

PRELIMINARY DRAINAGE REPORT

For

Cypress at Slover Industrial

APN: 0251-164-03, 04, 10, 11, 12, 14, 15, 16, 20, 23, & 25.
0251-163-01, 02, 03, 04, 05, 06, 07, 08, 09, 10 & 13.

PROJECT LOCATION

Northwest corner of Cypress Avenue and Slover Avenue
City of Fontana, CA

PREPARED FOR

Duke Realty
300 Spectrum Center Drive, Suite 1600
Irvine, CA 92618
949-797-7038

PREPARED BY

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PREPARATION DATE

September 13, 2021

HZ PROJECT NUMBER

R310156.01

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Ryan Peng, P.E.
C52921, Exp 06/31/2023

PREPARATION DATE

September 13, 2021

HZ PROJECT NUMBER

R310656.01

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Introduction

The project is a new development of an industrial warehouse facility located on the northwest corner of Cypress Avenue and Slover Avenue in the City of Fontana, California. The site will contain driveways, car and trailer parking, and vegetation throughout the proposed landscape areas. The proposed building is approximately 623,460 square feet in size on approximately 28.8 acres land.

Purpose

The purpose of this report is to present the drainage concept for the project and to determine the design flow rates and estimate storm drain sizes that will be needed for the proposed development. The drainage maps (Appendix A) and calculations (Appendix B) reflect the tributary areas and 100-year storm event runoff flows (Q_{100}).

Existing Condition

The project site is comprised of twenty-two (22) accessor parcels, which are occupied by single-family homes, vacant lands, and tractor-trailer parking/ storage lots. The site is bounded to the north by Southern Pacific Railroad, to the east by Cypress Avenue, to the south by Slover Avenue, and to the west by Oleander Avenue. Boyle Avenue bisects the site in the east-west direction and will be terminated by this project. The site slopes from north to south having eighteen (18) feet of fall (± 1099 to ± 1081 mean sea level). Runoff from the project site and offsite run-on from the railroad on the north of the site currently sheet flows onto Slover and Boyle Avenues, continue southerly, and collects by Oleander Avenue storm drain system, and ultimately discharges through Declez Channel, San Sevaine Channel, and Prado Basin.

Proposed Condition

For the proposed condition, all onsite runoff and offsite run-on will be directed to an on-site underground infiltration/ detention system under the south parking lots of the project site. The basin is designed to mitigate the peak flow increase to the downstream facilities from the proposed project. Once the storm water reaches to the basin outlets at elevation 1079.45, the water will overflow through two 5' wide parkway drains and discharge onto the Slover Avenue. See Appendix A for the proposed onsite hydrology map.

Hydrologic Analysis

A hydrologic analysis was prepared using the methodology outlined in the San Bernardino County Flood Control District (SBCFCD) Hydrology Manual. A rational method analysis was completed for the existing and proposed 100-year return event using Civild software, version 7.1. Unit Hydrograph and Basin Routing analyses were also completed using Civild software.

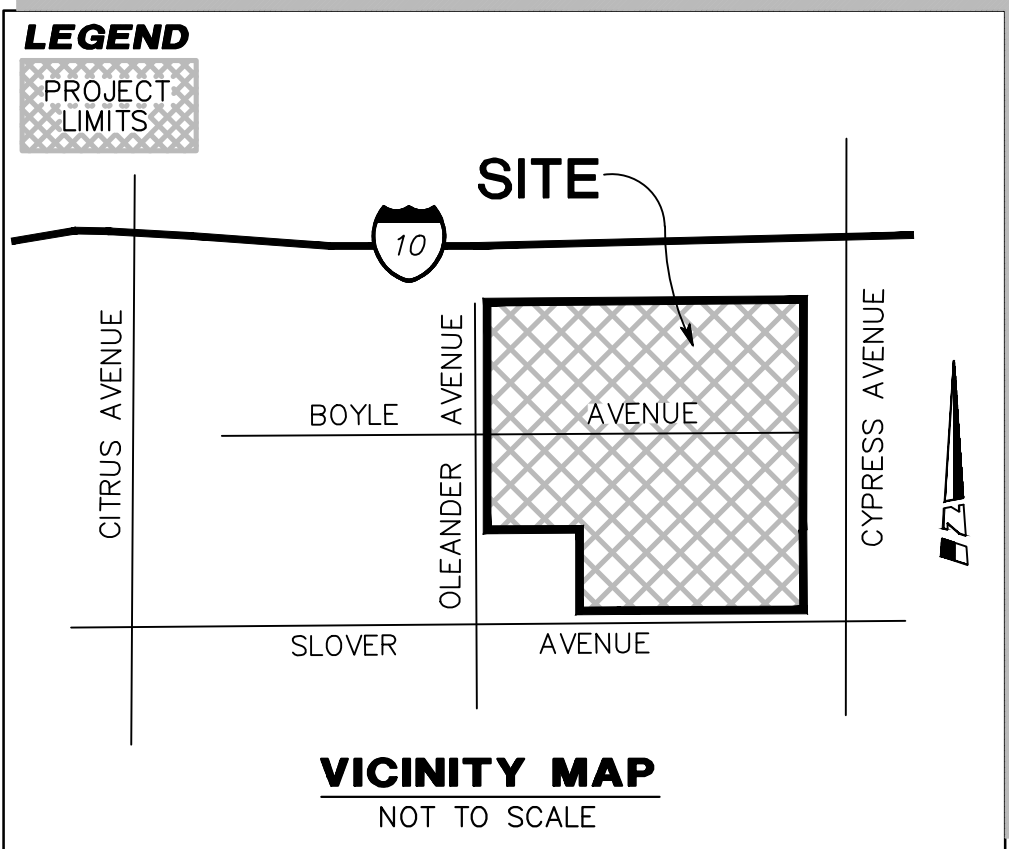
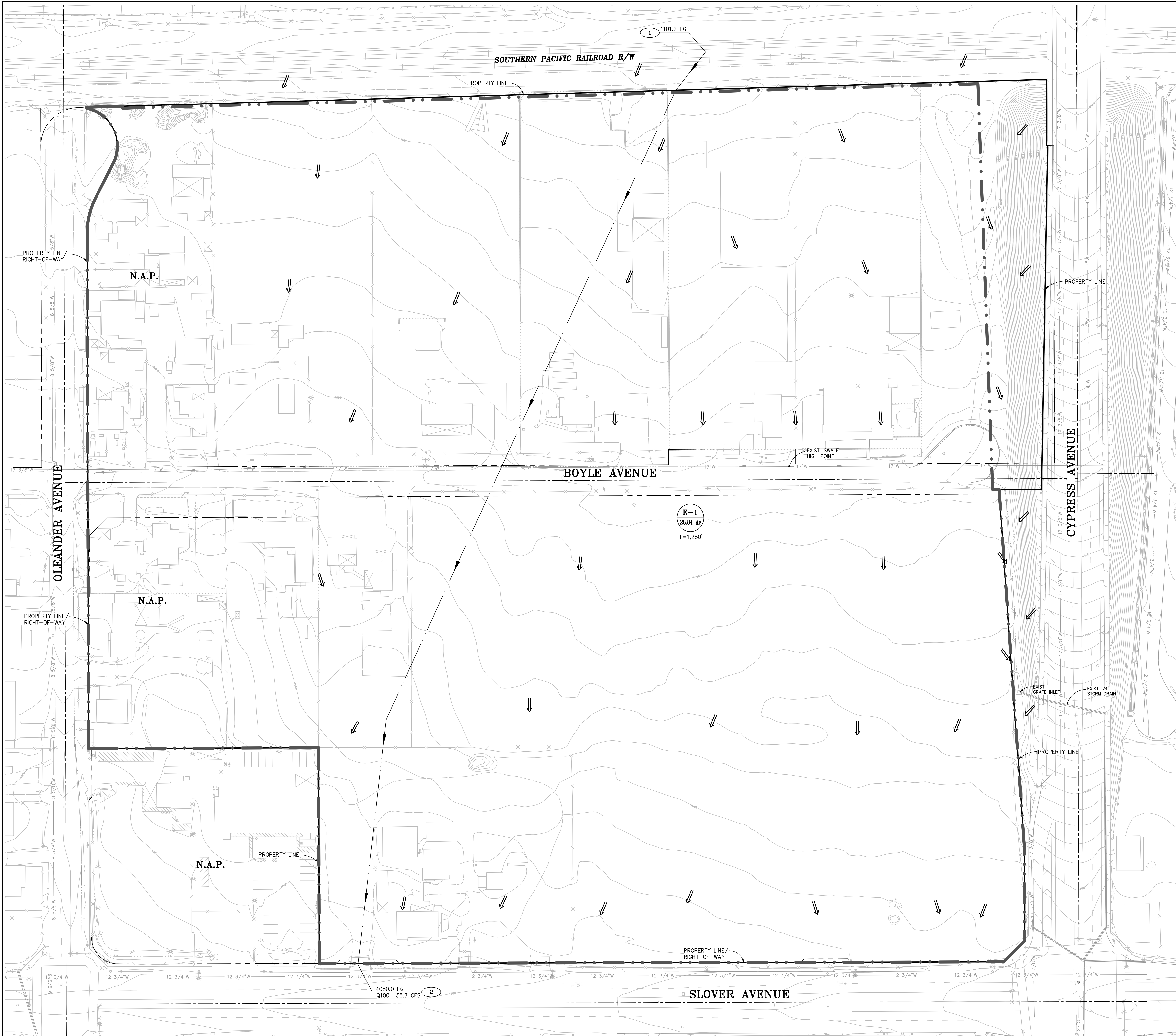
The 100-year, 1-hour rainfall rate was taken from the isohyetal maps in the County of San Bernardino Hydrology Manual. The hydrologic soils type for the site is "A" and was taken from the soil map in the Hydrology Manual. A "commercial" land use was used with an AMC of 3. See Appendix D for Soil Group and Isohyetal Maps.

