PRELIMINARY HYDROLOGY CALCULATIONS

FOR

ALLIANCE CALIFORNIA
GATEWAY SOUTH BUILDING 3
ORANGE SHOW ROAD
SAN BERNARDINO, CALIFORNIA

PREPARED FOR

HILLWOOD INVESTMENTS
301 VIA PIEMONTE, SUITE 175
ONTARIO CA 91764
(909) 382-0033

SEPTEMBER 26, 2013

JOB NO. 3158

PREPARED BY

THIENES ENGINEERING
14349 FIRESTONE BLVD.
LA MIRADA, CALIFORNIA 90638
(714) 521-4811

PRELIMINARY HYDROLOGY CALCULATIONS

FOR

ALLIANCE CALIFORNIA GATEWAY SOUTH BUILDING 3

PREPARED BY BRIAN WEIL
UNDER THE SUPERVISION OF

REINHARD STENZEL DATE:
R.C.E. 56155
EXP. 12/31/14

INTRODUCTION

A: PROJECT LOCATION

The project site is located on the south side of Orange Show Road between Waterman Avenue and Tippecanoe Avenue in the city of San Bernardino, California. Please see following page for vicinity map.

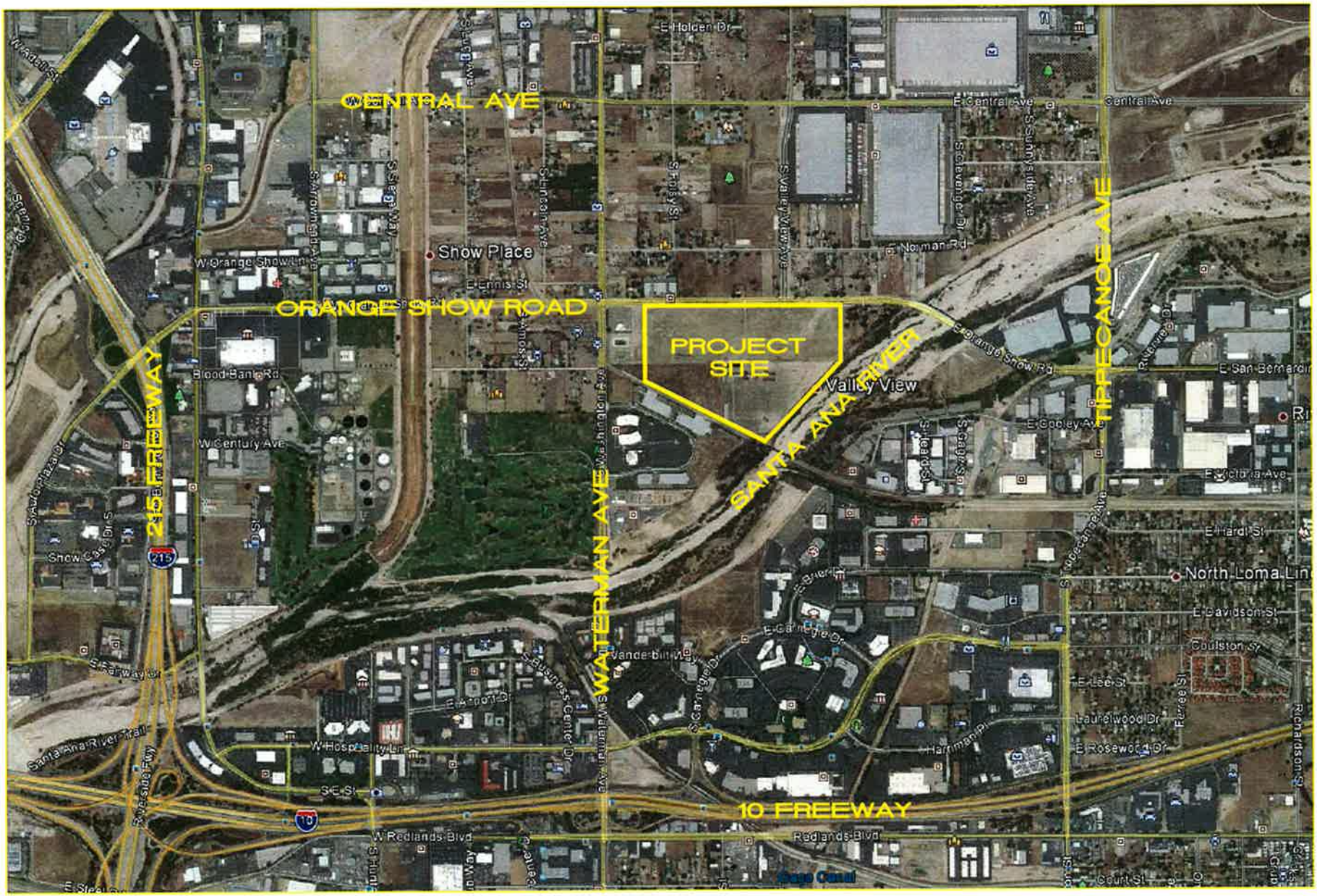
B: STUDY PURPOSE

The purpose of this study is to determine the 100-year peak flow rate from the site that will ultimately drain to the Santa Ana River via a proposed public storm drain in Orange Show Road.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel
Brian Weil



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VICINITY MAP

FOR

ALLIANCE CALIFORNIA
GATEWAY SOUTH BUILDING 3
ORANGE SHOW ROAD

NOT TO SCALE

DISCUSSION

The proposed project site encompasses approximately 56.7 acres. Proposed improvements to the site consist of the construction of a single commercial type building of approximately 1,100,000 square feet. Truck yards will be located north and south of the building, whereas vehicle parking lots will be to the east and west. The open area along the southerly property line will remain undeveloped. The remainder of the site will be reserved for landscaping.

Existing Condition:

The project site is currently an undeveloped dirt lot.

The majority of the site (Nodes 100-112) surface drains westerly towards Waterman Avenue. The 100-year existing condition peak flow rate for this area is approximately 79.9 cfs.

The south-easterly portion of the site (Nodes 200-201) surface drains southerly to the Santa Ana River. The 100-year existing condition peak flow rate for this area is approximately 14.9 cfs.

Please see Appendix "B" for existing condition hydrology calculations and Appendix "E" for existing condition hydrology map.

Proposed Condition:

The project site is part of a recent update to the City of San Bernardino's Master Plan of Drainage. The site is tabled to a proposed Master Plan storm drain in Orange Show Road. The storm drain continues westerly to Twin Creek which drains south to confluence with the Santa Ana River. The Master Plan of Drainage considers the project site as commercial development for the 100-year event. See Appendix "A" for Master Plan of Drainage hydrology map depicting the project site.

Runoff from the south half of the building, the southerly truck yard, the easterly vehicle parking lot, and the southerly open area (Nodes 100-127) drains to catch basins in the truck yard and the parking lot. It is conveyed westerly to the proposed detention basin via a proposed on-site storm drain. The 100-year proposed condition peak flow rate for this area is approximately 68.8 cfs.

Runoff from the north half of the building, the northerly truck yard, and the westerly vehicle parking lot (Nodes 130-136) drain to catch basins in the truck yard and the parking lot. It is then conveyed westerly via a proposed on-site storm drain to the same

proposed detention basin. The 100-year proposed condition peak flow rate for this area is approximately 53.2 cfs.

All runoff ultimately drains to the public storm drain system in Orange Show Road. The total 100-year peak flow rate for the project site is approximately 122.6 cfs. Until the public storm drain is constructed, runoff will be stored onsite (see detention below).

Please see Appendix "C" for proposed condition hydrology calculations and Appendix "E" for proposed condition hydrology map.

Detention

As previously mentioned, the site is part of the City's Master Plan of Drainage for the proposed storm drain system in Orange Show Road. Detention for the site would not be required once the Master Plan storm drain is constructed. Until then, a temporary detention basin is proposed for the project site adjacent to the westerly property line.

In addition to the detention basin, underground storage chambers are incorporated into the site for water quality purposes. Once the water quality volume is achieved, the remainder of runoff up to the 100-year event can be stored in the temporary detention basin. A unit hydrograph was established for the project site and area south of the site. The total volume of the 100-year storm is approximately 19.27 acre-feet.

The volume in the detention basin is approximately 18.1 acre-feet. An additional 4.15 acre-feet of storage available in the underground storage chambers for a total volume of 22.25 acre-feet. Overall, the entire 100-year 24-hour storm volume can be contained within the project site.

Methodology:

Hydrology calculations were computed using Advanced Engineering Software's (AES) Rational Method computer program for San Bernardino County. The hydrograph was generated using AES software's Flood program. The soil type is "A" for the majority of the project site and "B" for the westerly portion of the site per the San Bernardino Hydrology Manual. Please see Appendix "A" for reference material.

APPENDIX	DESCRIPTION
A	REFERENCE MATERIALS
B	EXISTING CONDITION HYDROLOGY CALCULATIONS
C	PROPOSED CONDITION HYDROLOGY CALCULATIONS
D	DETENTION ANALYSIS
E	HYDROLOGY MAPS

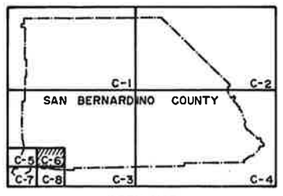
APPENDIX A

REFERENCE MATERIALS

SOURCE: GEOLOGY MAP

PROJECT SITE

SOURCE: GEOLOGY MAP
SOURCE: 1971 SCS SURVEY



INDEX MAP

LEGEND

SOIL GROUP BOUNDARY

A SOIL GROUP DESIGNATION

BOUNDARY OF INDICATED SOURCE

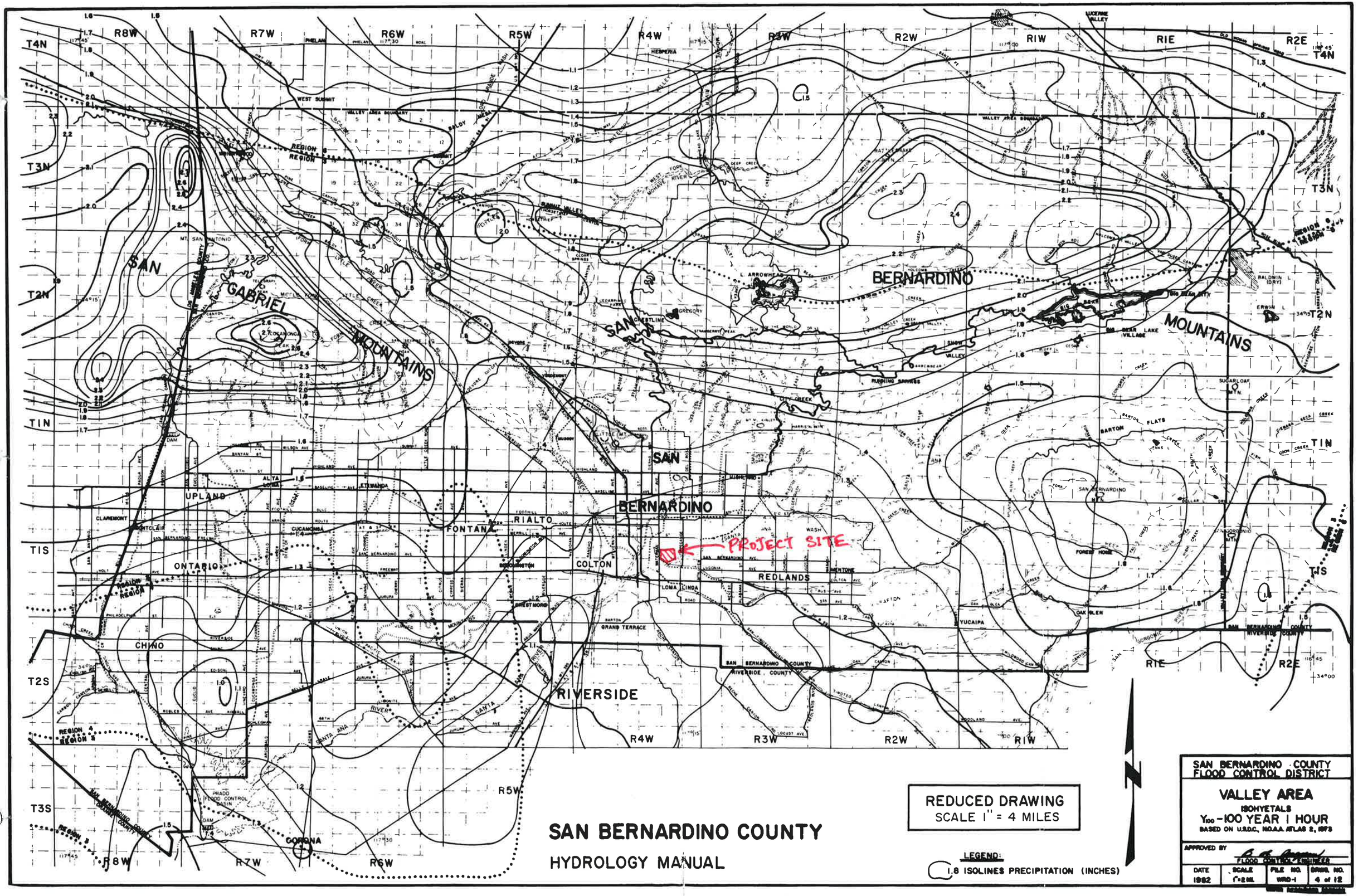
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
SCALE 1:48,000

