

FOR REVIEW ONLY

**CH REALTY IX-MC I RIVERSIDE PERRIS AIRPORT
CENTER, L.P. - Perris Airport Logistics Center - West
TPM Number 38412 (DPR 22-00005)
City of Perris, County of Riverside, California**

Preliminary Drainage Study

Prepared for:

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SECTION 1 - SUMMARY

PURPOSE

The purpose of this report is to document the hydrologic analyses performed in support of the Perris Airport Logistics Center – West Site project located in City of Perris, County of Riverside, California. The project is bounded by Goetz Road to the west, Ellis Avenue to the north, Perris Airport to the east, and vacant land to the south. The Perris Valley Airport separates the overall Perris Airport Logistics Center into east and west halves, which are proposed as separate sites. The West Site proposes to build two light industrial warehouse facilities (approximately 867,070 square feet) on approximately 59.9 net acres. The East Site of the project proposes to build a trailer parking lot on approximately 22.9 net acres, which is discussed in a separate report. This report will summarize the hydrologic analyses that were conducted in order to determine the necessary drainage improvements required to provide flood protection for the west half of the project and safely convey the runoff through the site.

The scope of this report will include the following:

- Determine the peak 100-year and 10-year flow rates for the developed condition using the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Rational Method.
- Determine the necessary basin area and volume required for water quality treatment and to mitigate for increases in runoff.
- Preparation of a preliminary report summarizing the hydrologic results.

DESCRIPTION OF WATERSHED

As previously described, the project is proposing two light industrial warehouse buildings (approximately 867,070 square feet) on approximately 59.9 net acres of largely vacant land. Existing elevations across the west site vary from 1425.5 to 1415.1 (NAVD88 datum). This area currently slopes down at approximately 0.5% grade to the southeast. The existing drainage pattern for the site and the general area is characterized by sheet flows that follow the slope.

The west site is bound to the west by existing improvements along Goetz Road, to the north by Ellis Ave, to the east by the Perris Valley Airport, and to the south by largely vacant land. The improvements in Goetz Road protect the project site from offsite flows with existing storm drain and water quality improvements within the street right of way. Ellis Avenue requires improvements to widen to the ultimate width, which will include expanding and revising the existing storm drain facilities. The onsite surface flows travel via sheet flow across the site, ultimately draining into a storm drain inlet within the Perris Valley Airport property. It is assumed that the existing storm drain inlet drains south to the San Jacinto River.

The project is located within the Mead Valley Area Plan (RCIP) and is also within the Santa Ana watershed, San Jacinto sub-watershed area. The project is within the San Jacinto River floodplain. The most recent floodplain analysis was conducted as part of the Conditional Letter of Map Revision (CLOMR) for Tract 36988 – Green Valley (See **Appendix D**). The FEMA Map No. 06065C1440H was revised to reflect the LOMR on January 3, 2019. The study shows that a portion of the project site will still be within Zone AE designation.

PROPOSED CONDITIONS

In the proposed condition, offsite flows are captured and conveyed within street right of ways. The proposed project site is only impacted by onsite stormwater flows. The graded elevation of the site was set with regards to the floodplain elevations. No portion of the proposed buildings will be lower than the 1420.1 regulatory elevation. Additionally, the top of grates elevations are set at 1418.6 feet minimum, which allows for 1.5 feet of ponding to the 1420.1 regulatory elevation, within the truck parking areas.

Onsite flows generated by the proposed project will be collected and conveyed using a combination of surface flows, curb and gutter, ribbon gutter, and storm drain lines to the proposed onsite bioretention basin. The west consists of two proposed industrial buildings along with all associated utilities, drive aisles, parking stalls, walkways, and landscape areas. The west site will be treated for water quality with a combination of a proposed MWS treatment device and a proposed bioretention basin. The WQ Basin will utilize a 3.0 foot section of media (1.5' of amended soil media, 0.5' of choker gravel, and 1.0' of gravel) to filter the runoff for water quality treatment. Low flows infiltrate down through the 3.0 foot section of designed media and into the perforated underdrain pipes within the gravel layer, which directly discharge into the proposed outlet structure. The top of grate will be positioned at a higher elevation to hold the existing 2-year, 24-hour storm event to address hydromodification. The outlet structure will require a pump to raise storm flows up to existing elevations, to outlet western site flows to the Perris Valley Airport storm drain inlet.

METHODOLOGY

HYDROLOGY

Hydrologic calculations were performed in accordance with the RCFC&WCD Hydrology Manual, dated April 1978. The Rational Method was utilized in determining peak flow rates.

The hydrological parameters, including rainfall values and soil types were derived from the RCFC&WCD Hydrology Manual. The isohyetal maps and soil map have been included in **Section 2**.

Rational Method calculations were performed using a computer program developed by CivilDesign Corporation and Joseph E. Bonadiman and Associates Inc. The computer program is commonly referred to as CivilD which incorporates the hydrological parameters outlined in the RCFC&WCD Hydrology Manual.

The Rational Method was used to determine the peak flow rates to size and design the drainage facilities need to convey onsite flows through the site to the proposed basin. The flow rates were computed by generating a hydrologic "link-node" model in which the overall area is divided into separate drainage sub-areas, each tributary to a concentration point (node) determined by the proposed layout and grading.

The Unit Hydrograph Method was used to determine the peak flow rates and volumes associated with the 100-year storm events for the site. Calculations were performed for both the existing condition and developed condition to be used in the analysis of the proposed basin.

HYDRAULICS

Water quality basin calculations were performed using spreadsheets that were created by RCFC&WCD. Final calculations and additional details can be found in the Preliminary-WQMP.

