



Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

**NEVADA STREET INDUSTRIAL DEVELOPMENT
COUNTY OF SAN BERNARDINO, CALIFORNIA**

PREPARED FOR

LDC INDUSTRIAL REALTY LLC

555 N. El Camino Real
Suite A456
San Clemente, CA 92672
(949) 226-4601

DECEMBER 17, 2021

JOB NO. 4013

PREPARED BY

THIENES ENGINEERING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
P. (714) 521-4811
FAX. (714) 521-4173

**PRELIMINARY HYDROLOGY
CALCULATIONS**

FOR

NEVADA STREET INDUSTRIAL DEVELOPMENT

PREPARED UNDER
THE SUPERVISION OF

REINHARD STENZEL
R.C.E. 56155
EXP. 12/31/2022

DATE:

INTRODUCTION

A: PROJECT LOCATION

The project site is located on the east side of Nevada Street south of the Santa Ana River in the County of San Bernardino. Please see figure 1 for vicinity map.

B: STUDY PURPOSE

The purpose of this study is to determine the 100-year peak flow rate for the project site that will drain to the existing 84" storm drain in Nevada Street.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel
James Wickenhaueser



DISCUSSION

Project Description

The project site encompasses approximately 17.70 acres. Proposed improvements include one warehouse type building that is approximately 378,540 square feet. There is a truck yard on the north side of the building and vehicle parking along the east, south, and west side. There will be landscaping throughout the project.

Existing Condition

The site is undeveloped with general slopes to the northwest. The site sheet flows into Nevada Street. Nevada Street is partially improved with asphalt curbs. There is a small existing catch basin in Nevada Street north of the project site which collects some runoff from the street. The majority of flows surface drain towards the Santa Ana River. The 100-year peak flow rate from the existing condition of the project site is approximately 21.4 cfs.

There is an existing 84" storm drain in Nevada Street flowing northerly towards the Santa Ana River. This is a 100-year drain designed to carry the developed condition runoff. The proposed project spans subarea A-20.2 and a portion of A-20.1 as defined in the Ultimate Hydrology Map prepared by Webb (see appendix B).

See Appendix "B" for existing condition hydrology calculations and Appendix "C" for existing condition hydrology map.

Proposed Condition

The southerly portion of the building and vehicle parking along the south property line will drain westerly through the auto parking area towards a catch basin in the parking area (nodes 100-102). Runoff will enter a private storm drain and continue westerly through the parking lot. The westerly portion of the parking lot will drain to a catch basin at the southwest corner of the property (node 103). The storm drain will convey storm water northerly through the auto drive isle towards the northwest driveway. Runoff from the westerly auto drive isle will be collected in catch basins and added to the drain (nodes 104-106).

Runoff from the northerly portion of the building, easterly auto parking area, and the truck yard will surface flow westerly through the truck yard towards a catch basin in the northwest corner of the truck yard (nodes 200-202). A storm drain will convey this runoff westerly towards the confluence with storm water from the southerly portion of the project. The combined flows will continue north towards and existing 36" stub built per plan SD 1867. This is a 100-year storm drain so no storm water detention will be required. The 100-year peak runoff will be approximately 43.1 cfs.

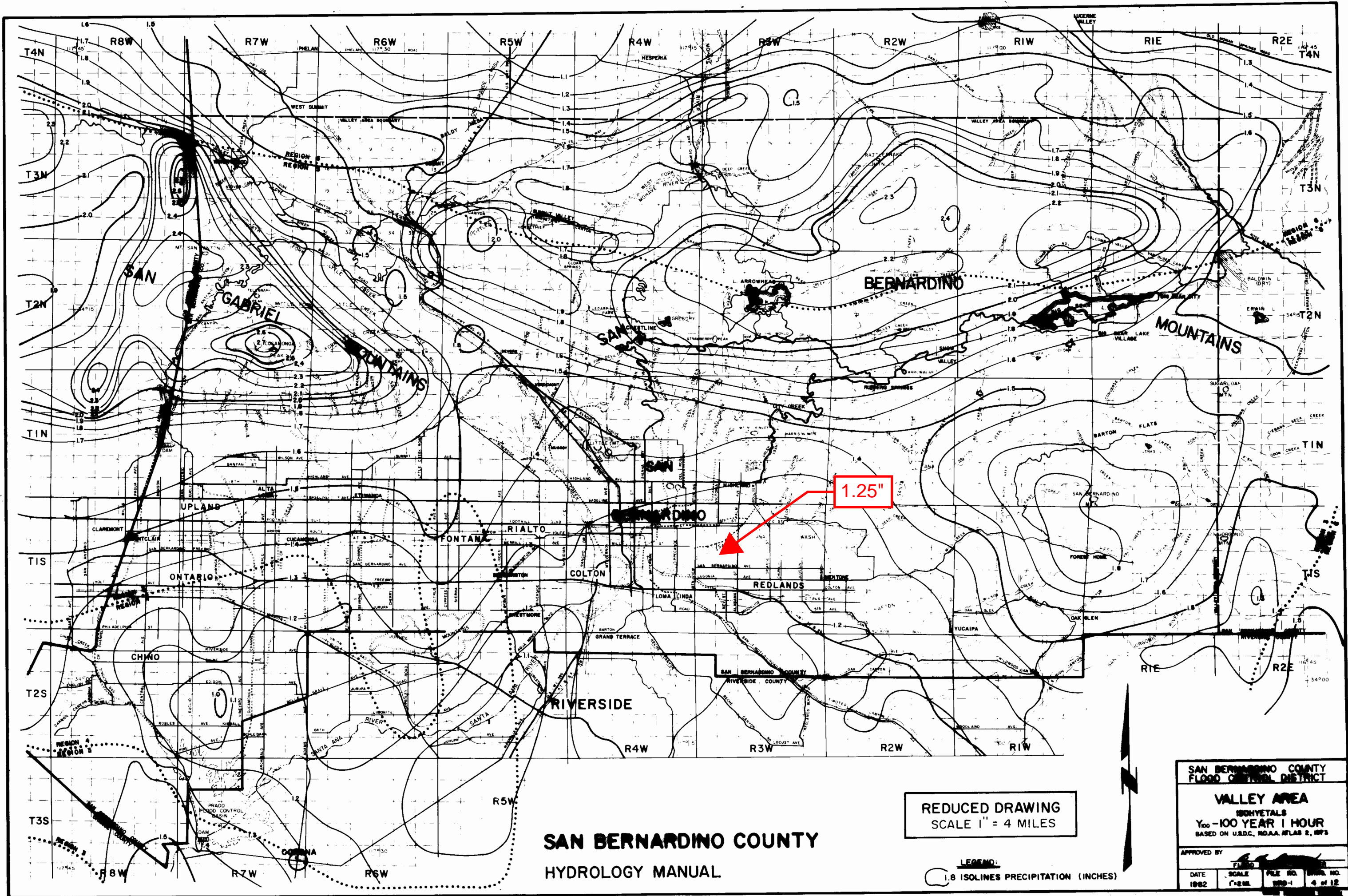
See Appendix "B" for proposed condition hydrology calculations and Appendix "C" for proposed condition hydrology map.

Methodology

Hydrology calculations were computed using the San Bernardino County Rational Method computer program (by AES Software). The site is soil type is "B" per the San Bernardino County Hydrology Manual. See Appendix "A" for reference materials.

APPENDIX A

REFERENCE MATERIALS



**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**REDUCED DRAWING
SCALE 1" = 4 MILES**

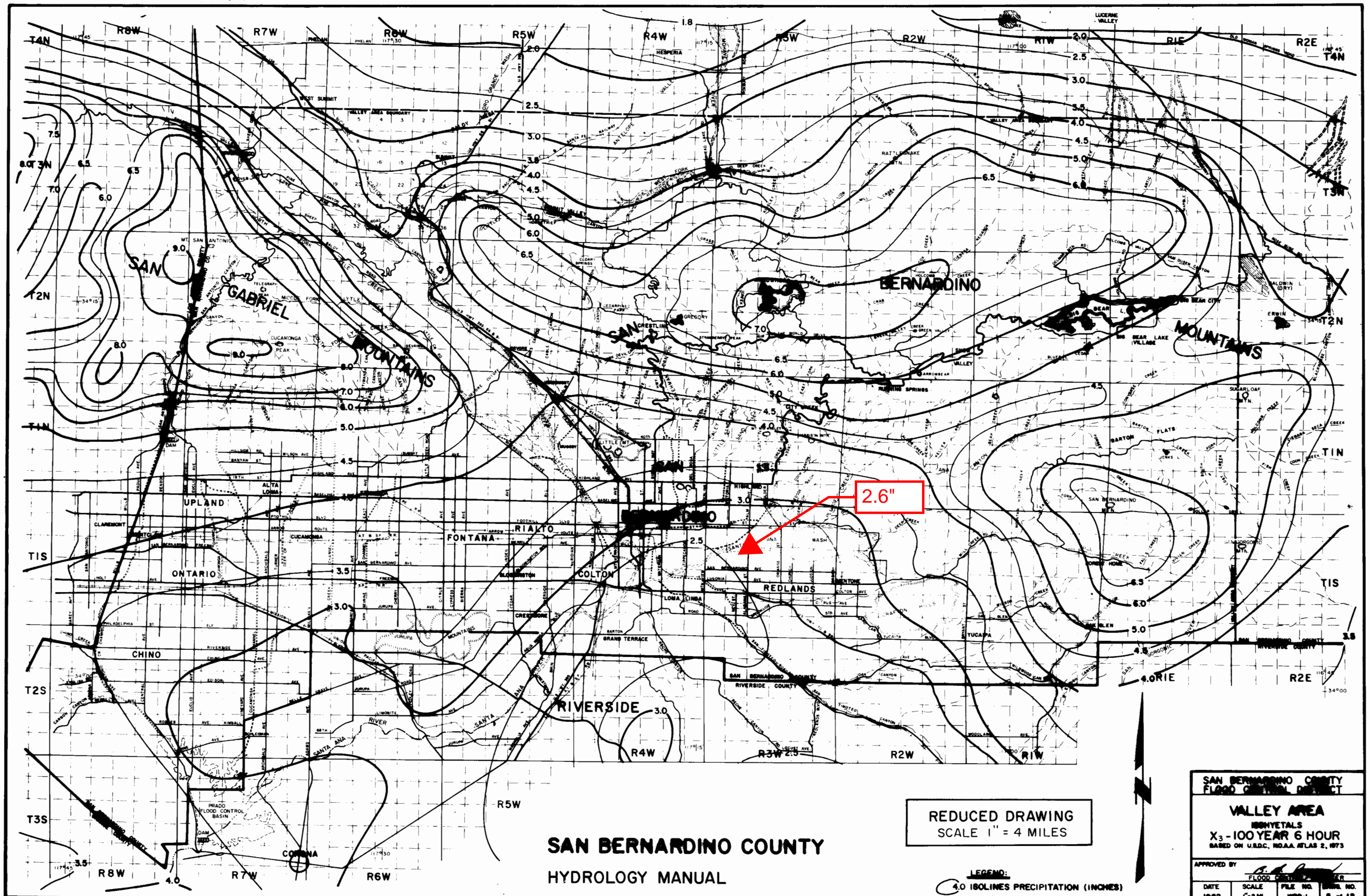
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1.8 ISOLINES PRECIPITATION (INCHES)

