TRACT 20473

Redlands, CA

PRELIMINARY DRAINAGE STUDY

December 2, 2021

Reference 149-215.009

PREPARED BY:

Encompass Associates, Inc.

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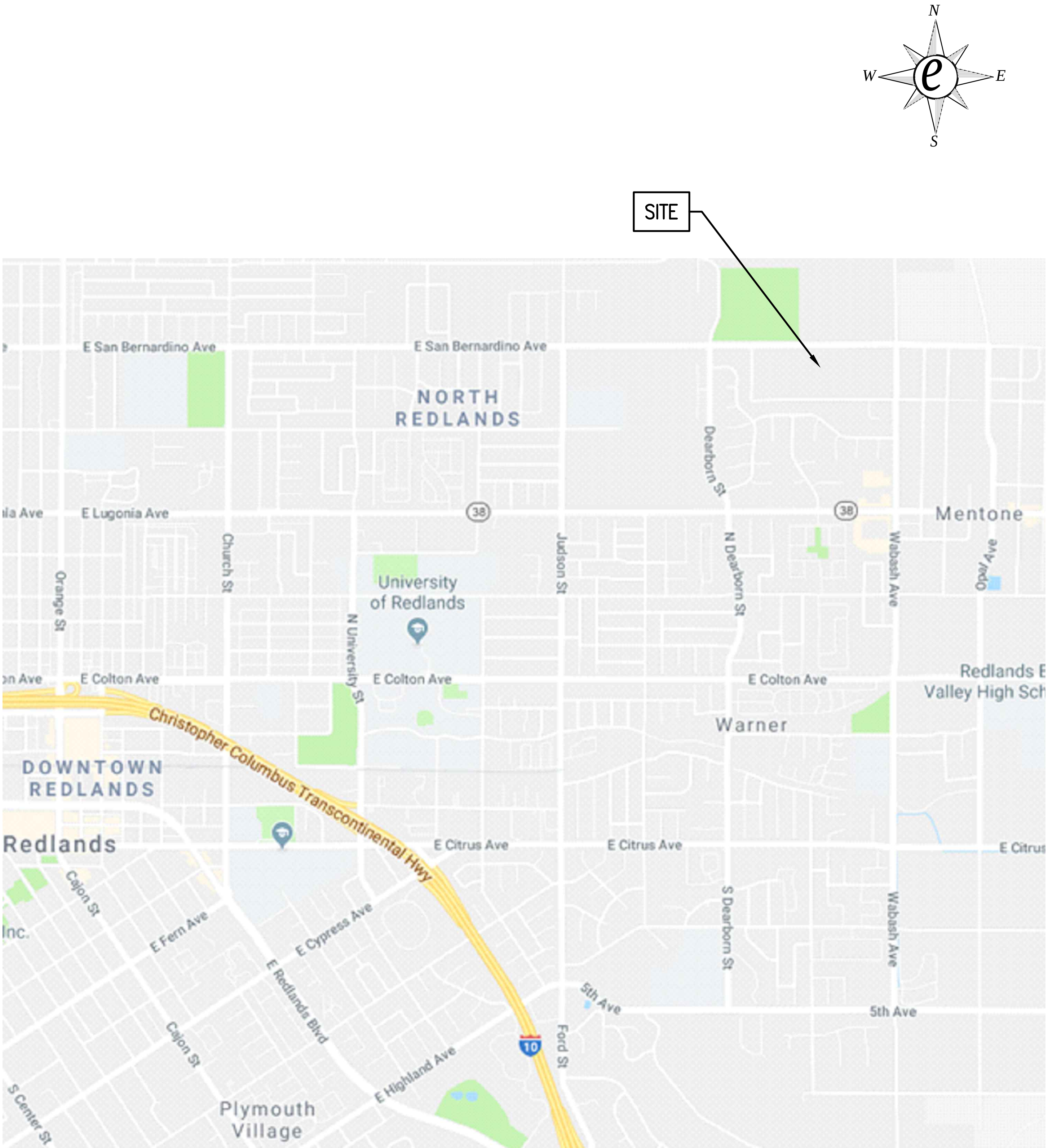

ENCOMPASS ASSOCIATES, INC.

VICINITY MAP
TRACT 20473

DISCUSSION

The purpose of this preliminary drainage study is to determine the drainage facility requirements for Tract 20473, a 36-acre single-family residential project in Redlands. Specifically, the subject project is located south of the San Bernardino Avenue, west of Wabash Avenue, north of Capri Avenue, and east of Granite Street, in the City of Redlands, County of San Bernardino, California.

Existing Condition

The site is currently vacant and covered by native grasses. The site has three frontages along San Bernardino Avenue, Wabash Avenue, and Capri Avneue, which have partially improved streets. All flows drain to the north and west, ultimately to San Bernardino Avenue. There is an existing storm drain with catch basins located on San Bernardino Avenue just west of the proejct.

Developed Condition

The subject site will consist of 98 single-family residences and four open lots, with an approximate area of 36 acres. Proposed drainage is overland and by sheet flow generally in a northwesterly direction. The site is not subject to runoff from off-site areas.

Of the total 36 acres, only about 28 acres will be developed into single family residences. A portion of the remainder of the site will be established as a park, Lot C, and will consist of 1.7 acres, and the proposed WQMP basin on Lot A is 0.5 acres. The remainder of the perimeter of the site will be established as a landscape buffer.

Runoff from the residences will be conveyed via street flow to catch basins proposed throughout the project, ultimately draining to the project low point located in the northwest corner, just prior to discharge onto San Bernardino Avenue. Low flows will be directed to the to the adjacent park (Lot A) in order to address Storm Water Quality Low Impact Development requirements. Overflows in excess of the LID capture requirements will be discharged via a proposed storm drain out to San Bernardino Avenue and westerly to the existing storm drain located near the intersection of Granite Street.

Methodology and Conclusion

Per city ordinance, the 10-, 25- and 100-year storm events were modeled in the rational method hydrology calculations in this study. The rational method hydrologic model, as defined by Flood Control for San Bernardino County, was followed in the determination of storm runoff. AES software was utilized for rational method hydrology calculations.

