Preliminary Hydrology-Hydraulics Study
for
Independence at Canyon Springs
2764 Gateway Drive
Riverside, California 92507

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PREPARER'S CERTIFICATION

This report has been prepared under the direction of a duly Registered Civil Engineer in the State of California. The civil engineer signing below approves of the technical information included within this report along with recommendations and conclusions made.

James H. Kawamura

James H. Kawamura, P.E.
Registered Civil Engineer No. C30560
Exp. 3/31/26



TABLE OF CONTENTS

1.0 Introduction 1
1.1 Project Description 1
1.2 Project Location 1
1.3 Purpose of the Study 2
2.0 Pre-Development Condition 3
2.1 Pre-Development Conditions 3
2.1.1 Hydrologic Setting 3
2.1.2 Watershed 3
2.1.3 Existing Topography, Drainage Patterns, and Facilities (Narrative) 3
2.1.4 Flood Zone 3
2.1.5 Adjacent Land Use 3
2.1.6 Soil Conditions 3
2.1.7 Downstream Conditions 4
2.2 Methodology of Hydrology Study 4
2.2.1 Design Criteria 4
2.2.2 Rational Method 4
2.2.3 Synthetic Unit Hydrograph & Modified Puls Routing 5
2.3 Hydrology Calculations 5
2.3.1 Summary of Drainage Delineation 6
2.4 Results of Pre-Development Hydrology Calculations 6
3.0 Post Development Condition 6
3.1 Post-Development Conditions 6
3.2 Methodology of Hydrology Study 6
3.2.1 Design Criteria 7
3.2.2 Rational Method 7
3.3 Hydrology Calculations 7
3.3.1 Summary of Drainage Delineation 7
3.4 Results of Post-Development Hydrology Calculations 8
4.0 Comparison of Post- and Pre-Development Hydrologic Conditions 8
4.1 Comparative Analyses and Conclusion 8
4.2 Proposed Runoff Management Facilities 9

EXHIBITS

Exhibit A Hydrologic Soils Group Map
Exhibit B Standard Intensity-Duration Curves Data & Precipitation Maps
Exhibit C Runoff Coefficient Curves & Index Number Charts

APPENDICES

Appendix 1 Pre-Development Hydrology Map
Appendix 1.1 Pre-Development Hydrology Calculations: Rational Method
Appendix 2 Post-Development Hydrology Map
Appendix 2.1 Post-Development Hydrology Calculations: Rational Method
Appendix 2.2 Post-Development Hydraulic Calculations: Street and Pipe Hydraulics
Appendix 3 Synthetic Unit Hydrographs
Appendix 4 Basin Routing Calculations
Appendix 5 USDA Soil Report
Appendix 6 FEMA Flood Zone Map
Appendix 7 Receiving Waters and Existing Stream Channel Delineation Maps

1.0 Introduction

1.1 Project Description

The proposed *Independence at Canyon Springs* multi-family residential project will consist of 156 residential dwelling units within 84 two-story duplex apartment buildings with 374 parking stalls on a 9.13 acre site, in the City of Riverside, California. As part of the proposed project, public street improvements, including new curb, gutter, sidewalks, and landscaping will be constructed along Gateway Drive and Canyon Park Drive frontages.

1.2 Project Location

The project site is bounded by vacant land, private parking, and Campus Parkway to the north; Riverside County Voter Registration Office to the west; Gateway Drive and WelbeHealth Medical Center to the south; and Canyon Park Drive to the east. The project site currently consists of vacant land. Figure 1 below shows the vicinity of the project site and its environs, while Figure 2 illustrates the most current site plan for the proposed project.



Figure 1 –Vicinity Map of Project Site



Figure 2 – Site Plan

1.3 Purpose of the Study

This drainage study presents an analysis of the hydrologic effects that may be associated with the proposed *Independence at Canyon Springs* multi-family residential project. The study details the general project characteristics, the design, criteria, and methodology applied to the analysis of the area in terms of drainage and associated conveyance facilities. The plans and specifications in this drainage study are not for construction purposes; the contractor shall refer to final approved construction documents for plans and specifications.

2.0 Pre-Development Condition

2.1 Pre-Development Conditions

2.1.1 Hydrologic Setting

This section summarizes the project's size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.

2.1.2 Watershed

The proposed project is located within the 2,650 square miles Santa Ana watershed and drains to the Santa Ana River. The watershed includes portions of Lost Angeles, Riverside Counties, and San Bernardino County.

2.1.3 Existing Topography, Drainage Patterns, and Facilities (Narrative)

The project site is currently an undeveloped, natural land that gradually slopes from northeast to southwest. Stormwater runoff from the property gradually flows southwesterly without stormwater treatment, where it eventually gets collected by an existing catch basin on the southwest corner of the site connected to an existing storm drainage system.

Adjacent to the subject property, an undeveloped land with a portion of it as a small private parking lot gradually slopes from northeast to southwest. Canyon Park Drive drains southerly, and Gateway Drive drains westerly.

2.1.4 Flood Zone

The subject property is located within Zone X (unshaded), considered to be a minimal risk area outside the 1% and 0.2% annual chance floodplains, as shown on the Federal Emergency Management's (FEMA) Flood Insurance Rate Map (FIRM) No. 06065C0745G, effective date August 28, 2008 (See **Appendix 6** for FEMA Flood Zone Map).

2.1.5 Adjacent Land Use

The project site is bounded by undeveloped land to the north and east; and institutional buildings to the west and south.

2.1.6 Soil Conditions

According to the geotechnical report prepared by LOR Geotechnical Group, Inc. (dated August 21, 2024), the site is underlain by a relatively thin layer of approximately 3 feet of fill materials overlying older alluvial materials. The fill materials comprises of silty sand to sandy silt. The older alluvial materials mainly consists of silty sand to sandy silt with occasional clayey sand

units that becomes dense/stiff with more depth. The site's soil is considered as hydrologic soil group "C" according to the RCFC&WCD Hydrology Manual and USDA Natural Resources Conservation Service. (See **Exhibit A** for Soils Group Map.)

2.1.7 Downstream Conditions

This section summarizes the existing downstream conditions and any conditions of concern with respect to erosion and/or sedimentation due to the proposed project.

The City-owned catch basin on southwest corner of the project site connects to a westerly flowing existing 21-inch reinforced concrete pipe (RCP) storm drain in Gateway Drive, which increases in size to a 48-inch RCP storm drain, 72-inch RCP storm drain, 96-inch RCP storm drain and 120-inch concrete pipe, ultimately discharging into the Tequesquite Arroyo. The Tequesquite Arroyo terminates in Santa Ana River (See **Appendix 7)**.

The existing 21-inch reinforced concrete pipe (RCP) is assumed to be designed to accommodate prospective non-residential uses of the site with 13.2 cfs as its 10-year storm event Q design (See **Appendix 8** for City As-built Storm Drain Plan).

2.2 Methodology of Hydrology Study

This section summarizes the design criteria and methodology applied for the drainage study. The design criteria and methodology follows the Riverside County Flood Control and Water Conservation District (RCFC & WCD) Hydrology Manual (April 1978) noted as "Riverside County Hydrology Manual or RCHM."

2.2.1 Design Criteria

Local storm drain facilities have been designed to conform to standards found in the RCHM. Storm drain facilities have been designed to accommodate both the 10-year and 100-year storm events.

2.2.2 Rational Method

Runoff calculations for this study were accomplished using Hydrowin / AES 2016 software, which incorporates the RCFC & WCD Hydrology Manual. This manual uses a method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage.

$$Q=CIA$$

Where... Q = Peak discharge (cfs);
C = runoff coefficient, based on land use and soil type;
i = Rainfall intensity (in/hr);
A = watershed area (acre)

The runoff coefficient represents the ratio of rainfall that runs off the watershed versus the portion that infiltrates to the soil or is held in depression storage. The runoff coefficient is dependent on the land use coverage and soil type. The RCFC & WCD Hydrology Manual methodology assumes hydrologic Soil Type C" (**Exhibit A**) for all soils near the project site.

The watershed time of concentration at any given point is defined as the time it would theoretically take runoff to travel from the most upstream point in the watershed to a concentration point, as estimated by the Time of Concentration Nomograph for Initial Subarea.

Rainfall Intensity for this site was determined by the intensity-duration curves from the RCHM (See **Exhibit B**). The runoff coefficient represents the ratio of rainfall that runs off the watershed versus the portion that infiltrates to the soil or is held in depression storage. The runoff coefficient (C) is dependent on rainfall intensity (I), and acreage area (A) (See **Exhibit C**).

A set of peak discharge rates were computed for both existing and Post-development Conditions of the project site to facilitate a comparative analysis between the two scenarios.

Rational Method calculations were accomplished using HydroWIN / Advance Engineering Software (AES) 2016 Software. Peak discharges for 10-year, and 100-year hypothetical storm return frequencies were computed and can be seen in the hydrology and drainage analysis section of this report.

2.2.3 Synthetic Unit Hydrograph & Modified Puls Routing

CivilDesign software in accordance with the Riverside County Flood Control and Water Conservation District Hydrology Manual 1978 was used to create synthetic unit hydrographs for both the pre-developed and post-developed conditions for hydrological comparative analysis for retention (See **Appendix 3**).

As per RCHM, if the drainage area is less than 100 acres and has a lag time of less than 8 minutes, a Short Cut Synthetic Hydrograph may be more appropriate to use. Unit times of 5 to 10 minutes for 3 and 6-hour storms are used, and 15-minutes for 24-hour storm. Since the above conditions are met, synthetic unit hydrograph is used to generate the flood volume for both conditions.

Modified Puls Method routing is used for basin routing, and SCS Convex Method is used for stream routing of discharging pipe. Both methods were generated with the same hydraulic software (See **Appendix 3**).

2.3 Hydrology Calculations

This section summarizes the quantitative hydrologic analysis of the Pre-development Conditions of the site.

2.3.1 Summary of Drainage Delineation

Pre-development Analysis:

To analyze the pre-development conditions, the site is subjected into one major drainage subarea EX-A (See **Appendix 1**).

The current conditions of the site is an undeveloped, natural land with 0 percentage of imperviousness with a grade of relatively uniform slope from northeast to southwest. Due to low rate of infiltration, stormwater runoff from subarea EX-A sheet flows southwesterly, discharging into an existing catch basin and eventually enters an existing 21" RCP storm drain pipe on Gateway Drive.

2.4 Results of Pre-Development Hydrology Calculations

Pre-development Calculations:

Under pre-development conditions, the existing site contributes 3.64 cfs for 1-year storm event, 5.26 cfs for 2-year storm event, 9.41 cfs of on-site runoff for 10-year storm event, and 15.36 cfs for 100-year storm event. The Pre-development Conditions results for the project site are summarized in **Table 1**. For the purpose of comparative analysis and conclusion of this report, only the 10-year storm events and 100-year storm events will be the used. (See **Appendix 1.1** for pre-development calculations).

Table 1: Pre-development Conditions Hydrology

Drainage Area	Area (acres)	∑Q1 (cfs)	∑Q2 (cfs)	∑Q10 (cfs)	∑Q100 (cfs)
Subarea EX-A	9.13	3.64	5.26	9.41	15.36
Total	**9.13**	**3.64**	**5.26**	**9.41**	**15.36**

3.0 Post Development Condition

3.1 Post-Development Conditions

The proposed project will have a net increase in total impervious area compared to the existing condition of the site, increasing the site's overall total imperviousness percentage to 80% and decreases perviousness to 20%. Following post-development changes, the average infiltration rate decreases to approximately 90% of the pre-development rate.

3.2 Methodology of Hydrology Study

This section summarizes the design criteria and methodology applied for the drainage study. The design criteria and methodology follows the RCFC & WCD Hydrology Manual (April 1978) noted as "Riverside County Hydrology Manual or RCHM."

3.2.1 Design Criteria

Local storm drain facilities have been designed to conform to standards found in the RCFC & WCD Hydrology Manual (April 1978). Storm drain facilities have been designed to accommodate both the 10-year and 100-year storm events.

3.2.2 Rational Method

Runoff calculations for this study were accomplished using Advanced Engineering Software / HydroWin (AES) 2016 software, which incorporates the RCFC & WCD Hydrology Manual. This manual uses a method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage. See section 2.2 for more information.

3.3 Hydrology Calculations

This section summarizes the quantitative hydrologic analysis of the Post-development Conditions of the site.

3.3.1 Summary of Drainage Delineation

Post-development Analysis:

The proposed site is designated into one main drainage areas: A (see **Appendix 2**) with three subareas: AA, AB, and AC. Each drainage subarea is further subdivided into multiple smaller subareas: A1-A9, A10-A13, and A14-A18.

