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DEPARTMENT OF PLANNING
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LOS WILLOWS
REVISED DRAINAGE/FLOODING

P 03-127
ER 10-02-009

PREPARED BY:

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Revised: 11/20/08

LOS WILLOWS
REVISED DRAINAGE
MAJOR DRAINAGE CHANNEL

NORTHEAST WATER SHED LENGTH UPPER AREA L=8000
H=1861-825=1036

AREA= 500 ACS S=12.9%

SOIL GROUP C=0.342 Tc= 17.1+6.9

Q100=0.342(3.4)(500) Tc=24 mins

Q^2100=581 cts I= 3.4 in/hr

EAST WATER SHED LENGTH UPPER SECTION L=6,400 FT
H=1681-825=856 FT.

AREA= 350 ACS S= 13.4%

SOIL GROUP C= 0.32 Tc= 13.2+6.9

Q100= 0.32(3.9)(350) Tc= 20.1 mins

Q^1100=437 I= 3.9 in/hr

Q @ JUNCTION

$$Q\ T = Q + \frac{T^1}{T^2} O^2$$

$$Q\ T = 437 + \frac{20.1}{24}\ 581 = 923 \text{ cfs}$$

LOWER SECTION TRAVEL TIME TO SITE L= 10,800 H= 363

OVERALL CHANNEL n= 0.05 S= 3.4%
S 1/2= 0.184

$$Q = \frac{1.486}{0.065}(100)(2.14)(0.184)$$

Q= 900 cfs

$$V = \frac{Q}{A} = \frac{900}{100} = 9 \text{ FT/SEC}$$

a=50+50=100

WP= 32 $r = \frac{100}{32}$ r 2/3=2.14

TOTAL AREA= 2350 ACS

$$Ti = \frac{10,800}{9(60)} = 20 \text{ mins}$$

Tt = 20 + 24 = 44 mins

I100 = 2.3 in Hr

SOIL GROUPS = 1/4 D + 1/8 C + 5/8 B

1/2 AREA NATURAL 1/2 LOW DENSITY

CAVG = 1/4 (0.38)+1/8(0.33) + 5/8 (0.285)

CAVG = 0.095 + 0.041 + 0.178

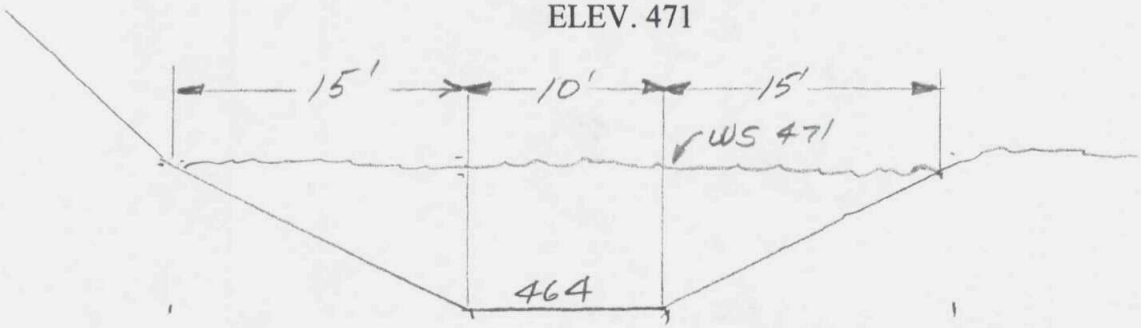
CAVG = 0.314

QT = 0.314(2.3) (2350)

<u>QT = 1697 cfs</u>

CAPACITY CHANNEL
ENTRANCE TO LOS WILLOWS

WATER SURFACE
ELEV. 471



A= ½ 15 (7) + 7' x 10' + ½ 15' (7)

$S = \frac{464 - 461.4}{260}$

S = 1% S ½ = 0.1

A = 52.5 + 70 + 52.5 = 175 sq ft

WP = 43 r 2/3 = 2.55

USE n = 0.04

$Q = \frac{1.486}{N}$ ar 2/3 51/2

$Q = \frac{1.486}{0.04}$ (175) (2.55) (0.1)

Q = 1657 cfs ~ 1697

V = Q/A = 9.7 FT/ SEC

Q channel = Q runoff

∴ OK

DEPTH OF WATER @ NORTH PL.

FLOWING ONTO LOS WILLOWS

7 FT.

TAZA CREEK
USE RATIONAL METHOD

AREA 90 ACS

SOIL GROUP ½ NATURAL ½ LOW DENSITY
C = 3/8 B + ½ C + 1/8 D = 3/8 (0.285) + ½ (0.36) + 1/8 (0.38)

C = 0.34
AVG.