Discussion

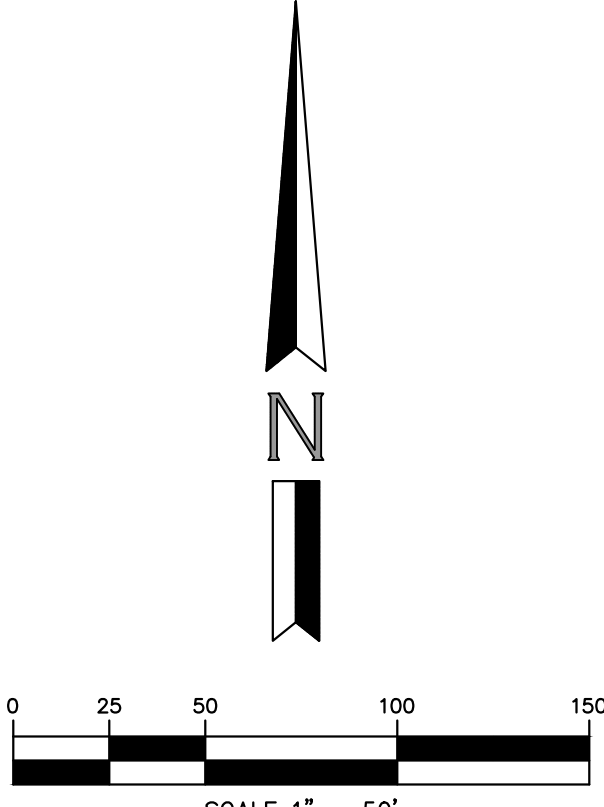
According to the hydrologic analysis and basin routing studies for existing and proposed conditions, the results indicate the proposed Q_{100} will be mitigated in the underground infiltration / detention system and the resulting discharge 12.5 cfs is less than the existing Q_{100} 60.8 cfs. The basin routing analysis is included in Appendix C. All proposed drainage and storm drain facilities will be sized adequately for Q_{100} and additional calculations will be provided in final drainage report including storm drain hydraulics and catch basins sizing.

Appendix A

Preliminary Drainage Maps



- LEGEND**
- NO. HYDROLOGY MODEL NODE NUMBER
 - A-11 7.40 Ac TRIBUTARY AREA IN ACRES
 - 673' LENGTH OF FLOW
 - DRAINAGE BOUNDARY
 - FLOW LINE
 - == FLOW DIRECTION



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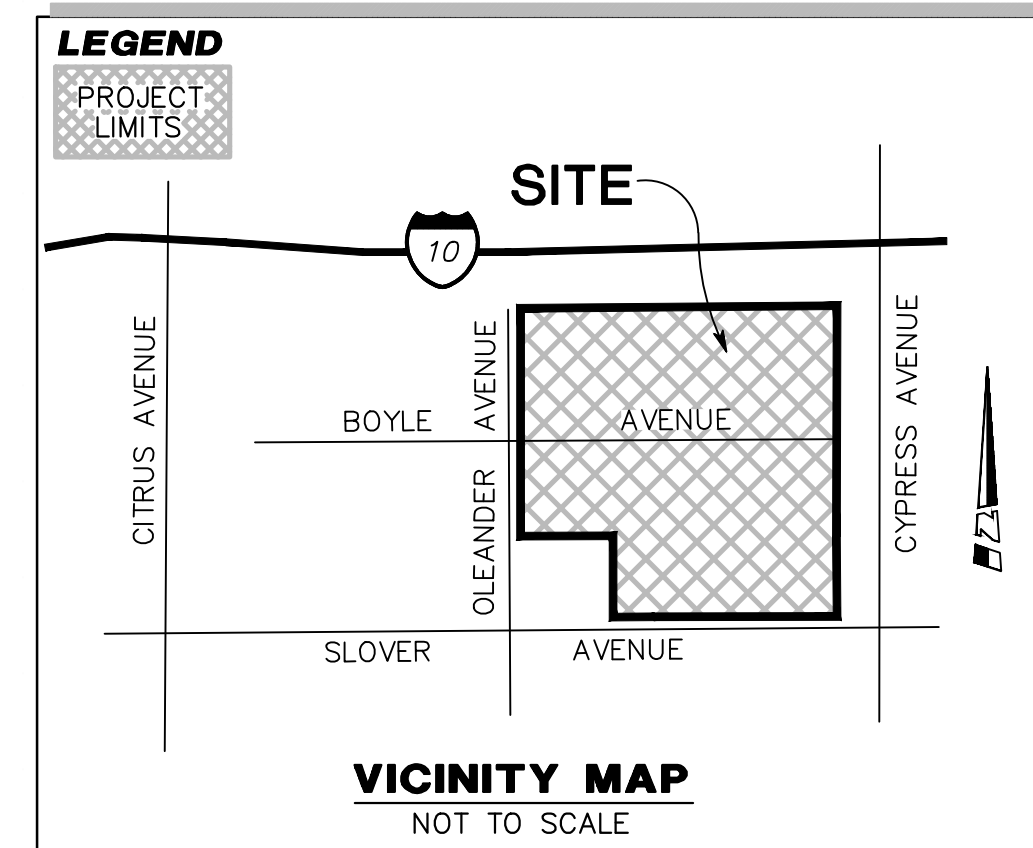
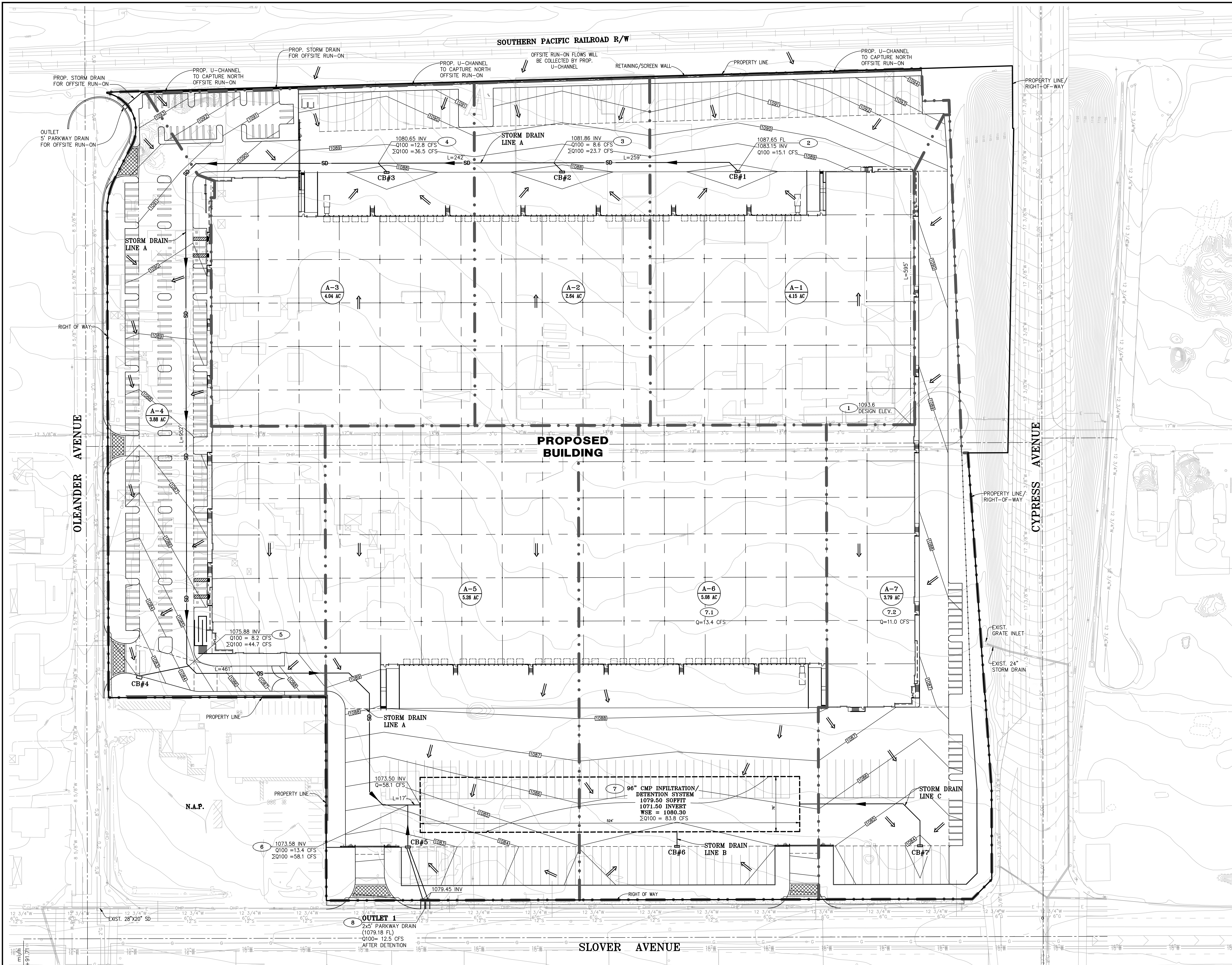
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HYDROLOGY MAP - EXISTING CONDITION
FOR
DUKE - CYPRESS AT SLOVER INDUSTRIAL
NORTHWEST CORNER OF CYPRESS AND SLOVER AVE
CITY OF FONTANA

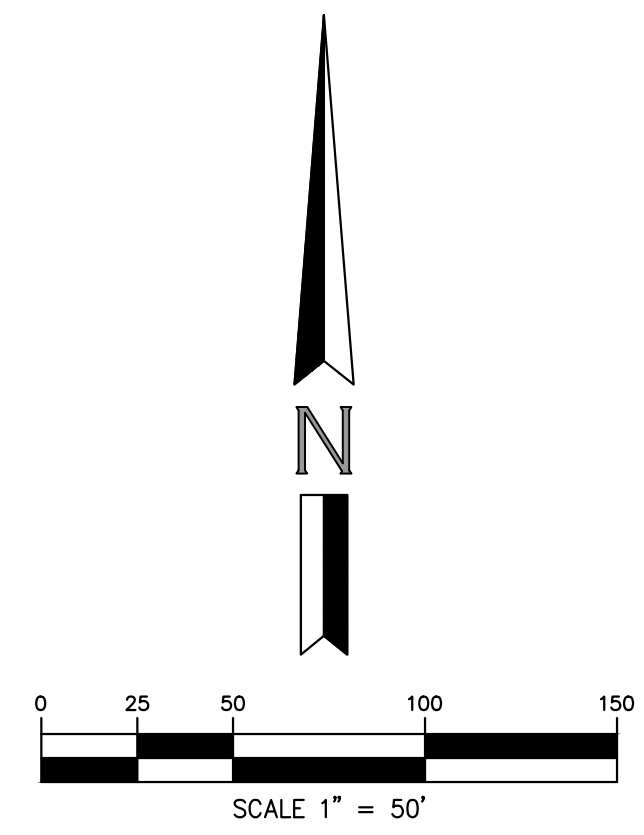
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DRAWN BY R.P.	OF 1
CHECKED BY D.W.	SHEETS
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- LEGEND**
- NO. — HYDROLOGY MODEL NODE NUMBER
 - A-11
7.40 AC — TRIBUTARY AREA IN ACRES
 - 673' — LENGTH OF FLOW
 - DRAINAGE BOUNDARY
 - FLOW LINE
 - FLOW DIRECTION
 - DRAINAGE INLET/CATCH BASIN (CB)
 - SD — PROPOSED STORM DRAIN