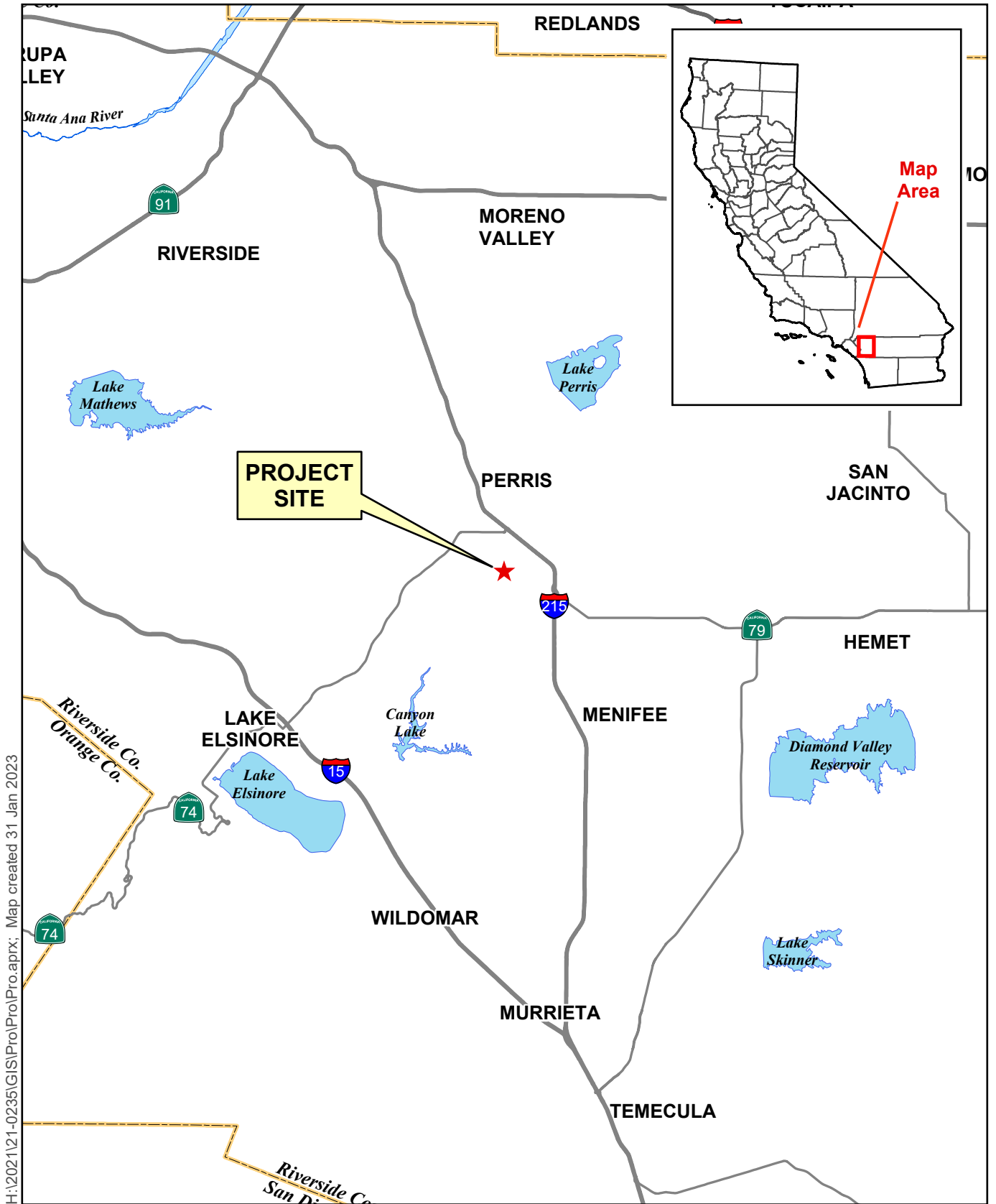
FIG. 1 VICINITY MAP

FIG. 2 USGS TOPOGRAPHY MAP

FIG. 3 AERIAL PHOTOGRAPH

FIG. 4 RECEIVING WATERBODIES

FIG. 5 SOILS MAP

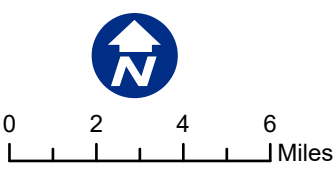


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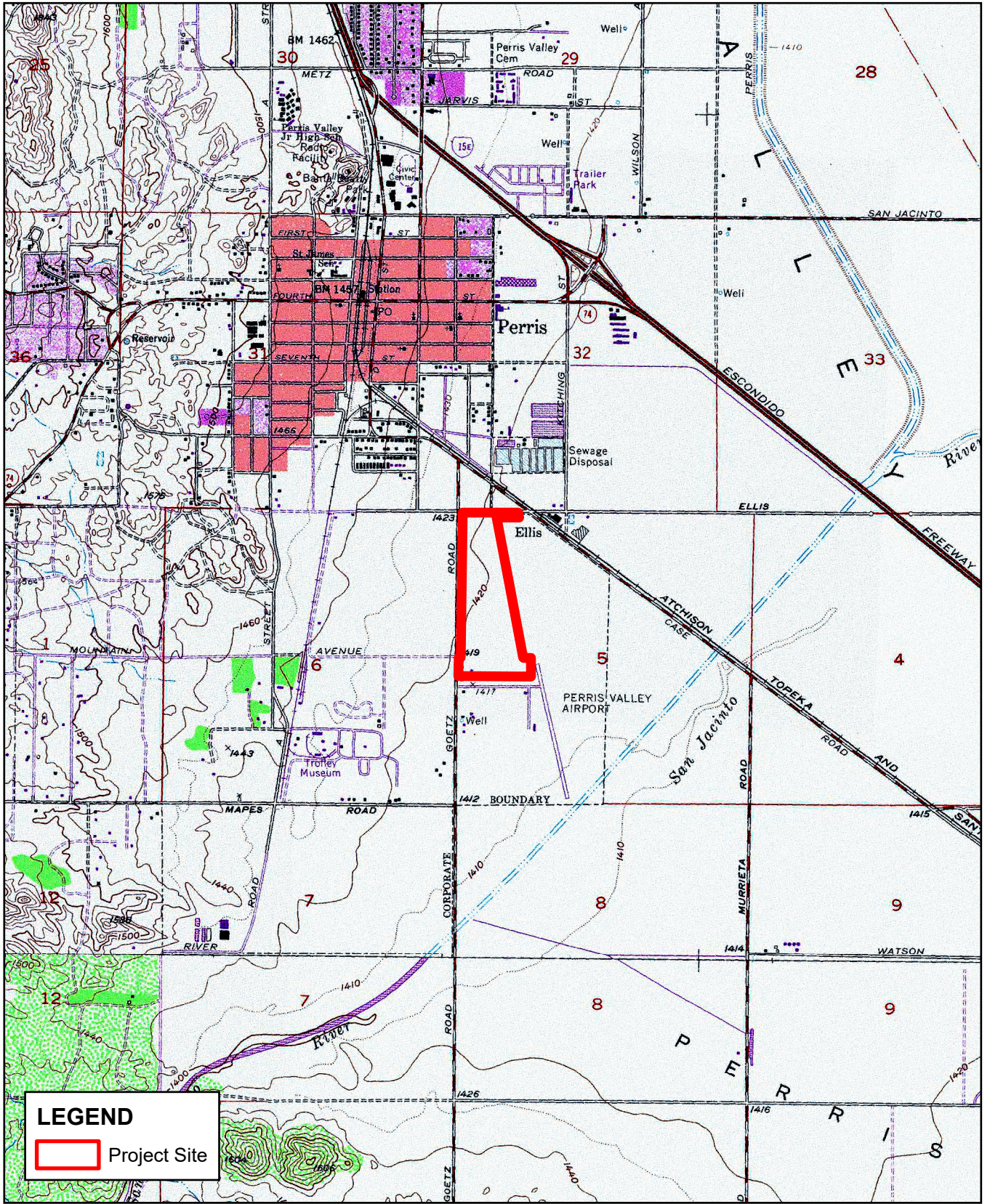
Source: Riverside County GIS, 2020

