SAFE YIELD - MATILIJA RESERVOIR

Report to

Board of Supervisors

Ventura County Flood Control District

Russel C. Cook, Chairman
Richard Bard
S. D. Butts
Robert W. Lefever
L. A. Price

Robert L. Ryan, Engineer

May, 1948

Harold Conkling

SAFE YIELD - MATILIJA RESERVOIR

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Member
AM. SOC. OF CIVIL ENGINEERS
AM. GEOPHYSICAL UNION
AM. WATER WORKS ASS'N

HAROLD CONKLING
CONSULTING ENGINEER
108 WEST SIXTH STREET
LOS ANGELES 14, CALIFORNIA

May 3, 1948

Honorable Board of Supervisors
Ventura County
Ventura, California

Gentlemen:

Herewith is report entitled "Safe Yield - Matilija Reservoir", as authorized by resolutions of your Board dated December 29, 1947 and April 9, 1948.

Yours truly

Harold Conkling

ACKNOWLEDGMENTS

The cooperation of others has been of great benefit to this report.

R. H. Jamison, Water Surveyor for the County in the office of Robert L. Ryan Engineer, Ventura County Flood Control District, aided in much of the laborious work involved in such a report.

California Forest and Range Experiment Station, U. S. Forest Service, in both the Berkeley and Glendora offices have, in advance of publication by that agency, made available the results of their considerable investigation into the probable erosion from Matilija Creek watershed.

Mr. Hugh M. Wood, Water Superintendent of the City of Ventura, has made available all records of water production and delivery of the City of Ventura and also reports dated 1941 and 1944 by Taylor and Taylor, Consulting Engineers for the City. These have been studied with interest.

TABLE OF EQUIVALENTS

1 acre foot = water required to cover 1 acre 1 foot in depth = 43,560 cubic feet = 325,851 gallons.

1 second foot = 1 cubic foot per second = 1 cubic foot of water passing a given point each second.

1 second foot = 448.83 gallons per minute.

1 second foot flowing for 24 hours = 1.9835 acre feet.

1 second foot flowing for 24 hours = 646,317 gallons.

1 second foot flowing for 1 year (365 days) = 723.97 acre feet.

1 second foot = 50 miner's inches (So. California).

1 acre foot = 605 miner's inch hours = 25.2083 miner's inch days.

1 acre foot per day = 226.29 gallons per minute, average rate of flow

1 cubic foot = 7.4805 gallons

Approximate

1 second foot flowing for 24 hours = 2 acre feet.

3 acre feet = 1,000,000 gallons.

DEFINITIONS

Water Year 1945-46 = year beginning October 1, 1945 and ending September 30, 1946.

Precipitation year 1943-44 = year beginning July 1, 1945 and ending June 30, 1944.

SAFE YIELD - MATILIJA RESERVOIR

Summary - Conclusions - Recommendations

This estimate of safe yield of Matilija Reservoir is based on numerous studies to determine what part of the water reaching the reservoir could be beneficially used by prior rights below, down to and including that of the City of Ventura to divert the water of Ventura River at Casitas Dam.

Because of these prior rights, not all the water which flows through Matilija Reservoir can be retained in it; only that part can be retained which would otherwise go on down river, pass Casitas Dam, and then waste to the ocean.

If 7000 acre feet of usable capacity at Matilija had first been fully occupied by water, and if no reduction in capacity had occurred due to deposition of silt, safe yield during the past 80 years would have been 1800 acre feet. It is believed that an adjudication of the rights, either by agreement or through court action, would result in negligible variation from the foregoing. In effect, this study has necessarily been an anticipation of the results of an adjudication.

The safe yield as estimated above is much lower than that of the previous estimates which have been given

publicity. To show the reason for this, studies have also been made for this report based on the same assumptions as to prior rights used in the reports in question.

Comparison with the Donald R. Warren Co. report entitled "Ventura County Flood Control District, Zone One, Flood Control and Conservation", 1945, pp.113-122.

The Warren analysis does not give the safe yield of the reservoir. Instead, it gives the safe yield of the stream during a 4-year drought, if regulated by a 7000 acre foot reservoir. This is a very different matter.

Safe yield of the stream in the Warren estimate is 4000 acre feet. This corresponds to 4500 acre feet safe yield in a 4-year drought found in this study for the reservoir, if there were no prior rights below.

However, from the stream alone, flowing in its natural regimen without a reservoir, an annual average of 2600 acre feet of water from above Matilija Reservoir could be diverted for beneficial use by prior rights below the reservoir during the 4-year period of the Warren analysis. The reservoir does not add to or subtract from this. Therefore, the safe yield of the reservoir in the case of the Warren estimate would be the difference between 4000 and 2600, which is 1400 acre feet. This figure is comparable to the 1800 acre feet safe yield of this report.

Comparison with Memorandum No. 18 from R. H. Jamison to Robert L. Ryan, Flood Control Engineer, entitled "Probable Safe Yield of Matilija and Casitas Reservoirs".

This estimate takes into consideration the demand by prior gravity rights immediately below Matilija Reservoir and states "there are other water rights farther down the river that may have to be considered later but they are beyond the scope of this memorandum". These are the pumping rights and the right of the City of Ventura considered in the present report.

Jamison estimate of safe yield (if reservoir completely emptied)	2900 ac.ft.
Incidental studies made for this report on same general basis as Jamison's	3000 ac.ft.

While the estimated safe yield is given as 1800 acre feet over the past 80 years, in a preceding paragraph, in order to give a figure comparable to previously published estimates; at no time will it be exactly that. From estimates of probable deposition of sediment its quantity is such that the reservoir would be filled with sediment twice over during the 80 years. The safe yield from the mass of sediment filling the reservoir would be the small amount which could be drained or pumped out.

Based on the conclusions of the U.S. Forest Service, if the runoff and the area burned on the watershed

are average, and if nothing is done to prevent the eroded material from reaching the reservoir, its remaining useful capacity by 1958 will be decreased to about 5200 acre feet and the safe yield to less than 1500 acre feet.

Based on the same data from the Forest Service, by the time of the next long dry period, which may occur 20 to 25 years from now, the capacity will be decreased to about 3400 - 2500 acre feet and the safe yield will be decreased to about 1200 - 1000 acre feet.

Even if fires in the watershed could be completely prevented, the Forest Service estimates that deposition would be sufficient to completely fill the reservoir in 80 years and perhaps less.

COMMENT

1. Silt might be kept from reaching the reservoir for a time by adequate check dams but this would be more costly than is usually anticipated and it might give only negligible results.

2. Capacity of a reservoir and its safe yield can be restored by increasing the height of the dam sufficiently. Although it might be costly this would impose no great difficulties in the case of an earth or rockfill dam, especially if the matter has been given consideration in the original design. Any considerable raise in the height of

a thin arch dam would also be costly, but more important, it would pose such difficult technical and operational problems that it might not be possible at Matilija.

3. In other than long drought periods which have comprised 22, or 28%, out of the 80 years considered in this report, there has been a large surplus in Ventura River. It might be possible to sell some of this water regulated by the reservoir. To do so, however, might reduce the safe yield because it could never be known when the last year of surplus was occurring.

4. Diversion of this surplus to the debris cones northeast of Ojai is one possibility. Although this possibility dose not promise much benefit, it should be explored. However, as noted in Item 3, safe yield might be decreased if it were done.

RECOMMENDATIONS

1. It is recommended that the foregoing four possibilities be explored as opportunity offers.

2. It is recommended that an adjudication of the water rights of Ventura River and tributaries under the statutory procedure of the State Water Code, be initiated as soon as possible so that a Water Master may be appointed to control releases from Matilija Reservoir.

- - - -

Percolation of Ventura River into its streambed is the measure of the entire claim of overlying lands below Matilija to water from above Matilija and the major part of the claim of the City of Ventura. The percolation measured by the State Division of Water Resources, 1928-1932 (before the floods in the latter year) is used as the basis of the findings of this report. No applicable measurements have since been made. Should they be made in the future and give different values, calculation would result in a different safe yield than found in this report. This, however, is only one element in the problem and it does not appear probable that there would be sufficient difference to make a substantial change in computed safe yield.

SECTION 1

Fundamentals of Study of Safe Yield of Matilija Reservoir

For irrigation of general annual farm crops, "safe yield" of a reservoir is often defined as the yield which can be sustained except for occasional deficiencies of about 20%.

For domestic use and for high-class perennials which are the major agricultural crops of Southern California, "safe yield" of a reservoir means the amount of water which can be provided by it in the year of most deficient runoff within the knowledge of man.

Safe yield is not determined only by the amount of discharge physically available at the reservoir site. Legal availability must also be given consideration. In other words, if other entities below the reservoir site have prior rights, none of the water passing the reservoir site, which is needed by those who have the rights, can be impounded in the reservoir. It cannot be considered in the estimate of safe yield. As used in this report, the term "safe yield" means the amount of water which the reservoir can furnish from that which otherwise would waste into the ocean.

A study of precipitation and streamflow records

in the coastal side of Santa Barbara, Ventura and Los Angeles counties shows that the storms are general over the whole region and that the same cyclic character has prevailed during the period of record. Pages 7 and 8 show graphically the annual departures above and below average of principal precipitation records and principal streamflow records in the three counties. The similarity of all is striking.

Precipitation records have been kept since 1868, or for more than 80 years, at Santa Barbara which is less than 20 miles as the crow flies from the most distant portion of the watershed above Matilija Reservoir and about 11 miles from the nearest portion. Precipitation at Santa Barbara has essentially the same variations as that on the watershed, judging by precipitation and runoff records. Therefore, it is concluded that the Santa Barbara record will give information as to the most drastic periods of shortage. It is not the single years of deficient precipitation which have disastrous effect on runoff, because the ground water storage in the mountains drains out into and sustains the stream in such years. It is the long periods of extremely deficient precipitation which occur in the dry phase of the weather cycle that cause trouble.

From records of precipitation at Santa Barbara, the critical periods in water supply appear to have been as follows:

Table 1

Major Periods of Deficient Precipitation

Period	Prec. year	No. of Years	Deficiency in % of Avg. An. precipitation during period	
			Total	Avg. Ann.
1	1868-69 1873-74	6	174	29
2	1880-81 1882-83	3	56	19
3	1893-94 1895-96	3	91	30
4	1897-98 1901-02	5	161	34
5	1922-23 1924-25	3	96	32
6	1927-28 1930-31	4	79	26
7	1944-45 1947-48	4	139	35

However, precipitation records are only indicative; they are not conclusive. Without considering other information, it might be concluded from the foregoing that Period 7 would have the least stream discharge but actual records of Santa Ynez River above Gibraltar Reservoir and of San Gabriel River at its canyon mouth show that both Periods 5 and 6 gave much less runoff. Records of San Gabriel River show that Periods 3 and 4 also had much less runoff. The records of no other stream in the three counties go so far back as that of San Gabriel which itself began after Period 2.

It is concluded that the runoff of the five years 1897-98 through 1901-02 (Period 4) was more deficient than that of any other period of consecutive years of the 80-year record, and that the safe yield of those 5 years should be considered the safe yield of Matilija Reservoir.

It should be noted that this study is made to determine the safe yield of Matilija Reservoir, i.e., the additional water which has been made available in the driest period of record by its construction, and which is salable by Zone 1.

The study by Donald R. Warren Company dated 1945, entitled "Ventura County Flood Control District, Zone One, Flood Control and Water Conservation", pp. 116-122, did not seek to determine the safe yield of the reservoir; it determined the safe yield of the stream after a reservoir of 7000 acre feet had been built. These are two entirely different matters. As heretofore stated, the water in the stream belongs to prior rights insofar as they have use for it. This water cannot be sold by Zone 1 because it does belong to the prior rights. It cannot become appurtenant to any new right such as that for which the reservoir was built, except by agreement of the prior right.

