# PRELIMINARY HYDROLOGY STUDY

# for

# Grand Terrace Trailer Storage

**Grand Terrace, California**
**Conditional Use Permit No. 19-01**

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Project No. 17164

TRANSTECH

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# 1. INTRODUCTION

This report presents the design criteria, hydrologic conditions and hydrologic and hydraulic analysis for the proposed Grand Terrace trailer Storage Project located on the east side of La Cadena Avenue and north of Vivienda Avenue and south of the Santa Ana River, in the City of Grand Terrace.

# 2. PROJECT DESCRIPTION

The Applicant is proposing to entitle and develop the approximate 22-acre subject property ("Site") for use as an industrial truck and trailer storage facility ("Project") is similar in nature and consistent with currently permitted uses under the City's Zoning Code. The Site is currently zoned Heavy Industrial (M-2), with a small portion of the northern boundary within an Agricultural Overlay District (AG). The majority of the Site (20 acres) would be utilized for the Project's storage facilities.

Under the City's current zoning ordinance, the Site is classified as Heavy Industrial (M-2) with a Flood Plan Overlay (AG). The City's General Plan designates the Site as Industrial. The Project's proposed industrial truck and trailer storage facility use is "similar in nature" to several permitted uses within the M-2 Zone, including, without limitation, the following: Automotive related services; Contractor's office and storage yards; Heavy equipment sales and service; Public storage facilities; and, Wholesale storage and distribution facilities. .

The subject property is designated Industrial with an Agricultural Overlay. The Site is one of the few parcels in the area designated as Industrial with an Agricultural Overlay, further, the subject property is unique in that it also is impacted with flood plain conditions, significant overhead utility transmission lines, towers and easements (affecting approximately 1/3 of the site) and adjacent to a major flood control channel (Santa Ana River) and two(2) rail road corridors, thereby separated by a private roadway easement abutting only two privately owned parcels.

A maximum of 650 total semi-trailers, shipping and storage containers and chassis will be stored on the Site at any given time. There will be five (5) total employees assigned to the Site whose duties will include, among other things, internal transportation of trailers, chassis and storage containers and general operation of the Project facilities.

The proposed improvements for the Project shall consist of perimeter fencing, a paved entrance and turn around area, security cameras, landscaping, and an acceptable pervious parking surface for the interior areas of the site to be utilized for storage of semi-trailers, shipping and storage containers, chassis and related equipment. The Applicant will conduct street sweeping as necessary and consider installation of temporary metal shaker plates at the Site's entrance/exit to minimize and eliminate track out. The storage containers and chassis do not contain oil, except in sealed axles which are covered by wheel hubs and do not leak thereby preventing any impacts to soil or hardscape surfaces.

# 3. HYDROLOGIC CONDITIONS

## 3.1 Existing Condition

The existing site is vacant and undeveloped. Vegetation consists predominately of non-native grasses. The existing vegetation is disked from time to time to reduce fire hazard conditions. Natural drainage patterns on the site is sheet flow in a southerly to northerly direction. There are no surface or underground drainage improvements located on the site. Storm water sheet flows across the site towards the Santa Ana River.

Offsite flows contributing runoff to the site are generally from the south and southeast. Most offsite flows southerly from the project site are intercepted by State Highway 215 and diverted southerly towards Barton Road. Offsite flows that do contribute runoff to the site are from the southeast and are conveyed under the State Highway via a 54-inch storm drain and continue northerly in a vegetated channel (water course) consisting of brush and trees. As this channel reaches the project site, flows are dissipated and spread as sheet flow across the site for discharge to the Santa Ana River. Additional offsite flows from the south are conveyed northerly along the easterly side of the railroad. These flows again are spread as sheet flow across the project site combining with the flows from the channel and continue northerly to the Santa Ana River.

The proposed project site is located in FEMA Flood Zone AE. Flood zone AE is defined as a Special Hazard Flood Zone. Flood Zone AE are areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown on the Flood Insurance Rate Map (FIRM).

