PRELIMINARY DRAINAGE REPORT

FOR

RABBIT RUN
PROPOSED RESIDENTIAL DEVELOPMENT
7 LOTS
TM 5478RPL1 / ER 06-08-017
APN 188 - 160 - 07,08,16

PREPARED FOR

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PREPARED BY

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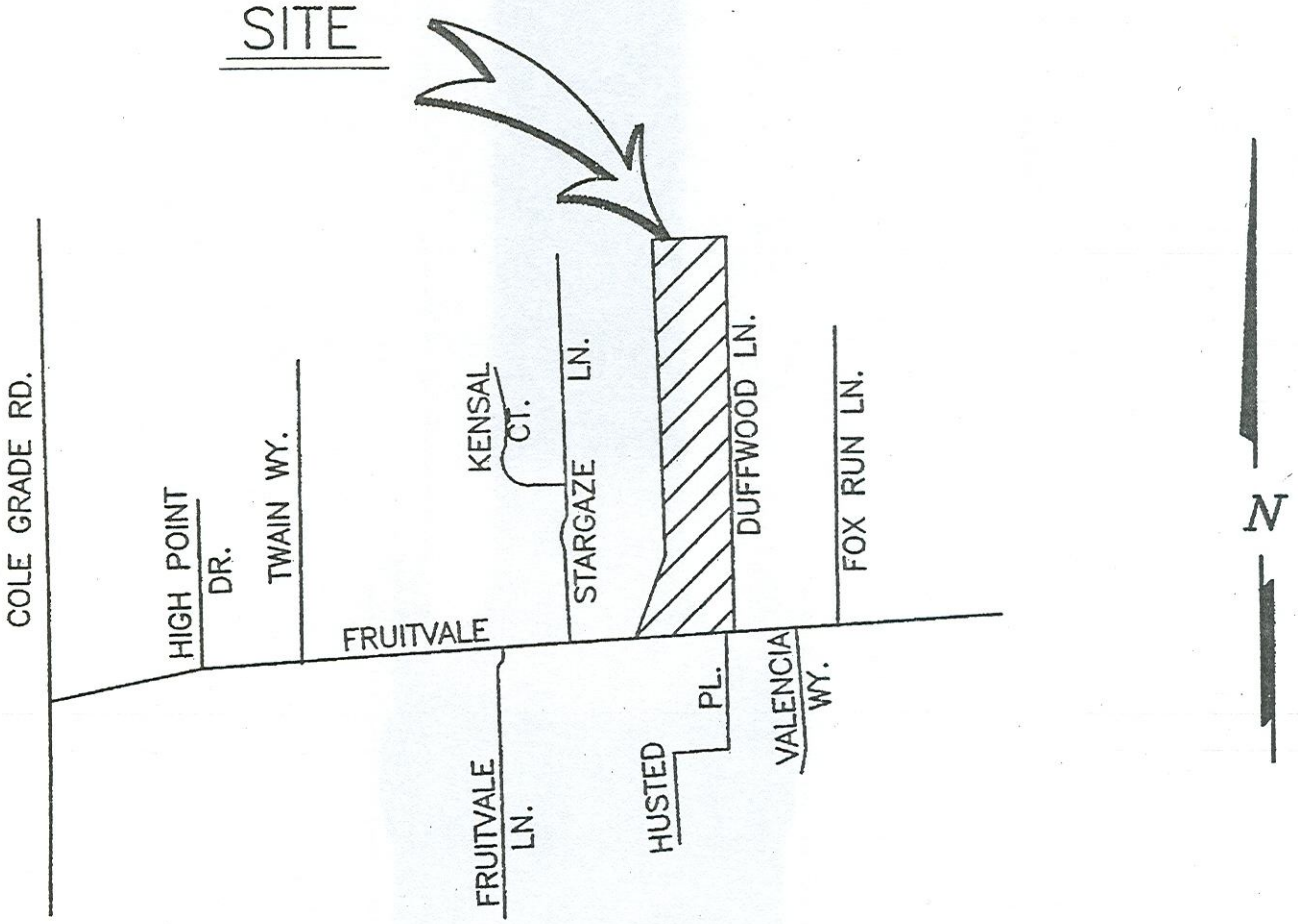
March 7, 2008

REGISTERED PROFESSIONAL ENGINEER
ROBERT O. SUKUP
No. C028302
Exp. 3/31/10
CIVIL
STATE OF CALIFORNIA

Robert Sukup

LOCATION MAP



VICINITY MAP

NO SCALE

THOM. BROS. PG. 1070, H–7

The proposed project is to create a 7 lot subdivision on about 17.7 acres of property. The property is a long rectangular shape. The owners live and own the house to the north and it is contiguous to the proposed subdivision. The property is bordered by Duffwood Lane along most of its eastern boundary, by single family homes on the west side, and by Fruitvale Road on the south.

Present drainage flows in a slight northeast to southwest direction for the northern part of the property and in a southern direction for the southern part. Property to the north and northeast of the proposed project is quite steep. I do not see any development occurring on that property. I have maintained the "C" value at .3 for the soil runoff coefficient for both the pre and post development conditions. Areas more to the east may see development but there flows do not "really enter" the subject property. The flows go into Duffwood Lane and flow down to Fruitvale Road. There is a well defined drainage swale that runs along the western boundary for about 1100' then travels offsite in a southwest and south direction to Fruitvale Road. This swale is intended to remain as is.

Duffwood Lane will have to be upgraded to a 24' wide roadway with A.C. berms on each side. It is intended for the road to carry all the offsite waters from the east to Fruitvale Road as it presently does. Near the southern end of Duffwood Lane, two spillways are proposed on the west side of the road and one spillway on the east side to treat low flow runoff through rip rap and vegetated swales. Any minor increase in drainage due to the widening of Duffwood Lane [increase in impervious area] will be mitigated by these three spillways. There will be no increase in drainage to Fruitvale Road. The project is at a high point or crown on Fruitvale Road. The drainage that flows to the east will remain the same. The drainage water flowing easterly travels in a dirt swale along the edge of Fruitvale Road. As it travels easterly, it crosses several driveways as well as Fox Run Road until it arrives at a spillway about 1,360 feet from the project boundary that takes Fruitvale water into a natural drainage course that goes through a 48" RCP pipe that crosses under Fruitvale and flows southerly in the continuation of the natural drainage course. Fruitvale Road handles the drainage in its present condition with its weedy dirt swales. I have walked the road after the rains and there are some puddles along the earthen swales due to minor low points along the way, but they dry up.

My theoretical calculations show a potential Q of about 47 cfs making its way to Fruitvale Road from the project and adjacent properties along Duffwood. It is my firm belief that almost none of the 20.67 cfs from the project will get to Fruitvale Road because of the contoured swales proposed for the lots and due to the large open area at the southern end of the project that water must path through.

All drainage from the proposed lots is proposed to be in surface swales, exiting

the pads into rip rap and vegetated swales, on contour.

The attached hydrology calculations, topography maps, etc. that follow show the drainage areas and corresponding flows.

