EXHIBIT 11

PART 3

FIGURE 7

GROUND WATER RECHARGE =

- Deep percolation of delivered water = Gross delivered water − (Consumptive use of delivered water on land use class areas + Consumptive use of water system losses + Net sewage export + Industrial waste and sewage passing Gage F-57 + Operational spills passing Gage F-57.)

  plus

- Deep percolation of precipitation on land use class areas. = Precipitation on valley fill areas. − (Consumptive use of precipitation on land use class areas + Residual rain.)

  plus

- Deep percolation of native water in the stream system. = (Hill and mountain runoff + Residual rain on the valley fill areas.) − (Native water spread + Surface diversions on valley fill areas + Runoff to reservoirs + Net storm runoff passing Gage F-57 + Evaporation of runoff in Hansen Dam.)

  plus

- Native water spread.

GROUND WATER DRAFT =

- Well extractions (including export) +
- Subsurface outflow +
- Consumptive use of ground water +
- Sewer infiltration +
- Rising water passing Gage F-57.

GROUND WATER RECHARGE − GROUND WATER DRAFT = CHANGE IN GROUND WATER STORAGE

HYDROLOGIC EQUATIONS FOR THE UPPER LOS ANGELES RIVER AREA GROUND WATER RESERVOIR SHOWING ITEMS OF RECHARGE AND DRAFT WITH REFERENCE TO THE GROUND WATER TABLE

TABLE 41

GROSS HISTORIC RECHARGE OF DELIVERED WATER TO THE GROUND WATER RESERVOIR

In 1,000 Acre-Feet

Year	Gross delivered water (1)	Precipitation on reservoirs (2)	Adjusted consumptive use of delivered water (3)	Net sewage export (4)	Outflows passing Gage F-57: Industrial waste and sewage (5)	Outflows passing Gage F-57: Owens (6)	Gross recharge of delivered water (7)
1928-29	139.0	0.9	98.0	5.1	0	0.7	34.3
29-30	146.0	0.9	100.5	6.1	0	0.3	38.2
1930-31	151.5	1.1	97.6	7.2	0	0.3	45.3
31-32	156.1	1.4	77.9	8.1	0	1.6	67.1
32-33	149.7	0.8	77.4	8.6	0	0	62.9
33-34	138.6	1.0	82.0	9.1	0	1.8	44.7
34-35	135.6	1.4	74.0	9.2	0	0.4	50.6
1935-36	159.0	1.0	95.4	9.9	0	0.6	52.1
36-37	133.5	1.7	81.1	10.4	0	1.8	38.5
37-38	132.0	1.7	75.4	11.1	0	1.7	41.1
38-39	145.9	1.4	83.5	12.1	0	2.9	46.0
39-40	127.9	1.2	79.4	13.1	0	0.8	33.4
1940-41	119.5	2.7	64.6	14.2	0.2	0	37.8
41-42	165.0	0.9	99.5	15.0	0.4	5.2	44.0
42-43	180.7	1.7	96.1	15.5	0.6	8.7	58.1
43-44	164.9	1.7	94.2	16.1	0.8	2.9	49.2
44-45	172.8	1.0	113.2	17.2	1.0	1.2	39.2
1945-46	188.2	1.0	113.9	18.7	1.3	4.1	49.2
46-47	197.0	1.1	117.9	20.4	1.5	6.0	50.1
47-48	210.4	0.5	138.3	23.3	1.7	0	48.6
48-49	209.2	0.6	134.5	26.5	1.9	0.7	45.0
49-50	202.2	0.9	125.1	28.9	2.1	0	45.2
1950-51	225.7	0.7	139.3	32.3	1.9	1.1	50.4
51-52	207.7	2.2	101.9	35.3	1.8	1.4	65.1
52-53	231.1	0.9	133.6	37.8	1.4	1.7	55.7
53-54	226.6	1.0	120.4	42.0	1.0	0.3	61.9
54-55	224.4	1.0	117.7	39.6	1.6	0	64.5
1955-56	220.9	1.3	107.7	44.0	2.4	0	65.5
56-57	237.0	0.9	122.4	51.2	0.8	0	61.7
57-58	222.0	2.2	106.1	55.1	1.3	0	57.3
29-Year Average 1929-57	175.8	1.2	102.2	20.3	0.8	1.6	49.8

Source and derivation of values by column number:

Column No.

1. Table 20, Column 17.
2. Table M-1, Column 6, Appendix M.
3. Table 40, Column 4.
4. Table 26, Column 4.
5. Table 28, Sum of Columns 2 and 3.
6. Table 28, Column 4.
7. Column 1 minus Columns 2 through 6 herein.

TABLE 42

GROSS HISTORIC RECHARGE OF NATIVE WATER TO THE GROUND WATER RESERVOIR

In 1,000 Acre-Feet

Year	Land use areas: Precipitation valley fill	Land use areas: Adjusted consumptive use of precipitation	Land use areas: Residual rain	Land use areas: Deep percolation of precipitation on land use areas	Stream system: Hill and mountain runoff	Stream system: Residual rain	Stream system: Native spread	Stream system: Surface diversion valley fill	Stream system: Runoff to reservoirs	Stream system: Evaporation of runoff	Stream system: Net storm runoff	Stream system: Deep percolation of native water in stream system	Native spread	Gross recharge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1928-29	122.4	101.4	6.8	14.2	7.0	6.8	0	0.5	0.1	0	3.0	10.2	0	24.4
29-30	125.7	100.1	8.8	16.8	5.7	8.8	0	0.5	0	0	1.3	12.7	0	29.5
1930-31	155.8	128.9	13.2	13.7	4.4	13.2	0	0.5	0	0	3.7	13.4	0	27.1
31-32	207.4	163.5	20.7	23.2	58.9	20.7	0	0.5	2.6	0	13.6	62.9	0	86.1
32-33	133.5	92.7	13.6	27.2	13.6	13.6	0	0.3	0.3	0	10.2	16.4	0	43.6
33-34	150.0	105.6	19.6	24.8	20.3	19.6	0.2	0.4	0.7	0	26.4	12.2	0.2	37.2
34-35	207.1	183.7	23.3	0.1	24.3	23.3	1.2	0.2	0.3	0	11.4	34.5	1.2	35.8
1935-36	131.0	98.5	13.8	18.7	19.2	13.8	2.0	0.1	0.6	0	4.5	25.8	2.0	46.5
36-37	242.2	180.6	30.1	31.5	91.7	30.1	4.7	0.2	3.4	0	21.3	92.2	4.7	128.4
37-38	258.6	171.4	34.1	53.1	177.6	34.1	3.8	0.1	5.1	0	123.2	79.5	3.8	136.4
38-39	219.1	173.1	29.3	16.7	29.0	29.3	0.4	0.2	1.0	0	24.9	31.8	0.4	48.9
39-40	172.0	136.1	21.8	14.1	20.4	21.8	0.9	0.3	0.5	0	24.6	15.7	0.9	30.7
1940-41	409.8	245.8	67.2	96.8	191.4	67.2	9.8	0.3	6.5	0.2	139.0	102.8	9.8	209.4
41-42	137.7	111.0	16.3	10.4	22.1	16.3	0	0.1	0.7	0.5	20.6	16.5	0	26.9
42-43	259.0	161.6	42.2	55.2	166.5	42.2	3.7	0.1	2.3	0.4	89.6	112.6	3.7	171.5
43-44	254.3	160.7	43.0	50.6	124.5	43.0	7.2	0.2	1.7	0.4	79.7	78.4	7.2	136.2
44-45	148.5	114.5	21.8	12.2	37.7	21.8	9.1	0.2	0.5	0.5	18.1	31.1	9.1	52.4
1945-46	141.3	100.9	22.8	17.8	25.1	22.8	2.8	0.1	0.2	0.5	20.0	24.3	2.8	44.7
46-47	156.0	113.8	25.2	17.0	32.6	25.2	12.5	0.1	0.2	0.5	14.2	30.9	12.5	59.8
47-48	80.1	46.3	12.0	21.8	6.4	12.0	0	0.2	0	0.6	6.0	11.6	0	33.4
48-49	86.6	55.5	10.3	20.8	3.7	10.3	0	0.1	0	0.6	12.6	0.7	0	21.5
49-50	111.2	76.4	16.4	18.4	6.0	16.4	0.3	0	0.1	0.6	8.7	12.7	0.3	31.4
1950-51	89.9	60.1	10.4	19.4	3.5	10.4	0	0	0.1	0.6	4.9	8.3	0	27.7
51-52	315.0	187.8	71.4	55.8	116.8	71.4	23.0	0	1.9	0.4	101.8	61.1	23.0	139.9
52-53	116.9	83.6	18.4	16.9	16.0	18.4	2.9	0	0.2	0.6	15.4	15.3	2.9	35.1
53-54	138.4	89.7	28.3	20.4	17.3	28.3	2.9	0	0.2	0.5	19.8	22.2	2.9	45.5
54-55	142.9	109.4	21.9	11.6	10.0	21.9	0.2	0	0.1	0.5	16.7	14.4	0.2	26.2
1955-56	171.2	112.8	42.1	16.3	14.5	42.1	0.6	0	0.2	0.4	33.5	21.9	0.6	38.8
56-57	134.0	84.4	31.5	18.1	10.0	31.5	0.5	0	0.1	0.5	24.1	16.3	0.5	34.9
57-58	278.6	168.8	74.9	34.9	93.3	74.9	30.4	0	1.4	0.5	89.8	46.1	30.4	111.4
29-Year Average 1929-57	173.1	122.4	25.4	25.3	44.0	25.4	3.0	0.2	1.0	0.3	30.8	34.1	3.0	62.4

Source and derivation of values by column number:

Column No.

1. Table 1.
2. Table 40, Column 7.
3. Column 1 minus Table 35, Column 22.
4. Column 1 minus Columns 2 and 3, herein.
5. Table 3.
6. Same as Column 3 herein.
7. Table 30.
8. Table 16, Column 1.
9. Table F-10, Appendix F.
10. Table 1-22A.
11. Table 28, Column 5.
12. Column 5 plus Column 6 minus Columns 7, 8, 9, 10 and 11.
13. Table 30.
14. Sum of Columns 4, 12 and 13, herein.

TABLE 43

HISTORIC HYDROLOGIC INVENTORY OF GROUND WATER RESERVOIR

In 1,000 Acre-Feet

Year	Supply: Gross recharge: Delivered water (1)	Supply: Gross recharge: Native water (2)	Supply: Total supply (3)	Disposal: Extractions (4)	Disposal: Subsurface outflow (5)	Disposal: Consumptive use of ground water (6)	Disposal: Sewer infiltration (7)	Disposal: Rising water passing Gage F-57 (8)	Disposal: Total disposal (9)	Change in ground water storage (10)	Supply minus disposal and change in storage (11)=(3)-(9)-(10)
1928-29	34.3	24.4	58.7	89.7	0.6	5.9	0.3	0	96.5	- 43.0	5.2
29-30	38.2	29.5	67.7	93.2	0.5	5.2	0.2	0	99.1	- 16.9	-14.5
1930-31	45.3	27.1	72.4	96.4	0.5	4.4	0.4	0	101.7	- 26.8	- 2.5
31-32	67.1	86.1	153.2	69.4	0.6	5.5	0.9	0.1	76.6	69.8	6.8
32-33	62.9	43.6	106.5	67.3	0.7	4.6	0.4	0.4	73.4	25.8	7.3
33-34	44.7	37.2	81.9	91.9	0.7	4.5	0.3	1.7	99.1	- 27.1	9.9
34-35	50.6	35.8	86.4	78.8	0.8	5.5	1.7	0.8	87.7	38.6	-39.9
1935-36	52.1	46.5	98.6	88.2	0.8	6.5	1.6	0.7	97.9	0.5	0.2
36-37	38.5	128.4	166.9	83.7	0.8	5.1	1.9	1.4	92.9	36.2	37.8
37-38	41.1	136.4	177.5	82.2	0.7	6.1	2.2	7.7	98.9	76.4	2.2
38-39	46.0	48.9	94.9	84.2	0.9	4.5	3.3	14.5	107.4	- 10.1	- 2.4
39-40	33.4	30.7	64.1	86.3	0.8	3.9	3.3	14.1	108.4	- 38.5	- 5.7
1940-41	37.8	209.4	247.2	87.9	0.8	5.3	6.3	25.8	126.1	128.0	- 6.9
41-42	44.0	26.9	70.9	86.4	0.8	9.2	5.7	28.6	130.7	- 34.2	-25.6
42-43	58.1	171.5	229.6	99.3	0.8	11.4	5.8	25.5	142.8	32.5	54.3
43-44	49.2	136.2	185.4	104.4	0.8	12.6	6.1	26.5	150.4	49.1	-14.1
44-45	39.2	52.4	91.6	122.1	0.8	3.6	5.3	16.5	148.4	- 77.2	20.4
1945-46	49.2	44.7	93.9	133.1	0.8	3.6	4.0	10.5	152.0	- 38.2	-19.9
46-47	50.1	59.8	109.9	137.0	0.8	2.6	5.3	9.7	155.4	- 47.9	2.4
47-48	46.6	33.4	80.0	137.7	0.7	2.7	4.0	7.3	152.4	- 62.1	-10.3
48-49	45.0	21.5	66.5	137.8	0.6	2.6	2.3	2.4	145.7	- 69.3	- 7.9
49-50	45.2	31.4	76.6	140.9	0.6	2.8	1.2	0	145.6	- 45.6	-23.3
1950-51	50.4	27.7	78.1	134.8	0.6	2.8	1.2	0	139.4	- 54.2	- 7.1
51-52	65.1	139.9	205.0	129.9	0.6	2.9	2.1	3.1	138.5	47.4	19.1
52-53	55.7	35.1	90.8	155.0	0.6	3.1	1.0	0	159.7	- 72.5	3.6
53-54	61.9	45.5	107.4	155.1	0.5	2.1	1.8	0	159.5	- 60.5	5.4
54-55	64.5	26.2	90.7	151.1	0.6	1.9	2.0	0	155.6	- 51.5	-13.4
1955-56	65.5	38.8	104.3	154.0	0.6	1.5	3.0	0	159.1	- 71.4	15.5
56-57	61.7	34.9	96.6	162.4	0.5	1.4	3.3	0	167.6	- 3.8	-67.2
57-58	57.3	111.4	168.7	146.5	0.4	1.2	2.3	0	150.4	- 4.3	22.6
29-Year Average 1929-57	49.8	62.4	112.2	111.7	0.7	4.6	2.6	6.8	126.5	-12.0	- 2.4

Source and derivation of values by column number:

Column No.

1. Table 41, Column 7.
2. Table 42, Column 13.
3. Sum of Columns 1 and 2 herein.
4. Table 15, Column 3.
5. Table 31, Column 3.
6. Table 4-22
7. Table 26, Column 3.
8. Table 28, Column 1.
9. Sum of Columns 4 through 8.
10. Table 33, Column 5.
11. Amounts should agree with those in column 9, Table 39. Annual amounts differ by a maximum of 300 acre-feet. 29-year averages are identical.

Z

CHAPTER VII. SAFE YIELD

This chapter contains the determination of the safe yield of the ground water reservoir of the Upper Los Angeles River area based on cultural conditions existing during the water years 1949-50, 1954-55 and 1957-58. The effect of the importation of foreign waters on the safe yield is also determined. These determinations are made to satisfy Paragraph I. 2, H. of the Order of Reference:

> "The safe yield, and the effect thereon of the importation of foreign waters, shall be determined for the water year immediately preceding the filing of the report for which data is available, and for the water years ending 1950 and 1955."

The safe yield of the ground water reservoir of the Upper Los Angeles River area is defined as the maximum average annual ground water extractions which can be continually withdrawn for useful purposes under a given set of conditions without causing an undesirable result. Conditions imposed herein for the determination of safe yield are summarized in Table 55, page 246b, and the maximum average annual ground water extractions which could be taken under these conditions without the undesirable occurrence of continued lowering of the ground water levels is determined as the safe yield.

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Limitations and Factors Influencing Safe Yield

Analysis has been restricted to the two potential limitations on ground water yield which are believed pertinent within the scope of the reference. These are the amount of the ground water recharge from native and imported water sources under conditions imposed for determination of safe yield, and the ability of the ground water reservoir to regulate this supply under those conditions.

The amount of the safe yield is dependent upon the average amount of water which can be stored in and used from the ground water reservoir over a period of normal water supply under a given set of conditions. Thus, safe yield is related to factors which influence or control ground water recharge and to the amount of storage space available to carry over recharge occurring in years of above average supply to years of deficient supply.

Recharge, in turn, depends on the available surface water supply and the factors influencing the percolation of that supply to the water table. The 29-year base period, 1928-29 through 1956-57, has been adopted as representative of normal native water supply conditions because the magnitude and occurrence of annual water supply from precipitation is representative of the long-time mean. The major land use trend of the base period is from agricultural to urban development and has resulted in an increased proportion of impervious area affecting rain recharge to the ground water reservoir through increased runoff and reduced opportunity for consumptive use. Concurrent improvement of drainage channels has partially removed a major medium of ground water recharge from the native supply. Reduction in recharge from these changes has been offset to some extent by the construction and operation of spreading works during the base period to increase the native water recharge. Urbanization of the valley also has affected the ground water recharge from import supplies, mainly through increased sewage outflows and changes in potential consumptive use. The above conditions have been considered in the determination of safe yield.

The change in ground water storage in the valley fill of the Upper Los Angeles River area from 1943-44 to 1957-58 ground water levels was a reduction of 611,000 acre-feet (see Table 33, page 166). An operational study of the ground water reservoir, using the conditions under which safe yield is determined, indicates that a maximum of about 360,000 acre-feet of storage is required for regulation of supply over the 29-year base period. Under such operation, about 210,000 acre-feet of this maximum amount was found to be required above the 1957-58 levels and about 150,000 acre-feet was found to be required below these levels. The data available since 1957-58 indicate that a total of at least 150,000 acre-feet has been taken from storage below the 1957-58 levels. Therefore, the availability of ground water storage space is not a limitation on safe yield under the conditions adopted.

Conditions for Safe Yield Determination

Safe yield is determined herein by evaluation of the average net ground water recharge which would occur if the culture of the safe yield year and the average historic import and export for the safe yield year had existed each year over a period of normal native supply. The average gross recharge of average historic import is obtained by (1) determining the average delivered water required by the culture and conditions of the safe yield year; (2) calculating the average gross recharge therefrom as a percent of the average delivered water; and (3) applying this percentage to the average historic import. In evaluating the average amounts of each item of supply and disposal, consideration has been given not only to the historic variation of the item but also to the factors causing the variation.

Gross recharge from native sources occurs as percolation from precipitation on land use areas on the valley fill, percolation from runoff in the stream system and percolation of native spread water, and is determined under normal precipitation and runoff conditions with the culture existing during the safe yield year.

In order to determine safe yields on a comparable basis with regard to availability of regulatory storage capacity and items dependent thereon, such as rejected recharge and rising water, the ground water levels existing as of 1957-58 are used as a beginning point for basin operation in the evaluation of safe yield for each of the three years.

The annual depths of water delivered to land use classes (Tables J-8 and J-12) during the 1932-40 period are small when compared to the amounts delivered in the 1949-58 period, which includes the safe yield years. This difference in depths of delivered water is believed related to changing economic conditions and in particular to the economic depression of the early 1930's. To eliminate this economic effect from the safe yield computations, the determination of recharge from delivered water for items responsive to both precipitation and economics is based on the 9-year period from 1949-50 through 1957-58. Items dependent only on precipitation on the valley fill area are evaluated over the 29-year base period. This 9-year period compares favorably with the 29-year base period and has an average precipitation on the valley floor that differs from the normal by less than one percent. The remaining items are based on historic amounts for the safe yield year adjusted by use of trend curves. In all instances the amount derived is the best average for the stated condition; i.e., the culture of the safe yield year existing over a period of normal supply

Conditions Affecting Recharge from Delivered Water on Land Use Class Areas

The annual amounts of water consumed and percolating on land use class areas (except commercial and industrial areas) are affected by, but not directly related to, the annual amounts of precipitation. The average amounts are therefore best obtained by averaging the historic amounts over a period of normal precipitation which contains the safe yield years, thus also including the effect of economic conditions. The 9-year period, 1949-50 through 1957-58, meets these requirements and is used to obtain average values of net recharge for all affected land use classes except as noted. The average adjusted depths of consumptive use and deep percolation for residential land use differ from the historic values in that they are

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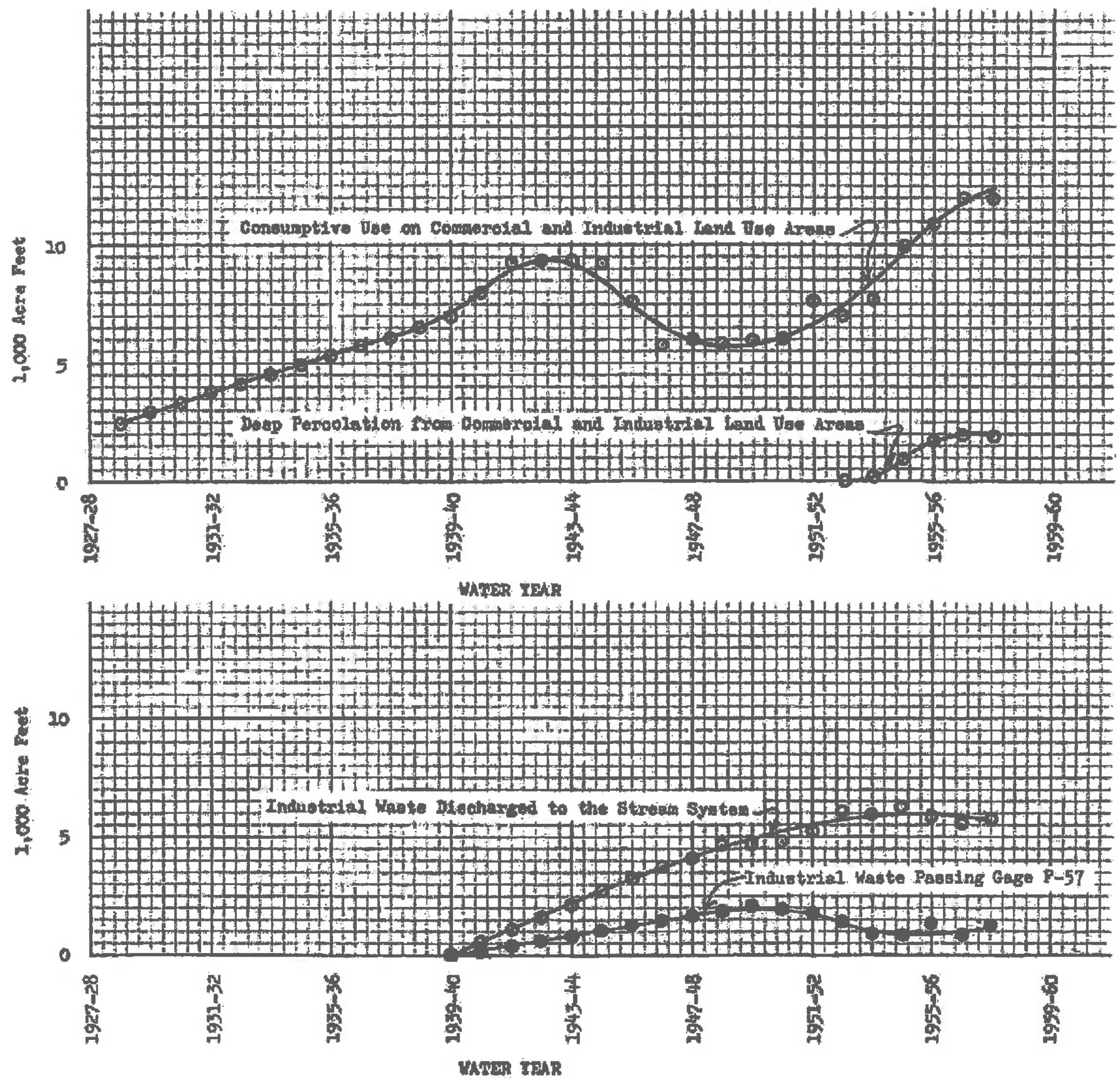
adjusted to reflect the percent of the residential area that was pervious during the safe yield year. The average annual amounts of consumptive use and deep percolation for safe yield determination are therefore computed as the product of these adjusted 9-year average depths (see Table R-2) and the acreage of each type of land use existing during the safe yield year.

Commercial and industrial consumptive use is not affected by variations in precipitation. To obtain the average consumptive use and deep percolation on this land use class for the safe yield years, the annual amounts are plotted on Figure 8 and a trend curve drawn. The amounts for the safe yield years are then taken from the trend curve on Figure 8.

Evaporation from water system reservoirs (Table M-1) is dependent on climate and was computed for each year. The 29-year period average is used as representative of normal. The portion of this evaporation assigned to precipitation is taken as the 29-year average rain on the reservoirs (Table M-1). The remainder of the evaporation is taken to be imported water.

A summary of average amounts of consumptive use and deep percolation of delivered water on land use class areas thus determined is shown in Table 44 along with a reference to the source and derivation of the values.

FIGURE 8



TREND CURVES FOR CONSUMPTIVE USE, DEEP PERCOLATION AND WASTE DISCHARGE
OF WATER DELIVERED TO COMMERCIAL AND INDUSTRIAL LAND USE AREAS

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TABLE 44

AVERAGE AMOUNTS OF CONSUMPTIVE USE AND DEEP PERCOLATION OF DELIVERED WATER REQUIRED BY THE LAND USE OF THE VALLEY FILL AREA FOR THE SAFE YIELD YEARS

In Acre-Feet

Land use class	Safe yield year								
	1949-50			1954-55			1957-58		
	Consump-tive use (1)	Deep percolation (2)	Total (3)=(1)+(2)	Consump-tive use (4)	Deep percolation (5)	Total (6)=(4)+(5)	Consump-tive use (7)	Deep percolation (8)	Total (9)=(7)+(8)
1. Deciduous	1,390	220	1,610	1,760	280	2,040	1,320	220	1,540
2. Citrus	17,020	3,980	21,000	12,840	3,010	15,850	7,480	1,750	9,230
3. Walnuts	6,120	1,070	7,190	4,200	730	4,930	1,670	290	1,960
4. Truck	9,430	3,230	12,660	7,450	2,510	9,960	6,470	2,180	8,650
5. Alfalfa	16,190	2,380	18,570	8,090	1,190	9,280	5,070	740	5,810
6. Vineyard	230	40	270	140	30	170	90	10	100
7. Lawn grass	5,040	1,130	6,170	5,280	1,190	6,470	5,960	1,340	7,300
8. Water supply reservoirs	3,560	0	3,560	3,560	0	3,560	3,560	0	3,560
9. Commercial and industrial	5,930	0	5,930	9,940	970	10,910	12,450	2,000	14,450
10. Residential	48,680	10,360	59,040	58,260	12,400	70,660	67,250	13,580	80,830
11. Total	113,520	22,410	136,000	111,520	22,310	133,830	111,320	22,110	133,430

Source and derivation of values by item number.

Item number

1 through 7 and 10. Average amounts of consumptive use and deep percolation of delivered water for these land use areas are the products of the 9-year average (1949-50 through 1957-58) mean weighted depths (Table R-2) and the acreage of each type of land use (Table K-6).

8. Average total consumptive use of delivered water in water supply reservoirs is the 29-year average total evaporation for water supply reservoirs (column 11, Table M-1) minus the 29-year average precipitation on the reservoirs (column 5, Table M-1).

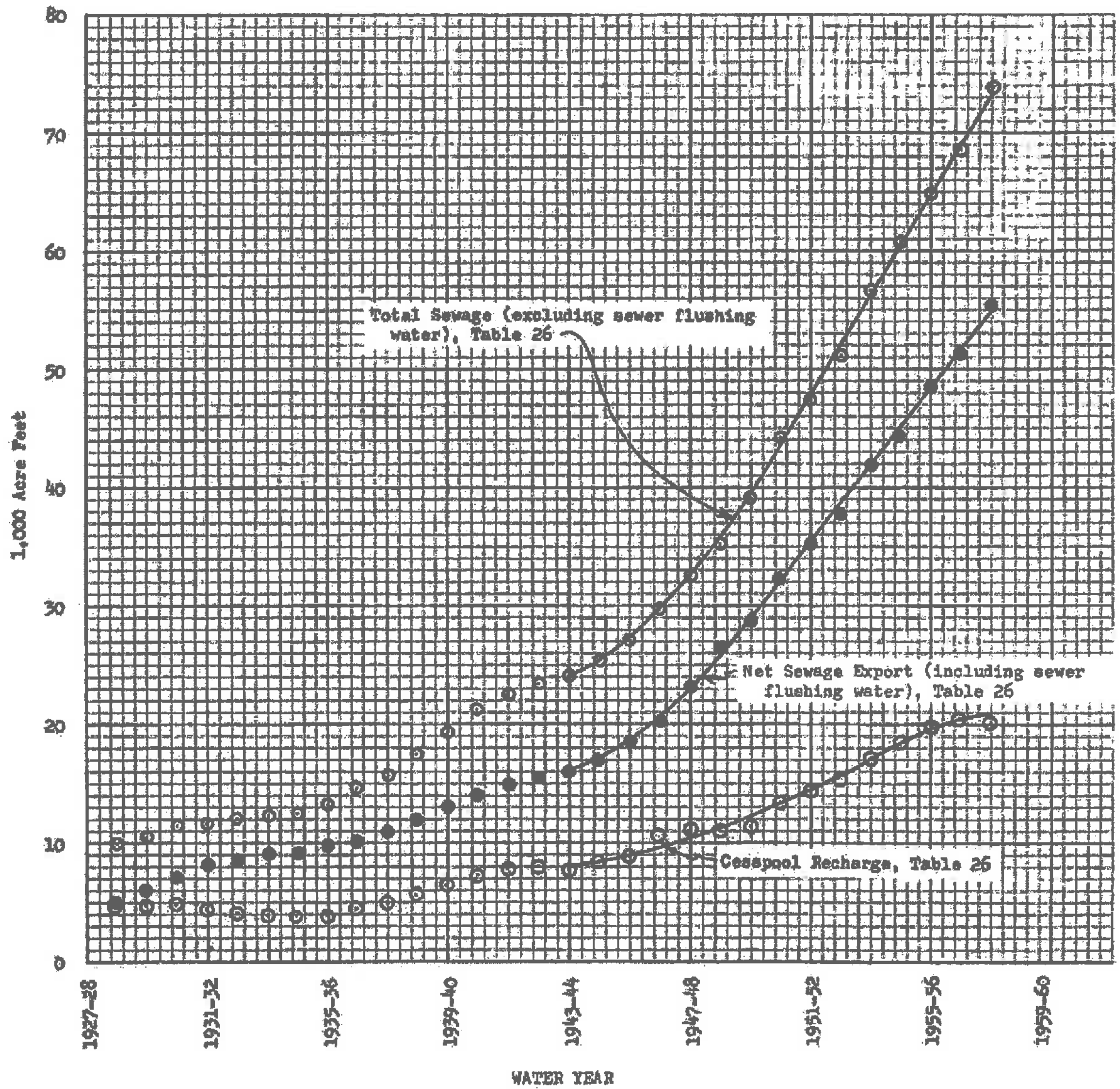
9. Average amounts of consumptive use and deep percolation for industrial and commercial areas are from trend curves on Figure 8.

Industrial Wastes. Waste discharges from industrial plants to the stream channels vary annually. To obtain the average amount of industrial wastes discharged to the stream channels for each of the safe yield years, the annual amounts (Table 26A, page 151b) are plotted on Figure 8 and a trend curve drawn. The amounts of industrial waste discharged to the stream channels for each of the safe yield years are taken as the ordinate of the trend curve for that year.

Annual amounts of industrial wastes passing Gage F-57 are also plotted on Figure 8 and a trend curve drawn. Comparison of industrial wastes discharged and the amounts passing Gage F-57 shows that a larger portion of these wastes percolated during the years after 1949-50. For safe yield computations the amount of industrial waste passing Gage F-57 is taken as the ordinate of the trend curve for that year.

Total Sewage, Sewage Export and Cesspool Recharge. The total amounts of sewage discharged to sewer lines and to cesspools have increased with the urbanization of the area and are dependent on the population of the area. The historic variation in amounts of total sewage (Table 26) is plotted on Figure 9. The trend curve is a close approximation of the historic points and is used to determine the average amounts for the safe yield years. Annual amounts of cesspool recharge and sewage export (plus sewer flushing water) are also plotted on Figure 9 and trend curves constructed. Sewage discharged to the Los Angeles River is considered as a random occurrence that would not recur and these amounts are included in sewage export. Amounts of sewer infiltration and sewer flushing water are not included in total sewage but are treated separately.

FIGURE 9



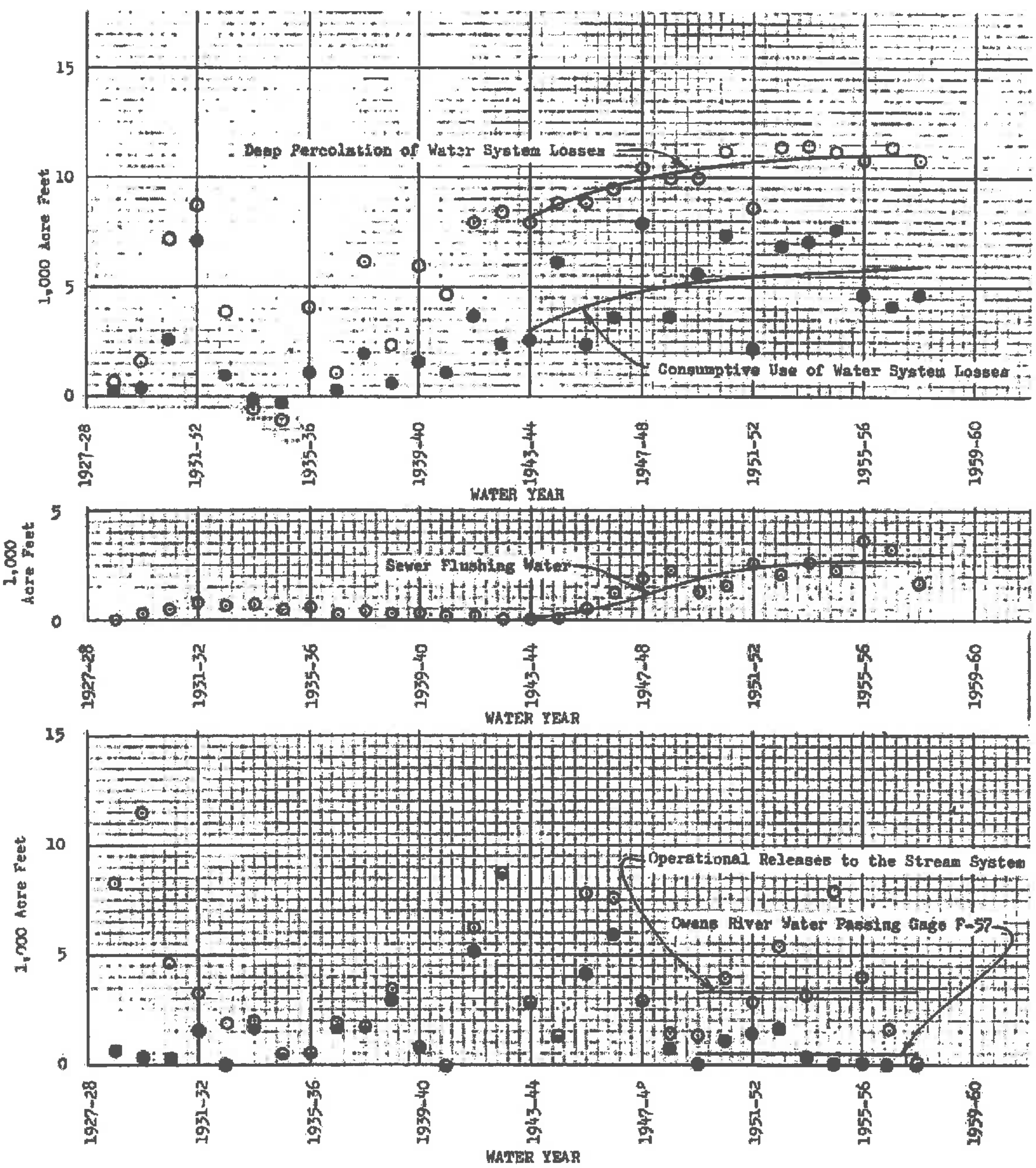
TREND CURVES FOR SEWAGE

Spread Import. Imported water has been spread only by the City of Los Angeles (Table 23, page 143). During the 9-year period, 1949-50 through 1957-58, the Los Angeles Aqueduct has operated at or near capacity with spreading occurring during four of the nine years. Spreading of import occurring during this period is considered to be caused by operational procedures; therefore, these amounts, which averaged 1,330 acre-feet per year, are included as an augmentation of operational releases, discussed hereafter, and the average amount of water imported for the purpose of spreading for each of the safe yield years is taken as zero.

Operational Releases. The annual amounts of operational releases of Owens River water to the stream system (Table 24, page 145) and the portion passing Gage F-57 (Table 28, page 155) are plotted on Figure 10. The annual variations were considered to be too irregular to permit use of a trend curve; therefore, the averages of these two items, based on a period of normal wetness (1949-50 through 1957-58) subsequent to the Los Angeles Aqueduct reaching capacity (circa 1949), are used. For the same reason the average amount of import spread due to operational procedures is also based on the 1949-50 through 1957-58 period. The average amount of operational release for each of the safe yield years is taken as the sum of average operational release of Owens River water (i.e., 3,300 acre-feet per year, Figure 10), and an additional operational release in lieu of spreading which averaged 1,330 acre-feet per year (i.e., average of annual import spread shown in Table 23, page 143, for the 9-year period 1949-50 through 1957-58).

Water System Loss. Water system loss for safe yield determination is computed as the sum of three parts; sewer flushing water, consumptive use of water system loss, and deep percolation of water system loss. The annual historic amounts of these items are shown in Table 36 and plotted on Figure 10. Trend curves were constructed to obtain average values and the amounts for safe yield conditions were obtained from ordinates of the curves for each safe yield year.

