

**FORD DA VALL GROUP L.L.C.  
TENTATIVE TRACT MAP 29771**

**HYDROLOGY & HYDRAULICS REPORT**

PREPARED BY.



PREPARED FOR:

**FORD DA VALL GROUP, L.L.C.**

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

**December 21, 2000**

**FORD DA VALL GROUP L.L.C.  
TENTATIVE TRACT MAP 29771**

**HYDROLOGY & HYDRAULICS REPORT**

PREPARED BY:



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

Prepared Under the Supervision of:

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



## PURPOSE AND SCOPE

The purpose of this report is to provide a hydrology and hydraulic analysis for the Ford Da Vall Group L.L.C. residential site located in a portion of the Northeast  $\frac{1}{4}$  of the Northeast  $\frac{1}{4}$  of Section 34, Township 4 South, Range 5 East, S.B.M., in the city of Cathedral City, California. The project area is bounded to the north by Gerald Ford Drive, to the east by Da Vall Drive, and to the south and west by existing residential tracts. The project site comprises approximately 36.5 acres of  $\frac{1}{4}$  acre single family lots. Storm run-off is directed via street flow to a retention basin located at the southeast portion of the site.

This report includes:

1. The determination of on-site drainage areas for both the developed and undeveloped conditions. Hydrology maps for both conditions are 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 were based on the minimum slope of the street. Per City of Cathedral City requirements, finished floor elevations shall be a minimum of 18-inches above the 10-year water surface elevation and a minimum of 6-inches above the 100-year water surface elevation.

### DESIGN CRITERIA:

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

- |  |       |             |
|--|-------|-------------|
| • Antecedant Moisture Condition – 100 year | 2     |             |
| • 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            | 0.8”  | Plate E-5.3 |
| • 100-year – 6 hour Precipitation          | 2.5”  | Plate E-5.4 |
| • 2-year – 24 hour Precipitation           | 1.15” | Plate E-5.5 |
| • 100-year – 24 hour Precipitation         | 3.75” | Plate E-5.6 |
| • Hydrologic Soil Type “A”                 |       |             |

## RETENTION BASIN SIZING:

The proposed retention basin is designed to retain the volume generated by the 100-year storm event as determined using the Riverside County Flood Control District Synthetic Unit Hydrograph Analysis. A percolation factor of one (1) inch per hour was used in the determination of the required basin size. In addition, a Maxwell System IV (or approved equal) drywell is proposed for the basin. The drywell is capable of percolating 0.35 cubic feet per second (cfs) and will help to dissipate nuisance flows.

The City of Rancho Mirage has agreed to allow the undeveloped peak flow for the 10-year event to be discharged into the existing 78-inch storm drain system. It was determined this discharge flow cannot exceed 12 cfs. It is proposed to utilize a 12-inch reinforced concrete pipe which has a maximum discharge of approximately 4 cfs.

### SYNTHETIC UNIT AREA SUMMARY:

DESCRIPTION	AREA	
	(square feet)	(acres)
Streets	249,160.47	5.72
¼ Acre Single Family Lots	1,266,046.34	29.06
Landscaped Areas	3,890.45	0.09
Retention Basin	15,418.37	0.35
CVWD Well Site	22,420.09	0.51
<b>TOTAL AREA</b>	<b>1,556,935.72</b>	<b>35.74</b>

### SYNTHETIC UNIT HYDROGRAPH SUMMARY:

STORM DURATION (hour)	EFFECTIVE RAIN (inch)	FLOOD VOLUME		REQUIRED STORAGE		PEAK FLOW RATE (cfs)
		(cuft)	(acft)	(cuft)	(acft)	
3	0.97	125,639	2.88	115,611	2.65	57.38
6	0.89	115,272	2.65	97,092	2.23	47.08
24	0.56	72,336	1.66	33,595	0.77	7.07

### VOLUME REQUIRED vs VOLUME PROVIDED 100 YEAR STORM EVENTS

DURATION (hour)	VOLUME REQUIRED (cf)	VOLUME PROVIDED (cf)	MAXIMUM DISCHARGE (cfs)	MAXIMUM WSEL (ft)	DEPTH (ft)
1	125,371.91	169,381	3.80	273.98	6.98
3	115,611		3.70	273.76	6.76
6	97,092		3.55	273.45	6.45
24	33,595		1.59	269.70	2.70

In accordance the City of Cathedral City requirements the lowest adjacent pad elevation is equal to 275.3 which is 1.32 feet above the maximum water surface elevation for the 100 year – 1 hour storm event. The maximum WSEL for the 10 year – 1 hour event is 273.01 which is 2.29 feet below the lowest adjacent pad elevation.

## STORM DRAIN SYSTEM:

Storm run-off is picked up in 'sag' type catch basins and discharged via storm drain to the drywell in the retention basin. The storm drain system is designed to accommodate the 100-year peak event, which was analyzed utilizing RCFCR 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. Catch basins will be per County of Riverside Standard 300. Storm drain pipes were sized utilizing "StormCad" software and shall be Advanced Drainage Systems N-12 storm drain pipe (or approved equal).

### CATCH BASIN SUMMARY

CATCH BASIN	TYPE	FLOW (cfs)	W (ft)	H (ft)
CB-1	SAG	36.2	14	8.51
CB-2	SAG	36.2	14	7.81

### STORM DRAIN SUMMARY

PIPE	FLOW (cfs)	SIZE (in)	TYPE	VELOCITY (fps)	COMMENTS
P1	72.4	48	ADS N-12	5.76	HGL in basin assumed to be at 272.08 ; Time of concentration equals 19.23 minutes.
P-2	36.2	30	ADS N-12	7.38	
P-3	3.8	12	RCP	7.19	Discharges into Existing 78" RCP (Da Vall Drive)

## STREET FLOW SUMMARY:

Per City of Cathedral City requirements, finished floor elevations shall be a minimum of 18-inches above the 10-year water surface elevation and a minimum of 6-inches above the 100-year water surface elevation.

The proposed streets are 36-feet wide (curb to curb) with a 6" wedge curb. A minimum longitudinal slope of 0.50 percent was maintained in the design of the streets. Street capacities were analyzed upstream of the catch basins on either side as well as at the catch basin location.

### 10-YEAR STORM EVENT

DESCRIPTION	FLOW (cfs)	WSEL (ft)	TC ELEV (ft)	MINIMUM PAD ELEVATION (ft)
Street 'B'	23.90	273.11	273.10	275.3
Street 'D'	19.10	273.07	273.10	275.3
Catch Basins	39.74	273.56	273.31	275.3

### 100-YEAR STORM EVENT

DESCRIPTION	FLOW (cfs)	WSEL (ft)	TC ELEV (ft)	MINIMUM PAD ELEVATION (ft)
Street 'B'	42.90	273.21	273.10	275.3
Street 'D'	34.40	273.17	273.10	275.3
Catch Basins	72.44	273.86	273.31	275.3

The maximum WSEL for the 100-year event is 273.98 - 1.32 feet below the lowest adjacent pad elevation. For the 10-year event, the maximum WSEL is 273.01 - 2.29 feet below the lowest adjacent pad elevation.

**UNDEVELOPED CONDITION  
RCFCD RATIONAL CALCULATIONS  
10 YEAR STORM EVENTS**

CONFLUENCE WORKSHEET

PREPARED BY: THE KEITH COMPANIES, PALM DESERT, CA  
 PROJECT: ARTISAN COLLECTION - FORD DA VALL GROUP  
 TKC JOB # 40692

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
AREA 'A'	8.70	25.97	1.55	7.74	A
AREA 'B'	9.10	9.09	2.85	4.37	B

$Qp = 9.10 + 3.05 = 12.14$   
 $Tp = 9.09$   
 $Ip = 2.85$   
 $Area = 12.11$



Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 1997 Version 5.0  
Rational Hydrology Study Date: 12/21/00 File:692002.out

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ARTISAN COLLECTION - FORD DA VALL GROUP  
UNDEVELOPED CONDITION - 10 YEAR STORM  
TKC JOB #40692  
FILE:692002  
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\*\*\*\*\* Hydrology Study Control Information \*\*\*\*\*

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

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

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

-----  
Initial area flow distance = 540.000(Ft.)  
Top (of initial area) elevation = 282.000(Ft.)  
Bottom (of initial area) elevation = 279.000(Ft.)  
Difference in elevation = 3.000(Ft.)  
Slope = 0.00556 s(percent)= 0.56  
TC = k(0.530)\*[(length^3)/(elevation change)]^0.2  
Initial area time of concentration = 18.548 min.  
Rainfall intensity = 1.882(In/Hr) for a 10.0 year storm  
UNDEVELOPED (poor cover) subarea  
Runoff Coefficient = 0.667  
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) = 67.00  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Initial subarea runoff = 5.110(CFS)

Total initial stream area = 4.070 (Ac.)  
Pervious area fraction = 1.000

\*\*\*\*\*  
Process from Point/Station 1005.000 to Point/Station 1010.000  
\*\*\*\* NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

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Top of natural channel elevation = 279.000 (Ft.)  
End of natural channel elevation = 275.500 (Ft.)  
Length of natural channel = 720.000 (Ft.)  
Estimated mean flow rate at midpoint of channel = 7.414 (CFS)

Natural valley channel type used  
L.A. County flood control district formula for channel velocity:  
Velocity (ft/s) =  $(7 + 8(q(\text{English Units})^{.352})(\text{slope}^{.5}))$   
Velocity using mean channel flow = 1.62 (Ft/s)

Correction to map slope used on extremely rugged channels with  
drops and waterfalls (Plate D-6.2)  
Normal channel slope = 0.0049  
Corrected/adjusted channel slope = 0.0049  
Travel time = 7.42 min. TC = 25.97 min.

Adding area flow to channel  
UNDEVELOPED (poor cover) subarea  
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) = 67.00  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Rainfall intensity = 1.548 (In/Hr) for a 10.0 year storm  
Subarea runoff = 3.591 (CFS) for 3.670 (Ac.)  
Total runoff = 8.701 (CFS) Total area = 7.740 (Ac.)

\*\*\*\*\*  
Process from Point/Station 2000.000 to Point/Station 2005.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

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Initial area flow distance = 195.000 (Ft.)  
Top (of initial area) elevation = 280.000 (Ft.)  
Bottom (of initial area) elevation = 275.000 (Ft.)  
Difference in elevation = 5.000 (Ft.)  
Slope = 0.02564 s (percent) = 2.56  
 $TC = k(0.530) * [(length^3) / (elevation\ change)]^{.2}$   
Initial area time of concentration = 9.089 min.  
Rainfall intensity = 2.846 (In/Hr) for a 10.0 year storm  
UNDEVELOPED (poor cover) subarea  
Runoff Coefficient = 0.731  
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) = 67.00  
Pervious area fraction = 1.000; Impervious fraction = 0.000  
Initial subarea runoff = 9.096(CFS)  
Total initial stream area = 4.370(Ac.)  
Pervious area fraction = 1.000  
End of computations, total study area = 12.11 (Ac.)  
The following figures may  
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction( $A_p$ ) = 1.000  
Area averaged RI index number = 67.0

# **SYNTHETIC UNIT HYDROGRAPH WORKSHEETS**

**100 YEAR STORM EVENTS**

**ARTISAN COLLECTION  
SYNTHETIC UNIT AREA WORKSHEET**

TKC JOB #40692  
November 1, 2000

DESCRIPTION	AREA	
	(sf)	(acres)
STREETS	249,160.47	5.72
LOTS (1/4 ACRE SF)	1,266,046.34	29.06
LANDSCAPING	3,890.45	0.09
RETENTION	15,418.37	0.35
CVWD WELL SITE	22,420.09	0.51
	1,556,935.72	35.74

ARTISAN COLLECTION  
CATHEDRAL CITY  
RAINFALL DEPTH VS RETURN PERIOD SUMMARY  
TKC JOB 40692

RETURN PERIOD	RAINFALL DEPTH (in)		
	3HR	6HR	24HR
2	0.70	0.80	1.15
5	1.05	1.25	1.80
10	1.25	1.55	2.25
25	1.52	1.90	2.75
50	1.80	2.20	3.30
100	2.00	2.50	3.75

	A	B	C	D
1	<b>RCFCD SYNTHETIC UNIT HYDROGRAPH</b>			
2	DATA INPUT SHEET			
3				
4	WORKSHEET PREPARED BY:	DLS		
5				
6	PROJECT NAME	ARTISAN COLLECTION		
7	TKC JOB #	40692		
8				
9	CONCENTRATION POINT DESIGNATION	1		
10	AREA DESIGNATION	DEVELOPED CONDITION TOTAL SITE		
11				
12	TRIBUTARY AREAS	ACRES		
13				
14	COMMERCIAL			
15	PAVING/HARDSCAPE	5.72		
16	SF - 1 ACRE			
17	SF - 1/2 ACRE			
18	SF - 1/4 ACRE	29.06		
19	MF - CONDOMINIUMS			
20	MF - APARTMENTS			
21	MOBILE HOME PARK			
22	LANDSCAPING	0.09		
23	RETENTION BASIN	0.87		
24	GOLF COURSE			
25	MOUNTAINOUS			
26	LOW LOSS RATE (PERCENT)	90%		
27				
28	LENGTH OF WATERCOURSE (L)	2100		
29	LENGTH TO POINT OPPOSITE CENTROID (Lca)	720		
30				
31	ELEVATION OF HEADWATER	283.6		
32	ELEVATION OF CONCENTRATION POINT	273		
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	2.5		
41	24-HOUR	3.75		
42				
43	BASIN CHARACTERISTICS:	ELEVATION	AREA	
44		267	6211	
45		268	7163	
46		269	8171	
47		270	9236	
48		272	11536	
49		273	23948	
50		275	83861	
51				
52	PERCOLATION RATE (in/hr)	1		
53				
54	DRYWELL DATA			
55	NUMBER USED	2		
56	PERCOLATION RATE (cfs)	0.35		

**PHYSICAL DATA**

[1] CONCENTRATION POINT	1
[2] AREA DESIGNATION	DEVELOPED CONDITION TOTAL SITE
[3] AREA - ACRES	35.740
[4] L- FEET	2100
[5] L- MILES	0.398
[6] La- FEET	720.00
[7] La- MILES	0.136
[8] ELEVATION OF HEADWATER	283.6
[9] ELEVATION OF CONCENTRATION POINT	273
[10] H- FEET	10.6
[11] S- FEET/MILE	26.7
[12] S^0.5	5.16
[13] L*LCA/S^0.5	0.011
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME- HOURS	0.08
[16] LAG TIME- MINUTES	5.1
[17] 100% OF LAG- MINUTES	5.1
[18] 200% OF LAG- MINUTES	10.2
[19] UNIT TIME- MINUTES (100%-200% OF LAG)	5
[24] TOTAL PERCOLATION RATE (cfs)	0.84

**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	35.740	1.00	2.00	2.50	35.740	1.00	2.50	3.75	35.740	1.00	3.75
		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]	35.74	SUM [7]	2.00	SUM [9]	35.74	SUM [11]	2.50	SUM [13]	35.74	SUM [15]	3.75
[16] AREA ADJ FACTOR			1.000				1.000				1.000
[17] ADJ AVG POINT RAIN			2.00				2.50				3.75

**STORM EVENT SUMMARY**

DURATION		3- HOUR	6- HOUR	24- HOUR
EFFECTIVE RAIN (in)		0.97	0.89	0.56
FLOOD VOLUME (cu-ft)		125,639	115,272	72,336
(acre-ft)		2.88	2.65	1.66
REQUIRED STORAGE (cu-ft)		115,611	97,092	33,595
(acre-ft)		2.65	2.23	0.77
STORAGE PROVIDED (cu-ft)		169381		
(acre-ft)		3.89		
PEAK FLOW (cfs)		57.38	47.08	7.07
PEAK DISCHARGE (cfs)		3.70	3.55	1.59
MAXIMUM WSEL (ft)		273.76	273.45	269.70





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

PROJECT: ARTISAN COLLECTION  
CONCENTRATION POINT: 1

BY: DLS DATE 11/09/2000

**EFFECTIVE RAIN CALCULATION FORM**

DRAINAGE AREA-ACRES 35.74  
UNIT TIME-MINUTES 5  
LAG TIME - MINUTES 5.10  
UNIT TIME-PERCENT OF LAG 98.0  
TOTAL ADJUSTED STORM RAIN-INCHES 2.00  
CONSTANT LOSS RATE-in/hr 0.36  
LOW LOSS RATE - PERCENT 90%

TOTAL PERCOLATION RATE (cfs) 0.84 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
1	5	0.08	1.3	0.312	0.36	0.28	0.03	1.12	81.39
2	10	0.17	1.3	0.312	0.36	0.28	0.03	1.12	81.39
3	15	0.25	1.1	0.264	0.36	0.24	0.03	0.94	29.93
4	20	0.33	1.5	0.360	0.36	0.32	0.04	1.29	132.86
5	25	0.42	1.5	0.360	0.36	0.32	0.04	1.29	132.86
6	30	0.50	1.8	0.432	0.36	0.39	0.07	2.48	490.44
7	35	0.58	1.5	0.360	0.36	0.32	0.04	1.29	132.86
8	40	0.67	1.8	0.432	0.36	0.39	0.07	2.48	490.44
9	45	0.75	1.8	0.432	0.36	0.39	0.07	2.48	490.44
10	50	0.83	1.5	0.360	0.36	0.32	0.04	1.29	132.86
11	55	0.92	1.6	0.384	0.36	0.35	0.02	0.76	0.00
12	60	1.00	1.8	0.432	0.36	0.39	0.07	2.48	490.44
13	65	1.08	2.2	0.528	0.36	0.48	0.17	5.91	1519.75
14	70	1.17	2.2	0.528	0.36	0.48	0.17	5.91	1519.75
15	75	1.25	2.2	0.528	0.36	0.48	0.17	5.91	1519.75
16	80	1.33	2.0	0.480	0.36	0.43	0.12	4.19	1005.10
17	85	1.42	2.6	0.624	0.36	0.56	0.26	9.34	2549.07
18	90	1.50	2.7	0.648	0.36	0.58	0.29	10.20	2806.39
19	95	1.58	2.4	0.576	0.36	0.52	0.21	7.63	2034.41
20	100	1.67	2.7	0.648	0.36	0.58	0.29	10.20	2806.39
21	105	1.75	3.3	0.792	0.36	0.71	0.43	15.34	4350.36
22	110	1.83	3.1	0.744	0.36	0.67	0.38	13.63	3835.71
23	115	1.92	2.9	0.696	0.36	0.63	0.33	11.91	3321.05
24	120	2.00	3.0	0.720	0.36	0.65	0.36	12.77	3578.38
25	125	2.08	3.1	0.744	0.36	0.67	0.38	13.63	3835.71
26	130	2.17	4.2	1.008	0.36	0.91	0.65	23.06	6666.31
27	135	2.25	5.0	1.200	0.36	1.08	0.84	29.93	8724.94
28	140	2.33	3.5	0.840	0.36	0.76	0.48	17.06	4865.02
29	145	2.42	6.8	1.632	0.36	1.47	1.27	45.37	13356.84
30	150	2.50	7.3	1.752	0.36	1.58	1.39	49.66	14643.48
31	155	2.58	8.2	1.968	0.36	1.77	1.61	57.38	16959.43
32	160	2.67	5.9	1.416	0.36	1.27	1.05	37.65	11040.89
33	165	2.75	2.0	0.480	0.36	0.43	0.12	4.19	1005.10
34	170	2.83	1.8	0.432	0.36	0.39	0.07	2.48	490.44
35	175	2.92	1.8	0.432	0.36	0.39	0.07	2.48	490.44
36	180	3.00	0.6	0.144	0.36	0.13	0.01	0.51	0.00

**EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY**

EFFECTIVE RAIN (in) 0.97  
FLOOD VOLUME (acft) 2.88  
FLOOD VOLUME (cuft) 125639.28  
REQUIRED STORAGE (acft) 2.65  
REQUIRED STORAGE (cuft) 115610.65  
PEAK FLOW RATE (cfs) 57.38

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD  
100 YEAR - 6 HOUR STORM EVENT

PROJECT: ARTISAN COLLECTION  
CONCENTRATION POINT: 1  
BY: DLS DATE: 11/09/2000

**EFFECTIVE RAIN CALCULATION FORM**

DRAINAGE AREA-ACRES 35.74  
UNIT TIME-MINUTES 5  
LAG TIME - MINUTES 5.10  
UNIT TIME-PERCENT OF LAG 98.0  
TOTAL ADJUSTED STORM RAIN-INCHES 2.50  
CONSTANT LOSS RATE-in/hr 0.363  
LOW LOSS RATE - PERCENT 90%

TOTAL PERCOLATION RATE (cfs) 0.84 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
1	5	0.08	0.5	0.150	0.36	0.14	0.02	0.54	0.00
2	10	0.17	0.6	0.180	0.36	0.16	0.02	0.64	0.00
3	15	0.25	0.6	0.180	0.36	0.16	0.02	0.64	0.00
4	20	0.33	0.6	0.180	0.36	0.16	0.02	0.64	0.00
5	25	0.42	0.6	0.180	0.36	0.16	0.02	0.64	0.00
6	30	0.50	0.7	0.210	0.36	0.19	0.02	0.75	0.00
7	35	0.58	0.7	0.210	0.36	0.19	0.02	0.75	0.00
8	40	0.67	0.7	0.210	0.36	0.19	0.02	0.75	0.00
9	45	0.75	0.7	0.210	0.36	0.19	0.02	0.75	0.00
10	50	0.83	0.7	0.210	0.36	0.19	0.02	0.75	0.00
11	55	0.92	0.7	0.210	0.36	0.19	0.02	0.75	0.00
12	60	1.00	0.8	0.240	0.36	0.22	0.02	0.86	4.20
13	65	1.08	0.8	0.240	0.36	0.22	0.02	0.86	4.20
14	70	1.17	0.8	0.240	0.36	0.22	0.02	0.86	4.20
15	75	1.25	0.8	0.240	0.36	0.22	0.02	0.86	4.20
16	80	1.33	0.8	0.240	0.36	0.22	0.02	0.86	4.20
17	85	1.42	0.8	0.240	0.36	0.22	0.02	0.86	4.20
18	90	1.50	0.8	0.240	0.36	0.22	0.02	0.86	4.20
19	95	1.58	0.8	0.240	0.36	0.22	0.02	0.86	4.20
20	100	1.67	0.8	0.240	0.36	0.22	0.02	0.86	4.20
21	105	1.75	0.8	0.240	0.36	0.22	0.02	0.86	4.20
22	110	1.83	0.8	0.240	0.36	0.22	0.02	0.86	4.20
23	115	1.92	0.8	0.240	0.36	0.22	0.02	0.86	4.20
24	120	2.00	0.9	0.270	0.36	0.24	0.03	0.96	36.36
25	125	2.08	0.8	0.240	0.36	0.22	0.02	0.86	4.20
26	130	2.17	0.9	0.270	0.36	0.24	0.03	0.96	36.36
27	135	2.25	0.9	0.270	0.36	0.24	0.03	0.96	36.36
28	140	2.33	0.9	0.270	0.36	0.24	0.03	0.96	36.36
29	145	2.42	0.9	0.270	0.36	0.24	0.03	0.96	36.36
30	150	2.50	0.9	0.270	0.36	0.24	0.03	0.96	36.36
31	155	2.58	0.9	0.270	0.36	0.24	0.03	0.96	36.36
32	160	2.67	0.9	0.270	0.36	0.24	0.03	0.96	36.36
33	165	2.75	1.0	0.300	0.36	0.27	0.03	1.07	68.53
34	170	2.83	1.0	0.300	0.36	0.27	0.03	1.07	68.53
35	175	2.92	1.0	0.300	0.36	0.27	0.03	1.07	68.53
36	180	3.00	1.0	0.300	0.36	0.27	0.03	1.07	68.53
37	185	3.08	1.0	0.300	0.36	0.27	0.03	1.07	68.53
38	190	3.17	1.1	0.330	0.36	0.30	0.03	1.18	100.69
39	195	3.25	1.1	0.330	0.36	0.30	0.03	1.18	100.69
40	200	3.33	1.1	0.330	0.36	0.30	0.03	1.18	100.69
41	205	3.42	1.2	0.360	0.36	0.32	0.04	1.29	132.86
42	210	3.50	1.3	0.390	0.36	0.35	0.03	0.98	40.12
43	215	3.58	1.4	0.420	0.36	0.38	0.06	2.05	361.78
44	220	3.67	1.4	0.420	0.36	0.38	0.06	2.05	361.78
45	225	3.75	1.5	0.450	0.36	0.41	0.09	3.12	683.44
46	230	3.83	1.5	0.450	0.36	0.41	0.09	3.12	683.44
47	235	3.92	1.6	0.480	0.36	0.43	0.12	4.19	1005.10
48	240	4.00	1.6	0.480	0.36	0.43	0.12	4.19	1005.10
49	245	4.08	1.7	0.510	0.36	0.46	0.15	5.27	1326.76
50	250	4.17	1.8	0.540	0.36	0.49	0.18	6.34	1648.42
51	255	4.25	1.9	0.570	0.36	0.51	0.21	7.41	1970.08
52	260	4.33	2.0	0.600	0.36	0.54	0.24	8.48	2291.74
53	265	4.42	2.1	0.630	0.36	0.57	0.27	9.56	2613.40
54	270	4.50	2.1	0.630	0.36	0.57	0.27	9.56	2613.40
55	275	4.58	2.2	0.660	0.36	0.59	0.30	10.63	2935.06
56	280	4.67	2.3	0.690	0.36	0.62	0.33	11.70	3256.72

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD  
100 YEAR - 6 HOUR STORM EVENT

PROJECT: ARTISAN COLLECTION  
CONCENTRATION POINT: 1

BY: DLS DATE: 11/09/2000

**EFFECTIVE RAIN CALCULATION FORM**

DRAINAGE AREA-ACRES 35.74  
UNIT TIME-MINUTES 5  
LAG TIME - MINUTES 5.10  
UNIT TIME-PERCENT OF LAG 98.0  
TOTAL ADJUSTED STORM RAIN-INCHES 2.50  
CONSTANT LOSS RATE-in/hr 0.363  
LOW LOSS RATE - PERCENT 90%

TOTAL PERCOLATION RATE (cfs) 0.84 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
57	285	4.75	2.4	0.720	0.36	0.65	0.36	12.77	3578.38
58	290	4.83	2.4	0.720	0.36	0.65	0.36	12.77	3578.38
59	295	4.92	2.5	0.750	0.36	0.68	0.39	13.84	3900.04
60	300	5.00	2.6	0.780	0.36	0.70	0.42	14.92	4221.70
61	305	5.08	3.1	0.930	0.36	0.84	0.57	20.28	5830.00
62	310	5.17	3.6	1.080	0.36	0.97	0.72	25.64	7438.30
63	315	5.25	3.9	1.170	0.36	1.05	0.81	28.85	8403.28
64	320	5.33	4.2	1.260	0.36	1.13	0.90	32.07	9368.26
65	325	5.42	4.7	1.410	0.36	1.27	1.05	37.43	10976.56
66	330	5.50	5.6	1.680	0.36	1.51	1.32	47.08	13871.50
67	335	5.58	1.9	0.570	0.36	0.51	0.21	7.41	1970.08
68	340	5.67	0.9	0.270	0.36	0.24	0.03	0.96	36.36
69	345	5.75	0.6	0.180	0.36	0.16	0.02	0.64	0.00
70	350	5.83	0.5	0.150	0.36	0.14	0.02	0.54	0.00
71	355	5.92	0.3	0.090	0.36	0.08	0.01	0.32	0.00
72	360	6.00	0.2	0.060	0.36	0.05	0.01	0.21	0.00

**EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY**

EFFECTIVE RAIN (in) 0.89  
FLOOD VOLUME (acft) 2.65  
FLOOD VOLUME (cuft) 115272.23  
REQUIRED STORAGE (acft) 2.23  
REQUIRED STORAGE (cuft) 97092.16  
PEAK FLOW RATE (cfs) 47.08

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD  
100 YEAR - 24 HOUR STORM EVENT

PROJECT: ARTISAN COLLECTION  
CONCENTRATION POINT: 1

BY: DLS DATE: 11/09/2000

**EFFECTIVE RAIN CALCULATION FORM**

DRAINAGE AREA-ACRES	35.740	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.3626
LAG TIME - MINUTES	5.10	MINIMUM LOSS RATE (for var. loss) - in/hr	0.181
UNIT TIME-PERCENT OF LAG	294.1	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	3.75	C	0.00336
		PERCOLATION RATE (cfs)	0.84