RATIONAL METHOD

HYDROLOGY

10-, 25- & 100-year Storms

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
          (c) Copyright 1983-2012 Advanced Engineering Software (aes)
             Ver. 19.0  Release Date: 06/01/2012  License ID 1584

                           Analysis prepared by:

                         ENCOMPASS ASSOCIATES, INC.
                             5699 Cousins Place
                         Rancho Cucamonga CA 91737
                    909-684-0093 askeers@encompasscivil.com

 ************************** DESCRIPTION OF STUDY **************************
 * TRACT 20473 REDLANDS                                                   *
 * HYDROLOGY                                                              *
 * 10-YEAR                                                                *
 **************************************************************************

  FILE NAME: X:\FTP\AES\20473D10.DAT
  TIME/DATE OF STUDY: 11:50 09/27/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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) = 0.8000

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   18.0      9.0    0.020/0.020/0.020   0.67    2.00 0.0313 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      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
```

```
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1695.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.140
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.904
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.50      0.98     0.600    32   14.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      1.78
  TOTAL AREA(ACRES) =      1.50   PEAK FLOW RATE(CFS) =      1.78

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
================================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1655.00
  STREET LENGTH(FEET) =   916.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.31
    HALFSTREET FLOOD WIDTH(FEET) =    7.39
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.91
  STREET FLOW TRAVEL TIME(MIN.) =   5.13   Tc(MIN.) =   19.27
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.581
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        0.90      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    0.81
  EFFECTIVE AREA(ACRES) =      2.40    AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        2.4        PEAK FLOW RATE(CFS) =       2.15

  END OF SUBAREA STREET FLOW HYDRAULICS:
```

```
  DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   7.33
  FLOW VELOCITY(FEET/SEC.) =  2.96   DEPTH*VELOCITY(FT*FT/SEC.) =   0.90
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1916.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.27
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.581
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        6.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    6.20      SUBAREA RUNOFF(CFS) =    5.56
  EFFECTIVE AREA(ACRES) =      8.60   AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        8.6       PEAK FLOW RATE(CFS) =       7.71

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1650.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.57
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        7.71
  PIPE TRAVEL TIME(MIN.) =   0.85    Tc(MIN.) =   20.12
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   20.12
  RAINFALL INTENSITY(INCH/HR) =   1.54
  AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97
  AREA-AVERAGED Ap =  0.60
  EFFECTIVE STREAM AREA(ACRES) =       8.60
  TOTAL STREAM AREA(ACRES) =       8.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.71

****************************************************************************
  FLOW PROCESS FROM NODE      4.10 TO NODE      4.20 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1690.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.930
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.843
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        4.00      0.98     0.600    32   14.93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      4.53
  TOTAL AREA(ACRES) =      4.00   PEAK FLOW RATE(CFS) =      4.53

****************************************************************************
  FLOW PROCESS FROM NODE      4.20 TO NODE      4.30 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1665.00
  STREET LENGTH(FEET) =   373.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.67
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.38
    HALFSTREET FLOOD WIDTH(FEET) =   11.29
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.87
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.49
  STREET FLOW TRAVEL TIME(MIN.) =   1.61   Tc(MIN.) =   16.54
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.734
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    2.27
  EFFECTIVE AREA(ACRES) =      6.20    AREA-AVERAGED Fm(INCH/HR) =  0.59
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.60
```

```
  TOTAL AREA(ACRES) =        6.2        PEAK FLOW RATE(CFS) =       6.41

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  11.92
  FLOW VELOCITY(FEET/SEC.) =  3.98   DEPTH*VELOCITY(FT*FT/SEC.) =   1.58
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.30 =    1373.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.54
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.734
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                A       1.70      0.98     0.850    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    1.38
  EFFECTIVE AREA(ACRES) =      7.90   AREA-AVERAGED Fm(INCH/HR) =  0.64
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.65
  TOTAL AREA(ACRES) =        7.9       PEAK FLOW RATE(CFS) =       7.79

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.54
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.734
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A       4.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    4.34
  EFFECTIVE AREA(ACRES) =     12.10   AREA-AVERAGED Fm(INCH/HR) =  0.62
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       12.1       PEAK FLOW RATE(CFS) =      12.13

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.40 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1660.00  DOWNSTREAM(FEET) =  1646.00
  FLOW LENGTH(FEET) =   598.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       12.13
  PIPE TRAVEL TIME(MIN.) =   1.02    Tc(MIN.) =   17.55
```

```
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.40 =    1971.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.55
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.672
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        3.60      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    3.52
  EFFECTIVE AREA(ACRES) =     15.70   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.63
  TOTAL AREA(ACRES) =       15.7       PEAK FLOW RATE(CFS) =      14.99

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.55
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.672
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.90      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    1.86
  EFFECTIVE AREA(ACRES) =     17.60   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       17.6       PEAK FLOW RATE(CFS) =      16.85

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1646.00  DOWNSTREAM(FEET) =  1645.00
  FLOW LENGTH(FEET) =    51.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.94
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.85
  PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   17.64
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.00 =    2022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   17.64
  RAINFALL INTENSITY(INCH/HR) =   1.67
  AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98
  AREA-AVERAGED Ap =  0.62
  EFFECTIVE STREAM AREA(ACRES) =      17.60
  TOTAL STREAM AREA(ACRES) =      17.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      16.85

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.71   20.12    1.541  0.97( 0.58) 0.60       8.6       1.00
      2       16.85   17.64    1.668  0.98( 0.61) 0.62      17.6       4.10

  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       24.51   17.64    1.668  0.98( 0.60) 0.62      25.1       4.10
      2       22.55   20.12    1.541  0.98( 0.60) 0.62      26.2       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      24.51    Tc(MIN.) =    17.64
  EFFECTIVE AREA(ACRES) =      25.14   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       26.2
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1645.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.68
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      24.51
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   18.10
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    2487.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   18.10
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.642
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.30      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    1.24
  EFFECTIVE AREA(ACRES) =     26.44   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       27.5       PEAK FLOW RATE(CFS) =      24.77

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.10
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.642
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    2.09
  EFFECTIVE AREA(ACRES) =     28.64   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.61
  TOTAL AREA(ACRES) =       29.7       PEAK FLOW RATE(CFS) =      26.87

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.10
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.642
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  URBAN GOOD COVER
  "TURF"                     A        0.50      0.97     1.000    33
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    0.30
  EFFECTIVE AREA(ACRES) =     29.14   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       30.2       PEAK FLOW RATE(CFS) =      27.17
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       30.2  TC(MIN.) =     18.10
  EFFECTIVE AREA(ACRES) =     29.14  AREA-AVERAGED Fm(INCH/HR)=  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.621
  PEAK FLOW RATE(CFS)   =      27.17
```

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	27.17	18.10	1.642	0.97(0.61)	0.62	29.1	4.10
2	24.86	20.59	1.520	0.97(0.61)	0.62	30.2	1.00

==
==

END OF RATIONAL METHOD ANALYSIS