FIGURE 10



TREND CURVES FOR WATER SYSTEM LOSSES AND OPERATIONAL RELEASES

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Conditions Affecting Recharge From Precipitation on Land Use Areas

The amounts of water applied either through deliveries or rainfall and the percent of the area that is impervious have an affect on the consumptive use of rain. The percentage of residential land that is impervious has increased, while agricultural areas have remained unchanged in this respect during the base period. The type of use on pervious residential areas has also changed during the base period and has affected the residential use of delivered water and precipitation.

The mean depths of consumptive use for the land use class areas are shown for the 29-year and 9-year periods in Tables L-13 through L-15 and Table R-2 respectively. The 29-year average unit values of consumptive use of precipitation are approximately three percent greater than the 9-year average values for the land use classes that are predominantly pervious. Average unit values for residential areas for the 29 and 9-year periods cannot be compared due to the variation in percent pervious. The best approximation of recharge from precipitation on the valley fill area under safe yield conditions is obtained by the combination of normal precipitation from Table 1, 9-year average consumptive use of precipitation derived in Table 45, and the 29-year average residual rain shown in Table 45. The 9-year average unit consumptive use values are compatible with normal precipitation on the valley fill area and include the influence of changing amounts of delivered water on consumptive use. The 29-year average is used for unit residual rain values because residual rain is unaffected by economic conditions and to provide continuity with the computation of recharge in the stream system which is based on the 29-year average.

TABLE 45

AVERAGE AMOUNTS OF CONSUMPTIVE USE OF PRECIPITATION ON LAND USE AREAS AND RESIDUAL RAIN ON VALLEY FILL AREA FOR SAFE YIELD YEARS

In Acre-Feet

	Item	Safe yield year		
		1949-50	1954-55	1957-58
	Consumptive use by land use class			
1.	Deciduous	1,190	1,520	1,150
2.	Citrus	11,560	8,740	5,100
3.	Walnuts	4,670	3,220	1,280
4.	Truck	6,440	4,970	4,340
5.	Alfalfa	9,770	4,900	3,070
6.	Vineyard	230	150	90
7.	Lawn grass	2,040	2,130	2,410
8.	Dry farm and native	34,570	33,990	32,760
9.	Miscellaneous	1,890	1,920	2,350
10.	Riparian	470	400	320
11.	Commercial and industrial	5,420	5,820	5,950
12.	Residential	33,010	37,630	41,610
13.	Water Surface	1,320	1,320	1,320
14.	Total consumptive use of precipitation	112,580	106,710	101,750
15.	Residual rain	30,590	36,420	42,330
16.	Total of consumptive use and residual rain	143,170	143,130	144,080

Source and derivation of values by line number:

Line No.

1. through 12. Average amounts of consumptive use of precipitation for these land use areas are the products of the 9-year average (1949-50 through 1957-58) depths (Table R-2) and the acreage of land use (Table K-6).

13. The evaporation of precipitation is the 29-year mean precipitation on water supply reservoirs (Table M-1). and Hansen Dam Reservoir.

14. Sum of Items 1 through 13.

15. Summation of the products of the 29-year average depth of residual rain (Tables L-13 through L-15) and the impervious area for the safe yield year (Table R-5).

Conditions Affecting Native Recharge in the Stream System

Recharge of native waters in the stream system is based on the assumption that the condition of the stream system existing during the safe yield year prevailed over a period of normal runoff. The available data on supply to and recharge from the stream system are shown in Table 42, page 202, for the 1928-29 through 1957-58 period. These data are plotted on Figure 11 and the relationship between annual amounts of supply and recharge for each of the safe yield years is determined in the form of a curve. The average amount of recharge of native water in the stream system is based on the 29-year base period, since runoff from hill and mountain areas is normal for this period.

To ascertain the relationship between native supply to the river system and deep percolation therein, the annual amounts of native supply less amounts diverted and spread are plotted against annual amounts of deep percolation on Figure 11. The deep percolation, as plotted on Figure 11, shows a decrease with time and in general varies inversely with the amount of improvements made to channels. The historic improvements made to the main channels are summarized in Table 18, page 131. The decreasing percent of the total length of main channels remaining unpaved is an indication of the loss of percolation capacity of the stream system. In order to construct curves showing the relationship between native supply and deep percolation of that supply, the years are grouped on the basis of length of channel remaining unpaved as follows:

Period	Channels with paved bottoms		Percent with open bottom
1928-29 through 1936-37	Miles	Percent	
1929-30	0.3	0.2	99.8
31-32	6.8	4.9	95.1
32-33	7.3	5.3	94.7
33-34	8.6	6.2	93.8
34-35	11.7	8.5	91.5
35-36	17.4	12.6	87.4
1937-38 through 1950-51			
1937-38	23.0	16.7	83.3
38-39	25.9	18.8	81.2
39-40	26.1	18.9	81.1
40-41	26.1	18.9	81.1
41-47	27.6	20.1	79.9
47-48	29.3	21.3	78.7
48-49	31.6	23.0	77.0
49-50	33.7	24.5	75.5
50-51	35.8	26.0	74.0
1951-52 through 1954-55			
1951-52	47.7	34.7	65.3
52-53	58.7	42.7	57.3
53-54	60.5	44.0	56.0
54-55	64.5	46.9	53.1
1955-56 through 1957-58			
1955-56	66.0	48.0	52.0
56-57	67.8	49.3	50.7
57-58	69.8	50.7	49.3

The curves for the above periods are shown on Figure 11 and are constructed by plotting the data on both logarithmic and rectangular coordinates, drawing average trend curves, and spacing the curves on the basis of the amounts of unpaved channels remaining during the period. The resulting family of curves on Figure 11 all intersect a line representing 100 percent percolation of supply at decreasing values of supply for the more recent years and

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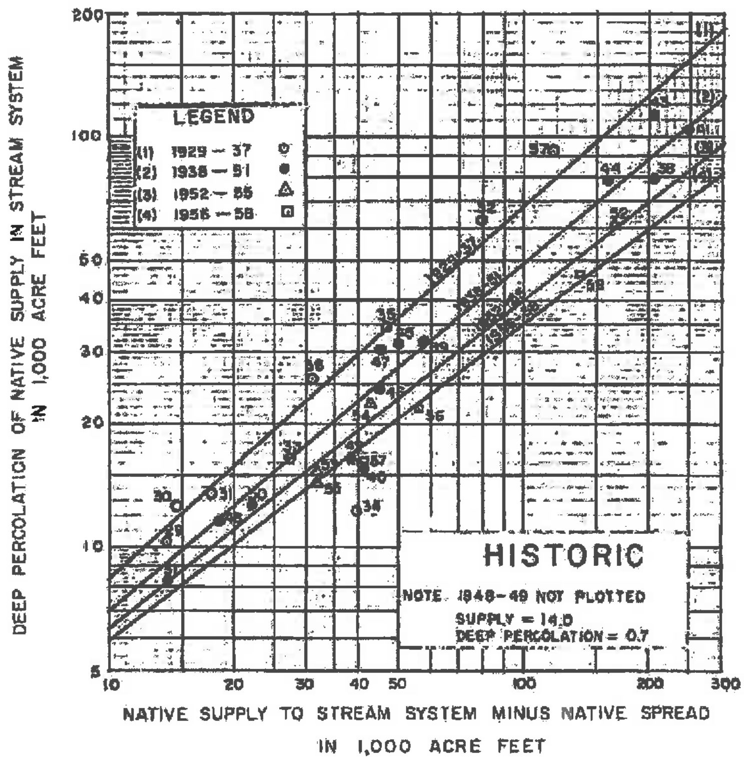
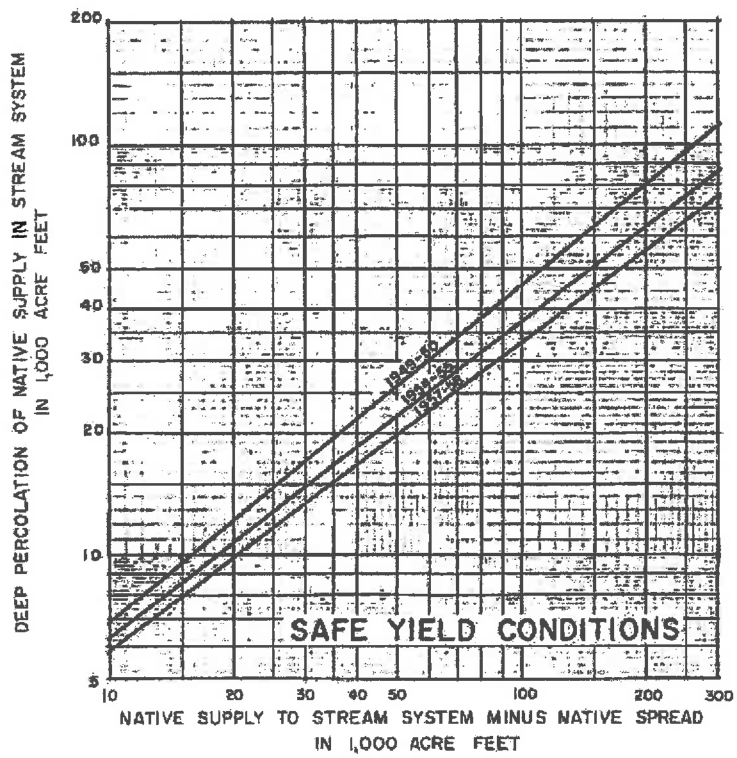
all diverge for increasing amounts of supply. The spacing of the curves indicates reduced percolation with reduced length of open bottom channels. The curves for the 1949-50 and 1954-55 safe yield years were drawn by interpolating between historic curves on the basis of the relative amounts of open bottom channels remaining during the safe yield year. The curve for 1957-58 is drawn in a similar manner by extrapolation.

The net supply to the stream system is the sum of hill and mountain runoff and residual rain draining off the valley fill area minus the runoff reaching water system reservoirs, native water spread, and surface diversions. Modifications of runoff items to conform to safe yield conditions are derived in Appendix R. These conditions differ from historic due to increased impervious areas in the hills and diversions works (constructed after 1941) which bypass runoff around water system reservoirs.

During the base period the amounts of surface water diverted on the valley fill area (Table 16, page 125) have not exceeded 500 acre-feet and have averaged 180 acre-feet per year. Surface diversions were not made during the 1949-50 through 1957-58 period. The amount of surface diversions on the valley fill area for each of the safe yield years has therefore been taken as zero. The amount of native water spread is that amount which would have been spread if the spreading grounds existing during the safe yield year (see Table 29, page 157) had existed over the period of normal supply (29-year period).





SAN FERNANDO VALLEY REFERENCE

RELATIONSHIP BETWEEN SUPPLY AND DEEP PERCOLATION IN THE STREAM SYSTEM

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STATE WATER RIGHTS BOARD

Conditions Affecting Natural Depletions from the Ground Water Reservoir

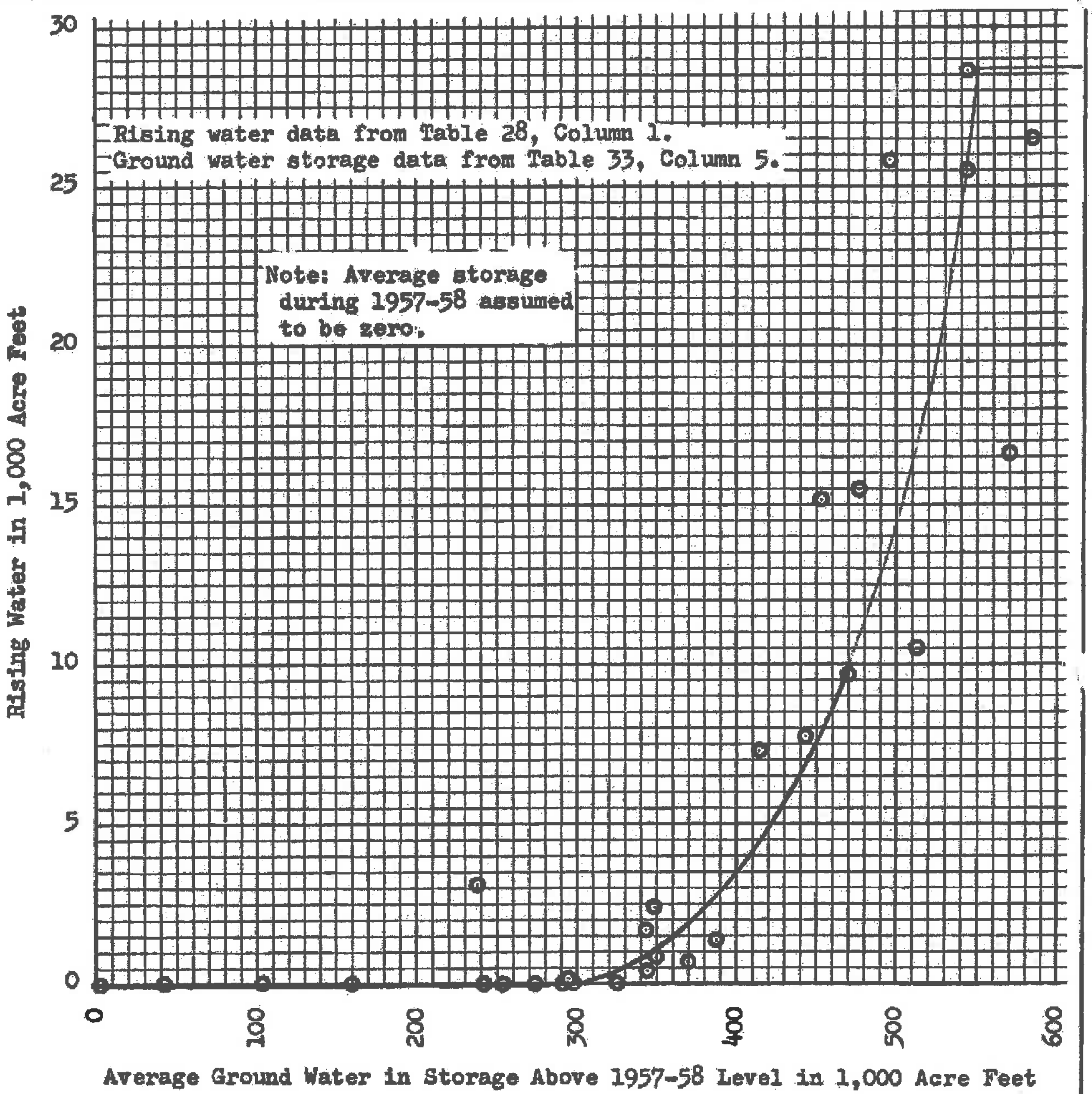
Natural depletions consist of rising water, subsurface outflows, sewer infiltration and direct consumption of ground water on land use areas (riparian and excess consumptive use). The average amounts of rising water passing Gage F-57 are controlled by the relative position of the stream channel invert and average ground water surface configuration. The latter is in turn dependent on basin operation. To provide a uniform basis for comparison of the safe yield for the three years, basin operation for each of the three years is assumed to commence with configuration of ground water levels the same as existed during 1957-58. Operation of the ground water reservoir under safe yield conditions requires a maximum of approximately 210,000 acre-feet of storage space above the 1957-58 water levels. This amount of storage space is required for the 1949-50 safe yield condition with the other two safe yield years requiring lesser amounts. Historic rising water passing Gage F-57 is plotted against storage above 1957-58 levels on Figure 12. This relationship indicates that the rising water outflow which would occur within the storage fluctuation noted above is nil; therefore, for the three safe yield years, average rising water has been taken as zero.

Subsurface outflows (Table 31) at Gage F-57 are plotted on Figure 13. The annual amounts have declined gradually from 500 acre-feet in 1934-35 to 160 acre-feet in 1957-58. The average amounts for the safe yield years have been taken from the curve. Estimated annual subsurface flows out of the Upper Los Angeles River area in the vicinity of Pickens Canyon have varied with the amount of natural supply and within a narrow range (250 to 400 acre-feet) during the 29-year period; therefore, the 29-year average has been used for the subsurface outflow in this vicinity.

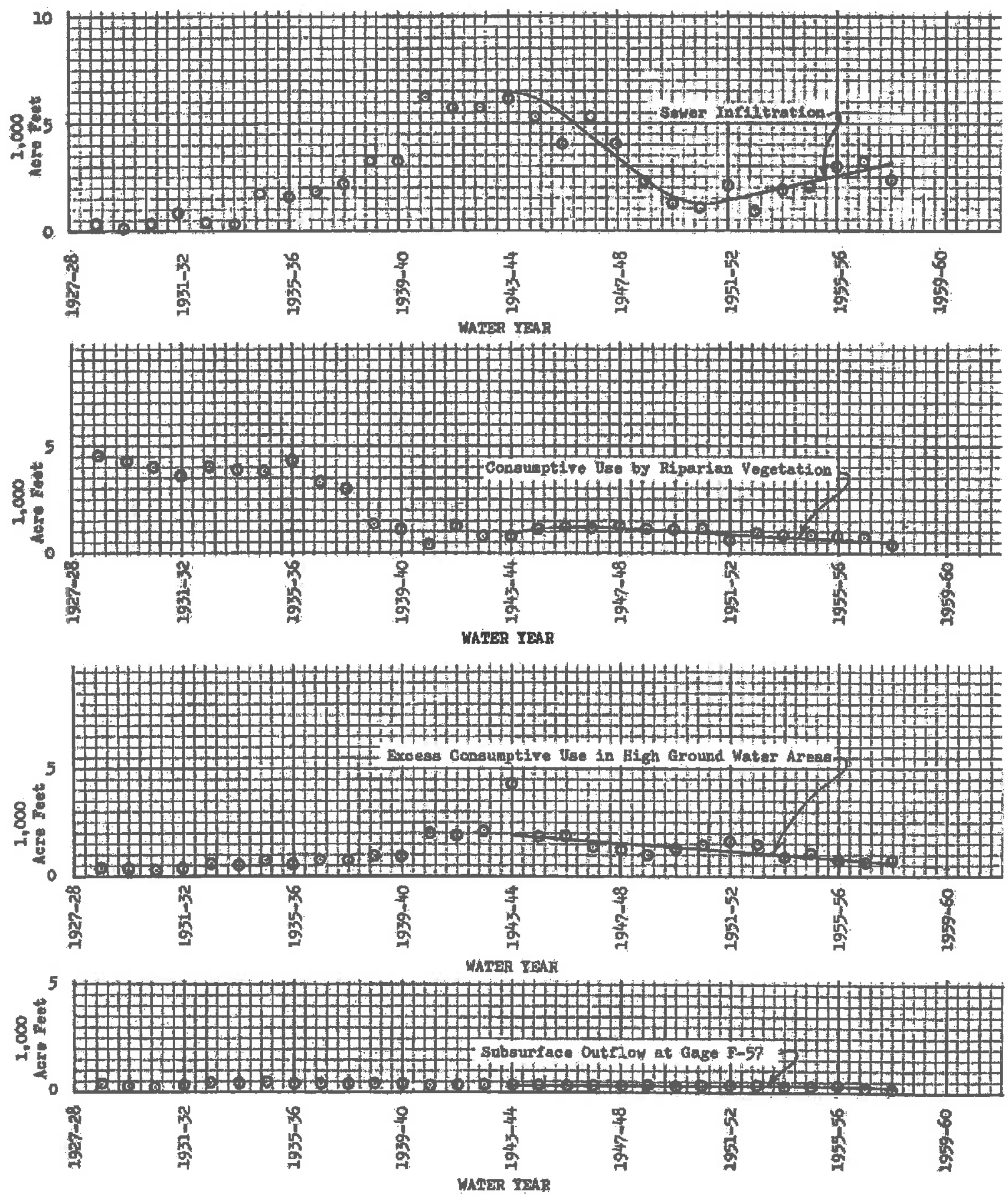
Annual amounts of sewer infiltration (Table 26, page 151) are plotted on Figure 13 and the trend curve, drawn to represent average sewer infiltration, reflects the general decline in ground water levels during the 1940's and increase in length of sewer lines during the 1950's. For safe yield computations, average values were taken as the ordinate to the trend curve for the safe yield year.

Improvement of channels made in 1938 through 1940 and the 1938 flood removed a large amount of riparian growth from the stream channels. The trend curve on Figure 13 from 1941 to 1947 shows a small increase in riparian use followed by a steady decline. The annual historic amounts of excess consumptive use presented in Table L-17 are for a depth to ground water interval of 0 to 10 feet. The area which had a depth to ground water of less than four feet is presently subdivided. It is believed that recurrence of a very high ground water table will be avoided since extensive damage to the homes would result. For this reason the trend curve for excess consumptive use shown on Figure 13 is based on the historic amounts for a depth to ground water interval of 4 to 10 feet. Average values for safe yield conditions were taken as the ordinate to the trend curve for the safe yield year.

FIGURE 12



RISING WATER AS A FUNCTION OF GROUND WATER IN STORAGE



TREND CURVES FOR NATURAL DEPLETIONS OF GROUND WATER

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Average Delivered Water Requirement Under Safe Yield Conditions

Average delivered water required by the culture of the safe yield year over a period of normal native supply is the sum of average demands and uses of delivered water by the culture of the safe yield year. The conditions governing these average demands and uses of delivered water are discussed in the preceding sections of this chapter. The average amounts of the demands and uses along with their source and derivation are shown in Table 46.

The average delivered water requirement for the 1957-58 culture conditions is 34,000 acre-feet greater than for the 1949-50 conditions. This change results from urbanization of the area and is reflected in the increase in the total of sewage export and cesspool recharge shown in Table 46.

TABLE 46

AVERAGE DELIVERED WATER
REQUIREMENT UNDER SAFE YIELD CONDITIONS

In 1,000 Acre-Feet

Item	Safe yield year		
	1949-50	1954-55	1957-58
1. Consumptive use plus deep percolation on land use class areas	136.0	133.8	133.4
2. Industrial wastes	4.9	6.0	5.7
3. Total sewage (sewage export plus cesspool recharge)	39.6	60.5	73.3
4. Operational releases	4.6	4.6	4.6
5. Spread import	0	0	0
6. Water system loss	17.5	19.4	19.5
7. Average delivered water requirement under safe yield conditions	202.6	224.3	236.5

Source and derivation of values by item number.

Item No.

1. Table 44, line 11, Columns 3, 6 and 9.
2. From industrial waste discharge trend curve, Figure 8.
3. From total sewage curve, Figure 9.
4. Average for 9-year period (1949-50 through 1957-58) of the sum of operational releases (Table 24, page 145) and spread import (Table 23, page 143).
5. There was no planned spreading in the 9-year period 1950-58.
6. Sum of amounts from trend curves for sewer flushing water, consumptive use of water system loss and deep percolation of water system loss, Figure 10.
7. Sum of Items 1 through 6.

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Ground Water Recharge Under Safe Yield Conditions

Gross ground water recharge under the safe yield conditions heretofore established has been evaluated as the supply from deliveries and native sources less consumptive use and outflows including sewage export. Net recharge has been determined as the gross recharge less natural ground water depletions under safe yield conditions. Gross recharge of the delivered water requirement is computed as a lump sum while gross recharge of native water is calculated in three parts: from land use areas, from the stream system and from native spread water.

Gross Recharge of Delivered Water Required by the Culture

The gross recharge from the average delivered water requirement under safe yield conditions is shown in Table 47 and is the difference between the average delivered water and its consumptive uses, outflows and exports.

TABLE 47

AVERAGE GROSS RECHARGE WITH SAFE YIELD
CULTURE WATER REQUIREMENT SATISFIED

In 1,000 Acre-Feet

Item	Safe yield year 1949-50	Safe yield year 1954-55	Safe yield year 1957-58
1. Average delivered water requirement for the safe yield year	202.6	224.3	236.5
2. Consumptive use on land use areas	113.6	111.5	111.3
3. Consumptive use of water system loss	5.2		5.9
4. Industrial waste passing Gage F-57	2.0	0.9	1.2
5. Owens River water passing Gage F-57	0.5	0.5	0.5
6. Sewage export (including sewer flushing water)	28.9	45.1	55.0
7. Total consumptive use and outflow	150.2	163.7	173.9
8. Gross recharge of average delivered water requirement	52.4	60.6	62.6
9. Gross recharge in percent of average delivered water requirement	25.9	27.0	26.5

Source and derivation of average values by item number:

Item No.

1. Gross delivered water is Item 7, Table 46.
2. Consumptive use of delivered water from Table 44, Item 11, columns 1, 4 and 7.
3. Consumptive use of water system loss is from curve, Figure 10.
4. Industrial waste passing Gage F-57 is from curve, Figure 8.
5. Operational release of Owens River water passing F-57 is the average of historic amounts in column 4, Table 28, page 155, for the 9-year period, 1949-50 through 1957-58 (also see Figure 10).
6. Sewage export (including sewer flushing water) is from curve, Figure 9.
7. Total consumptive use and outflow is the sum of Items 2 through 6.
8. Gross recharge of delivered water is the difference between Items 1 and 7.
9. Gross recharge in percent of average delivered water requirement is Item 8 divided by Item 1, times 100.

Gross Recharge of Precipitation on Land Use Areas

The gross recharge of precipitation on land use areas is the normal precipitation on the valley fill area (Table 1) minus the consumptive use and residual rain on the land use areas (Table 45). The average amounts of these items, their source, and the resulting gross recharge are listed in Table 48 for each of the three safe yield years.

TABLE 48

AVERAGE GROSS RECHARGE ON LAND USE AREAS FROM NORMAL PRECIPITATION UNDER SAFE YIELD CONDITIONS

In 1,000 Acre-Feet

Item	Safe yield year		
	1949-50	1954-55	1957-58
1. Normal precipitation, valley fill area	167.7	167.7	167.7
2. Consumptive use of normal precipitation plus residual rain on the valley fill	143.2	143.1	144.1
3. Gross recharge of normal precipitation, valley fill area	24.5	24.6	23.6
4. Gross recharge in percent of normal precipitation	14.6%	14.7%	14.1%

Source and derivation of values by item number:

Item
Number

1. 85-year mean precipitation for valley fill Table 1.
2. Total of average consumptive use of precipitation and residual rain from Table 45, line 16.
3. Item 1 minus Item 2.
4. Item 3 divided by Item 1 times 100.

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Gross Recharge of Native Spread Water

The historic amounts of net water spread at the four spreading grounds operated by the Los Angeles County Flood Control District are shown in Table 49. The average amount of native water spread is the estimated amount of water that would have been spread if the spreading grounds existing during a safe yield year had operated during a period of normal supply. The 29-year base period is the only period of near normal precipitation and runoff having adequate records. The amount of surface runoff which may be spread at these basins is a function of the occurrence and intensities of rainfall and the operating procedures of Pacoima, Big Tujunga and Hansen flood control dams. Pacoima spreading grounds have the longest period of record, with operation commencing in 1932-33. Hansen spreading grounds were completed and began operation in 1944-45 with Lopez and Branford being completed in 1955-56. Urbanization has been minor in areas tributary to the spreading grounds; therefore, the amount of native water spread historically during a given year has been used as the amount which could have been spread during that year under safe yield conditions. Estimation of spreading during the remainder of the 29-year base period is based on the historic amounts spread.

Water spread at Pacoima spreading grounds from 1928-29 through 1931-32 was taken as equal to stream runoff at Gage 118 multiplied by the average ratio of the annual amounts of water spread for the period of record (1932-33 through 1957-58) to the annual amount of hill and mountain runoff from Pacoima Canyon, measured at Gage 118 (see Plate 9 and Table 27). The annual estimated amount which could have been spread at the Lopez

TABLE 49

ACTUAL AND COMPUTED NATIVE WATER SPREAD

In Acre-Feet

Year	Pacoima (1)	Hansen (2)	Lopez (3)	Branford (4)	Total (5)
1928-29	340*	710*	30*	10*	1,090*
29-30	380*	800*	30*	20*	1,230*
1930-31	340*	710*	30*	10*	1,090*
31-32	3,300*	6,900*	260*	130*	10,590*
32-33	30	50*	0*	0*	80*
33-34	230	480*	20*	10*	740*
34-35	1,200	2,500*	100*	50*	3,850*
1935-36	2,000	4,200*	160*	80*	6,440*
36-37	4,680	9,800*	370*	190*	15,040*
37-38	3,840	8,100*	310*	150*	12,400*
38-39	360	760*	30*	10*	1,160*
39-40	910	1,900*	70*	40*	2,920*
1940-41	9,780	20,400*	780*	390*	31,350*
41-42	40	80*	0*	0*	120*
42-43	3,740	7,900*	300*	150*	12,090*
43-44	7,220	15,000*	580*	290*	23,090*
44-45	1,470	7,650	120*	60*	9,300*
1945-46	510	2,270	40*	20*	2,840*
46-47	3,760	8,730	300*	150*	12,940*
47-48	0	0	0*	0*	0*
48-49	0	0	0*	0*	0*
49-50	250	0	20*	10*	280*
1950-51	0	0	0*	0*	0*
51-52	6,120	16,780	490*	240*	23,630*
52-53	1,650	1,270	130*	70*	3,120*
53-54	1,890	1,010	150*	80*	3,130*
54-55	210	0	20*	10*	240*
1955-56	570	0	0	0	570
56-57	480	0	30	40	550
57-58	10,920	18,410	1,030	20	30,380
29-Year Average 1929-57	1,907	4,069	151	76	6,203

* Estimated amounts of runoff which would have been spread had spreading grounds been constructed and operated during these years.

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grounds was taken as equal to the amount spread at Pacoima (as extended) multiplied by the average ratio of water spread at Lopez to the amount spread at Pacoima, both taken over the period of concurrent records. Estimated amounts spread at Hansen and Branford were computed in a similar manner. Amounts of spreading, both estimated and of record, at the four spreading grounds are shown in Table 49. Comparison of amounts of runoff available for spreading with the amounts estimated as spread indicates that sufficient supply for the estimated spreading was historically available. In determining the amounts of native water spread under safe yield conditions, only the estimated amounts spread at Pacoima and Hansen spreading grounds were included in the 1949-50 and 1954-55 safe yield years. In the 1957-58 safe yield year, the estimated amounts for all four spreading grounds were utilized. The average amounts of native water spread for the safe yield years are listed in Table 50.

TABLE 50

ESTIMATED AVERAGE NATIVE WATER
SPREAD UNDER SAFE YIELD CONDITIONS

Item	Safe yield year		
	1949-50	1954-55	1957-58
Spreading grounds	Pacoima Hansen	Pacoima Hansen	Pacoima Hansen Lopez Branford
Estimated average annual amount spread, in 1,000 acre-feet	6.0	6.0	6.2

Gross Recharge of Native Waters From the Stream System of the Valley Fill Area

The supply to the stream system is made up of hill and mountain runoff and residual rain from valley fill areas. The net supply available for recharge from the stream system on the valley fill area is the total supply minus amounts spread, diverted and flowing into water system reservoirs. The annual amounts resulting in the net supply are shown in Table 51 for each of the three safe yield years. The residual rain is based on the 29-year average depth of residual rain for impervious areas (Tables L-13 through L-15) multiplied by the impervious area for the safe yield year. Hill and mountain runoff is the historic annual amount adjusted to reflect the culture of the safe yield year. Runoff to reservoirs is the annual historic amount corrected for the effect of drainage channels constructed around water supply reservoirs to bypass runoff. Evaporation of runoff at Hansen Dam cannot be accurately estimated for each year under safe yield conditions but can be estimated as an average value based on the 1949 through 1958 period (9-year average = 490 acre-feet).

The average recharge in the stream system is the average of the sum of the annual amounts of recharge for the 29-year base period. The annual amounts of recharge are obtained by entering the annual amounts of net supply and using the appropriate curve for the safe yield year on Figure 11. Average amounts of recharge in the stream system thus obtained for each of the safe yield years are shown as the 29-year average deep percolation in Table 51 and after correction for evaporation at Hansen Dam are 31,200, 27,900 and 26,700 acre-feet for the respective safe yield years of 1949-50, 1954-55 and 1957-58.

TABLE 51

DEEP PERCOLATION IN STREAM SYSTEM

Safe yield year 1949-50

In 1,000 Acre-Feet

Year	Residual rain (1)	Hill and mountain runoff (2)	Additional hill and mountain runoff (3)	Sub-total (4)	Runoff to reservoirs (5)	Native spread (6)	Sub-total (7)	Net supply (8)	Deep percolation in stream system (9)
1928-29	17.7	6.6	1.0	25.3	0	1.1	1.1	24.2	24.4
29-30	22.8	5.3	0.9	29.0	0	1.2	1.2	27.8	16.1
1930-31	28.0	3.9	1.2	33.1	0	1.1	1.1	32.0	17.9
31-32	37.8	58.3	1.4	97.5	1.0	10.2	11.2	86.3	40.1
32-33	26.6	13.1	1.2	40.9	0.2	0	0.2	40.7	21.9
33-34	30.6	19.6	1.7	51.9	0.3	0.7	1.0	50.9	26.2
34-35	34.3	23.6	1.6	59.5	0.1	3.7	3.8	55.7	28.1
1935-36	20.7	18.7	1.0	40.4	0.3	6.2	6.5	33.9	18.8
36-37	44.7	90.9	1.6	137.2	1.4	14.5	15.9	121.3	53.6
37-38	51.0	176.7	1.7	229.4	2.2	11.9	14.1	215.3	85.0
38-39	43.2	28.2	1.6	73.0	0.5	1.1	1.6	71.4	34.5
39-40	30.0	19.8	1.0	50.8	0.3	2.8	3.1	47.7	24.9
1940-41	85.2	190.0	2.7	277.9	2.8	30.2	33.0	244.9	95.0
41-42	18.6	21.8	0.7	41.1	0.3	0.1	0.4	40.7	21.8
42-43	51.8	165.7	1.6	219.1	2.3	11.6	13.9	205.2	82.0
43-44	50.4	123.8	1.5	175.7	1.7	22.2	23.9	151.8	64.0
44-45	24.7	37.1	1.0	62.8	0.5	9.1	9.6	53.2	27.2
1945-46	23.6	24.3	1.2	49.1	0.2	2.8	3.0	46.1	24.4
46-47	25.5	31.2	1.8	58.5	0.2	12.5	12.7	45.8	24.1
47-48	10.9	6.0	0.5	17.4	0	0	0	17.4	10.9
48-49	9.4	3.2	0.5	13.1	0	0	0	13.1	8.6
49-50	16.1	5.2	0.8	22.1	0.1	0.3	0.4	21.7	13.0
1950-51	10.4	2.9	0.5	13.8	0.1	0	0.1	13.7	8.8
51-52	60.3	113.7	2.2	176.2	1.9	22.9	24.8	151.4	64.0
52-53	16.5	15.0	0.6	32.1	0.2	2.9	3.1	29.0	16.6
53-54	24.1	15.3	1.1	40.5	0.2	2.9	3.1	37.4	20.5
54-55	19.2	8.3	0.8	28.3	0.1	0.2	0.3	28.0	16.1
1955-56	30.0	11.1	1.1	42.4	0.2	0.6	0.8	41.6	22.1
56-57	23.7	6.8	1.1	31.1	0.1	0.5	0.6	30.5	17.2
29-Year Average 1929-57	30.6	43.0	1.2	74.8	0.6	6.0	6.6	68.2	31.7-0.5*=31.2

DEEP PERCOLATION IN STREAM SYSTEM
(continued)

Safe yield year 1954-55

In 1,000 Acre-Feet

Year	Residual rain (1)	Hill and mountain runoff (2)	Additional hill and mountain runoff (3)	Sub-total (4)	Runoff to reservoirs (5)	Native spread (6)	Sub-total (7)	Net supply (8)	Deep percolation in stream system (9)
1928-29	21.1	6.6	2.2	29.9	0	1.1	1.1	28.8	24.4
29-30	27.1	5.3	2.0	34.4	0	1.2	1.2	33.2	16.2
1930-31	33.3	3.9	2.5	39.7	0	1.1	1.1	38.6	18.0
31-32	45.0	58.3	3.0	106.3	1.0	10.2	11.2	95.1	35.9
32-33	31.7	13.1	2.4	47.2	0.2	0	0.2	47.0	21.0
33-34	36.5	19.6	3.7	59.8	0.3	0.7	1.0	58.8	24.9
34-35	40.8	23.6	3.3	67.7	0.1	3.7	3.8	63.9	26.4
1935-36	24.7	18.7	2.2	45.6	0.3	6.2	6.5	39.1	18.1
36-37	53.3	90.9	3.4	147.6	1.4	14.5	15.9	131.7	46.0
37-38	60.7	176.6	3.6	241.0	2.2	11.9	14.1	226.9	69.0
38-39	51.5	28.2	3.4	83.1	0.5	1.1	1.6	81.5	31.9
39-40	35.7	19.8	2.2	57.7	0.2	2.8	3.1	54.6	23.6
1940-41	101.3	190.0	5.7	297.0	2.8	30.2	33.0	264.0	78.0
41-42	22.2	21.8	1.4	45.4	0.3	0.1	0.4	45.0	20.3
42-43	61.6	165.7	3.3	230.6	2.3	11.6	13.9	216.7	67.0
43-44	60.0	123.8	3.1	186.9	1.7	22.2	23.9	163.0	54.0
44-45	27.4	37.1	2.2	68.7	0.5	9.1	9.6	59.1	25.0
1945-46	28.1	24.3	2.3	54.7	0.2	2.8	3.0	51.7	22.5
46-47	30.4	31.2	3.7	65.3	0.2	12.5	12.7	52.6	22.9
47-48	13.0	6.0	1.1	20.1	0	0	0	20.1	10.9
48-49	11.2	3.2	1.1	15.5	0	0	0	15.5	8.8
49-50	19.2	5.2	1.7	26.1	0.1	0.3	0.4	25.7	13.1
1950-51	12.4	2.9	0.9	16.2	0.1	0	0.1	16.1	9.1
51-52	71.8	113.7	4.7	190.2	1.9	22.9	24.8	165.4	54.5
52-53	19.6	15.0	1.2	36.9	0.2	2.9	3.1	33.8	16.2
53-54	28.7	15.3	2.3	46.3	0.2	2.9	3.1	43.8	19.9
54-55	22.8	8.3	1.7	32.8	0.1	0.2	0.3	32.5	15.9
1955-56	35.7	11.1	2.7	49.5	0.2	0.6	0.8	48.7	21.6
56-57	27.6	6.8	2.2	36.6	0.1	0.5	0.6	36.0	17.1
29-Year Average 1929-57	36.4	43.0	2.6	82.0	0.6	6.0	6.6	75.6	28.4-0.5*=27.9

TABLE 51

DEEP PERCOLATION IN STREAM SYSTEM
(continued)

Safe yield year 1957-58

In 1,000 Acre-Feet

Year	Residual rain (1)	Hill and mountain runoff (2)	Additional hill and mountain runoff (3)	Sub-total (4)	Runoff to reservoirs (5)	Native spread (6)	Sub-total (7)	Net supply (8)	Deep percolation in stream system (9)
1928-29	24.5	6.6	3.5	34.6	0	1.1	1.1	33.5	14.8
29-30	31.5	5.3	3.2	40.0	0	1.2	1.2	38.8	16.4
1930-31	38.7	3.9	4.1	46.7	0	1.1	1.1	45.6	18.5
31-32	52.4	58.3	4.8	115.5	1.0	10.6	11.6	103.9	34.1
32-33	36.8	13.1	3.9	53.8	0.2	0	0.2	53.6	20.8
33-34	42.4	19.6	5.9	67.9	0.3	0.7	1.0	66.9	24.9
34-35	47.4	23.6	5.4	76.3	0.1	3.9	4.0	72.3	26.1
1935-36	28.6	18.7	3.5	50.8	0.3	6.4	6.7	44.1	28.1
36-37	61.9	90.9	5.6	158.4	1.4	15.0	16.4	142.0	43.5
37-38	70.6	176.7	5.8	253.1	2.2	12.4	14.6	238.5	63.0
38-39	59.8	28.2	5.5	93.5	0.5	1.2	1.7	91.8	32.0
39-40	41.5	19.8	3.5	64.8	0.2	2.9	3.1	61.7	23.1
1940-41	117.8	190.0	9.3	317.1	2.8	31.4	34.2	282.9	72.0
41-42	25.8	21.8	2.2	49.8	0.3	0.1	0.4	49.4	19.8
42-43	71.7	165.7	5.4	242.8	2.3	12.1	14.4	228.4	61.0
43-44	69.8	123.8	5.1	198.7	1.7	23.1	24.8	173.9	49.5
44-45	34.2	37.1	3.5	74.8	0.5	9.3	9.8	65.0	24.1
1945-46	32.7	24.3	3.7	60.7	0.2	2.8	3.0	57.7	22.0
46-47	35.4	31.2	6.0	72.6	0.2	12.9	13.1	59.5	22.5
47-48	15.1	6.0	1.8	22.9	0	0	0	22.9	11.0
48-49	13.0	3.2	1.8	18.0	0	0	0	18.0	9.1
49-50	22.2	5.2	2.8	30.2	0.1	0.3	0.4	29.8	13.3
1950-51	14.4	2.9	1.5	18.8	0.1	0	0.1	18.7	9.3
51-52	83.4	113.7	7.6	204.7	1.9	23.6	25.5	179.2	51.0
52-53	22.8	15.0	2.0	39.8	0.2	3.1	3.3	36.5	15.6
53-54	33.4	15.3	3.7	52.4	0.2	3.1	3.3	49.1	19.6
54-55	26.5	8.3	2.7	37.5	0.1	0.2	0.3	37.2	15.9
1955-56	41.5	11.1	4.4	57.0	0.2	0.6	0.8	56.2	21.8
56-57	32.1	6.8	3.6	42.5	0.1	0.6	0.7	41.8	17.2
29-Year Average 1929-57	42.3	43.0	4.2	89.5	0.6	6.2	6.8	82.7	27.2-0.5*=26.7

Source and derivation of values by column number:

Column No.

