PRELIMINARY DRAINAGE STUDY

For

TENTATIVE PARCEL MAP 20800 RPL1

In The

Unincorporated San Diego County Community Of Fallbrook

TPM 20800 STP 06-013 ER 04-02-002

Prepared For

Cross Roads L.L.C.
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OCTOBER 2006

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DECLARATION OF RESPONSIBLE CHARGE

I HEREBY DECLARE THAT I AM THE CIVIL ENGINEER OF WORK FOR THIS PROJECT. THAT I HAVE EXERCISED RESPONSIBLE CHARGE OVER THIS PROJECT AS DEFINED IN SECTION 6703 OF THE BUSINESS AND PROFESSIONS CODE, AND THAT THE DESIGN IS CONSISTENT WITH CURRENT DESIGN.

I UNDERSTAND THAT THE CHECK OF PROJECT DRAWINGS, SPECIFICATIONS AND TECHNICAL STUDIES BY THE COUNTY OF SAN DIEGO IS CONFINED TO A REVIEW ONLY AND DOES NOT RELIEVE ME, AS ENGINEER OF WORK OF MY RESPONSIBILITIES FOR PROJECT DESIGN.

10-18-06

KEVIN P. BRESNAHAN DATE

R.C.E. 59954 EXP. 06-30-08

SECTION 1.0 INTRODUCTION

Project Location 1.1

The project is located in the unincorporated community of Fallbrook (See Appendix A, Site Exhibits). The 15.73-acre site is approximately 5 miles due east of downtown Fallbrook and adjacent to Old Highway 395 and Interstate 15. Access to the project area is from Reche Road. Specifically, Ranger Road is about two tenths of a mile west of Old Highway 395 along Reche Road. The project consists of two parcels, APN 108-161-0500 and APN 108-161-0600. Both are located on the east side of Ranger Road. The site address is 1248 Ranger Road. The site can be described as being a portion of Monserate Rancho and a portion of southwest quarter of Section 23, Township 9 South, Range 3 West, and San Bernardino Base Meridian. The site can be found on the USGS Quadrangle sheet is entitled "Temecula".

The approximate geographic position of the project is
Latitude: 33° 22" 30" North. Longitude; 117° 10' 15" West

Site Description 1.2

The triangular shaped project covers nearly 16 acres of rolling terrain. The prominent feature of the site is a ridgeline that trends north to south. The useable land is west of the ridge. The site is utilized as a whole palm tree nursery. The project has an east-west dimension of nearly 1200 at it's widest and a dimension of 2000 feet north to south. The parcel has a maximum elevation of over 740 feet on the ridgeline. The lowest points of the site are in the southwest and southeast corners. Those elevations are about 570 Mean Sea Level. The majority of the site has a western exposure. The eastern portion of the site has slopes in excess of 60 percent. There are two historical drainage courses which trend from the north to south. The western course is basically a roadside ditch, which is on the easterly side of Ranger Road. The slope of the ditch varies between 4-percent and 6-percent. The near natural channel along the eastern edge and next to Old Highway 395 is sloped at about 5-percent. This drainage course is very deep with very steep sides. (130 feet on the westerly side and about 30 on the east) There are several structures on this parcel, including two concrete water reservoirs and a residential unit. The residential dwelling will be on the remainder parcel after the project concludes
The site is entirely with in the San Luis Rey Watershed, Hydrologic Unit 903. Specifically it is in the Lower San Luis Rey Hydrologic Area, (HA 903.12) and entirely in the Bonsall Hydrologic Sub-Area (HSA 903.12). (See Appendix A, Site Exhibits)

Project Description 1.3

Cross Roads L.L.C. has retained Kevin Bresnahan Engineering to prepare and submit to the County of San Diego documents for the subdivision and development of APN 108-161-0500 and 108-161-0600. This hydrology study is in support of those documents. The development plans includes the grading of four building pads and a private road.

Propose 1.3

This hydrology and hydraulics report is in support of those improvement plans. The document will provide the calculations required for the verifying the existing design of the storm drain and related infrastructure. This study will also provide technical design data for the construction of both temporary and permanent post construction storm water pollution prevention devices.

Scope 1.4

The scope of this study includes the following:

1-The determination if the proposed development lies within any designated flood plain as determined by the Federal Emergency Management Agency (FEMA).

2-Determine the pre-development (existing) 10-year year tributary and 100-year tributary On-Site Peak runoff.

3-Determine the post-development (proposed) 10-year tributary and 100-year tributary On-site peak runoff.

4-Provide a drainage table for pre-development versus post-development showing peak runoff rates (cfs), flow depths, velocities (fps) at all discrete discharge points.

5-Provide flow rate comparison calculations for pre-development and post-development discharge points for each drainage basin

6-Demonstrate the pre-development drainage conditions and post-development conditions do not have any adverse impact on any adjacent properties because of any change of the peak flow rate and velocity.

7-Show adequacy of impacted off-site/ on-site drainage facilities such as culverts, inlets, channels or other drainage structures.

8-Address local drainage facilities receiving additional runoff due to the proposed development and identify any runoff contribution that would exceed the capacity of existing drainage systems.

9-Determine the limits of the 100-year flood plain for basins with tributary areas greater than 25 acres.

Existing Land Use and Zoning 1.5

The current land use of Assessor's parcel 108-161-0500 is agriculture and is zoned A-70, The density is classified as Low Density Residential 0.50.DU/Ac (1dwelling unit per two acres).

The current land use of Assessor's parcel 108-161-0600 is agriculture and is zoned A-70. The density is classified as Low Density Residential 1.0.DU/Ac (1 dwelling unit per acre).

Developed Land Use and Zoning 1.6

The proposed land use of the properties will be for single-family dwellings. The proposed parcels will be classified as Low Density Residential 1.0.DU/Ac (1dwelling unit per acre). The proposed zoning will follow the San Diego General Plan categories #1 Residential / #17 Estate.

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The Coefficient of Runoff 1.7

The run off coefficients are based on land use arid soil type. The local on-site soil types were determined to be in the Hydrologic Soil Group "B" (San Diego County Soil Survey). There are three types of underlying soils. These soils are classified as 1) Vista Course Sandy Loam (VsG) with slopes 30% to 60%; 2) Vista Course Sandy Loam (VsE) with slopes 15% to 30%; and 3) Fallbrook Sandy Loam (FaD2) with slopes 9% to 15%; (See Appendix A, Site Exhibits) The value of the runoff coefficient (B) was taken from Table 3-1 (Page 3-6). Good engineering judgment was used when choosing the values presented in Table 3-1. No adjustments were made to these values.

From Table 3.1, SDCO HM using Low Density Residential (1.0 DU / Ac or less)
Hydrological Soil Group "B" the Value for the Coefficient of runoff, C=0.32

For basins tributary to the proposed private road improvement a weighted "c' value was calculated. Per Table 3.1, a "c" value of 0.9 was applied to the ac pavement portion of the private road. Calculations are attached Appendix D-Hydrology and Hydraulic Calculations.

Flood Zone Information 1.8

Community Panel
FEMA Community Panel ` 060284

Flood Panel
FIPS Code 6
Panel Full 175F
FIS Date 19-JUN-97

Flood Zone
FEMA Code 161

Floodplain
FEMA Zone X
FEMA Community Panel 060284

Hydrologic Method 2.10

The Rational Method (RM) was used to determine the peak runoff rates for the required storm events.

Topography 2.11

There is not any significant off-site tributary watershed for this project. This site is situated at the top and along a slight ridgeline. The on site topography was delineated from field survey. The tributary area for this project site is approximately 1.3 Acres.

On site Topography 2.12

The proposed on-site tributary watershed for this project was generated using a digital copy of the Tentative Map (20 Scale)

Runoff Intensity – Duration Curve 2.13

The intensity-duration information was calculated using the Figure 3.1, Figure 3.3 and Table 3.2 from the San Diego County Hydrology Manual". These charts are located in Appendix A. The data charts are generated using the formula shown below was used to calculate the intensity.

$$\text{Intensity, } I = 7.44\,(P^6)\,D^{-0.645}$$

Hydrologic Calculation Methods 2.20

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. The RM is recommended for analyzing the runoff response from drainage areas up to approximately one square mile in size. The RM was applied using any design storm frequency of 100-year and 10-year. The design storm frequency is based on the type of project and specific local requirements.
A procedure has been developed that converts the 6 hour and 24-hour precipitation isopluvial map data to an Intensity-Duration curve that can be used for the rainfall intensity in the RM formula as shown The RM is applicable to a 6-hour storm duration because The procedure uses Intensity-Duration design charts that are hosed on a 6-hour storm duration.

The Rational Method formula, Q=CIA is shown below, Where

Q = Peak rate of flow in cubic feet per second

C = Runoff Coefficient I = Rainfall Intensity A = Basin Area.

Hydrologic Conclusions 2.40

The increase of the impervious area on this site due to the proposed improvements will increase the total 10-year storm water the runoff (Q in CFS) by les than 1.4 CFS. The existing runoff was calculated to be 43.4 CFS and the post developed runoff calculated as 44.8 CFS.

The increase of the impervious area on this site due to the proposed improvements will increase the total 100-year storm water the runoff (Q in CFS) by less than 0.9 CFS. The existing runoff was calculated to be 58.2 CFS and the post developed runoff calculated as 59.1 CFS.

Results Table [Westerly Watershed] 2.41

Basin ID	Pre Q10 CFS	Post Q10 CFS	*Change*	Pre Q100 CFS	Post Q100 CFS	*Change*	DP	NOTES AND Comments
W10	3.0	3.0	***0***	3.9	3.9	***0***	1	Total @ Node 101
W11	3.8/6.8	3.8/6.8	***0***	4.9/8.8	4.9/8.8	***0***	2	Total @ Node 102
W20	1.5	1.6	***-0.3***	2.0	2.1			
W21	3.9	1.7	***-2.2***	5.0	2.1		7	
W22	N/A	4.0/7.3	***N/A***	N/A	5.2/9.4			
	5.4/12.2	7.3/14.1	***+1.9/+1.9***	7.0/15.8	18.3	***+2.5***		Sub-basin Total
W12	2.1/14.3	2.1/16.2	***0/+1.9***	2.7/18.5	2.7/21.0			Sub-basin Total
W30	2.7/17.0	2.6/18.8	***-0.1/+1.8***	3.5	3.3			Sub-basin Total
	17.0	18.8	***+1.8***	22.0	24.3	***+2.3***	3	Total @ Node 103
W13	1.5/18.5	1.4/20.2	***-0.1/+1.7***	1.9/23.9	1.9/25.6	***+1.7***	4	Total @ Node 104
				N/A	2.6/27.8			
W14	0.9/19.4	2.0/22.2	***+1.1/+1.8***	1.2/25.1	N/A			
W40	4.8	1.9	***-2.9***	6.2	2.4	***-3.8***	8	
W41	3.5	5.7	***+1.2***	4.5/10.7	7.3	***-3.4***	9	
W42	2.7/11.0	1.3/8.8	***-1.4/-2.2***	N/A	1.7/11.4			9.6 cfs /18" SD
	11.0	8.8	***-2.2***	10.7	11.4	***+0.70***	10	Sub-basin total
W15		N/A		3.5	N/A			
	11/34.0	8.8/31.0	***-2.2/-3.0***	14.2/39.3	11.4/39.2	***-2.8/-0.1***	5	Total @ Node 105
W50	N/A	3.9	N/A	N/A	5.1	N/A		
W51	N/A	0.2	N/A	N/A	0.2	N/A		
W52	N/A	1.1/5.2	N/A	N/A	1.4/6.7	N/A		Sub-basin Total
W16	2.2	N/A	***N/A***	2.8/422	N/A	***N/A***		Sub-basin Total
	2.2/36.2	4.8/33.6	***-2.6/-2.6***	2.8/42.2	6.7/45.5	***+2.3***	6	Total @ Node 106
Total	**32.6**	**34.3**	***+1.7***	**42.2**	**45.5**	***+2.3***	**6**	**Watershed Total**

Results Table 2 [Easterly Watershed] **2.42**

Basin ID	Pre Q10	Post Q10	CHANGE	Pre Q100	Post Q100	CHANGE	DP	NOTES AND COMMENTS
	cfs	cfs		cfs	cfs			
E10	2.0	1.8	*-0.2*	2.6	2.4	*-0.2*	11	
E11	4.9	4.8	*-0.1*	6.4	6.2	*-0.2*		
E12	3.9	3.9	*0*	5.0	5.0	*0.0*		
Totals	**10.8**	**10.5**	*-0.3*	**14.0**	**13.6**	*-0.4*	**12**	**Watershed Total**

1-The determination if the proposed development lies within any designated flood plain as determined by the Federal Emergency Management Agency (FEMA).

It was determined that the proposed development does not lie within any designated flood plain
The FEMA Zone is "X", not flood elevations are determined

2-Determine the pre-development (existing) 10-year year tributary and 100-year tributary peak runoff. rates

It was determined that there are two tributary watersheds,
The westerly watershed: pre-development run off rates though exit point, DP6
Q (10)= 32.6 CFS
Q (100)= 44.2 CFS
The easterly watershed pre-development run off rates through exit point, DP12
Q (10)= 10.8 CFS
Q (100)= 14.0 CFS

3-Determine the post-development (proposed) 10-year tributary and 100-year tributary On-site peak runoff.

It was determined that there are two tributary watersheds,
The westerly watershed: post-development run off rates though exit point, DP6
Q (10)= 34.3 CFS
Q (100)= 45.5 CFS

The easterly watershed post-development run off rates through exit point, DP12
Q (10)= 10.5 CFS
Q (100)= 13.6 CFS

4-Provide a drainage table for pre-development versus post-development showing peak runoff rates (cfs), flow depths, velocities (fps) at all discrete discharge points.

See Table 2.41 and Table 2.42

5-Provide flow rate comparison calculations for pre-development and post-development discharge points for each drainage basin

See Table 2.41 and Table 2.42

6-The pre-development drainage conditions and post-development conditions do not have any adverse impact on any adjacent properties because of any change of the peak flow rate and velocity. Peak flow change by less than 2.5 cfs at any given offsite basin discharge point and riprap pads are implemented to mitigate for any increased velocity.

7-Show adequacy of impacted off-site or on-site drainage facilities such as culverts, inlets, channels or other drainage structures

There is one existing drainage facility adjacent to this project; a pair of 12-inch HDPE culverts crossing under an asphalt driveway (APN 108-161-) this facility is not

impacted. The run-off will cross the property line and then will be conveyed through a single 18-inch storm drain.

8- Utilizing natural grades and historic drainage patterns, the project design maintains existing drainage patterns. Any increase in runoff due to the proposed development will be mitigated with riprap pads and bioswale. Furthermore, Implementation of additional storm water quality measures such as grass lined swales will eliminate sediment load and mitigate for minimal changes. ~~the project was designed with little diversion of drainage basins and resulting in minimal change in the overall quantities of the drainage basin~~. The proposed land use of the project is within that as shown within the county master plan. ~~Implementation of additional storm water quality measures such as grass lined swales will eliminate sediment load and mitigate for minimal changes.~~

9- The 100 year flood plain was established for the unnamed creek running along Old Highway 395. Appendix F provides for documentation of these calculations.

Hydraulics Analysis Methods 3.1

The velocity calculations were performed using "FlowMaster" software. "FlowMaster" uses the data to calculate the water surface elevation. These are on the right side of the irregular channel worksheet.

