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PROBABLE PEAK DISCHARGES AND EROSION RATES FROM SOUTHERN CALIFORNIA WATERSHEDS AS INFLUENCED BY FIRE

By P. B. Rowe, C. M. Countryman, and H. C. Storey

California Forest and Range Experiment Station

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California Forest and Range Experiment Station[1]

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Division Chief

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1/ Maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of California, Berkeley, California.

FOR PUBLICATION

ACKNOWLEDGMENT

The tables presented in this volume are the results of one phase of a fire damage appraisal study undertaken by the Forest Fire Research and the Forest Influences Divisions of the California Forest and Range Experiment Station in cooperation with the four southern California national forests. The project was sponsored and partially financed by the California Region of the Forest Service.

The major portion of the basic data used in the analysis leading to the results here presented were obtained from information published by, or made available through the courtesy of the U. S. Geological Survey, Los Angeles County Flood Control District, Los Angeles office of the U. S. Engineers, U. S. Weather Bureau, and many local agencies.

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INTRODUCTION

Damages from floods and erosion have been a serious problem in southern California since early pioneer days. The problem is becoming even more serious as the rapidly increasing population and expanding industrial and agricultural development encroach upon the flood plains and extend up the steep slopes and into canyons of the nearby mountains. Protection of forest vegetation from fire is an extremely important factor in maintaining damages at a minimum. The removal of the vegetative cover of the mountain watersheds by fire greatly increases the flood peaks and erosion rates with a consequent increase in flood and erosion damage. Estimates of the amount of damage, both actual and potential, caused by increased flood and erosion as a result of fires, therefore, are essential in checking the adequacy of present fire protection and in planning protection levels in keeping with the values involved.

This publication presents the results of one phase of a study seeking a uniform method of making such estimates for the national forests of southern California. The immediate objective of this phase of the study was to provide basic hydrologic information by (1) estab-

lishing reasonable estimates of the average frequency and size of flood events and erosion rates with watershed vegetation in normal condition, that is, fully recovered from past burns, and (2) determining the effect of burning the vegetation on those flood peaks and erosion rates.[2]/ Hydro-

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2/ The flood and erosion damages attributable to fire that were developed from this hydrologic information are given in the following publications of the California Forest and Range Experiment Station:

Fire Damage From Increased Run-off and Erosion, Angelus, Cleveland, San Bernardino, and Los Padres National Forests (in separate volumes), by Charles C. Buck, Wallace L. Fons, and Clive M. Countryman. 1948.

Average Fire Damage From Increased Run-off and Erosion on the Southern California National Forests, by Charles C. Buck, Wallace L. Fons, and Clive M. Countryman. 1948.

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logic data of this kind are critically needed for management of mountain watersheds in southern California. For this reason the results of this phase of the study are presented here, in advance of detailed discussion of the analysis, to make the data immediately available for those having need of such information.

The estimates of peak discharge[3]/ and erosion[4]/ are given for 256

3/ Peak discharge as used in this paper is the maximum instantaneous rate of transient flow (green stage) from given watersheds for individual storm events, expressed in cubic feet per second per square mile.

4/ Erosion rate, as used in this paper, is the volume of eroded material discharged from given watersheds expressed in cubic yards per square mile per year.

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watershed units with a combined area of approximately 6800 square miles. These watershed units embrace a major portion of the higher mountain drainages in a 20- to 80-mile wide strip extending along the coast from the Mexican border to watersheds a few miles north of San Luis Obispo.

Long dry summers and short winter rain seasons characterise the climate of the region. The mountain ranges, which lie across the path of the principal storms, are a major influence on the rainfall of the area. They lift and cool storm air masses moving inland from the ocean, an action often resulting in very intense precipitation. Rates of rainfall as high as 1.02 inches in one minute, and 26.20 inches in 24 hours have been recorded. Average annual precipitation varies widely over the area, ranging from 10 inches in the interior valleys to more than 38 inches in the higher mountain drainages.

Most of the drainages are small, generally fan shaped, with short, steep stream channels and precipitous side slopes. Such topographic characteristics are conducive to rapid concentration of run-off and when combined with intense rains are a primary cause of the high peak discharge and erosion rates of the region.

Brush, or chaparral, is the most extensive vegetative cover type of the region, occupying nearly 68% of the area. Open woodlands cover about 21% of the area and coniferous forests nearly 11%. Fires are usually less frequent and less severe in the woodland and coniferous forests than in the brush types. Severe or repeated turning in these types, however, often results in their replacement by brush.

GENERAL ANALYSIS PROCEDURE

The minimum study area used in making the estimates of peak discharge and erosion rates was a "watershed unit" (fig. 1). Each watershed unit was on upstream portion of a single stream or major tributary, or two or more similar small front drainages with separate discharge channels. The lower boundaries of the units were established by the specifications

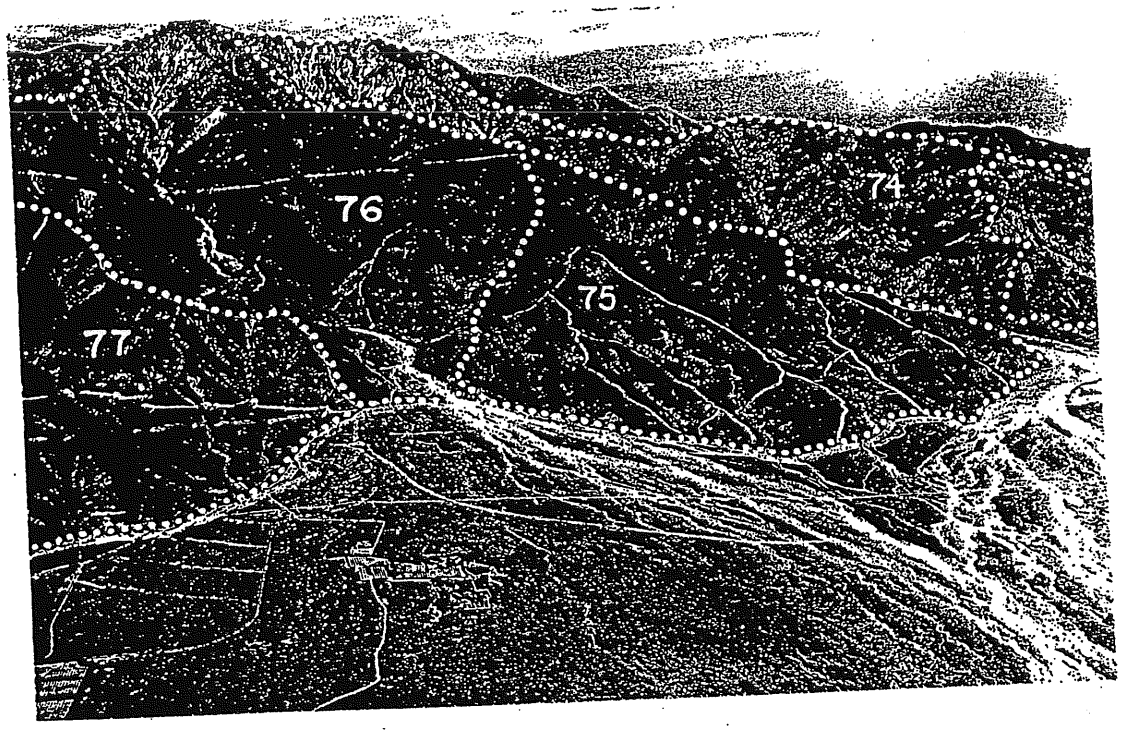
of the economic phase of the study, and generally followed the boundary between inflamable watershed cover and valley agricultural lands.

Figure 1.--Typical watershed unit delimitation. Units 74 and 76 illustrate watershed units having a single major stream. Units 75 and 77 are typical "front" units containing a group of similar, small drainages with separate drainage channels.

The units were grouped into five general "storm zones" (see Plate A), each zone consisting of a serious of adjacent watershed units which receive storms of approximately uniform characteristics and frequencies. The effect of fire on peak discharge was found by (1) establishing the relation between storm precipitation and peak discharge for a key watershed in each storm zone, (2) developing from this relation normal peak discharge frequencies for all watershed units in the zone, and then (3) determining the changes in normal peak discharge in the years following a fire. The effect on erosion was found by developing annual erosion rates for the normal discharge frequencies and determining the effect of fire on these rates.

DETERMINATION OF NORMAL PEAK DISCHARGE FREQUENCIES

A representative precipitation station having a 60 to 80 year record was selected as a key precipitation station for each storm zone. The number of storms of various sizes were then tabulated from the rainfall record of the station. The maximum recorded twenty-four hour precipitation of each storm was used to establish the size of the storm. From this tabulation a frequency curve was developed giving the average number of storm events per year by storm class for the storm zone.



CHG 2110

Figure 1.- Typical watershed unit delimitation. Units 74 and 76 illustrate watershed units having a single major stream. Units 75 and 77 are typical "front" units containing a group of similar, small drainages with separate drainage channels.

The relation between the size of storm events at the key station and those on a typical unburned key watershed was determined from Isohyetal maps and precipitation stations within the key watershed. Relations between the observed peak discharge on the key watershed and the 24-hour maximum watershed precipitation were then established. These relations were used to determine the number and size of discharge events during the period of record and to establish the peak discharge frequency curve. When necessary the observed peak discharge frequencies were adjusted to conform to those of the longer period represented by the key station storm frequencies. The peak discharge frequencies of other watersheds for which discharge measurements were available were computed by establishing the relation between observed discharges of each watershed and those of the key watershed in their storm zone.