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP FOR SOUTHWEST-B AREA

FIGURE C-14



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

REDUCED DRAWING
SCALE 1" = 4 MILES

LEGEND:
1.6 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

VALLEY AREA
ISOHYETALS
Y_{100} - 100 YEAR 1 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY _____ FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1"=2MI.	WRD-1	4 of 12

FIGURE B-4

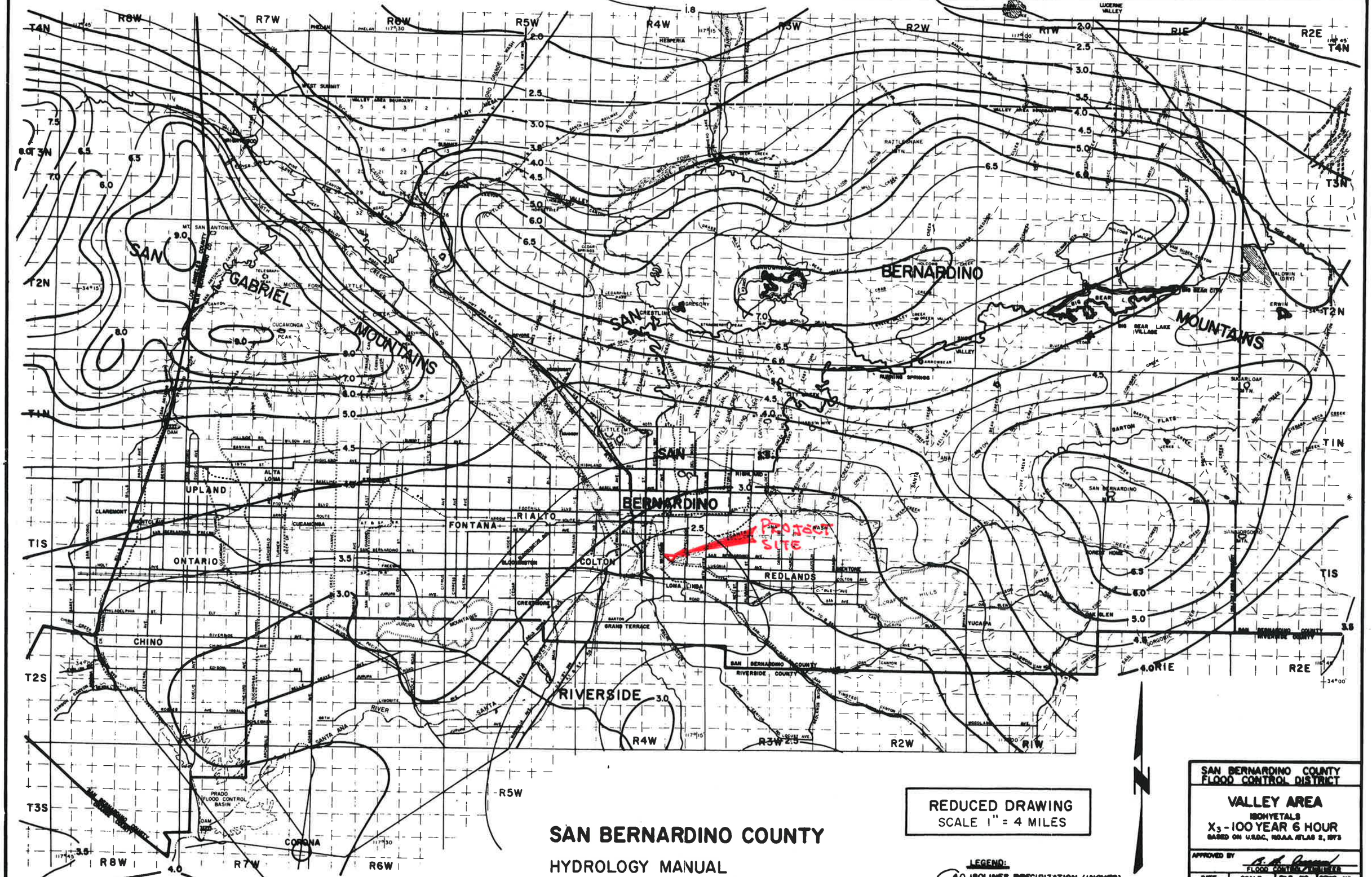
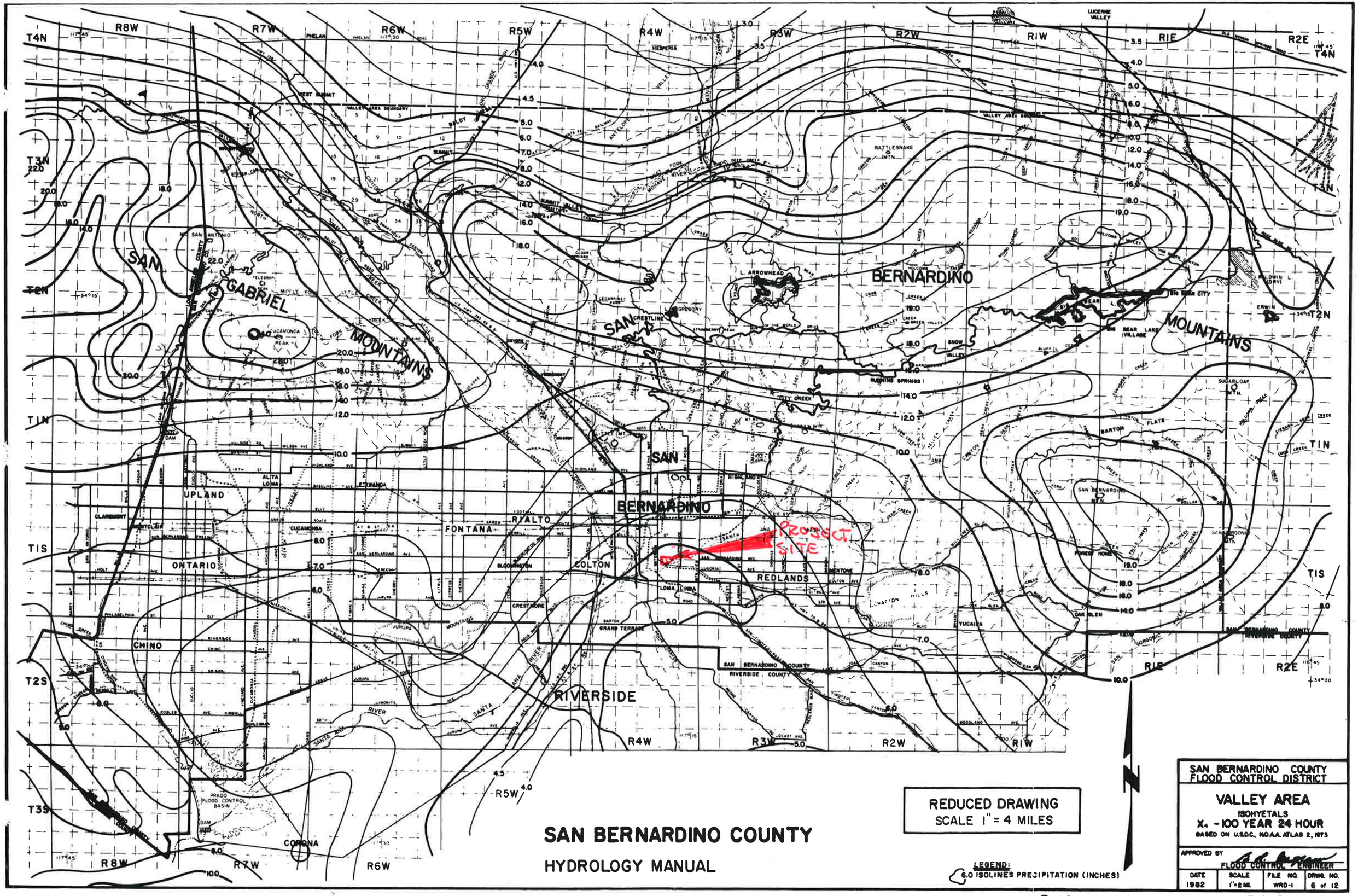

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL
REDUCED DRAWING
SCALE 1" = 4 MILES
LEGEND:
4.0 ISOLINES PRECIPITATION (INCHES)
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT
VALLEY AREA
ISOHYETALS
X3 - 100 YEAR 6 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973
APPROVED BY
FLOOD CONTROL ENGINEER
DATE 1982
SCALE 1"=2 MI.
FILE NO. WRD-1
DRWG. NO. 8 of 12
PROJECT SITE
SAN GABRIEL MOUNTAINS
SAN BERNARDINO MOUNTAINS
SAN BERNARDINO
RIVERSIDE
UPLAND
ONTARIO
CHINO
FONTANA
RIALTO
COLTON
REDLANDS
CORONA
CRESTLINE
BIG BEAR LAKE VILLAGE
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
PRADO FLOOD CONTROL BASIN
T4N
T3N
T2N
T1N
T1S
T2S
T3S
R8W
R7W
R6W
R5W
R4W
R3W
R2W
R1W
R1E
R2E

FIGURE B-5



REDUCED DRAWING
SCALE 1" = 4 MILES

LEGEND:
6.0 ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

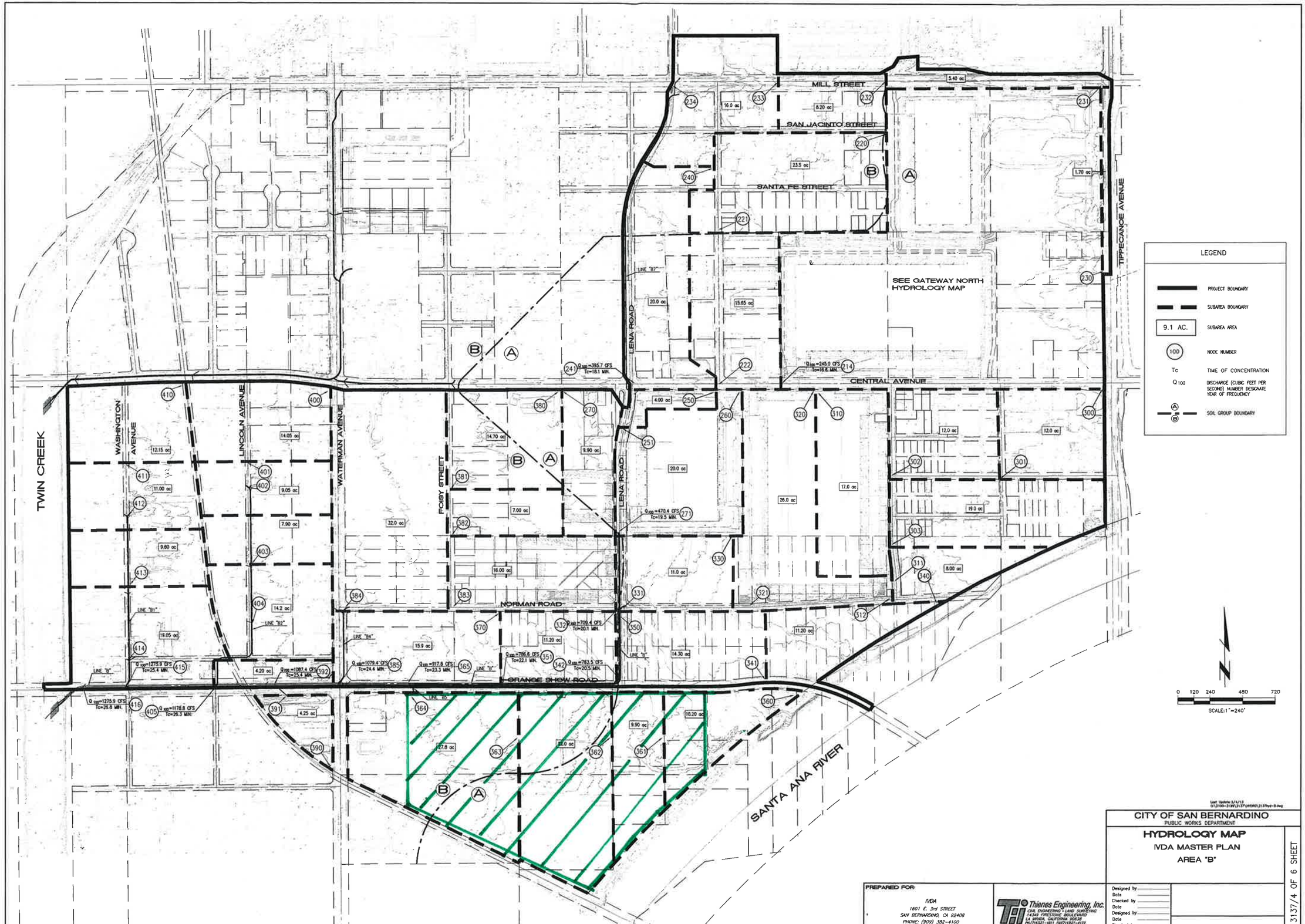
SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