Figure 1 – Vicinity Map

MC Blackacre Perris Airport ENT - West



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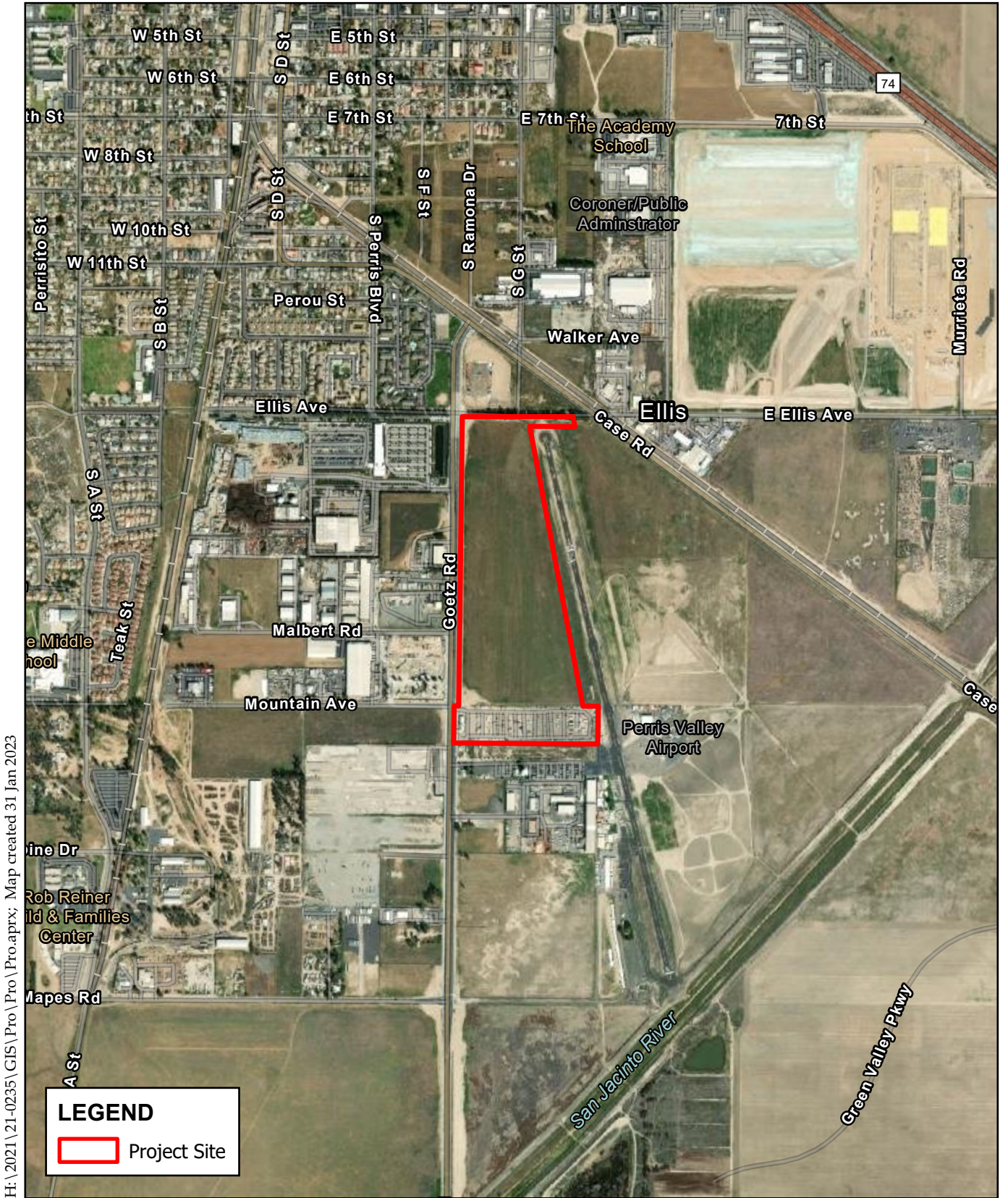


Sources: ESRI / USGS 7.5min Quads

Figure 2 - USGS Map
MC Blackacre Perris Airport ENT - West



0 2,000 4,000 6,000
|-----|-----|-----|-----|
Feet



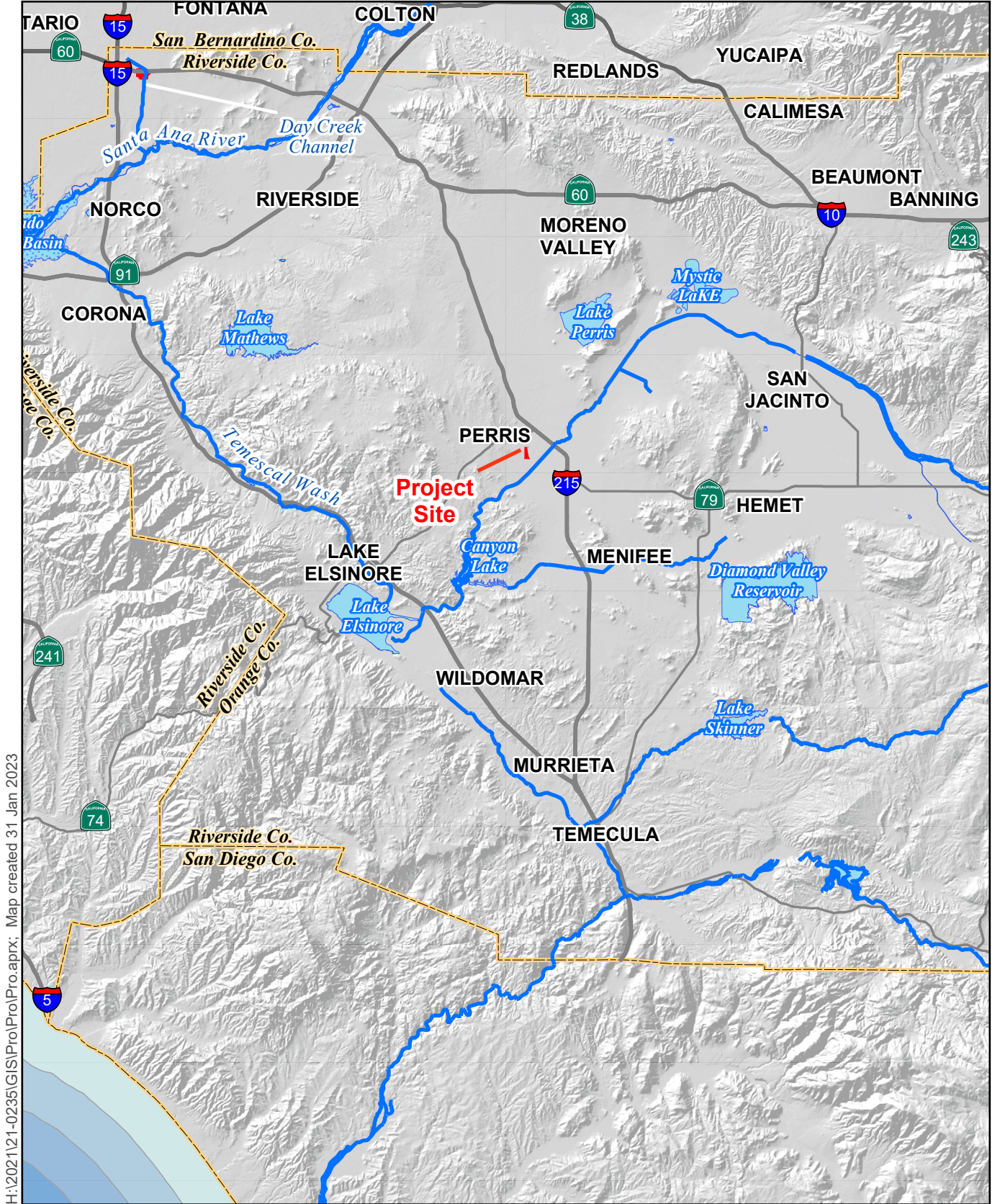
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Sources: Riverside Co. GIS, 2023.

Figure 3 - Aerial Photograph
MC Blackacre Perris Airport ENT - West



0 1,000 2,000 3,000 Feet



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Sources: USGS DLG; USGS 30m DEM