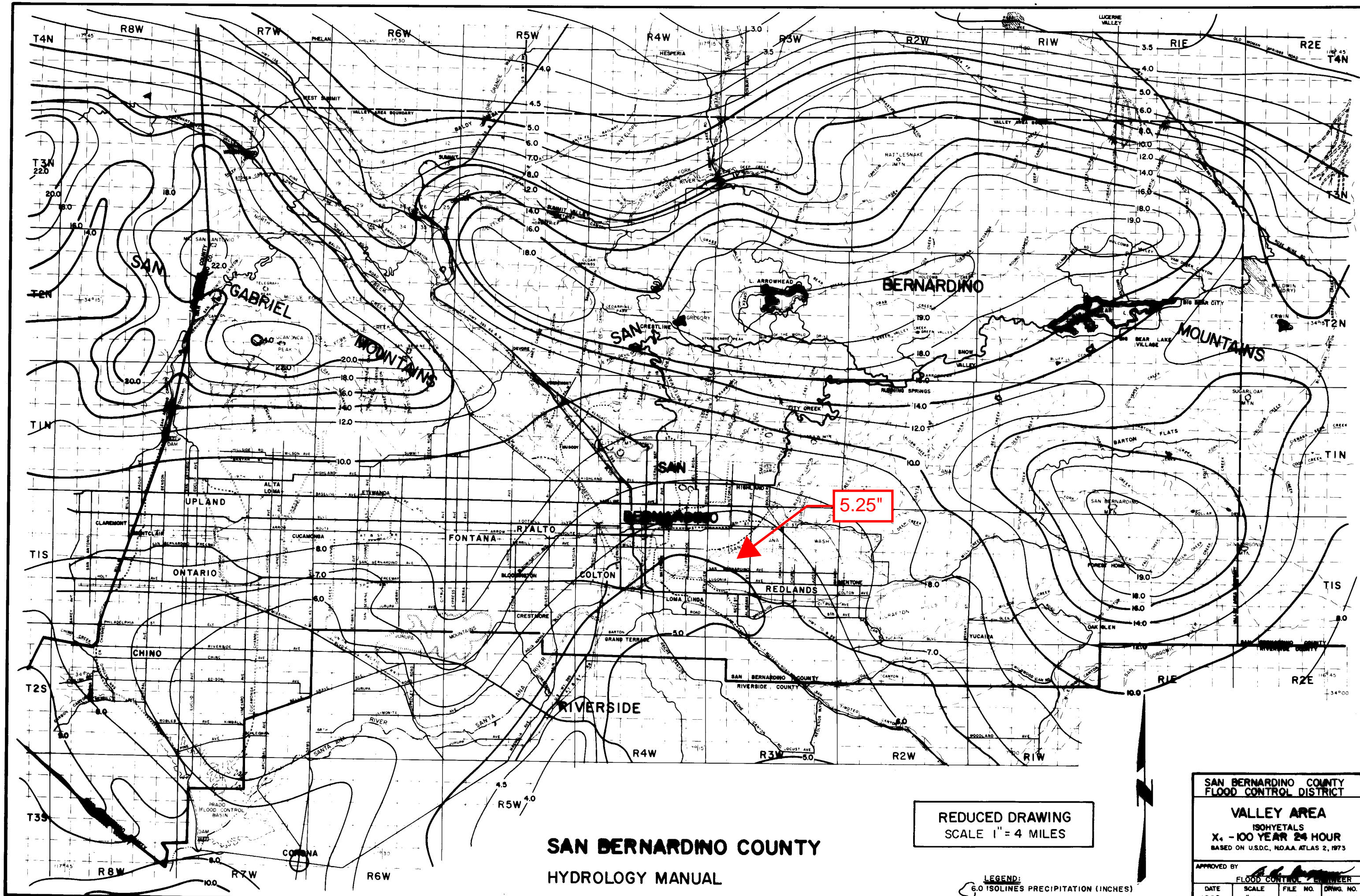
**SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT**

**VALLEY AREA
ISOHYETALS
Y₁₀₀-100 YEAR 1 HOUR
BASED ON U.S.D.C. NOAA ATLAS 2, 1973**

APPROVED BY: _____

DATE	SCALE	FILE NO.	SHEET NO.
1982	1"=4 MI.	WB-1	4 of 12





**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

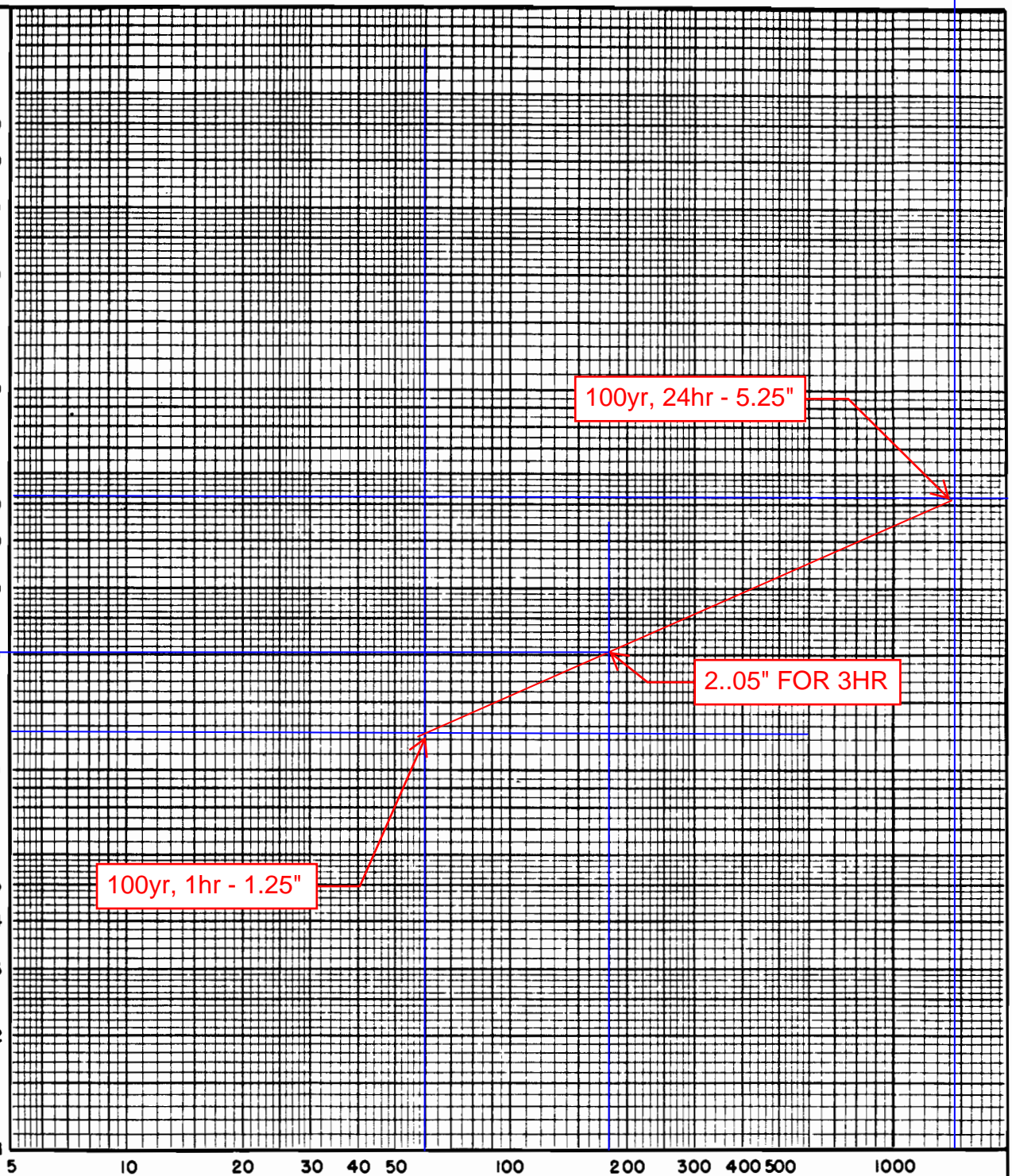
**REDUCED DRAWING
SCALE 1" = 4 MILES**

LEGEND:
6.0 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
VALLEY AREA			
ISOHYETALS			
X ₄ - 100 YEAR 24 HOUR			
BASED ON U.S.D.C. NOAA ATLAS 2, 1973			
APPROVED BY _____			
FLOOD CONTROL ENGINEER			
DATE	SCALE	FILE NO.	DRWG. NO.
1982	1" = 2 MI.	WRD-1	6 of 12