The irregular channel is a conveyance element lacking symmetry, consisting of two or more connected line segments. When calculating composite roughness, FlowMaster uses the Horton and Lotter equations. The Horton composite roughness equation is used for solving closed top irregular channels such as custom arches or Cunnette conduit sections. This equation is also applied in certain specific situations to open channels where steep banks or wide flat floodplains are encountered (see note below). The Lotter equation is applied for open, irregular channels such as natural floodplains. Both methods are based on Manning's conveyance equations.

Hydraulics Calculations 3.2

The FlowMaster worksheets and related reference information are in Appendix D

Hydraulic Results Table 3.31

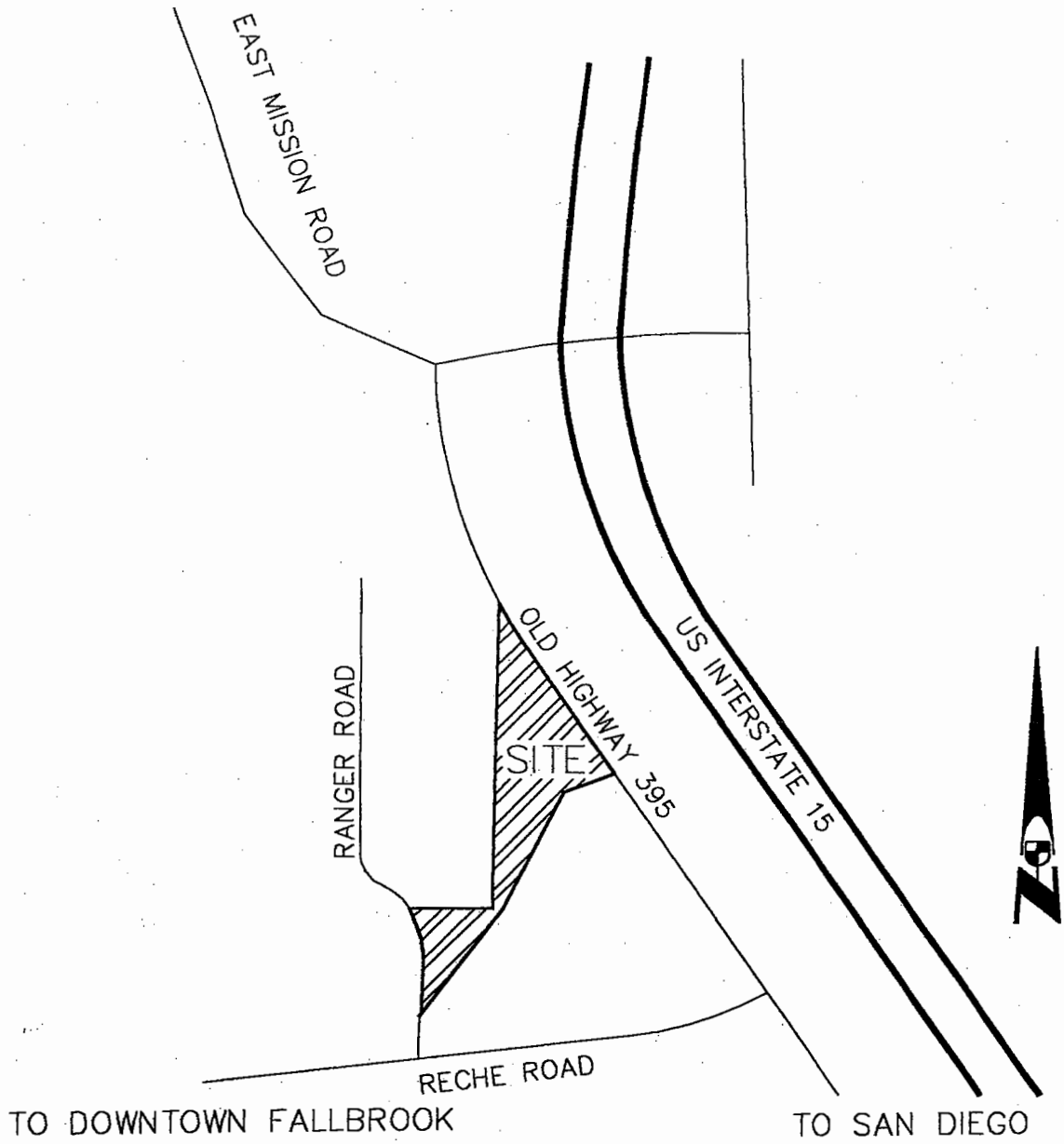
Device Type	DP No.	Q100 CFS	V100 FPS	Comments
D-40	7	4.2	3.05	Rip Rap No. 1
				Par 3 & Par 4/Adjacent APN 108-161-1900
D-40	8	2.4	2.49	Rip Rap No. 2
				Par 2 / Adjacent to APN 108-161-2100
Ex SD	9	3.7/pipe	11.8	Ex off site Dbl 12" culverts APN 108-161-2200
D-40	9	11.8	3.7	Rip Rap No. 3
				Ex off site Dbl 12" culverts APN 108-161-2200
18" SD	9	7.3	8.8	Private Road on Parcel 1
				Depth=0.84' Max. Cap 17.3 CFS
D-40	10	11.4	2.73	Rip Rap No. 4
				South of Private Road near Parcel 1
XG	4	32.7	5.88	Cross Gutter at Ranger Rd intersection
D-40	4	32.7	3.22	Rip Rap No. 6
				D/S from Cross Gutter at Ranger Rd intersection
D-40	5	39.2	2.72	Rip Rap No. 7
				Southwest Corner Parcel 1 Near Ranger Rd
D-40	6	45.5	2.86	Rip Rap No. 8
				Southwest Corner Parcel 1 @ Ranger Rd

Hydraulics Conclusions 3.4

The velocity of all surface waters runoff that discharges from or tributary to the site are non erosive

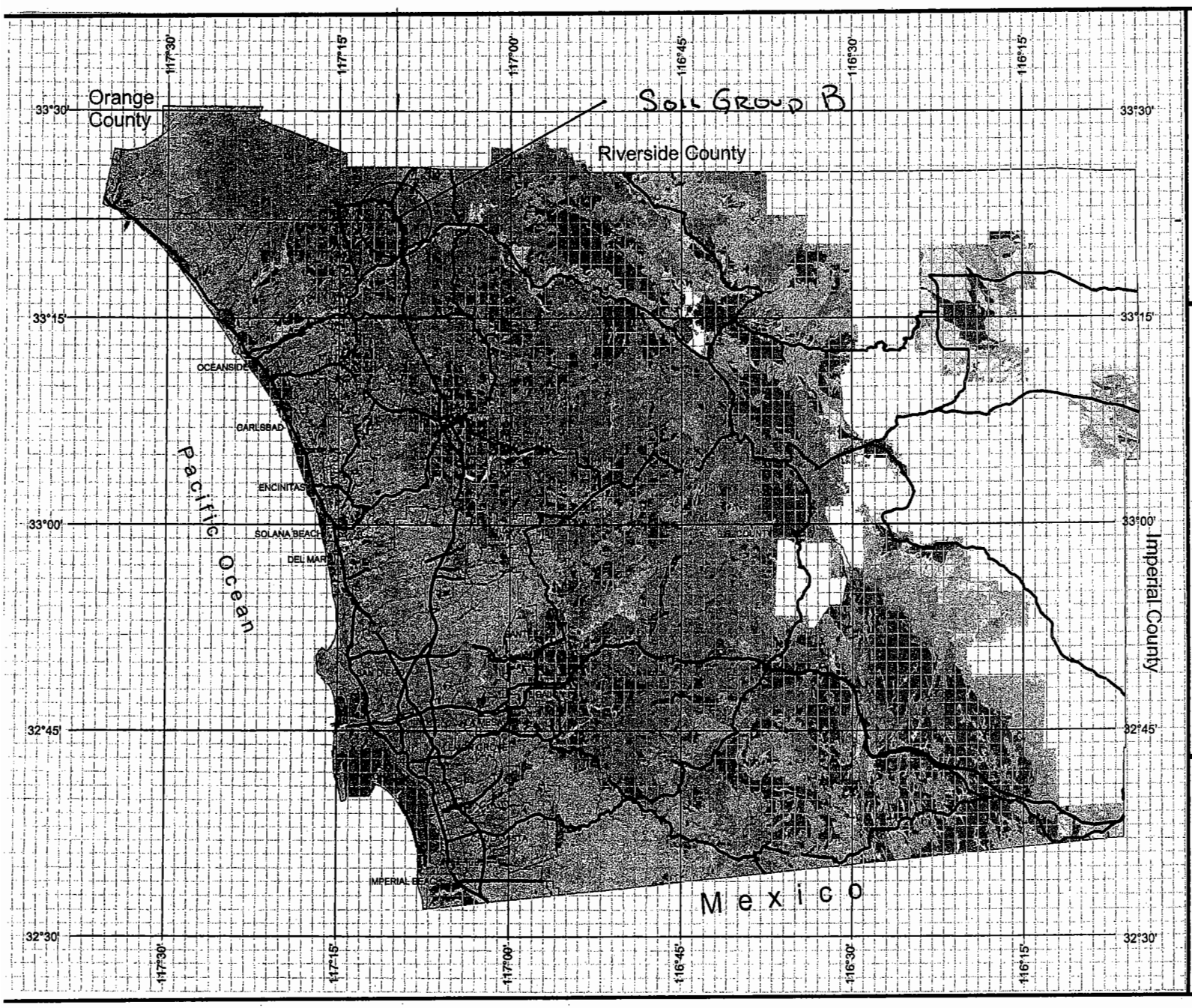
APPENDIX A **4.10**

SITE DESCRIPTIONS EXHIBITS **4.11**



VICINITY MAP

NOT TO SCALE



County of San Diego Hydrology Manual

Soil Hydrologic Groups

Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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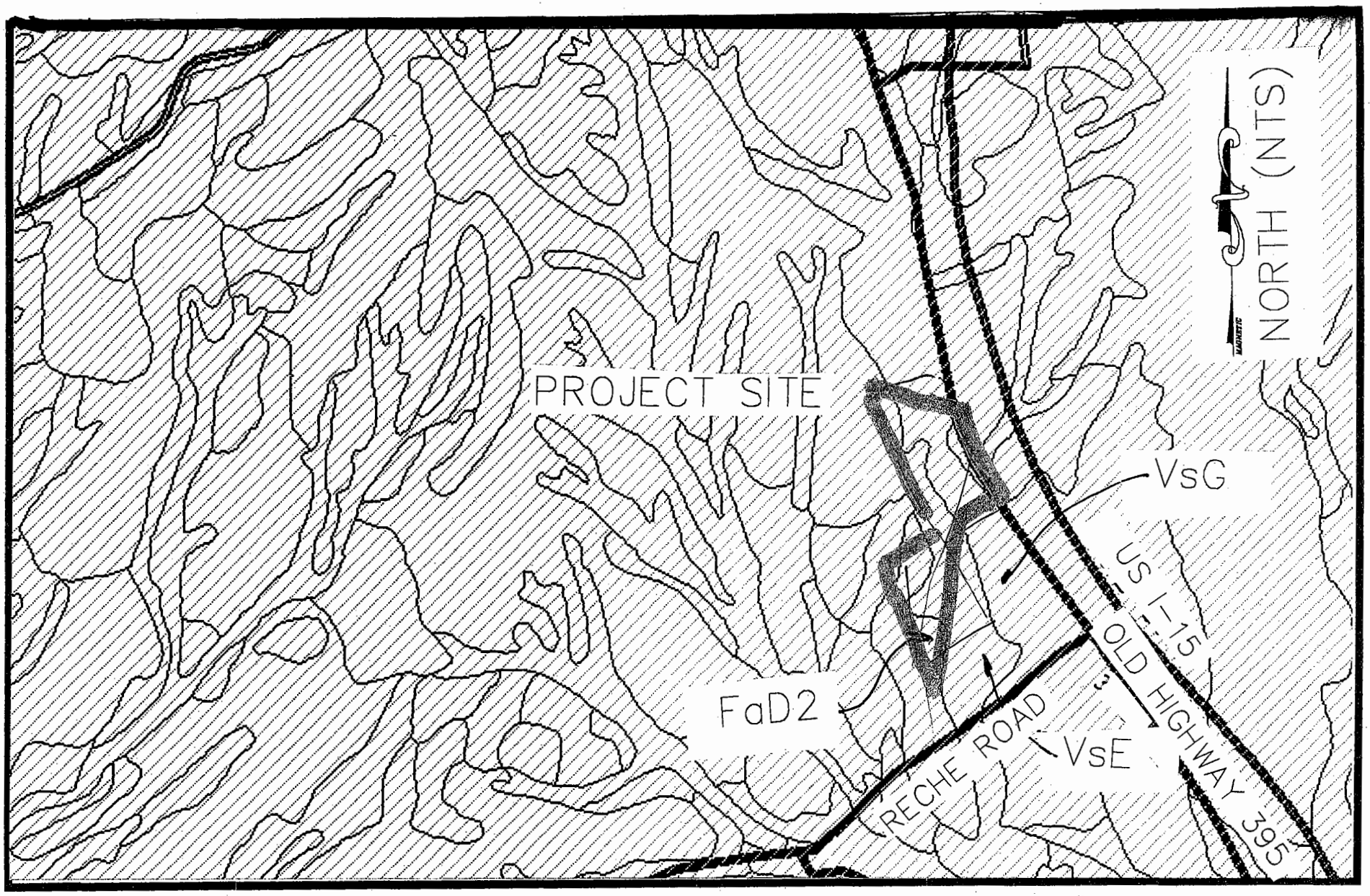
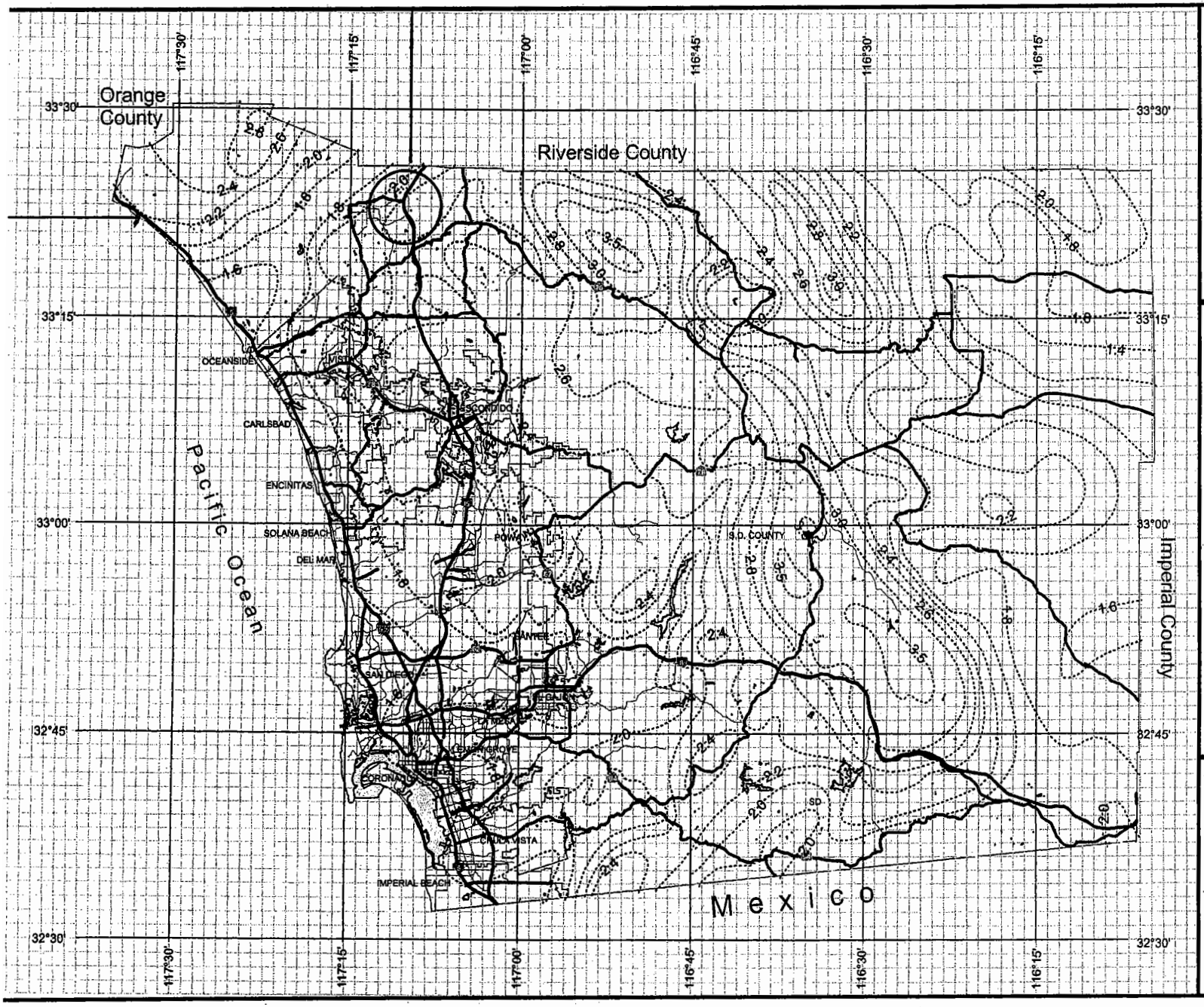