WATER SHED LENGTH 4800 FT.
WATER SHED H = 932 – 462 = 470'
S = 10.4%

Tc = 12 + 6.65
Tc = 18.6

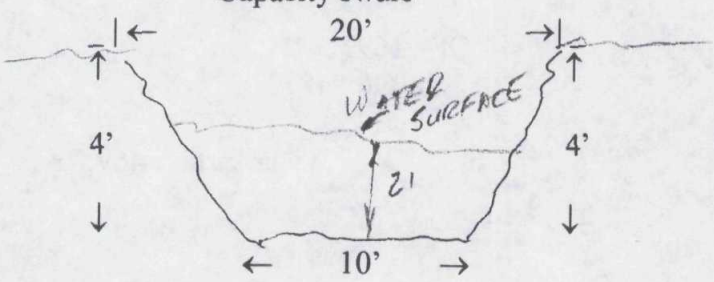
Q = CIA

Q_{100} = 0.34 (4) (90)

I_{100} = 4 in/hr

Q_{100} = 122.4 cfs

Capacity swale



Scope = 1%

S ½ = 0.1

ASSUME 2' DEPTH
N = 0.04
Q = $\frac{1.486}{N}$ a r 2/3 S ½

a = 20 + 4 = 24
wp = 14.6
r = $\frac{24}{14.6}$ = 1.64
r 2/3 = 1.4

Q = $\frac{1.486}{0.04}$ (2.4)(1.4)(0.1)

Q = 124 cfs EXCEED 122 cfs
V = 5.2 ft/sec.
∴ OK

DEPTH WATER TAZA CREEK 2 ft.

LOS WILLOWS
WEST SIDE

AREA 32 Acs

LENGTH WATERSHED = 2000

HEIGHT WATERSHED H =463 FT

H = 463 FT.

5 = 23%

SOIL GROUP B
LDR-1

TL = 5 + 6.4 (LDR1)
TC = 11.4 mins

C = 0.32

I 100 = 5.5 in/hr

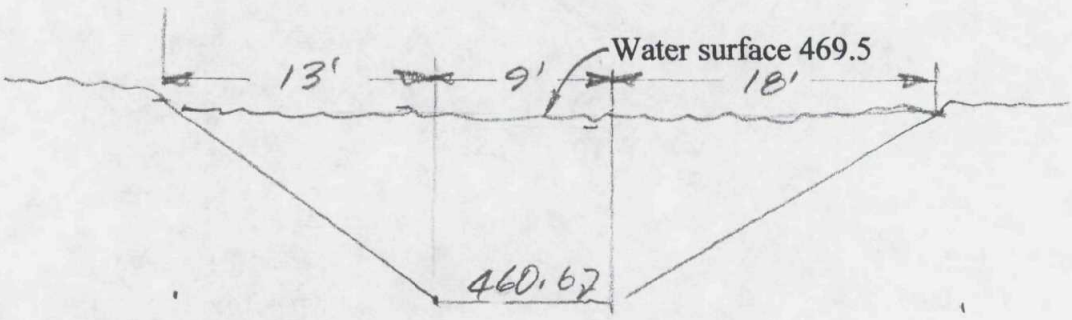
Q100 = 0.32 (5.5)(32)

Q100 = 56 cfs

CAPACITY NATURAL SWALE EXCEEDS 56 cfs
∴ OK

CROSS SECTION CHANNEL
25' DOWN STREAM FROM DRIVEABLE BRIDGE

Qt = 1697 + 122 + 56
Qt = 1875



Area = 81 sf + 81 + 58.5 = 220.5 sq. ft.

Wp = 45

$$S = \frac{461.4 - 460.6}{100} = 0.8\%$$

S ½ = 0.089

$Q = \frac{1.486}{N} a\, r\, 2/3\ S\ ½$ $\qquad$ $r = \frac{220.5}{45} = 4.9\ \ r\ 2/3 = 2.89$

$Q = \frac{1.486}{0.04} = 220.5(2.9)(0.089)$

Q = 2106 cfs $\qquad$ V = 9.56 ft/sec.

Use 0.5+/- ft. freeboard $\qquad$ Water surface Elev. 469.5

Exceed 1875 ∴ OK

Water depth 9.9 ft.