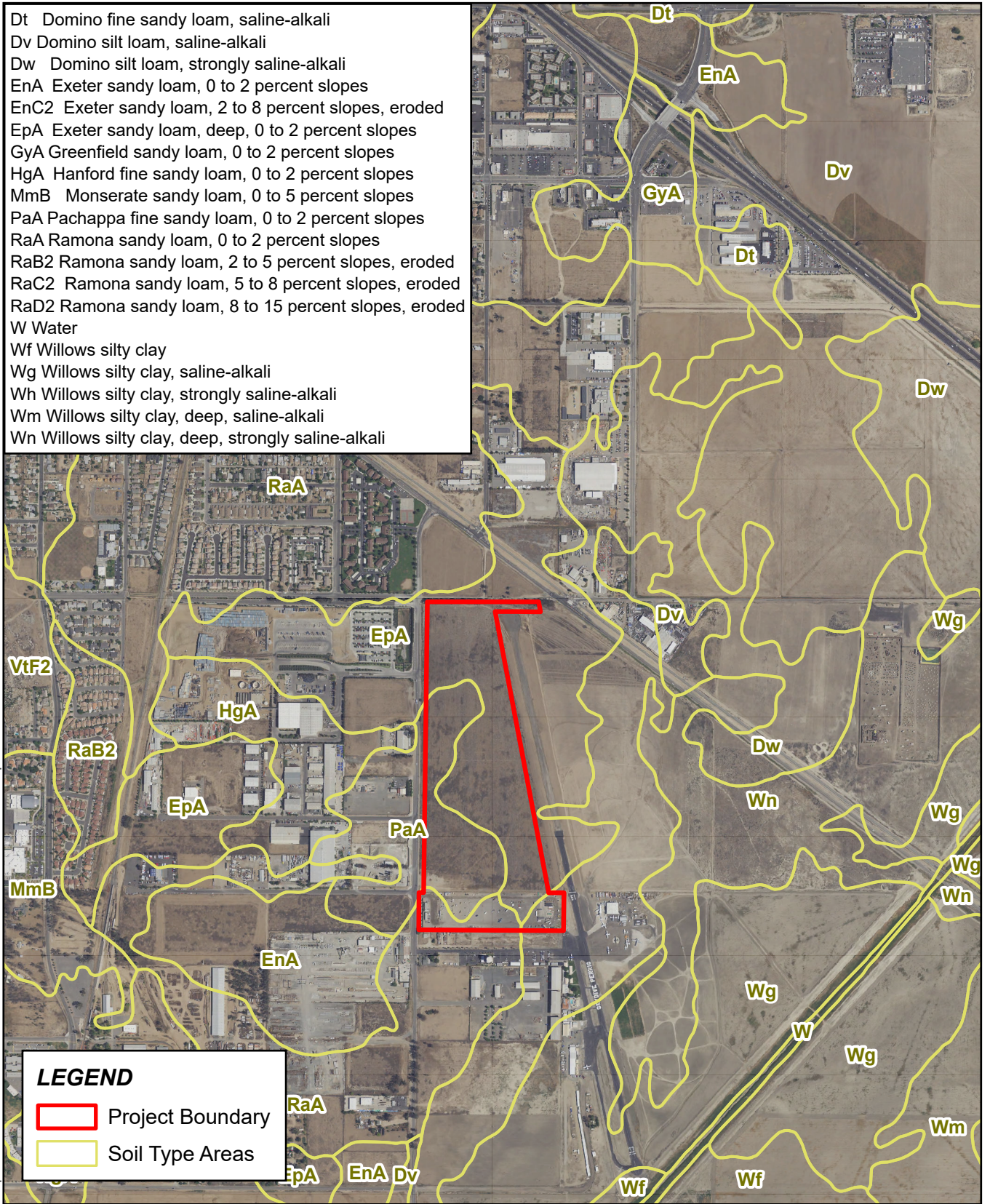
Figure 4 – Receiving Waterbodies
MC Blackacre Perris Airport ENT - West



0 2 4 6 8
Miles

- Dt Domino fine sandy loam, saline-alkali
- Dv Domino silt loam, saline-alkali
- Dw Domino silt loam, strongly saline-alkali
- EnA Exeter sandy loam, 0 to 2 percent slopes
- EnC2 Exeter sandy loam, 2 to 8 percent slopes, eroded
- EpA Exeter sandy loam, deep, 0 to 2 percent slopes
- GyA Greenfield sandy loam, 0 to 2 percent slopes
- HgA Hanford fine sandy loam, 0 to 2 percent slopes
- MmB Monserate sandy loam, 0 to 5 percent slopes
- PaA Pachappa fine sandy loam, 0 to 2 percent slopes
- RaA Ramona sandy loam, 0 to 2 percent slopes
- RaB2 Ramona sandy loam, 2 to 5 percent slopes, eroded
- RaC2 Ramona sandy loam, 5 to 8 percent slopes, eroded
- RaD2 Ramona sandy loam, 8 to 15 percent slopes, eroded
- W Water
- Wf Willows silty clay
- Wg Willows silty clay, saline-alkali
- Wh Willows silty clay, strongly saline-alkali
- Wm Willows silty clay, deep, saline-alkali
- Wn Willows silty clay, deep, strongly saline-alkali

Map created 31 Jan 2023. H:\2021\21-0235\GIS\Pro\Pro.aprx



Sources: USDA NRCS SSURGO, 2015;
Riverside Co. GIS, 2023; USDA NAIP, 2016.

Figure 5 – Soils Map

MC Blackacre Perris Airport ENT - West



0 1,000 2,000 3,000 Feet

SECTION 2 - HYDROLOGY ANALYSIS

HYDROLOGY PARAMETERS

The RCFC&WCD Hydrology Manual was used to determine several of the hydrological parameters. The following rainfall depths were utilized in the hydrology analyses, which were obtained from the isohyetal maps provided in the RCFC&WCD Hydrology Manual:

Table 1 – Precipitation Values

Storm Event	Duration			
	1-Hour (inches)	3-Hour (inches)	6-Hour (inches)	24-Hour (inches)
2-Year	0.48	0.8	1.1	1.8
100-Year	1.25	1.9	2.5	5.0

Based on the Plate D-4.1 for Perris Valley in the RCFC&WCD Hydrology Manual, the value for slope of intensity was determined to be 0.49. The isohyetal maps have been included in **Appendix A**.

Based on the Plate C-1.30 Perris in the RCFC&WCD Hydrology Manual, the project site is classified as soil type C. The soils map is included in **Appendix A**.

The cover type was determined based on the existing land cover and proposed land use of the site, as well as utilizing Plates D-5.5 and D-5.6 from the Hydrology Manual. Hydrological computations for the existing condition were done using 'Barren (Rockland, eroded and graded land)'. The 'Commercial Landscaping' cover type was used to represent the developed condition. The table below summarizes the runoff index values and the recommended values for percentage of impervious cover for each category:

Table 2 – Cover Type

Cover Type	Soil Group A	Soil Group B	Soil Group C	Soil Group D	Percentage of Impervious Cover
Barren (Rockland, eroded and graded land)	78	86	91	93	0%
Commercial Landscaping	32	56	69	75	90%

ON-SITE RATIONAL METHOD HYDROLOGY

The rational method was used to determine peak flow rates in order to adequately size the proposed subsurface storm drains and associated inlets used to convey on-site flows to the proposed basins. The project site was covered by one watershed, Area A. This watershed is ultimately tributary to WQ West

Basin. The project is comprised of approximately 10% pervious cover (landscaping and basin area). The project was modeled as commercial land use, which assumes 10% pervious cover. As previously described, the basins will utilize an outlet structure to dewater the basin and discharge flows into a storm drain lift station, where outflow will be pumped out.

A peak 100 year flow rate of 63.9 cfs is generated by the west site.

The following table summarizes the rational method results at key points:

Table 3 – Rational Method Results

Point of Interest	10-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
Node 104 – Area A-2 Northernmost SD stretch north of northern building	22.9	33.2
Node 203 – Area A-4 Half Building that drains to west	13.7	20.0
Node 214 – Area A-7 Southern building and associated parking lot	8.5	12.4
Node 304 – Area A-10 Southeastern quarter of northern building	25.1	36.2
Node 304 – West Basin Outflow	43.7	63.9

The rational method output files and hydrology map have been included in **Appendix A**.

SECTION 3 - HYDRAULIC ANALYSIS

ON-SITE STORM DRAIN FACILITIES

The west site of the overall Perris Airport Logistics Center project proposes one subsurface storm drain system to convey onsite flows. The runoff will discharge into the proposed basin, which will outlet via the proposed outlet structure. The storm drain system requires a pump to outlet flows from the proposed basin to existing outlet conditions. Ultimately, the project site flows drain south to the San Jacinto River. Full hydraulic analysis will be prepared during final engineering.

Outlet Structures

A grated inlet is proposed in the basin to facilitate onsite flow within the basin. This outlet structure will discharge into a proposed pump system that will raise outflow to existing adjacent grades and restrict outflow from the site to meet Hydraulic Conditions of Concern (HCOC) mitigation and mitigate for increases in runoff associated with the project. The sizing calculation will be included in final engineering.

