FORD PLUMLEY GROUP L.L.C.
TENTATIVE TRACT 29578

HYDROLOGY & HYDRAULICS REPORT

PREPARED BY:

THE KEITH COMPANIES | TKC

PREPARED FOR:

FORD PLUMLEY GROUP, L.L.C.

68936 Adelina Road
Cathedral City, CA 92234
(760) 322-3422
Contact – Mario Gonzales

January 4, 2000

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PALM DESERT DIVISION
41-865 BOARDWALK, SUITE 101
PALM DESERT, CA
92211

Prepared Under the Supervision of:

Kris R. Schulze
R.C.E. 46188
Expiration Date: Dec 31, 2002

TKC JOB No. 40635

PURPOSE AND SCOPE

The purpose of this report is to provide a hydrology and hydraulic analysis for the Ford Plumley Group L.L.C. residential site located in a portion of the North East ¼ of Section 34, Township 4 South, Range 5 East, SBM, in the city of Cathedral City, California. The project site consists of 33 - quarter acre single-family lots comprising approximately 9 acres.

This report includes:

1. The determination of on-site drainage areas. A hydrology map for the project site is included in the Appendix.
2. Determination of retention basin sizing utilizing Riverside County Flood Control District (RCFCD) Synthetic Unit Hydrograph (Short-cut Method) for the 100 year storm.
3. On-site storm drain sizing (including catch basins), utilizing RCFCD Rational Method for the determination of peak flow rates for the 100 year – 1 hour storm in conjunction with 'StormCAD' pipe sizing software.
4. Street flow capacities based on minimum slope of the street. Per City of Cathedral City requirements: the 10-year peak storm flow shall be contained within the curbs, and the 100-year peak storm flow shall be contained within the right-of-way.

DESIGN CRITERIA:

The following Riverside County Flood Control District (RCFCD) parameters were used in the preparation of the analyses:

• Antecedant Moisture Condition – 100 year	3	
• Antecedant Moisture Condition – 10 year	2	
• 2 year – 1 hour Precipitation	0.5"	Plate D-4.3
• 100 year – 1 hour Precipitation	1.6"	Plate D-4.4
• Slope of Intensity Duration Curve	0.58	Plate D-4.6
• 2-year – 3 hour Precipitation	0.7"	Plate E-5.1
• 100-year – 3 hour Precipitation	2.0"	Plate E-5.2
• 2-year – 6 hour Precipitation	0.9"	Plate E-5.3
• 100-year – 6 hour Precipitation	2.75"	Plate E-5.4
• 2-year – 24 hour Precipitation	1.45"	Plate E-5.5
• 100-year – 24 hour Precipitation	4.75"	Plate E-5.6

- Hydrologic Soil Type "A"

SYNTHETIC UNIT HYDROGRAPH SUMMARY:

STORM DURATION (hour)	EFFECTIVE RAIN (inch)	FLOOD VOLUME (cuft)	FLOOD VOLUME (acft)	REQUIRED STORAGE (cuft)	REQUIRED STORAGE (acft)	PEAK FLOW RATE (cfs)
3	0.96	30,872	0.71	25,844	0.59	14.20
6	1.05	33,682	0.77	26,292	0.60	13.13
24	0.98	31,562	0.72	16,214	0.37	2.93

RETENTION BASIN SIZING:

The proposed retention basin is designed to retain the volume generated by the 100-year storm event. A percolation rate of two (2) inches per hour was used in the determination of the required basin size. In addition, a Maxwell IV (or approved equal) drywell is proposed, capable of percolating 0.35 cubic feet per second.

VOLUME REQUIRED vs VOLUME PROVIDED
100 YEAR STORM EVENTS

DURATION (hour)	VOLUME REQUIRED (cf)	VOLUME PROVIDED (cf)	MAXIMUM WSEL (ft)	DEPTH (ft)
3	25,844	29,651	280.40	5.40
6	26,292		280.48	5.48
24	16,214		278.77	3.77

The top of slope is at an elevation of 281, which yields a freeboard depth of approximately 0.52-feet. The two adjacent lots have a pad elevation of 281.5 with a finished floor elevation of 282 – 1.52 feet above the maximum water surface elevation for the 6-hour storm. In addition, weep holes will be constructed in the perimeter wall to provide an emergency discharge path for any overflow.

STORM DRAIN SYSTEM:

Storm run-off is directed via gutter flow to low points located at the southeast corner of the project area. On the north side of the street a sag-type catch basin is proposed, while on the south side of the street it a Nyloplast® drainage system. The drainage system will allow truck entry to the retention area within the 10-foot drainage easement corridor. A grass-lined drainage swale is proposed to provide emergency overflow to the basin should the grates become clogged. The swale can convey 12 cfs at a depth of 1.14-feet. The storm drain system is designed to accommodate the 100 year – 1 hour peak event analyzed utilizing RCFCD Rational software.

Sag type catch basins were sized using equations from U.S. Department of Transportation Report No. FHWA-TS-84-202 for inclined throat inlets. The proposed catch basin will be per County of Riverside Standard 300. Storm flow interception for the Nyloplast system was approximated utilizing Chart 11 (Grate inlet capacity in sump conditions) per U.S. Department of Transportation Report FHWA-TS-84-202. Under optimum conditions (no clogging of the grates) each inlet can intercept approximately 5 cfs. Storm drain pipes were sized utilizing "StormCad" software and shall be ADS N-12 polyethylene pipe (or approved equal). A basin analysis was performed to determine the water surface elevation at the time of concentration for use in the "StormCad" analysis as the outlet HGL.

CATCH BASIN SUMMARY

CATCH BASIN	TYPE	FLOW (cfs)	W (ft)	H (ft)
CB1	SAG	9.9	5	7.84
CB2	Nyloplast Drain System	12.4	N/A	8.13

STORM DRAIN SUMMARY

PIPE	FLOW (cfs)	SIZE (in)	TYPE	VELOCITY (fps)	COMMENTS
P1	9.9	18	ADS	5.6	
P2	21.9	24	ADS	7.0	Outlet HGL at T_c= 17.78 min. = 277.96

STREET FLOW SUMMARY:

Per City of Cathedral City requirements storm flow for the 10-year event is to be contained within the curbs and run-off generated from the 100-year storm contained within the right-of-way. Two street sections are proposed. The first being 36-feet curb to curb and 37-feet ROW to ROW, and the second being 30-feet curb to curb and 31-feet ROW to ROW. As the right-of-way for both sections is a half of a foot behind the curb, the streets were analyzed for the 100-year event. The capacities were analyzed utilizing Manning's equation for open channel flow.

37-FOOT SECTION

AREAS	MINIMUM STREET SLOPE (%)	100-YEAR STORM	
		FLOW (cfs)	CAPACITY (cfs)
R1.2/R2.2	0.50	9.8	15.2

31-FOOT SECTION

NODE	MINIMUM STREET SLOPE (%)	100-YEAR STORM	
		FLOW (cfs)	CAPACITY (cfs)
R1.1/R2.1	0.50	12.2	15.9

SYNTHETIC UNIT HYDROGRAPH & RETENTION BASIN SIZING WORKSHEETS

100 YEAR STORM EVENTS

	A	B	C	D
1	**RCFCD SYNTHETIC UNIT HYDROGRAPH**			
2	DATA INPUT SHEET			
3				
4	WORKSHEET PREPARED BY:	DLS		
5				
6	PROJECT NAME	FORD PLUMLEY GROUP - GERALD FORD		
7	TKC JOB #	40635		
8				
9	CONCENTRATION POINT DESIGNATION	RETENTION BASIN		
10	AREA DESIGNATION	TR 29578		
11				
12	TRIBUTARY AREAS	ACRES		
13				
14	COMMERCIAL			
15	PAVING/HARDSCAPE	1.436		
16	SF - 1 ACRE			
17	SF - 1/2 ACRE			
18	SF - 1/4 ACRE	7.07		
19	MF - CONDOMINIUMS			
20	MF - APARTMENTS			
21	MOBILE HOME PARK			
22	LANDSCAPING	0.159		
23	RETENTION BASIN	0.201		
24	GOLF COURSE			
25	MOUNTAINOUS			
26	LOW LOSS RATE (PERCENT)	90%		
27				
28	LENGTH OF WATERCOURSE (L)	800		
29	LENGTH TO POINT OPPOSITE CENTROID (Lca)	995		
30				
31	ELEVATION OF HEADWATER	285.5		
32	ELEVATION OF CONCENTRATION POINT	280.4		
33				
34	AVERAGE MANNINGS 'N' VALUE	0.02		
35				
36	STORM FREQUENCY (YEAR)	100		
37				
38	POINT RAIN			
39	3-HOUR	2		
40	6-HOUR	2.75		
41	24-HOUR	4.75		
42				
43	BASIN CHARACTERISTICS:	ELEVATION	AREA	
44		275	3288.98	
45		276	3791.05	
46		277	4325.12	
47		278	4891.18	
48		279	5489.25	
49		280	6119.33	
50		281	6781.4	
51				
52	PERCOLATION RATE (in/hr)	2		
53				
54	DRYWELL DATA			
55	NUMBER USED	1		
56	PERCOLATION RATE (cfs)	0.35		

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
BASIC DATA CALCULATION FORM
SHORTCUT METHOD

PROJECT: FORD PLUMLEY GROUP - GERALD FORD
TKC JOB # 40635
BY DLS DATE 12/20/1999

PHYSICAL DATA

[1] CONCENTRATION POINT	RETENTION BASIN
[2] AREA DESIGNATION	TR 29578
[3] AREA - ACRES	8.866
[4] L-FEET	800
[5] L-MILES	0.152
[6] La-FEET	995.00
[7] La-MILES	0.188
[8] ELEVATION OF HEADWATER	285.5
[9] ELEVATION OF CONCENTRATION POINT	280.4
[10] H-FEET	5.1
[11] S-FEET/MILE	33.7
[12] S^0.5	5.80
[13] L*LCA/S^0.5	0.005
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.06
[16] LAG TIME-MINUTES	3.8
[17] 100% OF LAG-MINUTES	3.8
[18] 200% OF LAG-MINUTES	7.6
[19] UNIT TIME-MINUTES (100%-200% OF LAG)	5
[24] TOTAL PERCOLATION RATE (cfs)	0.50

RAINFALL DATA

[1] SOURCE
[2] FREQUENCY-YEARS 100
[3] DURATION:

3-HOURS				6-HOURS				24-HOURS			
[4] POINT RAIN INCHES (Plate E-5.2)	[5] AREA	[6]	[7] AVERAGE POINT RAIN INCHES	[8] POINT RAIN INCHES (Plate E-5.4)	[9] AREA	[10]	[11] AVERAGE POINT RAIN INCHES	[12] POINT RAIN INCHES (Plate E-5.6)	[13] AREA	[14]	[15] AVERAGE POINT RAIN INCHES
2.00	8.866	1.00	2.00	2.75	8.866	1.00	2.75	4.75	8.866	1.00	4.75
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
SUM [5]	8.866	SUM [7]	2.00	SUM [9]	8.87	SUM [11]	2.75	SUM [13]	8.87	SUM [15]	4.75
[16] AREA ADJ FACTOR			1.000				1.000				1.000
[17] ADJ AVG POINT RAIN			2.00				2.75				4.75

STORM EVENT SUMMARY

DURATION		3-HOUR	6-HOUR	24-HOUR
EFFECTIVE RAIN	(in)	0.96	1.05	0.98
FLOOD VOLUME	(cu-ft)	30,872	33,682	31,562
	(acre-ft)	0.71	0.77	0.72
REQUIRED STORAGE	(cu-ft)	25,844	26,292	16,214
	(acre-ft)	0.59	0.60	0.37
PEAK FLOW	(cfs)	14.20	13.13	2.93
MAXIMUM WSEL	(ft)	280.40	280.48	278.77

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD

PROJECT FORD PLUMLEY GROUP - GERALD FORD
CONCENTRATION POINT: RETENTION BASIN
BY DLS DATE 12/20/1999

ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA		AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
A	COMMERCIAL	32	0.74	90%	0.14	0.00	0.000	0.0000
A	PAVING/HARDSCAPE	32	0.74	100%	0.07	1.44	0.162	0.0120
A	SF - 1 ACRE	32	0.74	20%	0.61	0.00	0.000	0.0000
A	SF - 1/2 ACRE	32	0.74	40%	0.47	0.00	0.000	0.0000
A	SF - 1/4 ACRE	32	0.74	50%	0.41	7.07	0.797	0.3246
A	MF - CONDOMINIUMS	32	0.74	65%	0.31	0.00	0.000	0.0000
A	MF - APARTMENTS	32	0.74	80%	0.21	0.00	0.000	0.0000
A	MOBILE HOME PARKS	32	0.74	75%	0.24	0.00	0.000	0.0000
A	LANDSCAPING	32	0.74	0%	0.74	0.16	0.018	0.0133
A	RETENTION BASINS	32	0.74	0%	0.74	0.20	0.023	0.0168
A	GOLF COURSE	32	0.74	0%	0.74	0.00	0.000	0.0000
D	MOUNTAINOUS	93	0.95	90%	0.18	0.00	0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					SUM	8.866	SUM	0.3666

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.183293142
C= 0.00339

Ft=C(24-(T/60))^1.55 = 0.00339 (24-(T/60))^1.55 + 0.18 in/hr

LOW LOSS RATE (80-90 PERCENT) = 90%

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period, T=1 1/2 unit time for the second period, etc.

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 3 HOUR STORM EVENT

PROJECT: FORD PLUMLEY GROUP - GERALD FORD
CONCENTRATION POINT: RETENTION BASIN
BY: DLS DATE 12/20/1999

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	8.87
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	3.82
UNIT TIME-PERCENT OF LAG	130.8
TOTAL ADJUSTED STORM RAIN-INCHES	2.00
CONSTANT LOSS RATE-in/hr	0.37
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.50 cfs

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
1	5	0.08	1.3	0.312	0.37	0.28	0.03	0.28	0.00
2	10	0.17	1.3	0.312	0.37	0.28	0.03	0.28	0.00
3	15	0.25	1.1	0.264	0.37	0.24	0.03	0.23	0.00
4	20	0.33	1.5	0.360	0.37	0.32	0.04	0.32	0.00
5	25	0.42	1.5	0.360	0.37	0.32	0.04	0.32	0.00
6	30	0.50	1.8	0.432	0.37	0.39	0.07	0.58	23.31
7	35	0.58	1.5	0.360	0.37	0.32	0.04	0.32	0.00
8	40	0.67	1.8	0.432	0.37	0.39	0.07	0.58	23.31
9	45	0.75	1.8	0.432	0.37	0.39	0.07	0.58	23.31
10	50	0.83	1.5	0.360	0.37	0.32	0.04	0.32	0.00
11	55	0.92	1.6	0.384	0.37	0.35	0.02	0.15	0.00
12	60	1.00	1.8	0.432	0.37	0.39	0.07	0.58	23.31
13	65	1.08	2.2	0.528	0.37	0.48	0.16	1.43	278.65
14	70	1.17	2.2	0.528	0.37	0.48	0.16	1.43	278.65
15	75	1.25	2.2	0.528	0.37	0.48	0.16	1.43	278.65
16	80	1.33	2.0	0.480	0.37	0.43	0.11	1.01	150.98
17	85	1.42	2.6	0.624	0.37	0.56	0.26	2.28	533.99
18	90	1.50	2.7	0.648	0.37	0.58	0.28	2.50	597.82
19	95	1.58	2.4	0.576	0.37	0.52	0.21	1.86	406.32
20	100	1.67	2.7	0.648	0.37	0.58	0.28	2.50	597.82
21	105	1.75	3.3	0.792	0.37	0.71	0.43	3.77	980.84
22	110	1.83	3.1	0.744	0.37	0.67	0.38	3.35	853.16
23	115	1.92	2.9	0.696	0.37	0.63	0.33	2.92	725.49
24	120	2.00	3.0	0.720	0.37	0.65	0.35	3.13	789.33
25	125	2.08	3.1	0.744	0.37	0.67	0.38	3.35	853.16
26	130	2.17	4.2	1.008	0.37	0.91	0.64	5.69	1555.35
27	135	2.25	5.0	1.200	0.37	1.08	0.83	7.39	2066.03
28	140	2.33	3.5	0.840	0.37	0.76	0.47	4.20	1108.51
29	145	2.42	6.8	1.632	0.37	1.47	1.27	11.22	3215.07
30	150	2.50	7.3	1.752	0.37	1.58	1.39	12.28	3534.24
31	155	2.58	8.2	1.968	0.37	1.77	1.60	14.20	4108.76
32	160	2.67	5.9	1.416	0.37	1.27	1.05	9.30	2640.55
33	165	2.75	2.0	0.480	0.37	0.43	0.11	1.01	150.98
34	170	2.83	1.8	0.432	0.37	0.39	0.07	0.58	23.31
35	175	2.92	1.8	0.432	0.37	0.39	0.07	0.58	23.31
36	180	3.00	0.6	0.144	0.37	0.13	0.01	0.13	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	0.96
FLOOD VOLUME (acft)	0.71
FLOOD VOLUME (cuft)	30871.64
REQUIRED STORAGE (acft)	0.59
REQUIRED STORAGE (cuft)	25844.20
PEAK FLOW RATE (cfs)	14.20

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 6 HOUR STORM EVENT	PROJECT: FORD PLUMLEY GROUP - GERALD FORD CONCENTRATION POINT: RETENTION BASIN BY: DLS DATE: 12/20/1999

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	8.87		
UNIT TIME-MINUTES	5		
LAG TIME - MINUTES	3.82		
UNIT TIME-PERCENT OF LAG	130.8		
TOTAL ADJUSTED STORM RAIN-INCHES	2.75		
CONSTANT LOSS RATE-in/hr	0.367		
LOW LOSS RATE - PERCENT	90%	TOTAL PERCOLATION RATE (cfs)	0.50 cfs

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
1	5	0.08	0.5	0.165	0.37	0.15	0.02	0.15	0.00
2	10	0.17	0.6	0.198	0.37	0.18	0.02	0.18	0.00
3	15	0.25	0.6	0.198	0.37	0.18	0.02	0.18	0.00
4	20	0.33	0.6	0.198	0.37	0.18	0.02	0.18	0.00
5	25	0.42	0.6	0.198	0.37	0.18	0.02	0.18	0.00
6	30	0.50	0.7	0.231	0.37	0.21	0.02	0.20	0.00
7	35	0.58	0.7	0.231	0.37	0.21	0.02	0.20	0.00
8	40	0.67	0.7	0.231	0.37	0.21	0.02	0.20	0.00
9	45	0.75	0.7	0.231	0.37	0.21	0.02	0.20	0.00
10	50	0.83	0.7	0.231	0.37	0.21	0.02	0.20	0.00
11	55	0.92	0.7	0.231	0.37	0.21	0.02	0.20	0.00
12	60	1.00	0.8	0.264	0.37	0.24	0.03	0.23	0.00
13	65	1.08	0.8	0.264	0.37	0.24	0.03	0.23	0.00
14	70	1.17	0.8	0.264	0.37	0.24	0.03	0.23	0.00
15	75	1.25	0.8	0.264	0.37	0.24	0.03	0.23	0.00
16	80	1.33	0.8	0.264	0.37	0.24	0.03	0.23	0.00
17	85	1.42	0.8	0.264	0.37	0.24	0.03	0.23	0.00
18	90	1.50	0.8	0.264	0.37	0.24	0.03	0.23	0.00
19	95	1.58	0.8	0.264	0.37	0.24	0.03	0.23	0.00
20	100	1.67	0.8	0.264	0.37	0.24	0.03	0.23	0.00
21	105	1.75	0.8	0.264	0.37	0.24	0.03	0.23	0.00
22	110	1.83	0.8	0.264	0.37	0.24	0.03	0.23	0.00
23	115	1.92	0.8	0.264	0.37	0.24	0.03	0.23	0.00
24	120	2.00	0.9	0.297	0.37	0.27	0.03	0.26	0.00
25	125	2.08	0.8	0.264	0.37	0.24	0.03	0.23	0.00
26	130	2.17	0.9	0.297	0.37	0.27	0.03	0.26	0.00
27	135	2.25	0.9	0.297	0.37	0.27	0.03	0.26	0.00
28	140	2.33	0.9	0.297	0.37	0.27	0.03	0.26	0.00
29	145	2.42	0.9	0.297	0.37	0.27	0.03	0.26	0.00
30	150	2.50	0.9	0.297	0.37	0.27	0.03	0.26	0.00
31	155	2.58	0.9	0.297	0.37	0.27	0.03	0.26	0.00
32	160	2.67	0.9	0.297	0.37	0.27	0.03	0.26	0.00
33	165	2.75	1.0	0.330	0.37	0.30	0.03	0.29	0.00
34	170	2.83	1.0	0.330	0.37	0.30	0.03	0.29	0.00
35	175	2.92	1.0	0.330	0.37	0.30	0.03	0.29	0.00
36	180	3.00	1.0	0.330	0.37	0.30	0.03	0.29	0.00
37	185	3.08	1.0	0.330	0.37	0.30	0.03	0.29	0.00
38	190	3.17	1.1	0.363	0.37	0.33	0.04	0.32	0.00
39	195	3.25	1.1	0.363	0.37	0.33	0.04	0.32	0.00
40	200	3.33	1.1	0.363	0.37	0.33	0.04	0.32	0.00
41	205	3.42	1.2	0.396	0.37	0.36	0.03	0.26	0.00
42	210	3.50	1.3	0.429	0.37	0.39	0.06	0.55	15.33
43	215	3.58	1.4	0.462	0.37	0.42	0.10	0.85	103.10
44	220	3.67	1.4	0.462	0.37	0.42	0.10	0.85	103.10
45	225	3.75	1.5	0.495	0.37	0.45	0.13	1.14	190.87
46	230	3.83	1.5	0.495	0.37	0.45	0.13	1.14	190.87
47	235	3.92	1.6	0.528	0.37	0.48	0.16	1.43	278.65
48	240	4.00	1.6	0.528	0.37	0.48	0.16	1.43	278.65
49	245	4.08	1.7	0.561	0.37	0.50	0.19	1.72	366.42
50	250	4.17	1.8	0.594	0.37	0.53	0.23	2.02	454.19
51	255	4.25	1.9	0.627	0.37	0.56	0.26	2.31	541.97
52	260	4.33	2.0	0.660	0.37	0.59	0.29	2.60	629.74
53	265	4.42	2.1	0.693	0.37	0.62	0.33	2.89	717.51
54	270	4.50	2.1	0.693	0.37	0.62	0.33	2.89	717.51
55	275	4.58	2.2	0.726	0.37	0.65	0.36	3.19	805.29
56	280	4.67	2.3	0.759	0.37	0.68	0.39	3.48	893.06

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 6 HOUR STORM EVENT	PROJECT:	FORD PLUMLEY GROUP - GERALD FORD
	CONCENTRATION POINT:	RETENTION BASIN
	BY: DLS	DATE: 12/20/1999

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	8.87		
UNIT TIME-MINUTES	5		
LAG TIME - MINUTES	3.82		
UNIT TIME-PERCENT OF LAG	130.8		
TOTAL ADJUSTED STORM RAIN-INCHES	2.75		
CONSTANT LOSS RATE-in/hr	0.367		
LOW LOSS RATE - PERCENT	90%	TOTAL PERCOLATION RATE (cfs)	0.50 cfs