Since discharge measurements were available for only a relatively few watersheds, the peak discharges derived form the observed data were used to establish a system of watershed ratings to aid in making estimates of peak discharge for units without discharge records. These ratings were an expression of the total effect upon peak discharge of the watershed factors of size, shape, steepness, stream channel characteristics, infiltration and water storage capacities of various soil-geologic formations, and precipitation and vegetation characteristics. These watershed ratings were expressed as ratios between normal peak discharges of the key watersheds and peak discharges of each of the other watersheds. After being thoroughly tested against observed data the ratings were used to compute the normal peak discharges of these watersheds for which data were inadequate or not available.

Determination of Effect of Fire on Peak Discharge

Determination of the effects of complete burning[5] of the water-

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5/ Complete, part, or partial burning as used in this paper refer to the proportion of a watershed area burned over by a fire and not to the intensity of the burning or to the degree to which the vegetation cover was consumed by the burning.

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shed vegetative cover on peak discharge were made in two ways: by comparing peak discharge rates of burned watersheds with those of similar but unburned watersheds[6] for the same storms, or by comparing peak

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6/ Unburned watersheds were considered as those watersheds in which the vegetation has sufficiently recovered from past fires (if any), so that the effect of the past fires on peak discharge and erosion could be considered negligible.

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discharge rates from similar storms on the same watershed before and after burning. From these ways a series of curves showing the average effects of complete burning on normal peak discharge by years after burn were developed for each storm zone.

The average-effect-of-burning curves were adjusted to conditions of individual watersheds by applying corrections for the variations in type and density of cover, and for differences in proportion of burnable area. Burnable areas include those that have a vegetation cover of such type and density that its removal by fire will cause appreciable increase in peak discharge and erosion rates. Non-burnable areas are of two types: first, those having insufficient vegetation cover to carry a fire, and second, those having an open cover which may burn under extreme fire conditions but which, if burned, would not result in appreciable increase in the peak discharge and erosion rates. The first includes agricultural and cleared lands, rock areas, and barren Alpine and desert slopes. The second are comprised principally of areas of Alpine and other open forest cover without brush understories, open desert chaparral and pinyon juniper types, and steep and rocky slopes with open chaparral and sage cover of less than 25 percent density. These so-called non-burnable areas are excluded in computing fire effects. Probable peak discharges of the individual watersheds by years after burning were computed from the normal peak discharge and the adjusted effect-of-burning curves.

For the majority of the watersheds the effect on peak discharge of burning part of the watershed was assumed to be directly proportional to the area burned. In some watersheds, however, such factors as size and shape of the watershed, length of stream channels, and differ-

ences of concentration time modified considerably the influence of partial burns. In such watersheds weighted reductions in the increase in peak discharges resulting from fire were made to compensate for the average influence of those factors.

In the San Bernardino storm zone[7]/ snowfall in some portions

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7/ Tables 37 to 96, inclusive.

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of the area has a decided effect on peak discharge. In general, the effect of snow is to decrease the storm peak discharge for a given amount of precipitation, thus increasing the proportion of smaller peak discharge. To allow for the effect of snow, watershed units in this zone were classified as to high, moderate, or low snow effect and a discharge-frequency curve was developed for each class. The class to which each unit of the San Bernardino storm zone was assigned is indicated on the peak discharge and erosion tables.

Determination of Annual Erosion Rates

Estimates of normal erosion were made principally from measurements of sedimentation in reservoirs. The sedimentation records, although generally short, were available for periods that usually included a wide variety of discharge occurrences. The volume of material deposited in reservoirs between measurements was prorated in amounts proportional to the carrying power of the individual peak discharges recorded during the period. The relation between the computed erosion rates and individual peak discharges was established for each watershed for which data were available. Curves representing the average relation between peak dis-

charge and erosion rates were then developed from these computations. These average curves were used to determine the normal annual erosion rates for each of the watershed units. Because the objective of the study was to determine the effects of fire only, adjustments in erosion rates were made for watersheds influenced by excessive grazing, road construction or established gullies.

Determination of the Effect of Fire on Annual Erosion Rates

Determination of the effects of complete burning on the average annual erosion rates of individual watersheds was made by comparing erosion rates of burned watersheds with those of similar unburned watersheds. The weighted average ratios between normal annual erosion rates and the annual erosion rates following burning were then computed. These ratios, corrected for variation in proportion of burnable areas, were used in computing probable erosion rates of the individual watersheds by years from time of burning until return to normal.

Effects of partial burning of a watershed on erosion rates were assumed to be directly proportional to the area burned.

USE OF THE PEAK DISCHARGE AND EROSION TABLES

The storm peak discharges and annual erosion that can be expected from a watershed in any one season depend on, among many other things, the number and frequency of the storms and the amount and intensity of the precipitations. Since there is no way of forecasting what the character and number of storms will be in a given period in the future, the estimates of peak discharge and annual erosion presented are simply averages, or the most probable rates expected over a long period of time. Number end rise

discharge events and amount of annual erosion for individual seasons will thus vary from those indicated in Tables 1-256, which are given at the end of this report.

What the Tables Show

Methods used in the economic analysis of flood and erosion damage dictated the form in which the flood peak discharge and erosion estimates appear. Normal (70th year after burn) peak discharges are given as the weighted means of relatively small discharge classes (see fig. 2). Frequency of storm events is shown as the average total number of events per year within the discharge class. For example, in the Santa Anita unit (table 134, duplicated here for easy reference) the first discharge class has an average of 16.628 storms per year with a weighted average peak discharge of 0.85 CFS/sq. mi. The second discharge class has an average of 1.579 storms per year with an average peak discharge of 7.10 CFS/sq. mi. The sum of the number-of-events-per-year column, 21.095 for Santa Anita, indicates the average total number of storms per year for the storm zone.

Figure 2--Normal peak discharge frequencies for Santa Anita Watershed, Los Angeles storm zone.

Frequencies of peak discharges of a site equaled or exceeded less frequently than once in one hundred years were not determined. Thus the figures shown in the last line of section A of the tables are not the mean of a discharge class as are the proceding data, but rather indicate the peak discharge that will be equaled or exceeded on the average once in one hundred years.

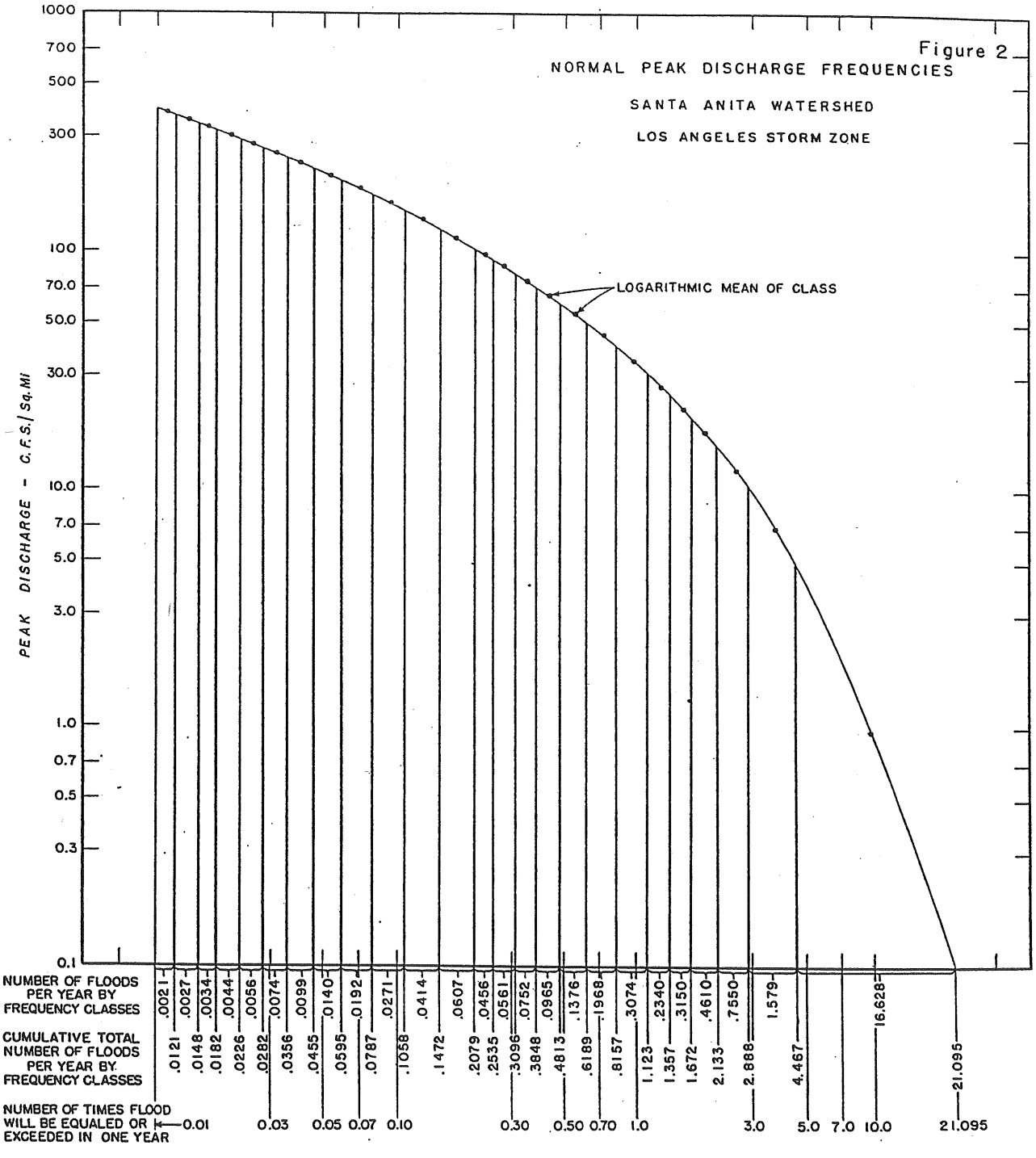
Figure 2.- Normal peak discharge frequencies for Santa Anita Watershed, Los Angeles storm zone.