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HYDROLOGY MAP - PROPOSED CONDITION
FOR
DUKE - CYPRESS AT SLOVER INDUSTRIAL
NORTHWEST CORNER OF CYPRESS AND SLOVER AVE
CITY OF FONTANA

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Hydrology Map - Proposed Condition - Duke - Cypress at Slover Industrial Designated Real Property, Layout 01, Sep 07 2021 9:20am

Appendix B

100-year Rational Method Hydrologic Analysis

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 08/31/21

DUKE - CYPRESS AT SLOVER INDUSTRIAL
100-YEAR STORM EVENT - EXISTING CONDITION
0156Q100E
RP

Program License Serial Number 6145

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.390 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 67.00
Adjusted SCS curve number for AMC 3 = 84.60
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.290(In/Hr)
Initial subarea data:
Initial area flow distance = 1280.000(Ft.)
Top (of initial area) elevation = 1101.200(Ft.)
Bottom (of initial area) elevation = 1080.000(Ft.)
Difference in elevation = 21.200(Ft.)
Slope = 0.01656 s(%)= 1.66
 $TC = k(0.525)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 20.855 min.
Rainfall intensity = 2.620(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.800
Subarea runoff = 60.489(CFS)
Total initial stream area = 28.840(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.290(In/Hr)
End of computations, Total Study Area = 28.84 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 67.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 08/31/21

DUKE - CYPRESS AT SLOVER INDUSTRIAL
100-YEAR STORM EVENT - PROPOSED CONDITION
0156Q100P
RP

Program License Serial Number 6145

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.390 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Initial subarea data:
Initial area flow distance = 595.000(Ft.)
Top (of initial area) elevation = 1093.600(Ft.)
Bottom (of initial area) elevation = 1087.650(Ft.)
Difference in elevation = 5.950(Ft.)
Slope = 0.01000 s(%)= 1.00
 $TC = k(0.304)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 9.833 min.
Rainfall intensity = 4.114(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff = 15.074(CFS)
Total initial stream area = 4.150(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.079(In/Hr)

+++++
Process from Point/Station 2.000 to Point/Station 3.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1083.150(Ft.)
Downstream point/station elevation = 1081.860(Ft.)
Pipe length = 259.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 15.074(CFS)

Nearest computed pipe diameter = 24.00(In.)
Calculated individual pipe flow = 15.074(CFS)
Normal flow depth in pipe = 17.34(In.)
Flow top width inside pipe = 21.49(In.)
Critical Depth = 16.78(In.)
Pipe flow velocity = 6.20(Ft/s)
Travel time through pipe = 0.70 min.
Time of concentration (TC) = 10.53 min.

+++++
Process from Point/Station 3.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Time of concentration = 10.53 min.
Rainfall intensity = 3.949(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.882
Subarea runoff = 8.579(CFS) for 2.640(Ac.)
Total runoff = 23.652(CFS)
Effective area this stream = 6.79(Ac.)
Total Study Area (Main Stream No. 1) = 6.79(Ac.)
Area averaged Fm value = 0.079(In/Hr)

+++++
Process from Point/Station 3.000 to Point/Station 4.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1081.860(Ft.)
Downstream point/station elevation = 1080.650(Ft.)
Pipe length = 242.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 23.652(CFS)
Nearest computed pipe diameter = 27.00(In.)
Calculated individual pipe flow = 23.652(CFS)
Normal flow depth in pipe = 22.08(In.)
Flow top width inside pipe = 20.85(In.)
Critical Depth = 20.42(In.)
Pipe flow velocity = 6.80(Ft/s)
Travel time through pipe = 0.59 min.
Time of concentration (TC) = 11.12 min.

+++++
Process from Point/Station 4.000 to Point/Station 4.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)

Time of concentration = 11.12 min.
Rainfall intensity = 3.821(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.882
Subarea runoff = 12.828(CFS) for 4.040(Ac.)
Total runoff = 36.480(CFS)
Effective area this stream = 10.83(Ac.)
Total Study Area (Main Stream No. 1) = 10.83(Ac.)
Area averaged Fm value = 0.079(In/Hr)

+++++
Process from Point/Station 4.000 to Point/Station 5.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1080.650(Ft.)
Downstream point/station elevation = 1075.880(Ft.)
Pipe length = 952.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 36.480(CFS)
Nearest computed pipe diameter = 33.00(In.)
Calculated individual pipe flow = 36.480(CFS)
Normal flow depth in pipe = 24.47(In.)
Flow top width inside pipe = 28.90(In.)
Critical Depth = 24.13(In.)
Pipe flow velocity = 7.73(Ft/s)
Travel time through pipe = 2.05 min.
Time of concentration (TC) = 13.18 min.

+++++
Process from Point/Station 5.000 to Point/Station 5.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Time of concentration = 13.18 min.
Rainfall intensity = 3.452(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.880
Subarea runoff = 8.179(CFS) for 3.880(Ac.)
Total runoff = 44.660(CFS)
Effective area this stream = 14.71(Ac.)
Total Study Area (Main Stream No. 1) = 14.71(Ac.)
Area averaged Fm value = 0.079(In/Hr)

+++++
Process from Point/Station 5.000 to Point/Station 6.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1075.880(Ft.)
Downstream point/station elevation = 1073.580(Ft.)
Pipe length = 461.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 44.660(CFS)
Nearest computed pipe diameter = 36.00(In.)
Calculated individual pipe flow = 44.660(CFS)
Normal flow depth in pipe = 26.11(In.)

Flow top width inside pipe = 32.14(In.)
Critical Depth = 26.13(In.)
Pipe flow velocity = 8.14(Ft/s)
Travel time through pipe = 0.94 min.
Time of concentration (TC) = 14.12 min.

+++++
Process from Point/Station 6.000 to Point/Station 6.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Time of concentration = 14.12 min.
Rainfall intensity = 3.312(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.879
Subarea runoff = 13.447(CFS) for 5.260 (Ac.)
Total runoff = 58.107(CFS)
Effective area this stream = 19.97 (Ac.)
Total Study Area (Main Stream No. 1) = 19.97 (Ac.)
Area averaged Fm value = 0.079 (In/Hr)

+++++
Process from Point/Station 6.000 to Point/Station 7.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1073.580 (Ft.)
Downstream point/station elevation = 1073.500 (Ft.)
Pipe length = 17.00 (Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 58.107 (CFS)
Nearest computed pipe diameter = 39.00 (In.)
Calculated individual pipe flow = 58.107 (CFS)
Normal flow depth in pipe = 30.28 (In.)
Flow top width inside pipe = 32.50 (In.)
Critical Depth = 29.22 (In.)
Pipe flow velocity = 8.42 (Ft/s)
Travel time through pipe = 0.03 min.
Time of concentration (TC) = 14.15 min.

+++++
Process from Point/Station 7.100 to Point/Station 7.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079 (In/Hr)
Time of concentration = 14.15 min.
Rainfall intensity = 3.307 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified

rational method) (Q=KCIA) is C = 0.879
Subarea runoff = 14.675(CFS) for 5.080(Ac.)
Total runoff = 72.781(CFS)
Effective area this stream = 25.05(Ac.)
Total Study Area (Main Stream No. 1) = 25.05(Ac.)
Area averaged Fm value = 0.079(In/Hr)

+++++
Process from Point/Station 7.200 to Point/Station 7.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.079(In/Hr)
Time of concentration = 14.15 min.
Rainfall intensity = 3.307(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.879
Subarea runoff = 11.012(CFS) for 3.790(Ac.)
Total runoff = 83.793(CFS)
Effective area this stream = 28.84(Ac.)
Total Study Area (Main Stream No. 1) = 28.84(Ac.)
Area averaged Fm value = 0.079(In/Hr)
End of computations, Total Study Area = 28.84 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 32.0

Appendix C
Infiltration/ Detention System Basin Routing Studies

DUKE - CYPRESS AT SLOVER INDUSTRIAL

Stage Storage Table

#	Depth	Elevation	Area (sf)	Incremental volume (cf)	Total Volume (cf)	Total Volume (acre-ft)	Outflow Q (CFS)	Notes
1	0.0	1071.00	36,632	0	0	0		Bottom of Infiltration System
2	0.5	1071.50	36,632	7,965	7,965	0.183	5.55	Invert of CMP
3	1.0	1072.00	36,632	10,861	18,826	0.432	5.55	
4	2.0	1073.00	36,632	27,478	46,304	1.063	5.55	
5	3.0	1074.00	36,632	31,197	77,501	1.779	5.55	
6	4.0	1075.00	36,632	33,028	110,529	2.537	5.55	
7	5.0	1076.00	36,632	33,596	144,125	3.309	5.55	Reachs WQMP DCV
8	6.0	1077.00	36,632	33,028	177,153	4.067	5.55	
9	7.0	1078.00	36,632	31,197	208,350	4.783	5.55	
10	8.0	1079.00	36,632	27,479	235,829	5.414	5.55	
11	8.45	1079.45	36,632	10,743	246,572	5.661	5.55	Release Water @ 2x5' Parkway Drain's Upstream @ ELEV. 1079.45
12	8.5	1079.50	36,632	117	246,689	5.663	5.61	Soffit of CMP
13	9.0	1080.00	36,632	7,965	254,654	5.846	15.34	Top of Infiltration System
14	10.0	1081.00	36,632	0	254,654	5.846	24.22	
96" CMP system with 6" rock top & bottom & 24" rock around perimeter								

Average Infiltration rate per geotechnical report = 18"/hr, Factor of Safety =3.