Line-A

The west site will surface flow to multiple low points in the east side of the truck court and be collected by Line A. Line A proposes to convey the 100-year peak flow rate to WQ West Basin. A normal depth calculation was used to determine the appropriate size for Line A. A hydraulic model for Line A will be included in final engineering to further assess the storm drain design.

OFF-SITE STORM DRAIN FACILITIES

Offsite flows do not impact the project and are captured and conveyed via existing improvements in Goetz Road. Existing catch basins and storm drain lines convey flows within Goetz Road. Offsite improvements per PM 35877 (P8-1106D, DPR 08-01-0007) propose catch basins within Ellis Avenue.

The improvement of Ellis Avenue will require a storm drain line that connects the existing storm drain facilities in Goetz Road to future storm drain facilities in Case Road. This storm drain line will replace the existing storm drain channel within the Ellis Avenue right of way. The hydraulic model for the offsite storm drain facilities are not included in this report.

SECTION 4 - BASIN ANALYSIS

ON-SITE UNIT HYDROGRAPH METHOD HYDROLOGY

The unit hydrograph method was used to determine the peak flow rates and volumes in order to adequately size the proposed basin to address Hydraulic Conditions of Concern (HCOC) and increased runoff mitigation. Unit hydrographs were performed for both the existing condition and developed condition. The existing condition is used to establish a baseline for comparative purposes. The developed condition is used for design purposes, it was utilized in the basin routing analysis in order to size and analyze the proposed basin. The following table summarizes the results of the unit hydrograph analysis:

Table 4 – Unit Hydrograph Results - West

Storm Event	Existing Condition		Proposed Condition	
	Volume (Ac-ft)	Peak Flow (cfs)	Volume (Ac-ft)	Peak Flow (cfs)
2-Year, 24-Hour	2.4	8.4	7.2	11.8
100-Year, 1-Hour	5.7	125	5.9	152
100-Year, 3-Hour	7.8	84.3	8.5	94.1
100-Year, 6-Hour	9.1	72.5	10.8	79.5
100-Year, 24-Hour	14.4	34.3	21.0	37.3

The unit hydrograph output files and hydrology map have been included in **Appendix C**.

BASIN ROUTING ANALYSIS

A more-detailed routing analysis will be prepared during final engineering to demonstrate that the basin contains substantial volume needed to mitigate flows down to existing condition peak flow rates. Due to the proximity of the project site to the Perris Valley Airport, preliminary basin routing was performed to ensure the basins will drawdown within 48 hours, per Airport Land Use Commission (ALUC) requirements.

Preliminary basin routing calculations were conducted for the west site. A stage-storage-discharge table was determined for the west site. The stage-storage-discharge table provides input data at select elevations in the basin which will determine the storage and discharge at each point based on the mitigation configuration of the outlet structure. The outlet structure for the proposed basin includes orifices for the 2-year, 24-hour storm event, to address hydromodification. A grated structure, sized with weir flow will outlet the 100-year storm event. The basin is proposed as a water quality, bioretention basin, and has underdrains to outlet treated flows. These water quality flows were not considered in the basin routing, and instead were evaluated as dead storage. A storm drain lift station is required to outlet all flows, since the basin outlet is lower than the downstream conveyances. The following table presents the result of routing analysis for the 2-year, 24-hour and 1-, 3-, 6-, and 24-hour 100-year storm events to demonstrate that the basin provides the necessary storage volume needed to restrict the outflow to existing condition flow rates.

Table 5 – Basin Routing Results - West

Storm Event	Existing Condition		Proposed Condition		Basin Routing Results			
	Volume (AC-ft)	Peak Flow (cfs)	Volume (AC-ft)	Peak Flow (cfs)	Peak Flow (cfs)	Maximum Basin Depth (feet)	Water Surface Elevation	Drawdown Time* (hours)
2-Year, 24-Hour	2.4	8.4	7.2	11.8	7.9	1.0	1409.7	3.9
100-Year, 1-Hour	5.7	125	5.9	152	81.2	2.6	1411.3	3.4
100-Year, 3-Hour	7.8	84.3	8.5	94.1	69.8	2.5	1411.2	3.4
100-Year, 6-Hour	9.1	72.5	10.8	79.5	60.4	2.3	1411.0	3.4
100-Year, 24-Hour	14.4	34.3	21.0	37.3	34.6	1.7	1410.4	9.8

**Drawdown time considered from the end of the storm to 0.1' of basin depth. (48 hour minimum per ALUC)*

The unit hydrograph output files and hydrology map have been included in **Appendix C**.

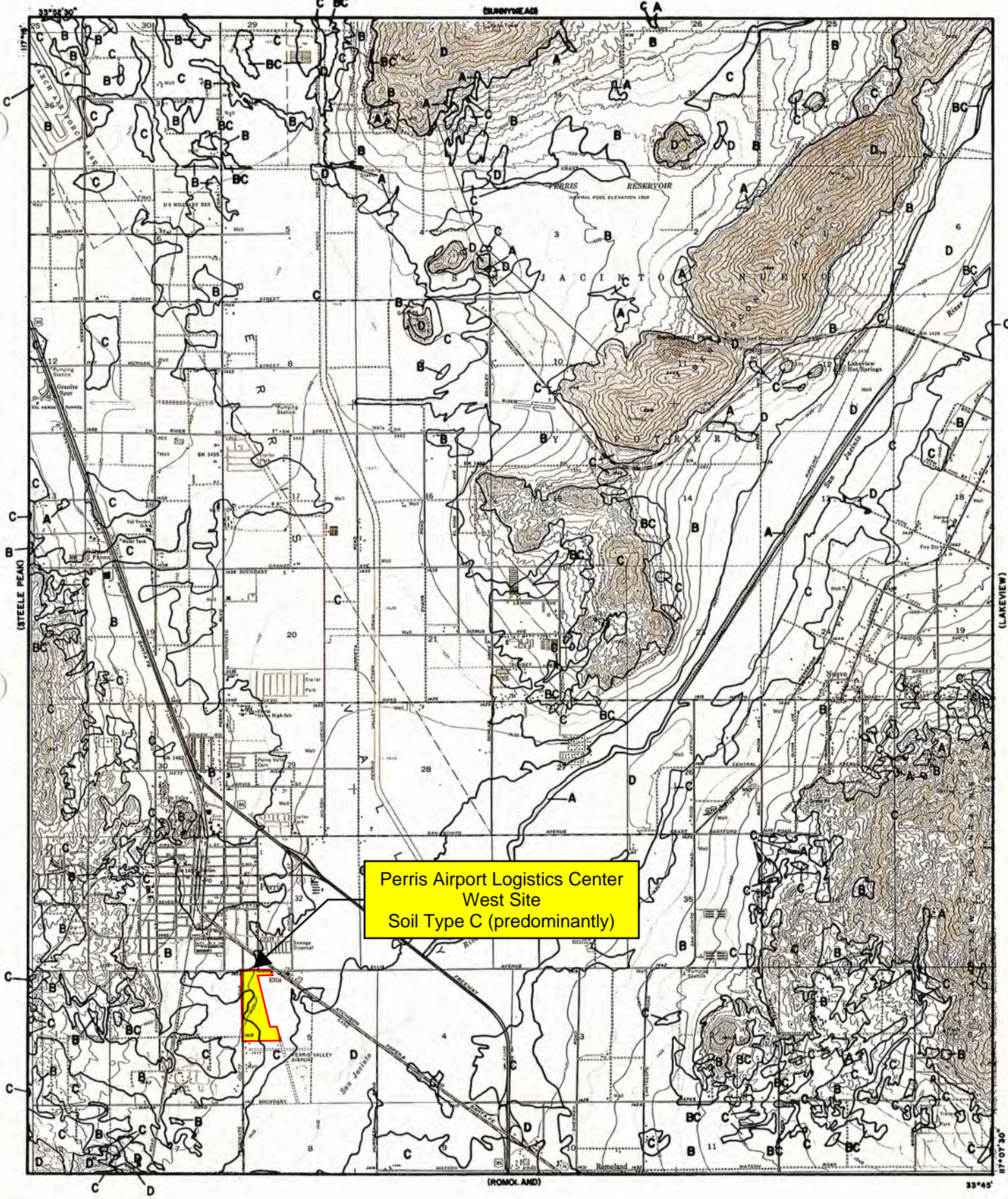
SECTION 5 - CONCLUSION

Based on the analyses and results of this report, the following conclusions were derived from the hydrology and hydraulic results:

- The proposed drainage improvements will adequately convey flows to the basin and provide flood protection for the 100-year storm event.
- The proposed basin will provide adequate water quality treatment and mitigation for HCOC.
- The proposed project will not impact flooding condition to upstream or downstream properties.