Figure 2

NORMAL PEAK DISCHARGE FREQUENCIES

SANTA ANITA WATERSHED

LOS ANGELES STORM ZONE



The effect of fire is indicated by showing how the normal storm peak discharge is increased for various years after burning. Again using the Santa Anita unit (table 134) as an example, the normal discharge of the first discharge class for the unburned watershed is 0.85 CFS per square mile. The first year after a complete burn peak discharges of this class would be increased to an average of 28.9 CFS/sq. mi., the second year to 5.09 CFS/sq. mi, the third year to 2.80 CFS/sq. mi., etc.

Tables A and B give the necessary information for duplicating the peak discharge-frequency curves used in obtaining the values in the peak discharge tables. Peak discharges given for any year after burn may be plotted against the logarithmic mean number of events, shown in tables A and B, for the storm zone in which the watershed unit is located to develop the discharge-frequency curve for that year after burn (see fig. 2).

Erosion rates shown by the available data, on the average returned to approximately normal by 10 years after the fire. Thus in section B of the peak discharge and erosion tables, which shows average annual erosion rates by years after burning, the normal rate is that for the tenth year after burning.

Application of Tables to Individual Watersheds

Besides showing the average number and size of peak discharge events and the effect of fire on peak discharge, the tables have several other uses with direct application to the watersheds for which they were compiled.

Estimates of the effect of burning on individual peak discharges following a fire are often desired. If the storms following the complete burning of a watershed follow average trends, this may be done simply by comparing the peak discharges that occur with those of the same frequency

BASIC FLOOD FREQUENCY DATA

TABLE A

Precipitation Zone							
Santa Ysabel		San Juan		Los Angeles		Santa Maria	
Number of Events		Number of Events		Number of Events		Number of Events	
Total	Mean	Total	Mean	Total	Mean	Total	Mean
14.77	13.4	19.12	11.22	16.628	9.8000	20.54	6.80
3.33	7.27	1.87	3.510	1.579	3.6250	1.34	2.64
1.38	4.99	.78	2.350	.755	2.5050	0.57	1.82
1.63	3.38	.87	1.490	.461	1.9050	.705	1.13
.770	2.24	.368	.920	.315	1.5100	.342	.646
.450	1.64	.209	.635	.234	1.2300	.176	.400
.300	1.27	.129	.475	.3074	.9670	.101	.272
.222	1.015	.091	.365	.1968	.7180	.069	.188
.275	.766	.110	.266	.1376	.5500	.0728	.114
.181	.541	.063	.182	.0965	.4320	.0347	.0644
.114	.397	.0425	.128	.0752	.3490	.0183	.0392
.079	.299	.0265	.094	.0561	.2840	.0105	.0253
.058	.230	.0185	.072	.0456	.2340	.0066	.0171
.041	.180	.0135	.0557	.0607	.1760	.0041	.0119
.0325	.143	.0098	.0439	.0414	.1270	.0100	.0100
.0455	.103	.0130	.0323	.0271	.0922		
.0280	.0672	.0079	.0218	.0192	.0690		
.0178	.0443	.0049	.0155	.0140	.0525		
.0120	.0300	.0034	.0116	.0099	.0405		
.0074	.0203	.01	.01	.0074	.0319		
.0050	.0140			.0056	.0253		
.0018	.0108			.0044	.0204		
.01	.01			.0034	.0166		
				.0027	.0136		
				.0021	.0111		
				.0100	.0095		

BASIC FLOOD FREQUENCY DATA

TABLE B

San Bernardino Precipitation Zone					
High Snow Effect		Moderate Snow Effect		Low Snow Effect	
Number of Events		Number of Events		Number of Events	
Total	Mean	Total	Mean	Total	Mean
15.0	15.1	14.35500	14.90	13.71	16.20
5.50	7.36	4.96000	8.33	4.42	9.37
1.59	3.60	1.64500	4.81	1.70	5.95
1.42	2.08	1.65000	3.30	1.88	4.13
.537	1.175	.71850	1.99	.900	2.80
.279	.805	.40950	1.44	.540	2.10
.168	.580	.27150	1.09	.375	1.62
.112	.457	.19050	0.90	.269	1.34
.136	.328	.24400	0.68	.352	1.03
.076	.226	.15000	.487	.224	.740
.049	.165	.09950	.366	.150	.550
.032	.125	.07050	.280	.109	.428
.023	.0986	.05200	.218	.0810	.335
.0167	.0792	.03835	.174	.0600	.266
.0121	.0652	.03055	.140	.0490	.212
.0169	.0497	.04320	.102	.0695	.150
.0106	.0365	.02605	.0678	.0415	.099
.0075	.0277	.01735	.0467	.0272	.0648
.0051	.0215	.01125	.0327	.0174	.0430
.0035	.0173	.00720	.0235	.0109	.0296
.0028	.0140	.00535	.0172	.0079	.0198
.0021	.0118	.00365	.0128	.0052	.0137
.0007	.01034	.00105	.0106	.0014	.0107
.01		.01000	.01	.0100	.0100

under normal conditions of cover. For example, suppose the vegetative cover of the Santa Anita unit (table 134) were completely burned and a peak discharge of 335 CFS/sq. mi. were recorded the second season following the burn. If the storms preceding this discharge followed average trends, the peak discharge of the unit in an unburned condition would have been 180 CFS. Since there is no assurance that storms for any short period will follow average trends the frequency of discharge should be checked by comparing it with similar adjacent unburned watersheds. If the peak discharges all fall in about the same frequency class, 0.0192 in this case, than the 180 CFS/sq. mi. discharge for Santa Anita can be assumed to be reasonably accurate. However, if the peak discharges of the comparative units fall in a different frequency class, then the normal peak discharge of that same class for Santa Anita would be a better estimate of the normal peak discharge for this storm than would the discharge of the 0.0192 frequency class.

The tables can also be used to determine the peak discharge that will be equaled or exceeded at any given frequency. For example, one may wish to know for the Santa Anita watershed (table 134) what size discharge will be equaled or exceeded once in 10 years. The most precise method of obtaining this information would be to plot the peak discharges for normal watershed conditions, or desired year after burn, against the logarithmic means of the basic frequency classes given for the Los Angeles storm zone in table A. This will give the peak discharge-frequency curve (see fig. 2) The peak discharge equaled or exceeded once in ten years can then be read directly from this curve. An approximate value can be more quickly obtained from the peak discharge tables. For example, the total of the last eleven

items (0.0100, 0.0021, 0.0027, 0.0034, 0.0044, 0.0056, 0.0074, 0.0099, 0.0140, 0.0192, 0.0271) of the frequency column is 0.1058 storms per year, or slightly more than an average of one storm in ten years. This indicates that there would be a storm with a peak discharge that would exceed that of the .0414 frequency class (12th item from bottom of column) on an average of about once in ten years. The upper limit of this class is approximately midway between its mean peak discharge and that of the .0271 class. Thus the peak discharge that would be equaled or exceeded on an average of about once in ten years for normal watershed cover would be between 135 and 158 CFS/sq. mi. or approximately 147 CFS/sq. mi. If this storm were to occur the first year after burning the peak discharge equaled or exceeded would fall between 345 and 384 CFS/sq. mi. or would be approximately 365 CFS/sq. mi.

The same procedures used in determining the peak discharges that will be equaled or exceeded once in ten years can be used to determine those that will be equaled or exceeded in any desired period of less than 100 years.

Use of Tables in Computing Effects of Partial Burns

Only occasionally do fires completely burn off the vegetation of an entire watershed, but effects of partial burning can be estimated by use of the peak discharge tables. In making these estimates it is necessary to know not only the type of the watershed (runoff concentration characteristics) but also its burnable area. The percent of the watershed considered burnable and the watershed type (I. II, or III) are shown on the peak discharge and erosion tables.