```
________________________________________________________________________________
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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             Ver. 19.0  Release Date: 06/01/2012  License ID 1584

                           Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
* TRACT 20473 REDLANDS                                                     *
* HYDROLOGY                                                                *
* 25-YEAR                                                                  *
 **************************************************************************

  FILE NAME: X:\FTP\AES\20473D25.DAT
  TIME/DATE OF STUDY: 11:51 09/27/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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) = 1.0000

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   18.0      9.0    0.020/0.020/0.020   0.67    2.00 0.0313 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      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1695.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.140
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.380
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.50      0.98     0.600    32   14.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      2.42
  TOTAL AREA(ACRES) =      1.50   PEAK FLOW RATE(CFS) =      2.42

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1655.00
  STREET LENGTH(FEET) =   916.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.00
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =    8.70
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.17
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   4.82   Tc(MIN.) =   18.96
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.996
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        0.90      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    1.14
  EFFECTIVE AREA(ACRES) =      2.40    AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =       2.4        PEAK FLOW RATE(CFS) =       3.05
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =   8.75
  FLOW VELOCITY(FEET/SEC.) =  3.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.06
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1916.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.96
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.996
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        6.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    6.20      SUBAREA RUNOFF(CFS) =    7.87
  EFFECTIVE AREA(ACRES) =      8.60   AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        8.6       PEAK FLOW RATE(CFS) =      10.92

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1650.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.13
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.92
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =   19.75
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   19.75
  RAINFALL INTENSITY(INCH/HR) =   1.95
  AREA-AVERAGED Fm(INCH/HR) =  0.58
  AREA-AVERAGED Fp(INCH/HR) =  0.97
  AREA-AVERAGED Ap =  0.60
  EFFECTIVE STREAM AREA(ACRES) =       8.60
  TOTAL STREAM AREA(ACRES) =       8.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.92

****************************************************************************
  FLOW PROCESS FROM NODE      4.10 TO NODE      4.20 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1690.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.930
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.304
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        4.00      0.98     0.600    32   14.93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      6.19
  TOTAL AREA(ACRES) =      4.00   PEAK FLOW RATE(CFS) =      6.19

****************************************************************************
  FLOW PROCESS FROM NODE      4.20 TO NODE      4.30 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1665.00
  STREET LENGTH(FEET) =   373.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.76
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.42
    HALFSTREET FLOOD WIDTH(FEET) =   12.97
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.15
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.73
  STREET FLOW TRAVEL TIME(MIN.) =   1.50   Tc(MIN.) =   16.43
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.175
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    3.15
  EFFECTIVE AREA(ACRES) =      6.20    AREA-AVERAGED Fm(INCH/HR) =  0.59
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.60
```

```
  TOTAL AREA(ACRES) =        6.2        PEAK FLOW RATE(CFS) =       8.87

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  13.75
  FLOW VELOCITY(FEET/SEC.) =  4.27   DEPTH*VELOCITY(FT*FT/SEC.) =   1.85
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.30 =    1373.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.43
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.175
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK               A        1.70      0.98     0.850    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    2.06
  EFFECTIVE AREA(ACRES) =      7.90   AREA-AVERAGED Fm(INCH/HR) =  0.64
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.65
  TOTAL AREA(ACRES) =        7.9       PEAK FLOW RATE(CFS) =      10.93

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.43
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.175
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"      A        4.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    6.01
  EFFECTIVE AREA(ACRES) =     12.10   AREA-AVERAGED Fm(INCH/HR) =  0.62
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       12.1       PEAK FLOW RATE(CFS) =      16.94

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.40 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1660.00  DOWNSTREAM(FEET) =  1646.00
  FLOW LENGTH(FEET) =   598.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.69
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      16.94
  PIPE TRAVEL TIME(MIN.) =   0.93    Tc(MIN.) =   17.36
```

```
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.40 =    1971.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.36
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.104
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        3.60      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    4.92
  EFFECTIVE AREA(ACRES) =     15.70   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.63
  TOTAL AREA(ACRES) =       15.7       PEAK FLOW RATE(CFS) =      21.10

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.36
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.104
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.90      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    2.60
  EFFECTIVE AREA(ACRES) =     17.60   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       17.6       PEAK FLOW RATE(CFS) =      23.69

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1646.00  DOWNSTREAM(FEET) =  1645.00
  FLOW LENGTH(FEET) =    51.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.83
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.69
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   17.44
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.00 =    2022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   17.44
  RAINFALL INTENSITY(INCH/HR) =   2.10
  AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.98
  AREA-AVERAGED Ap =  0.62
  EFFECTIVE STREAM AREA(ACRES) =      17.60
  TOTAL STREAM AREA(ACRES) =      17.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      23.69

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.92   19.75    1.948  0.97( 0.58) 0.60       8.6       1.00
      2       23.69   17.44    2.099  0.98( 0.61) 0.62      17.6       4.10

  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       34.41   17.44    2.099  0.97( 0.60) 0.62      25.2       4.10
      2       32.22   19.75    1.948  0.98( 0.60) 0.62      26.2       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      34.41    Tc(MIN.) =    17.44
  EFFECTIVE AREA(ACRES) =      25.19   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =      26.2
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1645.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.21
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      34.41
  PIPE TRAVEL TIME(MIN.) =   0.43    Tc(MIN.) =   17.87
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    2487.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   17.87
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.068
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.30      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    1.74
  EFFECTIVE AREA(ACRES) =     26.49   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       27.5       PEAK FLOW RATE(CFS) =      34.99

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.87
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.068
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.98     0.600    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    2.94
  EFFECTIVE AREA(ACRES) =     28.69   AREA-AVERAGED Fm(INCH/HR) =  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.61
  TOTAL AREA(ACRES) =       29.7       PEAK FLOW RATE(CFS) =      37.93

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.87
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.068
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  URBAN GOOD COVER
  "TURF"                     A        0.50      0.97     1.000    33
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    0.49
  EFFECTIVE AREA(ACRES) =     29.19   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       30.2       PEAK FLOW RATE(CFS) =      38.43
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       30.2  TC(MIN.) =     17.87
  EFFECTIVE AREA(ACRES) =     29.19  AREA-AVERAGED Fm(INCH/HR)=  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.621
  PEAK FLOW RATE(CFS)   =      38.43
```