APPENDIX A – HYDROLOGY ANALYSIS

HYDROLOGIC SOILS GROUP MAP (PLATE C-1.30 PERRIS)



Perris Airport Logistics Center
West Site
Soil Type C (predominantly)

LEGEND

— SOILS GROUP BOUNDARY
A SOILS GROUP DESIGNATION

RCFC & WCD
HYDROLOGY MANUAL

0 FEET 5000

**HYDROLOGIC SOILS GROUP MAP
FOR
PERRIS**

ISOHYETAL MAPS

RAINFALL INTENSITY - INCHES PER HOUR

MIRA LOMA			MURRIETA - TEMECULA & RANCHO CALIFORNIA			NORCO			PALM SPRINGS			PERRIS VALLEY		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	2.84	4.48	5	3.45	5.10	5	2.77	4.16	5	4.23	6.76	5	2.64	3.78
6	2.58	4.07	6	3.12	4.61	6	2.53	3.79	6	3.80	6.08	6	2.41	3.46
7	2.37	3.75	7	2.87	4.24	7	2.34	3.51	7	3.48	5.56	7	2.24	3.21
8	2.21	3.49	8	2.67	3.94	8	2.19	3.29	8	3.22	5.15	8	2.09	3.01
9	2.08	3.28	9	2.50	3.69	9	2.07	3.10	9	3.01	4.81	9	1.98	2.84
10	1.96	3.10	10	2.36	3.48	10	1.96	2.94	10	2.83	4.52	10	1.88	2.69
11	1.87	2.95	11	2.24	3.30	11	1.87	2.80	11	2.67	4.28	11	1.79	2.57
12	1.78	2.82	12	2.13	3.15	12	1.79	2.68	12	2.54	4.07	12	1.72	2.46
13	1.71	2.70	13	2.04	3.01	13	1.72	2.58	13	2.43	3.88	13	1.65	2.37
14	1.64	2.60	14	1.96	2.89	14	1.66	2.48	14	2.33	3.72	14	1.59	2.29
15	1.58	2.50	15	1.89	2.79	15	1.60	2.40	15	2.23	3.58	15	1.54	2.21
16	1.53	2.42	16	1.82	2.69	16	1.55	2.32	16	2.15	3.44	16	1.49	2.14
17	1.48	2.34	17	1.76	2.60	17	1.50	2.25	17	2.08	3.32	17	1.45	2.08
18	1.44	2.27	18	1.71	2.52	18	1.46	2.19	18	2.01	3.22	18	1.41	2.02
19	1.40	2.21	19	1.66	2.45	19	1.42	2.13	19	1.95	3.12	19	1.37	1.97
20	1.36	2.15	20	1.61	2.38	20	1.39	2.08	20	1.89	3.03	20	1.34	1.92
22	1.29	2.04	22	1.53	2.26	22	1.32	1.98	22	1.79	2.86	22	1.28	1.83
24	1.24	1.95	24	1.46	2.15	24	1.26	1.90	24	1.70	2.72	24	1.22	1.75
26	1.18	1.87	26	1.39	2.06	26	1.22	1.82	26	1.62	2.60	26	1.18	1.69
28	1.14	1.80	28	1.34	1.98	28	1.17	1.76	28	1.56	2.49	28	1.13	1.63
30	1.10	1.73	30	1.29	1.90	30	1.13	1.70	30	1.49	2.39	30	1.10	1.57
32	1.06	1.67	32	1.24	1.84	32	1.10	1.64	32	1.44	2.30	32	1.06	1.52
34	1.03	1.62	34	1.20	1.78	34	1.06	1.59	34	1.39	2.22	34	1.03	1.48
36	1.00	1.57	36	1.17	1.72	36	1.03	1.55	36	1.34	2.15	36	1.00	1.44
38	.97	1.53	38	1.13	1.67	38	1.01	1.51	38	1.30	2.09	38	.98	1.40
40	.94	1.49	40	1.10	1.62	40	.98	1.47	40	1.27	2.02	40	.95	1.37
45	.89	1.40	45	1.03	1.52	45	.92	1.39	45	1.18	1.89	45	.90	1.29
50	.84	1.32	50	.97	1.44	50	.88	1.31	50	1.11	1.78	50	.85	1.22
55	.80	1.26	55	.92	1.36	55	.84	1.25	55	1.05	1.68	55	.81	1.17
60	.76	1.20	60	.88	1.30	60	.80	1.20	60	1.00	1.60	60	.78	1.12
65	.73	1.15	65	.84	1.24	65	.77	1.15	65	.95	1.53	65	.75	1.08
70	.70	1.11	70	.81	1.19	70	.74	1.11	70	.91	1.46	70	.72	1.04
75	.68	1.07	75	.78	1.15	75	.72	1.07	75	.88	1.41	75	.70	1.00
80	.65	1.03	80	.75	1.11	80	.69	1.04	80	.85	1.35	80	.68	.97
85	.63	1.00	85	.73	1.07	85	.67	1.01	85	.82	1.31	85	.66	.94