Unit Time Period	Time Minutes	Time Hours	Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr Max	Loss Rate in/hr Low	Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
57	285	4.75	2.4	0.792	0.37	0.71	0.43	3.77	980.84
58	290	4.83	2.4	0.792	0.37	0.71	0.43	3.77	980.84
59	295	4.92	2.5	0.825	0.37	0.74	0.46	4.06	1068.61
60	300	5.00	2.6	0.858	0.37	0.77	0.49	4.36	1156.38
61	305	5.08	3.1	1.023	0.37	0.92	0.66	5.82	1595.25
62	310	5.17	3.6	1.188	0.37	1.07	0.82	7.28	2034.12
63	315	5.25	3.9	1.287	0.37	1.16	0.92	8.16	2297.44
64	320	5.33	4.2	1.386	0.37	1.25	1.02	9.04	2560.76
65	325	5.42	4.7	1.551	0.37	1.40	1.18	10.50	2999.62
66	330	5.50	5.6	1.848	0.37	1.66	1.48	13.13	3789.58
67	335	5.58	1.9	0.627	0.37	0.56	0.26	2.31	541.97
68	340	5.67	0.9	0.297	0.37	0.27	0.03	0.26	0.00
69	345	5.75	0.6	0.198	0.37	0.18	0.02	0.18	0.00
70	350	5.83	0.5	0.165	0.37	0.15	0.02	0.15	0.00
71	355	5.92	0.3	0.099	0.37	0.09	0.01	0.09	0.00
72	360	6.00	0.2	0.066	0.37	0.06	0.01	0.06	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	1.05
FLOOD VOLUME (acft)	0.77
FLOOD VOLUME (cuft)	33682.05
REQUIRED STORAGE (acft)	0.60
REQUIRED STORAGE (cuft)	26291.67
PEAK FLOW RATE (cfs)	13.13

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 24 HOUR STORM EVENT	PROJECT: FORD PLUMLEY GROUP - GERALD FORD CONCENTRATION POINT: RETENTION BASIN BY: DLS DATE: 12/20/1999

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	8.866	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.3666
LAG TIME - MINUTES	3.82	MINIMUM LOSS RATE (for var. loss) - in/hr	0.183
UNIT TIME-PERCENT OF LAG	392.4	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	4.75	C	0.00339
		PERCOLATION RATE (cfs)	0.50

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours	(Plate E-5.9)		Max	Low			
1	15	0.25	0.2	0.038	0.647	0.034	0.004	0.03	0.00
2	30	0.50	0.3	0.057	0.640	0.051	0.006	0.05	0.00
3	45	0.75	0.3	0.057	0.632	0.051	0.006	0.05	0.00
4	60	1.00	0.4	0.076	0.625	0.068	0.008	0.07	0.00
5	75	1.25	0.3	0.057	0.618	0.051	0.006	0.05	0.00
6	90	1.50	0.3	0.057	0.610	0.051	0.006	0.05	0.00
7	105	1.75	0.3	0.057	0.603	0.051	0.006	0.05	0.00
8	120	2.00	0.4	0.076	0.596	0.068	0.008	0.07	0.00
9	135	2.25	0.4	0.076	0.588	0.068	0.008	0.07	0.00
10	150	2.50	0.4	0.076	0.581	0.068	0.008	0.07	0.00
11	165	2.75	0.5	0.095	0.574	0.086	0.009	0.08	0.00
12	180	3.00	0.5	0.095	0.567	0.086	0.009	0.08	0.00
13	195	3.25	0.5	0.095	0.560	0.086	0.009	0.08	0.00
14	210	3.50	0.5	0.095	0.553	0.086	0.009	0.08	0.00
15	225	3.75	0.5	0.095	0.546	0.086	0.009	0.08	0.00
16	240	4.00	0.6	0.114	0.539	0.103	0.011	0.10	0.00
17	255	4.25	0.6	0.114	0.533	0.103	0.011	0.10	0.00
18	270	4.50	0.7	0.133	0.526	0.120	0.013	0.12	0.00
19	285	4.75	0.7	0.133	0.519	0.120	0.013	0.12	0.00
20	300	5.00	0.8	0.152	0.512	0.137	0.015	0.13	0.00
21	315	5.25	0.6	0.114	0.506	0.103	0.011	0.10	0.00
22	330	5.50	0.7	0.133	0.499	0.120	0.013	0.12	0.00
23	345	5.75	0.8	0.152	0.493	0.137	0.015	0.13	0.00
24	360	6.00	0.8	0.152	0.486	0.137	0.015	0.13	0.00
25	375	6.25	0.9	0.171	0.480	0.154	0.017	0.15	0.00
26	390	6.50	0.9	0.171	0.473	0.154	0.017	0.15	0.00
27	405	6.75	1.0	0.190	0.467	0.171	0.019	0.17	0.00
28	420	7.00	1.0	0.190	0.461	0.171	0.019	0.17	0.00
29	435	7.25	1.0	0.190	0.454	0.171	0.019	0.17	0.00
30	450	7.50	1.1	0.209	0.448	0.188	0.021	0.19	0.00
31	465	7.75	1.2	0.228	0.442	0.205	0.023	0.20	0.00
32	480	8.00	1.3	0.247	0.436	0.222	0.025	0.22	0.00
33	495	8.25	1.5	0.285	0.430	0.257	0.029	0.25	0.00
34	510	8.50	1.5	0.285	0.424	0.257	0.029	0.25	0.00
35	525	8.75	1.6	0.304	0.418	0.274	0.030	0.27	0.00
36	540	9.00	1.7	0.323	0.412	0.291	0.032	0.29	0.00
37	555	9.25	1.9	0.361	0.406	0.325	0.036	0.32	0.00
38	570	9.50	2.0	0.380	0.400	0.342	0.038	0.34	0.00
39	585	9.75	2.1	0.399	0.395	0.359	0.004	0.04	0.00
40	600	10.00	2.2	0.418	0.389	0.376	0.029	0.26	0.00
41	615	10.25	1.5	0.285	0.383	0.257	0.029	0.25	0.00
42	630	10.50	1.5	0.285	0.378	0.257	0.029	0.25	0.00
43	645	10.75	2.0	0.380	0.372	0.342	0.008	0.07	0.00
44	660	11.00	2.0	0.380	0.367	0.342	0.013	0.12	0.00
45	675	11.25	1.9	0.361	0.361	0.325	0.036	0.32	0.00
46	690	11.50	1.9	0.361	0.356	0.325	0.005	0.04	0.00
47	705	11.75	1.7	0.323	0.351	0.291	0.032	0.29	0.00
48	720	12.00	1.8	0.342	0.346	0.308	0.034	0.30	0.00
49	735	12.25	2.5	0.475	0.340	0.428	0.135	1.19	621.30
50	750	12.50	2.6	0.494	0.335	0.445	0.159	1.41	813.60
51	765	12.75	2.8	0.532	0.330	0.479	0.202	1.79	1157.03
52	780	13.00	2.9	0.551	0.325	0.496	0.226	2.00	1348.37
53	795	13.25	3.4	0.646	0.320	0.581	0.326	2.89	2145.65
54	810	13.50	3.4	0.646	0.316	0.581	0.330	2.93	2184.40
55	825	13.75	2.3	0.437	0.311	0.393	0.126	1.12	554.96
56	840	14.00	2.3	0.437	0.306	0.393	0.131	1.16	592.71
57	855	14.25	2.7	0.513	0.301	0.462	0.212	1.88	1236.38
58	870	14.50	2.6	0.494	0.297	0.445	0.197	1.75	1121.49
59	885	14.75	2.6	0.494	0.292	0.445	0.202	1.79	1157.70
60	900	15.00	2.5	0.475	0.288	0.428	0.187	1.66	1041.76
61	915	15.25	2.4	0.456	0.283	0.410	0.173	1.53	925.30

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 24 HOUR STORM EVENT		PROJECT: CONCENTRATION POINT: BY: DLS	FORD PLUMLEY GROUP - GERALD FORD RETENTION BASIN DATE: 12/20/1999

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	8.866	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.3666
LAG TIME - MINUTES	3.82	MINIMUM LOSS RATE (for var. loss) - in/hr	0.183
UNIT TIME-PERCENT OF LAG	392.4	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	4.75	C	0.00339
		PERCOLATION RATE (cfs)	0.50

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours	(Plate E-5.9)		Max	Low			
62	930	15.50	2.3	0.437	0.279	0.393	0.158	1.40	808.29
63	945	15.75	1.9	0.361	0.275	0.325	0.086	0.76	235.91
64	960	16.00	1.9	0.361	0.271	0.325	0.090	0.80	269.41
65	975	16.25	0.4	0.076	0.266	0.068	0.008	0.07	0.00
66	990	16.50	0.4	0.076	0.262	0.068	0.008	0.07	0.00
67	1005	16.75	0.3	0.057	0.258	0.051	0.006	0.05	0.00
68	1020	17.00	0.3	0.057	0.255	0.051	0.006	0.05	0.00
69	1035	17.25	0.5	0.095	0.251	0.086	0.009	0.08	0.00
70	1050	17.50	0.5	0.095	0.247	0.086	0.009	0.08	0.00
71	1065	17.75	0.5	0.095	0.243	0.086	0.009	0.08	0.00
72	1080	18.00	0.4	0.076	0.240	0.068	0.008	0.07	0.00
73	1095	18.25	0.4	0.076	0.236	0.068	0.008	0.07	0.00
74	1110	18.50	0.4	0.076	0.233	0.068	0.008	0.07	0.00
75	1125	18.75	0.3	0.057	0.229	0.051	0.006	0.05	0.00
76	1140	19.00	0.2	0.038	0.226	0.034	0.004	0.03	0.00
77	1155	19.25	0.3	0.057	0.223	0.051	0.006	0.05	0.00
78	1170	19.50	0.4	0.076	0.220	0.068	0.008	0.07	0.00
79	1185	19.75	0.3	0.057	0.217	0.051	0.006	0.05	0.00
80	1200	20.00	0.2	0.038	0.214	0.034	0.004	0.03	0.00
81	1215	20.25	0.3	0.057	0.211	0.051	0.006	0.05	0.00
82	1230	20.50	0.3	0.057	0.208	0.051	0.006	0.05	0.00
83	1245	20.75	0.3	0.057	0.206	0.051	0.006	0.05	0.00
84	1260	21.00	0.2	0.038	0.203	0.034	0.004	0.03	0.00
85	1275	21.25	0.3	0.057	0.201	0.051	0.006	0.05	0.00
86	1290	21.50	0.2	0.038	0.198	0.034	0.004	0.03	0.00
87	1305	21.75	0.3	0.057	0.196	0.051	0.006	0.05	0.00
88	1320	22.00	0.2	0.038	0.194	0.034	0.004	0.03	0.00
89	1335	22.25	0.3	0.057	0.192	0.051	0.006	0.05	0.00
90	1350	22.50	0.2	0.038	0.190	0.034	0.004	0.03	0.00
91	1365	22.75	0.2	0.038	0.189	0.034	0.004	0.03	0.00
92	1380	23.00	0.2	0.038	0.187	0.034	0.004	0.03	0.00
93	1395	23.25	0.2	0.038	0.186	0.034	0.004	0.03	0.00
94	1410	23.50	0.2	0.038	0.185	0.034	0.004	0.03	0.00
95	1425	23.75	0.2	0.038	0.184	0.034	0.004	0.03	0.00
96	1440	24.00	0.2	0.038	0.183	0.034	0.004	0.03	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	0.98
FLOOD VOLUME (acft)	0.72
FLOOD VOLUME (cuft)	31562.18
REQUIRED STORAGE (acft)	0.37
REQUIRED STORAGE (cuft)	16214.24
PEAK FLOW (cfs)	2.93

PROJECT: FORD PLUMLEY GROUP - GERALD FORD
TKC JOB # 40635
RETENTION BASIN

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
275	0	0		3289	0	0	0.00
276	1	1	502	3791	3540	3540	0.08
277	1	2	534	4325	4058	7598	0.17
278	1	3	566	4891	4608	12206	0.28
279	1	4	598	5489	5190	17396	0.40
280	1	5	630	6119	5804	23201	0.53
281	1	6	662	6781	6450	29651	0.68

PERCOLATION CALCULATIONS

PERCOLATION RATE	2 in/hr	0.15 cfs
MAXWELL IV DRYWELLS		
NUMBER USED	1	
RATE/DRYWELL	0.35 cfs	
TOTAL DISSIPATED		0.35 cfs
TOTAL PERCOLATION RATE		0.50 cfs

RETENTION BASIN
TKC JOB # 40635
100 YEAR - 3 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
1	5	0.28	83	83	151	-	275.00	-	0.00
2	10	0.28	83	83	151	-	275.00	-	0.00
3	15	0.23	70	70	151	-	275.00	-	0.00
4	20	0.32	96	96	151	-	275.00	-	0.00
5	25	0.32	96	96	151	-	275.00	-	0.00
6	30	0.58	174	174	151	23	275.01	23	0.00
7	35	0.32	96	119	151	-	275.00	-	0.00
8	40	0.58	174	174	151	23	275.01	23	0.00
9	45	0.58	174	197	151	47	275.01	47	0.00
10	50	0.32	96	142	151	-	275.00	-	0.00
11	55	0.15	46	46	151	-	275.00	-	0.00
12	60	0.58	174	174	151	23	275.01	23	0.00
13	65	1.43	429	453	151	302	275.09	302	0.01
14	70	1.43	429	731	151	581	275.16	581	0.01
15	75	1.43	429	1,010	151	859	275.24	859	0.02
16	80	1.01	302	1,161	151	1,010	275.29	1,010	0.02
17	85	2.28	685	1,695	151	1,544	275.44	1,544	0.04
18	90	2.50	749	2,293	151	2,142	275.61	2,142	0.05
19	95	1.86	557	2,699	151	2,548	275.72	2,548	0.06
20	100	2.50	749	3,297	151	3,146	275.89	3,146	0.07
21	105	3.77	1,132	4,278	151	4,127	276.14	4,127	0.09
22	110	3.35	1,004	5,131	151	4,980	276.35	4,980	0.11
23	115	2.92	876	5,856	151	5,706	276.53	5,706	0.13
24	120	3.13	940	6,646	151	6,495	276.73	6,495	0.15
25	125	3.35	1,004	7,499	151	7,348	276.94	7,348	0.17
26	130	5.69	1,706	9,054	151	8,904	277.28	8,904	0.20
27	135	7.39	2,217	11,120	151	10,970	277.73	10,970	0.25
28	140	4.20	1,259	12,229	151	12,078	277.97	12,078	0.28
29	145	11.22	3,366	15,444	151	15,293	278.59	15,293	0.35
30	150	12.28	3,685	18,978	151	18,827	279.25	18,827	0.43
31	155	14.20	4,259	23,087	151	22,936	279.95	22,936	0.53
32	160	9.30	2,791	25,727	151	25,577	280.37	25,577	0.59
33	165	1.01	302	25,878	151	25,728	280.39	25,728	0.59
34	170	0.58	174	25,902	151	25,751	280.40	25,751	0.59
35	175	0.58	174	25,925	151	25,774	280.40	25,774	0.59
36	180	0.13	38	25,813	151	25,662	280.38	25,662	0.59

RETENTION BASIN
TKC JOB # 40635
100 YEAR - 6 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
1	5	0.15	44	44	151	-	275.00	-	0.00
2	10	0.18	53	53	151	-	275.00	-	0.00
3	15	0.18	53	53	151	-	275.00	-	0.00
4	20	0.18	53	53	151	-	275.00	-	0.00
5	25	0.18	53	53	151	-	275.00	-	0.00
6	30	0.20	61	61	151	-	275.00	-	0.00
7	35	0.20	61	61	151	-	275.00	-	0.00
8	40	0.20	61	61	151	-	275.00	-	0.00
9	45	0.20	61	61	151	-	275.00	-	0.00
10	50	0.20	61	61	151	-	275.00	-	0.00
11	55	0.20	61	61	151	-	275.00	-	0.00
12	60	0.23	70	70	151	-	275.00	-	0.00
13	65	0.23	70	70	151	-	275.00	-	0.00
14	70	0.23	70	70	151	-	275.00	-	0.00
15	75	0.23	70	70	151	-	275.00	-	0.00
16	80	0.23	70	70	151	-	275.00	-	0.00
17	85	0.23	70	70	151	-	275.00	-	0.00
18	90	0.23	70	70	151	-	275.00	-	0.00
19	95	0.23	70	70	151	-	275.00	-	0.00
20	100	0.23	70	70	151	-	275.00	-	0.00
21	105	0.23	70	70	151	-	275.00	-	0.00
22	110	0.23	70	70	151	-	275.00	-	0.00
23	115	0.23	70	70	151	-	275.00	-	0.00
24	120	0.26	79	79	151	-	275.00	-	0.00
25	125	0.23	70	70	151	-	275.00	-	0.00
26	130	0.26	79	79	151	-	275.00	-	0.00
27	135	0.26	79	79	151	-	275.00	-	0.00
28	140	0.26	79	79	151	-	275.00	-	0.00
29	145	0.26	79	79	151	-	275.00	-	0.00
30	150	0.26	79	79	151	-	275.00	-	0.00
31	155	0.26	79	79	151	-	275.00	-	0.00
32	160	0.26	79	79	151	-	275.00	-	0.00
33	165	0.29	88	88	151	-	275.00	-	0.00
34	170	0.29	88	88	151	-	275.00	-	0.00
35	175	0.29	88	88	151	-	275.00	-	0.00
36	180	0.29	88	88	151	-	275.00	-	0.00
37	185	0.29	88	88	151	-	275.00	-	0.00
38	190	0.32	97	97	151	-	275.00	-	0.00
39	195	0.32	97	97	151	-	275.00	-	0.00
40	200	0.32	97	97	151	-	275.00	-	0.00
41	205	0.26	78	78	151	-	275.00	-	0.00
42	210	0.55	166	166	151	15	275.00	15	0.00
43	215	0.85	254	269	151	118	275.03	118	0.00
44	220	0.85	254	372	151	222	275.06	222	0.01
45	225	1.14	342	563	151	412	275.12	412	0.01
46	230	1.14	342	754	151	603	275.17	603	0.01
47	235	1.43	429	1,033	151	882	275.25	882	0.02
48	240	1.43	429	1,311	151	1,161	275.33	1,161	0.03
49	245	1.72	517	1,678	151	1,527	275.43	1,527	0.04
50	250	2.02	605	2,132	151	1,981	275.56	1,981	0.05
51	255	2.31	693	2,674	151	2,523	275.71	2,523	0.06
52	260	2.60	780	3,304	151	3,153	275.89	3,153	0.07
53	265	2.89	868	4,021	151	3,870	276.08	3,870	0.09
54	270	2.89	868	4,739	151	4,588	276.26	4,588	0.11
55	275	3.19	956	5,544	151	5,393	276.46	5,393	0.12

RETENTION BASIN
TKC JOB # 40635
100 YEAR - 6 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
56	280	3.48	1,044	6,437	151	6,286	276.68	6,286	0.14
57	285	3.77	1,132	7,418	151	7,267	276.92	7,267	0.17
58	290	3.77	1,132	8,399	151	8,248	277.14	8,248	0.19
59	295	4.06	1,219	9,467	151	9,317	277.37	9,317	0.21
60	300	4.36	1,307	10,624	151	10,473	277.62	10,473	0.24
61	305	5.82	1,746	12,219	151	12,068	277.97	12,068	0.28
62	310	7.28	2,185	14,253	151	14,102	278.37	14,102	0.32
63	315	8.16	2,448	16,550	151	16,400	278.81	16,400	0.38
64	320	9.04	2,711	19,111	151	18,960	279.27	18,960	0.44
65	325	10.50	3,150	22,111	151	21,960	279.79	21,960	0.50
66	330	13.13	3,940	25,900	151	25,750	280.40	25,750	0.59
67	335	2.31	693	26,442	151	26,292	280.48	26,292	0.60
68	340	0.26	79	26,371	151	26,220	280.47	26,220	0.60
69	345	0.18	53	26,273	151	26,122	280.45	26,122	0.60
70	350	0.15	44	26,166	151	26,015	280.44	26,015	0.60
71	355	0.09	26	26,042	151	25,891	280.42	25,891	0.59
72	360	0.06	18	25,908	151	25,758	280.40	25,758	0.59

RETENTION BASIN
TKC JOB # 40635
100 YEAR - 24 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
1	15	0.03	30	30	452	-	275.00	-	0.00
2	30	0.05	45	45	452	-	275.00	-	0.00
3	45	0.05	45	45	452	-	275.00	-	0.00
4	60	0.07	61	61	452	-	275.00	-	0.00
5	75	0.05	45	45	452	-	275.00	-	0.00
6	90	0.05	45	45	452	-	275.00	-	0.00
7	105	0.05	45	45	452	-	275.00	-	0.00
8	120	0.07	61	61	452	-	275.00	-	0.00
9	135	0.07	61	61	452	-	275.00	-	0.00
10	150	0.07	61	61	452	-	275.00	-	0.00
11	165	0.08	76	76	452	-	275.00	-	0.00
12	180	0.08	76	76	452	-	275.00	-	0.00
13	195	0.08	76	76	452	-	275.00	-	0.00
14	210	0.08	76	76	452	-	275.00	-	0.00
15	225	0.08	76	76	452	-	275.00	-	0.00
16	240	0.10	91	91	452	-	275.00	-	0.00
17	255	0.10	91	91	452	-	275.00	-	0.00
18	270	0.12	106	106	452	-	275.00	-	0.00
19	285	0.12	106	106	452	-	275.00	-	0.00
20	300	0.13	121	121	452	-	275.00	-	0.00
21	315	0.10	91	91	452	-	275.00	-	0.00
22	330	0.12	106	106	452	-	275.00	-	0.00
23	345	0.13	121	121	452	-	275.00	-	0.00
24	360	0.13	121	121	452	-	275.00	-	0.00
25	375	0.15	136	136	452	-	275.00	-	0.00
26	390	0.15	136	136	452	-	275.00	-	0.00
27	405	0.17	152	152	452	-	275.00	-	0.00
28	420	0.17	152	152	452	-	275.00	-	0.00
29	435	0.17	152	152	452	-	275.00	-	0.00
30	450	0.19	167	167	452	-	275.00	-	0.00
31	465	0.20	182	182	452	-	275.00	-	0.00
32	480	0.22	197	197	452	-	275.00	-	0.00
33	495	0.25	227	227	452	-	275.00	-	0.00
34	510	0.25	227	227	452	-	275.00	-	0.00
35	525	0.27	243	243	452	-	275.00	-	0.00
36	540	0.29	258	258	452	-	275.00	-	0.00
37	555	0.32	288	288	452	-	275.00	-	0.00
38	570	0.34	303	303	452	-	275.00	-	0.00
39	585	0.04	35	35	452	-	275.00	-	0.00
40	600	0.26	231	231	452	-	275.00	-	0.00
41	615	0.25	227	227	452	-	275.00	-	0.00
42	630	0.25	227	227	452	-	275.00	-	0.00
43	645	0.07	61	61	452	-	275.00	-	0.00
44	660	0.12	105	105	452	-	275.00	-	0.00
45	675	0.32	288	288	452	-	275.00	-	0.00
46	690	0.04	39	39	452	-	275.00	-	0.00
47	705	0.29	258	258	452	-	275.00	-	0.00
48	720	0.30	273	273	452	-	275.00	-	0.00
49	735	1.19	1,073	1,073	452	621	275.18	621	0.01
50	750	1.41	1,266	1,887	452	1,435	275.41	1,435	0.03
51	765	1.79	1,609	3,044	452	2,592	275.73	2,592	0.06
52	780	2.00	1,800	4,392	452	3,940	276.10	3,940	0.09
53	795	2.89	2,598	6,538	452	6,086	276.63	6,086	0.14
54	810	2.93	2,636	8,722	452	8,270	277.15	8,270	0.19
55	825	1.12	1,007	9,277	452	8,825	277.27	8,825	0.20
56	840	1.16	1,045	9,870	452	9,418	277.39	9,418	0.22
57	855	1.88	1,688	11,106	452	10,654	277.66	10,654	0.24
58	870	1.75	1,574	12,228	452	11,776	277.91	11,776	0.27

