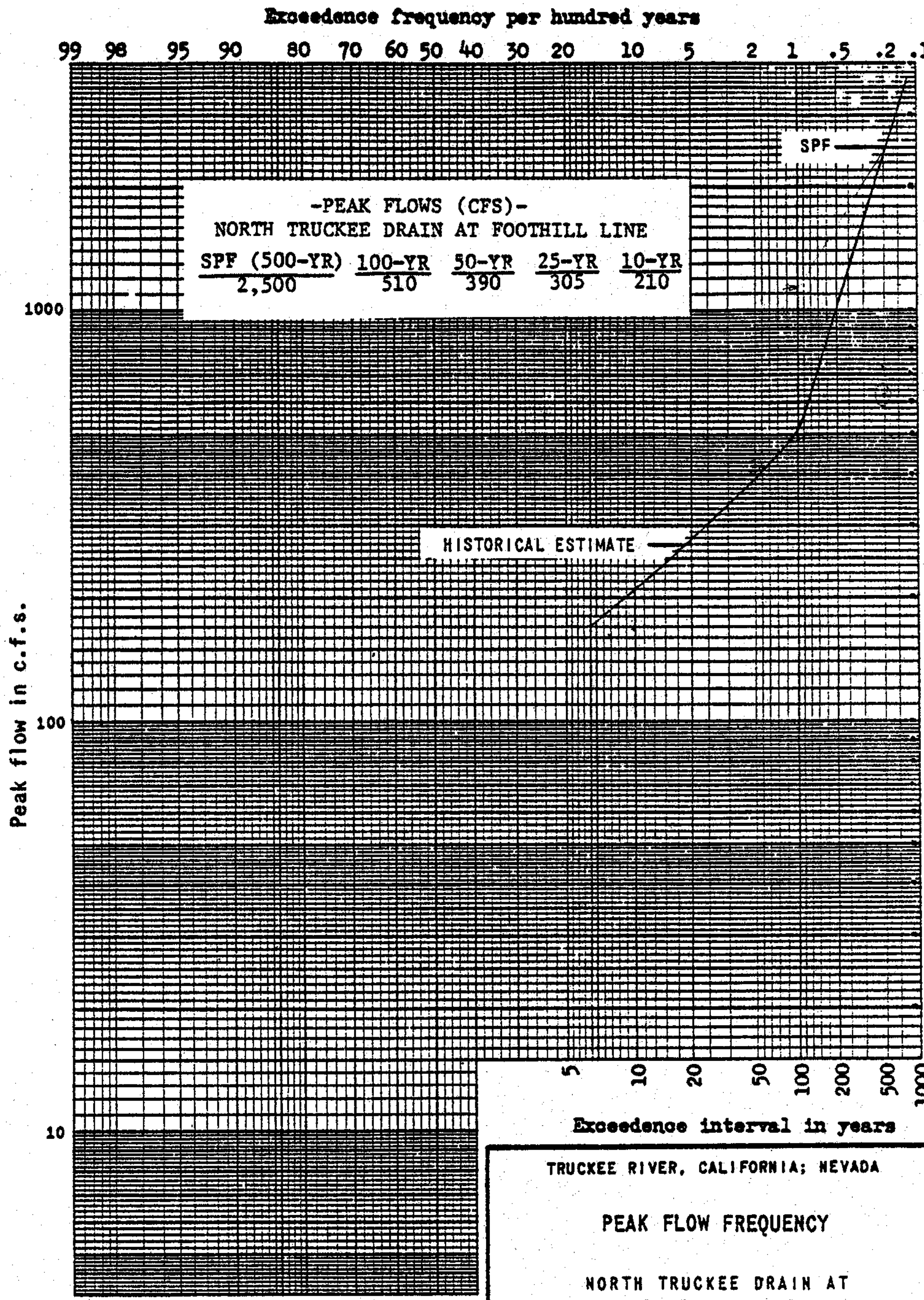
TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK FLOW FREQUENCY

BOYNTON SLOUGH BELOW DRY CREEK
(INDEX POINT 70)

Corps of Engineers, Sacramento, Calif.