VALLEY AREA
ISOHYETALS
X_4 - 100 YEAR 24 HOUR
BASED ON U.S.D.C., N.O.A.A. ATLAS 2, 1973

APPROVED BY _____
FLOOD CONTROL ENGINEER

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

FIGURE B-6



Last Update 2/6/13
D:\3100-3199\3137\HYDRO\3137hyd-B.dwg

CITY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

HYDROLOGY MAP
IVDA MASTER PLAN
AREA "B"

3137/4 OF 6 SHEET

PREPARED FOR:
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Designed by
Date
Checked by
Date
Designed by
Date
Checked by
Date

Sheet 4 of 6 Sheets

APPENDIX B

EXISTING CONDITION HYDROLOGY CALCULATIONS

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
         (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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            Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

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                          LA MIRADA CA 90638
                   PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* ORANGE SHOW ROAD                                                      *
* EXISTING HYDROLOGY                                                    *
* 100-YEAR EVENT                                                        *
 ************************************************************************

  FILE NAME: C:\XDRIVE\3158\3158AX.DAT
  TIME/DATE OF STUDY: 14:26 10/15/2012
========================================================================
  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) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  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) =   555.00
  ELEVATION DATA: UPSTREAM(FEET) =   1028.32  DOWNSTREAM(FEET) =   1025.92

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.530
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.510
  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 POOR COVER
  "OPEN BRUSH"                A        4.60      0.36       1.00    81   19.53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      8.89
  TOTAL AREA(ACRES) =      4.60   PEAK FLOW RATE(CFS) =      8.89
  ^
**************************************************************************
  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) =   1025.92  DOWNSTREAM(FEET) =   1020.06
  CHANNEL LENGTH THRU SUBAREA(FEET) =   495.00   CHANNEL SLOPE =  0.0118
  CHANNEL FLOW THRU SUBAREA(CFS) =      8.89
  FLOW VELOCITY(FEET/SEC) =   2.64 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.12   Tc(MIN.) =  22.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  1050.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN) =  22.65
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.296
```

```
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "OPEN BRUSH"                A        6.15      0.36       1.00    81
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    6.15      SUBAREA RUNOFF(CFS) =   10.71
 EFFECTIVE AREA(ACRES) =    10.75   AREA-AVERAGED Fm(INCH/HR) =  0.36
 AREA-AVERAGED Fp(INCH/HR) =  0.36  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =    10.75       PEAK FLOW RATE(CFS) =      18.71

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1020.06  DOWNSTREAM(FEET) =   1016.53
 CHANNEL LENGTH THRU SUBAREA(FEET) =   452.00   CHANNEL SLOPE =  0.0078
 CHANNEL FLOW THRU SUBAREA(CFS) =     18.71
 FLOW VELOCITY(FEET/SEC) =   2.60 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   2.90   Tc(MIN.) =  25.55
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =  1502.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  25.55
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.136
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "OPEN BRUSH"                A        6.50      0.36       1.00    81
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    6.50      SUBAREA RUNOFF(CFS) =   10.38
 EFFECTIVE AREA(ACRES) =    17.25   AREA-AVERAGED Fm(INCH/HR) =  0.36
 AREA-AVERAGED Fp(INCH/HR) =  0.36  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =    17.25       PEAK FLOW RATE(CFS) =      27.55

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1016.53  DOWNSTREAM(FEET) =   1014.69
 CHANNEL LENGTH THRU SUBAREA(FEET) =   432.00   CHANNEL SLOPE =  0.0043
 CHANNEL FLOW THRU SUBAREA(CFS) =     27.55
 FLOW VELOCITY(FEET/SEC) =   2.13 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   3.37   Tc(MIN.) =  28.92
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  1934.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  28.92
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "OPEN BRUSH"                A        2.90      0.36       1.00    81
 NATURAL POOR COVER
 "OPEN BRUSH"                B        2.90      0.16       1.00    92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.26
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    5.80      SUBAREA RUNOFF(CFS) =    8.99
 EFFECTIVE AREA(ACRES) =    23.05   AREA-AVERAGED Fm(INCH/HR) =  0.34
 AREA-AVERAGED Fp(INCH/HR) =  0.34  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =    23.05       PEAK FLOW RATE(CFS) =      34.16

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  52
```

```
--------------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
================================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1014.69  DOWNSTREAM(FEET) =   1013.82
 CHANNEL LENGTH THRU SUBAREA(FEET) =   139.00   CHANNEL SLOPE =  0.0063
 CHANNEL FLOW THRU SUBAREA(CFS) =     34.16
 FLOW VELOCITY(FEET/SEC) =   2.75 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.84   Tc(MIN.) =  29.77
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =  2073.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
--------------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
 MAINLINE Tc(MIN) =  29.77
 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.949
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL POOR COVER
 "OPEN BRUSH"                 B        8.10      0.16       1.00    92
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.16
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =    8.10      SUBAREA RUNOFF(CFS) =   13.04
 EFFECTIVE AREA(ACRES) =    31.15   AREA-AVERAGED Fm(INCH/HR) =  0.29
 AREA-AVERAGED Fp(INCH/HR) =  0.29  AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =    31.15       PEAK FLOW RATE(CFS) =      46.50
================================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     31.15  TC(MIN.) =     29.77
 EFFECTIVE AREA(ACRES) =     31.15  AREA-AVERAGED Fm(INCH/HR)=  0.29
 AREA-AVERAGED Fp(INCH/HR) =  0.29  AREA-AVERAGED Ap =  1.00
 PEAK FLOW RATE(CFS)    =     46.50
================================================================================
================================================================================
 END OF RATIONAL METHOD ANALYSIS

1
```

```
**************************************************************************
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            Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

                          THIENES ENGINEERING
                        16800 VALLEY VIEW AVENUE
                           LA MIRADA CA 90638
                    PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* ORANGE SHOW ROAD                                                        *
* EXISTING HYDROLOGY                                                      *
* 100-YEAR EVENT                                                          *
 **************************************************************************

  FILE NAME: C:\XDRIVE\3158\3158BX.DAT
  TIME/DATE OF STUDY: 14:30 10/15/2012
==========================================================================
  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) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   794.00
  ELEVATION DATA: UPSTREAM(FEET) =   1024.00  DOWNSTREAM(FEET) =   1016.84

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   19.457
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.516
  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 POOR COVER
  "OPEN BRUSH"                A        7.00      0.36       1.00    81   19.46
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =     13.57
  TOTAL AREA(ACRES) =      7.00   PEAK FLOW RATE(CFS) =     13.57

**************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  52
--------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1016.84  DOWNSTREAM(FEET) =   1012.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00   CHANNEL SLOPE =  0.0118
  CHANNEL FLOW THRU SUBAREA(CFS) =     13.57
  FLOW VELOCITY(FEET/SEC) =   2.94 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.33   Tc(MIN.) =  21.78
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =  1204.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
  MAINLINE Tc(MIN) =  21.78
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.351
```

SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
NATURAL POOR COVER "OPEN BRUSH"	A	5.60	0.36	1.00	81
NATURAL POOR COVER "OPEN BRUSH"	B	5.50	0.16	1.00	92

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.26
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.00
SUBAREA AREA(ACRES) = 11.10 SUBAREA RUNOFF(CFS) = 20.87
EFFECTIVE AREA(ACRES) = 18.10 AREA-AVERAGED Fm(INCH/HR) = 0.30
AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 1.00
TOTAL AREA(ACRES) = 18.10 PEAK FLOW RATE(CFS) = 33.40

==========

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 18.10 TC(MIN.) = 21.78
EFFECTIVE AREA(ACRES) = 18.10 AREA-AVERAGED Fm(INCH/HR)= 0.30
AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 1.00
PEAK FLOW RATE(CFS) = 33.40

==========

END OF RATIONAL METHOD ANALYSIS

1

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

                          THIENES ENGINEERING
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                          LA MIRADA CA 90638
                    PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* ORANGE SHOW ROAD                                                      *
* EXISTING HYDROLOGY                                                    *
* 100-YEAR EVENT                                                        *
 ************************************************************************

  FILE NAME: C:\XDRIVE\3158\3158CX.DAT
  TIME/DATE OF STUDY: 14:31 10/15/2012
========================================================================
  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) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  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) =   507.00
  ELEVATION DATA: UPSTREAM(FEET) =   1025.50  DOWNSTREAM(FEET) =   1023.19

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   18.640
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.581
  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 POOR COVER
  "OPEN BRUSH"                A        7.45      0.36       1.00    81   18.64
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.36
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =     14.88
  TOTAL AREA(ACRES) =      7.45   PEAK FLOW RATE(CFS) =     14.88
========================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =      7.45  TC(MIN.) =     18.64
  EFFECTIVE AREA(ACRES) =      7.45  AREA-AVERAGED Fm(INCH/HR)=  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.36  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     14.88
========================================================================
========================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX C

PROPOSED CONDITION HYDROLOGY CALCULATIONS

```
**************************************************************************
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                        Analysis prepared by:

                          THIENES ENGINEERING
                        16800 VALLEY VIEW AVENUE
                           LA MIRADA CA 90638
                    PH: (714) 521-4811 FAX: (714) 521-4173

 ************************** DESCRIPTION OF STUDY **************************
* ORANGE SHOW ROAD                                                        *
* PROPOSED CONDITION                                                      *
* 100-YEAR                                                                *
 **************************************************************************

  FILE NAME: C:\XDRIVE\3158\PR100.DAT
  TIME/DATE OF STUDY: 14:30 09/26/2013
==========================================================================
  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) = 1.2800

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*


**************************************************************************
  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) =   300.00
  ELEVATION DATA: UPSTREAM(FEET) =   1025.49  DOWNSTREAM(FEET) =   1022.60

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.533
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.446
  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                 A        1.70      0.80       0.10    52    7.53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      6.68
  TOTAL AREA(ACRES) =      1.70   PEAK FLOW RATE(CFS) =      6.68

**************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
--------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1018.60  DOWNSTREAM(FEET) =  1017.17
  FLOW LENGTH(FEET) =   285.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.99
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      6.68
  PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =   8.49
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   585.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  81
--------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==========================================================================
```

```
 MAINLINE Tc(MIN) =   8.49
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.139
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
    LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                A        1.50      0.80       0.10     52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.50      SUBAREA RUNOFF(CFS) =     5.48
 EFFECTIVE AREA(ACRES) =     3.20    AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.80   AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     3.20        PEAK FLOW RATE(CFS) =      11.69

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1017.17  DOWNSTREAM(FEET) =  1008.77
 FLOW LENGTH(FEET) =  1680.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.61
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     11.69
 PIPE TRAVEL TIME(MIN.) =   4.99    Tc(MIN.) =  13.48
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =  2265.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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.) =  13.48
 RAINFALL INTENSITY(INCH/HR) =   3.14
 AREA-AVERAGED Fm(INCH/HR) =  0.08
 AREA-AVERAGED Fp(INCH/HR) =  0.80
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =    3.20
 TOTAL STREAM AREA(ACRES) =    3.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.69