RETENTION BASIN
TKC JOB # 40635
100 YEAR - 24 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
59	885	1.79	1,610	13,386	452	12,934	278.14	12,934	0.30
60	900	1.66	1,494	14,427	452	13,975	278.34	13,975	0.32
61	915	1.53	1,377	15,353	452	14,901	278.52	14,901	0.34
62	930	1.40	1,260	16,161	452	15,709	278.67	15,709	0.36
63	945	0.76	688	16,397	452	15,945	278.72	15,945	0.37
64	960	0.80	721	16,666	452	16,214	278.77	16,214	0.37
65	975	0.07	61	16,275	452	15,823	278.70	15,823	0.36
66	990	0.07	61	15,883	452	15,431	278.62	15,431	0.35
67	1005	0.05	45	15,477	452	15,025	278.54	15,025	0.34
68	1020	0.05	45	15,070	452	14,618	278.46	14,618	0.34
69	1035	0.08	76	14,694	452	14,242	278.39	14,242	0.33
70	1050	0.08	76	14,318	452	13,866	278.32	13,866	0.32
71	1065	0.08	76	13,942	452	13,490	278.25	13,490	0.31
72	1080	0.07	61	13,550	452	13,098	278.17	13,098	0.30
73	1095	0.07	61	13,159	452	12,707	278.10	12,707	0.29
74	1110	0.07	61	12,767	452	12,315	278.02	12,315	0.28
75	1125	0.05	45	12,361	452	11,909	277.94	11,909	0.27
76	1140	0.03	30	11,939	452	11,487	277.84	11,487	0.26
77	1155	0.05	45	11,533	452	11,081	277.76	11,081	0.25
78	1170	0.07	61	11,141	452	10,689	277.67	10,689	0.25
79	1185	0.05	45	10,735	452	10,283	277.58	10,283	0.24
80	1200	0.03	30	10,313	452	9,861	277.49	9,861	0.23
81	1215	0.05	45	9,906	452	9,454	277.40	9,454	0.22
82	1230	0.05	45	9,500	452	9,048	277.31	9,048	0.21
83	1245	0.05	45	9,093	452	8,641	277.23	8,641	0.20
84	1260	0.03	30	8,672	452	8,220	277.13	8,220	0.19
85	1275	0.05	45	8,265	452	7,813	277.05	7,813	0.18
86	1290	0.03	30	7,843	452	7,391	276.95	7,391	0.17
87	1305	0.05	45	7,437	452	6,985	276.85	6,985	0.16
88	1320	0.03	30	7,015	452	6,563	276.74	6,563	0.15
89	1335	0.05	45	6,608	452	6,156	276.64	6,156	0.14
90	1350	0.03	30	6,187	452	5,735	276.54	5,735	0.13
91	1365	0.03	30	5,765	452	5,313	276.44	5,313	0.12
92	1380	0.03	30	5,343	452	4,891	276.33	4,891	0.11
93	1395	0.03	30	4,922	452	4,470	276.23	4,470	0.10
94	1410	0.03	30	4,500	452	4,048	276.13	4,048	0.09
95	1425	0.03	30	4,078	452	3,626	276.02	3,626	0.08
96	1440	0.03	30	3,656	452	3,204	275.91	3,204	0.07

RCFCD RATIONAL CALCULATIONS

100-YEAR EVENT
10-YEAR EVENT

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 1997 Version 5.0
Rational Hydrology Study Date: 12/30/99 File:635001.out

GHA ENTERPRISES
TENTATIVE TRACT 29578
GERALD FORD DRIVE/CATHEDRAL CITY
TKC JOB #40635

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Keith International, Inc, Palm Desert, California - S/N 709

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

2 year, 1 hour precipitation = 0.500(In.)
100 year, 1 hour precipitation = 1.600(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.600(In/Hr)
Slope of intensity duration curve = 0.5800

++

Process from Point/Station 1000.000 to Point/Station 1005.000
**** INITIAL AREA EVALUATION **** R1.1

Initial area flow distance = 850.000(Ft.)
Top (of initial area) elevation = 284.800(Ft.)
Bottom (of initial area) elevation = 280.400(Ft.)
Difference in elevation = 4.400(Ft.)
Slope = 0.00518 s(percent)= 0.52
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 16.597 min.
Rainfall intensity = 3.372(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.780
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 52.00
Pervious area fraction = 0.500; Impervious fraction = 0.500
Initial subarea runoff = 4.889(CFS)

```
Total initial stream area =        1.860(Ac.)
Pervious area fraction = 0.500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.860(Ac.)
Runoff from this stream =      4.889(CFS)
Time of concentration =   16.60 min.
Rainfall intensity =     3.372(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** INITIAL AREA EVALUATION ****  R1.2
------------------------------------------------------------------------------
Initial area flow distance =   858.000(Ft.)
Top (of initial area) elevation =   284.800(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.00513  s(percent)=       0.51
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.690 min.
Rainfall intensity =      3.361(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.779
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  52.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      5.003(CFS)
Total initial stream area =        1.910(Ac.)
Pervious area fraction = 0.500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****

------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.910(Ac.)
Runoff from this stream =      5.003(CFS)
Time of concentration =   16.69 min.
Rainfall intensity =     3.361(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
 No.        (CFS)        (min)                 (In/Hr)


1          4.889      16.60                   3.372
2          5.003      16.69                   3.361
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```
Largest stream flow has longer time of concentration
Qp =      5.003 + sum of
        Qb          Ia/Ib
         4.889 *    0.997 =      4.873
Qp =      9.876

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.889       5.003
Area of streams before confluence:
        1.860       1.910
Results of confluence:
Total flow rate =      9.876(CFS)
Time of concentration =    16.690 min.
Effective stream area after confluence =      3.770(Ac.)

FLOW TO CATCH BASIN #1
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** INITIAL AREA EVALUATION **** R2.1
------------------------------------------------------------------------
Initial area flow distance =   960.000(Ft.)
Top (of initial area) elevation =   285.300(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.900(Ft.)
Slope =    0.00510  s(percent)=       0.51
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.474 min.
Rainfall intensity =      3.272(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.777
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  52.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      5.034(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.500


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.980(Ac.)
Runoff from this stream =      5.034(CFS)
Time of concentration =   17.47 min.
Rainfall intensity =     3.272(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** INITIAL AREA EVALUATION **** R2.2
------------------------------------------------------------------------
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Initial area flow distance =   988.000(Ft.)
Top (of initial area) elevation =   285.300(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.900(Ft.)
Slope =    0.00496  s(percent)=       0.50
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.778 min.
Rainfall intensity =      3.240(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.776
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  52.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      7.342(CFS)
Total initial stream area =        2.920(Ac.)
Pervious area fraction = 0.500


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.920(Ac.)
Runoff from this stream =      7.342(CFS)
Time of concentration =   17.78 min.
Rainfall intensity =     3.240(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.034     17.47                  3.272
2        7.342     17.78                  3.240
Largest stream flow has longer time of concentration
Qp =      7.342 + sum of
        Qb          Ia/Ib
         5.034 *    0.990 =      4.984
Qp =     12.327

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.034       7.342
Area of streams before confluence:
        1.980        2.920
Results of confluence:
Total flow rate =     12.327(CFS)
Time of concentration =    17.778 min.
Effective stream area after confluence =      4.900(Ac.)
End of computations, total study area =           8.67 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

Area averaged pervious area fraction(Ap) = 0.500
Area averaged RI index number = 32.0

FLOW TO CATCH BASIN #2

CONFLUENCE WORKSHEET
PREPARED BY: THE KEITH COMPANIES, PALM DESERT, CA
PROJECT: GHA ENTERPRISES
TKC JOB # 40635

Storm Event 100 YR
Let Qa, Ta, & Ia correspond to the tributary area with the longer time of concentration.

If: Qa>Qb
Then: Qp=Qa+Qb(Ia/Ib); Tp=Ta

If: Qb>Qa
Then: Qp=Qb+Qa(Tb/Ta); Tp=Tb

NODE	FLOW RATE (cfs)	TC (min)	RAINFALL INTENSITY (In/Hr)	AREA (acres)	Designation
1005	9.88	16.69	3.36	3.77	B
2005	12.33	17.78	3.24	4.90	A

Qp=	12.33	+	9.52	=	**21.85**
Tp=					**17.78**
Ip=					**3.24**
Area=					**8.67**

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 1997 Version 5.0
Rational Hydrology Study Date: 12/30/99 File:635002.out

GHA ENTERPRISES
TENTATIVE TRACT 29578
GERALD FORD DRIVE/CATHEDRAL CITY
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********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Keith International, Inc, Palm Desert, California - S/N 709

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.500(In.)
100 year, 1 hour precipitation = 1.600(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.953(In/Hr)
Slope of intensity duration curve = 0.5800

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Process from Point/Station 1000.000 to Point/Station 1005.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 850.000(Ft.)
Top (of initial area) elevation = 284.800(Ft.)
Bottom (of initial area) elevation = 280.400(Ft.)
Difference in elevation = 4.400(Ft.)
Slope = 0.00518 s(percent)= 0.52
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 16.597 min.
Rainfall intensity = 2.007(In/Hr) for a 10.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.637
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 32.00
Pervious area fraction = 0.500; Impervious fraction = 0.500
Initial subarea runoff = 2.377(CFS)

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Total initial stream area =        1.860(Ac.)
Pervious area fraction = 0.500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.860(Ac.)
Runoff from this stream =      2.377(CFS)
Time of concentration =   16.60 min.
Rainfall intensity =     2.007(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   858.000(Ft.)
Top (of initial area) elevation =   284.800(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.400(Ft.)
Slope =    0.00513  s(percent)=       0.51
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.690 min.
Rainfall intensity =      2.001(In/Hr) for a    10.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.636
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      2.431(CFS)
Total initial stream area =        1.910(Ac.)
Pervious area fraction = 0.500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1000.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.910(Ac.)
Runoff from this stream =      2.431(CFS)
Time of concentration =   16.69 min.
Rainfall intensity =     2.001(In/Hr)
Summary of stream data:

Stream    Flow rate       TC            Rainfall Intensity
 No.        (CFS)        (min)                 (In/Hr)


1         2.377      16.60                2.007
2         2.431      16.69                2.001
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Largest stream flow has longer time of concentration
Qp =      2.431 + sum of
        Qb          Ia/Ib
         2.377 *    0.997 =      2.369
Qp =      4.800

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.377       2.431
Area of streams before confluence:
        1.860       1.910
Results of confluence:
Total flow rate =      4.800(CFS)
Time of concentration =    16.690 min.
Effective stream area after confluence =      3.770(Ac.)

FLOW TO CATCH BASIN #1
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   960.000(Ft.)
Top (of initial area) elevation =   285.300(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.900(Ft.)
Slope =    0.00510  s(percent)=       0.51
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.474 min.
Rainfall intensity =      1.948(In/Hr) for a    10.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.633
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      2.443(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.500


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.980(Ac.)
Runoff from this stream =      2.443(CFS)
Time of concentration =   17.47 min.
Rainfall intensity =     1.948(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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```
Initial area flow distance =   988.000(Ft.)
Top (of initial area) elevation =   285.300(Ft.)
Bottom (of initial area) elevation =   280.400(Ft.)
Difference in elevation =     4.900(Ft.)
Slope =    0.00496  s(percent)=       0.50
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.778 min.
Rainfall intensity =      1.929(In/Hr) for a    10.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.632
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  32.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      3.561(CFS)
Total initial stream area =        2.920(Ac.)
Pervious area fraction = 0.500


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2000.000 to Point/Station     2005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.920(Ac.)
Runoff from this stream =      3.561(CFS)
Time of concentration =   17.78 min.
Rainfall intensity =     1.929(In/Hr)
Summary of stream data:

Stream    Flow rate      TC            Rainfall Intensity
 No.        (CFS)       (min)                 (In/Hr)


1         2.443     17.47                  1.948
2         3.561     17.78                  1.929
Largest stream flow has longer time of concentration
Qp =      3.561 + sum of
        Qb          Ia/Ib
         2.443 *    0.990 =      2.419
Qp =      5.980

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.443       3.561
Area of streams before confluence:
        1.980        2.920
Results of confluence:
Total flow rate =      5.980(CFS)
Time of concentration =    17.778 min.
Effective stream area after confluence =      4.900(Ac.)
End of computations, total study area =            8.67 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
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Area averaged pervious area fraction(Ap) = 0.500
Area averaged RI index number = 32.0

FLOW TO CATCH BASIN #2

CONFLUENCE WORKSHEET
PREPARED BY: THE KEITH COMPANIES, PALM DESERT, CA
PROJECT: GHA ENTERPRISES
TKC JOB # 40635

Storm Event 10 YR
Let Qa, Ta, & Ia correspond to the tributary area with the longer time of concentration.

If: Qa>Qb
Then: Qp=Qa+Qb(Ia/Ib); Tp=Ta

If: Qb>Qa
Then: Qp=Qb+Qa(Tb/Ta); Tp=Tb

NODE	FLOW RATE (cfs)	TC (min)	RAINFALL INTENSITY (In/Hr)	AREA (acres)	Designation
1005	4.80	16.69	2.00	3.77	B
2005	5.98	17.78	1.93	4.90	A

Qp=	5.98	+	4.63	=	**10.61**
Tp=					**17.78**
Ip=					**1.93**
Area=					**8.67**

STORM DRAIN SYSTEM CALCULATIONS

CATCH BASIN SIZING
STORM DRAIN SIZING
RETENTION BASIN WSEL FOR 100 YEAR PEAK FLOW

GHA ENTERPRISES
TKC JOB # 40635
CATCH BASIN SIZING
CURB OPENING (SUMP)
CATCH BASIN #1

GIVEN:

TOTAL DISCHARGE	9.88 cfs	
DIVIDED FLOW	N	
FLOW TO CATCH BASIN		9.88 cfs
CURB TYPE	6 in	

EQUATIONS USED:

$$L = \frac{Q}{0.67\, h\sqrt{2\,g d_o}}$$

WHERE: L=LENGTH OF OPENING (ft)
Q=FLOW RATE (cfs)
h=ORIFICE THROAT WIDTH (ft)
do=EFFECTIVE HEAD ON THE CENTER OF THE ORIFICE THROAT (ft)

$$d_o = d_i - \left(\frac{h}{2}\right) SIN\theta$$

ASSUME: di=CURB HEIGHT +4"

	CURB FACE	
	6"	8"
do=	0.55	0.64
h=	0.61	0.79
θ=	66	

SOLUTION: L(req'd)= 4.06

USE L= 5 ft

Qmax=	12.15 cfs
Qint=	9.88 cfs
Qc=	0.00 cfs

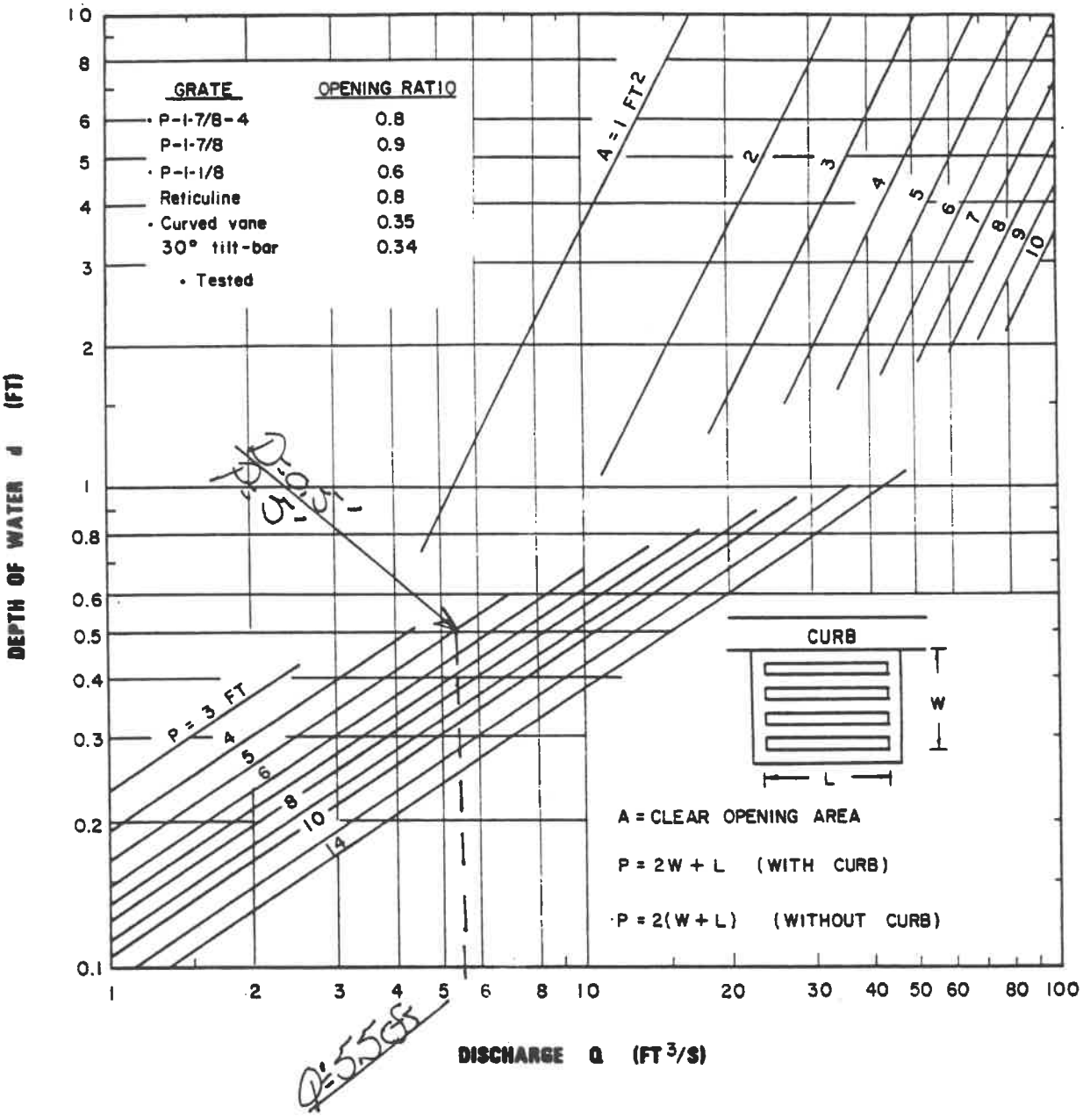
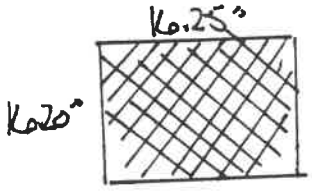


CHART 11. Grate inlet capacity in sump conditions.

NYLOPLAST 15" STANDARD H-20 RATED HINGED GRATES



⇒ P = 5.4'

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	GRASS SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data		
Channel Slope	0.005000	ft/ft
Discharge	12.00	cfs

Elevation range: 280.23 ft to 286.50 ft.

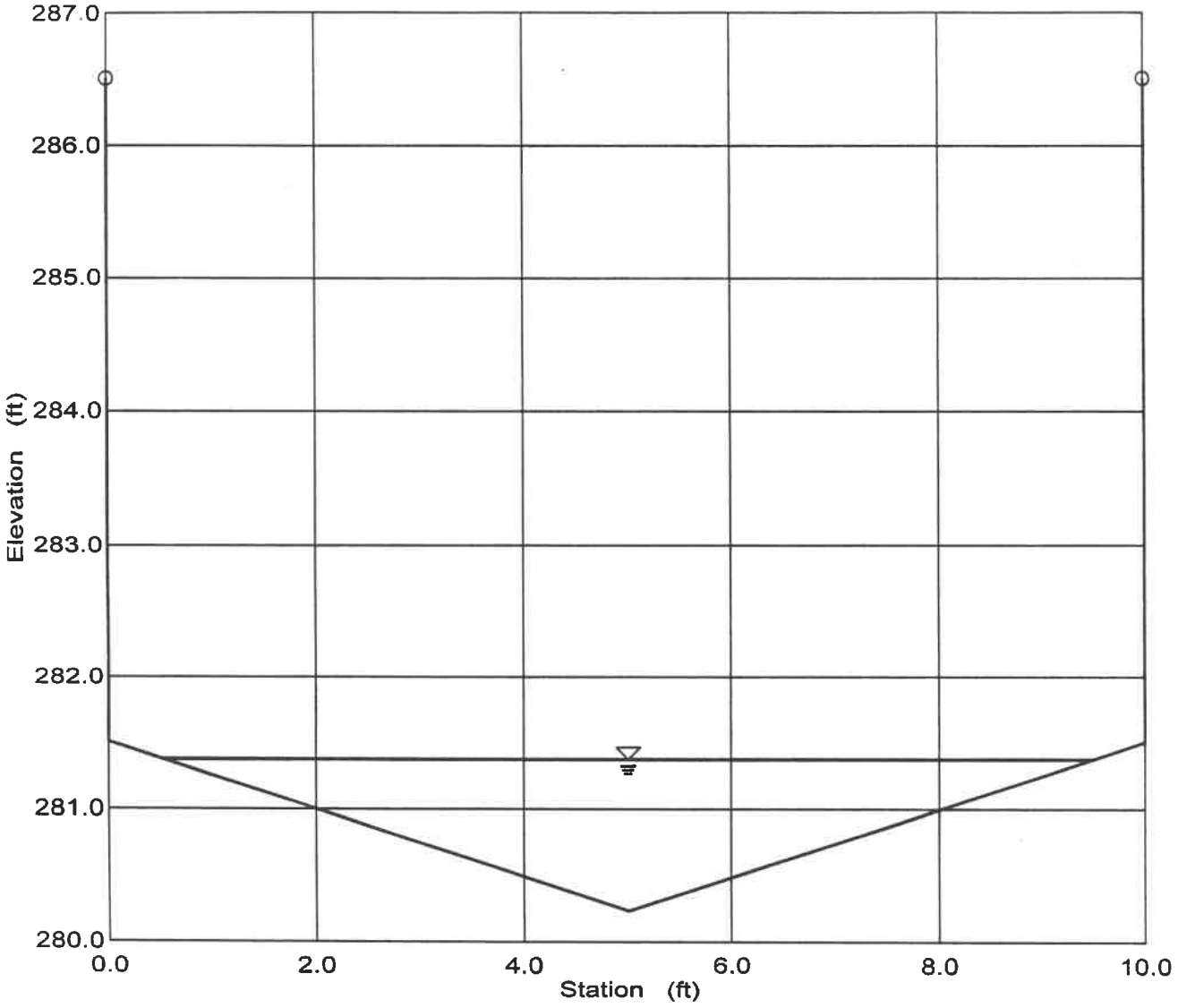
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	286.50	0.00	10.00	0.030
0.00	281.50			
5.00	280.23			
10.00	281.50			
10.00	286.50			

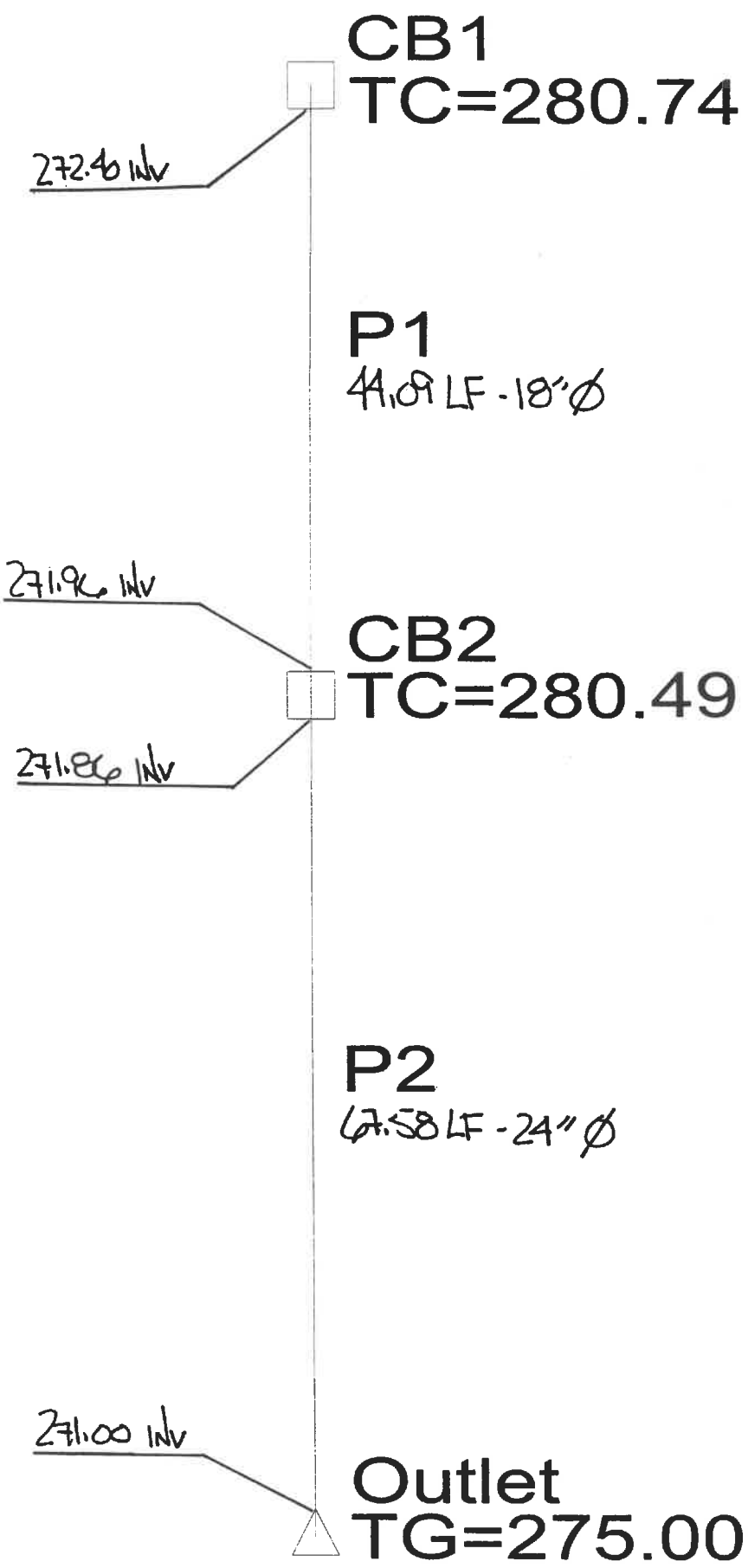
Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	281.37	ft
Flow Area	5.10	ft²
Wetted Perimeter	9.24	ft
Top Width	8.96	ft
Height	1.14	ft
Critical Depth	281.13	ft
Critical Slope	0.017869	ft/ft
Velocity	2.35	ft/s
Velocity Head	0.09	ft
Specific Energy	281.45	ft
Froude Number	0.55	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	GRASS SWALE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	281.37	ft
Discharge	12.00	cfs




CB1
TC=280.74
272.40 INV
P1
44.09 LF - 18" Ø
271.90 INV
CB2
TC=280.49
271.86 INV
P2
67.58 LF - 24" Ø
271.00 INV
Outlet
TG=275.00