Prepared: P.W. Date: NOVEMBER 1979



TRUCKEE RIVER, CALIFORNIA; NEVADA

PEAK FLOW FREQUENCY

NORTH TRUCKEE DRAIN AT FOOTHILL LINE

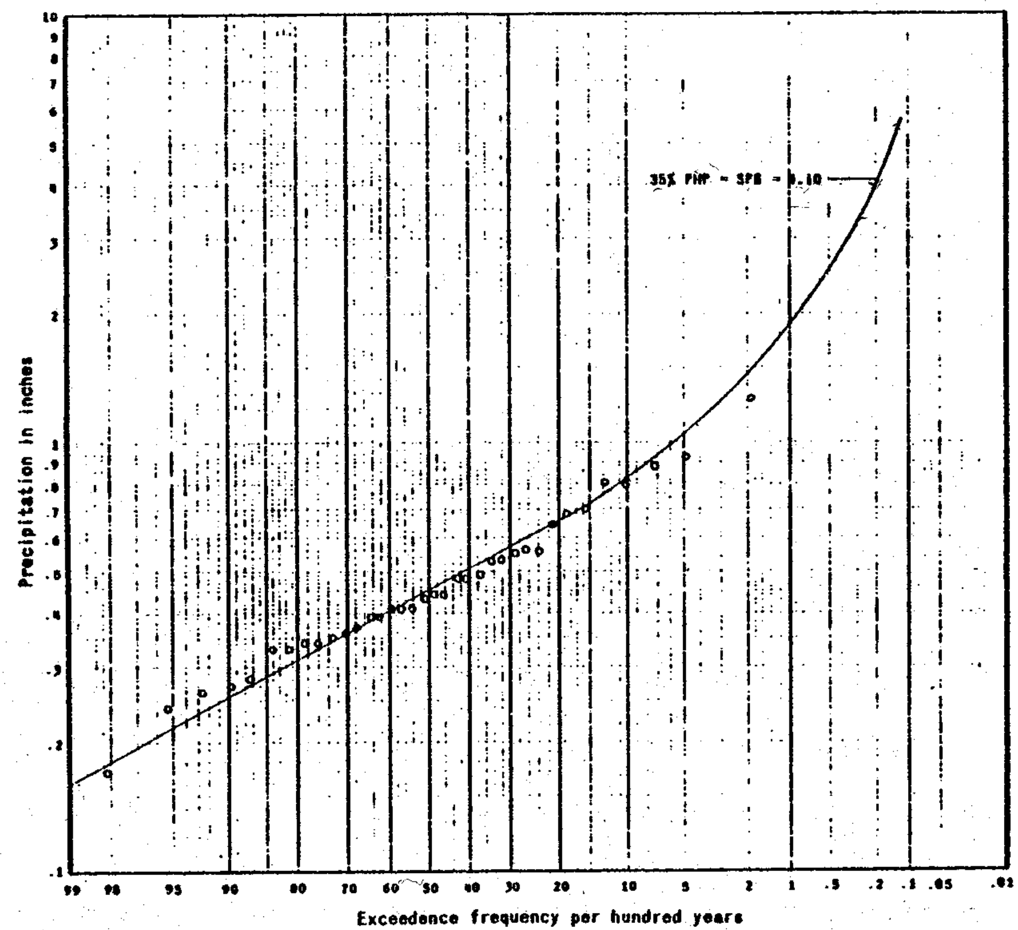
TOTAL D.A.= 78.5 sq.mi.

CONTRIBUTING D.A.= 58.9 sq.mi.

Corps of Engineers, Sacramento, Calif.