The study by Mr. Jamison in his Memorandum No. 18 to Robert L. Ryan, Flood Control Engineer, dated November 15, 1947 and entitled "Probable Safe Yield of Matilija and

Casitas Reservoirs" considered the prior rights in part as shown by the following quotation on page 4 of the Memorandum:

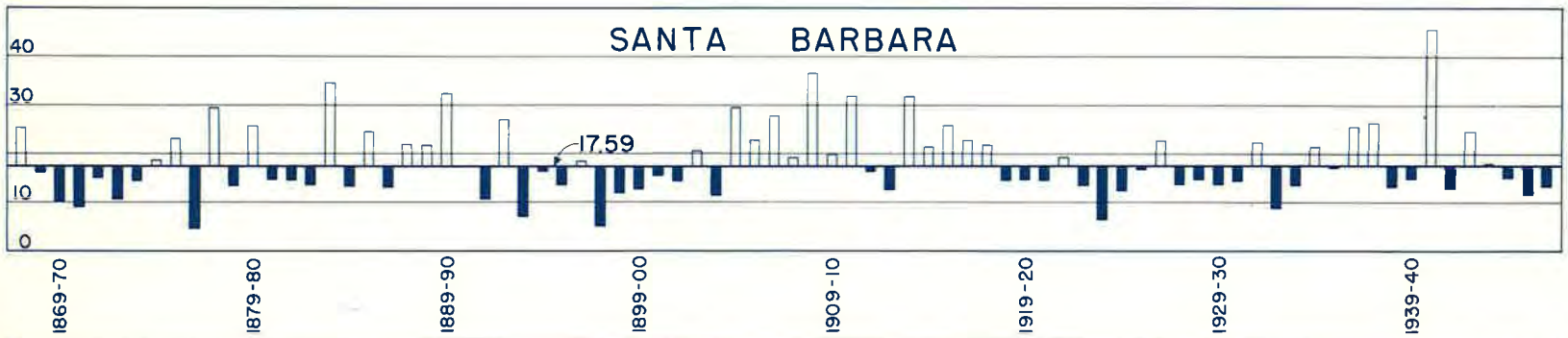
> "Before any water can be stored in Matilija Reservoir, the Old Water Rights must be satisfied. The rights considered here are those with diversion points on the Matilija Creek, North Fork and Ventura River within a mile or two below the dam. There are other water rights farther down the river that may have to be considered later but they are not within the scope of this memorandum.
>
> "The rights considered here are as follows:
>
> | | |
> |---|---|
> | Rancho Ojai Mutual Water Company - - - | 231 M.I. |
> | Rancho Matilija - - - - - - - - - - - - - | 231 M.I. |
> | Rowe - - - - - - - - - - - - - - - - - - | 16 M.I. |
> | Sheldon - - - - - - - - - - - - - - - - - | 30 M.I. |
> | Soper and others - - - - - - - - - - - - | 22 M.I. |
> | | 530 M.I. |
> | | 10.6 sec.ft." |

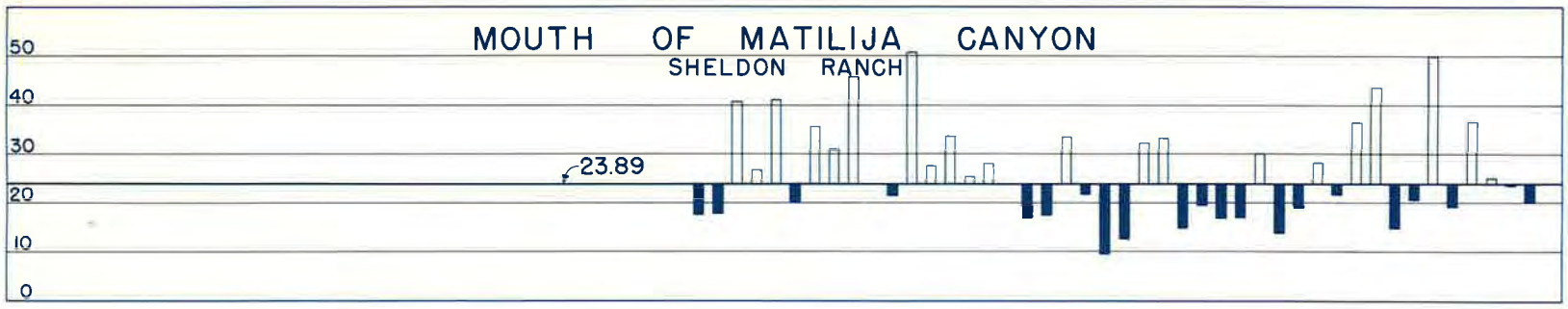
The memorandum served well in drawing attention to the fact that the safe yield of the reservoir is different from the safe yield of the stream on which the Warren Co. reported. The complicated studies necessary to approximate the amount of water belonging to the prior rights below the diversion point of Rancho Matilija were not made.

Runoff records of Matilija Creek and North Fork begin October 1927 and October 1928, respectively. There are no records of the runoff in Period 4 which has been selected as the most deficient of record. It was necessary to estimate the runoff for the period May-September 1927. This is readily done by comparison of runoff of

Santa Ynez River above Gibraltar Reservoir which is about 18 miles northwest of Matilija Reservoir.

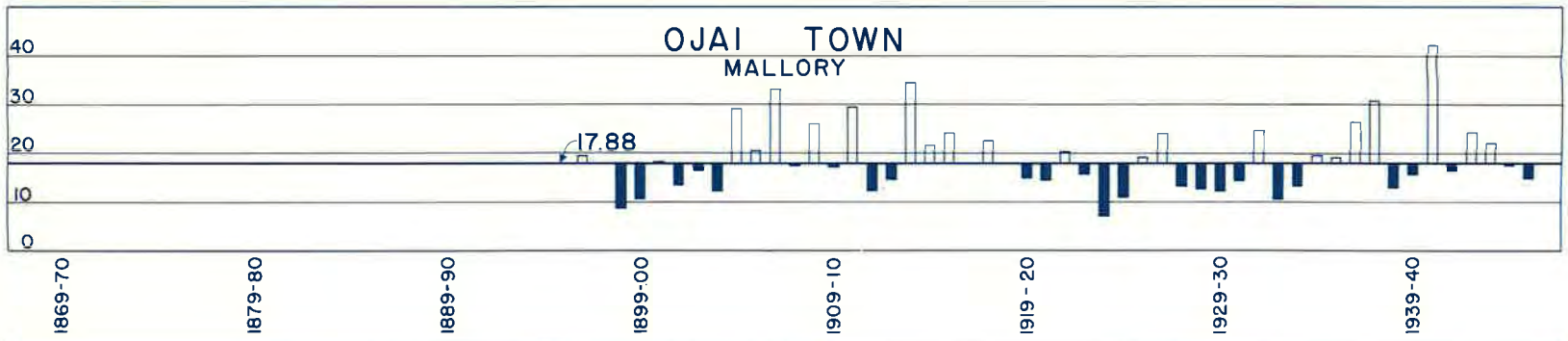
For Period 4 it was assumed that the runoff of the first four years was the same as that of the first four years of Period 6 and that the fifth year gave a discharge equal to the average of the last two years of Period 6.