SLOPE = .490

SLOPE = .580

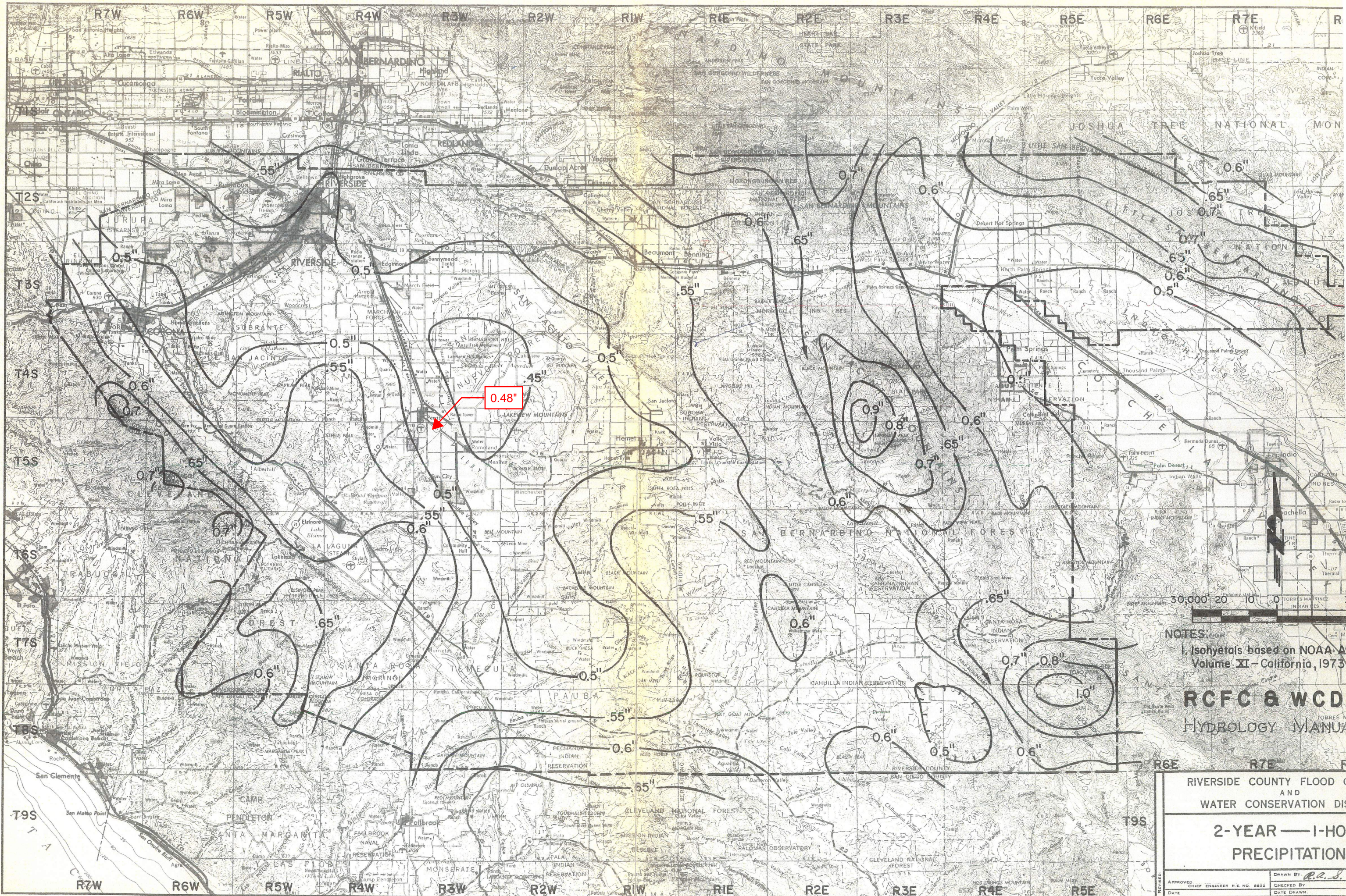
SLOPE = .500

SLOPE = .550

SLOPE = .530

RCFC & WCD
HYDROLOGY MANUAL

STANDARD
INTENSITY - DURATION
CURVES DATA

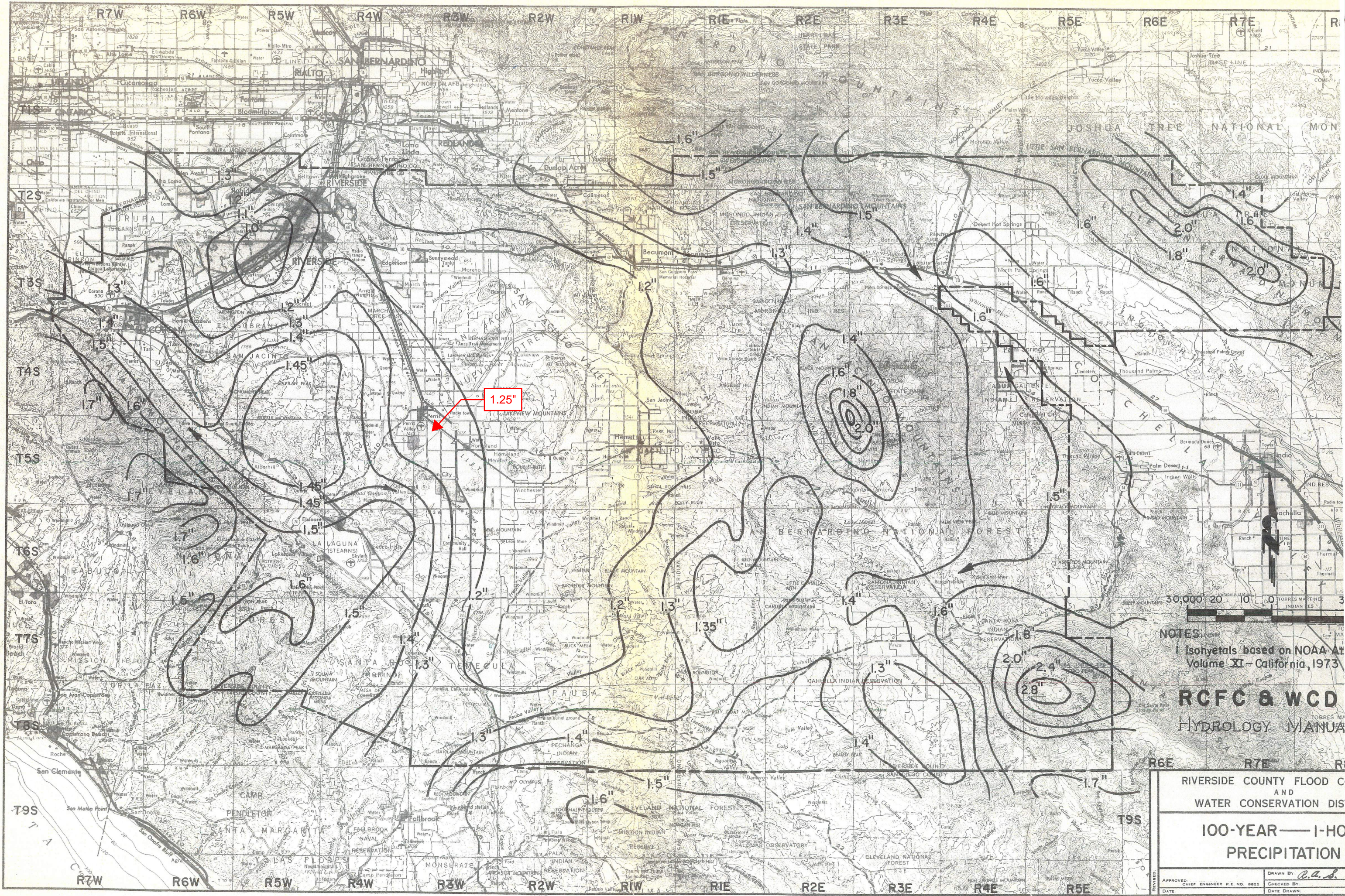


NOTES:
 Isohyets based on NOAA Atlas
 Volume XI - California, 1973

RCFC & WCD
 HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL
 AND
 WATER CONSERVATION DISTRICT
**2-YEAR — 1-HOUR
 PRECIPITATION**

