SPEAKER SESSION 10b

SEVERE STORMS IN ORANGE COUNTY, CALIFORNIA 1974 TO 1995

A. J. Nestlinger, E. Franklin, M. Sobhoni, T. Hromadka

Abstract:

Three sever storm events have occurred in the Orange County area in the time period of 1974 to 1995. Because of the compact size of Orange County, the probability of such a sequence of storm events introduces significant statistical issues. Also, the storm events show striking similarity with respect to the nested-duration design storm pattern used in many recent Hydrology Manuals.

SEVERE STORMS IN ORANGE COUNTY, CALIFORNIA 1974 TO 1995

T.V. Hromadka II, A.J. Nestlinger, E. Franklin
and M. Sobhoni

Abstract

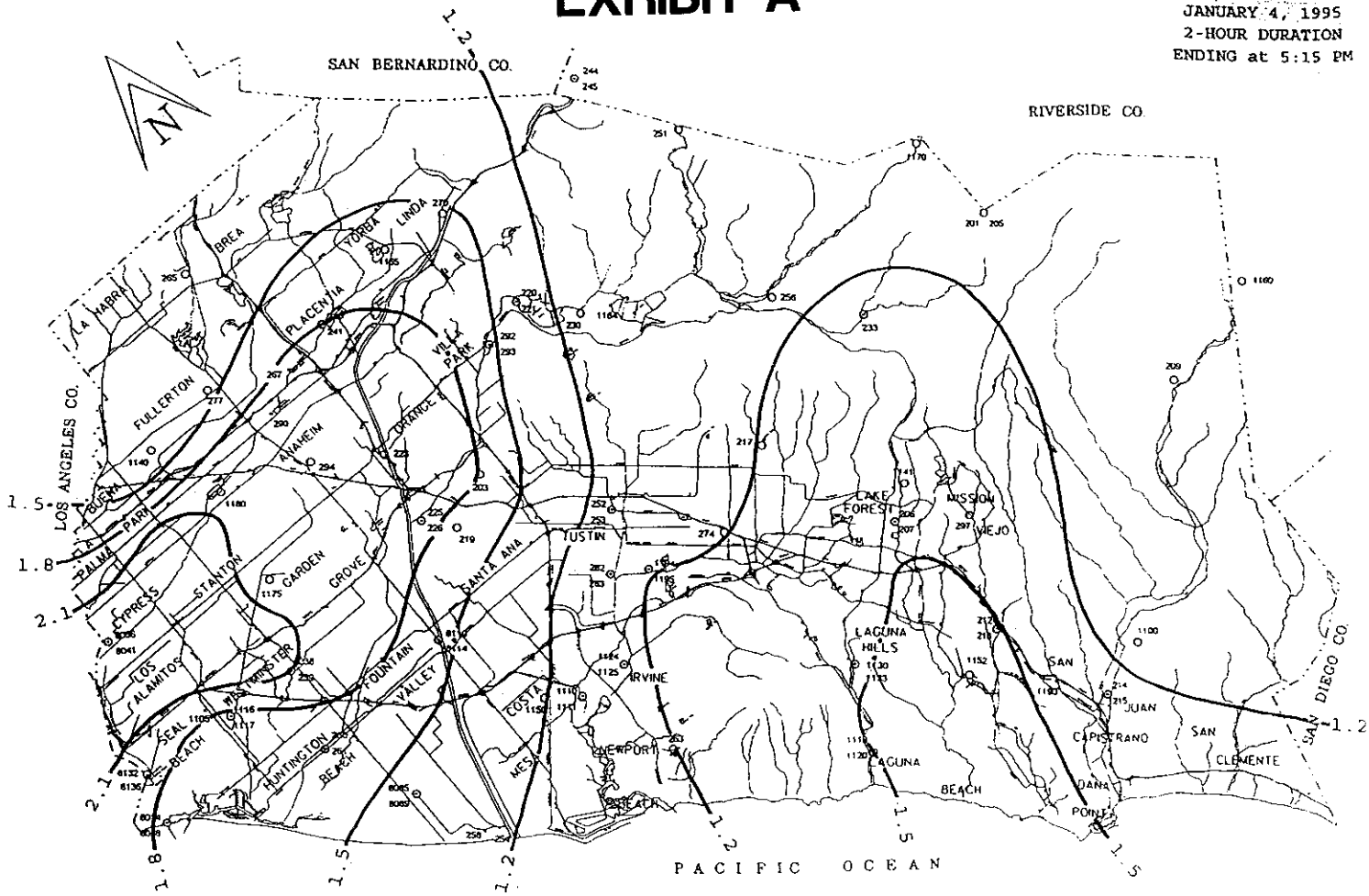
Proceedings: Flood Management Association, 1995 Spring Conference, March 29-31, 1995.

---

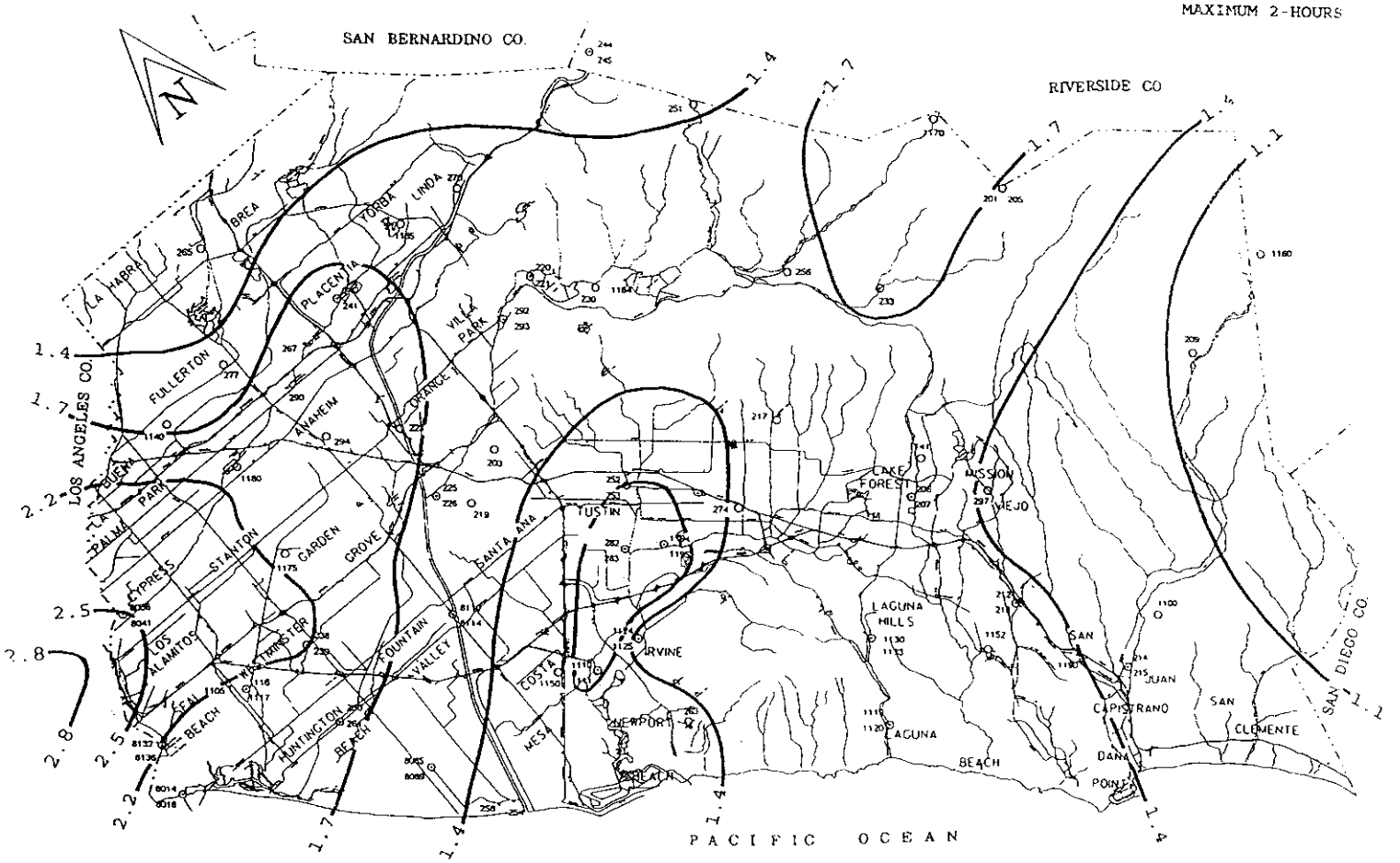
1 Principal Engineer, Boyle Engineering Corporation,
1501 Quail Street, Newport Beach, California 92658-9020