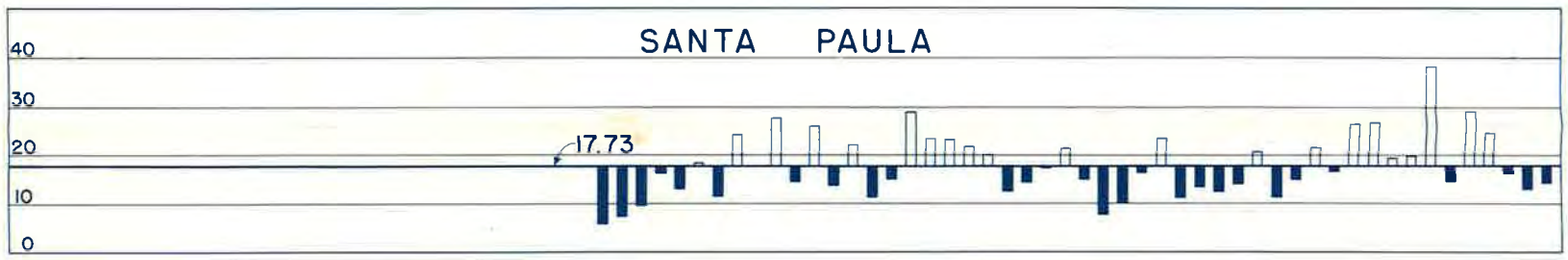


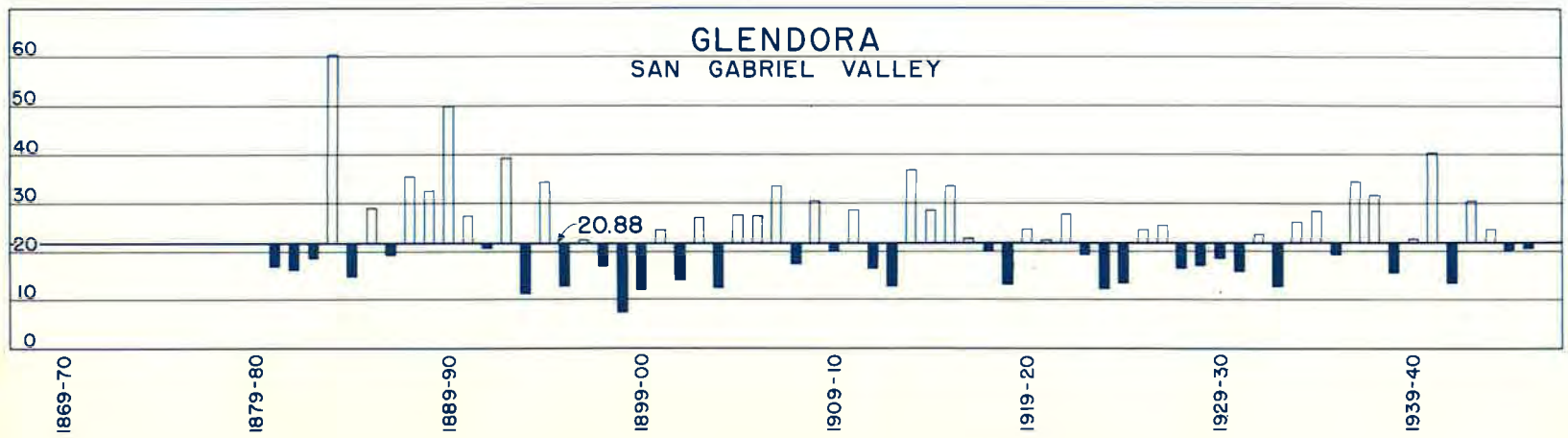


SURPLUS

DEFICIENCY

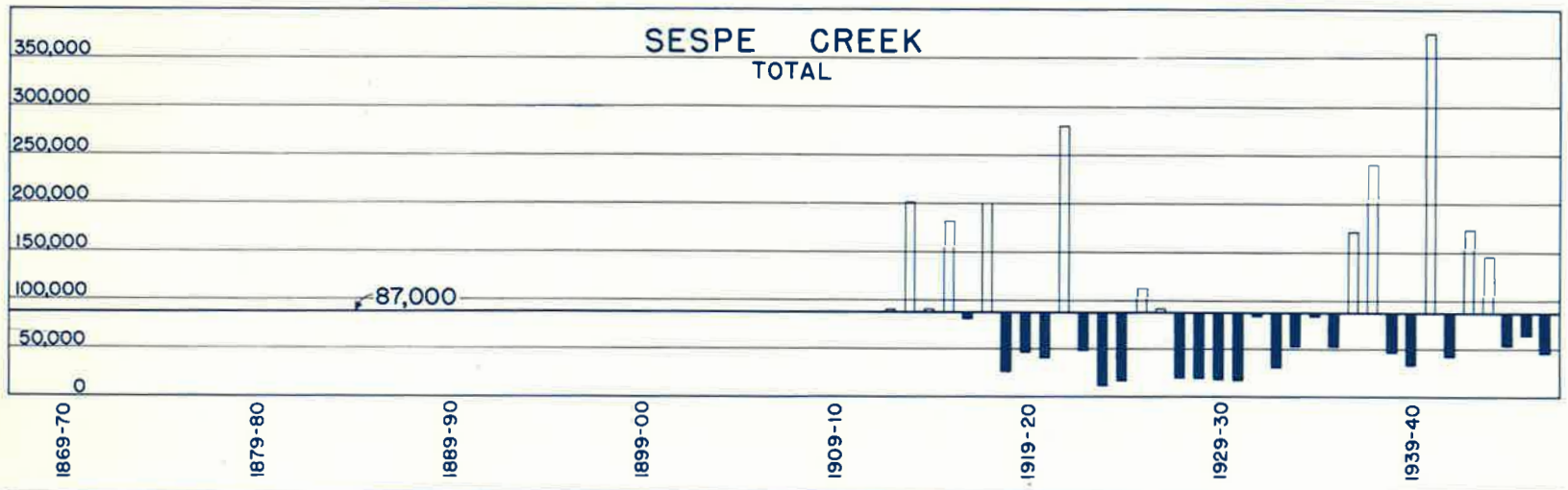


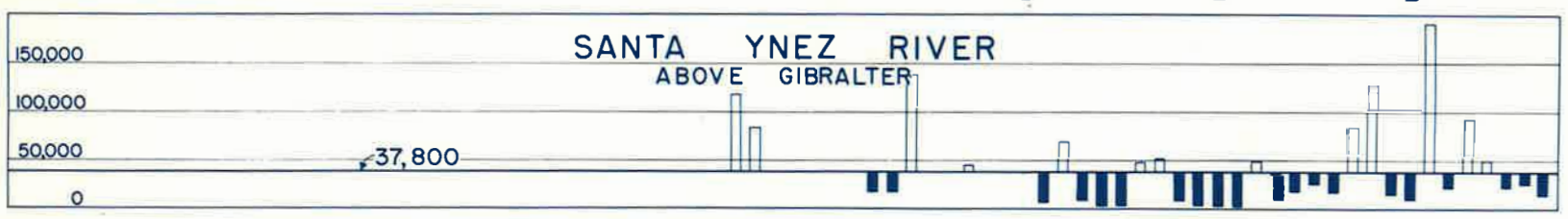


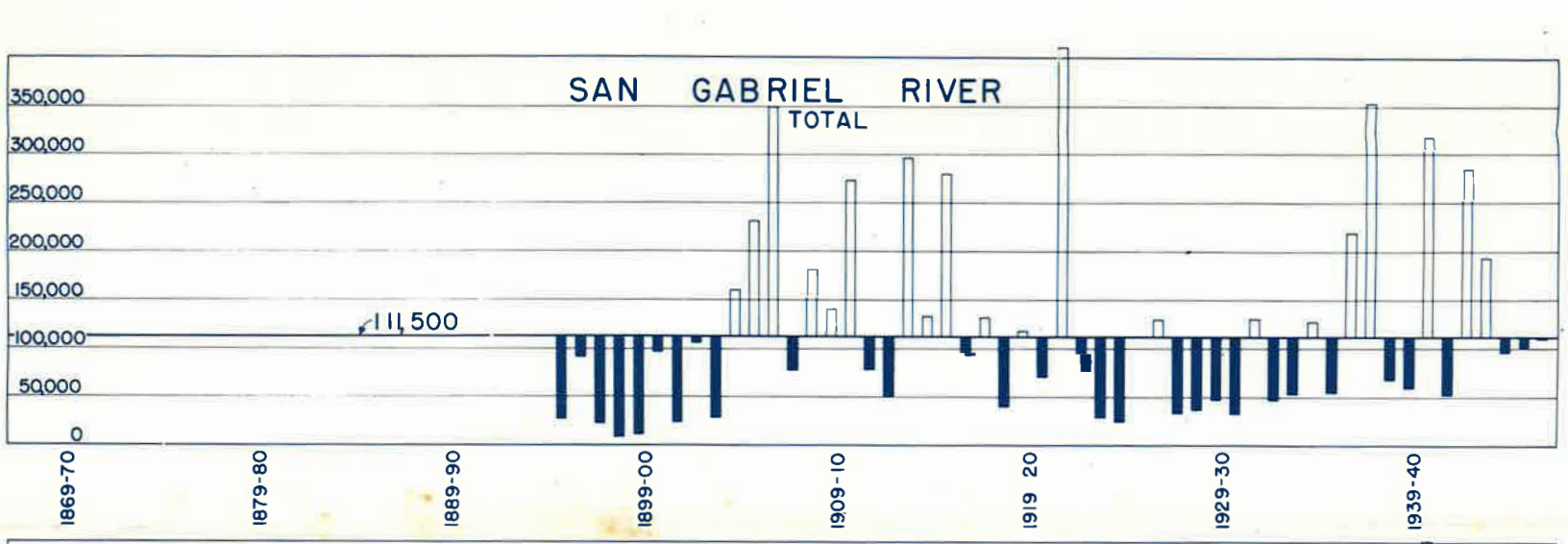


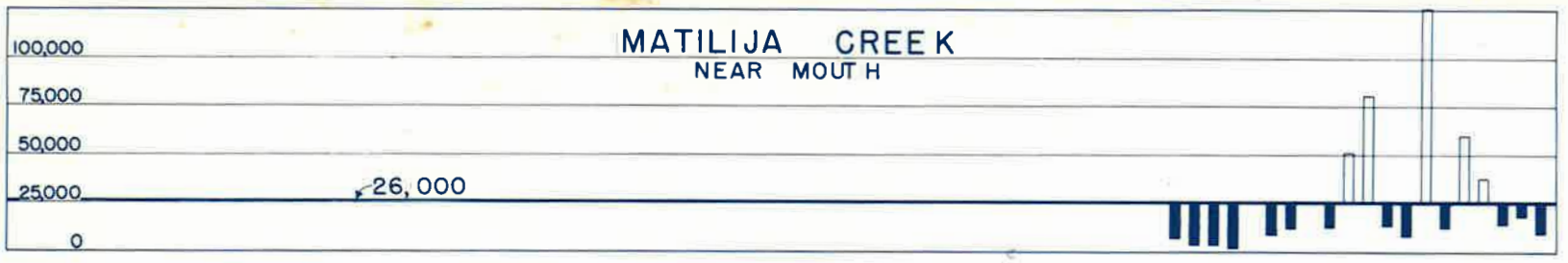
HEAVY HORIZONTAL LINE THROUGH EACH SET OF BARS IS ESTIMATED LONG TIME MEAN

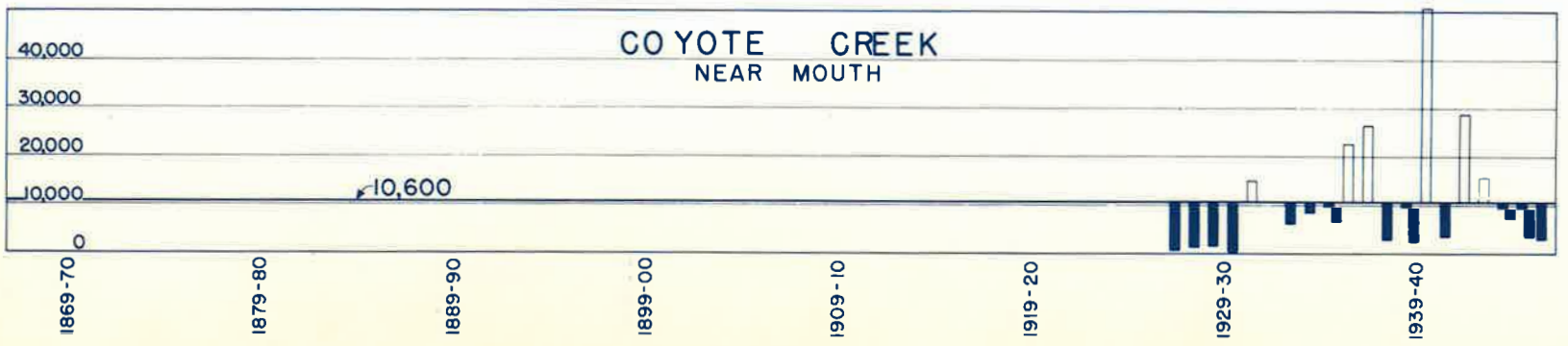
INCHES PRECIPITATION











SURPLUS

DEFICIENCY

HEAVY HORIZONTAL LINE THROUGH EACH SET OF BARS IS ESTIMATED LONG TIME MEAN

ACRE FEET RUNOFF

SECTION 2

Prior Water Rights

This is a brief discussion of existing used rights. All information except that pertaining to the City of Ventura is from Ventura County Water Survey.

Table 2

Prior Rights to Ventura River Water below Matilija Reservoir

Table 2-A
Gravity Rights

Diversion pt. miles below Matilija Dam	Name	Approx. Acreage	Crop	
0.52	W. A. Rowe	15	Citrus	
N. Fork	L. P. Sheldon	15	Citrus	
0.90	Soper	5	Truck	
1.35	Rancho Ojai Mutual Water Co. (east side of Ventura River)			
	Total acres			816
	Acres using water (1948)			
	Domestic	83		
	Citrus	286	369	
	Additional acres which could use water		447	816
	Water Right 231 M.I. = 4.62 sec.ft. (Decree of Oct. 24, 1902, and possible other subsequent decrees).			

Table 2-A contd.

Diversion pt. miles below Matilija Dam	Name	Approx. Acreage	Crop	
1.88	Rancho Matilija (west side of Ventura River)			
	Total acres			1600
	Acres using water (1948)			
	Citrus	51		
	Walnuts	44	95	
	Additional acres which could use water		1505	1600

Note: Sheldon's diversion is from North Fork but except in times of high water this has the same effect on water available to Matilija Reservoir as diversion from Matilija Creek would have because an amount equal to that diverted by Sheldon must go down stream to satisfy other rights.

Data from Ventura County Water Survey.

Table 2-B

Overlying and Riparian Rights between Rancho Ojai Diversion and Casitas Diversion Dam of City of Ventura

Notes: All of these users pump from wells. The supply is primarily the water of Ventura River which has percolated into the riverbed between Casitas Dam and the junction of Matilija Creek and North Fork.

In addition to the acreage given in the tabulation, there is an unirrigated area the extent of which is unknown without a detailed survey, which has a vested right in the underground water because it overlies it or adjoins it.

Table 2-B, contd.

Miles below Matilija Dam	Side of River	Name	Acreage using water	Character of use	Additional possible	Total
1.80	east	M. Etchhart	20	Citrus	15	35
5.25	"	Ventura Co. farm	40	Truck	0	40
6.12	west	F. Freaud	0	-	50	50
6.18	"	Live Oak Acres	9	Res. sub-division	41	50
6.20	east	A. H. Bahm	0	-	10	10
6.25	"	Linda Vista Knoll	7	Res. sub-division	20	27
6.60	west	W. Hoffman	38	Alfalfa & Perm. Past.	100	138
7.20	"	B. Hallyn	5	Alfalfa	10	15
7.45	"	John Newman	70	(Lemons 25 (Hay 45	8	78
7.70	east	Sunset Tract	9	Res. sub-division	9	18
8.00	east	A. B. Livesy	12	Alf. Orch. Walnuts	0	12
8.30	west	J. C. Hollingsworth	10±		0	10
8.90	east	Casitas Spring Tr. V.C.W.D. #4	43	Res. sub-division	7	50
9.10	east	Casitas Mut. Water Co.	19	Res. S.D.	2	21
9.20	west	Nye Estate	10	Walnuts, inter cropped	40	50
9.70	west	Foster Park Tract	5.5	Res. S.D.	19.5	25
9.80	"	T. Wear	3.75	Orchard) Truck) Alfalfa)	0	3.75
			301.25		331.5[a]	632.75[a]

Note: a. The columns headed "additional possible" and "total" probably have little significance as to total water rights

Table 2-C

Overlying and Riparian Rights between
Rancho Ojai Diversion and Casitas
Diversion Dam of City of Ventura

Acreage Using Water

	Residential subdivision	Citrus	Walnuts	Alfalfa Truck Hay Walnuts	Total	Additional in subdivision
East side	78	20	0	52.0	150.	48.5
West side	14.5	25	10	87.75	151.25	60.5
	92.5	45	10	139.75	301.25	109.0

Table 2-D

Use of Water by
Overlying and Riparian Rights between
Rancho Ojai Diversion and Casitas
Diversion Dam of City of Ventura

Use of water by individuals of the group has not been measured. It is estimated that in years when water is fully available during the entire season, consumptive use of ground water is as follows:

	Acres	Cons. use per acre acre feet	Total Acre Feet
Subdivision	92.5	1.25	115.6
Citrus	45.0	1.80	81.0
Walnuts	10.0	1.50	15.0
Alfalfa, etc.	139.75	2.00	279.5
	281.25		491.1

Note: Diversion would probably be about 30% more than the above or about 640 acre feet.

Use of Water below Casitas Dam

Most of the rights below Casitas Diversion are supplied from the City's mains. Three users as shown in Table 2-E, however, get their supply from surface flows and wells.

Table 2-E

Used Water Rights Dependent on River below Casitas Dam

Diversion pt. miles below Casitas Dam	Name	Acres	Character of use	Source
0.1	Williams	8.8	Res. Subdiv.	Wells
0.6	C. T. Train	15.	Citrus	Surface flow
0.7	L. W. Achenbach	30.	Walnuts	Surface flow

The City's diversion intervenes between Matilija and Casitas, and takes practically all the water available in droughts. In wet periods, much more than is necessary is available from sources below Matilija.

It is assumed that the rights above noted have no claim on water from above Matilija Reservoir.

Diversion by City of Ventura at Casitas Dam

Diversion is from (1) direct flow of the river; (2) water which has percolated into the river gravels upstream and has come to the surface above the dam, either naturally

or because the dam is carried down to bedrock and extends almost across the gravel channel; (3) ground water pumped from the gravels of Casitas Basin above the dam. Percolation of upriver water into the gravels is the major supply although San Antonio and Coyote Creeks also contribute to the total.

Diversion by the City in each of the 12 months, June 1946 - May 1947, was maximum of record and totalled 6455 acre feet for the year (Table 12). For computation purposes the demand each month in Table 14 was considered as the City's right for that month.

In calculations all the natural percolation was assumed to be a prior right. As stated above, it is the principal source not only of the City's diversion at Casitas but of the group of small ground water upriver users.

SECTION 3

Erosion and Sedimentation

After sufficient lapse of time the capacity of any reservoir must become fully occupied by silt eroded from the watershed above and carried into the reservoir by the stream. It becomes almost useless for the purpose for which it was built. However, there will remain space in the interstices of the deposited material which will absorb water and from which it will slowly drain after the flood season has passed.

The average annual rate at which sediment will be deposited in a reservoir controlling mountain runoff depends primarily on the resistance of the material of the watershed to erosion. Hard rocks will resist better than soft ones. A watershed denuded of vegetable cover by fire is much less resistant to erosion than one fully covered.

General geological conditions, topography, intensity of runoff, incidence of large floods and average runoff per unit of area also affect the situation. The runoff is both the tool which erodes the material and the vehicle which transports it to the reservoir sites.

State, Federal, and other agencies have gathered data on the sedimentation of reservoirs. The U. S. Forest Service and U. S. Soil Conservation Service have been most active in this. The Forest Service has been especially ac-

tive in experimental work on erosion and sedimentation and on the annual incidence of fires on different watersheds.