Unit convert = (18"/hr)/3 x (1'/12") X (1hr/60min) X (1 min/60 sec) = 0.00014 ft/sec

Underground Basin open area is 76' x 524' = 39,824 sf

Therefore, Q out for basin = 39,824 * 0.00014 = 5.55 cfs

*WQMP Design Capture Volume is 121,993 CF

Q OutFlow = 2 - 5' Parkway Drain + Basin Infiltration Q

= 2 x (CA x (2gh)^(1/2)) + Basin Infiltration Q

= 2 x (0.6A x (64.4xh)^(1/2)) + Basin Infiltration Q

A = 5'x4" Parkway Culvert Opening

h = Water Height Above half of opening (2")

Example: WSE @ 1080.00

=2 x {0.6 x (5 x 0.33) x [64.4 x (1080.0-1079.62)]^(1/2)}+5.55

= 15.34 CFS

Basin Routing Summary Table

100 YEAR STORM	24 Hour
Max. Q Out (CFS)	18.1
WSE	1080.30

Basin Infiltration Q = 5.6 CFS, Q_{OUT} to Slover Ave. = 18.0 - 5.6 = 12.5 CFS

Peak discharge is 12.5 CFS, which is less than allowable discharge 60.8 CFS (per Unit Hydrograph)



Date: 09/01/2021
Project Name: 96 CMP Detention

City / County: San Bernardino
State: CA

Designed By: Ryan Peng
Company: Huitt-Zollars, Inc
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular application and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	522.0	Backfill Porosity (%):	40%	System Diameter (in):	96
Out-to-out width (ft):	74.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	2.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	6
Number of Barrels (ea):	7.0	Width At Ends (ft):	1.0	System Invert (Elevation):	1071
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	1071.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	15,929.6
0.50	1071.50	0.0	0.0	7,964.8	7,964.8	7,964.8	7,964.8	0.0%	15,929.6
1.00	1072.00	4,826.7	4,826.7	6,034.1	13,998.9	10,860.8	18,825.6	25.6%	24,504.4
1.50	1072.50	8,555.1	13,381.8	4,542.8	18,541.7	13,097.8	31,923.5	41.9%	27,645.0
2.00	1073.00	10,693.2	24,075.0	3,687.5	22,229.2	14,380.7	46,304.2	52.0%	29,756.0
2.50	1073.50	12,186.5	36,261.5	3,090.2	25,319.4	15,276.7	61,580.9	58.9%	31,268.6
3.00	1074.00	13,259.2	49,520.7	2,661.1	27,980.5	15,920.3	77,501.2	63.9%	32,349.1
3.50	1074.50	14,009.6	63,530.3	2,361.0	30,341.5	16,370.5	93,871.8	67.7%	33,079.2
4.00	1075.00	14,488.1	78,018.3	2,169.6	32,511.1	16,657.6	110,529.4	70.6%	33,502.7
4.50	1075.50	14,721.5	92,739.8	2,076.2	34,587.3	16,797.7	127,327.1	72.8%	33,641.6
5.00	1076.00	14,721.5	107,461.3	2,076.2	36,663.5	16,797.7	144,124.8	74.6%	33,502.7
5.50	1076.50	14,488.1	121,949.4	2,169.6	38,833.1	16,657.6	160,782.4	75.8%	33,079.2
6.00	1077.00	14,009.6	135,958.9	2,361.0	41,194.0	16,370.5	177,153.0	76.7%	32,349.1
6.50	1077.50	13,259.2	149,218.2	2,661.1	43,855.1	15,920.3	193,073.3	77.3%	31,268.6
7.00	1078.00	12,186.5	161,404.6	3,090.2	46,945.3	15,276.7	208,350.0	77.5%	29,756.0
7.50	1078.50	10,693.2	172,097.9	3,687.5	50,632.9	14,380.7	222,730.7	77.3%	27,645.0
8.00	1079.00	8,555.1	180,652.9	4,542.8	55,175.6	13,097.8	235,828.6	76.6%	24,504.4
8.50	1079.50	4,826.7	185,479.6	6,034.1	61,209.7	10,860.8	246,689.4	75.2%	15,929.6
9.00	1080.00	0.0	185,479.6	7,964.8	69,174.5	7,964.8	254,654.2	72.8%	15,929.6

These results are submitted to you as a guideline only, without liability on the part of CONTECH Engineered Solutions, LLC for accuracy or suitability to any particular application, and are subject to your verification.

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

Study date 08/31/21

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6145

DUKE - CYPRESS AT SLOVER INDUSTRIAL
100-YEAR STORM EVENT - EXISTING CONDITION
0156UN100E
RP

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
28.84	1	1.39

Rainfall data for year 100
28.84 6 3.60

Rainfall data for year 100
28.84 24 8.30

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***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp (Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
67.0	84.6	28.84	1.000	0.290	1.000	0.290

Area-averaged adjusted loss rate Fm (In/Hr) = 0.290

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
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28.84 1.000 67.0 84.6 1.82 0.778

Area-averaged catchment yield fraction, Y = 0.778
Area-averaged low loss fraction, Yb = 0.222
User entry of time of concentration = 0.312 (hours)
++++
Watershed area = 28.84 (Ac.)
Catchment Lag time = 0.250 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 33.3868
Hydrograph baseflow = 0.00 (CFS)
Average maximum watershed loss rate (Fm) = 0.290 (In/Hr)
Average low loss rate fraction (Yb) = 0.222 (decimal)
VALLEY DEVELOPED S-Graph proportion = 0.200
VALLEY UNDEVELOPED S-Graph proportion = 0.800
FOOTHILL S-Graph proportion = 0.000
MOUNTAIN S-Graph proportion = 0.000
DESERT S-Graph proportion = 0.000

Computed peak 5-minute rainfall = 0.514 (In)
Computed peak 30-minute rainfall = 1.053 (In)
Specified peak 1-hour rainfall = 1.390 (In)
Computed peak 3-hour rainfall = 2.491 (In)
Specified peak 6-hour rainfall = 3.600 (In)
Specified peak 24-hour rainfall = 8.300 (In)

Rainfall depth area reduction factors:
Using a total area of 28.84 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.514 (In)
30-minute factor = 0.999	Adjusted rainfall = 1.052 (In)
1-hour factor = 0.999	Adjusted rainfall = 1.388 (In)
3-hour factor = 1.000	Adjusted rainfall = 2.491 (In)
6-hour factor = 1.000	Adjusted rainfall = 3.600 (In)
24-hour factor = 1.000	Adjusted rainfall = 8.300 (In)

U n i t H y d r o g r a p h
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Interval 'S' Graph Unit Hydrograph
Number Mean values ((CFS))

(K = 348.78 (CFS))

1	3.141	10.956
2	15.771	44.050
3	37.632	76.248
4	59.339	75.710
5	71.906	43.833
6	78.825	24.132
7	83.315	15.659
8	86.448	10.928
9	88.836	8.329
10	90.726	6.593
11	92.370	5.733
12	93.595	4.273
13	94.604	3.519
14	95.451	2.956
15	96.259	2.816
16	96.948	2.404
17	97.521	1.998
18	98.013	1.718

19	98.438	1.480
20	98.797	1.252
21	99.075	0.973
22	99.343	0.932
23	99.610	0.932
24	100.000	0.466

Total soil rain loss = 1.74(In)

Total effective rainfall = 6.56(In)

Peak flow rate in flood hydrograph = 60.84(CFS)

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24 - H O U R S T O R M

R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0

0+ 5	0.0010		0.15	Q				
0+10	0.0061		0.74	Q				
0+15	0.0184		1.78	VQ				
0+20	0.0377		2.80	VQ				
0+25	0.0611		3.40	VQ				
0+30	0.0868		3.73	V Q				
0+35	0.1140		3.95	V Q				
0+40	0.1423		4.11	V Q				
0+45	0.1714		4.23	V Q				
0+50	0.2012		4.33	V Q				
0+55	0.2316		4.41	V Q				
1+ 0	0.2625		4.48	V Q				
1+ 5	0.2938		4.54	V Q				
1+10	0.3254		4.59	V Q				
1+15	0.3573		4.64	V Q				
1+20	0.3895		4.68	V Q				
1+25	0.4220		4.72	VQ				
1+30	0.4547		4.75	VQ				
1+35	0.4877		4.78	VQ				
1+40	0.5208		4.81	VQ				
1+45	0.5541		4.83	VQ				
1+50	0.5875		4.86	VQ				
1+55	0.6211		4.88	VQ				
2+ 0	0.6549		4.90	VQ				
2+ 5	0.6887		4.91	VQ				
2+10	0.7226		4.92	VQ				
2+15	0.7565		4.93	VQ				
2+20	0.7906		4.94	Q				
2+25	0.8247		4.96	Q				
2+30	0.8589		4.97	Q				
2+35	0.8932		4.98	Q				
2+40	0.9276		4.99	Q				
2+45	0.9620		5.00	Q				
2+50	0.9966		5.01	Q				
2+55	1.0312		5.03	Q				
3+ 0	1.0659		5.04	Q				
3+ 5	1.1007		5.05	Q				
3+10	1.1356		5.06	Q				
3+15	1.1705		5.08	Q				
3+20	1.2056		5.09	QV				
3+25	1.2407		5.10	QV				

3+30	1.2760	5.12	QV				
3+35	1.3113	5.13	QV				
3+40	1.3467	5.14	QV				
3+45	1.3822	5.16	QV				
3+50	1.4178	5.17	QV				
3+55	1.4535	5.18	QV				
4+ 0	1.4893	5.20	QV				
4+ 5	1.5252	5.21	QV				
4+10	1.5612	5.23	QV				
4+15	1.5973	5.24	Q V				
4+20	1.6335	5.25	QV				
4+25	1.6698	5.27	QV				
4+30	1.7061	5.28	QV				
4+35	1.7426	5.30	QV				
4+40	1.7792	5.31	QV				
4+45	1.8159	5.33	QV				
4+50	1.8527	5.34	QV				
4+55	1.8896	5.36	QV				
5+ 0	1.9266	5.37	QV				
5+ 5	1.9637	5.39	QV				
5+10	2.0010	5.41	Q V				
5+15	2.0383	5.42	Q V				
5+20	2.0757	5.44	Q V				
5+25	2.1133	5.45	Q V				
5+30	2.1510	5.47	Q V				
5+35	2.1888	5.49	Q V				
5+40	2.2267	5.50	Q V				
5+45	2.2647	5.52	Q V				
5+50	2.3028	5.54	Q V				
5+55	2.3411	5.56	Q V				
6+ 0	2.3795	5.57	Q V				
6+ 5	2.4180	5.59	Q V				
6+10	2.4566	5.61	Q V				
6+15	2.4954	5.63	Q V				
6+20	2.5343	5.65	Q V				
6+25	2.5733	5.66	Q V				
6+30	2.6124	5.68	Q V				
6+35	2.6517	5.70	Q V				
6+40	2.6911	5.72	Q V				
6+45	2.7306	5.74	Q V				
6+50	2.7703	5.76	Q V				
6+55	2.8101	5.78	Q V				
7+ 0	2.8501	5.80	Q V				
7+ 5	2.8902	5.82	Q V				
7+10	2.9304	5.84	Q V				
7+15	2.9708	5.86	Q V				
7+20	3.0114	5.89	Q V				
7+25	3.0520	5.91	Q V				
7+30	3.0929	5.93	Q V				
7+35	3.1339	5.95	Q V				
7+40	3.1750	5.97	Q V				
7+45	3.2163	6.00	Q V				
7+50	3.2577	6.02	Q V				
7+55	3.2994	6.04	Q V				
8+ 0	3.3411	6.07	Q V				
8+ 5	3.3831	6.09	Q V				
8+10	3.4252	6.12	Q V				
8+15	3.4675	6.14	Q V				
8+20	3.5100	6.17	Q V				
8+25	3.5526	6.19	Q V				
8+30	3.5954	6.22	Q V				
8+35	3.6384	6.24	Q V				
8+40	3.6816	6.27	Q V				