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			in/hr				
					Max	Low			
1	15	0.25	0.2	0.030	0.640	0.027	0.003	0.11	0.00
2	30	0.50	0.3	0.045	0.633	0.041	0.005	0.16	0.00
3	45	0.75	0.3	0.045	0.626	0.041	0.005	0.16	0.00
4	60	1.00	0.4	0.060	0.618	0.054	0.006	0.21	0.00
5	75	1.25	0.3	0.045	0.611	0.041	0.005	0.16	0.00
6	90	1.50	0.3	0.045	0.604	0.041	0.005	0.16	0.00
7	105	1.75	0.3	0.045	0.596	0.041	0.005	0.16	0.00
8	120	2.00	0.4	0.060	0.589	0.054	0.006	0.21	0.00
9	135	2.25	0.4	0.060	0.582	0.054	0.006	0.21	0.00
10	150	2.50	0.4	0.060	0.575	0.054	0.006	0.21	0.00
11	165	2.75	0.5	0.075	0.568	0.068	0.007	0.27	0.00
12	180	3.00	0.5	0.075	0.561	0.068	0.007	0.27	0.00
13	195	3.25	0.5	0.075	0.554	0.068	0.007	0.27	0.00
14	210	3.50	0.5	0.075	0.547	0.068	0.007	0.27	0.00
15	225	3.75	0.5	0.075	0.540	0.068	0.007	0.27	0.00
16	240	4.00	0.6	0.090	0.534	0.081	0.009	0.32	0.00
17	255	4.25	0.6	0.090	0.527	0.081	0.009	0.32	0.00
18	270	4.50	0.7	0.105	0.520	0.095	0.011	0.38	0.00
19	285	4.75	0.7	0.105	0.513	0.095	0.011	0.38	0.00
20	300	5.00	0.8	0.120	0.507	0.108	0.012	0.43	0.00
21	315	5.25	0.6	0.090	0.500	0.081	0.009	0.32	0.00
22	330	5.50	0.7	0.105	0.494	0.095	0.011	0.38	0.00
23	345	5.75	0.8	0.120	0.487	0.108	0.012	0.43	0.00
24	360	6.00	0.8	0.120	0.481	0.108	0.012	0.43	0.00
25	375	6.25	0.9	0.135	0.474	0.122	0.014	0.48	0.00
26	390	6.50	0.9	0.135	0.468	0.122	0.014	0.48	0.00
27	405	6.75	1.0	0.150	0.462	0.135	0.015	0.54	0.00
28	420	7.00	1.0	0.150	0.456	0.135	0.015	0.54	0.00
29	435	7.25	1.0	0.150	0.449	0.135	0.015	0.54	0.00
30	450	7.50	1.1	0.165	0.443	0.149	0.017	0.59	0.00
31	465	7.75	1.2	0.180	0.437	0.162	0.018	0.64	0.00
32	480	8.00	1.3	0.195	0.431	0.176	0.020	0.70	0.00
33	495	8.25	1.5	0.225	0.425	0.203	0.023	0.80	0.00
34	510	8.50	1.5	0.225	0.419	0.203	0.023	0.80	0.00
35	525	8.75	1.6	0.240	0.413	0.216	0.024	0.86	12.59
36	540	9.00	1.7	0.255	0.408	0.230	0.026	0.91	60.84
37	555	9.25	1.9	0.285	0.402	0.257	0.029	1.02	157.34
38	570	9.50	2.0	0.300	0.396	0.270	0.030	1.07	205.58
39	585	9.75	2.1	0.315	0.390	0.284	0.032	1.13	253.83
40	600	10.00	2.2	0.330	0.385	0.297	0.033	1.18	302.08
41	615	10.25	1.5	0.225	0.379	0.203	0.023	0.80	0.00
42	630	10.50	1.5	0.225	0.374	0.203	0.023	0.80	0.00
43	645	10.75	2.0	0.300	0.368	0.270	0.030	1.07	205.58
44	660	11.00	2.0	0.300	0.363	0.270	0.030	1.07	205.58
45	675	11.25	1.9	0.285	0.358	0.257	0.029	1.02	157.34
46	690	11.50	1.9	0.285	0.352	0.257	0.029	1.02	157.34
47	705	11.75	1.7	0.255	0.347	0.230	0.026	0.91	60.84
48	720	12.00	1.8	0.270	0.342	0.243	0.027	0.96	109.09
49	735	12.25	2.5	0.375	0.337	0.338	0.038	1.36	468.37
50	750	12.50	2.6	0.390	0.332	0.351	0.058	2.08	1113.14
51	765	12.75	2.8	0.420	0.327	0.378	0.093	3.33	2238.48
52	780	13.00	2.9	0.435	0.322	0.392	0.113	4.04	2879.41
53	795	13.25	3.4	0.510	0.317	0.459	0.193	6.90	5448.35
54	810	13.50	3.4	0.510	0.312	0.459	0.198	7.07	5602.88
55	825	13.75	2.3	0.345	0.307	0.311	0.038	1.34	448.03
56	840	14.00	2.3	0.345	0.303	0.311	0.042	1.51	598.56
57	855	14.25	2.7	0.405	0.298	0.365	0.107	3.82	2677.02
58	870	14.50	2.6	0.390	0.294	0.351	0.096	3.44	2340.98
59	885	14.75	2.6	0.390	0.289	0.351	0.101	3.61	2485.35
60	900	15.00	2.5	0.375	0.285	0.338	0.090	3.23	2145.13
61	915	15.25	2.4	0.360	0.280	0.324	0.080	2.85	1802.78

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 24 HOUR STORM EVENT	PROJECT: ARTISAN COLLECTION CONCENTRATION POINT: 1  BY: DLS                      DATE: 11/09/2000
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**EFFECTIVE RAIN CALCULATION FORM**

DRAINAGE AREA-ACRES	35.740	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.3626
LAG TIME - MINUTES	5.10	MINIMUM LOSS RATE (for var. loss) - in/hr	0.181
UNIT TIME-PERCENT OF LAG	294.1	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	3.75	C	0.00336
		PERCOLATION RATE (cfs)	0.84

Unit Time Period	Time		Pattern Percent  (Plate E-5.9)	Storm Rain in/hr	Loss Rate		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			in/hr				
					Max	Low			
62	930	15.50	2.3	0.345	0.276	0.311	0.069	2.46	1458.28
63	945	15.75	1.9	0.285	0.272	0.257	0.013	0.47	0.00
64	960	16.00	1.9	0.285	0.268	0.257	0.017	0.62	0.00
65	975	16.25	0.4	0.060	0.264	0.054	0.006	0.21	0.00
66	990	16.50	0.4	0.060	0.260	0.054	0.006	0.21	0.00
67	1005	16.75	0.3	0.045	0.256	0.041	0.005	0.16	0.00
68	1020	17.00	0.3	0.045	0.252	0.041	0.005	0.16	0.00
69	1035	17.25	0.5	0.075	0.248	0.068	0.007	0.27	0.00
70	1050	17.50	0.5	0.075	0.244	0.068	0.007	0.27	0.00
71	1065	17.75	0.5	0.075	0.241	0.068	0.007	0.27	0.00
72	1080	18.00	0.4	0.060	0.237	0.054	0.006	0.21	0.00
73	1095	18.25	0.4	0.060	0.234	0.054	0.006	0.21	0.00
74	1110	18.50	0.4	0.060	0.230	0.054	0.006	0.21	0.00
75	1125	18.75	0.3	0.045	0.227	0.041	0.005	0.16	0.00
76	1140	19.00	0.2	0.030	0.224	0.027	0.003	0.11	0.00
77	1155	19.25	0.3	0.045	0.220	0.041	0.005	0.16	0.00
78	1170	19.50	0.4	0.060	0.217	0.054	0.006	0.21	0.00
79	1185	19.75	0.3	0.045	0.214	0.041	0.005	0.16	0.00
80	1200	20.00	0.2	0.030	0.212	0.027	0.003	0.11	0.00
81	1215	20.25	0.3	0.045	0.209	0.041	0.005	0.16	0.00
82	1230	20.50	0.3	0.045	0.206	0.041	0.005	0.16	0.00
83	1245	20.75	0.3	0.045	0.203	0.041	0.005	0.16	0.00
84	1260	21.00	0.2	0.030	0.201	0.027	0.003	0.11	0.00
85	1275	21.25	0.3	0.045	0.199	0.041	0.005	0.16	0.00
86	1290	21.50	0.2	0.030	0.196	0.027	0.003	0.11	0.00
87	1305	21.75	0.3	0.045	0.194	0.041	0.005	0.16	0.00
88	1320	22.00	0.2	0.030	0.192	0.027	0.003	0.11	0.00
89	1335	22.25	0.3	0.045	0.190	0.041	0.005	0.16	0.00
90	1350	22.50	0.2	0.030	0.188	0.027	0.003	0.11	0.00
91	1365	22.75	0.2	0.030	0.187	0.027	0.003	0.11	0.00
92	1380	23.00	0.2	0.030	0.185	0.027	0.003	0.11	0.00
93	1395	23.25	0.2	0.030	0.184	0.027	0.003	0.11	0.00
94	1410	23.50	0.2	0.030	0.183	0.027	0.003	0.11	0.00
95	1425	23.75	0.2	0.030	0.182	0.027	0.003	0.11	0.00
96	1440	24.00	0.2	0.030	0.181	0.027	0.003	0.11	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY	
EFFECTIVE RAIN (in)	0.56
FLOOD VOLUME (acft)	1.66
FLOOD VOLUME (cuft)	72335.69
REQUIRED STORAGE (acft)	0.77
REQUIRED STORAGE (cuft)	33594.80
PEAK FLOW (cfs)	7.07

PROJECT: ARTISAN COLLECTION  
 TKC JOB # 40692  
 1

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
267	0	0		6211	0	0	0.00
268	1	1	952	7163	6687	6687	0.15
269	1	2	1008	8171	7667	14354	0.33
270	1	3	1065	9236	8704	23058	0.53
272	2	5	2300	11536	20772	43830	1.01
273	1	6	12412	23948	17742	61572	1.41
275	2	8	59913	83861	107809	169381	3.89

PERCOLATION CALCULATIONS

PERCOLATION RATE 1 in/hr 0.14 cfs

MAXWELL IV DRYWELLS  
 NUMBER USED 2  
 RATE/DRYWELL 0.35 cfs  
 TOTAL DISSIPATED 0.7 cfs

TOTAL PERCOLATION RATE 0.84 cfs

ARTISAN COLLECTION  
TKC JOB # 40692

100 YEAR - 3 HOUR STORM EVENT

UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE DISCHARGE		BALANCE IN BASIN	
								(cfs)	(cuft)	(cuft)	(acre-ft)
1	5	1.12	335	335	253	81	267.01	0.01	2	79	0.00
2	10	1.12	335	414	253	161	267.02	0.01	4	156	0.00
3	15	0.94	283	439	253	186	267.03	0.02	5	181	0.00
4	20	1.29	386	567	253	314	267.05	0.03	8	306	0.01
5	25	1.29	386	692	253	439	267.07	0.04	12	427	0.01
6	30	2.48	744	1,171	253	918	267.14	0.08	24	894	0.02
7	35	1.29	386	1,280	253	1,027	267.15	0.09	27	1,000	0.02
8	40	2.48	744	1,743	253	1,490	267.22	0.13	39	1,451	0.03
9	45	2.48	744	2,195	253	1,942	267.29	0.17	51	1,891	0.04
10	50	1.29	386	2,277	253	2,023	267.30	0.18	53	1,970	0.05
11	55	0.76	229	2,199	253	1,946	267.29	0.17	51	1,895	0.04
12	60	2.48	744	2,639	253	2,386	267.36	0.21	63	2,323	0.05
13	65	5.91	1,773	4,096	253	3,843	267.57	0.34	101	3,742	0.09
14	70	5.91	1,773	5,515	253	5,262	267.79	0.46	138	5,124	0.12
15	75	5.91	1,773	6,896	253	6,643	267.99	0.58	174	6,469	0.15
16	80	4.19	1,258	7,727	253	7,474	268.10	0.64	193	7,281	0.17
17	85	9.34	2,802	10,083	253	9,830	268.41	0.82	247	9,582	0.22
18	90	10.20	3,060	12,642	253	12,389	268.74	1.02	306	12,083	0.28
19	95	7.63	2,288	14,370	253	14,117	268.97	1.15	346	13,771	0.32
20	100	10.20	3,060	16,830	253	16,577	269.26	1.32	397	16,180	0.37
21	105	15.34	4,603	20,783	253	20,530	269.71	1.60	479	20,052	0.46
22	110	13.63	4,089	24,141	253	23,887	270.08	1.82	545	23,343	0.54
23	115	11.91	3,574	26,917	253	26,664	270.35	1.97	592	26,072	0.60
24	120	12.77	3,832	29,903	253	29,650	270.63	2.13	639	29,011	0.67
25	125	13.63	4,089	33,100	253	32,847	270.94	2.29	688	32,159	0.74
26	130	23.06	6,919	39,079	253	38,825	271.52	2.60	779	38,046	0.87
27	135	29.93	8,978	47,024	253	46,771	272.17	2.94	882	45,889	1.05
28	140	17.06	5,118	51,008	253	50,754	272.39	3.05	916	49,839	1.14
29	145	45.37	13,610	63,449	253	63,196	273.03	3.35	1006	62,189	1.43
30	150	49.66	14,897	77,086	253	76,833	273.28	3.47	1042	75,791	1.74
31	155	57.38	17,213	93,004	253	92,750	273.58	3.61	1084	91,667	2.10
32	160	37.65	11,294	102,961	253	102,708	273.76	3.70	1110	101,598	2.33
33	165	4.19	1,258	102,856	253	102,603	273.76	3.70	1110	101,493	2.33
34	170	2.48	744	102,237	253	101,984	273.75	3.69	1108	100,876	2.32
35	175	2.48	744	101,619	253	101,366	273.74	3.69	1106	100,260	2.30
36	180	0.51	154	100,414	253	100,161	273.72	3.68	1103	99,058	2.27



TKC JOB # 40692  
 100 YEAR - 6 HOUR STORM EVENT

UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE DISCHARGE		BALANCE IN BASIN	
								(cfs)	(cuft)	(cuft)	(acre-ft)
1	5	0.54	161	161	253	-	267.00	0.00	0	-	0.00
2	10	0.64	193	193	253	-	267.00	0.00	0	-	0.00
3	15	0.64	193	193	253	-	267.00	0.00	0	-	0.00
4	20	0.64	193	193	253	-	267.00	0.00	0	-	0.00
5	25	0.64	193	193	253	-	267.00	0.00	0	-	0.00
6	30	0.75	225	225	253	-	267.00	0.00	0	-	0.00
7	35	0.75	225	225	253	-	267.00	0.00	0	-	0.00
8	40	0.75	225	225	253	-	267.00	0.00	0	-	0.00
9	45	0.75	225	225	253	-	267.00	0.00	0	-	0.00
10	50	0.75	225	225	253	-	267.00	0.00	0	-	0.00
11	55	0.75	225	225	253	-	267.00	0.00	0	-	0.00
12	60	0.86	257	257	253	4	267.00	0.00	0	4	0.00
13	65	0.86	257	261	253	8	267.00	0.00	0	8	0.00
14	70	0.86	257	265	253	12	267.00	0.00	0	12	0.00
15	75	0.86	257	269	253	16	267.00	0.00	0	16	0.00
16	80	0.86	257	273	253	20	267.00	0.00	1	19	0.00
17	85	0.86	257	277	253	24	267.00	0.00	1	23	0.00
18	90	0.86	257	280	253	27	267.00	0.00	1	26	0.00
19	95	0.86	257	284	253	31	267.00	0.00	1	30	0.00
20	100	0.86	257	287	253	34	267.01	0.00	1	33	0.00
21	105	0.86	257	290	253	37	267.01	0.00	1	36	0.00
22	110	0.86	257	294	253	41	267.01	0.00	1	39	0.00
23	115	0.86	257	297	253	44	267.01	0.00	1	43	0.00
24	120	0.96	289	332	253	79	267.01	0.01	2	77	0.00
25	125	0.86	257	334	253	81	267.01	0.01	2	79	0.00
26	130	0.96	289	368	253	115	267.02	0.01	3	112	0.00
27	135	0.96	289	402	253	149	267.02	0.01	4	145	0.00
28	140	0.96	289	434	253	181	267.03	0.02	5	176	0.00
29	145	0.96	289	466	253	213	267.03	0.02	6	207	0.00
30	150	0.96	289	497	253	243	267.04	0.02	6	237	0.01
31	155	0.96	289	527	253	273	267.04	0.02	7	266	0.01
32	160	0.96	289	556	253	303	267.05	0.03	8	295	0.01
33	165	1.07	322	616	253	363	267.05	0.03	10	354	0.01
34	170	1.07	322	675	253	422	267.06	0.04	11	411	0.01
35	175	1.07	322	733	253	480	267.07	0.04	13	467	0.01
36	180	1.07	322	789	253	536	267.08	0.05	14	522	0.01
37	185	1.07	322	843	253	590	267.09	0.05	15	575	0.01
38	190	1.18	354	928	253	675	267.10	0.06	18	658	0.02
39	195	1.18	354	1,011	253	758	267.11	0.07	20	738	0.02
40	200	1.18	354	1,092	253	839	267.13	0.07	22	817	0.02
41	205	1.29	386	1,203	253	950	267.14	0.08	25	925	0.02
42	210	0.98	293	1,218	253	965	267.14	0.08	25	940	0.02
43	215	2.05	615	1,555	253	1,302	267.19	0.11	34	1,267	0.03
44	220	2.05	615	1,882	253	1,629	267.24	0.14	43	1,586	0.04
45	225	3.12	937	2,523	253	2,270	267.34	0.20	60	2,210	0.05
46	230	3.12	937	3,147	253	2,894	267.43	0.25	76	2,818	0.06
47	235	4.19	1,258	4,076	253	3,823	267.57	0.33	100	3,723	0.09
48	240	4.19	1,258	4,981	253	4,728	267.71	0.41	124	4,604	0.11
49	245	5.27	1,580	6,184	253	5,930	267.89	0.52	156	5,775	0.13
50	250	6.34	1,902	7,676	253	7,423	268.10	0.64	192	7,231	0.17
51	255	7.41	2,223	9,454	253	9,201	268.33	0.78	233	8,968	0.21
52	260	8.48	2,545	11,513	253	11,260	268.60	0.93	280	10,980	0.25
53	265	9.56	2,867	13,846	253	13,593	268.90	1.11	334	13,259	0.30
54	270	9.56	2,867	16,126	253	15,873	269.17	1.28	383	15,490	0.36
55	275	10.63	3,188	18,678	253	18,425	269.47	1.45	435	17,989	0.41
56	280	11.70	3,510	21,499	253	21,246	269.79	1.64	493	20,753	0.48
57	285	12.77	3,832	24,584	253	24,331	270.12	1.84	552	23,779	0.55
58	290	12.77	3,832	27,610	253	27,357	270.41	2.01	604	26,754	0.61
59	295	13.84	4,153	30,907	253	30,654	270.73	2.18	654	29,999	0.69
60	300	14.92	4,475	34,474	253	34,221	271.07	2.36	709	33,512	0.77
61	305	20.28	6,083	39,596	253	39,342	271.57	2.62	787	38,555	0.89
62	310	25.64	7,691	46,247	253	45,994	272.12	2.92	875	45,119	1.04
63	315	28.85	8,656	53,775	253	53,522	272.55	3.13	938	52,584	1.21
64	320	32.07	9,621	62,206	253	61,953	273.01	3.34	1003	60,950	1.40
65	325	37.43	11,230	72,179	253	71,926	273.19	3.43	1029	70,897	1.63
66	330	47.08	14,125	85,022	253	84,769	273.43	3.54	1063	83,706	1.92
67	335	7.41	2,223	85,929	253	85,676	273.45	3.55	1065	84,611	1.94

TKC JOB # 40692

100 YEAR - 6 HOUR STORM EVENT

UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE DISCHARGE		BALANCE IN BASIN	
								(cfs)	(cuft)	(cuft)	(acre-ft)
68	340	0.96	289	84,900	253	84,647	273.43	3.54	1062	83,585	1.92
69	345	0.64	193	83,778	253	83,525	273.41	3.53	1060	82,465	1.89
70	350	0.54	161	82,626	253	82,373	273.39	3.52	1056	81,316	1.87
71	355	0.32	96	81,413	253	81,160	273.36	3.51	1053	80,106	1.84
72	360	0.21	64	80,171	253	79,918	273.34	3.50	1050	78,868	1.81

TKC JOB # 40692  
100 YEAR - 24 HOUR STORM EVENT

UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE DISCHARGE		BALANCE IN BASIN	
								(cfs)	(cuft)	(cuft)	(acre-ft)
1	15	0.11	96	96	759	0	267.00	0.00	0	0	0.00
2	30	0.16	145	145	759	0	267.00	0.00	0	0	0.00
3	45	0.16	145	145	759	0	267.00	0.00	0	0	0.00
4	60	0.21	193	193	759	0	267.00	0.00	0	0	0.00
5	75	0.16	145	145	759	0	267.00	0.00	0	0	0.00
6	90	0.16	145	145	759	0	267.00	0.00	0	0	0.00
7	105	0.16	145	145	759	0	267.00	0.00	0	0	0.00
8	120	0.21	193	193	759	0	267.00	0.00	0	0	0.00
9	135	0.21	193	193	759	0	267.00	0.00	0	0	0.00
10	150	0.21	193	193	759	0	267.00	0.00	0	0	0.00
11	165	0.27	241	241	759	0	267.00	0.00	0	0	0.00
12	180	0.27	241	241	759	0	267.00	0.00	0	0	0.00
13	195	0.27	241	241	759	0	267.00	0.00	0	0	0.00
14	210	0.27	241	241	759	0	267.00	0.00	0	0	0.00
15	225	0.27	241	241	759	0	267.00	0.00	0	0	0.00
16	240	0.32	289	289	759	0	267.00	0.00	0	0	0.00
17	255	0.32	289	289	759	0	267.00	0.00	0	0	0.00
18	270	0.38	338	338	759	0	267.00	0.00	0	0	0.00
19	285	0.38	338	338	759	0	267.00	0.00	0	0	0.00
20	300	0.43	386	386	759	0	267.00	0.00	0	0	0.00
21	315	0.32	289	289	759	0	267.00	0.00	0	0	0.00
22	330	0.38	338	338	759	0	267.00	0.00	0	0	0.00
23	345	0.43	386	386	759	0	267.00	0.00	0	0	0.00
24	360	0.43	386	386	759	0	267.00	0.00	0	0	0.00
25	375	0.48	434	434	759	0	267.00	0.00	0	0	0.00
26	390	0.48	434	434	759	0	267.00	0.00	0	0	0.00
27	405	0.54	482	482	759	0	267.00	0.00	0	0	0.00
28	420	0.54	482	482	759	0	267.00	0.00	0	0	0.00
29	435	0.54	482	482	759	0	267.00	0.00	0	0	0.00
30	450	0.59	531	531	759	0	267.00	0.00	0	0	0.00
31	465	0.64	579	579	759	0	267.00	0.00	0	0	0.00
32	480	0.70	627	627	759	0	267.00	0.00	0	0	0.00
33	495	0.80	724	724	759	0	267.00	0.00	0	0	0.00
34	510	0.80	724	724	759	0	267.00	0.00	0	0	0.00
35	525	0.86	772	772	759	13	267.00	0.00	1	12	0.00
36	540	0.91	820	832	759	72	267.01	0.01	6	67	0.00
37	555	1.02	917	983	759	224	267.03	0.02	18	206	0.00
38	570	1.07	965	1,171	759	412	267.06	0.04	32	380	0.01
39	585	1.13	1,013	1,393	759	633	267.09	0.06	50	584	0.01
40	600	1.18	1,061	1,645	759	886	267.13	0.08	70	816	0.02
41	615	0.80	724	1,540	759	780	267.12	0.07	61	719	0.02
42	630	0.80	724	1,443	759	683	267.10	0.06	54	629	0.01
43	645	1.07	965	1,594	759	835	267.12	0.07	66	769	0.02
44	660	1.07	965	1,734	759	975	267.15	0.09	77	898	0.02
45	675	1.02	917	1,815	759	1055	267.16	0.09	83	972	0.02
46	690	1.02	917	1,889	759	1130	267.17	0.10	89	1041	0.02
47	705	0.91	820	1,861	759	1102	267.16	0.10	87	1015	0.02
48	720	0.96	868	1,883	759	1124	267.17	0.10	88	1036	0.02
49	735	1.36	1,228	2,263	759	1504	267.22	0.13	118	1386	0.03
50	750	2.08	1,873	3,258	759	2499	267.37	0.22	197	2302	0.05
51	765	3.33	2,998	5,300	759	4541	267.68	0.40	357	4183	0.10
52	780	4.04	3,639	7,822	759	7063	268.05	0.61	552	6510	0.15
53	795	6.90	6,208	12,718	759	11959	268.69	0.99	888	11071	0.25
54	810	7.07	6,362	17,433	759	16673	269.27	1.33	1198	15475	0.36
55	825	1.34	1,207	16,683	759	15923	269.18	1.28	1152	14771	0.34
56	840	1.51	1,358	16,129	759	15370	269.12	1.24	1118	14252	0.33
57	855	3.82	3,436	17,689	759	16929	269.30	1.35	1214	15715	0.36
58	870	3.44	3,100	18,816	759	18056	269.43	1.43	1283	16773	0.39
59	885	3.61	3,245	20,018	759	19258	269.56	1.51	1357	17901	0.41
60	900	3.23	2,905	20,806	759	20046	269.65	1.56	1406	18641	0.43
61	915	2.85	2,562	21,203	759	20443	269.70	1.59	1430	19013	0.44
62	930	2.46	2,218	21,231	759	20471	269.70	1.59	1432	19040	0.44
63	945	0.47	424	19,463	759	18704	269.50	1.47	1323	17381	0.40
64	960	0.62	557	17,938	759	17178	269.32	1.37	1229	15949	0.37
65	975	0.21	193	16,142	759	15383	269.12	1.24	1119	14264	0.33
66	990	0.21	193	14,457	759	13698	268.91	1.12	1009	12688	0.29
67	1005	0.16	145	12,833	759	12073	268.70	1.00	896	11177	0.26

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TKC JOB # 40692  
100 YEAR - 24 HOUR STORM EVENT

UNIT PERIOD	TIME (min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE DISCHARGE		BALANCE IN BASIN	
								(cfs)	(cuft)	(cuft)	(acre-ft)
68	1020	0.16	145	11,322	759	10563	268.51	0.88	792	9770	0.22
69	1035	0.27	241	10,012	759	9252	268.33	0.78	702	8550	0.20
70	1050	0.27	241	8,791	759	8032	268.18	0.69	619	7413	0.17
71	1065	0.27	241	7,654	759	6895	268.03	0.60	541	6354	0.15
72	1080	0.21	193	6,547	759	5788	267.87	0.51	456	5332	0.12
73	1095	0.21	193	5,525	759	4766	267.71	0.42	375	4391	0.10
74	1110	0.21	193	4,584	759	3824	267.57	0.33	301	3523	0.08
75	1125	0.16	145	3,668	759	2909	267.43	0.25	229	2680	0.06
76	1140	0.11	96	2,776	759	2017	267.30	0.18	159	1858	0.04
77	1155	0.16	145	2,003	759	1244	267.19	0.11	98	1146	0.03
78	1170	0.21	193	1,339	759	579	267.09	0.05	46	534	0.01
79	1185	0.16	145	678	759	0	267.00	0.00	0	0	0.00
80	1200	0.11	96	96	759	0	267.00	0.00	0	0	0.00
81	1215	0.16	145	145	759	0	267.00	0.00	0	0	0.00
82	1230	0.16	145	145	759	0	267.00	0.00	0	0	0.00
83	1245	0.16	145	145	759	0	267.00	0.00	0	0	0.00
84	1260	0.11	96	96	759	0	267.00	0.00	0	0	0.00
85	1275	0.16	145	145	759	0	267.00	0.00	0	0	0.00
86	1290	0.11	96	96	759	0	267.00	0.00	0	0	0.00
87	1305	0.16	145	145	759	0	267.00	0.00	0	0	0.00
88	1320	0.11	96	96	759	0	267.00	0.00	0	0	0.00
89	1335	0.16	145	145	759	0	267.00	0.00	0	0	0.00
90	1350	0.11	96	96	759	0	267.00	0.00	0	0	0.00
91	1365	0.11	96	96	759	0	267.00	0.00	0	0	0.00
92	1380	0.11	96	96	759	0	267.00	0.00	0	0	0.00
93	1395	0.11	96	96	759	0	267.00	0.00	0	0	0.00
94	1410	0.11	96	96	759	0	267.00	0.00	0	0	0.00
95	1425	0.11	96	96	759	0	267.00	0.00	0	0	0.00
96	1440	0.11	96	96	759	0	267.00	0.00	0	0	0.00



# 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: 11/07/00 File:692100.out

ARTISAN COLLECTION  
100 YEAR - 1 HOUR STORM EVENT  
TKC JOB #40692

\*\*\*\*\* 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 = 2

Standard intensity-duration curves data (Plate D-4.1)

For the [ Cathedral City ] area used.

10 year storm 10 minute intensity = 2.770(In/Hr)

10 year storm 60 minute intensity = 0.980(In/Hr)

100 year storm 10 minute intensity = 4.520(In/Hr)

100 year storm 60 minute intensity = 1.600(In/Hr)

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 \*\*\*\*

Initial area flow distance = 880.000(Ft.)

Top (of initial area) elevation = 283.500(Ft.)

Bottom (of initial area) elevation = 277.500(Ft.)

Difference in elevation = 6.000(Ft.)

Slope = 0.00682 s(percent)= 0.68

TC = k(0.390)\*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 15.927 min.

Rainfall intensity = 3.453(In/Hr) for a 100.0 year storm

SINGLE FAMILY (1/4 Acre Lot)

Runoff Coefficient = 0.697

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 = 10.882(CFS)  
Total initial stream area = 4.520(Ac.)  
Pervious area fraction = 0.500

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Process from Point/Station 1005.000 to Point/Station 1025.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

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Top of street segment elevation = 277.500(Ft.)  
End of street segment elevation = 273.900(Ft.)  
Length of street segment = 693.000(Ft.)  
Height of curb above gutter flowline = 6.0(In.)  
Width of half street (curb to crown) = 18.000(Ft.)  
Distance from crown to crossfall grade break = 15.500(Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000(Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500(Ft.)  
Gutter hike from flowline = 2.000(In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 15.962(CFS)  
Depth of flow = 0.479(Ft.), Average velocity = 2.324(Ft/s)  
Note: depth of flow exceeds top of street crown.  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 18.000(Ft.)  
Flow velocity = 2.32(Ft/s)  
Travel time = 4.97 min. TC = 20.90 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.680  
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  
Rainfall intensity = 2.950(In/Hr) for a 100.0 year storm  
Subarea runoff = 8.459(CFS) for 4.220(Ac.)  
Total runoff = 19.341(CFS) Total area = 8.740(Ac.)  
Street flow at end of street = 19.341(CFS)  
Half street flow at end of street = 9.671(CFS)  
Depth of flow = 0.503(Ft.), Average velocity = 2.509(Ft/s)  
Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.00(Ft.)  
Flow width (from curb towards crown)= 18.000(Ft.)