Prepared: PW JH   Date: NOVEMBER 1979

CHART 28



RECURRENCE INTERVAL IN YEARS	RATIO OF SPS
3000	
1000	1.51
SPF	1.00
500	.95
200	.61
100	.46
50	.35
25	.27
10	.20

Period of Record: 1940-1975

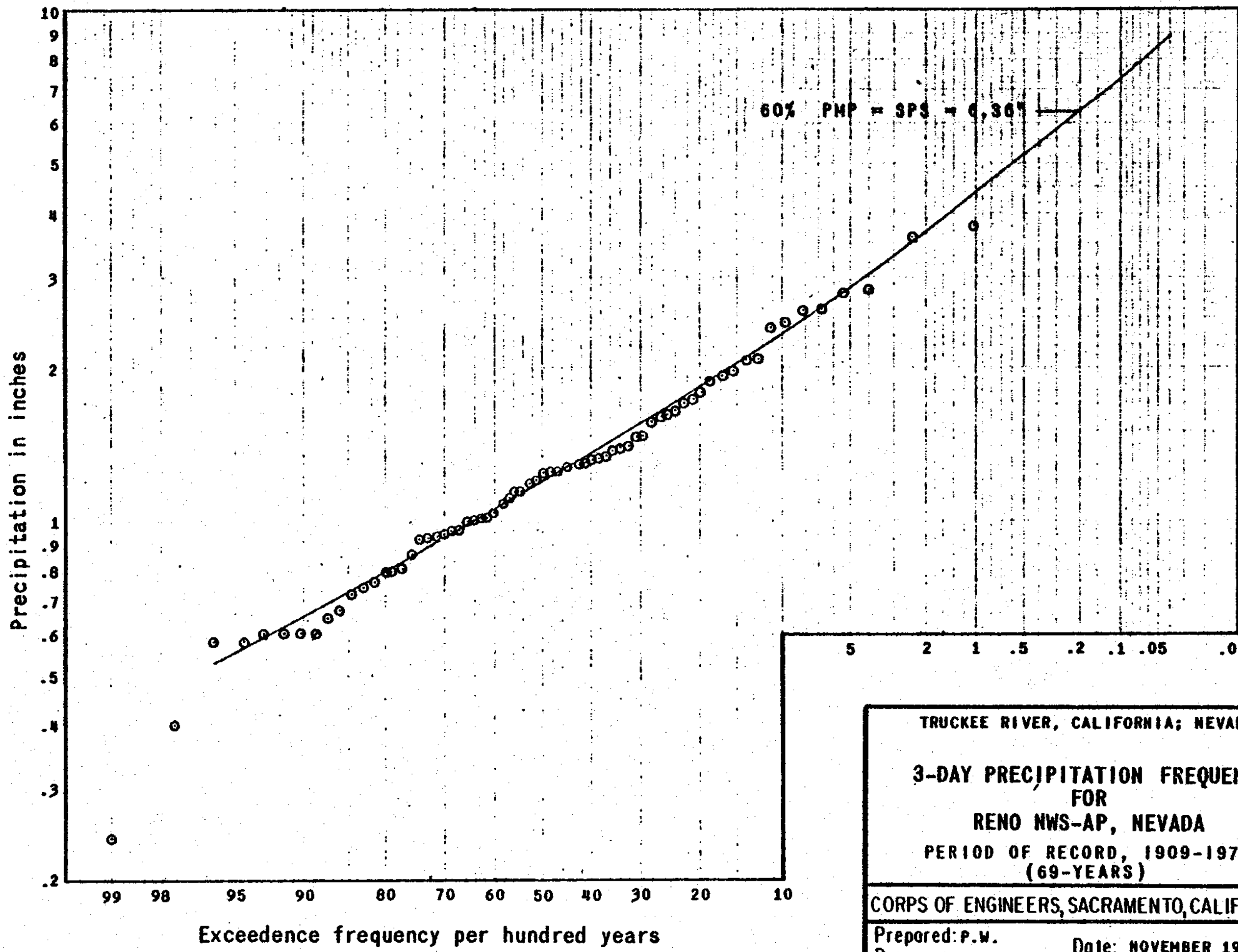
TRUCKEE RIVER, CALIFORNIA; NEVADA

3-HOUR PRECIPITATION FREQUENCY FOR RENO NWS-AP, NEVADA

CORPS OF ENGINEERS, SACRAMENTO, CALIFO[RNIA]