```
------------------ Beginning Calculation Cycle ------------------
Discharge: 9.87 cfs  at node CB1
Discharge: 21.87 cfs  at node CB2
Discharge: 21.75 cfs  at node Outlet
Beginning iteration 1
Discharge: 9.87 cfs  at node CB1
Discharge: 21.87 cfs  at node CB2
Discharge: 21.75 cfs  at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error:  0.0
Information: P2 Surcharged condition
Information: P1 Surcharged condition
--------------------- Calculations Complete ---------------------

** Analysis Options **
Friction method:  Manning's Formula
HGL Convergence Test:  0.001000
Maximum Network Traversals:  5
Number of Pipe Profile Steps:  5
Discharge Convergence Test:  0.001000
Maximum Design Passes:  3


 ----------------- Network Quick View  -----------------------

                                                |     Hydraulic Grade      |
 Label   | Length  |   Size   |  Discharge  |  Upstream  |  Downstream |
P2            67.58    24 inch          21.87       278.50         277.96
P1            44.09    18 inch           9.87       279.96         279.63

                      | -----------   Elevations   ---------------- |
 Label    | Discharge |    Ground   | Upstream HGL | Downstream HGL |
CB2               21.87        280.49         279.63           278.50
Outlet            21.75        275.00         277.96           277.96
CB1                9.87        280.74         280.69           279.96
Elapsed: 0 minute(s) 0 second(s)
```

PIPES

Node	Pipe	Q (cfs)	Cap (cfs)	Length (ft)	Section Material	Size	Number Sections	Roughness	S (ft/ft)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	Up HGL (ft)	Dn HGL (ft)	Up EGL (ft)	Dn EGL (ft)	Sys Flow Time (min)
CB1	P1	9.87	11.37	44.09	PVC	18 inch	1	0.012	0.009980	5.58	272.40	271.96	279.96	279.63	280.44	280.11	16.69
CB2	P2	21.87	27.65	67.58	PVC	24 inch	1	0.012	0.012726	6.96	271.86	271.00	278.50	277.96	279.25	278.71	17.78

INLETS

Node	Inlet Area (acres)	Inlet C	Inlet TC (min)	Inlet Intensity (in/hr)	Inlet Discharge (cfs)	Total CA (acres)	Carryover (cfs)	Structure Discharge (cfs)	System Intensity (in/hr)	Ground Elevation (ft)	Sump Elevation (ft)	HGL In (ft)	HGL Out (ft)	System Flow Time (min)
CB1	3.77	0.77	16.69	3.36	9.87	2.91	0.00	9.87	3.36	280.74	272.40	280.69	279.96	16.69
CB2	4.89	0.77	17.78	3.24	12.36	6.69	0.00	21.87	3.24	280.49	271.86	279.63	278.50	17.78
Outlet	N/A	N/A	N/A	N/A	N/A	6.69	N/A	21.75	3.23	275.00	267.00	277.96	277.96	17.94

Rainfall Table

Return Periods

Durations	2 year	5 year	10 year	25 year	50 year	100 year
5 min	2.10	3.30	4.10	5.10	6.80	6.80
6 min	1.89	2.95	3.70	4.50	5.30	6.10
7 min	1.72	2.70	3.40	4.10	4.80	5.55
8 min	1.60	2.50	3.15	3.80	4.50	5.15
9 min	1.49	2.34	2.95	3.60	4.20	4.80
10 min	1.40	2.20	2.75	3.35	3.90	4.50
15 min	1.10	1.75	2.17	2.65	3.10	3.55
20 min	0.94	1.45	1.85	2.25	2.62	3.00
25 min	0.82	1.30	1.62	1.95	2.30	2.65
30 min	0.74	1.15	1.45	1.77	2.08	2.40
35 min	0.68	1.06	1.35	1.62	1.90	2.18
40 min	0.63	0.98	1.25	1.50	1.75	2.00
45 min	0.59	0.92	1.15	1.40	1.59	1.87
50 min	0.55	0.86	1.08	1.31	1.55	1.76
55 min	0.52	0.82	1.03	1.25	1.45	1.66
60 min	0.50	0.78	0.95	1.18	1.39	1.60
70 min	0.45	0.71	0.90	1.08	1.26	1.45
80 min	0.42	0.66	0.83	1.00	1.17	1.35
90 min	0.39	0.62	0.78	0.94	1.10	1.25
100 min	0.37	0.58	0.73	0.88	1.04	1.18

Rainfall Intensities are in (in/hr)

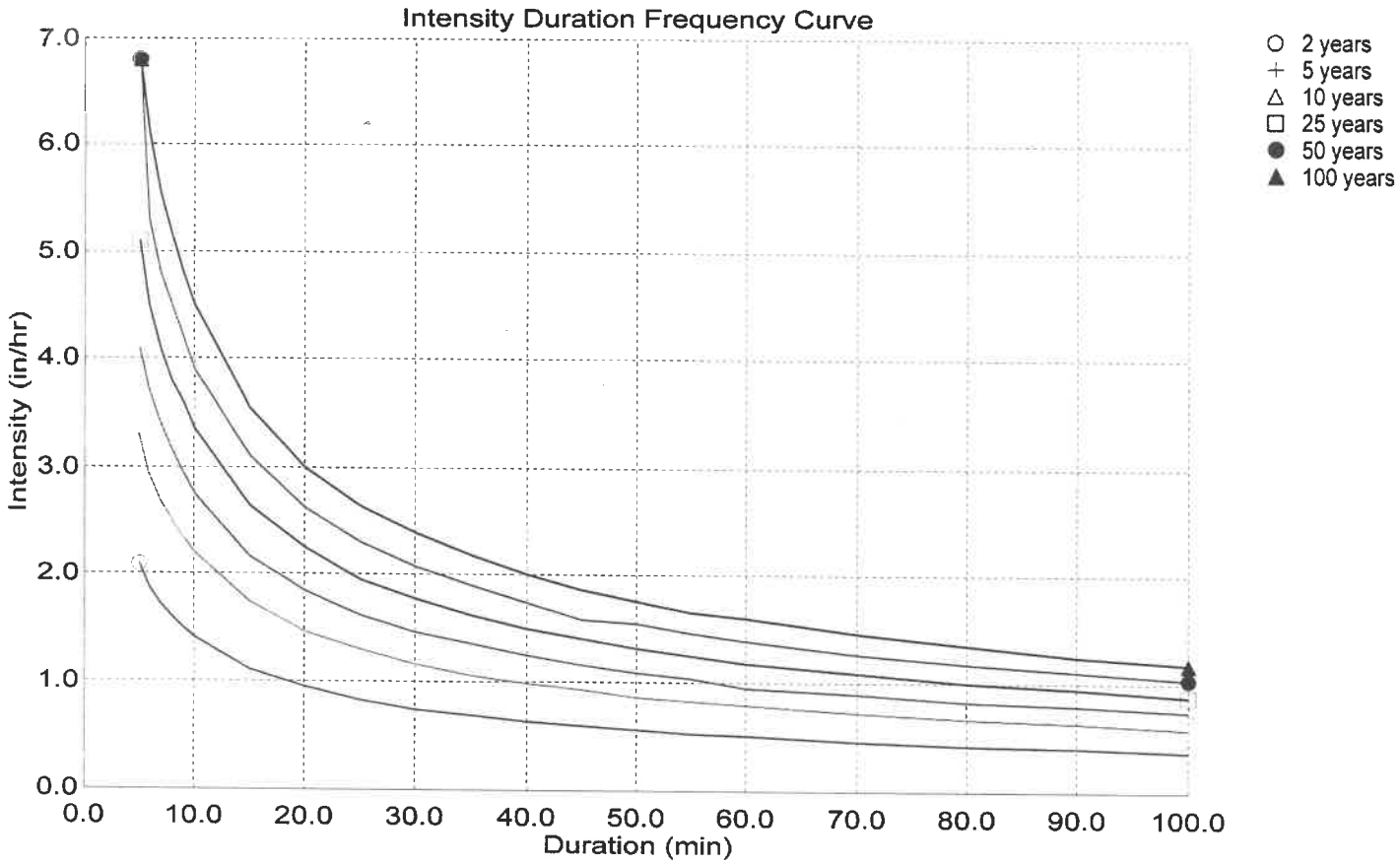

Intensity Duration Frequency Curve
Intensity (in/hr)
Duration (min)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
2 years
5 years
10 years
25 years
50 years
100 years

Table of Rational Coefficients

Following are ranges of rational coefficients. These ranges cover return periods of 2 to 10 years and are based on Intensity-Duration-Frequency (IDF) methodology. See References (HEC No. 19, 1984)

Area	"C" Values
Business	
Downtown	0.70-0.95
Neighborhood	0.50-0.70
Residential	
Single Family	0.30-0.50
Multiunit detached	0.40-0.60
Multiunit attached	0.60-0.75
Suburban resident	0.25-0.40
Apartment	0.50-0.70
Residential (1.2 acre lots or more)	0.30-0.45
Industrial	
Light	0.50-0.80
Heavy	0.60-0.90
Parks and Cemeteries	0.10-0.25
Playgrounds	0.20-0.40
Unimproved	0.10-0.30
Pavement	
Asphalt/Concrete	0.70-0.95
Brick	0.70-0.85
Drives and Walks	0.75-0.85
Lawns, Sandy soils	
Flat, 2%	0.05-0.10
Average, 2-7%	0.10-0.15
Steep, > 7%	0.15-0.20
Lawns, Heavy Soils	
Flat 2%	0.13-0.17
Average, 2-7%	0.18-0.22
Steep >7%	0.25-0.35
Railroad Yard	0.20-0.40
Roofs	0.70-0.95

GHA ENTERPRISES - GERALD FORD
JOB #: 40635
100 YEAR - 1 HOUR STORM
RETENTION BASIN
DATA INPUT

TRIANGULAR HYDROGRAPH		
FLOW	21.85	
Tc	17.78	
T (max)	53.34	
m1	0.0204818	0.0102409
m2	-0.010241	-0.00512
y-int	32.775	
VOL	34964.37	
TOTAL AREA		8.66
Ap		0.5
RI		32

PERCOLATION RATE 2 in/hr

0.15 cfs

DRYWELLS

#	cfs	
1	0.35	0.35 cfs

TOTAL PERCOLATION RATE (cf) =
(PER UNIT TIME PERIOD) 30.14 cf/min

WEIR DATA

OVERFLOW CONTOUR	281.5
b	19
h(min)	6.5

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
275	0	0		3288.98	0	0	0.0
276	1	1	502	3791.05	3540	3540	0.1
277	1	2	534	4325.12	4058	7598	0.2
278	1	3	566	4891.18	4608	12206	0.3
279	1	4	598	5489.25	5190	17396	0.4
280	1	5	630	6119.33	5804	23201	0.5
281	1	6	662	6781.40	6450	29651	0.7
281	0	6	0	6781.40	0	29651	0.7

MAXIMUM WATER SURFACE= 281.00

GHA ENTERPRISES - GERALD FORD
JOB #: 40635
DATE 30-Dec-99
RETENTION BASIN

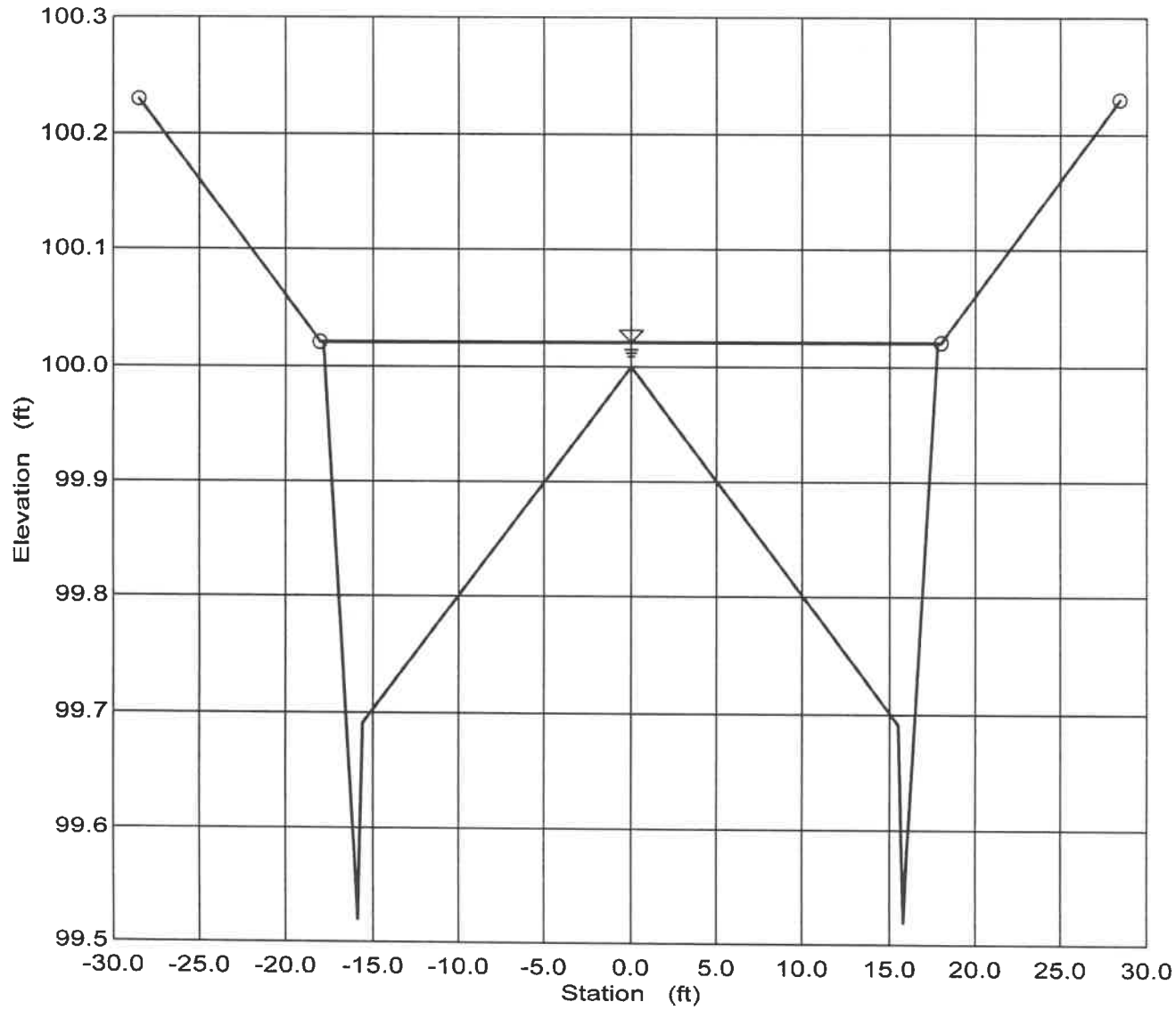
TIME (min)		FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	WEIR FLOW OUT (cfs)	WEIR VOL OUT (cuft)	BALANCE IN BASIN (cuft)	BALANCE IN BASIN (acre-ft)
0	1	1.23	74	74	30	43.60	275.01	0.00	0	43.60	0.00