1. Residual rain from Table R-5.
2. Hill and mountain runoff under conditions of native culture from Table F-7.
3. Additional hill and mountain runoff from Table R-6.
4. Total of columns 1, 2 and 3.
5. Runoff to reservoirs is sum of columns 2, 3 and 4 from Table F-10.
6. Native spread from Table 49.
7. Total of columns 5 and 6.
8. Net supply is column 4 minus column 7.
9. Deep percolation from curve for safe yield year on Figure 12.

* Correction for evaporation of runoff at Hansen Dam (Table L-22A).

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Natural Depletions from the Ground Water Reservoir

The average annual amounts of natural ground water depletions over a period of normal supply, along with their source and derivation, are shown in Table 52. Average amounts of natural depletions consisting of subsurface outflows, rising water, sewer infiltration and consumptive use of ground water are, with the exception of average subsurface outflow in the vicinity of Pickens Canyon (29-year average), based on the trend curves. The conditions governing these items are discussed in preceding portions of this chapter.

TABLE 52

NATURAL GROUND WATER DEPLETION
UNDER SAFE YIELD CONDITIONS

In 1,000 Acre-Feet

Items of depletion	Safe yield year 1949-50	Safe yield year 1954-55	Safe yield year 1957-58
1. Subsurface outflow, passing Gage F-57	0.3	0.3	0.2
2. Subsurface outflow, vicinity of Pickens Canyon	0.3	0.3	0.3
3. Consumptive use of ground water by riparian vegetation	1.0	0.7	0.5
4. Consumptive use of ground water in high ground water areas	1.4	0.9	0.6
5. Rising water passing Gage F-57	0.0	0.0	0.0
6. Sewer infiltration	1.6	2.3	3.1
7. Total natural ground water depletion	4.6	4.5	4.7

Source and derivation of values by item number:

Item No.

1. Subsurface outflow at Gage F-57 from trend curve, Figure 13.
2. Subsurface outflow in vicinity of Pickens Canyon taken as the 29-year average from Table 31, page 160.
3. Consumptive use of ground water by riparian vegetation from trend curve, Figure 13.
4. Consumptive use of ground water in high ground water areas from trend curve, Figure 13.
5. Rising water from curve on Figure 12. Maximum increase in storage above 1957-58 level under safe yield conditions over a period of normal native supply is 200,000 acre-feet.
6. Sewer infiltration from trend curve, Figure 13.
7. Total of columns 1 through 6.

Net Recharge of Native and Delivered Waters

The net recharge from normal native supply and average delivered water requirement is determined in Table 53 and is equal to the difference between the gross recharge and natural ground water depletion. The determination of net recharge demonstrates the effect of urbanization on recharge. The average gross recharge of native water was approximately 5,000 acre-feet greater for 1949-50 safe yield conditions than for the 1957-58 conditions. The average gross recharge of the delivered water requirement was approximately 10,000 acre-feet less for 1949-50 conditions than for 1957-58 conditions. The decrease in recharge of native water is primarily due to improvement of the drainage system. The increase in recharge of delivered water is due to the increase in cesspool recharge which has accompanied urbanization of the area. The average natural depletions are approximately the same for the three safe yield years. The resulting average net recharge for 1954-55 safe yield conditions is approximately 5,000 acre-feet greater than for the 1949-50 conditions and has remained about the same for 1957-58 conditions. The increase in recharge of delivered water has therefore kept pace with the decrease in recharge of native supply. It should be noted that if the entire area were connected to the sewer system the recharge of delivered water would be considerably less.

TABLE 53

NET RECHARGE FROM NORMAL NATIVE SUPPLY
AND AVERAGE REQUIRED DELIVERED WATER

In 1,000 Acre-Feet Per Annum

Item	Safe Yield Year		
	1949-50	1954-55	1957-58
1. Average gross recharge from precipitation on land use areas	24.5	24.6	23.6
2. Average gross recharge from native spread water	6.0	6.0	6.2
3. Average gross recharge from native water in the stream system on the valley fill area	31.2	27.9	26.7
4. Average gross recharge of native waters (total native except runoff to reservoirs)	61.7	58.5	56.5
5. Average gross recharge from average delivered water	52.4	60.6	62.6
6. Average gross recharge of delivered and native waters	114.1	119.1	119.1
7. Average natural depletions of ground water	4.6	4.5	4.7
8. Average net recharge of native and delivered waters	109.5	114.6	114.4

Source and derivation of values by item number:

Item No.

1. From Table 48, Item 3.
2. From Table 50.
3. From Table 51, Column 9 (29-year average).
4. Total of Items 1, 2 and 3.
5. From Table 47, Item 8.
6. Total of Items 4 and 5.
7. From Table 52, Item 7.
8. Item 6 minus Item 7.

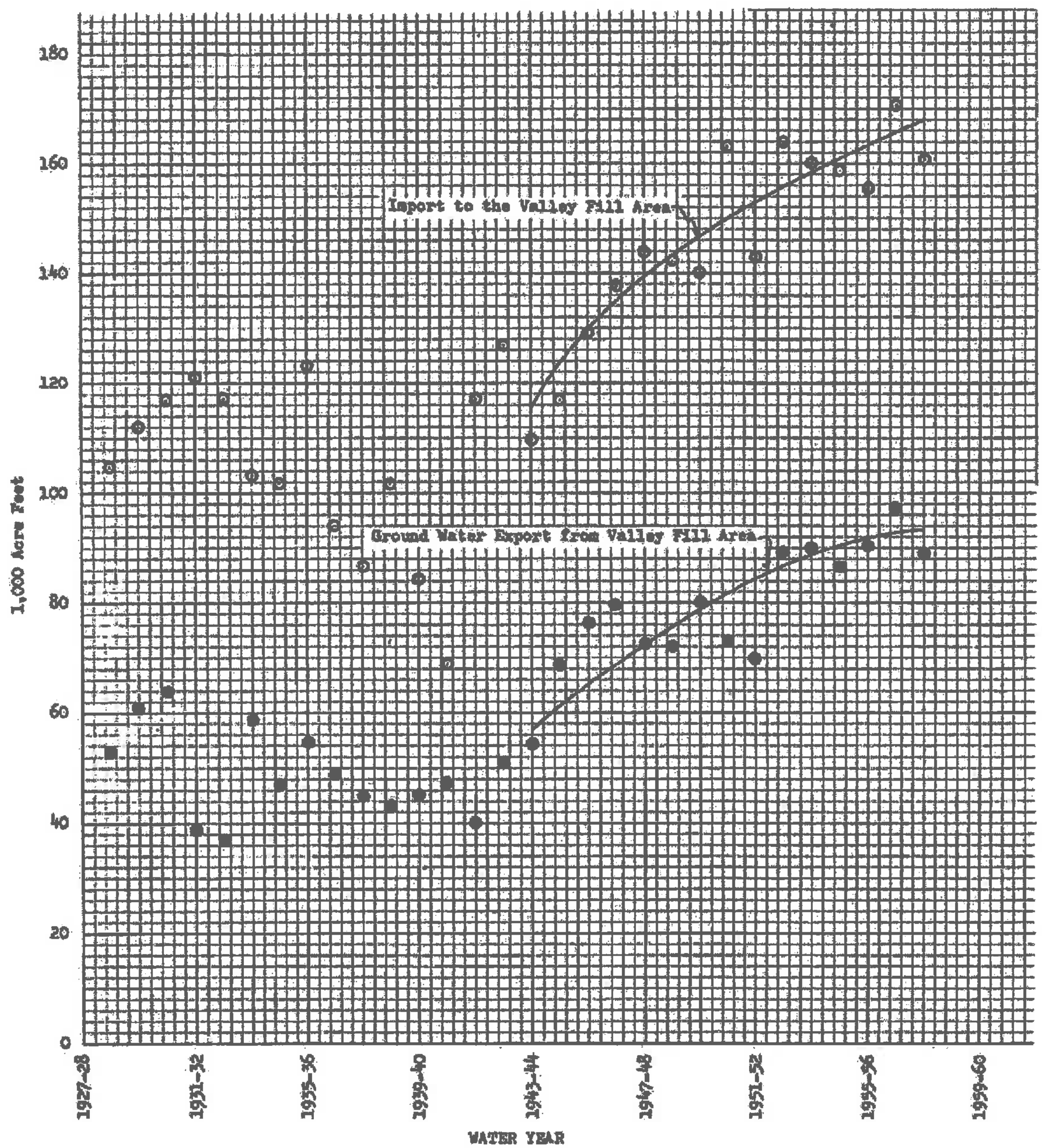
Evaluation of Safe Yield

The average net recharge from normal native supply and from average delivered water requirement can be the safe yield only if the delivered water requirement of, and export from, the valley fill area is met by import and ground water yield of imported and native waters. Thus, the amount of safe yield is affected by both the import and export conditions adopted for its determination.

Import and Export Conditions

Since the Order of Reference requires a determination of the effect of import on safe yield, and since export is related to import and also to the use of water in the City of Los Angeles outside the valley fill, the average historic amounts of import and export are used as a safe yield condition. The historic amounts of import to and export from the valley fill area are plotted on Figure 14 and trend curves representing the averages drawn. The ground water export (sum of columns 6 and 7, Table 34) includes amounts exported to hill and mountain areas and to areas outside the Upper Los Angeles River area. The annual amounts of import (column 1, Table 34) plotted on Figure 14 are those amounts available on the valley fill area after correction for changes in reservoir storage and do not include amounts of rain and runoff entering the water supply reservoirs (column 13, Table 20). It is apparent from Figure 14 that the historic amounts of each are influenced by both precipitation and operational procedures of municipal water supply systems. The average amounts of import and export taken from Figure 14 and the difference betweeen them are shown in Table 54.

FIGURE 14



TREND CURVES FOR IMPORT TO AND EXPORT FROM
THE VALLEY FILL AREA

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TABLE 54

AVERAGE IMPORT AND EXPORT
CONDITIONS FOR SAFE YIELD DETERMINATION

In 1,000 Acre-Feet

	Item	Safe yield year		
		1949-50	1954-55	1957-58
1.	Import (Figure 14)	146.8	161.0	168.0
2.	Export (Figure 14)	79.5	90.5	93.5
3.	Import minus export	67.3	70.5	74.5

Safe Yield

Computation of safe yield first requires the evaluation of net recharge from native and imported water under safe yield conditions. Net recharge from these sources is the gross recharge less natural ground water depletions. Net recharge has been thus derived under Item 9 of Table 55. Since there is no return from ground water pumped for exportation, the total safe yield is equal to export plus the remaining net recharge converted to equivalent pumpage. Amounts of safe yield thus derived in Table 55 are 100,800, 100,400 and 97,600 acre-feet for 1949-50, 1954-55 and 1957-58 respectively. The safe yield of normal native supply and of average historic import are shown in Table 55 and have been determined by splitting the total safe yield in the ratio of gross recharge from both sources with the recharge from runoff to reservoirs being included under native supply.

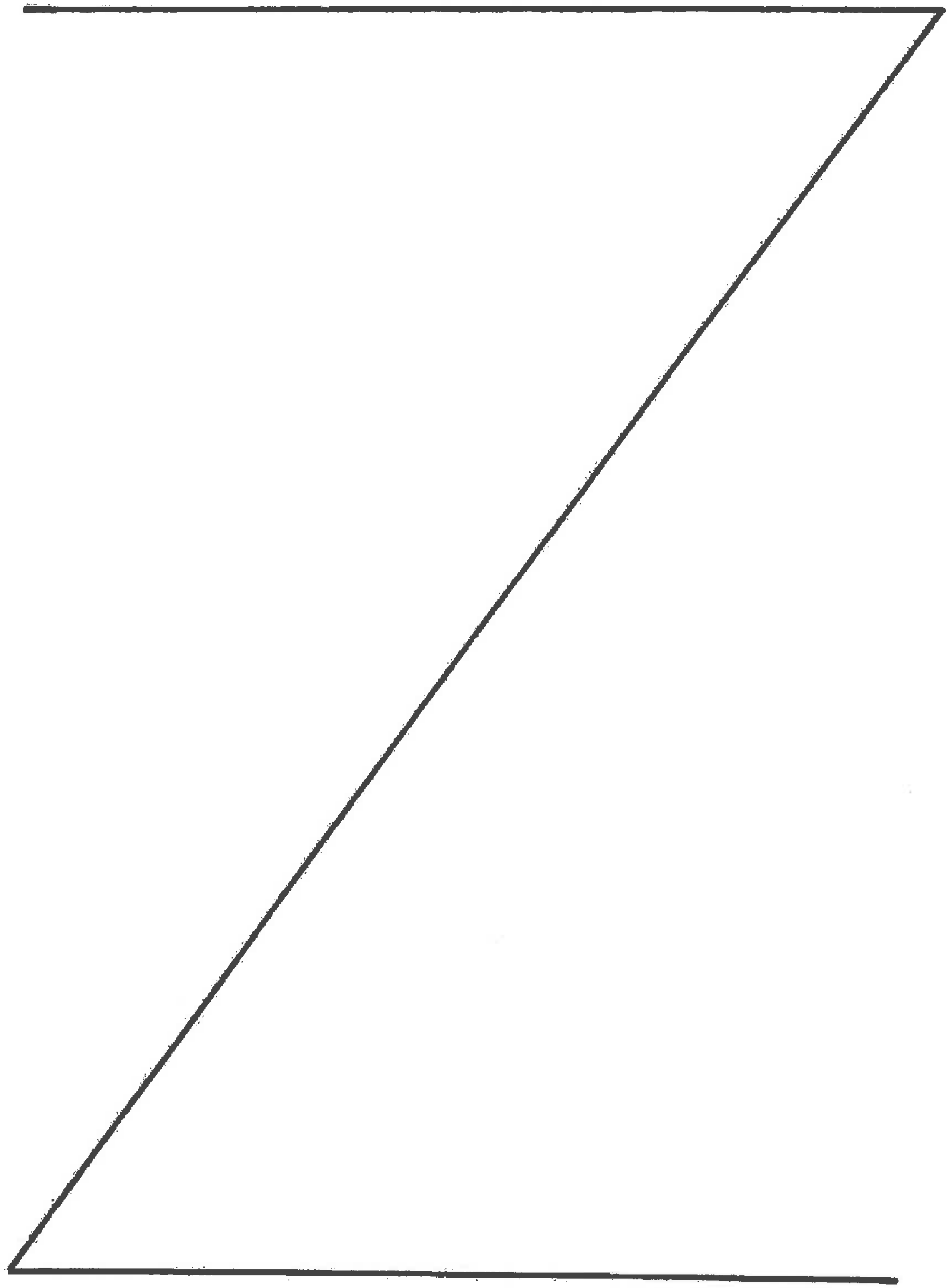

TABLE 55

SAFE YIELD

In 1,000 Acre-Feet

Item	Safe yield year 1949-50	Safe yield year 1954-55	Safe yield year 1957-58
AVERAGE GROSS GROUND WATER RECHARGE OVER A PERIOD OF NORMAL NATIVE SUPPLY			
1. Gross recharge of average import	38.0	43.5	44.5
Determined from:			
a. Average import	146.8	161.0	168.0
b. Percent of delivered water becoming gross recharge	25.9%	27.0%	26.5%
2. Gross recharge of runoff to reservoirs	0.2	0.2	0.2
Determined from:			
a. Average runoff to reservoirs	0.6	0.6	0.6
b. Percent of delivered water becoming gross recharge	25.9%	27.0%	26.5%
3. Gross recharge of normal native supply exclusive of runoff to reservoirs	61.7	58.5	56.5
4. Total average gross ground water recharge	99.9	102.2	101.2
AVERAGE GROUND WATER DRAFT OVER A PERIOD OF NORMAL NATIVE SUPPLY			
5. Average natural ground water depletions	4.6	4.5	4.7
6. Average ground water export from the valley fill area	79.5	90.5	93.5
7. Subtotal - ground water depletions and export	84.1	95.0	98.2
8. Net recharge remaining for use as delivered water on valley fill	15.8	7.2	3.0
9. Net recharge remaining (Item 8) converted to pumpage	21.3	9.9	4.1
Determined from:			
a. Percent consumed or leaving valley fill area exclusive of ground water export	74.1%	73.0%	73.5%
SAFE YIELD			
10. Safe yield of average import and normal native supply	100.8	100.4	97.6
Prorated into:			
a. Safe yield derived from average import	38.7	42.7	42.9
b. Safe yield derived from normal native supply	62.1	57.7	54.7

Source and derivation of amounts shown on following page.

TABLE 55

SAFE YIELD
(continued)

Source and derivation of amounts by item number:

1. Product of Items 1a and 1b.
1a. Trend curve on Figure 14, page 245.
1b. Item 9, Table 47, page 231.
2. Product of Items 2a and 2b.
2a. 29-year average in Column 5, Table 51, page 238.
2b. Item 9, Table 47, page 231.
3. Item 4, Table 53, page 243.
4. Sum of Items 1, 2 and 3.
5. Item 7, Table 52, page 241.
6. Trend curve on Figure 14, page 245.
7. Sum of Items 5 and 6.
8. Item 4 minus Item 7.
9. Item 8 divided by Item 9a and multiplied by 100.
9a. 100 percent minus Item 1b.
10. Sum of Items 6 and 9.
10a. Item 1 multiplied by Item 10 and divided by Item 4.
10b. Item 10 less Item 10a.

Water Requirement and Supply
Under Safe Yield Conditions

The relationship between delivered water required under safe yield conditions and the delivered water available under the same conditions is set forth in Table 56. The water requirements are those determined in Table 46 plus the export of ground water from the valley fill area. The available water is the sum of native surface water diversion, imported water, and pumped ground water which is limited to the safe yield. Since the available water is less than the required water, it is apparent that under the import and export conditions set forth, a greater amount of ground water has historically been extracted than was replenished by recharge from normal native supply and average import. The result of this condition has been a progressive annual reduction of ground water in storage. To eliminate the deficiency that would exist between the water requirements under safe yield conditions and water supply under safe yield conditions, it would be necessary to adopt one or a combination of the following:

1. A reduction in extractions for export in the amount of Item 12, Table 56, while meeting average import and delivered water requirements.

2. An additional import in the amount of Item 12, Table 56, while meeting average export and delivered water requirements.

3. A reduction in extractions for delivery to the valley fill area in the amount of Item 10, Table 56, while meeting average import and export requirements.

TABLE 56

RELATIONSHIP BETWEEN WATER REQUIREMENTS AND WATER SUPPLY UNDER SAFE YIELD CONDITIONS

In 1,000 Acre-Feet

Item	Safe yield year		
	1949-50	1954-55	1957-58
WATER REQUIREMENTS			
1. Average delivered water requirement, valley fill area	202.6	224.3	236.5
2. Average export from valley fill area	79.5	90.5	93.5
3. Total water requirement	282.1	314.8	330.0
WATER SUPPLY			
4. Surface diversion	0.0	0.0	0.0
5. Runoff to reservoirs	0.6	0.6	0.6
6. Safe yield derived from native sources	62.1	57.7	54.7
7. Average import	146.8	161.0	168.0
8. Safe yield derived from average import	38.7	42.7	42.9
9. Total water available to satisfy average delivered water requirement and average export	248.2	262.0	266.2
DEFICIENCY			
10. Portion of the total water requirement not satisfied by total water available	33.9	52.8	63.8
11. Percent of delivered water consumed or leaving valley fill area exclusive of ground water export	74.1%	73.0%	73.5%
12. Water requirement deficiency expressed as delivered water consumed or leaving valley fill area exclusive of ground water export	25.2	38.5	46.8

Source and derivation of amounts by item number:

Item No.

1. Item 7, Table 46, page 229.
2. Trend curve, Figure 14, page 245.
3. Sum of Items 1 and 2.
4. Assumed to be zero (see page 222).
5. 29-year average in column 5, Table 51, page 238.
6. Item 10b, Table 55, page 246b.
7. Trend curve, Figure 14, page 245.
8. Item 10a, Table 55, page 246b.
9. Sum of Items 4 through 8.
10. Item 3 minus Item 9.
11. Item 9a, Table 55, page 246b.
12. Item 10 multiplied by Item 11.

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That the foregoing amounts represent a consumptive demand that would not be satisfied under conditions of average import and export, is shown in the following example for the 1949-50 safe yield year be comparing the consumptive use and outflows of delivered water and ground water to the water available to satisfy these demands.

The consumptive demand consists of:

Average consumptive use and outflows of delivered water of 150,200 acre-feet (Item 7, Table 47, page 231).
Average natural depletions of ground water of 4,600 acre-feet (Item 7, Table 52, page 241).
Average export of ground water of 79,500 acre-feet (Item 2, Table 54, page 246).
For a total consumptive demand of 234,300 acre-feet.

The water available to satisfy the above demand consists of:

Average gross recharge of native waters of 61,700 acre-feet (Item 3, Table 55, page 246b).
Average runoff to reservoirs of 600 acre-feet (29-year average in Column 5, Table 51, page 238).
Average import to the valley fill area of 146,800 acre-feet (Item 1, Table 54, page 246).
For a total available water of 209,100 acre-feet.

The excess of consumptive demand over available water amounts to 25,200 acre-feet and is equivalent to the 25,200 acre-feet determined as Item 12 in Table 56.

Effect of Import on Safe Yield

Importation of foreign waters increased the safe yield of the ground water reservoir by 38,700, 42,700 and 42,900 acre-feet for the respective safe yield years of 1949-50, 1954-55 and 1957-58. As a result there was a decrease in deficiency of supply to meet the water requirements of the culture existing during the safe yield years to less than the deficiency which would have occurred had local sources been the sole supply.

CHAPTER VIII. THE USE OF WATER BY THE CITY OF LOS ANGELES AND ITS INHABITANTS

The scope of this chapter is limited to an evaluation of the gross water use from all sources by the City of Los Angeles and its inhabitants within the territory of the original Pueblo (since 1948) and within its expanded boundaries, and of the amounts of water distributed by the City of Los Angeles for use outside its boundaries, and satisfies the requirements of Paragraph I-5 and I-6 of the Order of Reference.

Use of Water by the City of Los Angeles Within the Territory of the Original Pueblo

The original Los Angeles Pueblo area contained four square leagues, the Spanish equivalent of 17,756 acres. However, the title of the land given to the City as a successor to the Pueblo, as surveyed in 1858, was only 17,172. The boundaries of the original Pueblo are delineated and recorded in the Book of Patents Number 3, pages 64 and 65.

The amount of water delivered by the City of Los Angeles for use within the original Pueblo boundary, as shown on Plate 36, has been determined by the City of Los Angeles for the period from 1949-50 through 1957-58. These values, including both measured and estimated amounts, consist of metered sales to customers, water pumped by the City Department of Recreation and Parks for irrigation of Elysian Park, and unaccounted-for water consisting of pipeline leakage and other minor losses. These values, tabulated in Table 57, do not include reservoir evaporation of approximately 175 acre-feet per year and a minor amount of pumpage from private wells within the pueblo area.

TABLE 57

USE OF WATER BY THE CITY OF LOS ANGELES WITHIN THE TERRITORY OF THE ORIGINAL PUEBLO*

Hydrologic year	Deliveries, in acre-feet
1949-50	73,533
1950-51	65,445
51-52	65,802
52-53	68,914
53-54	66,771
54-55	62,564
1955-56	63,673
56-57	64,368
57-58	60,692

* As per Patent 3, pages 64 and 65, encompassing 17,172 acres.

By applying the water requirements given in State Water Resources Board Bulletin No. 24 to the acreage of the various types of culture as determined in 1955 by the Department of Water Resources, the values determined by the City of Los Angeles appear reasonable. The existing culture is predominantly residential and industrial and commercial and includes a small amount of irrigated agriculture.

Use of Water by the City of Los Angeles Within its Expanded Boundaries

The total use of water by the City of Los Angeles within its expanded boundaries, including the original Pueblo, is considered to be that quantity of water which has been delivered to its distribution system to supply demands for all uses within the boundary in existence at that time. The present boundary of the City of Los Angeles and the changes in the boundary that have occurred from time to time are shown on Plate 36. In addition to consumer deliveries, use includes operational losses and use by the several city departments. Records of ground water pumpage by all private parties for use within the city's boundaries are not readily available and therefore are not included in the values of total use presented herein. Water distributed for use outside the city boundaries is discussed subsequently and included in the total use.

Water delivered to the City of Los Angeles distribution system includes the major portion of Owens-Mono Basin import measured in San Fernando Valley, Colorado River water measured at the several connections to Metropolitan Water District feeders and all local extractions by the several city departments in the Coastal Plain and in San Fernando Valley. Owens-Mono Basin water which is spread in San Fernando Valley and that which is spilled into the Los Angeles River were not considered to be in the distribution system and were subtracted from the measured import. Exchange of water between the City of Los Angeles and The Metropolitan Water District has occurred in several instances where the city supplies other agencies and is reimbursed with Colorado River water. That quantity has been subtracted from the city's Colorado River import. Measured change in storage in the surface reservoirs within the city's boundaries has also been included in the determination of total use.

Table 58 shows the water use within the expanded boundaries of the City of Los Angeles along with the items of supply to the distribution system and the modifications that were made in arriving at the use values.

A portion of the water used by the City of Los Angeles is extracted from the ground water supply of Central and West Coast Basins in the Coastal Plain. There exists, however, a state of overdraft in each basin (References: State Water Resources Board, "Central Basin Investigation", Bulletin No. 8, March, 1952; Department of Public Works, Draft of Report of Referee, West Coast Basin Reference, February, 1952).

The amounts of ground water extracted by the City of Los Angeles from areas outside the Upper Los Angeles River area and used by the City of Los Angeles within its boundaries, are listed in Table 59.

TABLE 58

USE OF WATER BY THE CITY OF LOS ANGELES WITHIN THE CITY BOUNDARIES

In Acre-Feet

Year	Import: Owens-Mono Basin (1)	Import: Owens-Mono Basin water spread (2)	Import: Owens-Mono Basin water spilled into Los Angeles River (3)	Import: Net Owens-Mono Basin (1)-(2)-(3)=(4)	Import: Colorado River (5)	Subtotal (4)+(5)=(6)	Local ground water extractions by City Departments: Water and power (7)	Parks (8)	Airports (9)	Harbor (10)	Subtotal (7)+(8)+(9)+(10)=(11)	Subtotal (6)+(11)=(12)	Change in reservoir storage (13)	Water used by the City (12)+(13)=(14)
1928-29	190,103	590	No record	189,513	0	190,103	79,567	1,750	9	830	82,156	271,669	- 2,222	273,891
29-30	198,127	0	No record	198,127	0	198,127	84,832	1,750	9	830	87,421	285,548	- 2,985	288,533
1930-31	215,747	7,280	No record	208,467	0	208,467	83,525	2,450	9	830	86,814	295,281	10,563	284,718
31-32	238,195	31,743	0	206,452	0	206,452	50,308	2,370	9	830	53,517	259,969	5,100	254,869
32-33	228,432	33,429	0	195,003	0	195,003	47,333	2,440	9	821	50,603	245,606	140	245,466
33-34	185,579	20,855	0	164,724	0	164,724	70,296	2,360	8	832	73,496	238,220	- 3,230	241,450
34-35	194,924	30,804	0	164,120	0	164,120	59,485	2,030	8	759	62,282	226,402	- 1,590	227,992
1935-36	236,945	22,716	0	214,229	0	214,229	59,219	2,520	7	896	62,642	276,871	5,240	271,631
36-37	206,673	9,307	0	197,366	0	197,366	53,687	2,990	8	842	57,527	254,893	- 1,330	256,223
37-38	209,081	7,315	0	201,766	0	201,766	49,246	3,510	4	758	52,518	254,314	- 1,970	256,284
38-39	237,254	14,911	0	222,343	0	222,343	46,385	4,030	6	915	51,336	273,679	170	273,509
39-40	217,158	3,407	0	213,751	0	213,751	47,464	3,800	3	1,087	52,354	266,105	2,580	263,525
1940-41	200,976	3,446	0	197,530	331	197,861	50,364	3,470	2	1,008	54,844	252,705	5,270	247,435
41-42	246,350	11,290	6,268	228,792	526	229,318	44,477	3,000	2	514	47,993	277,311	- 5,160	282,471
42-43	264,396	12,130	8,702	243,564	227	243,791	56,021	3,020	2	170	59,213	303,004	- 5,750	308,754
43-44	274,495	3,191	2,862	268,442	245	268,687	60,485	2,740	6	103	63,334	332,021	5,630	326,391
44-45	267,238	0	1,305	265,933	1,620	267,553	77,069	2,920	5	0	79,994	347,547	- 5,640	353,187
1945-46	283,968	0	7,869	276,099	7,190	283,289	86,141	4,390	6	79	90,616	373,905	- 1,920	375,825
46-47	291,015	1,687	7,683	281,645	9,294	290,939	90,825	2,820	3	110	93,758	384,697	- 890	385,587
47-48	306,458	0	2,935	303,523	14,888	318,411	85,460	3,220	4	499	89,183	407,594	3,030	404,564
48-49	298,462	0	1,463	296,999	15,378	312,377	84,019	3,390	552	228	88,189	400,566	- 5,169	405,735
49-50	305,398	762	1,337	303,299	5,155	308,454	92,437	3,430	551	367	96,785	405,239	7,611	397,628
1950-51	317,374	2,354	3,942	311,078	13,697	324,775	89,854	3,440	4	367	93,665	418,440	- 7,114	425,554
51-52	316,568	7,281	2,834	306,453	15,597	322,050	90,126	2,930	54	367	93,477	415,527	1,947	413,580
52-53	320,924	0	5,408	315,516	15,973	331,459	119,556	2,920	54	367	122,897	454,386	- 2,121	456,507
53-54	318,589	0	3,176	315,413	18,671	334,084	113,202	2,780	27	262	116,271	450,355	- 1,893	452,248
54-55	316,319	0	7,863	308,456	28,966	337,422	105,781	2,780	0	262	108,823	446,245	860	445,385
1955-56	321,256	1,610	4,003	315,643	29,303	344,946	109,487	2,440	0	262	112,189	457,135	6,010	451,125
56-57	318,389	0	1,565	316,824	36,007	352,831	116,107	2 720	0	262	119,089	471,920	- 5,714	477,634
57-58	325,387	0	90	325,297	28,768	354,065	106,327	2,131	0	48	108,506	462,571	3,225	459,346
29-year (1929-57) Average	259,531	7,797	2,387	249,347	7,347	256,694	75,957	2,912	47	533	79,414	336,109	- 19	336,128

Source and derivation of amounts by column numbers.

Column No.

1. Column 1, Table M-1.
2. Sum of Columns 2 and 3, Table 23.
3. Column 8, Table M-1 for years 1940-41 through 1957-58. Does not include discharge from River Power Plant.
5. City of Los Angeles.
7. City of Los Angeles.
8. City of Los Angeles. Year 1945-46 includes Department of Public Works extraction of 1,325 acre-feet.
9. City of Los Angeles.
10. City of Los Angeles.
13. Column 4, Table M-1.

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TABLE 59

GROUND WATER EXTRACTED BY CITY OF LOS ANGELES FROM AREAS OUTSIDE THE UPPER LOS ANGELES RIVER AREA

In Acre-Feet

Year	Ground water extractions outside Upper Los Angeles River area		
	Department of Water and Power[a]	Other departments[b]	Total
1928-29	17,984	839	18,823
29-30	18,960	839	19,799
1930-31	15,567	839	16,406
31-32	8,410	839	9,249
32-33	8,531	830	9,361
33-34	9,805	840	10,645
34-35	10,583	767	11,350
1935-36	3,591	903	4,494
36-37	2,983	850	3,833
37-38	3,423	762	4,185
38-39	2,482	921	3,403
39-40	2,195	1,090	3,285
1940-41	2,392	1,010	3,402
41-42	2,785	516	3,301
42-43	3,633	172	3,805
43-44	4,552	109	4,661
44-45	6,524	5	6,529
1945-46	9,113	85	9,198
46-47	8,394	113	8,507
47-48	8,413	503	8,916
48-49	7,800	780	8,580
49-50	10,496	918	11,414
1950-51	14,597	371	14,968
51-52	14,881	421	15,302
52-53	24,141	421	24,562
53-54	19,430	289	19,719
54-55	18,035	262	18,297
1955-56	16,798	262	17,060
56-57	17,172	262	17,434
57-58	16,436	48	16,484

a. From wells owned and operated by the City of Los Angeles and their predecessors in Central, West Coast and West Coastal Plain-North Basins.
b. Airports and Harbors (see Table 51).

Water Distributed by the City of Los Angeles for Use Outside Its Boundaries

Records of water distributed by the City of Los Angeles for use outside its boundaries, but not including unmeasured distribution along the Los Angeles Aqueduct or exchange water supplied to others for The Metropolitan Water District, are readily available only for the period from 1950-51 through 1954-55 and for the year 1959-60. The water so distributed during the 1950-51 through 1954-55 period is grouped into four categories: (1) acquired services are those served by a water company purchased by the City, (2) governmental services are either Federal, State, County or City agencies, (3) miscellaneous services are those in unincorporated areas and (4) reciprocal services are those in adjacent incorporated municipalities and in County Water Works District No. 3 supplied by the City and, in return, the City of Los Angeles is given a like amount by the entity in which the services are located. The water distributed during 1959-60 is shown as a total of these groups.

Amounts of water delivered by the City of Los Angeles for use to parcels partially outside and to parcels completely outside its boundaries for the 5-year period from 1950-51 through 1954-55 are shown in Table 60. The total amount served to both types of parcels is also shown in Table 60 for the period 1950-51 through 1959-60.