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Process from Point/Station 1005.000 to Point/Station 1025.000  
\*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

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The following data inside Main Stream is listed:

In Main Stream number: 1  
Stream flow area = 8.740(Ac.)  
Runoff from this stream = 19.341(CFS)  
Time of concentration = 20.90 min.  
Rainfall intensity = 2.950(In/Hr)  
Program is now starting with Main Stream No. 2

+++++  
Process from Point/Station 1010.000 to Point/Station 1020.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

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Initial area flow distance = 1000.000(Ft.)  
Top (of initial area) elevation = 283.100(Ft.)  
Bottom (of initial area) elevation = 275.300(Ft.)  
Difference in elevation = 7.800(Ft.)  
Slope = 0.00780 s(percent)= 0.78  
TC =  $k(0.390)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 16.317 min.  
Rainfall intensity = 3.405(In/Hr) for a 100.0 year storm  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.696  
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 = 12.980(CFS)  
Total initial stream area = 5.480(Ac.)  
Pervious area fraction = 0.500

+++++  
Process from Point/Station 1010.000 to Point/Station 1020.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

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Along Main Stream number: 2 in normal stream number 1  
Stream flow area = 5.480(Ac.)  
Runoff from this stream = 12.980(CFS)  
Time of concentration = 16.32 min.  
Rainfall intensity = 3.405(In/Hr)

+++++  
Process from Point/Station 1015.000 to Point/Station 1020.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 770.000(Ft.)  
Top (of initial area) elevation = 281.000(Ft.)  
Bottom (of initial area) elevation = 275.300(Ft.)  
Difference in elevation = 5.700(Ft.)  
Slope = 0.00740 s(percent)= 0.74

$TC = k(0.390) * [(length^3) / (elevation\ change)]^{0.2}$   
 Initial area time of concentration = 14.852 min.  
 Rainfall intensity = 3.596(In/Hr) for a 100.0 year storm  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.702  
 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 = 10.118(CFS)  
 Total initial stream area = 4.010(Ac.)  
 Pervious area fraction = 0.500

++++++  
 Process from Point/Station 1015.000 to Point/Station 1020.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

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Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 4.010(Ac.)  
 Runoff from this stream = 10.118(CFS)  
 Time of concentration = 14.85 min.  
 Rainfall intensity = 3.596(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
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1	12.980	16.32	3.405
2	10.118	14.85	3.596

Largest stream flow has longer time of concentration

$Q_p = 12.980 + \text{sum of}$   
 $Q_b \quad I_a/I_b$   
 $10.118 * 0.947 = 9.581$   
 $Q_p = 22.560$

Total of 2 streams to confluence:

Flow rates before confluence point:

12.980      10.118

Area of streams before confluence:

5.480      4.010

Results of confluence:

Total flow rate = 22.560(CFS)

Time of concentration = 16.317 min.

Effective stream area after confluence = 9.490(Ac.)

++++++  
 Process from Point/Station 1020.000 to Point/Station 1025.000  
 \*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 275.300(Ft.)  
 End of street segment elevation = 273.900(Ft.)  
 Length of street segment = 274.000(Ft.)

Height of curb above gutter flowline = 6.0(In.)  
 Width of half street (curb to crown) = 18.000(Ft.)  
 Distance from crown to crossfall grade break = 15.500(Ft.)  
 Slope from gutter to grade break (v/hz) = 0.020  
 Slope from grade break to crown (v/hz) = 0.020  
 Street flow is on [2] side(s) of the street  
 Distance from curb to property line = 5.000(Ft.)  
 Slope from curb to property line (v/hz) = 5.000  
 Gutter width = 2.500(Ft.)  
 Gutter hike from flowline = 2.000(In.)  
 Manning's N in gutter = 0.0150  
 Manning's N from gutter to grade break = 0.0150  
 Manning's N from grade break to crown = 0.0150  
 Estimated mean flow rate at midpoint of street = 23.785(CFS)  
 Depth of flow = 0.532(Ft.), Average velocity = 2.710(Ft/s)  
 Warning: depth of flow exceeds top of curb  
 Note: depth of flow exceeds top of street crown.  
 Distance that curb overflow reaches into property = 0.01(Ft.)  
 Streetflow hydraulics at midpoint of street travel:  
 Halfstreet flow width = 18.000(Ft.)  
 Flow velocity = 2.71(Ft/s)  
 Travel time = 1.69 min. TC = 18.00 min.  
 Adding area flow to street  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.689  
 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  
 Rainfall intensity = 3.216(In/Hr) for a 100.0 year storm  
 Subarea runoff = 2.283(CFS) for 1.030(Ac.)  
 Total runoff = 24.844(CFS) Total area = 10.520(Ac.)  
 Street flow at end of street = 24.844(CFS)  
 Half street flow at end of street = 12.422(CFS)  
 Depth of flow = 0.539(Ft.), Average velocity = 2.757(Ft/s)  
 Warning: depth of flow exceeds top of curb  
 Note: depth of flow exceeds top of street crown.  
 Distance that curb overflow reaches into property = 0.01(Ft.)  
 Flow width (from curb towards crown)= 18.000(Ft.)

+++++  
 Process from Point/Station 1020.000 to Point/Station 1025.000  
 \*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

The following data inside Main Stream is listed:  
 In Main Stream number: 2  
 Stream flow area = 10.520(Ac.)  
 Runoff from this stream = 24.844(CFS)  
 Time of concentration = 18.00 min.  
 Rainfall intensity = 3.216(In/Hr)  
 Summary of stream data:

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

1 19.341 20.90 2.950  
2 24.844 18.00 3.216

Largest stream flow has longer or shorter time of concentration

Qp = 24.844 + sum of  
Qa Tb/Ta  
19.341 \* 0.862 = 16.663  
Qp = 41.507

Total of 2 main streams to confluence:

Flow rates before confluence point:

19.341 24.844

Area of streams before confluence:

8.740 10.520

Results of confluence:

Total flow rate = 41.507 (CFS)

Time of concentration = 18.003 min.

Effective stream area after confluence = 19.260 (Ac.)

++++  
Process from Point/Station 1025.000 to Point/Station 1055.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 273.900 (Ft.)  
End of street segment elevation = 272.700 (Ft.)  
Length of street segment = 247.000 (Ft.)  
Height of curb above gutter flowline = 6.0 (In.)  
Width of half street (curb to crown) = 18.000 (Ft.)  
Distance from crown to crossfall grade break = 15.500 (Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000 (Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500 (Ft.)  
Gutter hike from flowline = 2.000 (In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 42.207 (CFS)  
Depth of flow = 0.638 (Ft.), Average velocity = 3.349 (Ft/s)  
Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.03 (Ft.)  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 18.000 (Ft.)  
Flow velocity = 3.35 (Ft/s)  
Travel time = 1.23 min. TC = 19.23 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.685  
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  
Rainfall intensity = 3.095(In/Hr) for a 100.0 year storm  
Subarea runoff = 1.378(CFS) for 0.650(Ac.)  
Total runoff = 42.885(CFS) Total area = 19.910(Ac.)  
Street flow at end of street = 42.885(CFS)  
Half street flow at end of street = 21.442(CFS)  
Depth of flow = 0.642(Ft.), Average velocity = 3.371(Ft/s)  
Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.03(Ft.)  
Flow width (from curb towards crown)= 18.000(Ft.)

++++  
Process from Point/Station 1025.000 to Point/Station 1055.000  
\*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

---

The following data inside Main Stream is listed:

In Main Stream number: 1  
Stream flow area = 19.910(Ac.)  
Runoff from this stream = 42.885(CFS)  
Time of concentration = 19.23 min.  
Rainfall intensity = 3.095(In/Hr)  
Program is now starting with Main Stream No. 2

++++  
Process from Point/Station 1030.000 to Point/Station 1040.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

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Initial area flow distance = 700.000(Ft.)  
Top (of initial area) elevation = 283.600(Ft.)  
Bottom (of initial area) elevation = 278.900(Ft.)  
Difference in elevation = 4.700(Ft.)  
Slope = 0.00671 s(percent)= 0.67  
TC =  $k(0.390)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 14.578 min.  
Rainfall intensity = 3.635(In/Hr) for a 100.0 year storm  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.703  
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 = 9.479(CFS)  
Total initial stream area = 3.710(Ac.)  
Pervious area fraction = 0.500

++++  
Process from Point/Station 1030.000 to Point/Station 1040.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

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Along Main Stream number: 2 in normal stream number 1  
 Stream flow area = 3.710(Ac.)  
 Runoff from this stream = 9.479(CFS)  
 Time of concentration = 14.58 min.  
 Rainfall intensity = 3.635(In/Hr)

+++++  
 Process from Point/Station 1035.000 to Point/Station 1040.000  
 \*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

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Initial area flow distance = 320.000(Ft.)  
 Top (of initial area) elevation = 281.300(Ft.)  
 Bottom (of initial area) elevation = 278.900(Ft.)  
 Difference in elevation = 2.400(Ft.)  
 Slope = 0.00750 s(percent) = 0.75  
 $TC = k(0.390) * [(length^3)/(elevation\ change)]^{0.2}$   
 Initial area time of concentration = 10.426 min.  
 Rainfall intensity = 4.415(In/Hr) for a 100.0 year storm  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.724  
 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 = 3.868(CFS)  
 Total initial stream area = 1.210(Ac.)  
 Pervious area fraction = 0.500

+++++  
 Process from Point/Station 1035.000 to Point/Station 1040.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

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Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 1.210(Ac.)  
 Runoff from this stream = 3.868(CFS)  
 Time of concentration = 10.43 min.  
 Rainfall intensity = 4.415(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	9.479	14.58	3.635
2	3.868	10.43	4.415

Largest stream flow has longer time of concentration  
 $Q_p = 9.479 + \text{sum of } Q_b \text{ Ia/Ib}$   
 $3.868 * 0.823 = 3.185$   
 $Q_p = 12.664$

Total of 2 streams to confluence:

Flow rates before confluence point:  
 9.479            3.868  
 Area of streams before confluence:  
 3.710            1.210  
 Results of confluence:  
 Total flow rate =    12.664(CFS)  
 Time of concentration =    14.578 min.  
 Effective stream area after confluence =    4.920(Ac.)

+++++  
 Process from Point/Station    1040.000 to Point/Station    1050.000  
 \*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

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Top of street segment elevation =    278.900(Ft.)  
 End of street segment elevation =    276.100(Ft.)  
 Length of street segment =    537.000(Ft.)  
 Height of curb above gutter flowline =    6.0(In.)  
 Width of half street (curb to crown) =    18.000(Ft.)  
 Distance from crown to crossfall grade break =    15.500(Ft.)  
 Slope from gutter to grade break (v/hz) =    0.020  
 Slope from grade break to crown (v/hz) =    0.020  
 Street flow is on [2] side(s) of the street  
 Distance from curb to property line =    5.000(Ft.)  
 Slope from curb to property line (v/hz) =    5.000  
 Gutter width =    2.500(Ft.)  
 Gutter hike from flowline =    2.000(In.)  
 Manning's N in gutter =    0.0150  
 Manning's N from gutter to grade break =    0.0150  
 Manning's N from grade break to crown =    0.0150  
 Estimated mean flow rate at midpoint of street =    16.332(CFS)  
 Depth of flow =    0.482(Ft.), Average velocity =    2.348(Ft/s)  
 Note: depth of flow exceeds top of street crown.  
 Streetflow hydraulics at midpoint of street travel:  
 Halfstreet flow width =    18.000(Ft.)  
 Flow velocity =    2.35(Ft/s)  
 Travel time =    3.81 min.    TC =    18.39 min.  
 Adding area flow to street  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.688  
 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  
 Rainfall intensity =    3.177(In/Hr) for a    100.0 year storm  
 Subarea runoff =    6.228(CFS) for    2.850(Ac.)  
 Total runoff =    18.892(CFS)    Total area =    7.770(Ac.)  
 Street flow at end of street =    18.892(CFS)  
 Half street flow at end of street =    9.446(CFS)  
 Depth of flow =    0.499(Ft.), Average velocity =    2.488(Ft/s)  
 Note: depth of flow exceeds top of street crown.  
 Flow width (from curb towards crown)=    18.000(Ft.)

+++++

Process from Point/Station 1040.000 to Point/Station 1050.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 1  
 Stream flow area = 7.770(Ac.)  
 Runoff from this stream = 18.892(CFS)  
 Time of concentration = 18.39 min.  
 Rainfall intensity = 3.177(In/Hr)

+++++  
 Process from Point/Station 1045.000 to Point/Station 1050.000  
 \*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

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Initial area flow distance = 710.000(Ft.)  
 Top (of initial area) elevation = 280.500(Ft.)  
 Bottom (of initial area) elevation = 276.100(Ft.)  
 Difference in elevation = 4.400(Ft.)  
 Slope = 0.00620 s(percent)= 0.62  
 $TC = k(0.390)*[(length^3)/(elevation\ change)]^{0.2}$   
 Initial area time of concentration = 14.898 min.  
 Rainfall intensity = 3.589(In/Hr) for a 100.0 year storm  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.701  
 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 = 7.730(CFS)  
 Total initial stream area = 3.070(Ac.)  
 Pervious area fraction = 0.500

+++++  
 Process from Point/Station 1045.000 to Point/Station 1050.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

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Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 3.070(Ac.)  
 Runoff from this stream = 7.730(CFS)  
 Time of concentration = 14.90 min.  
 Rainfall intensity = 3.589(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	18.892	18.39	3.177
2	7.730	14.90	3.589

Largest stream flow has longer time of concentration  
 $Q_p = 18.892 + \text{sum of } Q_b \text{ Ia/Ib}$   
 $7.730 * 0.885 = 6.842$   
 $Q_p = 25.733$



Total of 2 streams to confluence:  
 Flow rates before confluence point:  
     18.892          7.730  
 Area of streams before confluence:  
     7.770          3.070  
 Results of confluence:  
 Total flow rate =      25.733(CFS)  
 Time of concentration =    18.390 min.  
 Effective stream area after confluence =      10.840(Ac.)

+++++  
 Process from Point/Station      1050.000 to Point/Station      1055.000  
 \*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

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Top of street segment elevation =    276.100(Ft.)  
 End of street segment elevation =    272.700(Ft.)  
 Length of street segment =    710.000(Ft.)  
 Height of curb above gutter flowline =    6.0(In.)  
 Width of half street (curb to crown) =    18.000(Ft.)  
 Distance from crown to crossfall grade break =    15.500(Ft.)  
 Slope from gutter to grade break (v/hz) =    0.020  
 Slope from grade break to crown (v/hz) =    0.020  
 Street flow is on [2] side(s) of the street  
 Distance from curb to property line =    5.000(Ft.)  
 Slope from curb to property line (v/hz) =    5.000  
 Gutter width =    2.500(Ft.)  
 Gutter hike from flowline =    2.000(In.)  
 Manning's N in gutter =    0.0150  
 Manning's N from gutter to grade break =    0.0150  
 Manning's N from grade break to crown =    0.0150  
 Estimated mean flow rate at midpoint of street =      31.122(CFS)  
 Depth of flow =    0.581(Ft.), Average velocity =    2.956(Ft/s)  
 Warning: depth of flow exceeds top of curb  
 Note: depth of flow exceeds top of street crown.  
 Distance that curb overflow reaches into property =      0.02(Ft.)  
 Streetflow hydraulics at midpoint of street travel:  
 Halfstreet flow width =    18.000(Ft.)  
 Flow velocity =    2.96(Ft/s)  
 Travel time =    4.00 min.      TC =    22.39 min.  
 Adding area flow to street  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.675  
 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  
 Rainfall intensity =      2.834(In/Hr) for a    100.0 year storm  
 Subarea runoff =      8.685(CFS) for      4.540(Ac.)  
 Total runoff =      34.418(CFS)      Total area =      15.380(Ac.)  
 Street flow at end of street =      34.418(CFS)  
 Half street flow at end of street =      17.209(CFS)  
 Depth of flow =    0.599(Ft.), Average velocity =    3.076(Ft/s)  
 Warning: depth of flow exceeds top of curb

Note: depth of flow exceeds top of street crown.  
 Distance that curb overflow reaches into property = 0.02(Ft.)  
 Flow width (from curb towards crown)= 18.000(Ft.)

++++  
 Process from Point/Station 1050.000 to Point/Station 1055.000  
 \*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

The following data inside Main Stream is listed:

In Main Stream number: 2  
 Stream flow area = 15.380(Ac.)  
 Runoff from this stream = 34.418(CFS)  
 Time of concentration = 22.39 min.  
 Rainfall intensity = 2.834(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	42.885	19.23	3.095
2	34.418	22.39	2.834

Largest stream flow has longer or shorter time of concentration

Qp = 42.885 + sum of  
 Qa Tb/Ta  
 34.418 \* 0.859 = 29.559  
 Qp = 72.444

Total of 2 main streams to confluence:

Flow rates before confluence point:

42.885 34.418

Area of streams before confluence:

19.910 15.380

Results of confluence:

Total flow rate = 72.444(CFS)

Time of concentration = 19.232 min.

Effective stream area after confluence = 35.290(Ac.)

End of computations, total study area = 35.29 (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

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 1997 Version 5.0  
Rational Hydrology Study Date: 11/07/00 File:692010.out

-----  
ARTISAN COLLECTION  
10 YEAR - 1 HOUR STORM EVENT  
TKC JOB #40692

-----  
\*\*\*\*\* 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

Standard intensity-duration curves data (Plate D-4.1)

For the [ Cathedral City ] area used.

10 year storm 10 minute intensity = 2.770(In/Hr)

10 year storm 60 minute intensity = 0.980(In/Hr)

100 year storm 10 minute intensity = 4.520(In/Hr)

100 year storm 60 minute intensity = 1.600(In/Hr)

Storm event year = 10.0

Calculated rainfall intensity data:

1 hour intensity = 0.980(In/Hr)

Slope of intensity duration curve = 0.5800

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

Initial area flow distance = 880.000(Ft.)

Top (of initial area) elevation = 283.500(Ft.)

Bottom (of initial area) elevation = 277.500(Ft.)

Difference in elevation = 6.000(Ft.)

Slope = 0.00682 s(percent)= 0.68

TC = k(0.390)\*[(length^3)/(elevation change)]^0.2

Initial area time of concentration = 15.927 min.

Rainfall intensity = 2.115(In/Hr) for a 10.0 year storm

SINGLE FAMILY (1/4 Acre Lot)

Runoff Coefficient = 0.642

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 = 6.141(CFS)  
Total initial stream area = 4.520(Ac.)  
Pervious area fraction = 0.500

++++  
Process from Point/Station 1005.000 to Point/Station 1025.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 277.500(Ft.)  
End of street segment elevation = 273.900(Ft.)  
Length of street segment = 693.000(Ft.)  
Height of curb above gutter flowline = 6.0(In.)  
Width of half street (curb to crown) = 18.000(Ft.)  
Distance from crown to crossfall grade break = 15.500(Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000(Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500(Ft.)  
Gutter hike from flowline = 2.000(In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 9.007(CFS)  
Depth of flow = 0.406(Ft.), Average velocity = 2.018(Ft/s)  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 14.443(Ft.)  
Flow velocity = 2.02(Ft/s)  
Travel time = 5.72 min. TC = 21.65 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.623  
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  
Rainfall intensity = 1.770(In/Hr) for a 10.0 year storm  
Subarea runoff = 4.654(CFS) for 4.220(Ac.)  
Total runoff = 10.795(CFS) Total area = 8.740(Ac.)  
Street flow at end of street = 10.795(CFS)  
Half street flow at end of street = 5.397(CFS)  
Depth of flow = 0.428(Ft.), Average velocity = 2.107(Ft/s)  
Flow width (from curb towards crown)= 15.542(Ft.)

++++  
Process from Point/Station 1005.000 to Point/Station 1025.000  
\*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

---

The following data inside Main Stream is listed:

In Main Stream number: 1  
Stream flow area = 8.740(Ac.)  
Runoff from this stream = 10.795(CFS)  
Time of concentration = 21.65 min.  
Rainfall intensity = 1.770(In/Hr)  
Program is now starting with Main Stream No. 2

++++  
Process from Point/Station 1010.000 to Point/Station 1020.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 1000.000(Ft.)  
Top (of initial area) elevation = 283.100(Ft.)  
Bottom (of initial area) elevation = 275.300(Ft.)  
Difference in elevation = 7.800(Ft.)  
Slope = 0.00780 s(percent)= 0.78  
TC =  $k(0.390)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 16.317 min.  
Rainfall intensity = 2.086(In/Hr) for a 10.0 year storm  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.641  
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 = 7.323(CFS)  
Total initial stream area = 5.480(Ac.)  
Pervious area fraction = 0.500

++++  
Process from Point/Station 1010.000 to Point/Station 1020.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 1  
Stream flow area = 5.480(Ac.)  
Runoff from this stream = 7.323(CFS)  
Time of concentration = 16.32 min.  
Rainfall intensity = 2.086(In/Hr)

++++  
Process from Point/Station 1015.000 to Point/Station 1020.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 770.000(Ft.)  
Top (of initial area) elevation = 281.000(Ft.)  
Bottom (of initial area) elevation = 275.300(Ft.)  
Difference in elevation = 5.700(Ft.)  
Slope = 0.00740 s(percent)= 0.74  
TC =  $k(0.390)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 14.852 min.  
Rainfall intensity = 2.203(In/Hr) for a 10.0 year storm  
SINGLE FAMILY (1/4 Acre Lot)

Runoff Coefficient = 0.647  
 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 = 5.713(CFS)  
 Total initial stream area = 4.010(Ac.)  
 Pervious area fraction = 0.500

++++++  
 Process from Point/Station 1015.000 to Point/Station 1020.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 4.010(Ac.)  
 Runoff from this stream = 5.713(CFS)  
 Time of concentration = 14.85 min.  
 Rainfall intensity = 2.203(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	7.323	16.32	2.086
2	5.713	14.85	2.203

Largest stream flow has longer time of concentration  
 $Q_p = 7.323 + \text{sum of } Q_b \text{ Ia/Ib}$   
 $Q_p = 5.713 * 0.947 = 5.409$   
 $Q_p = 12.733$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 7.323 5.713  
 Area of streams before confluence:  
 5.480 4.010  
 Results of confluence:  
 Total flow rate = 12.733(CFS)  
 Time of concentration = 16.317 min.  
 Effective stream area after confluence = 9.490(Ac.)

++++++  
 Process from Point/Station 1020.000 to Point/Station 1025.000  
 \*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

Top of street segment elevation = 275.300(Ft.)  
 End of street segment elevation = 273.900(Ft.)  
 Length of street segment = 274.000(Ft.)  
 Height of curb above gutter flowline = 6.0(In.)  
 Width of half street (curb to crown) = 18.000(Ft.)  
 Distance from crown to crossfall grade break = 15.500(Ft.)  
 Slope from gutter to grade break (v/hz) = 0.020

Slope from grade break to crown (v/hz) = 0.020  
 Street flow is on [2] side(s) of the street  
 Distance from curb to property line = 5.000(Ft.)  
 Slope from curb to property line (v/hz) = 5.000  
 Gutter width = 2.500(Ft.)  
 Gutter hike from flowline = 2.000(In.)  
 Manning's N in gutter = 0.0150  
 Manning's N from gutter to grade break = 0.0150  
 Manning's N from grade break to crown = 0.0150  
 Estimated mean flow rate at midpoint of street = 13.424(CFS)  
 Depth of flow = 0.457(Ft.), Average velocity = 2.207(Ft/s)  
 Streetflow hydraulics at midpoint of street travel:  
 Halfstreet flow width = 17.016(Ft.)  
 Flow velocity = 2.21(Ft/s)  
 Travel time = 2.07 min. TC = 18.39 min.  
 Adding area flow to street  
 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  
 Rainfall intensity = 1.946(In/Hr) for a 10.0 year storm  
 Subarea runoff = 1.269(CFS) for 1.030(Ac.)  
 Total runoff = 14.002(CFS) Total area = 10.520(Ac.)  
 Street flow at end of street = 14.002(CFS)  
 Half street flow at end of street = 7.001(CFS)  
 Depth of flow = 0.463(Ft.), Average velocity = 2.229(Ft/s)  
 Flow width (from curb towards crown)= 17.304(Ft.)

++++++  
 Process from Point/Station 1020.000 to Point/Station 1025.000  
 \*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

The following data inside Main Stream is listed:

In Main Stream number: 2  
 Stream flow area = 10.520(Ac.)  
 Runoff from this stream = 14.002(CFS)  
 Time of concentration = 18.39 min.  
 Rainfall intensity = 1.946(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	10.795	21.65	1.770
2	14.002	18.39	1.946

Largest stream flow has longer or shorter time of concentration  
 $Q_p = 14.002 + \text{sum of } Q_a \cdot T_b/T_a$   
 $Q_p = 10.795 * 0.849 = 9.167$   
 $Q_p = 23.169$

Total of 2 main streams to confluence:

Flow rates before confluence point:

10.795 14.002

Area of streams before confluence:

8.740 10.520

Results of confluence:

Total flow rate = 23.169(CFS)

Time of concentration = 18.387 min.

Effective stream area after confluence = 19.260(Ac.)

\*\*\*\*\*  
Process from Point/Station 1025.000 to Point/Station 1055.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 273.900(Ft.)  
End of street segment elevation = 272.700(Ft.)  
Length of street segment = 247.000(Ft.)  
Height of curb above gutter flowline = 6.0(In.)  
Width of half street (curb to crown) = 18.000(Ft.)  
Distance from crown to crossfall grade break = 15.500(Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000(Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500(Ft.)  
Gutter hike from flowline = 2.000(In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 23.560(CFS)  
Depth of flow = 0.535(Ft.), Average velocity = 2.659(Ft/s)  
Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.01(Ft.)  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 18.000(Ft.)  
Flow velocity = 2.66(Ft/s)  
Travel time = 1.55 min. TC = 19.93 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.628  
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  
Rainfall intensity = 1.857(In/Hr) for a 10.0 year storm  
Subarea runoff = 0.758(CFS) for 0.650(Ac.)  
Total runoff = 23.927(CFS) Total area = 19.910(Ac.)  
Street flow at end of street = 23.927(CFS)  
Half street flow at end of street = 11.964(CFS)  
Depth of flow = 0.537(Ft.), Average velocity = 2.675(Ft/s)



Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.01(Ft.)  
Flow width (from curb towards crown)= 18.000(Ft.)

++++  
Process from Point/Station 1025.000 to Point/Station 1055.000  
\*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

---

The following data inside Main Stream is listed:

In Main Stream number: 1  
Stream flow area = 19.910(Ac.)  
Runoff from this stream = 23.927(CFS)  
Time of concentration = 19.93 min.  
Rainfall intensity = 1.857(In/Hr)  
Program is now starting with Main Stream No. 2

++++  
Process from Point/Station 1030.000 to Point/Station 1040.000  
\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 700.000(Ft.)  
Top (of initial area) elevation = 283.600(Ft.)  
Bottom (of initial area) elevation = 278.900(Ft.)  
Difference in elevation = 4.700(Ft.)  
Slope = 0.00671 s(percent)= 0.67  
TC =  $k(0.390)*[(\text{length}^3)/(\text{elevation change})]^{0.2}$   
Initial area time of concentration = 14.578 min.  
Rainfall intensity = 2.226(In/Hr) for a 10.0 year storm  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.648  
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 = 5.353(CFS)  
Total initial stream area = 3.710(Ac.)  
Pervious area fraction = 0.500

++++  
Process from Point/Station 1030.000 to Point/Station 1040.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 1  
Stream flow area = 3.710(Ac.)  
Runoff from this stream = 5.353(CFS)  
Time of concentration = 14.58 min.  
Rainfall intensity = 2.226(In/Hr)

++++  
Process from Point/Station 1035.000 to Point/Station 1040.000

\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 320.000(Ft.)  
 Top (of initial area) elevation = 281.300(Ft.)  
 Bottom (of initial area) elevation = 278.900(Ft.)  
 Difference in elevation = 2.400(Ft.)  
 Slope = 0.00750 s(percent)= 0.75  
 $TC = k(0.390)*[(length^3)/(elevation\ change)]^{0.2}$   
 Initial area time of concentration = 10.426 min.  
 Rainfall intensity = 2.704(In/Hr) for a 10.0 year storm  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.670  
 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 = 2.192(CFS)  
 Total initial stream area = 1.210(Ac.)  
 Pervious area fraction = 0.500

+++++  
 Process from Point/Station 1035.000 to Point/Station 1040.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 1.210(Ac.)  
 Runoff from this stream = 2.192(CFS)  
 Time of concentration = 10.43 min.  
 Rainfall intensity = 2.704(In/Hr)  
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	5.353	14.58	2.226
2	2.192	10.43	2.704

Largest stream flow has longer time of concentration

Qp = 5.353 + sum of  
 $Qb \cdot \frac{Ia}{Ib}$   
 $2.192 * 0.823 = 1.804$   
 Qp = 7.157

Total of 2 streams to confluence:

Flow rates before confluence point:

5.353          2.192

Area of streams before confluence:

3.710          1.210

Results of confluence:

Total flow rate = 7.157(CFS)

Time of concentration = 14.578 min.

Effective stream area after confluence = 4.920(Ac.)