8+45	3.7249	6.30	Q	V				
8+50	3.7685	6.32	Q	V				
8+55	3.8122	6.35	Q	V				
9+ 0	3.8562	6.38	Q	V				
9+ 5	3.9003	6.41	Q	V				
9+10	3.9447	6.44	Q	V				
9+15	3.9892	6.47	Q	V				
9+20	4.0340	6.50	Q	V				
9+25	4.0789	6.53	Q	V				
9+30	4.1241	6.56	Q	V				
9+35	4.1695	6.59	Q	V				
9+40	4.2151	6.62	Q	V				
9+45	4.2610	6.66	Q	V				
9+50	4.3070	6.69	Q	V				
9+55	4.3533	6.72	Q	V				
10+ 0	4.3999	6.76	Q	V				
10+ 5	4.4467	6.79	Q	V				
10+10	4.4937	6.83	Q	V				
10+15	4.5410	6.87	Q	V				
10+20	4.5886	6.90	Q	V				
10+25	4.6364	6.94	Q	V				
10+30	4.6845	6.98	Q	V				
10+35	4.7328	7.02	Q	V				
10+40	4.7814	7.06	Q	V				
10+45	4.8304	7.10	Q	V				
10+50	4.8796	7.14	Q	V				
10+55	4.9291	7.19	Q	V				
11+ 0	4.9789	7.23	Q	V				
11+ 5	5.0290	7.28	Q	V				
11+10	5.0794	7.32	Q	V				
11+15	5.1301	7.37	Q	V				
11+20	5.1812	7.42	Q	V				
11+25	5.2326	7.47	Q	V				
11+30	5.2844	7.52	Q	V				
11+35	5.3365	7.57	Q	V				
11+40	5.3890	7.62	Q	V				
11+45	5.4419	7.67	Q	V				
11+50	5.4951	7.73	Q	V				
11+55	5.5487	7.79	Q	V				
12+ 0	5.6028	7.85	Q	V				
12+ 5	5.6570	7.87	Q	V				
12+10	5.7108	7.81	Q	V				
12+15	5.7636	7.67	Q	V				
12+20	5.8154	7.52	Q	V				
12+25	5.8669	7.47	Q	V				
12+30	5.9183	7.47	Q	V				
12+35	5.9700	7.50	Q	V				
12+40	6.0220	7.55	Q	V				
12+45	6.0744	7.61	Q	V				
12+50	6.1273	7.67	Q	V				
12+55	6.1806	7.74	Q	V				
13+ 0	6.2344	7.82	Q	V				
13+ 5	6.2888	7.90	Q	V				
13+10	6.3437	7.98	Q	V				
13+15	6.3993	8.07	Q	V				
13+20	6.4556	8.17	Q	V				
13+25	6.5125	8.27	Q	V				
13+30	6.5702	8.38	Q	V				
13+35	6.6287	8.49	Q	V				
13+40	6.6879	8.61	Q	V				
13+45	6.7481	8.73	Q	V				
13+50	6.8091	8.86	Q	V				
13+55	6.8710	9.00	Q	V				

14+ 0	6.9340	9.14	Q		V			
14+ 5	6.9980	9.30	Q		V			
14+10	7.0632	9.46	Q		V			
14+15	7.1296	9.64	Q		V			
14+20	7.1973	9.83	Q		V			
14+25	7.2663	10.02	Q		V			
14+30	7.3368	10.23	Q		V			
14+35	7.4088	10.45	Q		V			
14+40	7.4824	10.69	Q		V			
14+45	7.5578	10.95	Q		V			
14+50	7.6351	11.23	Q		V			
14+55	7.7145	11.52	Q		V			
15+ 0	7.7961	11.85	Q		V			
15+ 5	7.8802	12.21	Q		V			
15+10	7.9671	12.61	Q		V			
15+15	8.0570	13.05	Q		V			
15+20	8.1503	13.55	Q		V			
15+25	8.2466	13.98	Q		V			
15+30	8.3437	14.11	Q		V			
15+35	8.4398	13.95	Q		V			
15+40	8.5359	13.95	Q		V			
15+45	8.6361	14.55	Q		V			
15+50	8.7443	15.71	Q		V			
15+55	8.8656	17.61	Q	Q	V			
16+ 0	9.0104	21.02		Q	V			
16+ 5	9.2190	30.30			V			
16+10	9.5465	47.54				V	Q	
16+15	9.9655	60.84				V		Q
16+20	10.3620	57.58				V		Q
16+25	10.6452	41.13				Q	V	
16+30	10.8534	30.23			Q		V	
16+35	11.0252	24.94		Q			V	
16+40	11.1755	21.83		Q			V	
16+45	11.3109	19.66		Q			V	
16+50	11.4344	17.92		Q			V	
16+55	11.5488	16.62		Q			V	
17+ 0	11.6535	15.21		Q			V	
17+ 5	11.7513	14.19		Q			V	
17+10	11.8432	13.35		Q			V	
17+15	11.9309	12.73		Q			V	
17+20	12.0140	12.06		Q			V	
17+25	12.0927	11.44		Q			V	
17+30	12.1678	10.91		Q			V	
17+35	12.2397	10.43		Q			V	
17+40	12.3084	9.98		Q			V	
17+45	12.3742	9.55		Q			V	
17+50	12.4378	9.23		Q			V	
17+55	12.4993	8.92		Q			V	
18+ 0	12.5575	8.45	Q				V	
18+ 5	12.6129	8.05	Q				V	
18+10	12.6677	7.96	Q				V	
18+15	12.7228	7.99	Q				V	
18+20	12.7781	8.03	Q				V	
18+25	12.8331	7.99	Q				V	
18+30	12.8876	7.91	Q				V	
18+35	12.9415	7.82	Q				V	
18+40	12.9947	7.72	Q				V	
18+45	13.0472	7.63	Q				V	
18+50	13.0991	7.53	Q				V	
18+55	13.1503	7.44	Q				V	
19+ 0	13.2010	7.35	Q				V	
19+ 5	13.2510	7.26	Q				V	
19+10	13.3004	7.18	Q				V	

19+15	13.3493	7.10	Q			V
19+20	13.3977	7.02	Q			V
19+25	13.4455	6.95	Q			V
19+30	13.4929	6.87	Q			V
19+35	13.5397	6.80	Q			V
19+40	13.5861	6.74	Q			V
19+45	13.6321	6.67	Q			V
19+50	13.6776	6.61	Q			V
19+55	13.7226	6.54	Q			V
20+ 0	13.7673	6.48	Q			V
20+ 5	13.8115	6.42	Q			V
20+10	13.8554	6.37	Q			V
20+15	13.8988	6.31	Q			V
20+20	13.9419	6.26	Q			V
20+25	13.9846	6.20	Q			V
20+30	14.0270	6.15	Q			V
20+35	14.0690	6.10	Q			V
20+40	14.1107	6.05	Q			V
20+45	14.1521	6.01	Q			V
20+50	14.1931	5.96	Q			V
20+55	14.2339	5.92	Q			V
21+ 0	14.2743	5.87	Q			V
21+ 5	14.3145	5.83	Q			V
21+10	14.3543	5.79	Q			V
21+15	14.3939	5.75	Q			V
21+20	14.4333	5.71	Q			V
21+25	14.4723	5.67	Q			V
21+30	14.5111	5.63	Q			V
21+35	14.5497	5.60	Q			V
21+40	14.5880	5.56	Q			V
21+45	14.6261	5.53	Q			V
21+50	14.6639	5.49	Q			V
21+55	14.7015	5.46	Q			V
22+ 0	14.7389	5.43	Q			V
22+ 5	14.7760	5.39	Q			V
22+10	14.8130	5.36	Q			V
22+15	14.8497	5.33	Q			V
22+20	14.8862	5.30	Q			V
22+25	14.9225	5.27	Q			V
22+30	14.9586	5.24	Q			V
22+35	14.9945	5.22	Q			V
22+40	15.0303	5.19	Q			V
22+45	15.0658	5.16	Q			V
22+50	15.1012	5.13	Q			V
22+55	15.1363	5.11	Q			V
23+ 0	15.1713	5.08	Q			V
23+ 5	15.2062	5.06	Q			V
23+10	15.2408	5.03	Q			V
23+15	15.2753	5.01	Q			V
23+20	15.3096	4.98	Q			V
23+25	15.3437	4.96	Q			V
23+30	15.3777	4.94	Q			V
23+35	15.4116	4.91	Q			V
23+40	15.4452	4.89	Q			V
23+45	15.4788	4.87	Q			V
23+50	15.5121	4.85	Q			V
23+55	15.5453	4.82	Q			V
24+ 0	15.5784	4.80	Q			V
24+ 5	15.6103	4.63	Q			V
24+10	15.6380	4.02	Q			V
24+15	15.6585	2.97	Q			V
24+20	15.6718	1.94	Q			V
24+25	15.6811	1.34	Q			V

24+30	15.6880	1.01	Q				V
24+35	15.6935	0.79	Q				V
24+40	15.6979	0.64	Q				V
24+45	15.7015	0.53	Q				V
24+50	15.7045	0.43	Q				V
24+55	15.7069	0.35	Q				V
25+ 0	15.7089	0.30	Q				V
25+ 5	15.7106	0.25	Q				V
25+10	15.7121	0.21	Q				V
25+15	15.7132	0.17	Q				V
25+20	15.7141	0.13	Q				V
25+25	15.7149	0.11	Q				V
25+30	15.7154	0.08	Q				V
25+35	15.7159	0.06	Q				V
25+40	15.7162	0.04	Q				V
25+45	15.7164	0.03	Q				V
25+50	15.7165	0.02	Q				V
25+55	15.7166	0.01	Q				V

Unit Hydrograph Analysis

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Study date 08/31/21

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6145

DUKE - CYPRESS AT SLOVER INDUSTRIAL
100-YEAR STORM EVENT - PROPOSED CONDITION
0156UH100P
RP

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
28.84	1	1.39

Rainfall data for year 100
28.84 6 3.60

Rainfall data for year 100
28.84 24 8.30

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No. (AMCII)	SCS curve NO. (AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	28.84	1.000	0.785	0.100	0.079

Area-averaged adjusted loss rate Fm (In/Hr) = 0.079

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
---------------	---------------	------------------	------------------	---	----------------------