1	2	2.46	147	191	30	160.93	275.05	0.00	0	160.93	0.00
2	3	3.69	221	382	30	352.00	275.10	0.00	0	352.00	0.01
3	4	4.92	295	647	30	616.80	275.17	0.00	0	616.80	0.01
4	5	6.14	369	985	30	955.34	275.27	0.00	0	955.34	0.02
5	6	7.37	442	1398	30	1367.61	275.39	0.00	0	1367.61	0.03
6	7	8.60	516	1884	30	1853.61	275.52	0.00	0	1853.61	0.04
7	8	9.83	590	2443	30	2413.35	275.68	0.00	0	2413.35	0.06
8	9	11.06	664	3077	30	3046.83	275.86	0.00	0	3046.83	0.07
9	10	12.29	737	3784	30	3754.04	276.05	0.00	0	3754.04	0.09
10	11	13.52	811	4565	30	4534.98	276.25	0.00	0	4534.98	0.10
11	12	14.75	885	5420	30	5389.66	276.46	0.00	0	5389.66	0.12
12	13	15.98	959	6348	30	6318.07	276.68	0.00	0	6318.07	0.15
13	14	17.20	1032	7350	30	7320.22	276.93	0.00	0	7320.22	0.17
14	15	18.43	1106	8426	30	8396.10	277.17	0.00	0	8396.10	0.19
15	16	19.66	1180	9576	30	9545.72	277.42	0.00	0	9545.72	0.22
16	17	20.89	1253	10799	30	10769.07	277.69	0.00	0	10769.07	0.25
17	18	21.71	1303	12072	30	12041.82	277.96	0.00	0	12041.82	0.28
18	19	21.10	1266	13308	30	13277.71	278.21	0.00	0	13277.71	0.30
19	20	20.49	1229	14507	30	14476.73	278.44	0.00	0	14476.73	0.33
20	21	19.87	1192	15669	30	15638.88	278.66	0.00	0	15638.88	0.36
21	22	19.26	1155	16794	30	16764.16	278.88	0.00	0	16764.16	0.38
22	23	18.64	1119	17883	30	17852.58	279.17	0.00	0	17852.58	0.41
23	24	18.03	1082	18934	30	18904.13	279.33	0.00	0	18904.13	0.43
24	25	17.41	1045	19949	30	19918.81	279.49	0.00	0	19918.81	0.46
25	26	17	1008	20927	30	20896.63	279.64	0.00	0	20896.63	0.48
26	27	16	971	21868	30	21837.58	279.79	0.00	0	21837.58	0.50
27	28	16	934	22772	30	22741.66	279.93	0.00	0	22741.66	0.52
28	29	15	897	23639	30	23608.87	280.06	0.00	0	23608.87	0.54
29	30	14	860	24469	30	24439.21	280.19	0.00	0	24439.21	0.56
30	31	14	824	25263	30	25232.69	280.32	0.00	0	25232.69	0.58
31	32	13	787	26019	30	25989.30	280.43	0.00	0	25989.30	0.60
32	33	12	750	26739	30	26709.05	280.54	0.00	0	26709.05	0.61
33	34	12	713	27422	30	27391.93	280.65	0.00	0	27391.93	0.63
34	35	11	676	28068	30	28037.94	280.75	0.00	0	28037.94	0.64
35	36	11	639	28677	30	28647.08	280.84	0.00	0	28647.08	0.66
36	37	10	602	29249	30	29219.35	280.93	0.00	0	29219.35	0.67
37	38	9	566	29785	30	29754.76	281.00	0.00	0	29754.76	0.68
38	39	9	529	30283	30	30253.30	281.00	0.00	0	30253.30	0.69
39	40	8	492	30745	30	30714.97	281.00	0.00	0	30714.97	0.71
40	41	8	455	31170	30	31139.78	281.00	0.00	0	31139.78	0.71
41	42	7	418	31558	30	31527.72	281.00	0.00	0	31527.72	0.72
42	43	6	381	31909	30	31878.79	281.00	0.00	0	31878.79	0.73
43	44	6	344	32223	30	32192.99	281.00	0.00	0	32192.99	0.74
44	45	5	307	32500	30	32470.33	281.00	0.00	0	32470.33	0.75
45	46	5	271	32741	30	32710.80	281.00	0.00	0	32710.80	0.75
46	47	4	234	32945	30	32914.40	281.00	0.00	0	32914.40	0.76
47	48	3	197	33111	30	33081.14	281.00	0.00	0	33081.14	0.76
48	49	3	160	33241	30	33211.01	281.00	0.00	0	33211.01	0.76
49	50	2	123	33334	30	33304.01	281.00	0.00	0	33304.01	0.76
50	51	1	86	33390	30	33360.14	281.00	0.00	0	33360.14	0.77
51	52	1	49	33410	30	33379.41	281.00	0.00	0	33379.41	0.77
52	53	0	13	33392	30	33361.81	281.00	0.00	0	33361.81	0.77
53	53.34	0	0	33362	30	33331.67	281.00	0.00	0	33331.67	0.77

STREET FLOW CALCULATIONS

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	37' R/W - WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.02	ft
Discharge	15.24	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	37' R/W - WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.02	ft

Elevation range: 99.52 ft to 100.23 ft.

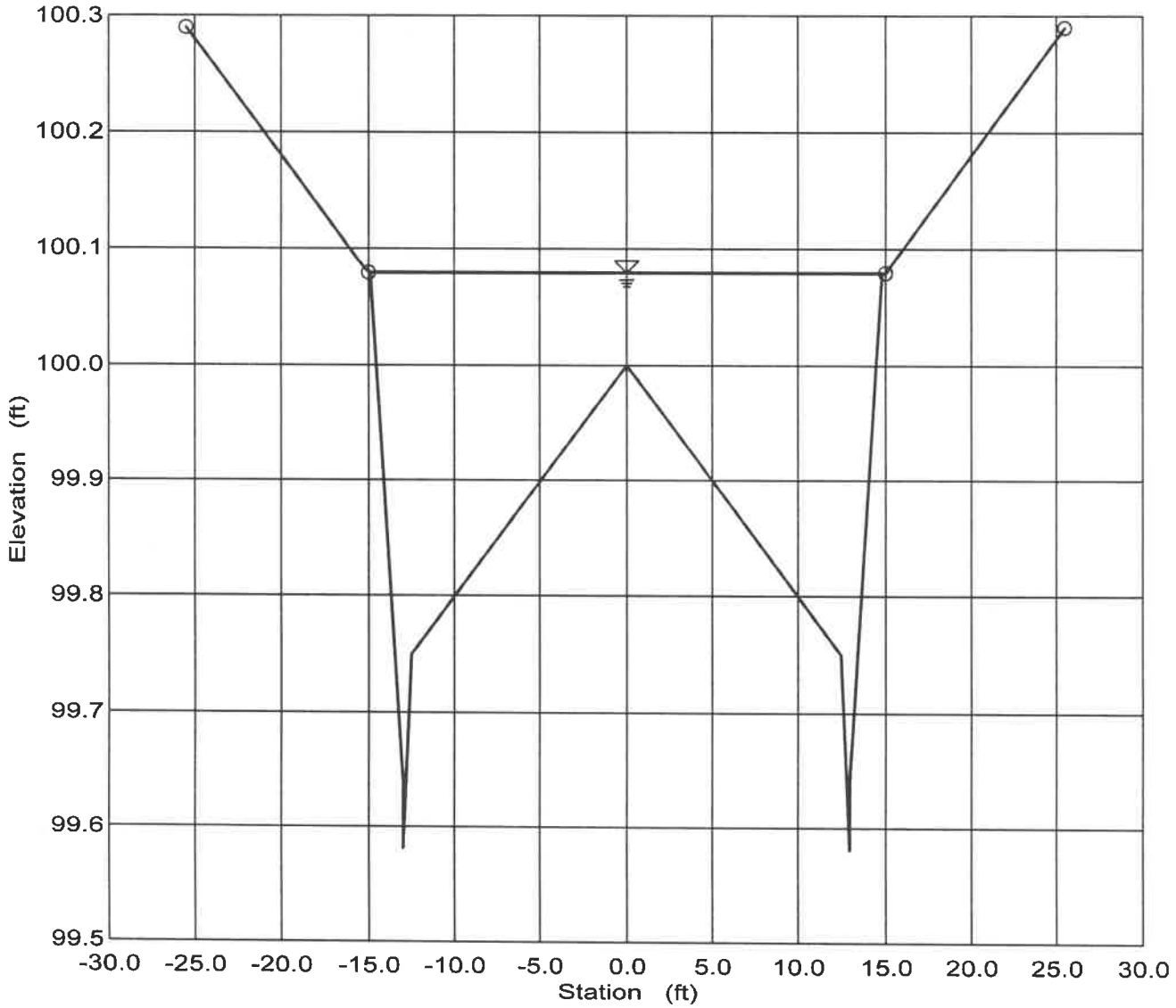
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.50	100.23	-28.50	-18.00	0.020
-18.50	100.03	-18.00	18.00	0.015
-18.00	100.02	18.00	28.50	0.020
-17.87	100.02			
-16.00	99.58			
-15.83	99.52			
-15.50	99.69			
0.00	100.00			
15.50	99.69			
15.83	99.52			
16.00	99.58			
17.87	100.02			
18.00	100.02			
18.50	100.03			
28.50	100.23			

Results		
Wtd. Mannings Coefficient	0.015	
Discharge	15.24	cfs
Flow Area	6.68	ft²
Wetted Perimeter	35.95	ft
Top Width	35.74	ft
Height	0.50	ft
Critical Depth	100.01	ft
Critical Slope	0.005870	ft/ft
Velocity	2.28	ft/s
Velocity Head	0.08	ft
Specific Energy	100.10	ft
Froude Number	0.93	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	31' R/W WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.08	ft
Discharge	15.92	cfs



Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	31' R/W WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.08	ft

Elevation range: 99.58 ft to 100.29 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-25.50	100.29	-25.50	-15.00	0.020
-15.50	100.09	-15.00	15.00	0.015
-15.00	100.08	15.00	25.50	0.020
-14.88	100.08			
-13.00	99.64			
-12.92	99.58			
-12.50	99.75			
0.00	100.00			
12.50	99.75			
12.92	99.58			
13.00	99.64			
14.88	100.08			
15.00	100.08			
15.50	100.09			
25.50	100.29			

Results		
Wtd. Mannings Coefficient	0.015	
Discharge	15.92	cfs
Flow Area	6.38	ft²
Wetted Perimeter	29.97	ft
Top Width	29.76	ft
Height	0.50	ft
Critical Depth	100.07	ft
Critical Slope	0.005592	ft/ft
Velocity	2.50	ft/s
Velocity Head	0.10	ft
Specific Energy	100.18	ft
Froude Number	0.95	
Flow is subcritical.		

CONFLUENCE WORKSHEET
PREPARED BY: THE KEITH COMPANIES, PALM DESERT, CA
PROJECT: GHA ENTERPRISES
TKC JOB # 40635

Storm Event 100 YR
Let Qa, Ta, & Ia correspond to the tributary area with the longer time of concentration.

If: Qa>Qb
Then: Qp=Qa+Qb(Ia/Ib); Tp=Ta

If: Qb>Qa
Then: Qp=Qb+Qa(Tb/Ta); Tp=Tb

NODE	FLOW RATE (cfs)	TC (min)	RAINFALL INTENSITY (In/Hr)	AREA (acres)	Designation
R1.1	4.89	16.60	3.37	1.86	B
R2.1	5.03	17.47	3.27	1.98	A