+++++  
Process from Point/Station 1040.000 to Point/Station 1050.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 278.900(Ft.)  
End of street segment elevation = 276.100(Ft.)  
Length of street segment = 537.000(Ft.)  
Height of curb above gutter flowline = 6.0(In.)  
Width of half street (curb to crown) = 18.000(Ft.)  
Distance from crown to crossfall grade break = 15.500(Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000(Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500(Ft.)  
Gutter hike from flowline = 2.000(In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 9.230(CFS)  
Depth of flow = 0.408(Ft.), Average velocity = 2.032(Ft/s)  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 14.576(Ft.)  
Flow velocity = 2.03(Ft/s)  
Travel time = 4.40 min. TC = 18.98 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.631  
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  
Rainfall intensity = 1.910(In/Hr) for a 10.0 year storm  
Subarea runoff = 3.437(CFS) for 2.850(Ac.)  
Total runoff = 10.594(CFS) Total area = 7.770(Ac.)  
Street flow at end of street = 10.594(CFS)  
Half street flow at end of street = 5.297(CFS)  
Depth of flow = 0.425(Ft.), Average velocity = 2.101(Ft/s)  
Flow width (from curb towards crown)= 15.413(Ft.)

+++++  
Process from Point/Station 1040.000 to Point/Station 1050.000  
\*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 1  
Stream flow area = 7.770(Ac.)  
Runoff from this stream = 10.594(CFS)  
Time of concentration = 18.98 min.  
Rainfall intensity = 1.910(In/Hr)

+++++  
Process from Point/Station 1045.000 to Point/Station 1050.000

\*\*\*\* INITIAL AREA EVALUATION \*\*\*\*

---

Initial area flow distance = 710.000(Ft.)  
 Top (of initial area) elevation = 280.500(Ft.)  
 Bottom (of initial area) elevation = 276.100(Ft.)  
 Difference in elevation = 4.400(Ft.)  
 Slope = 0.00620 s(percent)= 0.62  
 $TC = k(0.390)*[(length^3)/(elevation\ change)]^{0.2}$   
 Initial area time of concentration = 14.898 min.  
 Rainfall intensity = 2.199(In/Hr) for a 10.0 year storm  
 SINGLE FAMILY (1/4 Acre Lot)  
 Runoff Coefficient = 0.647  
 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 = 4.364(CFS)  
 Total initial stream area = 3.070(Ac.)  
 Pervious area fraction = 0.500

+++++  
 Process from Point/Station 1045.000 to Point/Station 1050.000  
 \*\*\*\* CONFLUENCE OF MINOR STREAMS \*\*\*\*

---

Along Main Stream number: 2 in normal stream number 2  
 Stream flow area = 3.070(Ac.)  
 Runoff from this stream = 4.364(CFS)  
 Time of concentration = 14.90 min.  
 Rainfall intensity = 2.199(In/Hr)  
 Summary of stream data:

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

1	10.594	18.98	1.910
2	4.364	14.90	2.199

Largest stream flow has longer time of concentration  
 $Q_p = 10.594 + \text{sum of } Q_b \cdot \frac{I_a}{I_b}$   
 $4.364 * 0.869 = 3.792$   
 $Q_p = 14.386$

Total of 2 streams to confluence:  
 Flow rates before confluence point:  
 10.594      4.364  
 Area of streams before confluence:  
 7.770      3.070  
 Results of confluence:  
 Total flow rate = 14.386(CFS)  
 Time of concentration = 18.982 min.  
 Effective stream area after confluence = 10.840(Ac.)

+++++  
Process from Point/Station 1050.000 to Point/Station 1055.000  
\*\*\*\* STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION \*\*\*\*

---

Top of street segment elevation = 276.100(Ft.)  
End of street segment elevation = 272.700(Ft.)  
Length of street segment = 710.000(Ft.)  
Height of curb above gutter flowline = 6.0(In.)  
Width of half street (curb to crown) = 18.000(Ft.)  
Distance from crown to crossfall grade break = 15.500(Ft.)  
Slope from gutter to grade break (v/hz) = 0.020  
Slope from grade break to crown (v/hz) = 0.020  
Street flow is on [2] side(s) of the street  
Distance from curb to property line = 5.000(Ft.)  
Slope from curb to property line (v/hz) = 5.000  
Gutter width = 2.500(Ft.)  
Gutter hike from flowline = 2.000(In.)  
Manning's N in gutter = 0.0150  
Manning's N from gutter to grade break = 0.0150  
Manning's N from grade break to crown = 0.0150  
Estimated mean flow rate at midpoint of street = 17.398(CFS)  
Depth of flow = 0.494(Ft.), Average velocity = 2.347(Ft/s)  
Note: depth of flow exceeds top of street crown.  
Streetflow hydraulics at midpoint of street travel:  
Halfstreet flow width = 18.000(Ft.)  
Flow velocity = 2.35(Ft/s)  
Travel time = 5.04 min. TC = 24.02 min.  
Adding area flow to street  
SINGLE FAMILY (1/4 Acre Lot)  
Runoff Coefficient = 0.617  
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  
Rainfall intensity = 1.666(In/Hr) for a 10.0 year storm  
Subarea runoff = 4.665(CFS) for 4.540(Ac.)  
Total runoff = 19.051(CFS) Total area = 15.380(Ac.)  
Street flow at end of street = 19.051(CFS)  
Half street flow at end of street = 9.526(CFS)  
Depth of flow = 0.506(Ft.), Average velocity = 2.433(Ft/s)  
Warning: depth of flow exceeds top of curb  
Note: depth of flow exceeds top of street crown.  
Distance that curb overflow reaches into property = 0.00(Ft.)  
Flow width (from curb towards crown)= 18.000(Ft.)

+++++  
Process from Point/Station 1050.000 to Point/Station 1055.000  
\*\*\*\* CONFLUENCE OF MAIN STREAMS \*\*\*\*

---

The following data inside Main Stream is listed:  
In Main Stream number: 2  
Stream flow area = 15.380(Ac.)  
Runoff from this stream = 19.051(CFS)  
Time of concentration = 24.02 min.

Rainfall intensity = 1.666(In/Hr)  
Summary of stream data:

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

1	23.927	19.93	1.857
2	19.051	24.02	1.666

Largest stream flow has longer or shorter time of concentration

$Q_p = 23.927 + \text{sum of}$   
 $Q_a \quad T_b/T_a$   
 $19.051 * \quad 0.830 = \quad 15.809$   
 $Q_p = \quad 39.736$

Total of 2 main streams to confluence:

Flow rates before confluence point:

23.927      19.051

Area of streams before confluence:

19.910      15.380

Results of confluence:

Total flow rate = 39.736(CFS)

Time of concentration = 19.935 min.

Effective stream area after confluence = 35.290(Ac.)

End of computations, total study area = 35.29 (Ac.)

The following figures may

be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction( $A_p$ ) = 0.500

Area averaged RI index number = 32.0

# **STORM DRAIN SYSTEM CALCULATIONS**

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

CATCH BASIN SIZING (SUMP CONDITION)  
 PROJECT ARTISAN COLLECTION  
 TRACT/PARCEL TR 26771  
 TKC JOB # 40692

CATCH BASIN # CB1/2

Curb inlets (in a sump condition) operate as weirs to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height.

These worksheets are based on the following design parameters:

1. Catch basin is assumed to be per Riverside County Std No 300 or RCFCD Std CB100 (i.e. The catch basin has an inclined throat)
2. Curb face is either 6" or 8" Curb and Gutter

KNOWN:	Q=	72.44 cfs
	Divided Flow	Y
	Flow to Catch Basin	36.22 cfs
	SI=	0.0004 ft/ft
	Sx=	0.02 ft/ft
	n=	0.015
	W=	4 ft
	a=	4 in
	Curb Type	6 in

RESULTS:	LENGTH OF CATCH BASIN	14 ft
	WEIR OR ORIFICE FLOW	ORIFICE
	FLOW INTERCEPTED	36.22 cfs
	FLOW CARRYOVER	0.00 cfs
	DEPTH AT CURB	1.30 ft
	SPREAD	48.25 ft
	ASSUMED Qs	26.94 cfs
	CALCULATED Qs	26.95 cfs



CATCH BASIN SIZING (SUMP CONDITION)  
 PROJECT ARTISAN COLLECTION  
 TRACT/PARCEL TR 26771  
 TKC JOB # 40692  
 CATCH BASIN # CB1/2

Depth Calculations:

GIVEN: Q= 36.22 cfs  
 S<sub>I</sub>= 0.0004 ft/ft  
 S<sub>x</sub>= 0.02 ft/ft  
 n= 0.015  
 W= 4 ft  
 a= 4 in  
 K<sub>c</sub>= 0.56  
  
 S<sub>w</sub>= 0.103  
  
 S<sub>w</sub>/S<sub>x</sub> 5.17

ASSUME Q<sub>s</sub>= 26.9430 cfs

Q<sub>w</sub>= 9.277  
 E<sub>o</sub>= 0.26  
 T= 48.25  
 T<sub>s</sub>= 44.25

Determine Q<sub>s</sub> for computed T Q<sub>s</sub>= 26.9459 cfs  
 Should be approximately equal to assumed Q<sub>s</sub>

Compute d d= 1.30 ft

$$(1) Q = \frac{K_c}{n} S_x^{5/3} S_L^{1/2} T^{8/3}$$

$$(2) E_o = \frac{Q_w}{Q}$$

$$(3) Q_w = Q - Q_s$$

$$(4) T = W \left[ \frac{S_w/S_x}{\left[ \frac{S_w/S_x}{1} + 1 \right]^{3/8} - 1} + 1 \right]$$

$$(5) S_w = S_x + \frac{a/12}{W}$$

$$(6) d = T S_x + \frac{a}{12}$$

CATCH BASIN SIZING (SUMP CONDITION)

PROJECT ARTISAN COLLECTION  
 TRACT/PARCEL TR 26771  
 TKC JOB # 40692  
 CATCH BASIN # CB1/2

GIVEN:

TOTAL DISCHARGE 72.44 cfs  
 DIVIDED FLOW Y  
 FLOW TO CATCH BASIN 36.22 cfs  
 CURB TYPE 6 in  
 h= 0.67 ft  
 W= 4 ft

Determine if d<h:  
 d= 1.30 ft  
 h= 0.67 ft

EQUATIONS USED (WEIR FLOW):

(1) For heads up to the height of the opening the inlet is assumed to act as a weir with the flow passing through critical depth at the entrance following

$$L_t = \frac{Q_i}{C_w d^{1.5}}$$

WHERE: Q<sub>i</sub>= Total flow intercepted, (cfs)  
 d= depth at curb measured from the normal cross slope, (ft)  
 C<sub>w</sub>= Weir Coefficient=3.0

EQUATIONS USED (ORIFICE FLOW):

d>1.4h

(2) Orifice Equation for curb opening inlets with other than vertical faces.

$$L_t = \frac{Q_i}{C_o h (2gd_o)^{0.5}}$$

WHERE: Q<sub>i</sub>= Total flow intercepted, (cfs)  
 C<sub>o</sub>= Orifice coefficient=0.67  
 h= Orifice throat width, (ft)  
 d<sub>o</sub>= Effective head on the center of the orifice throat, (ft)

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

WHERE:

d<sub>i</sub>= Depth at lip of curb opening, (ft)

	CURB FACE	
	6"	8"
h=	0.61	0.79
d <sub>i</sub> =	1.30	1.30
θ	66	66
d <sub>o</sub> =	1.02	0.94

DETERMINE LENGTH REQUIRED TO INTERCEPT FLOW:

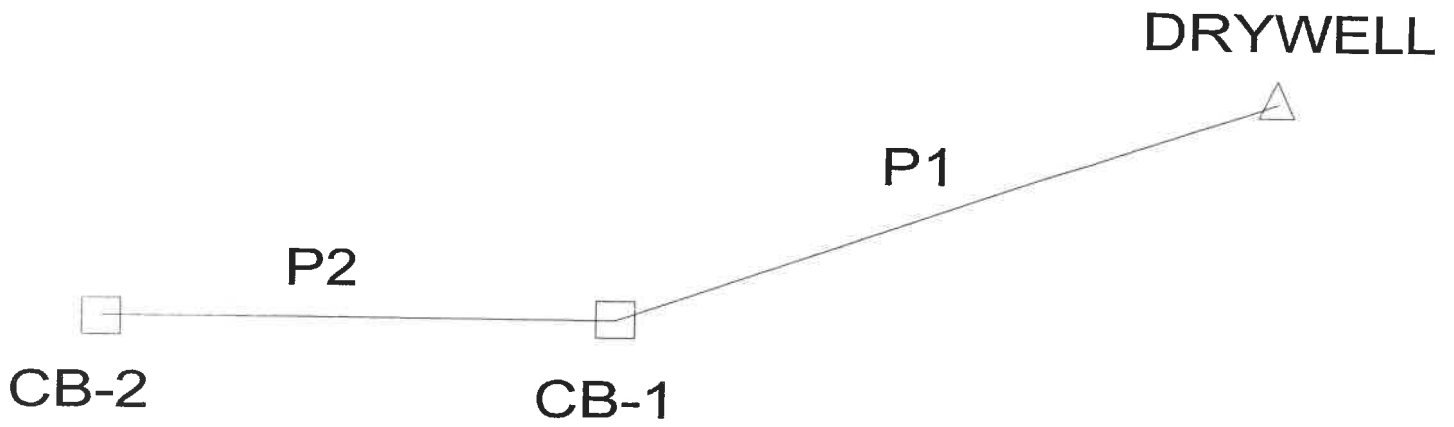
L<sub>t</sub>= 11 ft

LENGTH OF CATCH BASIN

L= 14 ft

DETERMINE FLOW INTERCEPTED

Q<sub>max</sub>= 46.37 cfs  
 Q<sub>int</sub>= 36.22 cfs  
 Q<sub>c</sub>= 0.00 cfs



----- Beginning Calculation Cycle -----

Discharge: 36.22 cfs at node CB-2  
 Discharge: 72.47 cfs at node CB-1  
 Discharge: 72.25 cfs at node DRYWELL  
 Beginning iteration 1  
 Discharge: 36.22 cfs at node CB-2  
 Discharge: 72.38 cfs at node CB-1  
 Discharge: 72.16 cfs at node DRYWELL  
 Completed iteration 1  
 Current discharge convergence relative error: 0.12992801e-2  
 Target discharge convergence relative error: 0.001  
 Beginning iteration 2  
 Discharge: 36.22 cfs at node CB-2  
 Discharge: 72.38 cfs at node CB-1  
 Discharge: 72.16 cfs at node DRYWELL  
 Discharge Convergence Achieved in 2 iterations: relative error: 0.0  
 Information: P1 Surcharged condition  
 Information: P2 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 -----

Label	Length	Size	Discharge	Hydraulic Grade	
				Upstream	Downstream
P2	57.32	30 inch	36.22	272.71	272.39
P1	30.00	48 inch	72.38	272.13	272.08

Label	Discharge	Elevations		
		Ground	Upstream HGL	Downstream HGL
CB-2	36.22	275.00	273.14	272.71
CB-1	72.38	275.00	272.39	272.13
DRYWELL	72.16	267.00	272.08	272.08

Elapsed: 0 minute(s) 0 second(s)

# INLETS

Node	Inlet Area (acres)	Inlet C	Inlet TC (min)	Inlet Intensity (in/hr)	Inlet Discharge (cfs)	Structure Discharge (cfs)	System Intensity (in/hr)	Ground Elevation (ft)	Sump Elevation (ft)	HGL In (ft)	HGL Out (ft)	System Flow Time (min)
CB-2	17.65	0.66	19.23	3.08	36.22	36.22	3.08	275.00	264.50	273.14	272.71	19.23
CB-1	17.65	0.67	19.23	3.08	36.50	72.38	3.07	275.00	263.25	272.39	272.13	19.36
DRYWELL	N/A	N/A	N/A	N/A	N/A	72.16	3.06	267.00	261.00	272.08	272.08	19.45

# PIPES

Node	Pipe	Q (cfs)	Cap (cfs)	Length (ft)	Section Material	Size	Number Sections	Roughness (ft/ft)	S (ft/ft)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	Up HGL (ft)	Dn HGL (ft)	Sys Flow Time (min)
CB-2	P2	36.22	68.66	57.32	PVC	30 inch	1	0.011	0.0201	7.38	264.50	263.35	272.71	272.39	19.23
CB-1	P1	72.38	450.19	30.00	PVC	48 inch	1	0.011	0.0703	5.76	263.25	261.14	272.13	272.08	19.36

TYPE IX INLET



Outlet

P-3

```

----- Beginning Calculation Cycle -----
Discharge: 3.80 cfs at node TYPE IX INLET
Discharge: 3.80 cfs at node Outlet
Beginning iteration 1
Discharge: 3.80 cfs at node TYPE IX INLET
Discharge: 3.80 cfs at node Outlet
Discharge Convergence Achieved in 1 iterations: relative error: 0.0
Warning: No Duration data exists in IDF Table
Information: Outlet Known flow propagated from upstream junctions.
----- 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 -----

```

Label	Length	Size	Discharge	Hydraulic Grade	
				Upstream	Downstream
P-3	96.77	12 inch	3.80	264.76	260.90

Label	Discharge	Elevations		
		Ground	Upstream HGL	Downstream HGL
TYPE IX I	3.80	267.00	264.99	264.76
Outlet	3.80	264.00	260.75	260.75

Elapsed: 0 minute(s) 0 second(s)



## Detailed Report for Pipe P-3

Section Material: Concrete  
 Section Shape: Circular  
 Section Size: 12 inch  
 Number Sections: 1

Description	Description
Discharge	3.80 cfs
Mannings Coefficient	0.013
Length	96.77 ft
Constructed Slope	0.036788 ft/ft
Upstream Flow Time	0.00 min
Pipe Flow Time	0.22 min
System Flow Time	0.22 min
Capacity	6.83 cfs
Hydraulic Drop	3.86 ft
Energy Slope	0.031826 ft/ft
Upstream Velocity	5.46 ft/s
Average Velocity	7.19 ft/s
Downstream Velocity	8.93 ft/s

### Grade Elevations

Location	Invert (ft)	Ground (ft)	Crown (ft)	Cover (ft)	Depth (ft)	HGL (ft)	EGL (ft)
Upstream	263.93	267.00	264.93	2.07	0.83	264.76	265.22
Downstream	260.37	264.00	261.37	2.63	0.53	260.90	262.14

### Messages:

Profile: Steep supercritical frontwater profile (S2).  
 Profile: Critical depth assumed upstream.  
 Profile: Normal depth achieved downstream.

ARTISAN COLLECTION

JOB #: 40692  
 100 YEAR - 1 HOUR STORM  
 RETENTION BASIN - 'B'

November 7, 2000

DATA INPUT

TRIANGULAR HYDROGRAPH

FLOW 72.44  
 Tc 19.23  
 T (max) 57.69  
 m1 0.06278384 0.03139192  
 m2 -0.0313919 -0.015696  
 y-int 108.66

PERCOLATION RATE

1 in/hr

8.63 cf/min

DRYWELLS

# cfs  
 1 0.35 0.35 cfs  
 21.00 cf/min

TOTAL PERCOLATION RATE

(PER UNIT TIME PERIOD) cf/min = 29.63

TOTAL AREA 35.29  
 Ap 0.5  
 RI 32

PIPE SIZE 12 in

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
267	0	0		6211	0	0	0.0
268	1	1	952	7163	6687	6687	0.2
269	1	2	1008	8171	7667	14354	0.3
270	1	3	1065	9236	8704	23058	0.5
271	1	4	1122	10358	9797	32855	0.8
272	1	5	1178	11536	10947	43802	1.0
273	1	6	12412	23948	17742	61544	1.4
275	2	8	59913	83861	107809	169353	3.9

MAXIMUM WATER SURFACE ELEVATION 273.98 ft

MAXIMUM WATER SURFACE DEPTH 6.98 ft

LOWEST ADJACENT PAD ELEVATION 275.3 ft

DIFFERENCE 1.32 ft

ARTISAN COLLECTION  
 JOB #: 40692  
 100 YEAR - 1 HOUR STORM  
 RETENTION BASIN - 'B'  
 November 7, 2000

TIME (min)		FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN DEPTH (ft)	PIPE FLOW OUT VOL OUT (cfs) (cuft)		BALANCE IN BASIN (cuft) (acre-ft)	
0	1	3.77	226	226	30	196	267.03	0.02	1	195	0.00
1	2	7.53	452	647	30	618	267.09	0.05	3	615	0.01
2	3	11.30	678	1293	30	1263	267.19	0.11	7	1256	0.03
3	4	15.07	904	2160	30	2131	267.32	0.19	11	2120	0.05
4	5	18.84	1130	3250	30	3220	267.48	0.28	17	3203	0.07
5	6	22.60	1356	4559	30	4530	267.68	0.40	24	4506	0.10
6	7	26.37	1582	6088	30	6058	267.91	0.53	32	6027	0.14
7	8	30.14	1808	7835	30	7805	268.15	0.67	40	7765	0.18
8	9	33.90	2034	9799	30	9770	268.40	0.82	49	9720	0.22
9	10	37.67	2260	11981	30	11951	268.69	0.99	59	11892	0.27
10	11	41.44	2486	14378	30	14348	269.00	1.17	70	14278	0.33
11	12	45.20	2712	16990	30	16961	269.30	1.35	81	16880	0.39
12	13	48.97	2938	19818	30	19788	269.62	1.54	93	19696	0.45
13	14	52.74	3164	22860	30	22830	269.97	1.75	105	22725	0.52
14	15	56.51	3390	26116	30	26086	270.31	1.95	117	25969	0.60
15	16	60.27	3616	29585	30	29556	270.66	2.14	129	29427	0.68
16	17	64.04	3842	33269	30	33240	271.40	2.54	152	33087	0.76
17	18	67.81	4068	37156	30	37126	271.62	2.65	159	36967	0.85
18	19	71.57	4294	41261	30	41232	271.86	2.78	167	41065	0.94
19	20	70.99	4259	45325	30	45295	272.08	2.90	174	45121	1.04
20	21	69.11	4146	49268	30	49238	272.31	3.01	181	49057	1.13
21	22	67.22	4033	53091	30	53061	272.52	3.11	187	52874	1.21
22	23	65.34	3920	56794	30	56765	272.73	3.21	193	56572	1.30
23	24	63.46	3807	60379	30	60350	272.93	3.31	198	60151	1.38
24	25	61.57	3694	63846	30	63816	273.04	3.36	202	63614	1.46
25	26	59.69	3581	67196	30	67166	273.10	3.39	203	66963	1.54
26	27	57.81	3468	70431	30	70402	273.16	3.42	205	70196	1.61
27	28	55.92	3355	73552	30	73522	273.22	3.44	207	73315	1.68
28	29	54.04	3242	76558	30	76528	273.28	3.47	208	76320	1.75
29	30	52.15	3129	79449	30	79420	273.33	3.50	210	79210	1.82
30	31	50.27	3016	82226	30	82196	273.38	3.52	211	81985	1.88
31	32	48.39	2903	84888	30	84859	273.43	3.54	213	84646	1.94
32	33	46.50	2790	87436	30	87407	273.48	3.57	214	87193	2.00
33	34	44.62	2677	89870	30	89840	273.52	3.59	215	89625	2.06
34	35	42.74	2564	92189	30	92160	273.57	3.61	216	91943	2.11
35	36	40.85	2451	94395	30	94365	273.61	3.63	218	94147	2.16
36	37	38.97	2338	96486	30	96456	273.65	3.65	219	96237	2.21
37	38	37.09	2225	98462	30	98433	273.68	3.66	220	98213	2.25
38	39	35.20	2112	100325	30	100296	273.72	3.68	221	100075	2.30
39	40	33.32	1999	102074	30	102044	273.75	3.69	222	101823	2.34
40	41	31.44	1886	103709	30	103679	273.78	3.71	223	103457	2.38
41	42	29.55	1773	105230	30	105200	273.81	3.72	223	104977	2.41
42	43	27.67	1660	106637	30	106607	273.84	3.73	224	106383	2.44
43	44	25.79	1547	107931	30	107901	273.86	3.75	225	107676	2.47
44	45	23.90	1434	109110	30	109081	273.88	3.76	225	108855	2.50
45	46	22.02	1321	110176	30	110147	273.90	3.76	226	109921	2.52
46	47	20.13	1208	111129	30	111099	273.92	3.77	226	110873	2.55
47	48	18.25	1095	111968	30	111938	273.93	3.78	227	111712	2.56
48	49	16.37	982	112694	30	112664	273.95	3.79	227	112437	2.58
49	50	14.48	869	113306	30	113276	273.96	3.79	228	113049	2.60
50	51	12.60	756	113805	30	113775	273.97	3.80	228	113547	2.61
51	52	10.72	643	114190	30	114161	273.98	3.80	228	113933	2.62
52	53	8.83	530	114463	30	114433	273.98	3.80	228	114205	2.62
53	54	6.95	417	114622	30	114592	273.98	3.80	228	114364	2.63
54	55	5.07	304	114668	30	114639	273.98	3.80	228	114410	2.63
55	56	3.18	191	114601	30	114572	273.98	3.80	228	114343	2.62
56	57	1.30	78	114421	30	114392	273.98	3.80	228	114164	2.62
57	57.69	0.00	0	114164	30	114134	273.98	3.80	228	113906	2.61

ARTISAN COLLECTION

JOB #: 40692  
 10 YEAR - 1 HOUR STORM  
 RETENTION BASIN - 'B'

November 7, 2000

DATA INPUT

TRIANGULAR HYDROGRAPH

PERCOLATION RATE

1 in/hr

FLOW 39.74

Tc 19.94

8.63 cf/min

T (max) 59.82

m1 0.03321632 0.01660816

m2 -0.0166082 -0.0083041

y-int 59.61

DRYWELLS

# cfs

1 0.35

0.35 cfs

VOL 71317.404

21.00 cf/min

TOTAL AREA 35.29

Ap 0.5

RI 32

TOTAL PERCOLATION RATE

(PER UNIT TIME PERIOD) cf/min =

29.63

PIPE SIZE

12 in

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	TOTAL (acre-ft)
267	0	0		6211	0	0	0.0
268	1	1	952	7163	6687	6687	0.2
269	1	2	1008	8171	7667	14354	0.3
270	1	3	1065	9236	8704	23058	0.5
271	1	4	1122	10358	9797	32855	0.8
272	1	5	1178	11536	10947	43802	1.0
273	1	6	12412	23948	17742	61544	1.4
275	2	8	59913	83861	107809	169353	3.9

MAXIMUM WATER SURFACE ELEVATION

273.01 ft

MAXIMUM WATER SURFACE DEPTH

6.01 ft

LOWEST ADJACENT PAD ELEVATION

275.3 ft

DIFFERENCE

2.29 ft

ARTISAN COLLECTION  
 JOB #: 40692  
 10 YEAR - 1 HOUR STORM  
 RETENTION BASIN - 'B'  
 November 7, 2000

TIME		FLOW IN	VOLUME IN	TOTAL IN	PERC	TOTAL IN	BASIN	PIPE		BALANCE	
(min)		(cfs)	(cuft)	BASIN	OUT	BASIN	DEPTH	FLOW OUT	VOL OUT	IN BASIN	(acre-ft)
				(cuft)	(cuft)	(cuft)	(ft)	(cfs)	(cuft)	(cuft)	
0	1	1.99	120	120	30	90	267.01	0.01	0	89	0.00
1	2	3.99	239	329	30	299	267.04	0.03	2	297	0.01
2	3	5.98	359	656	30	627	267.09	0.05	3	623	0.01
3	4	7.97	478	1102	30	1072	267.16	0.09	6	1066	0.02
4	5	9.96	598	1664	30	1635	267.24	0.14	9	1626	0.04
5	6	11.96	717	2343	30	2314	267.35	0.20	12	2302	0.05
6	7	13.95	837	3139	30	3109	267.46	0.27	16	3093	0.07
7	8	15.94	957	4049	30	4020	267.60	0.35	21	3999	0.09
8	9	17.94	1076	5075	30	5045	267.75	0.44	26	5019	0.12
9	10	19.93	1196	6215	30	6185	267.92	0.54	32	6153	0.14
10	11	21.92	1315	7468	30	7438	268.10	0.64	39	7400	0.17
11	12	23.92	1435	8835	30	8805	268.28	0.75	45	8760	0.20
12	13	25.91	1555	10315	30	10285	268.47	0.86	52	10234	0.23
13	14	27.90	1674	11908	30	11878	268.68	0.98	59	11819	0.27
14	15	29.89	1794	13613	30	13583	268.90	1.11	67	13517	0.31
15	16	31.89	1913	15430	30	15400	269.12	1.24	75	15326	0.35
16	17	33.88	2033	17358	30	17329	269.34	1.38	83	17246	0.40
17	18	35.87	2152	19399	30	19369	269.58	1.52	91	19278	0.44
18	19	37.87	2272	21550	30	21520	269.82	1.66	100	21421	0.49
19	20	39.68	2381	23801	30	23772	270.07	1.81	109	23663	0.54
20	21	38.68	2321	25984	30	25955	270.30	1.94	117	25838	0.59
21	22	37.69	2261	28099	30	28070	270.51	2.06	124	27946	0.64
22	23	36.69	2201	30147	30	30118	270.72	2.17	130	29987	0.69
23	24	35.69	2142	32129	30	32099	270.92	2.28	137	31962	0.73
24	25	34.70	2082	34044	30	34014	271.45	2.56	154	33861	0.78
25	26	33.70	2022	35883	30	35853	271.55	2.61	157	35696	0.82
26	27	32.70	1962	37659	30	37629	271.65	2.67	160	37469	0.86
27	28	31.71	1902	39371	30	39342	271.75	2.72	163	39179	0.90
28	29	30.71	1843	41021	30	40992	271.84	2.77	166	40826	0.94
29	30	29.72	1783	42609	30	42579	271.93	2.82	169	42410	0.97
30	31	28.72	1723	44133	30	44104	272.02	2.86	172	43932	1.01
31	32	27.72	1663	45595	30	45566	272.10	2.90	174	45391	1.04
32	33	26.73	1604	46995	30	46965	272.18	2.95	177	46788	1.07
33	34	25.73	1544	48332	30	48303	272.25	2.99	179	48123	1.10
34	35	24.73	1484	49607	30	49578	272.33	3.02	181	49397	1.13
35	36	23.74	1424	50821	30	50791	272.39	3.05	183	50608	1.16
36	37	22.74	1364	51972	30	51943	272.46	3.08	185	51758	1.19
37	38	21.74	1305	53062	30	53033	272.52	3.11	187	52846	1.21
38	39	20.75	1245	54091	30	54061	272.58	3.14	188	53872	1.24
39	40	19.75	1185	55057	30	55028	272.63	3.17	190	54838	1.26
40	41	18.75	1125	55963	30	55933	272.68	3.19	191	55742	1.28
41	42	17.76	1065	56808	30	56778	272.73	3.21	193	56585	1.30
42	43	16.76	1006	57591	30	57561	272.78	3.23	194	57367	1.32
43	44	15.76	946	58313	30	58283	272.82	3.25	195	58088	1.33
44	45	14.77	886	58974	30	58945	272.85	3.27	196	58748	1.35
45	46	13.77	826	59575	30	59545	272.89	3.29	197	59348	1.36
46	47	12.77	766	60114	30	60085	272.92	3.30	198	59887	1.37
47	48	11.78	707	60593	30	60564	272.94	3.31	199	60365	1.39
48	49	10.78	647	61012	30	60982	272.97	3.32	199	60783	1.40
49	50	9.79	587	61370	30	61340	272.99	3.33	200	61140	1.40
50	51	8.79	527	61668	30	61638	273.00	3.34	200	61438	1.41
51	52	7.79	468	61905	30	61875	273.01	3.34	201	61675	1.42
52	53	6.80	408	62083	30	62053	273.01	3.34	201	61852	1.42
53	54	5.80	348	62200	30	62171	273.01	3.35	201	61970	1.42
54	55	4.80	288	62258	30	62229	273.01	3.35	201	62028	1.42
55	56	3.81	228	62256	30	62227	273.01	3.35	201	62026	1.42
56	57	2.81	169	62194	30	62165	273.01	3.35	201	61964	1.42
57	58	1.81	109	62073	30	62043	273.01	3.34	201	61843	1.42
58	59	0.82	49	61892	30	61862	273.01	3.34	201	61662	1.42
59	59.82	0.00	0	61662	30	61632	273.00	3.34	200	61432	1.41