EXHIBIT A

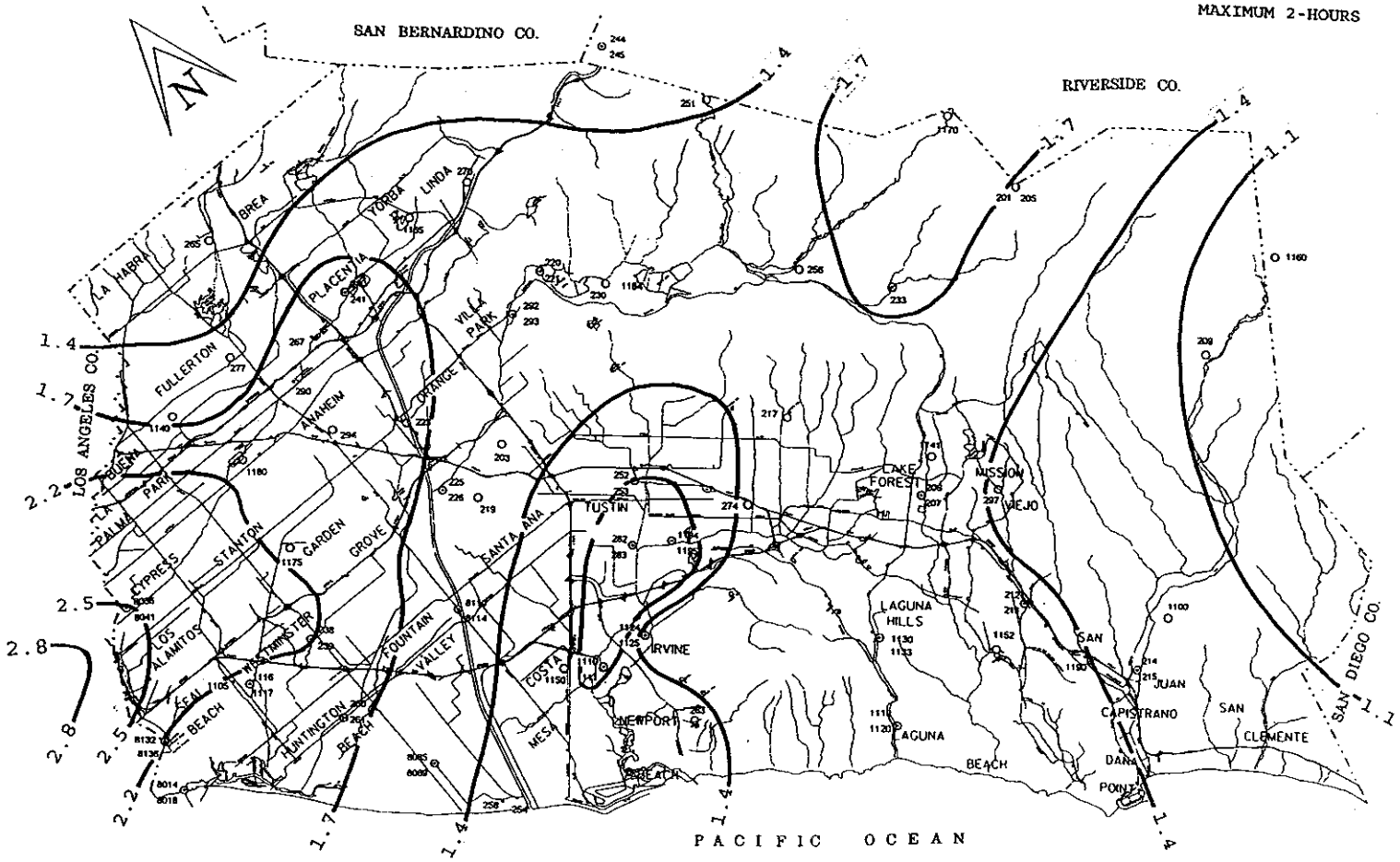
SYNOPTIC
ISOHYETAL MAP
JANUARY 4, 1995
2-HOUR DURATION
ENDING at 5:15 PM



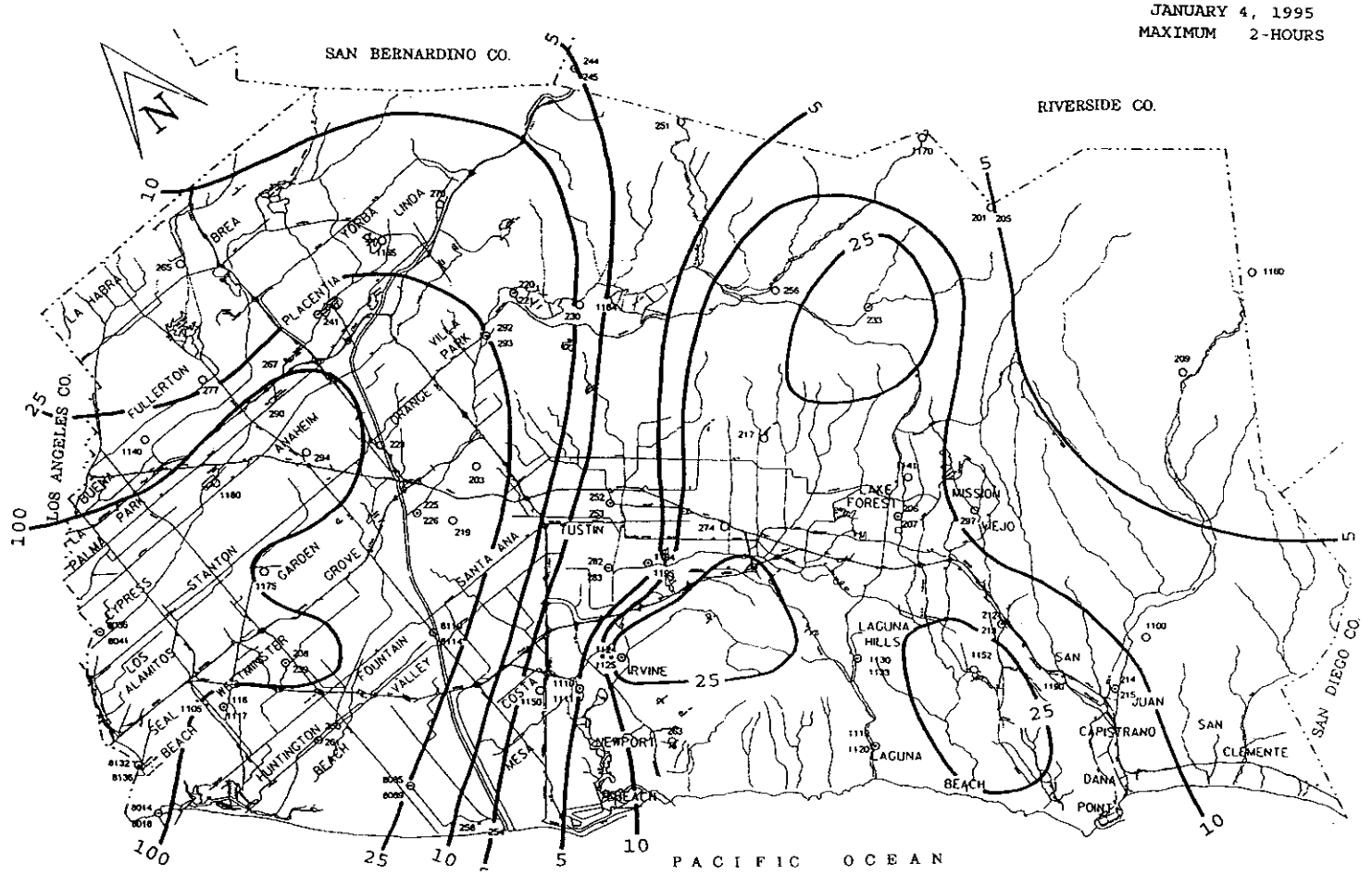
ISOHYETAL MAP
JANUARY 4, 1995
MAXIMUM 2-HOURS



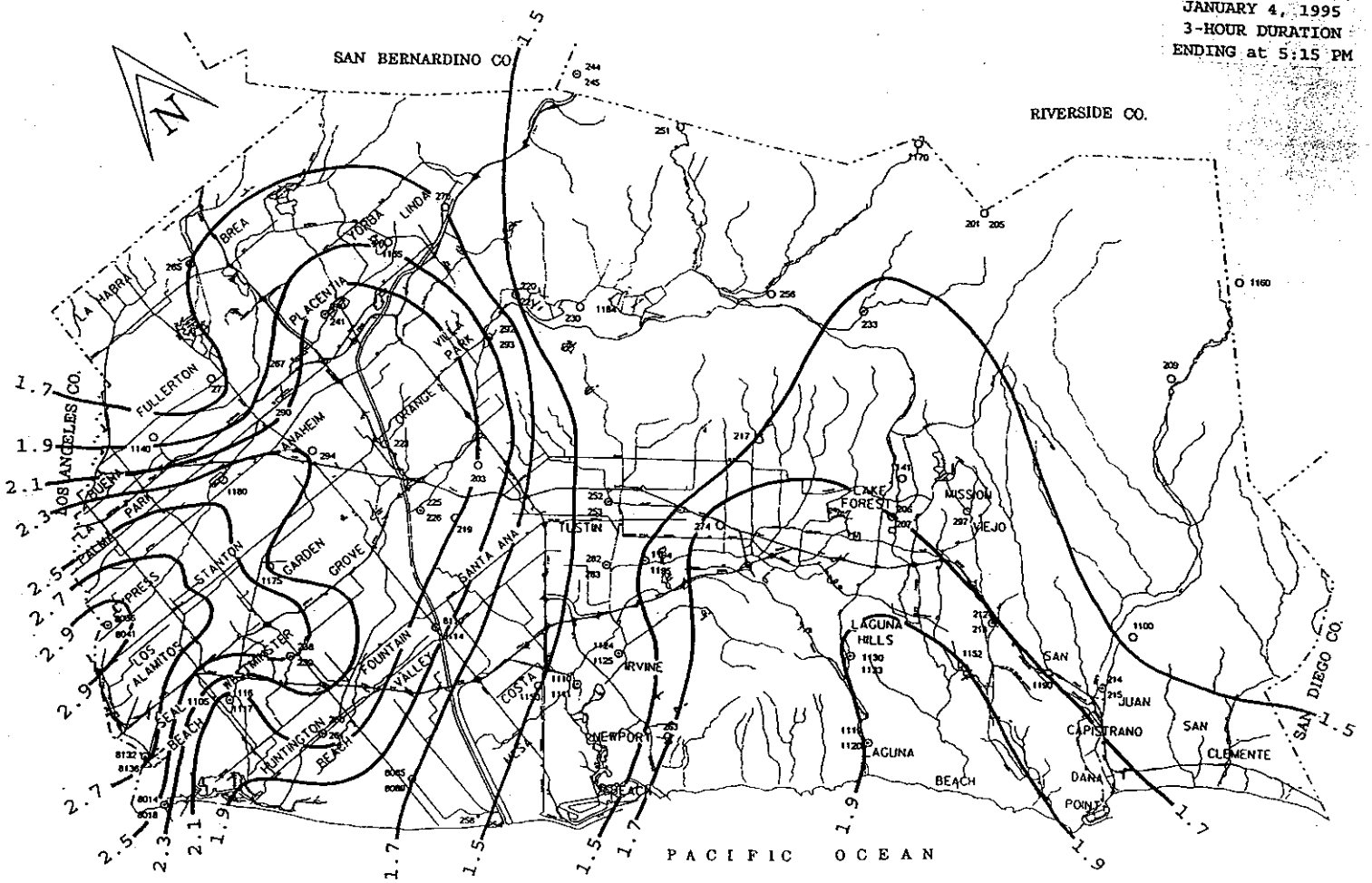
ISOHYETAL MAP
JANUARY 4, 1995
MAXIMUM 2-HOURS