POINT RAINFALL - INCHES

50.0
40.0
30.0
20.0
10.0
5.0
4.0
3.0
2.0
1.0
0.5
0.4
0.3
0.2
0.1



STORM DURATION - MINUTES

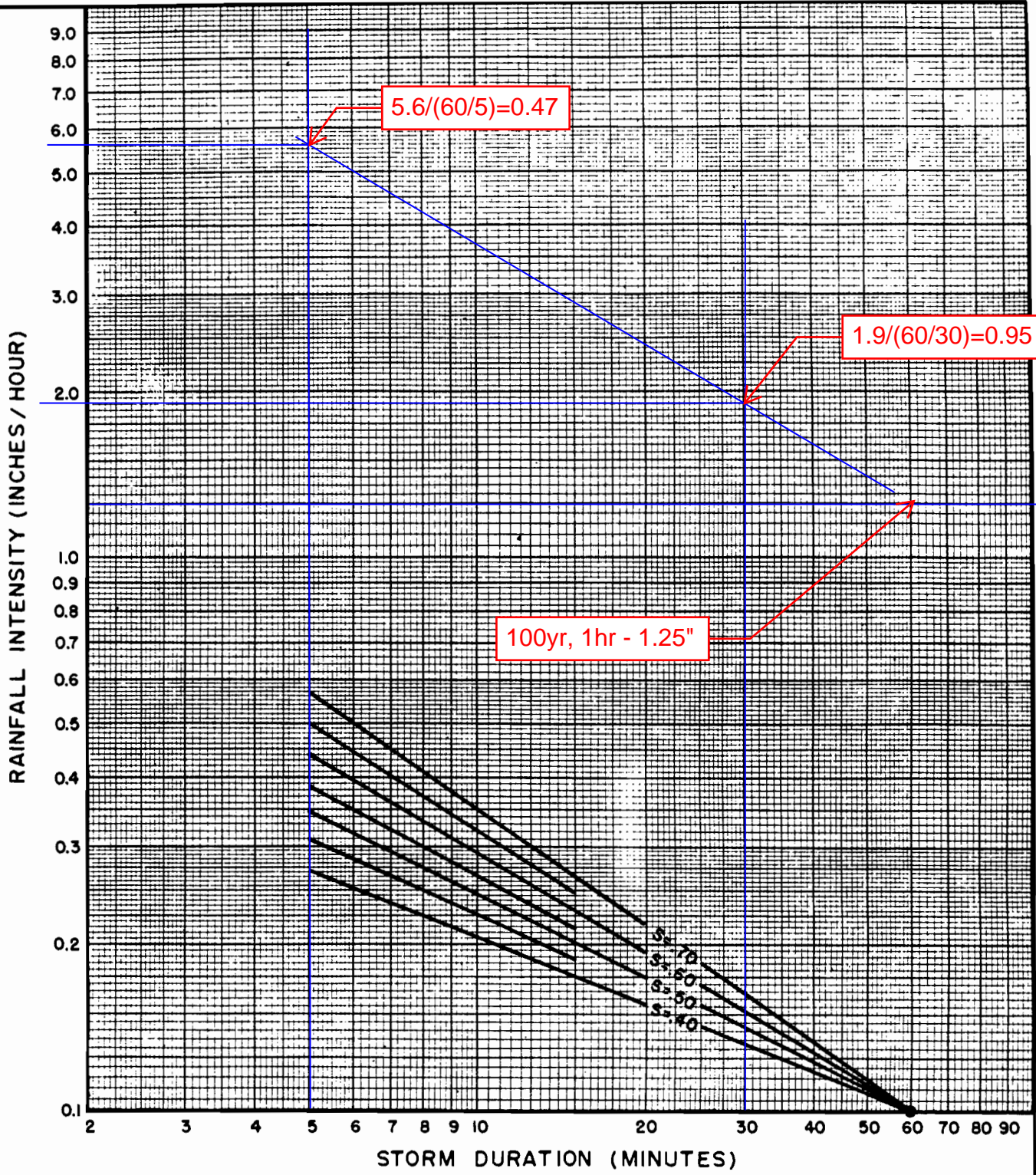
PROJECT LOCATION _____

NOTES _____

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

AREA - AVERAGED
MASS RAINFALL
PLOTING SHEET

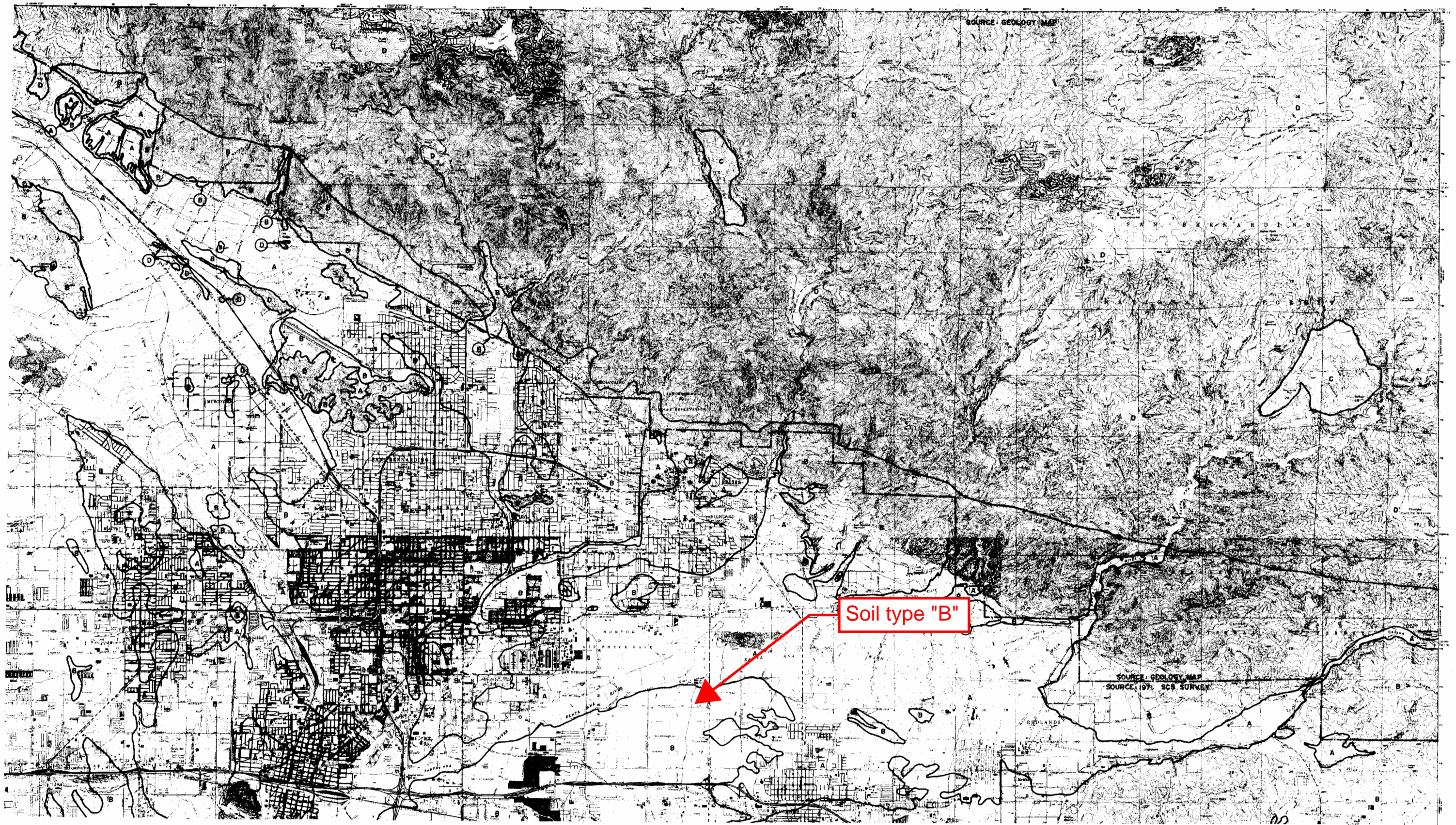
115



DESIGN STORM FREQUENCY = _____ YEARS
 ONE HOUR POINT RAINFALL = _____ INCHES
 LOG-LOG SLOPE = _____
 PROJECT LOCATION = _____

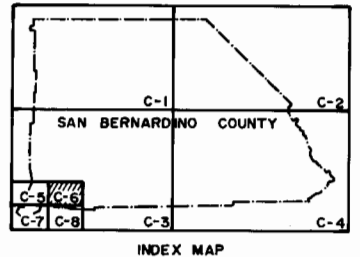
SAN BERNARDINO COUNTY
 HYDROLOGY MANUAL

**INTENSITY - DURATION
 CURVES
 CALCULATION SHEET**



SOURCE: GEOLOGY MAP

SOURCE: GEOLOGY MAP
SOURCE: 1971 SCS SURVEY

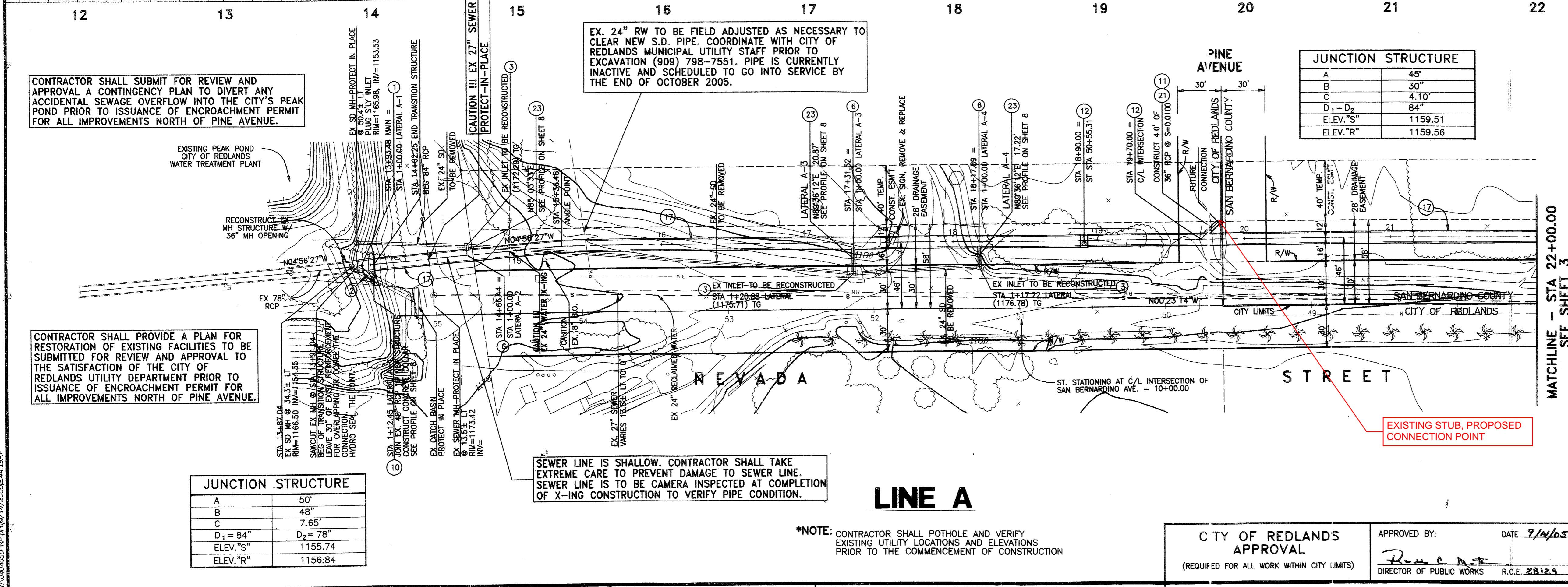
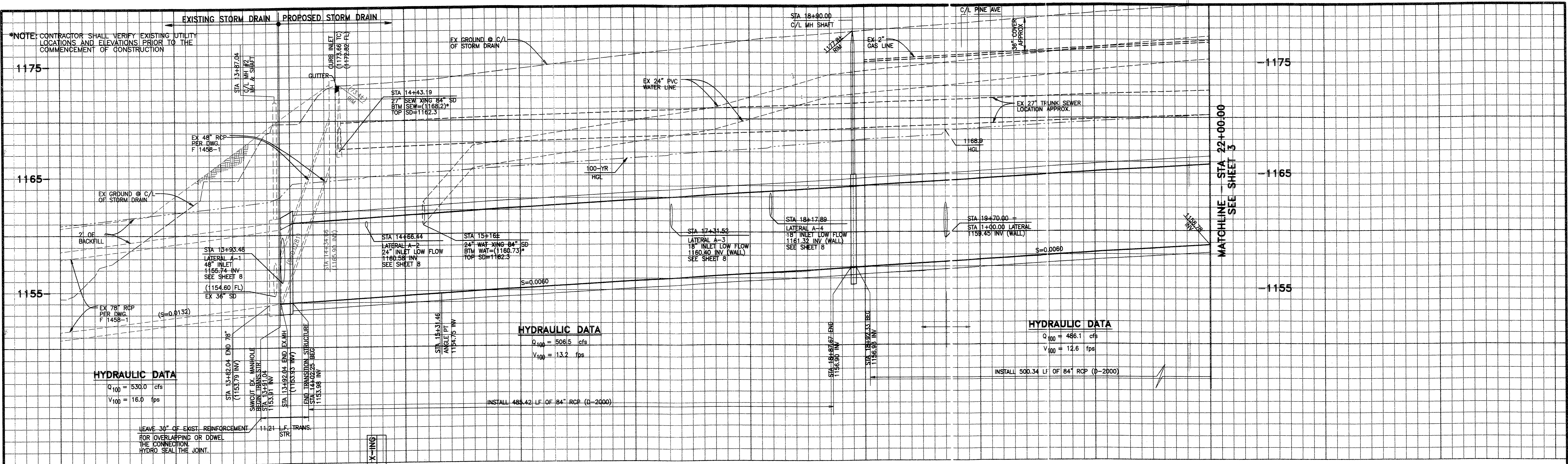


- LEGEND
- SOIL GROUP BOUNDARY
 - A SOIL GROUP DESIGNATION
 - - - BOUNDARY OF INDICATED SOURCE

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

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-B AREA



- CONSTRUCTION NOTES**
- NOTES MARKED * ARE APPLICABLE TO THIS SHEET, ALL OTHERS DO NOT APPLY
- * CONSTRUCT TRANSITION STRUCTURE PER APWA STD DWG NO 342-1 (RCB TO PIPE)
 - * CONSTRUCT SIDE CONNECTION PER APWA STD DWG NO 340-1 (TS PIPE TO PIPE)
 - INTENTIONALLY LEFT BLANK
 - INTENTIONALLY LEFT BLANK
 - INTENTIONALLY LEFT BLANK
 - * CONSTRUCT JUNCTION STRUCTURE PIPE TO PIPE (ID 24") PER APWA STD DWG NO 332-1
 - CONSTRUCT CMP RISER PER RCF&WCD STD DWG NO CB108 (10 GAUGE) (MODIFIED, SEE SHEET 13)
 - INSTALL CORRUGATED METAL PIPE (CMP)-(10 GAUGE)
 - CONSTRUCT MANHOLE PIPE TO PIPE (LARGE SIDE INLET) PER APWA STD DWG NO 322-1 WITH NO REDUCER PER APWA STD. DWG. NO'S. 326-1 & 633-3 (MODIFIED, SEE SHEET 11)
 - * CONSTRUCT CONCRETE COLLAR PER APWA STD DWG NO 380-3
 - * CONSTRUCT CONCRETE BULKHEAD PER RCF&WCD STD DWG NO MB16, SEE SHEET 13
 - * CONSTRUCT MANHOLE PIPE TO PIPE (MAIN LINE ID = 36" OR LARGER) PER APWA STD DWG NO 320-1 WITH NO REDUCER PER APWA STD. DWG. NO'S. 326-1 & 633-3 (MODIFIED, SEE SHEET 11)
 - INTENTIONALLY LEFT BLANK
 - CONSTRUCT JUNCTION STRUCTURE PIPE TO PIPE (ID = 24") PER APWA STD DWG NO 331-2
 - INTENTIONALLY LEFT BLANK
 - CONSTRUCT CURB OPENING CATCH BASIN PER APWA STD DWG NO 300-2 (MODIFIED, SEE SHEET 10) AND LOCAL DEPRESSION PER APWA STD DWG NO 313-1 (CASE-B)
 - * INSTALL 84" RCP (D-LOAD PER PLAN)
 - INSTALL 78" RCP (D-LOAD PER PLAN)
 - INSTALL 54" RCP (D-LOAD PER PLAN)
 - INSTALL 48" RCP (D-LOAD PER PLAN)
 - * INSTALL 36" RCP (D-LOAD PER PLAN)
 - INSTALL 30" RCP (D-LOAD PER PLAN)
 - INSTALL 24" RCP (CLASS IV)
 - INSTALL 18" RCP (D-LOAD PER PLAN)
 - INSTALL 12" RCP (D-LOAD PER PLAN)
 - INSTALL 36" HDPE PIPE (HIGH DENSITY POLYETHYLENE PIPE) PER ADS (ADVANCED DRAINAGE SYSTEMS) SPECIFICATIONS OR APPROVED EQUAL
 - INSTALL 24" HDPE PIPE (HIGH DENSITY POLYETHYLENE PIPE) PER ADS (ADVANCED DRAINAGE SYSTEMS) SPECIFICATIONS OR APPROVED EQUAL
 - INSTALL 18" HDPE PIPE (HIGH DENSITY POLYETHYLENE PIPE) PER ADS (ADVANCED DRAINAGE SYSTEMS) SPECIFICATIONS OR APPROVED EQUAL
 - INSTALL N-12 END CAP PER ADS (ADVANCED DRAINAGE SYSTEMS) SPECIFICATIONS OR APPROVED EQUAL