Soil Map Exhibit



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (Inches) 2.0

SITE LOCATION

W 117° 10' 15"

N 33° 22' 30"

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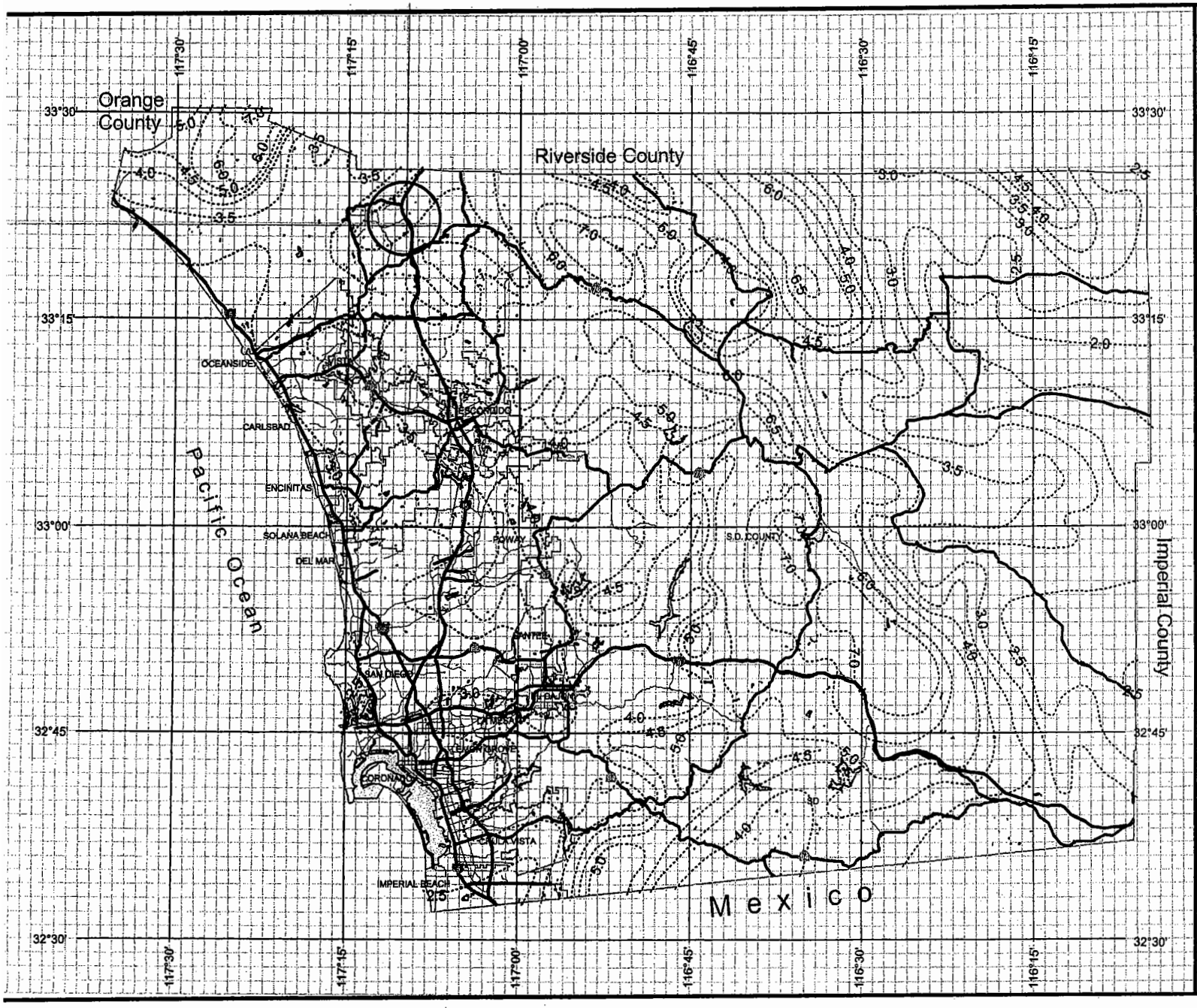

County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches) 4.5

SITE LOCATION

W 117° 10' 15"

N 33° 22' 30"

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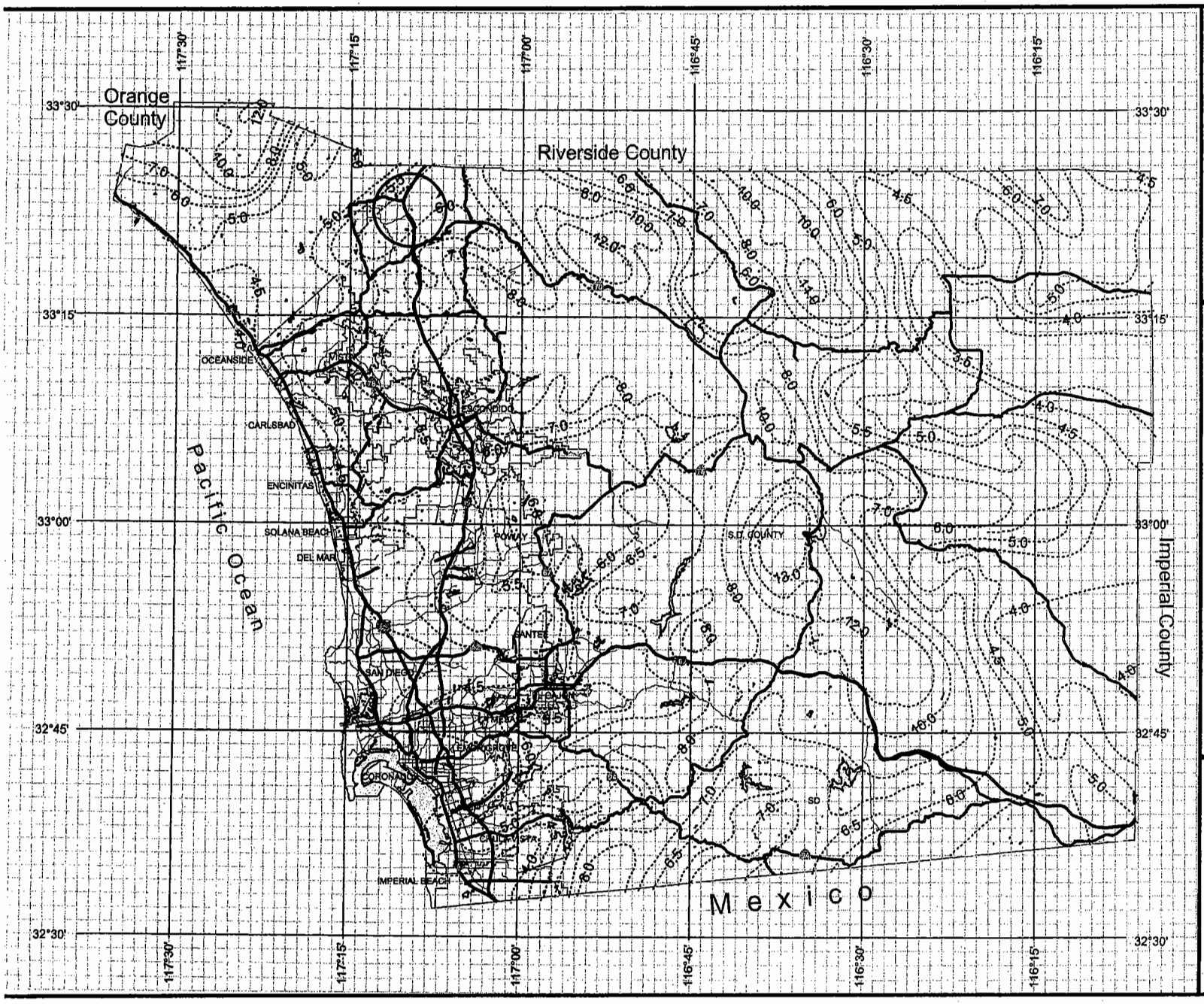

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches) 6.0

SITE LOCATION

W 117° 10' 15"

N 33° 22' 30"

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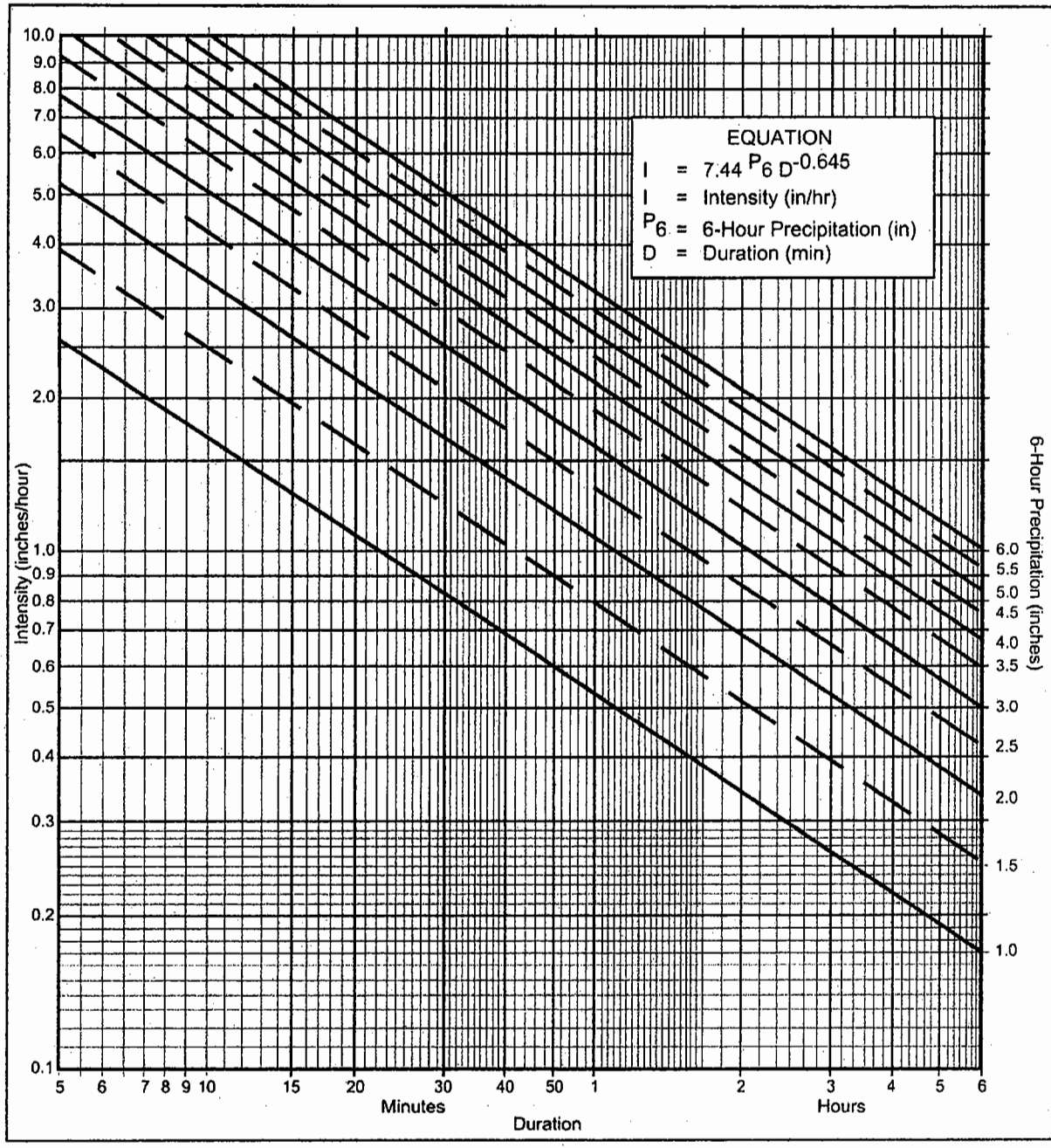
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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



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 10 year

(b) P_6 = 2.0 in., P_{24} = 4.5, $\frac{P_6}{P_{24}}$ = 44 %(2)

(c) Adjusted P_6(2) = 2.7 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

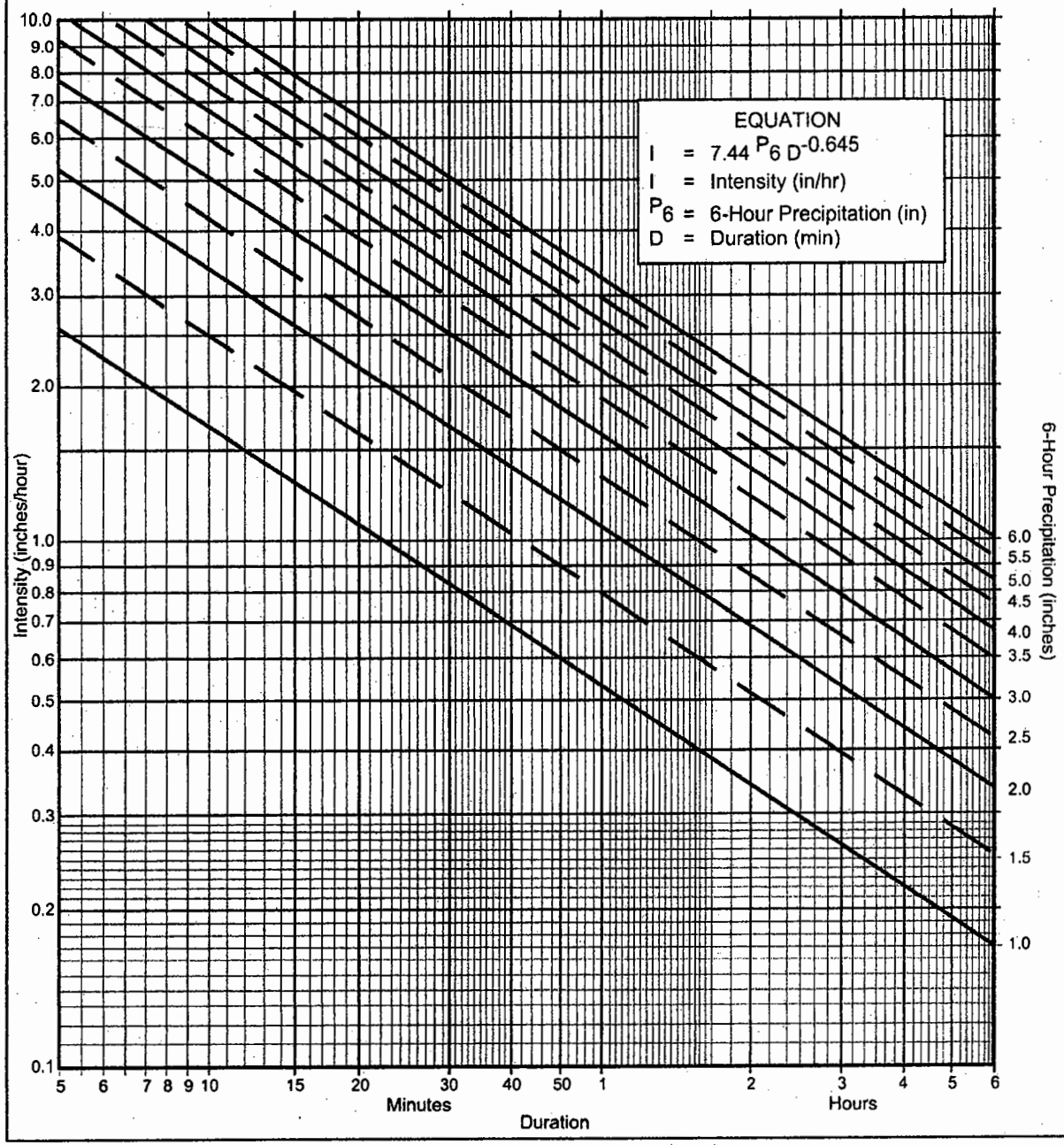
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
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



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

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

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

(d) t_x = _____ min.