Qp=	5.03	+	4.74	=	**9.78**
Tp=					**17.47**
Ip=					**3.27**
Area=					**3.84**

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	31' R/W WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

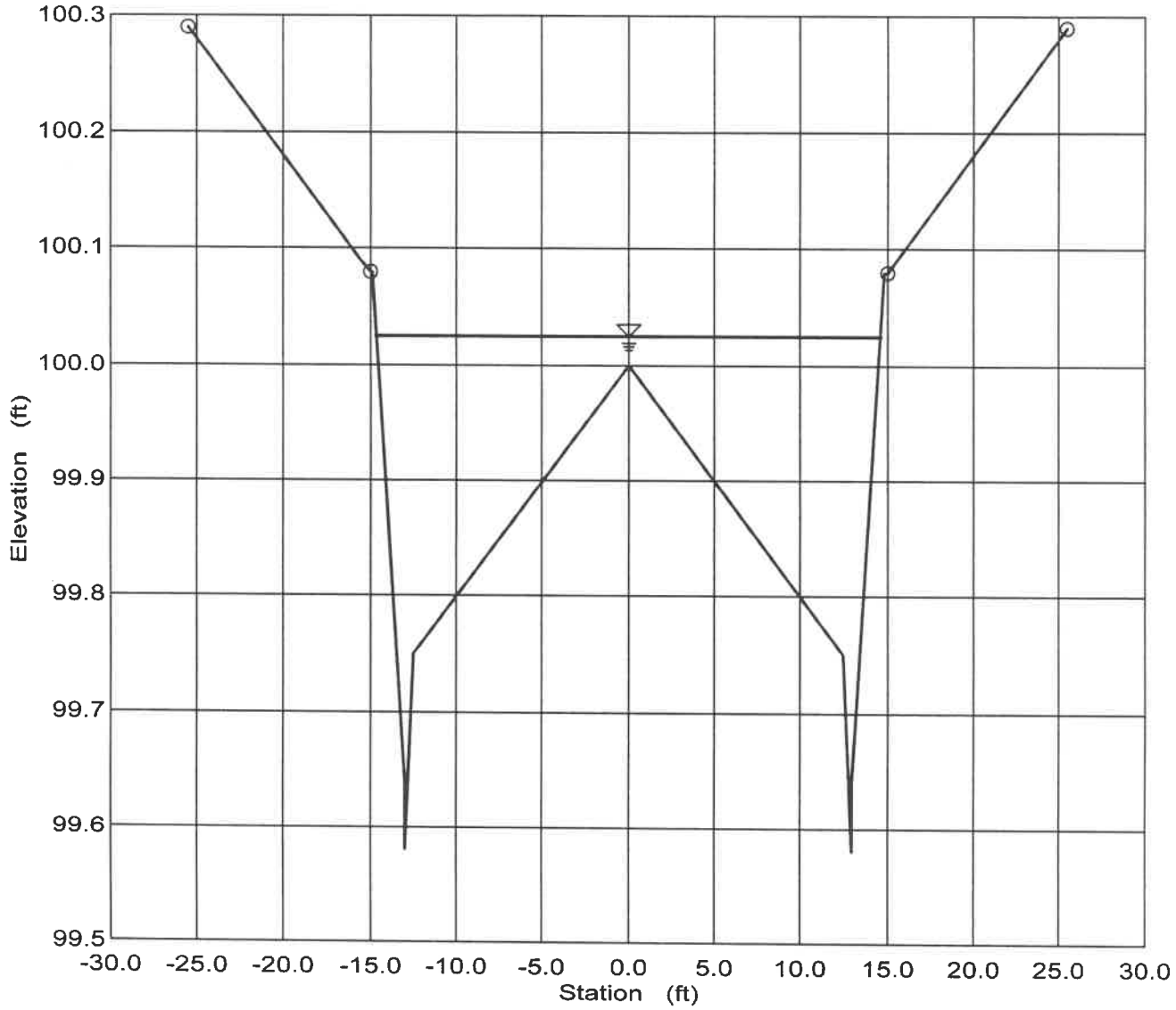
Input Data				
Channel Slope	0.005000 ft/ft			
Elevation range: 99.58 ft to 100.29 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-25.50	100.29	-25.50	-15.00	0.020
-15.50	100.09	-15.00	15.00	0.015
-15.00	100.08	15.00	25.50	0.020
-14.88	100.08			
-13.00	99.64			
-12.92	99.58			
-12.50	99.75			
0.00	100.00			
12.50	99.75			
12.92	99.58			
13.00	99.64			
14.88	100.08			
15.00	100.08			
15.50	100.09			
25.50	100.29			
Discharge	9.78 cfs			

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	100.02	ft
Flow Area	4.73	ft²
Wetted Perimeter	29.48	ft
Top Width	29.28	ft
Height	0.44	ft
Critical Depth	100.01	ft
Critical Slope	0.006204	ft/ft
Velocity	2.07	ft/s
Velocity Head	0.07	ft
Specific Energy	100.09	ft
Froude Number	0.91	
Flow is subcritical.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	31' R/W WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.02	ft
Discharge	9.78	cfs



CONFLUENCE WORKSHEET
PREPARED BY: THE KEITH COMPANIES, PALM DESERT, CA
PROJECT: GHA ENTERPRISES
TKC JOB # 40635

Storm Event 100 YR
Let Qa, Ta, & Ia correspond to the tributary area with the longer time of concentration.

If: Qa>Qb
Then: Qp=Qa+Qb(Ia/Ib); Tp=Ta

If: Qb>Qa
Then: Qp=Qb+Qa(Tb/Ta); Tp=Tb

NODE	FLOW RATE (cfs)	TC (min)	RAINFALL INTENSITY (In/Hr)	AREA (acres)	Designation
R1.2	5.00	16.69	3.36	1.91	B
R2.2	7.34	17.78	3.24	2.92	A

Qp=	7.34	+	4.82	=	**12.16**
Tp=					**17.78**
Ip=					**3.24**
Area=					**4.83**

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	37' R/W - WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

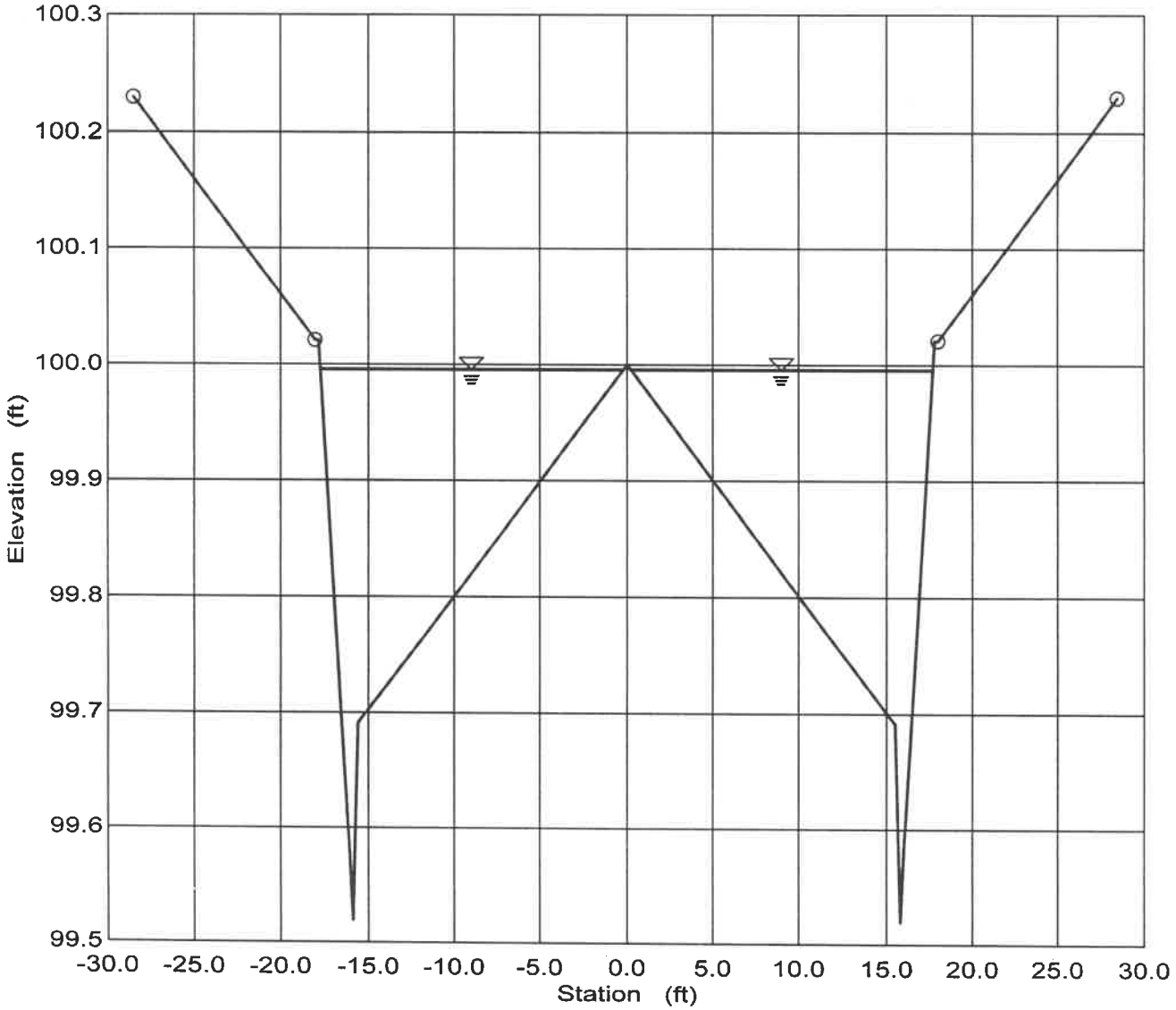
Input Data				
Channel Slope	0.005000 ft/ft			
Elevation range: 99.52 ft to 100.23 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-28.50	100.23	-28.50	-18.00	0.020
-18.50	100.03	-18.00	18.00	0.015
-18.00	100.02	18.00	28.50	0.020
-17.87	100.02			
-16.00	99.58			
-15.83	99.52			
-15.50	99.69			
0.00	100.00			
15.50	99.69			
15.83	99.52			
16.00	99.58			
17.87	100.02			
18.00	100.02			
18.50	100.03			
28.50	100.23			
Discharge	12.20 cfs			

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	100.00	ft
Flow Area	5.80	ft²
Wetted Perimeter	35.26	ft
Top Width	35.06	ft
Height	0.48	ft
Critical Depth	99.98	ft
Critical Slope	0.006094	ft/ft
Velocity	2.10	ft/s
Velocity Head	0.07	ft
Specific Energy	100.06	ft
Froude Number	0.91	
Flow is subcritical.		
Flow is divided.		

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40635.fm2
Worksheet	37' R/W - WEDGE CURB
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	100.00	ft
Discharge	12.20	cfs



RCFCD PLATES

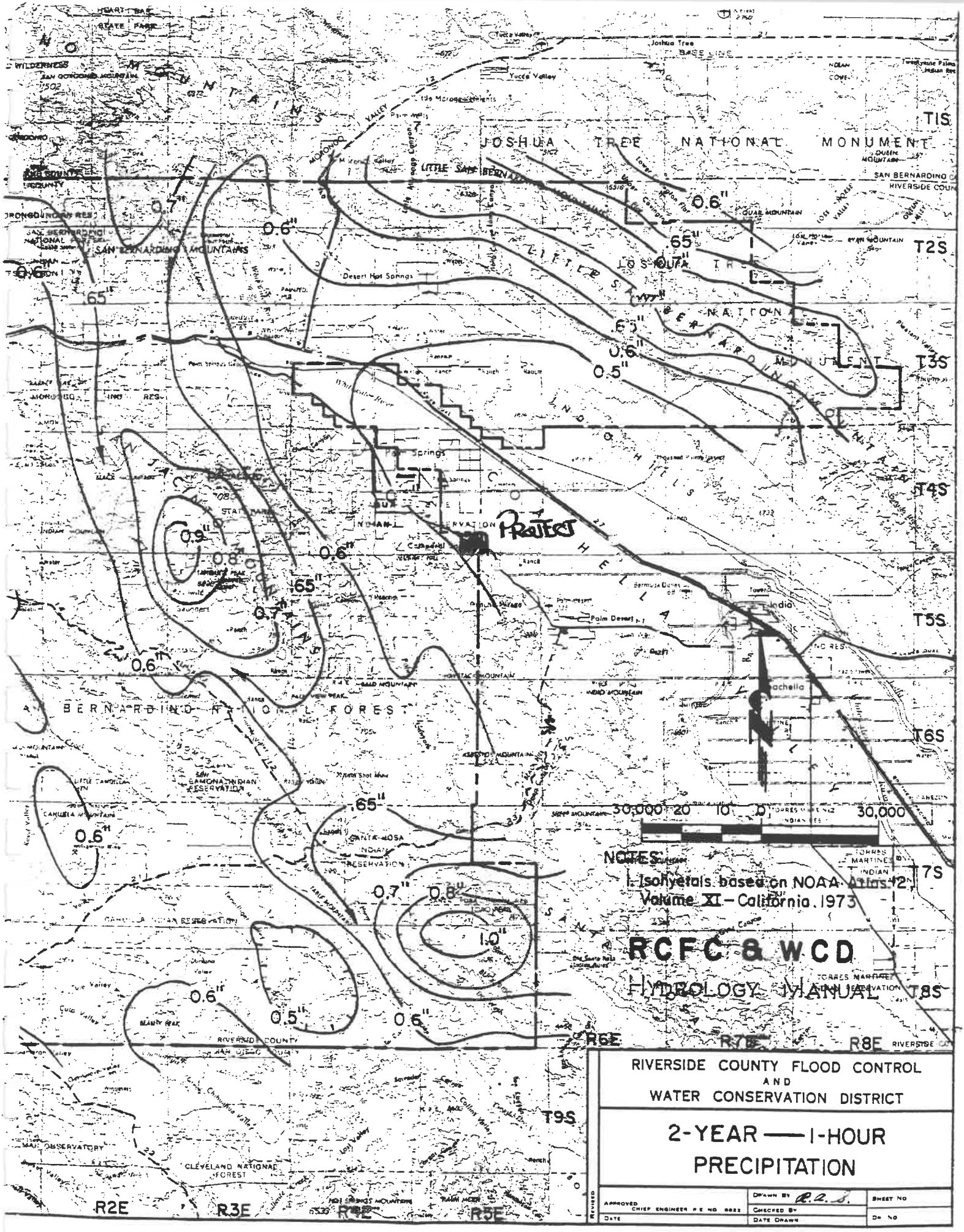
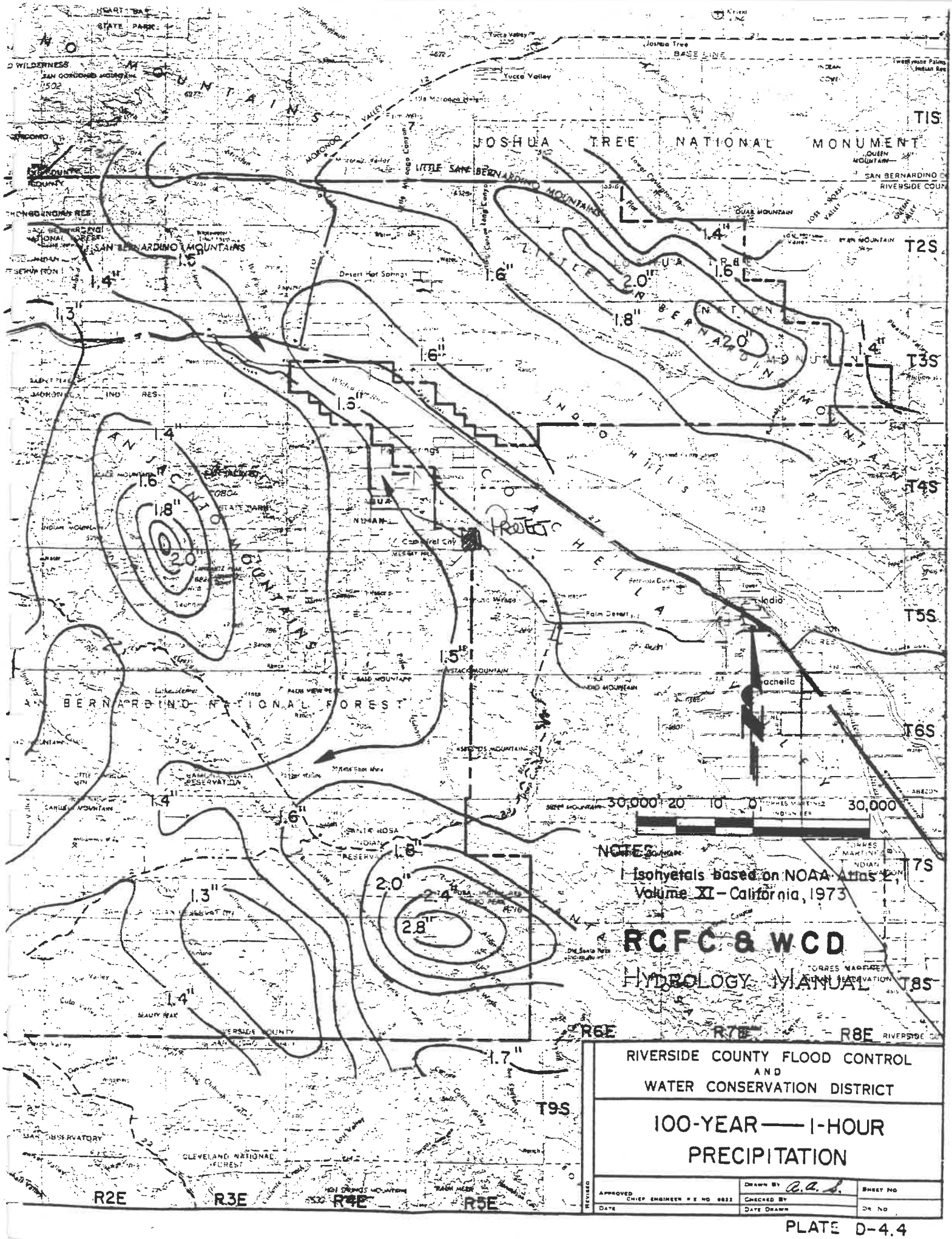

JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
LITTLE SAN BERNARDINO MOUNTAINS
Palm Springs
Desert Hot Springs
Indio
Coachella
Project
0.5"
0.6"
0.65"
0.7"
0.8"
0.9"
1.0"
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
2-YEAR — 1-HOUR PRECIPITATION
APPROVED CHIEF ENGINEER R.E. NO. 6822
DATE
REVISED
DRAWN BY R.A.S.
CHECKED BY
DATE DRAWN
SHEET NO
DR NO

PLATE D-4.3



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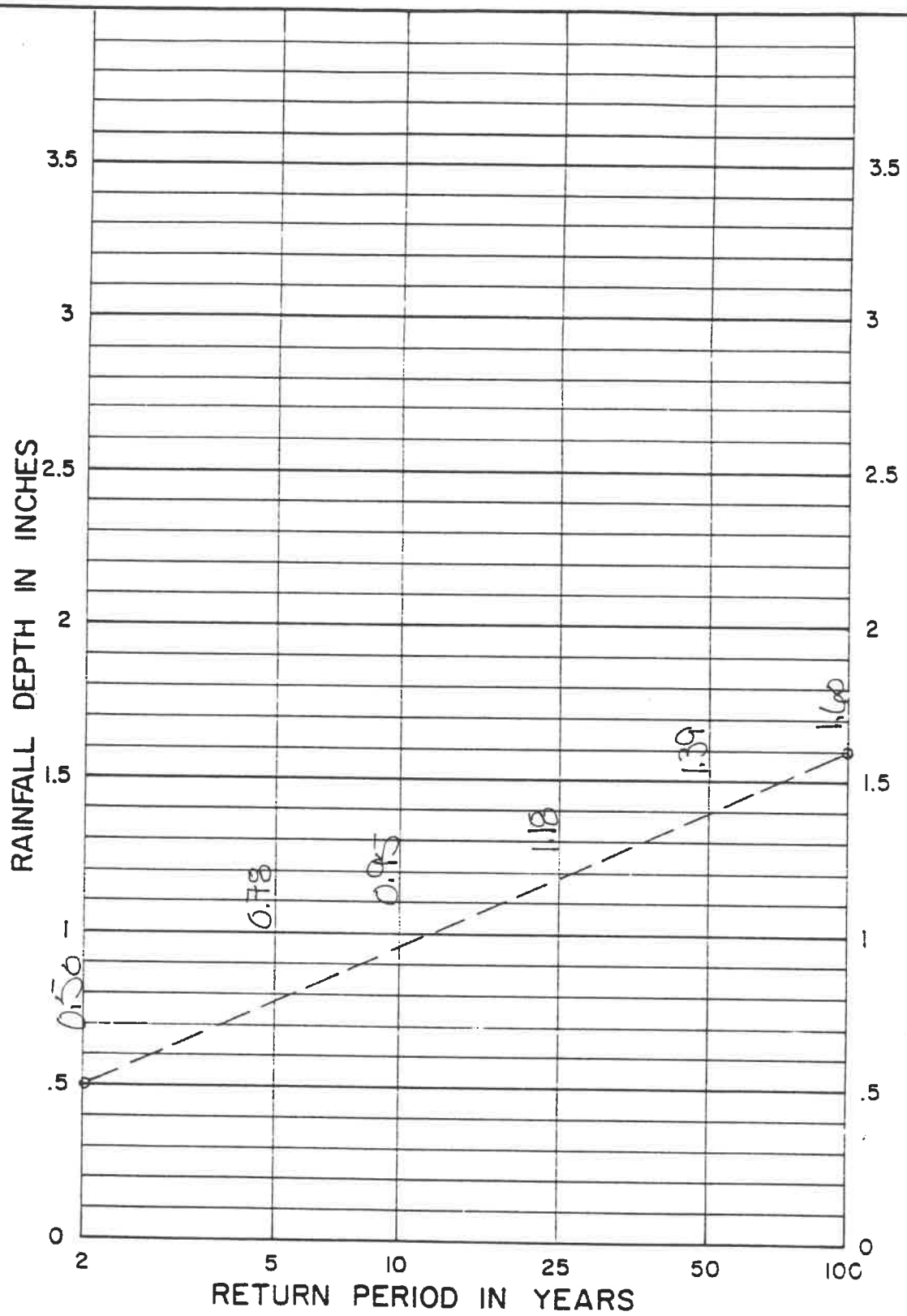
HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

100-YEAR — 1-HOUR PRECIPITATION

APPROVED CHIEF ENGINEER R.E. NO. 6822	DRAWN BY A.A.	SHEET NO
DATE	CHECKED BY	
REVISED	DATE DRAWN	DR. NO

PLATE D-4.4



NOTE:

1. For intermediate return periods plot 2-year and 100-year one hour values from maps, then connect points and read value for desired return period. For example given 2-year one hour = .50" and 100-year one hour = 1.60", 25-year one hour = 1.18"

Reference: NOAA Atlas 2, Volume XI - California, 1973.

RCFC & WCD

HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

PLATE D-4.5

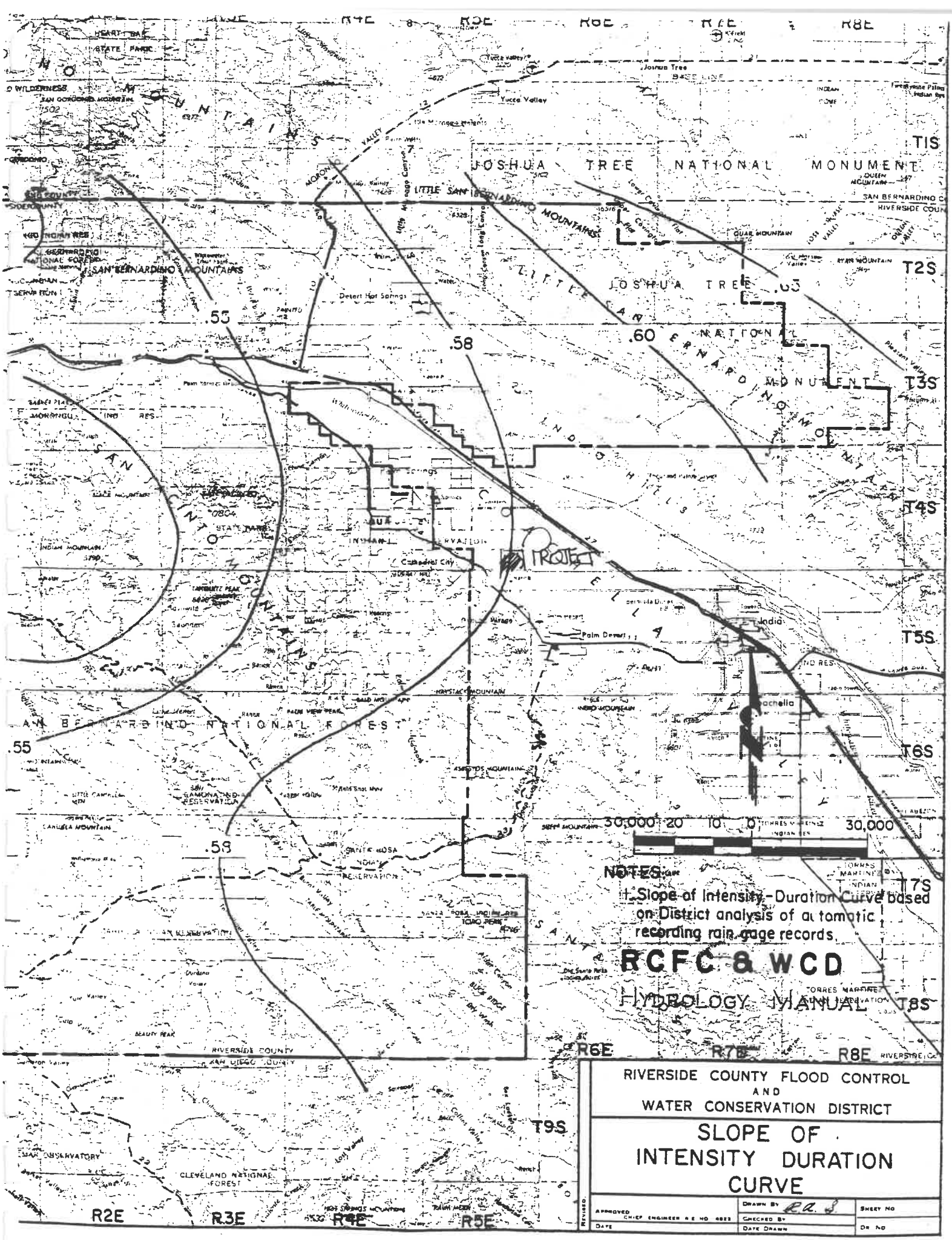
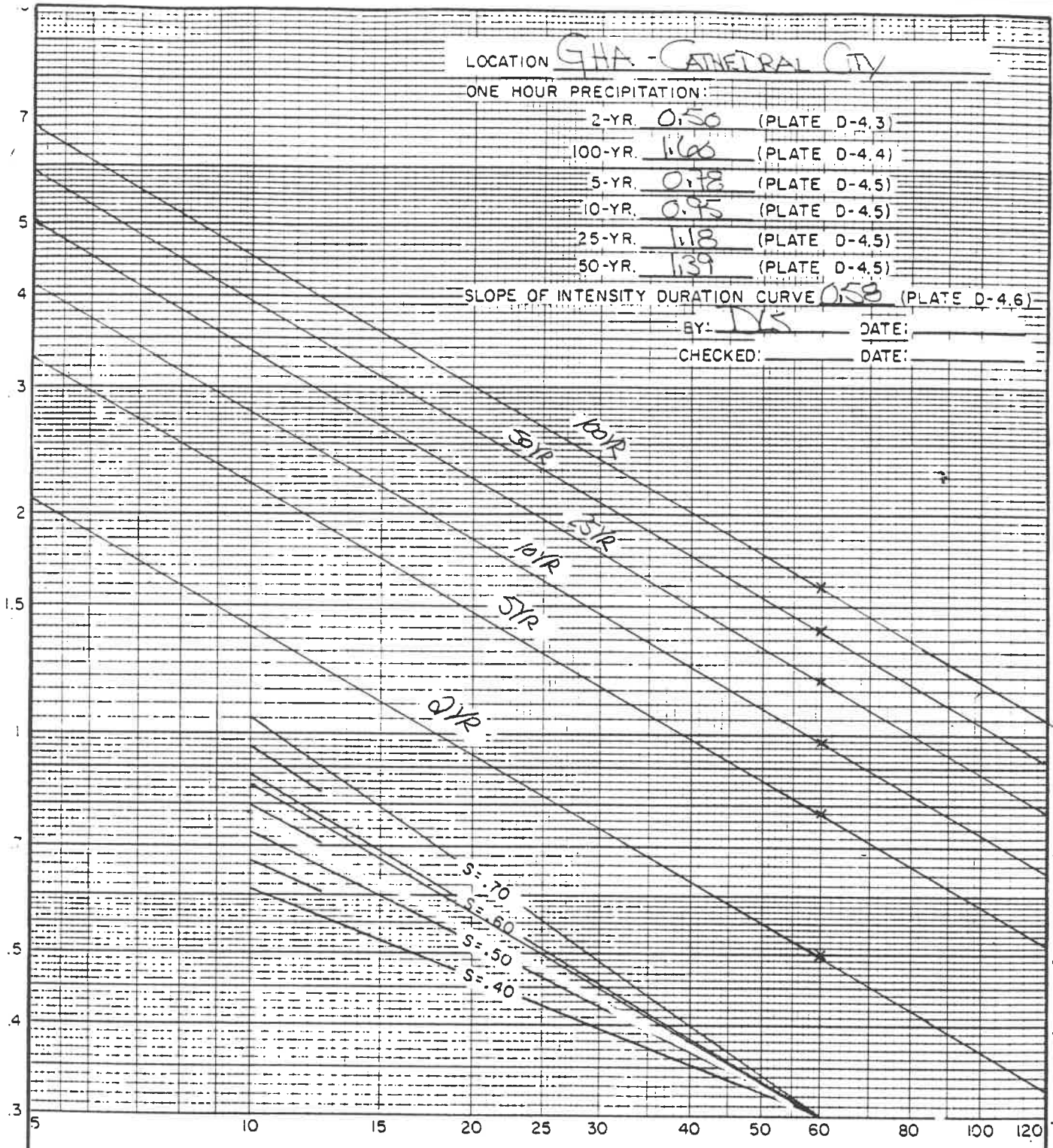

JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
SAN JACINTO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST
Palm Springs
Cathedral City
Indio
Coachella
Desert Hot Springs
Yucca Valley
Joshua Tree
.53
.55
.58
.59
.60
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES:
1. Slope of Intensity-Duration Curve based on District analysis of automatic recording rain gage records.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
SLOPE OF INTENSITY DURATION CURVE
APPROVED CHIEF ENGINEER R.E. NO. 4822
DATE
DRAWN BY R.A.S.
CHECKED BY
DATE DRAWN
SHEET NO
DR. NO
REVISED

PLATE D-4.6



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HYDROLOGY MANUAL

INTENSITY-DURATION CURVES .. CALCULATION SHEET

PLATE D-4.7

GHA- CATHEDRAL CITY

TKC JOB # 40635

INTENSITY DURATION WORKSHEET

2 YEAR - 1 HOUR PRECIPITATION	0.50
100 YEAR - 1 HOUR PRECIPITATION	1.60
SLOPE OF INTENSITY DURATION CURVE	0.58

SUMMARY OF PLATE D-4.7

STORM DURATION (min)	RAINFALL INTENSITY - INCHES PER HOUR					
	2 YEAR	5 YEAR	10 YEAR	25 YEAR	50 YEAR	100 YEAR
5	2.10	3.30	4.10	5.10	6.80	6.80
6	1.89	2.95	3.70	4.50	5.30	6.10
7	1.72	2.70	3.40	4.10	4.80	5.55
8	1.60	2.50	3.15	3.80	4.50	5.15
9	1.49	2.34	2.95	3.60	4.20	4.80
10	1.40	2.20	2.75	3.35	3.90	4.50
15	1.10	1.75	2.17	2.65	3.10	3.55
20	0.94	1.45	1.85	2.25	2.62	3.00
25	0.82	1.30	1.62	1.95	2.30	2.65
30	0.74	1.15	1.45	1.77	2.08	2.40
35	0.68	1.06	1.35	1.62	1.90	2.18
40	0.63	0.98	1.25	1.50	1.75	2.00
45	0.59	0.92	1.15	1.40	1.59	1.87
50	0.55	0.86	1.08	1.31	1.55	1.76