Stormwater runoff from the buildings in Subareas AA, AB, and AC will be collected by multiple roof drains, inlets, and catch basins which will be connected into the proposed storm drain system. Surface area runoff will flow along the proposed curb and gutters, to be collected by multiple catch basins distributed throughout the site. All runoff will be routed for pre-treatment, prior to a solid walled corrugated metal pipe (CMP) for detention, and be discharged via proposed 18-inch storm drain pipe, connecting to the existing catch basin and replacing a portion of the existing 21-inch RCP storm drain pipe in Gateway Drive with 24-inch storm drain pipe. A portion of the existing off-site 21-inch RCP storm drain pipe needs to be replaced to meet the invert requirements of the on-site storm drain lines. This replacement is equivalent to 75.68 linear feet of the storm drain pipe plus 4-feet manhole. Please refer to **Appendix 2** and **Appendix 2.2** for the extent of this replacement.

Stormwater flows exceeding the treatment volume capacity will bypass the treatment system and continue through the private storm drain system, where it will confluence with the existing catch basin on Gateway Drive. Please refer to WQMP report for further stormwater treatment narrative.

Catch basins, curb and gutter hydraulic calculations, and storm drain pipes sizing calculations will be provided on the **Appendix 2.2 Post-development Hydraulic Calculations** of this report.

3.4 Results of Post-Development Hydrology Calculations

Post-development Calculations:

Under the post-development conditions, the site will produce 8.81 cfs for 1-year storm event, 11.64 cfs for 2-year storm event, 18.47 cfs for 10-year storm event, and 27.91 cfs for 100-year storm event. Runoff from storm events will be collected by the on-site storm drain system routed into the proposed corrugated metal pipe (CMP) detention tank, prior to being discharged off-site into an existing catch basin via an 18-inch storm drain pipe. Results from the project's Post-Development Conditions are summarized in **Table 2** (See **Appendix 2.1** for post-development calculations). For the purpose of comparative analysis and conclusion of this report, only the 2-year, 10-year and 100-year storm events will be the used.

Table 2: Post-development Conditions Hydrology

Drainage Area	Area (acres)	∑Q1 (cfs)	∑Q2 (cfs)	∑Q10 (cfs)	∑Q100 (cfs)
Subareas A1-A9	3.68	4.16	5.49	8.67	13.08
Subareas A10-A13	2.51	2.37	3.13	4.96	7.50
Subareas A14-A18	2.94	2.55	3.35	5.26	7.81
Subarea P	0.30	0.06	0.09	0.17	0.29
Peak Flow Rate	**9.13**	**8.81**	**11.64**	**18.47**	**27.91**

4.0 Comparison of Post- and Pre-Development Hydrologic Conditions

4.1 Comparative Analyses and Conclusion

Site Analysis Results:

Table 3: Hydrology Comparative Analysis: Unit Hydrographs & Routing

Storm Event	Pre-development Condition		Post-development Condition		Detention		Post-routing	
	Q (cfs)	Volume (cf)	Q (cfs)	Volume (cf)	Q (cfs)	Volume (cf)	Q (cfs)	Volume (cf)
2-Year, 24-hour	0.312	6,447	1.732	45,851	5.70	39,403	0.324	7,013
10-Year, 24-hour	2.507	42,574	2.894	73,126	8.70	30,552	2.147	32,583
100-Year, 24-hour	4.904	115,543	5.265	125,398	13.55	9,855	4.181	34,456

The synthetic unit hydrographs for both pre- and post-development conditions for the 2-year, 10-year, and 100-year 24-hour storm events were developed using CivilDesign software. Results of the generated flowrate and volume are shown in **Table 3** (See **Appendices 3 & 4** for detailed synthetic unit hydrograph and basin routing calculations). The volume difference of 100-year 24-

hour storm events between pre- and post-development was compared for the required detention of the basin to accommodate smaller storm events.

Table 4: Hydrology Comparative Analysis: Rational Method Peak Flow Rates

Condition	Area (acres)	∑Q1 (cfs)	∑Q2 (cfs)	∑Q10 (cfs)	∑Q100 (cfs)
Pre-development	9.13	3.64	5.26	9.41	15.36
Post-development	9.13	8.81	11.64	18.47	27.91

Based on the results from the AES rational method calculations, the post-development conditions will generate higher peak flow rates compared to the pre-development conditions (See **Table 4** above). This increase in runoff is attributed to the development of the site, decreasing its perviousness and increasing its impervious area; thus a proposed underground detention system is proposed to mitigate this excessive runoff and volume.

Pre-detention for stormwater quality design volume is required to reduce the runoff volume discharging into the existing public storm drain system to match the pre-developed conditions. The proposed underground detention system is adequately sized to detain the post-development runoff volume and match the pre-development conditions by using a 6-ft Corrugated Metal Pipe (CMP) detention tank with two orifice sizes: 2.5"-inch orifice for low-flow and 12"-inch orifice pipe for high flow, eventually connecting to 24-inch discharge pipe. Please see basin characteristics in basin routing calculations in **Appendix 4.**

The release of post-development runoff is restricted to **0.324 cfs** for 2-year, 24-hour storm event, **2.14 cfs** for 10-year, 24-hour storm event and **4.18 cfs** for 100-year, 24-hour storm event (See **Table 3 Post-routing peak flow rates**). Therefore, the proposed development will not negatively impact the downstream storm drain system or receiving waters.

4.2 Proposed Runoff Management Facilities

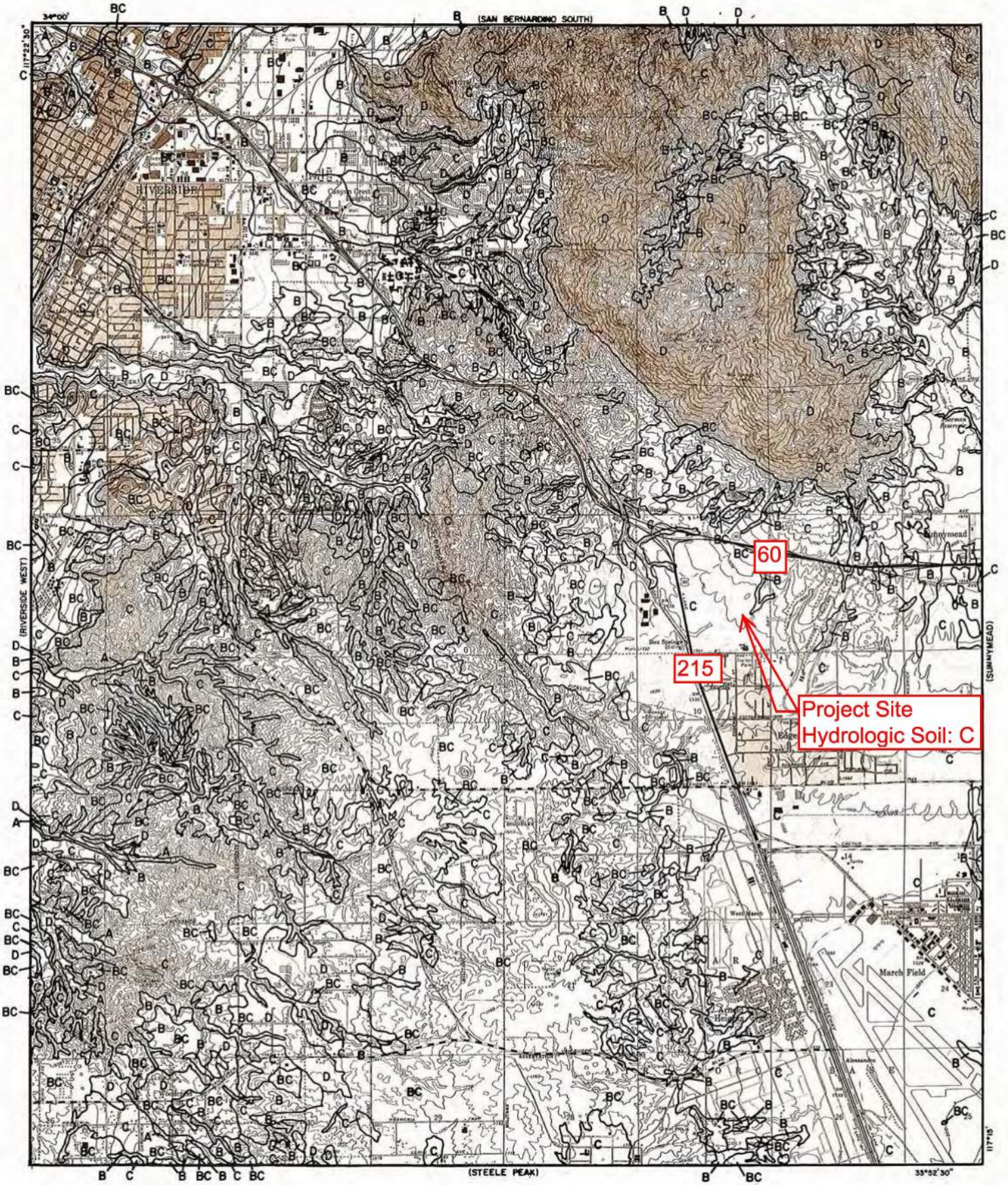
The proposed facilities managing runoff from the area include:

- ❑ Water quality treatment control Best Management Practices (BMPs); specifically, Modular Wetland Systems (refer to WQMP report)
- ❑ Proposed corrugated metal pipe (CMP) detention tank will be placed on the project site.
- ❑ A trash screen to meet SWRCB trash amendment requirements will be installed at the onsite junction structure located just upstream of the discharge point into the MS4.

EXHIBITS

Exhibit A

Hydrologic Soils Group Map
(Plate C-1.16)



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC&WCD

HYDROLOGY MANUAL

N

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR RIVERSIDE-EAST

PLATE C-1.16

Exhibit B

Standard Intensity-Duration Curves Data (Plate D-4.1) & Precipitation Maps (Plates D-4.3-4, D-4.6, E-5.1-6)