It is found that sedimentation by erosion from the Sierra Mountains, which are blocks of hard granitics sometimes overlaid with lava, is and will be minor - 0.11 to 0.70 acre feet per square mile annually. The reservoirs are large so that it is concluded that "the rates of sedimentation are so low that they need not be considered a determining factor in the total capacity to be provided".[o]

On the contrary, the rocks of the mountain ranges of Ventura and Santa Barbara Counties are soft and easily eroded. The sites for reservoirs generally afford small capacity except at large cost per unit of safe yield. In this region sedimentation of reservoirs is a matter which must be considered in any project planning and in reservoir design.

Table 3 gives the actual experience in sedimentation in Gibraltar Reservoir and Lake Jameson (Juncal Dam) on Santa Ynez watershed, adjacent and similar geologically, etc., to Matilija Creek watershed. These reservoirs were built in 1920 and 1930, respectively. In 1923 and 1933, a large area of the watershed above Gibraltar was burned.

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o. Special Report No. 10, U.S. Soil Conservation Service, 1947, "Reservoir Sedimentation in the Sacramento-San Joaquin Drainage Basins, California", Carl B. Brown and Eldon M. Thorp.

Jameson Lake is in the watershed above but information as to the area burned above it is not readily available for the present report.

Following the burn of 1933 check dams were built in the watershed above and the burned area was sowed to mustard seed. Precipitation and runoff were below average in the next several years until 1936-37.

Long-time average runoff from the watershed above Matilija Reservoir is estimated to be 2.8 times as much per square mile as that from the entire watershed above Gilbraltar and about 1.4 times as much as that from the watershed above Jameson Lake during the 11 years 1931-1941, during which period 428 acre feet of sediment accumulated in the lake.

It is believed that experience above Jameson Lake is the best criterion available as to the probable rate of sedimentation of Matilija Reservoir. The California Forest and Range Experiment Station has made a special study of the rate of erosion and deposition of sediment in the Matilija Creek watershed in connection with the report of the Federal Government on flood control in Ventura County. Its conclusion is that the probable average annual area of the watershed which will be burned over is 2% and that the probable average annual rate of sedimentation of a reservoir at Matilija would be 3.26 acre feet per square mile of watershed, or

a total of 179 acre feet.

This is a larger rate than the total which has arrived at Jameson Lake but the larger runoff per unit of area in Matilija would account for the greater estimated deposition. Likewise, the mustard plant growth must have aided materially in the Juncal watershed.

The above percentage of burn is long-time annual average to be expected with present protection of forest but with no assistance after a fire to prevent erosion. Rate of sedimentation would be much greater after a large fire and much less in periods of small or no fires. If protection were increased the percentage should lower.

At the above rate Matilija Reservoir would be completely filled in 39 years. In 10 years its capacity would be reduced to 5200 acre feet and the safe yield to 1480 acre feet.

There is no complete remedy for this. Check dams have been constructed to hold back sediment in some cases but it is not considered that in the long run these will be effective unless conditions are peculiarly favorable.

It might be possible to increase the height of Matilija Dam after the capacity has been decreased by some amount to be later decided. However, to raise a thin arch dam any considerable amount poses difficult technical and operational problems which would not exist with an earth or rockfill dam.

TABLE 3

Sedimentation in Reservoirs - Santa Ynez River Watershed

Reservoir	Avg.An. % of watershed burned Historical	Original capacity ac.ft.	Watershed above. square miles	Period	Total Years	Stream Discharge into Reservoir: avg.an. ac.ft. during period	Stream Discharge into Reservoir: Per sq. mi. of watershed	Avg. ann. ac.ft.	Total in Period	% In of stream disch.	Avg.An. ac. ft. per sq. mi. of watershed
Gibraltar(1)	4.63	15400	219	1920-1936	16.25	20000	91	264	4300	1.32	1.20
Gibraltar	-	15400	219	1920-1947	27.00	36000	164	350	9500(2)	0.97	1.59
Juncal(3)	-	7100	13.9	1931-1941	11.00	5490	343	38.6	428	0.70	3.50

Estimated Sedimentation - Matilija Reservoir (4)
in any future 10 years of average runoff

From data and Analyses of U.S. Forest Service
California Forest Range and Experiment Station
Berkeley and Glendora

Assumed										
0	7000	55	-	-	26000	475	88.5	885	0.34	1.61
2	-	-	-	-	-	-	179	1790	0.69	3.26

(1) From Technical Bulletin No. 524, Silting of Reservoirs, pg. 15, U.S. Soil Conservation Service, issued 1936, revised 1939, Henry M. Eakin and Carl B. Brown, except area of watershed and discharge which are taken from U.S.G.S. Water Supply Papers.

(2) From Raymond A. Hill as to silt in reservoir. Plus data on pg. 7 of report of U.S.Reclamation Bureau "Comprehensive Basin Plan,Santa Barbara County", 1945. This states that Mono and Caliente Debris Basins in the watershed above Gibraltar had held back 1000 acre feet and that Juncal Dam (Jameson Reservoir) also in the watershed and above Gibraltar had held back 428 acre feet (by the end of 1941). The sum of these two was rounded off to 1500 acre feet to allow for additional sedimentation through 1947. It is assumed that this additional amount would have been deposited in Gibraltar had these barriers not existed in the watershed above. Average annual discharge during this period was almost the same as estimated long-time average.

(3) The reservoir called Jameson Lake was completed in late 1930. A great fire in the general watershed occurred in 1933. Mustard was sown in the watershed after the fire. Check dams were also built. They may have assisted in holding back eroded material from the reservoir. The first succeeding year of heavy runoff was 1936-37. Data as to watershed from State Div. of Water Resources. Deposit of material in reservoir from U.S.R.B. report referred to in Note 2.

(4) Based on unpublished information in letters from officials of the U.S.Forest Service, Calif. Forest Range and Experiment Station to Harold Conkling. These values are based on exhaustive study of erosion and sedimentation on nearby watersheds. From experience on these it is assumed by the Service that 2% of Matilija Creek watershed will be burned each year on the average, but even if no burning occurred, sedimentation would go forward at about half, or more, of the rate estimated for an annual average burn of 2% of the watershed. Values for sediment from 2% burn may be reduced 10-15% before publication by the Forest Service. The quantities of sedimentation from a 2% burn are based on assumption that no steps to prevent erosion would be taken. If mustard seed were sown after the fire, sedimentation from a burned area would be reduced to some smaller quantity than given in the table but would evidently be more than for an unburned area.

SECTION 4

Method of Study of Safe Yield

A little more than two miles below Matilija Reservoir the Ventura River bottoms broaden and for the next approximately 8 miles the river wanders over an absorbent gravel bed. This overlies bedrock and is about 30 to 40 feet deep over the upper six miles of its length. Farther down in Casitas Basin it deepens and is about 200 feet at deepest.

The slope of the river bottom from north to south is about 80 feet to the mile. Percolation from the stream at flood time soon fills the shallow depth of the gravels. Their permeability and steep slope allow the water which has been absorbed into them, to drain out rapidly to the south so, at least as far as La Crosse, they are not a good source to tide over the long droughts for the overlying and abutting lands whose water is pumped from them.

Below La Crosse the Casitas Basin, with its deeper gravels, makes a much better source of ground water. From it the City of Ventura is by far the largest user.

San Antonio Creek from the east and Coyote Creek from the west enter Ventura River above Casitas dam which the City of Ventura has constructed across the river. Below the dam the City serves agricultural and other water

rights, except the three mentioned in Table 2.

The watershed above Casitas is 187 square miles while above Matilija it is 55 square miles. Because of the very considerable inflow below the reservoir, and other conditions, it is assumed that the rights below Casitas Dam can demand no water from above Matilija.

The river flow is flashy and in only a few days of the period investigated, or of any extended drought period, does water from above Matilija pass Casitas Dam. Such water is all that can be retained in the reservoir.

The gravity canals immediately below have first chance at the water passing Matilija. The surplus goes on down river and percolates in considerable amount (page 31) If the flow is of sufficient volume it does not all percolate; some is still in the river at Casitas and thus water directly from the mountains can be diverted by the City.

With the data available in this situation it ordinarily would be impossible to make a reasonably accurate approximation of the amount of water belonging to prior rights but under the conditions in Ventura River Basin it is possible.

A sufficient number of studies were completed as a basis for this report so that comparison with results of studies by others could be made and also to make reasonably certain that future conclusions of others as to amount of

water belonging to prior rights would not materially change the estimates of safe yield herein made.

The gravity rights immediately below the reservoir divert large quantities of water which are considerably in excess of consumptive use of crops on acreage using the rights. It can be assumed that the excess goes into the ground water and supplies others below, but primarily Ventura City. If the diversions of the gravity rights were reduced to a more nearly usual amount it would give little benefit to Matilija Reservoir because, on most days, the water not diverted would be appurtenant to other rights below, principally Ventura City. The exceptions are the occasional days of rain when gravity diversions are temporarily discontinued because of muddy water or because they do not need to irrigate, and the days of sustained flow after the peak of the rise has passed.

The various major steps in the study were as follows:

1. The annual discharge of Matilija Creek in the water year 1926-27 was estimated by comparison with Santa Ynez River above Gibraltar Dam (page 29). Monthly distribution of the annual discharge for that year was made from study of precipitation records. For the remaining years studied in detail, records are available.

2. Annual discharge of North Fork was estimated for 1926-27 and 1927-28 by comparison with Santa Ynez River

above Gibraltar Dam and with Matilija Creek. Monthly distribution was made in the same way as for Matilija Creek. Records are available for the remaining years.

3. The estimated and recorded discharges of North Fork were studied in detail to determine the amount of prior rights, whether gravity or percolating, which they would serve, thus decreasing the demand for Matilija Creek water.

4. Records of isolated measurements of Ventura River at various points were studied to determine percolation in the riverbed from Matilija to Casitas (page 31).

5. Spot measurements and later records of discharge of Ventura River at Casitas were studied, together with the records of diversions by City of Ventura (page 30 and Tables 6 and 12) to determine what effect the large subsequent increase in use by the City would have on the historical amount of water wasted past Casitas.

6. A schedule of diversions by the gravity rights below the dam, in accord with a normal duty for culture served, was used for one study. (Table 16).

7. For another study it was assumed that the owners of the gravity rights would use 50% of their rights for a combined domestic and irrigation service, with regimen of monthly demand similar to historical experience of Thermal Belt Mutual Water Co., Santa Paula, and with full utilization of that portion of the rights during the month of

maximum demand only. Under the remaining 50% of rights water would be used for irrigation only, with continuous diversion of all the water available to the 50% during entire year, unless precipitation made it unnecessary or diversions under the other 50% of rights were deemed sufficient. Actual diversions that would be made under these assumptions would be limited during most months by the amount of water available at the intakes (Tables 17 and 19). These assumptions are extreme but in the computations safe yield was found to be only 100 acre feet per year less than the results of the assumption of normal diversion used in Item 6 (Table 16).

8. In the period studied, water from above Matilija reached Casitas in sharp peaks at the beginning of periods of storm runoff. Study of the situation was made to determine whether it was probable that any diversion would be made at such times by the gravity users or by the City of Ventura. In most of such cases it was decided that, because the rain which produced the increase in flow would decrease the need for irrigation, because the water was probably muddy, and because the diversion works might be washed out, small or no gravity diversions would be made and that all or most of the water could be retained in Matilija Reservoir except that which would have percolated under natural regimen of stream discharge. It was further found that there were a few periods, each of several days' dura-

tion, when discharge at Matilija would waste past Casitas, even after diversion by upper gravity rights and present demand by City of Ventura. During such periods the excess over requirements of upper gravity rights and City of Ventura, plus natural streambed percolation, could be retained in Matilija.

The study on which the conclusions are based is, therefore, not only a study of prior rights but of necessity, also a study of reservoir operation.

The more detailed assumptions and the results of the major studies are given in Table 4.

The safe yield is considered to be 1800 acre feet with present reservoir capacity. After 25 years of average silt deposition capacity will be reduced to about 2500, based on studies of the U.S. Forest Service.

Table 4

Safe Yield of Matilija Reservoir

Results of Major Studies made in Present Investigation

Assumptions

1. Full capacity of 7000 acre feet is to be utilized; 250 acre feet of storage below outlet elevation is to be drawn upon by pumping.

2. No allowance has been made for possible inflow from springs between old gaging station and dam site. If such inflow occurs in the future it will add to the safe yield but it is anticipated that

said flow will not take place with the reservoir full or partly full.

3. Regimen of demand on safe yield is the same as that of historical experience of Thermal Belt Mutual Water Co.

4. Allowance for net effect of evaporation from reservoir equals 1.9 ac. ft. per year.

5. No allowance for seepage from reservoir has been made. Should seepage occur, it is anticipated that it will appear in stream channel downstream and will be recoverable by pumping or will be utilized to partly satisfy downstream rights.

6. No allowance has been made for inflow to Matilija Creek below the dam site. Such inflow, if it occurs, will satisfy the downstream water rights in part.