The Natural Resource Conservation Service soil data base was used to classify the onsite and offsite soils. Soils on the site are comprised of San Emigdio fine sandy loam (ScA) and Tujunga gravelly loamy sand (TvC). The San Emigdio series consists of very deep, well drained soils that formed in dominantly sedimentary alluvium. San Emigdio soils are on fans and floodplains and have slopes of 0 to 15 percent. The Tujunga series consists of very deep, somewhat excessively drained soils that formed in alluvium from granitic sources. Tujunga soils are on alluvial fans and floodplains, including urban areas. Slopes range from 0 to 12 percent.

The Natural Resource Conservation Service Hydrologic Soil Group Rating for these soils is A.

### 3.2 Developed Condition

The development of the proposed project will include the grading and construction of the trailer storage parking areas, main drive isles, parking lot and accessory buildings. Paved areas and trailer storage areas will be paved and graded to convey on-site runoff toward the infiltration basins. The design water quality volume will be infiltrated into the underlying soils. Once the water quality volume in the basins has been reach, stormwater overflow will overtop the basins and sheet flow northerly for discharge to the Santa Ana River.

## 4. METODOLOGY

The storm water peak flow rates of the subject property were calculated using the San Bernardino County Rational Method Analysis procedures. The Advanced Engineering Software version 19 was used to perform the rational method analysis. Peak flow rates for the 100-year storm event were prepared for both pre and post developed project conditions. Based upon the 2010 Hydrology Manual Addendum, the NOAA Atlas 14, Volume 6, Version 2 point precipitation frequency estimates were used to calculate the peak flow rates. The 100-year, 1-hour point precipitation near the middle of the watershed is 1.11 inches.

Water quality design capture volume calculations are based upon the County of San Bernardino Technical Guidance Manual. (See WQMP submitted separately)

USGS topographic mapping was used to determine the offsite watershed areas. Google imagery and field review was performed to verify flow patterns, land use and conditions of the offsite areas.

The results of the onsite Rational Method hydrologic analysis are used herein to present the pre and anticipated post-development runoff conditions for the proposed project.

## 5. WATER QUALITY

### 5.1 Water Quality Basin

The water quality infiltration basin and underground storage chambers are designed to capture and infiltrate 100 percent of the design water quality volume. The design infiltration rate used for the preliminary design of the water quality basins is .77 inches per hour. *(Soil Infiltration Study, prepared by Norcal Engineering, dated March 14, 2017)*

## 6. HYDROLOGIC RESULTS

The summary of the project site existing and developed condition peak flow rates for the proposed development areas are presented are as follows:

100-Year Existing Condition Peak Flow Rate: 18.2 cfs
100-Year Developed Condition Peak Flow Rate: 21.8 cfs

## 7. DRIANAGE AND WATER QUALITY DESIGN

As noted previously, the water quality infiltration basins will be designed to capture and infiltrate the water quality design capture volume. The design capture volume has been calculated for the project and the calculations are included in the project's Water Quality Management Plan submitted under separate cover. The design capture volumes for the projects three Drainage Areas are 1,623 c.f. (DA 1), 5,503 c.f. (DA 2) and 5,193 c.f. (DA3). Initial storm water runoff will be captured until the design capture volume has been reached. Once the design capture volume of the basins has been reached, flow rates will be allowed to be discharged.

The project site is topographically relatively flat with existing slopes typically less than one percent. Minor grading will be necessary to grade the trailer storage areas and paved drive aisles. Significant drainage structures such as catch basins and underground storm drains are not anticipated. The graded site will maintain the existing sheet flow condition.

The water quality basins will be shallow basins (less than one foot deep) located along the paved areas in order to collect runoff from these surfaces and also collect overflow runoff that may occur from the trailer parking areas. Although the trailer parking areas will be surfaced with a permeable material, some runoff should be expected. Pollutants from runoff from the trailer storage areas that are not directly infiltrated will be captured in the water quality basins.