FLOW MAJOR CHANNEL
SOUTH PROPERTY LINE

ELEVATION BEGIN CHANNEL 464 – 416 -48'
L = 1600 FT

Qt = 1697 + 122.4 + 56 + 30.7
Qt = 1906 cfs

ASSUME FLOW 7 FT/SEC S_{AVG} = 3%
T = 3.6 MINS S ½ = 0.173

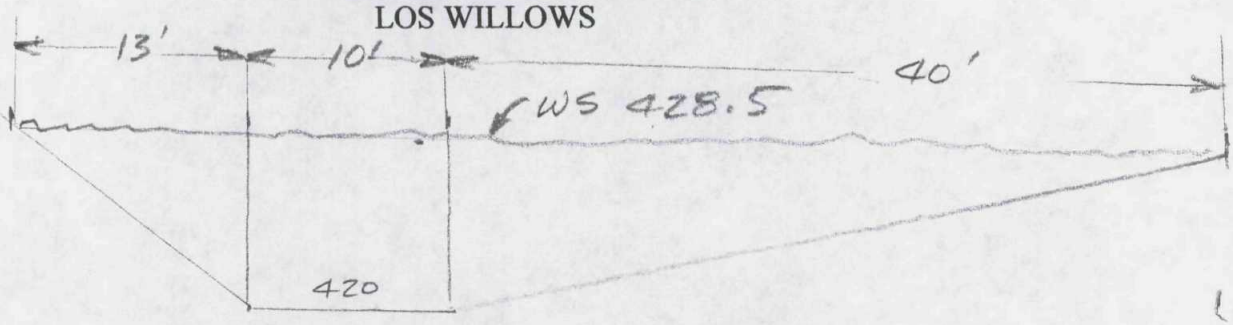
TT SOUTH PL. = 44 + 3.6 = 47.6 MINS

I_{100} = 2.3 IN/HR

AREA = 2488 SOIL C= 0.314

Q = 0.314(2.3)(2488)
Q_{100} = 1800 cfs

CAPACITY CHANNEL LEAVING
LOS WILLOWS



S = 1.25%
S ½ = 0.112

ASSUME WATER 8.5' DEEP

AREA = 34 + 85 + 85 = 204 $r = \frac{a}{wp} = \frac{204}{60} = 3.4$ r 2/3 = 2.26

CHANNEL n = 0.05

$Q = \frac{1.486}{0.04}(204)(2.26)(0.112)$
Q = 1918 cfs

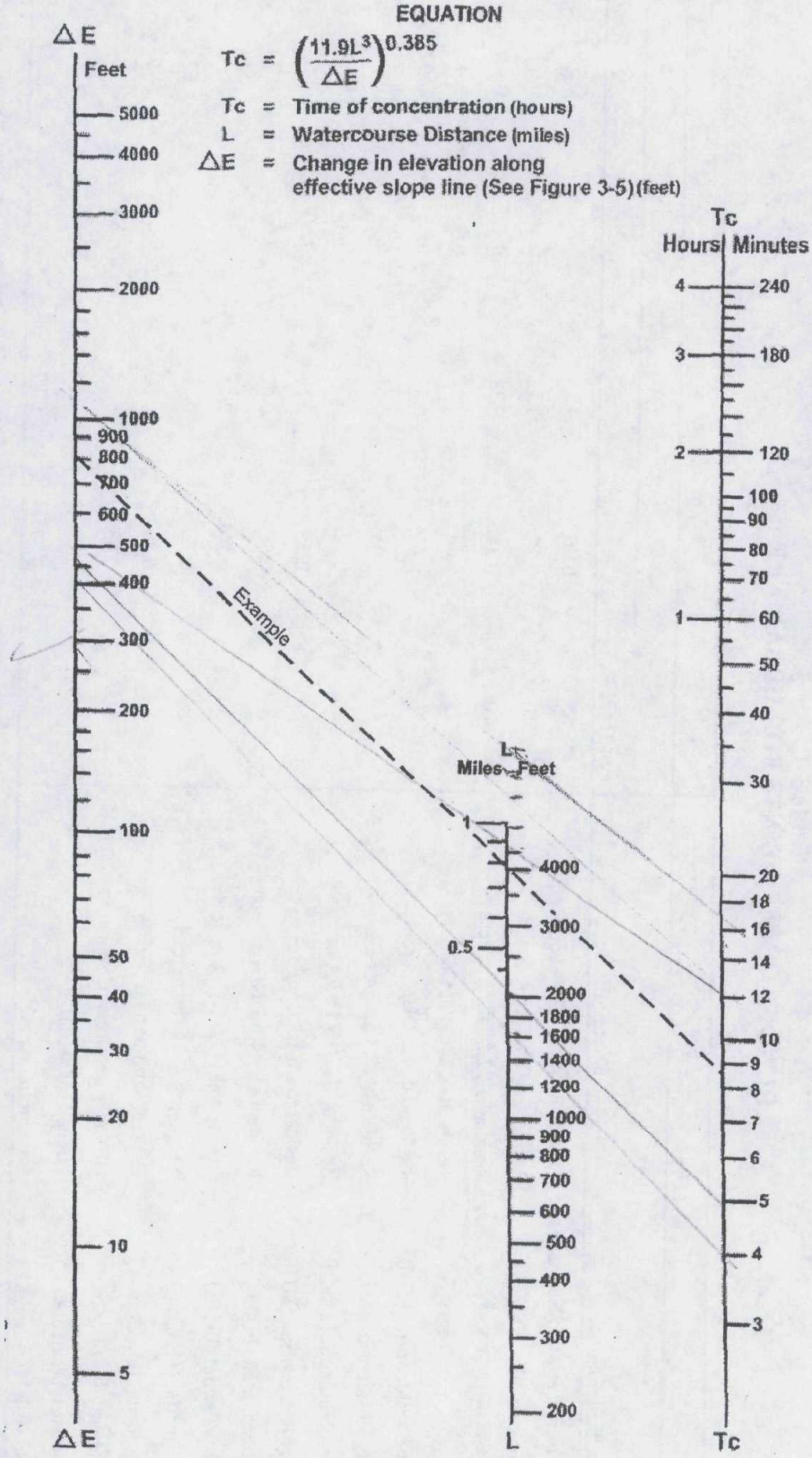
EXCEEDS 1906 cfs ∴ OK V = 9.4 ft/ sec.
DEPTH WATER LEAVING LOS WILLOWS AT SOUTH P/L = 8.5 ft

LOS WILLOWS
TABLE DRAINAGE AREAS

DESCRIPTION	AREA	LENGTH	HEIGHT	FLOW	VELOCITY
MAJOR DRAINAGE NORTH PL CHANNEL THROUGH PROPERTY	2350 ACS	3.64 MILES	1406 ft	1697 cfs	9.7 ft/sec.
TAZA CREEK	90 ACS	4800 ft	470 ft	122 cfs	5.2 ft/sec.
WEST SIDE	32 ACS	2000	463 ft	56 cfs	10 ft/sec.
SOUTH WEST AREA	16 ACS	1600	400 ft	31 cfs	10 ft/sec.
MAJOR DRAINAGE SOUTH PL.	2488	3.92 Miles	1454 ft	1906 cfs	9.4 ft/sec.