Prepared P.V.
Drawn C.A.P.
Date: NOVEMBER 1979

CHART



TRUCKEE RIVER, CALIFORNIA; NEVADA

3-DAY PRECIPITATION FREQUENCY FOR RENO NWS-AP, NEVADA

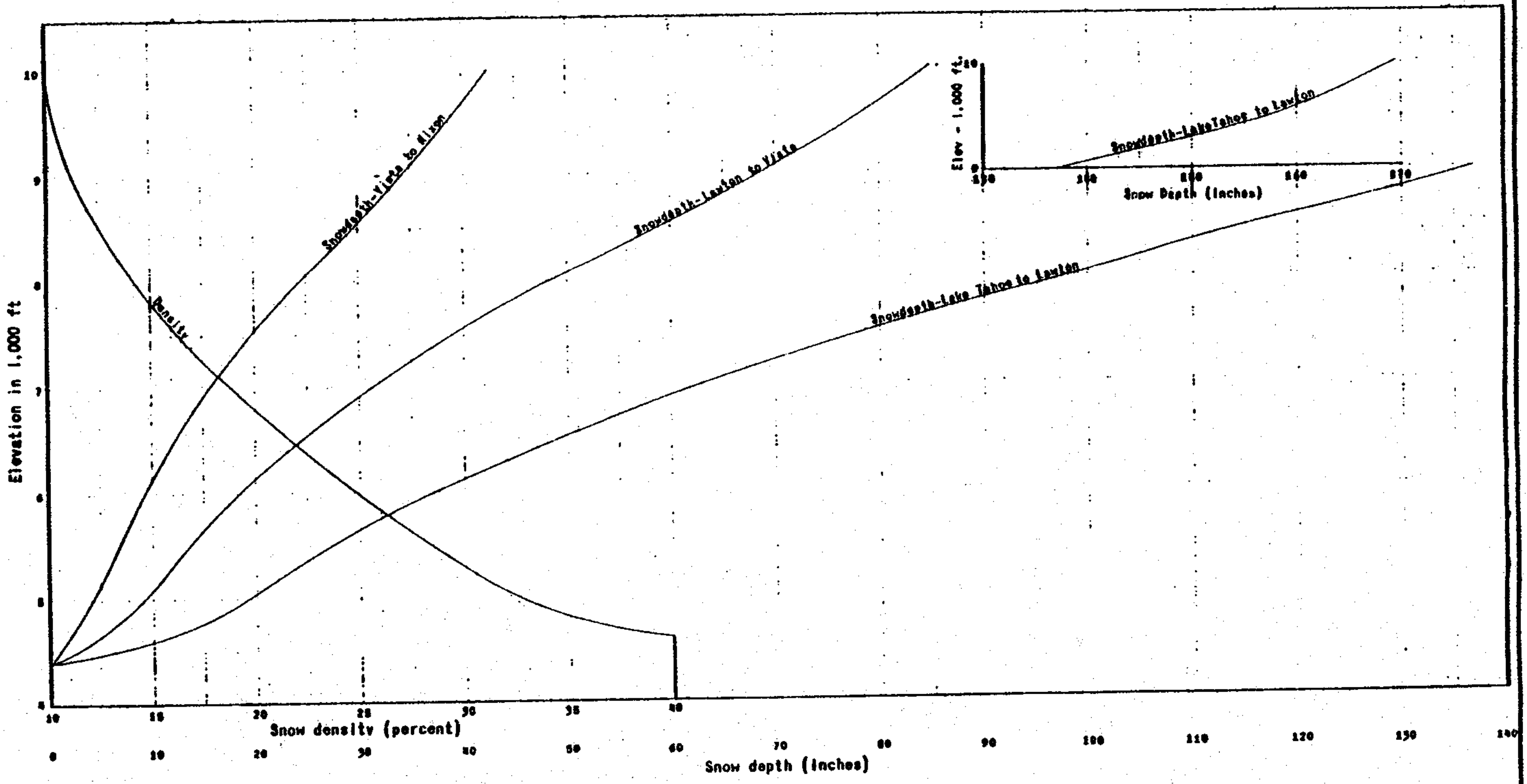
PERIOD OF RECORD, 1909-1977 (69-YEARS)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: J.H.