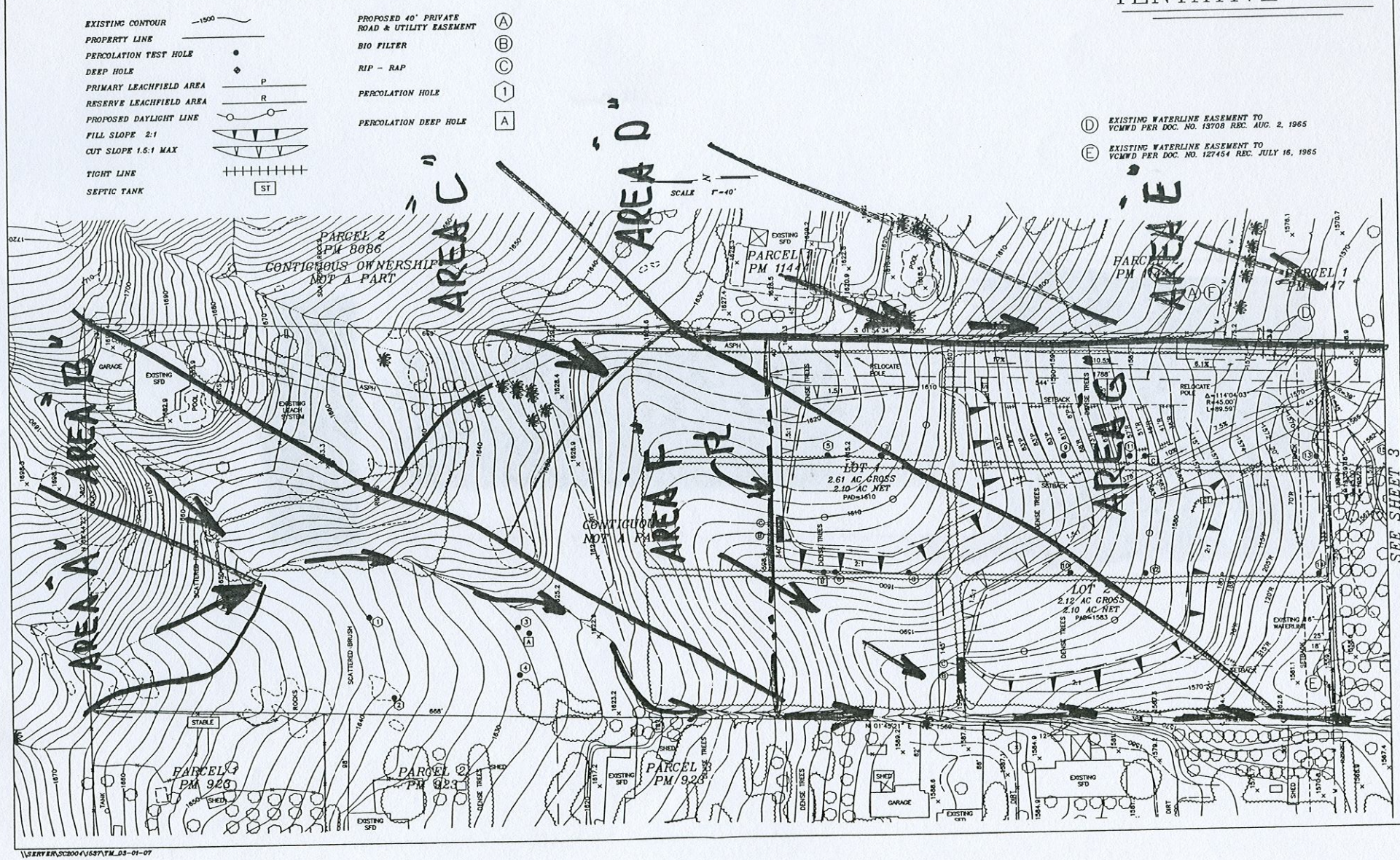
The proposed 7 lots will not have a negative affect on downstream drainage courses considering drainage patterns [Duffwood Lane on the east and the natural swale to the west] are remaining the same. The property is presently a grove situation which uses more water than a 2 acre residential pad. The proposed pads are large which will increase the times of concentration. Large areas off the pads will receive the exiting waters via energy dissipators and vegetated swales to provide erosion control, filtering and infiltration. The calculated net increase in flow for the project is 1.81 cfs which is minimal and would not have any measurable affect on downstream facilities. Provided the rip rap and vegetated swales are installed on contour, I see almost no water leaving the site. My field experience has shown me that rip rap and swales facing downhill don't have the effectiveness that on contour facilities have. One also has to understand that these facilities are receiving small quantities of water off of flat pads so they have the ability to work very well. The non developed areas of the lots where the leach fields go or where groves may remain will continue to function as they have been.

The high point of Fruitvale Road is at the western boundary of the project. No drainage water west of the property enters onto Fruitvale Road. The existing drainage along Fruitvale Road will be conveyed via an A.C. berm as part of the required road widening [approximately an additional 8' in width]. A minor low point along the frontage will be alleviated via the road widening. As discussed above, the drainage coming down Duffwood Lane will remain the same. The one difference will be that it will be conveyed in an A.C. berm as part of the street widening instead of its existing slightly rural nature. Therefore the drainage may make it to Fruitvale Road a little quicker than it does now. East of the project Fruitvale Road is gentle in grade [about 1%] with naturally established flow patterns. The existing drainage east of the project along Fruitvale Road will remain as is. No erosion or siltation, other than what has typically gone on over time, should occur.

A review of the 48" RCP Pipe approximately 1,360' east of the project, with headwalls on each side, was debris free [sometimes you find pipes half full of debris] and appeared to be functioning just fine.

