

**Rio Del Sol Rangel Steel Bldg
Thousand Palms, CA 92276
Hydrology Study
APN: 648-120-001,
648-110-013, 648-110-016**

Submitted to:

City of Palm Springs
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City PN: 648-120-001, 648-110-013, 648-110-016

Prepared by

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EXHIBITS

- 1- STREAM ANALYSIS, HYDROLOGY MAP
- 2- CALCULATION
- 3- REF MATERIALS-HYDRO PLATES, SOIL REPORT, RAINFALL

1 INTRODUCTION

The Rio Del Sol Rangel Steel Bldg is proposed on three parcels totalling approximately 30.72-acre site with APN 648-120-001, 648-110-013, 648-110-016 zoned as manufacturing-service commercial (M-SC) and controlled development areas (W-2-5), located in the County of Riverside, California. The subject lot is vacant and is bounded by Vista Chino on the northerly side, Rio Del Sol on the westerly side and existing vacant lots on the southerly & easterly sides.

The lots are located in **FEMA Effective Zone AO** has a flood depth of 1' and stream velocity of 6 ft/s. On the north-westerly sides there is **A stream generating from Indio Hills** is sheet flowing around the project site. This stream is about 1,675 acres and will be analyzed in this study.

Existing on-site drainage was accomplished by sheet flow towards the southwesterly corner. The proposed project consists of construction of 29,600 square foot metal building, parking spaces, driveways, landscaping, paving, water and storm drain systems. Proposed on-site drainage was accomplished by draining stormwater via ribbon gutters, catch basins and will be directed via SD pipes toward a proposed retention basin at the westerly side of the development. Though the lot is 30.72 acre, the retention basin is capturing drainage from proposed development of the site.

2 PROJECT SITE LOCATION MAP

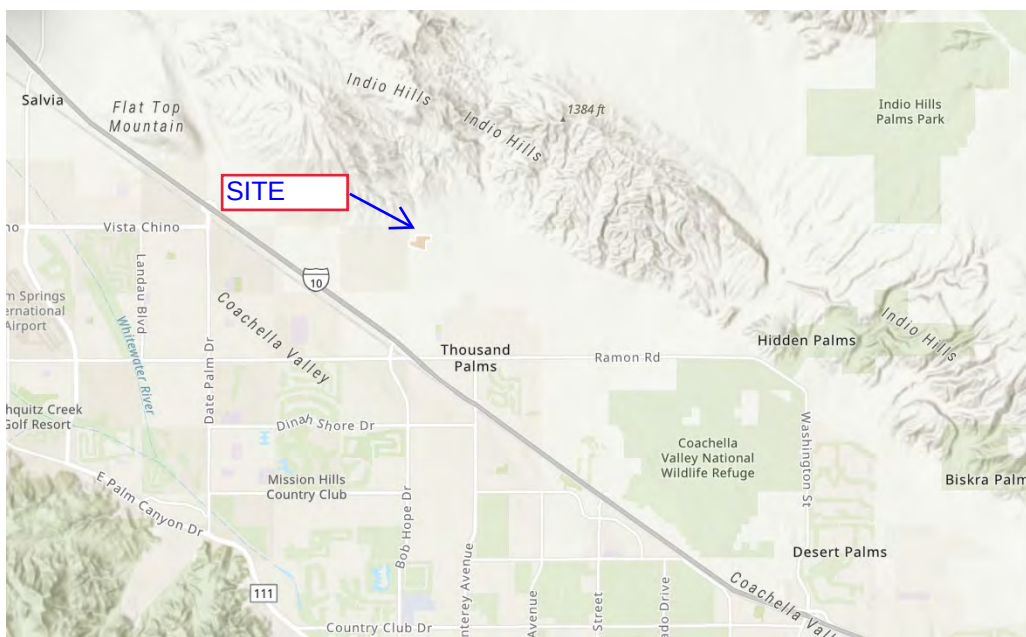


Figure 1: Project Location Map

3 PURPOSE AND SCOPE

The purpose of this study is to determine the rate of stormwater runoff which will flow through the property during a 100-year storm event and determine any mitigations which are necessary to protect the proposed development during the storm event. This study shows how the runoff will flow through the developed site. The scope of the study includes the following:

- Establish baseline drainage conditions and watershed areas.
- To calculate the proposed flows and storage requirement from the project site, per the Riverside County Design Standards and the Riverside County Flood Control Hydrology Manual.
- Design Levee and Culvert to protect from flood from Scatt Brush Stream

4 HYDROLOGY METHODOLOGY

The design calculations provided herein are in accordance with the methods “RCFC & WCD Short Cut Unit Hydrograph Method” described in the Riverside County Flood Control Hydrology Manual. Peak discharge runoff for the 100-yr storm event was calculated based on rainfall data, soil type, acreage, type of development, and topographic data for the study area. 100-yr Unit Hydrograph Method were run for the existing and developed condition.

Intensity-duration data was obtained from National Oceanic and Atmospheric Administration Precipitation data.

The soil type was obtained from USDA Web Soil Survey National Cooperative Soil Survey. A copy of this map is included within this report. The predominant onsite soil type obtained from the Hydrological Soils Group was determined to be type ‘A’.

For the proposed condition, land use was assumed to model current storm discharges building type development condition used.

5 HYDROLOGY CALCULATIONS

A summary of the offsite and onsite project areas subdivided are provided in the table below:

Subarea No.	Total Area (SF)	Area (Acre)
STREAM-A	72,963,000	1,675
DMA-A	86,900	2

The site is located in **FEMA Effective Zone AO** has a flood depth of 1’ and stream velocity of 6 ft/s. From north-westerly side **A stream from Indio Hills** is sheet flowing around the project site. This stream (named as **STREAM-A**) is about 1,675 acres and 100-yr peak flow hydrologic analysis is completed by Unit Hydrograph Method about 3,452 cfs. A Levee is proposed to capture this 3,452 cfs flow generating from north-westerly streams. This Levee will direct flow to a 24” Culvert which will subsequently flow towards south-westerly corner as existing stream does.

For the onsite proposed condition, during 100-Yr/24-Hr storm DMA-A (2-acre) produces about 3,600 ft³ runoff volume. The rainfall generated by the onsited watersheds will be conveyed to the proposed infiltration basin at westerly side of the property.

Runoff calculations for 100-yr watershed and the reference materials used to do the calculation can be seen in the attachment.

RESULTS OF THE HYDROLOGY ANALYSIS:

Onsite Drainage Area	100-YR 24HR VOLUME (UNIT HYDROGRAPH)
DMA-A	3,594 Cu-ft

Offsite Stream	100-YR 24HR RUNOFF (UNIT HYDROGRAPH)
STREAM-A	3,452 cfs

Capacity of Levee

10 ft deep Levee has capacity of **5,988 ft³** (See attached Exhibit)

Capacity of Infiltration Basin

Above ground volume of the Infiltration Basin = $(d/3) * (\text{bottom} + \text{top} + (\text{bottom} * \text{top})^{0.5})$
 = $(10/3) * (10,784 + 2,770 + (10,784 * 2,770)^{0.5})$ = **63,398 ft³**

Volume within the Infiltration Basin = **4,294 ft³**

Volume Provided by the Infiltration basin = $63,398 \text{ ft}^3 + 5,540 \text{ ft}^3$ = **68938 ft³**

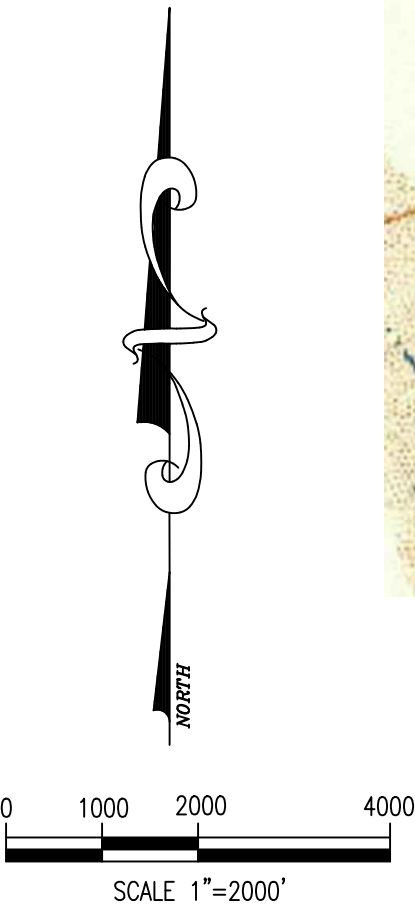
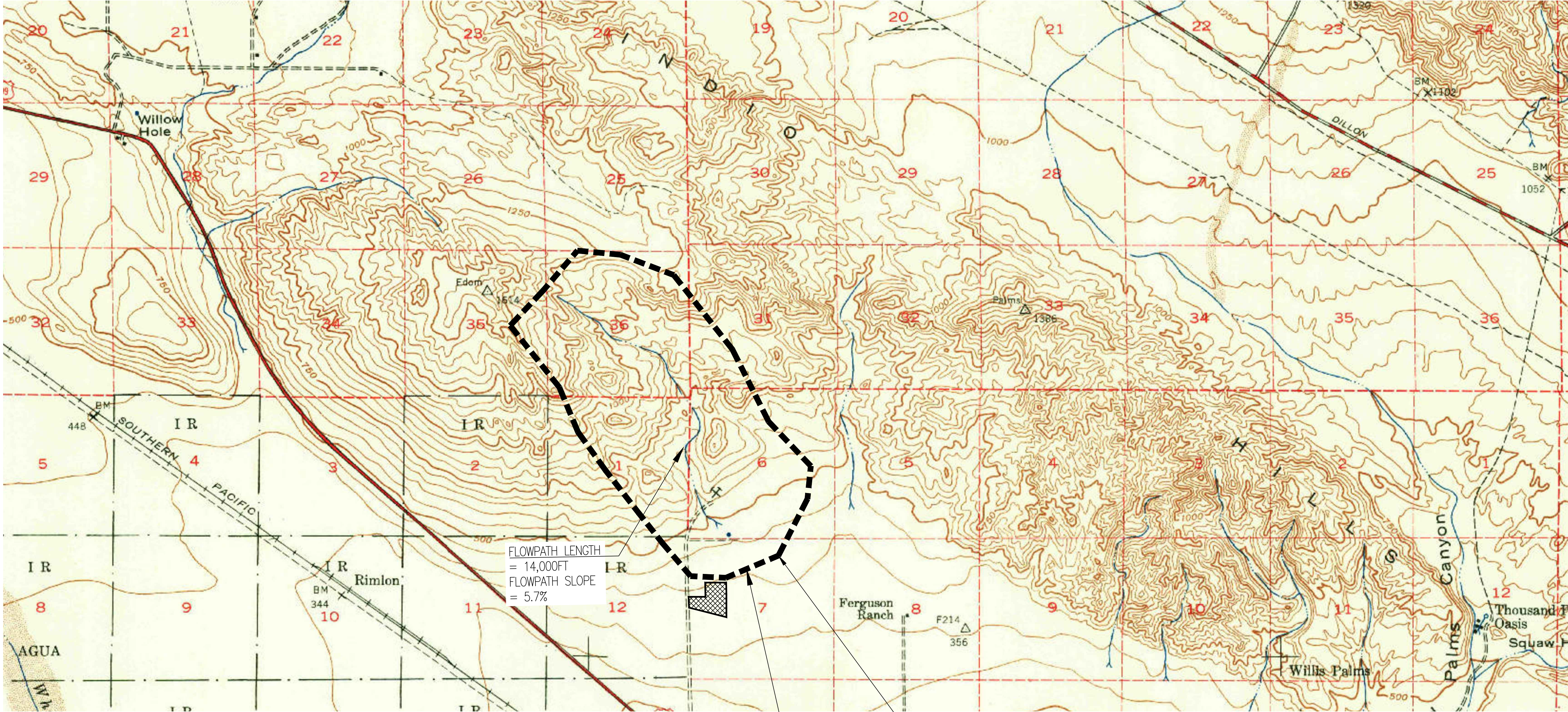
6 DISCUSSION OF RESULTS