2.88	0.100	32.0	52.0	9.23	0.320
25.96	0.900	98.0	98.0	0.20	0.971

Area-averaged catchment yield fraction, $Y = 0.906$
 Area-averaged low loss fraction, $Y_b = 0.094$
 User entry of time of concentration = 0.255 (hours)
 ++++++
 Watershed area = 28.84 (Ac.)
 Catchment Lag time = 0.204 hours
 Unit interval = 5.000 minutes
 Unit interval percentage of lag time = 40.8497
 Hydrograph baseflow = 0.00 (CFS)
 Average maximum watershed loss rate (F_m) = 0.079 (In/Hr)
 Average low loss rate fraction (Y_b) = 0.094 (decimal)
 VALLEY DEVELOPED S-Graph Selected
 Computed peak 5-minute rainfall = 0.514 (In)
 Computed peak 30-minute rainfall = 1.053 (In)
 Specified peak 1-hour rainfall = 1.390 (In)
 Computed peak 3-hour rainfall = 2.491 (In)
 Specified peak 6-hour rainfall = 3.600 (In)
 Specified peak 24-hour rainfall = 8.300 (In)

Rainfall depth area reduction factors:
 Using a total area of 28.84 (Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.514 (In)
30-minute factor = 0.999	Adjusted rainfall = 1.052 (In)
1-hour factor = 0.999	Adjusted rainfall = 1.388 (In)
3-hour factor = 1.000	Adjusted rainfall = 2.491 (In)
6-hour factor = 1.000	Adjusted rainfall = 3.600 (In)
24-hour factor = 1.000	Adjusted rainfall = 8.300 (In)

U n i t H y d r o g r a p h

+++++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 348.78 (CFS))		
1	3.149	10.984
2	20.376	60.085
3	51.474	108.464
4	79.346	97.212
5	91.904	43.800
6	97.070	18.021
7	98.579	5.264
8	99.315	2.564
9	100.000	2.390

Total soil rain loss = 0.72 (In)
 Total effective rainfall = 7.58 (In)
 Peak flow rate in flood hydrograph = 83.40 (CFS)

++++++
 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0012		0.17	Q				
0+10	0.0089		1.12	Q				
0+15	0.0284		2.83	VQ				
0+20	0.0584		4.36	VQ				
0+25	0.0933		5.06	V Q				
0+30	0.1302		5.36	V Q				
0+35	0.1677		5.45	V Q				
0+40	0.2056		5.50	V Q				
0+45	0.2439		5.55	V Q				
0+50	0.2822		5.56	V Q				
0+55	0.3206		5.58	V Q				
1+ 0	0.3591		5.59	V Q				
1+ 5	0.3977		5.60	V Q				
1+10	0.4363		5.61	V Q				
1+15	0.4750		5.62	VQ				
1+20	0.5139		5.64	VQ				
1+25	0.5528		5.65	VQ				
1+30	0.5918		5.66	VQ				
1+35	0.6309		5.68	VQ				
1+40	0.6700		5.69	VQ				
1+45	0.7093		5.70	VQ				
1+50	0.7487		5.71	VQ				
1+55	0.7881		5.73	VQ				
2+ 0	0.8276		5.74	VQ				
2+ 5	0.8673		5.75	VQ				
2+10	0.9070		5.77	VQ				
2+15	0.9468		5.78	Q				
2+20	0.9867		5.79	Q				
2+25	1.0267		5.81	Q				
2+30	1.0668		5.82	Q				
2+35	1.1070		5.84	Q				
2+40	1.1473		5.85	Q				
2+45	1.1877		5.86	Q				
2+50	1.2282		5.88	Q				
2+55	1.2688		5.89	Q				
3+ 0	1.3094		5.91	Q				
3+ 5	1.3502		5.92	Q				
3+10	1.3911		5.94	QV				
3+15	1.4321		5.95	QV				
3+20	1.4732		5.97	QV				
3+25	1.5144		5.98	QV				
3+30	1.5558		6.00	QV				
3+35	1.5972		6.01	QV				
3+40	1.6387		6.03	QV				
3+45	1.6804		6.05	QV				
3+50	1.7221		6.06	QV				
3+55	1.7640		6.08	QV				
4+ 0	1.8060		6.10	QV				
4+ 5	1.8480		6.11	Q V				
4+10	1.8903		6.13	Q V				
4+15	1.9326		6.15	Q V				
4+20	1.9750		6.16	Q V				
4+25	2.0176		6.18	Q V				
4+30	2.0602		6.20	Q V				
4+35	2.1030		6.21	Q V				
4+40	2.1460		6.23	Q V				
4+45	2.1890		6.25	Q V				
4+50	2.2322		6.27	Q V				
4+55	2.2755		6.29	Q V				
5+ 0	2.3189		6.30	Q V				

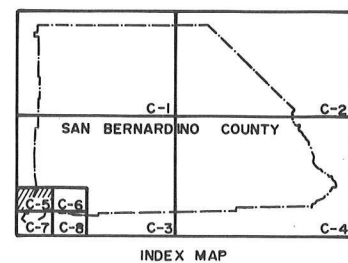
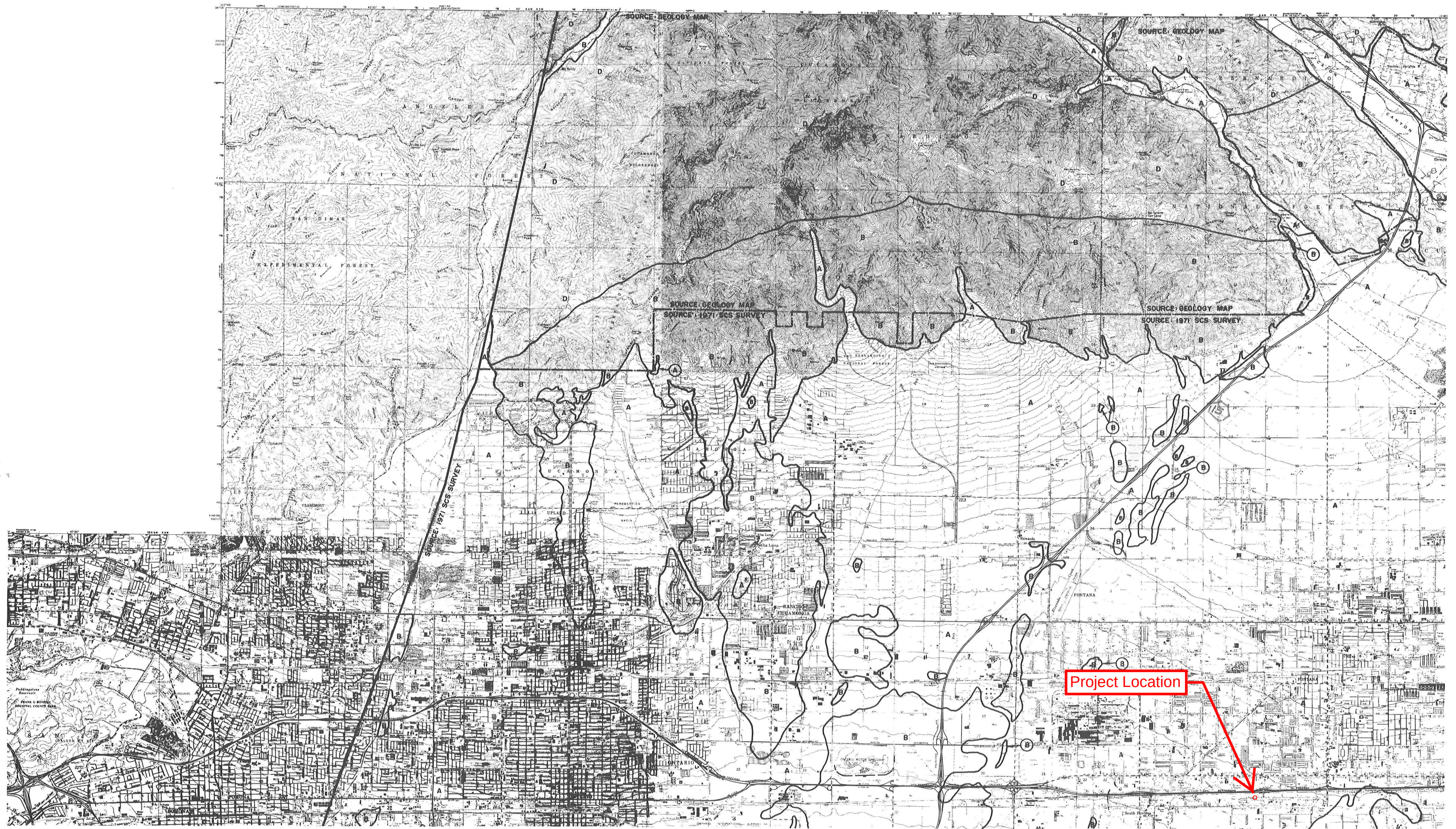
5+ 5	2.3624	6.32	Q	V				
5+10	2.4061	6.34	Q	V				
5+15	2.4499	6.36	Q	V				
5+20	2.4938	6.38	Q	V				
5+25	2.5379	6.40	Q	V				
5+30	2.5821	6.42	Q	V				
5+35	2.6265	6.44	Q	V				
5+40	2.6709	6.46	Q	V				
5+45	2.7156	6.48	Q	V				
5+50	2.7603	6.50	Q	V				
5+55	2.8052	6.52	Q	V				
6+ 0	2.8503	6.54	Q	V				
6+ 5	2.8955	6.56	Q	V				
6+10	2.9408	6.58	Q	V				
6+15	2.9863	6.61	Q	V				
6+20	3.0320	6.63	Q	V				
6+25	3.0777	6.65	Q	V				
6+30	3.1237	6.67	Q	V				
6+35	3.1698	6.69	Q	V				
6+40	3.2161	6.72	Q	V				
6+45	3.2625	6.74	Q	V				
6+50	3.3091	6.76	Q	V				
6+55	3.3558	6.79	Q	V				
7+ 0	3.4028	6.81	Q	V				
7+ 5	3.4498	6.84	Q	V				
7+10	3.4971	6.86	Q	V				
7+15	3.5445	6.89	Q	V				
7+20	3.5921	6.91	Q	V				
7+25	3.6399	6.94	Q	V				
7+30	3.6879	6.96	Q	V				
7+35	3.7360	6.99	Q	V				
7+40	3.7843	7.02	Q	V				
7+45	3.8329	7.04	Q	V				
7+50	3.8816	7.07	Q	V				
7+55	3.9305	7.10	Q	V				
8+ 0	3.9796	7.13	Q	V				
8+ 5	4.0288	7.16	Q	V				
8+10	4.0783	7.19	Q	V				
8+15	4.1280	7.22	Q	V				
8+20	4.1779	7.25	Q	V				
8+25	4.2280	7.28	Q	V				
8+30	4.2784	7.31	Q	V				
8+35	4.3289	7.34	Q	V				
8+40	4.3797	7.37	Q	V				
8+45	4.4306	7.40	Q	V				
8+50	4.4818	7.44	Q	V				
8+55	4.5333	7.47	Q	V				
9+ 0	4.5849	7.50	Q	V				
9+ 5	4.6368	7.54	Q	V				
9+10	4.6890	7.57	Q	V				
9+15	4.7414	7.61	Q	V				
9+20	4.7940	7.64	Q	V				
9+25	4.8469	7.68	Q	V				
9+30	4.9001	7.72	Q	V				
9+35	4.9535	7.76	Q	V				
9+40	5.0071	7.79	Q	V				
9+45	5.0611	7.83	Q	V				
9+50	5.1153	7.87	Q	V				
9+55	5.1698	7.91	Q	V				
10+ 0	5.2246	7.96	Q	V				
10+ 5	5.2797	8.00	Q	V				
10+10	5.3351	8.04	Q	V				
10+15	5.3908	8.08	Q	V				