COUNTY OF SAN DIEGO TRACT NO. _____

SHEET 2 OF 3 SHEETS
REPLACEMENT
TENTATIVE MAP



ENGINEER'S NAME: PAXTON SURVEYING AND ENGINEERING (760) 743-0430

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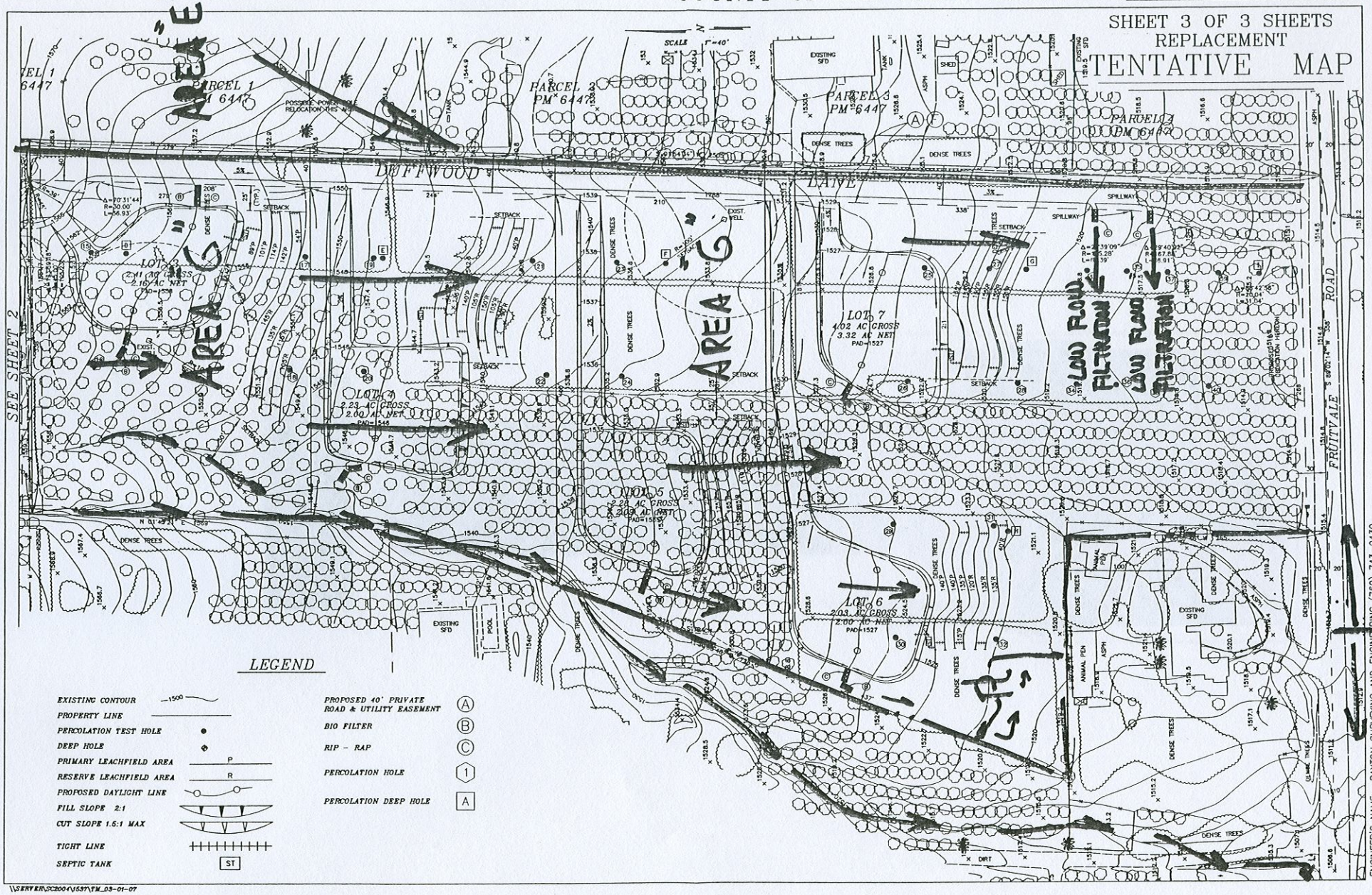
COUNTY OF SAN DIEGO TRACT NO. _____

SHEET 3 OF 3 SHEETS

REPLACEMENT

TENTATIVE MAP



LEGEND

EXISTING CONTOUR	1500
PROPERTY LINE	
PERCOLATION TEST HOLE	●
DEEP HOLE	◆
PRIMARY LEACHFIELD AREA	P
RESERVE LEACHFIELD AREA	R
PROPOSED DAYLIGHT LINE	
FILL SLOPE 2:1	
CUT SLOPE 1.5:1 MAX	
TIGHT LINE	
SEPTIC TANK	ST
PROPOSED 40' PRIVATE ROAD & UTILITY EASEMENT	Ⓐ
BIO FILTER	Ⓑ
RIP - RAP	Ⓒ
PERCOLATION HOLE	1
PERCOLATION DEEP HOLE	A

ENGINEER'S NAME: PAXTON SURVEYING AND ENGINEERING (760) 743-0430

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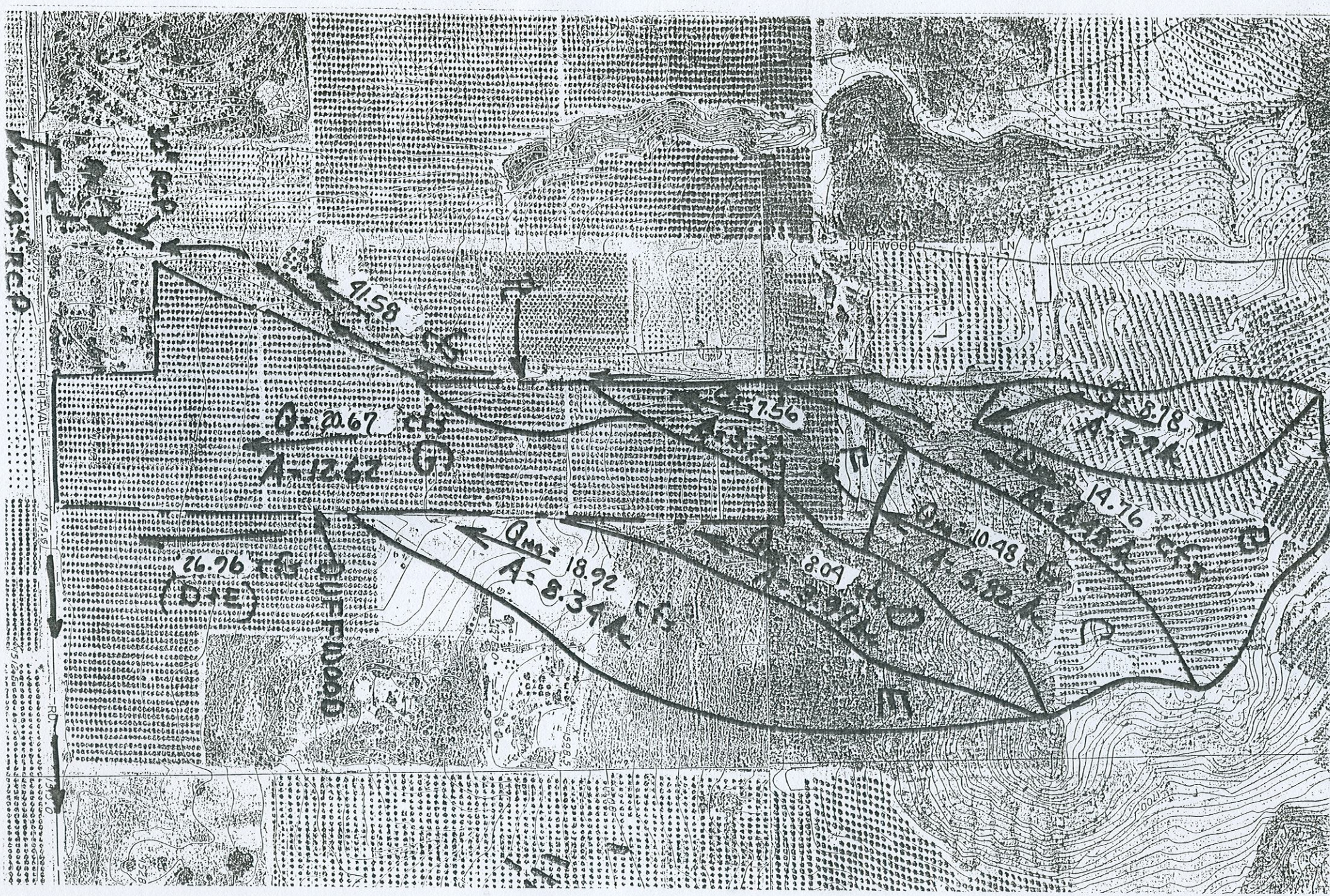


DUFFWOOD
LN
FRUITVALE
RD
41.58
Q = 20.67
A = 12.62
7.56
8.78
14.76
10.48
8.04
26.96
Q = 18.92
A = 8.34

HYDROLOGY CALCS

THE SOIL GROUP FOR THIS AREA IS C. (SEE ATTACHED COPY OF SOILS MAP)

THE "C" VALUE I WILL USE IS EITHER .3 (NATURAL) OR .36 (1DU/AC) (SEE TABLE 3-1)

T_i's VARY - SEE CALCS (FORMULA OF FIG. 3-3)

T_t's VARY - SEE FIGURE 3-4

P_6 = 3.7 SEE FIGURE 3-1

$$T_i = \frac{1.8(1.1-C)\sqrt{D}}{\sqrt[3]{S}}$$ (SEE FIGURE 3-3)

AREA "A"

A = 3.90 Ac. , L = 900' ΔH = 169'

INITIAL START AREA = 40' w/ 4' DROP; $T_i = \frac{(1.8)(1.1-.3)\sqrt{40}}{\sqrt[3]{10}} = 4.23$

T_t = 2.9 FIGURE 3.4

T_c = 4.23 + 2.9 = 7.13

I = 7.50 FIGURE 3-1

Q = CIA = .3 × 7.50 × 3.90 = 8.78 cfs.