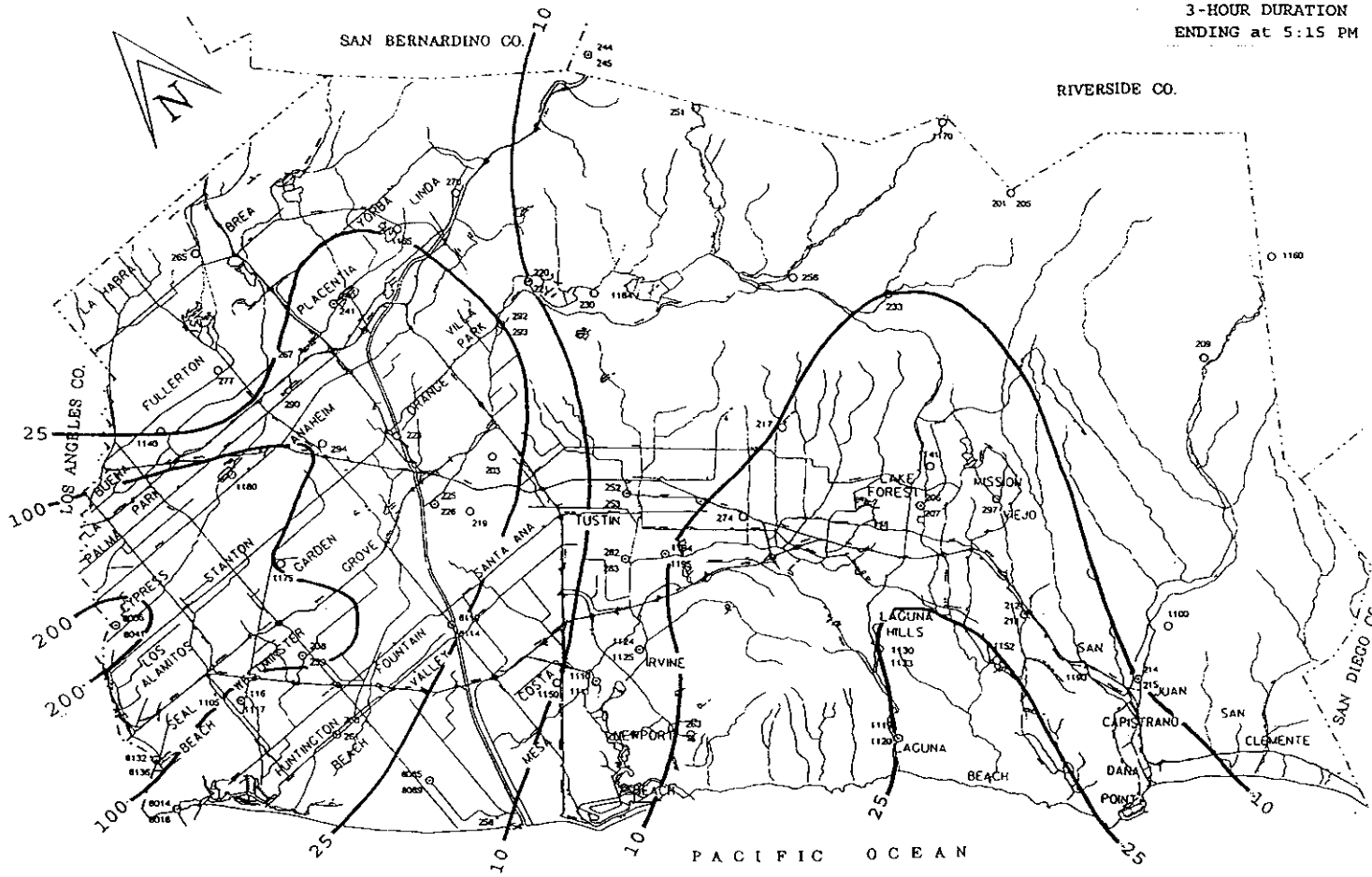
ISOFREQUENCY MAP
JANUARY 4, 1995
MAXIMUM 2-HOURS



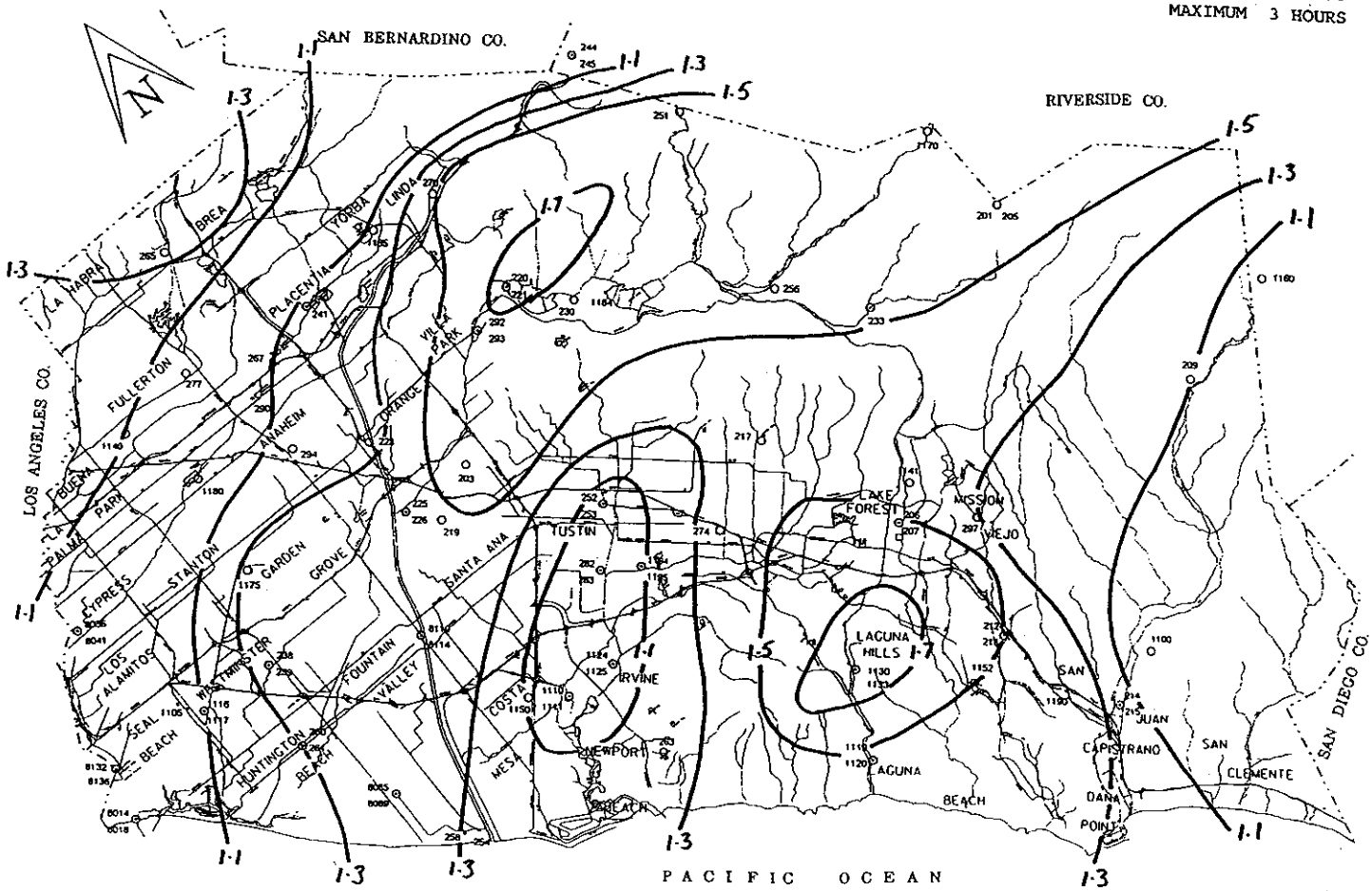
SYNOPTIC
ISOHYETAL MAP
JANUARY 4, 1995
3-HOUR DURATION
ENDING at 5:15 PM