ALBERT A. WEBB ASSOCIATES
CIVIL ENGINEERS
3788 McCRAV ST.
RIVERSIDE, CA. 92506
PH: (951) 886-1070
FAX: (951) 788-1256

NO. C44762
EXP. 3-31-06
CIVIL

PREPARED BY: *[Signature]*
R.C.E. NO. C44762
EXP. DATE 3-31-06

DIG ALERT
TWO WORKING DAYS BEFORE YOU DIG
TOLL FREE 1-800-227-2800
A PUBLIC SERVICE BY UNDERGROUND SERVICE ALERT

BENCHMARK 1/96 SBD
LOCATION: BRASS DISK IN TOP HEADWALL @ SE CORNER NEVADA STREET & CALMETTO AVENUE
ELEVATION: 1186.913

CITY OF REDLANDS APPROVAL
(REQUIRED FOR ALL WORK WITHIN CITY LIMITS)

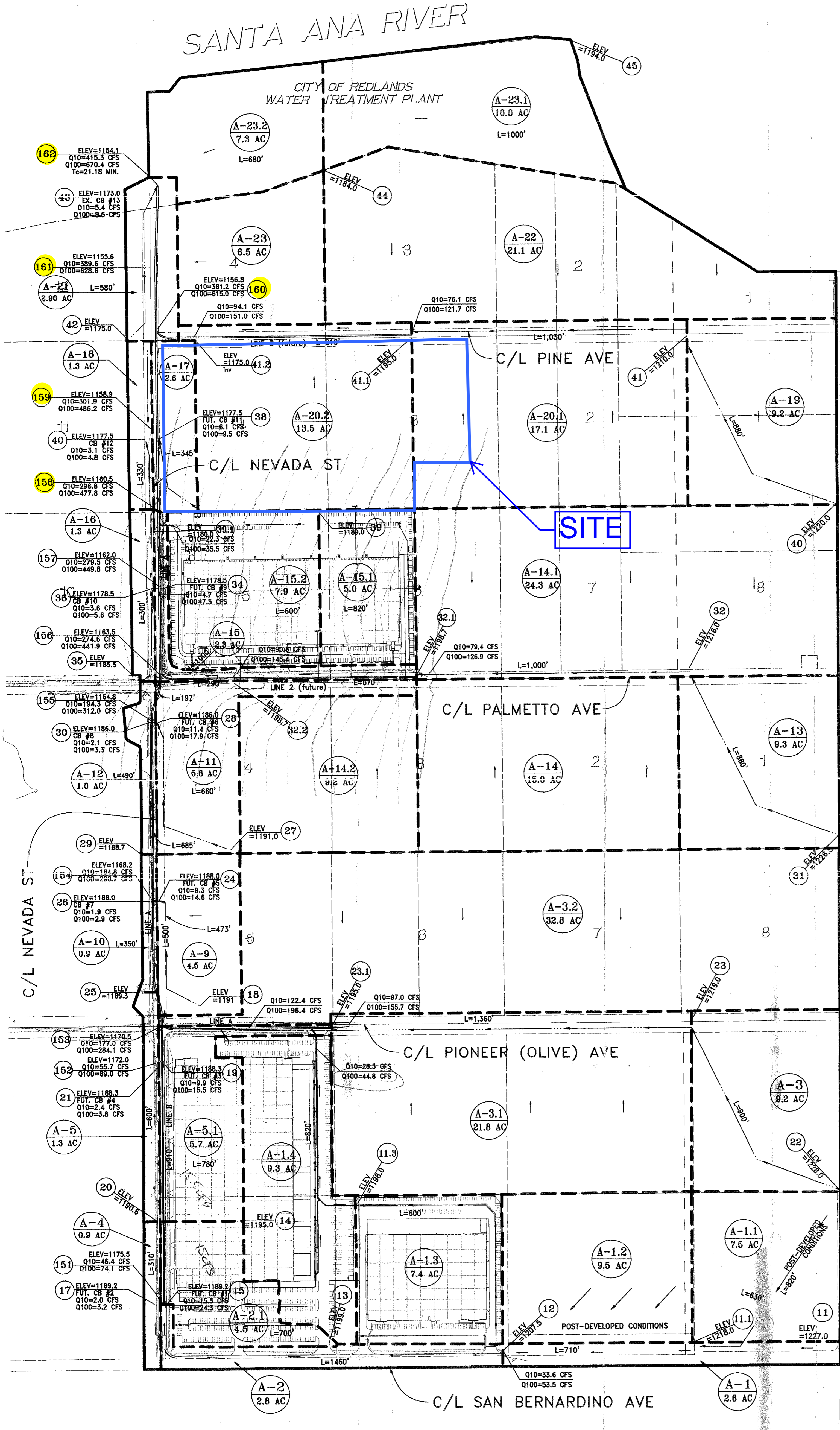
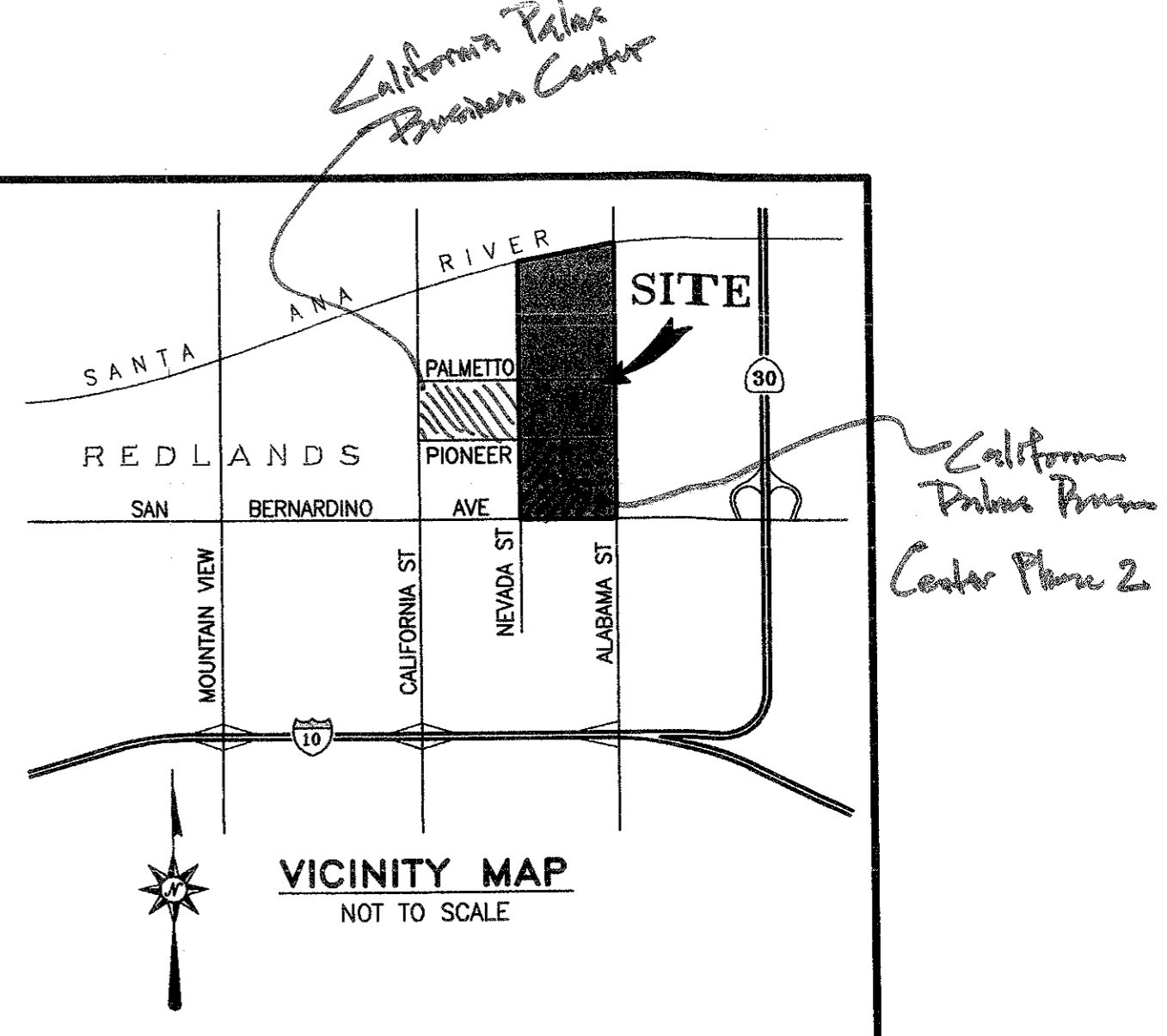
DESIGNED BY: _____ DRAWN BY: _____ CHECKED BY: _____
SUBMITTED BY: _____ RECOMMEN/DEVELOPER APPROVED BY: *[Signature]* C.D.E.
LAND DEVELOPMENT ENGINEER DATE 10-24-05

APPROVED BY: *[Signature]* DATE 9/14/05
DIRECTOR OF PUBLIC WORKS R.C.E. ZALZS

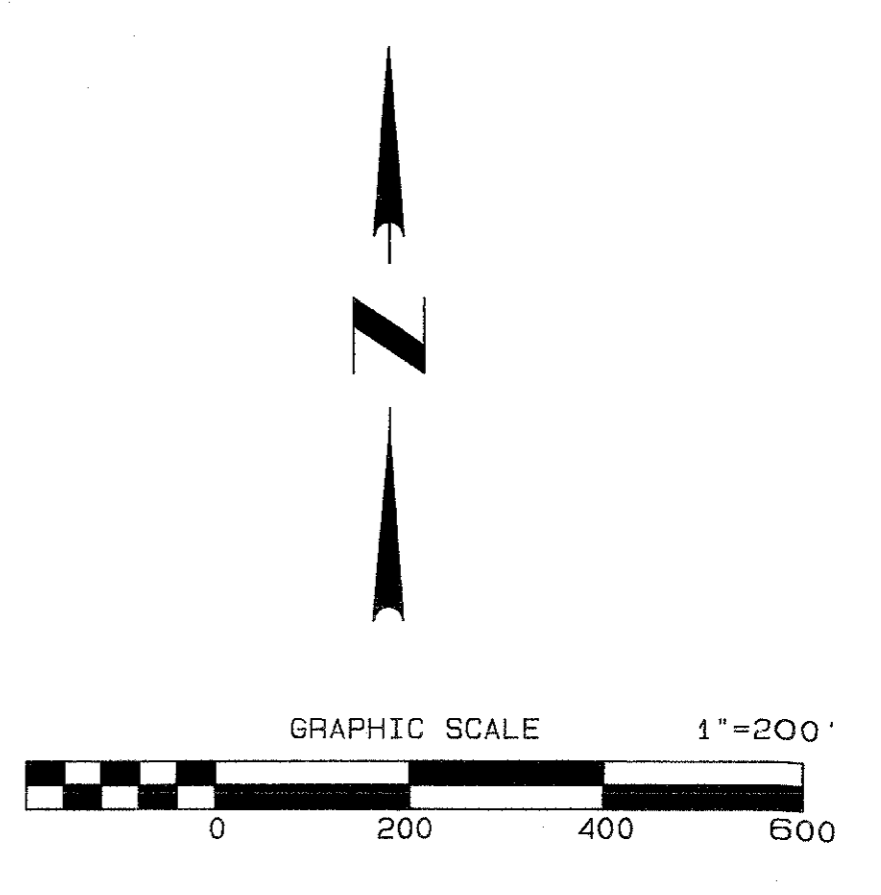
STORM DRAIN PLAN
W.O. No. 2004-0040
ROAD No. 590150
FILE No. 89-97
SHT. 2 OF 13