(e) I = _____ in./hr.

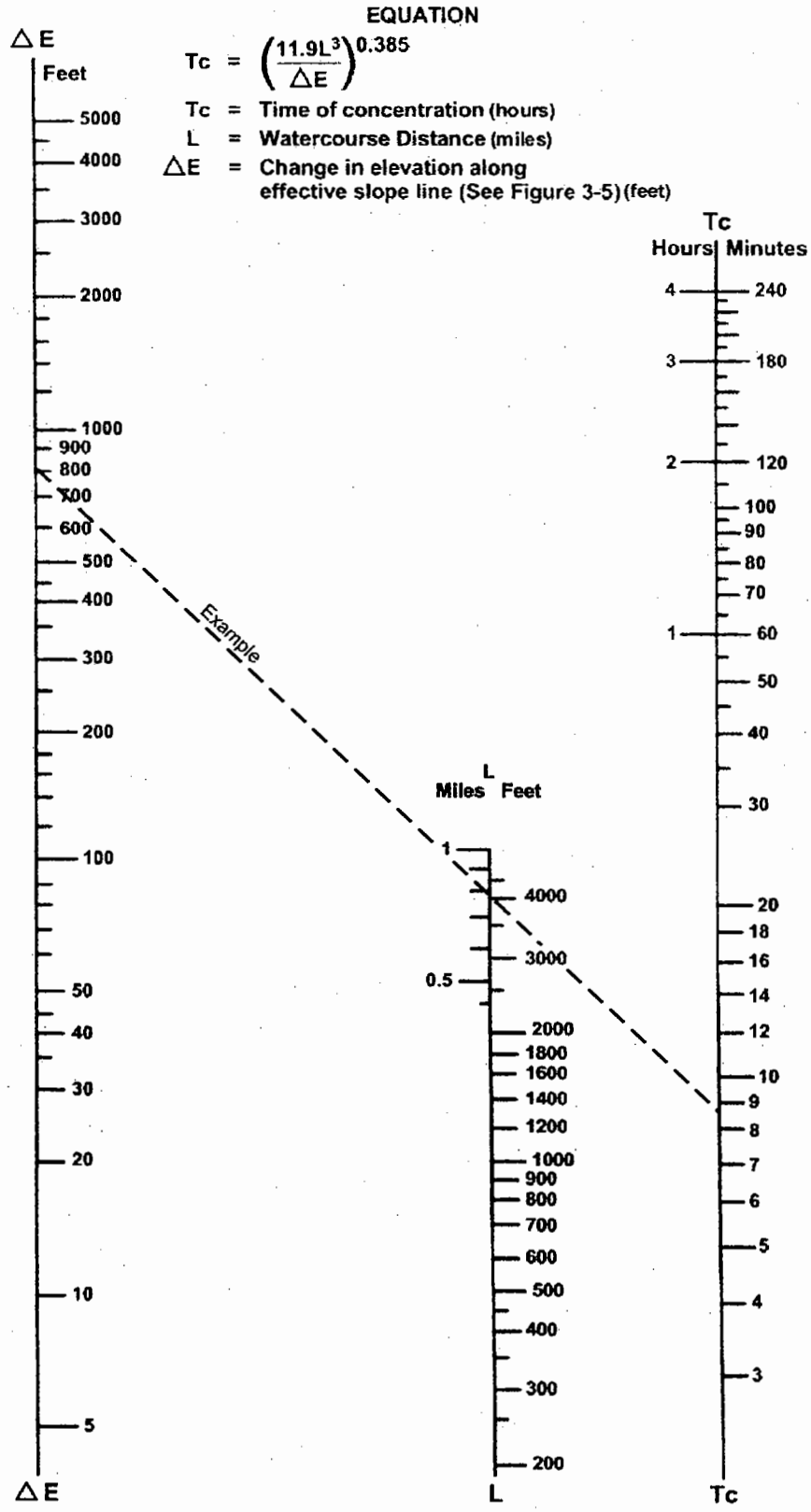
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6 / Duration	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
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



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

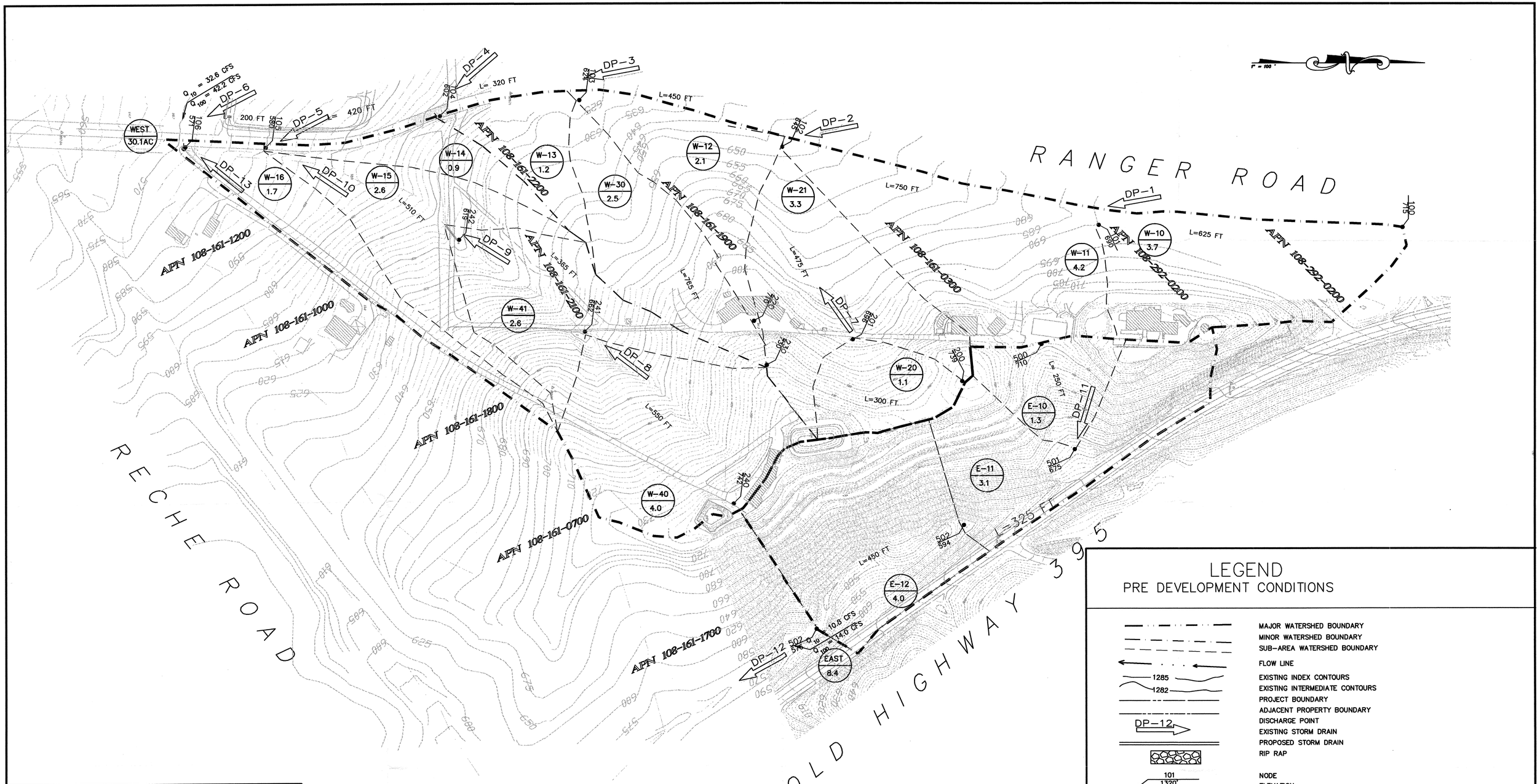
FIGURE

3-4

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

APPENDIX B **4.2**

Existing Conditions Hydrology Exhibits **4.21**



LEGEND
PRE DEVELOPMENT CONDITIONS

- MAJOR WATERSHED BOUNDARY
- MINOR WATERSHED BOUNDARY
- SUB-AREA WATERSHED BOUNDARY
- FLOW LINE
- 1285 EXISTING INDEX CONTOURS
- 1282 EXISTING INTERMEDIATE CONTOURS
- PROJECT BOUNDARY
- ADJACENT PROPERTY BOUNDARY
- DP-12 DISCHARGE POINT
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- RIP RAP
- 101 / 1320' NODE / ELEVATION
- Q_{10} = 10 CFS 10 YEAR FLOW
- Q_{100} = 100 CFS 100 YEAR FLOW
- A-10 / 10.0 AREA DESIGNATOR / AREA ACREAGE

HYDROLOGIC DATA TABLE
PRE DEVELOPMENT CONDITIONS

DISCHARGE POINT	Q10 CFS	Q100 CFS	V100 FPS
DP-1	3.0	3.9	–
DP-2	12.2	15.8	–
DP-3	17.0	22.0	–
DP-4	18.5	23.9	–
DP-5	30.4	39.3	–
DP-6	32.6	42.2	–
DP-7	1.5	2.0	–
DP-8	4.8	6.2	–
DP-9	3.5	10.7	–
DP-10	11.0	10.7	–
DP-13	2.2	2.8	–
DP-11	2.0	2.6	–
DP-12	10.8	14.0	–

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

Kevin Bresnahan, P.E.
Civil Engineer
Land Development Design & Consulting
51805 HIGHWAY 79 SOUTH # 196 TEMECULA CA 92592
(951) 552-6571 KPBrullbrook@Yahoo.com

KEVIN P. BRESNAHAN EXP: 06/30/08:

REGISTERED PROFESSIONAL ENGINEER KEVIN PATRICK BRESNAHAN No. C59954 Exp. 6/30/08 CIVIL STATE OF CALIFORNIA

PERMITS

REZONE PERMIT NO. _____
SPECIAL USE PERMIT NO. _____
TENTATIVE MAP NO. _____

BENCH MARK

DESCRIPTION: _____
LOCATION: _____
RECORD FROM: FIELD SURVEY
ELEVATION: 630.00 DATUM: NGVD 29

PRIVATE CONTRACT

SHEET 1 | COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS | 1 SHEETS

PREDEVELOPED HYDROLOGY EXHIBIT FOR:

TPM 20800 RPL1

CALIFORNIA COORDINATE INDEX ZONE 6 X=1914777.654 , Y=624215.047

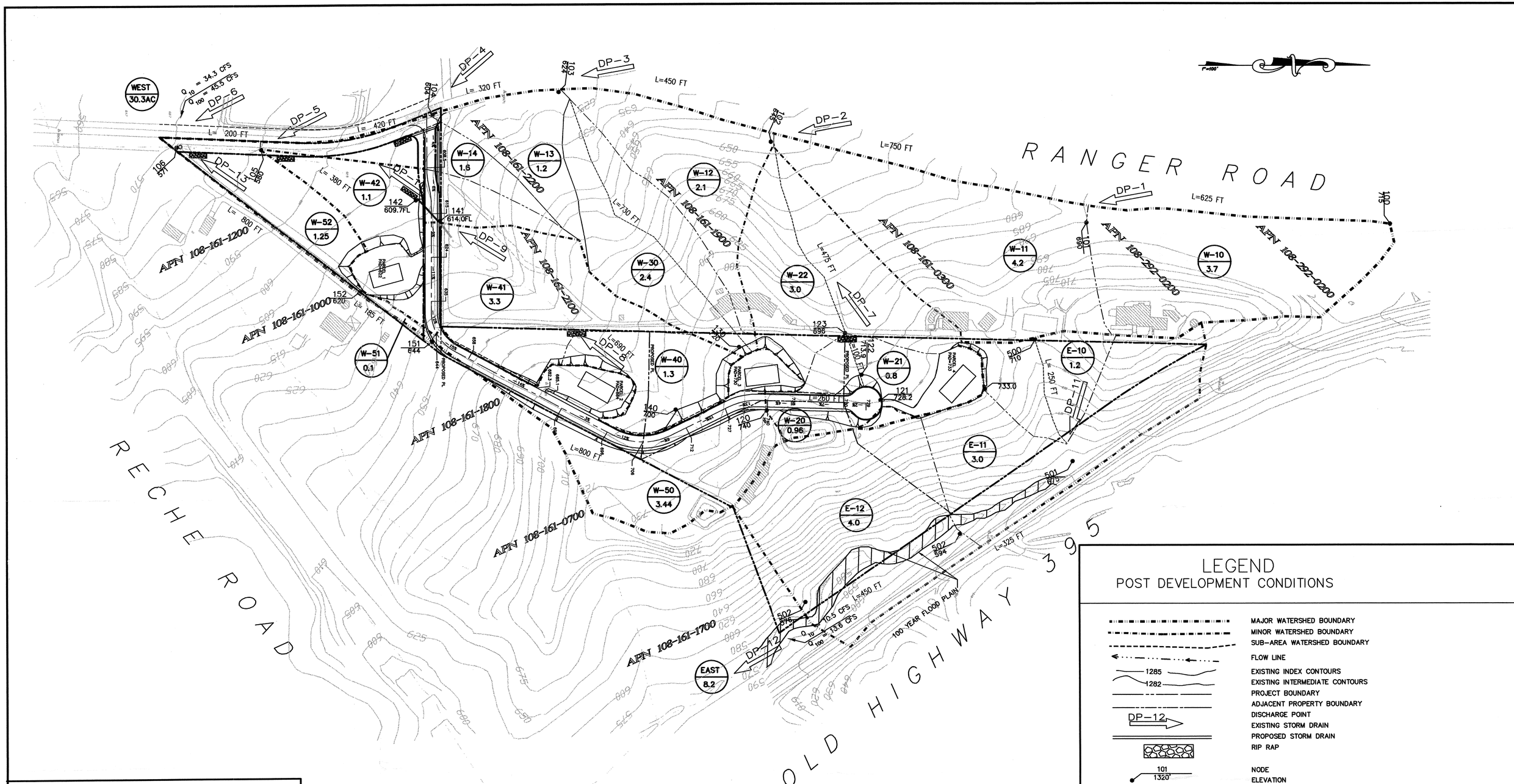
APPROVED FOR: MOHAMAD FAKHRUDDINE
COUNTY ENGINEER
BY: _____ DATE: _____

ENGINEER OF WORK
KEVIN PATRICK BRESNAHAN
R.C.E. C59954, EXP. 6-30-08

GRADING PERMIT NO:

APPENDIX C **4.3**

Developed Conditions Hydrology Exhibits **4.31**



LEGEND
POST DEVELOPMENT CONDITIONS

	MAJOR WATERSHED BOUNDARY
	MINOR WATERSHED BOUNDARY
	SUB-AREA WATERSHED BOUNDARY
	FLOW LINE
1285	EXISTING INDEX CONTOURS
1282	EXISTING INTERMEDIATE CONTOURS
	PROJECT BOUNDARY
	ADJACENT PROPERTY BOUNDARY
DP-12	DISCHARGE POINT
	EXISTING STORM DRAIN
	PROPOSED STORM DRAIN
	RIP RAP
101 / 1320'	NODE / ELEVATION
Q_{10} = 10 CFS	10 YEAR FLOW
Q_{100} = 100 CFS	100 YEAR FLOW
A-10 / 10.0	AREA DESIGNATOR / AREA ACREAGE

HYDROLOGIC DATA TABLE
POST DEVELOPMENT CONDITIONS

DISCHARGE POINT	Q10 CFS	Q100 CFS	V100 FPS
DP-1	3.0	3.9	–
DP-2	14.1	18.2	–
DP-3	18.3	23.7	–
DP-4	19.7	25.6	2.93
DP-5	28.8	37.4	2.75
DP-6	33.6	43.5	2.89
DP-7	3.3	4.2	2.89
DP-8	1.9	2.4	2.72
DP-9	4.2	5.5	2.79
DP-10	7.4	9.6	2.79
DP-13	5.2	6.7	–
DP-11	1.8	2.4	–
DP-12	10.5	13.6	–

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

Kevin Bresnahan, P.E.
Civil Engineer
Land Development Design & Consulting
31805 HIGHWAY 79 SOUTH #196, TEMECULA CA 92592
(951) 532-6571 KBFallbrook@Yahoo.com

KEVIN P. BRESNAHAN EXP: 06/30/08:

REGISTERED PROFESSIONAL ENGINEER KEVIN PATRICK BRESNAHAN No. C59954 Exp. 6/30/08 CIVIL STATE OF CALIFORNIA

PERMITS

REZONE PERMIT NO. _____
SPECIAL USE PERMIT NO. _____
TENTATIVE MAP NO. _____

BENCH MARK

DESCRIPTION: _____
LOCATION: _____
RECORD FROM: FIELD SURVEY
ELEVATION: 630.00 DATUM: NGVD 29

PRIVATE CONTRACT

SHEET 1 | COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS | 1 SHEETS

POST DEVELOPED HYDROLOGY EXHIBIT FOR:

TPM 20800 RPL1

CALIFORNIA COORDINATE INDEX ZONE 6 X=1914777.654 , Y=624215.047

APPROVED FOR: MOHAMAD FAKHRRIDDINE COUNTY ENGINEER
BY: _____ DATE: _____

ENGINEER OF WORK KEVIN PATRICK BRESNAHAN R.C.E. C59954, EXP. 6-30-08

GRADING PERMIT NO:

APPENDIX D **4.4**

HYDROLOGY AND HYDRAULIC CALCULATIONS **4.41**

Q10 PRE
RANGER ROAD
CROSS ROADS LLC
FALLBROOK CA

DRAINAGE STUDY

BASIN	Distance (D)	Elev. A	Elev. B	Slope	Tc(min)	Area(SF)	AREA (Acre)	C	I(in/hr)	Q100(cfs)	Total Q @ DP	Discharge Point	Comments
W10	725	715	690	3.45	25.0	161172	3.70	0.32	2.5177	3.0	3.0	1	
W11	750	690	645	6.00	21.2	182952	4.20	0.32	2.8052	3.8	3.8	2	
										6.8		2	
W20	300	730	696	11.33	10.8	47916	1.10	0.32	4.3219	1.5	1.5	7	
W21	475	696	645	10.74	13.9	143748	3.30	0.32	3.6836	3.9			
										5.4	5.4	2	
W12	450	645	624	4.67	17.8	91476	2.10	0.32	3.1336	2.1	2.1	3	
W30	765	730	624	13.86	16.2	108900	2.50	0.32	3.3368	2.7	2.7	3	
W13	320	624	602	6.88	13.2	52272	1.20	0.32	3.8016	1.5	1.5	4	
W14	420	602	580	5.24	16.6	39204	0.90	0.32	3.2847	0.9	0.9	10	
W40	550	742	662	14.55	13.5	174240	4.00	0.32	3.7504	4.8		8	
W41	365	662	614	13.15	11.4	113256	2.60	0.32	4.1889	3.5		9	
W15	510	614	580	6.67	16.8	113256	2.60	0.32	3.2495	2.7		10	
										11.0	11.0	10	
W16	200	580	571	4.50	12.0	74052	1.70	0.32	4.0386	2.2			
							29.90			2.2	2.2	13	
											34.0	6	
E10	250	710	675	14.00	9.2	56628	1.30	0.32	4.7967	2.0			
E11	325	675	594	24.92	8.7	135036	3.10	0.32	4.9893	4.9			
E12	450	594	576	4.00	18.8	174240	4.00	0.32	3.0315	3.9			
										10.8	10.8	12	

Q100 PRE
RANGER ROAD
CROSS ROADS LLC
FALLBROOK CA

DRAINAGE STUDY

BASIN	Distance (D)	Elev. A	Elev. B	Slope	Tc(min)	Area(SF)	AREA (Acre)	C	I(in/hr)	Q100(cfs)	Total Q @ DP	Discharge Point	Comments
W10	725	715	690	3.45	25.0	161172	3.70	0.32	3.2636	3.9		1	
W11	750	690	645	6.00	21.2	182952	4.20	0.32	3.6364	4.9		2	
										8.8	8.8	2	
W20	300	730	696	11.33	10.8	47916	1.10	0.32	5.6025	2.0	2.0	7	
W21	475	696	645	10.74	13.9	143748	3.30	0.32	4.7750	5.0			
										7.0	7.0	2	
W12	450	645	624	4.67	17.8	91476	2.10	0.32	4.0621	2.7	2.7	3	
W30	765	730	624	13.86	16.2	108900	2.50	0.32	4.3255	3.5	3.5	3	
W13	320	624	602	6.88	13.2	52272	1.20	0.32	4.9280	1.9	1.9	4	
W14	420	602	580	5.24	16.6	39204	0.90	0.32	4.2579	1.2	1.2	10	
W40	550	742	662	14.55	13.5	174240	4.00	0.32	4.8616	6.2		8	
W41	365	662	614	13.15	11.4	113256	2.60	0.32	5.4300	4.5		9	
W15	510	614	580	6.67	16.8	113256	2.60	0.32	4.2123	3.5		10	
										14.2	14.2	10	
W16	200	580	571	4.50	12.0	74052	1.70	0.32	5.2352	2.8			
							29.90			2.8	2.8	13	
											44.2	6	
E10	250	710	675	14.00	9.2	56628	1.30	0.32	6.2179	2.6			
E11	325	675	594	24.92	8.7	135036	3.10	0.32	6.4676	6.4			
E12	450	594	576	4.00	18.8	174240	4.00	0.32	3.9297	5.0			
										14.0	14.0	12	

Q100 POST
RANGER ROAD
CROSS ROADS LLC
FALLBROOK CA

DRAINAGE STUDY

BASIN	Distance (D)	Elev. A	Elev. B	Slope	Tc(min)	Area(SF)	AREA (Acre)	C	I(in/hr)	Q100(cfs)	Total Q @ DP	Discharge Point	Comments
W10	725	715	690	3.45	25.0	161172	3.70	0.32	3.2636	3.9	3.9	1	
W11	750	690	645	6.00	21.2	182952	4.20	0.32	3.6364	4.9	4.9	2	
										8.8		2	
W20	250	740	728.2	4.72	11.7	41818	0.96	0.41	5.3270	2.1			
W21	100	728.2	713.9	14.30	5.8	34848	0.80	0.32	8.3939	2.1	4.2	7	
W22	425	713.9	645	16.21	11.4	130680	3.00	0.32	5.4078	5.2			
										9.4	9.4	2	
W12	450	645	624	4.67	17.8	91476	2.10	0.32	4.0621	2.7	2.7	3	
W30	730	720	624	13.15	16.1	104544	2.40	0.32	4.3423	3.3	3.3	3	
W13	320	624	604	6.25	13.6	52272	1.20	0.32	4.8281	1.9	1.9	4	
W14	420	604	580	5.71	15.3	69696	1.60	0.36	4.4882	2.6	2.6	4	
W40	300	700	660	13.33	10.3	56628	1.30	0.32	5.8017	2.4		8	
W41	390	660	614	11.79	10.9	143748	3.30	0.4	5.5677	7.3		9	
W42	380	609.7	580	7.82	13.8	47916	1.10	0.32	4.7927	1.7		10	
										11.4	11.4	10	
W50	800	738	644	11.75	16.8	149846	3.44	0.35	4.2205	5.1			
W51	185	644	620	12.97	8.1	4356	0.10	0.32	6.7407	0.2			
W52	800	620	571	6.13	21.7	54450	1.25	0.32	3.5773	1.4			
							30.45			6.7	6.7	13	
											51.1	6	
E10	250	710	675	14.00	9.2	52272	1.20	0.32	6.2179	2.4			
E11	325	675	594	24.92	8.7	130680	3.00	0.32	6.4676	6.2			
E12	450	594	576	4.00	18.8	174240	4.00	0.32	3.9297	5.0			
										13.6	13.6	12	

Q10 POST
RANGER ROAD
CROSS ROADS LLC
FALLBROOK CA

DRAINAGE STUDY

BASIN	Distance (D)	Elev. A	Elev. B	Slope	Tc(min)	Area(SF)	AREA (Acre)	C	I(in/hr)	Q10(cfs)	Total Q @ DP	Discharge Point	Comments
W10	725	715	690	3.45	25.0	161172	3.70	0.32	2.5177	3.0		1	
W11	750	690	645	6.00	21.2	182952	4.20	0.32	2.8052	3.8		2	
										6.8	6.8	2	
W20	250	740	728.2	4.72	11.7	41818	0.96	0.41	4.1094	1.6			
W21	100	728.2	713.9	14.30	5.8	34848	0.80	0.32	6.4753	1.7	3.3	7	
W22	425	713.9	645	16.21	11.4	130680	3.00	0.32	4.1717	4.0			
										7.3	7.3	2	
W12	450	645	624	4.67	17.8	91476	2.10	0.32	3.1336	2.1	2.1	3	
W30	730	720	624	13.15	16.1	104544	2.40	0.32	3.3498	2.6	2.6	3	
W13	320	624	604	6.25	13.6	52272	1.20	0.32	3.7245	1.4	1.4	4	
W14	420	604	580	5.71	15.3	69696	1.60	0.36	3.4623	2.0	2.0	4	
W40	300	700	660	13.33	10.3	56628	1.30	0.32	4.4756	1.9		8	
W41	390	660	614	11.79	10.9	143748	3.30	0.4	4.2951	5.7		9	
W42	380	609.7	580	7.82	13.8	47916	1.10	0.32	3.6972	1.3		10	
										8.8	8.8	10	
W50	800	738	644	11.75	16.8	149846	3.44	0.35	3.2558	3.9			
W51	185	644	620	12.97	8.1	4356	0.10	0.32	5.2000	0.2			
W52	800	620	571	6.13	21.7	54450	1.25	0.32	2.7596	1.1			
										5.2	5.2	13	
											34.3	6	
E10	250	710	675	14.00	9.2	52272	1.20	0.32	4.7967	1.8			
E11	325	675	594	24.92	8.7	130680	3.00	0.32	4.9893	4.8			
E12	450	594	576	4.00	18.8	174240	4.00	0.32	3.0315	3.9			
										10.5	10.5	12	

POST DEVELOPMENT

WEIGHTED "C" CALCULATIONS FOR PROPOSED BASINS WITH PRIVATE ROAD

VARIABLE	A	B	C	D	E	F	G	H
BASIN	TOTAL BASIN	ROAD AREA	LOT AREA	% ROAD AREA	% OUTSIDE ROAD	"C" ROAD AREA	"C" LOT AREA"	**WEIGHTED "C"**
---	AREA (AC)	WITHIN BASIN (AC)	WITHIN BASIN (AC)	(%)	(%)	---	---	---
W-14	1.60	0.12	1.48	7.33	92.67	0.90	0.32	**0.36**
W-20	0.96	0.14	0.82	14.92	85.08	0.90	0.32	**0.41**
W-41	3.30	0.44	2.86	13.36	86.64	0.90	0.32	**0.40**
W-50	3.44	0.15	3.29	4.32	95.68	0.90	0.32	**0.35**

DEFINITIONS

A = TOTAL HYDROLOGIC BASIN AREA
B = PAVED PORTION OF PRIVATE ROAD (24' WIDE) WITHIN SUBJECT BASIN
C = TOTAL HYDROLOGIC BASIN AREA - PAVED PORTION OF PRIVATE ROAD (24' WIDE) WITHIN SUBJECT BASIN
D = PERCENTAGE OF BASIN COVERD BY PAVEMENT FROM 24' WIDE PRIVATE ROAD
E = 100% - PERCENTAGE OF BASIN COVERD BY PAVEMENT FROM 24' WIDE PRIVATE ROAD
F = "C" VALUE FOR PAVEMENT WITHIN PRIVATE ROAD (0.9%) PER COUNTY HYDRO MANUAL
G = "C"' Value for remaining basin minus paved road for Low Density Residential (LDR) Residential, 1.0 DU/A or less, type "b" soil
H = Weighted "c" value for basin using the equation F*D + E*G

Post Q100 RipRap No. 1 @ DP-7
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	4.2000 cfs
Slope	0.1000 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	0.1357 ft
Velocity	3.0530 fps
Full Flowrate	4.2000 cfs
Flow area	1.3757 ft2
Flow perimeter	10.3839 ft
Hydraulic radius	0.1325 ft
Top width	10.2715 ft
Area	1.3757 ft2
Perimeter	10.3839 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.1753 ft
Critical slope	0.0427 ft/ft
Critical velocity	2.3547 fps
Critical area	1.7837 ft2
Critical perimeter	10.4958 ft
Critical hydraulic radius	0.1699 ft
Critical top width	10.3506 ft
Specific energy	0.2806 ft
Minimum energy	0.2629 ft
Froude number	1.4707
Flow condition	Supercritical

Post Q100 RipRap No. 2 @ DP-8
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	2.4000 cfs
Slope	0.1057 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	0.0954 ft
Velocity	2.4926 fps
Full Flowrate	2.4000 cfs
Flow area	0.9628 ft2
Flow perimeter	10.2698 ft
Hydraulic radius	0.0938 ft
Top width	10.1907 ft
Area	0.9628 ft2
Perimeter	10.2698 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.1209 ft
Critical slope	0.0479 ft/ft
Critical velocity	1.9609 fps
Critical area	1.2240 ft2
Critical perimeter	10.3421 ft
Critical hydraulic radius	0.1183 ft
Critical top width	10.2419 ft
Specific energy	0.1919 ft
Minimum energy	0.1814 ft
Froude number	1.4297
Flow condition	Supercritical