Approximately 450 cubic feet per second of stormwater from offsite tributary areas located to the south and southeast of the project site contribute flows towards the project site. Most of the offsite flows originate from the south to southeast and are conveyed towards the project site by a vegetated water course beginning at the west side of the State Highway and continuing northerly towards the project site. Additional offsite flows originate south of the site and are conveyed northerly in a vegetated drainage channel along the railroad. Once these flows approach the site, they are dissipated and spread as sheet flow across the project site northerly for discharge to the Santa Ana River.

Drainage structures on the site to convey these flows are not considered to be necessary. First, these flows are spread and diverted to sheet flow. Visual review of these water courses and downstream discharge areas show very little channelization or erosion. Secondly, the proposed project is located in Flood Zone AE. The depicted base flood elevations (BFE) shown on the FIRM indicate the project site to

be inundated by several feet of water during the 100-year storm event. Offsite flows for the 100-year storm event flow rate would discharge into a ponded water condition.

## 8. CONCLUSION

The development of the proposed project will increase the peak flow rate of 18.2 cfs to 21.8 cfs. This is an increase of 3.6 cfs. The subject property fall within FEMA Zone AE and is subject to inundation by the 100-year storm event. The anticipated 100-year peak flow rate for the Santa Ana River according to the Flood Insurance Study (FIS) is 140,000 cfs. *(CLOMR Report for Tropica Ranch, prepared by Thienes Engineering, April 2019)* The increase in runoff from the proposed developed project site is not significant.

The proposed grading for the project site would convey onsite stormwater flows towards the water quality infiltration basins located throughout the site. The water quality design capture volume would be infiltrated into the underlying soils. Flows greater that the water quality storm would be allowed to continue to sheet flow towards the Santa Ana River. Due to the anticipated inundation of the site by being located in FEMA Zone AE, storm drain improvements to convey project stormwater and offsite stormwater flows would not be very effective.

## REFERENCES


Advanced Engineering Software, “Rational Method Computer Program Package,” version 18.2, 2012.

Advanced Engineering Software, “Pipe Flow Hydraulics Computer Program Package,” version 19.0, 2012.

County of San Bernardino, Department of Public Works “Hydrology Manual,” August 1986.

County of San Bernardino, Transportation Flood Control Water Resources Division, “Comprehensive Storm Drain Plan Project No. 3,” May 1973.

FEMA, Flood Insurance Rate Map Panel No. 06071C8687J, September 2, 2016.

Norcal Engineering, “Soil Infiltration Study,” March 14, 2017.

Soil Web Survey, San Bernardino Area, California (2013). U.S. Department of Agriculture, Natural Resource Conservation Service.

Thienes Engineering, “CLOMR Report for Tropica Ranch Santa Ana River Near La Cadena Drive,” April 2019.

# APPENDIX A
# Rational Method Hydrology

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
          (c) Copyright 1983-2012 Advanced Engineering Software (aes)
              Ver. 18.2  Release Date: 05/08/2012  License ID 1542

                              Analysis prepared by:

                            Transtech Engineers, Inc.
                                 413 Mackay Drive
                             San Bernardino, CA 92408


 ----------------------------------------------------------------------------
   FILE NAME: FLEETYRD.DAT
   TIME/DATE OF STUDY: 17:31 07/01/2019
 ============================================================================
   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) = 1.1100

   *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   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.00 FEET
        as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
     2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
   *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
    OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
   *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