SUMMARY AND CONCLUSION:

a. This project is a completed project and no changes are proposed. Substantial damage was done to this site in the 1993 floods. The existing channelization was done under emergency repair using an S.B.A. Loan. The project will not alter the existing drainage pattern of the area or substantially increase the rate or amount of surface runoff in a manner that would cause either substantial erosion or substantial siltation on or offsite. The existing channel through the site is a natural channel with vegetation which will mitigate surface runoff.
b. The project has not altered the existing drainage patterns of the area and has not substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or offsite. The existing natural landscape channel through the site will mitigate runoff from the site. The existing natural lake onsite can also act as a natural detention basin.



SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

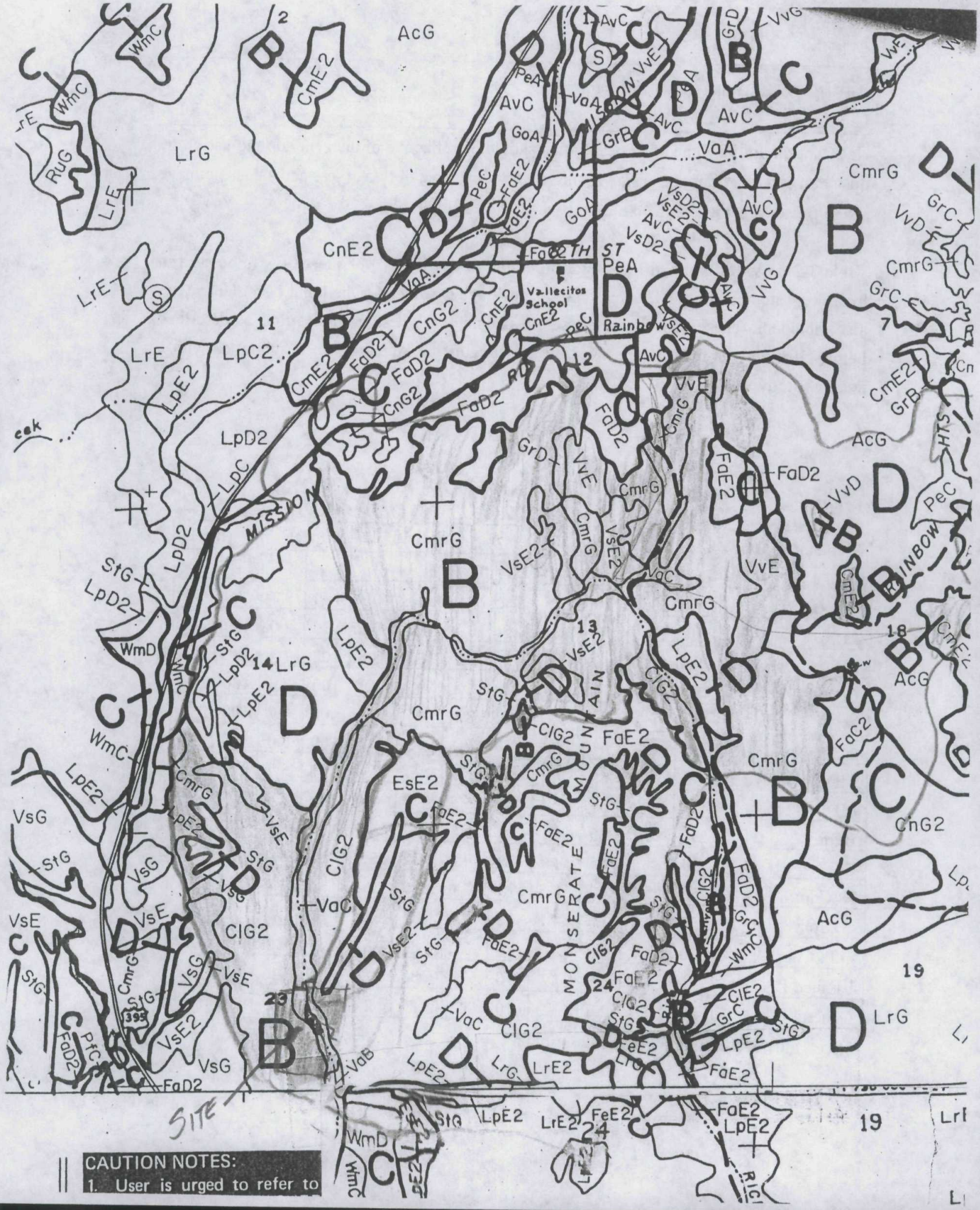
3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