Post Q100 offsite trib. to w-41 dp-9
Worksheet for 12" conc. pipe

Manning Pipe Calculator

Given Input Data:

Shape	Circular
Solving for	Depth of Flow
Diameter	1.0000 ft
Flowrate	3.7000 cfs
Slope	0.0796 ft/ft
Manning's n	0.0130

Computed Results:

Depth	0.4199 ft
Area	0.7854 ft2
Wetted Area	0.3130 ft2
Wetted Perimeter	1.4099 ft
Perimeter	3.1416 ft
Velocity	11.8228 fps
Hydraulic Radius	0.2220 ft
Percent Full	41.9911 %
Full flow Flowrate	10.0519 cfs
Full flow velocity	12.7985 fps

Critical Information

Critical depth	0.8594 ft
Critical slope	0.0082 ft/ft
Critical velocity	4.9193 fps
Critical area	0.7521 ft2
Critical perimeter	2.2897 ft
Critical hydraulic radius	0.3285 ft
Critical top width	1.0000 ft
Specific energy	2.5922 ft
Minimum energy	1.2892 ft
Froude number	3.7017
Flow condition	Supercritical

Post Q100 RipRap No. 3 @ DP-10
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	11.4000 cfs
Slope	0.0200 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	0.4013 ft
Velocity	2.7313 fps
Full Flowrate	11.4000 cfs
Flow area	4.1738 ft2
Flow perimeter	11.1350 ft
Hydraulic radius	0.3748 ft
Top width	10.8026 ft
Area	4.1738 ft2
Perimeter	11.1350 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.3392 ft
Critical slope	0.0350 ft/ft
Critical velocity	3.2506 fps
Critical area	3.5070 ft2
Critical perimeter	10.9594 ft
Critical hydraulic radius	0.3200 ft
Critical top width	10.6784 ft
Specific energy	0.5172 ft
Minimum energy	0.5088 ft
Froude number	0.7747
Flow condition	Subcritical

Post Q100 RipRap No. 4 @ DP-4
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	32.7000 cfs
Slope	0.0320 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	0.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	2.3572 ft
Velocity	5.8852 fps
Full Flowrate	32.7000 cfs
Flow area	5.5563 ft2
Flow perimeter	6.6671 ft
Hydraulic radius	0.8334 ft
Top width	4.7143 ft
Area	5.5563 ft2
Perimeter	6.6671 ft
Percent full	100.0000 %

Critical Information

Critical depth	2.3149 ft
Critical slope	0.0352 ft/ft
Critical velocity	6.1024 fps
Critical area	5.3586 ft2
Critical perimeter	6.5474 ft
Critical hydraulic radius	0.8184 ft
Critical top width	4.6297 ft
Specific energy	2.8954 ft
Minimum energy	3.4723 ft
Froude number	0.9557
Flow condition	Subcritical

Post Q100 RipRap No. 5 @ DP-4
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	32.7000 cfs
Slope	0.0100 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	0.9305 ft
Velocity	3.2152 fps
Full Flowrate	32.7000 cfs
Flow area	10.1704 ft2
Flow perimeter	12.6318 ft
Hydraulic radius	0.8051 ft
Top width	11.8609 ft
Area	10.1704 ft2
Perimeter	12.6318 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.6768 ft
Critical slope	0.0289 ft/ft
Critical velocity	4.5252 fps
Critical area	7.2262 ft2
Critical perimeter	11.9143 ft
Critical hydraulic radius	0.6065 ft
Critical top width	11.3536 ft
Specific energy	1.0911 ft
Minimum energy	1.0152 ft
Froude number	0.6121
Flow condition	Subcritical

Post Q100 RipRap No. 6 @ DP-5
Worksheet for Rectangular Channel
Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	39.2000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	1.2755 ft
Velocity	2.7256 fps
Full Flowrate	39.2000 cfs
Flow area	14.3820 ft2
Flow perimeter	13.6077 ft
Hydraulic radius	1.0569 ft
Top width	12.5510 ft
Area	14.3820 ft2
Perimeter	13.6077 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.7615 ft
Critical slope	0.0280 ft/ft
Critical velocity	4.7835 fps
Critical area	8.1949 ft2
Critical perimeter	12.1539 ft
Critical hydraulic radius	0.6743 ft
Critical top width	11.5230 ft
Specific energy	1.3910 ft
Minimum energy	1.1423 ft
Froude number	0.4489
Flow condition	Subcritical

Post Q100 RipRap No. 7 @ DP-6
Worksheet for Rectangular Channel

Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Depth of Flow
Flowrate	45.5000 cfs
Slope	0.0050 ft/ft
Manning's n	0.0400
Height	10000.0000 ft
Bottom width	10.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

Depth	1.3938 ft
Velocity	2.8651 fps
Full Flowrate	45.5000 cfs
Flow area	15.8809 ft2
Flow perimeter	13.9423 ft
Hydraulic radius	1.1390 ft
Top width	12.7876 ft
Area	15.8809 ft2
Perimeter	13.9423 ft
Percent full	100.0000 %

Critical Information

Critical depth	0.8388 ft
Critical slope	0.0274 ft/ft
Critical velocity	5.0048 fps
Critical area	9.0912 ft2
Critical perimeter	12.3724 ft
Critical hydraulic radius	0.7348 ft
Critical top width	11.6775 ft
Specific energy	1.5214 ft
Minimum energy	1.2582 ft
Froude number	0.4533
Flow condition	Subcritical

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APPENDIX F **4.6**

100 YEAR FLOOD PLAIN CALCULATIONS **4.61**

UNNAMED CREEK ALONG OLD 395
100 YEAR PEAK FLOW CALCS:

UTILIZE RATIONAL METHOD
Q=CIA

Calculate "C"
assume:

"C"' Value for Low Density Residential (LDR) Residential, 1.0 DU/A or less, type "d" soil

--- GROUP "D" AND UNKNOWN SOILS TYPICALLY THROUGHOUT MOST OF BASIN
CONSERVATIVELY ASSUME ALL GROUP "D" SOIL

therefore from table 3.1 County Hydro Manual C=0.41

Calculate "I"

--- from 100 year-6hour isopluval precipitation = 3.5 inches

--- Tc = Ti + TT (initial time + travel time)

Ti (from point z to y) 10% slope, natural watershed T
table 3.1 County Hydro Manual yields Ti = 6.9 minutes

TT = travel time from point y to x plus a tob plus b to c
={(11.9*L^3)/delta E}^0.385
TT (HOURS), DELTA E (FEET), LENGTH (MILES)

reach	L travel length (ft)	upper elev.	lower elev.	delta E elev. diff.	TT (mins)
y to z	100	1310	1282	28	0
a to b	1150	1200	974	226	3
b to c	4400	974	600	374	13
				sum(TT)=	16.7

z to a through reservoir assumed full, no travel time

THEREFORE TC = 6.9 MINUTES PLUS 16.7 MINUTES = 23.6

therefore from figure 3.2 County Hydro Manual I = 2.4

Calculate "A"

--- using a planimeter on attached topography maps for tributary basin
A=214.5 acres

BASIN AREA (AC)

TOPO MAP	5	6	
C	49.9	1.7	
D	78.1	8.0	
E	55.1	11.9	
F	5.6	4.1	TOTAL = 214.5

Calculate "Q"

Q = CIA 211 cfs

UNNAMED CREEK ALONG OLD 395
100 YEAR PEAK FLOW DEPTH CALCS:

UTILIZE MANNINGS EQUATION Q=(1.486./N)AR^.67S^.5

N VALUE FOR WEEDS/BRUSH AND BUSHY WILLOWS = 0.0375

CALCLUATE AT FLATEST SLOPE WHERE CASE 1 AND CASE 2 CHANNELS MEET

SLOPE = 3.3%

CASE 1

Given Input Data:

Shape	Advanced
Solving for	Depth of Flow
Flowrate	211.0000 cfs
Slope	0.0333 ft/ft
Manning's n	0.0375
Height	20.0000 ft
Bottom width	5.0000 ft
Left radius	3.0000 ft
Right radius	3.0000 ft
Left slope	2.0000 ft/ft (V/H)
Right slope	2.0000 ft/ft (V/H)

Computed Results:

Depth	2.2636 ft
Velocity	9.9933 fps
Full Flowrate	9948.6982 cfs
Flow area	21.1141 ft2
Flow perimeter	12.9964 ft
Hydraulic radius	1.6246 ft
Top width	10.9719 ft
Area	373.0038 ft2
Perimeter	52.6560 ft
Percent full	11.3182 %

Critical Information

Critical depth	2.6143 ft
Critical slope	0.0204 ft/ft
Critical velocity	8.4323 fps
Critical area	25.0227 ft2
Critical perimeter	13.7804 ft
Critical hydraulic radius	1.8158 ft
Critical top width	11.3225 ft
Specific energy	3.8156 ft
Minimum energy	3.9214 ft
Froude number	1.2700
Flow condition	Supercritical

CASE 2

Given Input Data:

Shape	Advanced
Solving for	Depth of Flow
Flowrate	211.0000 cfs
Slope	0.0333 ft/ft
Manning's n	0.0375
Height	20.0000 ft
Bottom width	25.0000 ft
Left radius	3.0000 ft
Right radius	3.0000 ft
Left slope	1.0000 ft/ft (V/H)
Right slope	1.0000 ft/ft (V/H)

Computed Results:

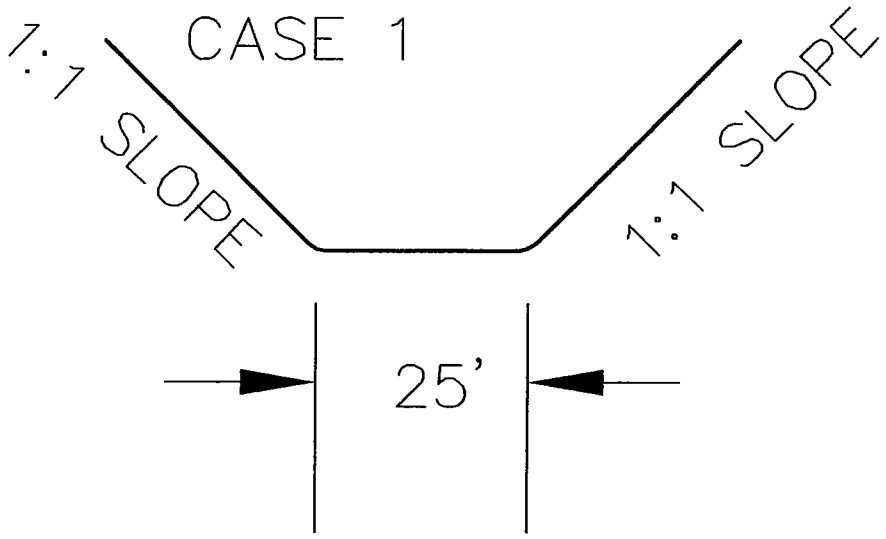
Depth	1.0503 ft
Velocity	7.1326 fps
Full Flowrate	34627.0224 cfs
Flow area	29.5824 ft2
Flow perimeter	30.1977 ft
Hydraulic radius	0.9796 ft
Top width	29.5858 ft
Area	949.3184 ft2
Perimeter	83.7957 ft
Percent full	5.2513 %

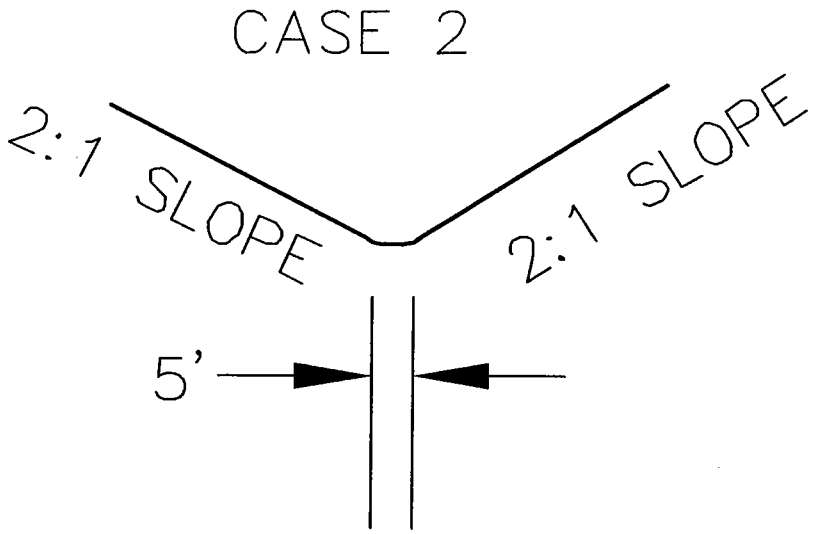
Critical Information

Critical depth	1.2187 ft
Critical slope	0.0202 ft/ft
Critical velocity	6.0990 fps
Critical area	34.5956 ft2
Critical perimeter	30.6742 ft
Critical hydraulic radius	1.1278 ft
Critical top width	29.9228 ft
Specific energy	1.8409 ft
Minimum energy	1.8281 ft
Froude number	1.2575
Flow condition	Supercritical