Culvert Calculator

Entered Data:

Shape ..... Circular  
 Number of Barrels ..... 1  
 Solving for ..... Headwater  
 Chart Number ..... 1  
 Scale Number ..... 3  
 Chart Description ..... CONCRETE PIPE CULVERT; NO BEVELED RING ENTRANCE  
 Scale Description ..... GROOVE END ENTRANCE, PIPE PROJECTING FROM FILL  
 Flowrate ..... 12.0000 cfs  
 Manning's n ..... 0.0130  
 Roadway Elevation ..... 274.0000 ft  
 Inlet Elevation ..... 267.0000 ft  
 Outlet Elevation ..... 260.0000 ft  
 Diameter ..... 12.0000 in  
 Length ..... 94.0000 ft  
 Entrance Loss ..... 0.5000  
 Tailwater ..... 3.2500 ft

Computed Results:

Headwater ..... 272.3040 ft From Outlet  
 Slope ..... 0.0745 ft/ft  
 Velocity ..... 15.2789 fps

DIS- CHARGE Flow cfs	HEAD- WATER ELEV. ft	INLET CONTROL DEPTH ft	OUTLET CONTROL DEPTH ft	FLOW TYPE	NORMAL DEPTH in	CRITICAL DEPTH in	OUTLET VEL. fps	OUTLET DEPTH ft	TAILWATER VEL. fps	TAILWATER DEPTH ft
0.00	267.55	0.55	0.26	NA	0.00	0.00	0.00	0.00	0.00	3.25
1.00	268.71	0.85	1.71	NA	2.60	12.00	1.27	1.00	0.00	3.25
2.00	270.39	1.14	3.39	NA	3.69	12.00	2.55	1.00	0.00	3.25
3.00	272.28	1.47	5.28	NA	4.57	12.00	3.82	1.00	0.00	3.25
4.00	274.40	1.94	7.40	NA	5.36	12.00	5.09	1.00	0.00	3.25
5.00	276.74	2.50	9.74	NA	6.10	12.00	6.37	1.00	0.00	3.25
6.00	279.30	3.17	12.30	NA	6.81	12.00	7.64	1.00	0.00	3.25
7.00	282.09	3.94	15.09	NA	7.53	12.00	8.91	1.00	0.00	3.25
8.00	285.10	4.82	18.10	NA	8.28	12.00	10.19	1.00	0.00	3.25
9.00	288.33	5.79	21.33	NA	9.11	12.00	11.46	1.00	0.00	3.25
10.00	273.87	6.87	0.00	NA	12.00	12.00	12.73	1.00	0.00	3.25
11.00	275.05	8.05	0.00	NA	12.00	12.00	14.01	1.00	0.00	3.25
12.00	276.34	9.34	0.00	NA	12.00	12.00	15.28	1.00	0.00	3.25
13.00	277.73	10.73	0.00	NA	12.00	12.00	16.55	1.00	0.00	3.25
14.00	279.22	12.22	0.00	NA	12.00	12.00	17.83	1.00	0.00	3.25

# STREET FLOW CALCULATIONS

**STREET 'B' - 100 YEAR STORM**  
**Worksheet for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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 101.58 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-38.00	101.58	-38.00	-18.00	0.030
-18.00	100.08	-18.00	16.00	0.015
-16.00	99.58	16.00	38.00	0.030
-15.50	99.69			
0.00	100.00			
15.50	99.69			
16.00	99.58			
18.00	100.08			
38.00	101.58			
Discharge	42.90	cfs		

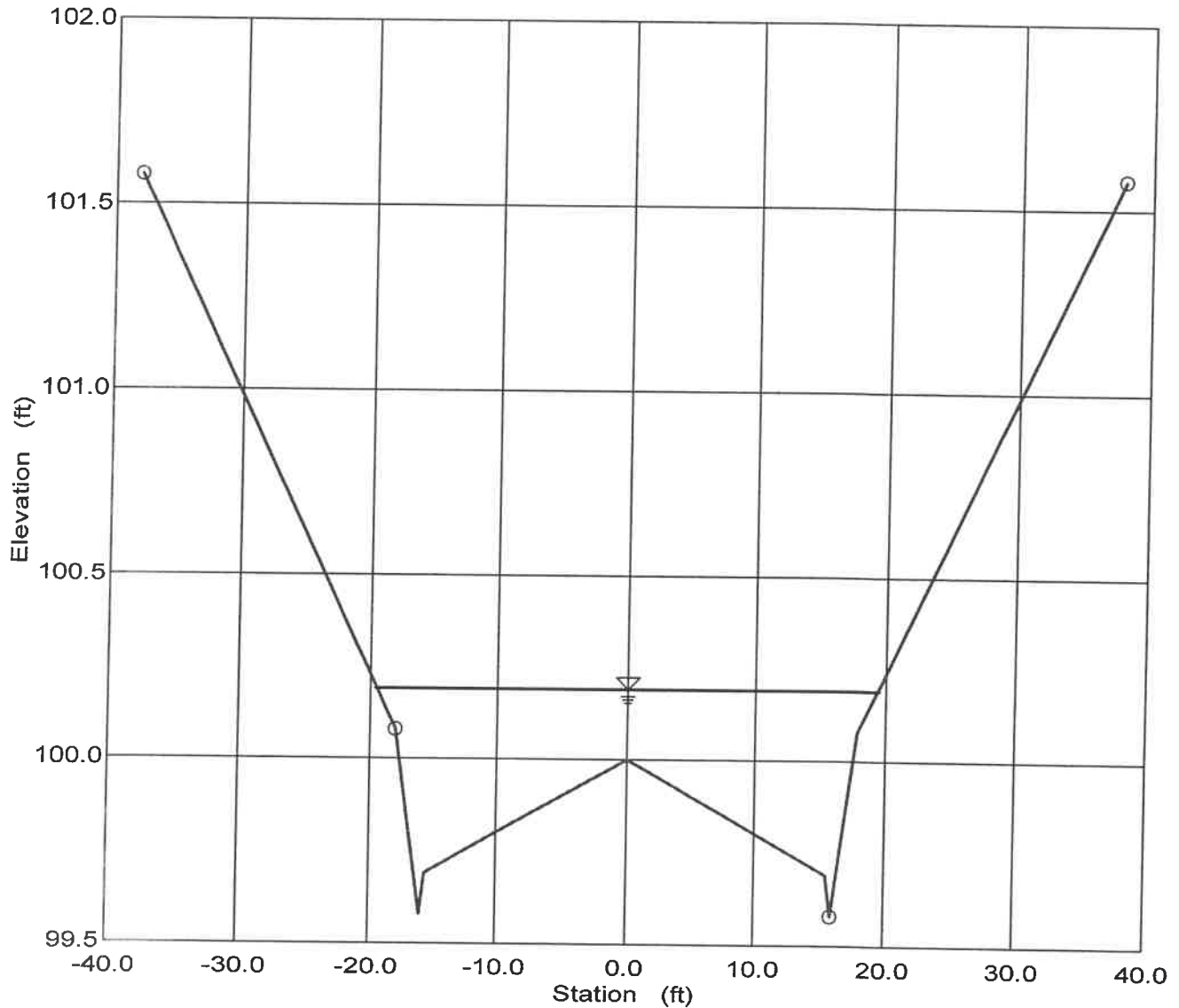
Results	
Wtd. Mannings Coefficient	0.015
Water Surface Elevation	100.19 ft
Flow Area	12.87 ft <sup>2</sup>
Wetted Perimeter	39.11 ft
Top Width	38.94 ft
Height	0.61 ft
Critical Depth	100.20 ft
Critical Slope	0.004755 ft/ft
Velocity	3.33 ft/s
Velocity Head	0.17 ft
Specific Energy	100.36 ft
Froude Number	1.02
Flow is supercritical.	



## STREET 'B' - 100 YEAR STORM Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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	100.19 ft
Discharge	42.90 cfs



**STREET 'D' - 100 YEAR STORM**  
**Worksheet for Irregular Channel**

Project Description	
Project File	d:\haestad\frmw\40692.fm2
Worksheet	TYPICAL STREET
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

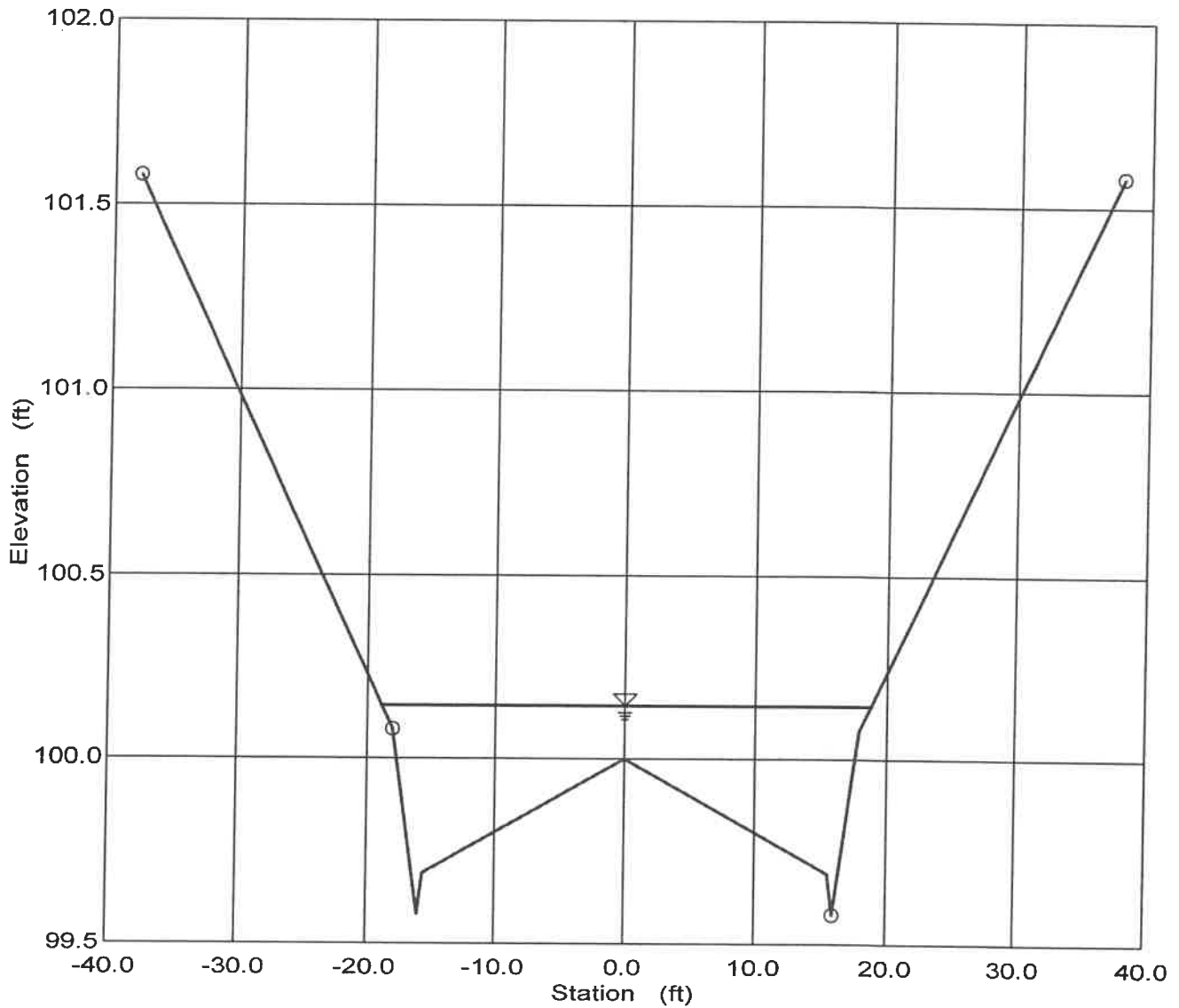
Input Data				
Channel Slope	0.005000 ft/ft			
Elevation range: 99.58 ft to 101.58 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-38.00	101.58	-38.00	-18.00	0.030
-18.00	100.08	-18.00	16.00	0.015
-16.00	99.58	16.00	38.00	0.030
-15.50	99.69			
0.00	100.00			
15.50	99.69			
16.00	99.58			
18.00	100.08			
38.00	101.58			
Discharge	34.40	cfs		

Results	
Wtd. Mannings Coefficient	0.015
Water Surface Elevation	100.15 ft
Flow Area	11.19 ft <sup>2</sup>
Wetted Perimeter	37.94 ft
Top Width	37.78 ft
Height	0.57 ft
Critical Depth	100.15 ft
Critical Slope	0.005048 ft/ft
Velocity	3.07 ft/s
Velocity Head	0.15 ft
Specific Energy	100.29 ft
Froude Number	1.00
Flow is subcritical.	

## STREET 'D' - 100 YEAR STORM Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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	100.15 ft
Discharge	34.40 cfs



100 YEAR STORM  
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	CATCH BASINS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

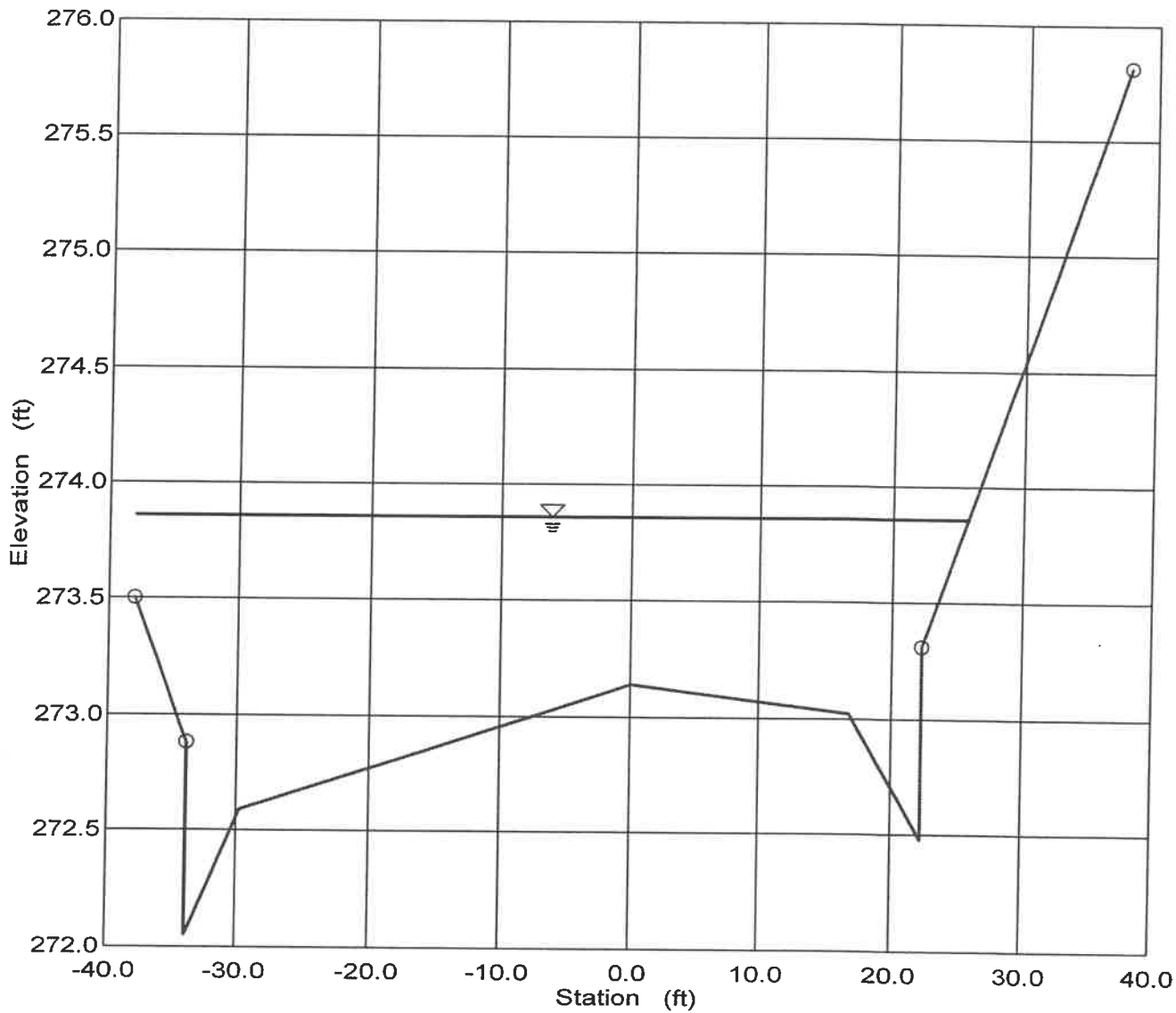
Input Data				
Channel Slope	0.000200 ft/ft			
Elevation range: 272.05 ft to 275.81 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-38.00	273.50	-38.00	-33.80	0.025
-33.80	272.88	-33.80	22.30	0.015
-33.80	272.05	22.30	38.00	0.025
-29.80	272.59			
0.00	273.14			
16.84	273.02			
22.30	272.48			
22.30	273.31			
38.00	275.81			
Discharge	72.44	cfs		

Results	
Wtd. Mannings Coefficient	0.016
Water Surface Elevation	273.86 ft
Flow Area	58.80 ft <sup>2</sup>
Wetted Perimeter	65.93 ft
Top Width	63.76 ft
Height	1.81 ft
Critical Depth	273.25 ft
Critical Slope	0.005088 ft/ft
Velocity	1.23 ft/s
Velocity Head	0.02 ft
Specific Energy	273.88 ft
Froude Number	0.23
Flow is subcritical.	
Water elevation exceeds lowest end station by 0.36 ft.	

**Cross Section - 100 YEAR STORM**  
**Cross Section for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	CATCH BASINS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.016
Channel Slope	0.000200 ft/ft
Water Surface Elevation	273.86 ft
Discharge	72.44 cfs



STREET 'B' - 10 YEAR STORM  
Worksheet for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

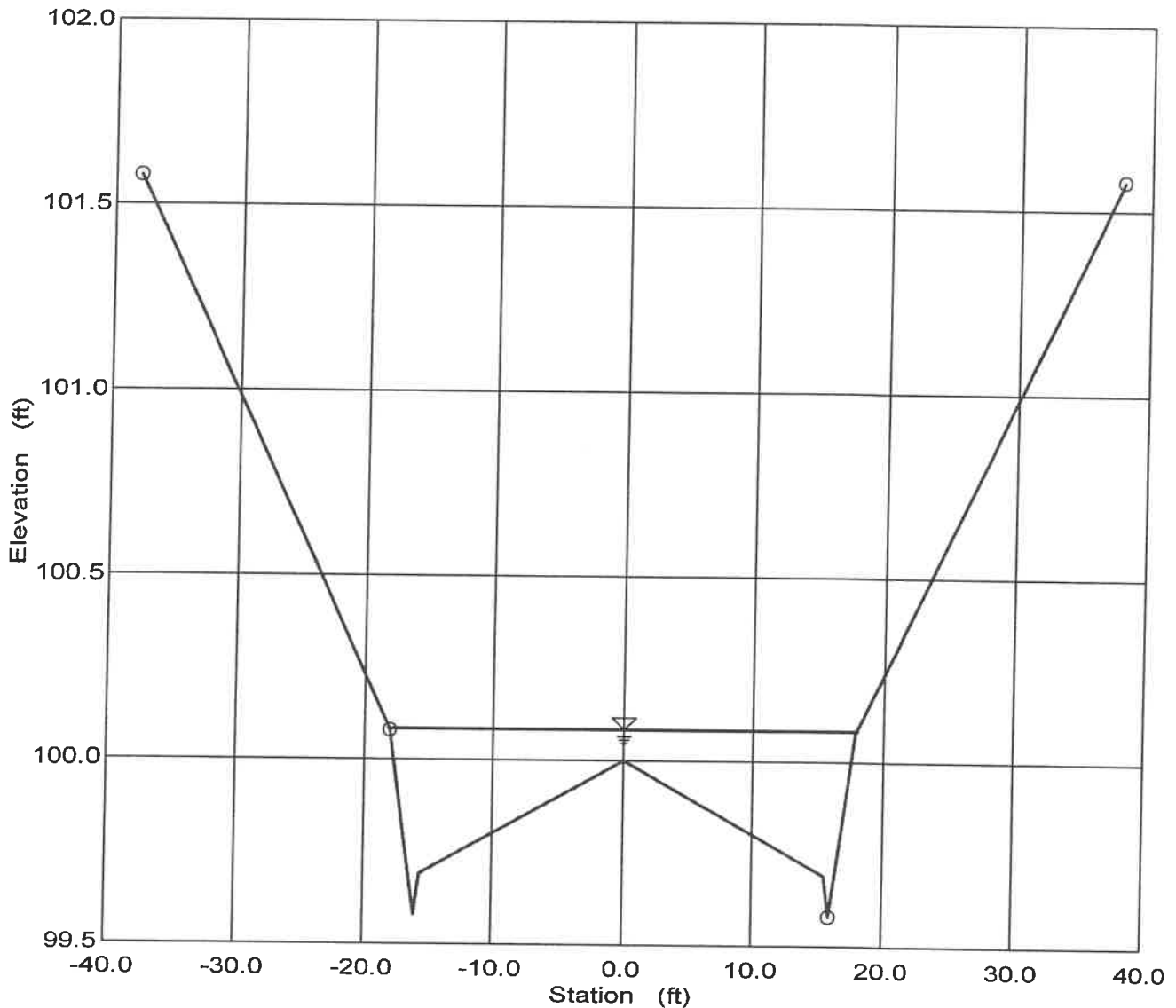
Input Data				
Channel Slope	0.005000 ft/ft			
Elevation range: 99.58 ft to 101.58 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-38.00	101.58	-38.00	-18.00	0.030
-18.00	100.08	-18.00	16.00	0.015
-16.00	99.58	16.00	38.00	0.030
-15.50	99.69			
0.00	100.00			
15.50	99.69			
16.00	99.58			
18.00	100.08			
38.00	101.58			
Discharge	23.90	cfs		

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	100.09	ft
Flow Area	8.93	ft <sup>2</sup>
Wetted Perimeter	36.30	ft
Top Width	36.15	ft
Height	0.51	ft
Critical Depth	100.08	ft
Critical Slope	0.005631	ft/ft
Velocity	2.68	ft/s
Velocity Head	0.11	ft
Specific Energy	100.20	ft
Froude Number	0.95	
Flow is subcritical.		

## STREET 'B' - 10 YEAR STORM Cross Section for Irregular Channel

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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	100.09 ft
Discharge	23.90 cfs



**STREET 'D' - 10 YEAR STORM  
Worksheet for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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 101.58 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
-38.00	101.58	-38.00	-18.00	0.030
-18.00	100.08	-18.00	16.00	0.015
-16.00	99.58	16.00	38.00	0.030
-15.50	99.69			
0.00	100.00			
15.50	99.69			
16.00	99.58			
18.00	100.08			
38.00	101.58			
Discharge	19.10	cfs		

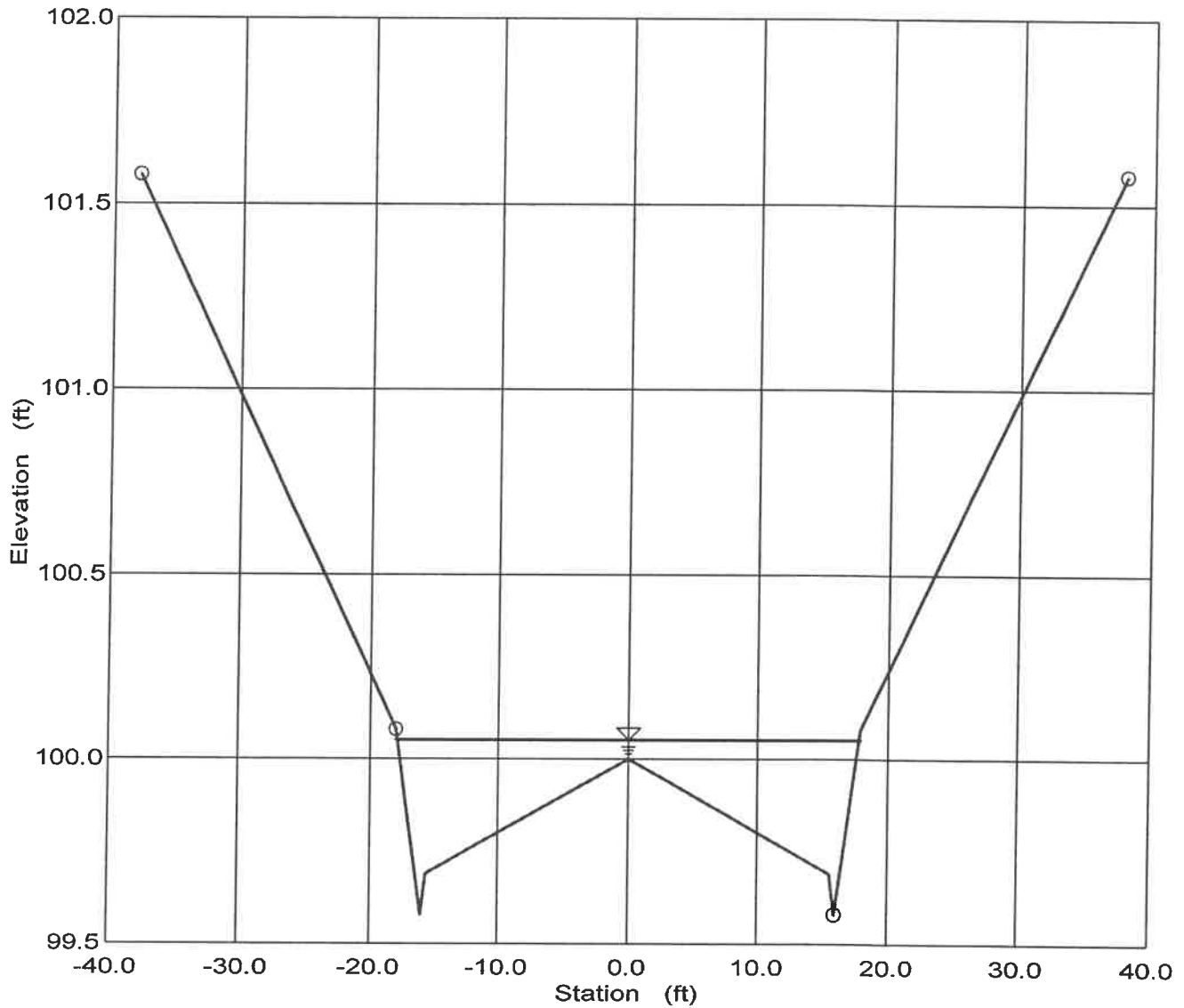
Results	
Wtd. Mannings Coefficient	0.015
Water Surface Elevation	100.05 ft
Flow Area	7.79 ft <sup>2</sup>
Wetted Perimeter	35.94 ft
Top Width	35.79 ft
Height	0.47 ft
Critical Depth	100.04 ft
Critical Slope	0.005926 ft/ft
Velocity	2.45 ft/s
Velocity Head	0.09 ft
Specific Energy	100.15 ft
Froude Number	0.93
Flow is subcritical.	