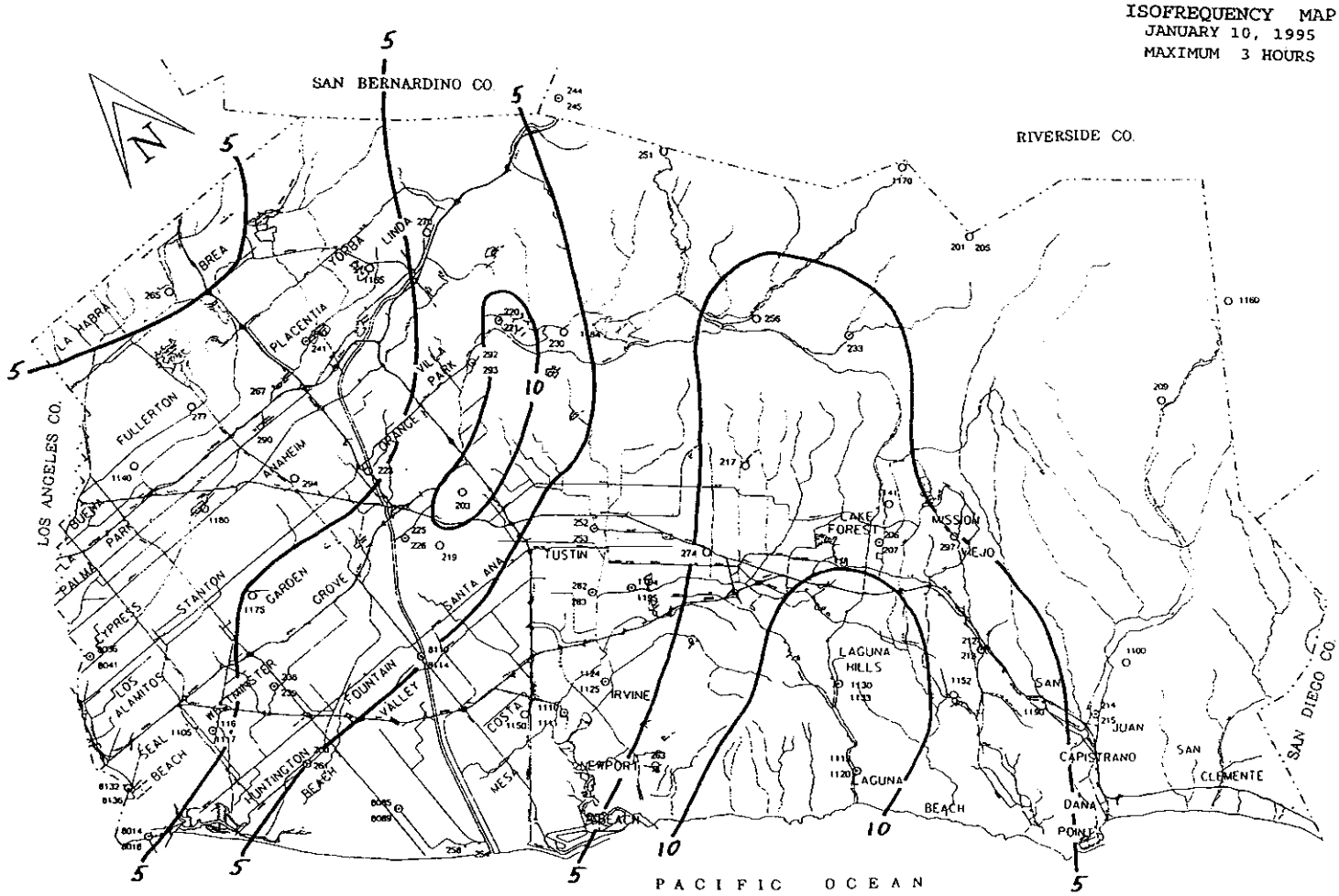
SYNOPTIC
ISOFREQUENCY MAP
JANUARY 4, 1995
3-HOUR DURATION
ENDING at 5:15 PM



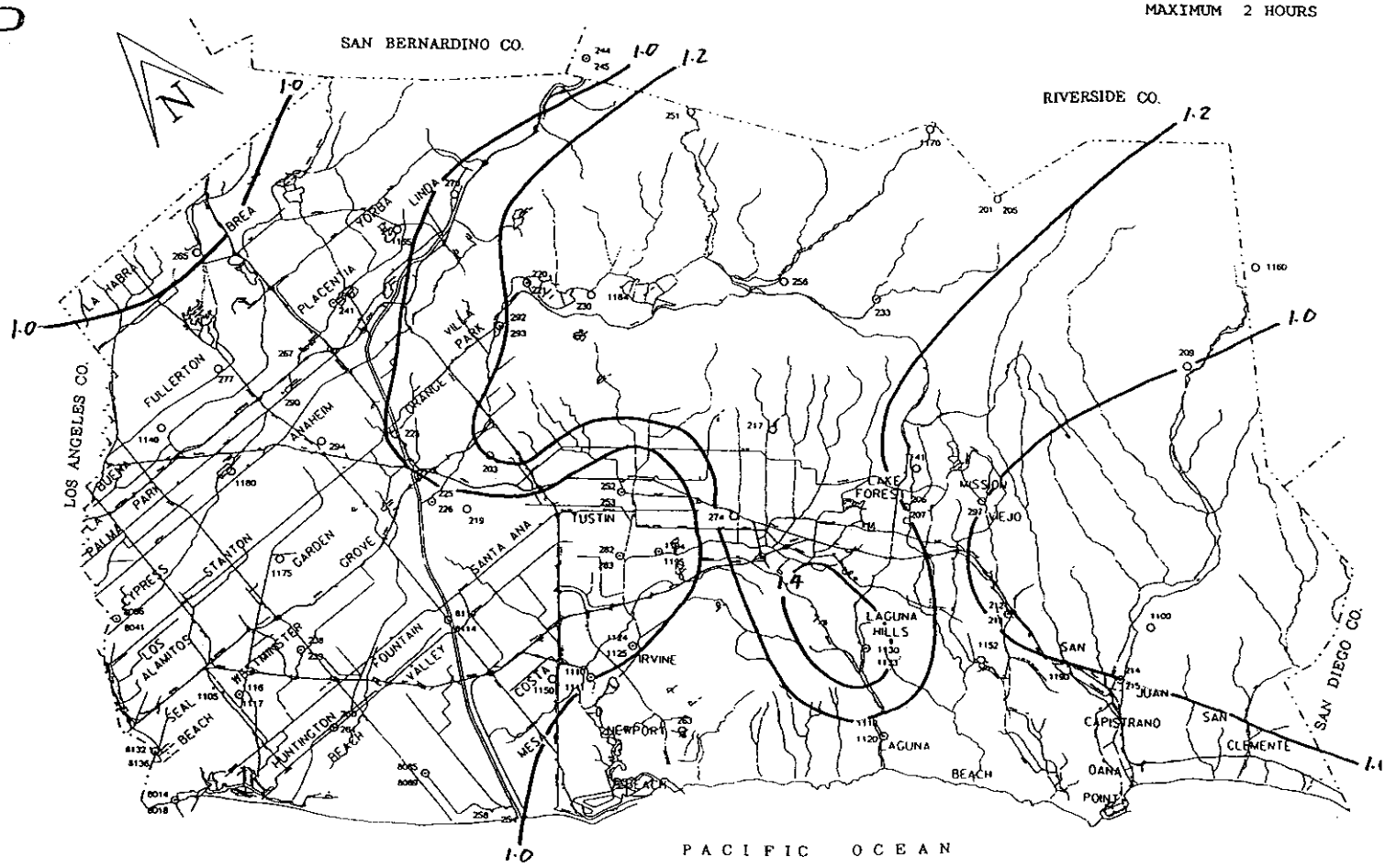
ISOHYETAL MAP
JANUARY 10, 1995
MAXIMUM 3 HOURS



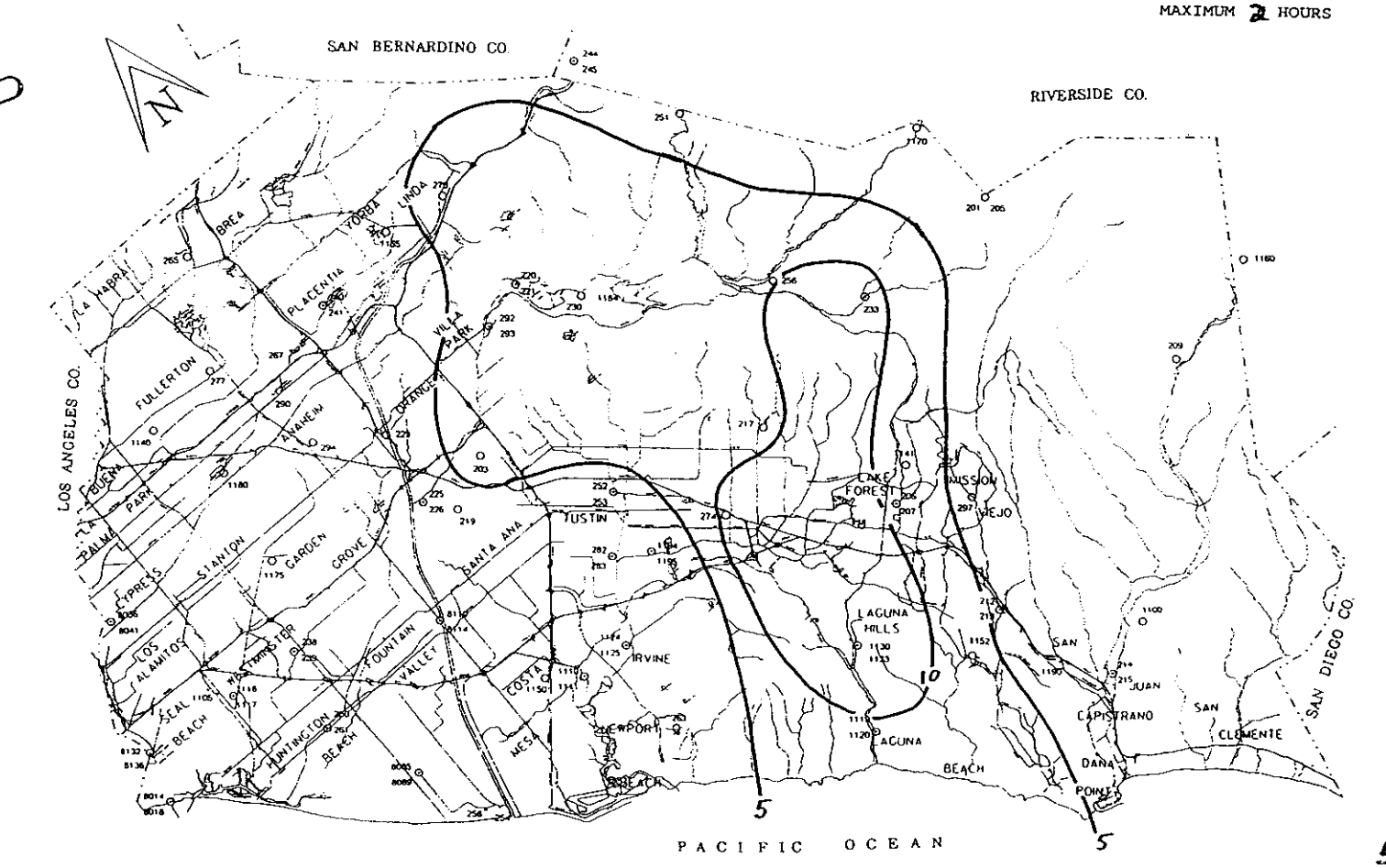
ISOFREQUENCY MAP
JANUARY 10, 1995
MAXIMUM 3 HOURS