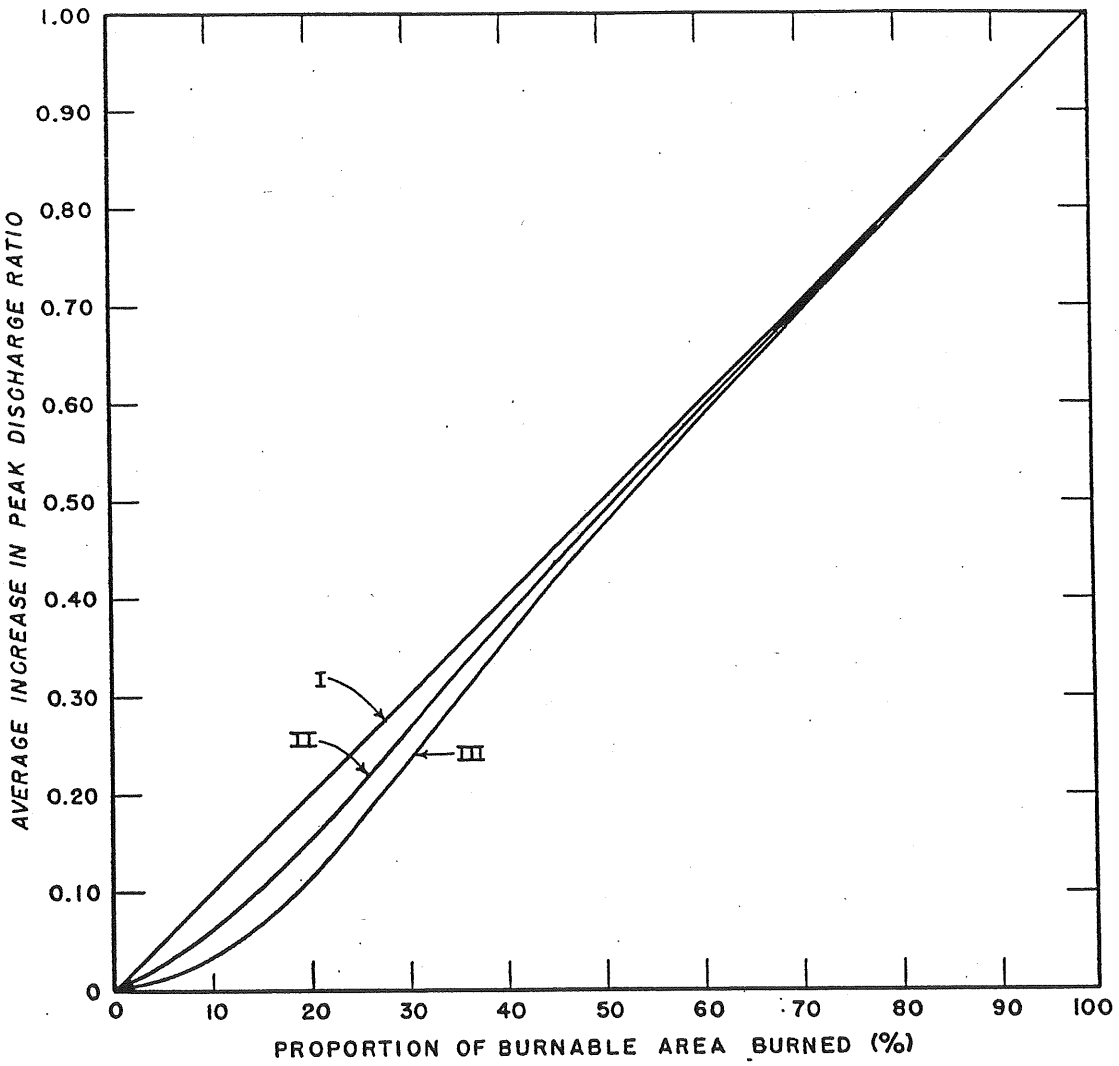
Type I watersheds are relatively small, steep, fan-shaped units conducive to rapid concentration of run-off. The effects of partial burns in this type were assumed to be directly proportional to the amount of burnable area burned (fig. 3). Type II watersheds are larger and have longer main stream channels with longer run-off concentration time. Type III watersheds are the largest units, with very long main stream channels, and quite long periods of concentration. The effects of partial burns in these two types are not directly proportional to the area burned, small burns having relatively less effect on increasing peak discharges than the large burns--as shown in Figure 3.

Figure 3--Relation between proporation of burnable area burned and average increase in peak discharge rating for three types of watershed.

The following steps are required to determine the effects of a partial burn on increasing peak discharge for any frequency class and year after burn:

1. Compute the percent of burnable area burned. This may be done by dividing the percentage of total area burned by the percent of the watershed that is burnable (as given at the top of the individual table), and multiplying by 100.
2. From the curves in Figure 3 determine the average increase in the peak discharge rates for the percent of burnable area burned (as obtained in step 1).
3. Subtract the normal (70th year after burn) peak discharge of the frequency class from the tabulated peak discharge for the year after burn for which the peak discharge is desired.

Figure 3.- Relation between proportion of burnable area burned and average increase in peak discharge ratio for three types of watersheds.


1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
AVERAGE INCREASE IN PEAK DISCHARGE RATIO
I
II
III
0
10
20
30
40
50
60
70
80
90
100
PROPORTION OF BURNABLE AREA BURNED (%)

This will give the amount of increase in peak discharge as the result of a complete burn.

4. Multiply the increase in peak discharge for complete burn (obtained in step 3) by the increase in peak discharge ratio (step 2). The result will be the increase in peak discharge from the partial burn.

5. Add the increase in peak discharge resulting from the partial burn (step 4) to the normal peak discharge for the frequency class to get the total peak discharge following the partial burn.

Following the above procedure for all frequency classes and years after burn, a peak discharge table for any partial burn can be computed. Such a table can be used in exactly the same ways as the peak discharge tables for complete burn given in this publication.

Annual erosion rates following partial burning of a watershed cover were assumed to be directly proportional to the burnable area burned. To complete the erosion rate following a partial burn the difference between the normal erosion rate and the erosion rate for the desired year after burn is multiplied by the percent of burnable area burned. This result added to the normal rate given the total annual erosion rate.

PEAK DISCHARGE AND EROSION TABLES

The following tables give the most probable average peak discharge and annual erosion rates for the watershed units studies. The tables are grouped by storm zones, with a map showing the locations of the units within

each zone preceding the group of tables for that zone. Except where noted below, the tables are numbered to correspond to the numbers of watershed units shown on the maps:

Storm zone	Watershed unit and table no.
Santa Ysabel	1 to 28
San Juan	29 to 36
San Bernardino[8]/	37 to 97

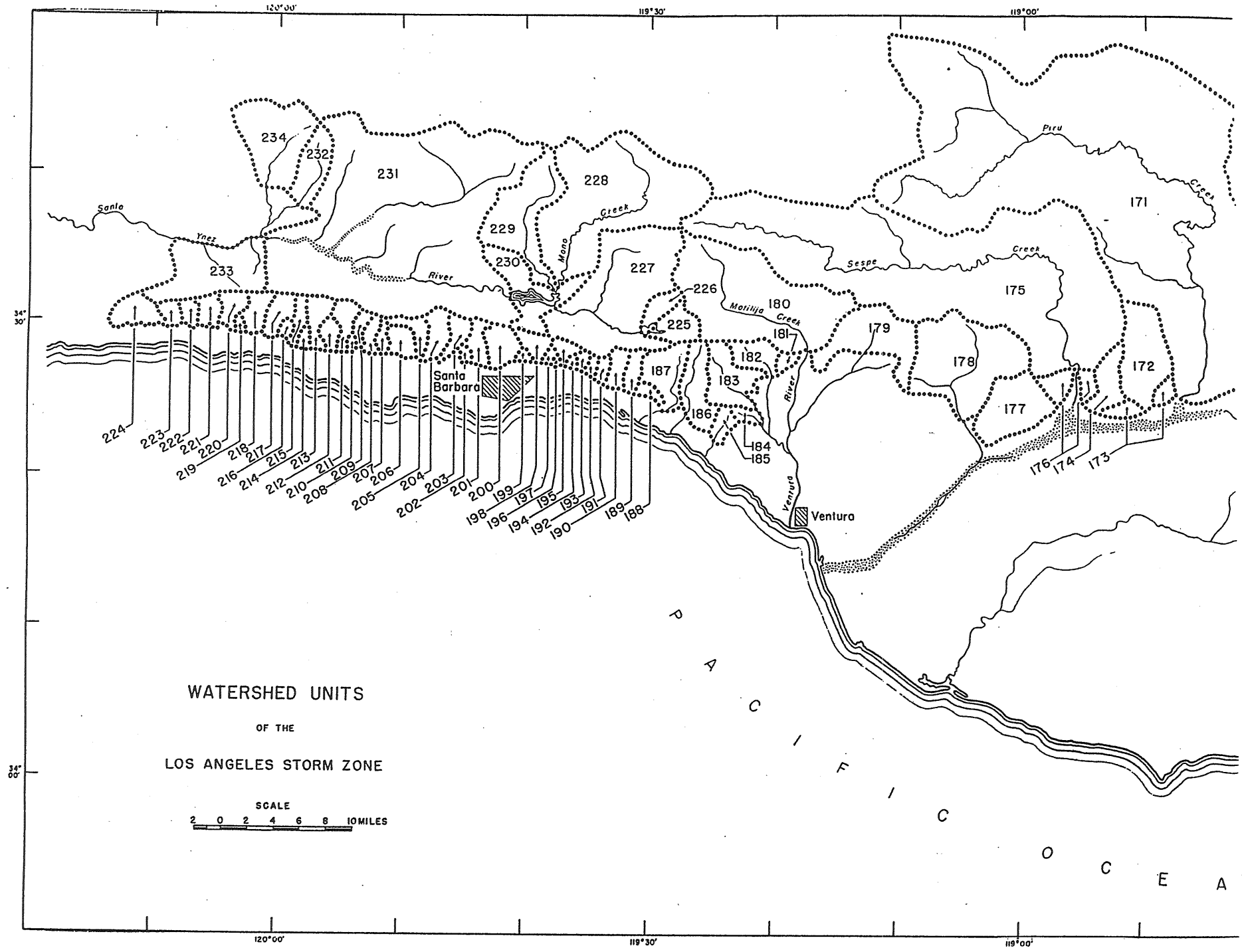
8/ Table 66 gives the most probable peak discharges and erosion rates for the combined area of watersheds 63, 64, and 65.

Table 96 gives the most probable peak discharges and erosion rates for the combined area of watershed units 92, 93, 94, and 95.

Los Angeles	98 to 235
Santa Maria[9]/	236 to 256

9/ Table 247 gives the most probable peak discharges and erosion rates for the Santa Maria River above latitude 34" 54' 8" and longitude 120" 18' 1".

Table 248 gives the most probable peak discharges and erosion rates for the Santa Maria River above Pugler's Point.