TABLE 60

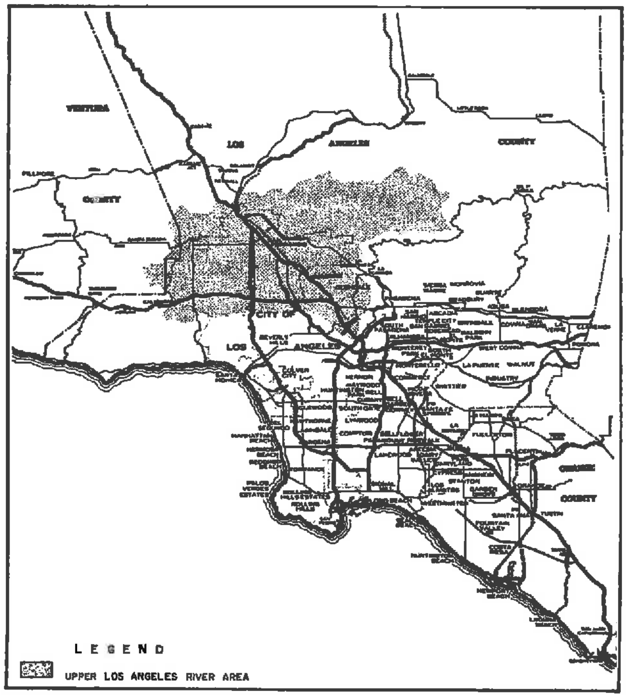
WATER DISTRIBUTED BY THE CITY OF LOS ANGELES TO AREAS OUTSIDE AND PARTIALLY OUTSIDE ITS BOUNDARIES

In Acre-Feet

Year	Distributed to parcels outside city boundary	Distributed to parcels partially outside city boundary[a]	Distributed to parcels wholly and partially outside city boundary[a]
1950-51	4,316	1,489	5,805
1951-52	4,865	1,469	6,334
1952-53	5,260	1,801	7,061
1953-54	5,386	1,865	7,251
1954-55	5,362	2,044	7,406
1955-56	--	--	7,699[b]
1956-57	--	--	7,993[b]
1957-58	--	--	8,286[b]
1958-59	--	--	8,580[b]
1959-60	--	--	8,873

a. Includes water delivered within the city boundary.
b. No data available, amounts estimated by interpolation between 1954-55 and 1959-60

72252-C 9-62 350 SPO



VICINITY MAP
SCALE
0 5 10 15 Miles

LOCATION MAP

STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

VICINITY & LOCATION MAPS

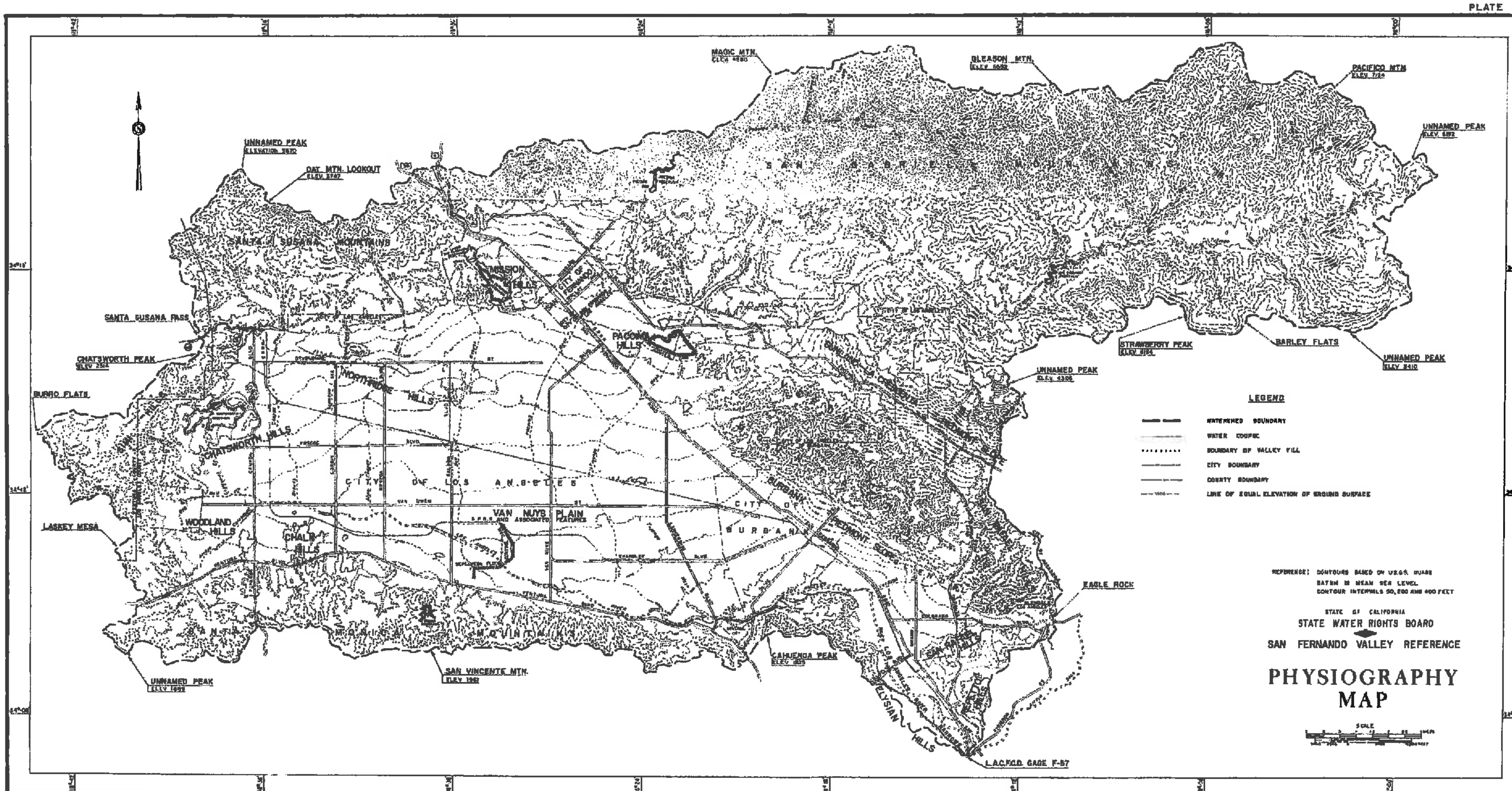
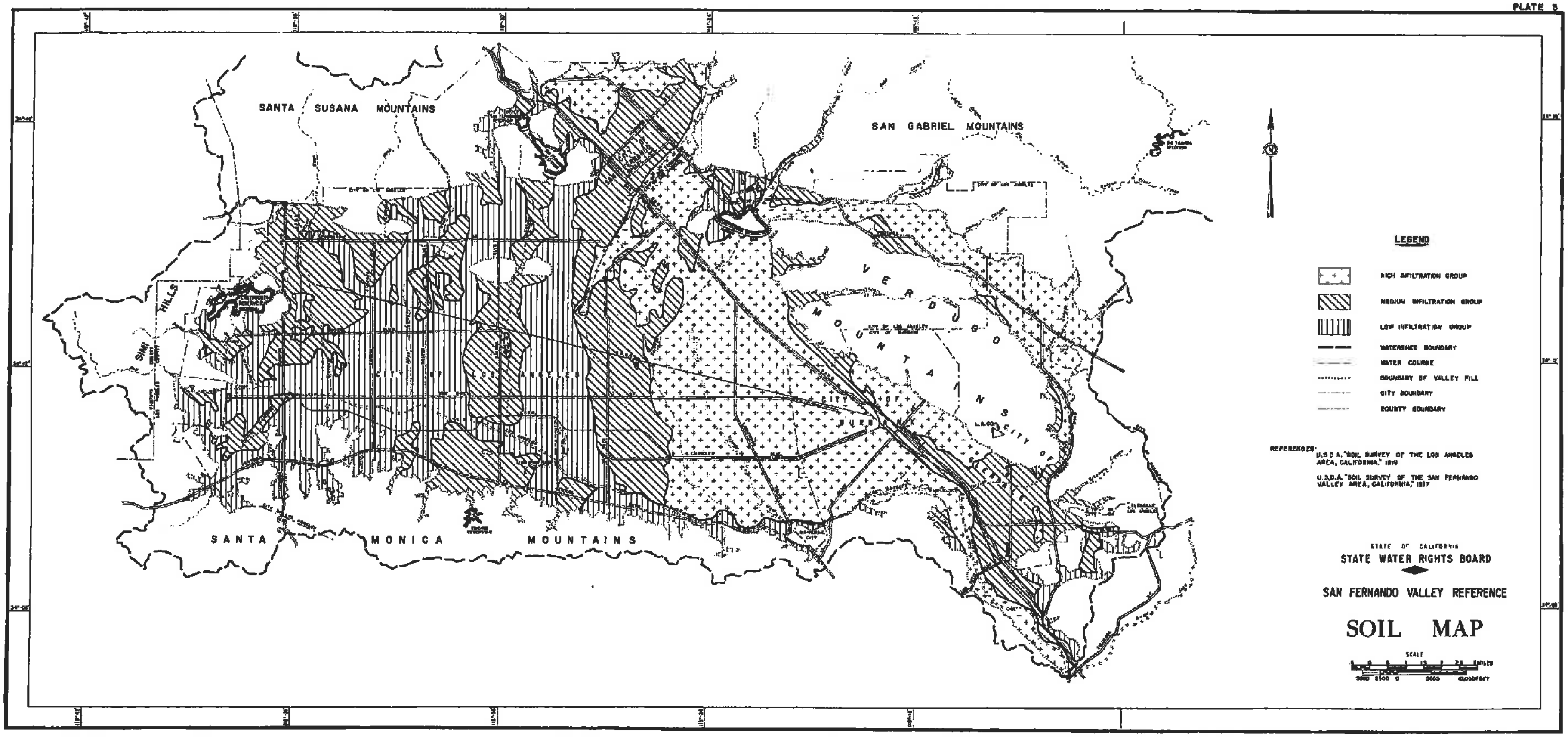
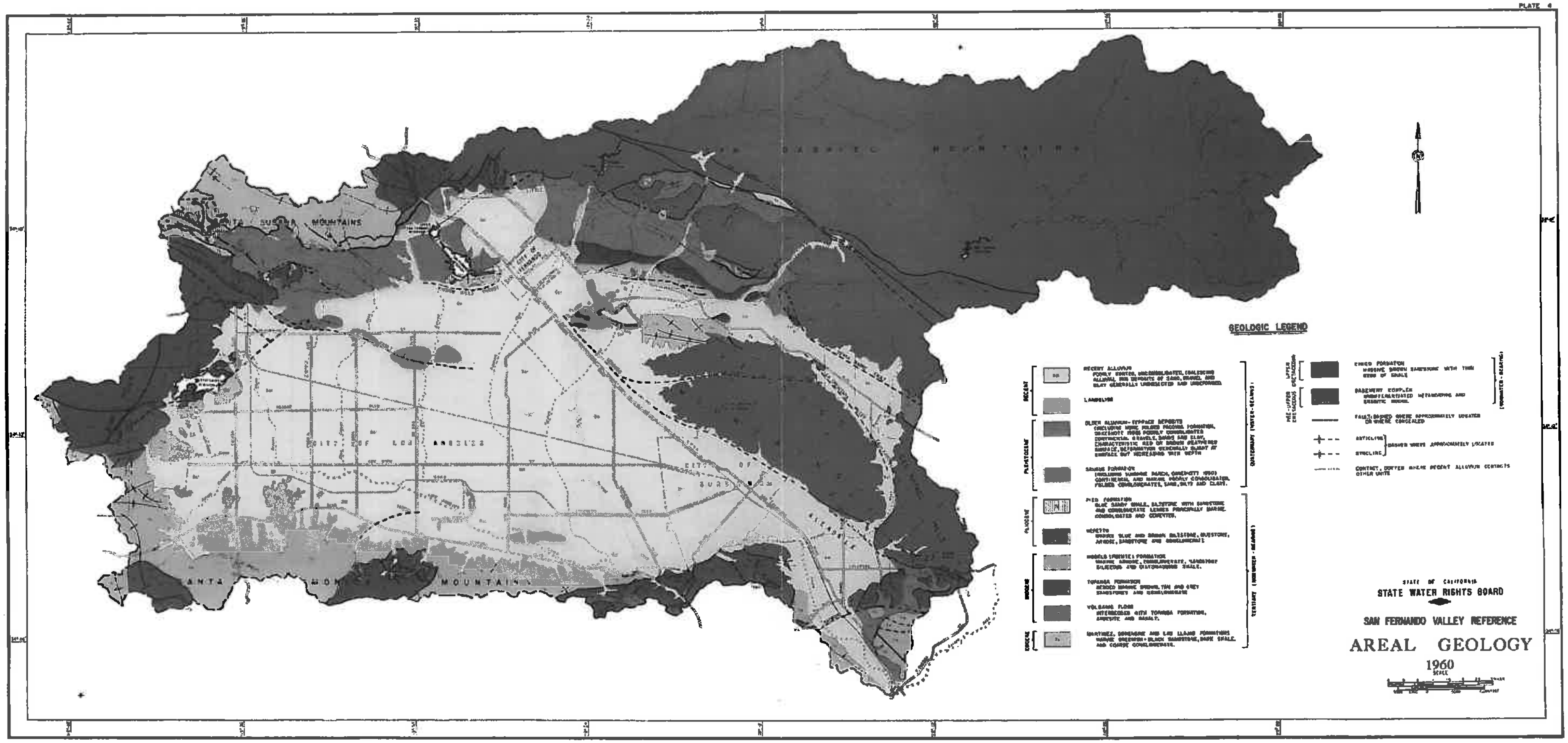

MAGIC MTN.
GLEASON MTN.
PACIFICO MTN.
UNNAMED PEAK
UNNAMED PEAK
OAT MTN. LOOKOUT
SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
MISSION HILLS
PACOIMA HILLS
SANTA SUSANA PASS
CHATSWORTH PEAK
BURRO FLATS
NORTHRIDGE HILLS
CHATSWORTH HILLS
CITY OF LOS ANGELES
VAN NUYS PLAIN
WOODLAND HILLS
CHALK HILLS
LASKEY MESA
CITY OF BURBANK
STRAWBERRY PEAK
BARLEY FLATS
UNNAMED PEAK
UNNAMED PEAK
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL ELEVATION OF GROUND SURFACE
EAGLE ROCK
SAN VINCENTE MTN.
UNNAMED PEAK
CAHUENGA PEAK
ELYSIAN HILLS
L.A.C.F.C.D. GAGE F-57
REFERENCE: CONTOURS BASED ON U.S.G.S. QUADS
DATUM IS MEAN SEA LEVEL
CONTOUR INTERVALS 50, 200 AND 400 FEET
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
PHYSIOGRAPHY
MAP
SCALE

PLATE 5



SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
CITY OF BURBANK
CITY OF GLENDALE
LEGEND
HIGH INFILTRATION GROUP
MEDIUM INFILTRATION GROUP
LOW INFILTRATION GROUP
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
REFERENCES:
U.S.D.A. "SOIL SURVEY OF THE LOS ANGELES AREA, CALIFORNIA," 1919
U.S.D.A. "SOIL SURVEY OF THE SAN FERNANDO VALLEY AREA, CALIFORNIA," 1917
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
SOIL MAP
SCALE


MOUNTAINS
GEOLOGIC LEGEND
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
AREAL GEOLOGY
1960
SCALE

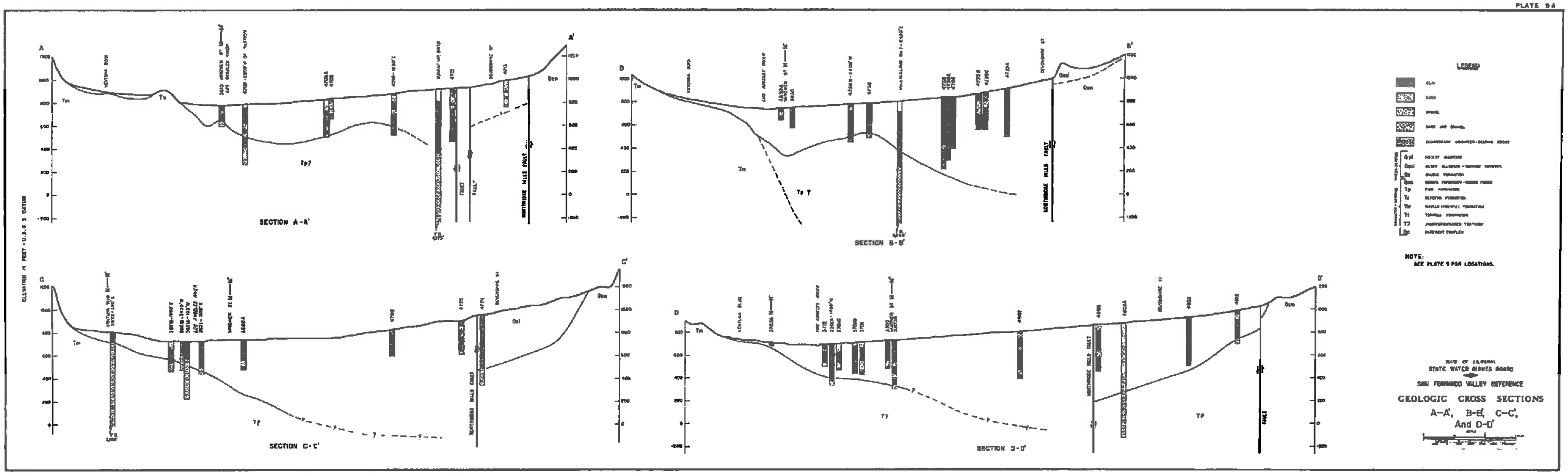


PLATE 9A
SECTION A-A'
SECTION B-B'
SECTION C-C'
SECTION D-D'
NORTHRIDGE HILLS FAULT
FAULT
Tm
Tp?
Tp ?
Tp
T?
Qsu
Qal
ELEVATION IN FEET - U.S.G.S. DATUM
LEGEND
NOTE:
SEE PLATE 5 FOR LOCATIONS.
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
A-A', B-B', C-C',
And D-D'

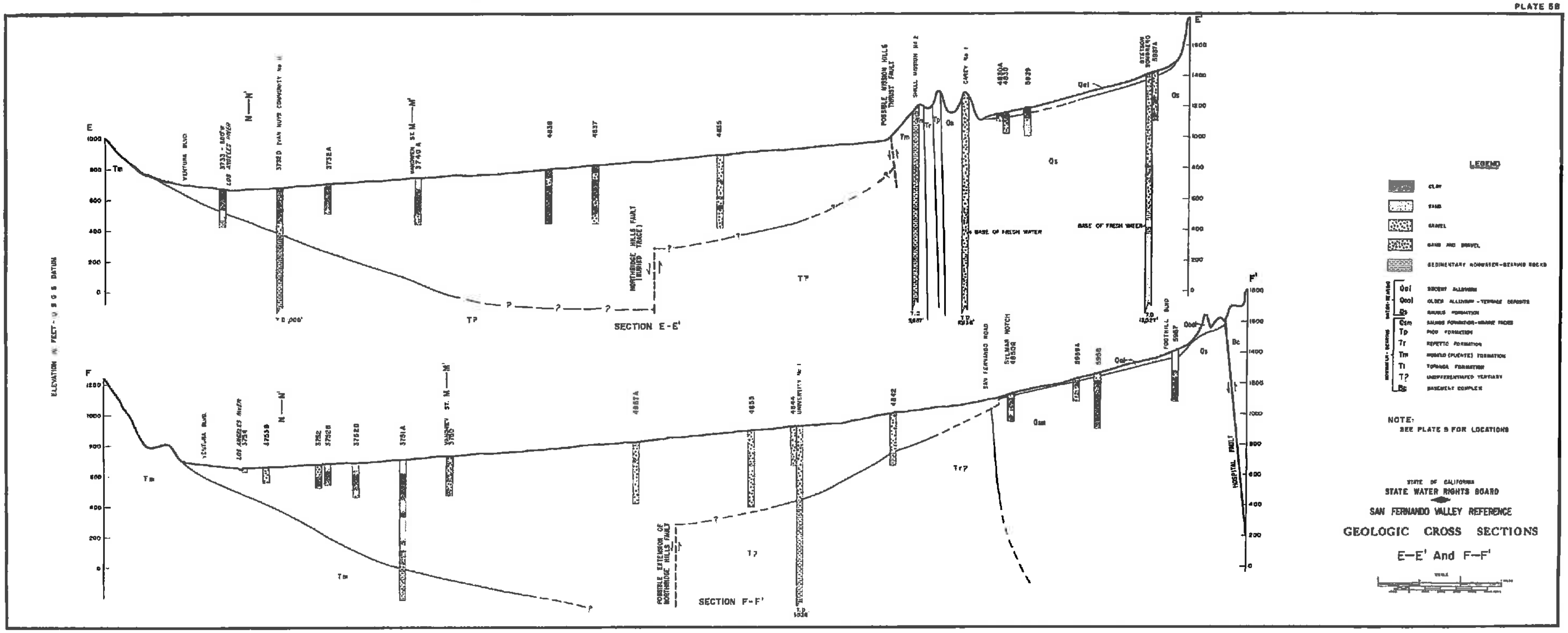


PLATE 58
SECTION E-E'
SECTION F-F'
ELEVATION IN FEET - U S G S DATUM
VENTURA BLVD
3733 - 580W LOS ANGELES RIVER
3732D (VAN NUYS COMMUNITY No. 1)
3732A
VANOWEN ST. M—M'
3740 A
4838
4837
4815
NORTHRIDGE HILLS FAULT (BURIED TRACE)
POSSIBLE MISSION HILLS THRUST FAULT
SHELL MISSION No. 2
CAREY No. 1
4830A
5029
STETSON SOMBRERO 5887A
BASE OF FRESH WATER
4852
LOS ANGELES RIVER 3754
4753B
3752
3752B
3752D
3751A
VANOWEN ST. M—M'
3760
4887A
4855
4844 UNIVERSITY No. 1
4842
POSSIBLE EXTENSION OF NORTHRIDGE HILLS FAULT
SAN FERNANDO ROAD
SYLMAR NOTCH 4850B
5998A
5998
FOOTHILL BLVD 5987
HOSPITAL FAULT
LEGEND
NOTE: SEE PLATE 5 FOR LOCATIONS
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
E—E' And F—F'

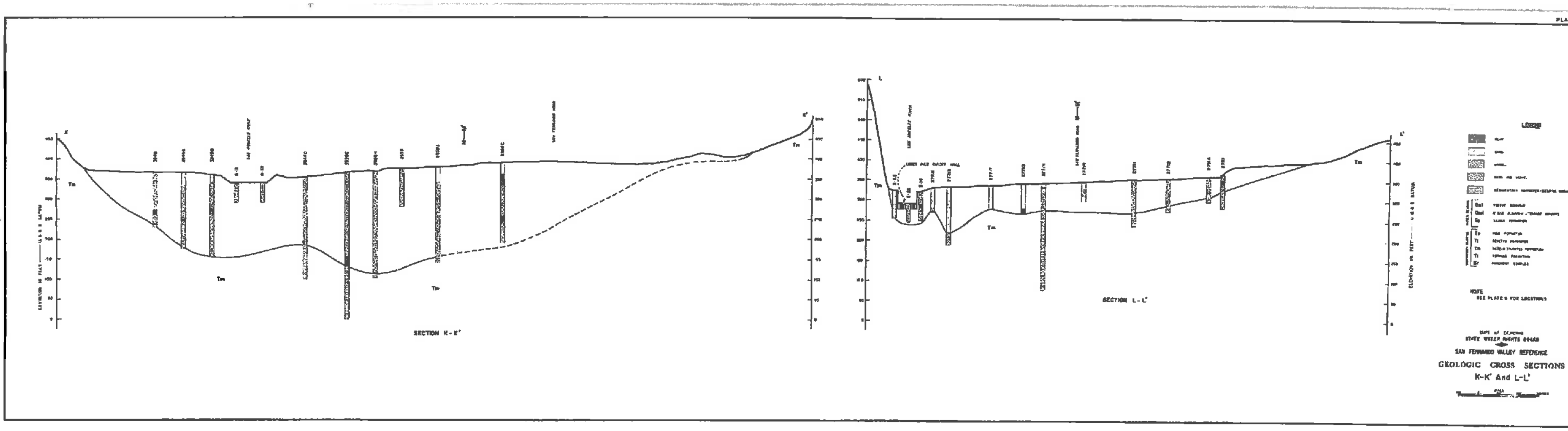
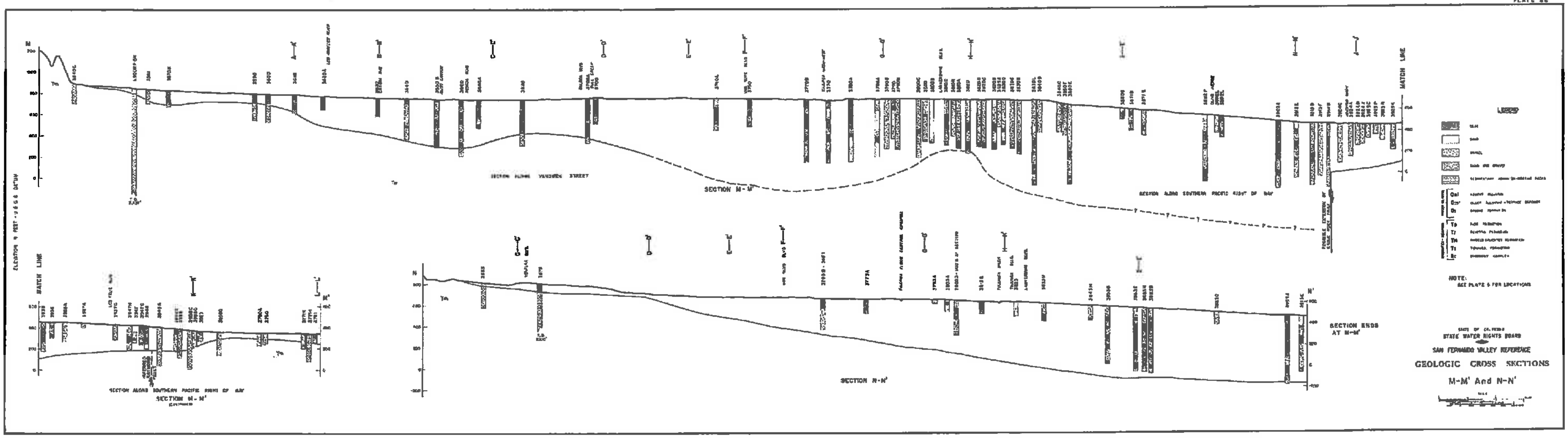


PLATE 59
SECTION K-K'
SECTION L-L'
NOTE
SEE PLATES FOR LOCATIONS
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
K-K' And L-L'


LEGEND
NOTE:
SEE PLATE 5 FOR LOCATIONS
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
M-M' And N-N'
MATCH LINE
SECTION M-M'
SECTION N-N'
SECTION ENDS AT M-M'
SECTION ALONG SOUTHERN PACIFIC RIGHT OF WAY
SECTION ALONG VANOWEN STREET

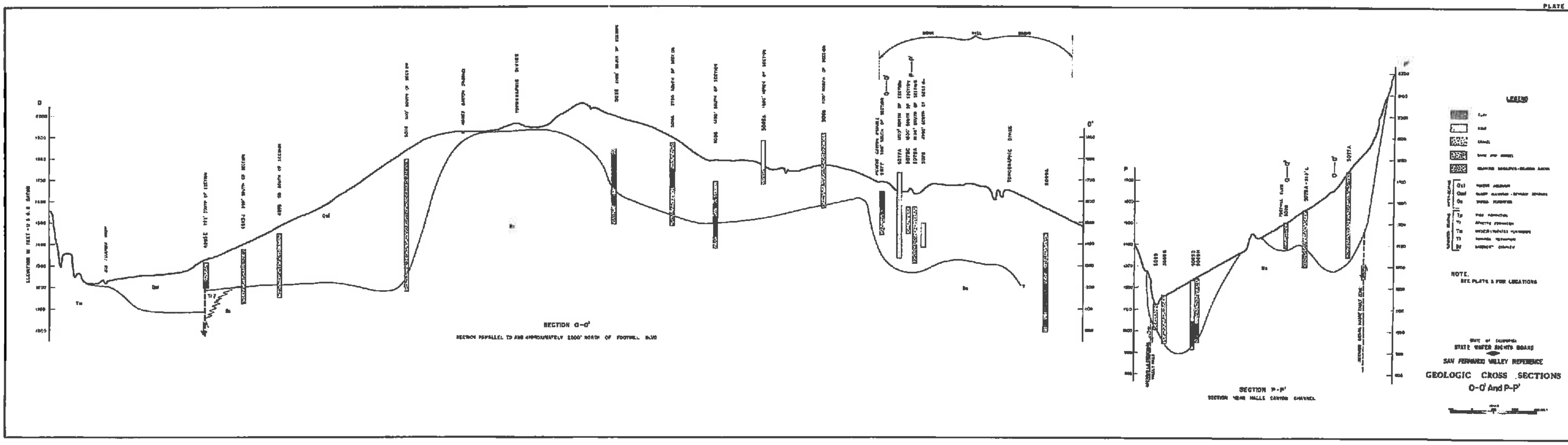
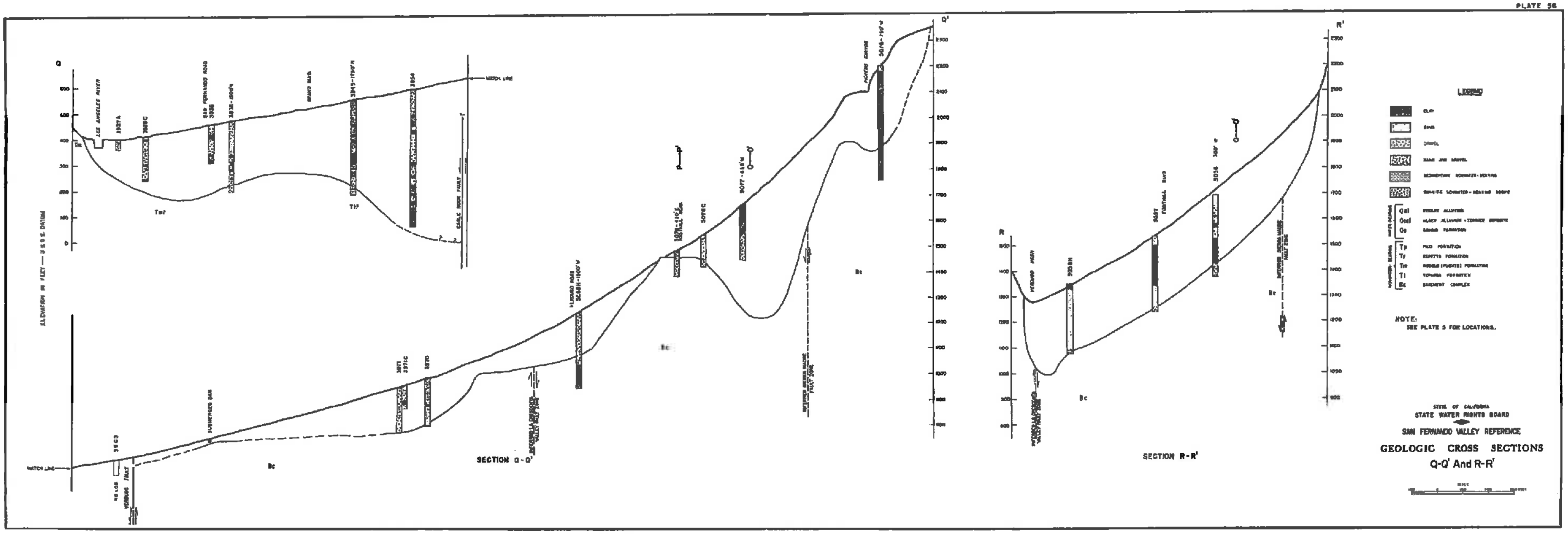
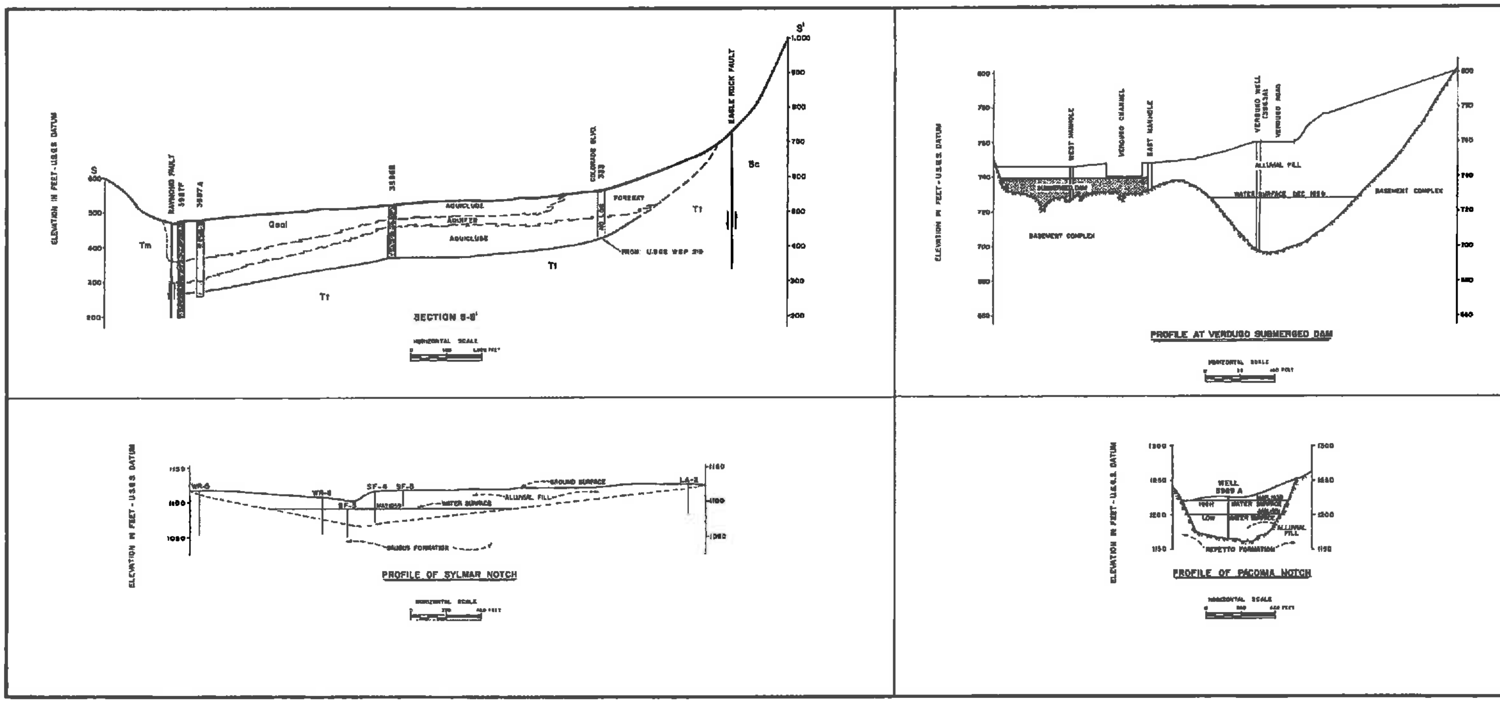


PLATE 8F
LEGEND
NOTE.
SEE PLATE 5 FOR LOCATIONS
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
O-O' And P-P'
SECTION O-O'
SECTION P-P'
TOPOGRAPHIC DIVIDE
Qal
Tm
Bc


Q
Q'
R
R'
SECTION Q-Q'
SECTION R-R'
ELEVATION IN FEET — U.S.G.S. DATUM
MATCH LINE
Bc
LEGEND
CLAY
SAND
GRAVEL
SAND AND GRAVEL
Qal
Qoal
Qs
Tp
Tr
Tm
Tt
Bc
NOTE:
SEE PLATE 5 FOR LOCATIONS.
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GEOLOGIC CROSS SECTIONS
Q-Q' And R-R'



LEGEND

- CLAY
- SAND
- GRAVEL
- SAND AND GRAVEL

- Qal — RECENT ALLUVIUM
- Qoal — OLDER ALLUVIUM + TERRACE DEPOSITS
- Qs — SAUGUS FORMATION

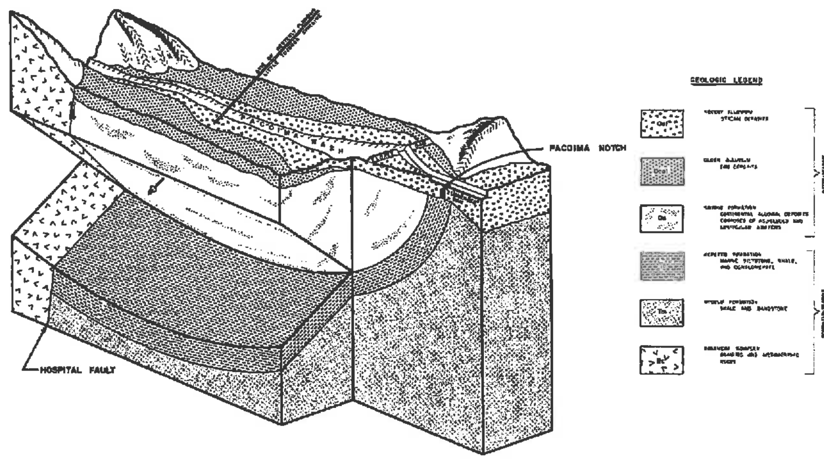
- Tp — PICO FORMATION
- Tr — REPETTO FORMATION
- Tm — MODELO (PUENTE) FORMATION
- Tt — TOPANGA FORMATION
- Bc — BASEMENT COMPLEX

NOTE:
SEE PLATE 8 FOR LOCATIONS

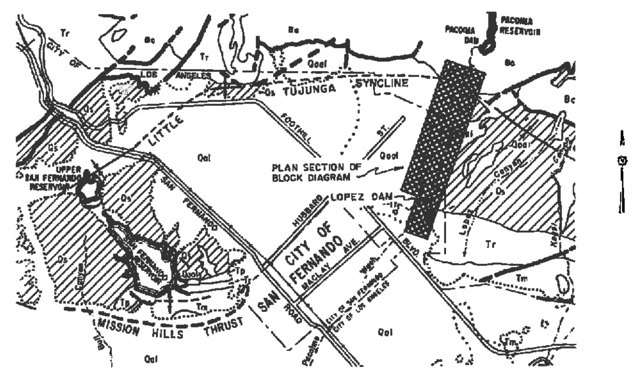
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