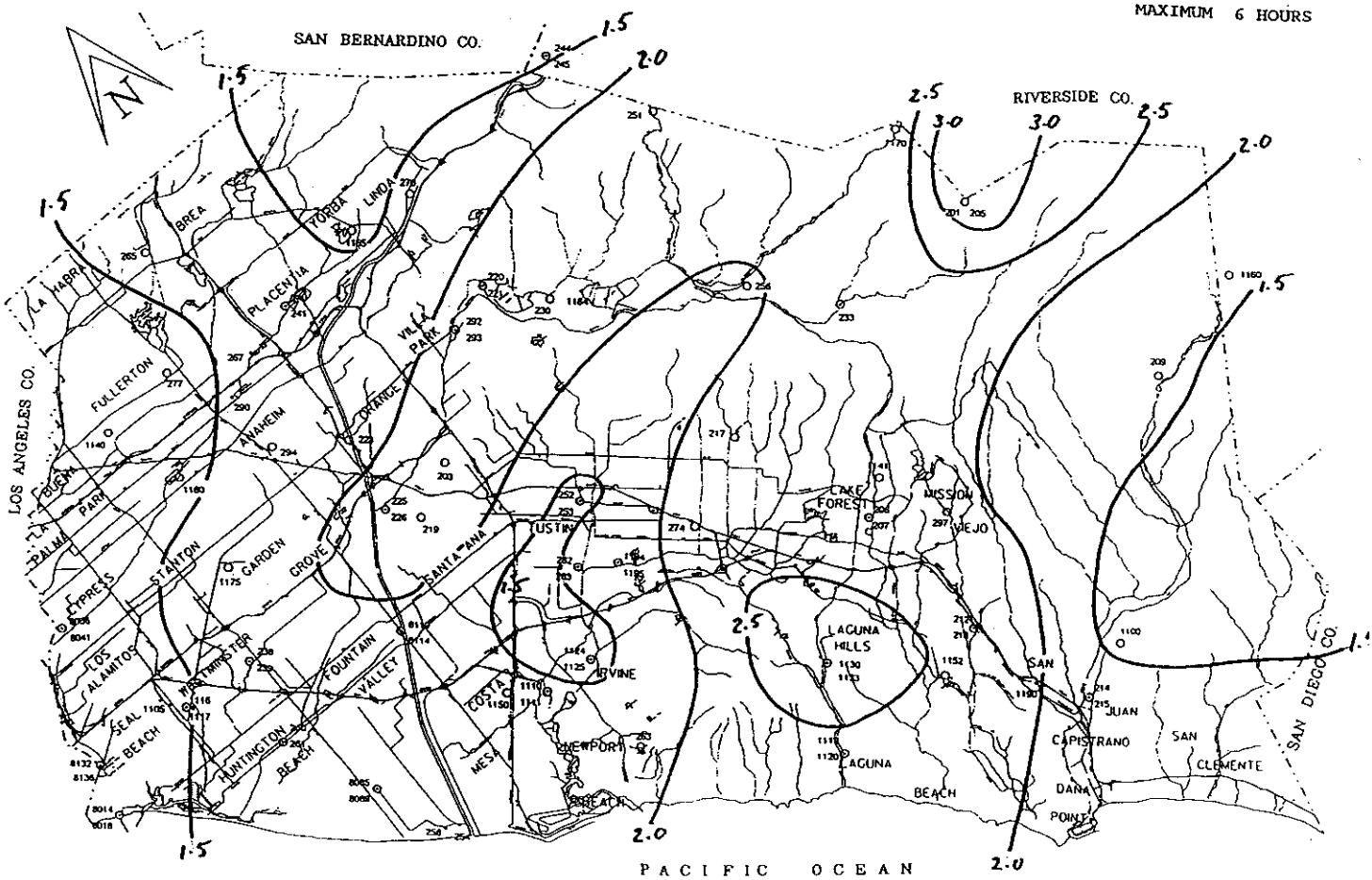
ISOHYETAL MAP
JANUARY 10, 1995
MAXIMUM 2 HOURS

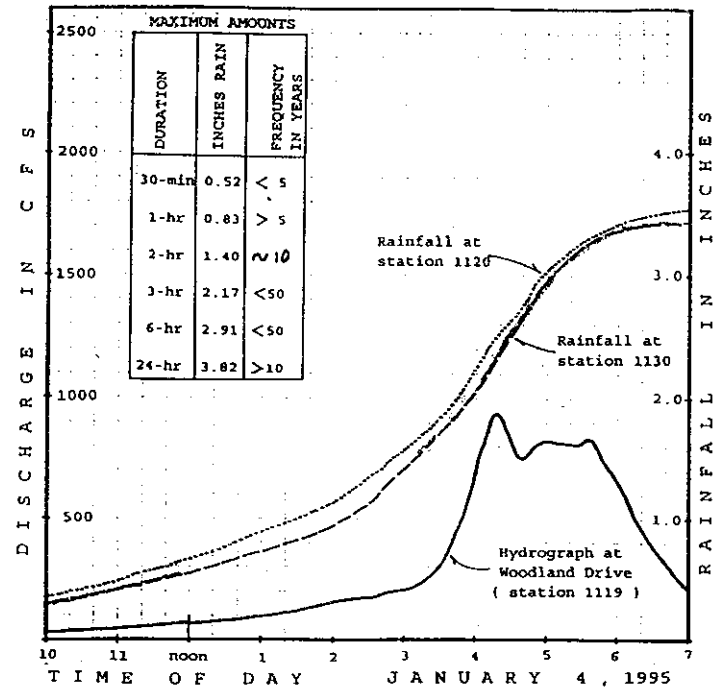


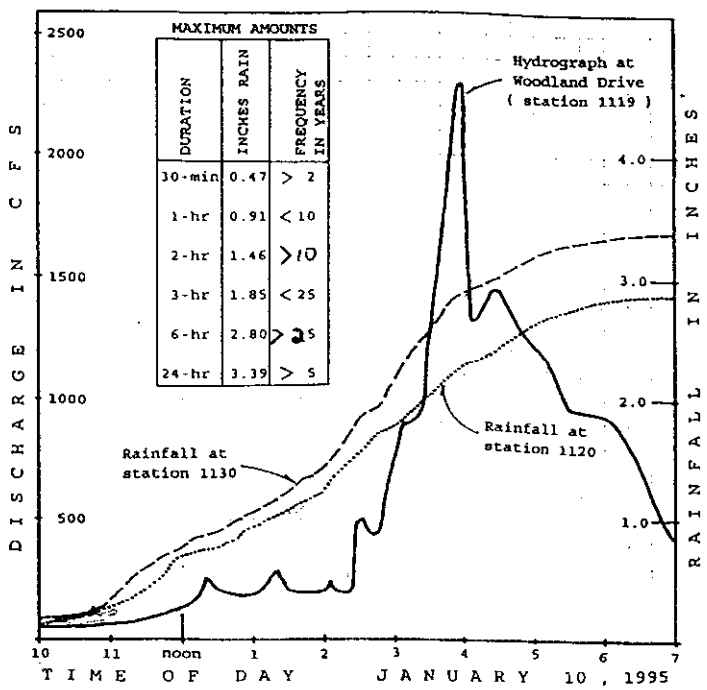
ISOFREQUENCY MAP
JANUARY 10, 1995
MAXIMUM 2 HOURS