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   560.00
 ELEVATION DATA: UPSTREAM(FEET) =   1024.00  DOWNSTREAM(FEET) =   1020.00

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   23.840
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.227
 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 FAIR COVER
 "OPEN BRUSH"              A        4.60      0.61       1.00     66   23.84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.61
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA RUNOFF(CFS) =      6.68
 TOTAL AREA(ACRES) =      4.60   PEAK FLOW RATE(CFS) =      6.68

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1020.00  DOWNSTREAM(FEET) =   1015.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   310.00   CHANNEL SLOPE =  0.0145
 CHANNEL FLOW THRU SUBAREA(CFS) =      6.68
 FLOW VELOCITY(FEET/SEC) =   2.72 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.90   Tc(MIN.) =  25.74
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =   870.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  25.74
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.127
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "OPEN BRUSH"                 A        1.80      0.61       1.00    66
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.61
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =     1.80      SUBAREA RUNOFF(CFS) =     2.45
 EFFECTIVE AREA(ACRES) =     6.40    AREA-AVERAGED Fm(INCH/HR) =  0.61
 AREA-AVERAGED Fp(INCH/HR) =  0.61   AREA-AVERAGED Ap =  1.00
 TOTAL AREA(ACRES) =     6.40        PEAK FLOW RATE(CFS) =        8.71

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1011.50  DOWNSTREAM(FEET) =  1008.77
 FLOW LENGTH(FEET) =   195.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.94
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.71
 PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =  26.15
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    113.00 =  1065.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 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.) =  26.15
 RAINFALL INTENSITY(INCH/HR) =   2.11
 AREA-AVERAGED Fm(INCH/HR) =  0.61
 AREA-AVERAGED Fp(INCH/HR) =  0.61
 AREA-AVERAGED Ap =  1.00
 EFFECTIVE STREAM AREA(ACRES) =    6.40
 TOTAL STREAM AREA(ACRES) =    6.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.71

 ** CONFLUENCE DATA **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      11.69  13.48     3.135   0.80( 0.08) 0.10      3.2      100.00
     2       8.71  26.15     2.107   0.61( 0.61) 1.00      6.4      110.00

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

 ** PEAK FLOW RATE TABLE **
  STREAM      Q      Tc    Intensity   Fp(Fm)      Ap   Ae      HEADWATER
  NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
     1      19.28  13.48     3.135   0.63( 0.35) 0.56      6.5      100.00
     2      16.47  26.15     2.107   0.62( 0.44) 0.70      9.6      110.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     19.28    Tc(MIN.) =    13.48
 EFFECTIVE AREA(ACRES) =     6.50   AREA-AVERAGED Fm(INCH/HR) =  0.35
 AREA-AVERAGED Fp(INCH/HR) =  0.63  AREA-AVERAGED Ap =  0.56
 TOTAL AREA(ACRES) =      9.60
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    113.00 =  2265.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1008.77  DOWNSTREAM(FEET) =  1006.72
 FLOW LENGTH(FEET) =   410.00   MANNING'S N =  0.012
```

```
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.51
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.28
 PIPE TRAVEL TIME(MIN.) =   1.05    Tc(MIN.) =  14.53
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    127.00 =  2675.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 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.) =  14.53
 RAINFALL INTENSITY(INCH/HR) =   3.00
 AREA-AVERAGED Fm(INCH/HR) =  0.35
 AREA-AVERAGED Fp(INCH/HR) =  0.63
 AREA-AVERAGED Ap =  0.56
 EFFECTIVE STREAM AREA(ACRES) =    6.50
 TOTAL STREAM AREA(ACRES) =    9.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.28

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   520.00
 ELEVATION DATA: UPSTREAM(FEET) =   1023.87  DOWNSTREAM(FEET) =   1019.93

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.849
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.785
 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                  A        3.60      0.80       0.10     52    9.85
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =     12.01
 TOTAL AREA(ACRES) =      3.60   PEAK FLOW RATE(CFS) =     12.01

****************************************************************************
 FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1019.93
 DOWNSTREAM NODE ELEVATION(FEET) =   1018.43
 CHANNEL LENGTH THRU SUBAREA(FEET) =   310.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
 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) =  3.371
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  A        3.90      0.80       0.10     52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     17.79
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.47
 AVERAGE FLOW DEPTH(FEET) =   0.53   FLOOD WIDTH(FEET) =   37.27
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.10   Tc(MIN.) =  11.94
 SUBAREA AREA(ACRES) =    3.90       SUBAREA RUNOFF(CFS) =   11.55
 EFFECTIVE AREA(ACRES) =    7.50     AREA-AVERAGED Fm(INCH/HR) =   0.08
 AREA-AVERAGED Fp(INCH/HR) =   0.80  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =    7.50         PEAK FLOW RATE(CFS) =      22.22

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.57   FLOOD WIDTH(FEET) =   40.75
 FLOW VELOCITY(FEET/SEC.) =   2.59   DEPTH*VELOCITY(FT*FT/SEC) =   1.47
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =   830.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =   9
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1018.43
 DOWNSTREAM NODE ELEVATION(FEET) =   1016.88
 CHANNEL LENGTH THRU SUBAREA(FEET) =   310.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
 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) =  3.089
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  A        3.90      0.80       0.10    52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     27.50
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.75
 AVERAGE FLOW DEPTH(FEET) =   0.60   FLOOD WIDTH(FEET) =   44.08
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =  13.82
 SUBAREA AREA(ACRES) =    3.90       SUBAREA RUNOFF(CFS) =   10.56
 EFFECTIVE AREA(ACRES) =   11.40     AREA-AVERAGED Fm(INCH/HR) =   0.08
 AREA-AVERAGED Fp(INCH/HR) =   0.80  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   11.40         PEAK FLOW RATE(CFS) =      30.87

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.62   FLOOD WIDTH(FEET) =   46.14
 FLOW VELOCITY(FEET/SEC.) =   2.83   DEPTH*VELOCITY(FT*FT/SEC) =   1.76
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =  1140.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1016.88
 DOWNSTREAM NODE ELEVATION(FEET) =   1015.32
 CHANNEL LENGTH THRU SUBAREA(FEET) =   310.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
 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) =  2.873
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  A        3.90      0.80       0.10    52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     35.78
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.92
 AVERAGE FLOW DEPTH(FEET) =   0.65   FLOOD WIDTH(FEET) =   48.99
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.77   Tc(MIN.) =  15.59
 SUBAREA AREA(ACRES) =    3.90       SUBAREA RUNOFF(CFS) =    9.81
 EFFECTIVE AREA(ACRES) =   15.30     AREA-AVERAGED Fm(INCH/HR) =   0.08
 AREA-AVERAGED Fp(INCH/HR) =   0.80  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   15.30         PEAK FLOW RATE(CFS) =      38.47

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.66   FLOOD WIDTH(FEET) =   50.41
 FLOW VELOCITY(FEET/SEC.) =   2.96   DEPTH*VELOCITY(FT*FT/SEC) =   1.97
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    124.00 =  1450.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    125.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1015.32
 DOWNSTREAM NODE ELEVATION(FEET) =   1013.76
 CHANNEL LENGTH THRU SUBAREA(FEET) =   315.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
 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) =  2.698
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        3.90      0.45       0.10    76
```

```
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     43.12
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.04
 AVERAGE FLOW DEPTH(FEET) =   0.69   FLOOD WIDTH(FEET) =   52.79
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.73   Tc(MIN.) =  17.32
 SUBAREA AREA(ACRES) =    3.90       SUBAREA RUNOFF(CFS) =    9.31
 EFFECTIVE AREA(ACRES) =   19.20     AREA-AVERAGED Fm(INCH/HR) =   0.07
 AREA-AVERAGED Fp(INCH/HR) =   0.73  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   19.20         PEAK FLOW RATE(CFS) =      45.36

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.70   FLOOD WIDTH(FEET) =   53.89
 FLOW VELOCITY(FEET/SEC.) =   3.07   DEPTH*VELOCITY(FT*FT/SEC) =   2.14
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    125.00 =  1765.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    125.00 TO NODE    126.00 IS CODE =   9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =   1013.76
 DOWNSTREAM NODE ELEVATION(FEET) =   1011.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   255.00
 "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
 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) =  2.600
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  B        2.90      0.45        0.10    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     48.69
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.90
 AVERAGE FLOW DEPTH(FEET) =   0.65   FLOOD WIDTH(FEET) =   49.46
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.09   Tc(MIN.) =  18.41
 SUBAREA AREA(ACRES) =    2.90       SUBAREA RUNOFF(CFS) =    6.67
 EFFECTIVE AREA(ACRES) =   22.10     AREA-AVERAGED Fm(INCH/HR) =   0.07
 AREA-AVERAGED Fp(INCH/HR) =   0.69  AREA-AVERAGED Ap =   0.10
 TOTAL AREA(ACRES) =   22.10         PEAK FLOW RATE(CFS) =      50.35

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.66   FLOOD WIDTH(FEET) =   50.09
 FLOW VELOCITY(FEET/SEC.) =   3.93   DEPTH*VELOCITY(FT*FT/SEC) =   2.59
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    126.00 =  2020.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    127.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1007.50  DOWNSTREAM(FEET) =  1006.72
 FLOW LENGTH(FEET) =    20.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  17.96
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     50.35
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  18.43
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    127.00 =  2040.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    127.00 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.) =  18.43
 RAINFALL INTENSITY(INCH/HR) =   2.60
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.69
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =   22.10
 TOTAL STREAM AREA(ACRES) =   22.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     50.35
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** CONFLUENCE DATA **
 STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
    1      19.28  14.53     2.997   0.63( 0.35) 0.56      6.5      100.00
    1      16.47  27.26     2.055   0.62( 0.44) 0.70      9.6      110.00
    2      50.35  18.43     2.599   0.69( 0.07) 0.10     22.1      120.00

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

 ** PEAK FLOW RATE TABLE **
 STREAM      Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER    (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)     NODE
    1      65.23  14.53     2.997   0.65( 0.15) 0.22     23.9      100.00
    2      55.99  27.26     2.055   0.64( 0.18) 0.28     31.7      110.00
    3      68.77  18.43     2.599   0.65( 0.15) 0.23     29.5      120.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     68.77    Tc(MIN.) =    18.43
 EFFECTIVE AREA(ACRES) =    29.55   AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.65  AREA-AVERAGED Ap =  0.23
 TOTAL AREA(ACRES) =     31.70
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    127.00 =  2675.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    127.00 TO NODE    128.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1006.72  DOWNSTREAM(FEET) =  1000.90
 FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  23.37
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     68.77
 PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =  18.49
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =  2765.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    138.00 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.) =  18.49
 RAINFALL INTENSITY(INCH/HR) =   2.59
 AREA-AVERAGED Fm(INCH/HR) =  0.15
 AREA-AVERAGED Fp(INCH/HR) =  0.65
 AREA-AVERAGED Ap =  0.23
 EFFECTIVE STREAM AREA(ACRES) =   29.55
 TOTAL STREAM AREA(ACRES) =   31.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     68.77

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   725.00
 ELEVATION DATA: UPSTREAM(FEET) =   1030.00  DOWNSTREAM(FEET) =   1019.74

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.928
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.767
 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                 A        4.60      0.80       0.10     52    9.93
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA RUNOFF(CFS) =     15.27
 TOTAL AREA(ACRES) =      4.60   PEAK FLOW RATE(CFS) =     15.27

****************************************************************************
 FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =   9
----------------------------------------------------------------------------
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>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
 UPSTREAM NODE ELEVATION(FEET) =    1019.74
 DOWNSTREAM NODE ELEVATION(FEET) =    1018.19
 CHANNEL LENGTH THRU SUBAREA(FEET) =    310.00
 "V" GUTTER WIDTH(FEET) =    3.00    GUTTER HIKE(FEET) =  0.170
 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) =  3.376
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A         3.70      0.80       0.10     52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      20.77
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    2.59
 AVERAGE FLOW DEPTH(FEET) =    0.55    FLOOD WIDTH(FEET) =    39.33
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =    1.99    Tc(MIN.) =   11.92
 SUBAREA AREA(ACRES) =     3.70        SUBAREA RUNOFF(CFS) =    10.98
 EFFECTIVE AREA(ACRES) =     8.30      AREA-AVERAGED Fm(INCH/HR) =    0.08
 AREA-AVERAGED Fp(INCH/HR) =    0.80  AREA-AVERAGED Ap =    0.10
 TOTAL AREA(ACRES) =     8.30          PEAK FLOW RATE(CFS) =       24.62