AREA "B"

A = 8.48 Ac. L = 1400' ΔH = 195'

T_i = 70' LENGTH w/ 3' DROP; $T_i = \frac{(1.8)(1.1-.3)\sqrt{70}}{\sqrt[3]{4.29}} = 7.41$

T_t = 4.2 (FIGURE 3-4)

T_c = 7.41 + 4.2 = 11.61

I = 5.8 (FIGURE 3-1)

Q = CIA = .3 × 5.8 × 8.48 = 14.76 cfs

AREA "C"

A = 5.82 Ac. , L = 1000 , ΔH = 154

T_i = 80' LENGTH w/ 4' DROP; $T_i = \frac{(1.8)(1.1-.3)\sqrt{80}}{\sqrt[3]{5.0}} = 7.53$

T_t = 3.3 (FIGURE 3-4)

T_c = 7.53 + 3.3 = 10.83

I = 6.0 (FIGURE 3-1)

Q = CIA = .3 × 6.0 × 5.82 = 10.48 cfs

AREA "D"

A = 3.97 Ac , L = 1250' , ΔH = 230'

T_i = 30' LENGTH w/ 1' DROP ; $T_i = \frac{1.8(1.1-.3)\sqrt{30}}{\sqrt[3]{3.33}} = 5.30$

T_t = 3.7 (FIGURE 3-4)

T_c = 5.3 + 3.7 = 9.0

I = 6.75 (FIGURE 3-1)

Q = CIA = .3 × 6.75 × 3.97 = 8.04

AREA "E"

A = 8.34 Ac , L = 1750' , ΔH = 260'

T_i = SAME AS "D" = 5.30

T_t = 5.0 (FIGURE 3-4)

T_c = 5.3 + 5.0 = 10.3

I = 6.30 (FIGURE 3-1)

Q = CIA = .36 × 6.30 × 8.34 = 18.92 cfs (HOUSE EXISTS, POOL, ETC)

∴ C = .36

AREA "F"

A = 3.75 Ac , L = 1050 , ΔH = 105'

T_i = 50' LENGTH w/ 1' DROP ; $T_i = \frac{1.8(1.1-.3)\sqrt{50}}{\sqrt[3]{2.0}} = 8.08$

T_t = 4.0 (FIGURE 3-4)

T_c = 8.08 + 4.0 = 12.08

I = 5.55 (FIGURE 3-1)

Q = CIA = .36 (EXISTING HOUSE, DWWY) × 5.55 × 3.75 = 7.49 cfs

AREA "G"

A = 12.62 Ac , L = 1930' ΔH = 110'

T_i = 75' LENGTH w/ 5' DROP ; $T_i = \frac{1.8(1.1-.3)\sqrt{75}}{\sqrt[3]{6.67}} = 6.63$

T_t = 7.8 FIGURE 3-4

T_c = 6.63 + 7.8 = 14.43

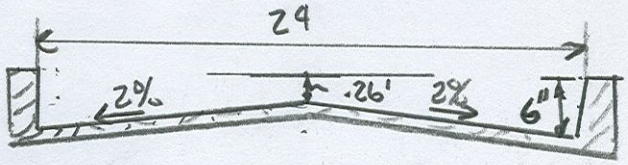
I = 5.0 (FIGURE 3-1)

Q = CIA = .3 × 5.0 × 12.62 = 18.93 cfs

DUFFWOOD LANE

THE INTENT IS TO HAVE DUFFWOOD LANE CONTINUE TO CARRY THE DRAINAGE AS IT HAS BEEN DOING. BASED ON MY HYDROLOGY THE TOTAL Q_{100} IN THE STREET = AREA'S D & E = 8.04 + 18.92 = 26.96 cfs. AREA C ENTERS INTO THE NATURAL DRAINAGE

THE STREET SECTION =



CHECK ITS CAPACITY

$$Q = \frac{AR^{2/3}(1.49)\sqrt{S}}{.015 \text{ (roughness)}}$$

$A = (24)(.26) + 2(\frac{1}{2})(12)(.24) = 9.12$ ⌀

WETTED PERIMETER = 24 + .5 + 12 + 12 + .5 = 49

$R = A/WP = 9.12/49 = .1861$

$S_{min} = .03$

$$Q = \frac{(9.12)(.1861)^{2/3}(1.49)\sqrt{.03}}{.015} = 51.15 \text{ cfs} > 26.96 \text{ cfs} = \text{OK}$$

CHECK TO SEE IF WATER FILLED TO THE CROWN LINE (OR 3" DEEP @ DIKE) WOULD THERE BE CAPACITY!

$A = 2 \times 12 \times \frac{1}{2} \times .24 = 2.88$, $R = (4 \times 12) + .24 + .24 = 48.48$

$R = 2.88/48.48 = .0594$; $.0594^{2/3} = .1522$

$S = .03$; $\sqrt{.03} = .1732$, ROUGHNESS = .015

$$Q = \frac{(2.88)(.1522)(1.49)(.1732)}{.015} = 7.54 < 26.96$$ WATER WILL TOP CROWN IN 100 YEAR STORM BY ABOUT 2" BUT STAY WITHIN ROAD. CARS WOULD HAVE TO TRAVEL IN ABOUT 3"-4" OF WATER DRIVING NEAR THE CENTER OF THE ROAD IF THEY ARE GOING TO DRIVE IN THAT KIND OF WEATHER. IT WOULD BE WITH OR AGAINST FLOW EXCEPT WHEN TURNING IN OR OUT OF THE DRIVEWAY. I DON'T ANTICIPATE MUCH DRIVING, IF ANY, DURING THE 100 YEAR STORM.

DUFFWOOD LANE

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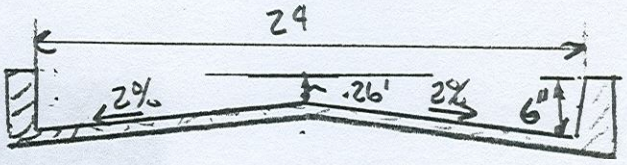

CHECK ITS CAPACITY

$$Q = \frac{AR^{2/3}(1.49)\sqrt{S}}{.015 \text{ (roughness)}}$$

$A = (24)(.26) + 2(\frac{1}{2})(12)(.24) = 9.12$ ¢

WETTED PERIMETER = 24 + .5 + 12 + 12 + .5 = 49

$R = A/WP = 9.12/49 = .1861$

$S_{min} = .03$

$$Q = \frac{(9.12)(.1861)^{2/3}(1.49)\sqrt{.03}}{.015} = 51.15 \text{ cfs} > 26.96 \text{ cfs} = \text{OK}$$

CHECK TO SEE IF WATER FILLED TO THE CROWN LINE (OR 3" DEEP @ DIKE) WOULD THERE BE CAPACITY!