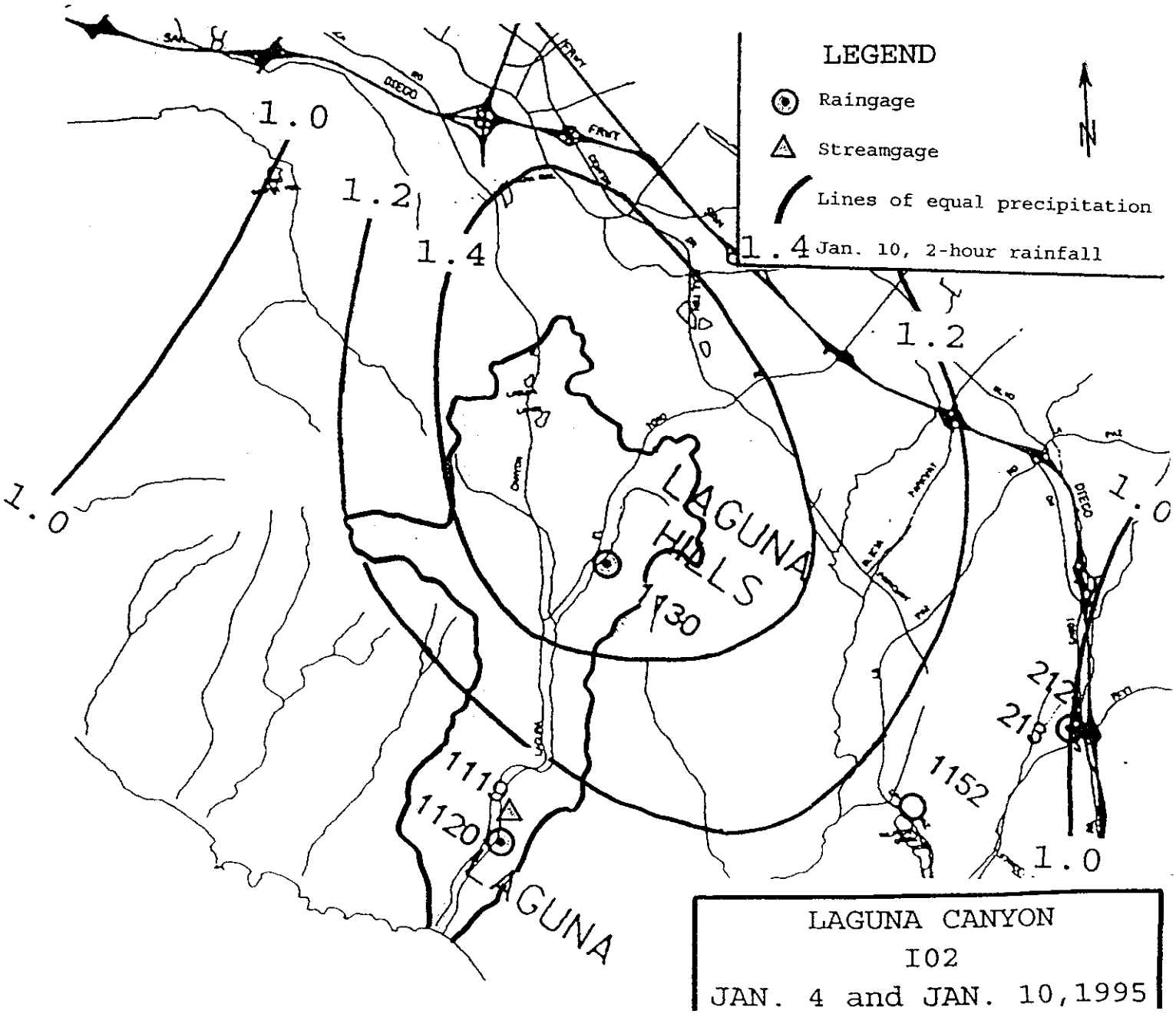


ISOHYETAL MAP
JANUARY 10, 1995
MAXIMUM 6 HOURS

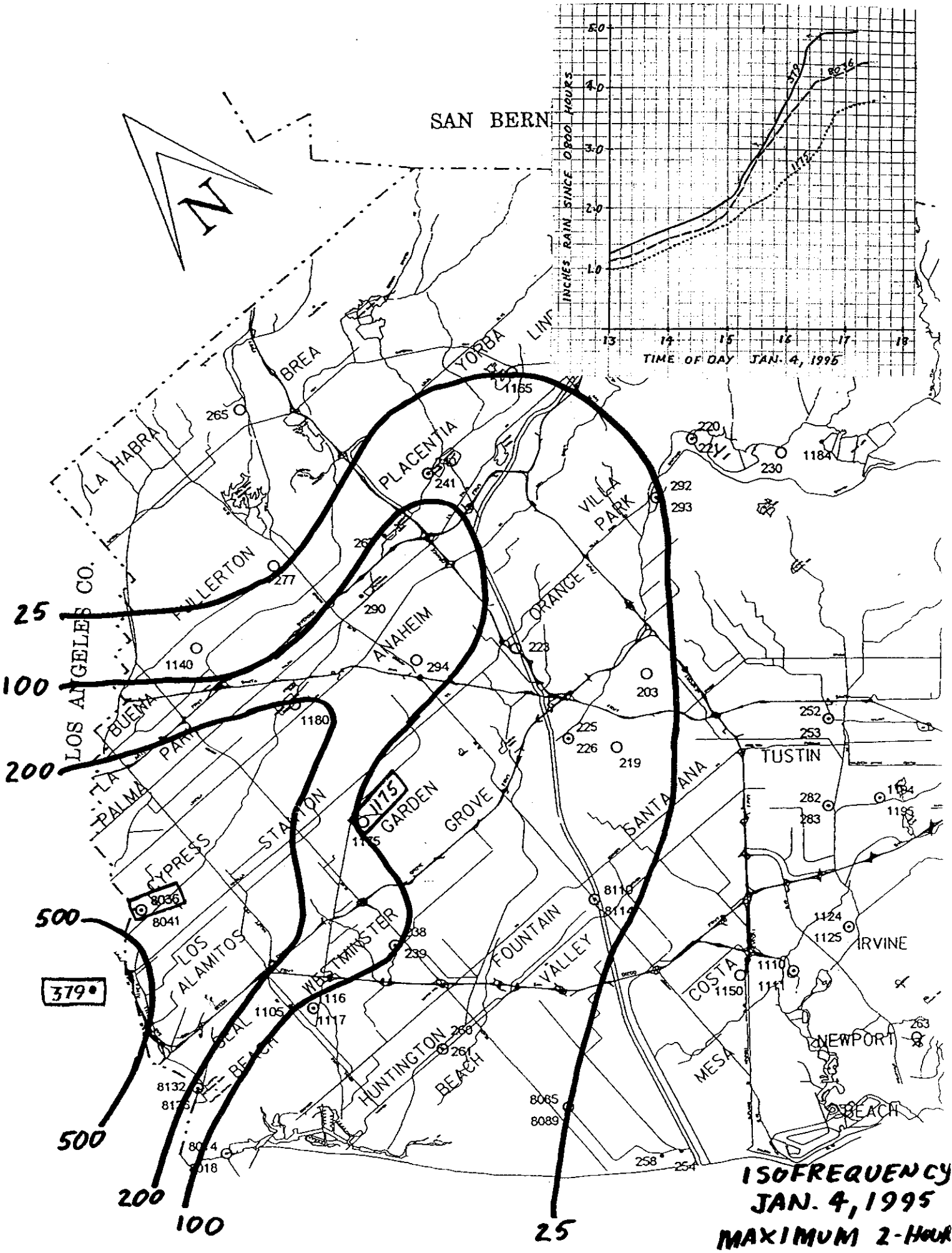


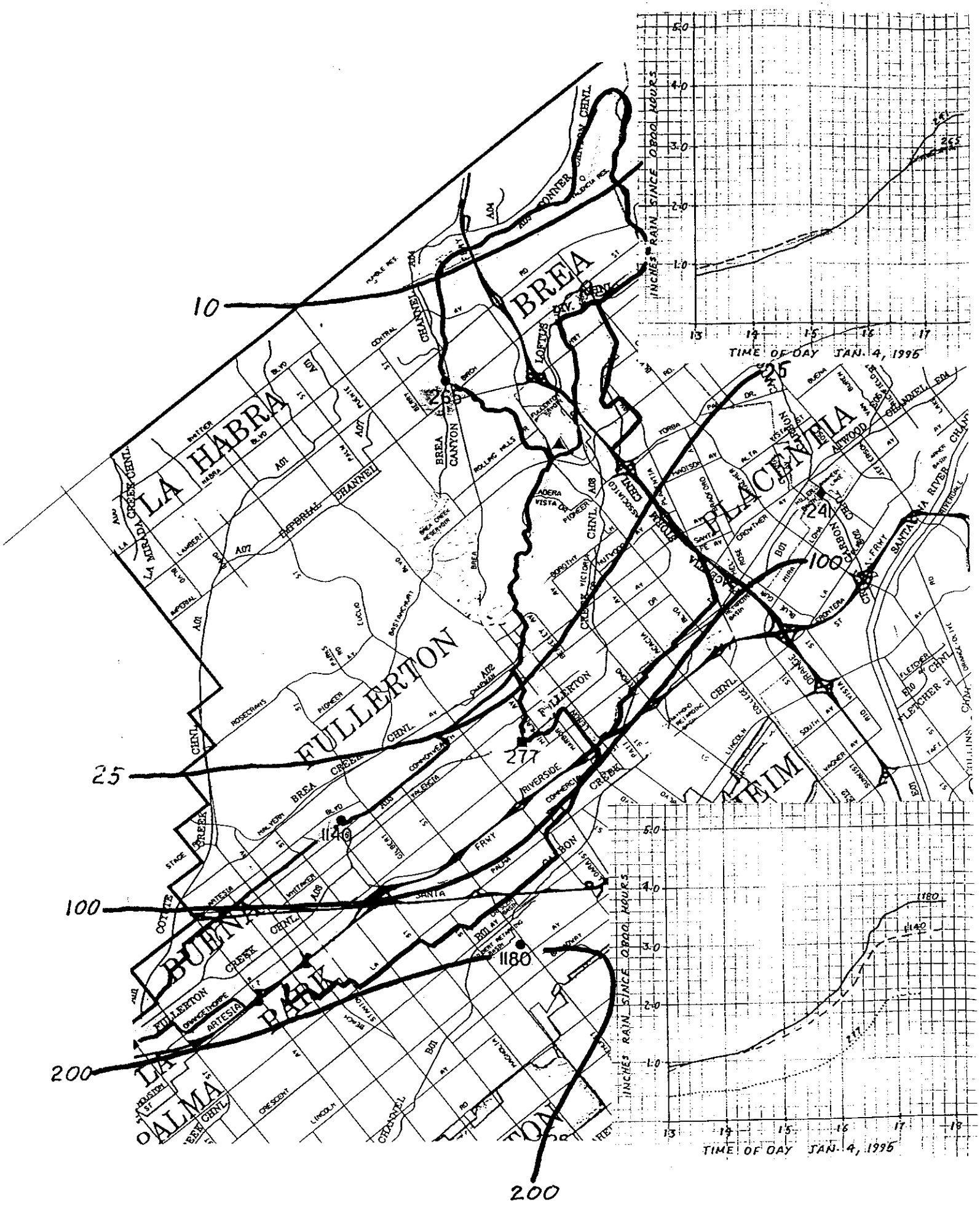