RCFC & WCD

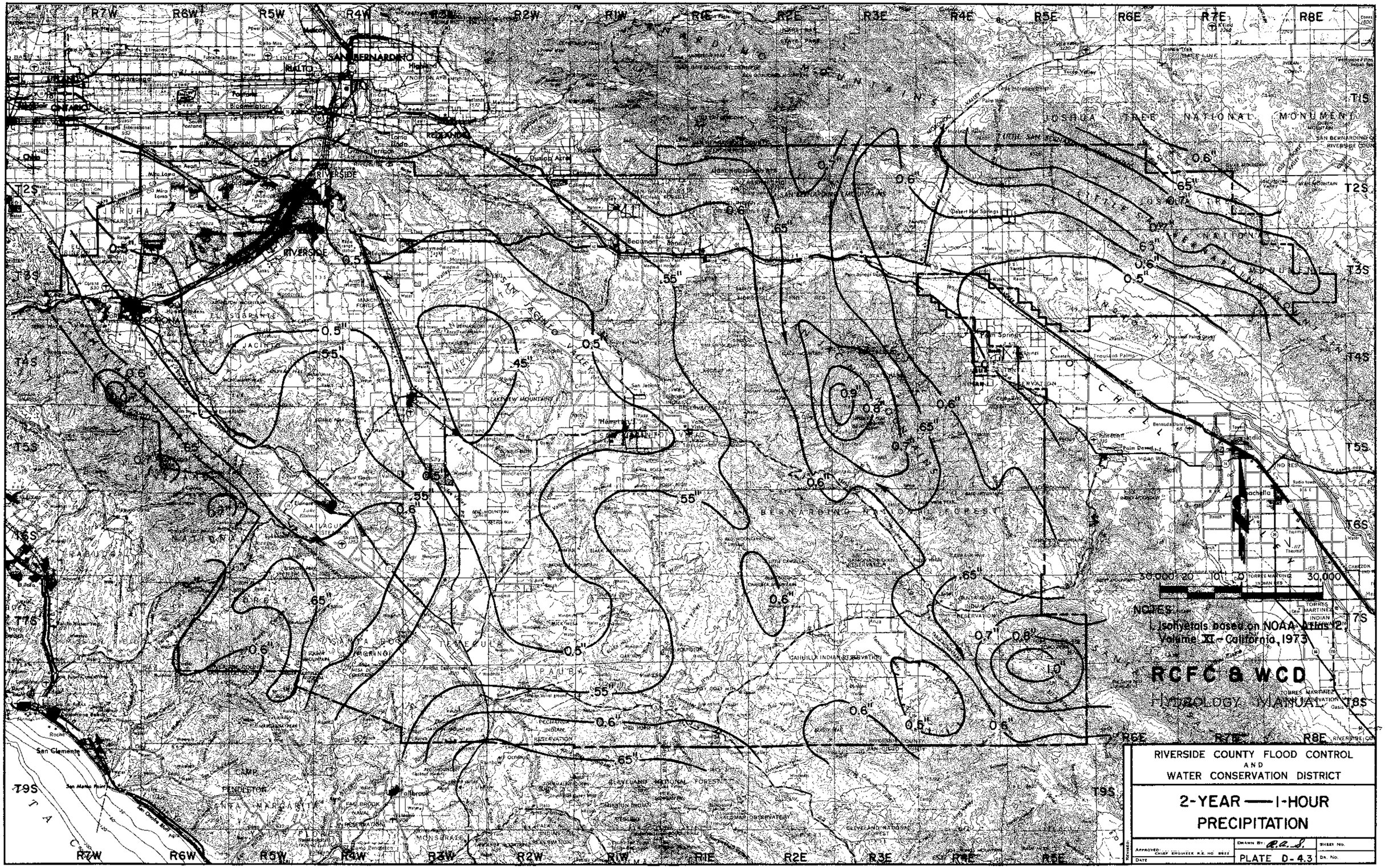
HYDROLOGY MANUAL

RAINFALL INTENSITY—INCHES PER HOUR

RIVERSIDE			RIVERSIDE (FOOTHILL AREAS)			RUBIDOUX			SAN JACINTO			SUN CITY		
DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR
5	2.75	3.92	5	3.14	4.71	5	3.18	4.71	5	2.81	4.16	5	3.25	4.85
6	2.48	3.55	6	2.84	4.26	6	2.87	4.26	6	2.56	3.79	6	2.95	4.40
7	2.28	3.26	7	2.61	3.91	7	2.64	3.91	7	2.37	3.51	7	2.72	4.06
8	2.12	3.03	8	2.42	3.63	8	2.45	3.63	8	2.22	3.29	8	2.53	3.78
9	1.99	2.84	9	2.27	3.41	9	2.30	3.41	9	2.09	3.10	9	2.38	3.55
10	1.88	2.68	10	2.14	3.21	10	2.17	3.21	10	1.98	2.94	10	2.25	3.36
11	1.78	2.54	11	2.03	3.05	11	2.06	3.05	11	1.89	2.80	11	2.14	3.19
12	1.70	2.42	12	1.94	2.91	12	1.96	2.91	12	1.81	2.68	12	2.04	3.05
13	1.62	2.32	13	1.86	2.78	13	1.88	2.78	13	1.74	2.58	13	1.96	2.92
14	1.56	2.23	14	1.78	2.67	14	1.80	2.67	14	1.68	2.48	14	1.88	2.81
15	1.50	2.14	15	1.71	2.57	15	1.74	2.57	15	1.62	2.40	15	1.81	2.71
16	1.45	2.07	16	1.66	2.48	16	1.68	2.48	16	1.57	2.32	16	1.75	2.62
17	1.40	2.00	17	1.60	2.40	17	1.62	2.40	17	1.52	2.25	17	1.70	2.54
18	1.36	1.94	18	1.55	2.33	18	1.57	2.33	18	1.48	2.19	18	1.65	2.46
19	1.32	1.88	19	1.51	2.26	19	1.52	2.26	19	1.44	2.13	19	1.60	2.39
20	1.28	1.83	20	1.46	2.20	20	1.48	2.20	20	1.40	2.08	20	1.56	2.33
22	1.22	1.74	22	1.39	2.08	22	1.41	2.08	22	1.34	1.98	22	1.48	2.21
24	1.16	1.66	24	1.32	1.99	24	1.34	1.99	24	1.28	1.90	24	1.41	2.11
26	1.11	1.58	26	1.27	1.90	26	1.28	1.90	26	1.23	1.82	26	1.36	2.03
28	1.06	1.52	28	1.22	1.82	28	1.23	1.82	28	1.19	1.76	28	1.30	1.95
30	1.02	1.46	30	1.17	1.76	30	1.19	1.76	30	1.15	1.70	30	1.26	1.88
32	.99	1.41	32	1.13	1.70	32	1.14	1.70	32	1.11	1.64	32	1.21	1.81
34	.96	1.37	34	1.09	1.64	34	1.11	1.64	34	1.08	1.59	34	1.18	1.76
36	.93	1.32	36	1.06	1.59	36	1.07	1.59	36	1.05	1.55	36	1.14	1.70
38	.90	1.29	38	1.03	1.54	38	1.04	1.54	38	1.02	1.51	38	1.11	1.66
40	.87	1.25	40	1.00	1.50	40	1.01	1.50	40	.99	1.47	40	1.08	1.61
45	.82	1.17	45	.94	1.41	45	.95	1.41	45	.94	1.39	45	1.01	1.51
50	.77	1.11	50	.88	1.33	50	.90	1.33	50	.89	1.31	50	.96	1.43
55	.73	1.05	55	.84	1.26	55	.85	1.26	55	.85	1.25	55	.91	1.36
60	.70	1.00	60	.80	1.20	60	.81	1.20	60	.81	1.20	60	.87	1.30
65	.67	.96	65	.77	1.15	65	.78	1.15	65	.78	1.15	65	.83	1.25
70	.64	.92	70	.73	1.10	70	.74	1.10	70	.75	1.11	70	.80	1.20
75	.62	.88	75	.71	1.06	75	.72	1.06	75	.72	1.07	75	.77	1.15
80	.60	.85	80	.68	1.02	80	.69	1.02	80	.70	1.04	80	.75	1.12
85	.58	.83	85	.66	.99	85	.67	.99	85	.68	1.01	85	.72	1.08
SLOPE = .550			SLOPE = .550			SLOPE = .550			SLOPE = .500			SLOPE = .530		

STANDARD INTENSITY – DURATION CURVES DATA

PLATE D-4.1 (5 of 6)



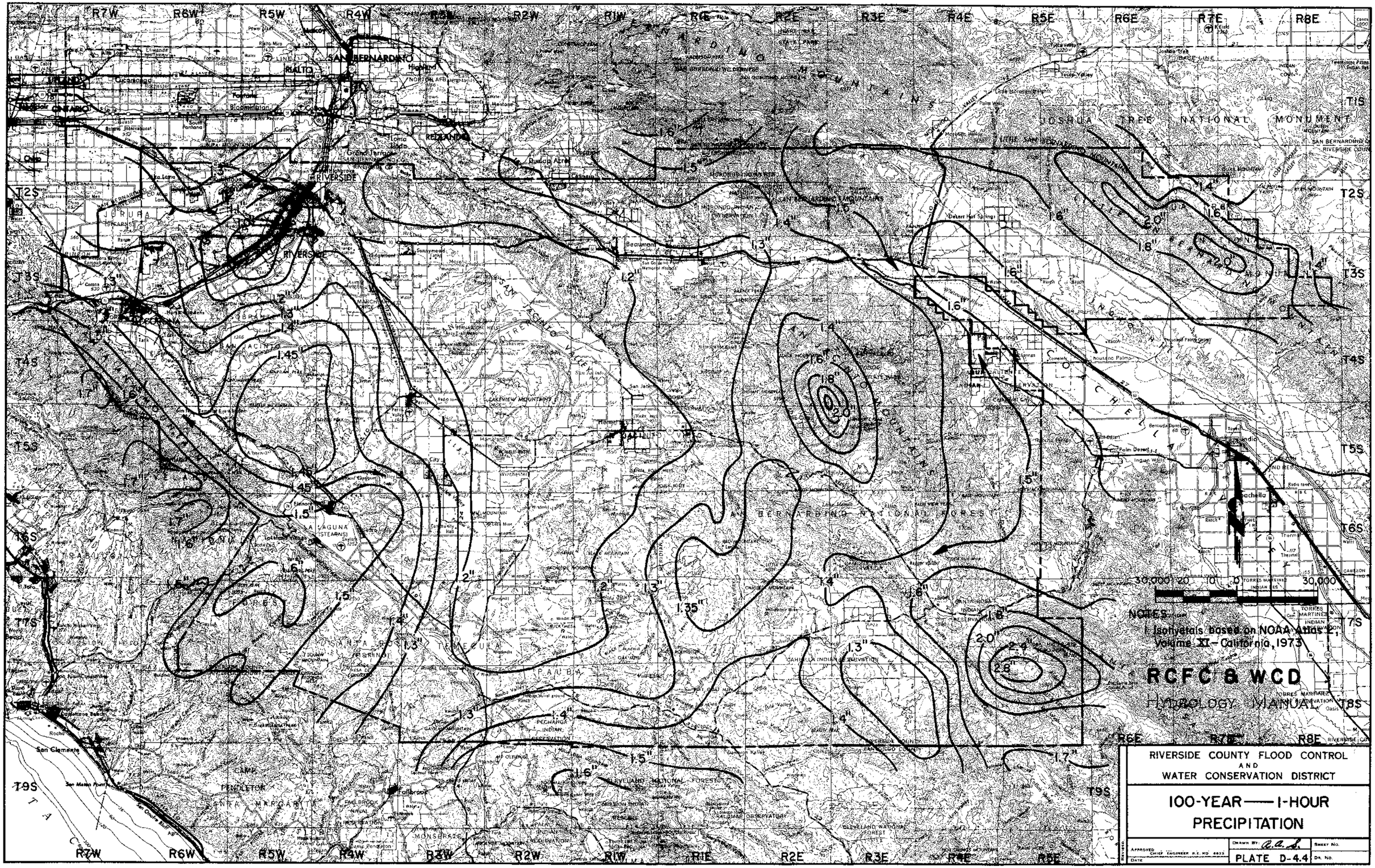
NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973