## EXISTING CONDITION 100 YEAR

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.10 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1025.00
  ELEVATION DATA: UPSTREAM(FEET) =    904.00  DOWNSTREAM(FEET) =    902.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   39.358
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.430
  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
  "GRASS"                    A       21.70      0.50     1.000    70   39.36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     18.25
  TOTAL AREA(ACRES) =     21.70   PEAK FLOW RATE(CFS) =     18.25
```

## DEVELOPED CONDITION 100 YEAR

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.10 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1025.00
  ELEVATION DATA: UPSTREAM(FEET) =    904.00  DOWNSTREAM(FEET) =    902.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   27.149
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.786
  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.)
  DEVELOPED
  "PAVING, LANDSCAPE         A       21.70      0.74     0.900    52   27.15
  PERVIOUS PARKING”
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA RUNOFF(CFS) =     21.84
  TOTAL AREA(ACRES) =     21.70   PEAK FLOW RATE(CFS) =     21.84
```

# OFFSITE 100 YEAR

```
****************************************************************************
  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) =   695.00
  ELEVATION DATA: UPSTREAM(FEET) =   1121.00  DOWNSTREAM(FEET) =   1095.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.892
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.090
  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        5.40      0.74     0.600    52   10.89
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.600
  SUBAREA RUNOFF(CFS) =     12.85
  TOTAL AREA(ACRES) =      5.40   PEAK FLOW RATE(CFS) =     12.85

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1095.00  DOWNSTREAM ELEVATION(FEET) = 1055.00
  STREET LENGTH(FEET) =  1175.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =      64.22
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.55
    HALFSTREET FLOOD WIDTH(FEET) =   22.75
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    6.74
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    3.74
  STREET FLOW TRAVEL TIME(MIN.) =   2.91   Tc(MIN.) =   13.80
```

```
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.681
  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
  "GRASS"                    B        0.59      0.27     1.000    86
  NATURAL FAIR COVER
  "GRASS"                    C        5.70      0.17     1.000    93
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       17.20      0.74     0.500    52
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C       19.00      0.27     0.500    86
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A        4.30      0.74     0.500    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.44
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.567
  SUBAREA AREA(ACRES) =   46.79      SUBAREA RUNOFF(CFS) =  102.38
  EFFECTIVE AREA(ACRES) =     52.19    AREA-AVERAGED Fm(INCH/HR) =  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.47  AREA-AVERAGED Ap =  0.57
  TOTAL AREA(ACRES) =       52.2        PEAK FLOW RATE(CFS) =     113.25

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.65   HALFSTREET FLOOD WIDTH(FEET) =  27.32
  FLOW VELOCITY(FEET/SEC.) =  8.02   DEPTH*VELOCITY(FT*FT/SEC.) =   5.19
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1175.0 FT WITH ELEVATION-DROP =  40.0 FT, IS  106.9 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    102.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    1870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1055.00  DOWNSTREAM ELEVATION(FEET) = 1005.00
  STREET LENGTH(FEET) =  1680.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =     139.04
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.70
```

```
    HALFSTREET FLOOD WIDTH(FEET) =   30.01
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    8.08
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    5.66
  STREET FLOW TRAVEL TIME(MIN.) =   3.46   Tc(MIN.) =   17.26
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.344
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       C        2.70      0.27     0.500    86
  RESIDENTIAL
  "3-4 DWELLINGS/ACRE"       A       27.00      0.74     0.600    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.71
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.591
  SUBAREA AREA(ACRES) =   29.70      SUBAREA RUNOFF(CFS) =   51.51
  EFFECTIVE AREA(ACRES) =     81.89    AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.56  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =       81.9        PEAK FLOW RATE(CFS) =     148.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.71   HALFSTREET FLOOD WIDTH(FEET) =  30.74