55	0.52	0.82	1.03	1.25	1.45	1.66
60	0.50	0.78	0.95	1.18	1.39	1.60
70	0.45	0.71	0.90	1.08	1.26	1.45
80	0.42	0.66	0.83	1.00	1.17	1.35
90	0.39	0.62	0.78	0.94	1.10	1.25
100	0.37	0.58	0.73	0.88	1.04	1.18

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

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RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

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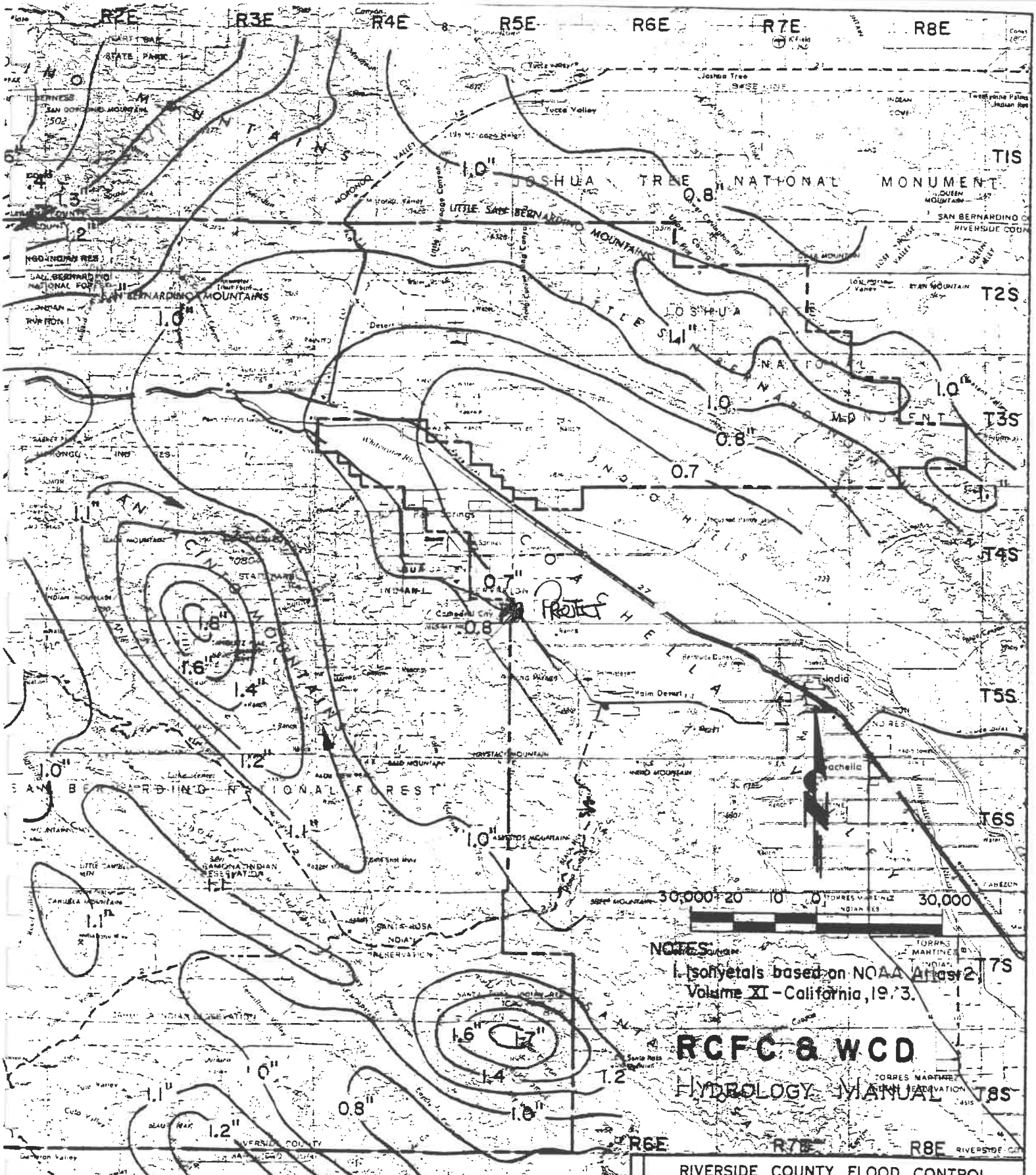
IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6



RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

2-YEAR — 3-HOUR PRECIPITATION

APPROVED CHIEF ENGINEER R.E. NO. 6882	DRAWN BY R.A.S.	SHEET NO
DATE	CHECKED BY	
	DATE DRAWN	DR. NO

REVISED

PLATE E-5.1

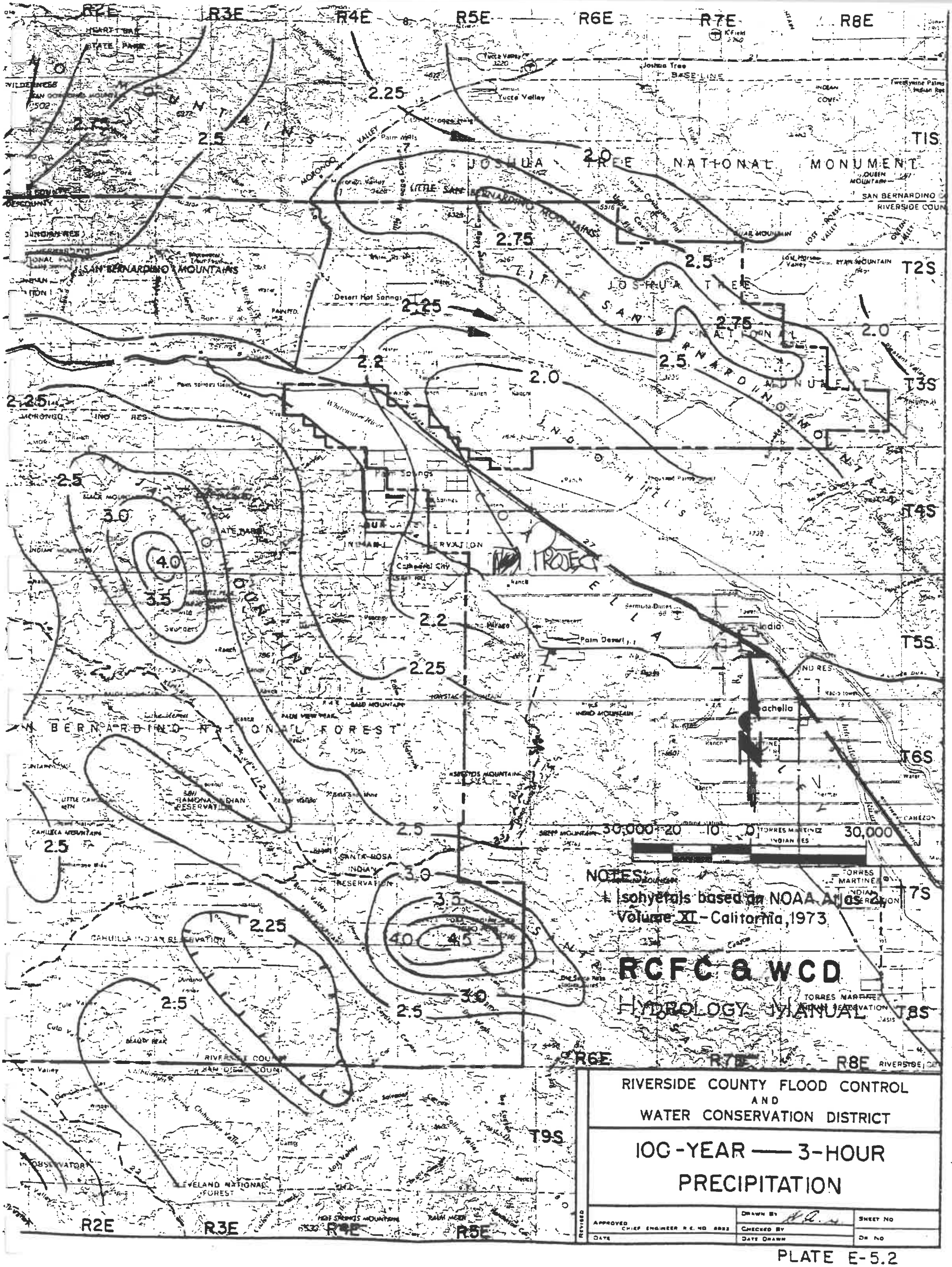
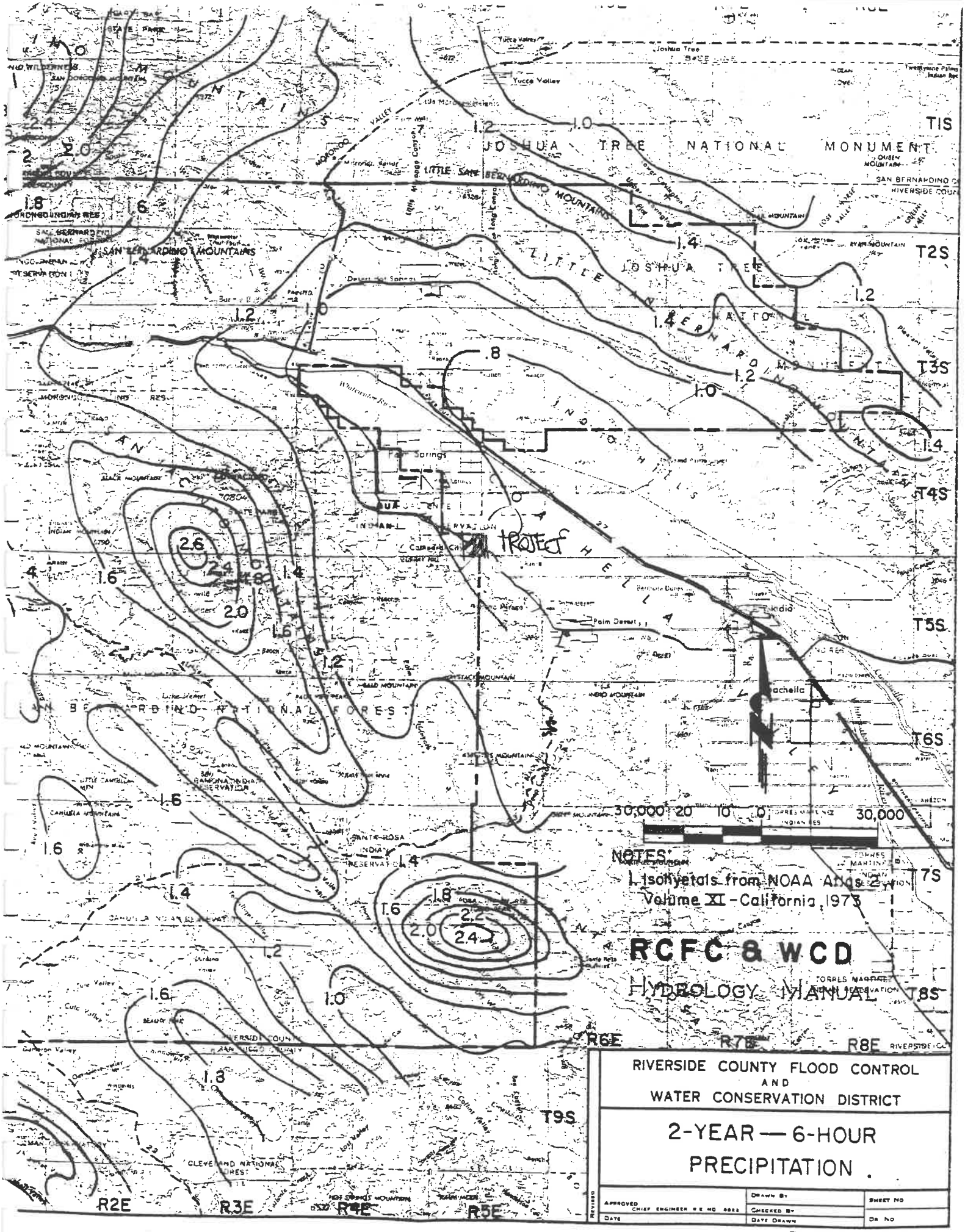

R2E
R3E
R4E
R5E
R6E
R7E
R8E
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
SAN BERNARDINO MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
Desert Hot Springs
Palm Springs
Cathedral City
Palm Desert
Indio
Coachella
MORONGO IND RES
SAN BERNARDINO NATIONAL FOREST
SANTA ROSA INDIAN RESERVATION
CAHUILLA INDIAN RESERVATION
CLEVELAND NATIONAL FOREST
TORRES MARTINEZ INDIAN RES
2.0
2.2
2.25
2.5
2.75
3.0
3.5
4.0
4.5
30,000 20 10 0 30,000
NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 3-HOUR PRECIPITATION
APPROVED
CHIEF ENGINEER R.E. NO.
DATE
DRAWN BY
CHECKED BY
DATE DRAWN
SHEET NO
DR. NO
REVISED

PLATE E-5.2


JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
JOSHUA TREE
INDIO HILLS
SAN JACINTO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
PROJECT
Palm Springs
Indio
Yucca Valley
Joshua Tree
Palm Desert
Coachella
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES:
1. Isohyetals from NOAA Atlas 2
Volume XI - California, 1973
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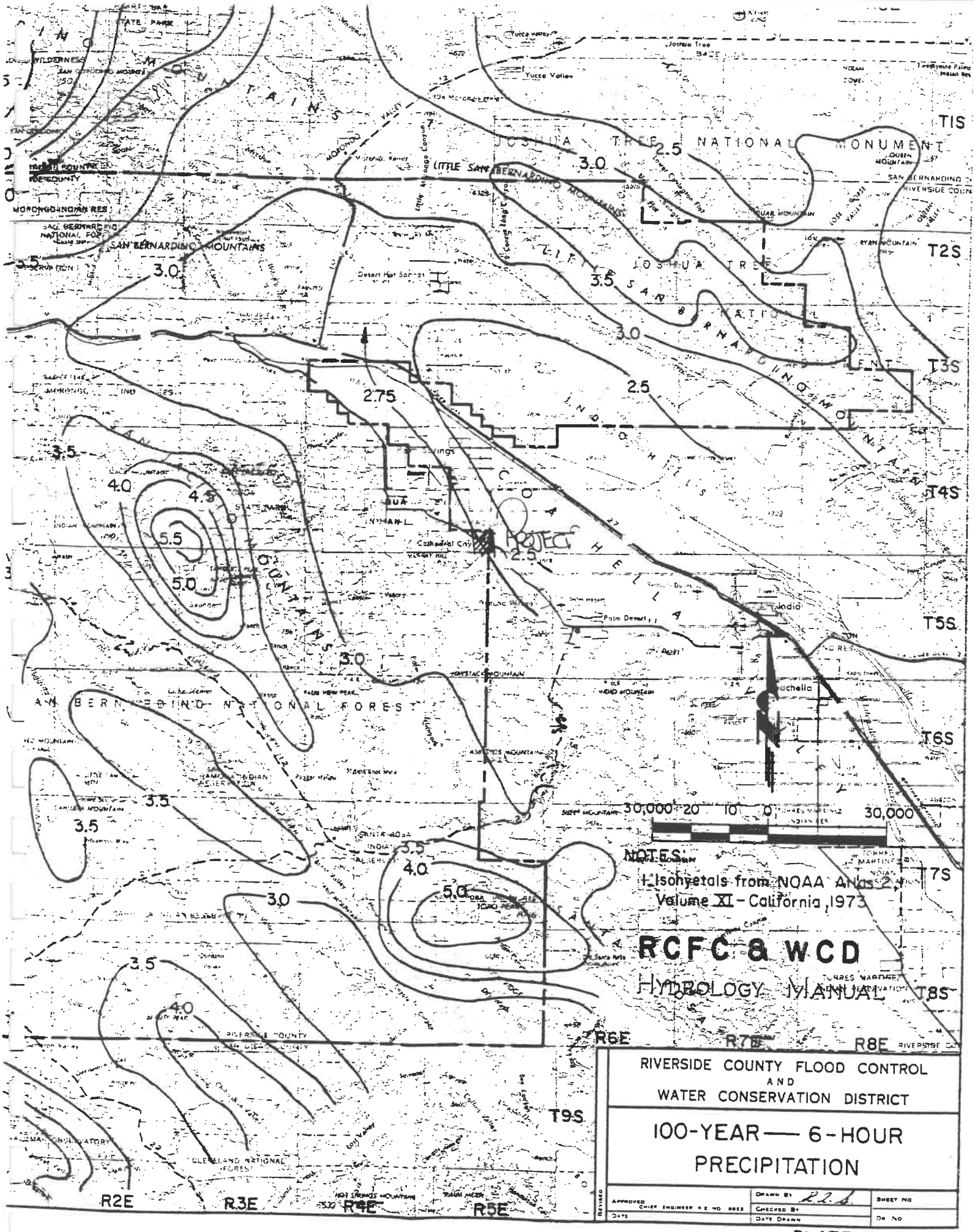
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 6-HOUR
PRECIPITATION
APPROVED
CHIEF ENGINEER R E NO 8882
DATE
REVISED
DRAWN BY
CHECKED BY
DATE DRAWN
SHEET NO
DR NO

PLATE E-5.3


JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
SAN JACINTO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
COACHELLA VALLEY
PROJECT
Cathedral City
Palm Desert
Indio
Thermal
Mecca
Yucca Valley
Joshua Tree
Desert Hot Springs
Morongo Valley
Morongo Indian Reservation
Santa Rosa Mountains
Orocopia Mountains
Chuckwalla Mountains
Eagle Mountains
Indio Hills
Cleveland National Forest
Torres Martinez Indian Reservation
3.0
2.5
3.5
2.75
4.0
4.5
5.5
5.0
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973
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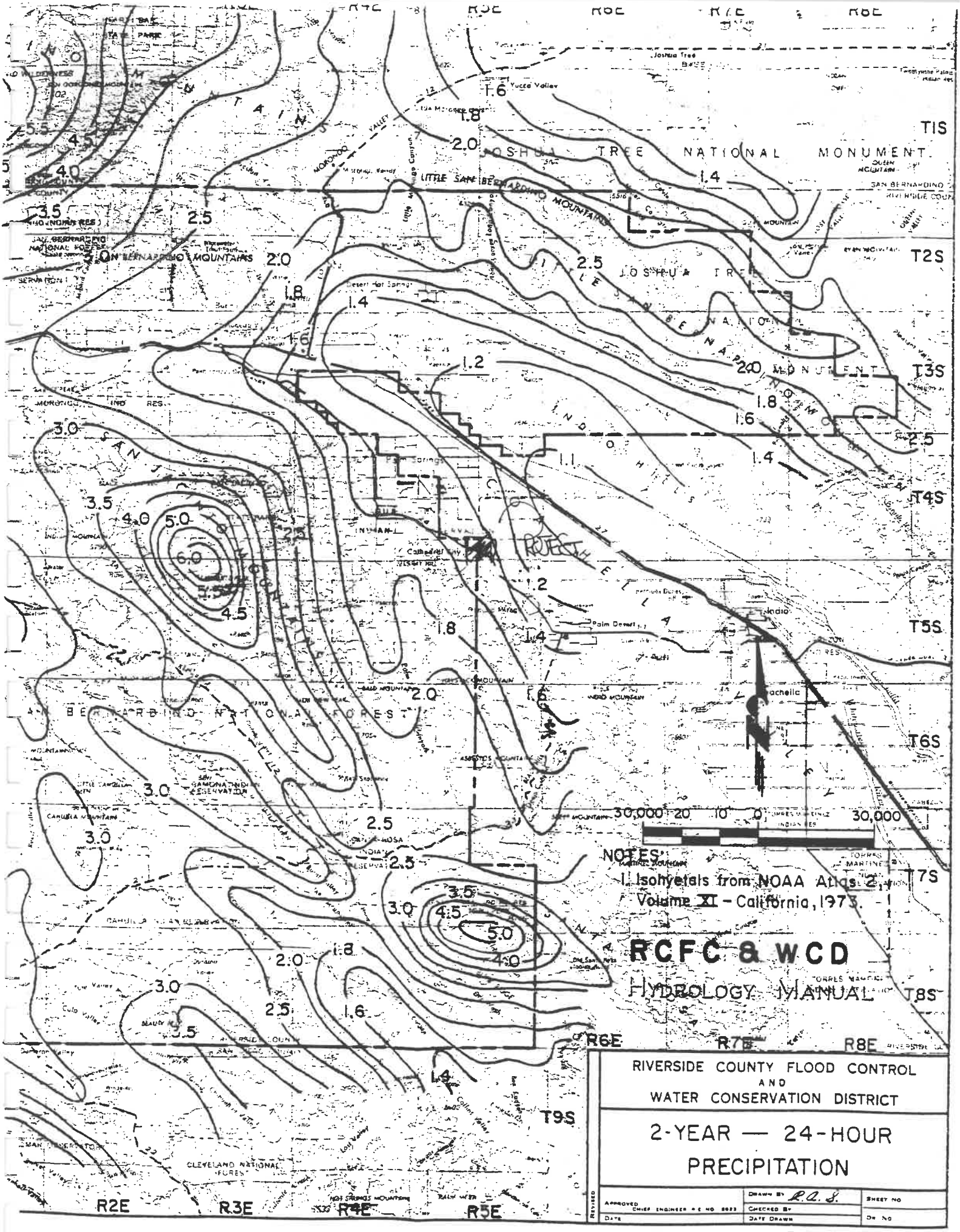
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 6-HOUR PRECIPITATION
APPROVED
CHIEF ENGINEER R.E. NO. 5822
DATE
DRAWN BY
CHECKED BY
DATE DRAWN
SHEET NO
DR. NO
REVISED

PLATE E-5.4


JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
SAN JACINTO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST
Palm Springs
Cathedral City
Rancho Mirage
Palm Desert
Indio
Yucca Valley
Joshua Tree
Twentynine Palms
Desert Hot Springs
Morongo Valley
Little San Bernardino Mountains
Coachella
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.
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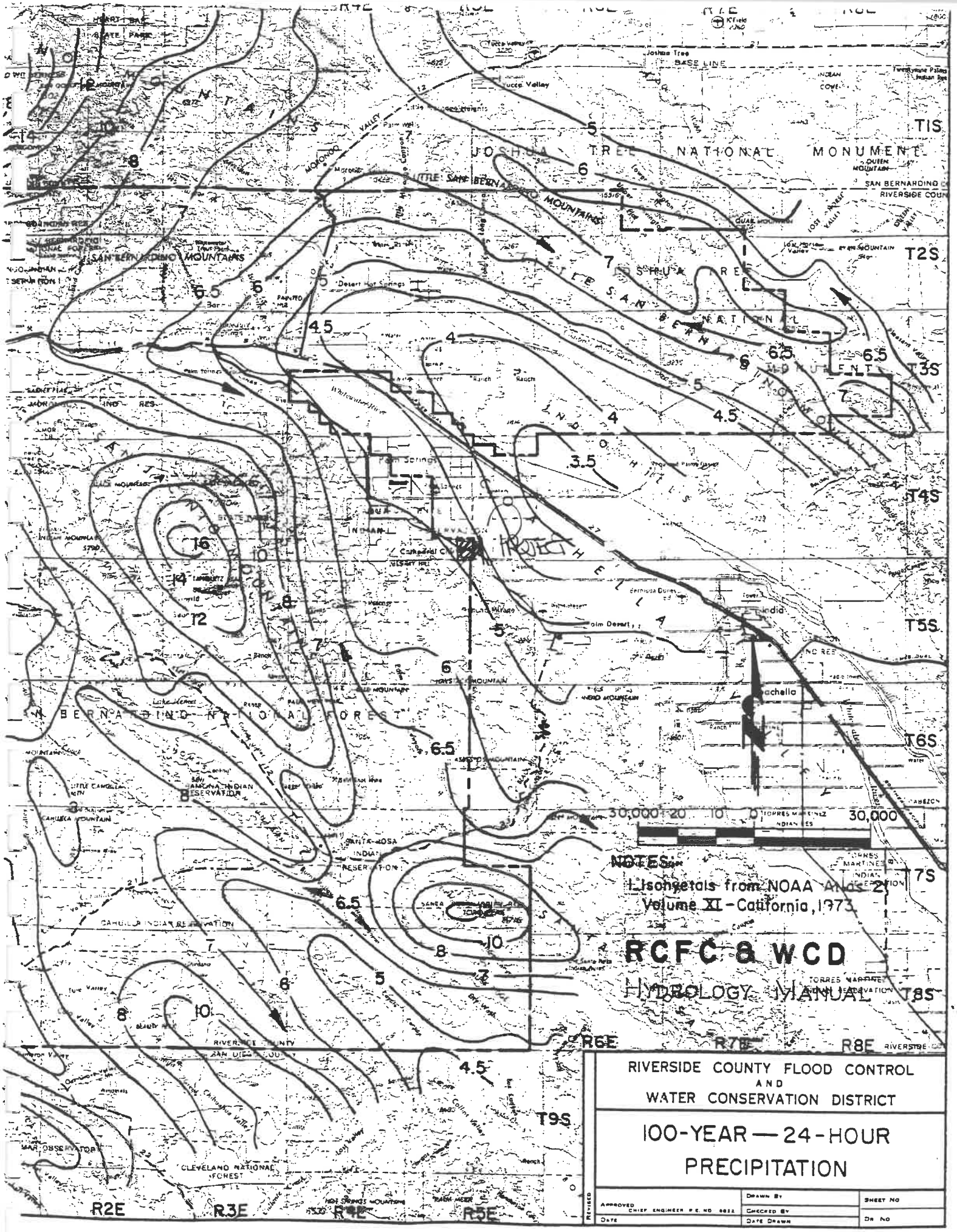
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
2-YEAR — 24-HOUR PRECIPITATION
REVISED
APPROVED CHIEF ENGINEER R.C.E. NO. 8023
DATE
DRAWN BY R.A.S.
CHECKED BY
DATE DRAWN
SHEET NO
DR. NO

PLATE E 5.5


JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
SANTA ROSA MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
INDIO HILLS
PROJECT AREA
Palm Springs
Indio
Coachella
Desert Hot Springs
Joshua Tree
Yucca Valley
CLEVELAND NATIONAL FOREST
SANTA ROSA INDIAN RESERVATION
CAHUILLA INDIAN RESERVATION
AGUA CALIENTE INDIAN RESERVATION
TORRES MARTINEZ INDIAN RESERVATION
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
R2E
R3E
R4E
R5E
R6E
R7E
R8E
30,000 20 10 0 30,000
NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.
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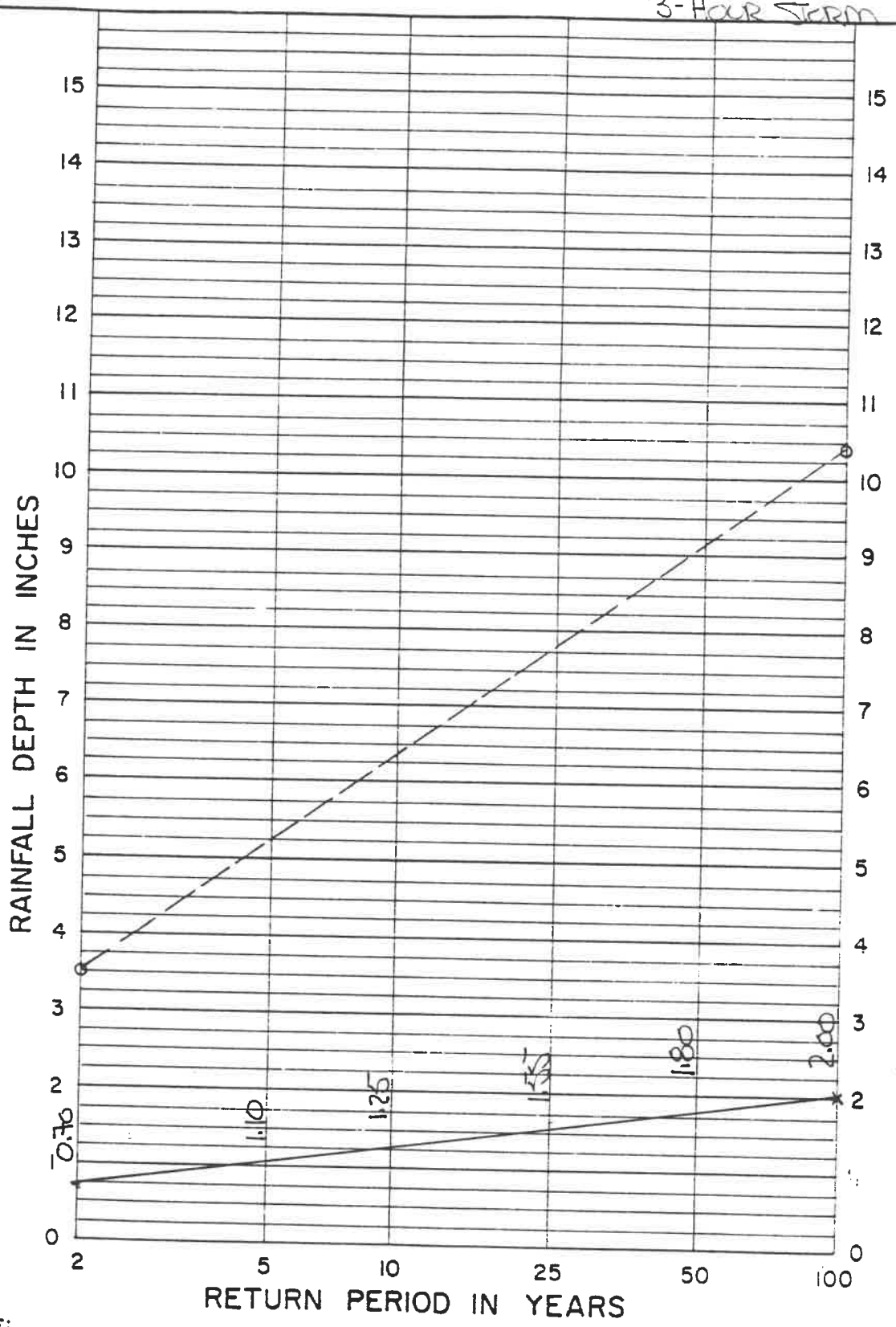
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 24-HOUR PRECIPITATION
APPROVED CHIEF ENGINEER R.E. NO. 6822
DATE
DRAWN BY
CHECKED BY
DATE DRAWN
SHEET NO
DR NO
REVISED

PLATE E-5.6

3-HOUR STORM



NOTE:

1. For intermediate return periods plot 2-year and 100-year values from maps for a specific duration, then connect points and read value for desired return period. For example given 2-year 24-hour = 3.50" and 100-year 24-hour = 10.40", 25-year 24-hour = 7.80"

Reference: NOAA Atlas 2, Volume XI - California, 1973.

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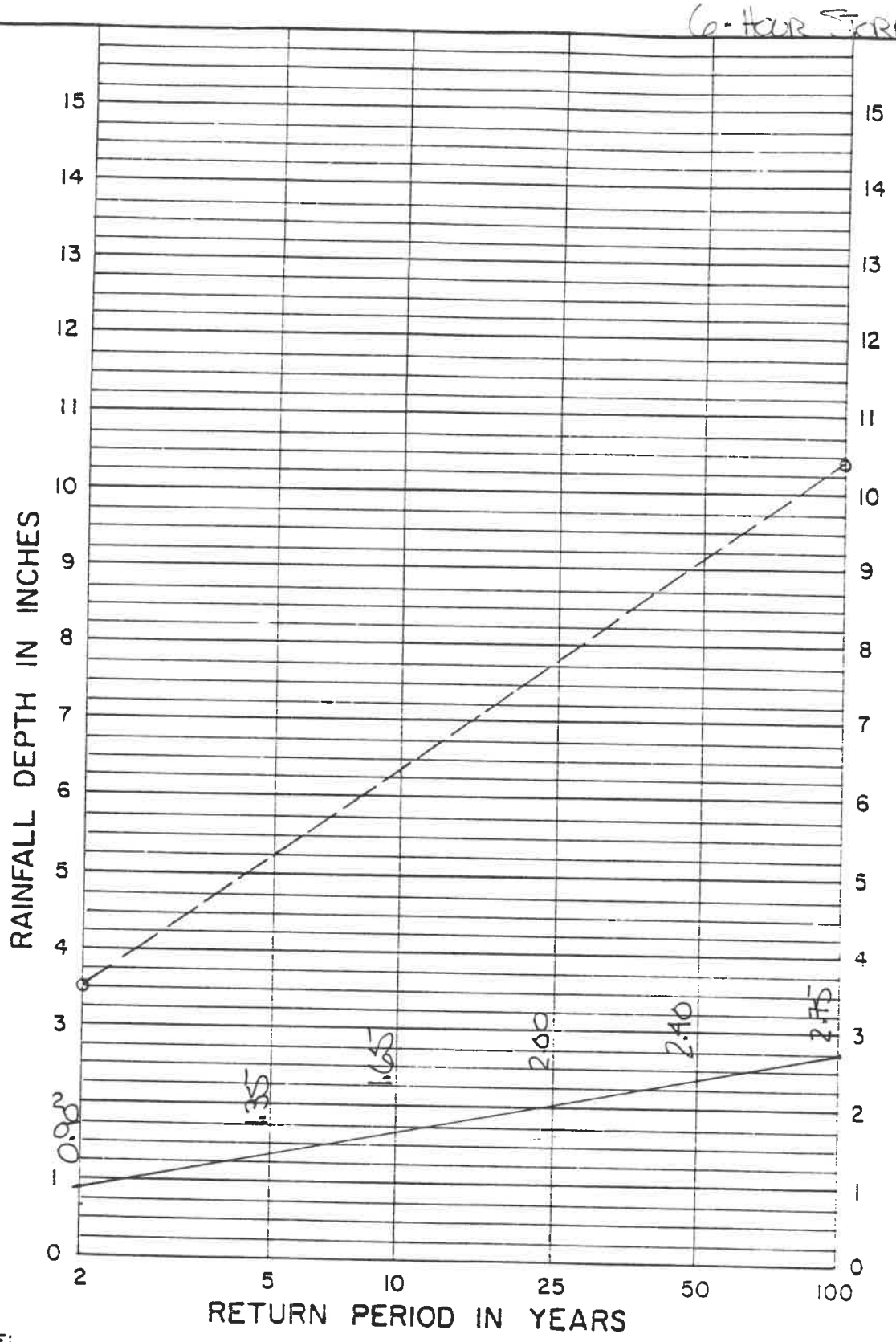
HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

PLATE E-5.7

6-HOUR STORM



NOTE:

1. For intermediate return periods plot 2-year and 100-year values from maps for a specific duration, then connect points and read value for desired return period. For example given 2-year 24-hour = 3.50" and 100-year 24-hour = 10.40", 25-year 24-hour = 7.80"

Reference: NOAA Atlas 2, Volume XI - California, 1973.

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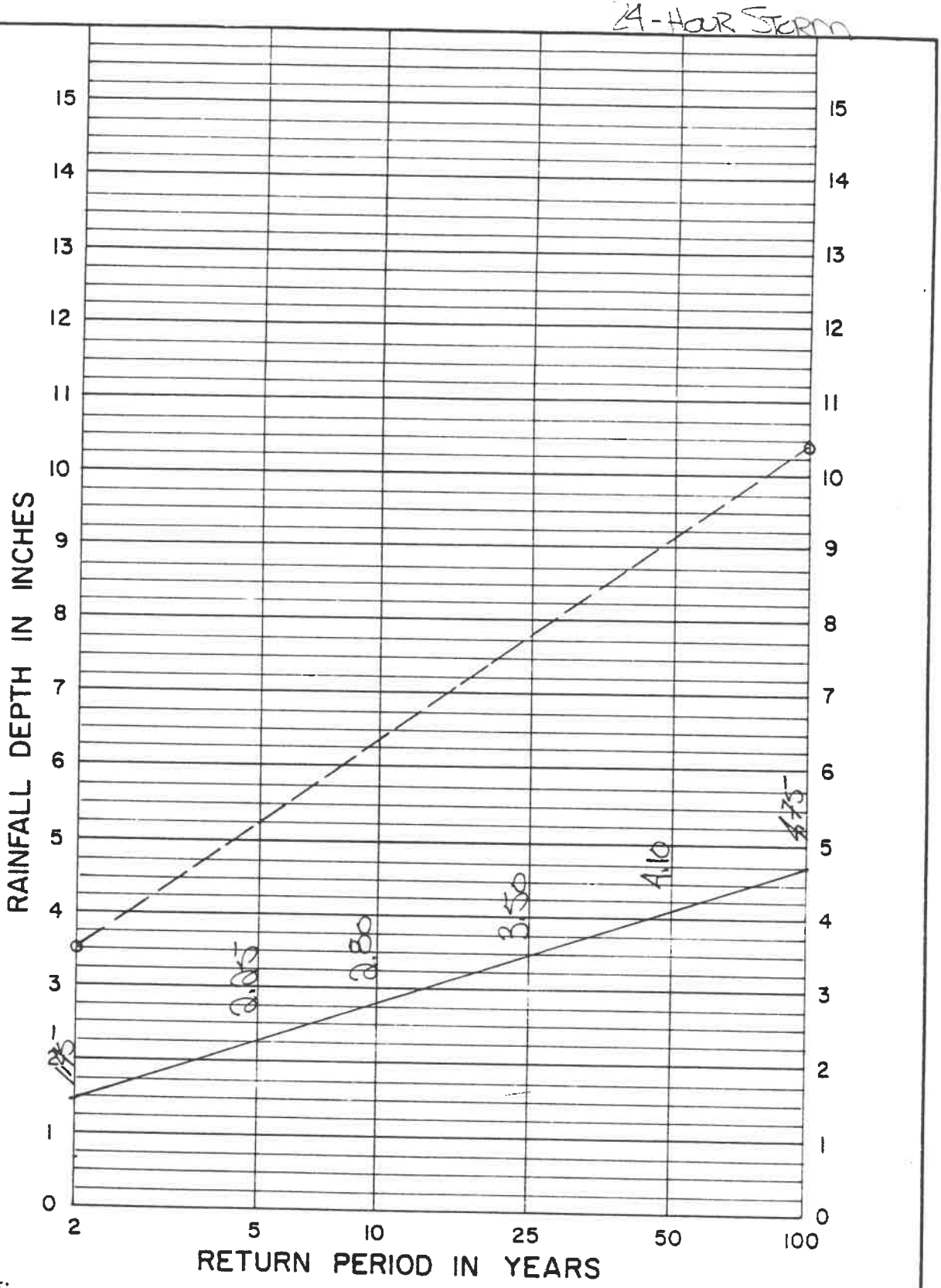
HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

PLATE E-5.7

24-Hour Storm



NOTE:

1. For intermediate return periods plot 2-year and 100-year values from maps for a specific duration, then connect points and read value for desired return period. For example given 2-year 24-hour = 3.50" and 100-year 24-hour = 10.40", 25-year 24-hour = 7.80"