```
  ** PEAK FLOW RATE TABLE **
   STREAM       Q       Tc    Intensity   Fp(Fm)      Ap      Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1       38.43   17.87     2.068  0.97( 0.61) 0.62      29.2        4.10
      2       35.81   20.19     1.923  0.97( 0.61) 0.62      30.2        1.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
____________________________________________________________________________
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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             Ver. 19.0  Release Date: 06/01/2012  License ID 1584

                           Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
 * TRACT 20473 REDLANDS                                                     *
 * HYDROLOGY                                                                *
 * 100-YEAR                                                                 *
 **************************************************************************

  FILE NAME: X:\FTP\AES\20473D00.DAT
  TIME/DATE OF STUDY: 11:19 09/27/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  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) = 1.3700

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   18.0      9.0    0.020/0.020/0.020   0.67    2.00 0.0313 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      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
```

```
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1695.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.140
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.261
  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.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.50      0.74     0.600    52   14.14
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      3.80
  TOTAL AREA(ACRES) =      1.50   PEAK FLOW RATE(CFS) =      3.80

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1655.00
  STREET LENGTH(FEET) =   916.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.75
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.37
    HALFSTREET FLOOD WIDTH(FEET) =   10.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.31
  STREET FLOW TRAVEL TIME(MIN.) =   4.36   Tc(MIN.) =   18.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.776
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        0.90      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    0.90      SUBAREA RUNOFF(CFS) =    1.89
  EFFECTIVE AREA(ACRES) =      2.40    AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =       2.4        PEAK FLOW RATE(CFS) =       5.03
```

```
  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  11.07
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.35
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1916.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.776
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        6.20      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    6.20      SUBAREA RUNOFF(CFS) =   13.00
  EFFECTIVE AREA(ACRES) =      8.60   AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.60
  TOTAL AREA(ACRES) =        8.6       PEAK FLOW RATE(CFS) =      18.04

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1650.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   385.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.11
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      18.04
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =   19.20
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   19.20
  RAINFALL INTENSITY(INCH/HR) =   2.71
  AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.74
  AREA-AVERAGED Ap =  0.60
  EFFECTIVE STREAM AREA(ACRES) =       8.60
  TOTAL STREAM AREA(ACRES) =       8.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      18.04

****************************************************************************
  FLOW PROCESS FROM NODE      4.10 TO NODE      4.20 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   1690.00  DOWNSTREAM(FEET) =   1674.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.930
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.156
  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.)
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        4.00      0.74     0.600    52   14.93
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =      9.76
  TOTAL AREA(ACRES) =      4.00   PEAK FLOW RATE(CFS) =      9.76

****************************************************************************
  FLOW PROCESS FROM NODE      4.20 TO NODE      4.30 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1674.00  DOWNSTREAM ELEVATION(FEET) = 1665.00
  STREET LENGTH(FEET) =   373.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   9.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.29
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.47
    HALFSTREET FLOOD WIDTH(FEET) =   15.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.62
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.18
  STREET FLOW TRAVEL TIME(MIN.) =   1.35   Tc(MIN.) =   16.28
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.997
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    5.05
  EFFECTIVE AREA(ACRES) =      6.20    AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.60
```

```
  TOTAL AREA(ACRES) =        6.2        PEAK FLOW RATE(CFS) =      14.24

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  16.70
  FLOW VELOCITY(FEET/SEC.) =  4.78   DEPTH*VELOCITY(FT*FT/SEC.) =   2.35
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.30 =    1373.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.28
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.997
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  PUBLIC PARK                A        1.70      0.74     0.850    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.850
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    3.62
  EFFECTIVE AREA(ACRES) =      7.90   AREA-AVERAGED Fm(INCH/HR) =  0.49
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.65
  TOTAL AREA(ACRES) =        7.9       PEAK FLOW RATE(CFS) =      17.86

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.30 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   16.28
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.997
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        4.20      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    9.65
  EFFECTIVE AREA(ACRES) =     12.10   AREA-AVERAGED Fm(INCH/HR) =  0.47
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       12.1       PEAK FLOW RATE(CFS) =      27.51

****************************************************************************
  FLOW PROCESS FROM NODE      4.30 TO NODE      4.40 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1660.00  DOWNSTREAM(FEET) =  1646.00
  FLOW LENGTH(FEET) =   598.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.97
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      27.51
  PIPE TRAVEL TIME(MIN.) =   0.83    Tc(MIN.) =   17.11
```

```
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.40 =    1971.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.11
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.909
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        3.60      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    7.98
  EFFECTIVE AREA(ACRES) =     15.70   AREA-AVERAGED Fm(INCH/HR) =  0.47
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.63
  TOTAL AREA(ACRES) =       15.7       PEAK FLOW RATE(CFS) =      34.52

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.40 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.11
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.909
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.90      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.90      SUBAREA RUNOFF(CFS) =    4.21
  EFFECTIVE AREA(ACRES) =     17.60   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       17.6       PEAK FLOW RATE(CFS) =      38.74

****************************************************************************
  FLOW PROCESS FROM NODE      4.40 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1646.00  DOWNSTREAM(FEET) =  1645.00
  FLOW LENGTH(FEET) =    51.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.06
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      38.74
  PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =   17.18
  LONGEST FLOWPATH FROM NODE      4.10 TO NODE      4.00 =    2022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 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.) =   17.18
  RAINFALL INTENSITY(INCH/HR) =   2.90
  AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74
  AREA-AVERAGED Ap =  0.62
  EFFECTIVE STREAM AREA(ACRES) =      17.60
  TOTAL STREAM AREA(ACRES) =      17.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      38.74

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       18.04   19.20    2.714  0.74( 0.45) 0.60       8.6       1.00
      2       38.74   17.18    2.901  0.74( 0.46) 0.62      17.6       4.10

  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       56.21   17.18    2.901  0.74( 0.46) 0.62      25.3       4.10
      2       53.80   19.20    2.714  0.74( 0.46) 0.62      26.2       1.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      56.21    Tc(MIN.) =    17.18
  EFFECTIVE AREA(ACRES) =      25.29   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       26.2
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    2301.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1645.00  DOWNSTREAM(FEET) =  1644.00
  FLOW LENGTH(FEET) =   186.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.10
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      56.21
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   17.56
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    2487.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  MAINLINE Tc(MIN.) =   17.56
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.863
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        1.30      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    2.83
  EFFECTIVE AREA(ACRES) =     26.59   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       27.5       PEAK FLOW RATE(CFS) =      57.59