  FLOW VELOCITY(FEET/SEC.) =  8.23   DEPTH*VELOCITY(FT*FT/SEC.) =   5.89
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L = 1680.0 FT WITH ELEVATION-DROP =  50.0 FT, IS   56.2 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    103.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    3550.00 FEET.

****************************************************************************
  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) =   1005.00  DOWNSTREAM(FEET) =    950.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1610.00   CHANNEL SLOPE =  0.0342
  CHANNEL FLOW THRU SUBAREA(CFS) =     148.92
  FLOW VELOCITY(FEET/SEC) =   9.90 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.71   Tc(MIN.) =   19.97
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    5160.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.97
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.148
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "5-7 DWELLINGS/ACRE"       A       36.30      0.74     0.500    52
```

```
  MOBILE HOME PARK           A        1.90      0.74     0.250    52
  NATURAL FAIR COVER
  "GRASS"                    B        7.80      0.27     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.574
  SUBAREA AREA(ACRES) =   46.00      SUBAREA RUNOFF(CFS) =   74.56
  EFFECTIVE AREA(ACRES) =    127.89   AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.58  AREA-AVERAGED Ap =  0.58
  TOTAL AREA(ACRES) =      127.9       PEAK FLOW RATE(CFS) =     209.00

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   19.97
  RAINFALL INTENSITY(INCH/HR) =   2.15
  AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.58
  AREA-AVERAGED Ap =  0.58
  EFFECTIVE STREAM AREA(ACRES) =     127.89
  TOTAL STREAM AREA(ACRES) =     127.89
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     209.00

****************************************************************************
  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) =   750.00
  ELEVATION DATA: UPSTREAM(FEET) =   1060.00  DOWNSTREAM(FEET) =   1040.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.311
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.519
  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
  "GRASS"                    B        1.70      0.27     1.000    86   20.59
  NATURAL POOR COVER
  "GRASS"                    C        7.70      0.11     1.000    97   15.31
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.14
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     20.16
  TOTAL AREA(ACRES) =      9.40   PEAK FLOW RATE(CFS) =     20.16

****************************************************************************
  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) =   1140.00  DOWNSTREAM(FEET) =   1000.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1730.00   CHANNEL SLOPE =  0.0809
  CHANNEL FLOW THRU SUBAREA(CFS) =      20.16
  FLOW VELOCITY(FEET/SEC) =   8.54 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.38   Tc(MIN.) =   18.69
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =    2480.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.69
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.235
  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
  "GRASS"                    C        2.10      0.11     1.000    97
  NATURAL POOR COVER
  "GRASS"                    A       27.30      0.30     1.000    85
  NATURAL FAIR COVER
  "GRASS"                    B        2.30      0.27     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.28
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =   31.70      SUBAREA RUNOFF(CFS) =   55.73
  EFFECTIVE AREA(ACRES) =     41.10   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       41.1       PEAK FLOW RATE(CFS) =      73.49

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    104.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1000.00  DOWNSTREAM ELEVATION(FEET) =  950.00
  STREET LENGTH(FEET) =   790.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 15.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =      74.16
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.52
    HALFSTREET FLOOD WIDTH(FEET) =   16.10
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    9.71
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    5.07
  STREET FLOW TRAVEL TIME(MIN.) =   1.36   Tc(MIN.) =   20.04
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.143
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         B        0.81      0.42     0.700    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    0.81      SUBAREA RUNOFF(CFS) =    1.35
  EFFECTIVE AREA(ACRES) =     41.91    AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.25  AREA-AVERAGED Ap =  0.99
  TOTAL AREA(ACRES) =       41.9        PEAK FLOW RATE(CFS) =      73.49
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  16.04
  FLOW VELOCITY(FEET/SEC.) =  9.67   DEPTH*VELOCITY(FT*FT/SEC.) =   5.04