7. Prior rights as discussed elsewhere in report.

Assumed Conditions	Acre Feet per Year	
	4-year drought period[a]	5-year drought period[b]
1. No downstream rights considered (same as Warren studies)	4500	4100
2. All present rights downstream considered - Demand by upper gravity rights in approximately past regimen	1900	1700
3. All present rights downstream considered - Normal demand by upper gravity rights	2100	1800

Notes: a. Similar to historical period from July 1927 to December 1931, inclusive.

b. Similar to historical period from July 1927 to December 1931, inclusive, but with a hypothetical runoff year added between Sept. 1930 and Oct. 1931. Monthly values of runoff for hypothetical year = averages of runoff for corresponding months in 1929-30 and 1930-31. Addition of one drought year is to approximate the situation 1898-1902 in which extreme drought was 5 years in duration.

Above figures are to nearest 100 acre feet.

SECTION 5

Percolation in Ventura River between Matilija and Casitas

Measurements of the river at strategic points, to determine the amount of percolation and its location, were begun in early 1928 by the State Division of Water Resources and were continued by that organization through the winter of 1931-32. The State's investigation ceased in 1932. The work has been continued by the Ventura County Water Survey to the present day.

It was found by the Division that practically all the percolation occurred in the reach of the river between Rancho Matilija Intake and Oak View Road, a distance of 5.15 miles. Percolation occurred also immediately below Oak View Road and above the rim of rising water but measurements were not made. It is presumed that the rising water rim moved up and down stream with variation in stream discharge and that therefore percolation below Oak View was inconsistent and small.

Aside from its variation with stream flow, amount of percolation in the reach varies with changes in streambed and underground conditions. In turn, these vary with the weather cycle.

Major historic conditions have been as follows:

Condition 1. No immediately antecedent floods - Water-table under river low.

This condition prevailed from May (probably) 1927 through November 1931. The percolation in that period is used in this report as the measure of the prior rights of the underground water users above Casitas, including the City of Ventura, to Matilija Creek water during the critical period. The curve of relationship of flow at Rancho Matilija Intake to percolation below that point is shown on the graph on Page 31.

Condition 2. Immediately antecedent floods - Water-table under river low.

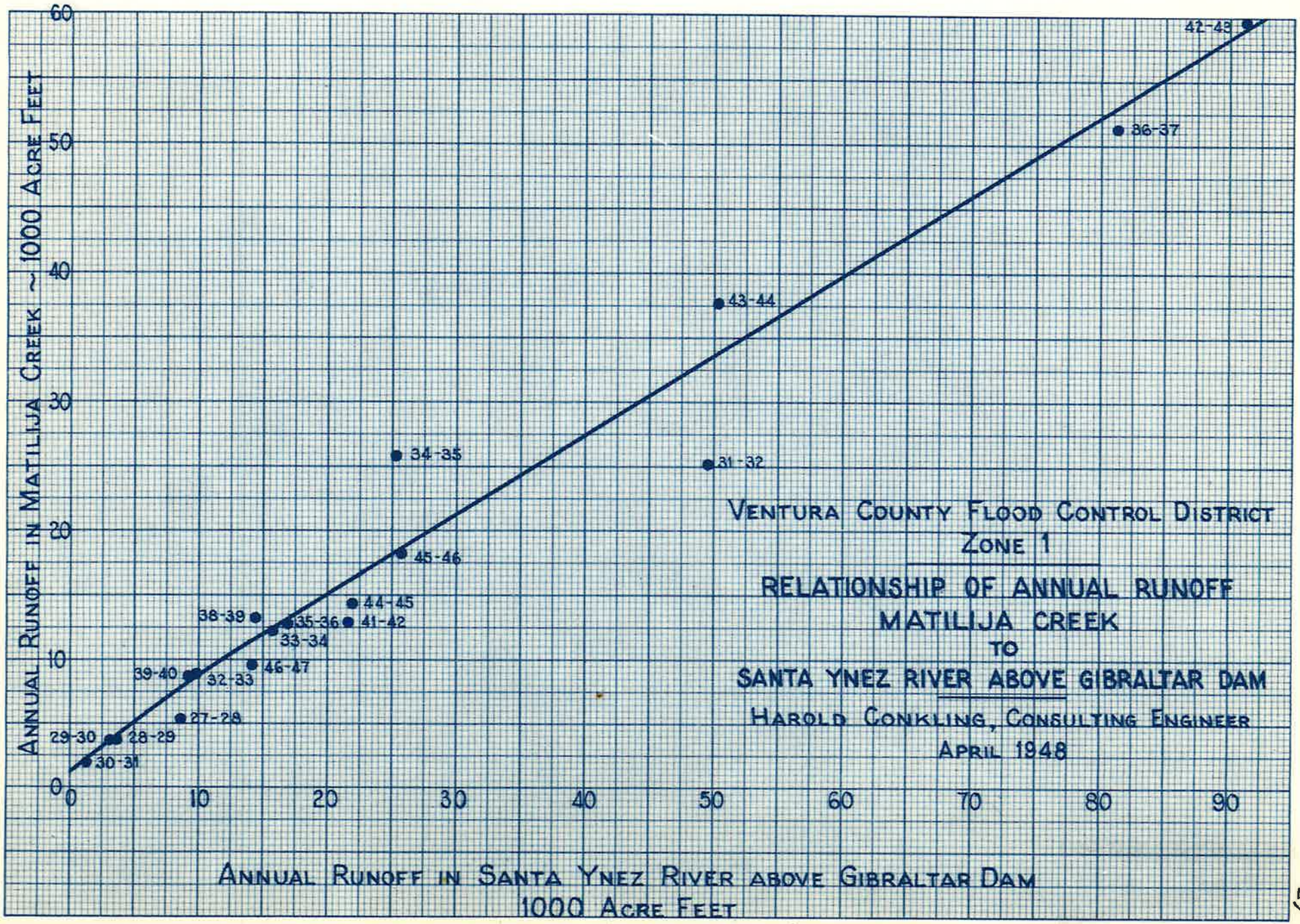
This condition prevailed during January 1932. Percolation in that period was much larger than in Condition 1. The curve of relationship between flow at Rancho Matilija Intake and percolation below is also shown on the graph on Page 31. A similar condition probably existed in February 1927 but percolation rates of that period are not pertinent to this study because flows were sufficient to fill Matilija Reservoir and supply all rights below.

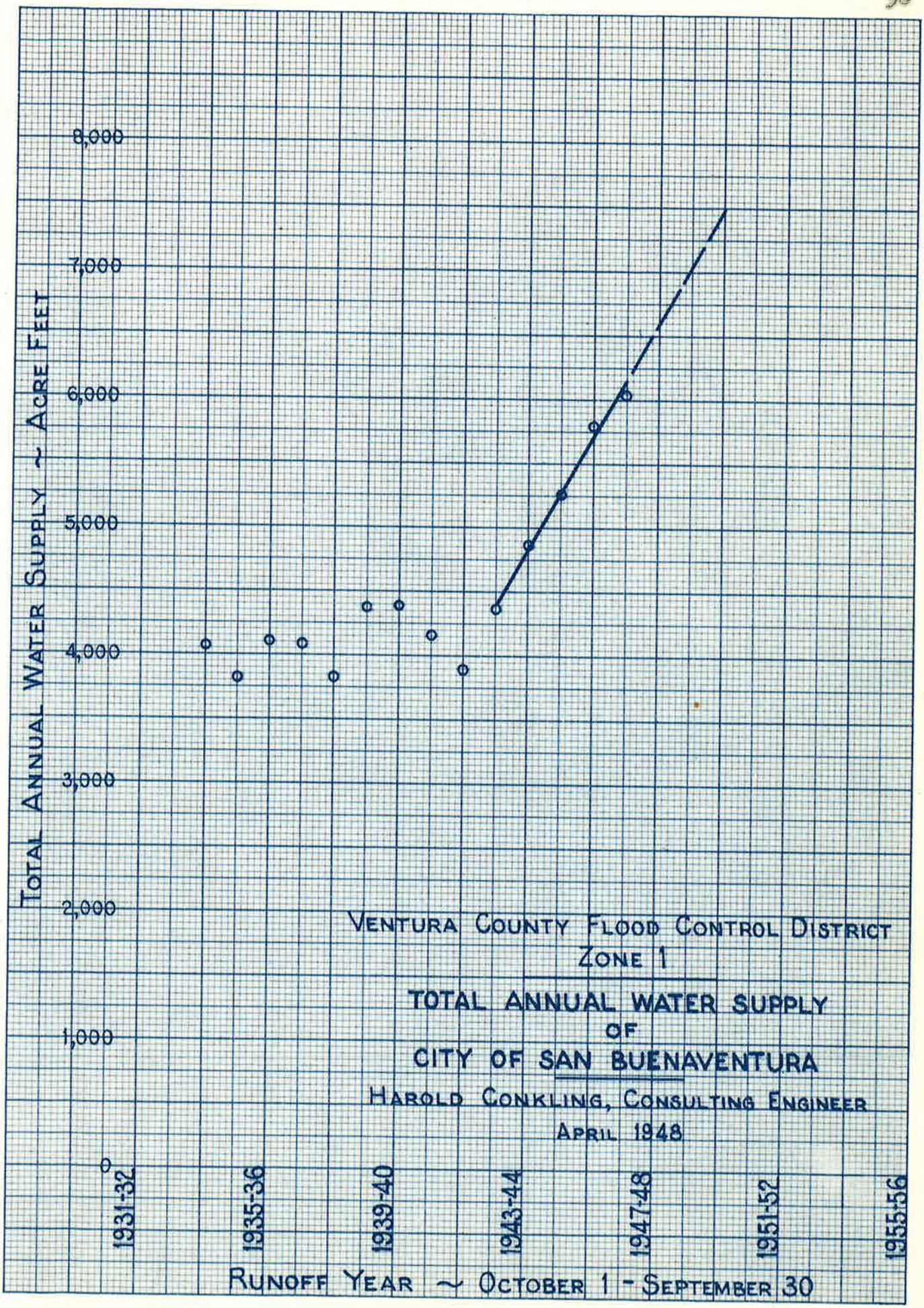
Conditions 3. Water-table under river high.

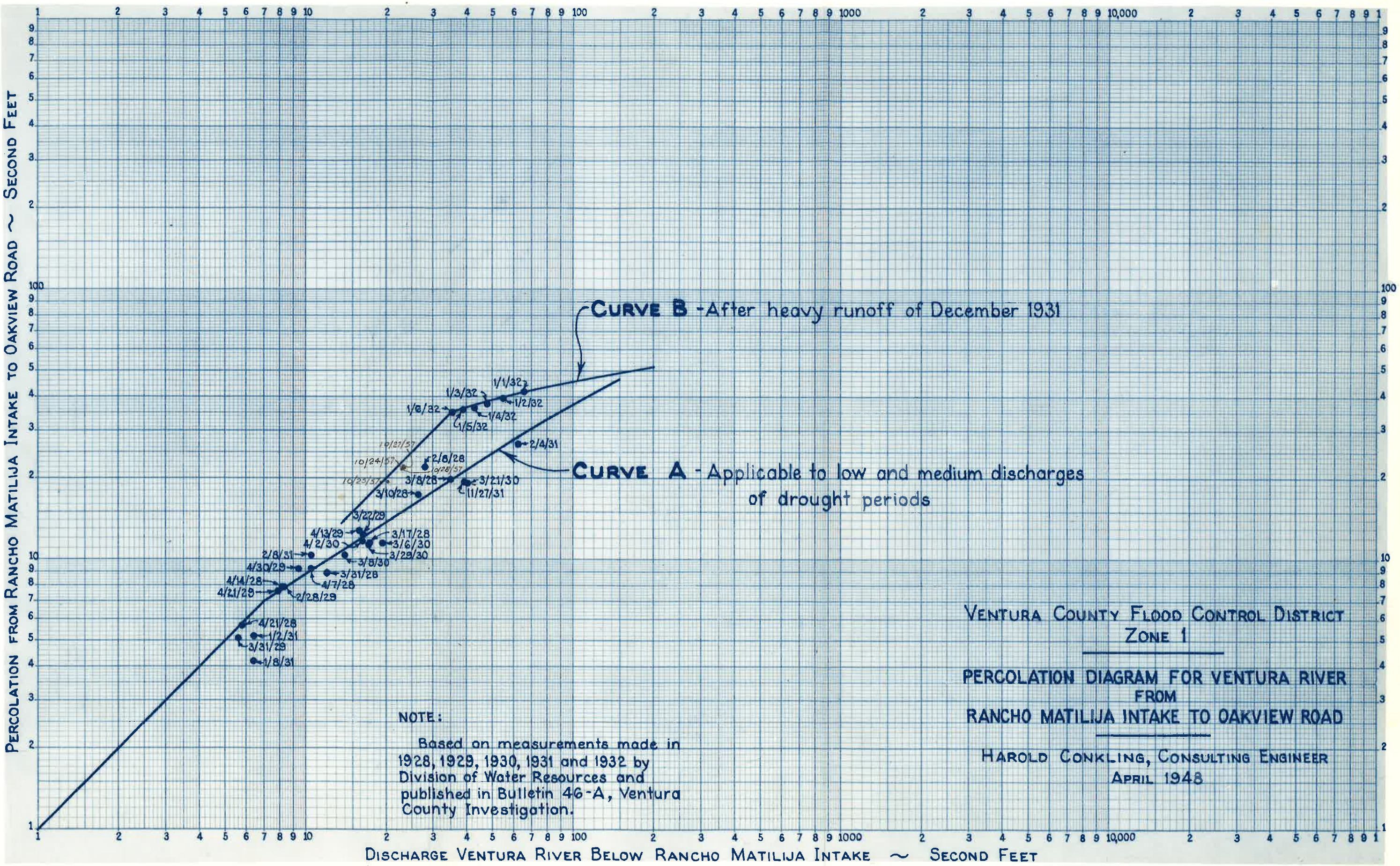
This condition prevailed February-May (first part) 1932. Percolation was much less than in Condition 1 but increased from time to time, presumably as the water-table fell between storms. By May 20, date of last measurement,

percolation was approximately the same as in Condition 1. This condition has existed during most of the time since 1932 through 1946.