10+20	5.4468	8.13	Q	V		
10+25	5.5031	8.18	Q	V		
10+30	5.5597	8.22	Q	V		
10+35	5.6166	8.27	Q	V		
10+40	5.6739	8.32	Q	V		
10+45	5.7316	8.37	Q	V		
10+50	5.7895	8.42	Q	V		
10+55	5.8479	8.47	Q	V		
11+ 0	5.9066	8.52	Q	V		
11+ 5	5.9656	8.58	Q	V		
11+10	6.0251	8.63	Q	V		
11+15	6.0849	8.69	Q	V		
11+20	6.1452	8.75	Q	V		
11+25	6.2058	8.81	Q	V		
11+30	6.2669	8.87	Q	V		
11+35	6.3284	8.93	Q	V		
11+40	6.3903	8.99	Q	V		
11+45	6.4527	9.06	Q	V		
11+50	6.5156	9.13	Q	V		
11+55	6.5789	9.19	Q	V		
12+ 0	6.6427	9.26	Q	V		
12+ 5	6.7067	9.30	Q	V		
12+10	6.7700	9.18	Q	V		
12+15	6.8313	8.91	Q	V		
12+20	6.8911	8.68	Q	V		
12+25	6.9505	8.62	Q	V		
12+30	7.0100	8.65	Q	V		
12+35	7.0701	8.72	Q	V		
12+40	7.1308	8.81	Q	V		
12+45	7.1920	8.90	Q	V		
12+50	7.2540	9.00	Q	V		
12+55	7.3166	9.10	Q	V		
13+ 0	7.3801	9.21	Q	V		
13+ 5	7.4442	9.32	Q	V		
13+10	7.5092	9.44	Q	V		
13+15	7.5750	9.56	Q	V		
13+20	7.6417	9.68	Q	V		
13+25	7.7093	9.81	Q	V		
13+30	7.7778	9.95	Q	V		
13+35	7.8474	10.09	Q	V		
13+40	7.9179	10.24	Q	V		
13+45	7.9895	10.40	Q	V		
13+50	8.0623	10.57	Q	V		
13+55	8.1362	10.74	Q	V		
14+ 0	8.2115	10.92	Q	V		
14+ 5	8.2880	11.11	Q	V		
14+10	8.3660	11.32	Q	V		
14+15	8.4455	11.54	Q	V		
14+20	8.5266	11.78	Q	V		
14+25	8.6094	12.02	Q	V		
14+30	8.6940	12.29	Q	V		
14+35	8.7806	12.57	Q	V		
14+40	8.8692	12.87	Q	V		
14+45	8.9601	13.19	Q	V		
14+50	9.0534	13.55	Q	V		
14+55	9.1493	13.93	Q	V		
15+ 0	9.2481	14.35	Q	V		
15+ 5	9.3501	14.81	Q	V		
15+10	9.4557	15.33	Q	V		
15+15	9.5652	15.90	Q	V		
15+20	9.6791	16.55	Q	V		
15+25	9.7972	17.14	Q	V		
15+30	9.9154	17.17	Q	V		

15+35	10.0301	16.66		Q			V		
15+40	10.1440	16.53		Q			V		
15+45	10.2640	17.43		Q			V		
15+50	10.3965	19.23		Q			V		
15+55	10.5490	22.15			Q		V		
16+ 0	10.7367	27.26				Q	V		
16+ 5	11.0068	39.21					V		
16+10	11.4520	64.65				Q			
16+15	12.0264	83.40					V	Q	
16+20	12.5289	72.96					V		Q
16+25	12.8381	44.90				Q	V	Q	
16+30	13.0404	29.37			Q		V		
16+35	13.1901	21.73					V		
16+40	13.3227	19.25			Q		V		
16+45	13.4451	17.77			Q		V		
16+50	13.5527	15.63			Q		V		
16+55	13.6531	14.57			Q		V		
17+ 0	13.7477	13.73			Q		V		
17+ 5	13.8375	13.04		Q			V		
17+10	13.9230	12.42		Q			V		
17+15	14.0049	11.89		Q			V		
17+20	14.0835	11.42		Q			V		
17+25	14.1593	11.01		Q			V		
17+30	14.2325	10.64		Q			V		
17+35	14.3035	10.31		Q			V		
17+40	14.3724	10.01		Q			V		
17+45	14.4395	9.73		Q			V		
17+50	14.5048	9.48		Q			V		
17+55	14.5685	9.25		Q			V		
18+ 0	14.6307	9.03		Q			V		
18+ 5	14.6918	8.87		Q			V		
18+10	14.7529	8.88		Q			V		
18+15	14.8153	9.05		Q			V		
18+20	14.8787	9.21		Q			V		
18+25	14.9421	9.20		Q			V		
18+30	15.0048	9.12		Q			V		
18+35	15.0668	9.00		Q			V		
18+40	15.1280	8.88		Q			V		
18+45	15.1884	8.77		Q			V		
18+50	15.2479	8.65		Q			V		
18+55	15.3068	8.54		Q			V		
19+ 0	15.3649	8.44		Q			V		
19+ 5	15.4222	8.33		Q			V		
19+10	15.4790	8.24		Q			V		
19+15	15.5351	8.14		Q			V		
19+20	15.5905	8.06		Q			V		
19+25	15.6454	7.97		Q			V		
19+30	15.6997	7.89		Q			V		
19+35	15.7535	7.81		Q			V		
19+40	15.8067	7.73		Q			V		
19+45	15.8595	7.65		Q			V		
19+50	15.9117	7.58		Q			V		
19+55	15.9634	7.51		Q			V		
20+ 0	16.0147	7.45		Q			V		
20+ 5	16.0655	7.38		Q			V		
20+10	16.1159	7.32		Q			V		
20+15	16.1659	7.25		Q			V		
20+20	16.2154	7.19		Q			V		
20+25	16.2646	7.14		Q			V		
20+30	16.3133	7.08		Q			V		
20+35	16.3617	7.03		Q			V		
20+40	16.4097	6.97		Q			V		
20+45	16.4574	6.92		Q			V		

20+50	16.5047	6.87	Q				V
20+55	16.5517	6.82	Q				V
21+ 0	16.5983	6.77	Q				V
21+ 5	16.6446	6.72	Q				V
21+10	16.6906	6.68	Q				V
21+15	16.7363	6.63	Q				V
21+20	16.7817	6.59	Q				V
21+25	16.8268	6.55	Q				V
21+30	16.8716	6.51	Q				V
21+35	16.9161	6.46	Q				V
21+40	16.9604	6.42	Q				V
21+45	17.0043	6.39	Q				V
21+50	17.0480	6.35	Q				V
21+55	17.0915	6.31	Q				V
22+ 0	17.1347	6.27	Q				V
22+ 5	17.1777	6.24	Q				V
22+10	17.2204	6.20	Q				V
22+15	17.2628	6.17	Q				V
22+20	17.3051	6.13	Q				V
22+25	17.3471	6.10	Q				V
22+30	17.3889	6.07	Q				V
22+35	17.4304	6.04	Q				V
22+40	17.4718	6.00	Q				V
22+45	17.5129	5.97	Q				V
22+50	17.5538	5.94	Q				V
22+55	17.5946	5.91	Q				V
23+ 0	17.6351	5.88	Q				V
23+ 5	17.6754	5.85	Q				V
23+10	17.7155	5.83	Q				V
23+15	17.7555	5.80	Q				V
23+20	17.7952	5.77	Q				V
23+25	17.8348	5.74	Q				V
23+30	17.8742	5.72	Q				V
23+35	17.9134	5.69	Q				V
23+40	17.9524	5.67	Q				V
23+45	17.9912	5.64	Q				V
23+50	18.0299	5.62	Q				V
23+55	18.0684	5.59	Q				V
24+ 0	18.1068	5.57	Q				V
24+ 5	18.1437	5.37	Q				V
24+10	18.1741	4.40	Q				V
24+15	18.1925	2.68	Q				V
24+20	18.2004	1.14	Q				V
24+25	18.2035	0.45	Q				V
24+30	18.2046	0.16	Q				V
24+35	18.2051	0.08	Q				V
24+40	18.2054	0.04	Q				V