CAUTION NOTES:
1. User is urged to refer to

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

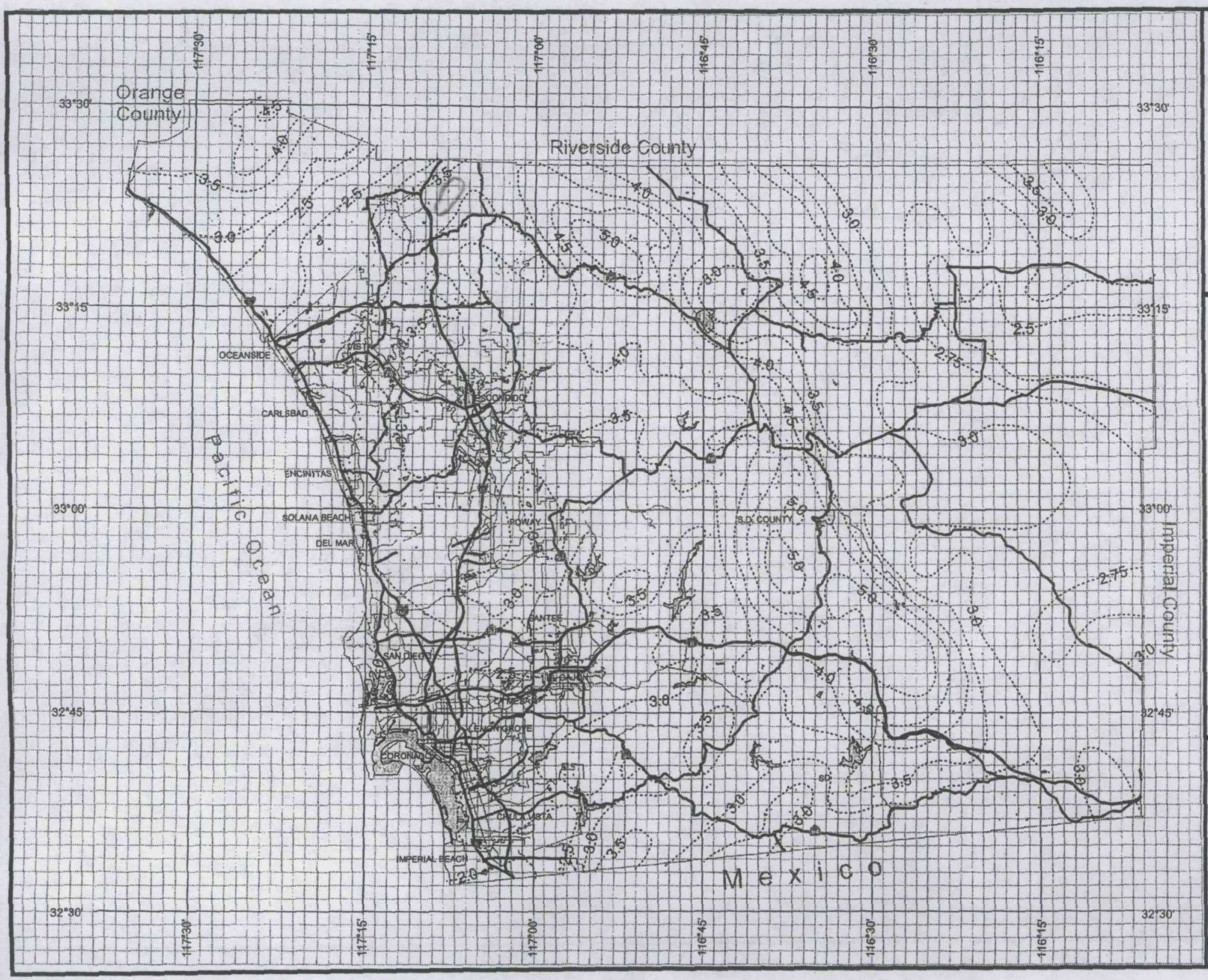
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/	.5%		1%		2%		3%		5%		10%	
	Acre	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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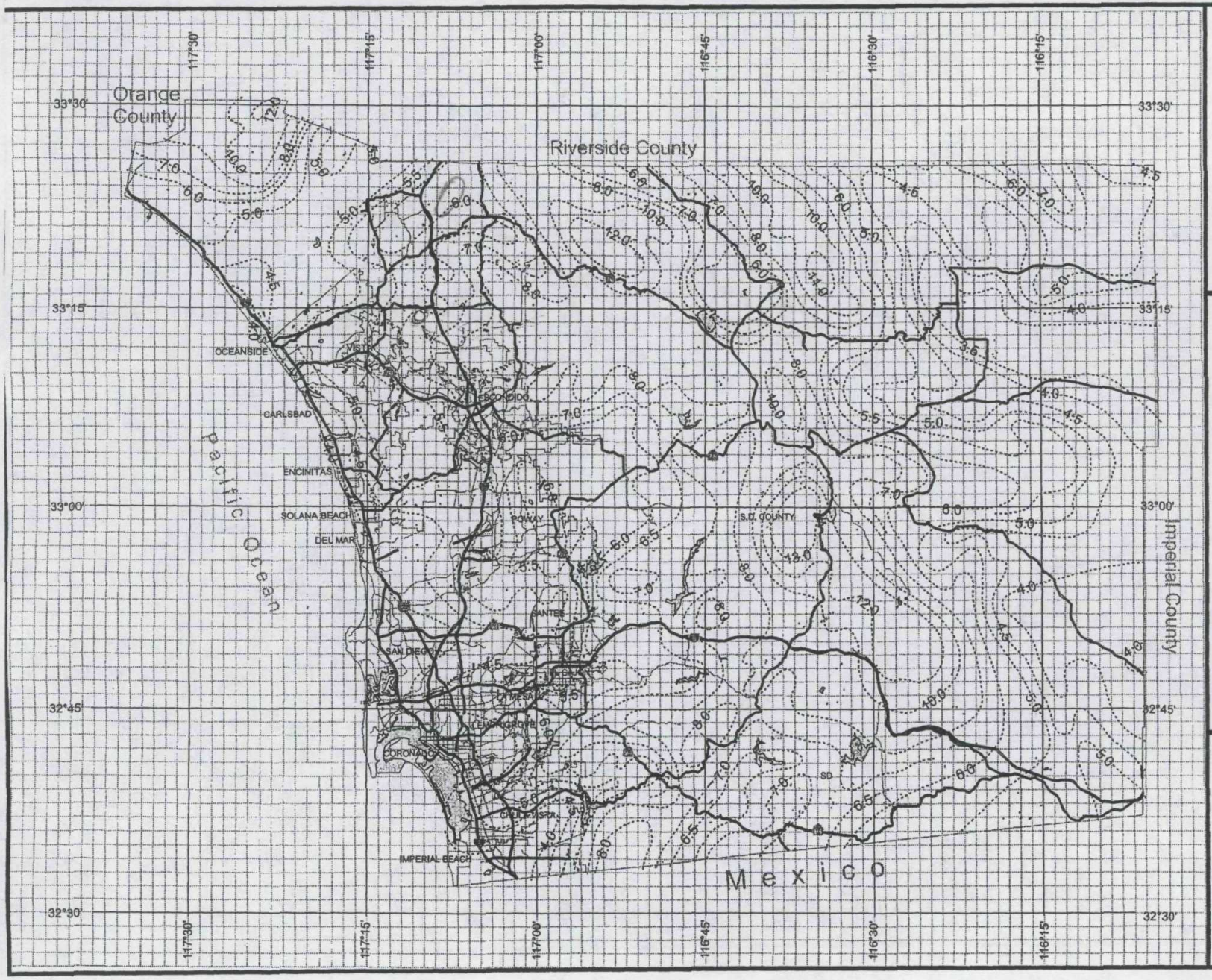