PLOT 100 YEAR FLOWLINE WITH A DEPTH OF 2.25' ALONG CREEK

UNNAMED CREEK OLD 395
TYPICAL CROSS SECTIONS



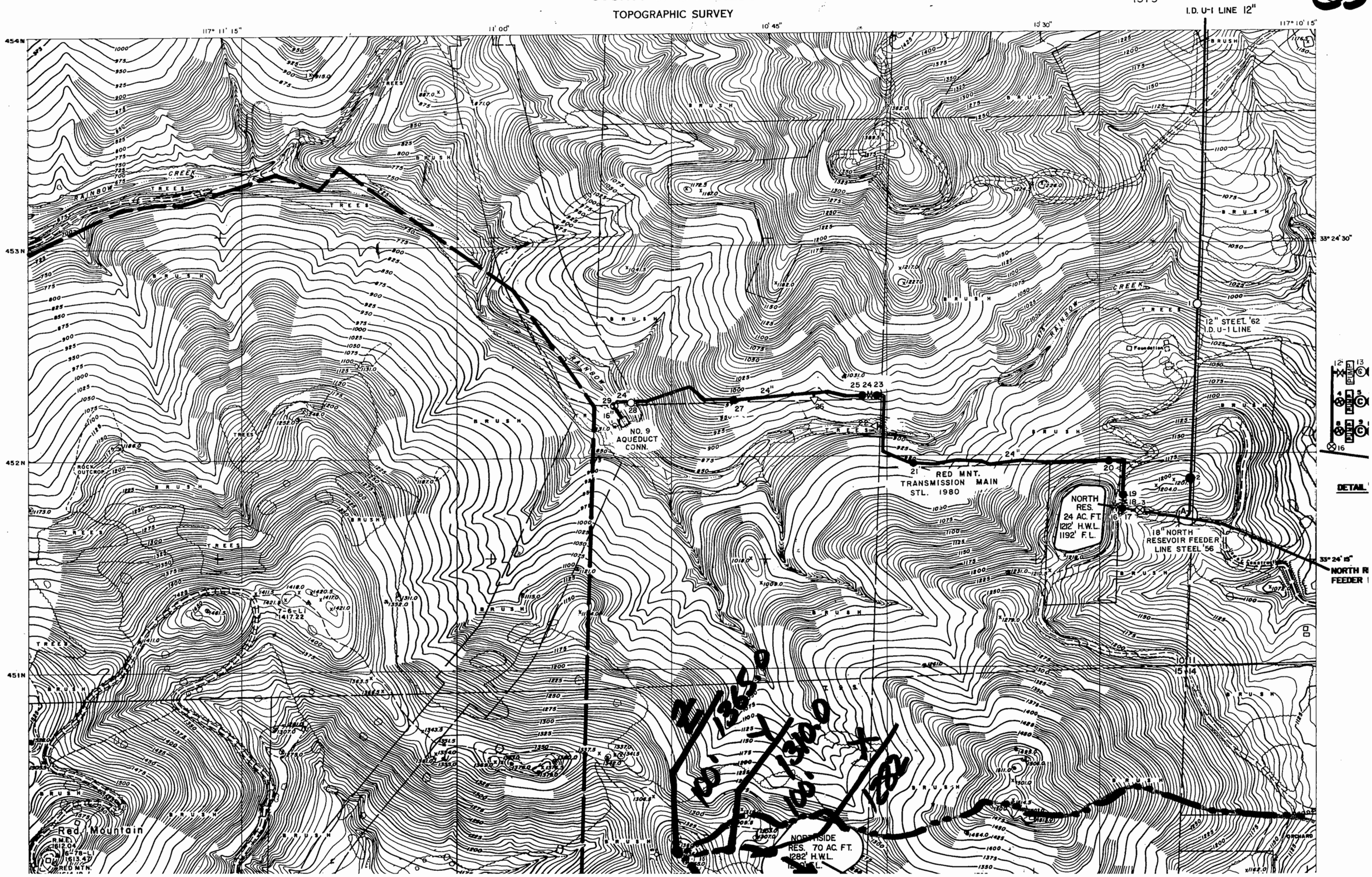


Topo Map Index

C5	C6
D5	D6
E5	E6
F5	F6

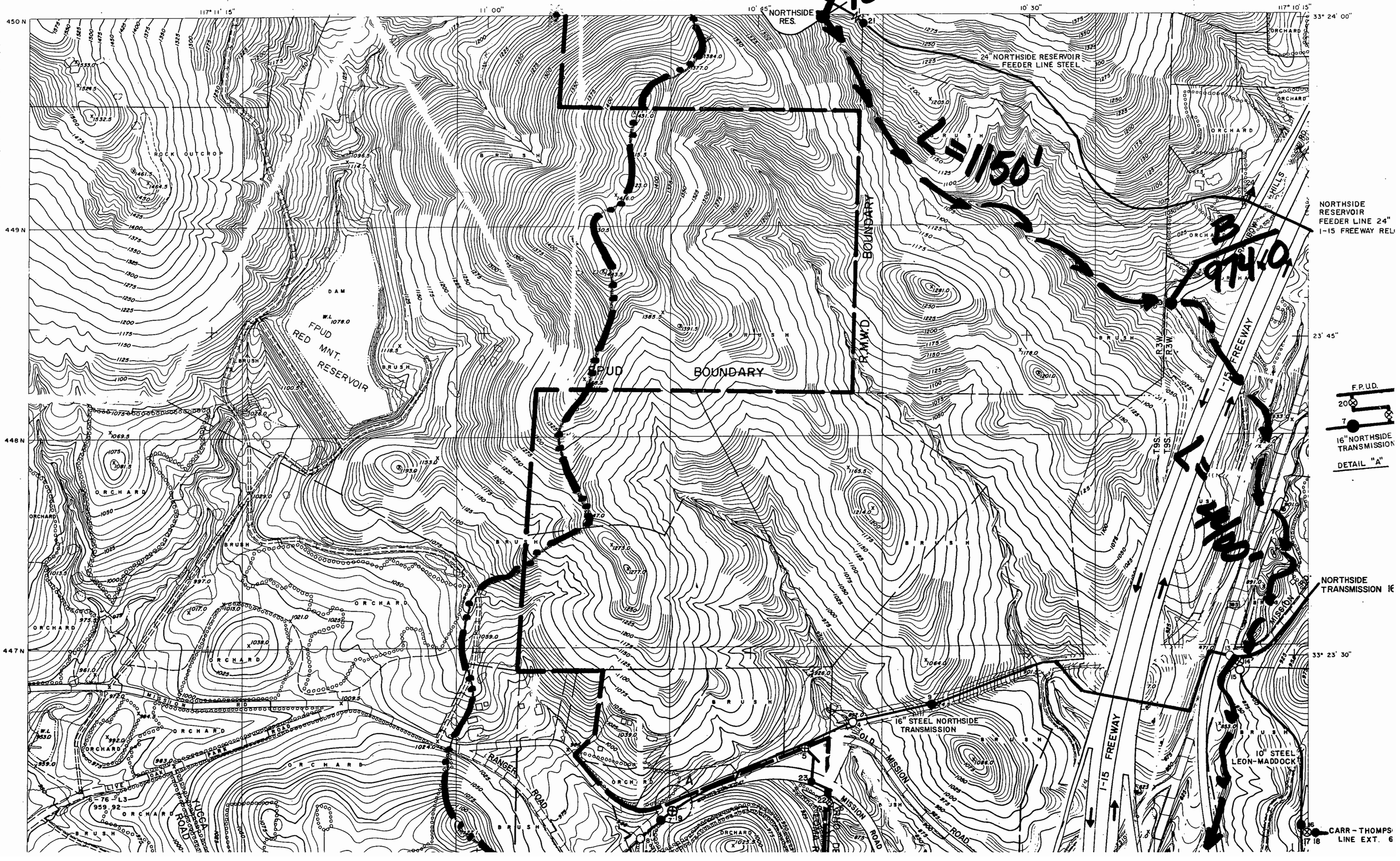
COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY



COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY

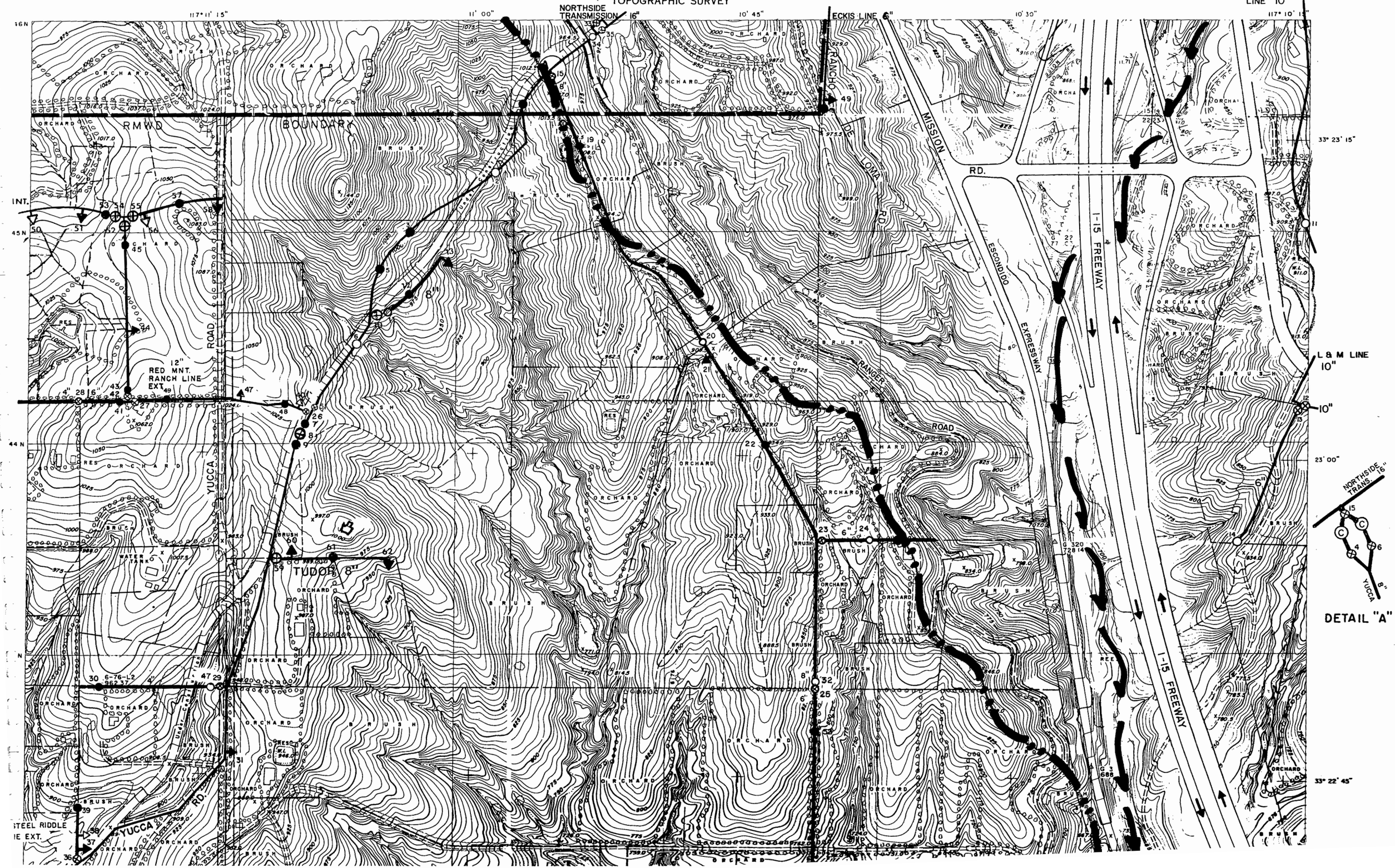


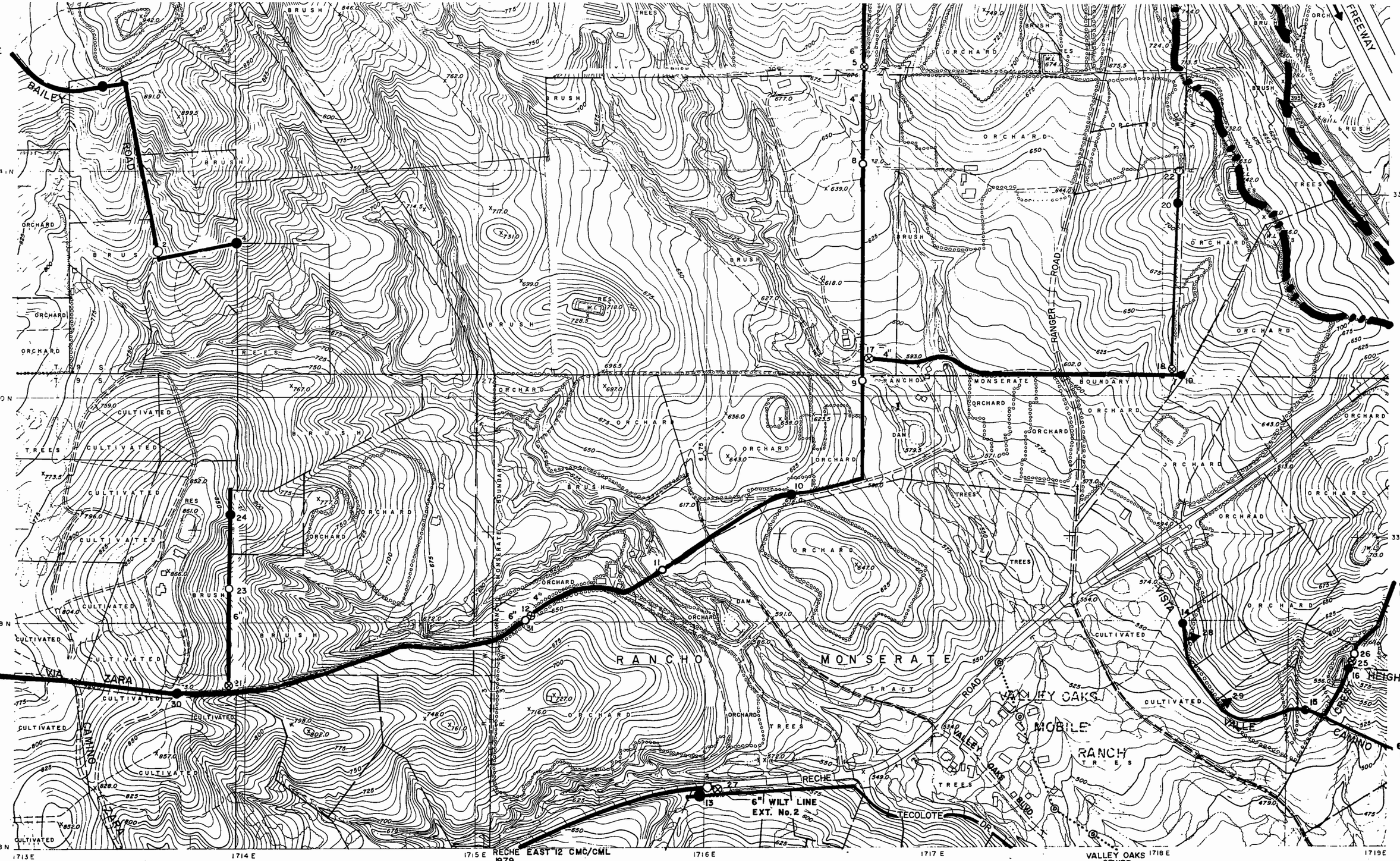
COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY

NORTHSIDE RES. SYSTEM
H.W. 1282'

E5





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CONTROL BY U.S.C. & G.S., U.S.G.S. AND THE COUNTY OF SAN DIEGO.
NORTH AMERICAN DATUM 1927.