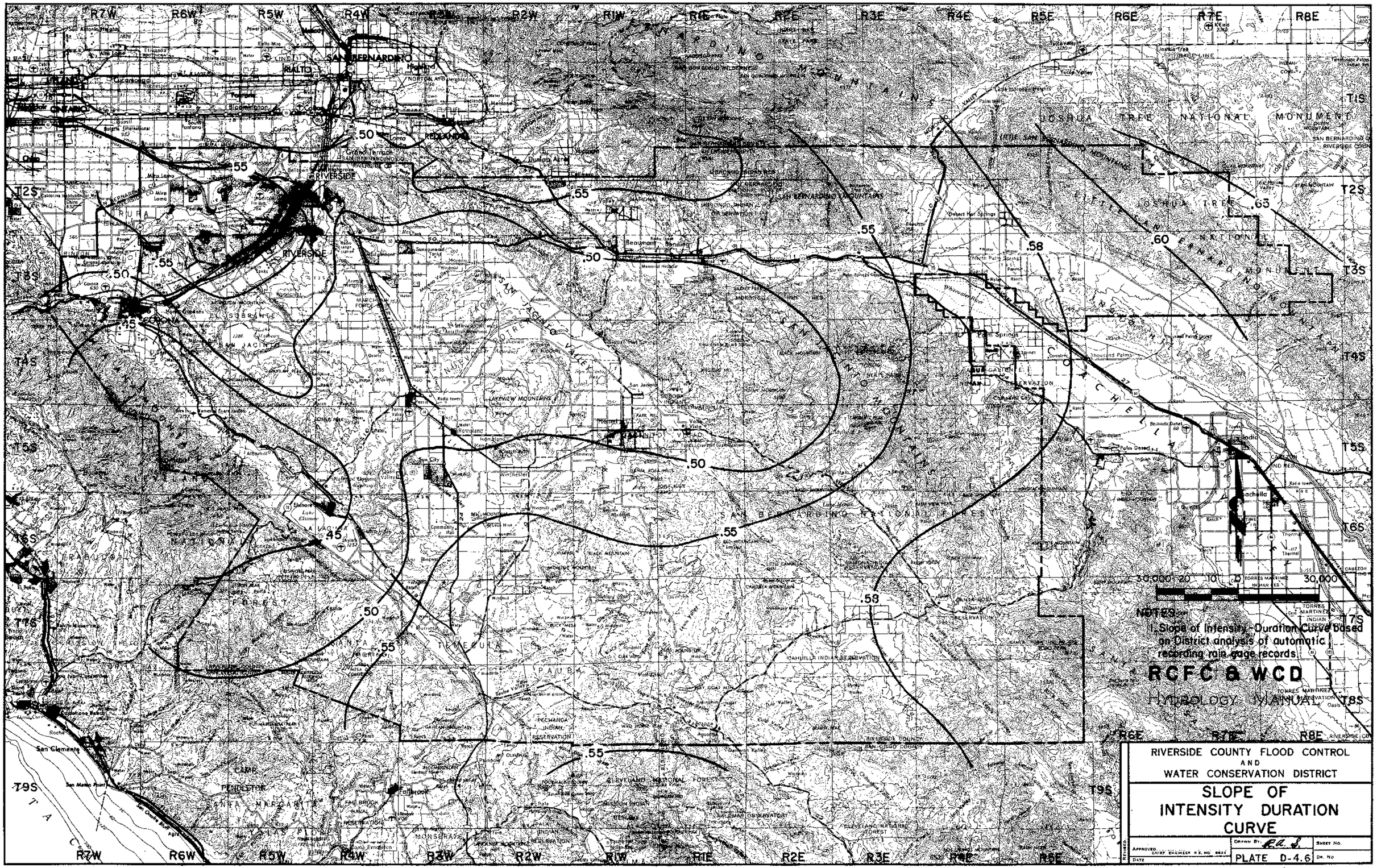
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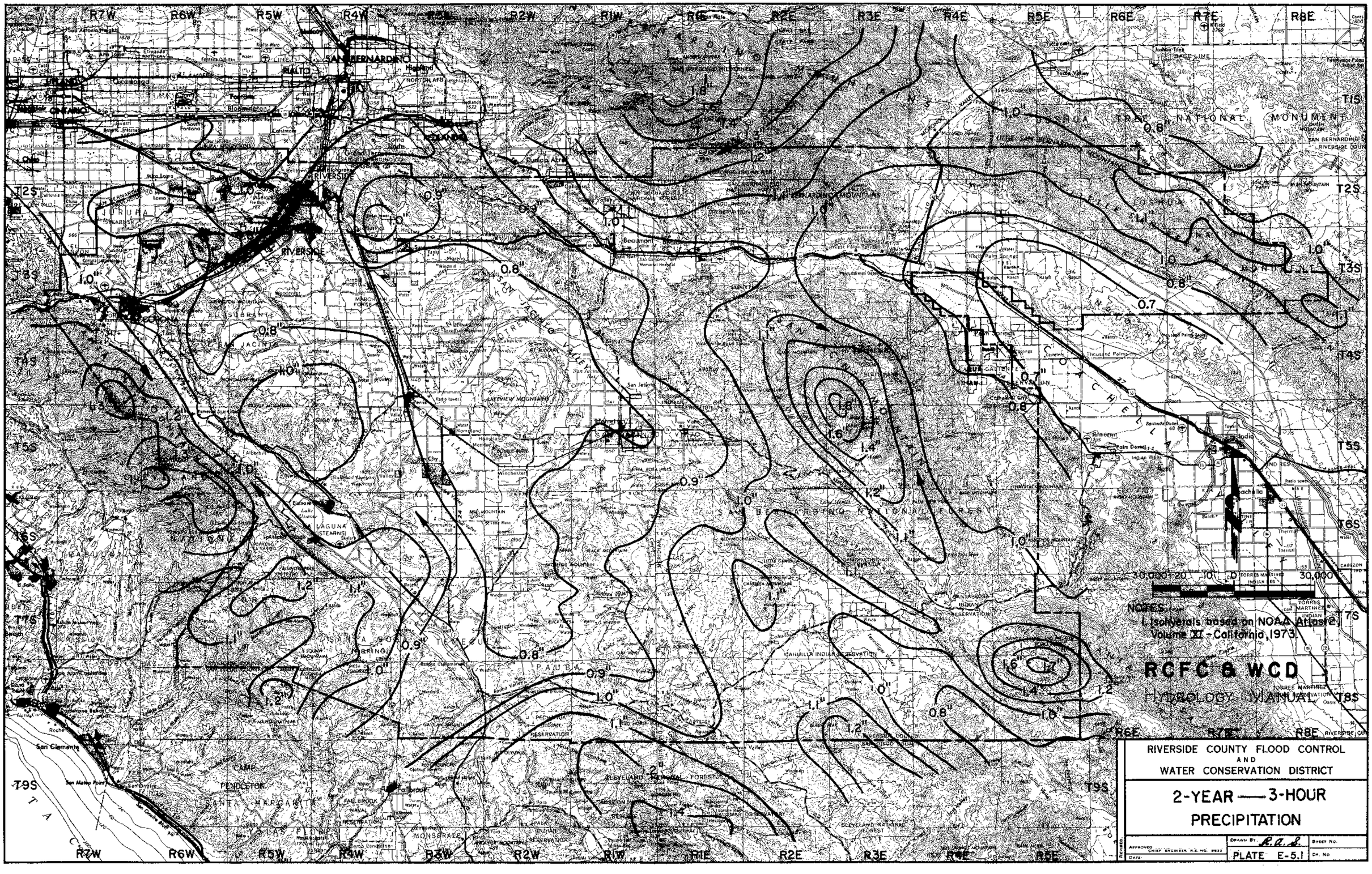
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

2-YEAR — 1-HOUR PRECIPITATION

APPROVED: CHIEF ENGINEER R.E. NO. 8822	DRAWN BY: R.A.S.	SHEET No.
DATE	PLATE D-4.3	DR. No.
REVISED		


R7W
R6W
R5W
R4W
R3W
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JURUPA
PERRIS
HEMET
SAN JACINTO
BEAUMONT
BANNING
CABAZON
INDIO
COACHELLA
PALM SPRINGS
DESERT HOT SPRINGS
THOUSAND PALMS
PALM DESERT
INDIAN WELLS
LA QUINTA
SAN JACINTO MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN GABRIEL MOUNTAINS
JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST
SANTA ROSA MOUNTAINS
SAN JACINTO FAULT
SAN ANDREAS FAULT
SAN JACINTO VALLEY
SAN TIMOTEO CANYON
SANTA ANA RIVER
SANTA MARGARITA RIVER
SAN LUIS REY RIVER
TEMECULA
MURRIETA
LAKE ELSINORE
LAKE MATHEWS
LAKE PERRIS
LAKE SKINNER
LAKE HEMET
LAKE CAHUILLA
SALTON SEA
CAMP PENDLETON
TORRES MARTINEZ INDIAN RESERVATION
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FALLBROOK
VISTA
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SAN ONOFRE BLUFF
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1.7"
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NOTES
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973.
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 1-HOUR PRECIPITATION
APPROVED CHIEF ENGINEER R.E. NO. 6823
DATE
DRAWN BY R.A.S.
PLATE D-4.4
SHEET NO.
DR. NO.
REVISED


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SAN BERNARDINO MOUNTAINS
SAN JACINTO MOUNTAINS
JOSHUA TREE NATIONAL MONUMENT
SAN BERNARDINO NATIONAL FOREST
CLEVELAND NATIONAL FOREST
SANTA ROSA MOUNTAINS
SAN JACINTO VALLEY
SAN JACINTO FAULT
SAN ANDREAS FAULT
SAN JACINTO WILDERNESS
SAN GORGONIO WILDERNESS
SANTA ROSA WILDERNESS
SAN GABRIEL MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
LAKEVIEW MOUNTAINS
RIVERSIDE
SAN BERNARDINO
RIALTO
ONTARIO
CORONA
MORENO VALLEY
PERRIS
HEMET
BEAUMONT
BANNING
PALM SPRINGS
INDIO
LA QUINTA
COACHELLA
SAN JACINTO
HEMET LAKE
LAKE ELSINORE
LAKE MATHEWS
MARCH AFB
NORTON AFB
TEMECULA
MURRIETA
SAN CLEMENTE
CAMP PENDLETON
PECHANGA INDIAN RESERVATION
AGUANGA INDIAN RESERVATION
MORONGO INDIAN RESERVATION
SANTA ROSA INDIAN RESERVATION
CAHUILLA INDIAN RESERVATION
TORRES MARTINEZ INDIAN RES
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T4S
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NOTES
1. Slope of Intensity-Duration Curve based on District analysis of automatic recording rain gage records
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
SLOPE OF INTENSITY DURATION CURVE
APPROVED CHIEF ENGINEER R.E. NO. 8822
DATE
DRAWN BY: R.A.S.
SHEET NO.
PLATE D-4.6
DR. NO.
REVISED