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.58    FLOOD WIDTH(FEET) =    42.18
 FLOW VELOCITY(FEET/SEC.) =    2.69    DEPTH*VELOCITY(FT*FT/SEC) =    1.56
 LONGEST FLOWPATH FROM NODE     130.00 TO NODE     132.00 =  1035.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     132.00 TO NODE     133.00 IS CODE =    9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =    1018.19
 DOWNSTREAM NODE ELEVATION(FEET) =    1015.58
 CHANNEL LENGTH THRU SUBAREA(FEET) =    350.00
 "V" GUTTER WIDTH(FEET) =    3.00    GUTTER HIKE(FEET) =  0.170
 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) =  3.104
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A         3.70      0.80       0.10     52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      29.66
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    3.26
 AVERAGE FLOW DEPTH(FEET) =    0.58    FLOOD WIDTH(FEET) =    42.02
 "V" GUTTER FLOW TRAVEL TIME(MIN.) =    1.79    Tc(MIN.) =   13.71
 SUBAREA AREA(ACRES) =     3.70        SUBAREA RUNOFF(CFS) =    10.07
 EFFECTIVE AREA(ACRES) =    12.00      AREA-AVERAGED Fm(INCH/HR) =    0.08
 AREA-AVERAGED Fp(INCH/HR) =    0.80  AREA-AVERAGED Ap =    0.10
 TOTAL AREA(ACRES) =    12.00          PEAK FLOW RATE(CFS) =       32.66

 END OF SUBAREA "V" GUTTER HYDRAULICS:
 DEPTH(FEET) =  0.60    FLOOD WIDTH(FEET) =    43.60
 FLOW VELOCITY(FEET/SEC.) =    3.34    DEPTH*VELOCITY(FT*FT/SEC) =    1.99
 LONGEST FLOWPATH FROM NODE     130.00 TO NODE     133.00 =  1385.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     133.00 TO NODE     134.00 IS CODE =    9
----------------------------------------------------------------------------
 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
 UPSTREAM NODE ELEVATION(FEET) =    1015.58
 DOWNSTREAM NODE ELEVATION(FEET) =    1013.70
 CHANNEL LENGTH THRU SUBAREA(FEET) =    325.00
 "V" GUTTER WIDTH(FEET) =    3.00    GUTTER HIKE(FEET) =  0.170
 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) =  2.889
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 A         3.80      0.80       0.10     52
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SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.80
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     37.47
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.11
AVERAGE FLOW DEPTH(FEET) =   0.64   FLOOD WIDTH(FEET) =   48.51
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.74   Tc(MIN.) =  15.45
SUBAREA AREA(ACRES) =    3.80       SUBAREA RUNOFF(CFS) =    9.61
EFFECTIVE AREA(ACRES) =   15.80     AREA-AVERAGED Fm(INCH/HR) =   0.08
AREA-AVERAGED Fp(INCH/HR) =   0.80  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =   15.80         PEAK FLOW RATE(CFS) =      39.95

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.66   FLOOD WIDTH(FEET) =   49.78
FLOW VELOCITY(FEET/SEC.) =   3.16   DEPTH*VELOCITY(FT*FT/SEC) =   2.07
LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =  1710.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    134.00 TO NODE    135.00 IS CODE =   9
----------------------------------------------------------------------------
>>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
UPSTREAM NODE ELEVATION(FEET) =   1013.70
DOWNSTREAM NODE ELEVATION(FEET) =   1012.46
CHANNEL LENGTH THRU SUBAREA(FEET) =   245.00
"V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.170
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) =  2.751
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B        5.35      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     46.46
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.11
AVERAGE FLOW DEPTH(FEET) =   0.70   FLOOD WIDTH(FEET) =   54.21
"V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.31   Tc(MIN.) =  16.76
SUBAREA AREA(ACRES) =    5.35       SUBAREA RUNOFF(CFS) =   13.03
EFFECTIVE AREA(ACRES) =   21.15     AREA-AVERAGED Fm(INCH/HR) =   0.07
AREA-AVERAGED Fp(INCH/HR) =   0.71  AREA-AVERAGED Ap =   0.10
TOTAL AREA(ACRES) =   21.15         PEAK FLOW RATE(CFS) =      51.02

END OF SUBAREA "V" GUTTER HYDRAULICS:
DEPTH(FEET) =  0.72   FLOOD WIDTH(FEET) =   56.11
FLOW VELOCITY(FEET/SEC.) =   3.19   DEPTH*VELOCITY(FT*FT/SEC) =   2.30
LONGEST FLOWPATH FROM NODE    130.00 TO NODE    135.00 =  1955.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    135.00 TO NODE    136.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1007.46  DOWNSTREAM(FEET) =  1006.21
FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.012
DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.31
ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     51.02
PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =  17.26
LONGEST FLOWPATH FROM NODE    130.00 TO NODE    136.00 =  2205.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    136.00 TO NODE    136.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
MAINLINE Tc(MIN) =  17.26
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.703
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
COMMERCIAL                 B        1.30      0.45       0.10    76
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.45
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
SUBAREA AREA(ACRES) =    1.30       SUBAREA RUNOFF(CFS) =    3.11
EFFECTIVE AREA(ACRES) =   22.45     AREA-AVERAGED Fm(INCH/HR) =  0.07
AREA-AVERAGED Fp(INCH/HR) =  0.69  AREA-AVERAGED Ap =  0.10
```

```
 TOTAL AREA(ACRES) =    22.45       PEAK FLOW RATE(CFS) =      53.21

****************************************************************************
 FLOW PROCESS FROM NODE    136.00 TO NODE    137.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1006.21  DOWNSTREAM(FEET) =  1000.90
 FLOW LENGTH(FEET) =    45.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  27.13
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     53.21
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  17.29
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    137.00 =  2250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    137.00 TO NODE    138.00 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.) =  17.29
 RAINFALL INTENSITY(INCH/HR) =   2.70
 AREA-AVERAGED Fm(INCH/HR) =  0.07
 AREA-AVERAGED Fp(INCH/HR) =  0.69
 AREA-AVERAGED Ap =  0.10
 EFFECTIVE STREAM AREA(ACRES) =   22.45
 TOTAL STREAM AREA(ACRES) =   22.45
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     53.21

 ** CONFLUENCE DATA **
 STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1     65.23  14.59     2.989   0.65( 0.15) 0.22     23.9      100.00
    1     55.99  27.33     2.052   0.64( 0.18) 0.28     31.7      110.00
    1     68.77  18.49     2.593   0.65( 0.15) 0.23     29.5      120.00
    2     53.21  17.29     2.700   0.69( 0.07) 0.10     22.4      130.00