APPENDIX B

HYDROLOGY CALCULATIONS



- LEGEND**
- HYDROLOGY BOUNDARY
 - DRAINAGE AREA
 - FLOW DIRECTION
 - NODE
 - SUBAREA ACREAGE



ULTIMATE HYDROLOGY MAP

<p>ALBERT A. WEBB REGISTERED PROFESSIONAL ENGINEER NO. C44762 EXP. 3-31-08 CIVIL STATE OF CALIFORNIA</p>	<p>CIVIL ENGINEERS 3788 MCCRAY STREET RIVERSIDE, CA 92506 (909) 686-1070 R.C.E. NO. C44762</p> <p>APPROVED BY: <i>[Signature]</i> DATE: 1/16/05</p>	<p>COUNTY OF SAN BERNARDINO</p> <p>PROPOSED HYDROLOGY MAP FOR: TRAMMEL CROW COMPANY REDLANDS NEVADA STREET STORM DRAIN</p> <p>FOR: TRAMMEL CROW W.O. 04-040</p>	<p>SHEET</p> <p>1</p> <p>OF 1 SHEETS</p> <p>DWG. NO.</p>
			<p>SCALE: 1"=200'</p> <p>DATE: Dec 2004</p>

S:\2004\04-040\Nevada 3D\04-040\Nevada 3D\04-040\Nevada_NEW.dwg 12/27/2004 12:25:44 PM

 Process from Point/Station 157.000 to Point/Station 157.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 2.300 (Ac.)
 Runoff from this stream = 7.323 (CFS)
 Time of concentration = 10.51 min.
 Rainfall intensity = 3.611 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000

 Process from Point/Station 35.000 to Point/Station 36.000
 **** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil (AMC 2) = 56.00
 Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.073 (In/Hr)
 Initial subarea data:
 Initial area flow distance = 300.000 (Ft.)
 Top (of initial area) elevation = 1185.500 (Ft.)
 Bottom (of initial area) elevation = 1178.500 (Ft.)
 Difference in elevation = 7.000 (Ft.)
 Slope = 0.02333 s(%) = 2.33
 $TC = k(0.304) * [(length^3) / (elevation\ change)]^{0.2}$
 Initial area time of concentration = 6.311 min.
 Rainfall intensity = 4.905 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
 Subarea runoff = 5.653 (CFS)
 Total initial stream area = 1.300 (Ac.)
 Pervious area fraction = 0.100
 Initial area Fm value = 0.073 (In/Hr)

 Process from Point/Station 157.000 to Point/Station 157.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 3
 Stream flow area = 1.300 (Ac.)
 Runoff from this stream = 5.653 (CFS)
 Time of concentration = 6.31 min.
 Rainfall intensity = 4.905 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	441.866	19.20	2.516

2	7.323	10.51	3.611	
3	5.653	6.31	4.905	
Qmax(1) =				
	1.000 *	1.000 *	441.866)	+
	0.691 *	1.000 *	7.323)	+
	0.506 *	1.000 *	5.653)	+ = 449.780
Qmax(2) =				
	1.448 *	0.548 *	441.866)	+
	1.000 *	1.000 *	7.323)	+
	0.732 *	1.000 *	5.653)	+ = 361.916
Qmax(3) =				
	1.978 *	0.329 *	441.866)	+
	1.366 *	0.600 *	7.323)	+
	1.000 *	1.000 *	5.653)	+ = 298.953

Total of 3 streams to confluence:

Flow rates before confluence point:

441.866 7.323 5.653

Maximum flow rates at confluence using above data:

449.780 361.916 298.953

Area of streams before confluence:

183.376 2.300 1.300

Effective area values after confluence:

186.976 104.027 62.960

Results of confluence:

Total flow rate = 449.780 (CFS)

Time of concentration = 19.200 min.

Effective stream area after confluence = 186.976 (Ac.)

Stream Area average Pervious fraction (Ap) = 0.100

Stream Area average soil loss rate (Fm) = 0.073 (In/Hr)

Study area (this main stream) = 186.98 (Ac.)

 Process from Point/Station 157.000 to Point/Station 158.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1162.000 (Ft.)
 Downstream point/station elevation = 1160.500 (Ft.)
 Pipe length = 300.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 449.780 (CFS)
 Nearest computed pipe diameter = 84.00 (In.)
 Calculated individual pipe flow = 449.780 (CFS)
 Normal flow depth in pipe = 68.53 (In.)
 Flow top width inside pipe = 65.12 (In.)
 Critical Depth = 66.87 (In.)
 Pipe flow velocity = 13.38 (Ft/s)
 Travel time through pipe = 0.37 min.
 Time of concentration (TC) = 19.57 min.

 Process from Point/Station 158.000 to Point/Station 158.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 186.976 (Ac.)
 Runoff from this stream = 449.780 (CFS)
 Time of concentration = 19.57 min.

Rainfall intensity = 2.487(In/Hr)
Area averaged loss rate (Fm) = 0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000

++++
Process from Point/Station 32.100 to Point/Station 39.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 820.000(Ft.)
Top (of initial area) elevation = 1198.700(Ft.)
Bottom (of initial area) elevation = 1189.000(Ft.)
Difference in elevation = 9.700(Ft.)
Slope = 0.01183 s(%)= 1.18
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.810 min.
Rainfall intensity = 3.551(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff = 15.651(CFS)
Total initial stream area = 5.000(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073(In/Hr)

++++
Process from Point/Station 39.000 to Point/Station 39.100
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1189.000(Ft.)
Downstream point elevation = 1180.000(Ft.)
Channel length thru subarea = 600.000(Ft.)
Channel base width = 5.000(Ft.)
Slope or 'Z' of left channel bank = 50.000
Slope or 'Z' of right channel bank = 50.000
Estimated mean flow rate at midpoint of channel = 28.016(CFS)
Manning's 'N' = 0.015
Maximum depth of channel = 2.000(Ft.)
Flow(q) thru subarea = 28.016(CFS)
Depth of flow = 0.329(Ft.), Average velocity = 3.959(Ft/s)
Channel flow top width = 37.949(Ft.)
Flow Velocity = 3.96(Ft/s)
Travel time = 2.53 min.
Time of concentration = 13.34 min.
Critical depth = 0.408(Ft.)

Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00

Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
 Rainfall intensity = 3.131(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 = 19.848(CFS) for 7.900(Ac.)
 Total runoff = 35.500(CFS)
 Effective area this stream = 12.90(Ac.)
 Total Study Area (Main Stream No. 1) = 201.20(Ac.)
 Area averaged Fm value = 0.073(In/Hr)

++++++
 Process from Point/Station 158.000 to Point/Station 158.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 12.900(Ac.)
 Runoff from this stream = 35.500(CFS)
 Time of concentration = 13.34 min.
 Rainfall intensity = 3.131(In/Hr)
 Area averaged loss rate (Fm) = 0.0734(In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	449.780	19.57	2.487
2	35.500	13.34	3.131
Qmax(1) =			
	1.000 *	1.000 *	449.780) +
	0.789 *	1.000 *	35.500) + = 477.803
Qmax(2) =			
	1.267 *	0.681 *	449.780) +
	1.000 *	1.000 *	35.500) + = 423.685

Total of 2 streams to confluence:
 Flow rates before confluence point:
 449.780 35.500
 Maximum flow rates at confluence using above data:
 477.803 423.685
 Area of streams before confluence:
 186.976 12.900
 Effective area values after confluence:
 199.876 140.284
 Results of confluence:
 Total flow rate = 477.803(CFS)
 Time of concentration = 19.573 min.
 Effective stream area after confluence = 199.876(Ac.)
 Stream Area average Pervious fraction(Ap) = 0.100
 Stream Area average soil loss rate(Fm) = 0.073(In/Hr)
 Study area (this main stream) = 199.88(Ac.)

++++++
 Process from Point/Station 158.000 to Point/Station 159.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1160.500(Ft.)
Downstream point/station elevation = 1158.900(Ft.)
Pipe length = 350.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 477.803(CFS)
Nearest computed pipe diameter = 87.00(In.)
Calculated individual pipe flow = 477.803(CFS)
Normal flow depth in pipe = 71.91(In.)
Flow top width inside pipe = 65.89(In.)
Critical Depth = 68.38(In.)
Pipe flow velocity = 13.09(Ft/s)
Travel time through pipe = 0.45 min.
Time of concentration (TC) = 20.02 min.

Process from Point/Station 159.000 to Point/Station 159.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 199.876(Ac.)
Runoff from this stream = 477.803(CFS)
Time of concentration = 20.02 min.
Rainfall intensity = 2.454(In/Hr)
Area averaged loss rate (Fm) = 0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000

Process from Point/Station 39.100 to Point/Station 38.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 345.000(Ft.)
Top (of initial area) elevation = 1180.000(Ft.)
Bottom (of initial area) elevation = 1177.500(Ft.)
Difference in elevation = 2.500(Ft.)
Slope = 0.00725 s(%)= 0.72
TC = $k(0.304) * [(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 8.433 min.
Rainfall intensity = 4.122(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
Subarea runoff = 9.474(CFS)
Total initial stream area = 2.600(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073(In/Hr)

Process from Point/Station 159.000 to Point/Station 159.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2

Stream flow area = 2.600 (Ac.)
 Runoff from this stream = 9.474 (CFS)
 Time of concentration = 8.43 min.
 Rainfall intensity = 4.122 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000

 Process from Point/Station 39.100 to Point/Station 40.000
 **** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type

Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil (AMC 2) = 56.00
 Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.073 (In/Hr)
 Initial subarea data:
 Initial area flow distance = 330.000 (Ft.)
 Top (of initial area) elevation = 1180.000 (Ft.)
 Bottom (of initial area) elevation = 1177.500 (Ft.)
 Difference in elevation = 2.500 (Ft.)
 Slope = 0.00758 s (%) = 0.76
 $TC = k(0.304) * [(length^3) / (elevation\ change)]^{0.2}$
 Initial area time of concentration = 8.211 min.
 Rainfall intensity = 4.188 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
 Subarea runoff = 4.815 (CFS)
 Total initial stream area = 1.300 (Ac.)
 Pervious area fraction = 0.100
 Initial area Fm value = 0.073 (In/Hr)

 Process from Point/Station 159.000 to Point/Station 159.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 3

Stream flow area = 1.300 (Ac.)
 Runoff from this stream = 4.815 (CFS)
 Time of concentration = 8.21 min.
 Rainfall intensity = 4.188 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	477.803	20.02	2.454
2	9.474	8.43	4.122
3	4.815	8.21	4.188
Qmax (1) =			
	1.000 *	1.000 *	477.803) +
	0.588 *	1.000 *	9.474) +
	0.578 *	1.000 *	4.815) + = 486.158

$Q_{max}(2) =$
 1.701 * 0.421 * 477.803) +
 1.000 * 1.000 * 9.474) +
 0.984 * 1.000 * 4.815) + = 356.544
 $Q_{max}(3) =$
 1.729 * 0.410 * 477.803) +
 1.016 * 0.974 * 9.474) +
 1.000 * 1.000 * 4.815) + = 352.988

Total of 3 streams to confluence:
 Flow rates before confluence point:
 477.803 9.474 4.815
 Maximum flow rates at confluence using above data:
 486.158 356.544 352.988
 Area of streams before confluence:
 199.876 2.600 1.300
 Effective area values after confluence:
 203.776 88.097 85.813

Results of confluence:
 Total flow rate = 486.158 (CFS)
 Time of concentration = 20.019 min.
 Effective stream area after confluence = 203.776 (Ac.)
 Stream Area average Pervious fraction (A_p) = 0.100
 Stream Area average soil loss rate (F_m) = 0.073 (In/Hr)
 Study area (this main stream) = 203.78 (Ac.)