At no time since 1932 have measurements of percolation been made when conditions existed suitable for checking the rate of percolation found in the critical drought period.


ANNUAL RUNOFF IN MATILIJA CREEK ~ 1000 ACRE FEET
ANNUAL RUNOFF IN SANTA YNEZ RIVER ABOVE GIBRALTAR DAM
1000 ACRE FEET
0
10
20
30
40
50
60
70
80
90
60
50
40
30
20
10
0
42-43
43-44
34-35
31-32
45-46
44-45
38-39
35-36
41-42
33-34
46-47
39-40
32-33
27-28
29-30
28-29
30-31
VENTURA COUNTY FLOOD CONTROL DISTRICT
ZONE 1
RELATIONSHIP OF ANNUAL RUNOFF
MATILIJA CREEK
TO
SANTA YNEZ RIVER ABOVE GIBRALTAR DAM
HAROLD CONKLING, CONSULTING ENGINEER
APRIL 1948


TOTAL ANNUAL WATER SUPPLY ~ ACRE FEET
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1931-32
1935-36
1939-40
1943-44
1947-48
1951-52
1955-56
RUNOFF YEAR ~ OCTOBER 1 - SEPTEMBER 30
VENTURA COUNTY FLOOD CONTROL DISTRICT
ZONE 1
TOTAL ANNUAL WATER SUPPLY
OF
CITY OF SAN BUENAVENTURA
HAROLD CONKLING, CONSULTING ENGINEER
APRIL 1948


CURVE B - After heavy runoff of December 1931
CURVE A - Applicable to low and medium discharges of drought periods
1/1/32
1/3/32
1/2/32
1/6/32
1/4/32
1/5/32
2/4/31
10/21/57
10/24/57
2/8/28
10/28/57
10/25/57
3/8/28
3/21/30
3/10/28
11/27/31
3/22/29
4/13/29
3/17/28
4/2/30
3/6/30
2/8/31
3/29/30
4/30/29
3/8/30
3/31/28
4/14/28
4/7/28
4/21/29
2/28/29
4/21/28
1/2/31
3/31/29
1/8/31
PERCOLATION FROM RANCHO MATILIJA INTAKE TO OAKVIEW ROAD ~ SECOND FEET
DISCHARGE VENTURA RIVER BELOW RANCHO MATILIJA INTAKE ~ SECOND FEET
NOTE:
Based on measurements made in 1928, 1929, 1930, 1931 and 1932 by Division of Water Resources and published in Bulletin 46-A, Ventura County Investigation.
VENTURA COUNTY FLOOD CONTROL DISTRICT
ZONE 1
PERCOLATION DIAGRAM FOR VENTURA RIVER FROM RANCHO MATILIJA INTAKE TO OAKVIEW ROAD
HAROLD CONKLING, CONSULTING ENGINEER
APRIL 1948

T A B L E S

BASIC DATA

and

RESULTS OF PRINCIPAL ANALYSES

TABLE 5

Ventura County Flood Control District
Zone 1

Monthly Runoff in Ventura River
near Ojai

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1911-12	-	726	904	793	662	4380	2730	1350	714	398	271	249	-
12-13	257	270	322	1090	6050	4390	1540	978	595	367	275	176	16300
13-14	165	303	707	-	-	-	5280	3210	1760	1160	848	595	-
14-15	564	-	-	-	-	-	-	-	-	-	-	-	-
1921-22	-	-	-	-	-	9780	5250	2830	1280	904	526	379	-
22-23	523	1290	6580	2510	2440	1960	1580	762	487	257	191	205	18800
23-24	191	223	257	329	326	916	869	254	149	-	-	-	-

Note: Data from U.S.G.S. Water Supply Papers.

Gaging station located in N 1/2 SW 1/4 Sec. 28, T5N, R23W, SBB&M, just below junction of Matilija Creek and North Fork of Matilija Creek.

Diversions above gaging station are not included.

TABLE 6

Ventura County Flood Control District
Zone 1

Monthly Runoff in Ventura River
near Ventura

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1911-12	1280.	1250.	1520.	1370.	869.	7010.	4180.	1580.	726.	403.	280.	163.	20100.
12-13	246.	298.	258.	1390.	15600.	5120.	1830.	1080.	625.	738.	480.	339.	28000.
13-14	298.	469.	351.	-	-	-	-	-	-	-	-	-	-
1929-30	0	0	0	263.	0	2270.	261.	12.3	11.9	10.7	0	0	2830.
1930-31	0	0	0	0	233.	1.4	18.6	10.7	7.7	0	0	0	271.
31-32	-	-	10700.	2100.	38000.	4160.	1270.	599.	300.	238.	153.	28.	57500.
32-33	54.2	30.5	8.5	11700.	2370.	1060.	372.	83.6	108.	0	0	0	15800.
33-34	0	0	8140.	14300.	3910.	1850.	345.	0	0	0	0	0	28500.
34-35	1080.	539.	4610.	12530.	2790.	5510	9700.	2340.	831.	122.	23.	14.	40090.
1935-36	24.	45.	167.	251.	17530.	3480.	2040.	610.	98.	57.	26.	0	24330.
36-37	446.	17.	7100.	4890.	43610.	33180.	11180.	4100.	1880.	786.	451.	470.	108100.
37-38	465.	474.	2000.	1170.	40910.	120100.	11960.	5950.	3200.	2030	1050.	891.	190100.
38-39	833.	647.	3420.	3930.	2540.	4810.	1300.	796.	305.	184.	87.	107.	18960.
39-40	76.	0	4.4	196.	6410.	2120.	1110.	580.	306.	108.	21.	8.5	10940.
1940-41	0	7.3	5830.	18620.	58790.	94130.	52020.	13920.	6120.	3450.	2200.	1260.	256300.
41-42	1320.	1270.	4550.	3110.	1910.	1920.	4660.	1880.	851.	383.	208.	144.	22210.
42-43	58.	81.	105.	50520.	23320.	46630.	8000.	3650.	2020.	1070.	650.	400.	136500.
43-44	376.	351.	1660.	1950.	29690.	27180.	6280.	3400.	1830.	970.	615.	466.	74770.
44-45	406.	1810.	853.	835.	14710.	5580.	3090.	1380.	615.	477.	227.	97.	30080.
1945-46	101.	94.	5940.	609.	1380.	7810.	5160.	1480.	390.	190.	140.	46	23340.

Note: Data from U.S.G.S. Water Supply Papers
Diversions above gaging station are not included

TABLE 7

Ventura County Flood Control District
Zone 1

Monthly Runoff in Matilija Creek
near Matilija

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1927-28	263.	387.	575.	498.	1213.	1104.	500.	382.	210.	116.	73.	61.	5380.
28-29	69.	110.	221.	279.	659.	857.	747.	335.	206.	84.	53.	34.	3650.
29-30	31.	38.	54.	283.	296.	1620.	649.	381.	149.	58.	35.	33.	3630.
1930-31	39.	59.	93.	153.	507.	262.	184.	296.	203.	67.	39.	47.	1950.
31-32	34.7	126.	2840.	1570.	15300.	2410.	1150.	742.	443.	250.	151.	120.	25100.
32-33	215.	257.	282.	3840.	1530.	928.	549.	438.	342.	225.	168.	156.	8930.
33-34	207.	171.	2750.	4360.	1600.	1310.	622.	393.	302.	200.	134.	142.	12200.
34-35	552.	296.	1900.	7360.	2290.	3350.	5520.	2070.	1000.	678.	490.	339.	25840.
1935-36	327.	383.	419.	370.	6680.	1930.	1160.	632.	361.	217.	150.	155.	12780.
36-37	446.	319.	2100.	2450.	14510.	18360.	6850.	2810.	1490.	932.	563.	402.	51230.
37-38	404.	405.	1050.	716.	16260.	48170.	6150.	3460.	1900.	1240.	821.	586.	81160.
38-39	612.	581.	1940.	2020.	1610.[a]	2990.	1210.	765.	423.	400.	307.	339.	13200.
39-40	340.	324.	400.	761.	2930.	1750.	895.	522.	306.	176.	131.	121.	8660.
1940-41	118.	193.	2930.	8970.	29450.	44780.	25040.	6520.	3020.	2040.	1300.	914.	125280.
41-42	891.	778.	2190.	1690.	988.	1020.	2600.	1290.	660.	361.	257.	222.	12950.
42-43	220.	270.	315.	17670.	12610.	19740.	3720.	2280.	1190.	778.	514.	355.	59660.
43-44	382.	421.	1120.	1190.	10780.	14500.	3880.	2220.	1370.	829.	497.	427.	37620.
44-45	437.	1090.	698.	616.	4990.	2380.	1700.	1030.	615.	364.	239.	193.	14350.
1945-46	223.	303.	4040.	1140.	950.	5150.	3470.	1380.	706.	361.	231.	180.	18130.
46-47	207.	1340.	3140.	1790.	865.	719.	516.	351.	244.	165.	104.	103.	9540.

Note: a. Gaging station moved 0.6 mile downstream on 11 Feb. 1939. Previous location was a short distance above dam site.

Data from U.S.G.S. Water Supply Papers

TABLE 8

Ventura County Flood Control District
Zone 1

Monthly Runoff in North Fork of
Matilija Creek at Matilija

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1928-29	26.8	50.0	84.1	113.	260.	291.	255.	93.2	44.8	22.8	12.5	13.7	1270.
29-30	25.2	25.6	24.6	136.	72.2	562.	149.	89.	31.9	16.1	12.3	17.3	1160.
1930-31	17.8	26.2	55.1	101.	173.	49.4	90.	108.	39.7	16.9	9.1	11.9	698.
31-32	12.3	52.4	869.	493.	4640.	611.	254.	178.	119.	67.6	47.6	38.9	7380.
32-33	-	-	-	-	No record			-	-	-	-	-	
33-34	26.8	33.9	875.	1130.	427.	235.	117.	71.6	55.7	41.9	30.7	35.3	3080.
34-35	129.	70.	636.	1690.	347.	866.	965.	408.	186.	90.	61.	60.	5510.
1935-36	63.	62.	87.	88.	1830.	484.	296.	160.	102.	72.	48.	40.	3330.
36-37	106.	76.	915.	828.	3750.	4390.	1720.	813.	437.	249.	170.	135.	13590.
37-38	139.	150.	377.	236.	4960.	12630.	1930.	996.	646.	400.	273.	182.	22920.
38-39	179.	167.	468.	424.	276.	510.	234.	172.	108.	81.	63.	59.	2740.
39-40	64.	65.	86.	193.	872.	374.	234.	154.	89.	52.	36.	32.	2250.
1940-41	47.	54.	761.	2150.	5990.	10710.	6740.	2100.	1110.	783.	503.	342.	31290.
41-42	328.	297.	812.	513.	340.	376.	788.	372.	224.	109.	74.	69.	4300.
42-43	75.	81.	99.	3710.	3440.	5660.	1220.	711.	447.	213.	176.	142.	15970.
43-44	136.	142.	490.	388.	2890.	3500.	871.	553.	366.	243.	155.	135.	9870.
44-45	132.	631.	203.	193.	1470.	815.	550.	327.	217.	126.	82.	72.	4820.
1945-46	92.	86.	1190.	317.	304.	1440.	963.	353.	159.	102.	80.	61.	5150.