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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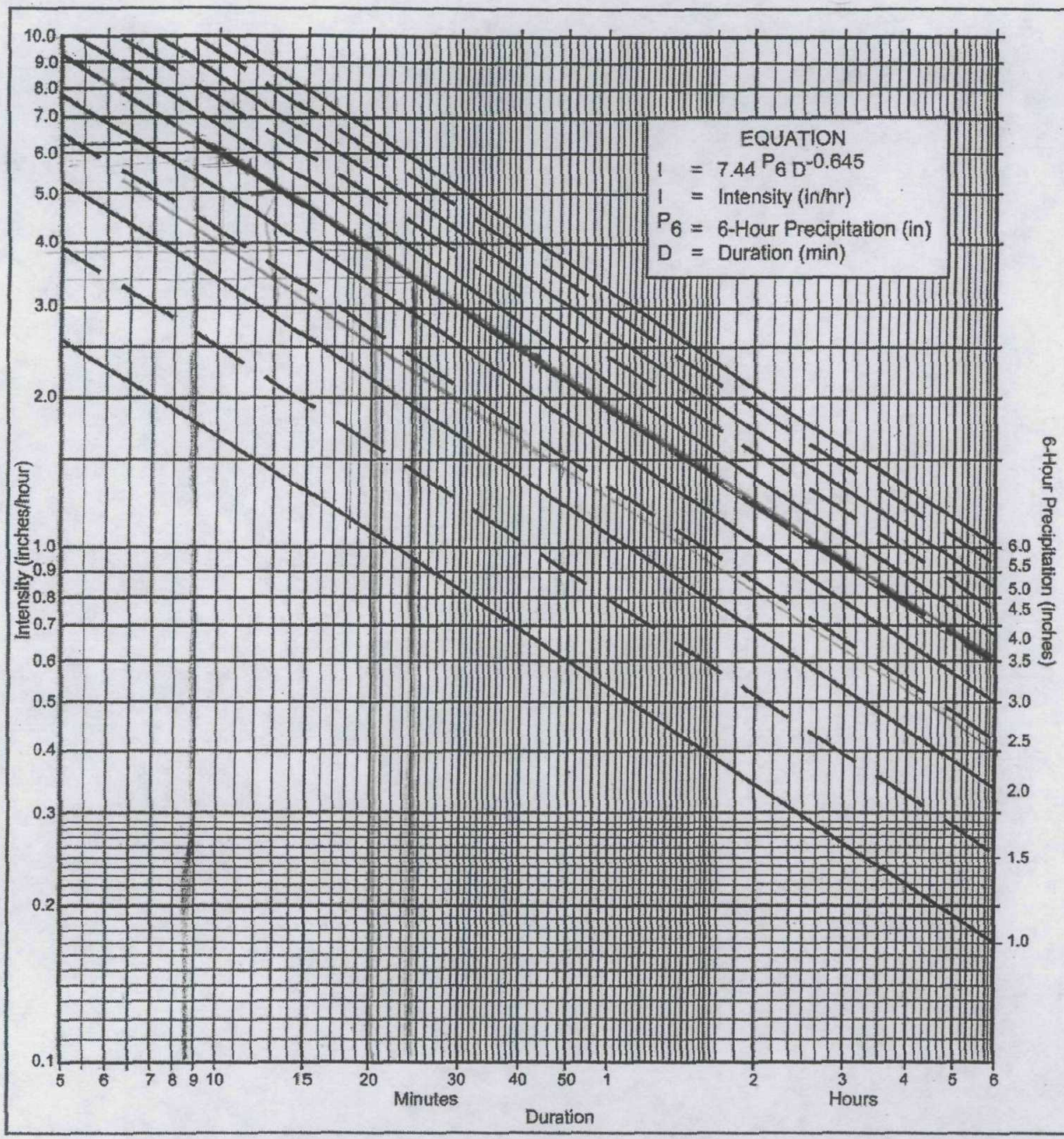


Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year
10

(b) P_6 = 3.5 in., P_{24} = 6.0, $\frac{P_6}{P_{24}}$ = 58 %(2)
2.4 4.0 60

(c) Adjusted P_6(2) = 3.5 in.
2.4

(d) t_x = 24 min. t_{20} = 20 minutes
24

(e) I = 3.4 in./hr. I_{100} = 3.9 in/HR
100

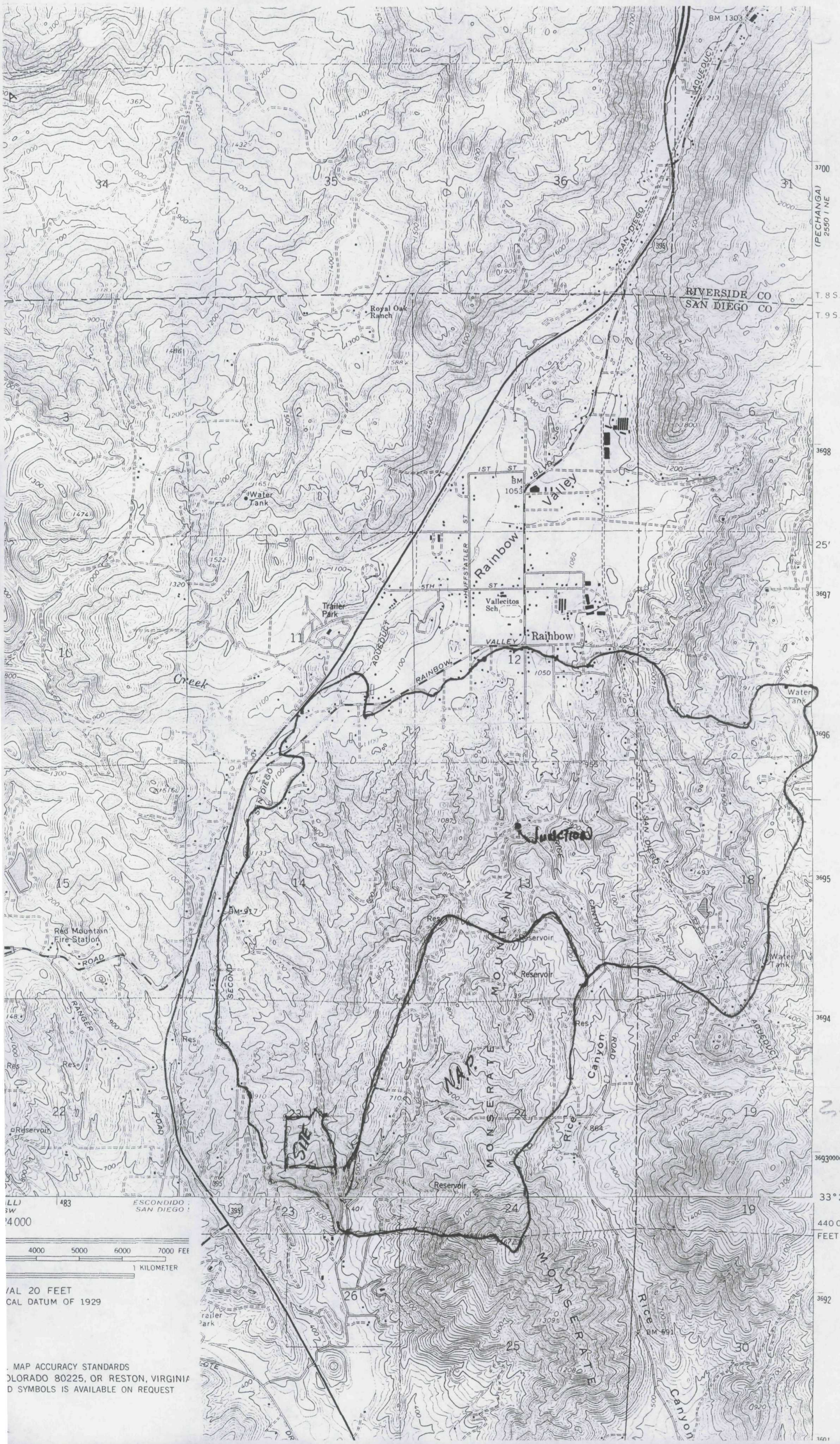
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1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RIVERSIDE CO
SAN DIEGO CO
T. 8 S.
T. 9 S.
Royal Oak Ranch
Water Tank
1ST ST
BLVD