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

 ** PEAK FLOW RATE TABLE **
 STREAM     Q      Tc    Intensity   Fp(Fm)      Ap    Ae      HEADWATER
 NUMBER   (CFS)  (MIN.)  (INCH/HR)  (INCH/HR)          (ACRES)    NODE
    1    115.07  14.59     2.989   0.66( 0.11) 0.17     42.9      100.00
    2    119.82  18.49     2.593   0.66( 0.11) 0.17     52.0      120.00
    3     96.09  27.33     2.052   0.65( 0.13) 0.21     54.1      110.00
    4    120.89  17.29     2.700   0.66( 0.11) 0.17     50.3      130.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    120.89    Tc(MIN.) =    17.29
 EFFECTIVE AREA(ACRES) =    50.27   AREA-AVERAGED Fm(INCH/HR) =  0.11
 AREA-AVERAGED Fp(INCH/HR) =  0.66  AREA-AVERAGED Ap =  0.17
 TOTAL AREA(ACRES) =     54.15
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    138.00 =  2765.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    138.00 TO NODE    138.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =  17.29
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.700
 SUBAREA LOSS RATE DATA(AMC III):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 NATURAL FAIR COVER
 "OPEN BRUSH"                 B        2.55      0.31       1.00    84
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.31
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
 SUBAREA AREA(ACRES) =     2.55      SUBAREA RUNOFF(CFS) =     5.49
 EFFECTIVE AREA(ACRES) =    52.82   AREA-AVERAGED Fm(INCH/HR) =  0.12
 AREA-AVERAGED Fp(INCH/HR) =  0.58  AREA-AVERAGED Ap =  0.21
 TOTAL AREA(ACRES) =     56.70      PEAK FLOW RATE(CFS) =     122.58
============================================================================
 END OF STUDY SUMMARY:
```

TOTAL AREA(ACRES) = 56.70 TC(MIN.) = 17.29
EFFECTIVE AREA(ACRES) = 52.82 AREA-AVERAGED Fm(INCH/HR)= 0.12
AREA-AVERAGED Fp(INCH/HR) = 0.58 AREA-AVERAGED Ap = 0.21
PEAK FLOW RATE(CFS) = 122.58

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	117.18	14.59	2.989	0.57(0.12)	0.22	45.4	100.00
2	122.58	17.29	2.700	0.58(0.12)	0.21	52.8	130.00
3	121.31	18.49	2.593	0.58(0.12)	0.21	54.5	120.00
4	97.45	27.33	2.052	0.59(0.14)	0.24	56.7	110.00

END OF RATIONAL METHOD ANALYSIS

1

APPENDIX D

DETENTION ANALYSIS

VOLUME OF DETENTION BASIN

Elevation	Depth (feet)	Area (sq. ft.)	Volume (c.f.)	Σ Volume (c.f.)	Σ Volume (ac-ft)
1001.00	0.00	37200			
			39450	39450	0.91
1002.00	1.00	41700			
			44000	83450	1.92
1003.00	2.00	46300			
			48650	132100	3.03
1004.00	3.00	51000			
			53350	185450	4.26
1005.00	4.00	55700			
			58100	243550	5.59
1006.00	5.00	60500			
			62900	306450	7.04
1007.00	6.00	65300			
			67800	374250	8.59
1008.00	7.00	70300			
			72800	447050	10.26
1009.00	8.00	75300			
			77850	524900	12.05
1010	9.00	80400			
			82950	607850	13.95
1011	10.00	85500			
			88000	695850	15.97
1012	11.00	90500			
			93250	789100	18.12
1013	12.00	96000			

****

NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS

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Analysis prepared by:

THIENES ENGINEERING
16800 VALLEY VIEW AVENUE
LA MIRADA CA 90638
PH: (714) 521-4811 FAX: (714) 521-4173

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC III:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 5.00 (inches)

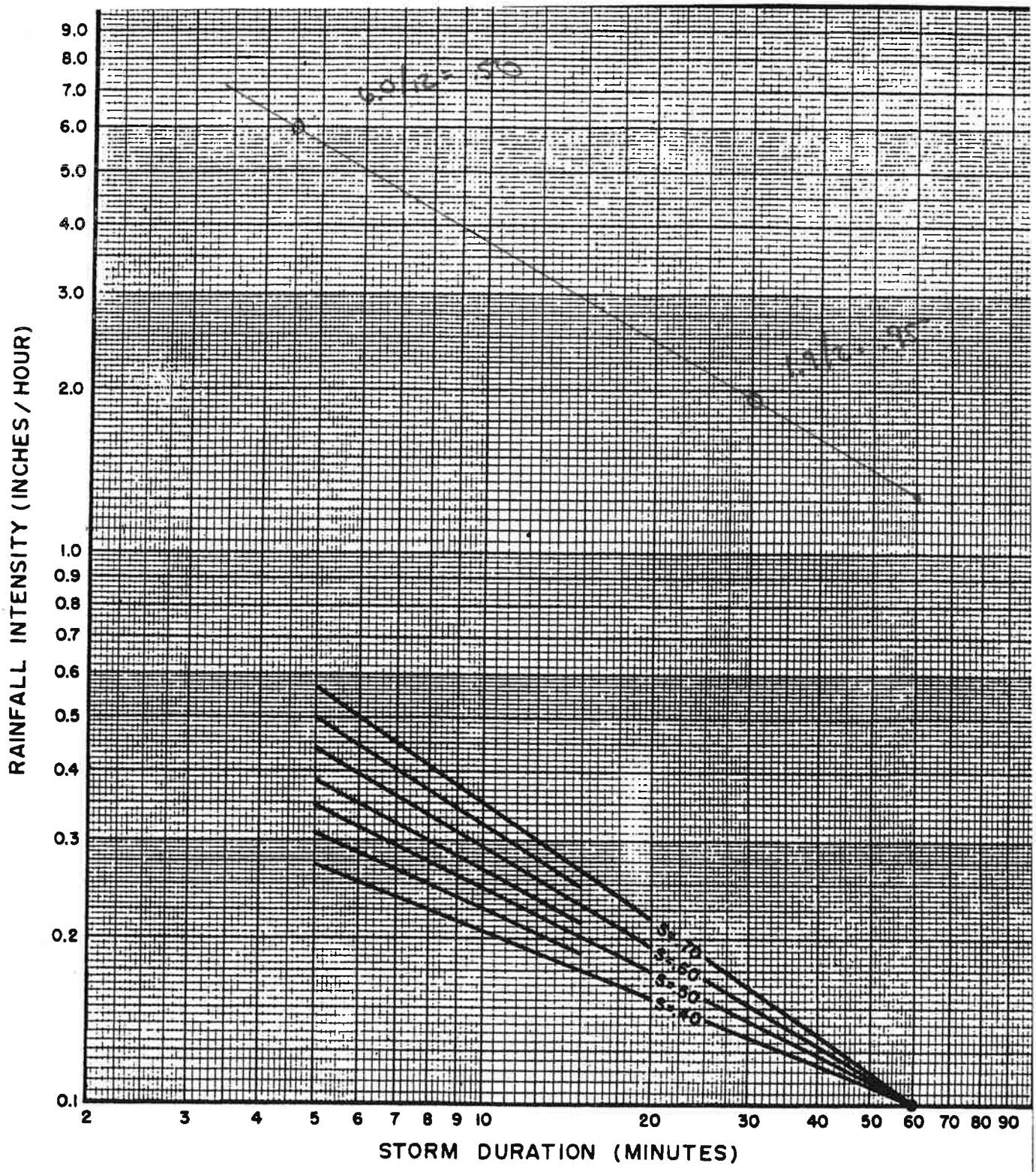
SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
*1	8.90	100.00	66.(46.)	0.547	0.346
2	47.90	10.00	52.(32.)	0.742	0.873

TOTAL AREA (Acres) = 56.80

AREA-AVERAGED LOSS RATE, $\bar{Fm}$ (in./hr.) = 0.148

AREA-AVERAGED LOW LOSS FRACTION, $\bar{Y}$ = 0.209

1



DESIGN STORM FREQUENCY = _____ YEARS

ONE HOUR POINT RAINFALL = _____ INCHES

LOG-LOG SLOPE = _____

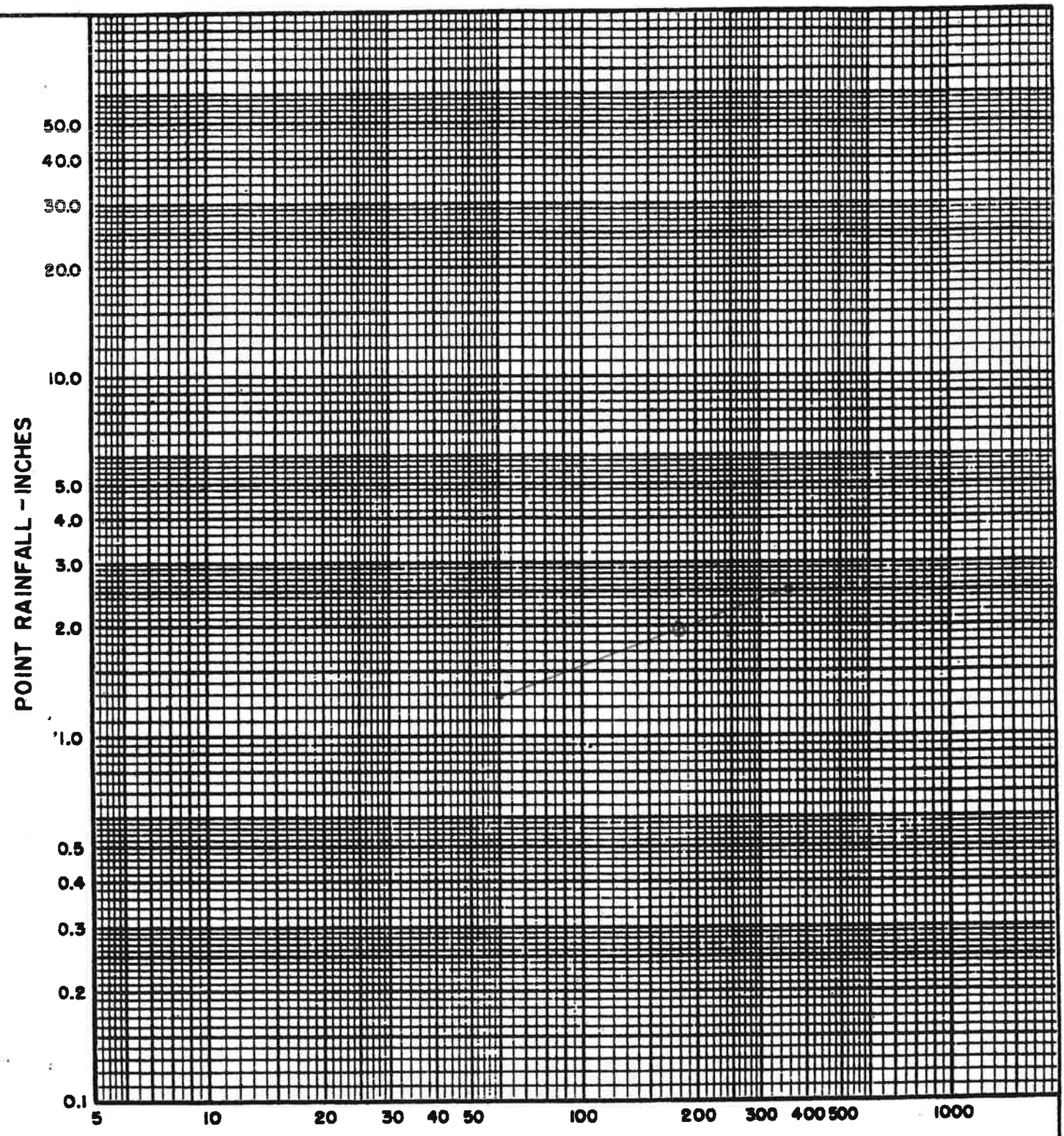
PROJECT LOCATION = _____

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3



PROJECT LOCATION _____

NOTES _____

_____

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

AREA - AVERAGED MASS RAINFALL PLOTTING SHEET

FIGURE E-8

```
**************************************************************************

            F L O O D    R O U T I N G    A N A L Y S I S
          USING COUNTY HYDROLOGY MANUAL OF SAN BERNARDINO(1986)
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                          Analysis prepared by:

                           THIENES ENGINEERING
                         16800 VALLEY VIEW AVENUE
                            LA MIRADA CA 90638
                     PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* DETENTION BASIN                                                       *
* 100-YEAR                                                              *
*                                                                       *
 *************************************************************************

  FILE NAME: C:\XDRIVE\3158\BASIN3.DAT
  TIME/DATE OF STUDY: 15:33 09/26/2013


**************************************************************************
  FLOW PROCESS FROM NODE   138.00 TO NODE   138.00 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
==========================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =      56.700 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
         *USER ENTERED "LAG" TIME =    0.140 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY(DEVELOPED) S-GRAPH SELECTED
         MAXIMUM WATERSHED LOSS RATE(INCH/HOUR) =  0.148
         LOW LOSS FRACTION = 0.209
         *HYDROGRAPH MODEL #1 SPECIFIED*

         SPECIFIED PEAK  5-MINUTES RAINFALL(INCH)=  0.50
         SPECIFIED PEAK 30-MINUTES RAINFALL(INCH)=  0.95
         SPECIFIED PEAK  1-HOUR RAINFALL(INCH) =  1.28
         SPECIFIED PEAK  3-HOUR RAINFALL(INCH) =  1.94
         SPECIFIED PEAK  6-HOUR RAINFALL(INCH) =  2.50
         SPECIFIED PEAK 24-HOUR RAINFALL(INCH) =  5.00

         PRECIPITATION DEPTH-AREA REDUCTION FACTORS:
           5-MINUTE FACTOR = 0.997
          30-MINUTE FACTOR = 0.997
           1-HOUR FACTOR = 0.997
           3-HOUR FACTOR = 1.000
           6-HOUR FACTOR = 1.000
          24-HOUR FACTOR = 1.000

         UNIT HYDROGRAPH TIME UNIT =   5.000 MINUTES
         UNIT INTERVAL PERCENTAGE OF LAG-TIME =  59.524


==========================================================================
                      UNIT HYDROGRAPH DETERMINATION

--------------------------------------------------------------------------
    INTERVAL          "S" GRAPH          UNIT HYDROGRAPH
     NUMBER          MEAN VALUES          ORDINATES(CFS)
--------------------------------------------------------------------------
         1                6.309               43.263
         2               40.673              235.640
         3               80.787              275.066
         4               95.387              100.114
         5               98.616               22.143
         6               99.463                5.809
         7               99.785                2.208
         8               99.946                1.104
         9              100.000                0.368
```