**STREET 'D' - 10 YEAR STORM  
Cross Section for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	TYPICAL STREET
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	100.05 ft
Discharge	19.10 cfs



**10 YEAR STORM**  
**Worksheet for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	CATCH BASINS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

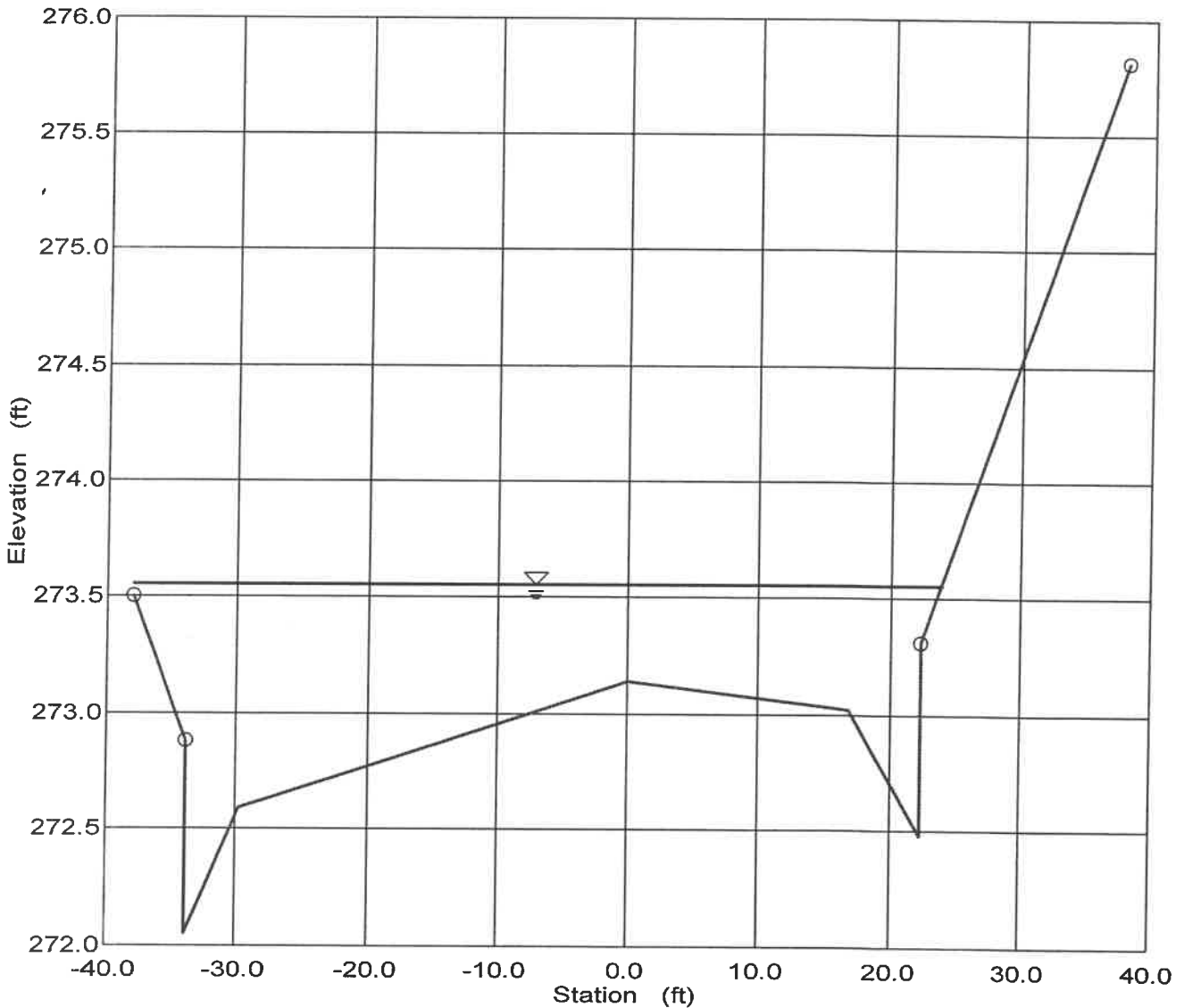
Input Data		
Channel Slope	0.000200 ft/ft	
Elevation range: 272.05 ft to 275.81 ft.		
Station (ft)	Elevation (ft)	Start Station
-38.00	273.50	-38.00
-33.80	272.88	-33.80
-33.80	272.05	22.30
-29.80	272.59	
0.00	273.14	
16.84	273.02	
22.30	272.48	
22.30	273.31	
38.00	275.81	
Discharge	39.74	cfs

Results		
Wtd. Mannings Coefficient	0.015	
Water Surface Elevation	273.56	ft
Flow Area	39.74	ft <sup>2</sup>
Wetted Perimeter	63.70	ft
Top Width	61.85	ft
Height	1.51	ft
Critical Depth	273.12	ft
Critical Slope	0.005614	ft/ft
Velocity	1.00	ft/s
Velocity Head	0.02	ft
Specific Energy	273.57	ft
Froude Number	0.22	
Flow is subcritical.		
Water elevation exceeds lowest end station by 0.06 ft.		

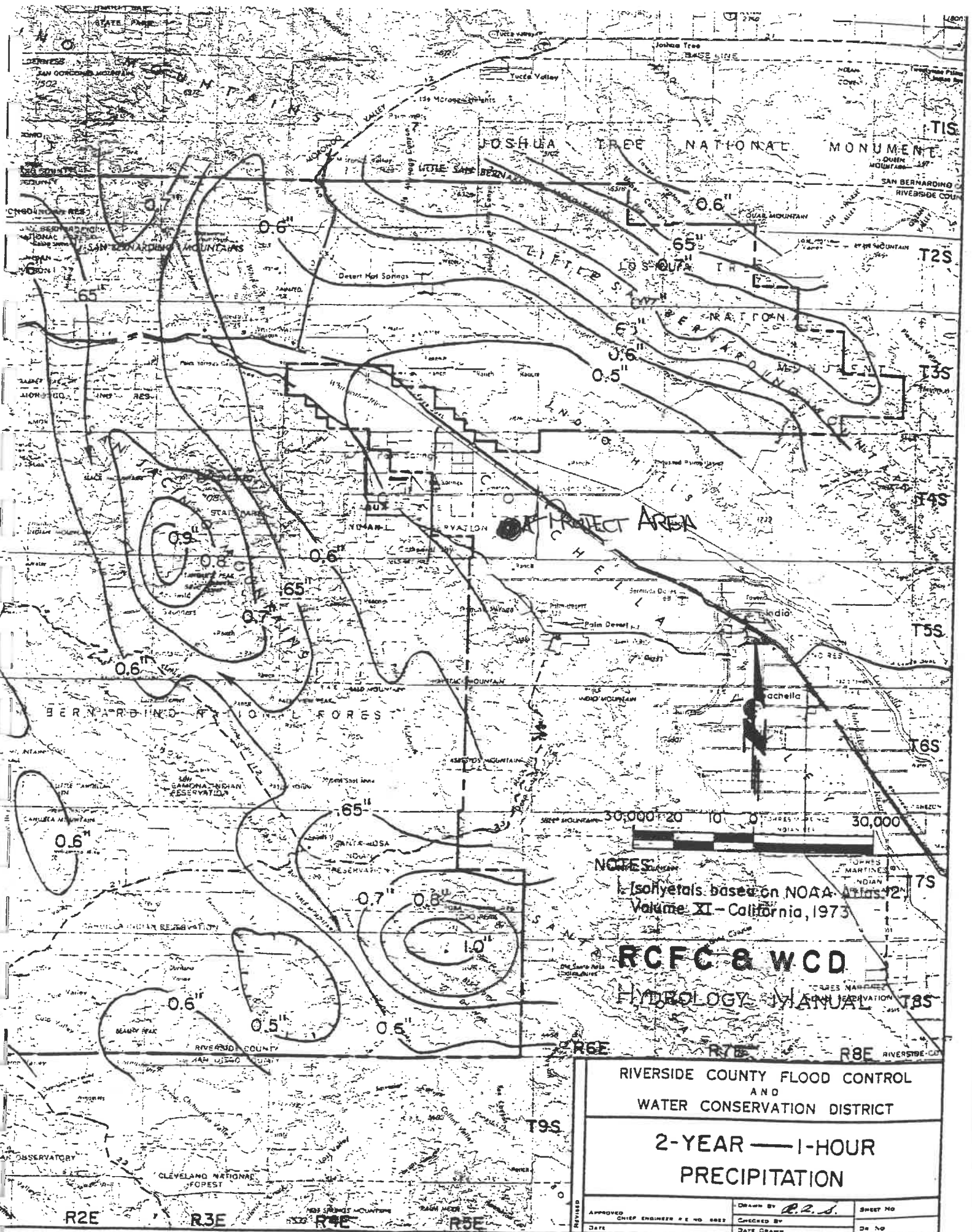
**Cross Section - 10 YEAR STORM**  
**Cross Section for Irregular Channel**

Project Description	
Project File	d:\haestad\fmw\40692.fm2
Worksheet	CATCH BASINS
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data	
Wtd. Mannings Coefficient	0.015
Channel Slope	0.000200 ft/ft
Water Surface Elevation	273.56 ft
Discharge	39.74 cfs



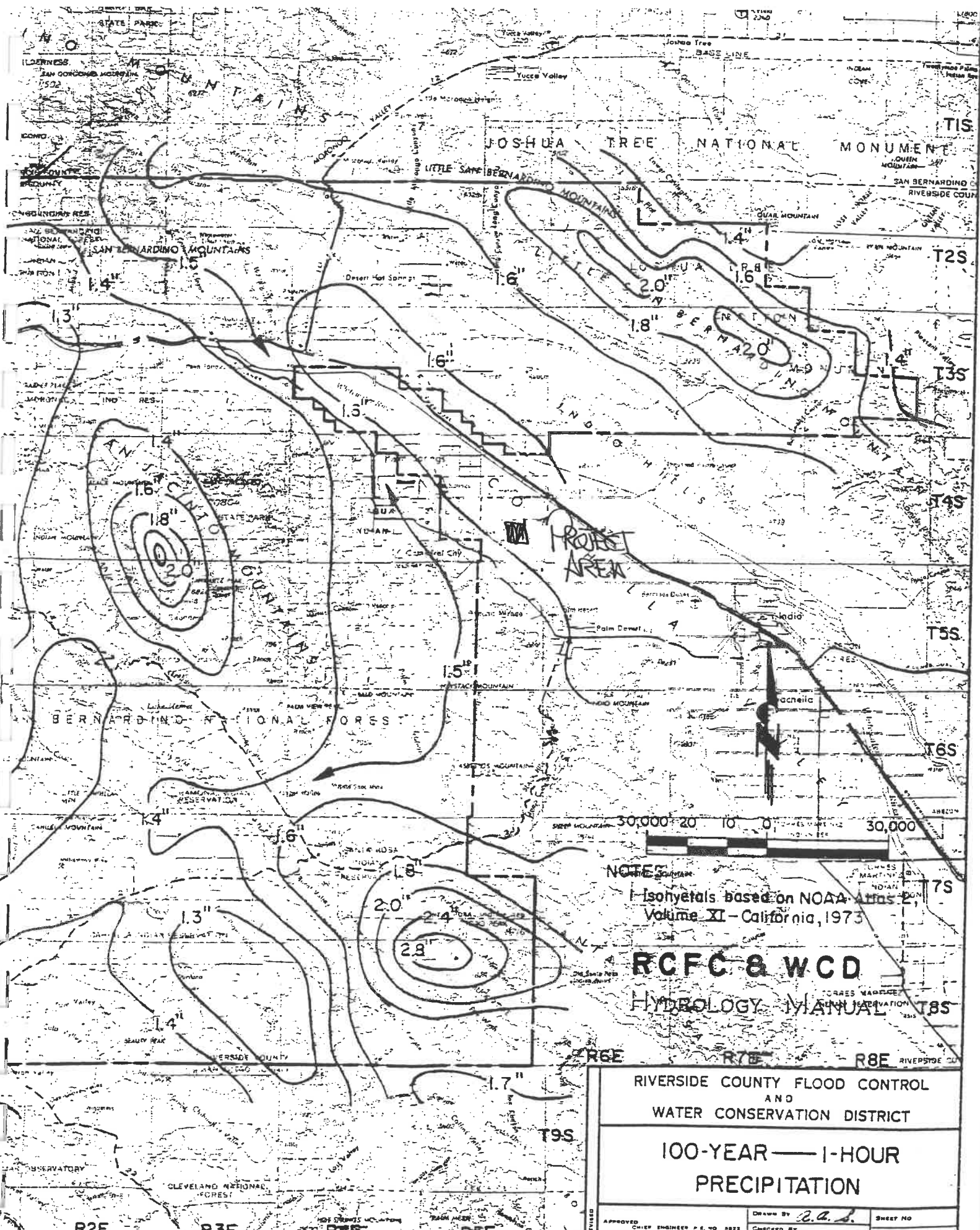
# RCFCD PLATES



NOTES:  
 Isohyets based on NOAA Atlas 72  
 Volume XI - California, 1973

**RCFC & WCD**  
 HYDROLOGY MANUAL

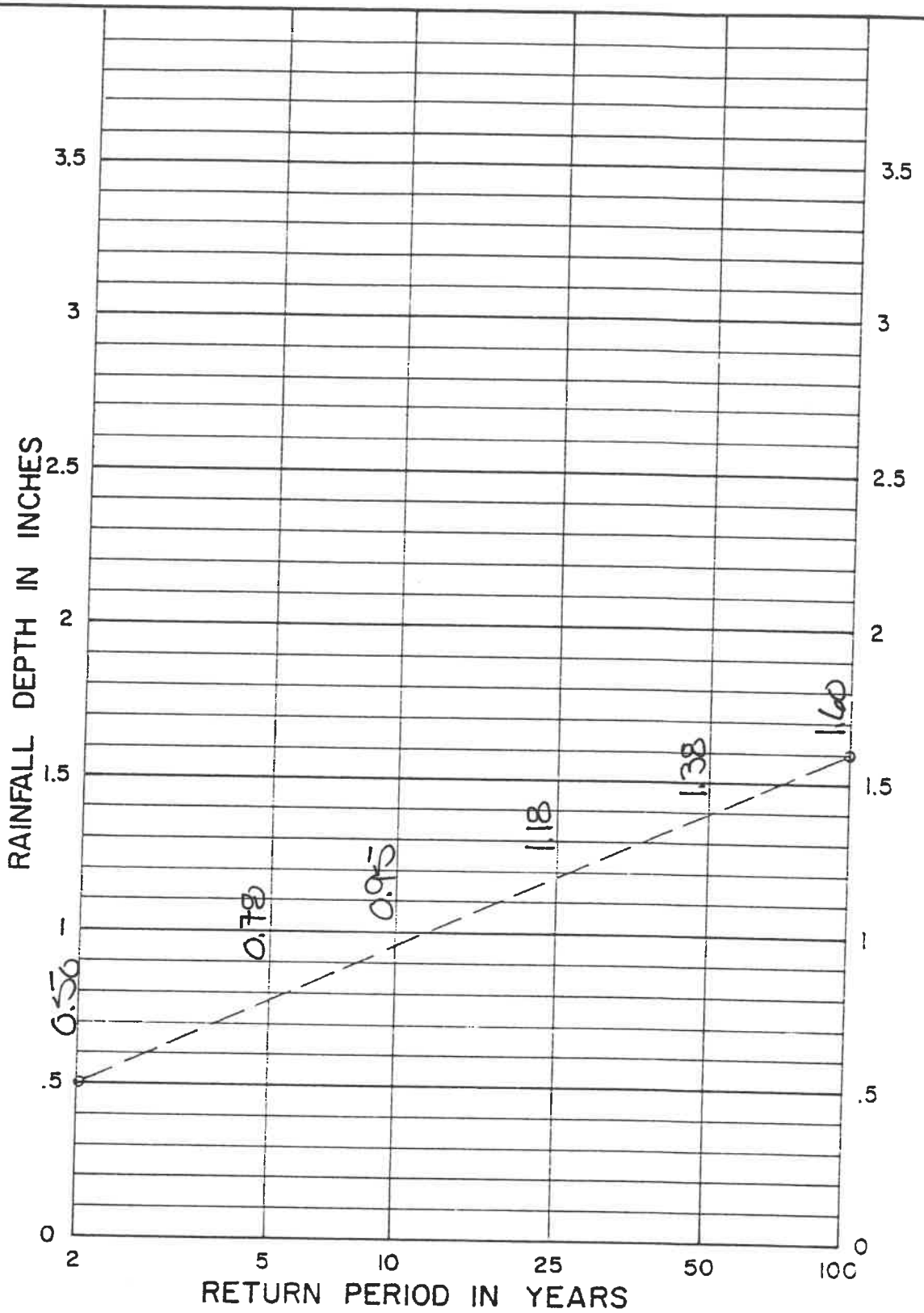
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		
<b>2-YEAR — 1-HOUR PRECIPITATION</b>		
APPROVED CHIEF ENGINEER # E NO. 8822	DRAWN BY <i>R.P.S.</i>	SHEET NO.
DATE	CHECKED BY	DR. NO.



NOTES:  
 Isohyets based on NOAA Atlas 2,  
 Volume XI - California, 1973

**RCFC & WCD**  
 HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		
100-YEAR — 1-HOUR PRECIPITATION		
APPROVED	Drawn By <i>R.A.S.</i>	SHEET NO
CHIEF ENGINEER P.E. NO. 8822	CHECKED BY	OF NO
DATE	DATE DRAWN	



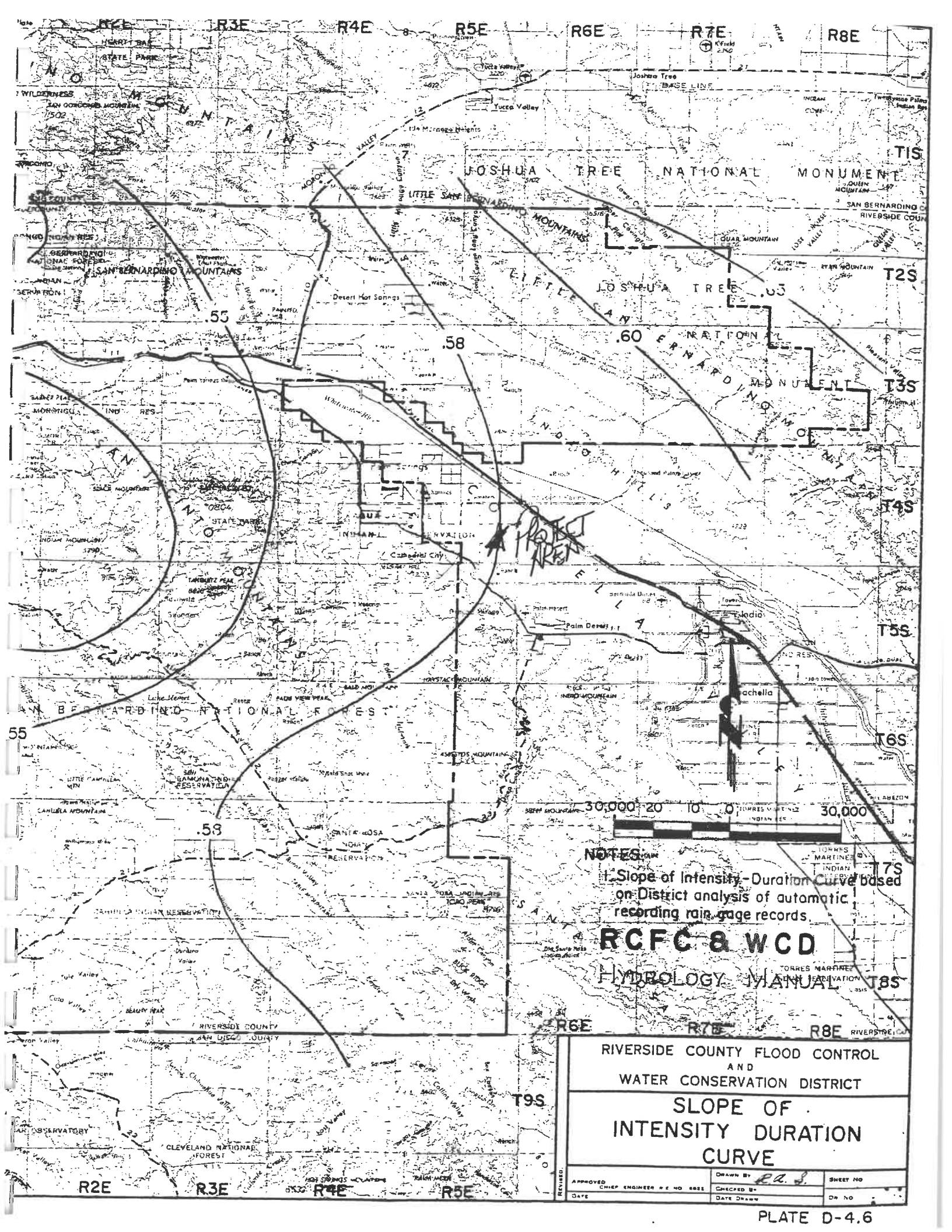
**NOTE:**

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



**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		
<b>SLOPE OF INTENSITY DURATION CURVE</b>		
APPROVED: _____	DRAWN BY: <i>R.A.S.</i>	SHEET NO. _____
CHIEF ENGINEER # E NO 8882	CHECKED BY: _____	DATE DRAWN _____
DATE _____	DATE _____	DATE _____



LOCATION ARTISAN COLLECTION - CATHEDRAL CITY

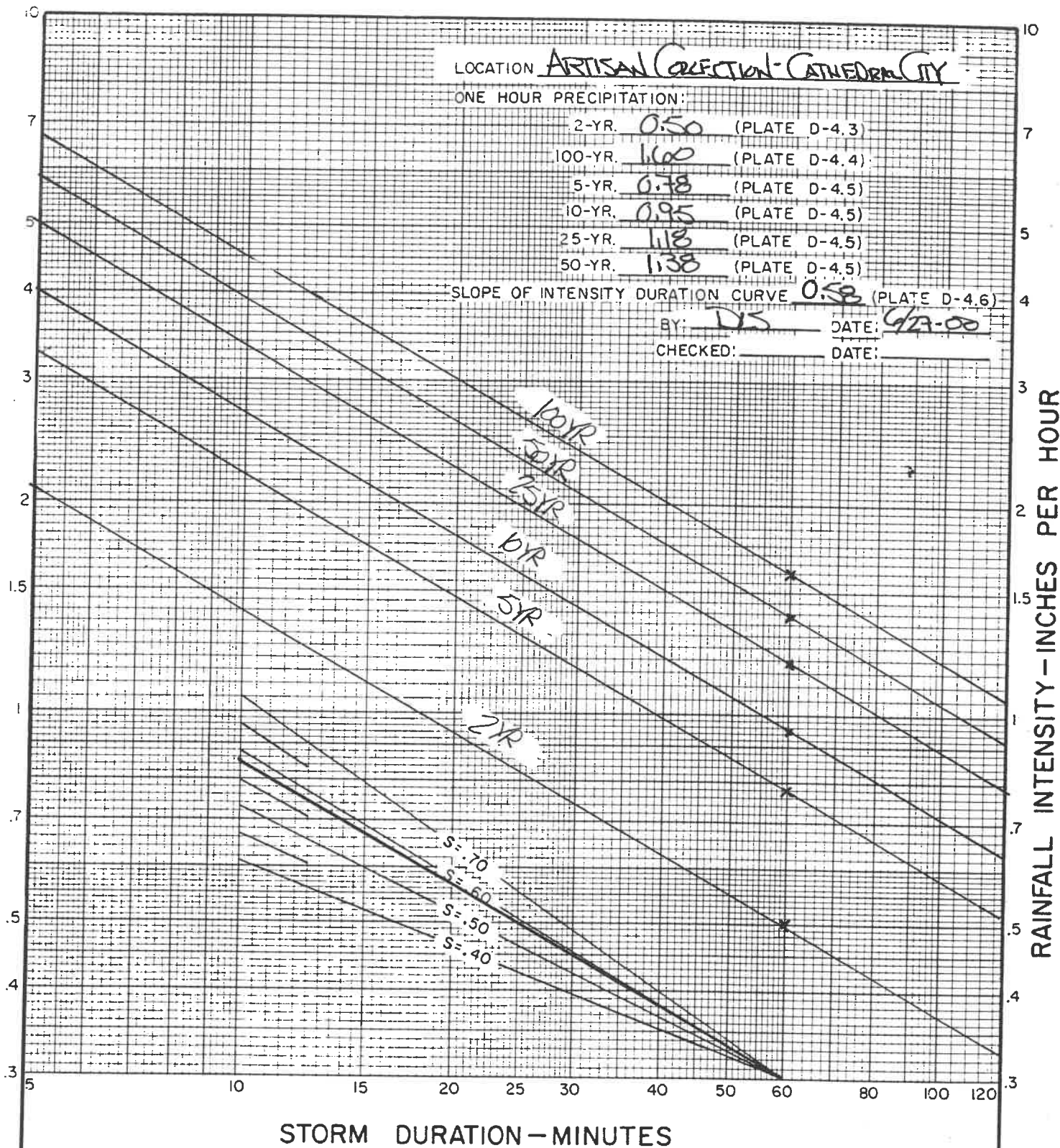
ONE HOUR PRECIPITATION:

2-YR. 0.50 (PLATE D-4.3)  
100-YR. 1.60 (PLATE D-4.4)  
5-YR. 0.78 (PLATE D-4.5)  
10-YR. 0.95 (PLATE D-4.5)  
25-YR. 1.18 (PLATE D-4.5)  
50-YR. 1.38 (PLATE D-4.5)

SLOPE OF INTENSITY DURATION CURVE 0.58 (PLATE D-4.6)

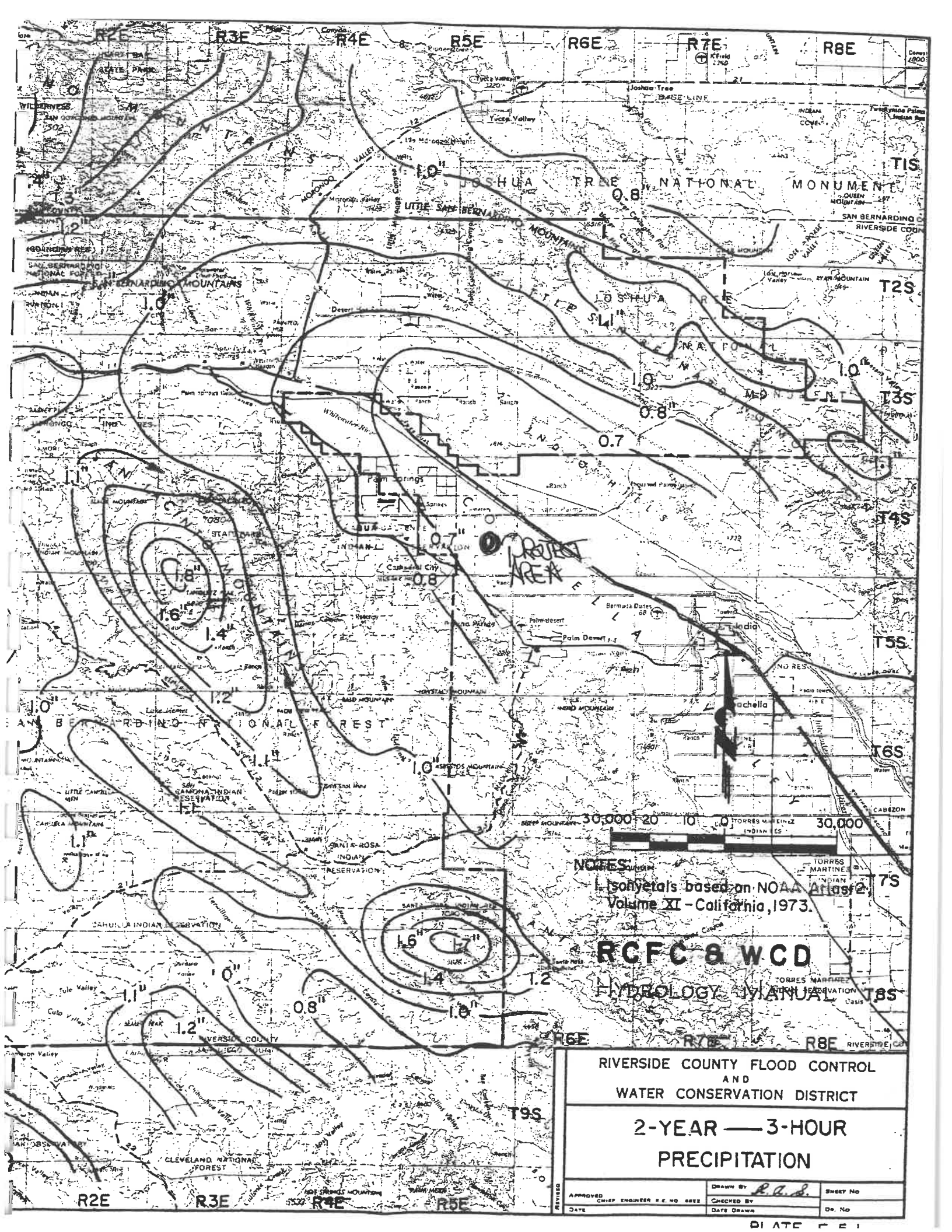
BY: DJS DATE: 9/22-00

CHECKED: \_\_\_\_\_ DATE: \_\_\_\_\_



**RCFC & WCD**  
HYDROLOGY MANUAL

INTENSITY-DURATION  
CURVES  
CALCULATION SHEET

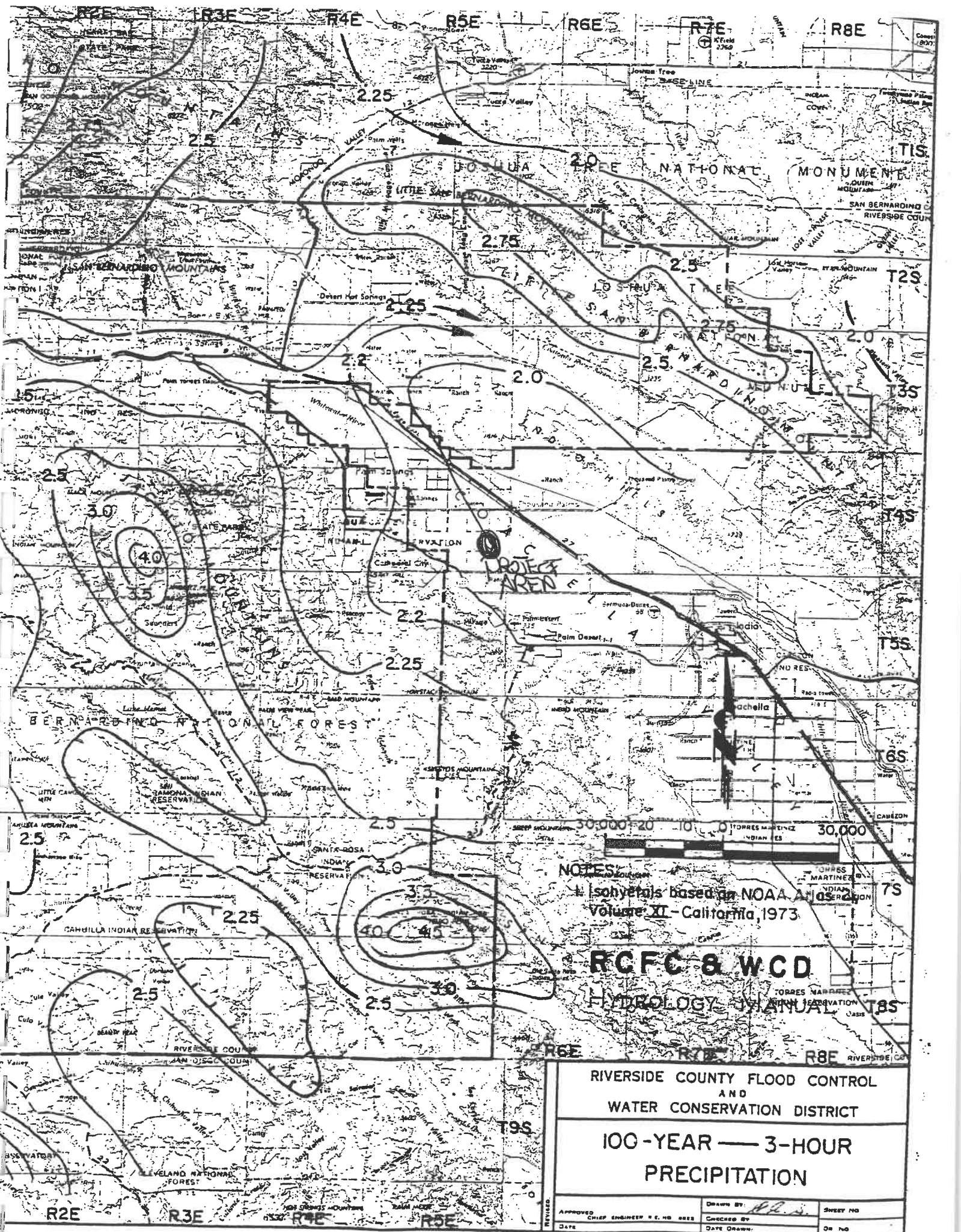


REQUEST AREA

NOTES:  
 Isohyets based on NOAA Atlas 2,  
 Volume XI - California, 1973.