++++++
 Process from Point/Station 159.000 to Point/Station 160.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1158.900 (Ft.)
 Downstream point/station elevation = 1156.800 (Ft.)
 Pipe length = 410.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 486.158 (CFS)
 Nearest computed pipe diameter = 84.00 (In.)
 Calculated individual pipe flow = 486.158 (CFS)
 Normal flow depth in pipe = 75.19 (In.)
 Flow top width inside pipe = 51.48 (In.)
 Critical Depth = 69.23 (In.)
 Pipe flow velocity = 13.38 (Ft/s)
 Travel time through pipe = 0.51 min.
 Time of concentration (TC) = 20.53 min.

++++++
 Process from Point/Station 160.000 to Point/Station 160.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 203.776 (Ac.)
 Runoff from this stream = 486.158 (CFS)
 Time of concentration = 20.53 min.
 Rainfall intensity = 2.417 (In/Hr)
 Area averaged loss rate (F_m) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (A_p) = 0.1000

++++++

Process from Point/Station 40.000 to Point/Station 41.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 880.000(Ft.)
Top (of initial area) elevation = 1220.000(Ft.)
Bottom (of initial area) elevation = 1210.000(Ft.)
Difference in elevation = 10.000(Ft.)
Slope = 0.01136 s(%)= 1.14
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.209 min.
Rainfall intensity = 3.475(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.881
Subarea runoff = 28.165(CFS)
Total initial stream area = 9.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073(In/Hr)

Process from Point/Station 41.000 to Point/Station 41.100
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 1210.000(Ft.)
End of street segment elevation = 1195.000(Ft.)
Length of street segment = 1030.000(Ft.)
Height of curb above gutter flowline = 8.0(In.)
Width of half street (curb to crown) = 32.000(Ft.)
Distance from crown to crossfall grade break = 30.000(Ft.)
Slope from gutter to grade break (v/hz) = 0.020
Slope from grade break to crown (v/hz) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 12.000(Ft.)
Slope from curb to property line (v/hz) = 0.025
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150
Estimated mean flow rate at midpoint of street = 54.341(CFS)
Depth of flow = 0.607(Ft.), Average velocity = 4.608(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 24.020(Ft.)
Flow velocity = 4.61(Ft/s)
Travel time = 3.73 min. TC = 14.93 min.
Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00

Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073 (In/Hr)
Rainfall intensity = 2.925(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.877
Subarea runoff = 39.342(CFS) for 17.100(Ac.)
Total runoff = 67.507(CFS)
Effective area this stream = 26.30(Ac.)
Total Study Area (Main Stream No. 1) = 231.40(Ac.)
Area averaged Fm value = 0.073(In/Hr)
Street flow at end of street = 67.507(CFS)
Half street flow at end of street = 33.754(CFS)
Depth of flow = 0.649(Ft.), Average velocity = 4.862(Ft/s)
Flow width (from curb towards crown)= 26.107(Ft.)

+++++
Process from Point/Station 41.000 to Point/Station 41.100
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073 (In/Hr)
Time of concentration = 14.93 min.
Rainfall intensity = 2.925(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.877
Subarea runoff = 54.160(CFS) for 21.100(Ac.)
Total runoff = 121.667(CFS)
Effective area this stream = 47.40(Ac.)
Total Study Area (Main Stream No. 1) = 252.50(Ac.)
Area averaged Fm value = 0.073(In/Hr)

+++++
Process from Point/Station 41.100 to Point/Station 41.200
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1189.000(Ft.)
Downstream point/station elevation = 1175.000(Ft.)
Pipe length = 810.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 121.667(CFS)
Nearest computed pipe diameter = 42.00(In.)
Calculated individual pipe flow = 121.667(CFS)
Normal flow depth in pipe = 31.73(In.)
Flow top width inside pipe = 36.10(In.)
Critical Depth = 39.13(In.)
Pipe flow velocity = 15.60(Ft/s)
Travel time through pipe = 0.87 min.
Time of concentration (TC) = 15.80 min.

+++++
Process from Point/Station 39.000 to Point/Station 41.200
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil(AMC 2) = 56.00
 Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073 (In/Hr)
 Time of concentration = 15.80 min.
 Rainfall intensity = 2.828(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.877
 Subarea runoff = 29.323(CFS) for 13.500(Ac.)
 Total runoff = 150.989(CFS)
 Effective area this stream = 60.90(Ac.)
 Total Study Area (Main Stream No. 1) = 266.00(Ac.)
 Area averaged Fm value = 0.073 (In/Hr)

++++++
 Process from Point/Station 41.200 to Point/Station 160.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1175.000 (Ft.)
 Downstream point/station elevation = 1156.800 (Ft.)
 Pipe length = 155.00 (Ft.) Manning's N = 0.013
 No. of pipes = 1 Required pipe flow = 150.989 (CFS)
 Nearest computed pipe diameter = 33.00 (In.)
 Calculated individual pipe flow = 150.989 (CFS)
 Normal flow depth in pipe = 23.02 (In.)
 Flow top width inside pipe = 30.32 (In.)
 Critical depth could not be calculated.
 Pipe flow velocity = 34.14 (Ft/s)
 Travel time through pipe = 0.08 min.
 Time of concentration (TC) = 15.88 min.

++++++
 Process from Point/Station 160.000 to Point/Station 160.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 60.900 (Ac.)
 Runoff from this stream = 150.989 (CFS)
 Time of concentration = 15.88 min.
 Rainfall intensity = 2.820 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	486.158	20.53	2.417
2	150.989	15.88	2.820
Qmax(1) =			
	1.000 *	1.000 *	486.158) +
	0.853 *	1.000 *	150.989) + = 614.986
Qmax(2) =			

1.172 * 0.773 * 486.158) +
1.000 * 1.000 * 150.989) + = 591.598

Total of 2 streams to confluence:
Flow rates before confluence point:
486.158 150.989
Maximum flow rates at confluence using above data:
614.986 591.598
Area of streams before confluence:
203.776 60.900
Effective area values after confluence:
264.676 218.478
Results of confluence:
Total flow rate = 614.986(CFS)
Time of concentration = 20.530 min.
Effective stream area after confluence = 264.676(Ac.)
Stream Area average Pervious fraction(Ap) = 0.100
Stream Area average soil loss rate(Fm) = 0.073(In/Hr)
Study area (this main stream) = 264.68(Ac.)

Process from Point/Station 160.000 to Point/Station 161.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1156.800(Ft.)
Downstream point/station elevation = 1155.600(Ft.)
Pipe length = 250.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 614.986(CFS)
Nearest computed pipe diameter = 93.00(In.)
Calculated individual pipe flow = 614.986(CFS)
Normal flow depth in pipe = 82.50(In.)
Flow top width inside pipe = 58.86(In.)
Critical Depth = 76.07(In.)
Pipe flow velocity = 13.89(Ft/s)
Travel time through pipe = 0.30 min.
Time of concentration (TC) = 20.83 min.

Process from Point/Station 161.000 to Point/Station 161.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 264.676(Ac.)
Runoff from this stream = 614.986(CFS)
Time of concentration = 20.83 min.
Rainfall intensity = 2.396(In/Hr)
Area averaged loss rate (Fm) = 0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000

Process from Point/Station 44.000 to Point/Station 161.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000

Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil (AMC 2) = 56.00
 Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.073 (In/Hr)
 Initial subarea data:
 Initial area flow distance = 770.000 (Ft.)
 Top (of initial area) elevation = 1184.000 (Ft.)
 Bottom (of initial area) elevation = 1174.000 (Ft.)
 Difference in elevation = 10.000 (Ft.)
 Slope = 0.01299 s (%) = 1.30
 $TC = k(0.304) * [(length^3) / (elevation\ change)]^{0.2}$
 Initial area time of concentration = 10.346 min.
 Rainfall intensity = 3.646 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.882
 Subarea runoff = 20.901 (CFS)
 Total initial stream area = 6.500 (Ac.)
 Pervious area fraction = 0.100
 Initial area Fm value = 0.073 (In/Hr)

++++++
 Process from Point/Station 161.000 to Point/Station 161.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
 Stream flow area = 6.500 (Ac.)
 Runoff from this stream = 20.901 (CFS)
 Time of concentration = 10.35 min.
 Rainfall intensity = 3.646 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	614.986	20.83	2.396
2	20.901	10.35	3.646
Qmax(1) =			
	1.000 *	1.000 *	614.986) +
	0.650 *	1.000 *	20.901) + = 628.573
Qmax(2) =			
	1.538 *	0.497 *	614.986) +
	1.000 *	1.000 *	20.901) + = 490.773

Total of 2 streams to confluence:
 Flow rates before confluence point:
 614.986 20.901
 Maximum flow rates at confluence using above data:
 628.573 490.773
 Area of streams before confluence:
 264.676 6.500
 Effective area values after confluence:
 271.176 137.963
 Results of confluence:
 Total flow rate = 628.573 (CFS)
 Time of concentration = 20.830 min.
 Effective stream area after confluence = 271.176 (Ac.)

Stream Area average Pervious fraction(Ap) = 0.100
Stream Area average soil loss rate(Fm) = 0.073(In/Hr)
Study area (this main stream) = 271.18(Ac.)

Process from Point/Station 161.000 to Point/Station 162.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1155.600(Ft.)
Downstream point/station elevation = 1154.100(Ft.)
Pipe length = 300.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 628.573(CFS)
Nearest computed pipe diameter = 93.00(In.)
Calculated individual pipe flow = 628.573(CFS)
Normal flow depth in pipe = 82.88(In.)
Flow top width inside pipe = 57.93(In.)
Critical Depth = 76.80(In.)
Pipe flow velocity = 14.16(Ft/s)
Travel time through pipe = 0.35 min.
Time of concentration (TC) = 21.18 min.

Process from Point/Station 162.000 to Point/Station 162.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 271.176(Ac.)
Runoff from this stream = 628.573(CFS)
Time of concentration = 21.18 min.
Rainfall intensity = 2.372(In/Hr)
Area averaged loss rate (Fm) = 0.0734(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000

Process from Point/Station 42.000 to Point/Station 43.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.073(In/Hr)
Initial subarea data:
Initial area flow distance = 580.000(Ft.)
Top (of initial area) elevation = 1175.000(Ft.)
Bottom (of initial area) elevation = 1173.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00345 s(%)= 0.34
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.043 min.
Rainfall intensity = 3.329(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff = 8.496(CFS)
Total initial stream area = 2.900(Ac.)

Pervious area fraction = 0.100
Initial area Fm value = 0.073 (In/Hr)

Process from Point/Station 162.000 to Point/Station 162.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 2.900 (Ac.)
Runoff from this stream = 8.496 (CFS)
Time of concentration = 12.04 min.
Rainfall intensity = 3.329 (In/Hr)
Area averaged loss rate (Fm) = 0.0734 (In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000

Process from Point/Station 45.000 to Point/Station 44.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.073 (In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000 (Ft.)
Top (of initial area) elevation = 1194.000 (Ft.)
Bottom (of initial area) elevation = 1184.000 (Ft.)
Difference in elevation = 10.000 (Ft.)
Slope = 0.01000 s(%) = 1.00
TC = $k(0.304) * [(length^3) / (elevation\ change)]^{0.2}$
Initial area time of concentration = 12.102 min.
Rainfall intensity = 3.319 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.880
Subarea runoff = 29.208 (CFS)
Total initial stream area = 10.000 (Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.073 (In/Hr)

Process from Point/Station 44.000 to Point/Station 43.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation = 1184.000 (Ft.)
Downstream point elevation = 1173.000 (Ft.)
Channel length thru subarea = 680.000 (Ft.)
Channel base width = 50.000 (Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel = 39.869 (CFS)
Manning's 'N' = 0.030
Maximum depth of channel = 2.000 (Ft.)
Flow (q) thru subarea = 39.869 (CFS)
Depth of flow = 0.254 (Ft.), Average velocity = 2.082 (Ft/s)