Reference: NOAA Atlas 2, Volume XI - California, 1973.

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RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

PLATE E-5.7

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HYDROLOGY MANUAL

RAINFALL PATTERNS IN PERCENT

3-HOUR STORM

TIME PERIOD	5-MIN PERIOD	10-MIN PERIOD	15-MIN PERIOD	30-MIN PERIOD
1	1.3	2.6	3.7	8.5
2	1.3	2.6	4.8	10.0
3	1.1	3.3	5.1	13.9
4	1.5	3.3	4.9	17.4
5	1.5	3.3	6.6	29.9
6	1.8	3.4	7.3	20.3
7	1.5	4.4	8.4	
8	1.8	4.2	9.0	
9	1.8	5.3	12.3	
10	1.5	5.1	17.6	
11	1.6	6.4	16.1	
12	1.8	5.9	4.2	
13	2.2	7.3		
14	2.2	8.5		
15	2.2	14.1		
16	2.0	14.1		
17	2.6	3.8		
18	2.7	2.4		
19	2.6			
20	2.7			
21	3.3			
22	3.1			
23	2.9			
24	3.0			
25	3.1			
26	4.2			
27	5.0			
28	3.5			
29	6.8			
30	7.3			
31	8.2			
32	5.9			
33	2.0			
34	1.8			
35	1.8			
36	.6			

6-HOUR STORM

TIME PERIOD	5-MIN PERIOD	10-MIN PERIOD	15-MIN PERIOD	30-MIN PERIOD
1	.5	1.1	1.7	3.6
2	.6	1.2	1.9	4.3
3	.6	1.3	2.1	4.8
4	.6	1.4	2.2	4.9
5	.6	1.4	2.4	5.3
6	.7	1.5	2.4	5.8
7	.7	1.6	2.4	6.8
8	.7	1.6	2.5	9.0
9	.7	1.6	2.6	11.6
10	.7	1.6	2.7	14.4
11	.7	1.6	2.8	25.1
12	.8	1.7	3.0	4.4
13	.8	1.7	3.2	
14	.8	1.8	3.6	
15	.8	1.8	4.3	
16	.8	1.8	4.7	
17	.8	2.0	5.4	
18	.8	2.0	6.2	
19	.8	2.1	6.9	
20	.8	2.2	7.5	
21	.8	2.5	10.6	
22	.8	2.8	14.5	
23	.8	3.0	3.4	
24	.9	3.2	1.0	
25	.8	3.5		
26	.9	3.9		
27	.9	4.2		
28	.9	4.5		
29	.9	4.8		
30	.9	5.1		
31	.9	6.7		
32	.9	8.1		
33	1.0	10.3		
34	1.0	2.8		
35	1.0	1.1		
36	1.0	.5		
37	1.0			
38	1.1			
39	1.1			
40	1.1			
41	1.2			
42	1.3			
43	1.4			
44	1.4			
45	1.5			
46	1.5			
47	1.6			
48	1.6			

TIME PERIOD	5-MIN PERIOD
49	1.7
50	1.8
51	1.9
52	2.0
53	2.1
54	2.1
55	2.2
56	2.3
57	2.4
58	2.4
59	2.5
60	2.6
61	3.1
62	3.6
63	3.9
64	4.2
65	4.7
66	5.6
67	1.9
68	.9
69	.6
70	.5
71	.3
72	.2

24-HOUR STORM

TIME PERIOD	15-MIN PERIOD	30-MIN PERIOD	60-MIN PERIOD
1	.2	.5	1.2
2	.3	.7	1.3
3	.3	.6	1.8
4	.4	.7	2.1
5	.3	.8	2.8
6	.3	1.0	2.9
7	.3	1.0	3.8
8	.4	1.1	4.6
9	.4	1.3	6.3
10	.4	1.5	8.2
11	.5	1.3	7.0
12	.5	1.6	7.3
13	.5	1.8	10.8
14	.5	2.0	11.4
15	.5	2.1	10.4
16	.6	2.5	8.5
17	.6	3.0	1.4
18	.7	3.3	1.9
19	.7	3.9	1.3
20	.8	4.3	1.2
21	.6	3.0	1.1
22	.7	4.0	1.0
23	.8	3.8	.9
24	.8	3.5	.8
25	.9	5.1	
26	.9	5.7	
27	1.0	6.8	
28	1.0	4.6	
29	1.0	5.3	
30	1.1	5.1	
31	1.2	4.7	
32	1.3	3.8	
33	1.5	.8	
34	1.5	.6	
35	1.6	1.0	
36	1.7	.9	
37	1.9	.8	
38	2.0	.5	
39	2.1	.7	
40	2.2	.5	
41	1.5	.6	
42	1.5	.5	
43	2.0	.5	
44	2.0	.5	
45	1.9	.5	
46	1.9	.4	
47	1.7	.4	
48	1.8	.4	

TIME PERIOD	15-MIN PERIOD
49	2.5
50	2.6
51	2.8
52	2.9
53	3.4
54	3.4
55	2.3
56	2.3
57	2.7
58	2.6
59	2.6
60	2.5
61	2.4
62	2.3
63	1.9
64	1.9
65	.4
66	.4
67	.3
68	.3
69	.5
70	.5
71	.5
72	.4
73	.4
74	.4
75	.3
76	.2
77	.3
78	.4
79	.3
80	.2
81	.3
82	.3
83	.3
84	.2
85	.3
86	.2
87	.3
88	.2
89	.3
90	.2
91	.2
92	.2
93	.2
94	.2
95	.2
96	.2

NOTES:

1. 3 and 6-hour patterns based on the Indio area thunderstorm of September 24,1939.
2. 24-hour patterns based on the general storm of March 2 & 3,1938.

RAINFALL PATTERNS IN PERCENT

PLATE E-5.9

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

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RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

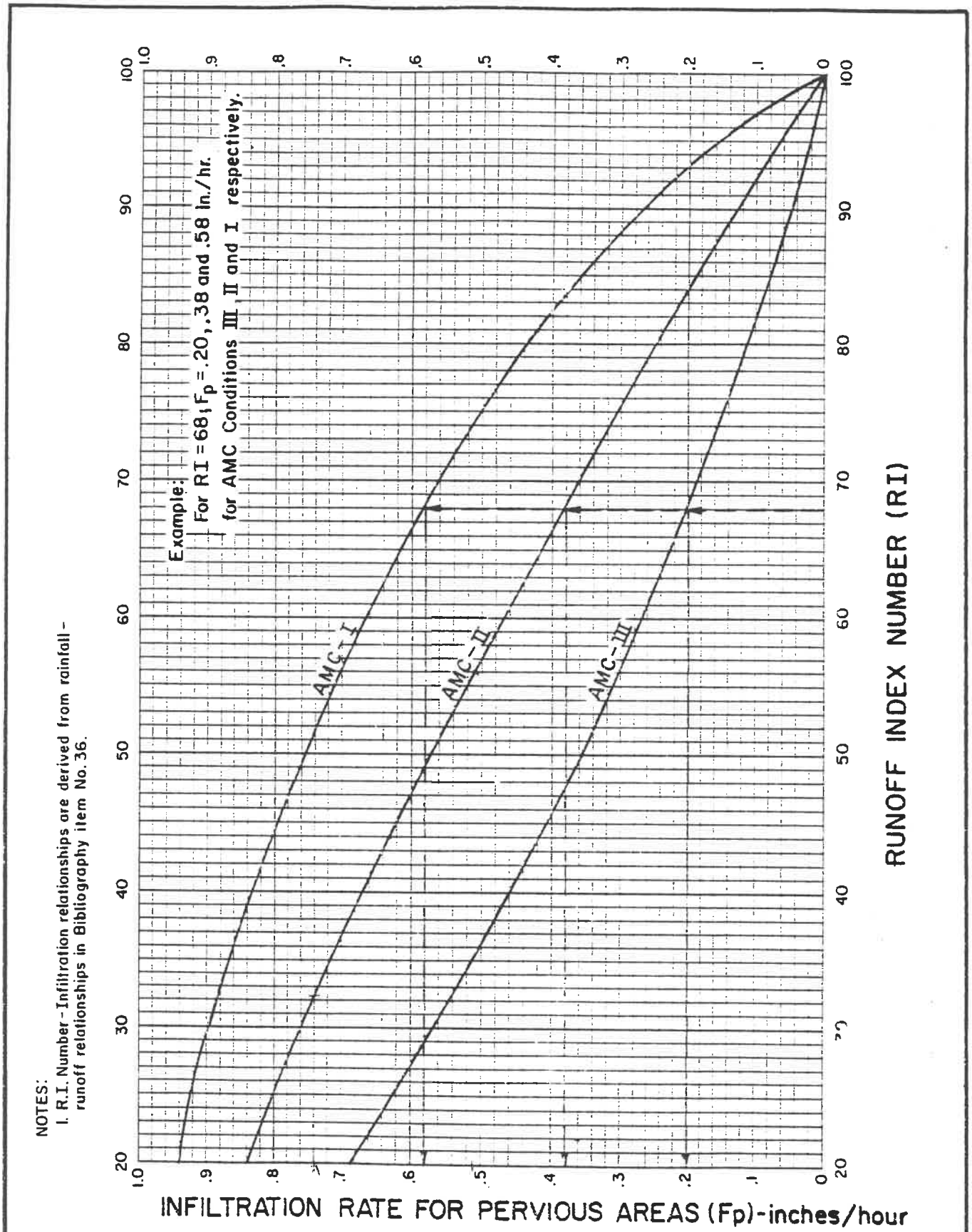
1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.



NOTES:
1. R.I. Number - Infiltration relationships are derived from rainfall - runoff relationships in Bibliography item No. 36.

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INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS

PLATE E-6.2

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

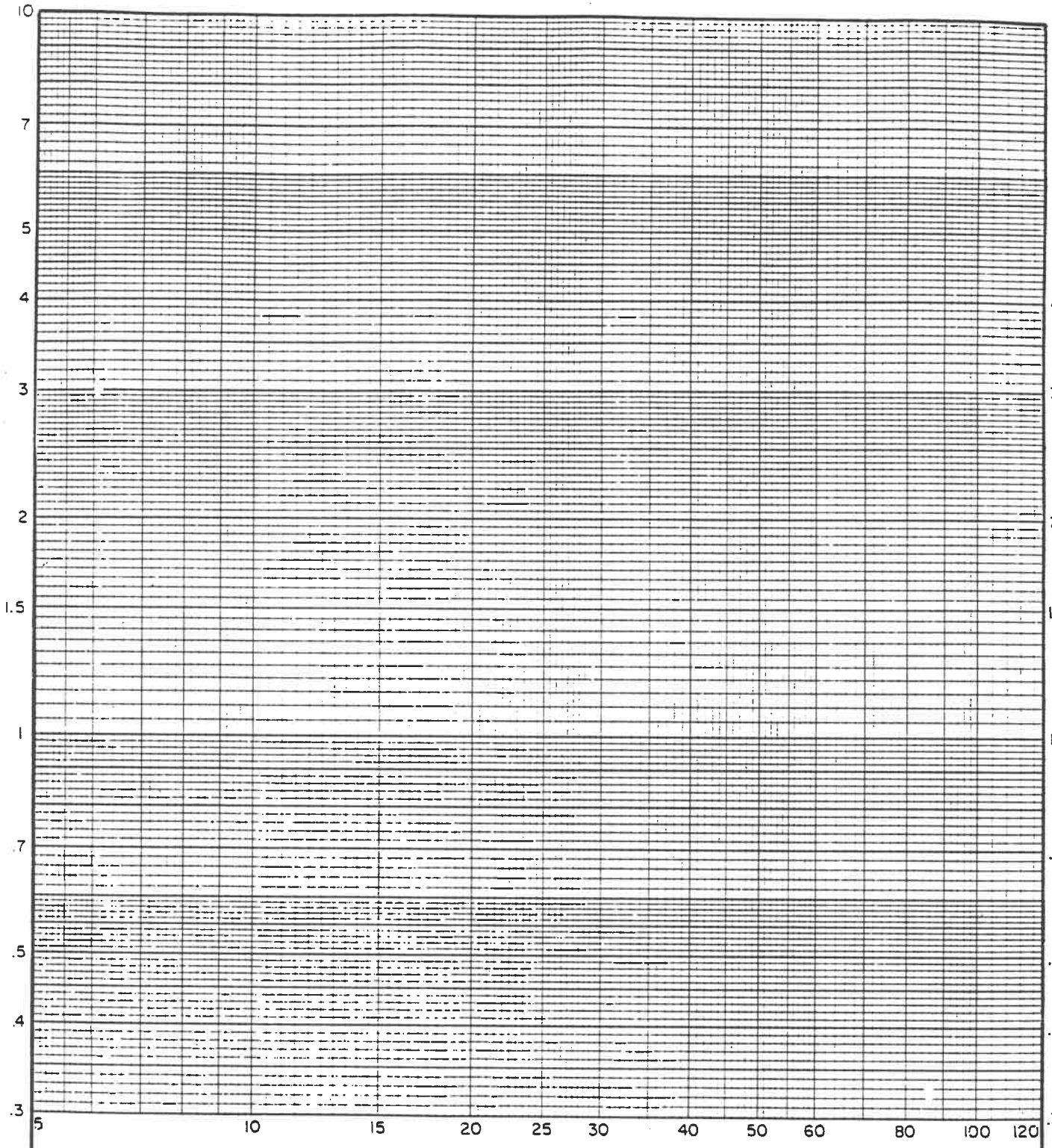
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE E-6.3

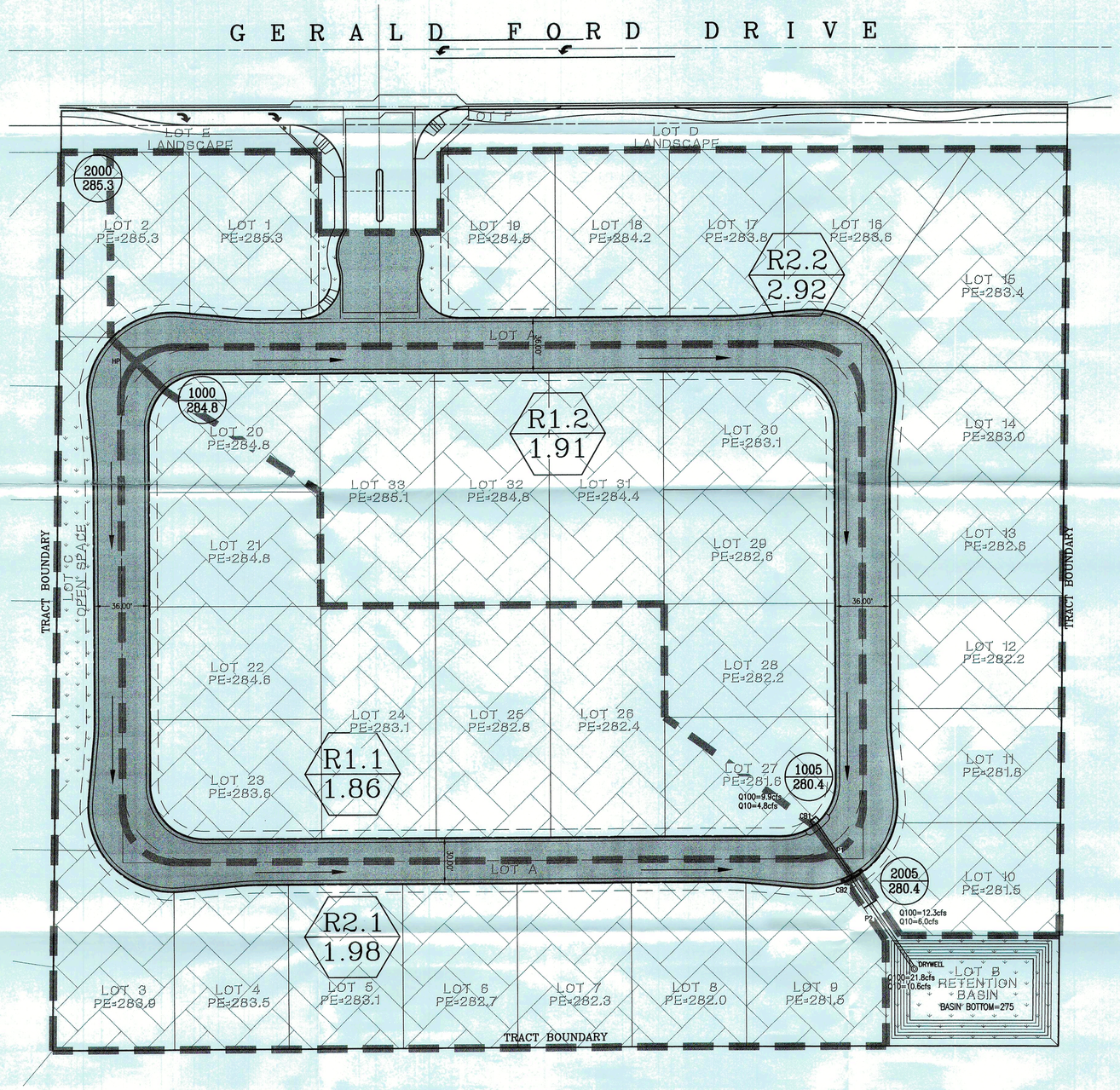


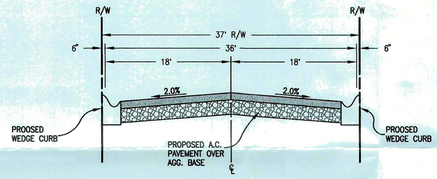
RCFC & WCD

HYDROLOGY MANUAL

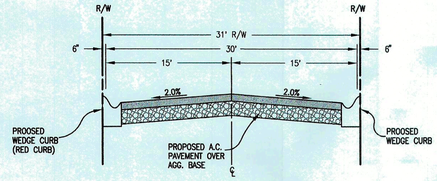
INTENSITY – DURATION CURVES

PLATE D-4.2





PROPOSED STREET



PROPOSED STREET

OWNER/DEVELOPER

FORD PLUMLEY GROUP LLC.
68936 ADELINA ROAD
CATHEDRAL CITY, CA 92234
PHONE (760) 322-3422
CONTACT – MARIO GONZALES

A.P. NO:

674-020-014

ZONING

EXISTING ZONING – R2
PROPOSED ZONING – R1

AREAS
–LOTS 1–33
(RESIDENTIAL LOTS 8,300 SF MIN. LOT SIZE)
–LOTS 'A' (PRIVATE STREET)
–LOT 'B' (STORM DRAIN RETENTION)

ON–SITE STORM DRAIN SUMMARY

PIPE	Q100 (cfs)	DIAMETER (inch)	TYPE	VELOCITY (fps)
1	9.9	18	ADS – N12	5.6
2	21.9	24	ADS – N12	7.0

ON–SITE CATCH BASIN SUMMARY

CB#	W (ft)	H (ft)	Q100 (cfs)
1	5	7.84'	9.8
2	NYLOPLAST	8.13'	12.3

SYMBOLS

NODE / ELEV

AREA / ACRES

SYNTHETIC UNIT HYDROGRAPH SUMMARY

SINGLE FAMILY 1/4 ACRE LOT		7.07 ACRES
PAVING/HARDSCAPE		1.44 ACRES
LANDSCAPED AREA/RETENTION BASIN		0.36 ACRES

Underground Service Alert
Call: TOLL FREE
1–800
422–4133
TWO WORKING DAYS BEFORE YOU DIG

BASIS OF BEARINGS:

BEARING ARE BASED UPON THE SOUTHERLY LINE OF THE WHITEWATER CHANNEL AS PER TRACT 3697, MB 62/12–13 BEING NORTH 46° 38' 55" WEST

BENCHMARK:

CITY OF CATHEDRAL CITY BENCHMARK NO. 123 (DATE PALM/WHITEWATER) IN WESTERLY CORNER OF BRIDGE OVER WHITEWATER RIVER ON DATE PALM DRIVE – NGVD29 ELEV = 300.550

REFERENCES

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

The Keith Companies TKC
41–865 Boardwalk, Suite 101, Palm Desert, CA 92211 (760) 346–9844

CITY OF CATHEDRAL CITY

HYDROLOGY MAP

LOCATED IN A PORTION OF THE NE 1/4 OF SECTION 34, TOWNSHIP 4 SOUTH, RANGE 5 EAST, S.B. & M.

FOR FORD PLUMLEY GROUP L.L.C. TR 29578

DESIGN: DLS | DRAFT: DLS
CHECK: KRS | DATE: JAN 00
DWG NO. HY63501
SHEET 1 OF 1