Hydrologic Analysis for 100-year storm frequency have been calculated. As, the site is located in **FEMA Effective Zone AO** has a flood depth of 1' and stream velocity of 6 ft/s, the proposed Levee can protect the building and other structures from flood depth of 1'.

As a result of the increase in impervious areas onsite, the runoff volume produced about 3,594 ft³ will be directed toward the proposed infiltration basin has greater capacity.

Detail exhibits can be seen in the attachment.

STREAM ANALYSIS
APN: 648-120-001, 648-110-013, 648-110-016
RIO DEL SOL, THOUSAND PALMS, CA 92276
JOSHUA TREE, CA 92252
SAN BERNARDINO COUNTY



- LEGEND:
- CENTERLINE
 - PROPERTY LINE
 - DRAINAGE AREA BOUNDARY
 - DRAINAGE AREA BOUNDARY

100-YR
PEAK FLOW
=3,452 CFS

STREAM-A
1,675 AC

CIVIL ENGINEER

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Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

1



Legend

Hyd.	Origin	Description
1	SCS Runoff	SCATT BRUSH

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	3451.58	1	630	38,201,796	-----	-----	-----	SCATT BRUSH
C:\Users\fazla\Desktop\NEW PROJECTS\0-South Bridge\001\Year 100 Year aaaaaaaaaa					Friday, 02/25/2023 SCATT BRUSH.gpw				

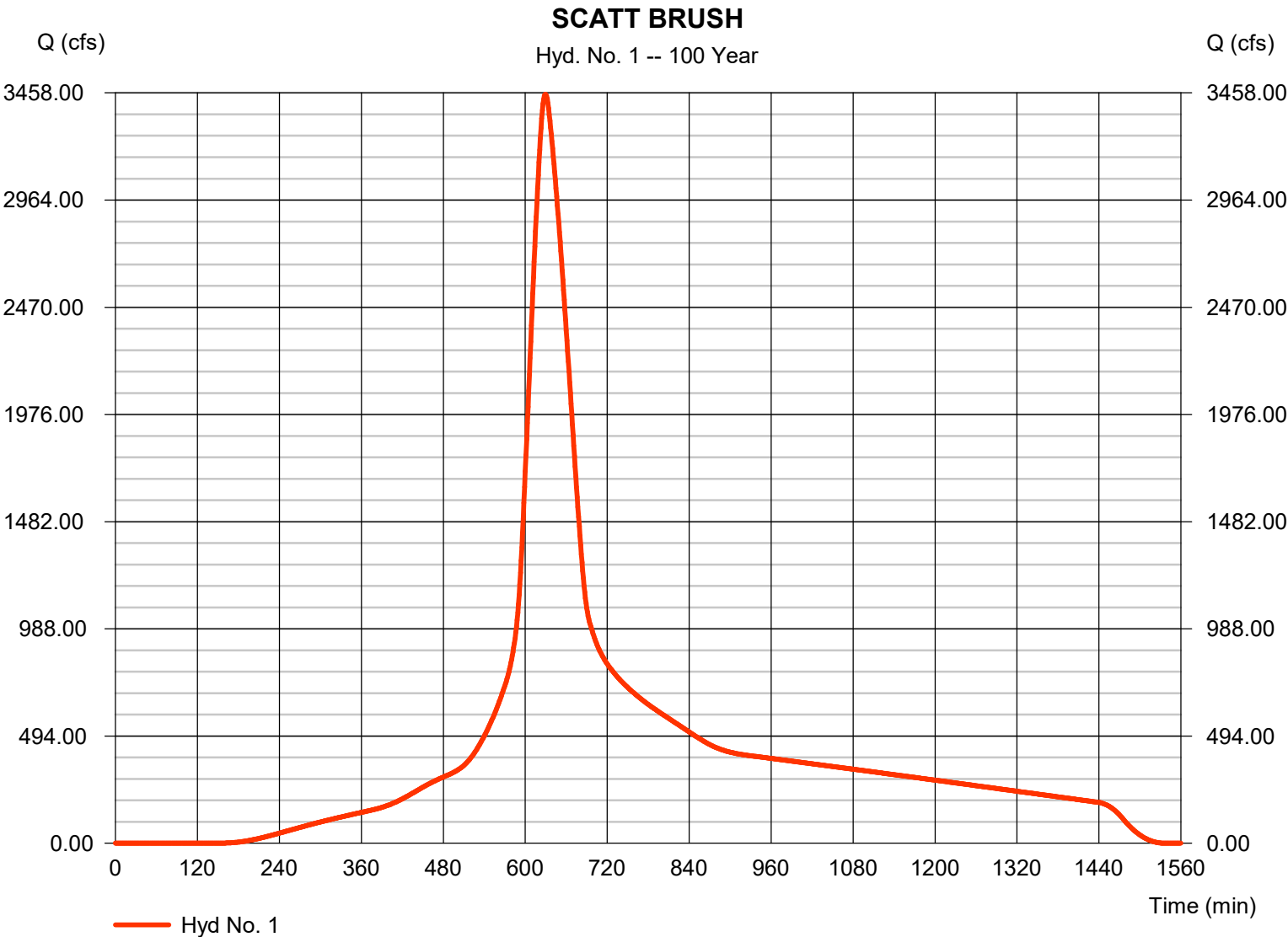
Hydrograph Report

Hyd. No. 1

SCATT BRUSH

Hydrograph type	= SCS Runoff	Peak discharge	= 3451.58 cfs
Storm frequency	= 100 yrs	Time to peak	= 630 min
Time interval	= 1 min	Hyd. volume	= 38,201,796 cuft
Drainage area	= 1675.000 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 60.60 min
Total precip.	= 7.95 in	Distribution	= Type I
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1675.000 x 86)] / 1675.000



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2023

Hyd. No. 1

SCATT BRUSH

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.011	0.011	0.011				
Flow length (ft)	= 0.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 0.00	0.00	0.00				
Land slope (%)	= 0.00	0.00	0.00				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Shallow Concentrated Flow							
Flow length (ft)	= 14000.00	0.00	0.00				
Watercourse slope (%)	= 5.70	0.00	0.00				
Surface description	= Unpaved	Paved	Paved				
Average velocity (ft/s)	=3.85	0.00	0.00				
Travel Time (min)	= 60.57	+	0.00	+	0.00	=	60.57
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	(0)0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				60.60 min			

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	3.2926	2.7000	0.5694	-----
2	4.9019	2.8000	0.5710	-----
3	0.0000	0.0000	0.0000	-----
5	7.2684	2.7000	0.5711	-----
10	9.5383	2.8000	0.5732	-----
25	12.4784	2.5000	0.5643	-----
50	15.7897	2.7000	0.5704	-----
100	18.6688	2.5000	0.5630	-----

File name: RIO DEL SOL.IDF

Intensity = $B / (T_c + D)^E$

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	1.03	0.77	0.64	0.56	0.50	0.45	0.42	0.39	0.36	0.34	0.33	0.31
2	1.52	1.14	0.95	0.82	0.73	0.67	0.62	0.57	0.54	0.51	0.48	0.46
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	2.27	1.70	1.41	1.22	1.09	0.99	0.91	0.85	0.80	0.76	0.72	0.68
10	2.94	2.21	1.83	1.59	1.42	1.29	1.19	1.11	1.04	0.98	0.93	0.89
25	4.00	3.00	2.48	2.15	1.92	1.75	1.61	1.50	1.41	1.34	1.27	1.21
50	4.93	3.70	3.07	2.66	2.37	2.16	1.99	1.86	1.74	1.65	1.56	1.49
100	6.00	4.50	3.73	3.23	2.89	2.63	2.43	2.26	2.12	2.01	1.91	1.82

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	7.95
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	4.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	8.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	7.10

Watershed Model Schematic.....

1

Hydrograph Return Period Recap.....

2

100 - Year

Summary Report.....

3

Hydrograph Reports.....

4

Hydrograph No. 1, SCS Runoff, SCATT BRUSH.....

4

TR-55 Tc Worksheet.....

5

IDF Report.....