Channel flow top width = 100.796 (Ft.)
 Flow Velocity = 2.08 (Ft/s)
 Travel time = 5.44 min.
 Time of concentration = 17.55 min.
 Critical depth = 0.230 (Ft.)
 Adding area flow to channel
 COMMERCIAL subarea type
 Decimal fraction soil group A = 0.000
 Decimal fraction soil group B = 1.000
 Decimal fraction soil group C = 0.000
 Decimal fraction soil group D = 0.000
 SCS curve number for soil (AMC 2) = 56.00
 Pervious ratio (Ap) = 0.1000 Max loss rate (Fm) = 0.073 (In/Hr)
 Rainfall intensity = 2.656 (In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area, (total area with modified
 rational method) (Q=KCIA) is C = 0.875
 Subarea runoff = 10.999 (CFS) for 7.300 (Ac.)
 Total runoff = 40.207 (CFS)
 Effective area this stream = 17.30 (Ac.)
 Total Study Area (Main Stream No. 1) = 292.70 (Ac.)
 Area averaged Fm value = 0.073 (In/Hr)

++++++
 Process from Point/Station 162.000 to Point/Station 162.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 3
 Stream flow area = 17.300 (Ac.)
 Runoff from this stream = 40.207 (CFS)
 Time of concentration = 17.55 min.
 Rainfall intensity = 2.656 (In/Hr)
 Area averaged loss rate (Fm) = 0.0734 (In/Hr)
 Area averaged Pervious ratio (Ap) = 0.1000
 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	628.573	21.18	2.372
2	8.496	12.04	3.329
3	40.207	17.55	2.656
Qmax(1) =			
	1.000 *	1.000 *	628.573) +
	0.706 *	1.000 *	8.496) +
	0.890 *	1.000 *	40.207) + = 670.361
Qmax(2) =			
	1.416 *	0.569 *	628.573) +
	1.000 *	1.000 *	8.496) +
	1.261 *	0.686 *	40.207) + = 549.365
Qmax(3) =			
	1.123 *	0.828 *	628.573) +
	0.793 *	1.000 *	8.496) +
	1.000 *	1.000 *	40.207) + = 631.892

Total of 3 streams to confluence:
 Flow rates before confluence point:
 628.573 8.496 40.207

Maximum flow rates at confluence using above data:

670.361 549.365 631.892

Area of streams before confluence:

271.176 2.900 17.300

Effective area values after confluence:

291.376 168.943 244.822

Results of confluence:

Total flow rate = 670.361(CFS)

Time of concentration = 21.183 min.

Effective stream area after confluence = 291.376 (Ac.)

Stream Area average Pervious fraction(A_p) = 0.100

Stream Area average soil loss rate(F_m) = 0.073 (In/Hr)

Study area (this main stream) = 291.38 (Ac.)

End of computations, Total Study Area = 292.70 (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(A_p) = 0.100

Area averaged SCS curve number = 56.0

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

THIENES ENGINEERING, INC.
14349 FIRESTONE BLVD
LA MIRADA, CA 90638
714-521-4811

***** DESCRIPTION OF STUDY *****
* TEI JOB 4013 *
* 100-YEAR STORM *
* EXISTING CONDITION (NODES 100-102) *

FILE NAME: W:\4013\100X.DAT
TIME/DATE OF STUDY: 12:12 09/07/2021

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

Table with columns: NO., HALF-CROWN WIDTH (FT), CROWN TO STREET-CROSSFALL (FT), STREET-CROSSFALL IN-/OUT-/PARK-SIDE / SIDE/WAY, CURB HEIGHT (FT), GUTTER WIDTH (FT), GEOMETRIES LIP (FT), MANNING HIKE (FT), FACTOR (n). Row 1: 1, 30.0, 20.0, 0.018/0.018/0.020, 0.67, 2.00, 0.0312, 0.167, 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

- 1. Relative Flow-Depth = 0.00 FEET as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 788.00
ELEVATION DATA: UPSTREAM(FEET) = 1200.00 DOWNSTREAM(FEET) = 1190.08

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 32.317
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.812
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
NATURAL GOOD COVER
"GRASS" B 7.70 0.36 1.000 80 32.32
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.36
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF(CFS) = 10.03
TOTAL AREA(ACRES) = 7.70 PEAK FLOW RATE(CFS) = 10.03

FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 52

>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>TRAVELTIME THRU SUBAREA<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1190.08 DOWNSTREAM(FEET) = 1181.25
CHANNEL LENGTH THRU SUBAREA(FEET) = 610.00 CHANNEL SLOPE = 0.0145
CHANNEL FLOW THRU SUBAREA(CFS) = 10.03
FLOW VELOCITY(FEET/SEC) = 3.01 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 3.38 Tc(MIN.) = 35.69
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 = 1398.00 FEET.

FLOW PROCESS FROM NODE 102.00 TO NODE 102.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 35.69
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 1.707
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL GOOD COVER
"GRASS" B 10.00 0.36 1.000 80
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.36
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA AREA(ACRES) = 10.00 SUBAREA RUNOFF(CFS) = 12.09
EFFECTIVE AREA(ACRES) = 17.70 AREA-AVERAGED Fm(INCH/HR) = 0.36
AREA-AVERAGED Fp(INCH/HR) = 0.36 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 17.7 PEAK FLOW RATE(CFS) = 21.39

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 17.7 TC(MIN.) = 35.69
EFFECTIVE AREA(ACRES) = 17.70 AREA-AVERAGED Fm(INCH/HR)= 0.36
AREA-AVERAGED Fp(INCH/HR) = 0.36 AREA-AVERAGED Ap = 1.000
PEAK FLOW RATE(CFS) = 21.39

END OF RATIONAL METHOD ANALYSIS



 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638
 714-521-4811

***** DESCRIPTION OF STUDY *****
 * TEI JOB 4013 *
 * 100-YEAR STORM EVENT *
 * PROPOSED CONDITION (NODES 100-204) *

FILE NAME: W:\4013\100P.DAT
 TIME/DATE OF STUDY: 08:53 12/17/2021

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.2500

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0312	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

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

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 605.00
 ELEVATION DATA: UPSTREAM(FEET) = 1195.31 DOWNSTREAM(FEET) = 1192.07

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.215
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.419
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	B	0.95	0.42	0.100	76	11.22

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 2.89
 TOTAL AREA(ACRES) = 0.95 PEAK FLOW RATE(CFS) = 2.89

 FLOW PROCESS FROM NODE 101.00 TO NODE 102.00 IS CODE = 91

 >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<

```

=====
UPSTREAM NODE ELEVATION(FEET) = 1192.07
DOWNSTREAM NODE ELEVATION(FEET) = 1188.49
CHANNEL LENGTH THRU SUBAREA(FEET) = 530.00
"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.125
PAVEMENT LIP(FEET) = 0.020 MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
MAXIMUM DEPTH(FEET) = 0.50
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.866
SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/   SCS SOIL   AREA   Fp       Ap   SCS
  LAND USE           GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL           B       3.25   0.42   0.100  76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 6.96
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 2.30
AVERAGE FLOW DEPTH(FEET) = 0.35 FLOOD WIDTH(FEET) = 23.73
"V" GUTTER FLOW TRAVEL TIME(MIN.) = 3.83 Tc(MIN.) = 15.05
SUBAREA AREA(ACRES) = 3.25 SUBAREA RUNOFF(CFS) = 8.26
EFFECTIVE AREA(ACRES) = 4.20 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 4.2 PEAK FLOW RATE(CFS) = 10.67

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) = 0.40 FLOOD WIDTH(FEET) = 28.58
FLOW VELOCITY(FEET/SEC.) = 2.49 DEPTH*VELOCITY(FT*FT/SEC) = 1.00
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 102.00 = 1135.00 FEET.

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FLOW PROCESS FROM NODE 102.00 TO NODE 103.00 IS CODE = 31
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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 1183.45 DOWNSTREAM(FEET) = 1180.10
FLOW LENGTH(FEET) = 400.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.88
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 10.67
PIPE TRAVEL TIME(MIN.) = 0.97 Tc(MIN.) = 16.02
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 103.00 = 1535.00 FEET.

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*****
FLOW PROCESS FROM NODE 103.00 TO NODE 103.00 IS CODE = 81
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>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
MAINLINE Tc(MIN.) = 16.02
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.761
SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/   SCS SOIL   AREA   Fp       Ap   SCS
  LAND USE           GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL           B       1.40   0.42   0.100  76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 1.40 SUBAREA RUNOFF(CFS) = 3.43
EFFECTIVE AREA(ACRES) = 5.60 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 5.6 PEAK FLOW RATE(CFS) = 13.70

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*****
FLOW PROCESS FROM NODE 103.00 TO NODE 104.00 IS CODE = 31
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>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 1180.10 DOWNSTREAM(FEET) = 1179.68
FLOW LENGTH(FEET) = 50.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 21.0 INCH PIPE IS 15.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 7.21
ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 13.70
PIPE TRAVEL TIME(MIN.) = 0.12 Tc(MIN.) = 16.13
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 104.00 = 1585.00 FEET.

```

 FLOW PROCESS FROM NODE 104.00 TO NODE 104.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 16.13
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.749
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	B	0.10	0.42	0.100	76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.24
 EFFECTIVE AREA(ACRES) = 5.70 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 5.7 PEAK FLOW RATE(CFS) = 13.89

 FLOW PROCESS FROM NODE 104.00 TO NODE 105.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1179.68 DOWNSTREAM(FEET) = 1175.90
 FLOW LENGTH(FEET) = 451.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 15.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.22
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 13.89
 PIPE TRAVEL TIME(MIN.) = 1.04 Tc(MIN.) = 17.17
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 105.00 = 2036.00 FEET.

 FLOW PROCESS FROM NODE 105.00 TO NODE 105.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 17.17
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 2.648
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	B	0.40	0.42	0.100	76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.40 SUBAREA RUNOFF(CFS) = 0.94
 EFFECTIVE AREA(ACRES) = 6.10 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 6.1 PEAK FLOW RATE(CFS) = 14.30

 FLOW PROCESS FROM NODE 105.00 TO NODE 203.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1175.90 DOWNSTREAM(FEET) = 1175.60
 FLOW LENGTH(FEET) = 36.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 21.0 INCH PIPE IS 16.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.22
 ESTIMATED PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 14.30
 PIPE TRAVEL TIME(MIN.) = 0.08 Tc(MIN.) = 17.26
 LONGEST FLOWPATH FROM NODE 100.00 TO NODE 203.00 = 2072.00 FEET.

 FLOW PROCESS FROM NODE 203.00 TO NODE 203.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 17.26
 RAINFALL INTENSITY(INCH/HR) = 2.64
 AREA-AVERAGED Fm(INCH/HR) = 0.04
 AREA-AVERAGED Fp(INCH/HR) = 0.42

AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 6.10
TOTAL STREAM AREA(ACRES) = 6.10
PEAK FLOW RATE(CFS) AT CONFLUENCE = 14.30

FLOW PROCESS FROM NODE 200.00 TO NODE 201.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 747.00
ELEVATION DATA: UPSTREAM(FEET) = 1195.31 DOWNSTREAM(FEET) = 1187.77

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 10.750
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.507
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL B 5.00 0.42 0.100 76 10.75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 15.59
TOTAL AREA(ACRES) = 5.00 PEAK FLOW RATE(CFS) = 15.59

FLOW PROCESS FROM NODE 201.00 TO NODE 202.00 IS CODE = 91

>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<

=====

UPSTREAM NODE ELEVATION(FEET) = 1187.77
DOWNSTREAM NODE ELEVATION(FEET) = 1184.43
CHANNEL LENGTH THRU SUBAREA(FEET) = 390.00
"V" GUTTER WIDTH(FEET) = 3.00 GUTTER HIKE(FEET) = 0.125
PAVEMENT LIP(FEET) = 0.020 MANNING'S N = .0150
PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
MAXIMUM DEPTH(FEET) = 1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.166
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL B 5.75 0.42 0.100 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 23.67
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 3.25
AVERAGE FLOW DEPTH(FEET) = 0.49 FLOOD WIDTH(FEET) = 37.65
"V" GUTTER FLOW TRAVEL TIME(MIN.) = 2.00 Tc(MIN.) = 12.75
SUBAREA AREA(ACRES) = 5.75 SUBAREA RUNOFF(CFS) = 16.16
EFFECTIVE AREA(ACRES) = 10.75 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 10.8 PEAK FLOW RATE(CFS) = 30.22

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) = 0.53 FLOOD WIDTH(FEET) = 41.49
FLOW VELOCITY(FEET/SEC.) = 3.43 DEPTH*VELOCITY(FT*FT/SEC) = 1.82
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 202.00 = 1137.00 FEET.