120°30'
119°30'
119°00'
34° 30'
34° 00'
234
232
231
228
229
230
227
226
225
233
Santa Ynez River
Mono Creek
Sespe Creek
Piru Creek
Matilija Creek
Santa Barbara
Ventura
Ventura River
171
175
180
181
179
178
172
182
183
187
186
184
185
177
176
174
173
224
223
222
221
220
219
218
217
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188
WATERSHED UNITS
OF THE
LOS ANGELES STORM ZONE
SCALE
2 0 2 4 6 8 10 MILES
PACIFIC OCEAN

VENTURA RIVER BASIN

Kennedy Canyon and Adjacent Streams

Table 181

Drainage area: 4.99 sq. mi. Precipitation (40-yr. mean annual): 23.4 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	17.2	3.13	1.77	1.01	0.75	0.62	0.61
1.579	40.1	17.7	11.8	7.32	5.82	5.00	4.85
.755	49.6	25.0	17.9	11.7	9.60	8.24	8.00
.461	58.4	32.0	23.6	16.0	13.3	11.6	11.2
.315	64.9	37.9	28.7	20.0	16.8	14.8	14.2
.234	72.2	44.0	34.1	24.2	20.4	18.3	17.4
.3074	80.7	51.9	41.2	29.7	25.4	22.8	21.7
.1968	92.3	62.3	50.9	37.8	32.5	29.2	27.8
.1376	105	73.7	60.7	46.0	40.1	36.4	34.3
.0965	117	83.6	70.2	53.6	47.5	43.0	40.6
.0752	129	94.2	80.1	62.2	55.1	49.9	47.1
.0561	140	104	89.2	70.0	61.9	56.6	53.4
.0456	153	115	98.8	78.5	69.5	63.5	59.9
.0607	172	131	113	91.3	81.4	74.4	70.2
.0414	193	150	131	107	95.4	88.0	83.0
.0271	215	172	150	125	112	103	97.0
.0192	240	192	171	142	128	118	111
.0140	260	211	187	157	143	131	124
.0099	283	230	206	175	159	148	138
.0074	304	251	225	192	175	163	152
.0056	327	271	244	209	189	178	166
.0044	349	290	263	227	205	193	180
.0034	371	310	279	244	221	208	194
.0027	391	331	297	262	237	223	208
.0021	419	354	320	282	255	240	224
.0100	431	366	333	291	266	249	233

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
56,510	19,660	12,550	9,070	6,430	4,720	3,210	2,000	1,890

1/ Estimates are average unit area peak discharges of two or more separate channels.

Santa Ana Creek

Table 182.

Drainage area: 8.95 sq. mi. Precipitation (40-yr. mean annual): 29.2 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	22.2	3.96	2.21	1.23	0.89	0.72	0.71
1.579	55.4	23.9	15.3	9.35	7.29	6.06	5.88
.755	72.0	35.5	25.0	15.6	12.5	10.6	10.2
.461	85.1	45.6	33.0	21.5	17.4	15.0	14.3
.315	95.7	54.5	40.5	27.2	22.3	19.3	18.4
.234	108	64.1	48.8	33.4	27.5	24.3	22.9
.3074	121	76.0	59.5	41.6	34.7	30.6	28.9
.1968	140	92.0	74.1	53.1	44.9	39.6	37.4
.1376	158	108	88.1	64.5	55.3	49.3	46.1
.0965	176	124	102	75.9	66.0	58.9	55.0
.0752	194	139	116	87.8	76.3	68.1	63.6
.0561	212	154	130	99.5	86.4	77.7	72.6
.0456	228	169	143	111	96.9	87.1	81.4
.0607	259	194	165	129	114	102	95.8
.0414	288	220	190	151	133	121	113
.0271	325	253	219	178	157	142	133
.0192	356	281	246	201	178	162	151
.0140	387	308	270	223	199	181	169
.0099	417	335	295	247	221	202	187
.0074	445	361	320	267	241	220	204
.0056	473	385	343	290	259	239	221
.0044	498	408	365	308	277	256	237
.0034	524	430	385	329	296	273	253
.0027	551	456	408	351	316	292	270
.0021	578	480	429	372	335	309	286
.0100	588	491	441	379	344	318	294

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
99,050	34,530	22,360	15,560	11,040	7,640	5,090	3,030	2,830

Coyote Creek

Table 183

Drainage area: 17.32 sq. mi. Precipitation (40-yr. mean annual): 27.1 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	15.8	2.82	1.57	0.88	0.63	0.51	0.50
1.579	51.3	22.1	14.5	8.65	6.75	5.60	5.44
.755	67.1	33.1	23.3	14.5	11.7	9.88	9.50
.461	80.9	43.4	31.4	20.4	16.6	14.3	13.6
.315	91.0	51.8	38.5	25.9	21.2	18.4	17.5
.234	103	61.0	46.4	31.8	26.2	23.1	21.8
.3074	115	71.8	56.2	39.3	32.8	28.9	27.3
.1968	131	86.6	69.7	50.0	42.2	37.3	35.2
.1376	149	102	82.9	60.8	52.1	46.4	43.4
.0965	166	117	96.3	71.5	62.2	55.4	51.8
.0752	182	130	109	82.5	71.8	64.0	59.8
.0561	199	145	122	93.6	81.3	73.1	68.3
.0456	217	160	136	105	91.7	82.5	77.1
.0607	245	184	156	123	108	97.3	90.9
.0414	275	211	181	145	127	116	108
.0271	305	238	206	168	148	134	125
.0192	335	264	231	189	168	152	142
.0140	364	289	254	210	188	170	159
.0094	390	313	276	231	206	189	175
.0074	419	340	301	252	227	207	192
.0056	445	362	322	272	243	225	208
.0044	470	385	345	291	262	242	224
.0034	497	408	365	312	281	259	240
.0027	524	434	388	334	301	278	257
.0021	553	460	411	356	321	296	274
.0100	566	473	424	365	331	306	283

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
91,000	31,720	20,540	14,300	10,140	7,020	4,680	2,780	2,600

1/ Estimates are average unit area peak discharges of two or more separate channels.

Willow Creek

Table 184

Drainage area: 1.92 sq. mi. Precipitation (40-yr. mean annual): 23.7 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.3	3.59	1.98	1.08	0.77	0.62	0.61
1.579	47.7	20.4	13.3	7.86	6.06	5.00	4.85
.755	58.4	28.6	20.0	12.5	9.92	8.32	8.00
.461	68.3	36.5	26.3	17.0	13.8	11.8	11.2
.315	75.7	42.9	31.8	21.2	17.3	14.9	14.2
.234	83.9	49.6	37.6	25.6	21.1	18.4	17.4
.3074	93.3	58.2	45.4	31.5	26.3	23.0	21.7
.1968	106	69.5	55.9	39.8	33.6	29.5	27.8
.1576	120	82.0	66.5	48.4	41.5	36.7	34.3
.0965	133	92.6	76.7	56.4	48.1	43.4	40.6
.0752	146	105	86.7	65.5	57.0	50.4	47.1
.0561	159	115	96.7	73.7	64.1	57.1	53.4
.0456	172	126	107	82.1	71.9	64.1	59.9
.0607	193	144	122	95.5	84.2	75.1	70.2
.0414	216	164	141	112	98.8	88.8	83.0
.0271	241	187	162	131	115	104	97.0
.0192	266	210	183	149	132	119	111
.0140	289	229	201	165	145	133	124
.0099	313	250	221	184	164	149	138
.0074	337	272	242	201	181	164	152
.0056	360	292	261	219	196	179	166
.0044	383	313	281	236	212	194	180
.0034	407	334	299	254	229	210	194
.0027	431	356	318	272	245	225	208
.0021	459	381	340	293	264	242	224
.0100	473	394	354	303	275	252	233

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
66,500	23,180	15,010	10,450	7,410	5,130	3,420	2,030	1,900

1/ Estimates are average unit area peak discharges of two or more separate channels.

Los Sauces Creek

Table 185.

Drainage area: 4.85 sq. mi. Precipitation (74-yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	17.6	3.17	1.75	1.00	0.74	0.60	0.59
1.579	43.0	18.5	12.5	7.62	5.99	5.10	4.95
.755	54.3	27.2	19.3	12.5	10.1	8.69	8.36
.461	64.4	35.2	25.7	17.1	14.2	12.4	11.8
.315	72.5	41.8	31.4	21.6	18.0	15.9	15.1
.234	81.1	48.9	37.6	26.4	21.9	19.5	18.6
.3074	91.3	58.0	45.9	32.8	27.6	24.6	23.4
.1968	104	69.8	56.9	41.5	35.5	31.6	30.1
.1376	118	82.1	67.3	50.3	43.7	39.2	37.0
.0965	132	93.7	78.3	59.0	51.9	46.6	44.0
.0752	146	106	88.7	68.3	60.2	54.1	51.0
.0561	159	116	99.0	77.0	67.7	61.4	57.9
.0456	173	129	110	86.7	76.3	69.1	65.2
.0607	194	147	126	101	89.4	81.0	76.4
.0414	216	167	146	118	104	95.4	90.0
.0271	242	191	167	138	122	111	105
.0192	268	214	188	156	139	127	120
.0140	291	233	206	173	155	142	134
.0089	314	255	226	192	173	159	149
.0074	339	279	249	210	190	175	164
.0056	363	299	268	229	206	192	179
.0044	388	320	289	246	223	208	194
.0034	412	341	307	265	240	224	209
.0027	436	364	328	286	258	241	225
.0021	465	392	351	307	278	259	242
.0100	476	401	361	314	286	266	249

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
66,360	23,100	15,120	10,500	7,560	5,460	3,570	2,230	2,100