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

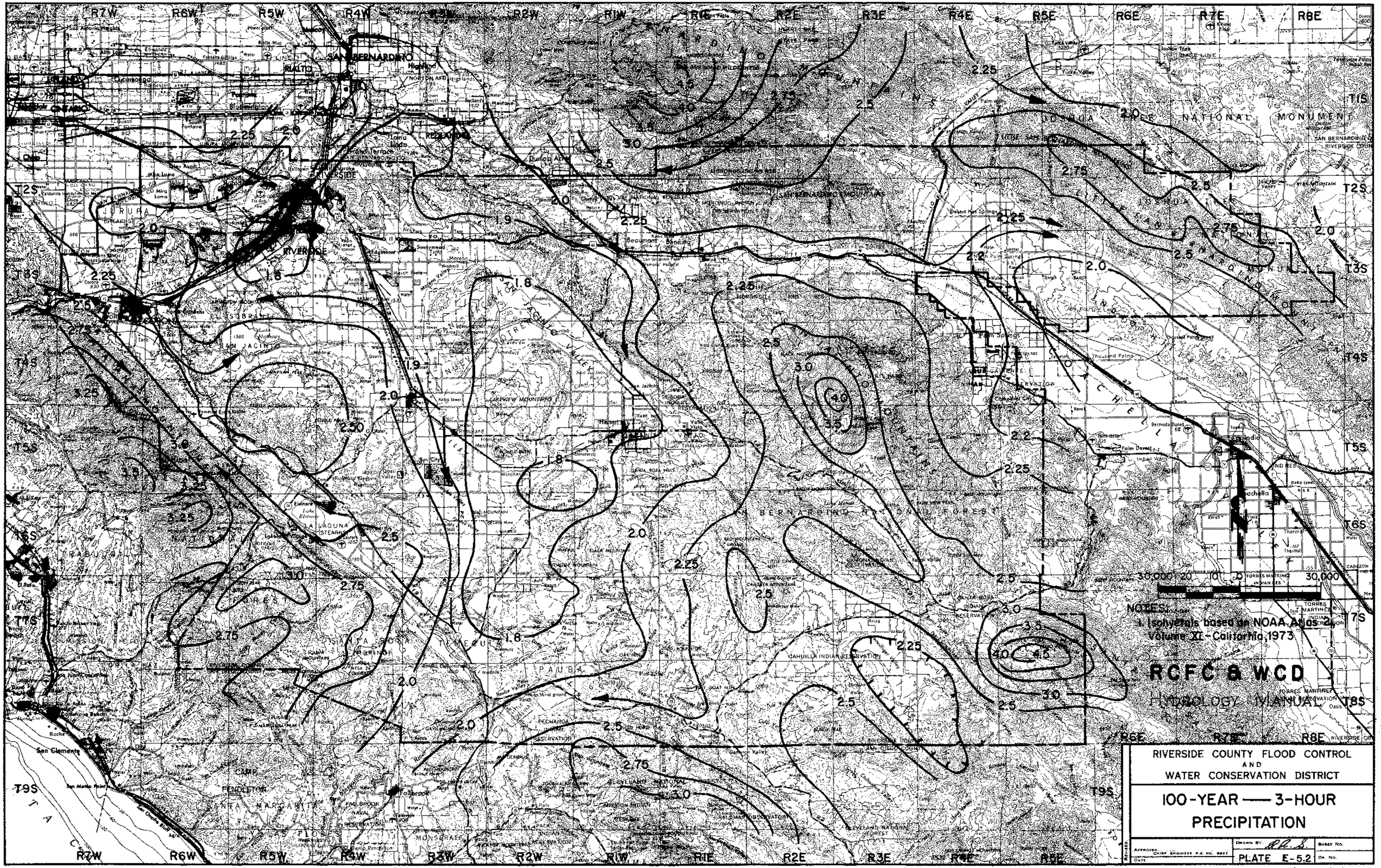
RCFC & WCD

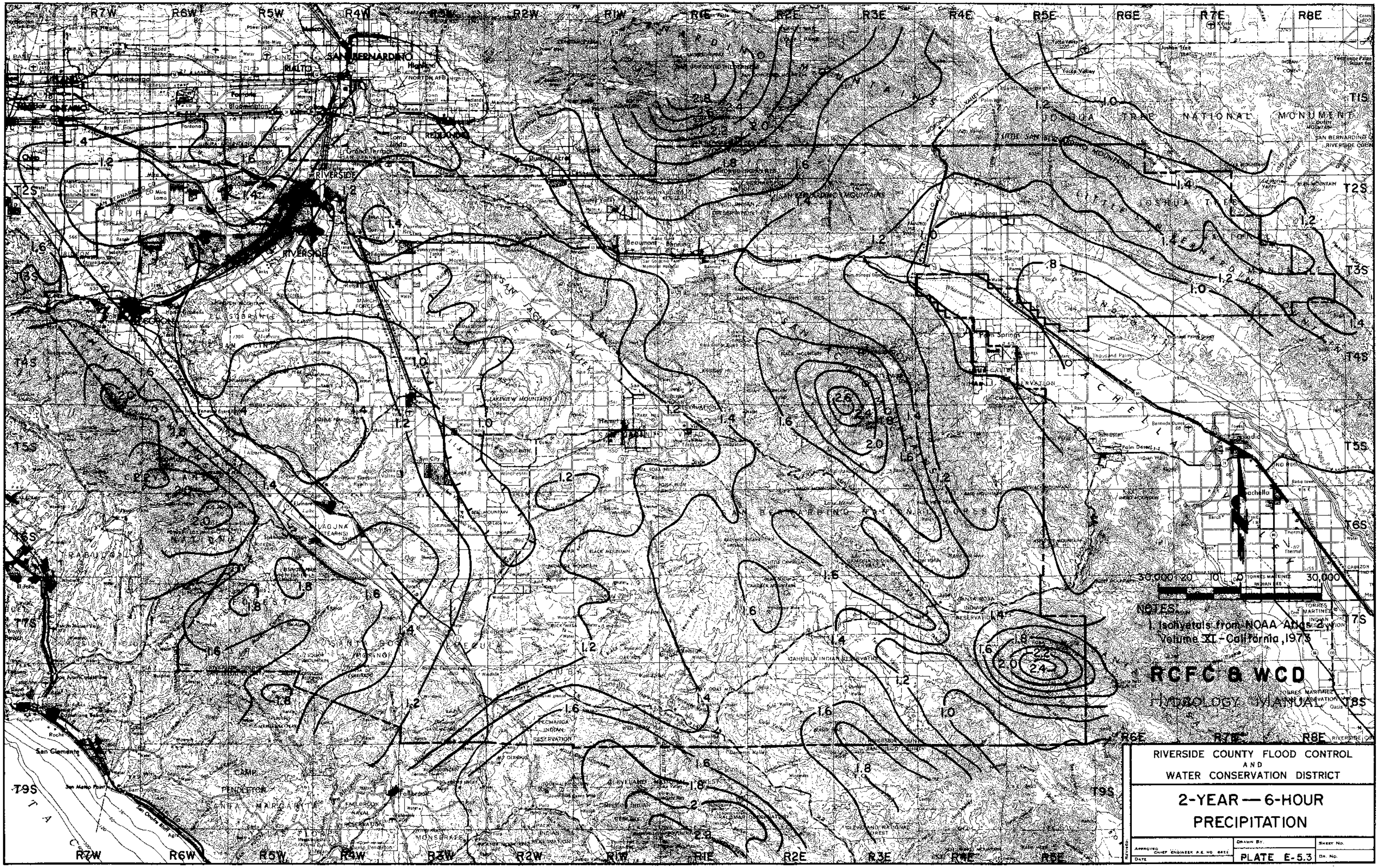
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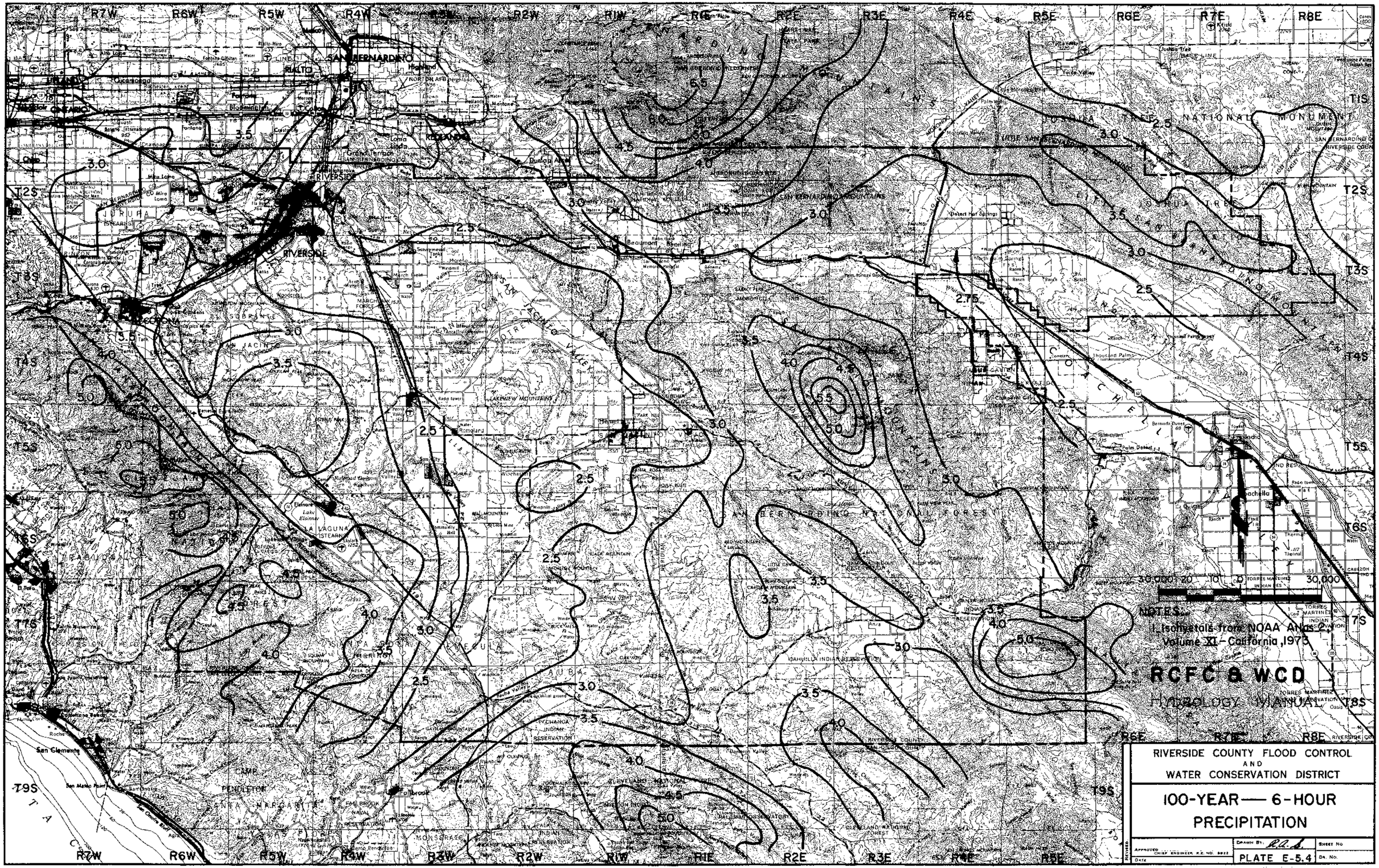
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

2-YEAR — 3-HOUR PRECIPITATION

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DATE	PLATE E-5.1	DR. NO.


NOTES:
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 3-HOUR PRECIPITATION
PLATE E-5.2
SAN BERNARDINO MOUNTAINS
SAN JACINTO MOUNTAINS
SAN BERNARDINO NATIONAL FOREST
SANTA ROSA MOUNTAINS
SANTA ROSA INDIAN RESERVATION
AGUA CALIENTE INDIAN RESERVATION
MORONGO INDIAN RESERVATION
TORRES MARTINEZ INDIAN RESERVATION
SAN JACINTO WILDERNESS
SAN GORGONIO WILDERNESS
JOSHUA TREE NATIONAL MONUMENT
CAMP PENDLETON
SANTA MARGARITA
LAGUNA MOUNTAINS
PECHANGA INDIAN RESERVATION
SAN MANUEL INDIAN RESERVATION
SAN JACINTO FAULT
SAN ANDREAS FAULT
SAN JACINTO VALLEY
PAUBA
SANTA ROSA PLATEAU
SAN ONOFRE BLUFF
SAN MATEO POINT
SAN CLEMENTE
SAN BERNARDINO
RIVERSIDE
RIALTO
COLTON
REDLANDS
LOMA LINDA
HIGHLAND
NORTON AFB
DURHAM AFB
BANNING
BEAUMONT
CALIMESA
PALM SPRINGS
DESERT HOT SPRINGS
INDIO
COACHELLA
TEMECULA
MURRIETA
FALLBROOK
BONSALL
VISTA
OCEANSIDE
CARLSBAD
ESCONDIDO
SAN MARCOS
SAN DIEGUITO
ENCINITAS
SOLANA BEACH
DEL MAR
LA JOLLA
BLACK MOUNTAIN
LAKEVIEW MOUNTAINS
SAN JACINTO PEAK
SAN GORGONIO MOUNTAIN
SAN JACINTO MOUNTAINS
SANTA ROSA MOUNTAINS
LITTLE SAN BERNARDINO MOUNTAINS
R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E
T2S T3S T4S T5S T6S T7S T8S T9S


RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 6-HOUR
PRECIPITATION
APPROVED CHIEF ENGINEER R.E. NO.
DATE
DRAWN BY.
PLATE E-5.3
SHEET NO.
DR. NO.
REVISED:
NOTES:
1. Isohyetals from NOAA Atlas 2 Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL
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SAN BERNARDINO
RIVERSIDE
JOSHUA TREE NATIONAL MONUMENT
Palm Springs
Indio
Coachella
Hemet
San Clemente
Fallbrook
CAMP PENDLETON


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MORENO VALLEY
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HEMET
SAN JACINTO
TEMECULA
MURRIETA
LAKE ELSINORE
SAN JACINTO MOUNTAINS
SAN BERNARDINO MOUNTAINS
SANTA ROSA MOUNTAINS
LAKEVIEW MOUNTAINS
SAN JACINTO FAULT ZONE
SAN JACINTO VALLEY
SAN JACINTO RIVER
SANTA ANA RIVER
SANTA MARGARITA RIVER
TEMECULA CREEK
SAN JACINTO WILDERNESS
SAN BERNARDINO NATIONAL FOREST
JOSHUA TREE NATIONAL MONUMENT
CAHUILLA INDIAN RESERVATION
AGUANGA INDIAN RESERVATION
SANTA ROSA INDIAN RESERVATION
TORRES MARTINEZ INDIAN RESERVATION
CABAZON INDIAN RESERVATION
MARCH AIR FORCE BASE
NORTON AFB
CAMP PENDLETON
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NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973
RCFC & WCD
HYDROLOGY MANUAL
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 6-HOUR PRECIPITATION
APPROVED CHIEF ENGINEER R.E. NO. 8822
DATE
REVISED
DRAWN BY: R.A.L.
SHEET NO.
PLATE E-5.4
DR. NO.

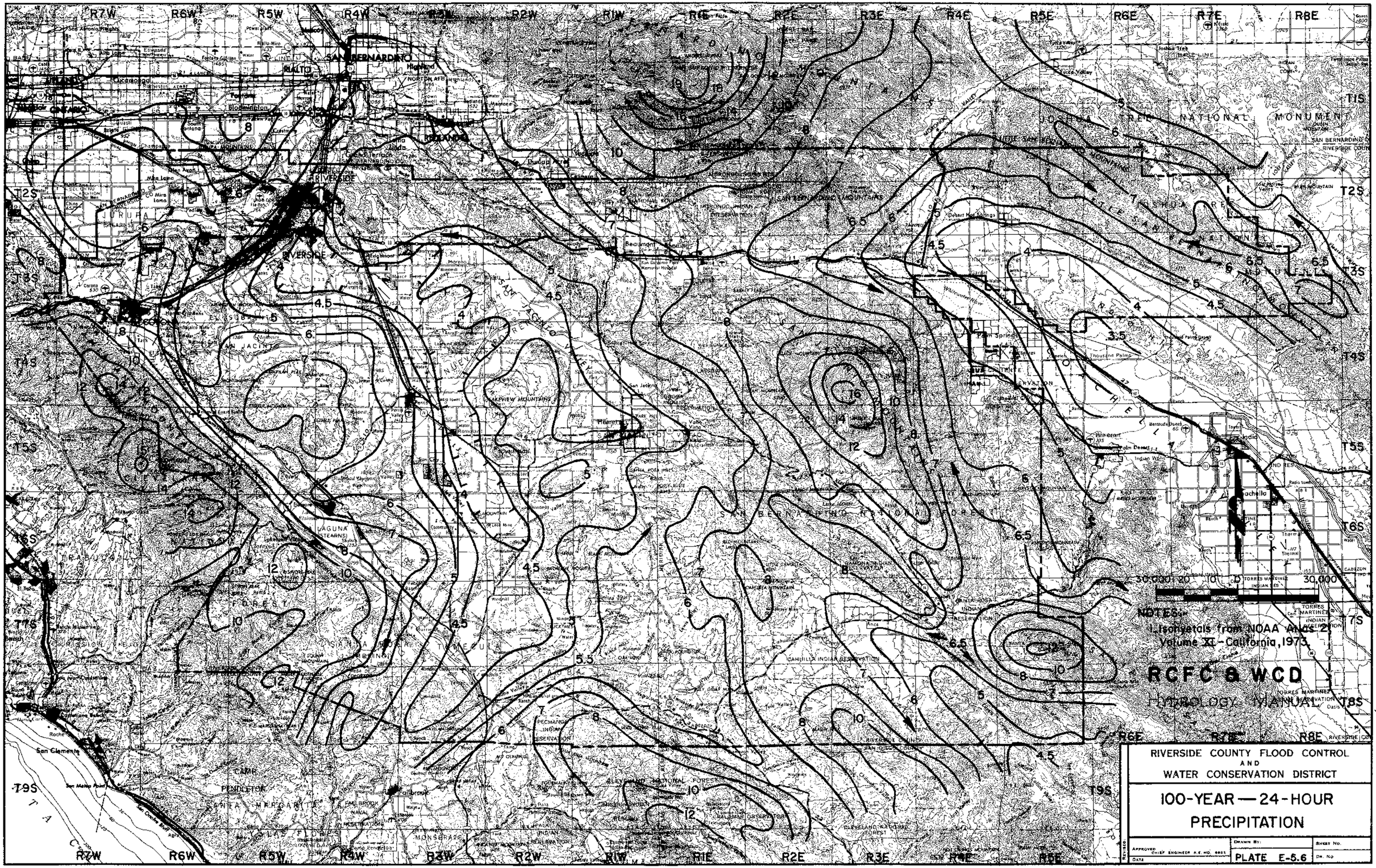
NOTES:
1. Isohyetals from NOAA Atlas 2, Volume XI - California, 1973.