GEOLOGIC CROSS SECTIONS
S-S', VERDUGO SUBMERGED DAM,
SYLMAR NOTCH & PACOIMA NOTCH



DIAGRAMMATIC BLOCK DIAGRAM ILLUSTRATING THE LITTLE TUJUNGA SYNCLINE
IN SYLMAR HYDROLOGIC SUBAREA



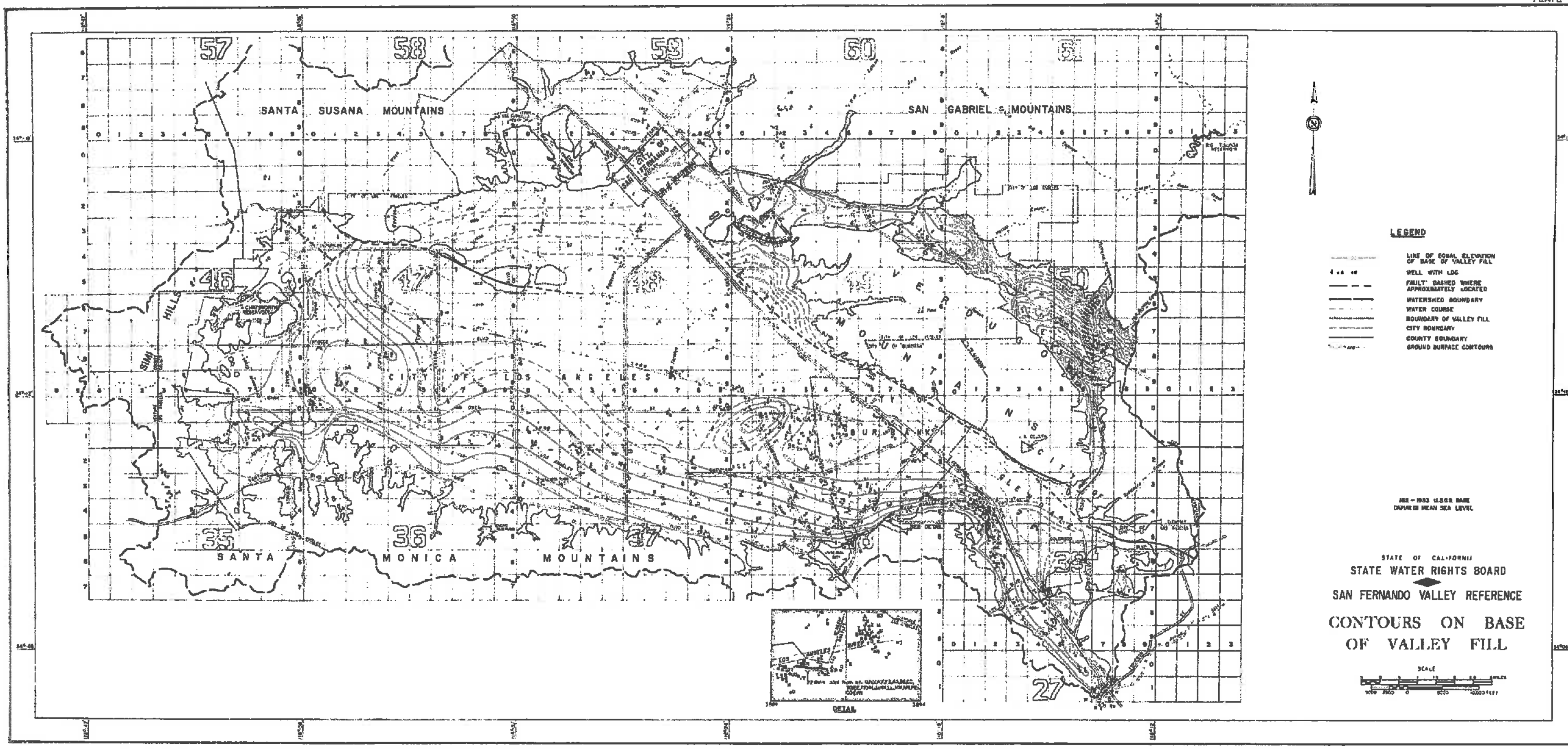
LOCATION MAP
SCALE
0 5,000 10,000 Feet

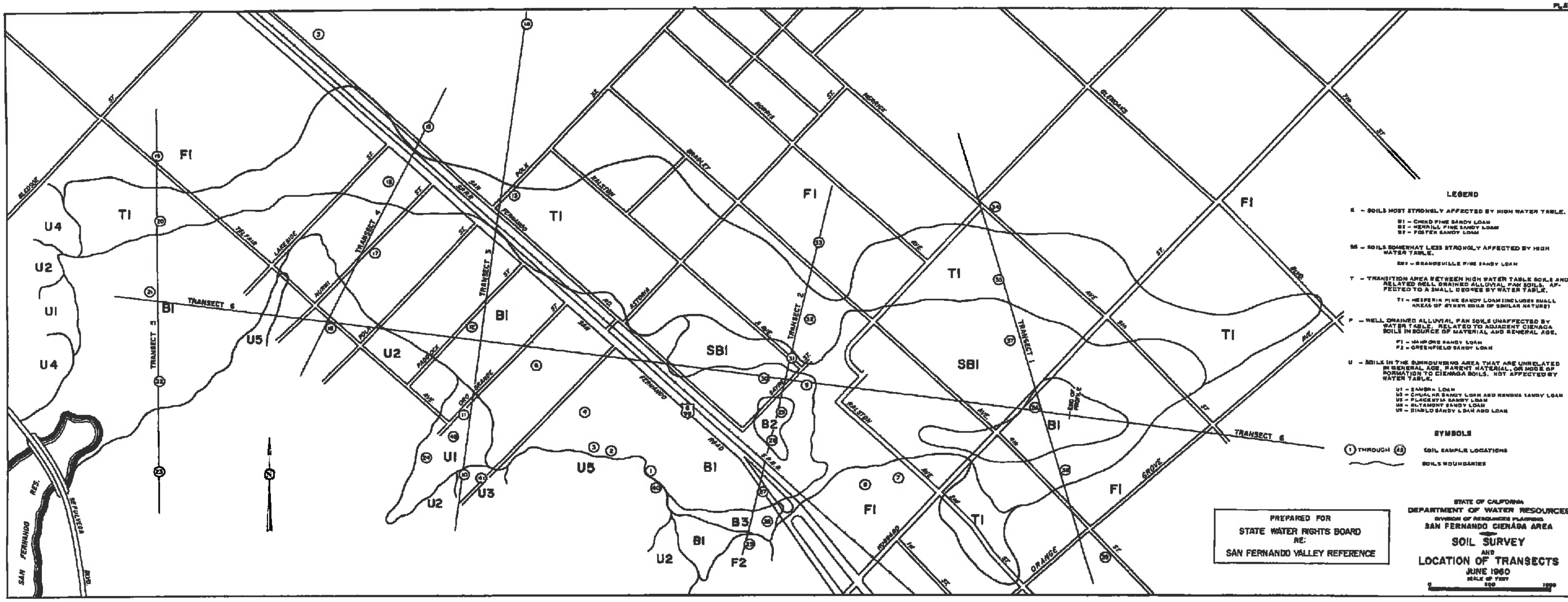
NOTE: FOR IDENTIFICATION AND DESCRIPTION OF GEOLOGIC SYMBOLS SHOWN ON THE LOCATION MAP SEE "GEOLOGIC LEGEND" ON PLATE 4.

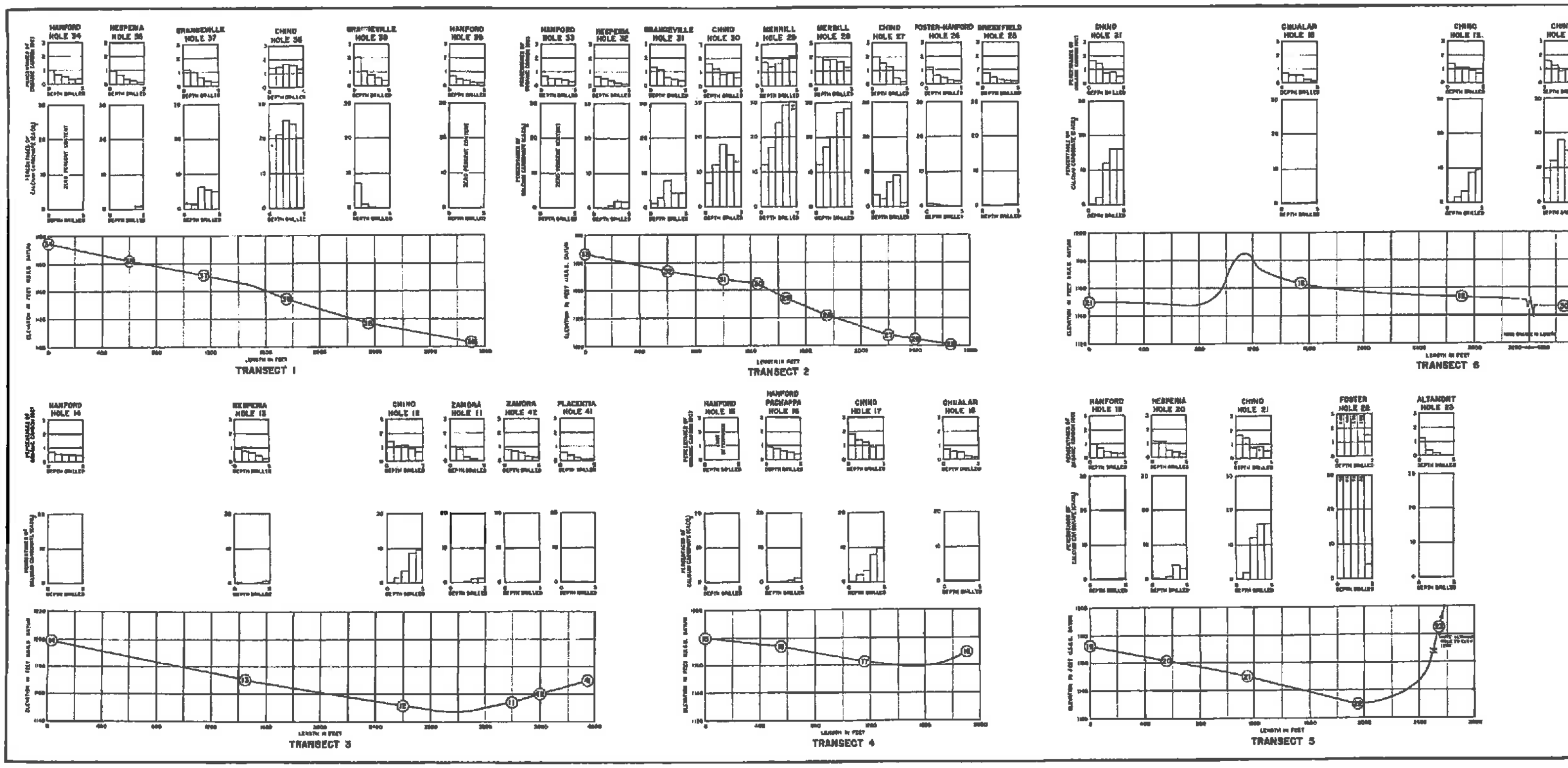
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE

GEOLOGIC CROSS SECTION

BLOCK DIAGRAM
of
LITTLE TUJUNGA SYNCLINE


57
58
59
60
61
SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SIMI HILLS
CITY OF LOS ANGELES
VERDUGO MOUNTAINS
BURBANK
SANTA MONICA MOUNTAINS
45
46
47
48
49
50
35
36
37
38
27
DETAIL
LEGEND
LINE OF EQUAL ELEVATION OF BASE OF VALLEY FILL
WELL WITH LOG
FAULT, DASHED WHERE APPROXIMATELY LOCATED
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
GROUND SURFACE CONTOURS
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
CONTOURS ON BASE OF VALLEY FILL
SCALE


LEGEND
B – SOILS MOST STRONGLY AFFECTED BY HIGH WATER TABLE.
B1 – CHINO FINE SANDY LOAM
B2 – MERRILL FINE SANDY LOAM
B3 – FOSTER SANDY LOAM
SB – SOILS SOMEWHAT LESS STRONGLY AFFECTED BY HIGH WATER TABLE.
SB1 – GRANGEVILLE FINE SANDY LOAM
T – TRANSITION AREA BETWEEN HIGH WATER TABLE SOILS AND RELATED WELL DRAINED ALLUVIAL FAN SOILS. AFFECTED TO A SMALL DEGREE BY WATER TABLE.
T1 – HESPERIA FINE SANDY LOAM (INCLUDES SMALL AREAS OF OTHER SOILS OF SIMILAR NATURE)
F – WELL DRAINED ALLUVIAL FAN SOILS UNAFFECTED BY WATER TABLE. RELATED TO ADJACENT CIENAGA SOILS IN SOURCE OF MATERIAL AND GENERAL AGE.
F1 – HANFORD SANDY LOAM
F2 – GREENFIELD SANDY LOAM
U – SOILS IN THE SURROUNDING AREA THAT ARE UNRELATED IN GENERAL AGE, PARENT MATERIAL, OR MODE OF FORMATION TO CIENAGA SOILS. NOT AFFECTED BY WATER TABLE.
U1 – ZAMORA LOAM
U2 – CHUALAR SANDY LOAM AND RAMONA SANDY LOAM
U3 – PLACENTIA SANDY LOAM
U4 – ALTAMONT SANDY LOAM
U5 – DIABLO SANDY LOAM AND LOAM
SYMBOLS
1 THROUGH 42 SOIL SAMPLE LOCATIONS
SOILS BOUNDARIES
PREPARED FOR
STATE WATER RIGHTS BOARD
RE:
SAN FERNANDO VALLEY REFERENCE
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
SAN FERNANDO CIENAGA AREA
SOIL SURVEY
AND
LOCATION OF TRANSECTS
JUNE 1960
SCALE OF FEET
TRANSECT 1
TRANSECT 2
TRANSECT 3
TRANSECT 4
TRANSECT 5
TRANSECT 6
SAN FERNANDO RES.
SEPULVEDA BLVD.
SAN FERNANDO ROAD
GLENOAKS
BRADLEY
BALSTON
TELFAIR
LAKESIDE
ORANGE
GROVE



PREPARED FOR
STATE WATER RIGHTS BOARD
RE:
SAN FERNANDO VALLEY REFERENCE

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
SAN FERNANDO CIENAGA AREA

TOPOGRAPHIC FEATURES
AND
SPECIAL CHEMICAL ANALYSES OF SOIL PROFILES ALONG TRANSECTS
JUNE 1960

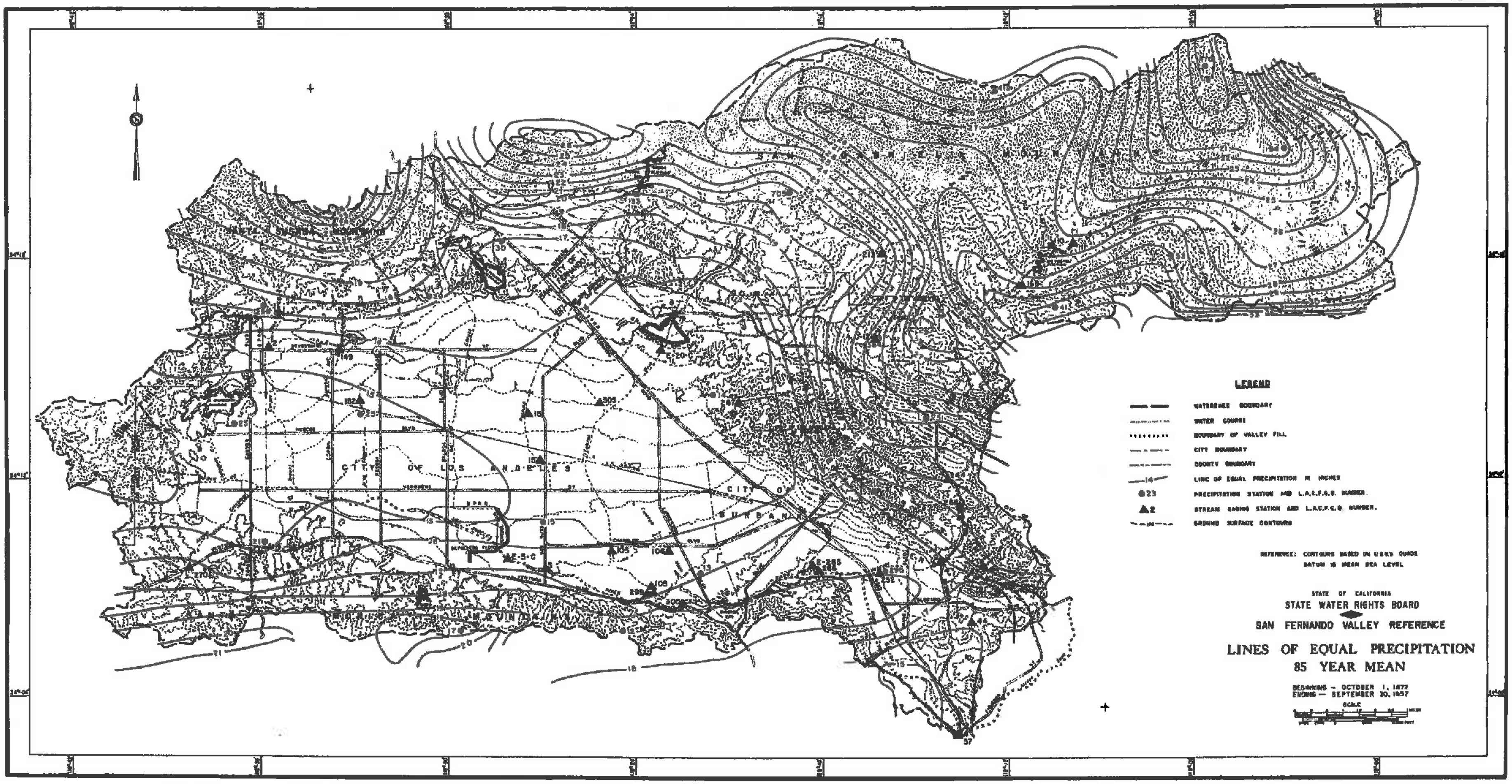
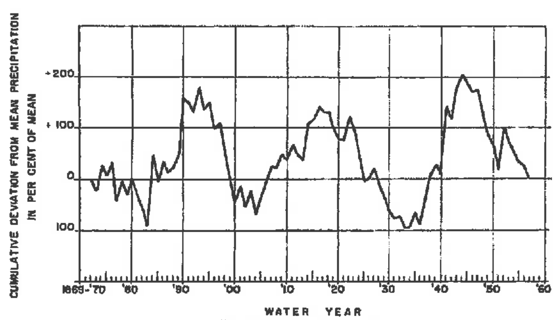
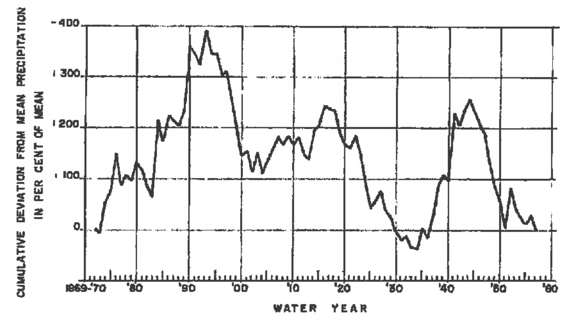

LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL PRECIPITATION IN INCHES
PRECIPITATION STATION AND L.A.C.F.C.D. NUMBER.
STREAM GAGING STATION AND L.A.C.F.C.D. NUMBER.
GROUND SURFACE CONTOURS
REFERENCE: CONTOURS BASED ON U.S.G.S. QUADS
DATUM IS MEAN SEA LEVEL
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
LINES OF EQUAL PRECIPITATION
85 YEAR MEAN
BEGINNING — OCTOBER 1, 1872
ENDING — SEPTEMBER 30, 1957
SCALE
CITY OF LOS ANGELES

PLATE 10



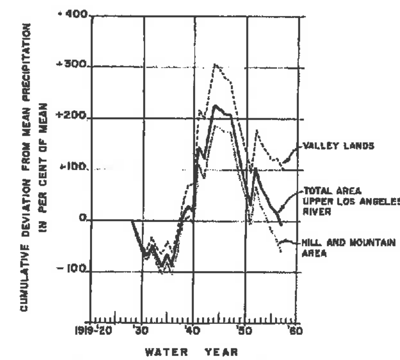
PASADENA CITY HALL

85 YEAR MEAN ANNUAL PRECIPITATION = 20.19 INCHES, ELEVATION 864 FEET



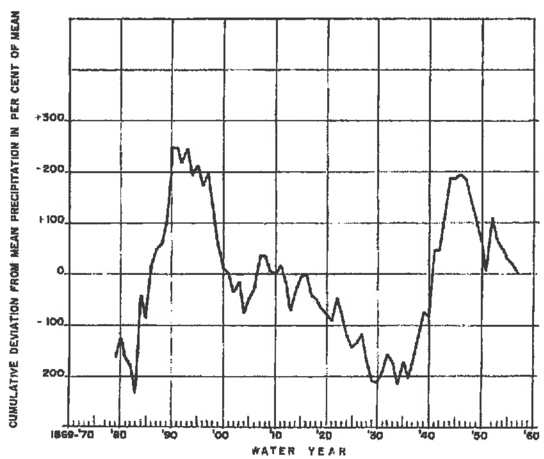
LOS ANGELES, CITY (UNITED STATES WEATHER BUREAU)

85 YEAR MEAN ANNUAL PRECIPITATION = 15.26 INCHES, ELEVATION 282 FEET



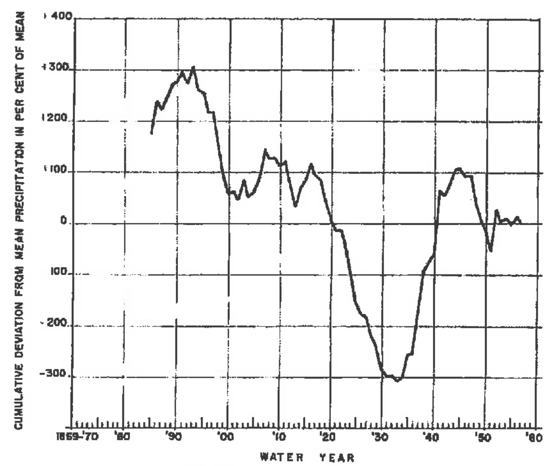
UPPER LOS ANGELES RIVER AREA

1928-'29 THROUGH 1956-'57



ACTON ESCONDIDO CANYON

85 YEAR MEAN ANNUAL PRECIPITATION = 10.10 INCHES, ELEVATION 2,920 FEET



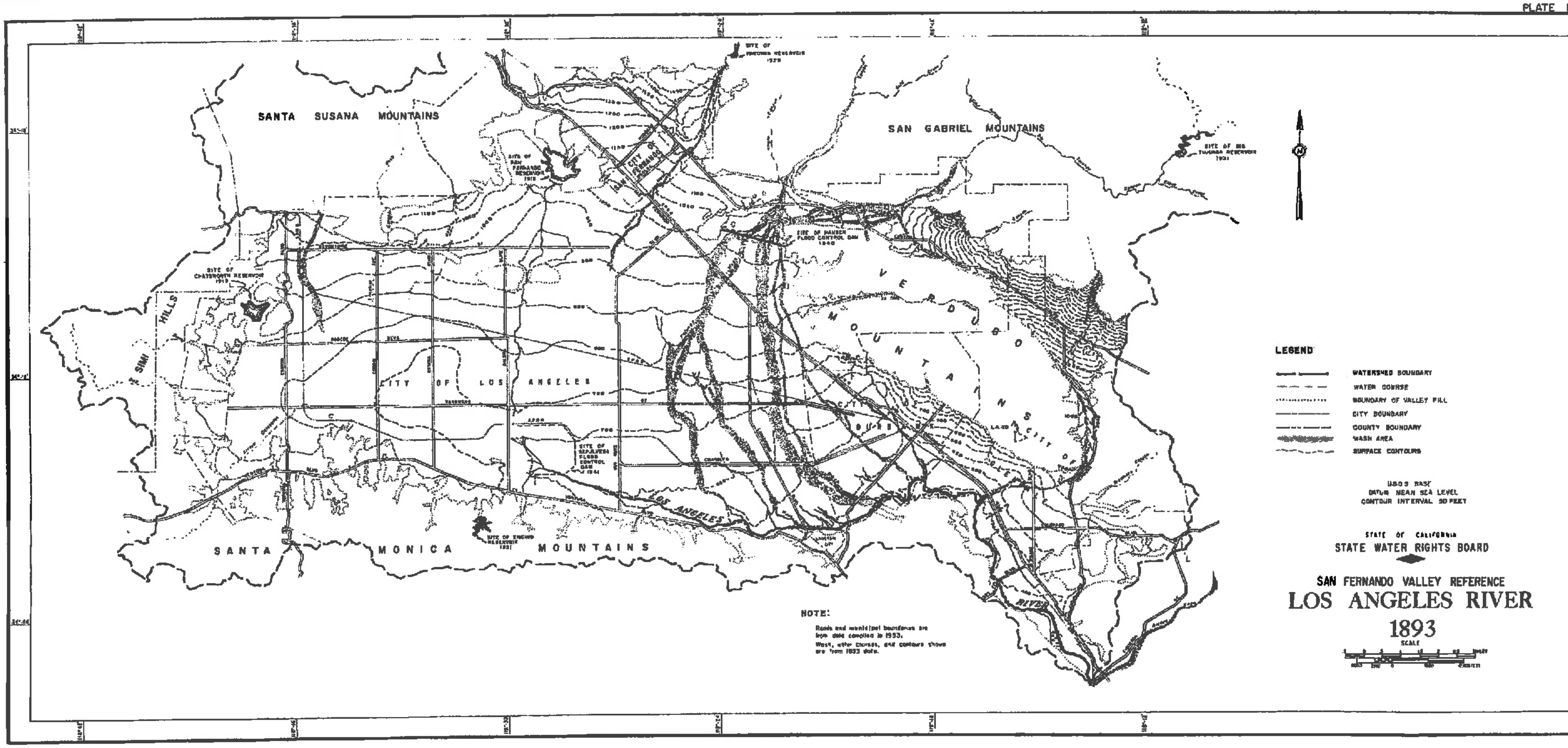
SAWTELLE SOLDIERS HOME

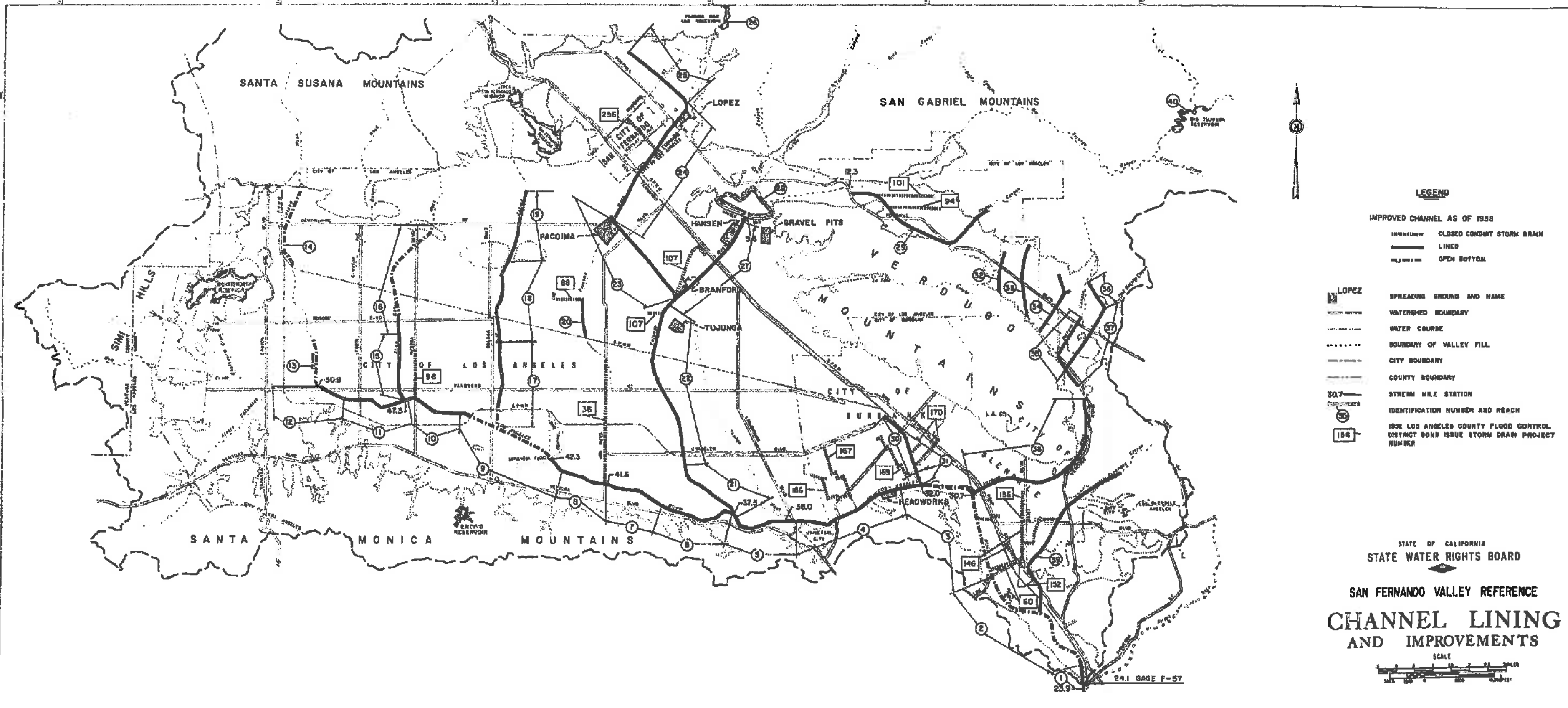
85 YEAR MEAN ANNUAL PRECIPITATION = 15.22 INCHES, ELEVATION 230 FEET

SAN FERNANDO VALLEY REFERENCE
CUMULATIVE DEVIATION FROM 85 YEAR MEAN PRECIPITATION
OCTOBER, 1872 THROUGH SEPTEMBER, 1957

STATE WATER RIGHTS BOARD

PLATE II

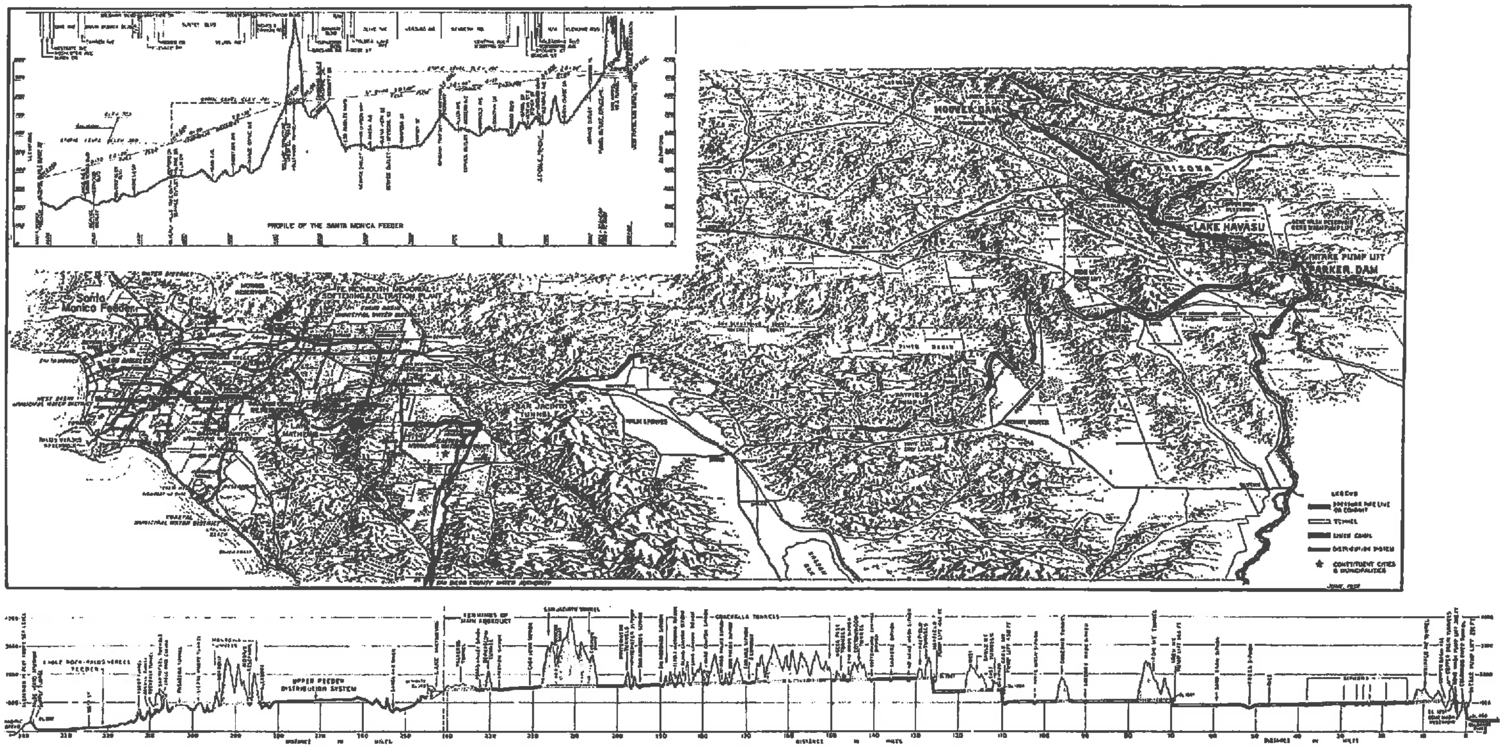

SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
VERDUGO MOUNTAINS
CITY OF LOS ANGELES
SIMI HILLS
LOS ANGELES RIVER
SITE OF CHATSWORTH RESERVOIR 1919
SITE OF SAN FERNANDO RESERVOIR 1918
SITE OF ENCINO RESERVOIR 1921
SITE OF HANSEN FLOOD CONTROL DAM 1940
SITE OF SEPULVEDA FLOOD CONTROL DAM 1941
SITE OF BIG TUJUNGA RESERVOIR 1931
NOTE:
Roads and municipal boundaries are from data compiled in 1953.
Wash, water courses, and contours shown are from 1893 data.
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
WASH AREA
SURFACE CONTOURS
USGS BASE
DATUM MEAN SEA LEVEL
CONTOUR INTERVAL 50 FEET
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
LOS ANGELES RIVER
1893
SCALE



STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

CHANNEL LINING AND IMPROVEMENTS

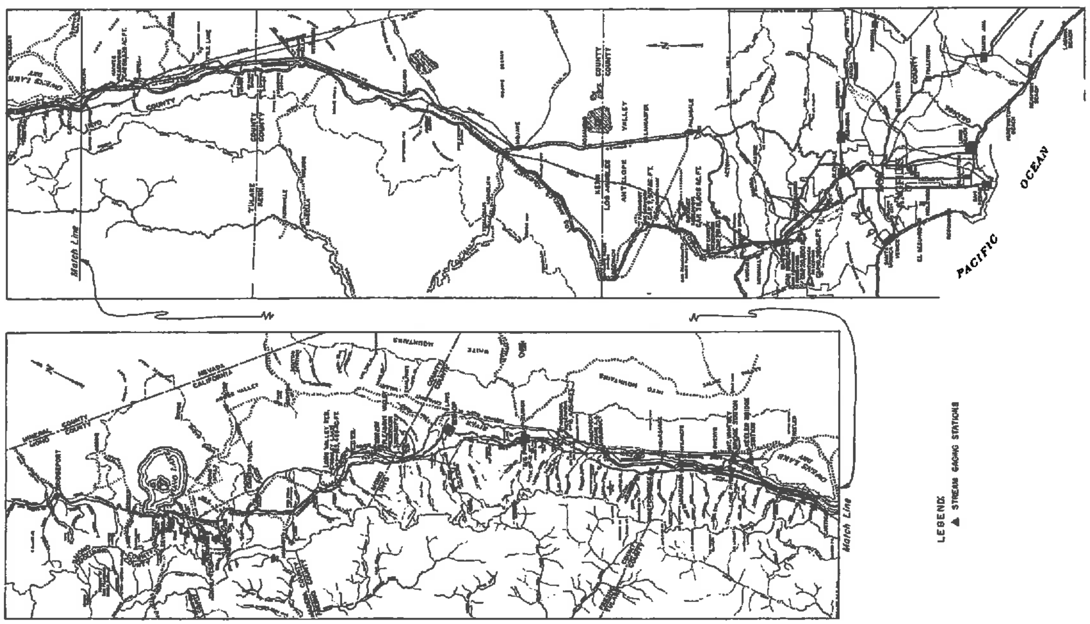


REFERENCE:
Schematic map showing Colorado River Aqueduct and Santa Monica Feeder per The Metropolitan Water District of Southern California
June, 1959

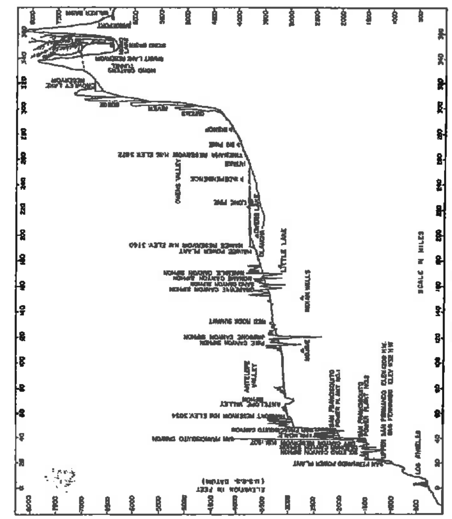
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

COLORADO RIVER AQUEDUCT



LEGEND
▲ STREAM GAGING STATIONS



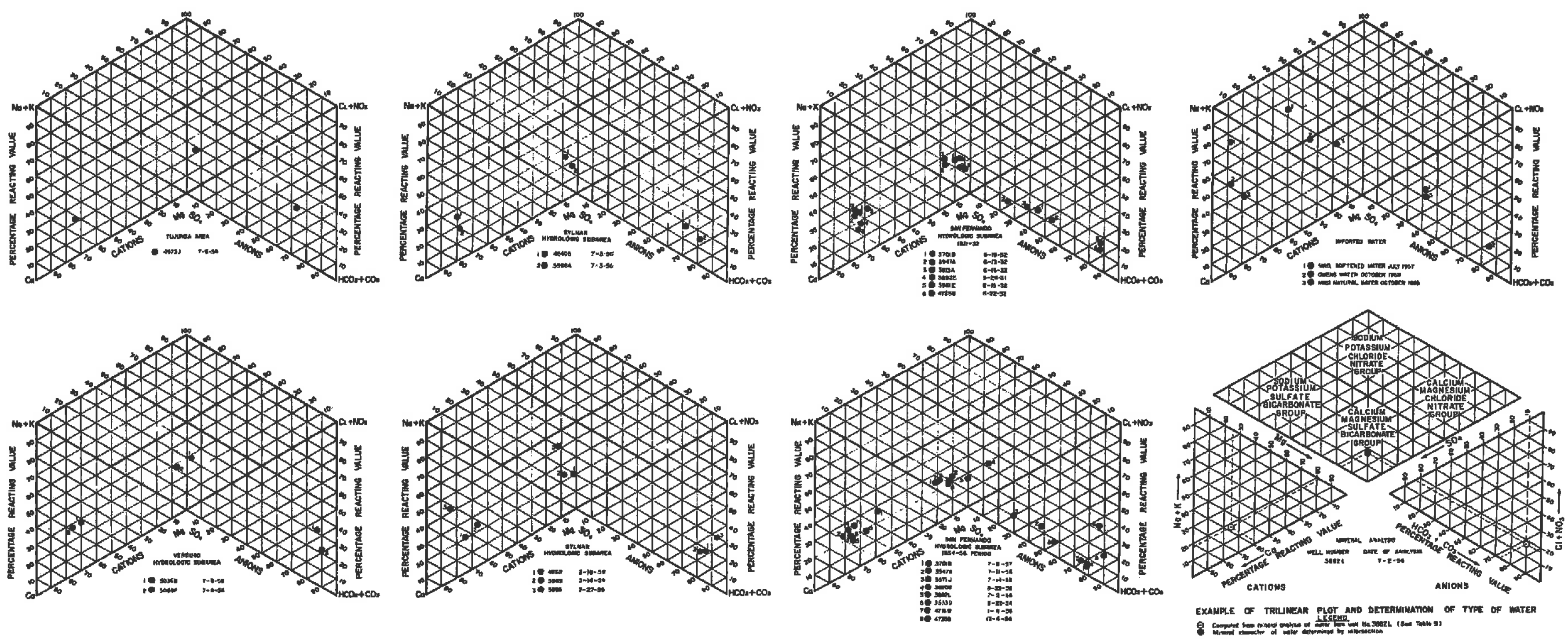
REFERENCE:
Map showing Los Angeles Aqueduct and Mono Basin Extension based on Department of Water and Power, City of Los Angeles.
Map dated 1962.

STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE
LOS ANGELES AQUEDUCT

SCALE

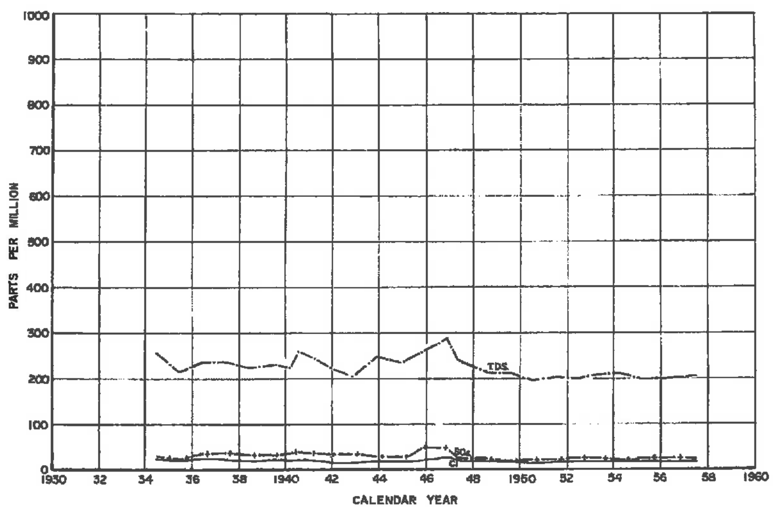
PLATE [illegible]



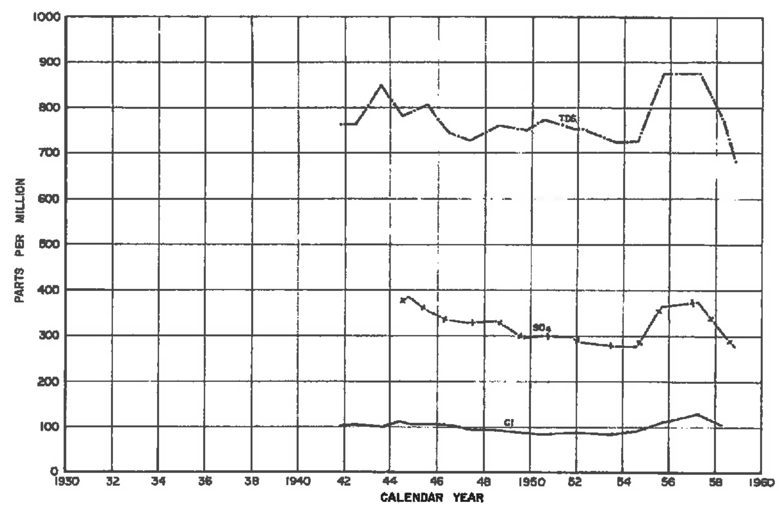
SAN FERNANDO VALLEY REFERENCE

MINERAL CHARACTER OF IMPORTED AND GROUND WATER

STATE WATER RIGHTS BOARD



OWENS RIVER WATER
AT UPPER SAN FERNANDO RESERVOIR INLET



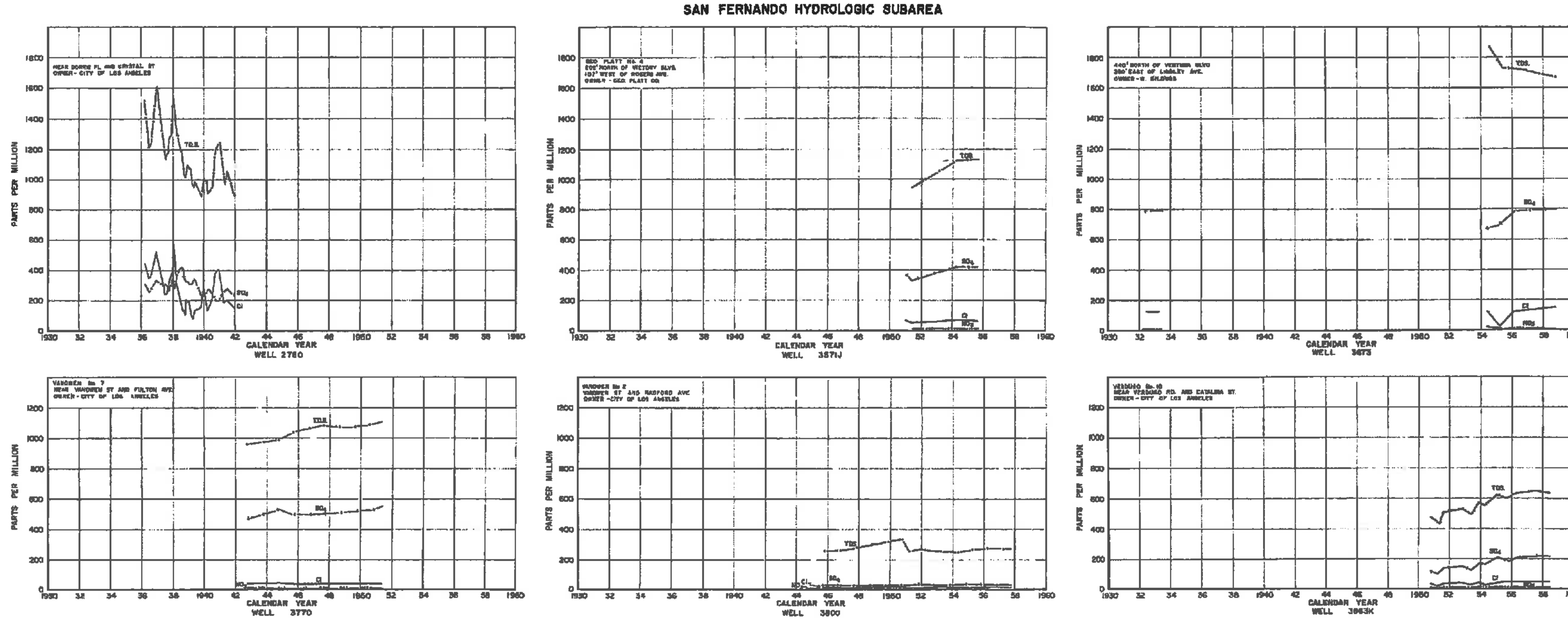
SOFTENED COLORADO RIVER WATER FROM METROPOLITAN WATER DISTRICT
AT CITY OF BURBANK

SAN FERNANDO VALLEY REFERENCE

TOTAL DISSOLVED SOLIDS, SULFATE AND CHLORIDE CONTENT OF IMPORTED WATER

STATE WATER RIGHTS BOARD

SAN FERNANDO HYDROLOGIC SUBAREA

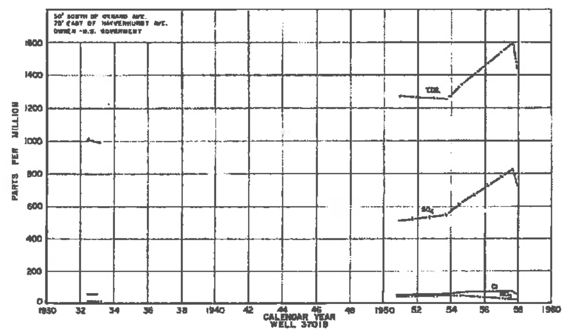


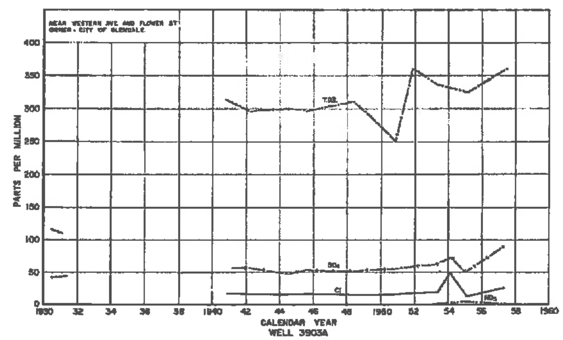
SAN FERNANDO VALLEY REFERENCE

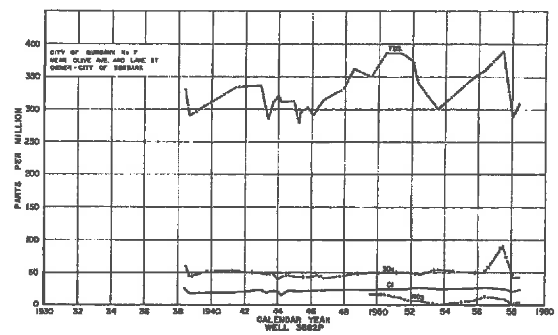
TOTAL DISSOLVED SOLIDS, SULFATE AND CHLORIDE CONTENT OF WELL WATER

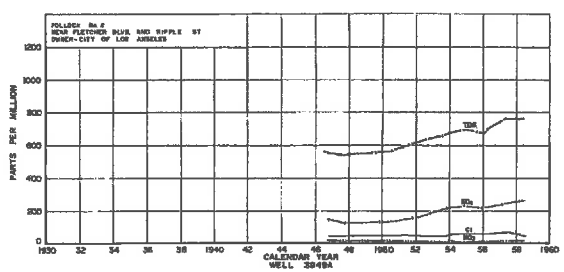
STATE WATER RIGHTS BOARD

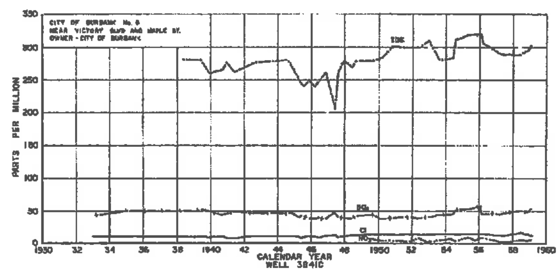
SAN FERNANDO HYDROLOGIC SUBAREA









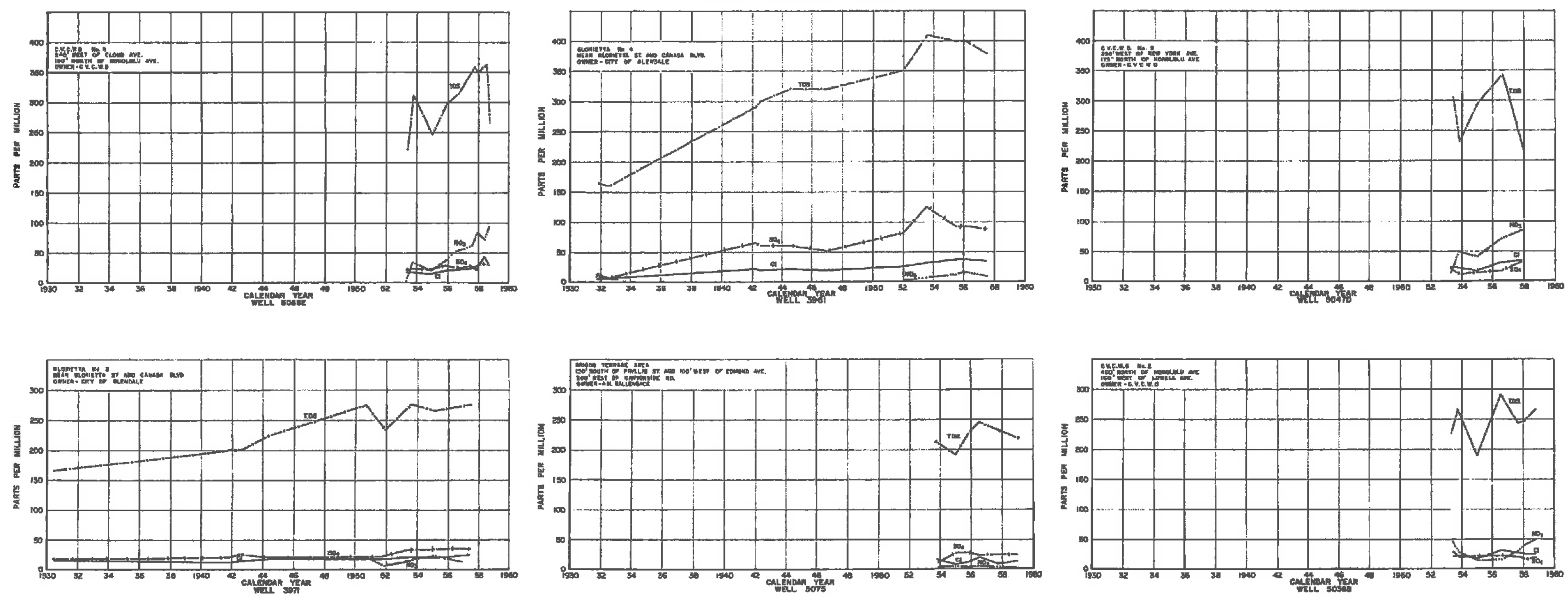


SAN FERNANDO VALLEY REFERENCE

TOTAL DISSOLVED SOLIDS, SULFATE AND CHLORIDE CONTENT OF WELL WATER

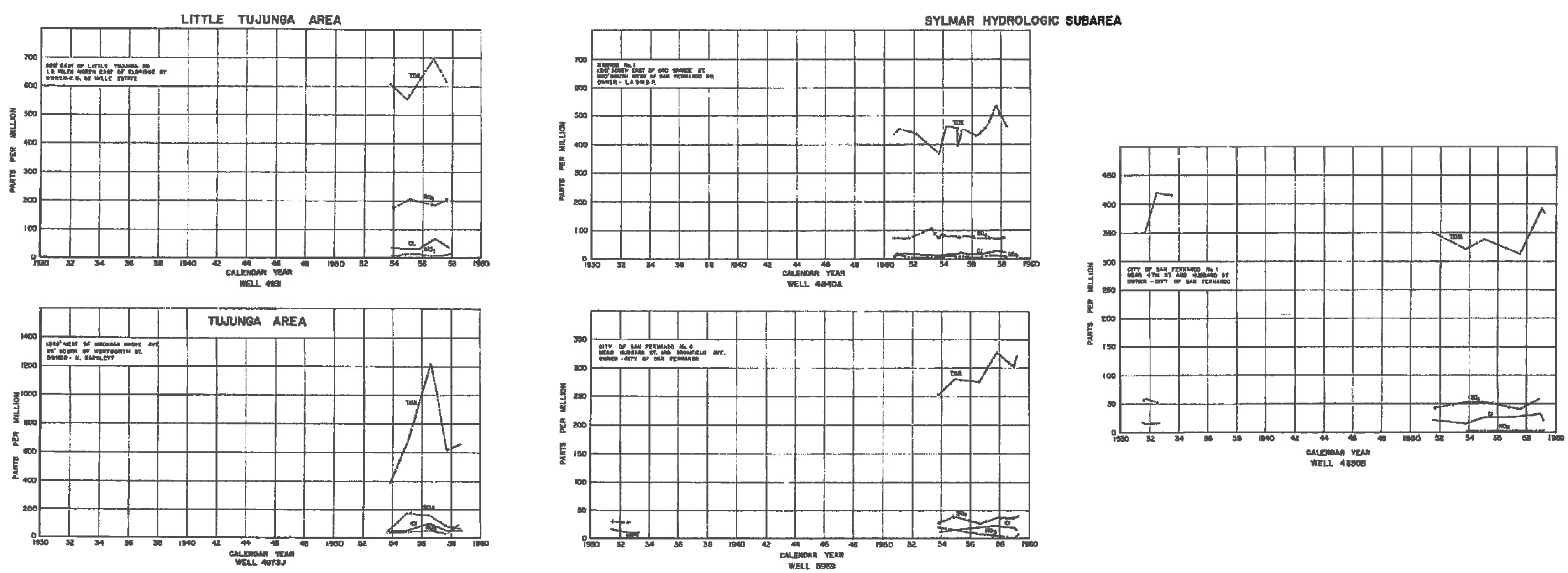
STATE WATER RIGHTS BOARD

VERDUGO HYDROLOGIC SUBAREA



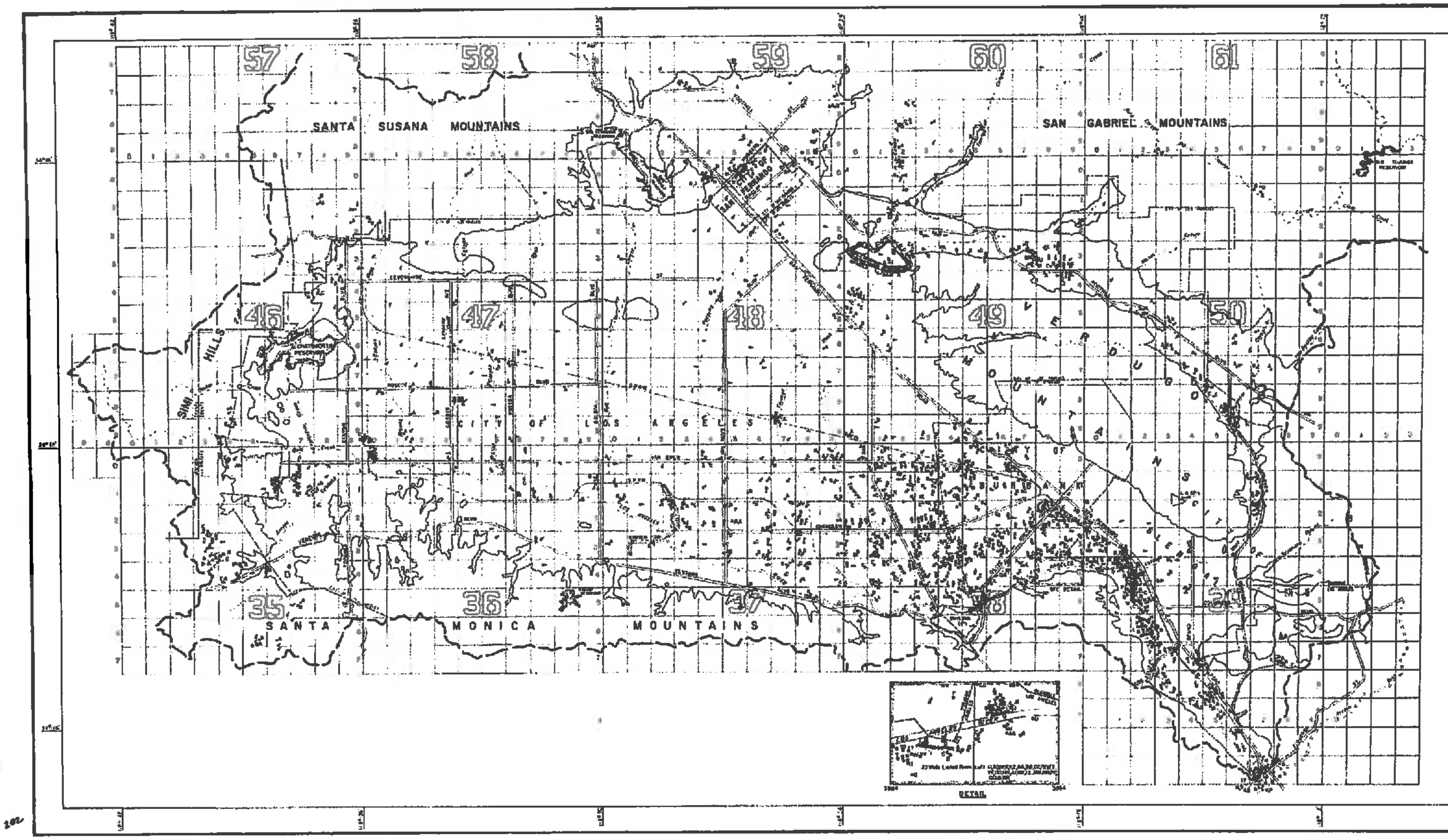
SAN FERNANDO VALLEY REFERENCE

TOTAL DISSOLVED SOLIDS, SULFATE AND CHLORIDE CONTENT OF WELL WATER



SAN FERNANDO VALLEY REFERENCE

TOTAL DISSOLVED SOLIDS, SULFATE AND CHLORIDE CONTENT OF WELL WATER

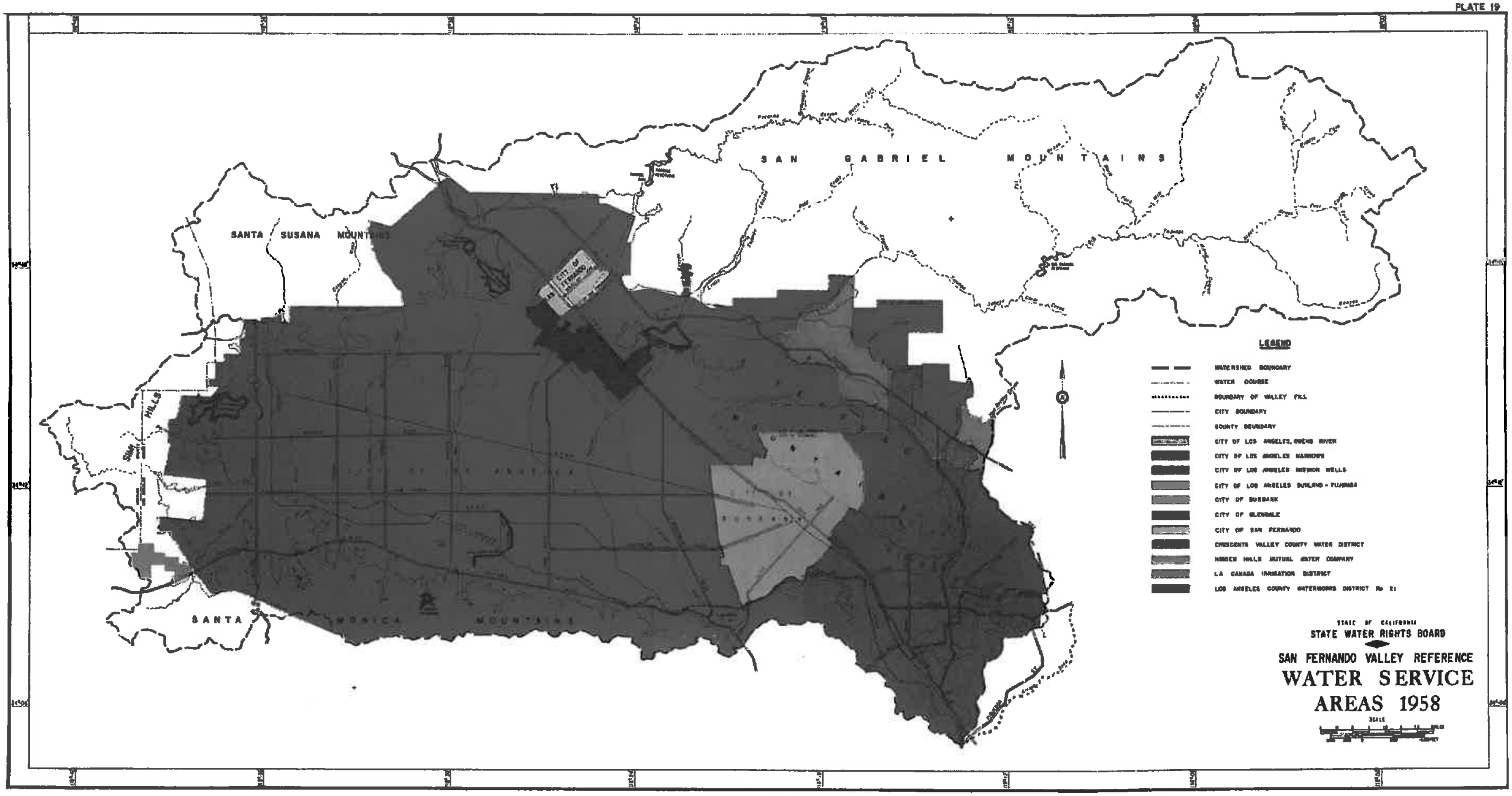


STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

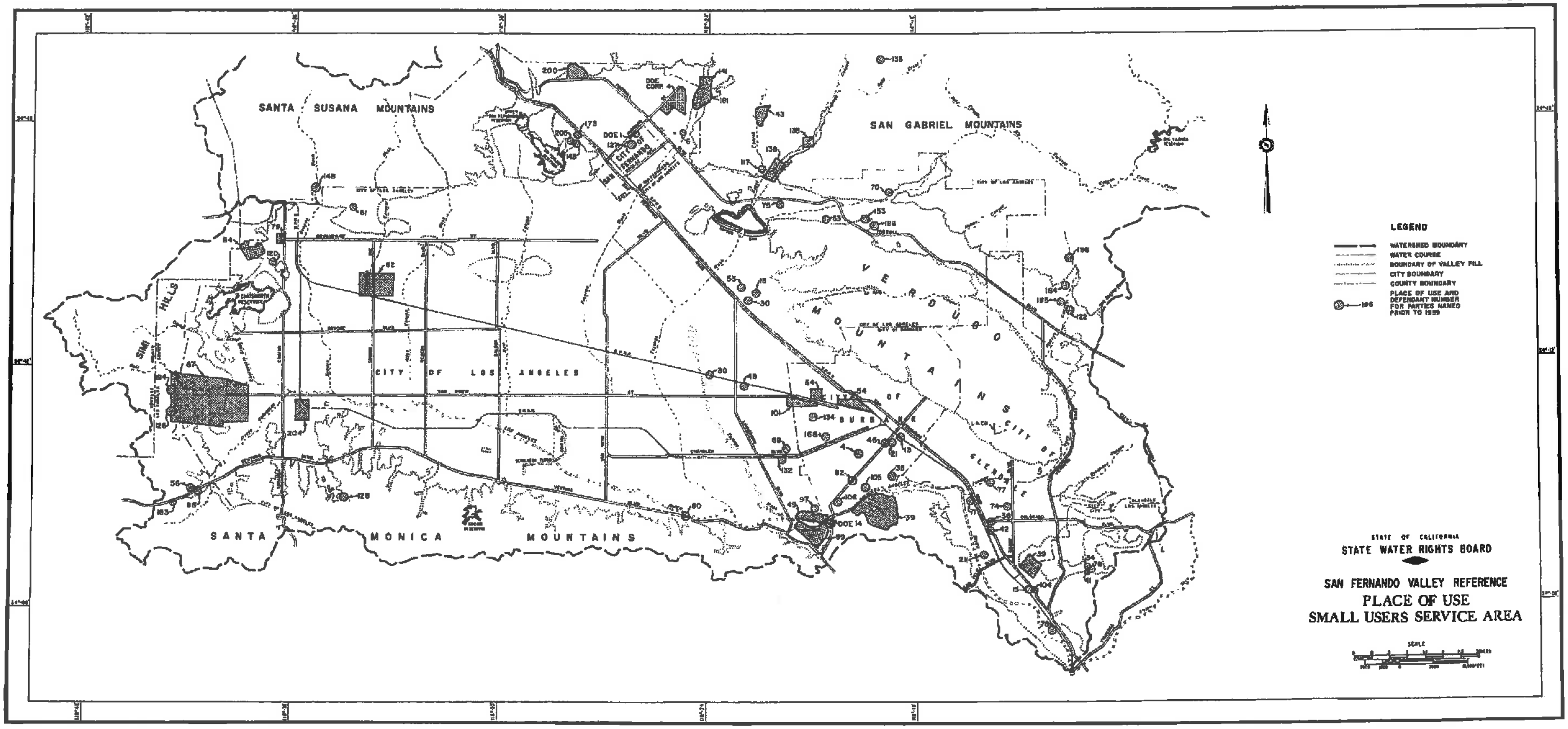
LOCATION OF WELLS

PLATE 19


STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
WATER SERVICE
AREAS 1958
SCALE
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
CITY OF LOS ANGELES, OWENS RIVER
CITY OF LOS ANGELES NARROWS
CITY OF LOS ANGELES MISSION WELLS
CITY OF LOS ANGELES SUNLAND - TUJUNGA
CITY OF BURBANK
CITY OF GLENDALE
CITY OF SAN FERNANDO
CRESCENTA VALLEY COUNTY WATER DISTRICT
HIDDEN HILLS MUTUAL WATER COMPANY
LA CANADA IRRIGATION DISTRICT
LOS ANGELES COUNTY WATERWORKS DISTRICT No 21
SAN GABRIEL MOUNTAINS
SANTA SUSANA MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
CITY OF SAN FERNANDO

703

PLATE 2D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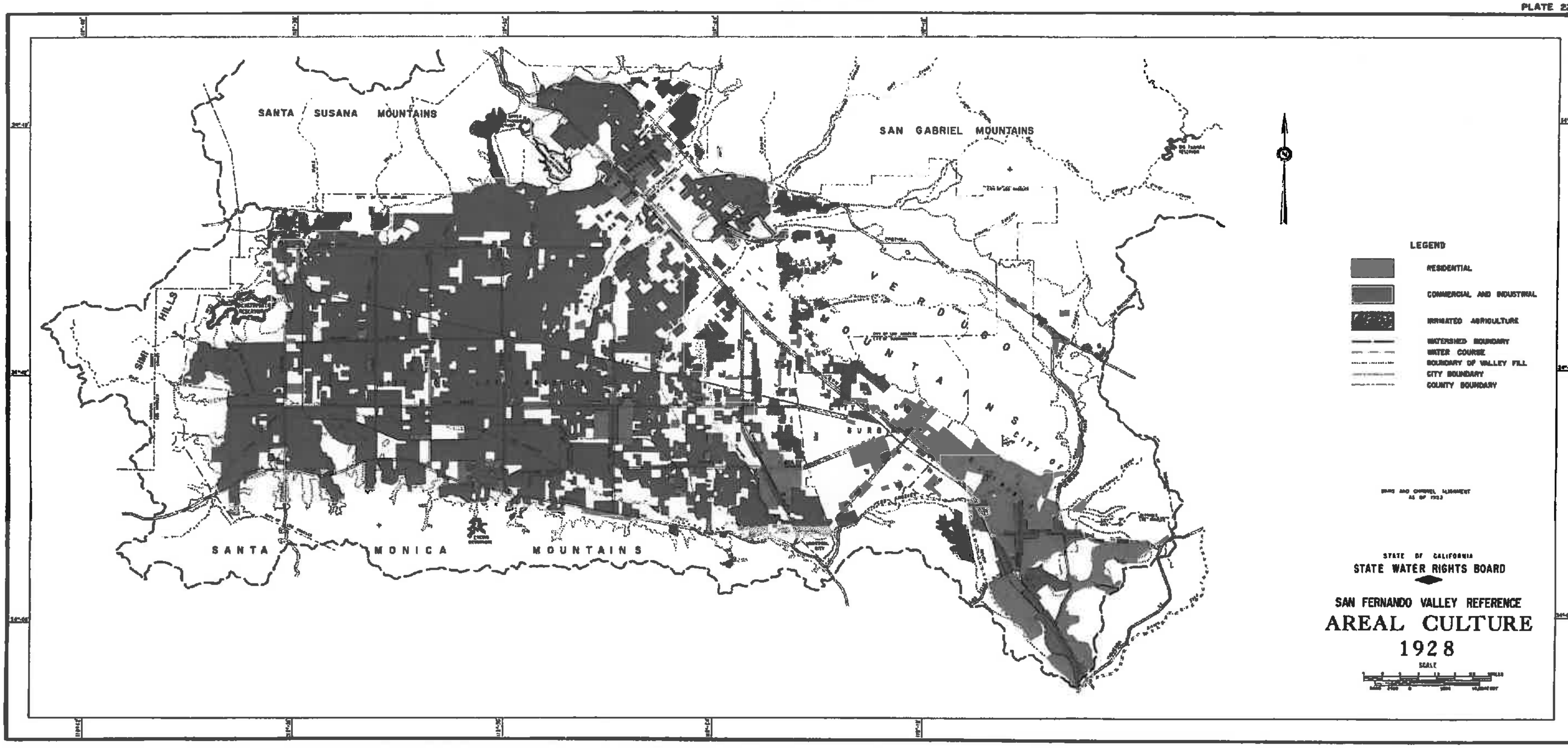
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
VERDUGO MOUNTAINS
CITY OF LOS ANGELES
CITY OF BURBANK
CITY OF GLENDALE
CITY OF SAN FERNANDO
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
PLACE OF USE AND DEFENDANT NUMBER FOR PARTIES NAMED PRIOR TO 1959
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
PLACE OF USE
SMALL USERS SERVICE AREA
SCALE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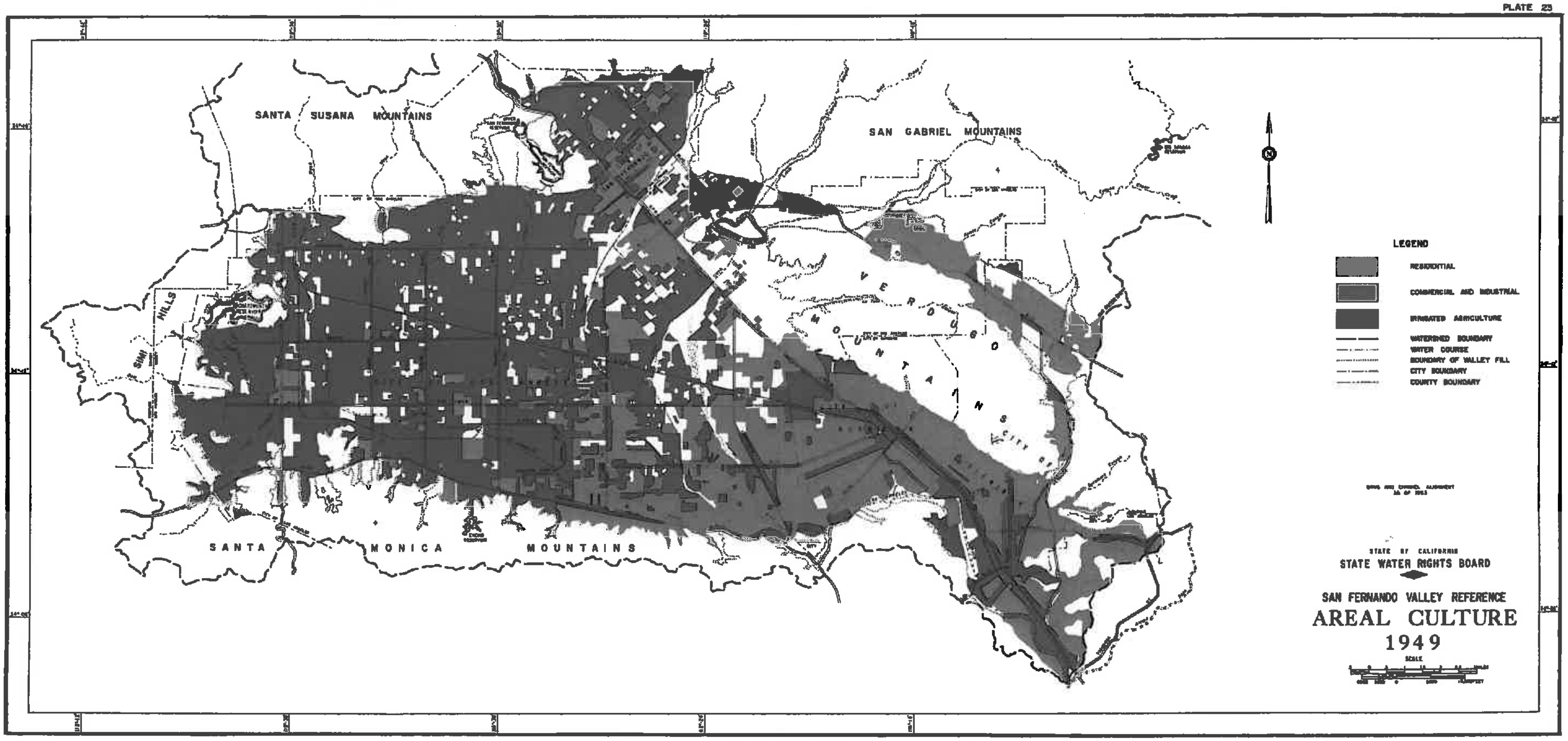
SAN GABRIEL MOUNTAINS
SIMI HILLS
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
AREAL CULTURE
1928
SCALE