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    104.00 =    3270.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   20.04
  RAINFALL INTENSITY(INCH/HR) =   2.14
  AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.25
  AREA-AVERAGED Ap =  0.99
  EFFECTIVE STREAM AREA(ACRES) =      41.91
  TOTAL STREAM AREA(ACRES) =      41.91
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      73.49

****************************************************************************
  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) =   840.00
  ELEVATION DATA: UPSTREAM(FEET) =   1000.00  DOWNSTREAM(FEET) =    990.00
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.705
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.481
  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
  "2 DWELLINGS/ACRE"         A        5.90      0.74     0.700    52   15.71
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         B        0.24      0.42     0.700    76   15.71
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.73
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =     10.89
  TOTAL AREA(ACRES) =      6.14   PEAK FLOW RATE(CFS) =     10.89

****************************************************************************
  FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  990.00  DOWNSTREAM ELEVATION(FEET) =  980.00
  STREET LENGTH(FEET) =  1105.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =      12.19
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.42
    HALFSTREET FLOOD WIDTH(FEET) =   14.71
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.67
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.12
  STREET FLOW TRAVEL TIME(MIN.) =   6.89   Tc(MIN.) =   22.60
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.994
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        1.23      0.74     0.700    52
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         B        0.64      0.42     0.700    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.63
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
```

```
  SUBAREA AREA(ACRES) =    1.87      SUBAREA RUNOFF(CFS) =    2.61
  EFFECTIVE AREA(ACRES) =      8.01    AREA-AVERAGED Fm(INCH/HR) =  0.49
  AREA-AVERAGED Fp(INCH/HR) =  0.71  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =        8.0        PEAK FLOW RATE(CFS) =      10.89
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.08
  FLOW VELOCITY(FEET/SEC.) =  2.59   DEPTH*VELOCITY(FT*FT/SEC.) =   1.06
  LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =    1945.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    122.00 TO NODE    104.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.60
  RAINFALL INTENSITY(INCH/HR) =   1.99
  AREA-AVERAGED Fm(INCH/HR) =  0.49
  AREA-AVERAGED Fp(INCH/HR) =  0.71
  AREA-AVERAGED Ap =  0.70
  EFFECTIVE STREAM AREA(ACRES) =       8.01
  TOTAL STREAM AREA(ACRES) =       8.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      10.89

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      209.00   19.97    2.148  0.58( 0.33) 0.58     127.9     100.00
      2       73.49   20.04    2.143  0.25( 0.25) 0.99      41.9     110.00
      3       10.89   22.60    1.994  0.71( 0.49) 0.70       8.0     120.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      293.02   19.97    2.148  0.47( 0.32) 0.68     176.7     100.00
      2      292.61   20.04    2.143  0.47( 0.32) 0.68     176.9     110.00
      3      269.95   22.60    1.994  0.47( 0.32) 0.68     177.8     120.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     293.02    Tc(MIN.) =    19.97
  EFFECTIVE AREA(ACRES) =     176.74   AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.47  AREA-AVERAGED Ap =  0.68
  TOTAL AREA(ACRES) =      177.8
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    5160.00 FEET.
```

```
****************************************************************************
  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) =    950.00  DOWNSTREAM(FEET) =    930.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   485.00   CHANNEL SLOPE =  0.0412
  CHANNEL FLOW THRU SUBAREA(CFS) =     293.02
  FLOW VELOCITY(FEET/SEC) =  13.42 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.60   Tc(MIN.) =   20.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    5645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.58
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.110
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  ".4 DWELLING/ACRE"         B        4.60      0.42     0.900    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.900
  SUBAREA AREA(ACRES) =    4.60      SUBAREA RUNOFF(CFS) =    7.16
  EFFECTIVE AREA(ACRES) =    181.34   AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.47  AREA-AVERAGED Ap =  0.69
  TOTAL AREA(ACRES) =      182.4       PEAK FLOW RATE(CFS) =     293.02