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HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

2-YEAR — 24-HOUR PRECIPITATION

APPROVED: CHIEF ENGINEER R.E. NO. 6823	DRAWN BY: R.A.J.	SHEET NO.
DATE	PLATE E-5.5	DR. NO.



RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

100-YEAR — 24-HOUR PRECIPITATION

APPROVED CHIEF ENGINEER R.E. NO. 6883	DRAWN BY:	SHEET No.
DATE	PLATE E-5.6	DR. NO.

NOAA Atlas 14, Volume 6, Version 2
Location name: Riverside, California, USA*
Latitude: 33.9348°, Longitude: -117.2819°
Elevation: 1567 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.091 (0.076-0.110)	0.119 (0.099-0.144)	0.157 (0.131-0.191)	0.189 (0.156-0.232)	0.235 (0.187-0.298)	0.271 (0.211-0.351)	0.308 (0.234-0.410)	0.349 (0.257-0.477)	0.405 (0.286-0.579)	0.451 (0.307-0.668)
10-min	0.130 (0.108-0.157)	0.171 (0.142-0.207)	0.225 (0.187-0.274)	0.272 (0.224-0.333)	0.336 (0.268-0.427)	0.388 (0.302-0.503)	0.442 (0.336-0.588)	0.500 (0.369-0.684)	0.581 (0.410-0.830)	0.646 (0.440-0.958)
15-min	0.157 (0.131-0.190)	0.206 (0.172-0.250)	0.273 (0.227-0.331)	0.328 (0.271-0.403)	0.407 (0.324-0.516)	0.469 (0.365-0.609)	0.535 (0.406-0.711)	0.604 (0.446-0.828)	0.702 (0.496-1.00)	0.781 (0.533-1.16)
30-min	0.240 (0.201-0.291)	0.315 (0.263-0.382)	0.417 (0.347-0.507)	0.502 (0.414-0.616)	0.622 (0.495-0.789)	0.718 (0.559-0.931)	0.818 (0.621-1.09)	0.924 (0.681-1.27)	1.07 (0.759-1.54)	1.20 (0.815-1.77)
60-min	0.346 (0.289-0.419)	0.454 (0.378-0.550)	0.600 (0.499-0.729)	0.723 (0.596-0.886)	0.895 (0.713-1.14)	1.03 (0.804-1.34)	1.18 (0.893-1.56)	1.33 (0.981-1.82)	1.54 (1.09-2.21)	1.72 (1.17-2.55)
2-hr	0.499 (0.416-0.604)	0.643 (0.536-0.779)	0.835 (0.694-1.02)	0.994 (0.819-1.22)	1.21 (0.966-1.54)	1.38 (1.08-1.80)	1.56 (1.19-2.08)	1.75 (1.29-2.39)	2.00 (1.42-2.86)	2.21 (1.50-3.27)
3-hr	0.609 (0.508-0.736)	0.780 (0.650-0.945)	1.01 (0.837-1.22)	1.19 (0.984-1.46)	1.45 (1.15-1.84)	1.65 (1.28-2.14)	1.85 (1.41-2.46)	2.07 (1.52-2.83)	2.36 (1.66-3.37)	2.59 (1.76-3.83)
6-hr	0.836 (0.698-1.01)	1.07 (0.891-1.30)	1.38 (1.14-1.67)	1.62 (1.34-1.99)	1.96 (1.56-2.49)	2.23 (1.74-2.89)	2.50 (1.89-3.32)	2.77 (2.04-3.79)	3.14 (2.22-4.50)	3.44 (2.34-5.09)
12-hr	1.09 (0.910-1.32)	1.41 (1.17-1.70)	1.82 (1.51-2.21)	2.16 (1.78-2.64)	2.61 (2.08-3.31)	2.96 (2.31-3.84)	3.32 (2.52-4.41)	3.68 (2.72-5.04)	4.18 (2.95-5.98)	4.56 (3.11-6.76)
24-hr	1.43 (1.27-1.65)	1.87 (1.66-2.16)	2.45 (2.16-2.84)	2.92 (2.55-3.41)	3.56 (3.01-4.29)	4.05 (3.36-4.98)	4.55 (3.69-5.73)	5.07 (3.99-6.56)	5.76 (4.36-7.77)	6.30 (4.62-8.79)
2-day	1.71 (1.52-1.97)	2.28 (2.01-2.63)	3.02 (2.66-3.50)	3.63 (3.17-4.23)	4.46 (3.77-5.37)	5.09 (4.23-6.26)	5.74 (4.65-7.24)	6.42 (5.06-8.30)	7.33 (5.55-9.88)	8.04 (5.88-11.2)
3-day	1.83 (1.62-2.11)	2.47 (2.18-2.85)	3.31 (2.92-3.83)	4.00 (3.50-4.67)	4.95 (4.19-5.96)	5.68 (4.71-6.98)	6.43 (5.20-8.09)	7.20 (5.68-9.32)	8.26 (6.25-11.1)	9.08 (6.65-12.7)
4-day	1.98 (1.75-2.28)	2.69 (2.38-3.11)	3.64 (3.21-4.21)	4.42 (3.86-5.15)	5.48 (4.64-6.61)	6.31 (5.23-7.76)	7.16 (5.80-9.02)	8.04 (6.34-10.4)	9.25 (7.00-12.5)	10.2 (7.46-14.2)
7-day	2.25 (1.99-2.60)	3.11 (2.74-3.59)	4.24 (3.74-4.91)	5.18 (4.53-6.04)	6.47 (5.48-7.80)	7.48 (6.20-9.20)	8.51 (6.90-10.7)	9.59 (7.56-12.4)	11.1 (8.38-14.9)	12.2 (8.95-17.1)
10-day	2.41 (2.13-2.78)	3.35 (2.96-3.87)	4.61 (4.06-5.34)	5.65 (4.94-6.60)	7.10 (6.01-8.55)	8.22 (6.82-10.1)	9.38 (7.60-11.8)	10.6 (8.35-13.7)	12.3 (9.29-16.5)	13.6 (9.94-18.9)
20-day	2.89 (2.56-3.33)	4.06 (3.59-4.69)	5.65 (4.98-6.54)	6.97 (6.10-8.13)	8.82 (7.47-10.6)	10.3 (8.53-12.6)	11.8 (9.56-14.9)	13.4 (10.6-17.3)	15.6 (11.8-21.1)	17.4 (12.7-24.2)
30-day	3.43 (3.03-3.95)	4.81 (4.26-5.56)	6.70 (5.91-7.76)	8.29 (7.25-9.67)	10.5 (8.92-12.7)	12.3 (10.2-15.1)	14.2 (11.5-17.9)	16.1 (12.7-20.9)	18.9 (14.3-25.5)	21.1 (15.5-29.4)
45-day	4.07 (3.60-4.70)	5.68 (5.02-6.55)	7.88 (6.94-9.12)	9.74 (8.52-11.4)	12.4 (10.5-14.9)	14.5 (12.0-17.9)	16.8 (13.6-21.1)	19.2 (15.1-24.8)	22.5 (17.1-30.4)	25.2 (18.5-35.2)
60-day	4.74 (4.19-5.46)	6.53 (5.77-7.54)	9.00 (7.93-10.4)	11.1 (9.71-13.0)	14.1 (11.9-17.0)	16.5 (13.7-20.3)	19.1 (15.5-24.1)	21.9 (17.2-28.3)	25.8 (19.5-34.7)	29.0 (21.2-40.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

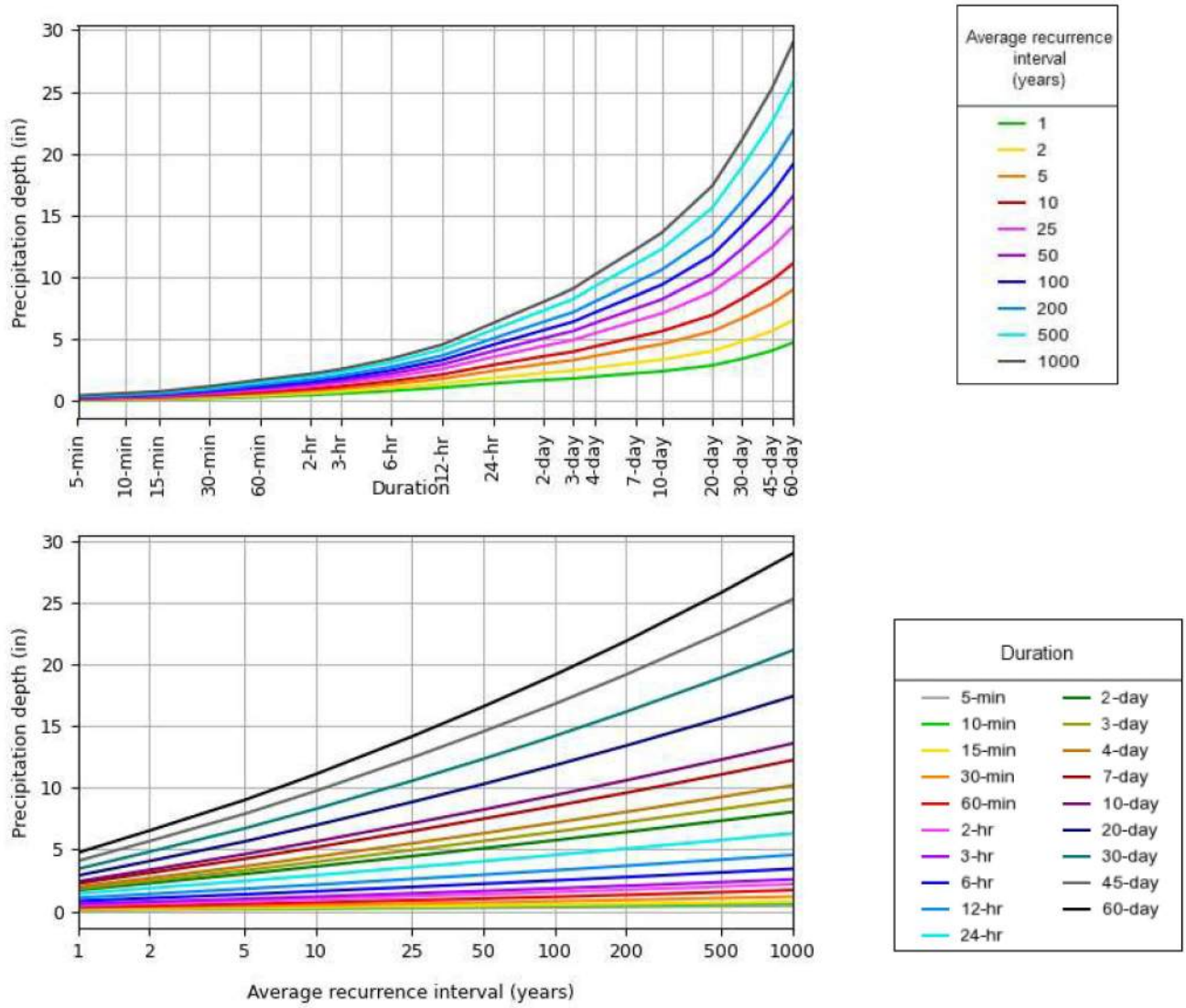
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.9348°, Longitude: -117.2819°