**RCFC & WCD**  
 HYDROLOGY MANUAL

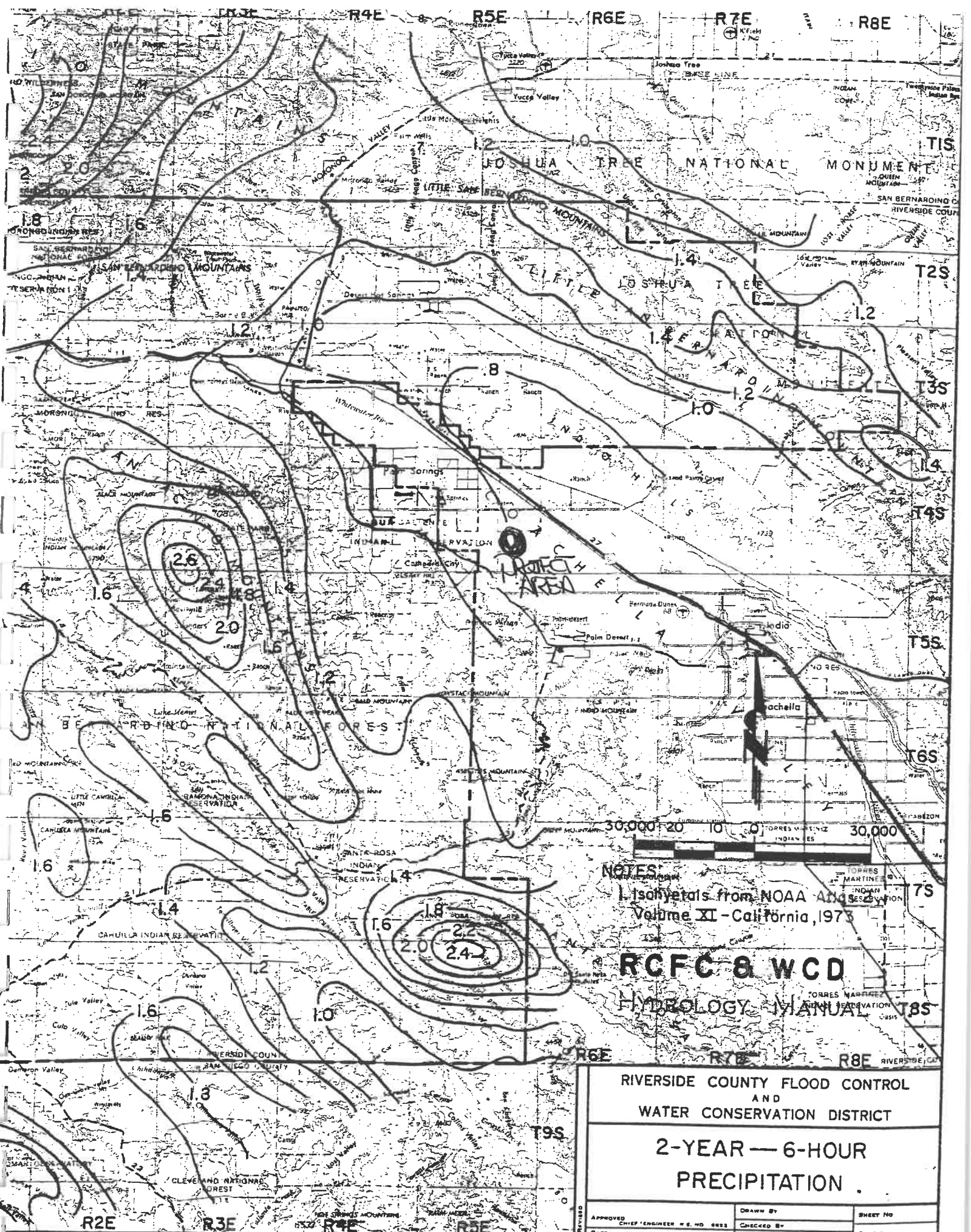
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		
<b>2-YEAR — 3-HOUR PRECIPITATION</b>		
APPROVED	DRAWN BY <i>R.L.S.</i>	SHEET NO
CHIEF ENGINEER P.E. NO. 8822	CHECKED BY	DATE DRAWN
DATE		DR. NO.



NOTES:  
 Isohyets based on NOAA Atlas 14  
 Volume XI - California, 1973

**RCFC & WCD**  
**HYDROLOGY MANUAL**

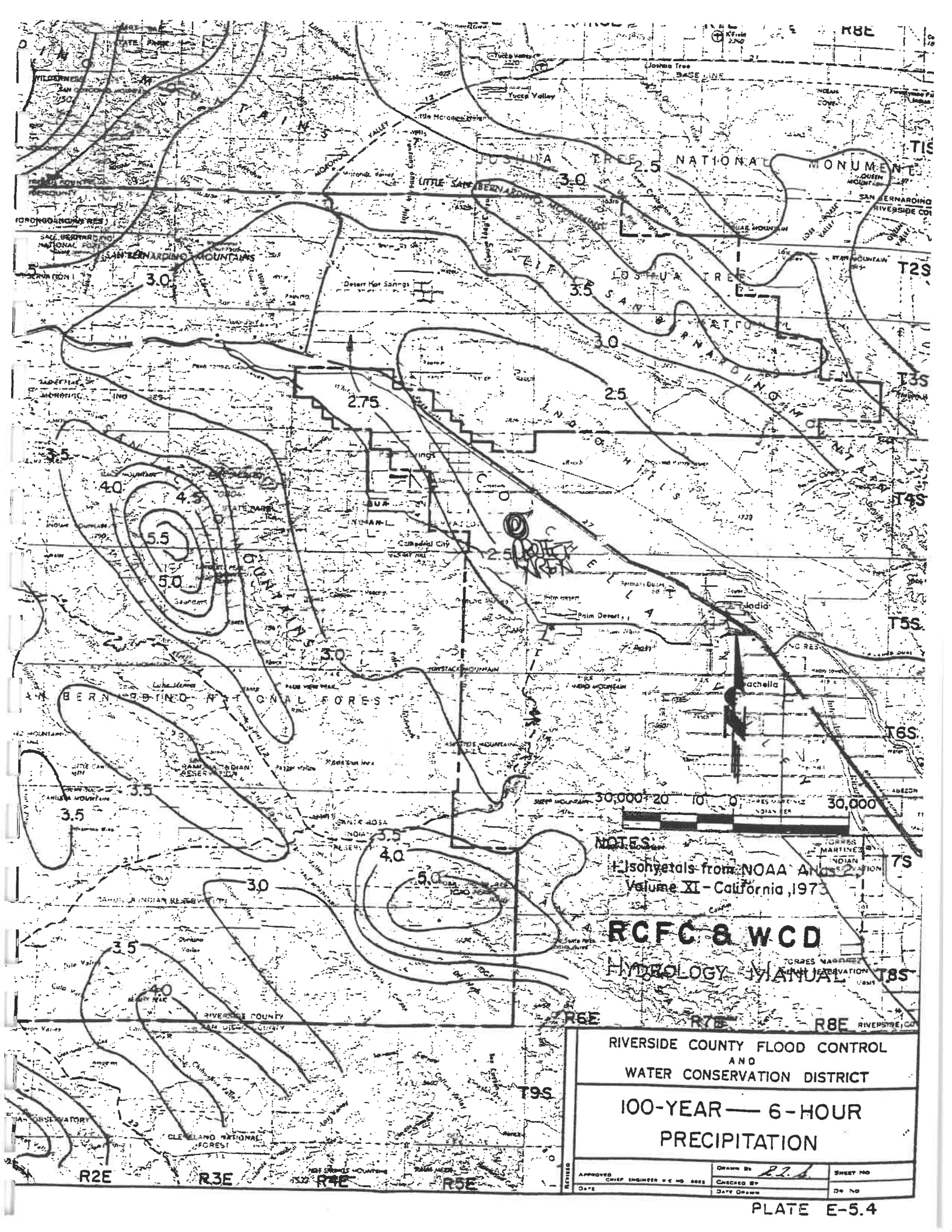
<b>RIVERSIDE COUNTY FLOOD CONTROL          AND          WATER CONSERVATION DISTRICT</b>		
<b>100-YEAR — 3-HOUR          PRECIPITATION</b>		
Approved _____ Chief Engineer R.C. No. 0001 Date _____	Drawn By: <i>h.h.s.</i> Checked By: _____ Date Drawn: _____	Sheet No. _____ Of No. _____



NOTES:  
 Isohyets from NOAA Atlas  
 Volume XI - California, 1973

**RCFC & WCD**  
 HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		
2-YEAR — 6-HOUR PRECIPITATION		
APPROVED	DRAWN BY	SHEET NO
DATE	CHECKED BY	DR. NO
DATE	DATE DRAWN	

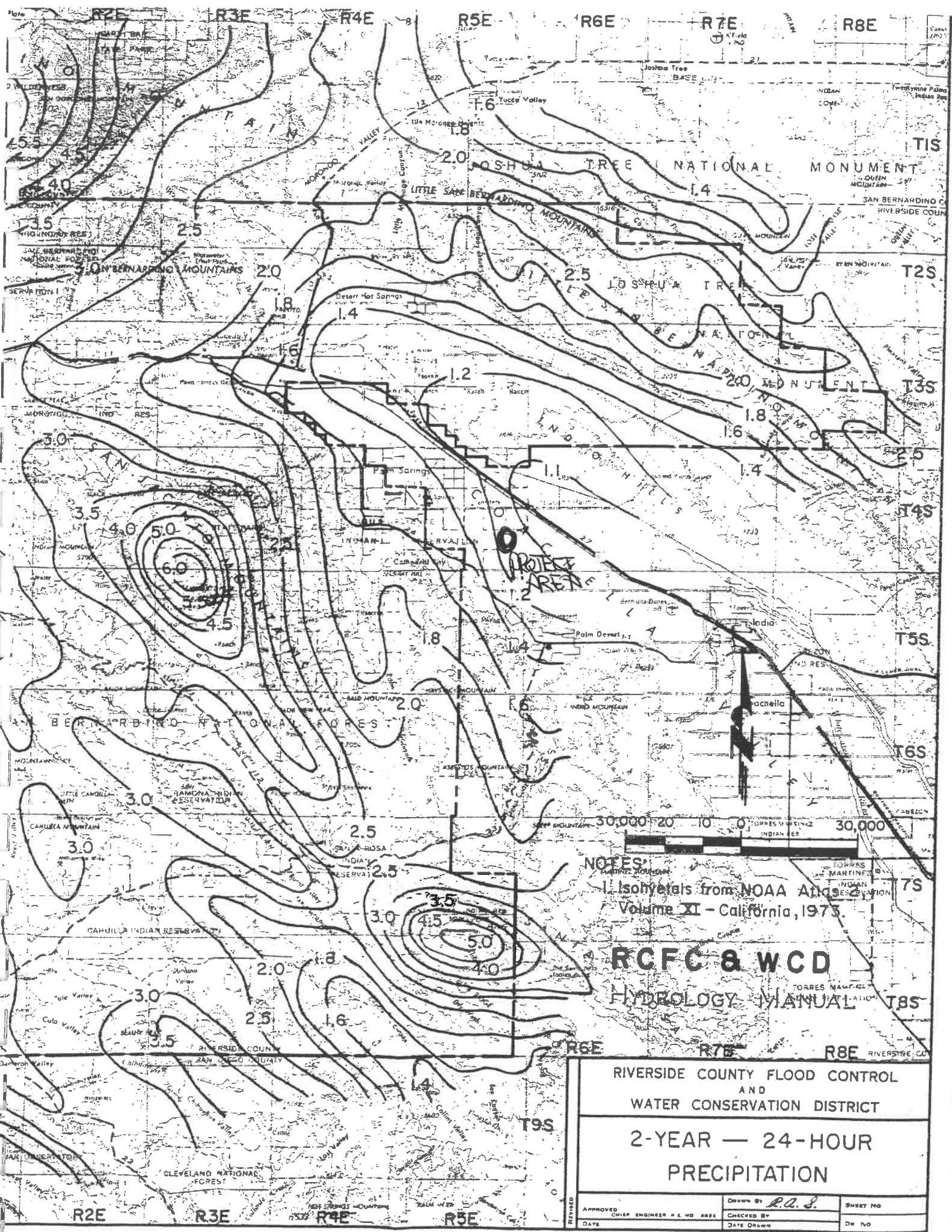


NOTES:  
 Isohyets from NOAA Atlas  
 Volume XI - California, 1973

**RCFC & WCD**  
 HYDROLOGY MANUAL

**RIVERSIDE COUNTY FLOOD CONTROL  
 AND  
 WATER CONSERVATION DISTRICT**  
**100-YEAR — 6-HOUR  
 PRECIPITATION**

APPROVED	CHIEF ENGINEER	DATE	DRAWN BY	DATE DRAWN	SHEET NO.
	NO. 4883				100

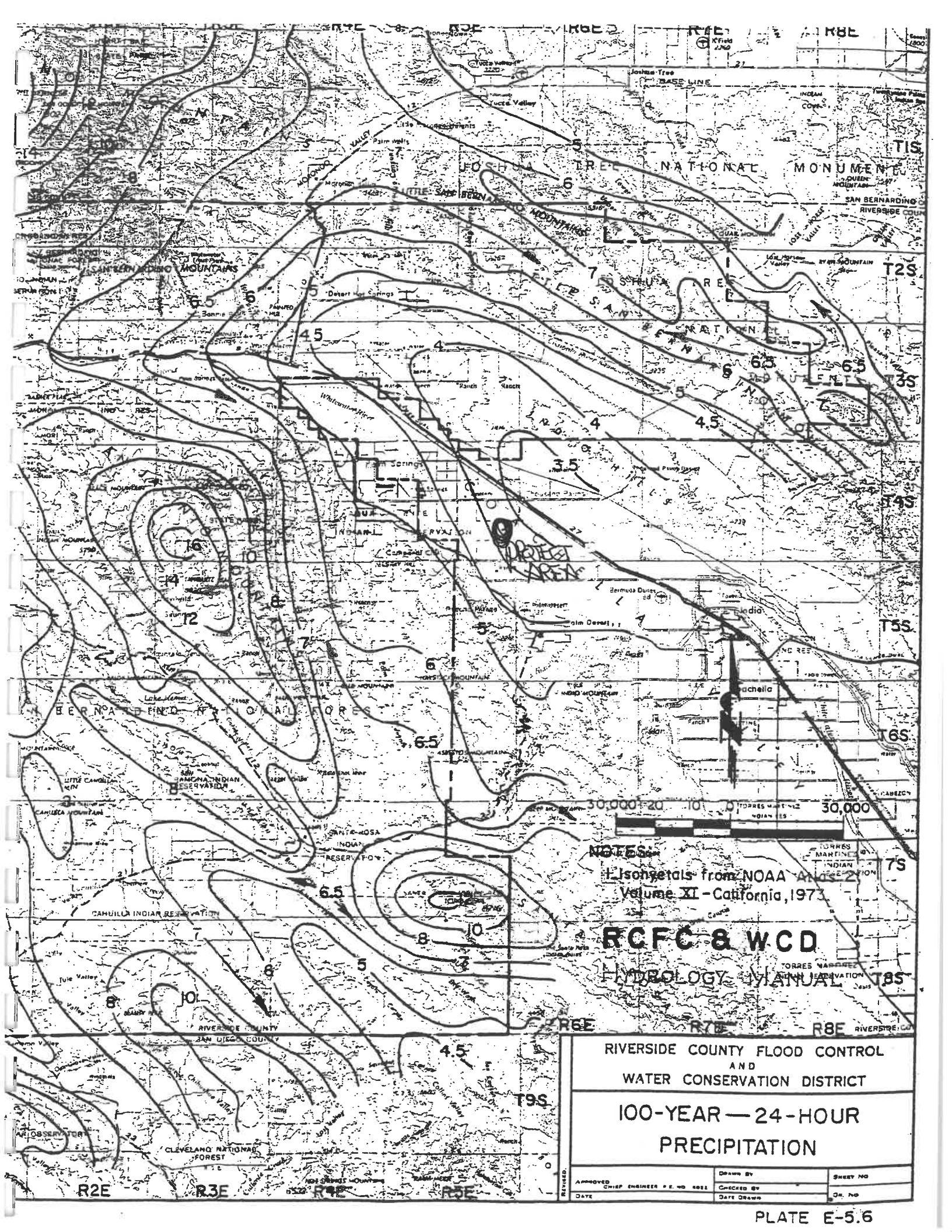


NOTES:  
 1. Isohyets from NOAA Atlas  
 Volume XI - California, 1973.

**RCFC & WCD**  
 HYDROLOGY MANUAL

**RIVERSIDE COUNTY FLOOD CONTROL  
 AND  
 WATER CONSERVATION DISTRICT**  
**2-YEAR — 24-HOUR  
 PRECIPITATION**

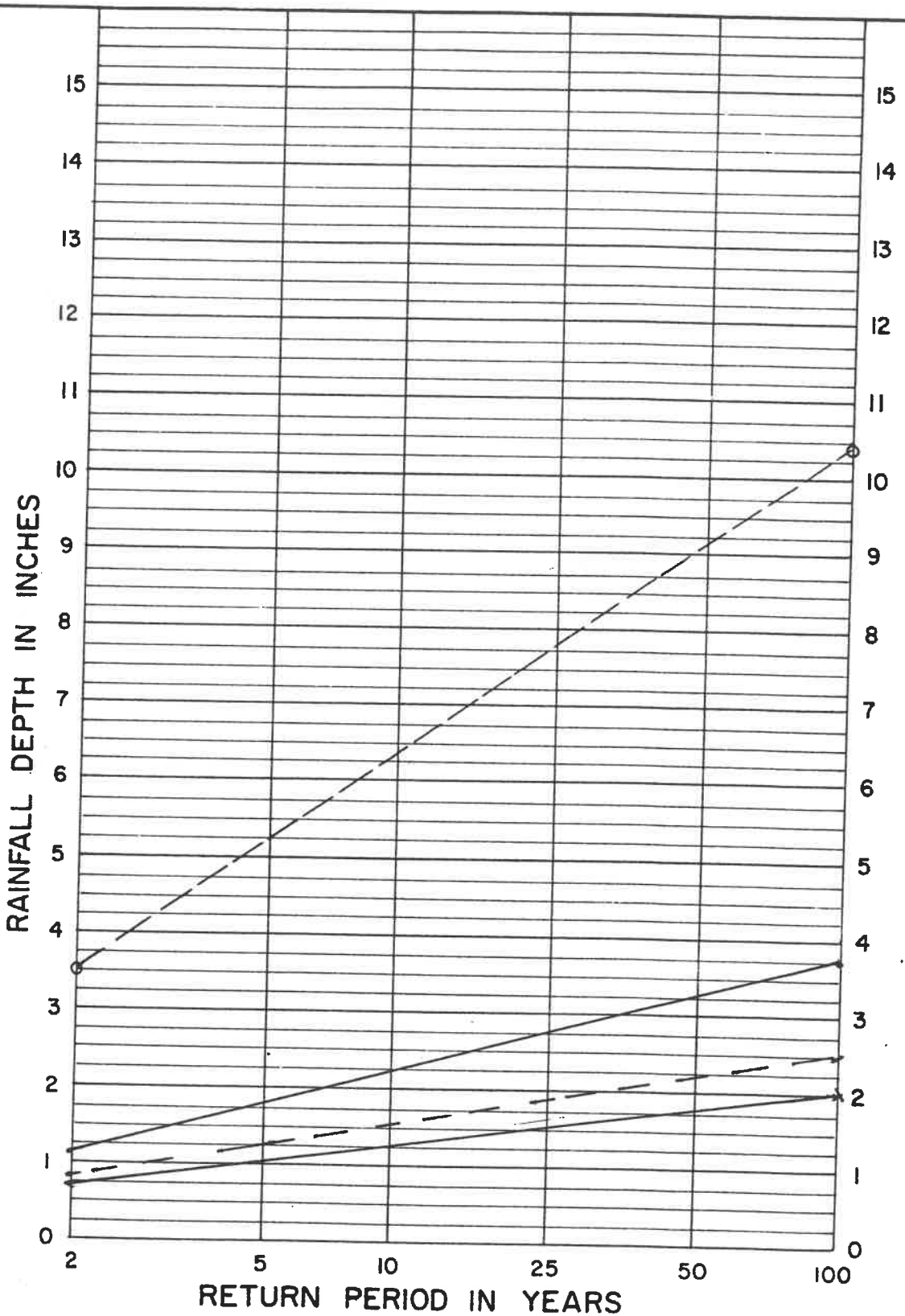
APPROVED	DRAWN BY	SHEET NO
CHIEF ENGINEER R. E. HO 8821	R. D. J.	
DATE	CHECKED BY	DR NO
	DATE DRAWN	



NOTES:  
 Isohyets from NOAA Atlas 2  
 Volume XI - California, 1973

**RCFC & WCD**  
 HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT		
<b>100-YEAR — 24-HOUR          PRECIPITATION</b>		
APPROVED CHIEF ENGINEER P.E. NO. 6022	DRAWN BY	SHEET NO.
DATE	CHECKED BY	OR. NO.
DATE DRAWN		



**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.

**RCFC & WCD**  
HYDROLOGY MANUAL

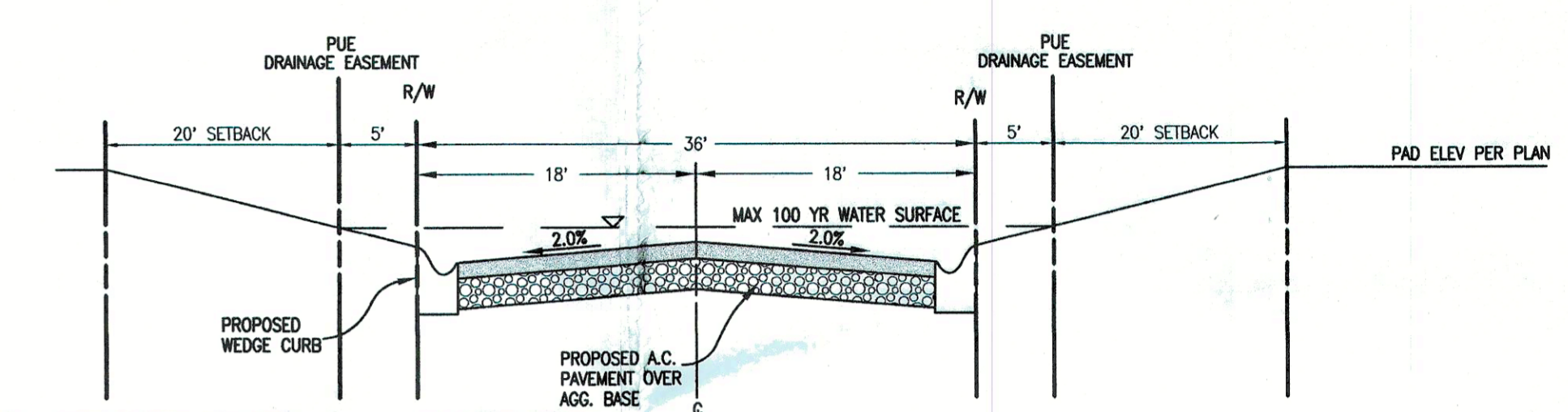
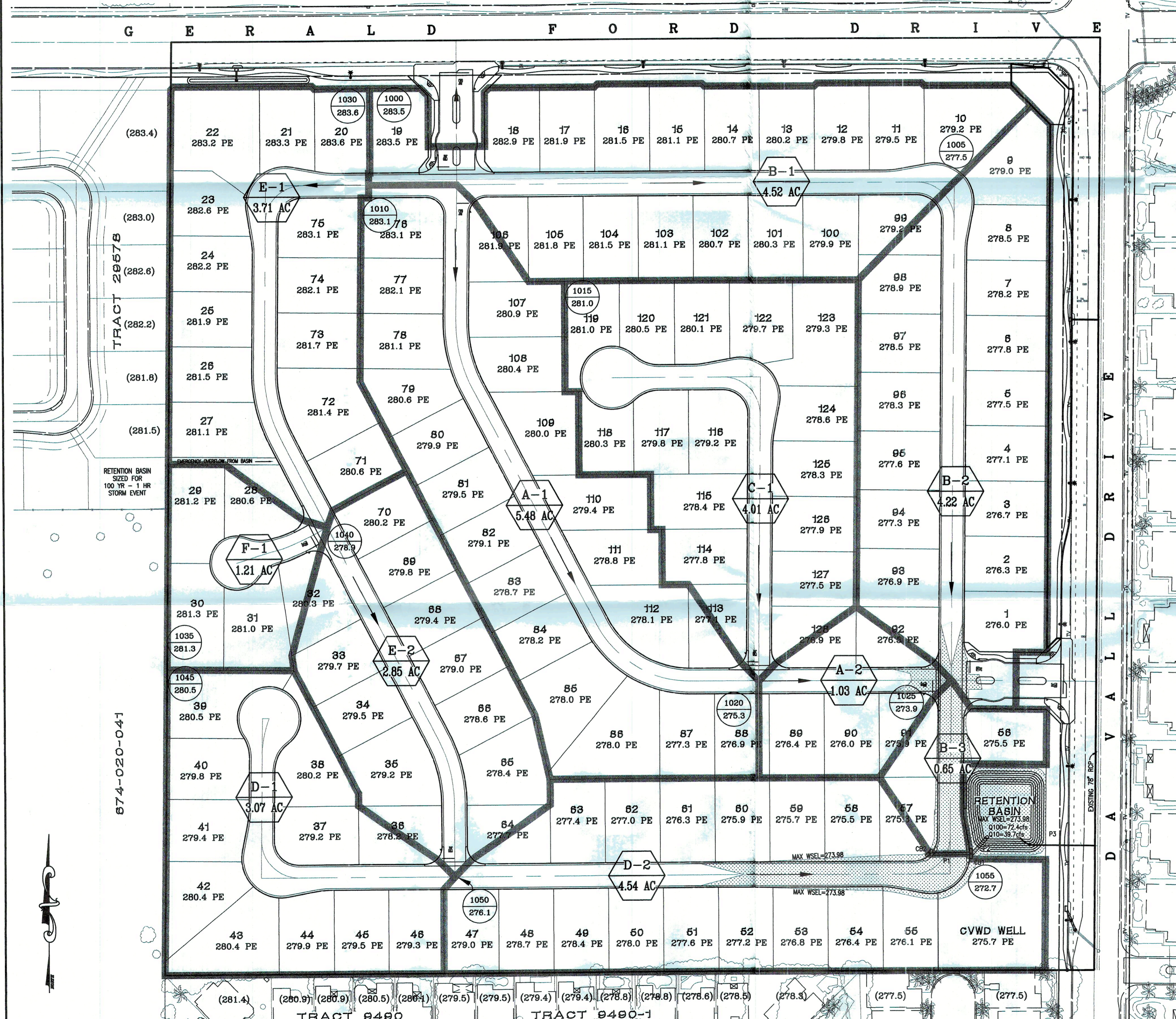
RAINFALL DEPTH VERSUS  
RETURN PERIOD FOR  
PARTIAL DURATION SERIES



# IN THE CITY OF CATHEDRAL CITY, STATE OF CALIFORNIA HYDROLOGY MAP - RATIONAL ANALYSIS DEVELOPED CONDITION

## FORD-DA VALL GROUP, LLC - TRACT MAP 29771

LOCATED IN A PORTION OF THE N.E. 1/4 OF SECTION 34, T. 4 S., R. 5 E., S.B.M.