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.56
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.863
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A        2.20      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    4.79
  EFFECTIVE AREA(ACRES) =     28.79   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.61
  TOTAL AREA(ACRES) =       29.7       PEAK FLOW RATE(CFS) =      62.38

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   17.56
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.863
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  URBAN GOOD COVER
  "TURF"                     A        0.50      0.73     1.000    53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.73
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.50      SUBAREA RUNOFF(CFS) =    0.96
  EFFECTIVE AREA(ACRES) =     29.29   AREA-AVERAGED Fm(INCH/HR) =  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =       30.2       PEAK FLOW RATE(CFS) =      63.34
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       30.2  TC(MIN.) =     17.56
  EFFECTIVE AREA(ACRES) =     29.29  AREA-AVERAGED Fm(INCH/HR)=  0.46
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.621
  PEAK FLOW RATE(CFS)   =      63.34
```

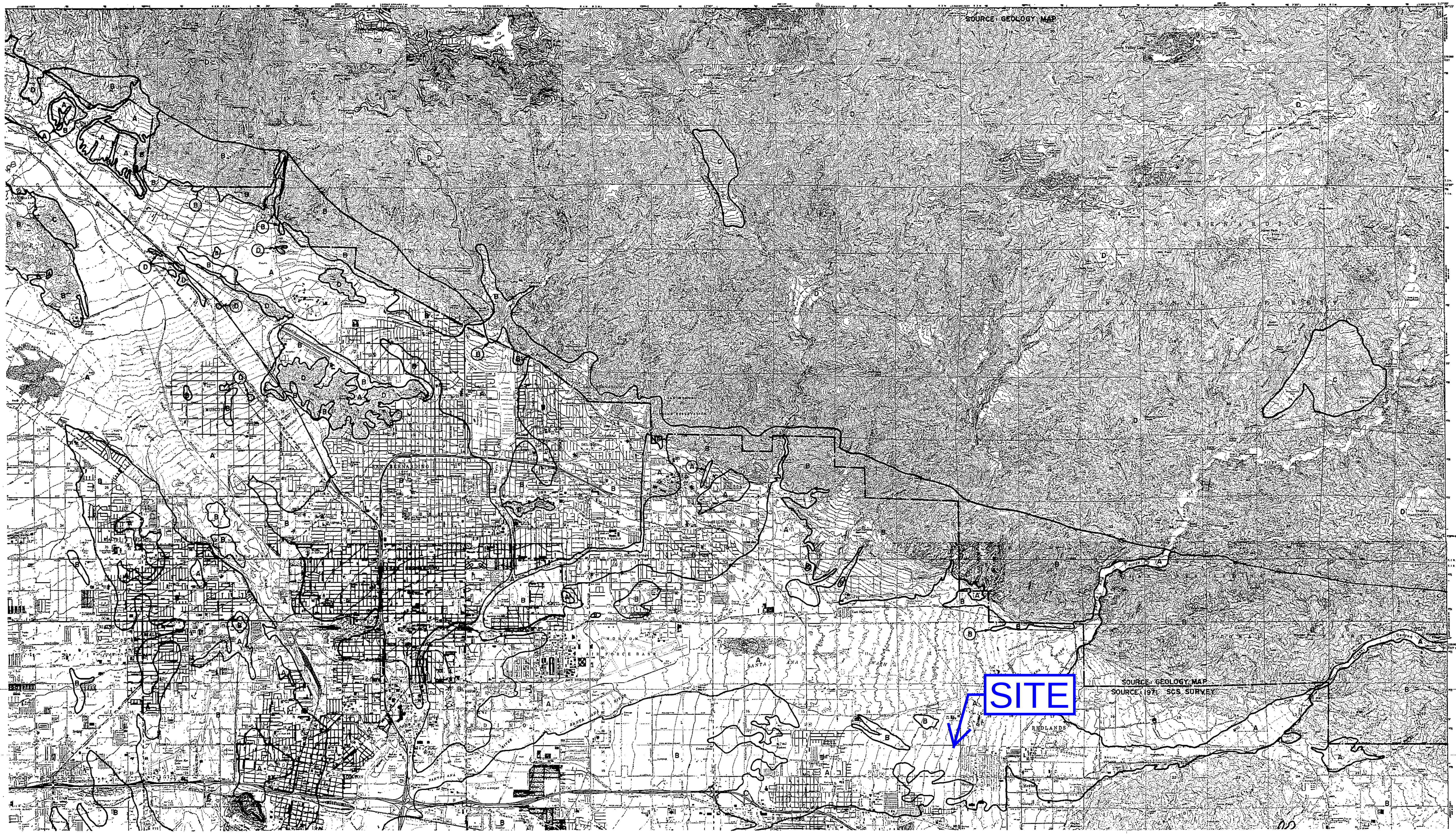
** PEAK FLOW RATE TABLE **

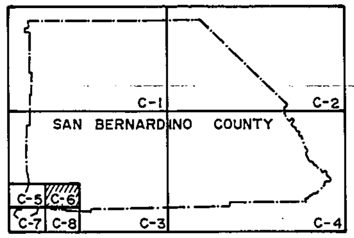
STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	63.34	17.56	2.863	0.74(0.46)	0.62	29.3	4.10
2	60.38	19.59	2.682	0.74(0.46)	0.62	30.2	1.00

==
==

END OF RATIONAL METHOD ANALYSIS

REFERENCES & MAPS





INDEX MAP

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

FIGURE C-14

NOAA Atlas 14, Volume 6, Version 2
Location name: Redlands, California, USA*
Latitude: 34.0762°, Longitude: -117.1426°
Elevation: 1572.58 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.105** (0.087-0.127)	**0.138** (0.115-0.168)	**0.185** (0.153-0.225)	**0.225** (0.185-0.277)	**0.283** (0.225-0.360)	**0.331** (0.258-0.431)	**0.383** (0.290-0.510)	**0.439** (0.324-0.603)	**0.521** (0.368-0.746)	**0.589** (0.402-0.874)