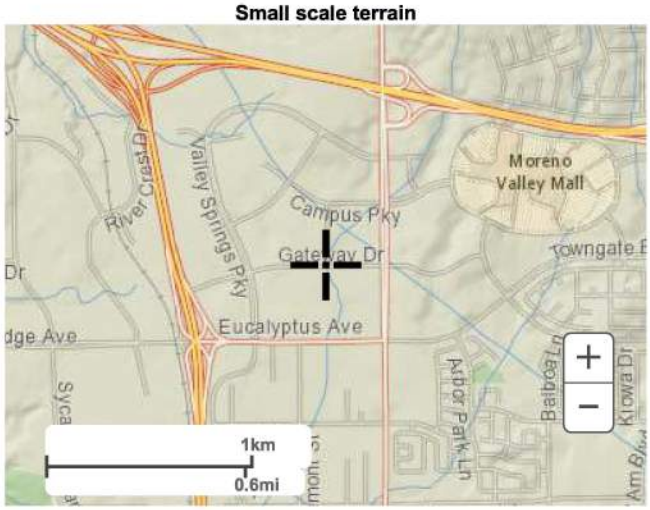
NOAA Atlas 14, Volume 6, Version 2

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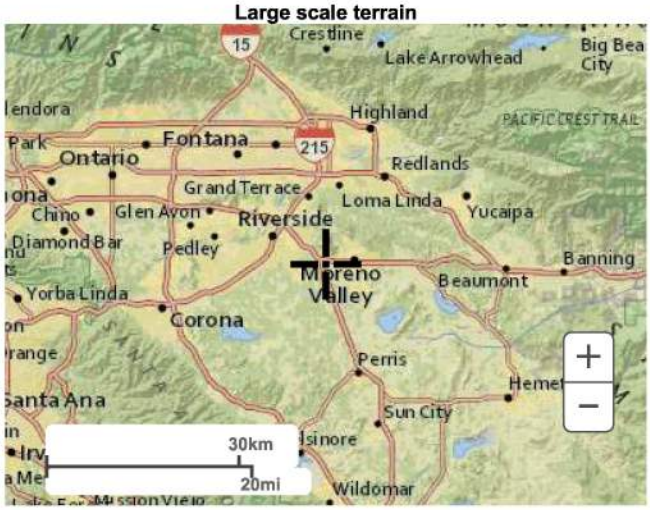
Back to Top

Maps & aerials

Small scale terrain



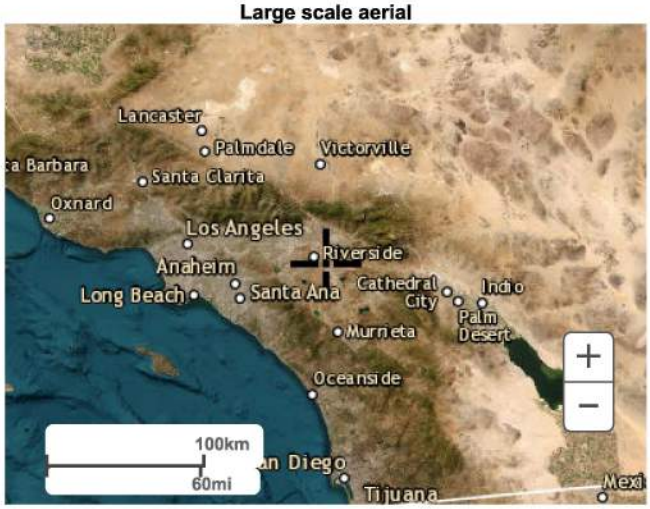
Large scale terrain



Large scale map



Large scale aerial



Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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Exhibit C

Runoff Coefficient Curves (Plate D-5.3) & Index Number Charts (Plate E-6.1)

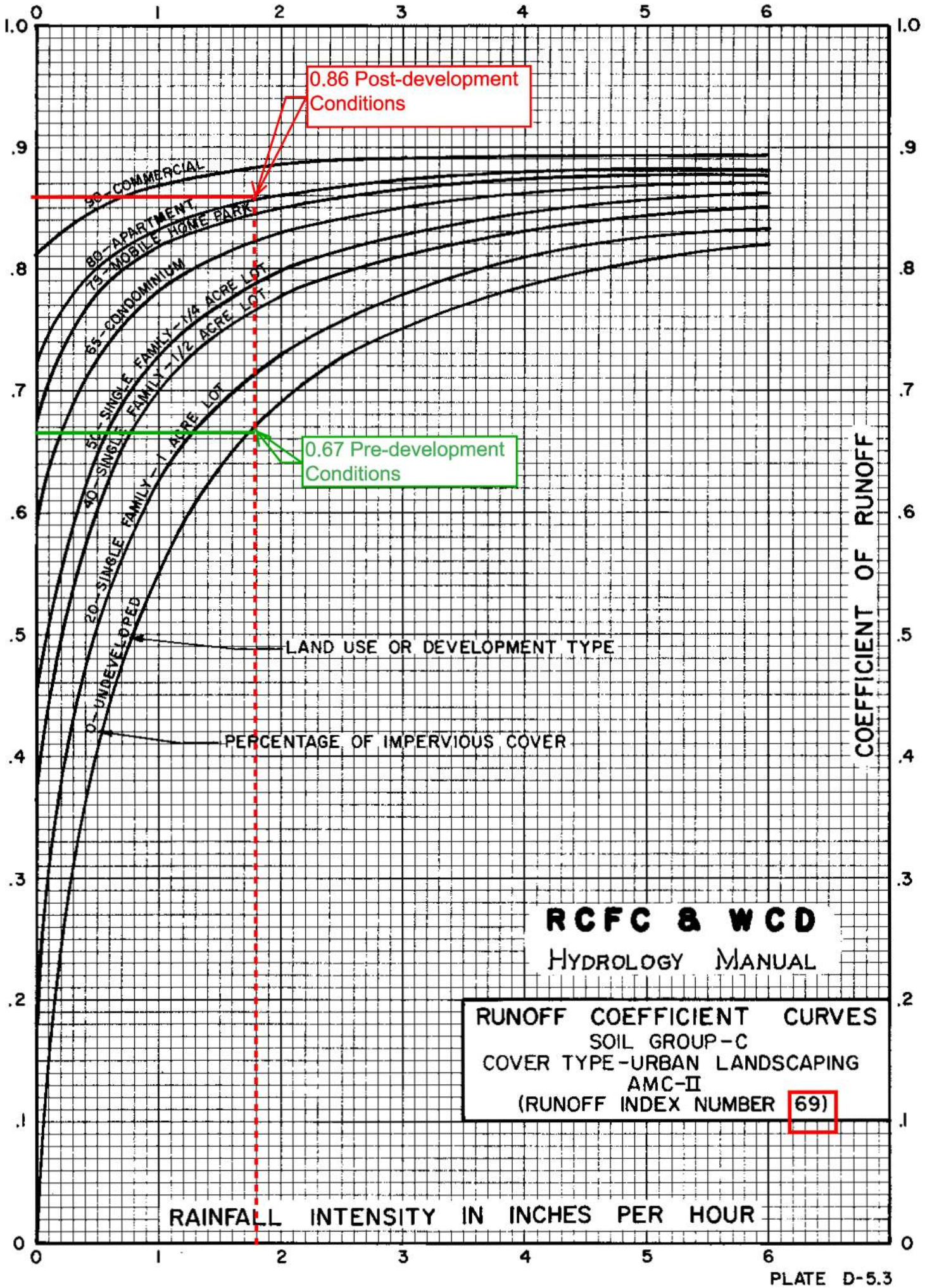

0.86 Post-development Conditions
0.67 Pre-development Conditions
90 - COMMERCIAL
80 - APARTMENT
75 - MOBILE HOME PARK
65 - CONDOMINIUM
50 - SINGLE FAMILY - 1/4 ACRE LOT
40 - SINGLE FAMILY - 1/2 ACRE LOT
20 - SINGLE FAMILY - 1 ACRE LOT
0 - UNDEVELOPED
LAND USE OR DEVELOPMENT TYPE
PERCENTAGE OF IMPERVIOUS COVER
COEFFICIENT OF RUNOFF
RAINFALL INTENSITY IN INCHES PER HOUR
0 1 2 3 4 5 6
1.0 .9 .8 .7 .6 .5 .4 .3 .2 .1 0
RCFC & WCD
HYDROLOGY MANUAL
RUNOFF COEFFICIENT CURVES
SOIL GROUP - C
COVER TYPE - URBAN LANDSCAPING
AMC - II
(RUNOFF INDEX NUMBER 69)

PLATE D-5.3

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

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

RCFC & WCD
HYDROLOGY MANUAL

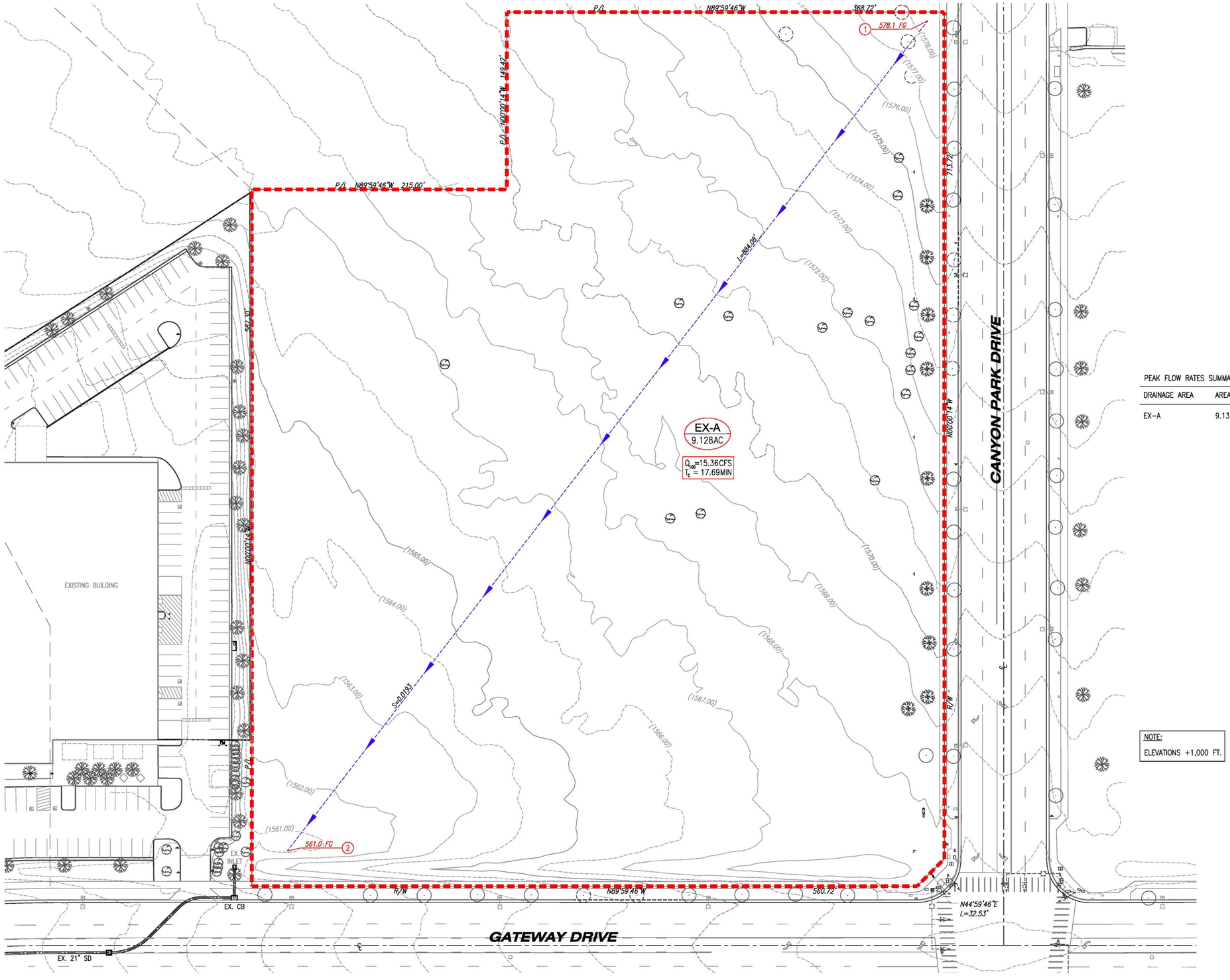
RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS

PLATE E-6.1 (1 of 2)

APPENDICES

Appendix 1

Pre-Development Hydrology Map



LEGEND

- ON-SITE SUBAREA BOUNDARY
- SURFACE FLOW PATH
- S — SURFACE FLOW PATH SLOPE
- L — SURFACE FLOW PATH LENGTH
- XX / XX.XXAC — ON-SITE SUBAREA LABEL
- XXX.XX FL (XX) — ON-SITE ELEVATION NODE
- Q_{XXX} = XXX.CFS, T_c = XX.XMIN — PEAK FLOW RATE (CFS), TIME OF CONCENTRATION (MIN)

PEAK FLOW RATES SUMMARY

DRAINAGE AREA	AREA (ACRES)	SUBAREAS	Q1 (CFS)	Q2 (CFS)	Q10 (CFS)	Q100 (CFS)
EX-A	9.13 AC	EX-A	3.64	5.26	9.41	15.36

NOTE:
ELEVATIONS +1,000 FT.