```
--------------------------------------------------------------------------------
    TOTAL SOIL-LOSS VOLUME(ACRE-FEET) =        4.3442
    TOTAL STORM RUNOFF VOLUME(ACRE-FEET) =      19.2681
--------------------------------------------------------------------------------
```

— TOTAL VOLUME

2 4 - 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 FIVE-MINUTE UNIT INTERVALS(CFS)
(Note: Time indicated is at END of Each Unit Intervals)

TIME(HRS)	VOLUME(AF)	Q(CFS)	0. 50.0 100.0 150.0 200.0
0.083	0.0020	0.30	Q
0.167	0.0153	1.92	Q
0.250	0.0415	3.81	Q
0.333	0.0726	4.51	Q
0.417	0.1047	4.67	Q
0.500	0.1373	4.73	Q
0.583	0.1700	4.75	Q
0.667	0.2029	4.77	Q
0.750	0.2359	4.79	Q
0.833	0.2689	4.80	Q
0.917	0.3021	4.81	Q
1.000	0.3353	4.83	Q
1.083	0.3687	4.84	Q
1.167	0.4021	4.85	Q
1.250	0.4356	4.87	Q
1.333	0.4693	4.88	Q
1.417	0.5030	4.90	QV
1.500	0.5368	4.91	QV
1.583	0.5707	4.92	QV
1.667	0.6047	4.94	QV
1.750	0.6388	4.95	QV
1.833	0.6730	4.97	QV
1.917	0.7073	4.98	QV
2.000	0.7417	4.99	QV
2.083	0.7762	5.01	.Q
2.167	0.8108	5.02	.Q
2.250	0.8455	5.04	.Q
2.333	0.8803	5.05	.Q
2.417	0.9152	5.07	.Q
2.500	0.9502	5.08	.Q
2.583	0.9854	5.10	.QV
2.667	1.0206	5.12	.QV
2.750	1.0559	5.13	.QV
2.833	1.0914	5.15	.QV
2.917	1.1269	5.16	.QV
3.000	1.1626	5.18	.QV
3.083	1.1984	5.20	.QV
3.167	1.2343	5.21	.QV
3.250	1.2703	5.23	.QV
3.333	1.3065	5.25	.QV
3.417	1.3427	5.26	.QV
3.500	1.3791	5.28	.QV
3.583	1.4156	5.30	.QV
3.667	1.4522	5.32	.Q V
3.750	1.4889	5.33	.Q V
3.833	1.5258	5.35	.Q V
3.917	1.5628	5.37	.Q V
4.000	1.5999	5.39	.Q V
4.083	1.6371	5.41	.Q V
4.167	1.6745	5.43	.Q V
4.250	1.7120	5.44	.Q V
4.333	1.7496	5.46	.Q V
4.417	1.7873	5.48	.Q V
4.500	1.8252	5.50	.Q V
4.583	1.8632	5.52	.Q V
4.667	1.9014	5.54	.Q V
4.750	1.9397	5.56	.Q V
4.833	1.9782	5.58	.Q V
4.917	2.0167	5.60	.Q V
5.000	2.0555	5.62	.Q V
5.083	2.0943	5.64	.Q V
5.167	2.1333	5.67	.Q V
5.250	2.1725	5.69	.Q V
5.333	2.2118	5.71	.Q V
5.417	2.2513	5.73	.Q V
5.500	2.2909	5.75	.Q V
5.583	2.3307	5.78	.Q V
5.667	2.3706	5.80	.Q V

5.750	2.4107	5.82	.Q	V	.	.	.	.
5.833	2.4509	5.84	.Q	V	.	.	.	.
5.917	2.4914	5.87	.Q	V	.	.	.	.
6.000	2.5319	5.89	.Q	V	.	.	.	.
6.083	2.5727	5.92	.Q	V	.	.	.	.
6.167	2.6136	5.94	.Q	V	.	.	.	.
6.250	2.6547	5.96	.Q	V	.	.	.	.
6.333	2.6959	5.99	.Q	V	.	.	.	.
6.417	2.7374	6.02	.Q	V	.	.	.	.
6.500	2.7790	6.04	.Q	V	.	.	.	.
6.583	2.8207	6.07	.Q	V	.	.	.	.
6.667	2.8627	6.09	.Q	V	.	.	.	.
6.750	2.9049	6.12	.Q	V	.	.	.	.
6.833	2.9472	6.15	.Q	V	.	.	.	.
6.917	2.9897	6.18	.Q	V	.	.	.	.
7.000	3.0324	6.20	.Q	V	.	.	.	.
7.083	3.0754	6.23	.Q	V	.	.	.	.
7.167	3.1185	6.26	.Q	V	.	.	.	.
7.250	3.1618	6.29	.Q	V	.	.	.	.
7.333	3.2053	6.32	.Q	V	.	.	.	.
7.417	3.2490	6.35	.Q	V	.	.	.	.
7.500	3.2929	6.38	.Q	V	.	.	.	.
7.583	3.3371	6.41	.Q	V	.	.	.	.
7.667	3.3814	6.44	.Q	V	.	.	.	.
7.750	3.4260	6.47	.Q	V	.	.	.	.
7.833	3.4708	6.50	.Q	V	.	.	.	.
7.917	3.5158	6.54	.Q	V	.	.	.	.
8.000	3.5611	6.57	.Q	V	.	.	.	.
8.083	3.6065	6.60	.Q	V	.	.	.	.
8.167	3.6522	6.64	.Q	V	.	.	.	.
8.250	3.6982	6.67	.Q	V	.	.	.	.
8.333	3.7444	6.71	.Q	V	.	.	.	.
8.417	3.7908	6.74	.Q	V	.	.	.	.
8.500	3.8375	6.78	.Q	V	.	.	.	.
8.583	3.8844	6.82	.Q	V	.	.	.	.
8.667	3.9316	6.85	.Q	V	.	.	.	.
8.750	3.9791	6.89	.Q	V	.	.	.	.
8.833	4.0268	6.93	.Q	V	.	.	.	.
8.917	4.0748	6.97	.Q	V	.	.	.	.
9.000	4.1231	7.01	.Q	V	.	.	.	.
9.083	4.1717	7.05	.Q	V	.	.	.	.
9.167	4.2205	7.09	.Q	V	.	.	.	.
9.250	4.2696	7.13	.Q	V	.	.	.	.
9.333	4.3191	7.18	.Q	V	.	.	.	.
9.417	4.3688	7.22	.Q	V	.	.	.	.
9.500	4.4189	7.27	.Q	V	.	.	.	.
9.583	4.4692	7.31	.Q	V	.	.	.	.
9.667	4.5199	7.36	.Q	V	.	.	.	.
9.750	4.5709	7.41	.Q	V	.	.	.	.
9.833	4.6222	7.45	.Q	V	.	.	.	.
9.917	4.6739	7.50	.Q	V	.	.	.	.
10.000	4.7259	7.55	.Q	V	.	.	.	.
10.083	4.7783	7.60	.Q	V	.	.	.	.
10.167	4.8310	7.66	.Q	V	.	.	.	.
10.250	4.8841	7.71	.Q	V	.	.	.	.
10.333	4.9375	7.76	.Q	V	.	.	.	.
10.417	4.9914	7.82	.Q	V	.	.	.	.
10.500	5.0456	7.88	.Q	V	.	.	.	.
10.583	5.1003	7.93	.Q	V	.	.	.	.
10.667	5.1553	7.99	.Q	V	.	.	.	.
10.750	5.2108	8.05	.Q	V	.	.	.	.
10.833	5.2667	8.12	.Q	V	.	.	.	.
10.917	5.3230	8.18	.Q	.V	.	.	.	.
11.000	5.3798	8.24	.Q	.V	.	.	.	.
11.083	5.4370	8.31	.Q	.V	.	.	.	.
11.167	5.4947	8.38	.Q	.V	.	.	.	.
11.250	5.5529	8.45	.Q	.V	.	.	.	.
11.333	5.6116	8.52	.Q	.V	.	.	.	.
11.417	5.6708	8.59	.Q	.V	.	.	.	.
11.500	5.7305	8.67	.Q	.V	.	.	.	.
11.583	5.7908	8.75	.Q	. V	.	.	.	.
11.667	5.8516	8.83	.Q	. V	.	.	.	.
11.750	5.9129	8.91	.Q	. V	.	.	.	.
11.833	5.9749	8.99	.Q	. V	.	.	.	.
11.917	6.0374	9.08	.Q	. V	.	.	.	.
12.000	6.1006	9.17	.Q	. V	.	.	.	.
12.083	6.1633	9.10	.Q	. V	.	.	.	.
12.167	6.2206	8.33	.Q	. V	.	.	.	.
12.250	6.2717	7.41	.Q	. V	.	.	.	.
12.333	6.3209	7.14	.Q	. V	.	.	.	.

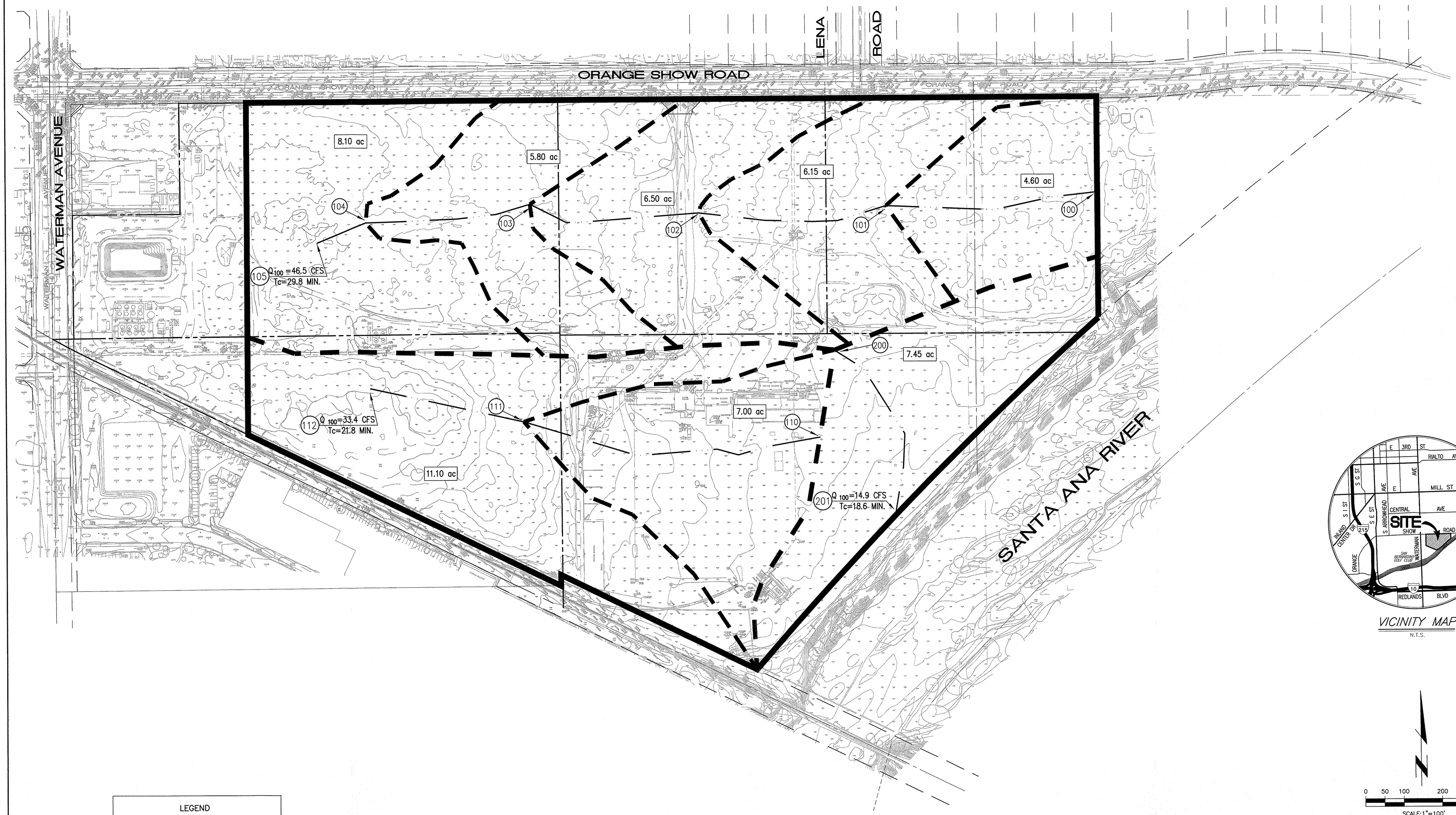
12.417	6.3702	7.16	.Q . V . . .
12.500	6.4200	7.24	.Q . V . . .
12.583	6.4705	7.33	.Q . V . . .
12.667	6.5217	7.44	.Q . V . . .
12.750	6.5737	7.55	.Q . V . . .
12.833	6.6265	7.67	.Q . V . . .
12.917	6.6801	7.79	.Q . V . . .
13.000	6.7347	7.92	.Q . V . . .
13.083	6.7901	8.05	.Q . V . . .
13.167	6.8465	8.19	.Q . V . . .
13.250	6.9039	8.33	.Q . V . . .
13.333	6.9623	8.48	.Q . V . . .
13.417	7.0218	8.64	.Q . V . . .
13.500	7.0825	8.81	.Q . V . . .
13.583	7.1444	8.99	.Q . V . . .
13.667	7.2076	9.17	.Q . V . . .
13.750	7.2721	9.37	.Q . V . . .
13.833	7.3380	9.57	.Q . V . . .
13.917	7.4055	9.79	.Q . V . . .
14.000	7.4745	10.03	. Q . V . . .
14.083	7.5454	10.30	. Q . V . . .
14.167	7.6192	10.71	. Q . V . . .
14.250	7.6960	11.16	. Q . V . . .
14.333	7.7754	11.52	. Q . V . . .
14.417	7.8571	11.87	. Q . V . . .
14.500	7.9413	12.22	. Q . V . . .
14.583	8.0281	12.61	. Q . V . . .
14.667	8.1178	13.03	. Q . V . . .
14.750	8.2107	13.48	. Q . V . . .
14.833	8.3070	13.98	. Q . V . . .
14.917	8.4071	14.53	. Q . V . . .
15.000	8.5114	15.15	. Q . V . . .