$A = 2 \times 12 \times \frac{1}{2} \times .24 = 2.88$, $R = (4 \times 12) + .24 + .24 = 48.48$

$R = 2.88/48.48 = .0594$; $.0594^{2/3} = .1522$

$S = .03$; $\sqrt{.03} = .1732$, ROUGHNESS = .015

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POST DEVELOPMENT

AREAS A, B, C, D & E REMAIN THE SAME AFTER THE PROPOSED DEVELOPMENT.

AREA F HAS A PORTION OF LOTS 1 & 2 THAT WILL HAVE PORTIONS OF GRADED PADS IN AREA F. THE AREA IS ABOUT 1.25 ACRES. IN POST DEVELOPMENT THE LOTS WILL HAVE INITIAL DRAINAGE SWALES OF 100' @ 1%. PER FIGURE 3-3 THAT YIELDS A T_i OF 9 MIN. A T_c OF 50' VERTICAL TO 635' N YIELDS A T_c OF 3 MIN FOR A TOTAL TIME OF 12 MIN. PER FIG. 3-1 I = 5.7 FOR 12 MIN W P-6 = 3.7.

PRE DEV. Q = .36 x 5.55 x 1.25 = 2.50 cfs (HAS EXIST. HOUSE)

POST DEV. Q = .36 x 5.7 x 1.25 = 2.57 cfs.

THEREFORE, AREA F HAS A THEORETICAL MINOR INCREASE IN FLOW OF .07 cfs. AFTER DEVELOPMENT.

IN AREA G, WE DO HAVE DEVELOPMENT OF THE LOTS. ALL LOTS HAVE 50' SWALES @ 1% = T_i = 9 MIN (FIGURE 3-3) THE T_c FOR AREA G IS 7.8 (≈ 110' V. OVER 1900')

PRE DEV. Q = .30 x 5.0 x 12.62 Ac. = 18.93 cfs.

POST DEV Q = .36 x 4.55 x 12.62 Ac = 20.67 cfs.

THEREFORE, AREA G HAS A THEORETICAL MINOR INCREASE IN FLOW OF 1.74 cfs AFTER DEVELOPMENT.

ALL OF THE PAD DRAINAGE IS BEING "SENT" THROUGH RIP RAP & VEGETATED SWALES AND THE STREET WATER IS ALSO BEING DIRECTED THROUGH TWO SPILLWAYS, RIP RAP & VEGETATED SWALES TO ABSORB, FILTER & DISPERSE RUN OFF BEFORE IT LEAVES THE SITE.

FLOW TABULATIONS

AREA	C	Tc	I	A	Q	
A-PRE	.3	7.13	7.50	3.90	8.78	
A-POST	"	"	"	"	"	
B-PRE	.3	11.61	5.8	8.48	14.76	
B-POST	"	"	"	"	"	
C-PRE	.3	10.83	6.0	5.82	10.48	
C-POST	"	"	"	"	"	
D-PRE	.3	9.0	6.75	3.97	8.04	
D-POST	"	"	"	"	"	
E-PRE	.36	10.3	6.30	8.34	18.92	
E-POST	"	"	"	"	"	
F-PRE	.36	12.08	5.55	3.75	7.49	
F-POST	.36 .36	=12.08" 12.0	5.55 5.70	2.50 1.25	7.56	SEE SHT 4 - SMALL AREA
G-PRE	.30	14.43	5.0	12.62	18.93	
G-POST	.36	16.8	4.55	12.62	20.67	SEE SHT - 4

FLOW SUMMARY

AREA	PRE DEV. Q	POST DEV. Q
A	8.78	8.78
B	14.76	14.76
C	10.48	10.48
D	8.04	8.04
E	18.92	18.92
F	7.49	7.56
G	18.93	20.67
TOTAL	87.40	89.21

THE THEORETICAL NET INCREASE IS 1.81 cfs WHICH IS MINIMAL, AND WILL NOT HAVE ANY MEASURABLE AFFECT ON DOWNSTREAM FLOWS, EROSION & SILTATION.

THE ABOVE STATEMENT IS BASED ON RIP RAP & VEGETATED SWALES, ON CONTOUR, BEING INSTALLED ON ALL LOTS IN ADDITION TO THE 2 SPILLWAYS, RIP RAP, ETC FOR DUFFWOOD LANE WATER ONTO THE SOUTHERN PORTION OF LOT 7.

CONCERN WAS RAISED ABOUT "PONDING" WATER ALONG FRUITVALE. THERE IS A POSITIVE GRADE DIFFERENTIAL FROM WEST TO EAST ACROSS THE FRONTAGE OF THE PROPERTY. AN A.C. BERM WILL BE INSTALLED WITH HALF WIDTH IMPROVEMENTS. THERE IS A HIGH POINT IN FRUITVALE NEAR THE WESTERN BOUNDARY. WE WILL HAVE POSITIVE FLOW TO THE EAST & MATCH EXISTING GRADE WHERE THE WATER WILL CONTINUE TO FLOW EASTERLY, ON GRADE, AS IT PRESENTLY DOES.