10-min	**0.150** (0.125-0.183)	**0.198** (0.165-0.241)	**0.265** (0.219-0.323)	**0.322** (0.265-0.396)	**0.406** (0.323-0.517)	**0.475** (0.369-0.617)	**0.549** (0.416-0.732)	**0.630** (0.464-0.864)	**0.747** (0.528-1.07)	**0.845** (0.576-1.25)
15-min	**0.182** (0.151-0.221)	**0.240** (0.199-0.291)	**0.320** (0.265-0.390)	**0.390** (0.320-0.479)	**0.491** (0.390-0.625)	**0.574** (0.446-0.747)	**0.664** (0.503-0.885)	**0.762** (0.561-1.05)	**0.904** (0.638-1.29)	**1.02** (0.696-1.51)
30-min	**0.267** (0.222-0.324)	**0.352** (0.292-0.427)	**0.470** (0.389-0.573)	**0.572** (0.470-0.704)	**0.721** (0.572-0.917)	**0.843** (0.655-1.10)	**0.975** (0.739-1.30)	**1.12** (0.824-1.53)	**1.33** (0.936-1.90)	**1.50** (1.02-2.22)
60-min	**0.374** (0.311-0.454)	**0.493** (0.409-0.599)	**0.658** (0.546-0.803)	**0.802** (0.659-0.986)	**1.01** (0.802-1.29)	**1.18** (0.918-1.54)	**1.37** (1.03-1.82)	**1.57** (1.15-2.15)	**1.86** (1.31-2.66)	**2.10** (1.43-3.11)
2-hr	**0.536** (0.446-0.651)	**0.693** (0.576-0.843)	**0.910** (0.754-1.11)	**1.10** (0.900-1.35)	**1.36** (1.08-1.73)	**1.57** (1.22-2.04)	**1.80** (1.36-2.40)	**2.04** (1.51-2.80)	**2.39** (1.69-3.42)	**2.67** (1.82-3.96)
3-hr	**0.657** (0.546-0.797)	**0.843** (0.700-1.02)	**1.10** (0.909-1.34)	**1.31** (1.08-1.61)	**1.62** (1.29-2.06)	**1.86** (1.45-2.42)	**2.12** (1.61-2.83)	**2.40** (1.76-3.29)	**2.78** (1.97-3.98)	**3.10** (2.11-4.59)
6-hr	**0.916** (0.762-1.11)	**1.17** (0.969-1.42)	**1.51** (1.25-1.84)	**1.79** (1.47-2.20)	**2.18** (1.73-2.78)	**2.50** (1.94-3.25)	**2.82** (2.14-3.76)	**3.17** (2.33-4.34)	**3.65** (2.57-5.22)	**4.03** (2.74-5.97)
12-hr	**1.24** (1.03-1.50)	**1.58** (1.31-1.92)	**2.04** (1.69-2.48)	**2.41** (1.98-2.96)	**2.93** (2.32-3.72)	**3.33** (2.59-4.33)	**3.74** (2.84-4.99)	**4.18** (3.08-5.73)	**4.77** (3.37-6.82)	**5.23** (3.57-7.75)