Note: Data from U.S.G.S. Water Supply Papers

TABLE 9

Ventura County Flood Control District
Zone 1

Monthly Runoff in San Antonio Creek near Ojai

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1927-28	53.3	93.8	145.	120.	129.	154.	54.5	43.8	24.6	9.5	6.1	5.9	840.
28-29	9.1	55.5	56.7	39.7	54.5	54.3	34.3	16.9	14.1	1.6	0	0	337.
29-30	0	0	0	58.1	27.4	207.	18.6	16.4	2.8	0	0	0	330.
1930-31	0	0	0	118.	103.	12.3	11.9	8.5	3.0	0	0	0	257
31-32	0	42.6	1920.	270.	4080.	192.	83.5	59.9	27.8	7.1	9.3	8.1	6700

Note: Data are from U.S.G.S. Water Supply Papers

TABLE 10

Ventura County Flood Control District
Zone 1

Monthly Runoff in Coyote Creek near Ventura

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1927-28	6.1	11.9	50.7	61.5	140.	389.	58.3	35.3	17.3	13.1	12.3	11.9	808.
28-29	12.3	43.6	65.4	107.	466.	442.	190.	62.3	27.8	9.3	3.6	2.4	1430.
29-30	6.1	5.9	6.1	219.	42.8	1280.	93.2	29.7	11.9	9.9	6.1	5.9	1720.
1930-31	6.1	6.7	12.3	26.4	245.	39.9	119.	87.8	7.9	3.1	4.6	4.5	563.
31-32	6.1	6.5	4370.	886.	8300.	576.	148.	96.6	52.9	37.3	35.3	37.3	15000.
32-33	-	-	-	-	No record			-	-	-	-	-	
33-34	6.1	6.0	2660.	2350.	670.	265.	60.9	17.3	9.7	4.6	3.1	2.4	6060.
34-35	235.	128.	1330.	2780.	377.	933.	2500.	289.	70.	24.	8.7	11.	8690.
1935-36	12.	8.1	23.	47.	5560.	676.	367.	68.	28.	14.	6.1	6.0	6820.
36-37	10.	7.7	1670.	1300.	11800.	5340.	1450.	473.	147.	36.	21.	21.	22280.
37-38	14.	13.	430.	224.	6870.	16740.	1310.	531.	247.	101.	47.	29.	26560.
38-39	35.	49.	440.	769.	445.	920.	189.	85.	43.	14.	7.5	6.5	3000.
39-40	2.7	4.1	8.4	20.	1600.	483.	184.	73.	30.	14.	4.9	4.5	2430.
1940-41	3.6	3.6	2570.	5760.	11540.	18490.	9310.	1760.	678.	441.	202.	130.	50890.
41-42	132.	131.	1020.	498.	295.	332.	790.	286.	90.	29.	14.	12.	3630.
42-43	13.	12.	16.	14090.	4300.	8640.	1070.	468.	166.	80.	32.	19.	28910.
43-44	18.	19.	366.	257.	8260.	5060.	612.	307.	174.	62.	35.	23.	15190.
44-45	20.	262.	115.	118.	4390.	1600.	485.	151.	69.	35.	15.	11.	7270.
1945-46	10.	8.5	1200.	172.	271.	1190.	571.	118.	36.	16.	16.	6.5	3600.
46-47	4.3	997.	1070.	338.	153.	118.	85.	34.	17.	7.5	3.5	3.0	2830.

Note: Data from U.S.G.S. Water Supply Papers

TABLE 11

Ventura County Flood Control District
Zone 1

Full Natural Monthly Runoff in Santa Ynez River
above Gibraltar Dam near Santa Barbara

Acre Feet

Season	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug.	Sept.	Total
1903-04	-	- a	- a	- a	690.	1882.	1137.	424	42.	2.	0	11425.	-
04-05	541.	381.	430.	4544.	50260.	49010.	8509.	3148.	946.	234.	160.	83.	118000
1905-06	61.	125.	246.	916.	1520.	64600.	9400.	4140.	1420.	357.	86.	60.	82900
06-07	61.	83.	3210.	90400.	27200.	93500.	14100.	-	-	-	-	-	-
07-08	885.	161.	344.	16400.	-	-	-	-	-	-	-	-	-
1910-11	-	-	-	-	-	- a	13760.	5620.	2620.	1040.	420.	240.	-
11-12	357.	619.	812.	916.	684.	7190.	3910.	1690.	553.	160.	40.	18.4	16900.
12-13	20.	33.	49.	503.	8720.	4760.	1550.	769.	449.	76.	85.	15.	17000
13-14	6.	1070.	486.	49000.	57000.	18200.	5840.	3040.	1430.	585.	213.	121.	137000
14-15	140.	159.	1080.	3950.	28200.	10400.	-	-	-	-	-	-	-
1915-16	-	-	- a	- a	- a	- a	- a	- a	690.	181.	65.	12.	-
16-17	400.	357.	7560.	6760.	16700.	7930.	2740.	1450.	472.	81.8	33.8	14.9	44500
17-18	-	-	-	- a	21900.	57200.	9520.	3460.	1230.	343.	183.	316.	-
1919-20	-	-	-	-	-	-	2680.	924.	179.	60.3	27.2	21.0	-
1920-21	18.4	21.0	24.6	1146.	1517.	2136.	657.	631.	192.	73.8	47.2	36.5	6500
21-22	32.7	26.8	11310.	7561.	28205.	12306.	5294.	5477.	899.	258.	48.	19.	68400
22-23	23.8	96.4	3424.	1025.	1488.	914.	776.	597.	218.	67.4	37.1	28.2	8690
23-24	20.4	55.9	202.	178.	140.	1178.	381.	117.	44.	34.7	31.	45.	2430
24-25	53.	43.	80.9	92.	95.	653.	1626.	303.	99.	20.	12.9	20.	3100
1925-26	18.	85.	266.	204.	8402.	976.	36215.	1057.	369.	100.	50.	35.1	47800
26-27	20.	4566.	1230.	926.	31633.	9435.	3493.	504.	242.	137.	63.4	67.4	52300
27-28	59.5	155.	355.	290.	4691.	1902.	670.	266.	100.	40.	20.4	20.	8570
28-29	17.	102.	307.	192.	780.	1375.	799.	68.	46.6	10.7	0.4	0	3700
29-30	0	0	0	187.	64.	2186.	353.	224.	54.7	12.9	2.22	2.56	3090
1930-31	2.5	14.9	7.7	83.6	567.	174.	176.	146.	60.1	36.3	22.2	11.3	1300
31-32	15.0	107.	7380.	2680.	33690.	3080.	1520.	754.	265.	69.8	32.7	22.5	49620
32-33	10.7	23.2	10.9	5550.	2180.	1090.	561.	311.	145.	29.0	11.3	7.7	9930
33-34	7.7	6.0	1470.	10110.	2380.	1230.	325.	93.8	122.	18.2	8.3	6.3	15780
34-35	438.	740.	1960.	8250.	1600.	3380.	6900.	1620.	351.	62.	29.	21.	25350
1935-36	22.	23.	24.	30.	11540.	2520.	2100.	498.	92.	36.	24.	21.	16930
36-37	34.	22.	3700.	3530.	29730.	28270.	11550.	3310.	1020.	99.	30.	28.	81320
37-38	38.	34.	762.	448.	27580.	78910.	9610.	5130.	1720.	493.	99.	49.	124870
38-39	59.	128.	1550.	2570.	2450.	5120.	1280.	555.	141.	23.	13.	538.	14430
39-40	22.	23.	31.	1070.	4070.	2320.	1080.	370.	80.	12.	22.	12.	9110
1940-41	11.	12.	5020.	12170.	35650.	72160.	46400.	11310.	4660.	1860.	819.	378.	190450
41-42	345.	499.	3200.	3430.	2370.	2940.	5850.	2310.	521.	46.	22.	21.	21550
42-43	21.	23.	27.	35100.	14940.	29270.	7630.	2930.	1050.	198.	34.	39.	91260
43-44	30.	21.	696.	838.	18580.	22950.	4390.	1880.	758.	132.	9.9	6.9	50290
44-45	45.	1010.	394.	458.	11100.	5100.	2530.	804.	297.	55.	43.	58.	21890
1945-46	36.	21.	7030.	952.	1260.	8520.	6520.	911.	265.	96.	55.	51.	25720
46-47	3.3	2170.	5380.	3130.	1410.	1170.	595.	153.	20.	12.	11.	10.	14060

Notes: a. Partial record available.

For period from April 1920, when Gibraltar Dam was completed, to Dec. 1930, when Juncal Dam was completed upstream, data are from U.S.G.S. Water Supply Papers and represent reconstructed full natural runoff at dam site computed from reservoir operation records corrected for diversion, change in storage, precipitation, and evaporation.

For period from Dec. 1930, when Juncal Dam was completed, to date, data given herein represent reconstructed full natural runoff at Gibraltar Dam site and are based upon data given in U.S.G.S. Water Supply Papers corrected for effect of operation of Juncal Reservoir (Jameson Lake) upon inflow to Gibraltar Reservoir. Operation records for Juncal Reservoir were furnished by Montecito County Water District.

Except as noted, all data are from U S.G.S. Water Supply Papers.

TABLE 12

Ventura County Flood Control District
Zone 1

Diversion by City of San Buenaventura from Ventura River
at Casitas including Water Pumped above Submerged Dam

Acre Feet

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Calendar Year Total	Runoff Year Oct.1-Sep.30	Total
1920	-	-	223.	233.	349.	503.	361.	390.	376.	288.	233.	237.	-		
1921	178.	108.	165.	275.	255.	237.	355.	333.	278.	223.	197.	183.	2787.	1920-21	2942.
22	115.	110.	124.	141.	259.	324.	328.	348.	353.	251.	170.	123.	2646.	21-22	2705.
23	144.	129.	276.	328.	337.	370.	401.	400.	322.	333.	325.	276.	3641.	22-23	3251.
24	285.	207.	309.	366.	410.	377.	340.	254.	239.	229.	-		-	23-24	3721.
25	-	-	-	-	-	-	235.	233.	177.	176.	148.	174.	-	24-25	-
1926	174.	103.	148.	236.	343.	364.	-	-	-	-	-	-	-	1925-26	-
1932	-	-	-	-	-	-	-	-	-	-	246.3	237.6	-	1931-32	-
33	185.5	173.3	309.8	365.1	313.5	293.1	265.8	234.1	220.7	158.7	176.3	186.8	2882.7	32-33	-
34	152.8	177.4	143.6	287.3	299.0	271.6	224.9	191.6	199.6	174.6	191.7	174.0	2488.1	33-34	2469.6
35	144.6	191.2	204.1	226.9	290.9	337.7	428.9	421.1	328.5	351.1	284.9	286.6	3496.5	34-35	3114.2
1936	275.7	206.5	285.3	272.1	356.0	412.7	432.2	343.6	315.4	278.8	270.7	238.3	3687.3	1935-36	3822.1
37	225.7	186.1	256.7	289.8	338.5	418.4	447.0	440.6	359.5	379.6	268.1	232.5	3842.5	36-37	3750.1
38	223.3	193.9	162.3	277.8	334.0	432.9	427.9	391.1	329.9	365.5	336.6	271.1	3746.3	37-38	3653.3
39	263.5	249.5	259.7	293.6	344.8	506.1	517.8	479.5	422.8	413.4	364.1	297.3	4412.1	38-39	4310.5
40	269.1	302.7	273.4	296.9	376.0	475.4	458.4	412.8	382.5	365.9	301.0	227.2	4141.3	39-40	4322.0
1941	249.4	225.0	277.7	271.3	319.3	405.9	545.5	453.5	442.0	352.6	328.3	281.8	4152.3	1940-41	4083.7
42	267.2	223.5	229.4	247.3	319.3	445.1	400.7	440.0	360.1	365.5	257.6	260.9	3816.6	41-42	3895.3
43	258.6	245.1	270.8	257.7	323.9	576.0	559.5	524.3	466.9	412.6	371.1	327.3	4593.8	42-43	4366.8
44	315.2	299.0	345.0	399.7	308.7	533.3	521.2	540.7	495.6	483.6	352.4	353.5	4947.9	43-44	4869.4
45	389.7	379.0	358.3	371.1	426.4	648.2	516.5	589.3	390.5	490.0	387.1	355.4	5301.5	44-45	5258.5
1946	412.4	375.9	422.7	439.2	457.3	655.9	624.1	620.7	539.3	504.2	387.9	406.2	5845.8	1945-46	5780.0
47	487.5	448.2	536.1	582.2	662.8	588.6	579.5	464.2	369.7					46-47	6017.1

Note: Data for 1920 to 1926 inclusive, are from Report to City of San Buenaventura by J. B. Lippincott, May 1934, Table 2.
Data for 1932 and after were obtained from City records.