Date: NOVEMBER 1979

CHART 30



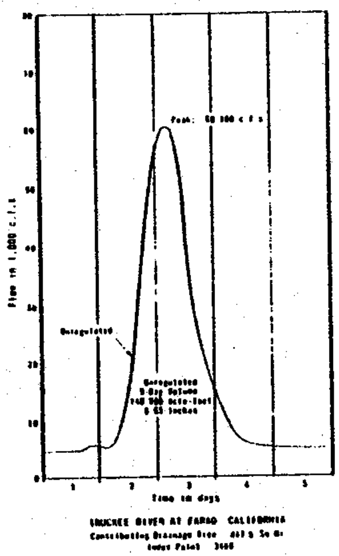
TRUCKEE RIVER, CALIFORNIA; NEVADA

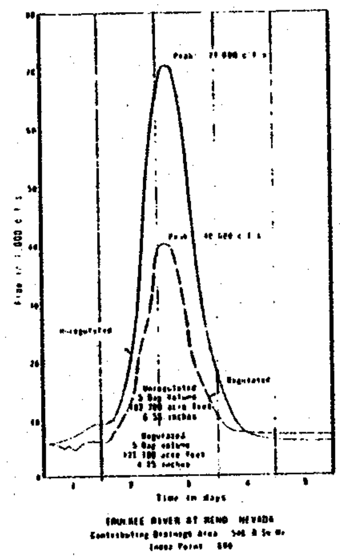
SNOW DEPTHS AND DENSITIES PRIOR TO STANDARD PROJECT STORM

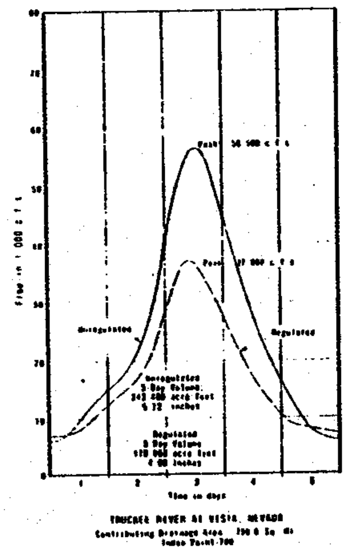
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

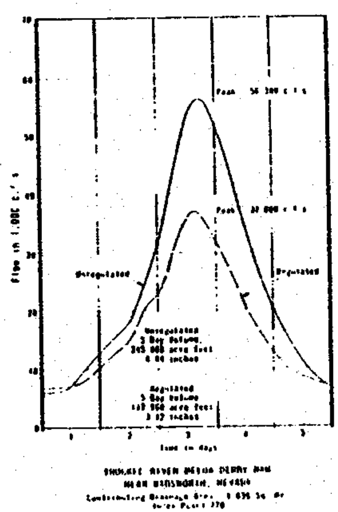
Prepared: R.C.K.
Drawn: J.R.
Date: NOVEMBER 1979