24-hr	**1.67** (1.48-1.92)	**2.15** (1.90-2.48)	**2.78** (2.45-3.22)	**3.30** (2.88-3.84)	**4.00** (3.39-4.82)	**4.55** (3.77-5.59)	**5.10** (4.13-6.43)	**5.68** (4.47-7.35)	**6.46** (4.89-8.71)	**7.07** (5.17-9.85)
2-day	**2.03** (1.80-2.34)	**2.65** (2.35-3.06)	**3.48** (3.07-4.03)	**4.17** (3.64-4.86)	**5.10** (4.32-6.15)	**5.83** (4.84-7.17)	**6.58** (5.33-8.29)	**7.36** (5.80-9.53)	**8.43** (6.38-11.4)	**9.27** (6.78-12.9)
3-day	**2.17** (1.93-2.51)	**2.88** (2.55-3.32)	**3.83** (3.38-4.43)	**4.61** (4.04-5.38)	**5.70** (4.83-6.87)	**6.56** (5.44-8.06)	**7.44** (6.03-9.37)	**8.37** (6.60-10.8)	**9.65** (7.31-13.0)	**10.7** (7.81-14.9)
4-day	**2.34** (2.07-2.70)	**3.13** (2.77-3.61)	**4.18** (3.69-4.84)	**5.06** (4.43-5.90)	**6.29** (5.33-7.58)	**7.25** (6.02-8.92)	**8.26** (6.69-10.4)	**9.31** (7.34-12.1)	**10.8** (8.15-14.5)	**11.9** (8.74-16.6)
7-day	**2.70** (2.39-3.11)	**3.65** (3.23-4.21)	**4.92** (4.34-5.69)	**5.98** (5.23-6.97)	**7.46** (6.32-8.99)	**8.62** (7.16-10.6)	**9.83** (7.97-12.4)	**11.1** (8.75-14.4)	**12.9** (9.74-17.3)	**14.3** (10.4-19.9)
10-day	**2.92** (2.59-3.37)	**3.98** (3.52-4.59)	**5.39** (4.76-6.24)	**6.57** (5.75-7.66)	**8.22** (6.96-9.90)	**9.51** (7.89-11.7)	**10.9** (8.79-13.7)	**12.3** (9.67-15.9)	**14.2** (10.8-19.2)	**15.8** (11.5-22.0)
20-day	**3.63** (3.22-4.19)	**4.99** (4.41-5.76)	**6.82** (6.02-7.89)	**8.35** (7.31-9.74)	**10.5** (8.88-12.6)	**12.2** (10.1-15.0)	**13.9** (11.3-17.5)	**15.8** (12.4-20.4)	**18.3** (13.9-24.7)	**20.4** (14.9-28.4)
30-day	**4.32** (3.82-4.98)	**5.93** (5.25-6.84)	**8.11** (7.15-9.38)	**9.93** (8.69-11.6)	**12.5** (10.6-15.0)	**14.5** (12.0-17.8)	**16.6** (13.5-20.9)	**18.8** (14.8-24.4)	**21.9** (16.6-29.5)	**24.3** (17.8-33.9)
45-day	**5.21** (4.61-6.00)	**7.10** (6.28-8.20)	**9.67** (8.53-11.2)	**11.8** (10.3-13.8)	**14.8** (12.6-17.9)	**17.2** (14.3-21.2)	**19.7** (16.0-24.9)	**22.4** (17.6-29.0)	**26.0** (19.7-35.1)	**28.9** (21.2-40.4)