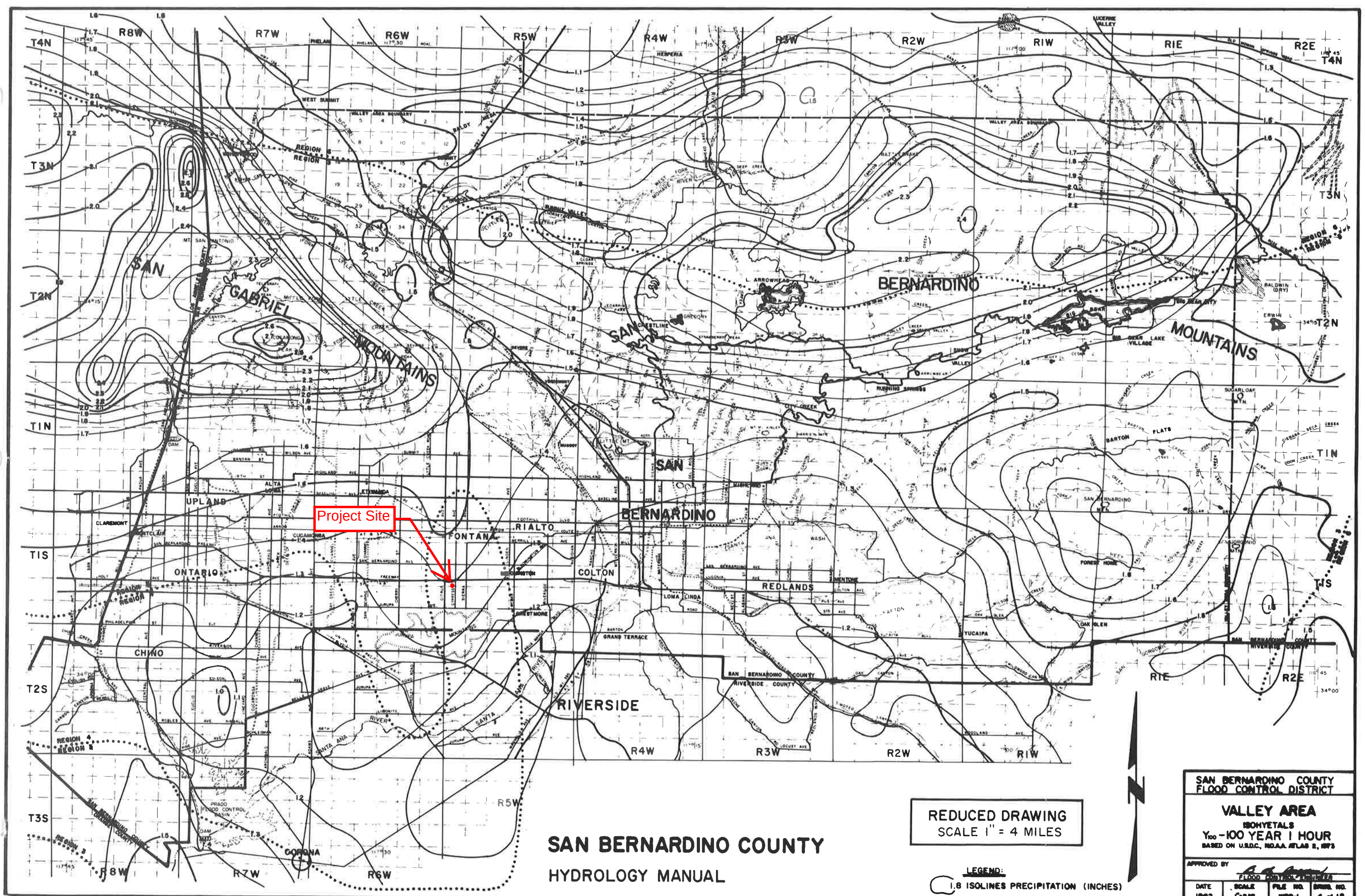
Appendix D
Soil Group Map and Isohyetal Map

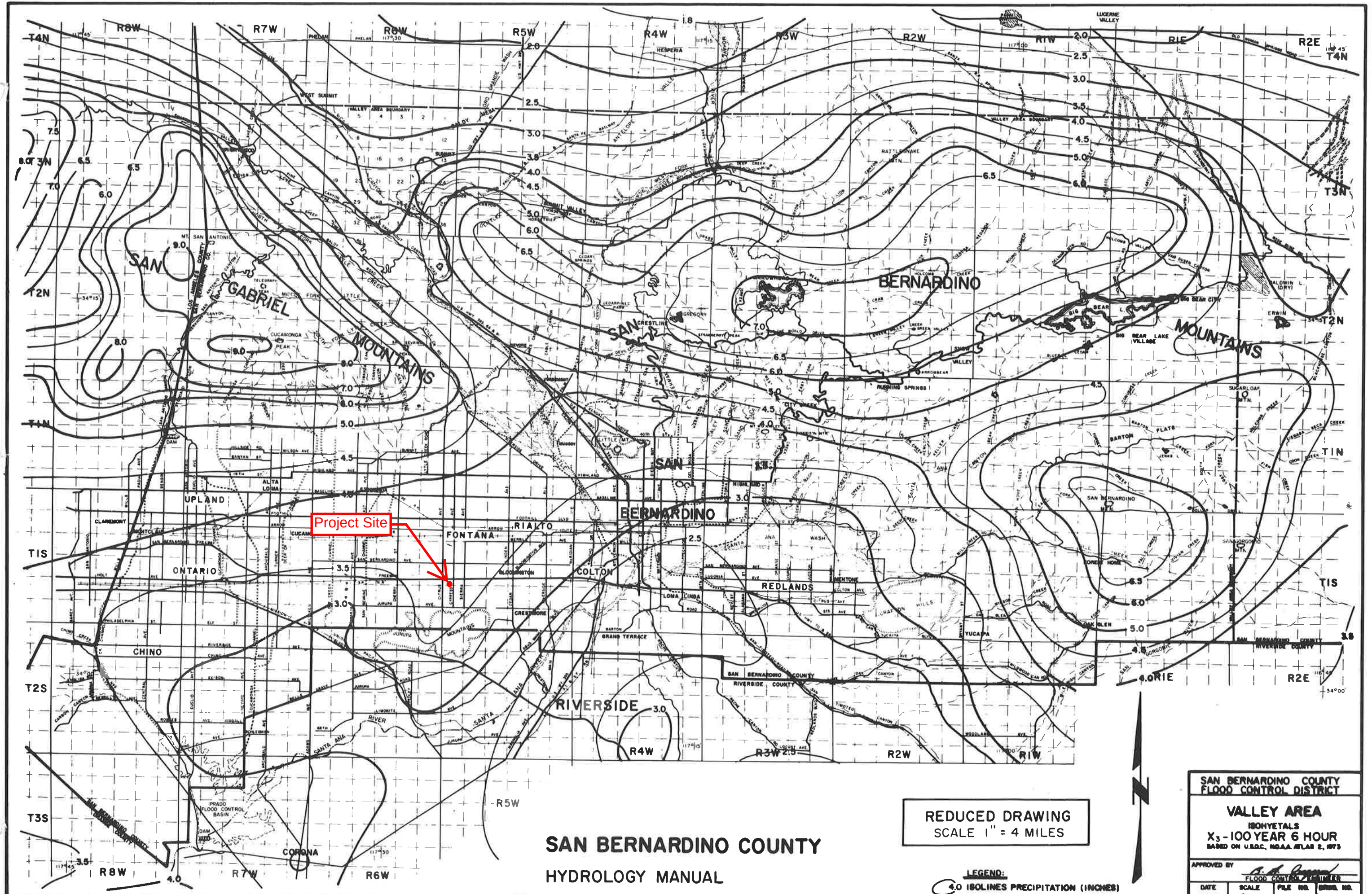


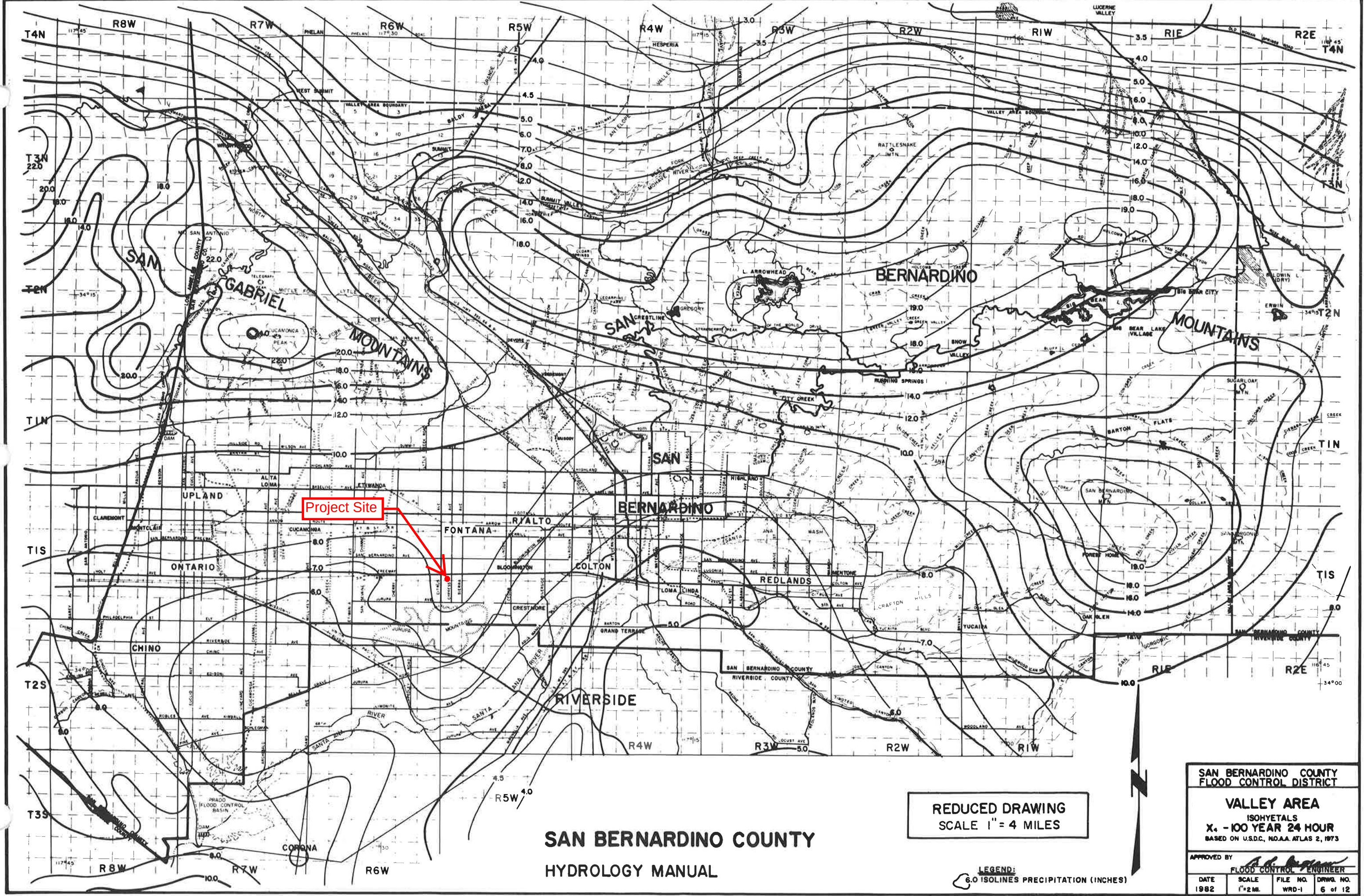
LEGEND
 ——— SOIL GROUP BOUNDARY
 A SOIL GROUP DESIGNATION
 - - - - - BOUNDARY OF INDICATED SOURCE

SCALE REDUCED BY 1/2
 SCALE 1:48,000

HYDROLOGIC SOILS GROUP MAP
 FOR
 SOUTHWEST-A AREA







Project Site

SAN BERNARDINO COUNTY HYDROLOGY MANUAL

REDUCED DRAWING
SCALE 1" = 4 MILES

LEGEND:
6.0 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

VALLEY AREA
ISOHYETALS
X4 - 100 YEAR 24 HOUR
BASED ON U.S.D.C. NO. AA ATLAS 2, 1973

APPROVED BY
[Signature]
FLOOD CONTROL ENGINEER

DATE 1982	SCALE 1" = 2 MI.	FILE NO. WRD-1	DRWG. NO. 6 of 12
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