MAP #24
VALLEY CENTER

ROWE PROPOSED
SUBDIVISION
"RABBIT RUN"
SOIL = C

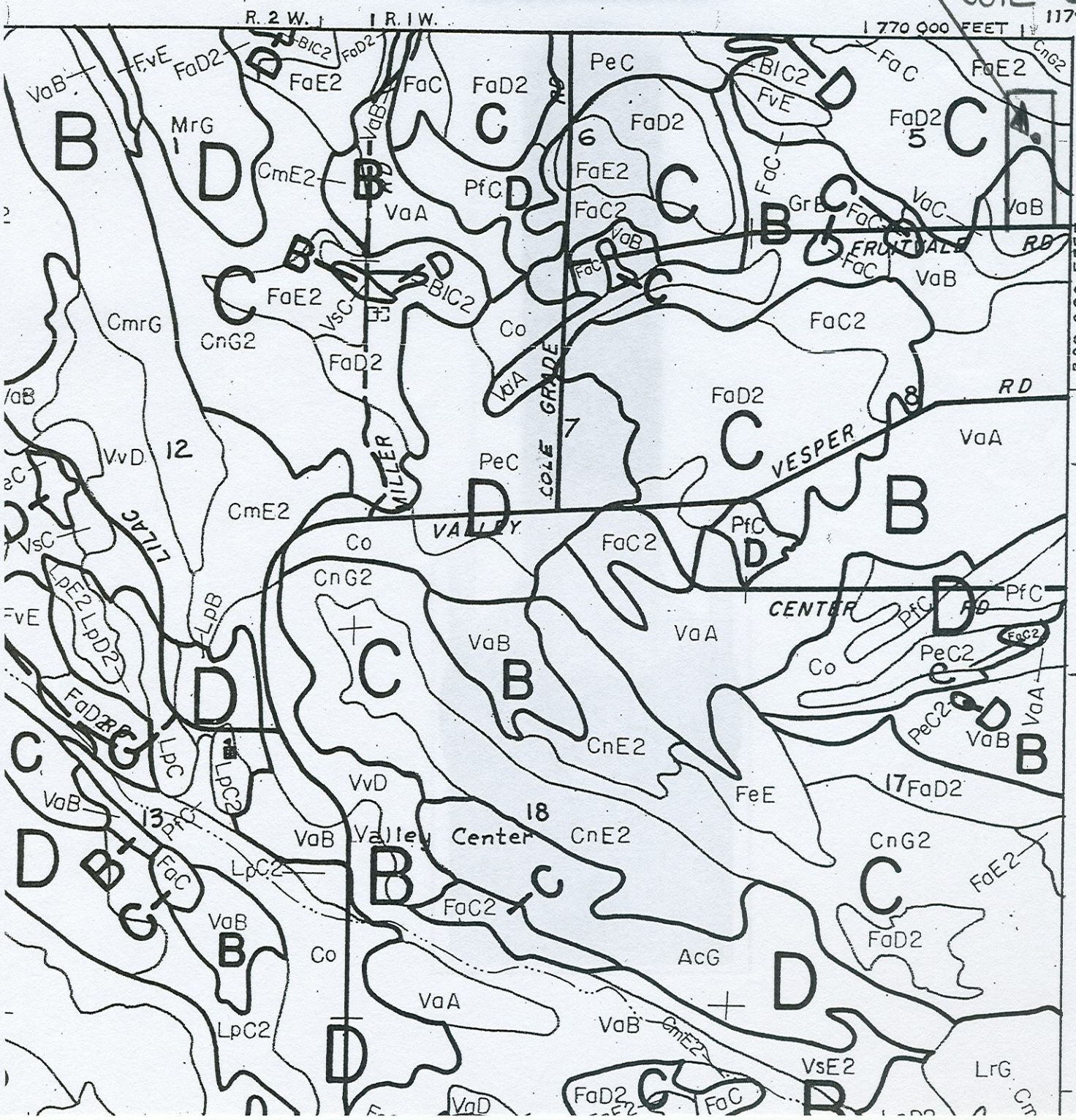
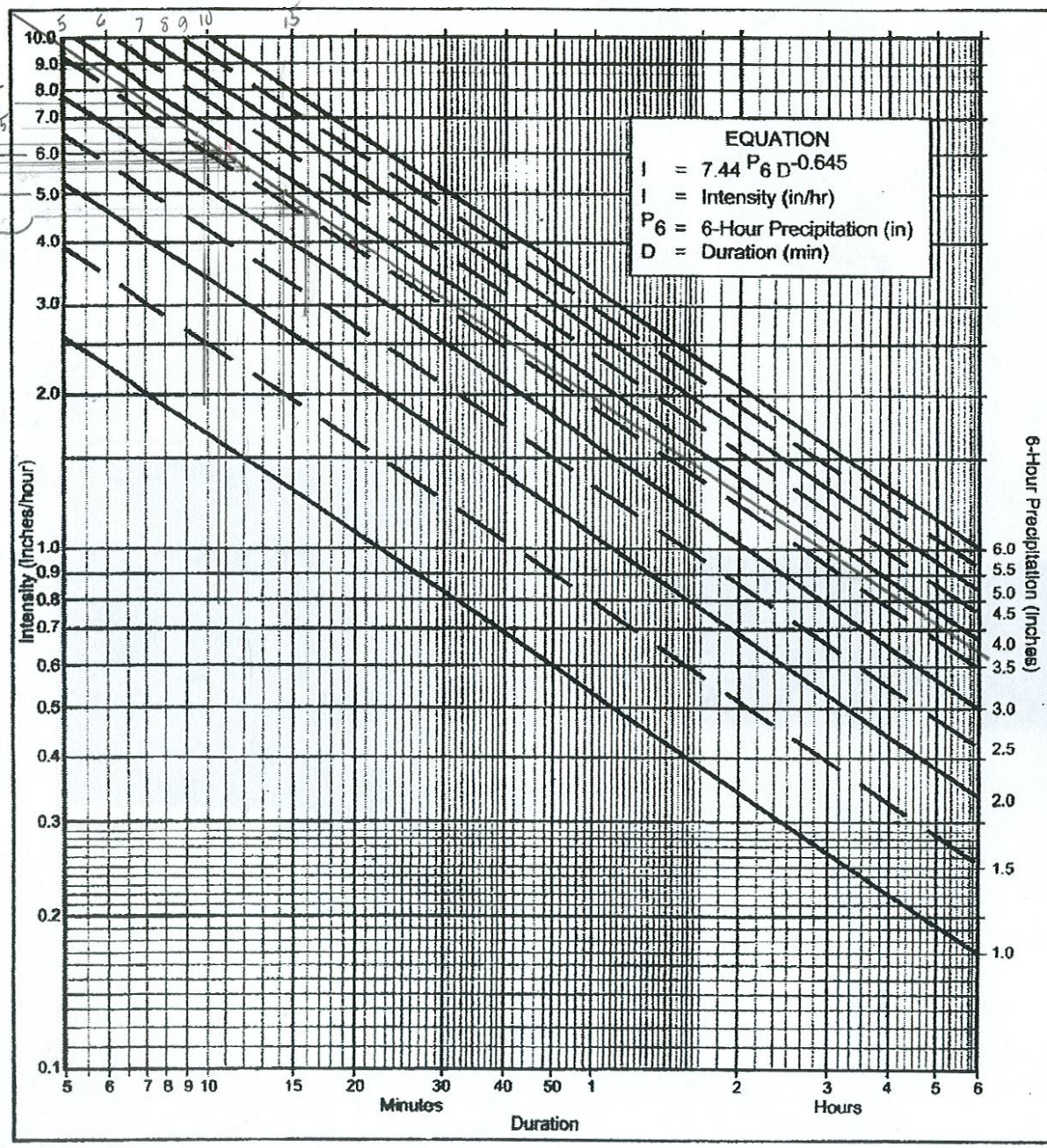


Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

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 bei[illegible]alyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 3.7 in., P_{24} = 8.1 , $\frac{P_6}{P_{24}}$ = 45.6 %(2)