PLATE 23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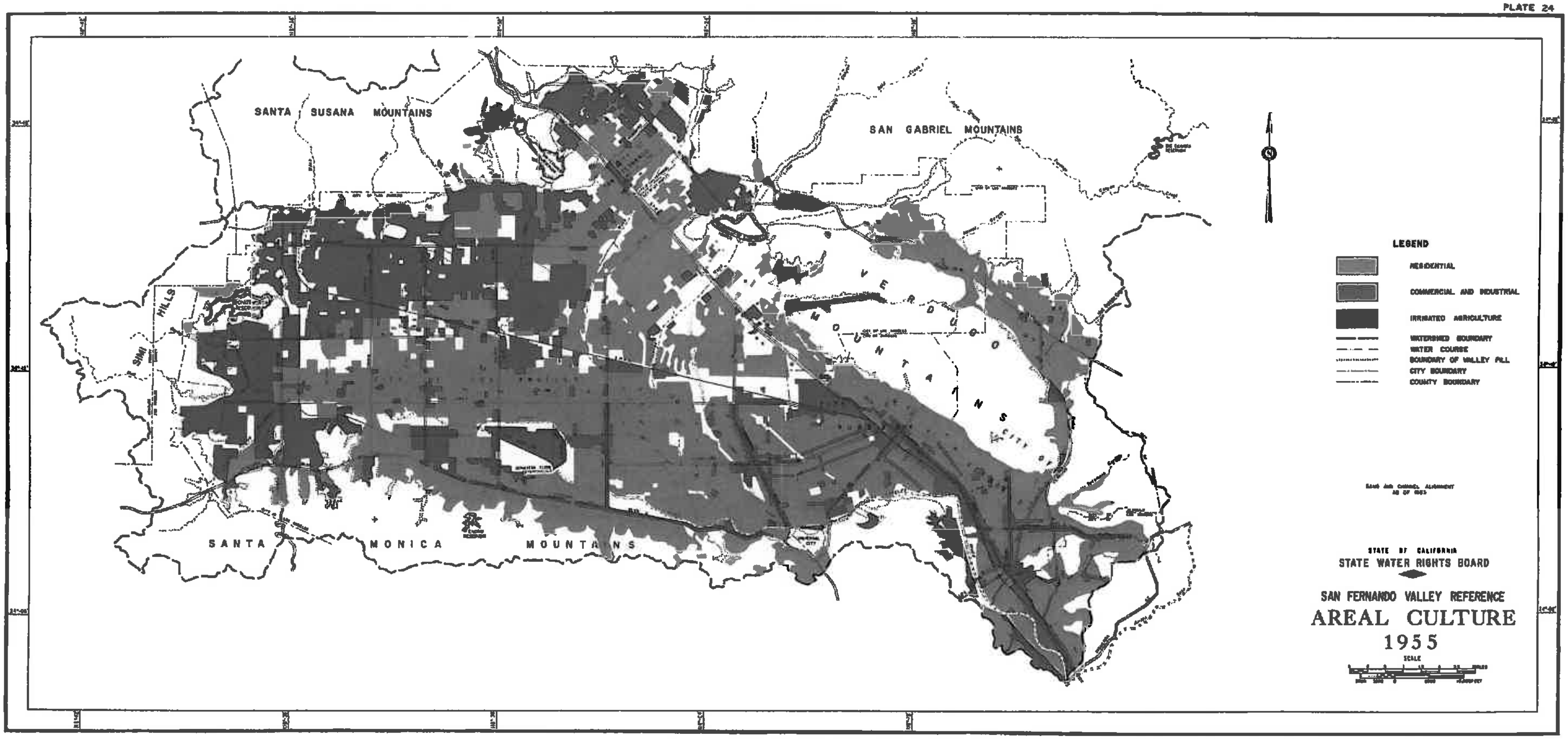
SAN GABRIEL MOUNTAINS
VERDUGO MOUNTAINS
SIMI HILLS
SANTA MONICA MOUNTAINS
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
AREAL CULTURE
1949
SCALE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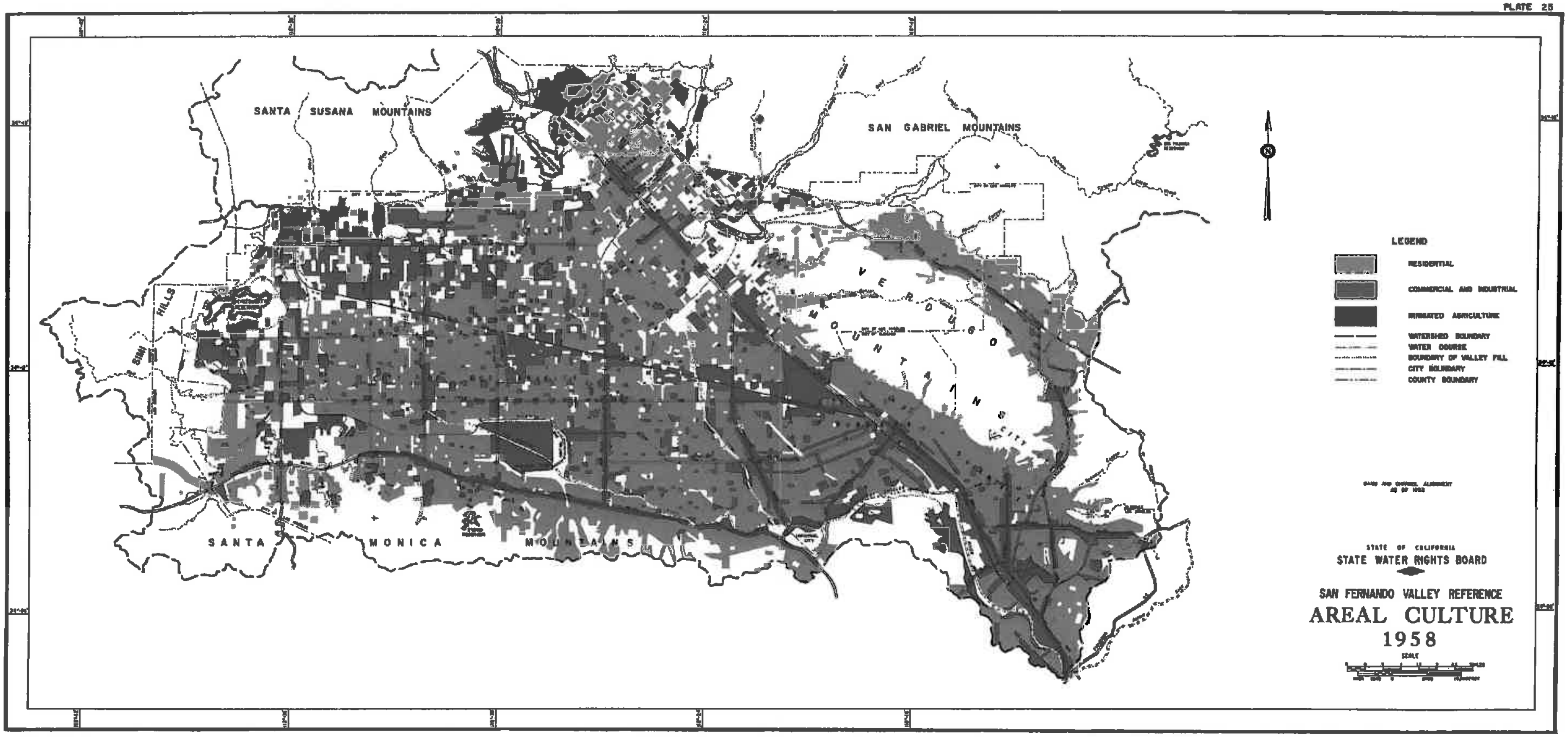
SAN GABRIEL MOUNTAINS
SIMI HILLS
VERDUGO MOUNTAINS
CITY OF
SANTA MONICA MOUNTAINS
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
AREAL CULTURE
1955
SCALE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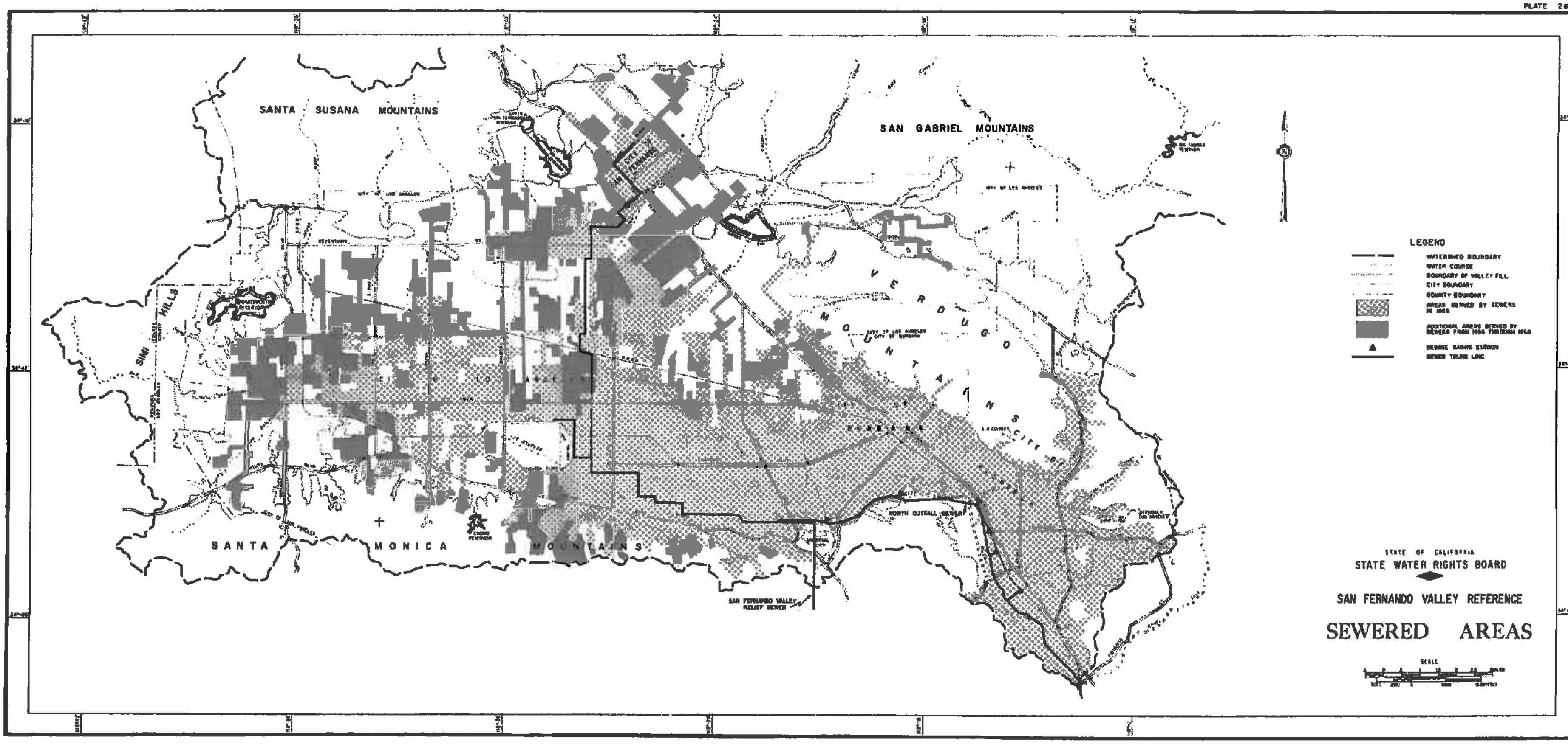
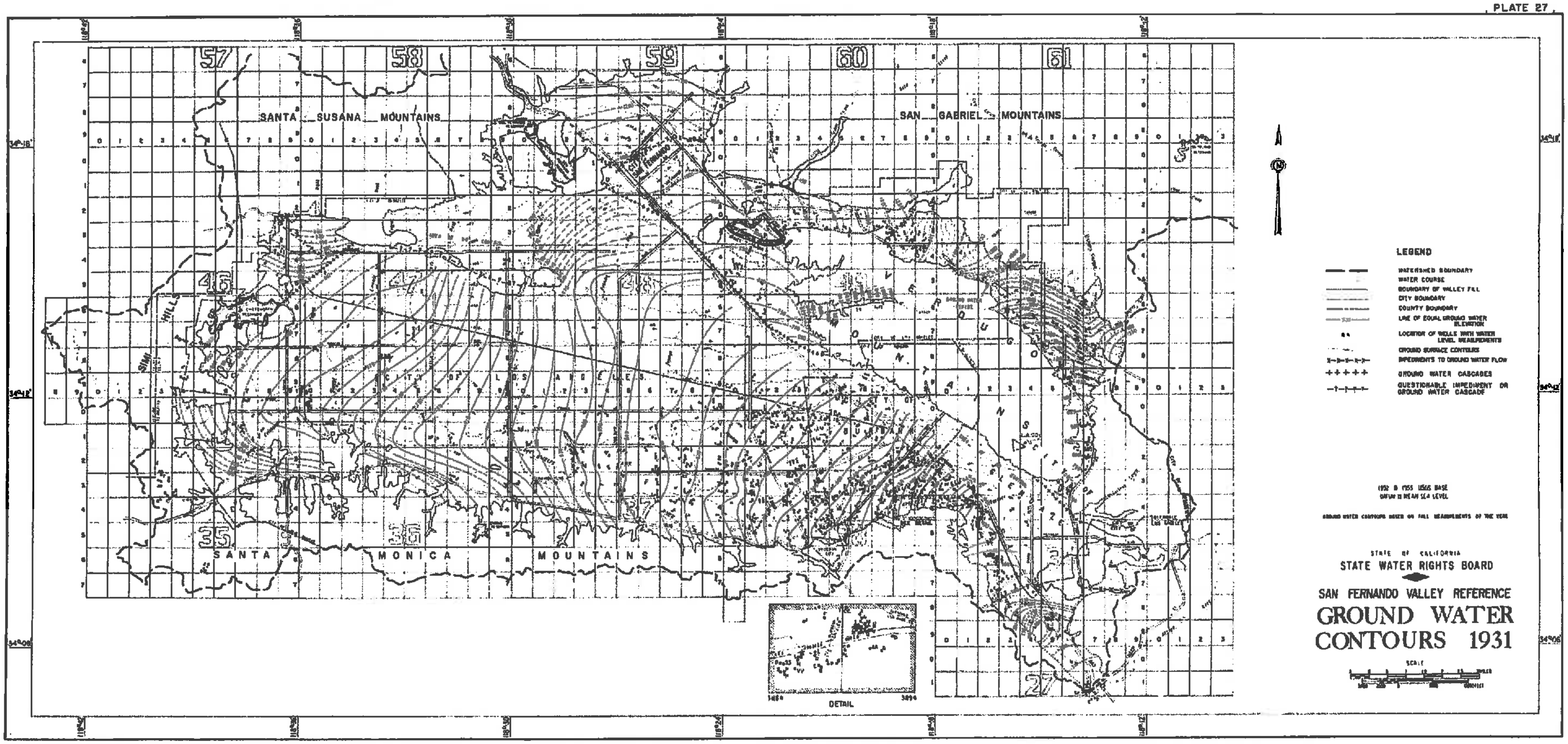
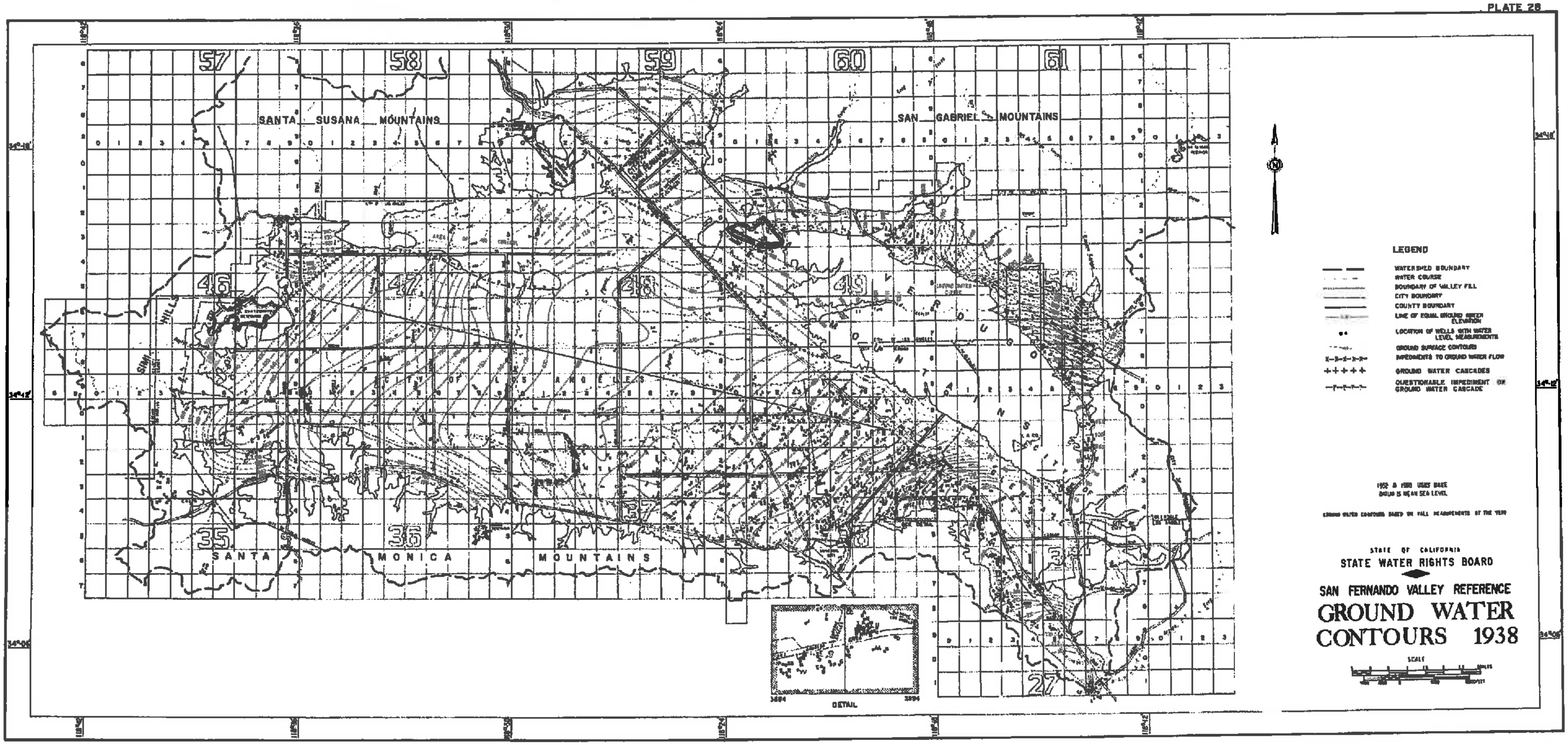
SAN GABRIEL MOUNTAINS
SIMI HILLS
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
LEGEND
RESIDENTIAL
COMMERCIAL AND INDUSTRIAL
IRRIGATED AGRICULTURE
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
AREAL CULTURE
1958
SCALE


SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SIMI HILLS
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
NORTH OUTFALL SEWER
SAN FERNANDO VALLEY RELIEF SEWER
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
AREAS SERVED BY SEWERS
ADDITIONAL AREAS SERVED BY SEWERS
SEWAGE PUMPING STATION
SEWER TRUNK LINE
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
SEWERED AREAS
SCALE


SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
CITY OF LOS ANGELES
57
58
59
60
61
46
35
36
27
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL GROUND WATER ELEVATION
LOCATION OF WELLS WITH WATER LEVEL MEASUREMENTS
GROUND SURFACE CONTOURS
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADE
DATUM IS MEAN SEA LEVEL
GROUND WATER CONTOURS BASED ON FALL MEASUREMENTS OF THE YEAR
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GROUND WATER CONTOURS 1931
SCALE
DETAIL


SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
CITY OF LOS ANGELES
57
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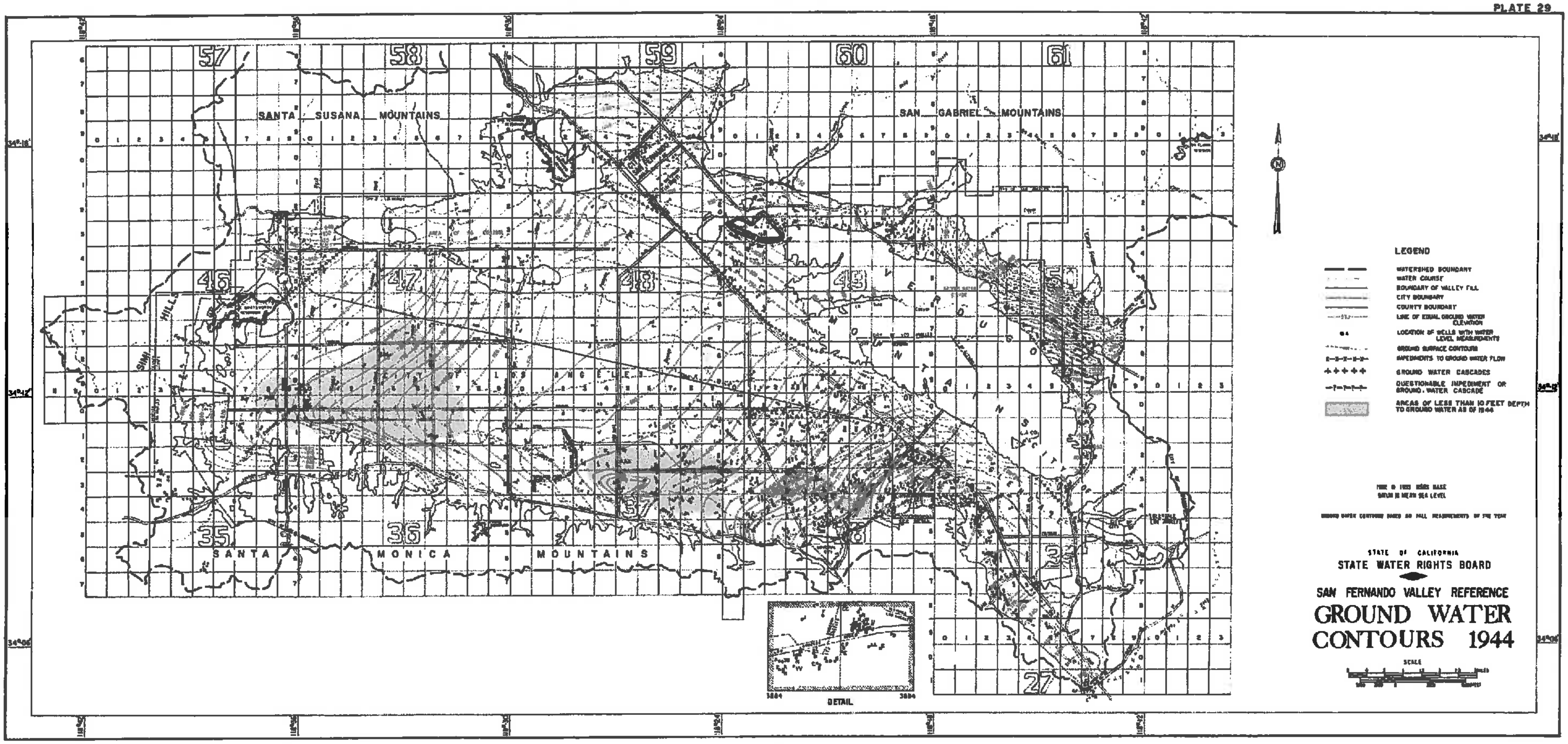
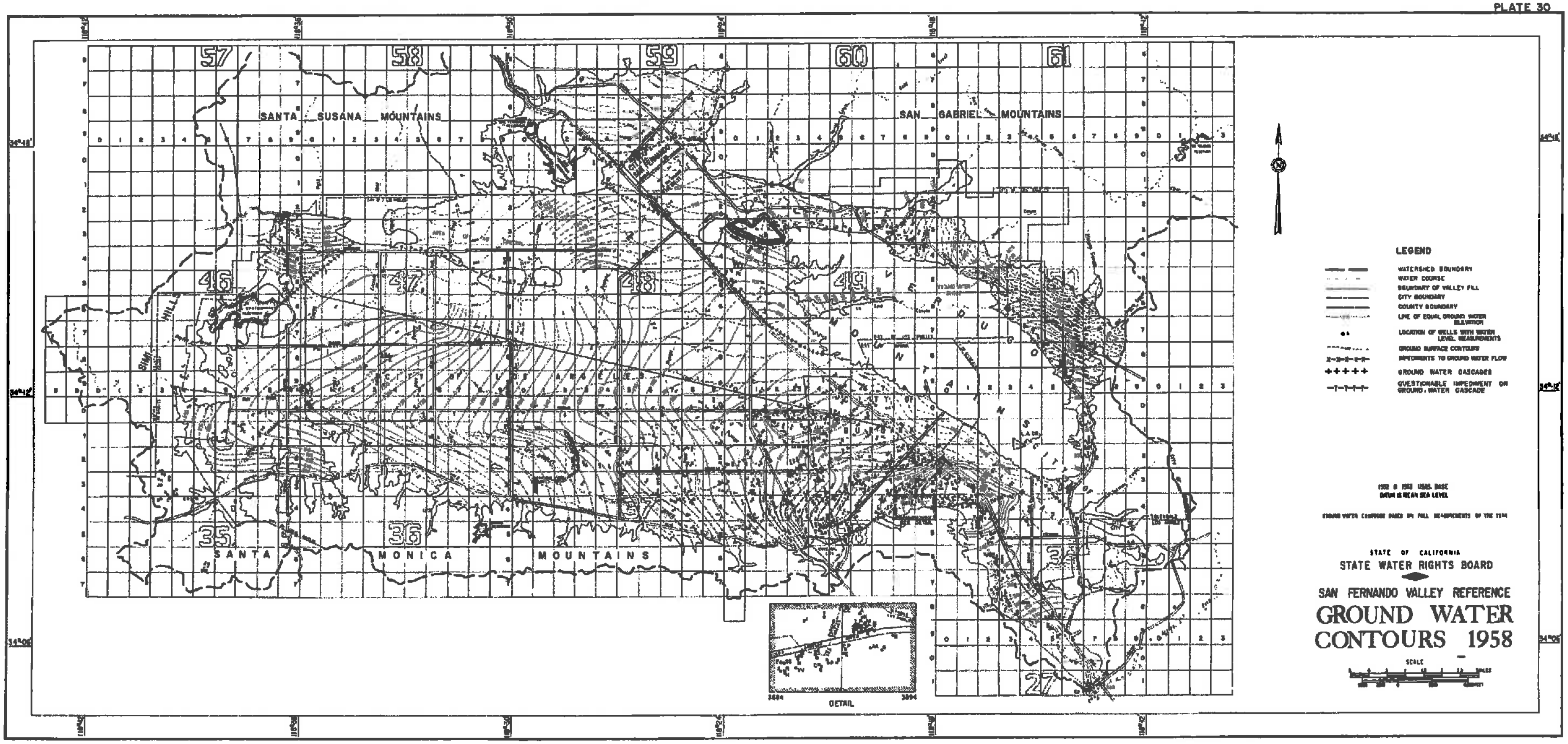
37
38
39
27
DETAIL
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL GROUND WATER ELEVATION
LOCATION OF WELLS WITH WATER LEVEL MEASUREMENTS
GROUND SURFACE CONTOURS
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADE
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GROUND WATER
CONTOURS 1938
SCALE

PLATE 29



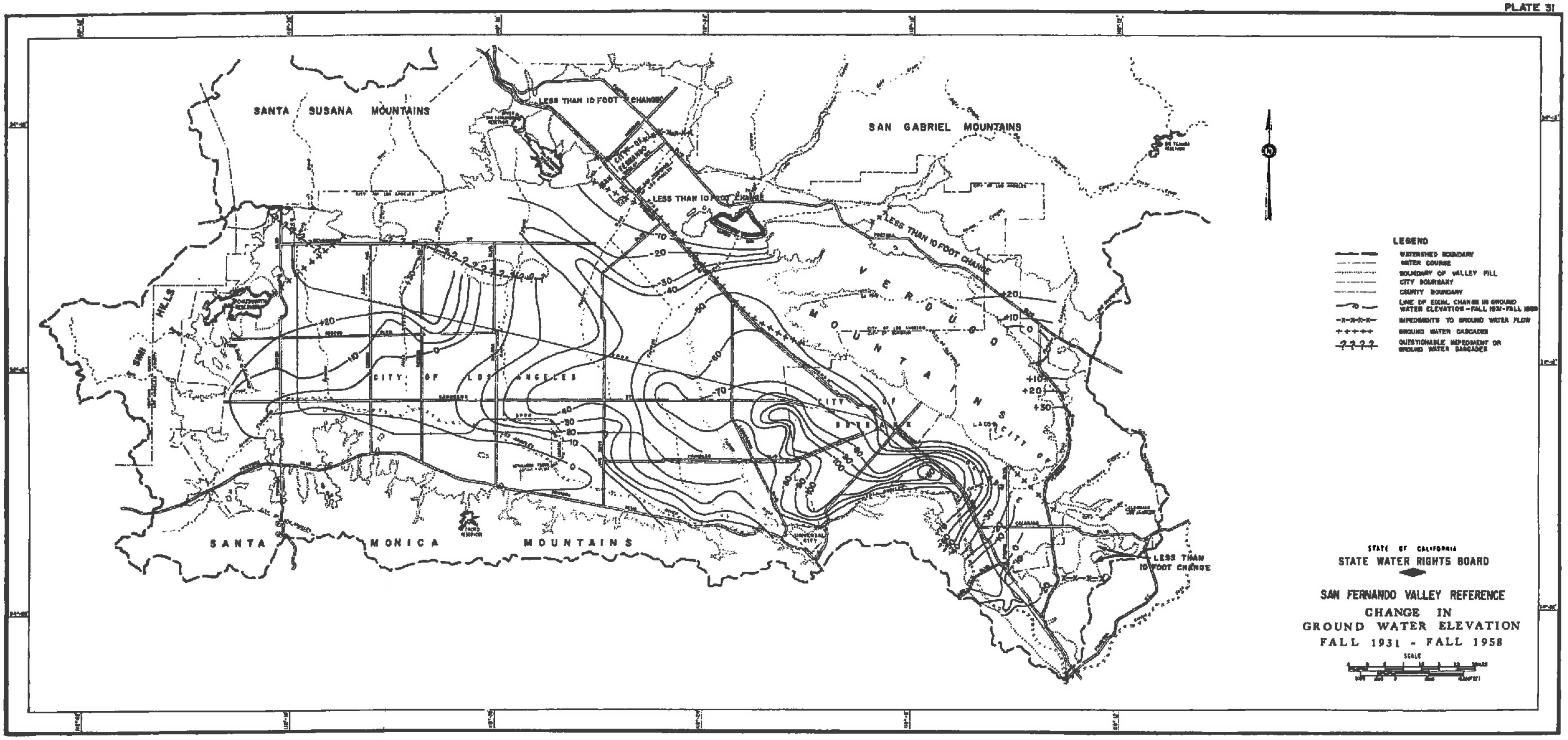
SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL GROUND WATER ELEVATION
LOCATION OF WELLS WITH WATER LEVEL MEASUREMENTS
GROUND SURFACE CONTOURS
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND-WATER CASCADE
AREAS OF LESS THAN 10 FEET DEPTH TO GROUND WATER AS OF 1944
DETAIL
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GROUND WATER
CONTOURS 1944
SCALE

PLATE 30



SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
57
58
59
60
61
46
47
48
49
50
35
36
37
27
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL GROUND WATER ELEVATION
LOCATION OF WELLS WITH WATER LEVEL MEASUREMENTS
GROUND SURFACE CONTOURS
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADE
DETAIL
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
GROUND WATER CONTOURS 1958
SCALE

214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SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
VERDUGO MOUNTAINS
CITY OF LOS ANGELES
LESS THAN 10 FOOT CHANGE
LESS THAN 10 FOOT CHANGE
LESS THAN 10 FOOT CHANGE
LESS THAN 10 FOOT CHANGE
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL CHANGE IN GROUND WATER ELEVATION—FALL 1931-FALL 1958
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADES
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
CHANGE IN
GROUND WATER ELEVATION
FALL 1931 - FALL 1958
SCALE