6

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Friday, Feb 2 2024

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Trapezoidal

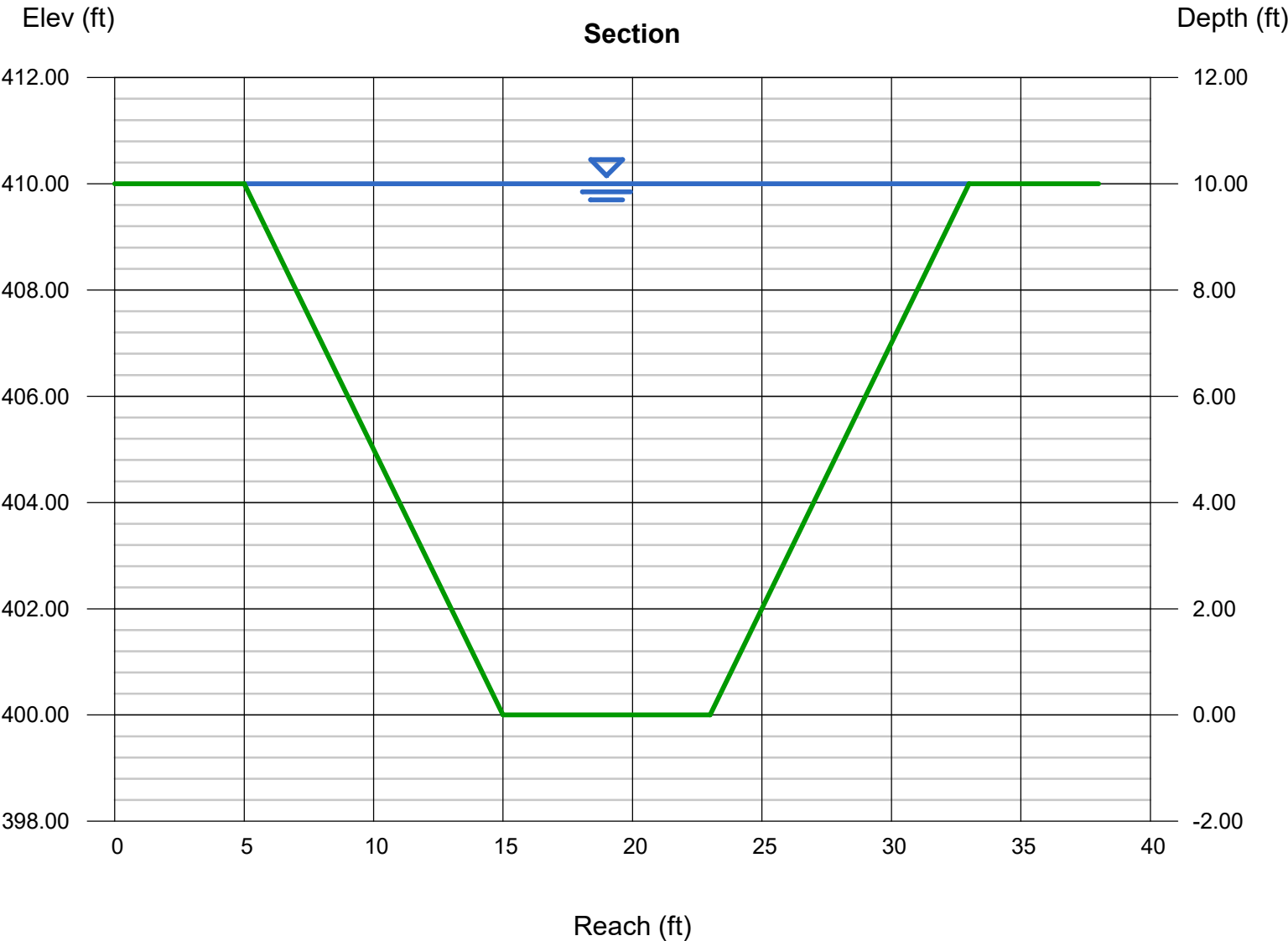
Bottom Width (ft) = 8.00
Side Slopes (z:1) = 1.00, 1.00
Total Depth (ft) = 10.00
Invert Elev (ft) = 400.00
Slope (%) = 1.00
N-Value = 0.013

Highlighted

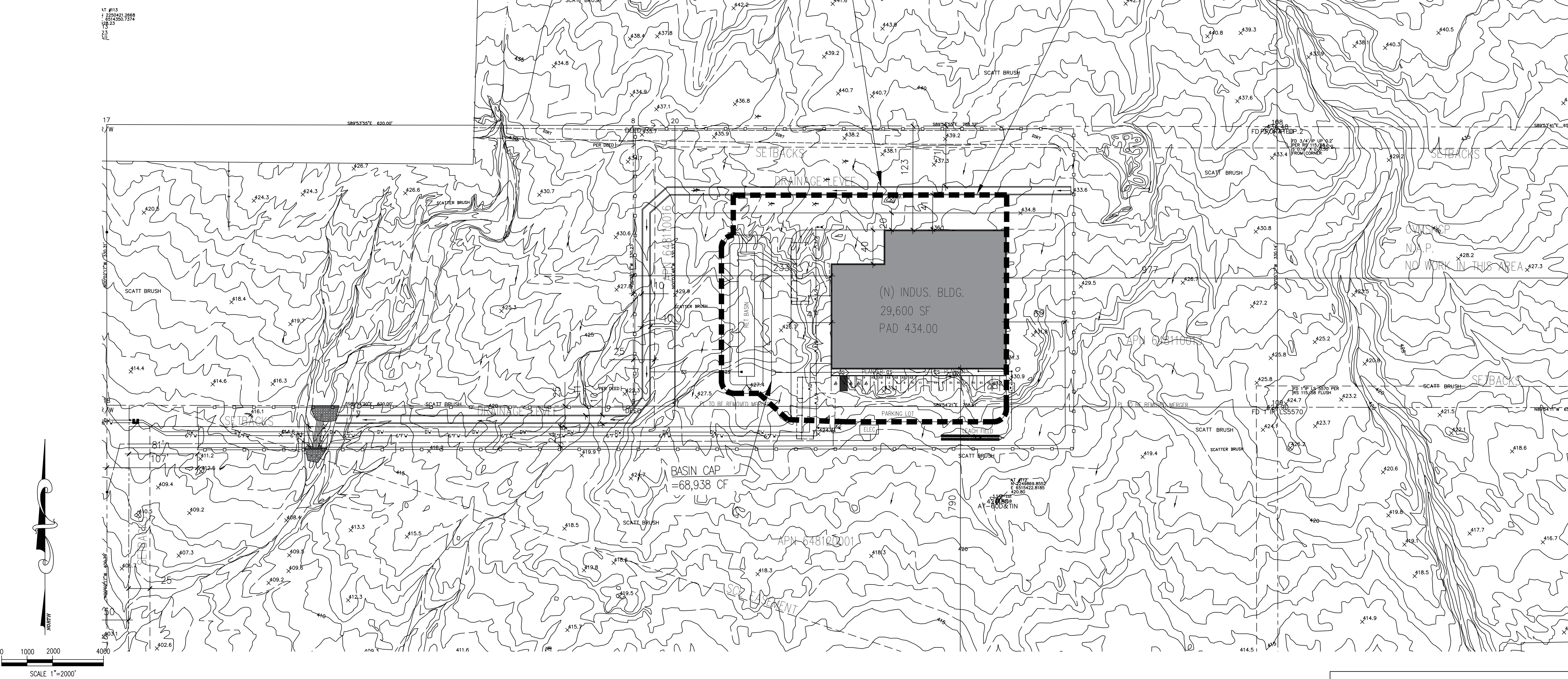
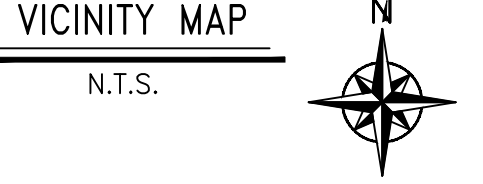
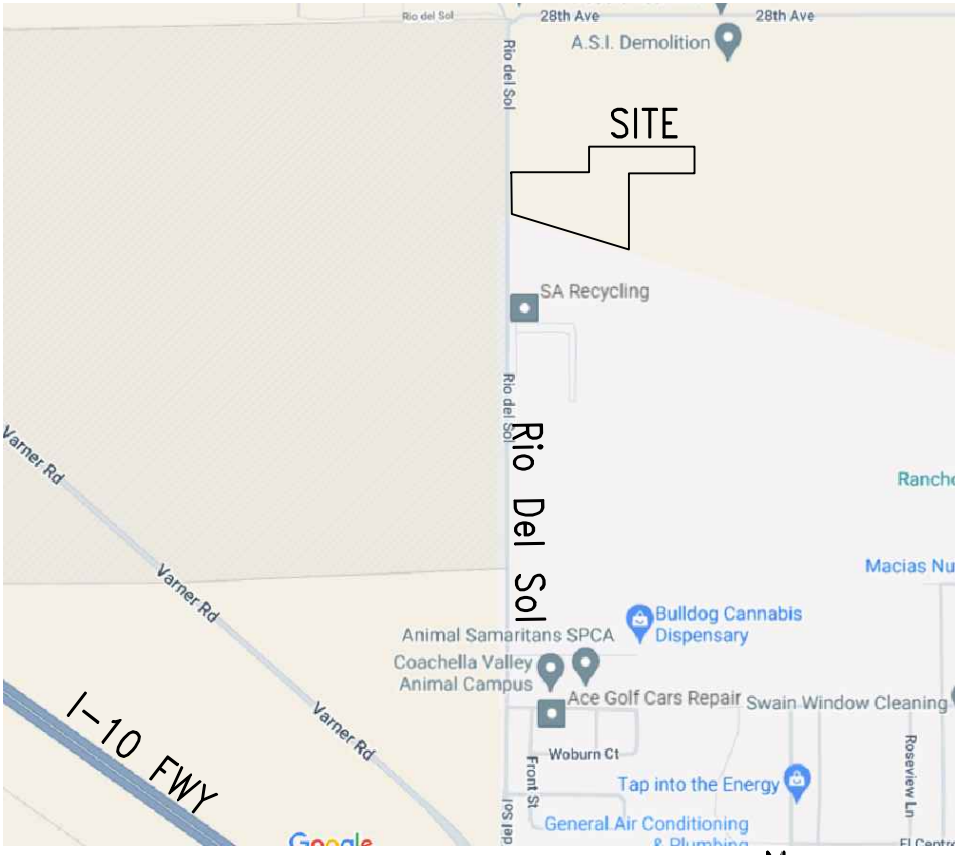
Depth (ft) = 10.00
Q (cfs) = 5,988
Area (sqft) = 180.00
Velocity (ft/s) = 33.27
Wetted Perim (ft) = 36.28
Crit Depth, Yc (ft) = 10.00
Top Width (ft) = 28.00
EGL (ft) = 27.21

Calculations

Compute by: Q vs Depth
No. Increments = 10



POST-DEVELOPMENT HYDROLOGY MAP
APN: 648-120-001, 648-110-013, 648-110-016
RIO DEL SOL, THOUSAND PALMS, CA 92276
JOSHUA TREE, CA 92252
SAN BERNARDINO COUNTY



- LEGEND:
- CENTERLINE
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 - DRAINAGE AREA BOUNDARY
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HYDROLOGY CALCULATIONS - RIO DEL SOL, THOUSAND PALMS, CA 92276

program updated 4-14-22 LC

Using the RCFC&WCD Short Cut Unit Hydrograph Method
Area Designations DMA-A

Drainage Area (ac.)	2.00	86,900 s.f. by measure on plans
Unit time (minutes)	5	5 5 15
100 Year Storm Duration (hrs)	1	3 6 24
Total Precipitation (Plates D-4.4,E-5.2, 5.4, 5.6)(in.)	1.46	2.24 3.06 4.95
Soils Group	A	
AMC index II Runoff Number (plate E-6.1)	32	
Plate E-6.2 Pervious Area Loss Rate (Fp)(in/hr)	0.74 (AMC II)	
Percentage of Impervious Cover (Ai)(%) (plate E-6.3)	0.75	(estimated from plan)
Weighted Average Loss Rate (F=Fp(1-.9Ai))(in./hr.)	0.74	(used for 1, 3, and 6 hour storm, the 24 hour storm uses variable maximum loss rate per plate E-1.1 (3 of 6))
Low Loss Rate Percent (%)	90	
Retention Basin Percolation Rate (in/hr)	2	(also used for drywell percolation rate)

Or data from NOAA interactive website

Percolation is taken incrementally.