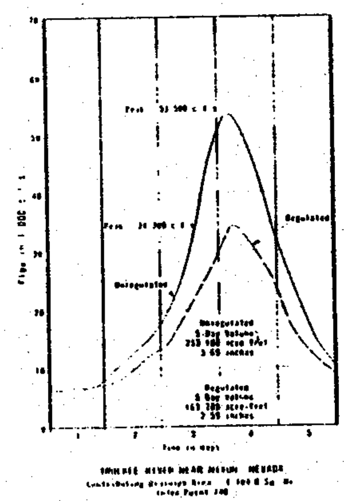
CHART 31











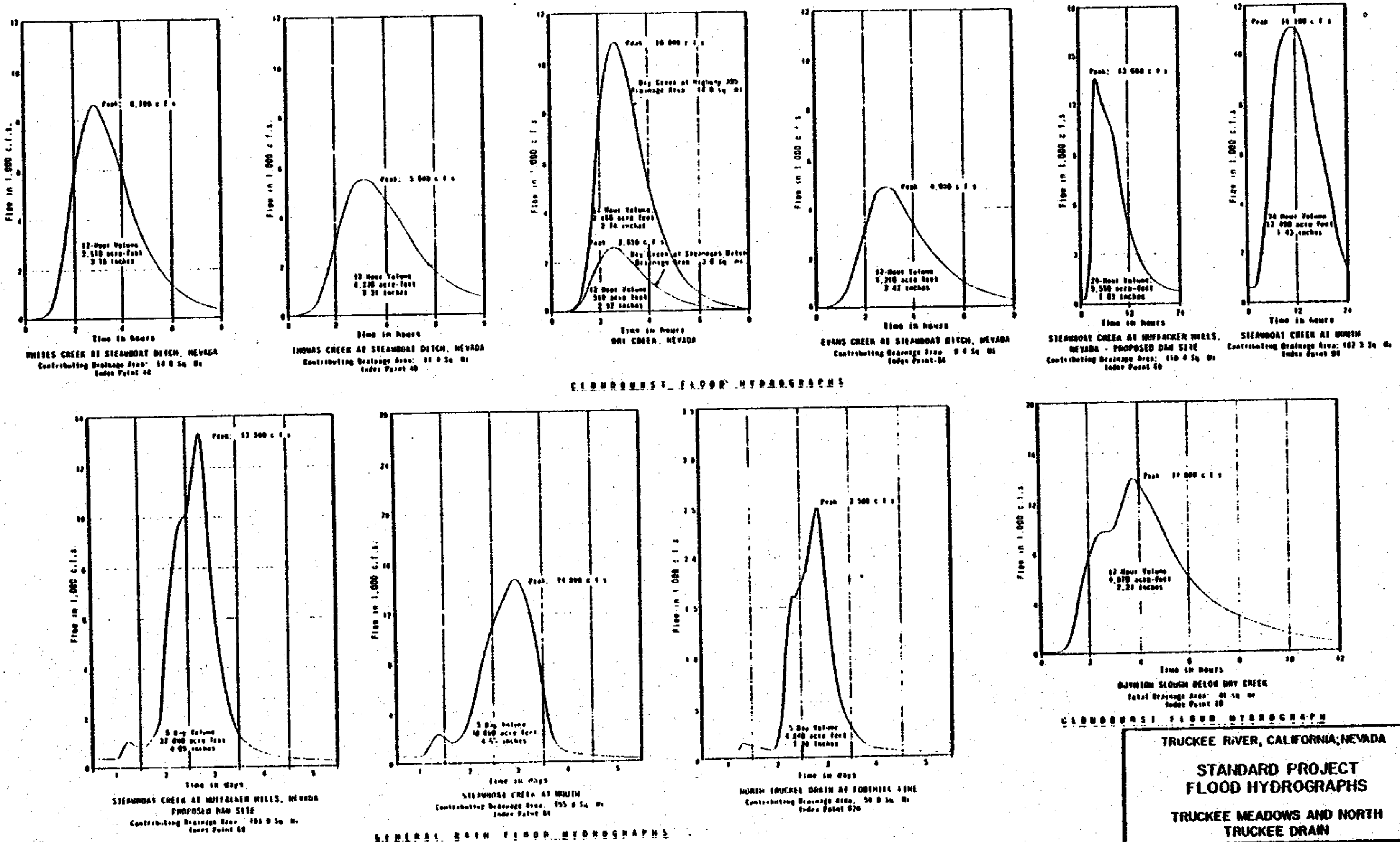
NOTES

1. Hydrographs and Peak Flows shown for Index Points 700, 720 and 740 are representative of future land use conditions-year [illegible]

2. Contributing drainage area does not include areas above Lake Tahoe and above Washoe Lake, non-contributing area in Spanish Springs Valley, and areas above 9000 elevation

TRUCKEE RIVER, CALIFORNIA;NEVADA
STANDARD PROJECT FLOOD HYDROGRAPHS
TRUCKEE RIVER
CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA
Prepared P.W. Drawn: C.A.P. Date. NOVEMBER 1979