TABLE 13

Ventura County Flood Control District
Zone 1

Total Water Production
by City of San Buenaventura

Acre Feet

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Calendar Year Total	Runoff Year Oct.1-Sep.30	Total
1932	-	-	-	-	-	-	-	-	-	-	267.8	237.6	-		
33	245.0	208.4	309.8	365.1	313.5	306.9	325.1	345.1	368.1	293.4	267.3	254.5	3602.2	1932-33	
34	295.3	239.2	278.3	362.9	457.0	406.0	373.9	421.6	422.5	347.2	309.0	289.0	4201.9	33-34	4071.9
35	284.5	248.8	265.3	256.2	290.9	337.7	443.9	423.8	329.1	386.5	284.9	286.6	3838.2	34-35	3825.4
1936	275.8	243.2	285.3	272.1	356.0	412.7	467.2	376.3	460.2	333.5	329.3	311.2	4122.8	1935-36	4106.8
37	271.3	244.8	298.8	289.8	339.6	424.3	447.0	440.6	359.5	379.6	275.9	232.5	4003.7	36-37	4089.7
38	233.7	224.2	294.5	281.0	334.0	432.9	427.9	391.1	329.9	365.5	359.4	289.7	3963.8	37-38	3837.2
39	263.5	249.5	259.7	293.6	344.8	506.1	517.8	479.5	449.0	441.6	403.9	297.3	4506.3	38-39	4378.1
40	269.3	302.7	273.4	296.9	376.0	475.4	458.4	412.8	382.5	376.4	320.3	306.9	4251.0	39-40	4390.2
1941	249.4	225.0	277.7	271.3	319.3	405.9	545.5	453.5	442.0	352.6	328.3	281.8	4152.3	1940-41	4193.2
42	268.3	223.5	229.4	247.3	319.3	445.1	400.7	440.0	360.1	365.5	257.6	260.9	3817.7	41-42	3896.4
43	259.7	245.1	270.8	257.7	323.9	576.0	559.5	524.3	466.9	412.6	371.1	327.3	4594.9	42-43	4367.9
44	315.2	299.0	345.0	399.7	308.7	533.3	521.2	540.7	495.6	483.6	352.4	353.5	4947.9	43-44	4869.4
45	389.7	379.0	358.3	371.1	426.4	648.2	516.5	589.3	390.5	490.0	398.1	363.3	5320.4	44-45	5258.5
1946	412.4	378.1	422.7	439.2	457.3	655.9	624.1	620.7	539.3	504.2	387.9	429.0	5870.8	1945-46	5801.1
47	487.5	448.2	536.1	582.2	662.8	588.6	579.5	464.2	369.7					46-47	6039.9

Note: Data were obtained from City records.

TABLE 14

Estimated Maximum Monthly Demand
upon Ventura River by
City of San Buenaventura

Month	Acre Feet	%
Jan.	488	7.6
Feb.	448	6.9
March	536	8.3
April	582	9.0
May	663	10.3
June	656	10.2
July	624	9.7
Aug.	621	9.6
Sept.	539	8.3
Oct.	504	7.8
Nov.	388	6.0
Dec.	406	6.3
Total	6455	100.0

Note: Each value equals maximum historical diversion for corresponding month for five year period, Oct. 1942 through Sept. 1927. See Table 12. Includes water pumped from ground water above Casitas submerged dam.

TABLE 15

Estimated Average Net Effect of Evaporation from Matilija Reservoir on Stream Flow

Feet Depth

Month	Estimated evaporation from reservoir water surface [a]	Estimated original consumptive use in reservoir site	Net loss of water
Jan.	.08	.04	.04
Feb.	.08	.04	.04
Mar.	.18	.08	.10
Apr.	.26	.12	.14
May	.34	.15	.19
June	.43	.19	.24
July	.49	.22	.27
Aug.	.52	.24	.28
Sept.	.50	.23	.27
Oct.	.35	.16	.19
Nov.	.16	.07	.09
Dec.	.09	.04	.05
Total	3.48	1.58	1.90

Note: a. Based on average evaporation from a U. S. Weather Bureau evaporation pan located at Jameson Lake, 1932 through 1945, corrected by factors given in Table 10, Division of Water Resources Bulletin No. 54, "Evaporation from Water Surfaces in California", to obtain evaporation from reservoir surface.

TABLE 16

Estimated Maximum Demand on Ventura River by Upper Gravity Rights
Assuming Normal Duty of Water for Present Culture Served

(Physical Availability of Water for Diversion not considered)

1. Priority	Owner	Culture	Present Acreage	Estimated Duty Feet	Acre Feet Required	
1	Sheldon	Citrus	15	2.35	35	
	Rowe	Citrus	15	2.35	35	
	Soper	Truck	5	3.3	16	86
2	Rancho Ojai Mutual Water Company	Subdiv.	83	1.75	145	
		Citrus	286	2.35	672	817
3	Rancho Matilija	Citrus	51	2.35	120	
		Walnuts	44	1.90	84	204
						1107

2. Estimated Percent Distribution of Demand by Months

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Citrus	3	3	3	4	8	11	12	14	13	11	10	8	100
Truck	3	3	3	4	8	11	12	14	13	11	10	8	100
Walnuts	0	0	9	9	11	17	19	19	11	5	0	0	100
Subdivision	6	6	7	7	8	10	11	11	10	9	8	7	100

Table 16, contd.

3. Estimated Demand by Months

Acre Feet

Owner	Culture	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Sheldon	Citrus	1	1	1	2	3	4	4	5	4	4	3	3	35
Rowe	Citrus	1	1	1	2	3	4	4	5	4	4	3	3	35
Soper	Truck	0	0	1	1	1	2	2	2	2	2	2	1	16
		2	2	3	5	7	10	10	12	10	10	8	7	86
Rancho	Subdiv.	9	9	10	10	12	14	16	16	14	13	12	10	145
Ojai Mut.	Citrus	20	20	20	27	54	74	81	94	87	74	67	54	672
Water Co.		29	29	30	37	66	88	97	110	101	87	79	64	817
Rancho	Citrus	4	3	4	5	10	13	14	17	15	13	12	10	120
Matilija	Walnuts	0	0	8	8	9	14	16	16	9	4	0	0	84
		4	3	12	13	19	27	30	33	24	17	12	10	204

Note: Data concerning present culture are from Ventura County Water Survey.
Percent distribution by months is based upon experience of other water service organizations and of City of San Buenaventura.

TABLE 17

Estimated Maximum Demand on Ventura River by Upper Gravity Rights
Assuming 50% combined Irrigation and Domestic Culture with
Normal Demand and 50% entirely Irrigation Culture with
Demand approximating present practice

(Physical Availability of Water for Diversion not considered)

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1927	Combined service	-	-	-	-	202	315	296	224	287	211	98	138	-
	Irrigation service	-	-	-	-	326	315	326	326	315	263	0	0	-
	Total					528	630	622	550	602	474	98	138	-
1928	Combined service	172	175	135	286	326	270	288	272	278	199	170	124	
	Irrigation service	0	0	0	263	284	315	326	326	315	326	116	0	
	Total	172	175	135	549	610	585	614	598	593	525	286	124	4966
1929	Combined service	139	38	132	106	218	291	326	278	258	260	245	238	
	Irrigation service	0	0	95	221	326	315	326	326	315	326	315	326	
	Total	139	38	227	327	544	606	652	604	573	586	560	564	5420
1930	Combined service	80	83	91	210	265	315	326	320	293	310	243	224	
	Irrigation service	0	0	0	305	274	315	326	326	315	326	158	221	
	Total	80	83	91	515	539	630	652	646	608	636	401	445	5326
1931	Combined service	51	13	150	252	89	197	326	288	246	252	190	64	
	Irrigation service	0	0	326	231	168	315	326	326	315	326	137	0	
	Total	51	13	476	483	257	512	652	614	561	578	327	64	4588

Note: It is assumed that 50% of gravity rights, or 265 miner's inches, are to be used for combined domestic and irrigation service with regimen of monthly demand the same as historical experience of Thermal Belt Mutual Water Co. with continuous utilization of full right in maximum month. Remaining 50% of rights is assumed to be used solely for irrigation service with continuous utilization of that amount of water during irrigation season as determined by regimen of rainfall.

TABLE 18

Distribution of Monthly Inflow
to Matilija Reservoir

1. All downstream rights considered.

2. Use by Upper Gravity Rights based upon normal duty of water for present culture served. See Table 16.

Acre Feet

Year	Month	Inflow to Reservoir	Estimated release from reservoir required for upper gravity users	Estimated release from reservoir required for all users below	Estimated amount available for storage
1927	July[a]	860[b]	4	622	234
	Aug.	520[b]	5	515	0
	Sept.	350[b]	25	325	0
	Oct.	263	14	249	0
	Nov.	387	3	384	0
	Dec.	575	3	463	109
	Total for period	2955	54	2558	343
1928	Jan.	498	1	421	76
	Feb.	1213	1	548	664
	Mar.	1104	1	594	509
	Apr.	500	2	427	71
	May	382	6	376	0
	June	210	85	125	0
	July	116	107	9	0
	Aug.	73	73	0	0
	Sept.	61	61	0	0
	Oct.	69	69	0	0
	Nov.	110	49	61	0
	Dec.	221	26	195	0
	Total	4557	481	2756	1320

Table 18, contd.

Year	Month	Inflow to Reservoir	Estimated release from reservoir required for upper gravity users	Estimated release from reservoir required for all users below	Estimated amount available for storage
1929	Jan.	279	1	278	0
	Feb.	659	1	481	177
	Mar.	857	1	527	329
	Apr.	747	2	500	245
	May	335	12	315	8
	June	206	80	126	0
	July	84	84	0	0
	Aug.	53	53	0	0
	Sept.	34	34	0	0
	Oct.	31	31	0	0
	Nov.	38	38	0	0
	Dec.	54	54	0	0
	Total	3377	391	2227	759
1930	Jan.	283	2	256	25
	Feb.	296	1	295	0
	Mar.	1620	1	759	860
	Apr.	649	2	499	148
	May	381	14	357	10
	June	149	93	56	0
	July	58	58	0	0
	Aug.	35	35	0	0
	Sept.	33	33	0	0
	Oct.	39	39	0	0
	Nov.	59	59	0	0
	Dec.	93	26	67	0
	Total	3695	363	2289	1043
1931	Jan.	153	1	152	0
	Feb.	507	1	420	86
	Mar.	262	4	258	0
	Apr.	184	24	127	33
	May	296	18	254	24
	June	203	85	118	0
	July	67	67	0	0
	Aug.	39	39	0	0
	Sept.	47	47	0	0
	Oct.	35	35	0	0
	Nov.[a]	126	53	55	18
	Dec.[a]	2840	8	509	2323
	Total	4759	382	1893	2484

Note: a. For calculations of safe yield, reservoir was assumed full on 1 July 1927 and empty on 30 Nov. 1931.
b. Estimated.

TABLE 19

Distribution of Monthly Inflow
to Matilija Reservoir

1. All downstream rights considered.

2. Upper gravity rights assumed to be devoted 50% to combined Domestic and Irrigation Service, and 50% to Irrigation Service. See Table 17.

Acre Feet

Year	Month	Inflow to Reservoir	Estimated release from reservoir required for upper gravity users	Estimated release from reservoir required for lower users	Estimated amount available for storage
1927	July[a]	860[b]	392	450	18
	Aug.	520[b]	380	140	0
	Sept.	350[b]	350	0	0
	Oct.	263	222	41	0
	Nov.	387	0	387	0
	Dec.	575	0	470	105
	Total for period	2955	1344	1488	123
1928	Jan.	498	4	473	21
	Feb.	1213	1	678	534
	Mar.	1104	0	647	457
	Apr.	500	377	116	7
	May	382	371	11	0
	June	210	210	0	0
	July	116	116	0	0
	Aug.	73	73	0	0
	Sept.	61	61	0	0
	Oct.	69	69	0	0
	Nov.	110	100	10	0
	Dec.	221	54	167	0
	Total	4557	1436	2102	1019

Table 19, contd.

Year	Month	Inflow to Reservoir	Estimated release from reservoir required for upper gravity users	Estimated release from reservoir required for lower users	Estimated amount available for storage
1929	Jan.	279	47	232	0
	Feb.	659	0	485	174
	Mar.	857	89	483	285
	Apr.	747	166	453	128
	May	335	322	13	0
	June	206	206	0	0
	July	84	84	0	0
	Aug.	53	53	0	0
	Sept.	34	34	0	0
	Oct.	31	31	0	0
	Nov.	38	38	0	0
	Dec.	54	54	0	0
	Total	3377	1124	1666	587
1930	Jan.	283	7	250	26
	Feb.	296	17	279	0
	Mar.	1620	0	781	839
	Apr.	649	363	274	12
	May	381	307	74	0
	June	149	149	0	0
	July	58	58	0	0
	Aug.	35	35	0	0
	Sept.	33	33	0	0
	Oct.	39	39	0	0
	Nov.	59	59	0	0
	Dec.	93	93	0	0
	Total	3695	1160	1658	877
1931	Jan.	153	0	153	0
	Feb.	507	0	419	88
	Mar.	262	262	0	0
	Apr.	184	99	60	25
	May	296	123	149	24
	June	203	203	0	0
	July	67	67	0	0
	Aug.	39	39	0	0
	Sept.	47	47	0	0
	Oct.	35	35	0	0
	Nov.	126	69	39	18
	Dec.	2840	1	490	2349
	Total	4759	945	1310	2504

Note: a. For calculations of safe yield, reservoir was assumed full on 1 July 1927 and empty on 30 Nov. 1931.
b. Estimated.

TABLE 20

Estimated Deficiency in Supply for Upper Gravity Rights from Natural Runoff in Ventura River System Assuming Normal Duty of Water for Present Culture Served (See Table 16)

Acre Feet

	1927	1928	1929	1930	1931
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	0	0	0	0	0
May	0	0	0	0	0
June	0	0	0	0	0
July	0	0	30	63	53
August	0	62	90	108	107
Sept.	0	54	87	85	76
Oct.	0	18	58	57	67
Nov.	0	0	35	14	0
Dec.	0	0	2	0	0
	0	134	302	327	303