Basin volume is calculated using the "truncated pyramid" formula, a more conservative estimate than "averaged end areas" sometimes used

See plan for Infiltration basin

(Drywell can be "zeroed out" by reducing numbers to less than .001, but should not entered as zeros or program chokes.)

Drywell storage includes 40% of the 1' wide rock bed surrounding the drywell: formula $(upper) \cdot \pi \cdot (diam/2)^2 + (lower) \cdot \pi \cdot ((diam/2)^2 + 0.4 \cdot ((diam/2 + (grav + 0.4166)) \cdot 2 - (diam/2 + 0.4166)^2))$

The drywell wall thickness is assumed at 5" (0.4166) and the gravel bed width is variable "grav"

No drywell is used. It is zeroed out by reducing size to 0.001

Drywell design factors	Upper sec. (ft.)=	0.001	Lower sec. (ft.)=	0.001	Ring diam. (ft.) =	0.001	Drywell lower max. (cf)=	0.00	Upper max.(cf)=	0.00
Gravel bed width around drwyell=		1					Drywell total(cf)=	0.00		
Ret. Basin design (area, depth)	Top =	10784 s.f.	Bot. =	2770 s.f.	Max. Depth (d)=	10	Max. storage=	63398.33	$(d/3) \cdot (bottom + top + (bottom \cdot top)^{0.5})$	
Formulas	$vol = (h/3) \cdot (bottom + top + (bottom \cdot top)^{0.5})$		$area = bottom + (h/d) \cdot (top - bottom)$		$h = (vol \cdot 3) / (bottom + top + (bottom \cdot top)^{0.5})$		(values must be non-zero or error occurs)			
Outside input from:	N/A									

24 Hour Storm in 15 minute increments

Time	Pattern	Storm	Loss	Rate	Value	Effective	Flow	Flow	Outside	Drywell	Drywell	Drywell	Drywell	Overflow	Basin	Basin	Basin	Basin	Basin	Basin
	%	Rain (in/hr)	Max.	Min.		Rain (in/hr)	Rate (cfs)	Vol. (cf)	Input (cf)	Retention	Period	Storage	Storage	To	Retention	Period	Storage	Storage	Overflow	Overflow
0:15	0.2	0.04		1.29	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
0:30	0.3	0.06		1.28	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
0:45	0.3	0.06		1.26	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
1:00	0.4	0.08		1.25	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
1:15	0.3	0.06		1.23	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
1:30	0.3	0.06		1.22	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
1:45	0.3	0.06		1.20	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
2:00	0.4	0.08		1.19	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
2:15	0.4	0.08		1.17	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
2:30	0.4	0.08		1.16	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
2:45	0.5	0.10		1.14	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
3:00	0.5	0.10		1.13	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
3:15	0.5	0.10		1.12	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
3:30	0.5	0.10		1.10	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
3:45	0.5	0.10		1.09	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
4:00	0.6	0.12		1.07	0.11	0.0119	0.0240	21.56	0.00	0.00	0.00	0.00	0.00	21.56	2770.00	21.56	0.00	0.00	0.00	0.00
4:15	0.6	0.12		1.06	0.11	0.0119	0.0240	21.56	0.00	0.00	0.00	0.00	0.00	21.56	2770.00	21.56	0.00	0.00	0.00	0.00
4:30	0.7	0.14		1.05	0.12	0.0139	0.0280	25.16	0.00	0.00	0.00	0.00	0.00	25.16	2770.00	25.16	0.00	0.00	0.00	0.00
4:45	0.7	0.14		1.03	0.12	0.0139	0.0280	25.16	0.00	0.00	0.00	0.00	0.00	25.16	2770.00	25.16	0.00	0.00	0.00	0.00
5:00	0.8	0.16		1.02	0.14	0.0158	0.0319	28.75	0.00	0.00	0.00	0.00	0.00	28.75	2770.00	28.75	0.00	0.00	0.00	0.00
5:15	0.6	0.12		1.01	0.11	0.0119	0.0240	21.56	0.00	0.00	0.00	0.00	0.00	21.56	2770.00	21.56	0.00	0.00	0.00	0.00
5:30	0.7	0.14		0.99	0.12	0.0139	0.0280	25.16	0.00	0.00	0.00	0.00	0.00	25.16	2770.00	25.16	0.00	0.00	0.00	0.00
5:45	0.8	0.16		0.98	0.14	0.0158	0.0319	28.75	0.00	0.00	0.00	0.00	0.00	28.75	2770.00	28.75	0.00	0.00	0.00	0.00
6:00	0.8	0.16		0.97	0.14	0.0158	0.0319	28.75	0.00	0.00	0.00	0.00	0.00	28.75	2770.00	28.75	0.00	0.00	0.00	0.00
6:15	0.9	0.18		0.96	0.16	0.0178	0.0359	32.34	0.00	0.00	0.00	0.00	0.00	32.34	2770.00	32.34	0.00	0.00	0.00	0.00
6:30	0.9	0.18		0.94	0.16	0.0178	0.0359	32.34	0.00	0.00	0.00	0.00	0.00	32.34	2770.00	32.34	0.00	0.00	0.00	0.00
6:45	1	0.20		0.93	0.18	0.0198	0.0399	35.94	0.00	0.00	0.00	0.00	0.00	35.94	2770.00	35.94	0.00	0.00	0.00	0.00
7:00	1	0.20		0.92	0.18	0.0198	0.0399	35.94	0.00	0.00	0.00	0.00	0.00	35.94	2770.00	35.94	0.00	0.00	0.00	0.00
7:15	1	0.20		0.90	0.18	0.0198	0.0399	35.94	0.00	0.00	0.00	0.00	0.00	35.94	2770.00	35.94	0.00	0.00	0.00	0.00
7:30	1.1	0.22		0.89	0.20	0.0218	0.0439	39.53	0.00	0.00	0.00	0.00	0.00	39.53	2770.00	39.53	0.00	0.00	0.00	0.00
7:45	1.2	0.24		0.88	0.21	0.0238	0.0479	43.12	0.00	0.00	0.00	0.00	0.00	43.12	2770.00	43.12	0.00	0.00	0.00	0.00
8:00	1.3	0.26		0.87	0.23	0.0257	0.0519	46.72	0.00	0.00	0.00	0.00	0.00	46.72	2770.00	46.72	0.00	0.00	0.00	0.00
8:15	1.5	0.30		0.86	0.27	0.0297	0.0599	53.91	0.00	0.00	0.00	0.00	0.00	53.91	2770.00	53.91	0.00	0.00	0.00	0.00
8:30	1.5	0.30		0.84	0.27	0.0297	0.0599	53.91	0.00	0.00	0.00	0.00	0.00	53.91	2770.00	53.91	0.00	0.00	0.00	0.00
8:45	1.6	0.32		0.83	0.29	0.0317	0.0639	57.50	0.00	0.00	0.00	0.00	0.00	57.50	2770.00	57.50	0.00	0.00	0.00	0.00
9:00	1.7	0.34		0.82	0.30	0.0337	0.0679	61.09	0.00	0.00	0.00	0.00	0.00	61.09	2770.00	61.09	0.00	0.00	0.00	0.00
9:15	1.9	0.38		0.81	0.34	0.0376	0.0759	68.28	0.00	0.00	0.00	0.00	0.00	68.28	2770.00	68.28	0.00	0.00	0.00	0.00
9:30	2	0.40		0.80	0.36	0.0396	0.0799	71.87	0.00	0.00	0.00	0.00	0.00	71.87	2770.00	71.87	0.00	0.00	0.00	0.00
9:45	2.1	0.42		0.79	0.37	0.0416	0.0839	75.47	0.00	0.00	0.00	0.00	0.00	75.47	2770.00	75.47	0.00	0.00	0.00	0.00
10:00	2.2	0.44		0.77	0.39	0.0436	0.0878	79.06	0.00	0.00	0.00	0.00	0.00	79.06	2770.00	79.06	0.00	0.00	0.00	0.00
10:15	1.5	0.30		0.76	0.27	0.0297	0.0599	53.91	0.00	0.00	0.00	0.00	0.00	53.91	2770.00	53.91	0.00	0.00	0.00	0.00
10:30	1.5	0.30		0.75	0.27	0.0297	0.0599	53.91	0.00	0.00	0.00	0.00	0.00	53.91	2770.00	53.91	0.00	0.00	0.00	0.00
10:45	2	0.40		0.74	0.36	0.0396	0.0799	71.87	0.00	0.00	0.00	0.00	0.00	71.87	2770.00	71.87	0.00	0.00	0.00	0.00
11:00	2	0.40		0.73	0.36	0.0396	0.0799	71.87	0.00	0.00	0.00	0.00	0.00	71.87	2770.00	71.87	0.00	0.00	0.00	0.00
11:15	1.9	0.38		0.72	0.34	0.0376	0.0759	68.28	0.00	0.00	0.00	0.00	0.00	68.28	2770.00	68.28	0.00	0.00	0.00	0.00
11:30	1.9	0.38		0.71	0.34	0.0376	0.0759	68.28	0.00	0.00	0.00	0.00	0.00	68.28	2770.00	68.28	0.00	0.00	0.00	0.00
11:45	1.7	0.34		0.70	0.30	0.0337	0.0679	61.09	0.00	0.00	0.00	0.00	0.00	61.09	2770.00	61.09	0.00	0.00	0.00	0.00
12:00	1.8	0.36		0.69	0.32	0.0356	0.0719	64.69	0.00	0.00	0.00	0.00	0.00	64.69	2770.00	64.69	0.00	0.00	0.00	0.00
12:15	2.5	0.50		0.68	0.45	0.0495	0.0998	89.84	0.00	0.00	0.00	0.00	0.00	89.84	2770.00	89.84	0.00	0.00	0.00	0.00