CHART 32



TRUCKEE RIVER, CALIFORNIA;NEVADA

STANDARD PROJECT FLOOD HYDROGRAPHS

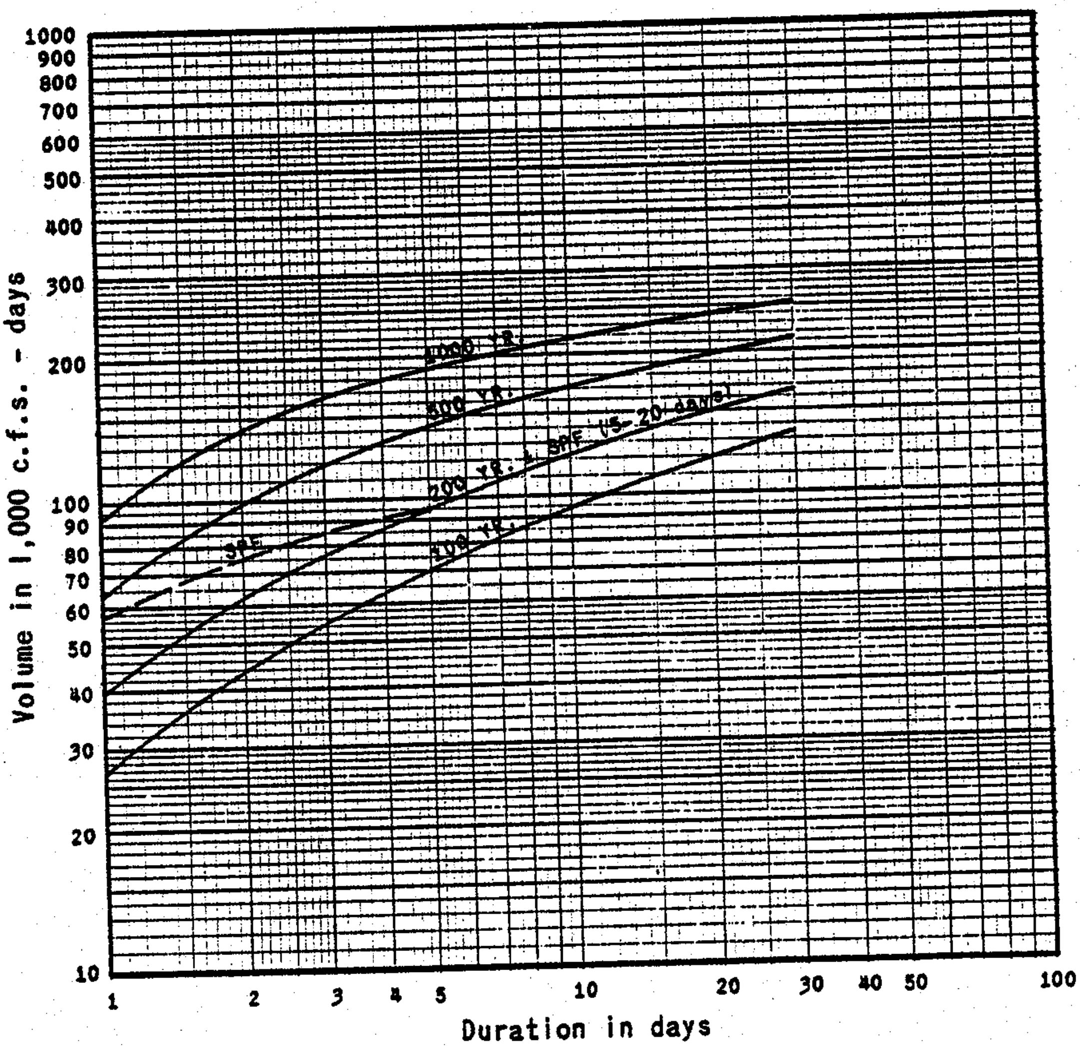
TRUCKEE MEADOWS AND NORTH TRUCKEE DRAIN

CORPS OF ENGINEERS SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: C.A.P.