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 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.) =   20.58
  RAINFALL INTENSITY(INCH/HR) =   2.11
  AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.47
  AREA-AVERAGED Ap =  0.69
  EFFECTIVE STREAM AREA(ACRES) =     181.34
  TOTAL STREAM AREA(ACRES) =     182.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     293.02

****************************************************************************
  FLOW PROCESS FROM NODE    232.00 TO NODE    105.00 IS CODE =   7
----------------------------------------------------------------------------
```

```
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =   20.71   RAINFALL INTENSITY(INCH/HR) =  2.10
  EFFECTIVE AREA(ACRES) =    44.31
  TOTAL AREA(ACRES) =    49.50        PEAK FLOW RATE(CFS) =     70.79
  AREA-AVERAGED Fm(INCH/HR) =   0.33  AREA-AVERAGED Fp(INCH/HR) =   0.49
  AREA-AVERAGED Ap =  0.67
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
         CONFLUENCE ANALYSES.

******************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    105.00 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.) =   20.71
  RAINFALL INTENSITY(INCH/HR) =   2.10
  AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.49
  AREA-AVERAGED Ap =  0.67
  EFFECTIVE STREAM AREA(ACRES) =      44.31
  TOTAL STREAM AREA(ACRES) =      49.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      70.79

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      293.02   20.58    2.110  0.47( 0.32) 0.69     181.3     100.00
      1      292.61   20.64    2.105  0.47( 0.32) 0.69     181.5     110.00
      1      269.95   23.22    1.962  0.47( 0.32) 0.69     182.4     120.00
      2       70.79   20.71    2.101  0.49( 0.33) 0.67      44.3     232.00

  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      363.68   20.58    2.110  0.47( 0.32) 0.68     225.4     100.00
      2      363.33   20.64    2.105  0.47( 0.32) 0.68     225.7     110.00
      3      362.82   20.71    2.101  0.47( 0.32) 0.68     225.8     232.00
      4      335.19   23.22    1.962  0.47( 0.32) 0.68     226.7     120.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     363.68    Tc(MIN.) =    20.58
  EFFECTIVE AREA(ACRES) =     225.36   AREA-AVERAGED Fm(INCH/HR) =  0.32
  AREA-AVERAGED Fp(INCH/HR) =  0.47  AREA-AVERAGED Ap =  0.68
  TOTAL AREA(ACRES) =      231.9
```

```
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    5645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    930.00  DOWNSTREAM(FEET) =    904.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1180.00   CHANNEL SLOPE =  0.0220
  CHANNEL FLOW THRU SUBAREA(CFS) =     363.68
  FLOW VELOCITY(FEET/SEC) =  10.50 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.87   Tc(MIN.) =   22.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    6825.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   22.45
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.002
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL GOOD COVER
  "GRASS"                    B        4.50      0.36     1.000    80
  NATURAL GOOD COVER
  "GRASS"                    A        8.80      0.66     1.000    58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.56
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =   13.30      SUBAREA RUNOFF(CFS) =   17.28
  EFFECTIVE AREA(ACRES) =    238.66   AREA-AVERAGED Fm(INCH/HR) =  0.34
  AREA-AVERAGED Fp(INCH/HR) =  0.48  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =      245.2       PEAK FLOW RATE(CFS) =     363.68
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   760.00
  ELEVATION DATA: UPSTREAM(FEET) =    995.00  DOWNSTREAM(FEET) =    985.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.727
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.307
  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
  "GRASS"                    A       16.90      0.30     1.000    85   17.73
  NATURAL POOR COVER
  "GRASS"                    B        0.07      0.18     1.000    93   17.73
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     30.72
  TOTAL AREA(ACRES) =     16.97   PEAK FLOW RATE(CFS) =     30.72

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    212.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  985.00  DOWNSTREAM ELEVATION(FEET) =  975.00
  STREET LENGTH(FEET) =  1040.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =      35.54
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.56
    HALFSTREET FLOOD WIDTH(FEET) =   23.05
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.62
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.03
  STREET FLOW TRAVEL TIME(MIN.) =   4.79   Tc(MIN.) =   22.51
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.999
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  MOBILE HOME PARK           A        5.90      0.74     0.250    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.250