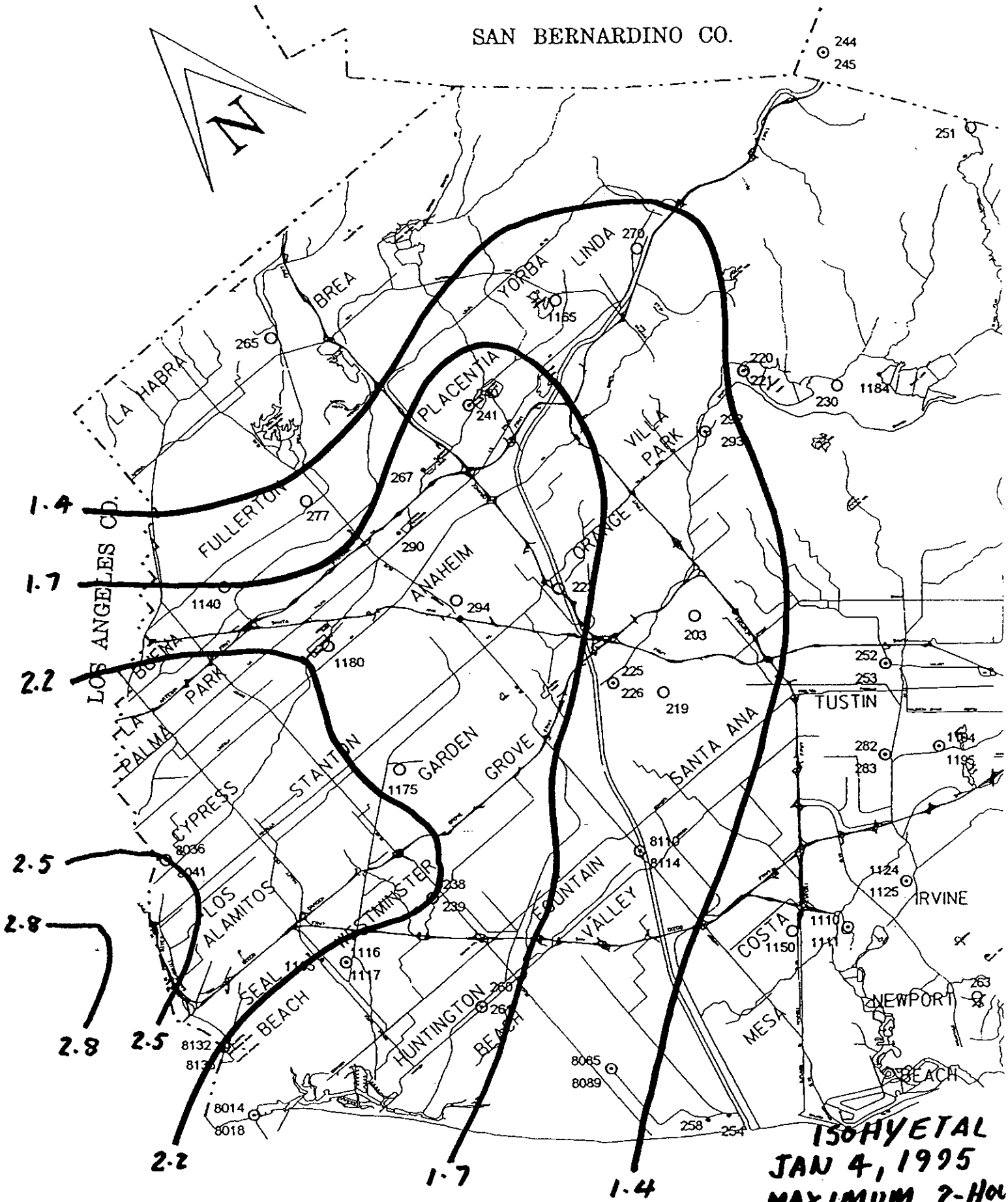


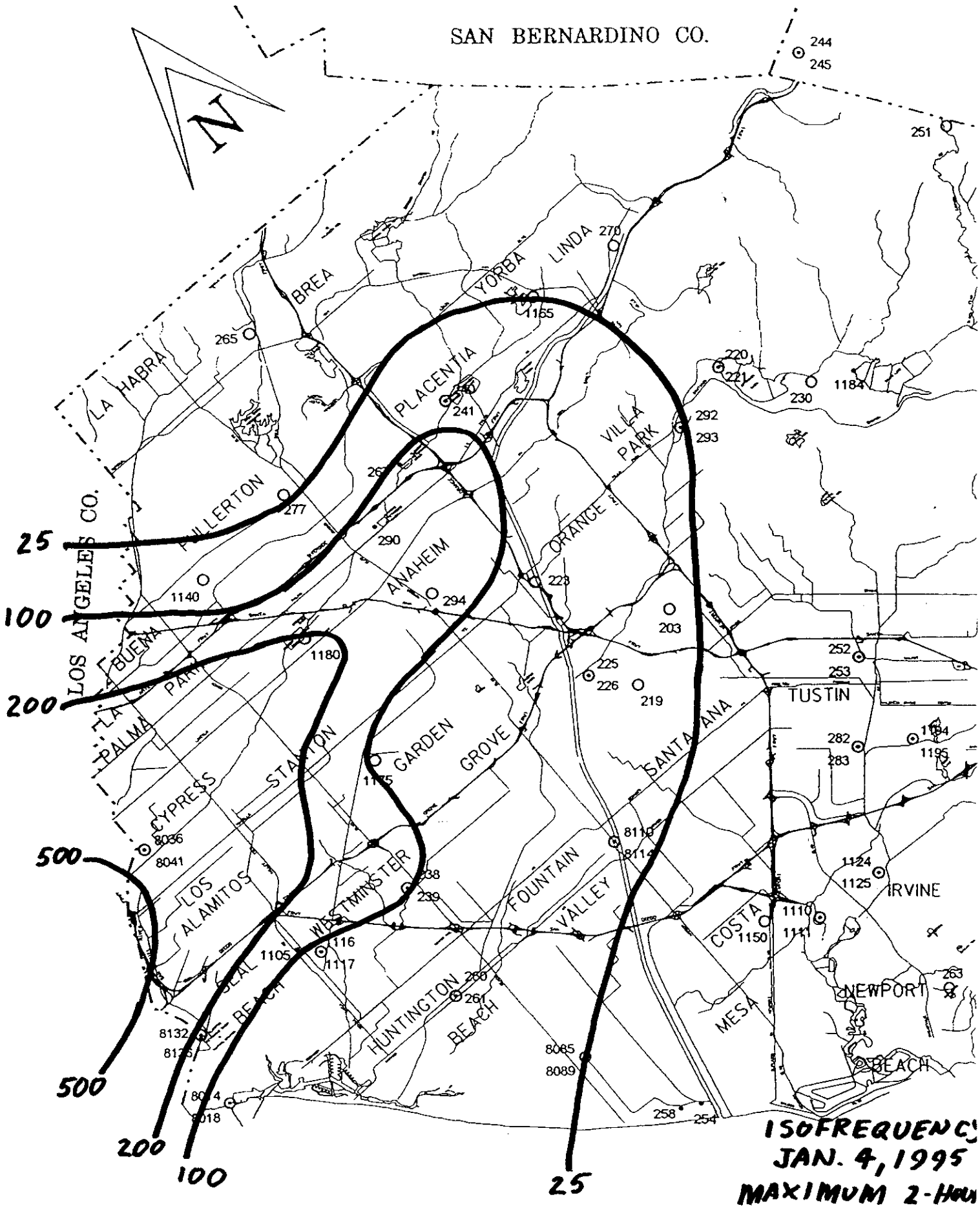


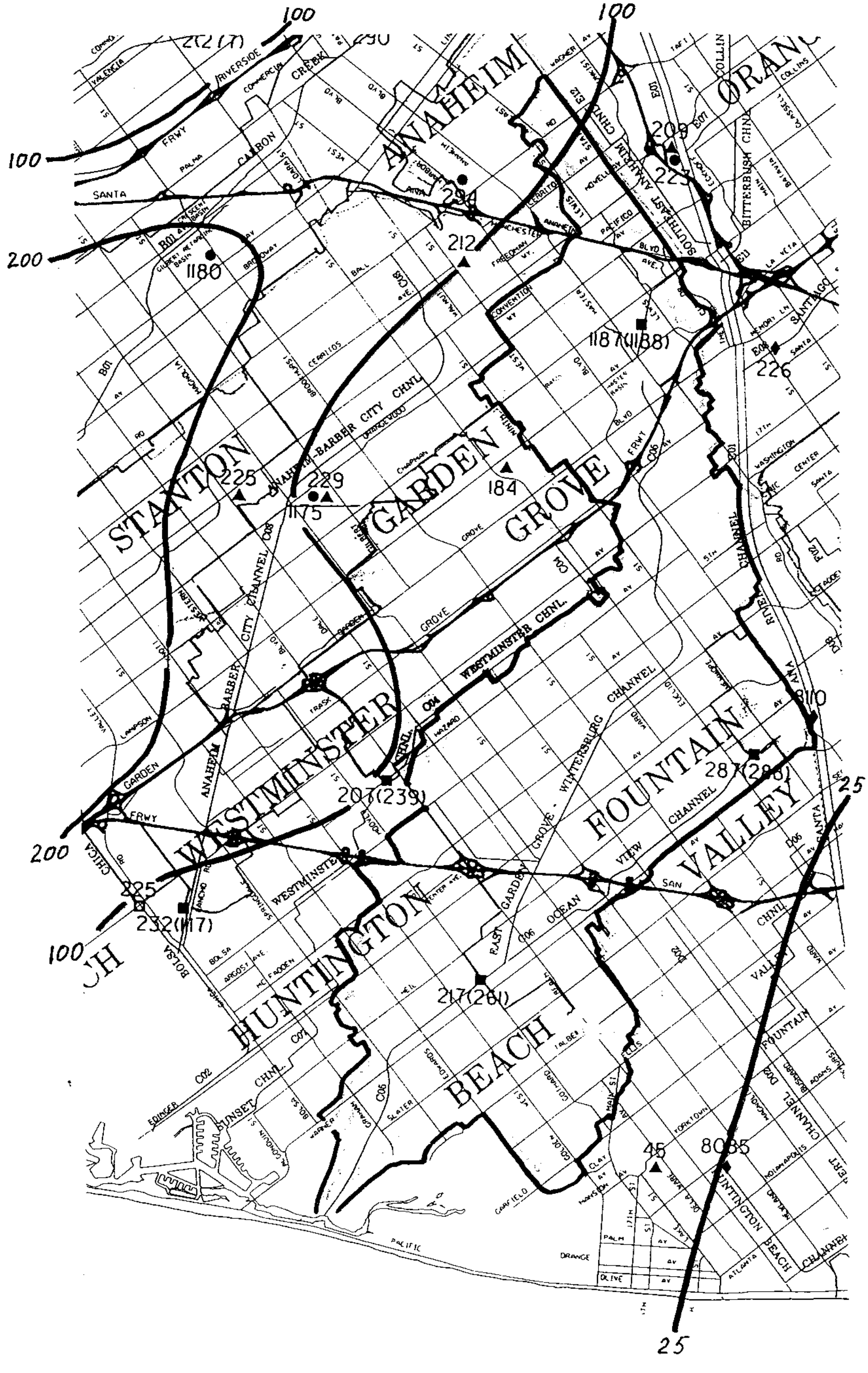
LAGUNA CANYON
I02
JAN. 4 and JAN. 10, 1995