COMPILED BY PHOTOGRAMMETRIC METHODS FROM PHOTOGRAPHY DATED JULY 1960 BY
INTERNATIONAL MAPPING CORPORATION
LOS ANGELES, CALIFORNIA

WATER LINE
PROPERTY LINE
GATE VALVE
PLUG VALVE
BLOW OFF
AIR RELEASE
FIRE HYDRANT
WARF HEAD
CLA VALVE

SCALE 1:2400
200 0 200 400 600 800 1000

CONTOUR INTERVAL 5 FEET
U. S. C. & G. S. DATUM

ONE THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VI)
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

THE RECTANGULAR COORDINATE VALUES ARE SHOWN ON THE SOUTH AND WEST MARGINS
THE GEOGRAPHIC VALUES ARE SHOWN ON THE NORTH AND EAST MARGINS

442-1707	442-1713	442-1719
438-1707	438-1713	438-1719
434-1707	434-1713	434-1719

ASSESSOR'S MAPS

	108-29	108-37
107-32	107-7	108-16
	107-19	108-17

SAN DIEGO COUNTY, CALIFORNIA

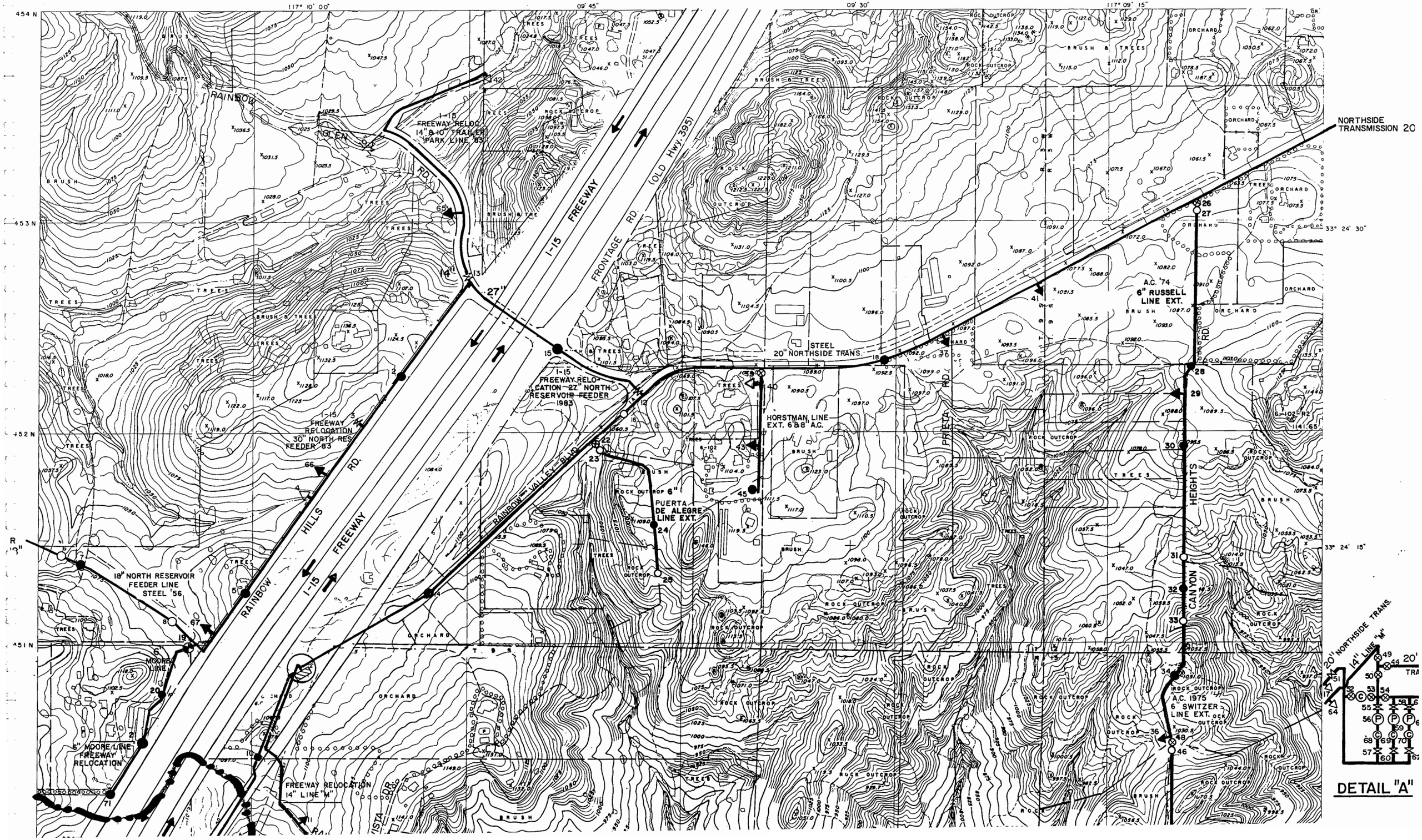
EDITION OF 1960

SHEET ~~22~~
438-17
F-5

COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY

C6c



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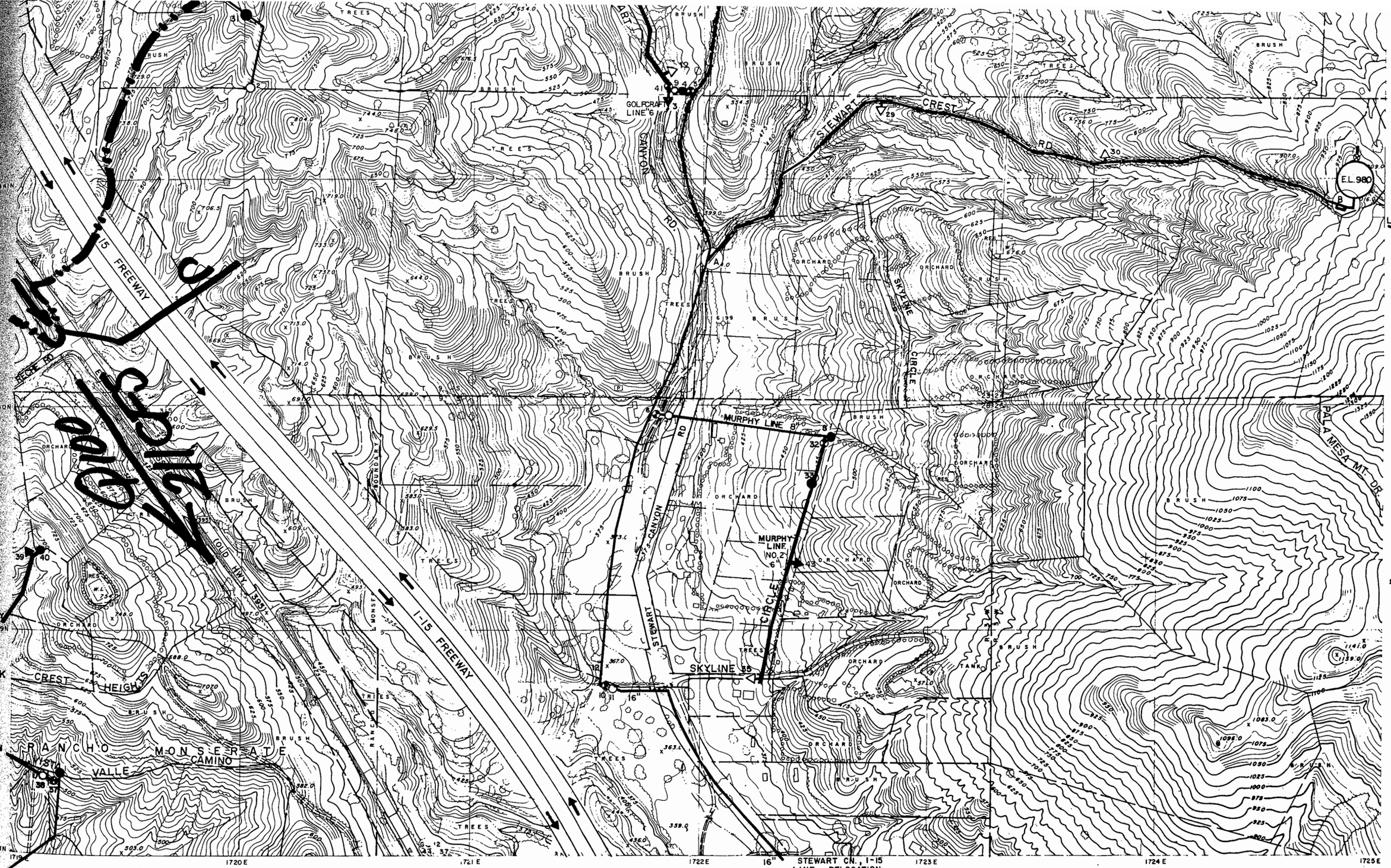

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▲ FIRE HYDRANT
WATER LINE
PROPERTY LINE
⊗ GATE VALVE
○ BLOW OFF
● AIR RELEASE
Ⓐ ALTITUDE VALVE
△ WARF HEAD
PLUG VALVE

SCALE 1:2400
200 0 200 400 600 800 1000

CONTOUR INTERVAL 5 FEET
U. S. C. & G. S. DATUM

ONE THOUSAND FOOT CALIFORNIA RECTANGULAR GRID (ZONE VI)
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THE RECTANGULAR COORDINATE VALUES ARE SHOWN ON THE SOUTH AND WEST MARGINS
THE GEOGRAPHIC VALUES ARE SHOWN ON THE NORTH AND EAST MARGINS

442-1713	442-1719	442-1725
438-1713	438-1719	438-1725
434-1713	434-1719	434-1725

ASSESSOR'S MAPS

108-37	108-38	108-39
108-16	108-44	
108-17	108-19	108-42

SAN DIEGO COUNTY
CALIFORNIA

EDITION OF 1960

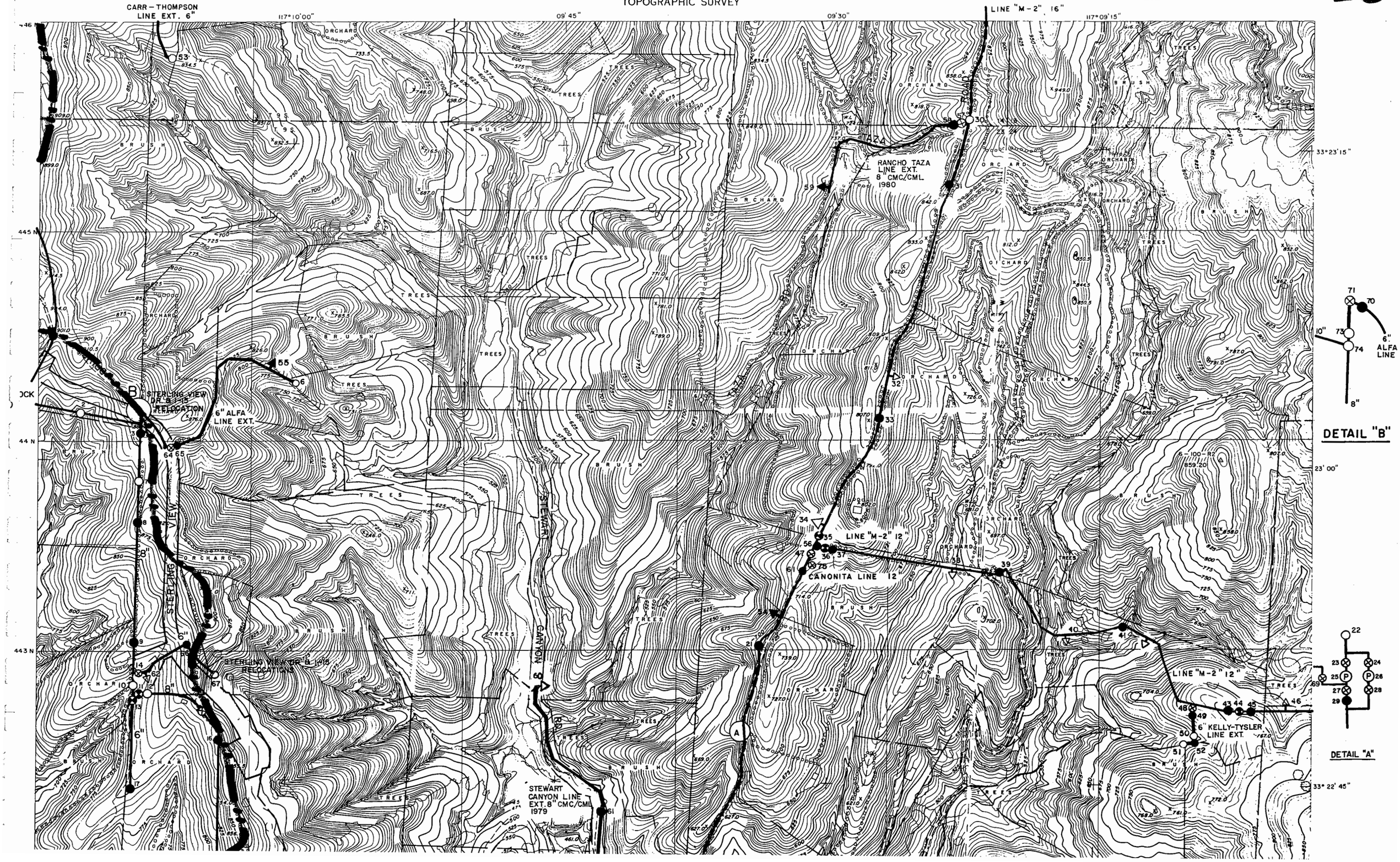
SHEET ~~33~~
438-1719
F-6

COUNTY OF SAN DIEGO

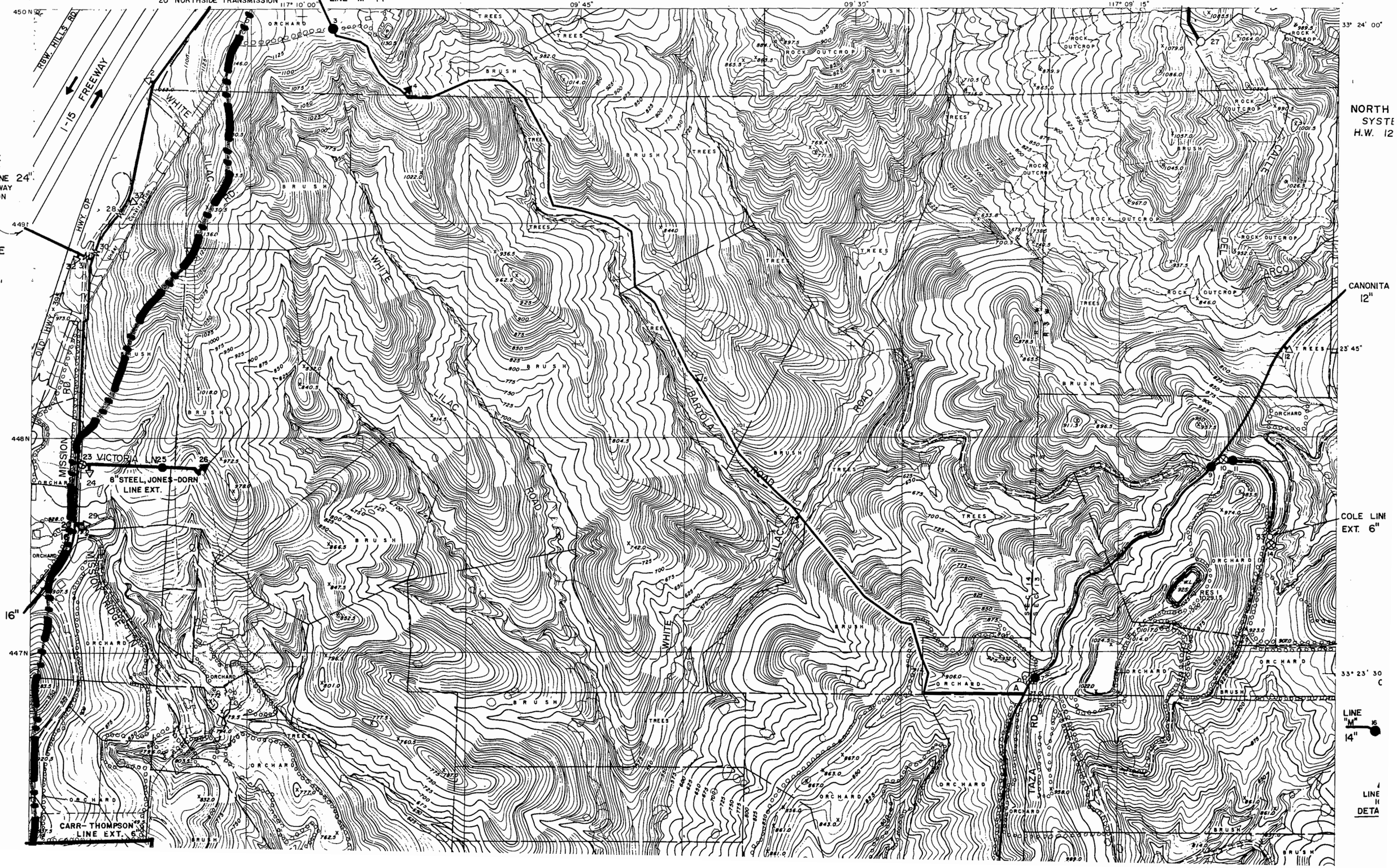
TOPOGRAPHIC SURVEY

NORTH RES.
1212'

E6



COUNTY OF SAN DIEGO

TOPOGRAPHIC SURVEY

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