**PROPOSED INTERIOR STREET**

NOTE: FINISHED FLOOR MUST BE 15" MINIMUM ABOVE 10 YEAR WATER SURFACE ELEVATION  
FINISHED FLOOR MUST BE 6" MINIMUM ABOVE 100 YEAR WATER SURFACE ELEVATION

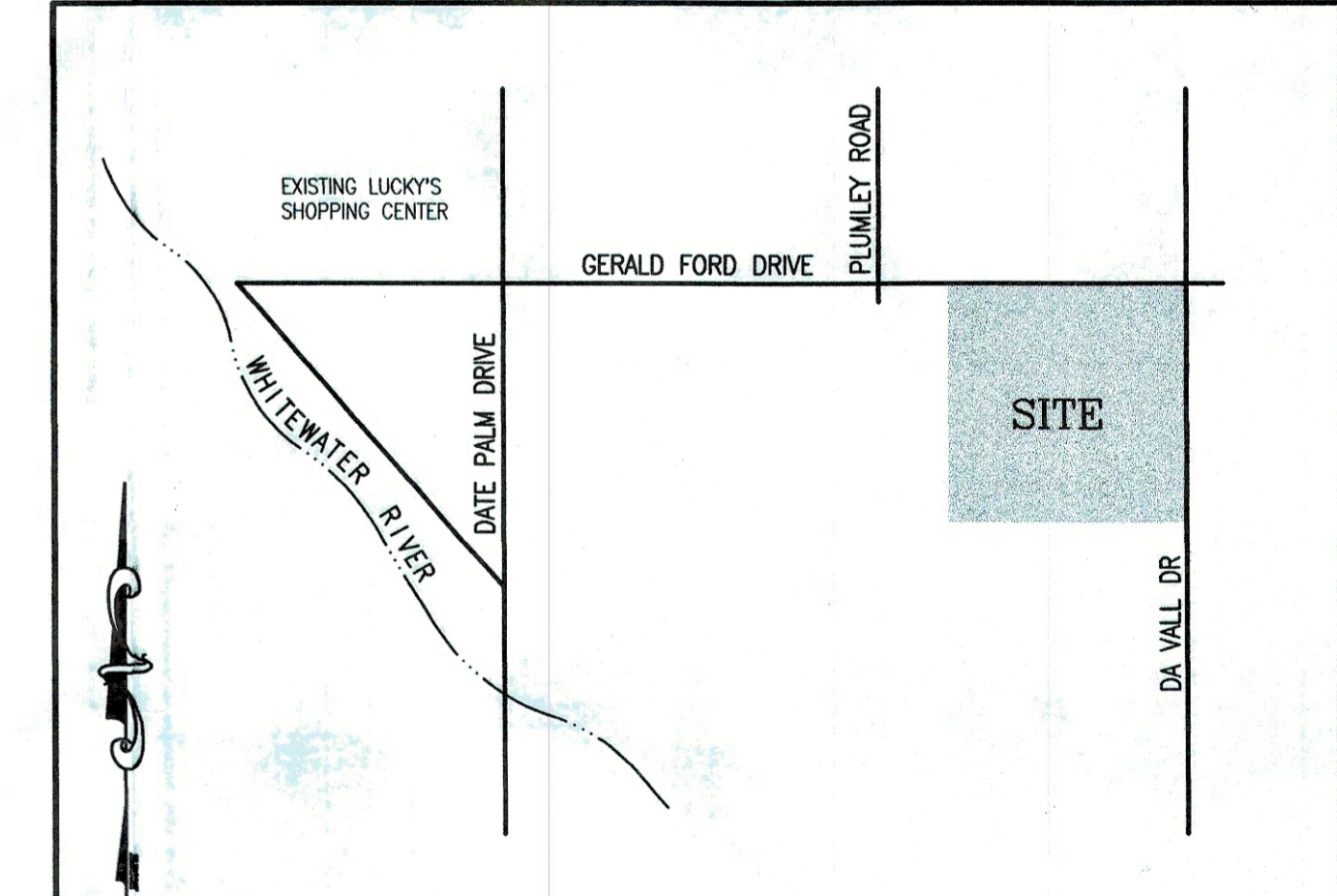
ON-SITE STORM DRAIN SUMMARY				
PIPE	Q100 (cfs)	DIAMETER (inch)	TYPE	VELOCITY (fps)
P1	72.4	48	ADS - N12	5.8
P2	36.2	30	ADS - N12	7.4
P3	3.8	12	RCP	7.2

ON-SITE CATCH BASIN SUMMARY				
CB#	W (ft)	H (ft)	Q100 (cfs)	
CB1	14	8.51'	36.2	
CB2	14	7.81L	36.2	

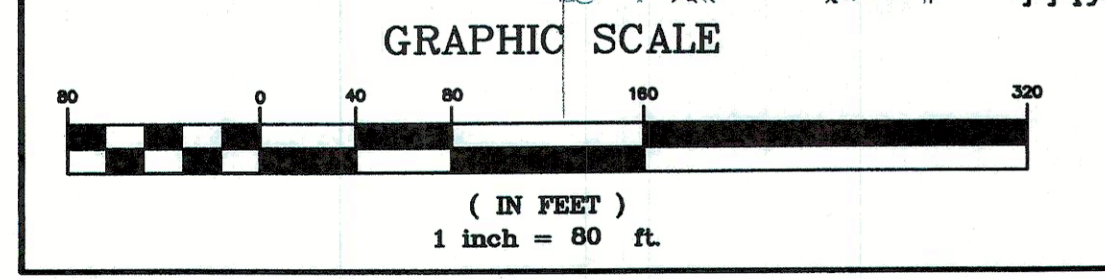
**SYMBOLS**

- NODE
- ELEV
- AREA
- ACRES

DENOTES LIMITS OF FLOODING  
100 YEAR - 1 HOUR STORM EVENT



**VICINITY MAP**  
NO SCALE



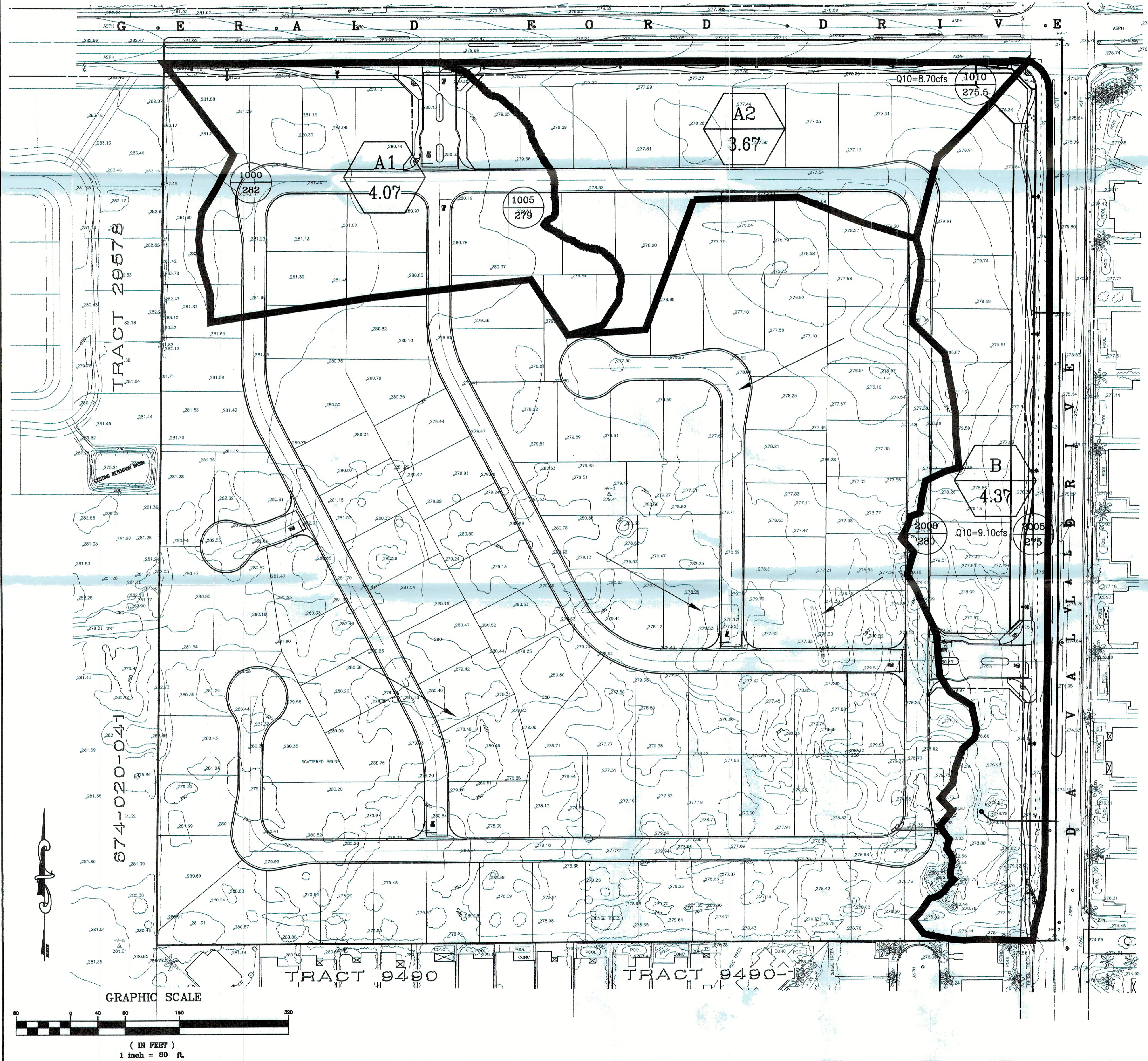
The Keith Companies **TKC**

DESIGN: DLS	DRAFT: DLS
CHECK: KRS	DATE: NOV 00
DWG NO. HY692101	
SHEET 1 OF 3	

41-865 Boardwalk, Suite 101, Palm Desert, CA 92211 (760) 346-9844

C:\40692\DRAWINGS\Hydro\Hy692101.dwg Thu Dec 21 13:47:12 2000 THE KEITH COMPANIES - D. SCHULZE

IN THE CITY OF CATHEDRAL CITY, STATE OF CALIFORNIA  
**HYDROLOGY MAP - RATIONAL ANALYSIS**  
**UNDEVELOPED CONDITION**  
**FORD-DA VALL GROUP, LLC - TRACT MAP 29771**  
 LOCATED IN A PORTION OF THE N.E. 1/4 OF SECTION 34, T. 4 S., R. 5 E., S.B.M.

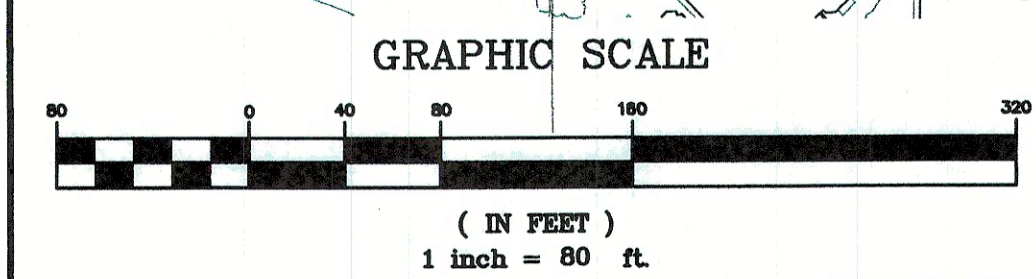
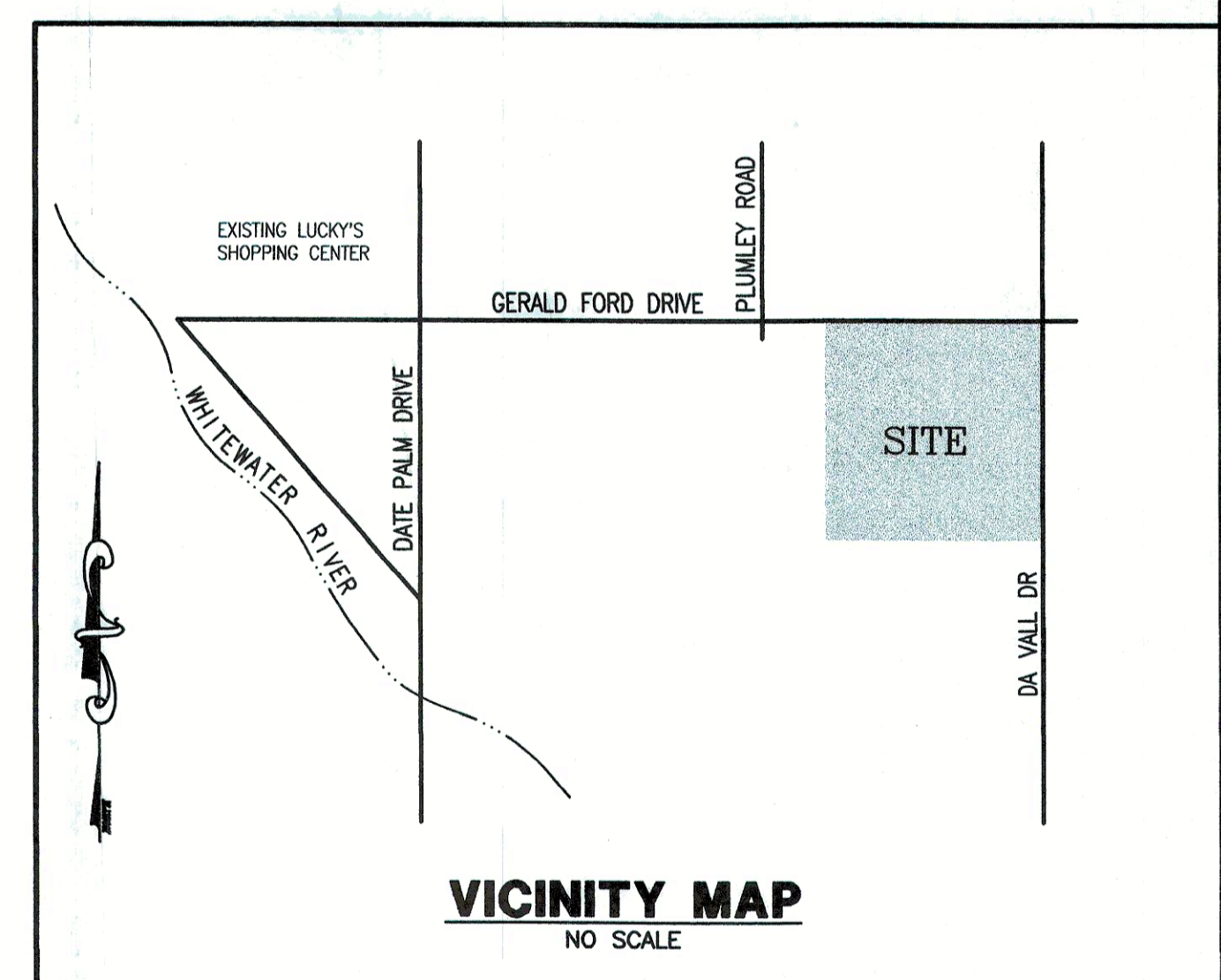


**RATIONAL SUMMARY**  
**10 YEAR - 1 HOUR EVENT**

AREA	ACRES	FLOW (cfs)
'A'	7.74	8.70
'B'	4.37	9.10
CONFLUENCE	12.11	12.14

**SYMBOLS**

- NODE  
ELEV
- AREA  
ACRES



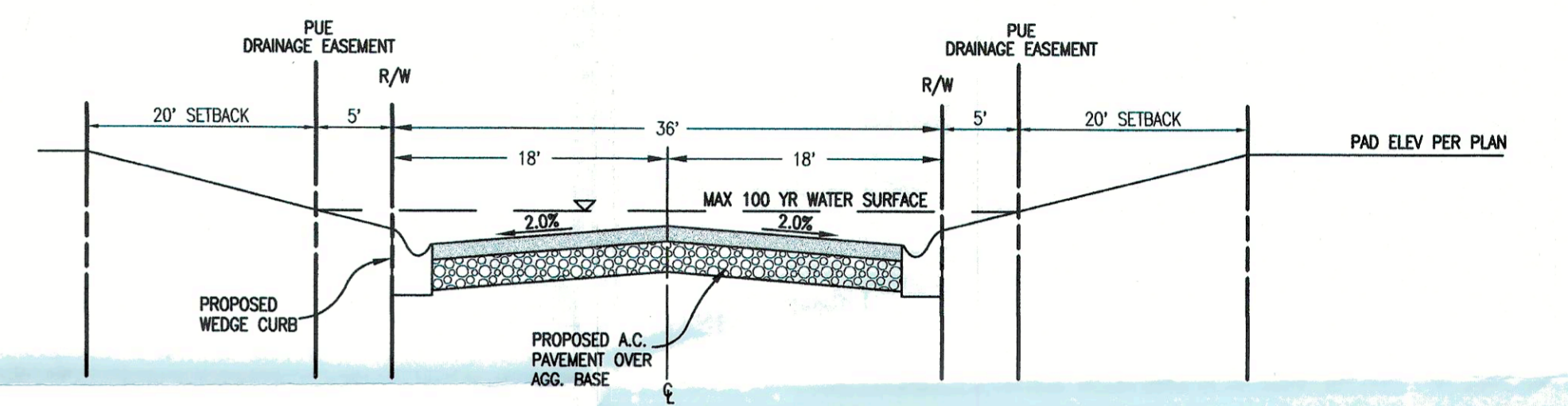
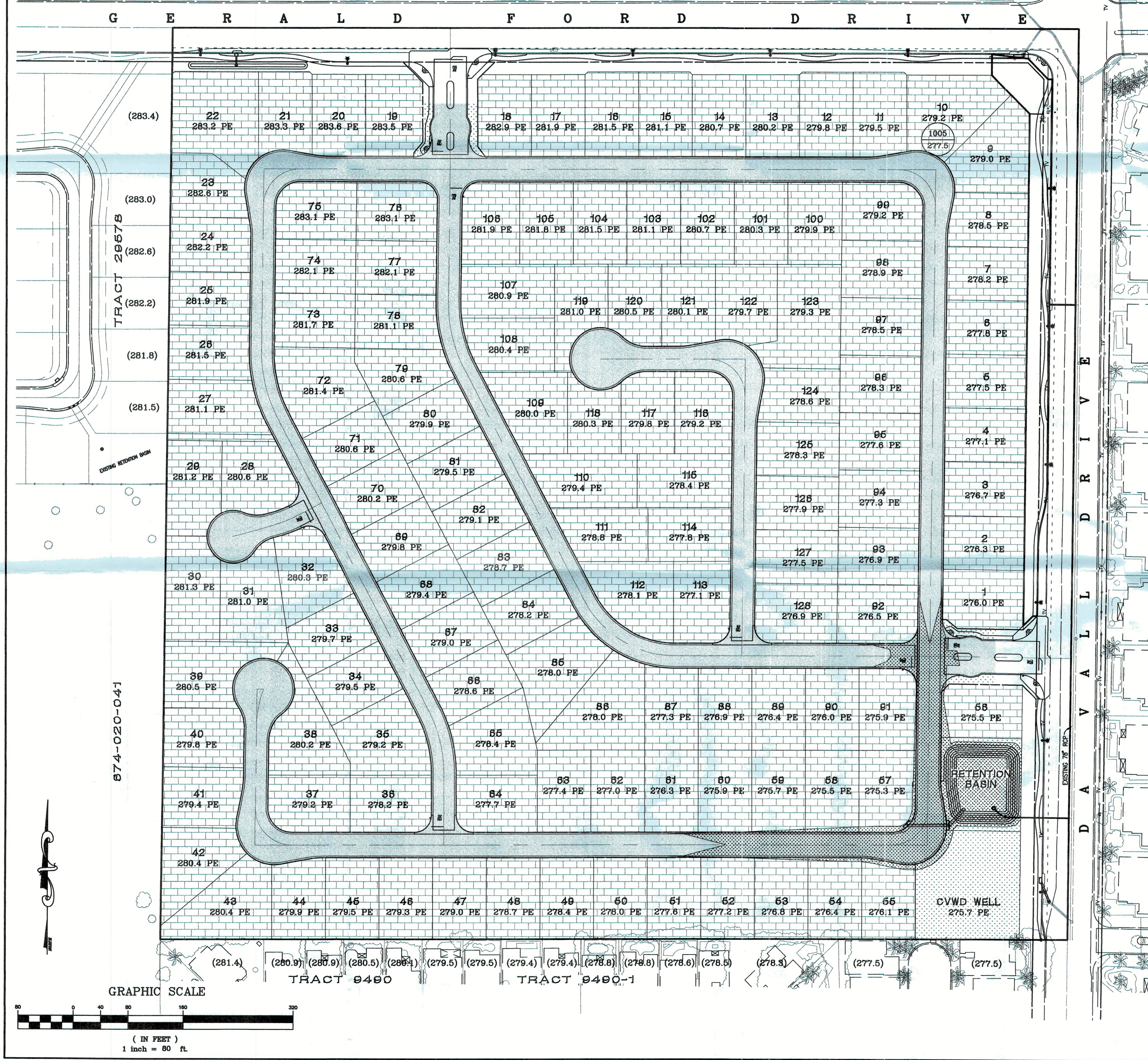
The Keith Companies **TKC**

DESIGN: DLS	DRAFT: DLS
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DWG NO. HY692102	
SHEET 2 OF 3	

41-865 Boardwalk, Suite 101, Palm Desert, CA 92211 (760) 346-9844

D:\40692\DRAWINGS\Hydro\Hy692102.dwg Thu Dec 21 13:49:48 2000 THE KEITH COMPANIES - D. SCHULZE

IN THE CITY OF CATHEDRAL CITY, STATE OF CALIFORNIA  
**HYDROLOGY MAP**  
**SYNTHETIC UNIT HYDROGRAPH**  
**FORD-DA VALL GROUP, LLC - TRACT MAP 29771**  
 LOCATED IN A PORTION OF THE N.E. 1/4 OF SECTION 34, T. 4 S., R. 5 E., S.B.M.



**PROPOSED INTERIOR STREET**

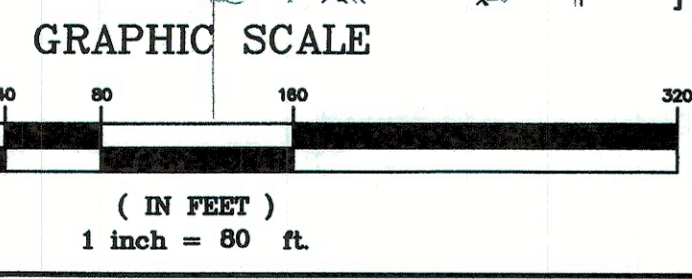
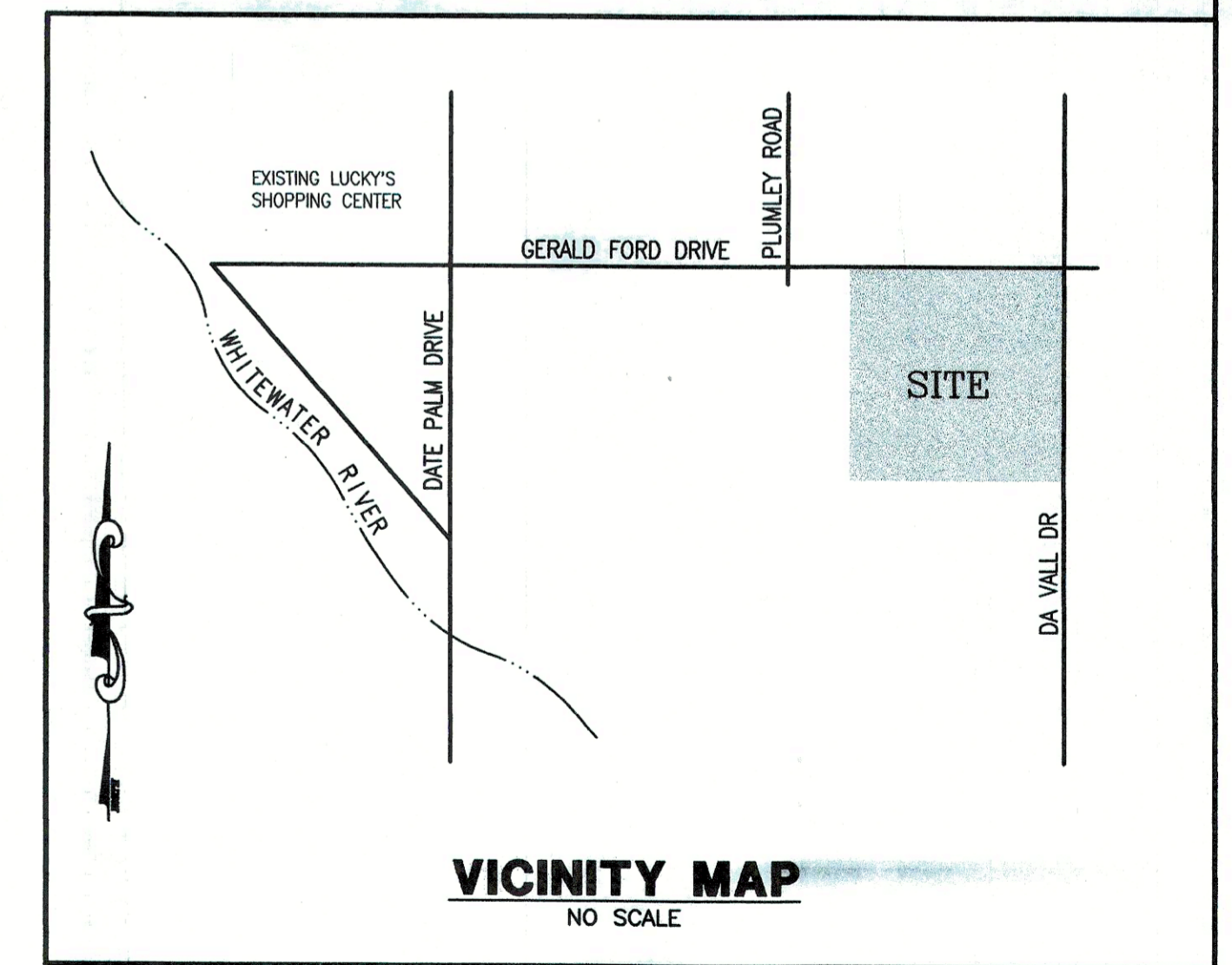
NOTE: FINISHED FLOOR MUST BE 18" MINIMUM ABOVE 10 YEAR WATER SURFACE ELEVATION  
 FINISHED FLOOR MUST BE 6" MINIMUM ABOVE 100 YEAR WATER SURFACE ELEVATION

STORM DURATION (hour)	EFFECTIVE RAIN (in)	FLOOD VOLUME		REQUIRED STORAGE		PEAK FLOW (cfs)
		(cuft)	(acre-ft)	(cuft)	(acre-ft)	
3	0.97	125,639	2.88	115,611	2.65	57.38
6	0.89	115,272	2.65	97,092	2.23	47.08
24	0.56	72,336	1.66	33,595	0.77	7.07

STORM DURATION (hour)	VOLUME REQUIRED (cuft)	VOLUME PROVIDED (cuft)	MAXIMUM DISCHARGE (cfs)	MAXIMUM WSEL (ft)	DEPTH (ft)
3	115,611	3.70	273.76	6.76	
6	97,092	3.55	273.45	6.45	
24	33,595	1.59	269.70	2.70	

**LEGEND**

- STREETS 5.72 acres
- 1/4 ACRE SF LOTS 29.06 acres
- LANDSCAPING 0.96 acres
- DENOTES LIMITS OF FLOODING 100 YEAR - 1 HOUR STORM EVENT



The Keith Companies **TKC**

DESIGN: DLS	DRAFT: DLS
CHECK: KRS	DATE: NOV 00
DWG NO. HY692103	
41-865 Boardwalk, Suite 101, Palm Desert, CA 92211 (760) 346-9844	
<b>SHEET 3 OF 3</b>	

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