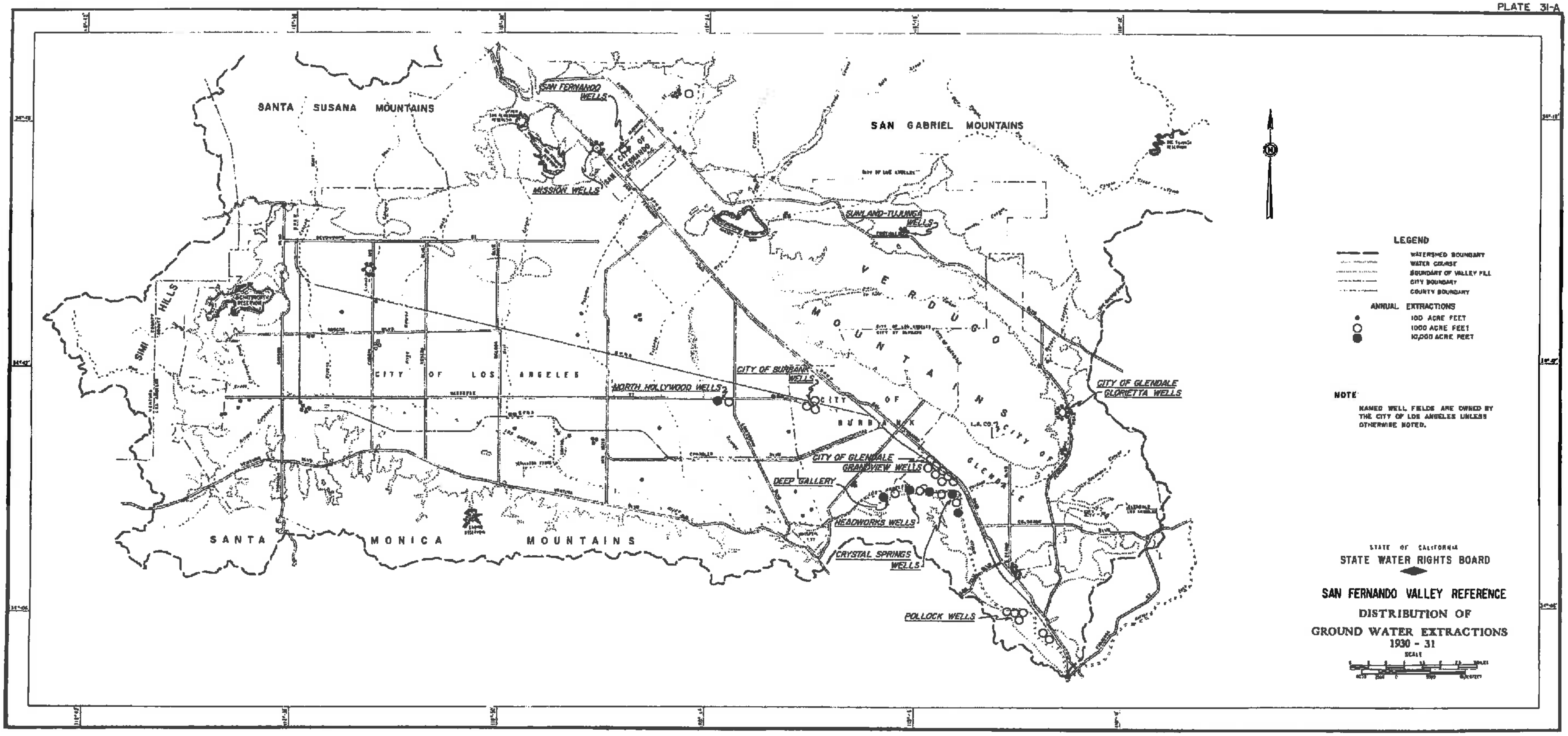
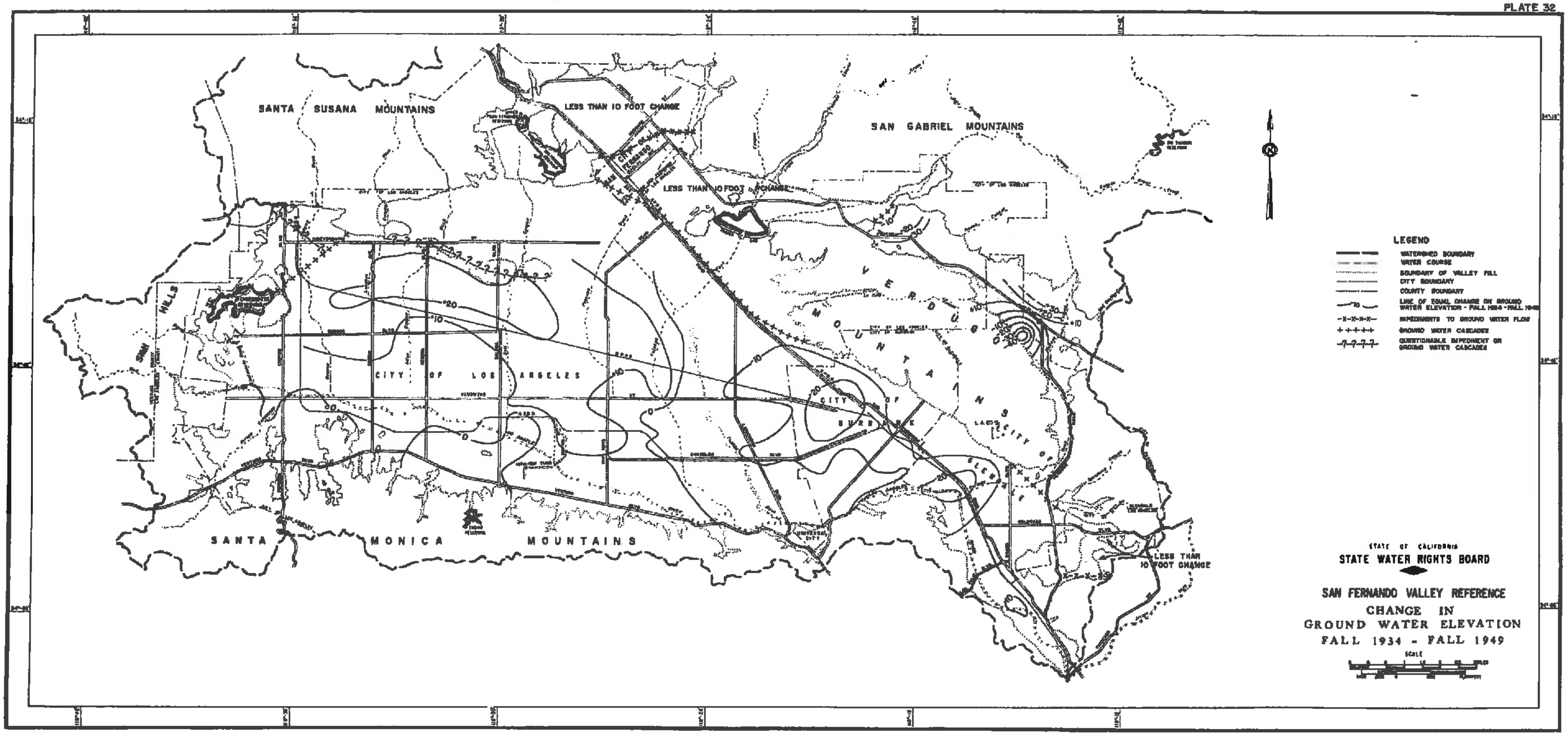
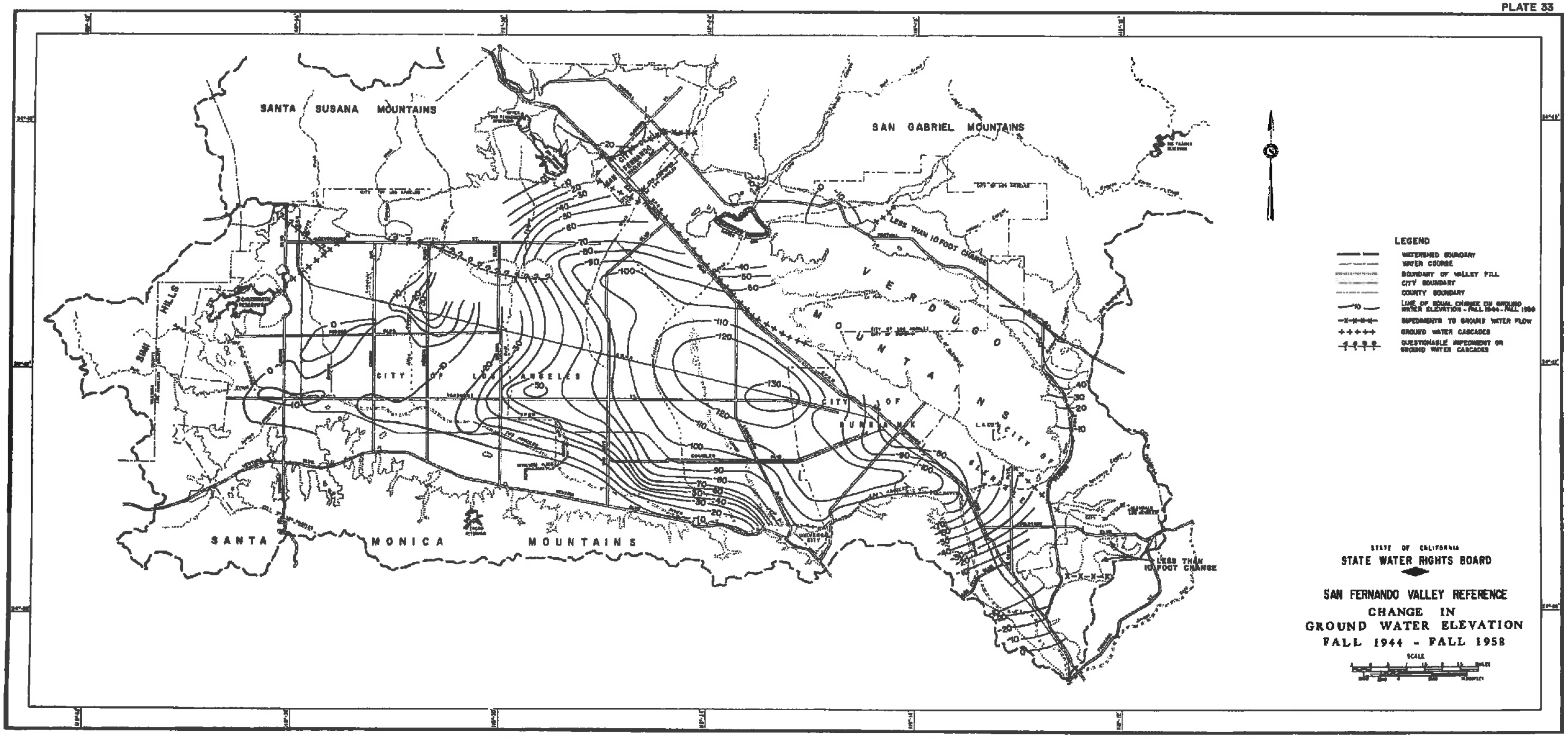
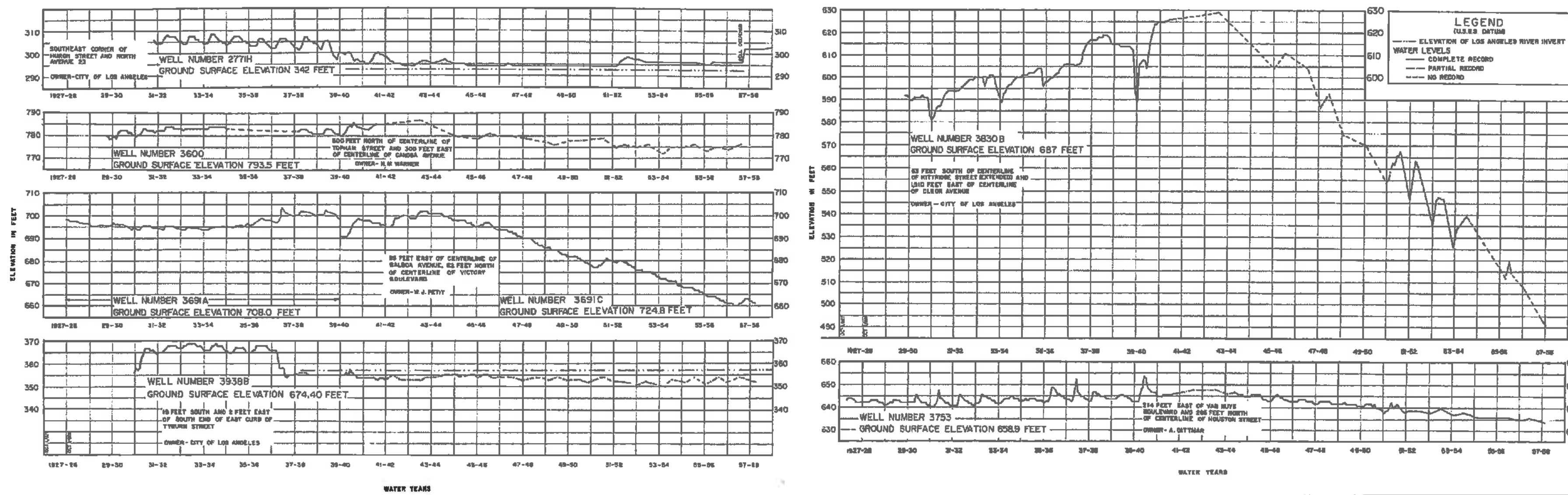

SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
SANTA MONICA MOUNTAINS
VERDUGO MOUNTAINS
SIMI HILLS
CITY OF LOS ANGELES
CITY OF BURBANK
CITY OF GLENDALE
CITY OF SAN FERNANDO
SAN FERNANDO WELLS
MISSION WELLS
SUNLAND-TUJUNGA WELLS
NORTH HOLLYWOOD WELLS
CITY OF BURBANK WELLS
CITY OF GLENDALE GLORIETTA WELLS
CITY OF GLENDALE GRANDVIEW WELLS
DEEP GALLERY
HEADWORKS WELLS
CRYSTAL SPRINGS WELLS
POLLOCK WELLS
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
ANNUAL EXTRACTIONS
100 ACRE FEET
1000 ACRE FEET
10,000 ACRE FEET
NOTE
NAMED WELL FIELDS ARE OWNED BY THE CITY OF LOS ANGELES UNLESS OTHERWISE NOTED.
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
DISTRIBUTION OF
GROUND WATER EXTRACTIONS
1930 - 31
SCALE

PLATE 32

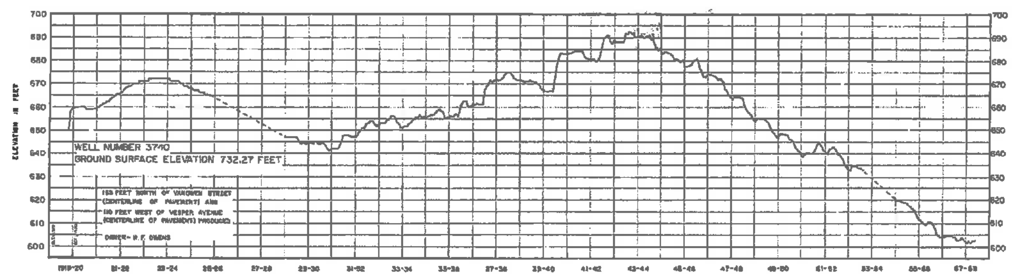

SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
LESS THAN 10 FOOT CHANGE
LESS THAN 10 FOOT CHANGE
VERDUGO MOUNTAINS
CITY OF LOS ANGELES
CITY OF BURBANK
CITY OF GLENDALE
SIMI HILLS
SANTA MONICA MOUNTAINS
LESS THAN 10 FOOT CHANGE
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL CHANGE IN GROUND WATER ELEVATION - FALL 1934 -
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADES
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
CHANGE IN
GROUND WATER ELEVATION
FALL 1934 - FALL 1949
SCALE

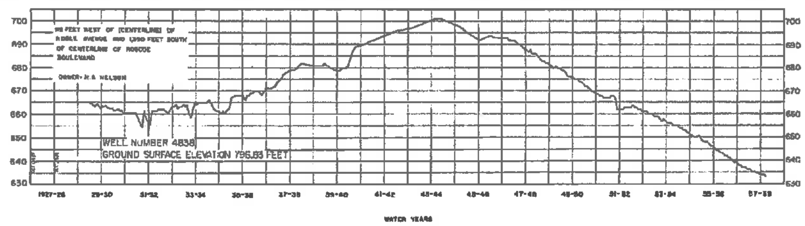

SANTA SUSANA MOUNTAINS
SAN GABRIEL MOUNTAINS
VERDUGO MOUNTAINS
SANTA MONICA MOUNTAINS
SIMI HILLS
CITY OF LOS ANGELES
CITY OF BURBANK
CITY OF GLENDALE
LESS THAN 10 FOOT CHANGE
LEGEND
WATERSHED BOUNDARY
WATER COURSE
BOUNDARY OF VALLEY FILL
CITY BOUNDARY
COUNTY BOUNDARY
LINE OF EQUAL CHANGE IN GROUND WATER ELEVATION - FALL 1944 - FALL 1958
IMPEDIMENTS TO GROUND WATER FLOW
GROUND WATER CASCADES
QUESTIONABLE IMPEDIMENT OR GROUND WATER CASCADES
STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
CHANGE IN
GROUND WATER ELEVATION
FALL 1944 - FALL 1958
SCALE

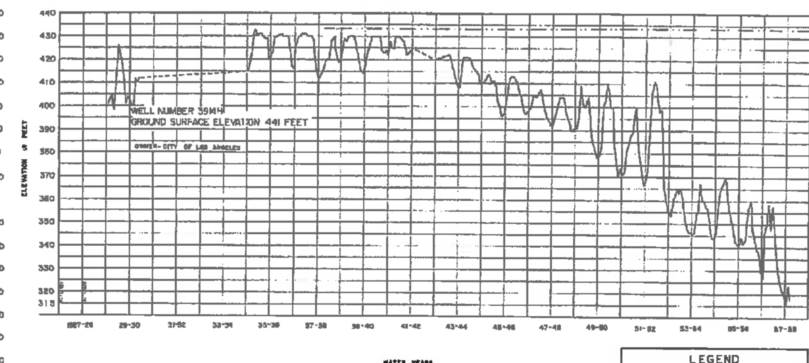


SAN FERNANDO VALLEY REFERENCE

SAN FERNANDO SUBAREA WELL HYDROGRAPHS



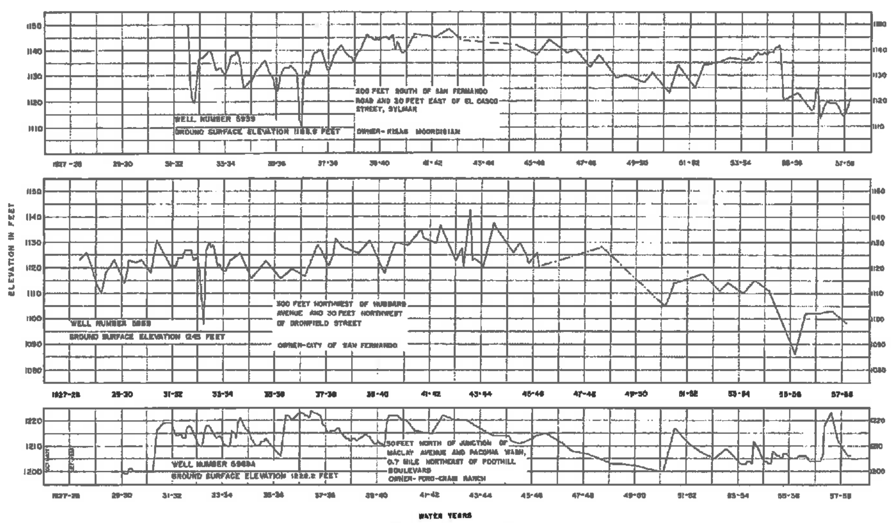


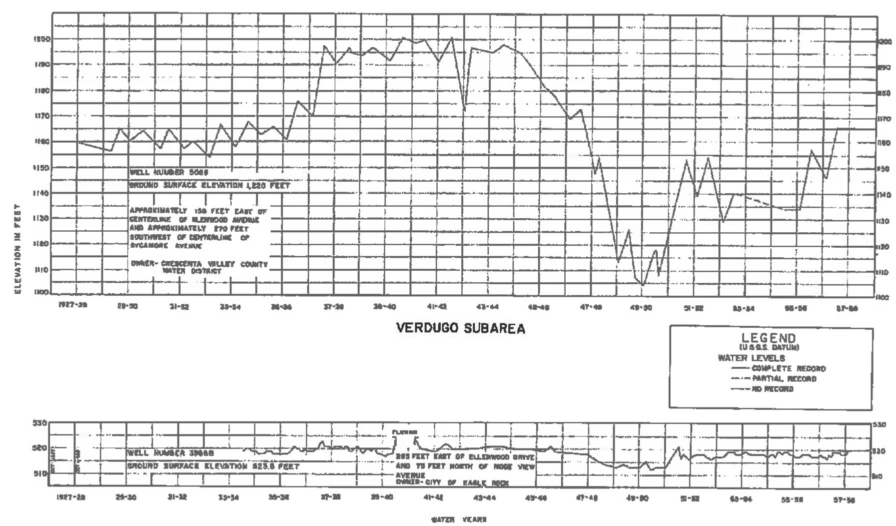


LEGEND
(U.S.G.S. DATUM)
— — ELEVATION OF LOS ANGELES RIVER INVERT
WATER LEVELS
—— COMPLETE RECORD
– – PARTIAL RECORD
--- NO RECORD

SAN FERNANDO VALLEY REFERENCE

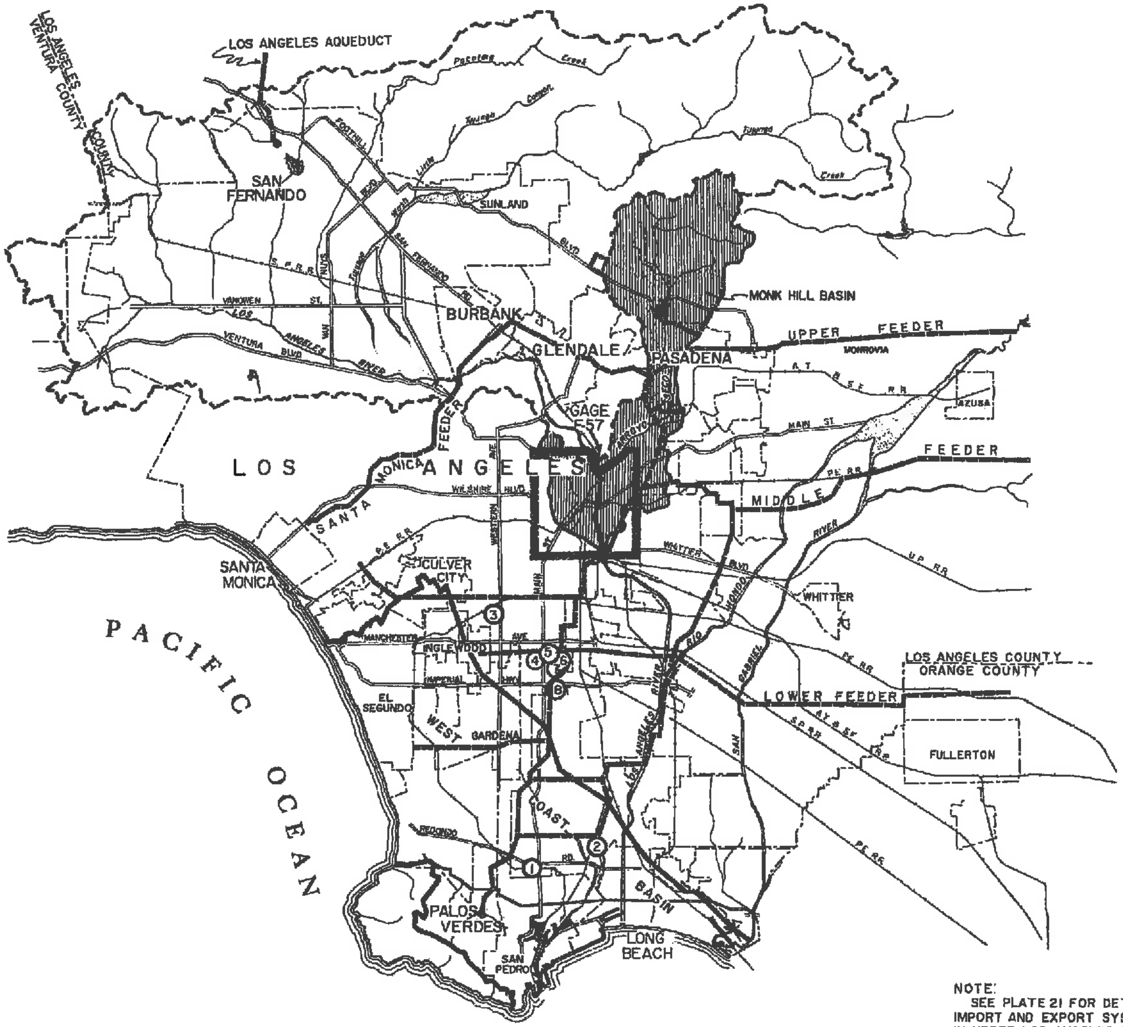
SAN FERNANDO SUBAREA WELL HYDROGRAPHS





SAN FERNANDO VALLEY REFERENCE

SYLMAR, EAGLE ROCK AND VERDUGO SUBAREA WELL HYDROGRAPHS



LEGEND

- WATERSHED BOUNDARY OF UPPER LOS ANGELES RIVER AREA
- CITY BOUNDARY
- COUNTY BOUNDARY
- PUEBLO BOUNDARY
- SURFACE DRAINAGE BOUNDARY OF LOS ANGELES RIVER BETWEEN SOUTH BOUNDARY OF PUEBLO AND STREAM GAGE F-57 AND GROUND WATER BOUNDARIES
- DISTRIBUTION SYSTEM OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

CITY OF LOS ANGELES WELL FIELDS ACTIVE IN 1959:

WEST COAST BASIN
1. LOMITA WELLS
2. HARBOR DEPARTMENT WELLS

CENTRAL COASTAL BASIN
3. MANHATTAN FIELD WELLS
4. COLDEN WELLS
5. TOWNE WELLS
6. 99th. STREET WELLS
7. AVALON WELLS
8. DEL MAR WELLS

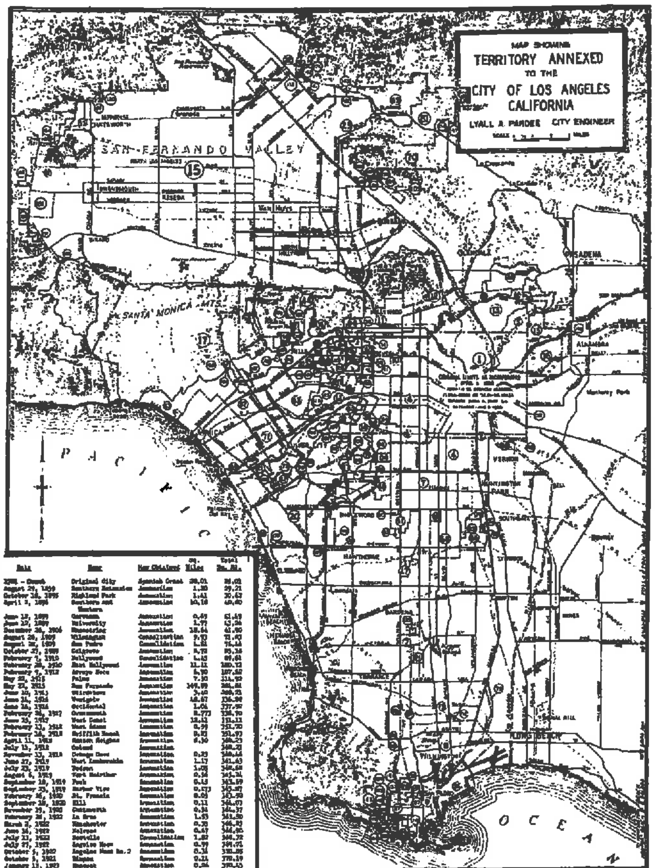
NOTE:
SEE PLATE 21 FOR DETAILED IMPORT AND EXPORT SYSTEM IN UPPER LOS ANGELES RIVER AREA.

STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD

SAN FERNANDO VALLEY REFERENCE

WATERSHED BOUNDARY AND OTHER SOURCES OF SUPPLY

SCALE
0 2 4 6 MILES



No.	Date	Name	How Obtained	Sq. Miles	Total Sq. Mi.
1	1781 - Grant	Original City	Spanish Grant	28.01	28.01
2	August 29, 1859	Southern Extension	Annexation	1.20	29.21
3	October 19, 1895	Highland Park	Annexation	1.41	30.62
4	April 2, 1896	Southern and Western	Annexation	10.18	40.80
5	June 12, 1899	Garvanza	Annexation	0.69	41.49
6	June 12, 1899	University	Annexation	1.77	43.26
7	December 26, 1906	Shoestring	Annexation	18.64	61.90
8	August 28, 1909	Wilmington	Consolidation	9.93	71.83
9	August 28, 1909	San Pedro	Consolidation	4.51	76.34
10	October 27, 1909	Colegrove	Annexation	8.72	85.06
11	February 7, 1910	Hollywood	Consolidation	4.45	89.61
12	February 28, 1910	East Hollywood	Annexation	11.11	100.72
13	February 9, 1912	Arroyo Seco	Annexation	6.90	107.62
14	May 22, 1915	Palms	Annexation	7.30	114.92
15	May 22, 1915	San Fernando	Annexation	169.89	284.81
16	June 10, 1916	Bairdstown	Annexation	3.40	288.21
17	June 14, 1916	Westgate	Annexation	48.67	336.88
18	June 14, 1916	Occidental	Annexation	1.04	337.92
19	February 26, 1917	Owensmouth	Annexation	0.773	338.70
20	June 25, 1917	West Coast	Annexation	12.43	351.13
21	February 13, 1918	West Adams	Annexation	0.59	351.70
22	February 26, 1918	Griffith Ranch	Annexation	0.21	351.93
23	April 11, 1918	Hansen Heights	Annexation	6.30	358.23
24	July 15, 1918	Oakwood	Annexation		358.23
25	November 13, 1918	Cottage Home	Annexation	0.23	358.46
26	June 27, 1919	West Lankershim	Annexation	1.17	361.63
27	July 23, 1919	Tedson	Annexation	1.05	362.68
28	August 6, 1919	Fort MacArthur	Annexation	0.56	363.24
29	September 10, 1919	Peck	Annexation	0.15	363.39
30	September 23, 1919	Harbor View	Annexation	0.173	363.57
31	February 16, 1920	St. Francis	Annexation	0.09	363.66
32	September 16, 1920	Hill	Annexation	0.11	363.77
33	November 29, 1920	Cudahy Ranch	Annexation	0.34	364.11
34	February 28, 1922	La Brea	Annexation	1.93	366.04
35	March 2, 1922	Manchester	Annexation	0.30	366.34
36	June 14, 1922	Melrose	Annexation	0.47	366.81
37	July 11, 1922	Sawtelle	Consolidation	1.82	368.63
38	July 27, 1922	Angeles Mesa	Annexation	0.79	369.42
39	October 5, 1922	Angeles Mesa No. 2	Annexation	0.31	369.73
40	October 5, 1922	Rimpau	Annexation	0.21	369.94
41	January 12, 1923	Hancock	Annexation	0.06	370.00
42	January 12, 1923	Evans	Annexation	0.13	370.13
43	May 16, 1923	Ambassador	Annexation	2.69	372.82
44	May 16, 1923	Laurel Canyon	Annexation	13.57	386.39
45	May 17, 1923	Hyde Park	Consolidation	1.30	387.69
46	May 17, 1923	Eagle Rock	Consolidation	3.37	391.06
47	May 17, 1923	Vermont	Annexation	0.028	391.09
48	May 17, 1923	Lagoon	Annexation	0.28	391.37
49	May 17, 1923	Carthay	Annexation	0.38	391.75
50	December 20, 1923	Rosedale	Annexation	0.63	392.38
51	December 20, 1923	Agoure	Annexation	0.02	392.40
52	December 29, 1923	Lankershim	Annexation	7.64	400.04
53	February 1, 1924	Providencia	Annexation	4.43	404.47
54	February 13, 1924	Cienega	Annexation	0.70	405.17
55	February 21, 1924	Annandale	Annexation	0.68	405.85
56	May 20, 1924	Clinton	Annexation	0.03	405.88
57	September 4, 1924	Wagner	Annexation	0.94	406.82
58	September 9, 1924	Fairfax	Annexation	1.88	408.70
59	January 3, 1925	Bairdstown (?)	Annexation	0.41	409.11
60	January 6, 1925	Danziger	Annexation	0.223	409.34
61	January 30, 1925	Hamilton	Annexation	0.11	409.45
62	April 28, 1925	Norvell	Annexation	0.21	409.66
63	April 28, 1925	Santa Monica Canyon	Annexation	0.17	409.83
64	October 26, 1925	Beverly Glen	Annexation	0.81	410.64
65	November 2, 1925	Venice	Consolidation	4.105	414.75
66	March 18, 1926	Green Meadows	Annexation	2.57	417.32
67	May 14, 1926	Buckler	Annexation	0.30	417.62
68	May 29, 1926	Watts	Consolidation	1.69	419.31
69	August 4, 1926	Sunland	Annexation	6.04	425.35
70	November 18, 1926	Tuna Canyon	Annexation	7.67	433.02
71	March 3, 1927	Mar Vista	Annexation	4.864	437.89
72	April 11, 1927	Barnes City	Consolidation	1.81	439.70
73	June 11, 1927	Wagner	Annexation	0.074	439.77
74	February 10, 1928	Hansen (?)	Annexation	0.14	439.91
75	November 27, 1928	White Point	Annexation	0.81	440.72
76	February 27, 1930	Classification Yard	Annexation	0.41	441.13
77	April 17, 1930	Vineyard	Annexation	0.62	441.75
78	August 1, 1930	Rowley	Annexation	0.01	441.76
79	December 22, 1930	Tobias	Annexation	0.01	441.77
80	June 17, 1931	Gaja	Annexation	0.05	441.82
81	March 7, 1932	Tujunga	Consolidation	8.70	450.52
82	January 31, 1933	Lakeside Park Addition	Annexation	0.13	450.65
83	March 14, 1938	Ventura Avenue Highlands	Annexation	0.12	450.78
84	August 15, 1940	Crenshaw Manor	Annexation	0.054	450.834
85	July 29, 1941	Fairfax Addition No. 2	Annexation	0.263	451.097
86	August 14, 1941	Crenshaw Manor Addition No. 2	Annexation	0.095	451.190
87	September 17, 1941	Woodland Heights Addition	Annexation	0.014	451.204
88	April 23, 1942	Palos Verdes Addition	Annexation	0.013	451.217
89	April 21, 1942	Fairfax Addition No. 3	Annexation	0.015	451.232
90	November 11, 1942	Fairfax Addition No. 4	Annexation	0.031	451.263
91	April 30, 1943	Hemingway Addition	Annexation	0.446	451.709
92	January 7, 1944	Florence Addition	Annexation	0.075	451.783
93	September 25, 1944	Fairfax Addition No. 5	Annexation	0.024	451.807
94	December 1, 1944	Florence Addition No. 2	Annexation	0.037	451.844
95	December 1, 1944	Florence Addition No. 3	Annexation	0.014	451.858
96	August 27, 1945	Lomita Addition	Annexation	0.027	451.885
97	July 19, 1946	Lomita Addition No. 2	Annexation	0.028	451.913
98	September 18, 1946	Nash Addition No. 3	Annexation	0.056	451.969
99	November 6, 1946	Mar Vista Addition No. 2	Annexation	0.062	452.031
100	January 24, 1947	Angeles Mesa Addition No. 4	Annexation	0.409	452.440
101	January 29, 1947	Mar Vista Addition No. 3	Annexation	0.205	452.645
102	October 14, 1947	Fairfax Addition No. 6	Annexation	0.073	452.718
103	March 1, 1948	Burbank Detachment	Detachment	0.444	452.272
104	April 6, 1948	Hineburn Addition No. 2	Annexation	0.002	452.274
105	April 13, 1948	Swaniger Addition No. 2	Annexation	0.003	452.277
106	April 22, 1948	Angeles Mesa Addition No. 5	Annexation	0.990	453.267
107	July 23, 1948	Angeles Mesa Addition No. 6	Annexation	0.065	453.332
108	December 28, 1948	Beverly Hills Detachment No. 1	Detachment	0.0096	453.322
109	December 28, 1948	Beverly Hills Detachment No. 2	Detachment	0.0000	453.322

No.	Date	Name	How Obtained	Sq. Miles	Total Sq. Mi.
110	July 26, 1949	Arnaz Addition	Annexation	0.1150	453.460
111	November 1, 1949	Fairfax Addition No. 7	Annexation	0.0106	453.475
112	December 14, 1949	Culver City Exclusion	Exclusion	0.0066	453.479
113	January 21, 1950	San Fernando Detachment	Detachment	0.0217	453.481
114	May 3, 1950	Lomita Addition No. 1	Annexation	0.0209	453.502
115	October 9, 1950	Beverly Hills Detachment No. 3	Detachment	0.0063	453.496
116	November 13, 1950	Lomita Addition No. 3	Annexation	0.0042	453.500
117	December 28, 1950	Chatsworth Addition No. 2	Annexation	0.0109	453.511
118	January 15, 1951	Beverly Hills Detachment No. 4	Detachment	0.0134	453.498
119	October 26, 1951	Belvedere Addition	Annexation	0.0032	453.501
120	October 26, 1951	Fairfax Addition No. 8	Annexation	0.0058	453.507
121	October 26, 1951	Belmont Addition No. 2	Annexation	0.0037	453.510
122	November 7, 1951	Lomita Addition No. 5	Annexation	0.0065	453.516
123	June 4, 1952	Warner Addition	Annexation	0.0082	453.598
124	June 11, 1952	Lomita Addition No. 6	Annexation	0.0152	453.613
125	August 28, 1952	Culver City Detachment No. 1	Detachment	0.013	453.600
126	October 14, 1952	Mar Vista Addition No. 4	Annexation	0.0096	453.609
127	January 7, 1953	Westgate Addition No. 2	Annexation	0.0631	453.671
128	June 3, 1953	Rolling Hills Addition	Annexation	0.1107	453.781
129	June 12, 1953	Mar Vista Addition No. 5	Annexation	0.0202	453.801
130	August 14, 1953	Inglewood Detachment No. 1	Detachment	0.0270	453.774
131	September 18, 1953	Fairfax Addition No. 9	Annexation	0.0029	453.776
132	September 30, 1953	Keystone Addition No. 2	Annexation	0.0724	453.848
133	October 28, 1953	Rolling Hills Addition No. 2	Annexation	0.0243	453.873
134	December 21, 1953	Burbank Detachment No. 2	Detachment	0.0207	453.852
135	April 28, 1954	Glassell Addition	Annexation	0.0067	453.858
136	June 30, 1954	Beverly Hills Detachment No. 5	Detachment	0.0074	453.851
137	August 10, 1954	Rolling Hills Addition No. 4	Annexation	0.0013	453.852
138	August 11, 1954	Rolling Hills Addition No. 3	Annexation	0.0252	454.177
139	August 19, 1954	Burbank Exclusion No. 1	Exclusion	0.1264	454.050
140	May 9, 1955	Chatsworth Addition No. 3	Annexation	0.0066	454.137
141	June 13, 1955	Sunland Addition No. 2	Annexation	0.0236	454.1711
142	June 27, 1955	Sunland Addition No. 3	Annexation	0.0111	454.1823
143	July 13, 1955	Sunland Addition No. 4	Annexation	0.0142	454.1967
144	August 16, 1955	Burbank Detachment No. 3	Detachment	0.0207	454.1760
145	August 16, 1955	Rolling Hills Addition No. 6	Annexation	0.1963	454.3723
146	September 21, 1955	Rolling Hills Addition No. 7	Annexation	0.2990	454.6713
147	October 5, 1955	Tuna Canyon Addition No. 2	Annexation	0.0145	454.6858
148	October 19, 1955	Burbank Detachment No. 4	Detachment	0.0117	454.6741
149	February 14, 1956	Arroyo Seco Addition No. 2	Annexation	0.0011	454.679
150	May 9, 1956	Angeles Mesa Addition No. 7	Annexation	0.0034	454.679
151	July 17, 1956	Rolling Hills Addition No. 8	Annexation	0.0004	454.679
152	September 11, 1956	Sunland Addition No. 5	Annexation	0.0409	454.720
153	November 13, 1956	Calabasas Addition	Annexation	0.0267	454.746
154	December 17, 1956	Tuna Canyon Addition No. 3	Annexation	0.0049	454.751
155	January 6, 1957	Torrance Detachment No. 1	Detachment	0.0022	454.749
156	April 17, 1957	La Habla Addition	Annexation	0.0031	454.752
157	May 1, 1957	Torrance Addition No. 1	Annexation	0.0017	454.754
158	September 13, 1957	Beverly Hills Detachment No. 6	Detachment	0.0116	454.742
159	October 8, 1957	Mar Vista Addition No. 6	Annexation	0.0537	454.796
160	October 14, 1957	Culver City Detachment No. 2	Detachment	0.0030	454.793
161	May 19, 1958	Westgate Addition No. 3	Annexation	0.0017	454.795
162	May 29, 1958	Palos Verdes Addition No. 2	Annexation	0.1299	454.925
163	September 12, 1958	Lomita Addition No. 7	Annexation	0.0004	454.925
164	October 28, 1958	Calabasas Addition No. 5	Annexation	0.0067	454.932
165	November 6, 1958	Calabasas Addition No. 6	Annexation	1.7579	456.690
166	February 4, 1959	Calabasas Addition No. 2	Annexation	0.3996	457.089
167	February 4, 1959	Calabasas Addition No. 3	Annexation	0.3971	457.486
168	February 4, 1959	Calabasas Addition No. 4	Annexation	0.2796	457.766
169	February 4, 1959	Burbank Detachment No. 5	Detachment	0.0249	457.741
170	February 25, 1959	Laurel Canyon Addition No. 3	Annexation	0.0004	457.741
171	March 9, 1959	Calabasas Addition No. 7	Annexation	0.0761	457.818
172	March 11, 1959	Laurel Canyon Addition No. 2	Annexation	0.0070	457.825
173	April 1, 1959	Mar Vista Addition No. 7	Annexation	0.2512	458.076
174	September 14, 1959	Sunland Addition No. 5	Annexation	0.0052	458.081
175	November 11, 1959	El Segundo Detachment	Detachment	0.0115	458.070
176	February 29, 1960	Fairfax Addition No. 10	Annexation	0.0015	458.071
177	February 29, 1960	Beverly Hills Detachment No. 6	Exclusion	0.0014	458.070

No. Shown on Map or Table	Date of Boundary Change	Name of Boundary Change	Type of Change	Area Involved	Total Area Within City Boundary After Change

EXPLANATION OF ABOVE PRINTED DATA

REFERENCE:
From Map No. A-1350 prepared by the City Engineer of Los Angeles.

STATE OF CALIFORNIA
STATE WATER RIGHTS BOARD
SAN FERNANDO VALLEY REFERENCE
TERRITORY ANNEXED
TO THE
CITY OF LOS ANGELES

PLATE 14