APPROVED	DATE	CHIEF ENGINEER P.E. NO. 8822	DRAWN BY	DATE DRAWN
			<i>P.A.S.</i>	

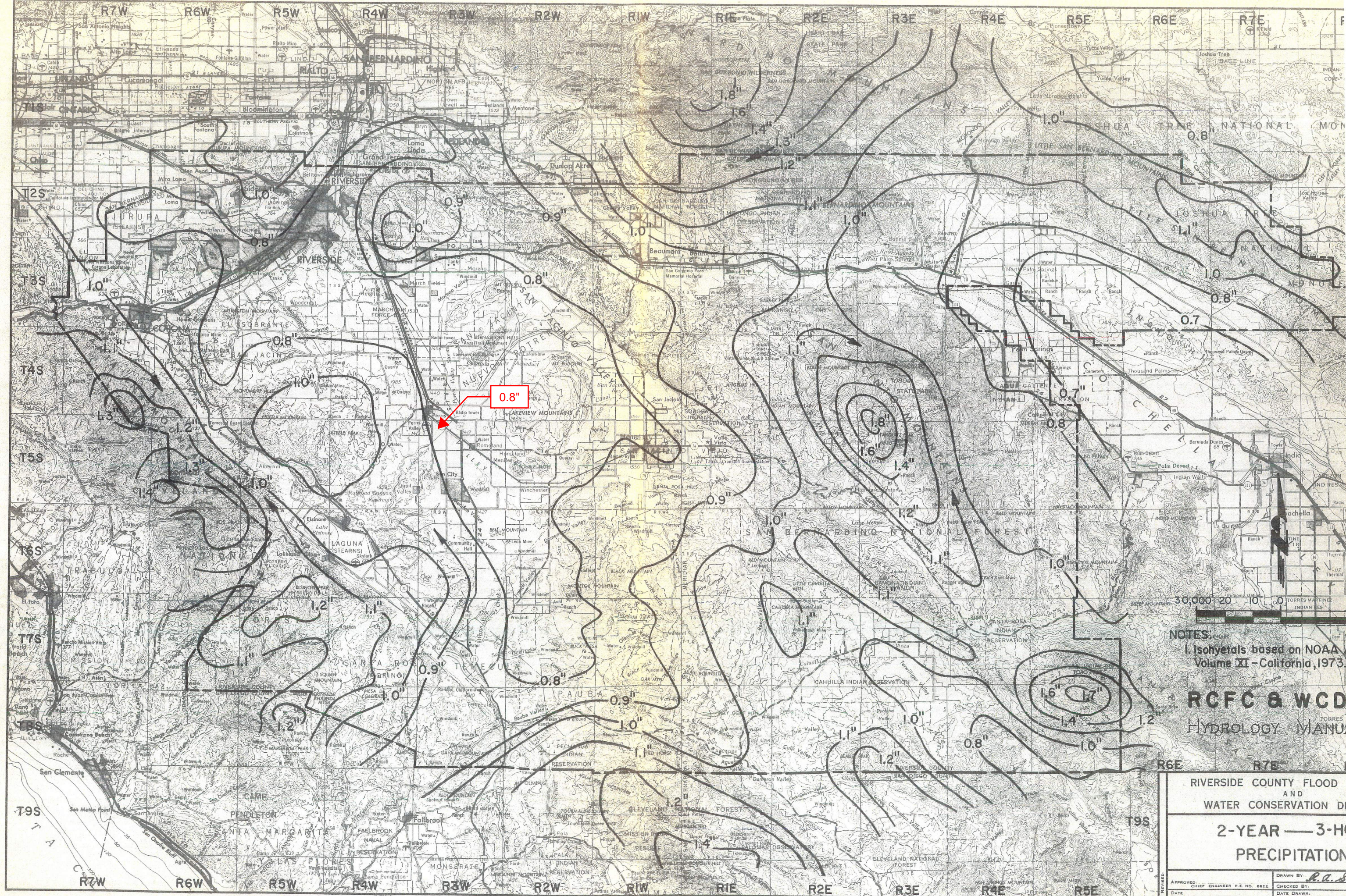


NOTES
 1 Isohyets based on NOAA Atlas
 Volume XI - California, 1973

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RIVERSIDE COUNTY FLOOD CONTROL
 AND
 WATER CONSERVATION DISTRICT
**100-YEAR — 1-HOUR
 PRECIPITATION**

APPROVED: _____
 CHIEF ENGINEER R.C. NO. 8822
 DATE: _____
 DRAWN BY: *C.A.S.*
 CHECKED BY: _____
 DATE DRAWN: _____

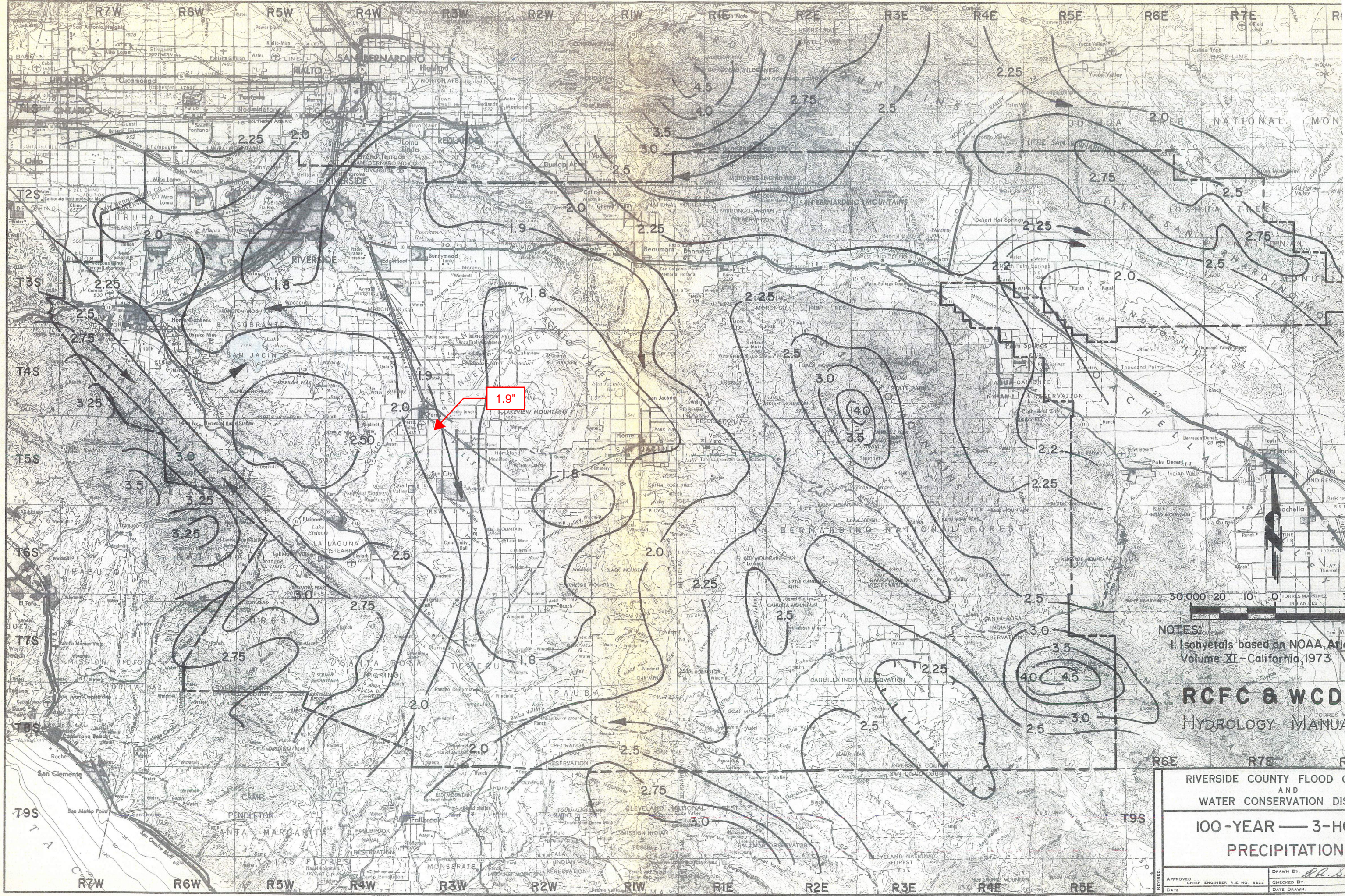


NOTES:
 1. Isohyets based on NOAA Volume XI - California, 1973.

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RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
2-YEAR — 3-HOUR PRECIPITATION

APPROVED	DATE	CHIEF ENGINEER R.E. NO. 882	DRAWN BY	DATE
			<i>R.A.S.</i>	
			CHECKED BY	DATE



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

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**RIVERSIDE COUNTY FLOOD CONTROL
 AND
 WATER CONSERVATION DISTRICT
 100-YEAR — 3-HOUR
 PRECIPITATION**

APPROVED	DRAWN BY
DATE	DATE DRAWN
CHIEF ENGINEER R.E. NO. 8823	PI 4TF