SAN BERN
N
INCHES RAIN SINCE 0800 HOURS
5.0
4.0
3.0
2.0
1.0
13
14
15
16
17
18
TIME OF DAY JAN. 4, 1995
379
1175
BREA
YORBA LINDA
LA HABRA
PLACENTIA
FULLERTON
ANAHEIM
ORANGE
VILLA PARK
BUENA PARK
LA PALMA
CYPRESS
STANTON
GARDEN GROVE
SANTA ANA
TUSTIN
LOS ALAMITOS
WESTMINSTER
FOUNTAIN VALLEY
SEAL BEACH
HUNTINGTON BEACH
COSTA MESA
IRVINE
NEWPORT BEACH
LOS ANGELES CO.
25
100
200
500
500
200
100
25
ISOFREQUENCY
JAN. 4, 1995
MAXIMUM 2-HOUR


BREA
LA HABRA
FULLERTON
PLACENTIA
BUENA PARK
ANAHEIM
10
25
100
200
24
277
1140
1180
BREA CANYON
BREA CREEK
RIVERSIDE FWY
SANTA ANA RIVER
INCHES RAIN SINCE 0800 HOURS
TIME OF DAY JAN. 4, 1995


SAN BERNARDINO CO.
N
LOS ANGELES CO.
1.4
1.7
2.2
2.5
2.8
2.8
2.5
2.2
1.7
1.4
LA HABRA
BREA
YORBA LINDA
PLACENTIA
VILLA PARK
FULLERTON
ANAHEIM
ORANGE
LA PALMA
BUENA PARK
CYPRESS
STANTON
GARDEN GROVE
SANTA ANA
TUSTIN
LOS ALAMITOS
SEAL BEACH
HUNTINGTON BEACH
FOUNTAIN VALLEY
COSTA MESA
IRVINE
NEWPORT BEACH
ISOHYETAL
JAN 4, 1995
MAXIMUM 2-Hou


SAN BERNARDINO CO.
N
LOS ANGELES CO.
LA HABRA
BREA
YORBA LINDA
PLACENTIA
FULLERTON
ANAHEIM
VILLA PARK
ORANGE
LA BUENA PARK
LA PALMA
CYPRESS
STANTON
GARDEN GROVE
SANTA ANA
TUSTIN
LOS ALAMITOS
SEAL BEACH
WESTMINSTER
FOUNTAIN VALLEY
HUNTINGTON BEACH
COSTA MESA
IRVINE
NEWPORT BEACH
25
100
200
500
ISOFREQUENC
JAN. 4, 1995
MAXIMUM 2-Hou


100
100
100
200
200
100
25
25
ANAHEIM
ORANGE
STANTON
GARDEN GROVE
WESTMINSTER
HUNTINGTON BEACH
FOUNTAIN VALLEY
294
212
209
223
1180
1187(1188)
226
225
229
1175
184
207(239)
287(288)
810
225
232(117)
217(281)
45
8085
SANTA
FRWY
RIVERSIDE
PALMA
CARBON
CREEK
CERRITOS
ANAHEIM-BARBER CITY CHNL
BARBER CITY CHANNEL
WESTMINSTER CHNL.
GARDEN GROVE - WINTERSBURG CHANNEL
OCEAN VIEW CHANNEL
HUNTINGTON BEACH CHANNEL
SUNSET
EDINGER
BOLSA
CHNL.
PACIFIC

B.4. UNIT HYDROGRAPH METHOD DESIGN STORM

The Orange County desgin storm shall be used for all unit hydrograph method calculations (Figures B-5a, b, c).

The point precipitation depths in Table B.2 shall be used for the single-day design storm.

For watersheds with detention basins, a multi-day storm shall be used as shown in Sections B.5 and B.6.

Due to the variations in point precipitation values between mountainous and nonmountainous areas, area averaging of rainfall is required when catchments include areas both above and below the 2,000-foot elevation.

TABLE B.2.

ORANGE COUNTY POINT PRECIPITATION DATA (inches)

	DURATION					
T-YR.	5M	30M	1H	3H	6H	24H
100	0.52(.78)	1.09(1.34)	1.45(1.94)	2.43(3.96)	3.36(6.19)	5.63(11.27)
50	0.45(.71)	0.98(1.19)	1.30(1.73)	2.19(3.52)	3.02(5.51)	5.07(10.02)
25	0.40(.63)	0.87(1.04)	1.15(1.51)	1.94(3.08)	2.71(4.81)	4.49(8.76)
10	0.34(.50)	0.72(.84)	0.95(1.22)	1.59(2.48)	2.20(3.87)	3.68(7.05)
5	0.26(.40)	0.59(.68)	0.78(.99)	1.31(2.01)	1.81(3.14)	3.03(5.71)
2	0.19(.26)	0.40(.45)	0.53(.66)	0.89(1.34)	1.22(2.09)	2.05(3.81)

NOTES:

(1.) Numbers in ( ) are from the Santiago Peak gage station #156, DWR depth-duration-frequency table (1983). Use in areas above 2,000 feet in elevation.

(2.) Precipitation data for nonmountainous areas taken from an average of 25 rain gages (see ref. 7). Use in areas below 2,000 feet in elevation.

(3.) All 5M values are extrapolations (see ref. 7).

(4.) M = minutes; H = hours.

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. BSN ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG	LOT	BMM	LATITUDE	LONGITUDE	COUNTY CODE
Y01 4300 15	IRVINE EVAPORATION	125	200	12	05S	10W	J	S	33.683	117.769	30

MAXIMUM PRECIPITATION FOR INDICATED DURATION D-DAYS H-HOURS

RETURN PERIOD IN YEARS	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	F-YR
2	0.00	.25	.30	.41	.55	.76	.92	1.18	1.52	1.91	11.88
5	0.00	.36	.44	.60	.82	1.12	1.35	1.74	2.25	2.81	16.72
10	0.00	.44	.54	.73	.99	1.36	1.64	2.10	2.72	3.41	19.79
20	0.00	.51	.63	.85	1.15	1.58	1.91	2.45	3.16	3.97	22.61
25	0.00	.53	.65	.88	1.20	1.65	1.99	2.55	3.30	4.14	23.48
40	0.00	.58	.71	.96	1.31	1.80	2.16	2.78	3.59	4.50	25.28
50	0.00	.60	.74	1.00	1.36	1.86	2.24	2.88	3.72	4.67	26.11
100	0.00	.67	.82	1.10	1.51	2.07	2.49	3.19	4.13	5.18	28.64
200	0.00	.73	.90	1.21	1.65	2.27	2.73	3.50	4.53	5.68	31.09
1000	0.00	.88	1.07	1.45	1.98	2.72	3.27	4.20	5.43	6.81	36.57
10000	0.00	1.08	1.32	1.79	2.43	3.34	4.03	5.16	6.68	8.37	44.07
PMP	0.00	2.16	2.64	3.58	4.88	6.70	8.06	10.34	13.38	16.77	91.65
MEAN	0.000	.271	.331	.448	.610	.838	1.009	1.295	1.674	2.098	12.738
CLOCK HR. COR.	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CALCULATED SKEW	0.000	.420	.252	.088	.299	.634	1.025	.755	.718	1.205	1.026
REGIONAL SKEW	0.000	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.000
SKEW USED	0.000	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.000
KURTOSIS	0.000	2.733	2.614	2.849	2.958	2.866	3.796	3.271	3.192	4.216	3.538
N	0	44	44	44	44	44	44	44	44	44	43
RECORD YEAR	0	1953	1981	1961	1969	1969	1946	1969	1969	1969	1978
RECORD MAXIMUM	0.000	.510	.590	.760	1.050	1.450	2.020	2.560	3.540	4.840	27.400
NORMALIZED MAX	0.000	2.307	2.282	2.245	2.416	2.150	2.639	2.672	2.782	2.748	2.510
CALC. COEF. VAR	0.000	.383	.343	.311	.298	.340	.379	.366	.401	.475	.459
REGN. COEF. VAR	0.000	.466	.466	.466	.466	.466	.466	.466	.466	.466	.413
USED COEF. VAR	0.000	.466	.466	.466	.466	.466	.466	.466	.466	.466	.413
MEAN/A	0.0000	.0213	.0260	.0351	.0479	.0658	.0792	.1016	.1314	.1647	1.0000
RP10/A	0.0000	.0346	.0422	.0571	.0779	.1069	.1287	.1651	.2135	.2676	1.5536
RP25/A	0.0000	.0420	.0513	.0693	.0945	.1298	.1563	.2005	.2593	.3250	1.8436
RP50/A	0.0000	.0473	.0578	.0782	.1066	.1463	.1762	.2260	.2923	.3664	2.0499
RP100/A	0.0000	.0525	.0641	.0867	.1183	.1623	.1955	.2508	.3243	.4065	2.2483
RP1000/A	0.0000	.0690	.0843	.1140	.1555	.2134	.2570	.3297	.4263	.5344	2.8714
RP10000/A	0.0000	.0848	.1036	.1402	.1911	.2624	.3160	.4053	.5242	.6570	3.4602
PMP/A	0.0000	.1699	.2076	.2808	.3829	.5256	.6331	.8120	1.0501	1.3163	7.1950

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

LOCATION	PEAK DISCHARGE JAN. 4, 1995			HISTORICAL		RECORD	DESIGN Q	
	CFS	TIME	CFS/ACRE	CFS	DATE	BEGAN	WITH FREEBOARD	WITHOUT FREEBOARD
Fullerton Cr @ Richman	2680	1710	.3	2760	1983	1961	3000	4400 *
Westminster Ch @ Hazard	1160	1730	.3	1480	1983	1968	1100	1800 *
E. Garden Grove - Wintersburg @ Gothard	4000	1730	.3	4000	1980	1968	2980	4300 *
Oso Cr. @ Crown Valley Parkway	7800		.9	8000 #	1993	1971	7600	-
Santa Ana - Delhi Ch. @ Irvine Ave	4800	1650	.4	4800	1992	1971	8700	11600 *
Laguna Canyon Ch @ Woodland	1150	1620	.2	1398	1983	1973	2000	2950 *
Bolsa Chica Ch. @ Westminster	>5000	1700	.8	5740	1986	1986	-	-
San Diego Cr. @ Campus Dr.	23000	1815	.3	16400	1992	1978	-	-
Peters Canyon Wash @ Barranca								
Anaheim - Barber City @ Ranch Rd	11300	1700	1.2	6080	1992	1987	6200	11300 *
Alameda Storm Ch @ Hewes	500	1710	1.8	1490	1983	1938	1200	2000 *

* Estimated

\# Conflicting information