PACIFIC SLOPE SANTA YNEZ MOUNTAINS

Rincon Creek

Table 186

Drainage area: 13.93 sq. mi. Precipitation (74-yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	22.7	4.04	2.24	1.24	0.89	0.72	0.71
1.579	52.2	22.4	14.7	8.74	6.77	5.62	5.46
.755	63.5	31.3	22.0	13.8	11.0	9.29	8.93
.461	73.8	39.6	28.6	18.6	15.1	13.0	12.4
.315	82.2	46.8	34.8	23.4	19.1	16.6	15.8
.234	91.4	54.3	41.3	28.3	23.3	20.6	19.4
.3074	102	63.6	49.9	34.8	29.0	25.7	24.2
.1968	115	75.8	61.0	43.7	37.0	32.6	30.8
.1576	130	88.8	72.2	52.9	45.4	40.4	37.8
.0965	143	100	83.0	61.5	53.5	47.7	44.6
.0752	158	113	94.1	71.3	62.0	55.3	51.7
.0561	172	125	105	80.6	70.0	62.9	58.8
.0456	186	137	116	89.6	78.4	70.5	65.9
.0607	209	157	133	105	92.2	82.9	77.5
.0414	232	177	153	122	107	97.3	90.9
.0271	259	201	175	142	125	113	106
.0192	286	225	197	161	143	129	121
.0140	311	248	218	180	160	146	136
.0099	339	272	240	201	179	164	152
.0074	362	294	261	217	196	179	166
.0056	385	313	279	236	211	194	180
.0044	412	337	302	255	229	212	196
.0034	437	359	321	274	247	228	211
.0027	463	384	343	295	266	245	227
.0021	491	408	364	316	284	262	243
.0100	502	419	376	324	294	271	251

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
	(Cubic yards per square mile)							
75,600	26,350	17,060	11,650	8,420	5,830	3,890	2,310	2,160

Carpenteria Creek

Table 187.

Drainage area: 13.25 sq. mi. Precipitation (74-yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	15.4	2.25	1.54	0.86	0.62	0.50	0.50
1.579	41.8	18.0	11.8	7.04	5.49	4.56	4.43
.755	54.1	26.7	18.7	11.8	9.40	7.95	7.64
.461	64.9	34.8	25.2	16.4	13.3	11.4	10.9
.315	73.1	41.6	30.8	20.7	16.9	14.7	14.0
.234	82.0	48.6	37.0	25.3	20.8	18.3	17.3
.3074	91.8	57.5	44.9	31.2	26.0	23.0	21.7
.1968	105	68.9	55.5	39.6	33.5	29.6	27.9
.1376	118	80.9	65.9	48.0	41.2	36.7	34.3
.0965	132	92.4	76.5	56.4	49.1	43.8	40.9
.0752	145	104	86.6	65.3	56.8	50.6	47.3
.0561	159	115	97.2	74.0	64.3	57.8	54.3
.0456	172	127	107	82.4	72.1	64.8	60.6
.0607	195	145	124	96.7	85.2	76.6	71.6
.0414	217	165	143	113	99.6	90.3	84.4
.0271	243	189	164	133	117	106	99.0
.0192	268	211	185	150	133	121	113
.0140	294	234	206	169	151	137	128
.0099	318	256	226	187	168	153	142
.0074	344	279	248	206	185	170	157
.0056	370	301	268	225	201	186	172
.0044	395	324	290	243	219	202	187
.0034	420	345	309	263	236	218	202
.0027	445	369	330	282	254	234	217
.0021	475	395	353	304	274	253	234
.0100	486	407	365	312	283	261	242

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
66,500	23,180	15,010	10,450	7,410	5,130	3,420	2,030	1,900

Franklin Canyon and Adjacent Streams — Table 188

Drainage area: 1.94 sq. mi. Precipitation (74-yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	19.6	3.45	1.89	1.03	0.73	0.58	0.51
1.579	47.6	20.4	13.3	7.86	6.06	5.00	4.85
.755	60.3	29.5	20.6	12.9	10.2	8.59	8.26
.461	72.0	38.5	27.7	17.9	14.5	12.4	11.8
.315	81.5	46.2	34.3	22.8	18.7	16.1	15.3
.234	90.6	53.6	40.6	27.6	22.7	19.9	18.8
.3074	102	64.8	49.7	34.5	28.8	25.2	23.8
.1968	116	75.2	61.3	43.6	36.9	32.3	30.5
.1576	131	83.6	72.8	52.5	45.4	40.1	37.9
.0965	145	102	83.9	61.7	53.7	47.5	44.4
.0752	159	114	94.2	71.2	62.0	54.8	51.2
.0561	175	126	106	80.9	70.3	62.7	58.6
.0456	189	139	117	90.1	79.0	70.4	65.8
.0607	213	156	135	105	92.8	82.7	77.3
.0414	237	181	155	123	109	97.6	91.2
.0271	265	207	173	144	127	114	107
.0192	293	231	204	163	149	131	122
.0140	327	250	220	181	162	146	136
.0099	345	275	243	202	181	164	153
.0074	369	297	264	219	198	179	166
.0056	393	319	284	239	214	195	181
.0044	417	341	306	257	231	212	196
.0034	443	363	325	276	249	228	211
.0027	470	385	347	297	268	245	227
.0021	498	413	369	318	287	262	243
.0100	520	434	382	326	296	271	251

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
74,200	25,860	16,750	11,660	8,270	5,720	3,820	2,270	2,120

1/ Estimates are average unit area peak discharges of two or more separate channels.

Santa Monica Canyon

Table 159

Drainage area: 4.07 sq. mi. Precipitation (7½ yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	17.6	3.15	1.75	0.98	0.71	0.57	0.56
1.579	43.8	19.0	12.5	7.46	5.84	4.89	4.75
.755	54.4	26.9	19.0	12.0	9.66	8.24	7.92
.461	65.0	35.0	25.5	16.7	13.7	11.9	11.3
.315	73.9	42.3	31.6	21.5	17.6	15.4	14.7
.234	83.0	49.7	37.9	26.2	21.7	19.3	18.2
.3074	94.0	59.1	46.7	32.8	27.5	24.5	23.1
.1968	108	71.5	57.8	41.7	35.5	31.6	29.8
.1376	123	84.6	68.8	50.8	43.8	39.4	35.8
.0965	136	96.1	80.0	59.4	52.0	46.8	43.7
.0752	150	108	90.6	68.8	60.2	54.1	50.6
.0561	165	121	102	79.0	68.6	62.2	58.1
.0456	180	133	113	88.3	77.2	70.0	65.4
.0607	203	152	130	103	90.9	82.4	77.0
.0414	227	174	150	121	106	97.4	91.0
.0271	255	199	173	142	125	114	107
.0192	284	225	197	162	144	132	123
.0140	307	245	216	179	160	147	137
.0089	334	269	239	200	179	165	153
.0074	358	292	260	218	197	181	168
.0056	382	313	280	238	212	198	183
.0044	408	335	301	255	230	214	198
.0034	434	357	321	276	248	231	214
.0027	462	383	344	298	268	249	231
.0021	489	408	366	319	287	267	247
.0100	498	417	376	325	295	274	254

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
69,600	24,240	15,680	10,870	7,730	5,430	3,550	2,230	2,090

M-1

Arroya Parida Table 190

Drainage area: 3.44 sq. mi. Precipitation (74-yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	19.0	3.36	1.85	1.01	0.72	0.58	0.57
1.579	47.7	20.4	13.3	7.86	6.06	5.00	4.85
.755	60.3	29.5	20.6	12.9	10.2	8.59	8.26
.461	72.0	38.5	27.7	17.9	14.5	12.4	11.8
.315	81.5	46.2	34.3	22.8	18.7	16.1	15.3
.234	90.6	53.6	40.6	27.6	22.7	19.9	18.8
.3074	102	63.8	49.7	34.5	28.8	25.2	23.8
.1968	116	76.2	61.3	43.6	36.9	32.3	30.5
.1576	131	89.6	72.8	52.9	45.4	40.1	37.5
.0965	145	102	83.9	61.7	53.7	47.5	44.4
.0752	159	114	94.2	71.2	62.0	54.8	51.2
.0561	175	126	106	80.9	70.3	62.7	58.6
.0456	189	139	117	90.1	79.0	70.4	65.8
.0607	213	158	135	105	92.8	82.7	77.3
.0414	237	181	155	123	109	97.6	91.2
.0271	265	207	179	144	127	114	107
.0192	293	231	201	163	145	131	122
.0140	317	250	220	181	162	146	136
.0099	345	275	243	202	181	164	152
.0074	369	297	264	219	198	179	166
.0056	393	319	284	239	214	195	181
.0044	417	341	306	257	231	212	196
.0034	443	363	325	276	249	228	211
.0027	470	388	347	297	268	245	227
.0021	498	413	369	318	287	262	243
.0100	510	424	382	326	296	271	251

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
74,200	25,860	16,750	11,660	8,270	5,720	3,820	2,270	2,120

Tore Canyon

Table 191.

Drainage area: 2.09 sq. mi. Precipitation (4 -yr. mean annual): 24.5 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.1	3.56	1.97	1.08	0.77	0.62	0.61
1.579	47.2	20.2	13.2	7.81	6.01	5.00	4.85
.755	57.9	28.4	19.9	12.4	9.84	8.32	8.00
.461	67.8	36.2	26.2	16.9	13.7	11.8	11.2
.315	75.0	42.6	31.5	21.2	17.2	14.9	14.2
.234	83.2	49.4	37.4	25.6	20.9	18.4	17.4
.3074	92.4	57.7	45.1	31.5	26.0	23.0	21.7
.1968	105	69.2	55.6	39.8	33.4	29.5	27.8
.1376	119	81.6	66.2	48.4	41.2	36.7	34.3
.0965	132	92.6	75.9	56.4	48.7	43.4	40.6
.0752	146	104	86.7	65.5	56.5	50.4	47.1
.0561	158	114	96.7	73.7	63.5	57.1	53.4
.0456	171	126	107	82.1	71.3	64.1	59.9
.0607	192	143	121	95.5	83.5	75.1	70.2
.0414	214	164	140	112	97.9	88.8	83.0
.0271	240	186	161	131	114	104	97.0
.0192	265	209	182	149	131	119	111
.0140	288	228	200	165	146	133	124
.0099	310	250	219	184	163	149	138
.0074	334	272	240	201	179	164	152
.0056	359	290	259	219	194	179	166
.0044	382	311	279	236	211	194	180
.0034	405	332	297	254	227	210	194
.0027	428	354	316	272	243	225	208
.0021	457	379	338	293	262	242	224
.0100	471	391	352	303	273	252	233

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
66,500	23,180	15,010	10,450	7,410	5,130	3,420	2,030	1,900

1/ Estimates are average unit area peak discharges of two or more separate channels.