FLOW PROCESS FROM NODE 202.00 TO NODE 203.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1178.09 DOWNSTREAM(FEET) = 1175.60
FLOW LENGTH(FEET) = 240.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 27.0 INCH PIPE IS 20.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 9.50
ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 30.22
PIPE TRAVEL TIME(MIN.) = 0.42 Tc(MIN.) = 13.17
LONGEST FLOWPATH FROM NODE 200.00 TO NODE 203.00 = 1377.00 FEET.

FLOW PROCESS FROM NODE 203.00 TO NODE 203.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 13.17
RAINFALL INTENSITY(INCH/HR) = 3.10
AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 10.75
TOTAL STREAM AREA(ACRES) = 10.75
PEAK FLOW RATE(CFS) AT CONFLUENCE = 30.22

** CONFLUENCE DATA **

Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

Table with 8 columns: STREAM NUMBER, Q (CFS), Tc (MIN.), Intensity (INCH/HR), Fp(Fm) (INCH/HR), Ap, Ae (ACRES), HEADWATER NODE. Rows 1 and 2.

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 43.09 Tc(MIN.) = 13.17
EFFECTIVE AREA(ACRES) = 15.41 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 16.9
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 203.00 = 2072.00 FEET.

FLOW PROCESS FROM NODE 203.00 TO NODE 204.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1175.60 DOWNSTREAM(FEET) = 1172.04
FLOW LENGTH(FEET) = 18.00 MANNING'S N = 0.012
DEPTH OF FLOW IN 18.0 INCH PIPE IS 13.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 31.48
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 43.09
PIPE TRAVEL TIME(MIN.) = 0.01 Tc(MIN.) = 13.18
LONGEST FLOWPATH FROM NODE 100.00 TO NODE 204.00 = 2090.00 FEET.

FLOW PROCESS FROM NODE 204.00 TO NODE 204.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 13.18
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.103
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
COMMERCIAL B 0.05 0.42 0.100 76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.42
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.05 SUBAREA RUNOFF(CFS) = 0.14
EFFECTIVE AREA(ACRES) = 15.46 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 16.9 PEAK FLOW RATE(CFS) = 43.09
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 16.9 TC(MIN.) = 13.18
EFFECTIVE AREA(ACRES) = 15.46 AREA-AVERAGED Fm(INCH/HR) = 0.04
AREA-AVERAGED Fp(INCH/HR) = 0.42 AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS) = 43.09

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	100P HEADWATER NODE
1	43.09	13.18	3.103	0.42(0.04)	0.10	15.5	200.00
2	39.94	17.27	2.639	0.42(0.04)	0.10	16.9	100.00

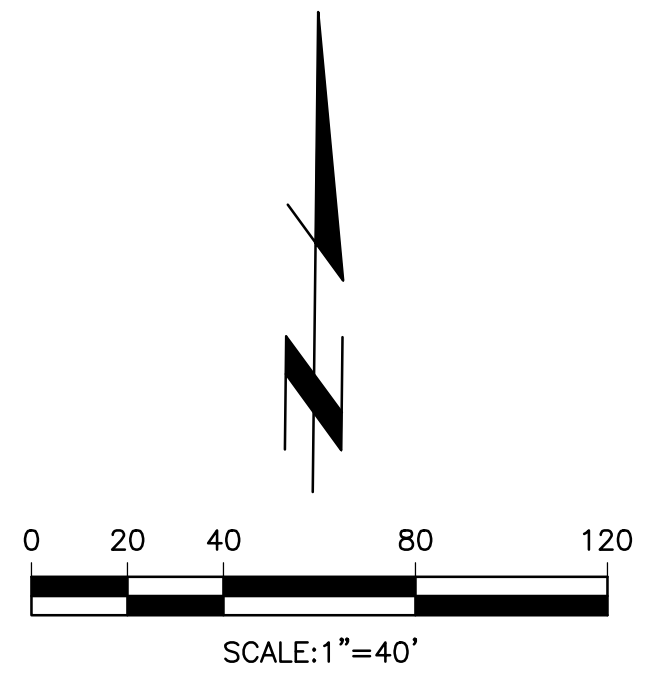
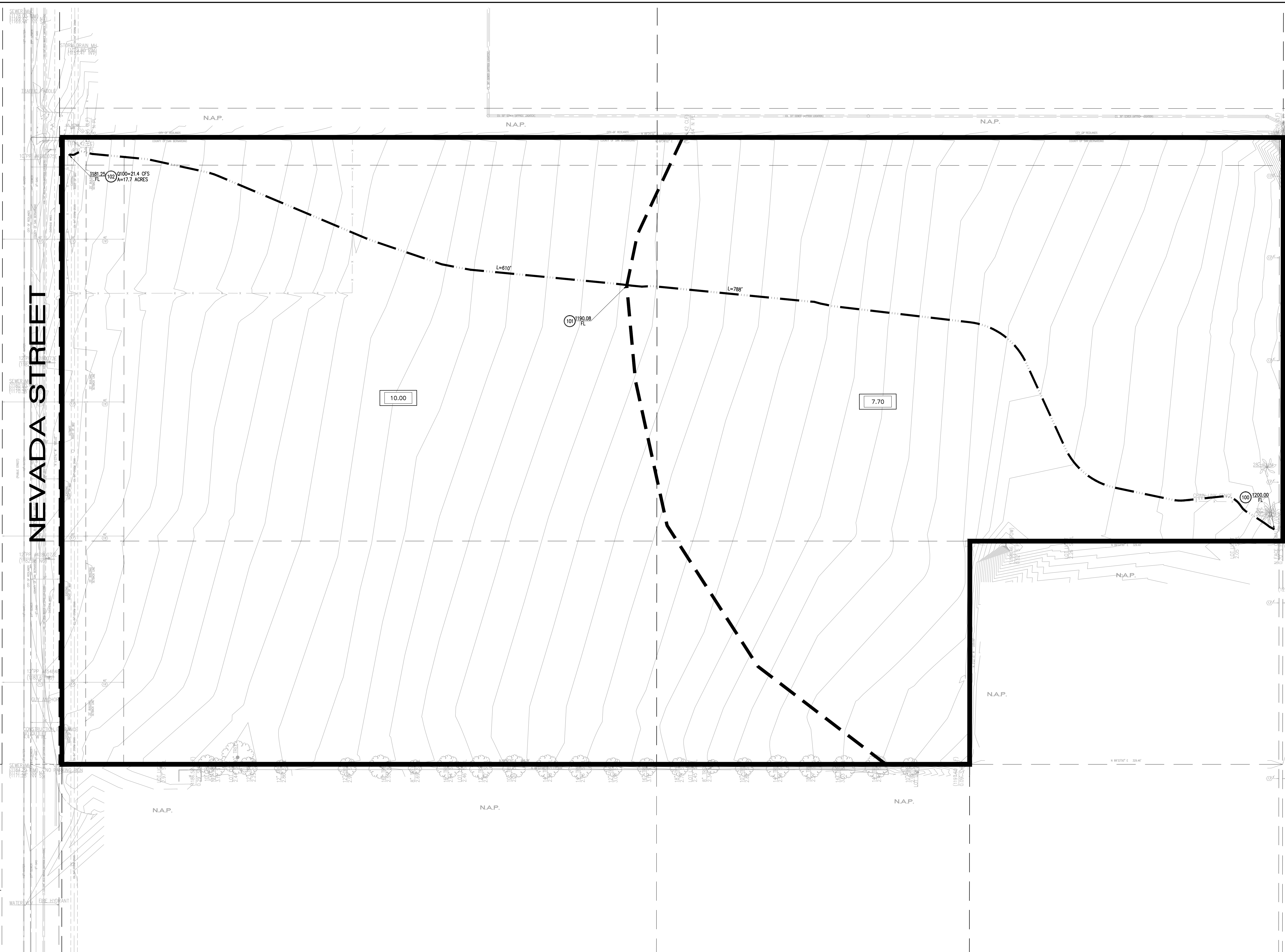
=====
 END OF RATIONAL METHOD ANALYSIS

↑

APPENDIX F

HYDROLOGY MAP

NEVADA STREET



LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SUBAREA AREA
	NODE NUMBER

COUNTY OF SAN BERNARDINO
 PUBLIC WORKS DEPARTMENT
EXISTING CONDITION HYDROLOGY
 NEVADA STREET INDUSTRIAL DEVELOPMENT
 NEVADA STREET
 LDC INDUSTRIAL REALTY LLC

PREPARED FOR:
LDC INDUSTRIAL REALTY LLC
 555 N. EL CAMINO REAL, SUITE 145B
 SAN CLEMENTE, CA 92672
 PHONE: (949) 226-4601

T*e*i *Thienes Engineering, Inc.*
 CIVIL ENGINEERING • LAND SURVEYING
 14146 FIRESTONE BOULEVARD
 LA MIRADA, CALIFORNIA 90638
 PH: (714) 521-4811 FAX: (714) 521-4133

Designed by _____	Approved by _____	Date _____
Checked by _____	Public Works Director _____	R.C.E. XXXXX
Designed by _____		
Checked by _____		
Date _____	Sheet 1 of 1	Sheets

JUN 4013

NEVADA STREET

BUILDING AREA

58 DOCK DOORS

5.75 AC

5.00 AC

0.95 AC

1.40 AC

3.25 AC

0.40 AC

0.10 AC

0.05 AC

0.80 AC

Q100=43.1 CFS
A=6.9 ACRES

203 1175.60 INV

1175.90 INV (105)

1184.43 FL
1178.09 INV (202)

20 1187.77 FL

200 1182.10 FL

100 1182.10 FL

1179.66 INV (104)

1180.10 INV (103)

1188.49 FL
1183.45 INV (102)

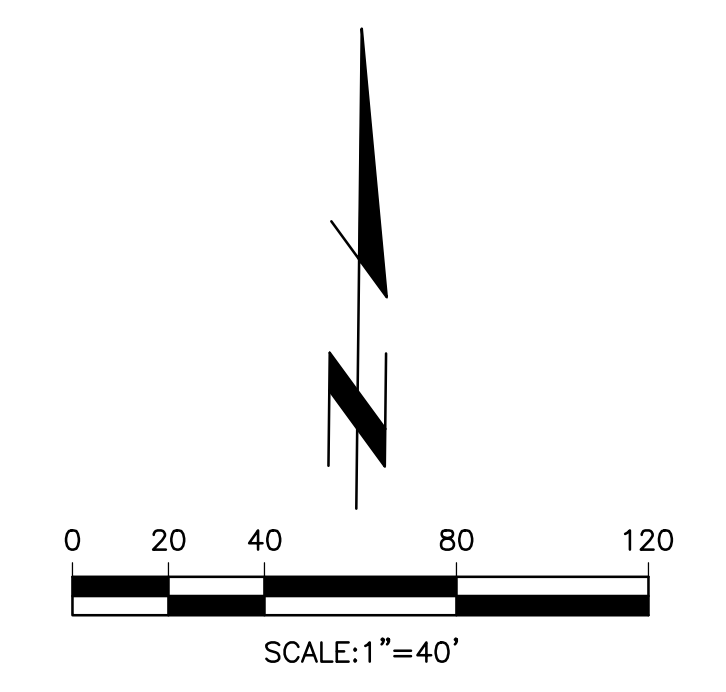
1192.07 FL (101)

L=290'

L=747'

L=605'

L=530'



LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SUBAREA AREA
	NODE NUMBER

COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT
PROPOSED CONDITION HYDROLOGY
NEVADA STREET INDUSTRIAL DEVELOPMENT
NEVADA STREET
LDC INDUSTRIAL REALTY LLC

PREPARED FOR:
LDC INDUSTRIAL REALTY LLC
555 N. EL CAMINO REAL, SUITE 1456
SAN CLEMENTE, CA 92672
PHONE: (949) 226-4601

TEI Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14146 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH: (714) 521-4811 FAX: (714) 521-4133

Designed by _____	Approved by _____	Date _____
Checked by _____	Public Works Director _____	R.C.E. XXXXX
Designed by _____		
Date _____		
Checked by _____		
Date _____		
Sheet 1 of 1 Sheets		

JN 4013