BM 1053
Rainbow Valley
HUFFSTATLER ST
5TH ST
Vallecitos Sch
Rainbow
VALLEY
RAINBOW
Trailer Park
Creek
Junction
MONSERATE
CANYON
Reservoir
Red Mountain Fire Station
ROAD
SECOND
RANGER
Rice Canyon
SITE
N.A.P.
2200 ACS
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VAL 20 FEET
CAL DATUM OF 1929
MAP ACCURACY STANDARDS
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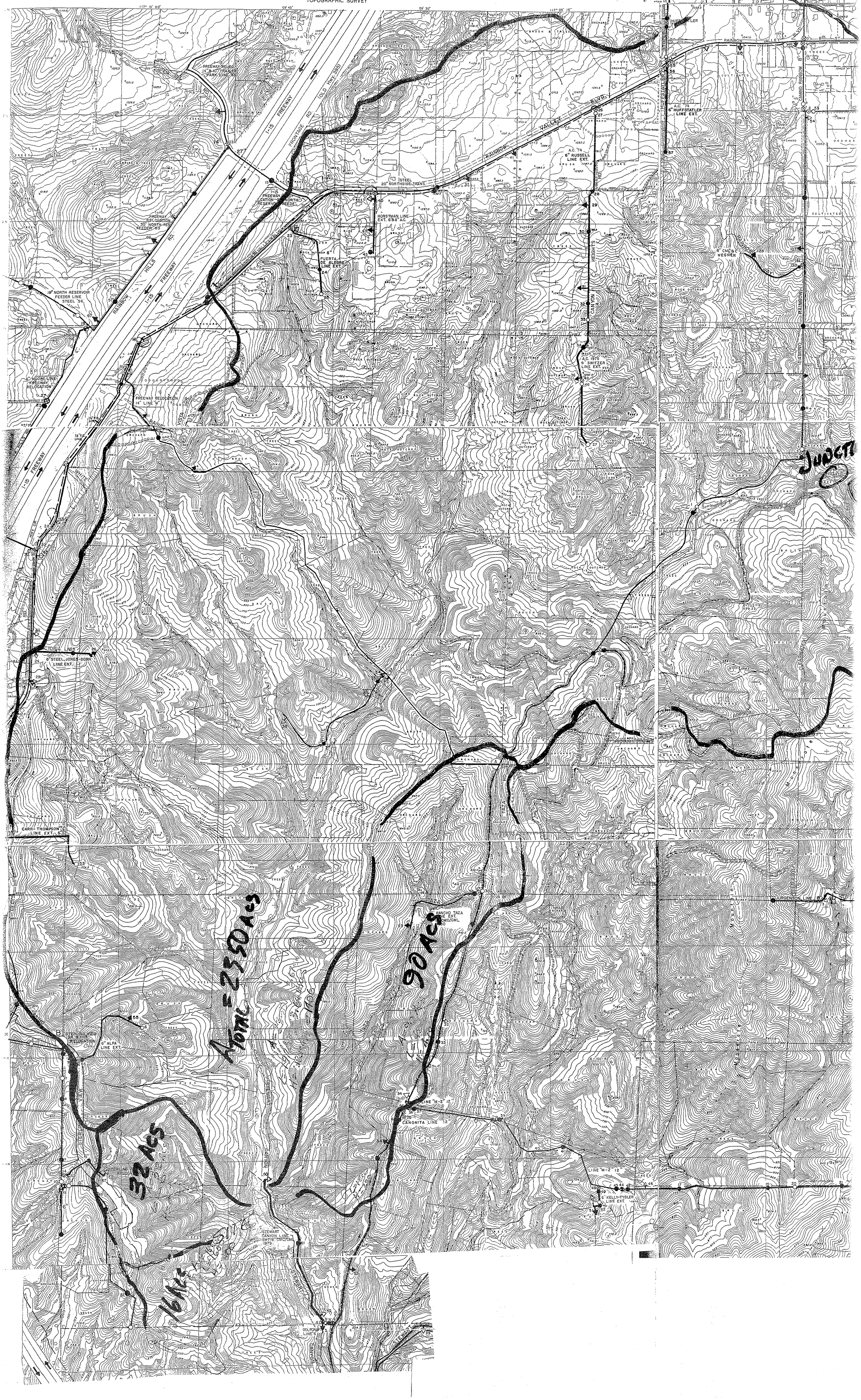
COUNTY OF SAN DIEGO

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