Piney Canyon

Table 192.

Drainage area: 0.99 sq. mi. Precipitation (74-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.7	3.66	2.01	1.10	0.78	0.62	0.61
1.579	48.5	20.7	13.5	7.91	6.06	5.00	4.85
.755	59.4	29.0	20.2	12.6	9.92	8.32	8.00
.461	69.4	37.0	26.7	17.1	13.8	11.8	11.2
.315	76.8	43.5	32.1	21.3	17.3	14.9	14.2
.234	85.3	50.3	38.1	25.8	21.1	18.4	17.4
.3074	94.6	58.8	45.8	31.7	26.3	23.0	21.7
.1968	108	70.3	56.4	40.0	33.6	29.5	27.8
.1376	122	83.0	67.2	48.7	41.5	36.7	34.3
.0965	134	93.8	77.1	56.8	49.1	43.4	40.6
.0752	148	106	87.6	65.9	57.0	50.4	47.1
.0561	161	116	97.7	74.2	64.1	57.1	53.4
.0456	174	128	108	82.7	71.9	64.1	59.9
.0607	196	145	124	96.2	84.2	75.1	70.2
.0414	218	166	142	113	98.8	88.8	83.0
.0271	243	189	163	132	115	104	97.0
.0192	270	211	184	150	132	119	111
.0140	291	231	202	166	148	133	124
.0099	316	253	222	185	164	149	138
.0074	340	275	243	202	181	164	152
.0056	365	295	262	221	198	179	166
.0044	389	317	283	238	214	194	180
.0034	411	338	301	256	231	210	194
.0027	435	358	320	275	248	225	208
.0021	464	383	343	296	267	242	224
.0100	478	396	356	305	277	252	233

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
66,500	23,180	15,010	10,450	7,410	5,130	3,420	2,030	1,900

PACIFIC SLOPE SANTA YNEZ MOUNTAINS

Romero Canyon

Table 193.

Drainage area: 1.96 sq. mi. Precipitation (74-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.2	3.56	1.96	1.07	0.76	0.60	0.59
1.579	49.5	21.1	13.8	8.07	6.19	5.10	4.95
.755	62.0	30.3	21.2	13.1	10.4	8.69	8.36
.461	73.2	38.9	28.1	18.1	14.5	12.4	11.8
.315	81.7	46.2	34.1	22.6	18.4	15.9	15.1
.234	91.1	53.8	40.7	27.5	22.5	19.7	18.6
.3074	102	63.4	49.4	34.2	28.3	24.8	23.4
.1968	116	76.2	61.1	43.3	36.4	31.9	30.1
.1376	131	89.5	72.5	52.5	44.8	39.6	37.0
.0965	146	102	83.6	61.6	53.2	47.1	44.0
.0752	161	114	94.9	71.4	61.7	54.6	51.0
.0561	175	126	106	80.5	69.5	62.0	57.9
.0456	190	139	117	90.0	78.2	69.8	65.2
.0607	213	158	134	105	91.7	81.7	76.4
.0414	237	180	154	122	107	96.3	90.0
.0271	264	205	176	143	125	112	105
.0192	292	228	199	162	143	128	120
.0140	315	249	218	180	159	143	134
.0099	341	273	240	200	177	161	149
.0074	367	297	262	218	195	177	164
.0056	394	319	283	238	213	193	179
.0044	419	341	305	256	231	210	194
.0034	443	364	324	276	249	226	209
.0027	470	387	346	297	268	243	225
.0021	501	414	370	319	288	261	242
.0100	510	423	381	326	296	269	249

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
73.500	25.620	16.590	11.550	8.190	5.670	3.780	2.250	2.100

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West Romero Canyon

Table 194.

Drainage area: 1.09 sq. mi. Precipitation (74 yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.0	3.53	1.95	1.06	0.76	0.60	0.59
1.579	49.1	21.0	13.7	8.02	6.19	5.10	4.95
.755	61.5	30.1	21.1	13.0	10.4	8.69	8.36
.461	72.6	38.7	27.8	17.9	14.5	12.4	11.8
.315	81.1	45.9	34.0	22.6	18.4	15.9	15.1
.234	90.4	53.4	40.5	27.5	22.5	19.7	18.6
.3074	101	63.2	49.1	34.2	28.3	24.8	23.4
.1968	116	75.9	60.8	43.3	36.4	31.9	30.1
.1376	131	88.8	72.2	52.5	44.8	39.6	37.0
.0965	145	101	83.2	61.6	53.2	47.1	44.0
.0752	160	114	94.4	71.4	61.7	54.6	51.0
.0561	174	125	105	79.9	69.5	62.0	57.9
.0456	188	138	117	89.3	78.2	69.8	65.2
.0607	212	157	134	104	91.7	81.7	76.4
.0414	235	179	154	122	107	96.3	90.0
.0271	262	204	176	142	125	112	105
.0192	289	227	199	161	143	128	120
.0140	314	248	217	178	159	143	134
.0099	340	271	238	198	177	161	149
.0074	366	295	261	216	195	177	164
.0056	392	317	281	236	211	193	179
.0044	415	340	303	254	229	210	194
.0034	441	362	322	274	247	226	209
.0027	468	387	344	295	266	243	225
.0021	499	414	368	317	286	261	242
.0100	508	423	378	324	294	269	249

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
73,500	25,620	16,590	11,550	8,190	5,670	3,780	2,250	2,100

1/ Estimates are average unit area peak discharges of two or more separate channels.

San Ysidro Canyon

Table 195.

Drainage area: 3.14 sq. mi. Precipitation (74-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	19.6	3.45	1.89	1.03	0.73	0.58	0.57
1.579	53.1	22.4	14.4	8.20	6.21	5.00	4.85
.755	61.8	30.1	21.1	13.0	10.2	8.59	8.26
.461	73.8	39.2	28.2	18.1	14.5	12.4	11.8
.315	83.4	47.1	34.7	23.1	18.7	16.1	15.3
.234	92.7	54.7	41.4	28.0	22.7	19.9	18.8
.3074	104	65.0	50.5	35.0	28.8	25.2	23.8
.1968	119	77.8	62.2	44.2	36.9	32.3	30.5
.1376	134	91.1	73.5	53.2	45.4	40.1	37.5
.0965	148	103	84.8	62.2	53.7	47.5	44.4
.0752	162	115	95.7	71.7	62.0	54.8	51.2
.0561	178	128	108	81.5	70.3	62.7	58.6
.0456	193	141	119	90.8	79.0	70.4	65.8
.0607	216	161	136	106	92.8	82.7	77.3
.0414	241	183	157	124	109	97.6	91.2
.0271	271	209	181	146	127	114	107
.0192	298	233	204	165	145	131	122
.0140	322	254	223	182	162	146	136
.0099	350	280	245	204	181	164	152
.0074	374	302	266	221	198	179	166
.0056	398	322	286	241	214	195	181
.0044	425	345	308	259	231	212	196
.0034	449	367	327	279	249	228	211
.0027	477	393	350	295	268	245	227
.0021	505	418	372	316	287	262	243
.0100	517	429	384	329	296	271	251

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
74,200	25,860	16,750	11,660	8,270	5,720	3,820	2,270	2,120

PACIFIC SLOPE SANTA YNEZ MOUNTAINS

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Oak Creek

Table 196

Drainage area: 0.40 sq. mi. Precipitation (7-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.6	3.62	1.99	1.08	0.76	0.60	0.59
1.579	48.4	20.7	13.5	7.97	6.14	5.10	4.95
.755	60.5	29.7	20.8	13.0	10.3	8.69	8.36
.461	71.4	38.1	27.6	17.8	14.4	12.4	11.8
.315	79.7	45.3	33.5	22.5	18.3	15.9	15.1
.234	88.9	52.8	40.0	27.3	22.3	19.7	18.6
.3074	99.7	62.2	48.7	33.9	28.1	24.8	23.4
.1968	114	74.9	60.2	43.0	36.1	31.9	30.1
.1376	129	88.1	71.4	52.2	44.4	39.6	37.0
.0965	143	100	82.7	61.2	52.8	47.1	44.0
.0752	158	112	93.8	70.9	61.2	54.6	51.0
.0561	171	124	105	79.9	68.9	62.0	57.9
.0456	186	137	116	89.3	77.6	69.8	65.2
.0607	209	156	132	104	90.9	81.7	76.4
.0414	232	177	152	122	106	96.3	90.0
.0271	259	202	174	142	124	112	105
.0192	287	226	197	161	142	128	120
.0140	311	247	216	178	158	143	134
.0094	335	270	237	198	176	161	149
.0074	361	294	259	216	194	177	164
.0056	387	313	279	236	209	193	179
.0044	411	336	301	254	227	210	194
.0034	437	357	320	274	245	226	209
.0027	464	382	342	295	263	243	225
.0021	494	409	365	317	283	261	242
.0100	503	418	376	324	291	269	249

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
73,500	25,620	16,590	11,550	8,190	5,670	3,780	2,250	2,100

1/ Estimates are average unit area peak discharges of two or more separate channels.