Date: NOVEMBER 1979

CHART 33



TRUCKEE RIVER, CALIFORNIA; NEVADA

VOLUME-DURATION CURVES

TRUCKEE RIVER AT RENO

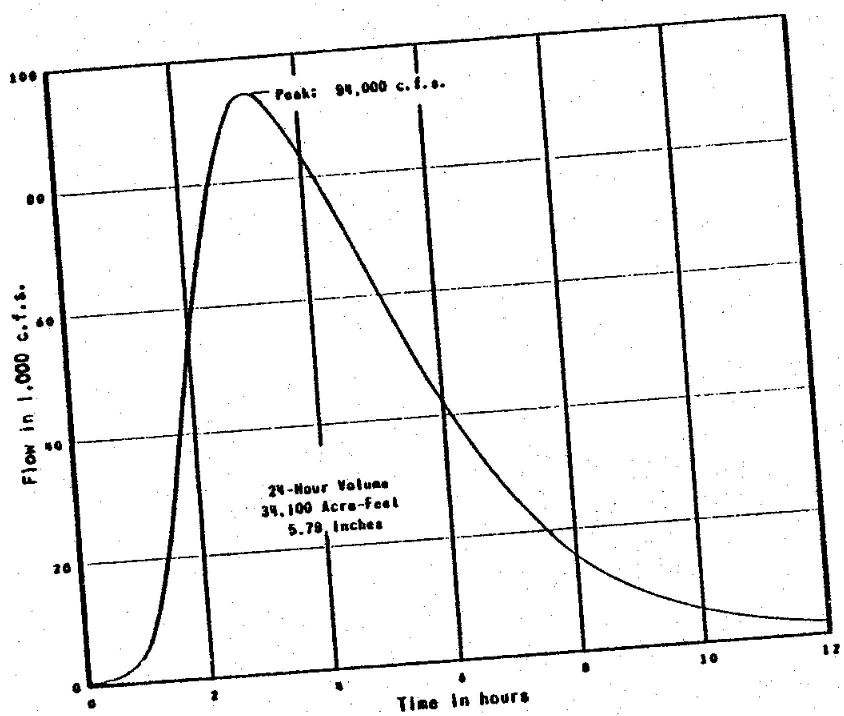
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: R.C.K.
Drawn: C.A.P.

Date: NOVEMBER 1979

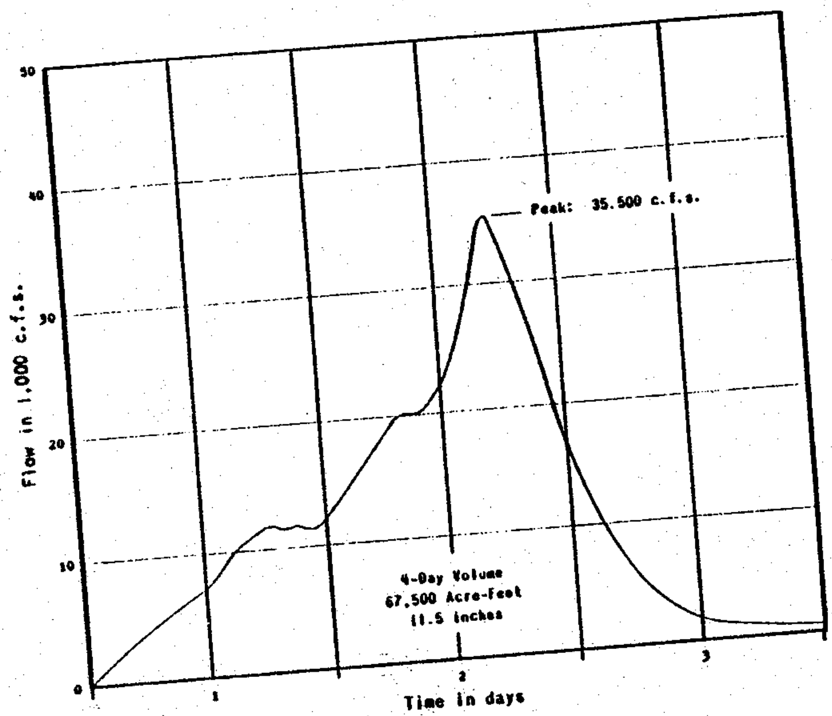
CHART 34

GPO 689-166/036



CLOUDBURST

Contributing Drainage Area: 110.4 sq.mi.



GENERAL RAIN

Contributing Drainage Area: 110.4 sq. mi.

Revised July 1980

TRUCKEE RIVER, CALIFORNIA; NEVADA	
PROBABLE MAXIMUM FLOOD HYDROGRAPHS Steamboat Creek at Proposed Huffaker Hills Dam Site (Index point 60)	
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA	
Prepared: P.W.	Date: NOVEMBER 1979
Drawn: C.A.P.	

CHART 35

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