12:30	2.6	0.51	0.67	0.46	0.0515	0.1038	93.44	0.00	0.00	0.00	0.00	0.00	93.44	2770.00	93.44	0.00	0.00	0.00	0.00
12:45	2.8	0.55	0.66	0.50	0.0554	0.1118	100.62	0.00	0.00	0.00	0.00	0.00	100.62	2770.00	100.62	0.00	0.00	0.00	0.00
13:00	2.9	0.57	0.65	0.52	0.0574	0.1158	104.22	0.00	0.00	0.00	0.00	0.00	104.22	2770.00	104.22	0.00	0.00	0.00	0.00
13:15	3.4	0.67	0.64	0.61	0.0673	0.1358	122.19	0.00	0.00	0.00	0.00	0.00	122.19	2770.00	115.42	6.77	0.00	0.00	0.00
13:30	3.4	0.67	0.63	0.61	0.0673	0.1358	122.19	0.00	0.00	0.00	0.00	0.00	122.19	2770.86	115.45	13.50	0.00	0.00	0.00
13:45	2.3	0.46	0.62	0.41	0.0455	0.0918	82.66	0.00	0.00	0.00	0.00	0.00	82.66	2771.71	115.49	0.00	0.00	0.00	0.00
14:00	2.3	0.46	0.61	0.41	0.0455	0.0918	82.66	0.00	0.00	0.00	0.00	0.00	82.66	2770.00	82.66	0.00	0.00	0.00	0.00
14:15	2.7	0.53	0.60	0.48	0.0535	0.1078	97.03	0.00	0.00	0.00	0.00	0.00	97.03	2770.00	97.03	0.00	0.00	0.00	0.00
14:30	2.6	0.51	0.59	0.46	0.0515	0.1038	93.44	0.00	0.00	0.00	0.00	0.00	93.44	2770.00	93.44	0.00	0.00	0.00	0.00
14:45	2.6	0.51	0.58	0.46	0.0515	0.1038	93.44	0.00	0.00	0.00	0.00	0.00	93.44	2770.00	93.44	0.00	0.00	0.00	0.00
15:00	2.5	0.50	0.57	0.45	0.0495	0.0998	89.84	0.00	0.00	0.00	0.00	0.00	89.84	2770.00	89.84	0.00	0.00	0.00	0.00
15:15	2.4	0.48	0.56	0.43	0.0475	0.0958	86.25	0.00	0.00	0.00	0.00	0.00	86.25	2770.00	86.25	0.00	0.00	0.00	0.00
15:30	2.3	0.46	0.56	0.41	0.0455	0.0918	82.66	0.00	0.00	0.00	0.00	0.00	82.66	2770.00	82.66	0.00	0.00	0.00	0.00
15:45	1.9	0.38	0.55	0.34	0.0376	0.0759	68.28	0.00	0.00	0.00	0.00	0.00	68.28	2770.00	68.28	0.00	0.00	0.00	0.00
16:00	1.9	0.38	0.54	0.34	0.0376	0.0759	68.28	0.00	0.00	0.00	0.00	0.00	68.28	2770.00	68.28	0.00	0.00	0.00	0.00
16:15	0.4	0.08	0.53	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
16:30	0.4	0.08	0.52	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
16:45	0.3	0.06	0.51	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
17:00	0.3	0.06	0.51	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
17:15	0.5	0.10	0.50	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
17:30	0.5	0.10	0.49	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
17:45	0.5	0.10	0.48	0.09	0.0099	0.0200	17.97	0.00	0.00	0.00	0.00	0.00	17.97	2770.00	17.97	0.00	0.00	0.00	0.00
18:00	0.4	0.08	0.48	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
18:15	0.4	0.08	0.47	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
18:30	0.4	0.08	0.46	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
18:45	0.3	0.06	0.46	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
19:00	0.2	0.04	0.45	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
19:15	0.3	0.06	0.44	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
19:30	0.4	0.08	0.44	0.07	0.0079	0.0160	14.37	0.00	0.00	0.00	0.00	0.00	14.37	2770.00	14.37	0.00	0.00	0.00	0.00
19:45	0.3	0.06	0.43	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
20:00	0.2	0.04	0.43	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
20:15	0.3	0.06	0.42	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
20:30	0.3	0.06	0.41	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
20:45	0.3	0.06	0.41	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
21:00	0.2	0.04	0.40	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
21:15	0.3	0.06	0.40	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
21:30	0.2	0.04	0.40	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
21:45	0.3	0.06	0.39	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
22:00	0.2	0.04	0.39	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
22:15	0.3	0.06	0.38	0.05	0.0059	0.0120	10.78	0.00	0.00	0.00	0.00	0.00	10.78	2770.00	10.78	0.00	0.00	0.00	0.00
22:30	0.2	0.04	0.38	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
22:45	0.2	0.04	0.38	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
23:00	0.2	0.04	0.37	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
23:15	0.2	0.04	0.37	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
23:30	0.2	0.04	0.37	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
23:45	0.2	0.04	0.37	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
24:00	0.2	0.04	0.37	0.04	0.0040	0.0080	7.19	0.00	0.00	0.00	0.00	0.00	7.19	2770.00	7.19	0.00	0.00	0.00	0.00
	0	0.00	0.37	0.00	0.0000		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
						3.99	3593.70												
						Flow (cfs)	Volume (cf)												

Volume Requirement					
Drainage Management Areas (DMA's)	DRAINAGE Area DMA-A (Acres)	Impervious Area (Post-Devlp.) (Acres)	Landscape Area (Acres)	Percent Impervious %	Volume Requirement (CF)
DMA-A	2.00	1.50	0.50	75	3594

Volume above Infiltration Basin				
Proposed Retention Facility Name	Infiltration Basin Top Area (top) (SF)	Infiltration Basin Bottom Area (bottom) (SF)	Depth of Infiltration Basin (d) (ft)	Excavated Volume (CF)
Basin	10784	2770	10.00	63398

Volume Within Infiltration Basin					
Proposed Infiltration Facility Name	Infiltration Basin Bottom Area (bottom) (SF)	Infiltration Basin Width (ft)	Absolute Volume (CF)	Infiltration Basin Porosity	Volume within Infiltration Basin (CF)
Basin	2770	5.00	13850	0.40	5540

Calculations:

Excavated Volume (CF) = $(d/3) * (bottom + top + (bottom * top)^{0.50})$ 63,398 cubic feet

Absolute Volume within Infiltration Basin (CF) = Basin depth x Surface area = $2,720 \times 5 =$ 13850 cubic feet

Volume within Infiltration Basin (CF) = Absolute Volume x Porosity = $38,480 \times 0.31 =$ 5540 cubic feet

Total Volume Provided = Volume above Infiltration Basin (CF) + Volume within Infiltration Basin (CF)
= $63,398 + 5,540$
= $68,938 \text{ ft}^3$

RAINFALL PATTERNS IN PERCENT

RCFC & WCD
HYDROLOGY MANUAL

3-HOUR STORM

TIME PERIOD	5-MIN PERIOD	15-MIN PERIOD	30-MIN PERIOD
1	1.3	2.6	3.7
2	1.3	2.6	4.6
3	1.1	3.3	5.1
4	1.5	3.3	5.9
5	1.5	3.3	6.9
6	1.8	3.4	7.3
7	1.6	4.2	8.4
8	1.6	4.2	9.5
9	1.6	5.3	12.3
10	1.6	5.3	17.6
11	1.6	5.3	16.1
12	1.6	5.9	16.2
13	1.6	7.3	18.2
14	2.2	8.5	18.1
15	2.2	8.5	18.1
16	2.0	14.1	18.1
17	2.4	3.4	2.4
18	2.7	2.4	2.4
19	2.7	2.4	2.4
20	2.7	2.4	2.4
21	3.3	3.3	3.3
22	3.3	3.3	3.3
23	2.9	2.9	2.9
24	3.0	3.0	3.0
25	3.0	3.0	3.0
26	5.2	5.2	5.2
27	5.0	5.0	5.0
28	3.6	3.6	3.6
29	6.4	6.4	6.4
30	7.3	7.3	7.3
31	8.2	8.2	8.2
32	5.0	5.0	5.0
33	2.0	2.0	2.0
34	1.8	1.8	1.8
35	1.8	1.8	1.8
36	1.6	1.6	1.6

6-HOUR STORM

TIME PERIOD	5-MIN PERIOD	15-MIN PERIOD	30-MIN PERIOD
1	1.7	1.7	3.6
2	1.6	1.6	4.3
3	1.9	2.1	4.9
4	2.0	2.2	5.3
5	2.1	2.4	5.8
6	2.1	2.4	6.8
7	2.2	2.4	7.2
8	2.3	2.5	9.2
9	2.4	2.5	11.6
10	2.4	2.5	14.4
11	2.4	2.5	25.1
12	2.5	2.6	4.6
13	2.6	2.6	4.6
14	3.1	3.2	4.6
15	3.6	3.6	4.6
16	3.2	3.2	4.6
17	3.2	3.2	4.6
18	3.2	3.2	4.6
19	3.2	3.2	4.6
20	3.2	3.2	4.6
21	3.2	3.2	4.6
22	3.2	3.2	4.6
23	3.2	3.2	4.6
24	3.2	3.2	4.6
25	3.2	3.2	4.6
26	3.2	3.2	4.6
27	3.2	3.2	4.6
28	3.2	3.2	4.6
29	3.2	3.2	4.6
30	3.2	3.2	4.6
31	3.2	3.2	4.6
32	3.2	3.2	4.6
33	3.2	3.2	4.6
34	3.2	3.2	4.6
35	3.2	3.2	4.6
36	3.2	3.2	4.6

24-HOUR STORM

TIME PERIOD	15-MIN PERIOD	30-MIN PERIOD	15-MIN PERIOD
1	2	2	2.5
2	2	2	2.5
3	2	2	2.5
4	2	2	2.5
5	2	2	2.5
6	2	2	2.5
7	2	2	2.5
8	2	2	2.5
9	2	2	2.5
10	2	2	2.5
11	2	2	2.5
12	2	2	2.5
13	2	2	2.5
14	2	2	2.5
15	2	2	2.5
16	2	2	2.5
17	2	2	2.5
18	2	2	2.5
19	2	2	2.5
20	2	2	2.5
21	2	2	2.5
22	2	2	2.5
23	2	2	2.5
24	2	2	2.5
25	2	2	2.5
26	2	2	2.5
27	2	2	2.5
28	2	2	2.5
29	2	2	2.5
30	2	2	2.5
31	2	2	2.5
32	2	2	2.5
33	2	2	2.5
34	2	2	2.5
35	2	2	2.5
36	2	2	2.5

NOTES:

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

RAINFALL PATTERNS
IN PERCENT

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

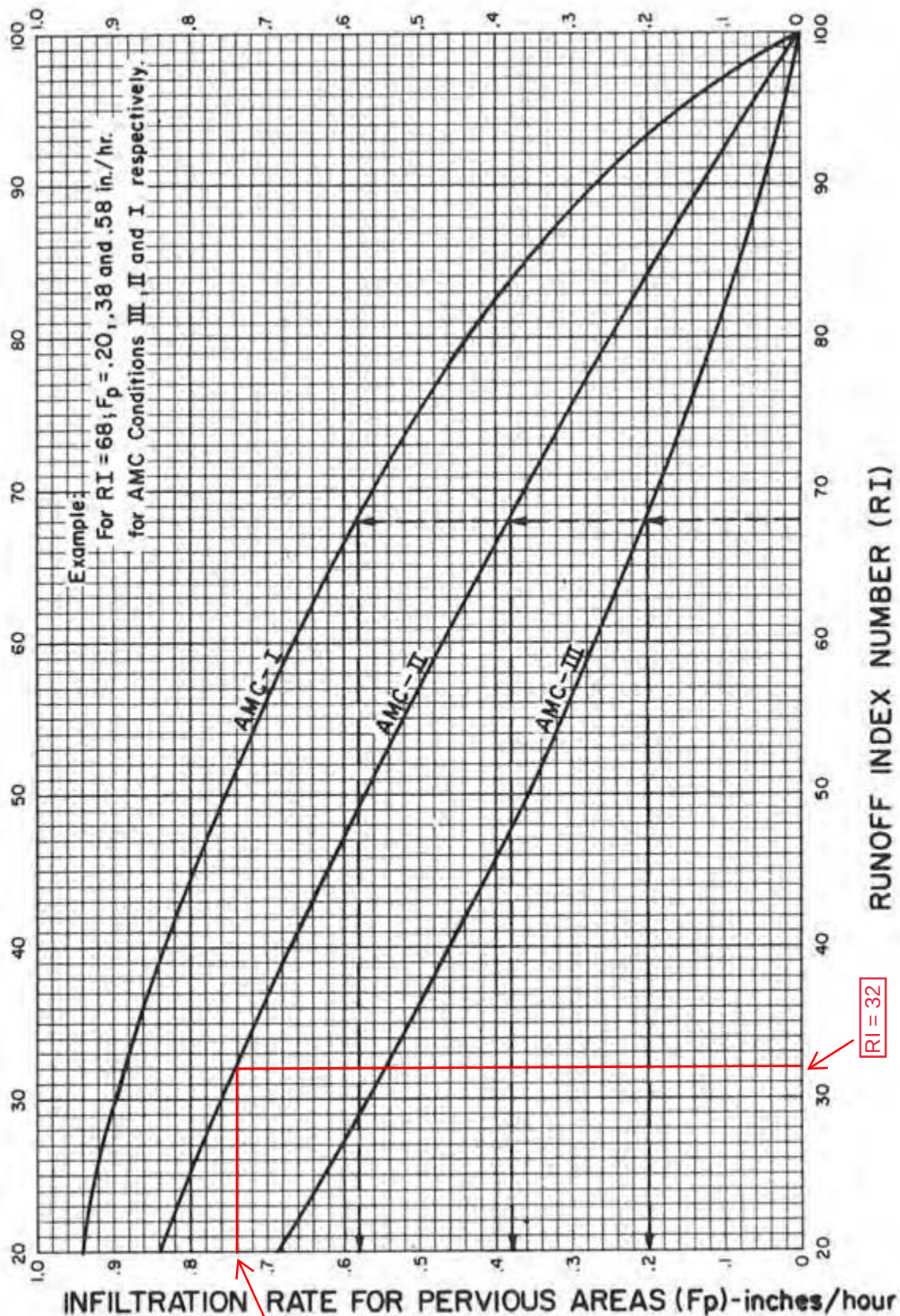
Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<u>NATURAL COVERS -</u>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	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
<u>URBAN COVERS -</u>					
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
<u>AGRICULTURAL COVERS -</u>					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

RCFC & WCD
HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS
FOR
PERVIOUS AREAS

NOTES:

I. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography Item No. 36.



RCFC & WCD
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$F_p = 0.74$
IN/HR

INFILTRATION RATE FOR
PERVIOUS AREAS VERSUS
RUNOFF INDEX NUMBERS

ACTUAL IMPERVIOUS COVER

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

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.
3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER
FOR
DEVELOPED AREAS



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Riverside County, Coachella Valley Area, California



February 2, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

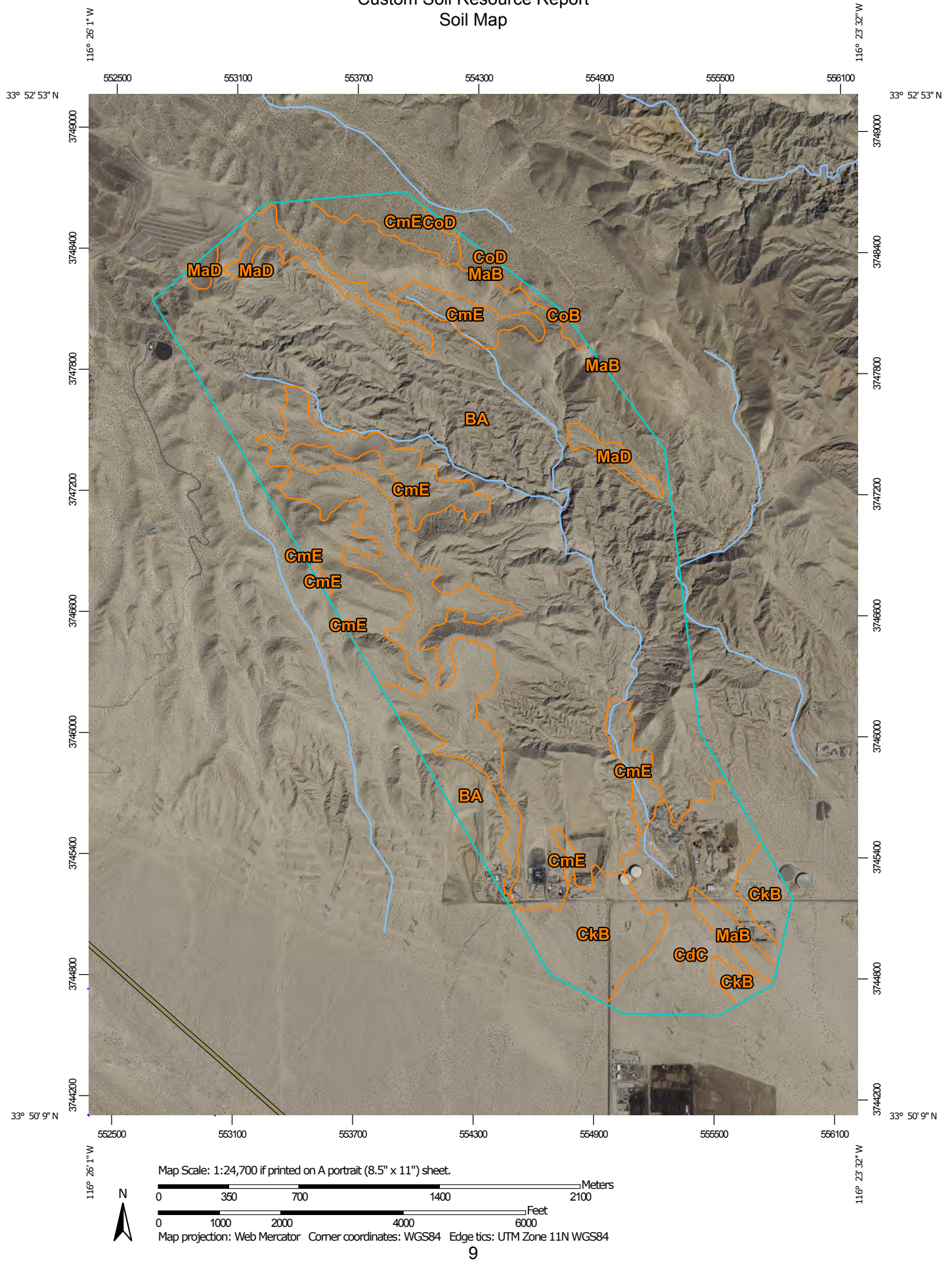
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Riverside County, Coachella Valley Area, California

Survey Area Data: Version 15, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 15, 2022—May 28, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BA	Badland	1,071.9	66.1%
CdC	Carsitas gravelly sand, 0 to 9 percent slopes	130.1	8.0%
CkB	Carsitas fine sand, 0 to 5 percent slopes	98.9	6.1%
CmE	Carsitas variant, 5 to 30 percent slopes	249.4	15.4%
CoB	Chuckawalla very gravelly sandy clay loam, 2 to 5 percent slopes	5.1	0.3%
CoD	Chuckawalla very gravelly sandy clay loam, 5 to 15 percent slopes	1.7	0.1%
MaB	Myoma fine sand, 0 to 5 percent slopes	22.7	1.4%
MaD	Myoma fine sand, 5 to 15 percent slopes	41.6	2.6%
Totals for Area of Interest		1,621.4	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Riverside County, Coachella Valley Area, California

BA—Badland

Map Unit Composition

Badland: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Badland

Setting

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Consolidated sandy alluvium

Typical profile

H1 - 0 to 60 inches: weathered bedrock

Properties and qualities

Slope: 50 to 75 percent

Depth to restrictive feature: 0 to 3 inches to paralithic bedrock

Drainage class: Excessively drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydric soil rating: No

Minor Components

Carsitas

Percent of map unit: 10 percent

Hydric soil rating: No

Riverwash

Percent of map unit: 5 percent

Hydric soil rating: No

CdC—Carsitas gravelly sand, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hkv0

Elevation: 800 feet

Mean annual precipitation: 4 inches

Mean annual air temperature: 72 to 73 degrees F

Frost-free period: 275 to 325 days

Farmland classification: Not prime farmland

Map Unit Composition

Carsitas and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carsitas

Setting

Landform: Alluvial fans

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Gravelly alluvium derived from granite

Typical profile

H1 - 0 to 10 inches: gravelly sand

H2 - 10 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 9 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 1 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4s

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: R040XD200CA - Rarely Flooded Fans

Hydric soil rating: No

Minor Components

Riverwash

Percent of map unit: 4 percent

Landform: Channels

Hydric soil rating: Yes

Carsitas

Percent of map unit: 4 percent

Hydric soil rating: No

Myoma

Percent of map unit: 4 percent

Hydric soil rating: No

Unnamed, stony or gravelly

Percent of map unit: 3 percent

Hydric soil rating: No

CkB—Carsitas fine sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hkv4

Elevation: 800 feet

Mean annual precipitation: 4 inches

Mean annual air temperature: 72 to 73 degrees F

Frost-free period: 275 to 325 days

Farmland classification: Not prime farmland

Map Unit Composition

Carsitas and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carsitas

Setting

Landform: Alluvial fans

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Sandy alluvium derived from granite