Hot Springs Canyon Table 197

Drainage area: 0.78 sq. mi. Precipitation (74-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.0	3.53	1.95	1.06	0.76	0.60	0.59
1.579	49.1	21.0	13.7	8.02	6.19	5.10	4.95
.755	61.5	30.1	21.1	13.0	10.4	8.69	8.36
.461	72.6	38.7	27.8	17.9	14.5	12.4	11.8
.315	81.1	45.9	34.0	22.6	18.4	15.9	15.1
.234	90.4	53.4	40.5	27.5	22.5	19.7	18.6
.3074	101	63.2	49.1	34.2	28.3	24.8	23.4
.1968	116	75.9	60.8	43.3	36.4	31.9	30.1
.1376	131	88.8	72.2	52.5	44.8	39.3	37.0
.0965	145	101	83.2	61.6	53.2	47.1	44.0
.0752	160	114	94.4	71.4	61.7	54.6	51.0
.0561	174	125	105	79.9	69.5	62.0	57.9
.0456	188	138	117	89.3	78.2	69.8	65.2
.0607	212	157	134	104	91.7	81.7	76.4
.0414	235	179	154	122	107	96.3	90.0
.0271	262	204	176	142	125	112	105
.0192	289	227	199	161	143	128	120
.0140	314	248	217	178	159	143	134
.0099	340	271	238	198	177	161	149
.0074	366	295	261	216	195	177	164
.0056	392	317	281	236	211	193	179
.0044	415	340	303	254	229	210	194
.0034	441	362	322	274	247	226	209
.0027	468	387	344	295	266	243	225
.0021	499	414	368	317	286	261	242
.0100	508	423	378	324	294	269	249

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
73,150	25,500	16,510	11,500	8,150	5,640	3,760	2,240	2,090

Cold Springs Canyon

Table 195.

Drainage area: 3.84 sq. mi. Precipitation (74-yr. mean annual): 24.8 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	20.7	3.66	2.01	1.10	0.78	0.62	0.61
1.579	48.9	21.0	13.7	8.14	6.31	5.24	5.09
.755	60.7	29.8	21.0	13.1	10.5	8.86	8.52
.461	72.6	38.9	28.2	18.3	14.9	12.8	12.2
.315	81.6	46.5	34.5	23.2	19.0	16.5	15.7
.234	91.8	54.6	41.5	28.5	23.4	20.7	19.5
.3074	102	63.9	50.1	35.0	29.2	25.8	24.3
.1968	119	78.5	63.2	45.3	38.3	33.8	31.9
.1376	135	92.4	75.1	55.0	47.2	42.1	39.3
.0965	149	105	86.5	64.2	55.8	49.8	46.5
.0752	165	118	98.3	74.5	64.8	57.8	54.0
.0561	180	130	110	84.3	73.2	65.8	61.5
.0456	195	144	122	94.2	82.5	74.2	69.3
.0607	221	166	141	111	97.6	87.7	82.0
.0414	245	188	162	129	114	103	96.2
.0271	273	213	185	150	132	120	112
.0192	302	238	209	170	151	137	128
.0140	327	260	229	189	169	153	143
.0099	355	285	251	210	188	172	159
.0074	379	308	273	228	205	188	174
.0056	407	331	294	249	222	205	190
.0044	433	354	317	268	241	222	206
.0034	460	377	337	289	260	240	222
.0027	486	402	359	309	278	257	238
.0021	513	427	381	330	297	274	254
.0100	526	439	394	339	306	284	263

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
79,100	27,570	17,850	12,430	8,810	6,300	4,070	2,420	2,260

1/ Estimates are average unit area peak discharges of two or more separate channels.

Sycamore Canyon Table 199.

Drainage area: 1.41 sq. mi. Precipitation (7 yr. mean annual): 25.9 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	21.9	3.85	2.11	1.15	0.82	0.64	0.64
1.579	50.1	21.4	14.0	8.26	6.36	5.28	5.13
.755	62.8	30.8	21.6	13.4	10.7	9.02	8.67
.461	74.4	39.7	28.8	18.6	15.0	12.9	12.3
.315	84.0	47.7	35.3	23.7	19.2	16.7	15.9
.234	94.2	55.9	42.4	29.0	23.6	20.9	19.7
.3074	106	66.2	51.8	36.1	29.9	26.4	24.9
.1968	122	80.4	64.6	46.2	38.8	34.2	32.3
.1576	139	95.2	77.2	56.4	48.0	42.6	40.0
.0965	154	109	89.5	66.2	57.1	50.9	47.6
.0752	171	121	102	76.7	66.2	59.1	55.2
.0561	187	135	114	87.2	75.2	67.6	63.2
.0456	204	150	127	97.7	84.8	76.3	71.3
.0607	231	173	146	115	101	90.5	84.6
.0414	261	199	171	136	119	108	101
.0271	291	227	196	159	139	126	118
.0192	323	254	221	181	159	144	135
.0140	355	282	246	203	181	164	153
.0094	382	308	270	226	201	184	170
.0074	411	335	295	247	221	202	187
.0056	438	355	317	268	238	219	203
.0044	466	381	341	288	257	238	220
.0034	493	404	361	309	276	255	236
.0027	521	430	385	331	296	273	253
.0021	551	456	408	354	316	292	270
.0100	562	467	420	361	325	300	278

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
83,300	29,040	18,600	13,090	9,280	6,430	4,280	2,550	2,380

1/ Estimates are average unit area peak discharges of two or more separate channels.

Mission Canyon

Table 200.

Drainage area: 6.27 sq. mi. Precipitation (74-yr. mean annual): 25.9 in.

A. Peak Discharge Rates Following Burning

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	18.7	3.36	1.87	1.05	0.76	0.62	0.61
1.579	45.5	19.7	13.1	7.89	6.21	5.24	5.09
.755	56.8	28.3	20.0	12.8	10.3	8.86	8.52
.461	68.3	37.0	27.1	17.8	14.6	12.8	12.2
.315	77.1	44.3	33.3	22.8	18.8	16.5	15.7
.234	86.8	52.1	40.0	27.9	23.2	20.7	19.5
.3074	96.7	61.2	48.4	34.3	28.9	25.8	24.3
.1968	113	75.3	60.9	44.3	38.0	33.8	31.9
.1376	128	88.8	72.7	53.8	46.8	42.1	39.3
.0965	142	100	83.7	62.8	55.3	49.8	46.5
.0752	157	113	95.0	72.9	64.3	57.8	54.0
.0561	172	125	106	82.4	72.6	65.8	61.5
.0456	186	139	119	92.2	81.8	74.2	69.3
.0607	212	160	137	109	96.8	87.7	82.0
.0414	235	181	157	127	113	103	96.2
.0271	262	206	179	148	131	120	112
.0192	289	230	204	168	150	137	128
.0140	315	252	223	186	167	153	143
.0099	340	275	245	207	186	170	159
.0074	365	299	266	224	204	186	174
.0056	391	321	287	245	220	203	190
.0044	416	344	309	264	239	220	206
.0034	444	366	329	284	258	238	222
.0027	469	390	350	305	276	255	238
.0021	495	414	373	325	295	272	254
.0100	508	426	387	334	305	281	263

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
(Cubic yards per square mile)								
71,640	24,860	16,270	11,300	8,140	5,880	3,840	2,400	2,260

M-1

San Rogue Canyon

Table 201

Drainage area: 5.63 sq. mi. Precipitation (7-yr. mean annual): 25.9 in.

A. Peak Discharge Rates Following Burning 1/

Number of events per year	Years after burning: 1	2	3	7	15	30	70 (Normal)
	(Cubic feet per second per square mile)						
16.628	16.9	3.08	1.74	1.01	0.75	0.62	0.61
1.579	41.5	18.3	12.3	7.64	6.11	5.19	5.09
.755	52.1	26.3	18.9	12.4	10.1	8.78	8.52
.461	62.8	34.6	25.6	17.3	14.4	12.7	12.2
.315	71.0	41.4	31.6	22.0	18.5	16.3	15.7
.234	80.3	48.9	38.0	27.1	22.8	20.5	19.5
.3074	89.7	57.6	45.9	33.3	28.4	25.5	24.3
.1968	105	71.1	58.1	43.1	37.3	33.5	31.9
.1376	119	83.7	69.2	52.7	46.0	41.7	39.3
.0965	133	95.3	80.0	61.4	54.4	49.3	46.5
.0752	147	107	91.3	71.3	63.2	57.2	54.0
.0561	161	119	102	80.6	71.3	65.2	61.5
.0456	175	132	114	90.1	80.4	73.5	69.3
.0607	199	153	131	106	95.1	86.9	82.0
.0414	221	173	151	124	111	102	96.2
.0271	248	197	174	144	129	119	112
.0192	274	220	196	164	147	136	128
.0140	297	242	214	182	164	152	143
.0099	323	264	237	202	183	170	159
.0074	346	287	258	219	200	186	174
.0056	372	308	277	239	217	203	190
.0044	396	330	299	258	235	220	206
.0034	422	353	320	278	253	238	222
.0027	450	376	340	298	271	255	238
.0021	472	399	361	318	290	272	254
.0100	454	410	373	326	300	281	263

B. Annual Erosion Rates Following Burning

Years after burning: 1	2	3	4	5	6	7	8	10 (Normal)
			(Cubic yards per square mile)					
67,570	23,730	15,370	10,850	7,680	5650	3,840	2,400	2,260

1/ Estimates are average unit area peak discharges of two or more separate channels.