(c) Adjusted P_6(2) = 3.7 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

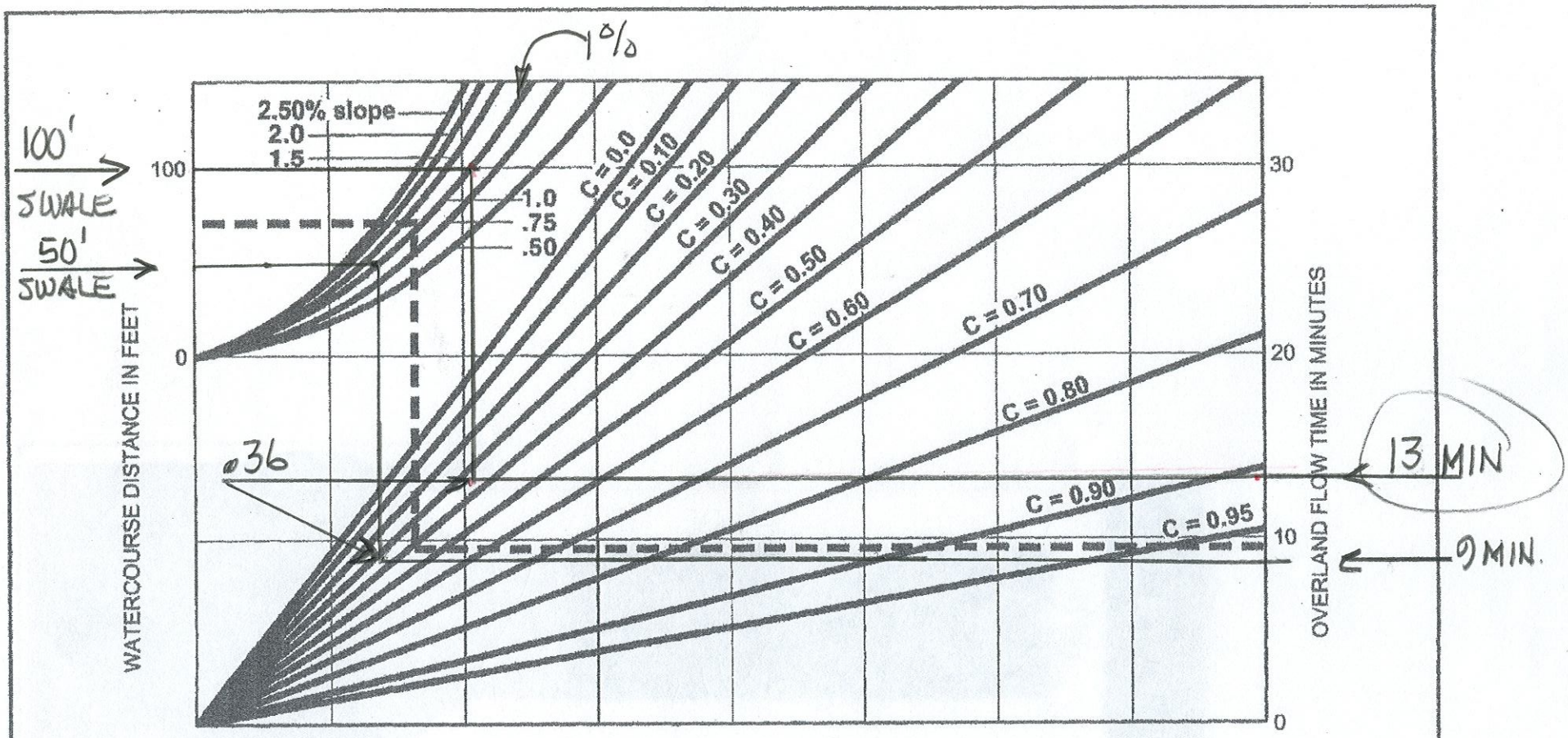
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

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



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

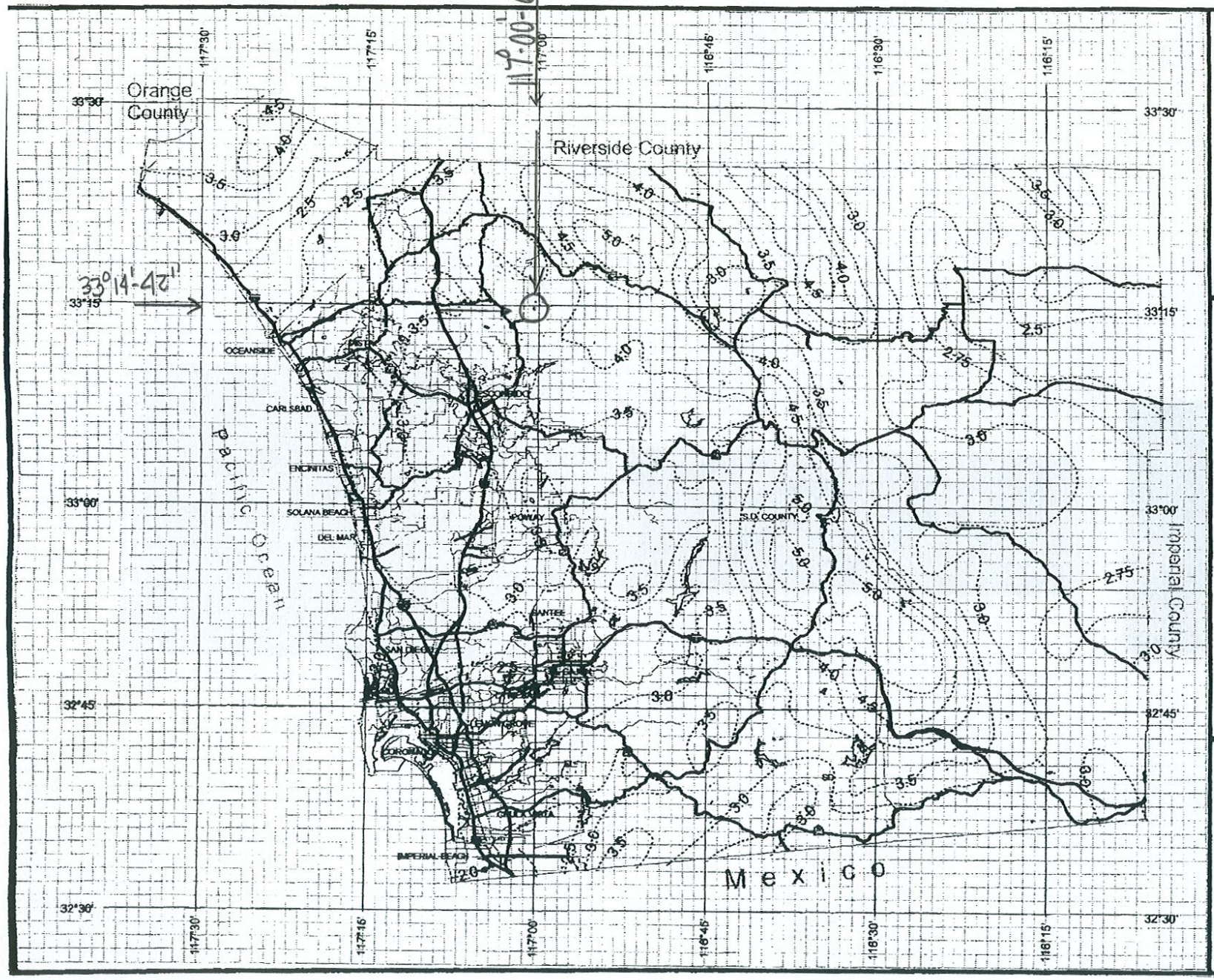
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