Typical profile

H1 - 0 to 10 inches: fine sand

H2 - 10 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 1 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: R040XD200CA - Rarely Flooded Fans

Hydric soil rating: No

Minor Components

Myoma

Percent of map unit: 10 percent
Hydric soil rating: No

Coachella

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed, gravel surface

Percent of map unit: 2 percent
Hydric soil rating: No

CmE—Carsitas variant, 5 to 30 percent slopes

Map Unit Setting

National map unit symbol: hkv6
Elevation: -270 to 1,390 feet
Mean annual precipitation: 4 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 275 to 325 days
Farmland classification: Not prime farmland

Map Unit Composition

Carsitas variant and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Carsitas Variant

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sandstone

Typical profile

H1 - 0 to 6 inches: fine sand
H2 - 6 to 18 inches: sand
H3 - 18 to 22 inches: weathered bedrock

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: 18 to 22 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R040XD200CA - Rarely Flooded Fans
Hydric soil rating: No

Minor Components

Myoma

Percent of map unit: 10 percent
Hydric soil rating: No

Carsitas

Percent of map unit: 3 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

CoB—Chuckawalla very gravelly sandy clay loam, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: hkv9
Elevation: 400 to 1,000 feet
Mean annual precipitation: 4 inches
Mean annual air temperature: 72 degrees F
Frost-free period: 270 to 320 days
Farmland classification: Not prime farmland

Map Unit Composition

Chuckawalla and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chuckawalla

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Custom Soil Resource Report

Parent material: Gravelly alluvium

Typical profile

H1 - 0 to 12 inches: very gravelly sandy clay loam

H2 - 12 to 25 inches: very gravelly fine sandy loam

H3 - 25 to 60 inches: very gravelly sand

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: B

Ecological site: R040XD002CA - Desert Pavement 2-4" p.z.

Hydric soil rating: No

Minor Components

Alluvium or colluvium

Percent of map unit: 10 percent

Hydric soil rating: No

Carsitas

Percent of map unit: 3 percent

Hydric soil rating: No

Riverwash

Percent of map unit: 2 percent

Hydric soil rating: No

CoD—Chuckawalla very gravelly sandy clay loam, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: hkvb

Elevation: 400 to 1,000 feet

Mean annual precipitation: 4 inches

Mean annual air temperature: 72 degrees F

Frost-free period: 270 to 320 days

Farmland classification: Not prime farmland

Map Unit Composition

Chuckawalla and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chuckawalla

Setting

Landform: Alluvial fans

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Gravelly alluvium

Typical profile

H1 - 0 to 12 inches: very gravelly sandy clay loam

H2 - 12 to 25 inches: very gravelly fine sandy loam

H3 - 25 to 60 inches: very gravelly sand

Properties and qualities

Slope: 5 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

*Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: B

Ecological site: R040XD002CA - Desert Pavement 2-4" p.z.

Hydric soil rating: No

Minor Components

Unnamed, sand

Percent of map unit: 10 percent

Hydric soil rating: No

Carrizo

Percent of map unit: 3 percent

Hydric soil rating: No

Carsitas

Percent of map unit: 2 percent

Hydric soil rating: No

MaB—Myoma fine sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: hkw3
Elevation: -200 to 1,800 feet
Mean annual precipitation: 2 to 4 inches
Mean annual air temperature: 72 to 75 degrees F
Frost-free period: 270 to 320 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Myoma and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Myoma

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind blown sandy alluvium

Typical profile

H1 - 0 to 18 inches: fine sand
H2 - 18 to 60 inches: sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R040XD007CA - Lacustrine Basin and Large River Floodplain
Hydric soil rating: No

Minor Components

Coachella

Percent of map unit: 4 percent

Hydric soil rating: No

Carsitas

Percent of map unit: 4 percent

Hydric soil rating: No

Unnamed, noncalcareous soils

Percent of map unit: 4 percent

Hydric soil rating: No

Riverwash

Percent of map unit: 3 percent

Landform: Channels

Hydric soil rating: Yes

MaD—Myoma fine sand, 5 to 15 percent slopes

Map Unit Setting

National map unit symbol: hkw4

Elevation: -200 to 1,800 feet

Mean annual precipitation: 2 to 4 inches

Mean annual air temperature: 72 to 75 degrees F

Frost-free period: 270 to 320 days

Farmland classification: Prime farmland if irrigated

Map Unit Composition

Myoma and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Myoma

Setting

Landform: Alluvial fans

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Wind blown sandy alluvium

Typical profile

H1 - 0 to 18 inches: fine sand

H2 - 18 to 60 inches: sand

Properties and qualities

Slope: 5 to 15 percent

Depth to restrictive feature: More than 80 inches

Custom Soil Resource Report

Drainage class: Somewhat excessively drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: A

Ecological site: R040XD007CA - Lacustrine Basin and Large River Floodplain

Hydric soil rating: No

Minor Components

Coachella

Percent of map unit: 5 percent

Hydric soil rating: No

Unnamed, calcareous soils

Percent of map unit: 5 percent

Hydric soil rating: No

Riverwash

Percent of map unit: 3 percent

Landform: Channels

Hydric soil rating: Yes

Carsitas

Percent of map unit: 2 percent

Hydric soil rating: No

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NOAA Atlas 14, Volume 6, Version 2
Location name: Thousand Palms, California, USA*
Latitude: 33.8417°, Longitude: -116.4038°
Elevation: 428 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 & aeriels](#)

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	0.058 (0.049-0.071)	0.089 (0.074-0.108)	0.134 (0.111-0.163)	0.175 (0.144-0.216)	0.240 (0.191-0.305)	0.297 (0.231-0.386)	0.363 (0.275-0.482)	0.438 (0.323-0.600)	0.556 (0.393-0.794)	0.662 (0.452-0.980)
10-min	0.084 (0.070-0.101)	0.127 (0.106-0.154)	0.192 (0.159-0.234)	0.251 (0.207-0.309)	0.344 (0.274-0.438)	0.426 (0.332-0.553)	0.520 (0.395-0.692)	0.628 (0.463-0.860)	0.797 (0.564-1.14)	0.949 (0.648-1.40)
15-min	0.101 (0.084-0.123)	0.154 (0.128-0.186)	0.232 (0.192-0.283)	0.304 (0.250-0.374)	0.417 (0.331-0.529)	0.516 (0.401-0.669)	0.629 (0.477-0.836)	0.760 (0.560-1.04)	0.964 (0.682-1.38)	1.15 (0.784-1.70)
30-min	0.156 (0.130-0.189)	0.237 (0.197-0.288)	0.358 (0.297-0.436)	0.469 (0.386-0.577)	0.643 (0.511-0.817)	0.796 (0.619-1.03)	0.970 (0.736-1.29)	1.17 (0.865-1.60)	1.49 (1.05-2.12)	1.77 (1.21-2.62)
60-min	0.234 (0.195-0.284)	0.355 (0.296-0.432)	0.537 (0.445-0.654)	0.704 (0.579-0.865)	0.964 (0.767-1.22)	1.19 (0.929-1.55)	1.46 (1.10-1.94)	1.76 (1.30-2.41)	2.23 (1.58-3.19)	2.66 (1.82-3.93)
2-hr	0.342 (0.285-0.415)	0.505 (0.420-0.613)	0.745 (0.618-0.907)	0.962 (0.791-1.18)	1.30 (1.03-1.65)	1.58 (1.23-2.06)	1.91 (1.45-2.54)	2.28 (1.68-3.12)	2.84 (2.01-4.06)	3.34 (2.28-4.93)
3-hr	0.415 (0.346-0.504)	0.608 (0.505-0.738)	0.890 (0.738-1.08)	1.14 (0.941-1.41)	1.53 (1.22-1.95)	1.87 (1.45-2.42)	2.24 (1.70-2.98)	2.66 (1.96-3.64)	3.30 (2.34-4.72)	3.86 (2.64-5.71)
6-hr	0.572 (0.477-0.694)	0.837 (0.696-1.02)	1.22 (1.02-1.49)	1.57 (1.29-1.93)	2.10 (1.67-2.67)	2.55 (1.99-3.32)	3.06 (2.32-4.07)	3.63 (2.68-4.96)	4.48 (3.17-6.40)	5.22 (3.57-7.73)
12-hr	0.680 (0.566-0.825)	1.02 (0.847-1.24)	1.52 (1.26-1.85)	1.97 (1.62-2.42)	2.66 (2.11-3.38)	3.25 (2.53-4.22)	3.92 (2.97-5.21)	4.68 (3.45-6.40)	5.83 (4.12-8.33)	6.84 (4.67-10.1)
24-hr	0.791 (0.700-0.912)	1.22 (1.08-1.41)	1.85 (1.63-2.14)	2.43 (2.13-2.83)	3.32 (2.81-3.99)	4.08 (3.39-5.02)	4.95 (4.01-6.23)	5.94 (4.69-7.68)	7.45 (5.65-10.0)	8.78 (6.44-12.2)
2-day	0.862 (0.764-0.994)	1.36 (1.20-1.56)	2.08 (1.83-2.41)	2.73 (2.39-3.18)	3.72 (3.15-4.48)	4.56 (3.79-5.61)	5.51 (4.46-6.93)	6.57 (5.19-8.50)	8.18 (6.20-11.0)	9.58 (7.02-13.3)
3-day	0.896 (0.793-1.03)	1.42 (1.26-1.64)	2.19 (1.93-2.53)	2.87 (2.51-3.35)	3.90 (3.31-4.70)	4.78 (3.97-5.88)	5.75 (4.66-7.24)	6.84 (5.40-8.85)	8.48 (6.43-11.4)	9.89 (7.25-13.8)
4-day	0.922 (0.816-1.06)	1.47 (1.30-1.70)	2.27 (2.00-2.62)	2.98 (2.61-3.48)	4.04 (3.43-4.87)	4.95 (4.11-6.08)	5.95 (4.82-7.48)	7.06 (5.58-9.13)	8.74 (6.62-11.8)	10.2 (7.46-14.1)
7-day	0.982 (0.869-1.13)	1.58 (1.40-1.83)	2.45 (2.16-2.84)	3.22 (2.82-3.76)	4.37 (3.71-5.27)	5.34 (4.44-6.57)	6.42 (5.20-8.07)	7.61 (6.00-9.84)	9.38 (7.11-12.6)	10.9 (7.99-15.2)
10-day	1.04 (0.917-1.19)	1.68 (1.48-1.94)	2.60 (2.29-3.01)	3.42 (2.99-3.98)	4.63 (3.93-5.58)	5.66 (4.70-6.96)	6.79 (5.51-8.54)	8.05 (6.35-10.4)	9.92 (7.52-13.3)	11.5 (8.44-16.0)
20-day	1.14 (1.01-1.31)	1.84 (1.63-2.12)	2.85 (2.51-3.29)	3.74 (3.27-4.36)	5.07 (4.30-6.11)	6.20 (5.14-7.61)	7.43 (6.02-9.35)	8.81 (6.95-11.4)	10.8 (8.23-14.6)	12.6 (9.23-17.5)
30-day	1.28 (1.13-1.48)	2.06 (1.82-2.38)	3.18 (2.80-3.68)	4.17 (3.65-4.87)	5.66 (4.79-6.81)	6.91 (5.74-8.49)	8.29 (6.72-10.4)	9.83 (7.76-12.7)	12.1 (9.19-16.3)	14.1 (10.3-19.6)
45-day	1.40 (1.24-1.62)	2.24 (1.98-2.59)	3.46 (3.05-4.00)	4.53 (3.97-5.29)	6.15 (5.21-7.41)	7.52 (6.24-9.24)	9.03 (7.32-11.4)	10.7 (8.46-13.9)	13.2 (10.0-17.8)	15.4 (11.3-21.4)
60-day	1.55 (1.37-1.79)	2.46 (2.17-2.83)	3.76 (3.32-4.35)	4.93 (4.31-5.75)	6.68 (5.66-8.05)	8.17 (6.79-10.0)	9.82 (7.96-12.4)	11.7 (9.21-15.1)	14.4 (10.9-19.4)	16.8 (12.3-23.4)