60-day	**6.16** (5.45-7.10)	**8.31** (7.35-9.59)	**11.2** (9.91-13.0)	**13.7** (12.0-16.0)	**17.1** (14.5-20.6)	**19.9** (16.5-24.4)	**22.7** (18.4-28.6)	**25.7** (20.3-33.3)	**29.9** (22.6-40.3)	**33.3** (24.3-46.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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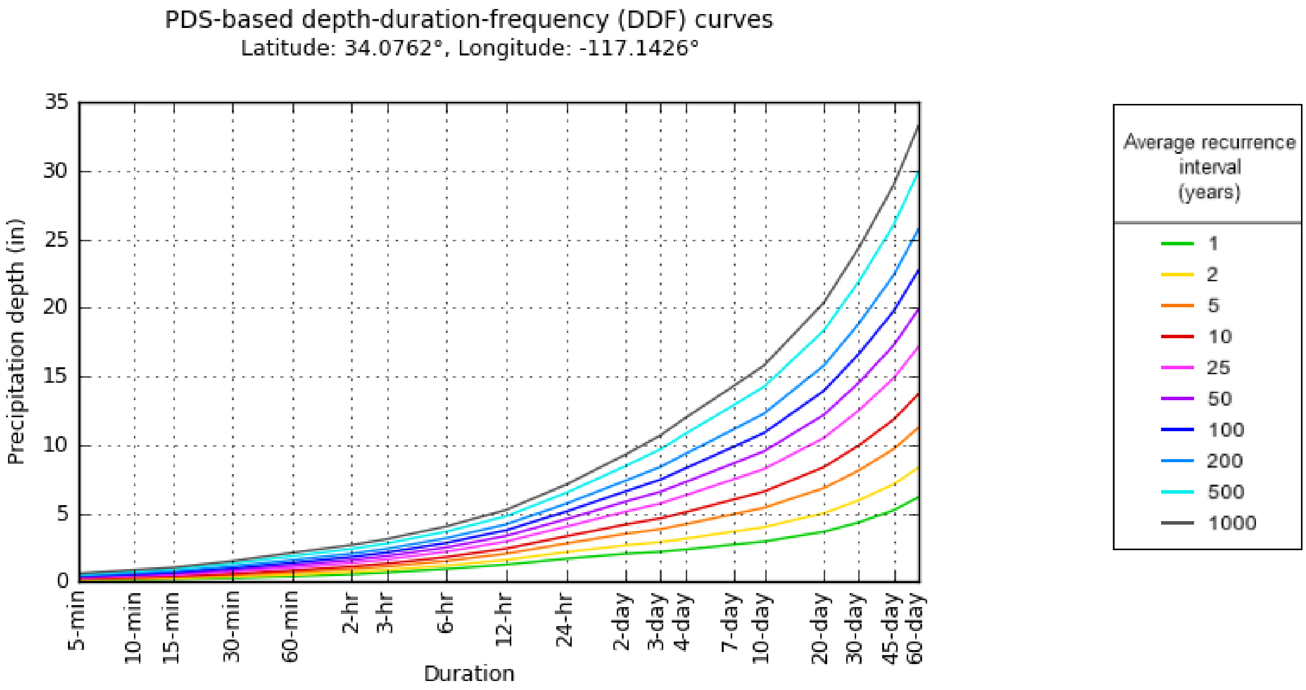
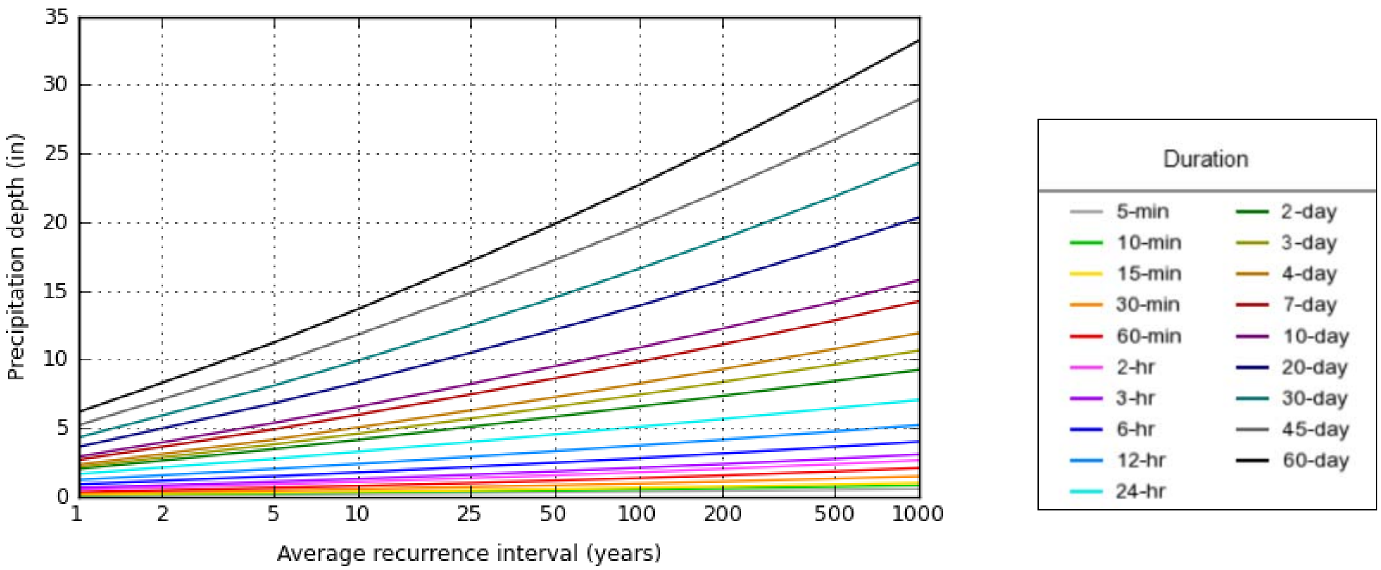
PF graphical





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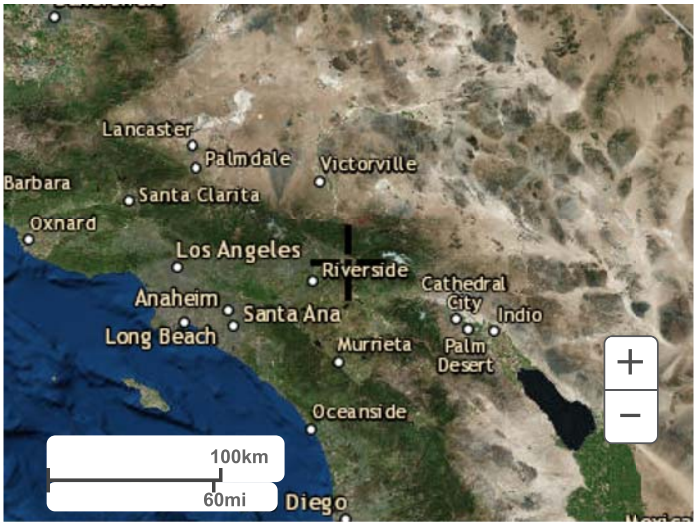
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial



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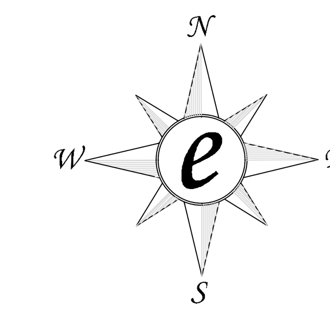
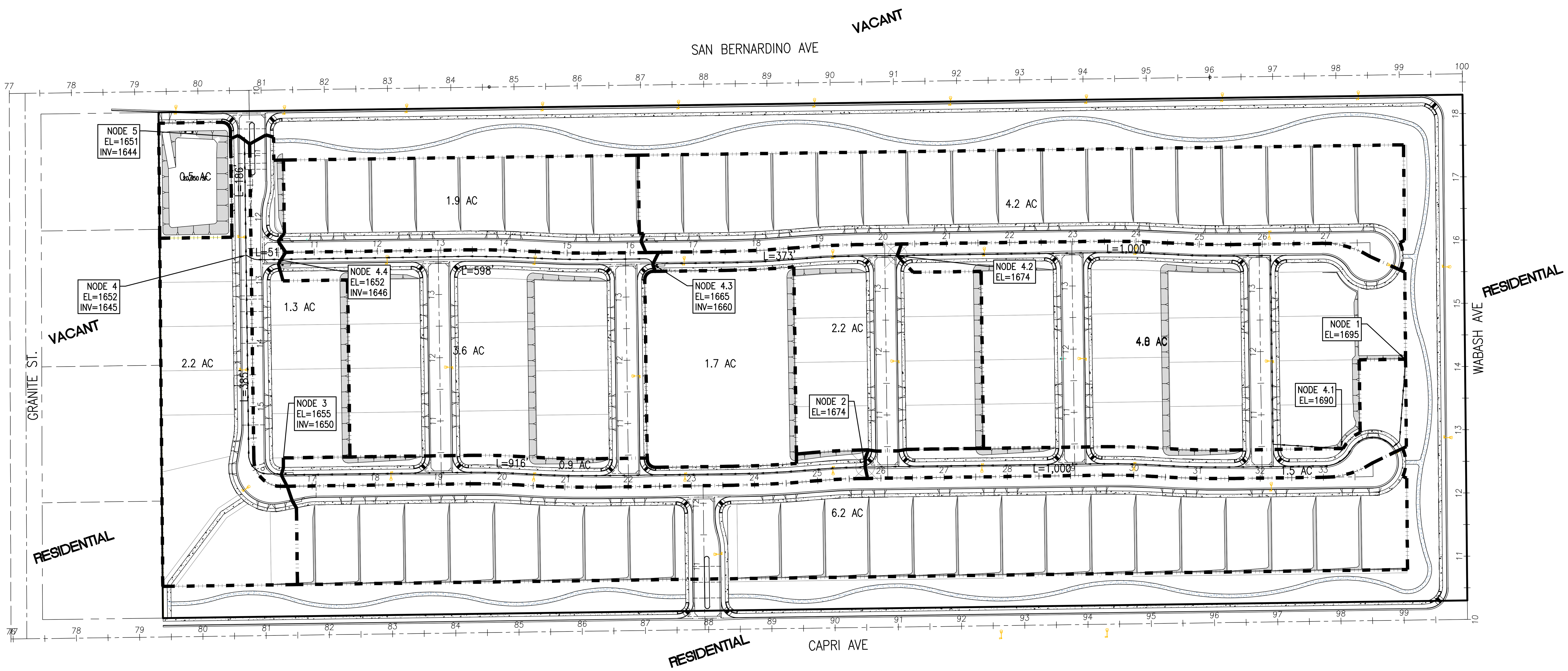
TRACT 20473
HYDROLOGY MAP





GRAPHIC SCALE

100 0 50 100 200

(IN FEET)

1 INCH = 100 FT.

LEGEND

TB	—	TRACT BOUNDARY
PL	—	PROPERTY LINE
R/W	—	RIGHT OF WAY
CL	—	CENTERLINE
EP	—	EDGE OF PAVEMENT
TC	—	TOP OF CURB
FL	—	FLOWLINE
FS	—	FINISHED SURFACE
GB	—	GRADE BREAK
INV	—	PIPE INVERT
FG	—	FINISH GRADE
ES	—	EXISTING SURFACE
EG	—	EXISTING GROUND
PAD	—	PAD ELEVATION
FF	—	FINISH FLOOR ELEVATION
GF	—	GARAGE FLOOR ELEVATION
HP	—	HIGH POINT
TRW	—	TOP OF RETAINING WALL
TF	—	TOP OF FOOTING
97.61	—	INDICATES PROPOSED ELEVATION
(97.61)	—	INDICATES EXISTING ELEVATION
——SD——		PROPOSED STORM DRAIN
——SD——		EXISTING STORM DRAIN
——W——		PROPOSED WATER LINE
——W——		EXISTING WATER LINE
——F——		PROPOSED FIRE LINE
——F——		EXISTING FIRE LINE
——S——		PROPOSED SEWER LINE
——S——		EXISTING SEWER LINE
————		PROPERTY LINE
————		RIGHT-OF-WAY
————		CENTERLINE
————		LIMITS OF SUBAREA

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Aaron T. Skeers, RCE 62183 Expires 9-30-23

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HYDROLOGY MAP

TRACT 20473

Letter	Description	Date	Initial	Initial

Revisions

Checked by: ______
Date: ______
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Sheet 1 of 1 Sheets