Rational Formula - Overland Time of Flow Nomograph

3-3



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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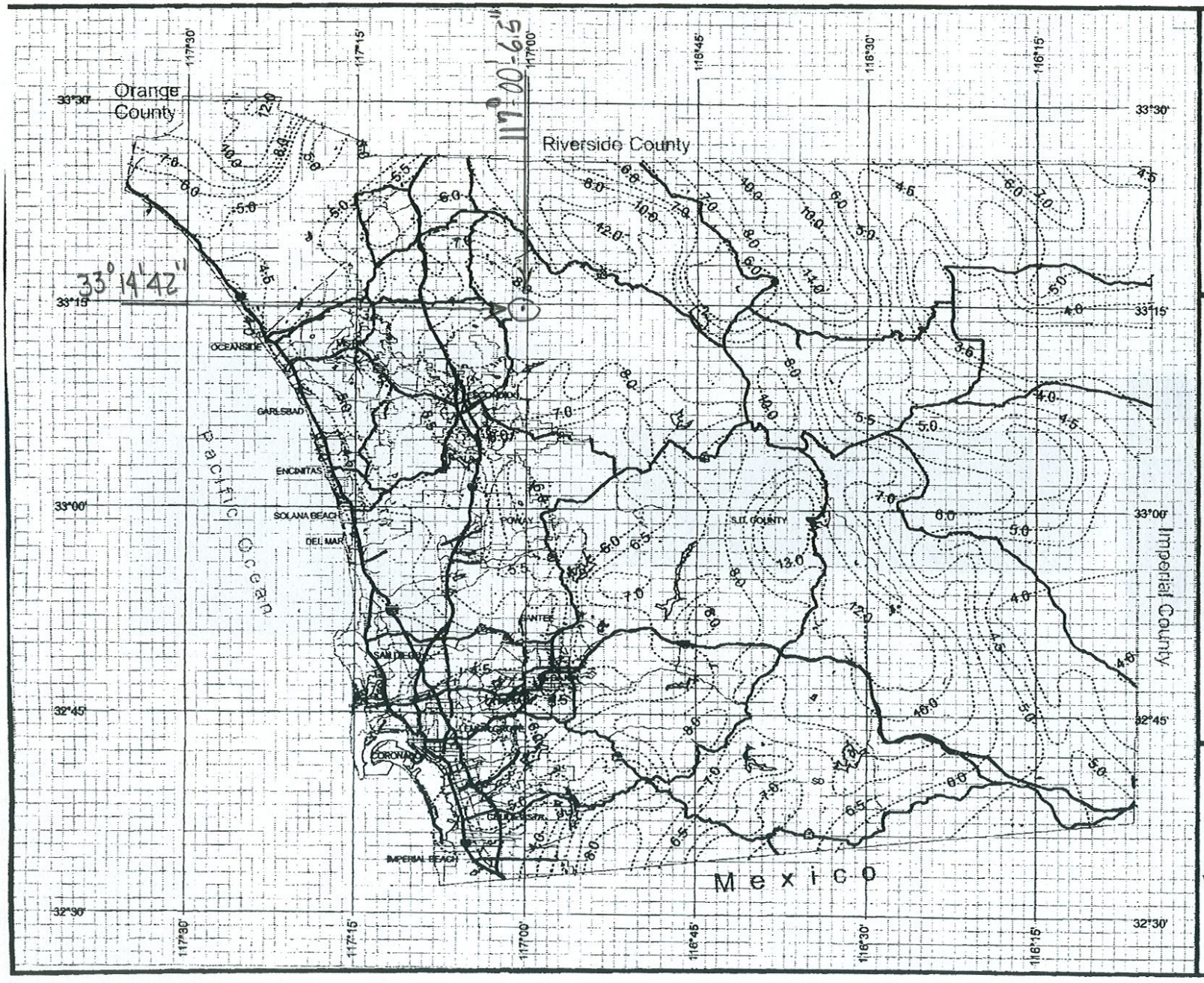
N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

I=8.1

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N W E S

3 0 3 Miles

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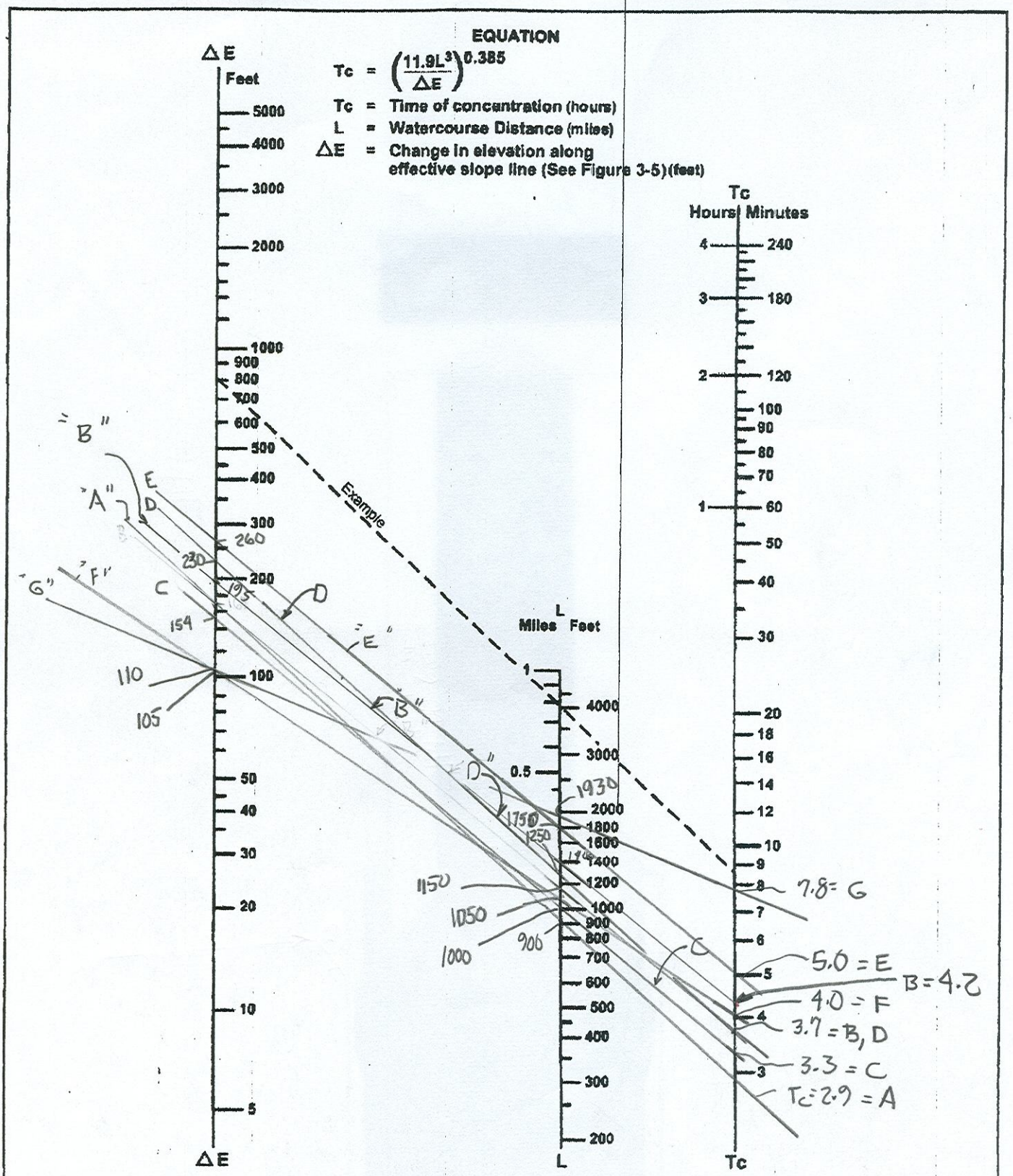

SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

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

3-4