15.083	8.6204	15.83	. Q . V . . .
15.167	8.7348	16.61	. Q . V . . .
15.250	8.8552	17.48	. Q . V . . .
15.333	8.9827	18.51	. Q . V . . .
15.417	9.1195	19.87	. Q . V . . .
15.500	9.2730	22.29	. Q . V. . .
15.583	9.4464	25.18	. Q . V. . .
15.667	9.6381	27.83	. Q . V . . .
15.750	9.8475	30.40	. Q . V . . .
15.833	10.0700	32.31	. Q . V . . .
15.917	10.3188	36.13	. Q . .V . . .
16.000	10.6478	47.76	. Q. . V . . .
16.083	11.2155	82.44	. . Q . V . . .
16.167	12.3402	163.30	. . . V . Q .
16.250	13.4927	167.35	. . . V . Q .
16.333	14.0788	85.09	. . Q . V. . .
16.417	14.3828	44.15	. Q . . V. . .
16.500	14.5888	29.91	. Q . . V . .
16.583	14.7475	23.04	. Q . . V . .
16.667	14.8806	19.34	. Q . . V . .
16.750	14.9972	16.92	. Q . . .V . .
16.833	15.1021	15.23	. Q . . .V . .
16.917	15.1986	14.02	. Q . . .V . .
17.000	15.2884	13.04	. Q . . .V . .
17.083	15.3725	12.20	. Q . . .V . .
17.167	15.4508	11.37	. Q . . . V . .
17.250	15.5239	10.61	. Q . . . V . .
17.333	15.5931	10.04	. Q . . . V . .
17.417	15.6590	9.57	.Q . . . V . .
17.500	15.7221	9.17	.Q . . . V . .
17.583	15.7827	8.80	.Q . . . V . .
17.667	15.8411	8.48	.Q . . . V . .
17.750	15.8975	8.18	.Q . . . V . .
17.833	15.9519	7.91	.Q . . . V . .
17.917	16.0047	7.66	.Q . . . V . .
18.000	16.0558	7.43	.Q . . . V . .
18.083	16.1066	7.37	.Q . . . V . .
18.167	16.1620	8.04	.Q . . . V . .
18.250	16.2230	8.86	.Q . . . V . .
18.333	16.2853	9.05	.Q . . . V . .
18.417	16.3470	8.95	.Q . . . V . .
18.500	16.4076	8.81	.Q . . . V . .
18.583	16.4673	8.66	.Q . . . V . .
18.667	16.5259	8.51	.Q . . . V . .
18.750	16.5836	8.37	.Q . . . V . .
18.833	16.6403	8.24	.Q . . . V . .
18.917	16.6962	8.11	.Q . . . V . .
19.000	16.7512	7.99	.Q . . . V . .

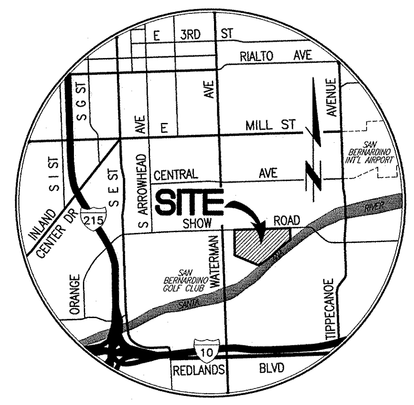
19.083	16.8054	7.87	.Q	.	.	.	V	.
19.167	16.8588	7.76	.Q	.	.	.	V	.
19.250	16.9115	7.65	.Q	.	.	.	V	.
19.333	16.9635	7.55	.Q	.	.	.	V	.
19.417	17.0148	7.45	.Q	.	.	.	V	.
19.500	17.0654	7.35	.Q	.	.	.	V	.
19.583	17.1154	7.26	.Q	.	.	.	V	.
19.667	17.1648	7.17	.Q	.	.	.	V	.
19.750	17.2136	7.09	.Q	.	.	.	V	.
19.833	17.2619	7.01	.Q	.	.	.	V	.
19.917	17.3096	6.93	.Q	.	.	.	V	.
20.000	17.3568	6.85	.Q	.	.	.	V	.
20.083	17.4034	6.78	.Q	.	.	.	V	.
20.167	17.4496	6.70	.Q	.	.	.	V	.
20.250	17.4953	6.63	.Q	.	.	.	V	.
20.333	17.5405	6.57	.Q	.	.	.	V	.
20.417	17.5853	6.50	.Q	.	.	.	V	.
20.500	17.6296	6.44	.Q	.	.	.	V	.
20.583	17.6735	6.38	.Q	.	.	.	V	.
20.667	17.7170	6.32	.Q	.	.	.	V	.
20.750	17.7601	6.26	.Q	.	.	.	V	.
20.833	17.8028	6.20	.Q	.	.	.	V	.
20.917	17.8451	6.14	.Q	.	.	.	V	.
21.000	17.8870	6.09	.Q	.	.	.	V	.
21.083	17.9286	6.04	.Q	.	.	.	V	.
21.167	17.9699	5.99	.Q	.	.	.	V	.
21.250	18.0108	5.94	.Q	.	.	.	V	.
21.333	18.0513	5.89	.Q	.	.	.	V	.
21.417	18.0915	5.84	.Q	.	.	.	V	.
21.500	18.1315	5.80	.Q	.	.	.	V	.
21.583	18.1711	5.75	.Q	.	.	.	V	.
21.667	18.2104	5.71	.Q	.	.	.	V	.
21.750	18.2493	5.66	.Q	.	.	.	V	.
21.833	18.2881	5.62	.Q	.	.	.	V	.
21.917	18.3265	5.58	.Q	.	.	.	V	.
22.000	18.3646	5.54	.Q	.	.	.	V	.
22.083	18.4025	5.50	.Q	.	.	.	V	.
22.167	18.4401	5.46	.Q	.	.	.	V	.
22.250	18.4775	5.42	.Q	.	.	.	V	.
22.333	18.5145	5.39	.Q	.	.	.	V	.
22.417	18.5514	5.35	.Q	.	.	.	V	.
22.500	18.5880	5.31	.Q	.	.	.	V	.
22.583	18.6243	5.28	.Q	.	.	.	V	.
22.667	18.6605	5.24	.Q	.	.	.	V	.
22.750	18.6964	5.21	.Q	.	.	.	V	.
22.833	18.7320	5.18	.Q	.	.	.	V	.
22.917	18.7675	5.15	.Q	.	.	.	V	.
23.000	18.8027	5.11	.Q	.	.	.	V	.
23.083	18.8377	5.08	.Q	.	.	.	V	.
23.167	18.8725	5.05	.Q	.	.	.	V	.
23.250	18.9071	5.02	.Q	.	.	.	V	.
23.333	18.9414	4.99	Q	.	.	.	V	.
23.417	18.9756	4.96	Q	.	.	.	V	.
23.500	19.0096	4.94	Q	.	.	.	V	.
23.583	19.0434	4.91	Q	.	.	.	V	.
23.667	19.0770	4.88	Q	.	.	.	V	.
23.750	19.1105	4.85	Q	.	.	.	V	.
23.833	19.1437	4.83	Q	.	.	.	V	.
23.917	19.1767	4.80	Q	.	.	.	V	.
24.000	19.2096	4.77	Q	.	.	.	V	.
24.083	19.2403	4.45	Q	.	.	.	V	.
24.167	19.2597	2.81	Q	.	.	.	V	.
24.250	19.2659	0.91	Q	.	.	.	V	.
24.333	19.2674	0.22	Q	.	.	.	V	.
24.417	19.2679	0.07	Q	.	.	.	V	.
24.500	19.2681	0.03	Q	.	.	.	V	.
24.583	19.2681	0.01	Q	.	.	.	V	.
24.667	19.2681	0.00	Q	.	.	.	V	.

END OF FLOODSCx ROUTING ANALYSIS

APPENDIX E

HYDROLOGY MAPS





VICINITY MAP

N.T.S.

0 50 100 200 300

SCALE:1"=100'

LEGEND

	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
9.10 AC.	SUBAREA AREA
100	NODE NUMBER
Tc	TIME OF CONCENTRATION
Q_{100}	DISCHARGE (CUBIC FEET PER SECOND) NUMBER DESIGNATE YEAR OF FREQUENCY

Last Update:7/29/13
O:\3100-3199\3158\3158hyd-ex.dwg

CITY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

EXISTING CONDITION HYDROLOGY MAP

Alliance California

Gateway South Building 3

OPTION A

PREPARED FOR:

Hillwood Investments
901 Via Piemonte, Suite 175
Ontario, CA 91764
PHONE: (909)382-0033
FAX: (909)382-0073

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

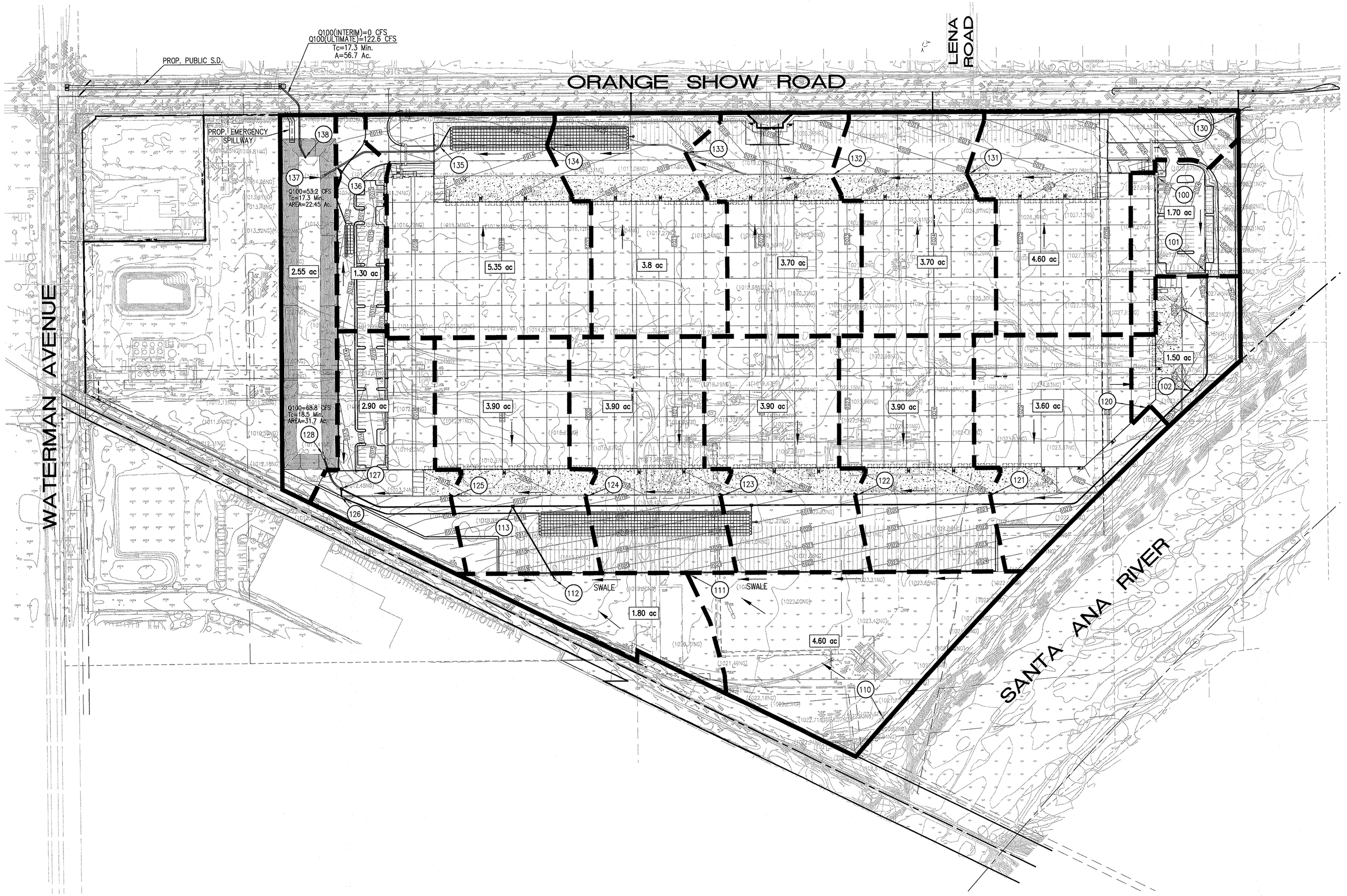
Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

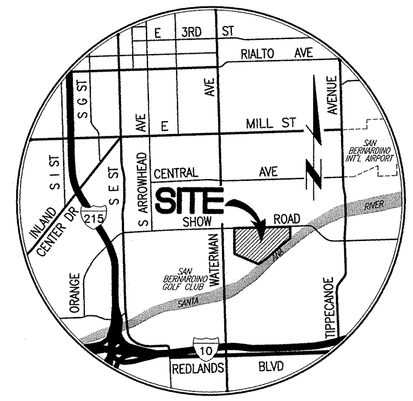
Approved by _____ Date _____

Public Works Director _____ R.C.E. XX

Sheet 1 of 1 Sheets

3158/1 OF 1 SHEET





VICINITY MAP

N.T.S.

LEGEND

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- 9.1 AC. — SUBAREA AREA
- (100) — NODE NUMBER
- Tc — TIME OF CONCENTRATION
- Q_{100} — DISCHARGE (CUBIC FEET PER SECOND) NUMBER DESIGNATE YEAR OF FREQUENCY
- FLOW LINE

0 50 100 200 300

SCALE:1"=100'

Last Update:9/26/13
O:\3100-3199\3158\3158HYD.dwg

CITY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

PROPOSED CONDITION HYDROLOGY MAP

Alliance California

Gateway South Building 3

3158/1 OF 1 SHEET

PREPARED FOR:

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Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____

Public Works Director _____ R.C.E. 28129

Sheet 1 of 1 Sheets