0 20 40 80 120

SCALE: 1"=40' DATE: 05/29/2025

INDEPENDENCE AT CANYON SPRINGS

PRE-DEVELOPMENT HYDROLOGY MAP

LSBTR DEVELOPMENT, LLC

RIVERSIDE, CALIFORNIA

KHR ASSOCIATES
CONSULTING ENGINEERS/SURVEYORS/PLANNERS
17530 Von Karman Ave. - Suite 200 Tel (949) 756-6440
Irvine, California 92614

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Appendix 1.1

Pre-Development Hydrology Calculations:
Rational Method
1-year, 2-year, 10-year, &100-year Storm Events

```
**************************************************************************
           RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
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                    (Rational Tabling Version 23.0)
                Release Date: 07/01/2016  License ID 1681

                          Analysis prepared by:

                              KHR Associates
                            17530 Von Karman Avenue
                                Irvine, CA 92626


 ************************* DESCRIPTION OF STUDY *************************
* Independence at Canyon Springs                                         *
* Pre-development Hydrology                                              *
* 1-Year Storm Event                                                     *
 **************************************************************************

  FILE NAME: LMCR-EX.DAT
  TIME/DATE OF STUDY: 14:55 05/16/2025
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    1.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.140
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.800
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.210
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5491525
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5491524
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    1.00   1-HOUR INTENSITY(INCH/HOUR) =   0.400
  SLOPE OF INTENSITY DURATION CURVE = 0.5492
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
```

```
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   884.08
  UPSTREAM ELEVATION(FEET) =   1578.10
  DOWNSTREAM ELEVATION(FEET) =   1561.00
  ELEVATION DIFFERENCE(FEET) =     17.10
  TC = 0.533*[(  884.08**3)/(    17.10)]**.2 =   17.689
     1 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.782
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .5097
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      3.64
  TOTAL AREA(ACRES) =      9.13   TOTAL RUNOFF(CFS) =      3.64
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.1  TC(MIN.) =     17.69
  PEAK FLOW RATE(CFS)   =       3.64
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
**************************************************************************
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                    (Rational Tabling Version 23.0)
                Release Date: 07/01/2016  License ID 1681

                          Analysis prepared by:

                              KHR Associates
                            17530 Von Karman Avenue
                                Irvine, CA 92626


 ************************* DESCRIPTION OF STUDY *************************
* Independence at Canyon Springs                                        *
* Pre-development Hydrology                                             *
* 2-Year Storm Event                                                    *
 ************************************************************************

  FILE NAME: LMCR-EX.DAT
  TIME/DATE OF STUDY: 15:22 03/13/2025
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.140
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.800
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.210
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5491525
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5491524
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.520
  SLOPE OF INTENSITY DURATION CURVE = 0.5492
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
```

```
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   884.08
  UPSTREAM ELEVATION(FEET) =   1578.10
  DOWNSTREAM ELEVATION(FEET) =   1561.00
  ELEVATION DIFFERENCE(FEET) =     17.10
  TC = 0.533*[(  884.08**3)/(    17.10)]**.2 =   17.689
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.018
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .5665
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      5.26
  TOTAL AREA(ACRES) =      9.13   TOTAL RUNOFF(CFS) =      5.26
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.1  TC(MIN.) =     17.69
  PEAK FLOW RATE(CFS)   =       5.26
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
**************************************************************************
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        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
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                    (Rational Tabling Version 23.0)
                Release Date: 07/01/2016  License ID 1681

                          Analysis prepared by:

                              KHR Associates
                            17530 Von Karman Avenue
                                Irvine, CA 92626


 ************************* DESCRIPTION OF STUDY *************************
* Independence at Canyon Springs                                        *
* Pre-development Hydrology                                             *
* 10-Year Storm Event                                                   *
 ************************************************************************

  FILE NAME: LMCR-EX.DAT
  TIME/DATE OF STUDY: 15:22 03/13/2025
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.140
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.800
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.210
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5491525
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5491524
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) =   0.808
  SLOPE OF INTENSITY DURATION CURVE = 0.5492
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
```

```
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   884.08
  UPSTREAM ELEVATION(FEET) =   1578.10
  DOWNSTREAM ELEVATION(FEET) =   1561.00
  ELEVATION DIFFERENCE(FEET) =     17.10
  TC = 0.533*[(  884.08**3)/(    17.10)]**.2 =   17.689
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.580
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6526
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      9.41
  TOTAL AREA(ACRES) =      9.13   TOTAL RUNOFF(CFS) =      9.41
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.1  TC(MIN.) =     17.69
  PEAK FLOW RATE(CFS)   =       9.41
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



```
**************************************************************************
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                Release Date: 07/01/2016  License ID 1681

                          Analysis prepared by:

                              KHR Associates
                            17530 Von Karman Avenue
                                Irvine, CA 92626


 ************************* DESCRIPTION OF STUDY *************************
* Independence at Canyon Springs                                        *
* Pre-development Hydrology                                             *
* 100-Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: LMCR-EX.DAT
  TIME/DATE OF STUDY: 15:21 03/13/2025
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   4.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  2.140
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.800
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.210
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.200
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.5491525
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.5491524
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.5492
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
```

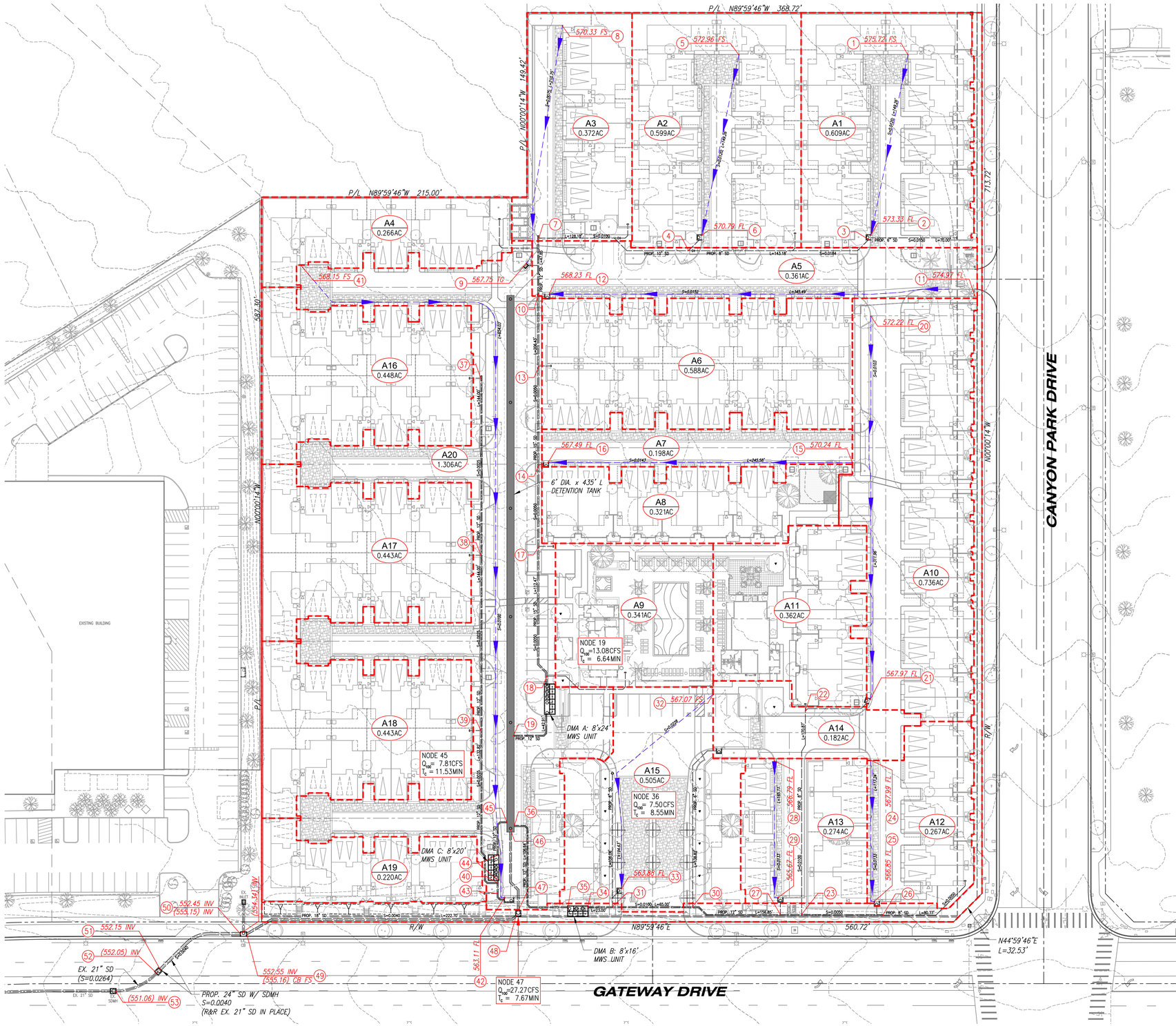
```
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   884.08
  UPSTREAM ELEVATION(FEET) =   1578.10
  DOWNSTREAM ELEVATION(FEET) =   1561.00
  ELEVATION DIFFERENCE(FEET) =     17.10
  TC = 0.533*[(  884.08**3)/(    17.10)]**.2 =   17.689
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.347
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7170
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =     15.36
  TOTAL AREA(ACRES) =      9.13   TOTAL RUNOFF(CFS) =     15.36
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        9.1  TC(MIN.) =     17.69
  PEAK FLOW RATE(CFS)   =      15.36
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```



Appendix 2

Post-Development Hydrology Map



LEGEND

- DRAINAGE AREA/SYSTEM BOUNDARY
- ON-SITE SUB-AREA BOUNDARY
- SURFACE FLOW PATH
- S — SURFACE FLOW PATH SLOPE
- L — SURFACE FLOW PATH LENGTH
- PROP. X" SD — PROPOSED STORM DRAIN PIPE SIZE
- S=XXXXX — PROPOSED STORM DRAIN PIPE SLOPE
- L=XXXXX — PROPOSED STORM DRAIN PIPE LENGTH
- XX / XX.XXAC — ON-SITE SUBAREA LABEL
- XX / XX.XXAC — OFF-SITE SUBAREA LABEL
- XXX.XX FL (X) — ON-SITE ELEVATION NODES
- XXX.XX FL (X) — OFF-SITE ELEVATION NODES
- PROPOSED CMP DETENTION TANK
- NODE #, Q_{100}= XXX.CFS, T_c = XX.XMIN — NODE NO., PEAK FLOW RATE (CFS), TIME OF CONCENTRATION (MIN)

PEAK FLOW RATES SUMMARY

DRAINAGE SYSTEM	AREA (ACRES)	SUBAREAS	Q1 (CFS)	Q2 (CFS)	Q10 (CFS)	Q100 (CFS)
A	3.68 AC	A1-A9	4.16	5.49	8.67	13.08
B	2.51 AC	A10-A13	2.37	3.13	4.96	7.50
C	2.94 AC	A14-A16	2.55	3.35	5.26	7.81
Q PEAK	8.83 AC	A1-A16	8.75	11.55	18.30	27.62
P	0.30 AC	P1	0.06	0.09	0.17	0.29
TOTAL	9.13 AC	A1-A16-P1	8.81	11.64	18.47	27.91

POST-ROUTED

DRAINAGE SYSTEM	Q2 (CFS)	Q10 (CFS)	Q100 (CFS)
A-B-C	0.324	2.147	4.181

NOTE:
ELEVATIONS +1,000 FT.

0 20 40 80 120

SCALE: 1"=40' DATE: 1/13/26

INDEPENDENCE AT CANYON SPRINGS — POST-DEVELOPMENT HYDROLOGY MAP

LS BTR DEVELOPMENT, LLC — RIVERSIDE, CALIFORNIA

KHR ASSOCIATES
CONSULTING ENGINEERS/SURVEYORS/PLANNERS
17530 Von Karman Ave. - Suite 200 Tel (949) 756-6440
Irvine, California 92614

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