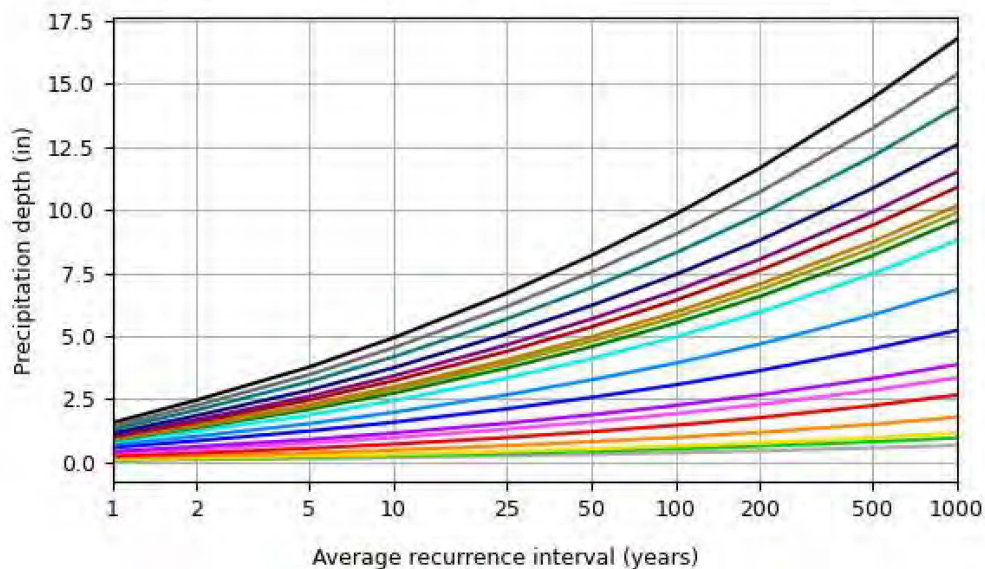
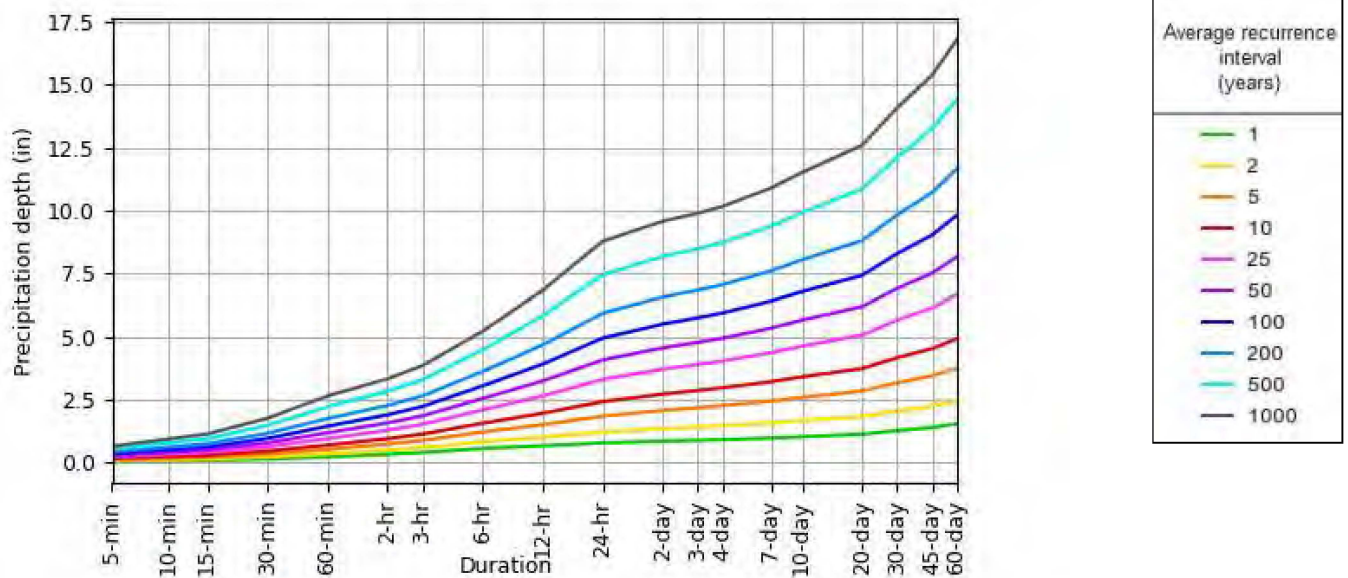
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and 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.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves

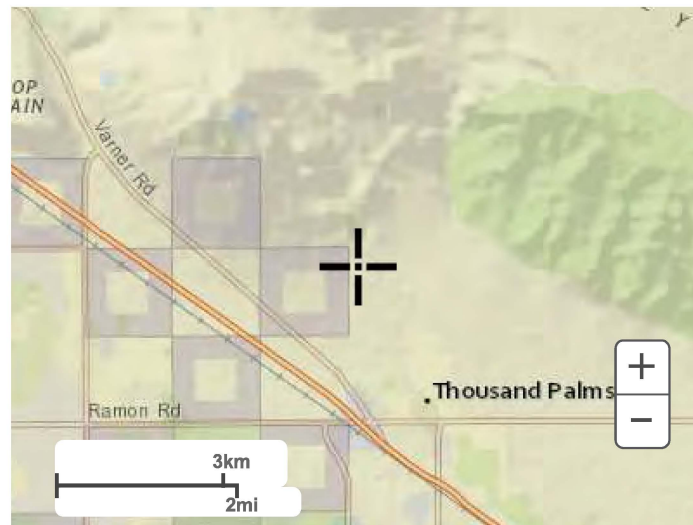
Latitude: 33.8417°, Longitude: -116.4038°



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Feb 2 13:52:56 2024

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**Large scale terrain****Large scale map****Large scale aerial**



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1325 East West Highway
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Questions?: HDSC.Questions@noaa.gov

[Disclaimer](#)

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

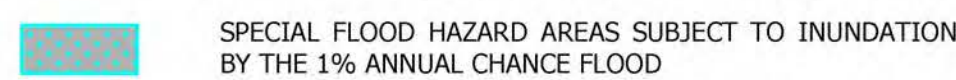
To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

This map may reflect more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at <http://msc.fema.gov>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov>.



ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 3 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decommissioned. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

 OTHERWISE PROTECTED AREAS (OPAs)

CBRs areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.


 1% annual chance floodplain boundary
 0.2% annual chance floodplain boundary
 Floodway boundary
 Zone D boundary
 CBRs and OPA boundary
 Boundary dividing Special Flood Hazard Area Zones and floodway dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
 513
 Base Flood Elevation line and value; elevation in feet*
 (EL 987)
 Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

87°07'45", 32°22'30"

27°6'00"N	1000-meter Universal Transverse Mercator grid values, zone 11N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPSZONE 0406), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

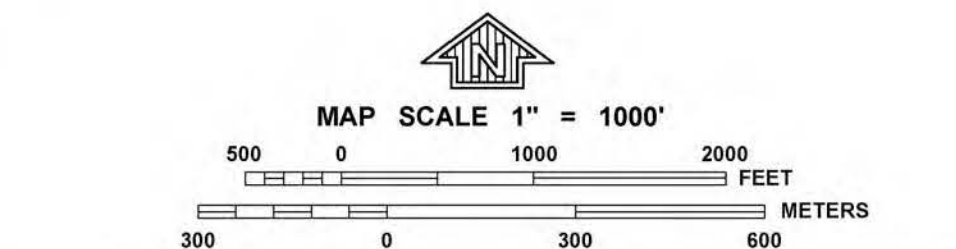
MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 28, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



**RIVERSIDE COUNTY,
CALIFORNIA
AND INCORPORATED AREAS**

PANEL 1585 OF 3805
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

<u>COMMUNITY</u>	<u>NUMBER</u>	<u>PANEL</u>	<u>SUFFIX</u>
AGUA CALIENTE BAND OF CAHUILLA INDIAN RESERVATION	060763	1585	G
CATHEDRAL CITY, CITY OF	060704	1585	G
RIVERSIDE COUNTY	060245	1585	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



MAP NUMBER
06065C1585G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

CountyRiverside (33.84173, -116.40382) X 16 ft

Floodplain Layer	100-YR	200-YR	500-YR	Last Updated
FEMA Effective	AO	N/A	Y	View Data
DWR Awareness	N	N/A	N/A	Sept 27, 2012
Regional/Special Studies	N	N/A	N	Jan 07, 2008
USACE Comp. Study	N	N	N	Dec 20, 2002

[View Data Layer Definitions](#)

Y: The location is within the floodplain

N: The location is not within the floodplain

N/A: Data not available

✓ = Active Layer(s)

[Zoom to](#)

Palm Springs

Thousand Palms

INDIO HILLS

Coachella
Vly Natl
Wildlife