  SUBAREA AREA(ACRES) =    5.90      SUBAREA RUNOFF(CFS) =    9.63
  EFFECTIVE AREA(ACRES) =     22.87    AREA-AVERAGED Fm(INCH/HR) =  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.33  AREA-AVERAGED Ap =  0.81
  TOTAL AREA(ACRES) =       22.9        PEAK FLOW RATE(CFS) =      35.64

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.56   HALFSTREET FLOOD WIDTH(FEET) =  23.05
  FLOW VELOCITY(FEET/SEC.) =  3.63   DEPTH*VELOCITY(FT*FT/SEC.) =   2.04
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    212.00 =    1800.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    212.00 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.) =   22.51
  RAINFALL INTENSITY(INCH/HR) =   2.00
  AREA-AVERAGED Fm(INCH/HR) =  0.27
  AREA-AVERAGED Fp(INCH/HR) =  0.33
  AREA-AVERAGED Ap =  0.81
  EFFECTIVE STREAM AREA(ACRES) =      22.87
  TOTAL STREAM AREA(ACRES) =      22.87
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      35.64

****************************************************************************
  FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   365.00
  ELEVATION DATA: UPSTREAM(FEET) =    990.00  DOWNSTREAM(FEET) =    985.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.114
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.764
  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
  "GRASS"                    A        0.42      0.30     1.000    85   13.11
  NATURAL POOR COVER
  "GRASS"                    C        1.28      0.11     1.000    97   13.11
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.15
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.00
  TOTAL AREA(ACRES) =      1.70   PEAK FLOW RATE(CFS) =      4.00

****************************************************************************
  FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  985.00  DOWNSTREAM ELEVATION(FEET) =  975.00
  STREET LENGTH(FEET) =   695.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =       8.64
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.65
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.93
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.05
  STREET FLOW TRAVEL TIME(MIN.) =   3.96   Tc(MIN.) =   17.07
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.360
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  MOBILE HOME PARK           A        2.20      0.74     0.250    52
  MOBILE HOME PARK           C        2.40      0.27     0.250    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.250
  SUBAREA AREA(ACRES) =    4.60      SUBAREA RUNOFF(CFS) =    9.25
  EFFECTIVE AREA(ACRES) =      6.30    AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.29  AREA-AVERAGED Ap =  0.45
  TOTAL AREA(ACRES) =        6.3        PEAK FLOW RATE(CFS) =      12.63

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.60
  FLOW VELOCITY(FEET/SEC.) =  3.21   DEPTH*VELOCITY(FT*FT/SEC.) =   1.28
  LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =    1060.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    222.00 TO NODE    212.00 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.) =   17.07
  RAINFALL INTENSITY(INCH/HR) =   2.36
  AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.29
  AREA-AVERAGED Ap =  0.45
  EFFECTIVE STREAM AREA(ACRES) =       6.30
  TOTAL STREAM AREA(ACRES) =       6.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.63

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
```

```
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
    1       35.64   22.51    1.999  0.33( 0.27) 0.81      22.9     210.00
    2       12.63   17.07    2.360  0.29( 0.13) 0.45       6.3     220.00

  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       45.29   17.07    2.360  0.32( 0.23) 0.71      23.6     220.00
    2       46.22   22.51    1.999  0.33( 0.24) 0.73      29.2     210.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      46.22    Tc(MIN.) =    22.51
  EFFECTIVE AREA(ACRES) =      29.17   AREA-AVERAGED Fm(INCH/HR) =  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.33  AREA-AVERAGED Ap =  0.73
  TOTAL AREA(ACRES) =       29.2
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    212.00 =    1800.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    231.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   975.00  DOWNSTREAM(FEET) =   960.00
  FLOW LENGTH(FEET) =   495.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.91
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      46.22
  PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =   23.07
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    231.00 =    2295.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    231.00 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.) =   23.07
  RAINFALL INTENSITY(INCH/HR) =   1.97
  AREA-AVERAGED Fm(INCH/HR) =  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.33
  AREA-AVERAGED Ap =  0.73
  EFFECTIVE STREAM AREA(ACRES) =      29.17
  TOTAL STREAM AREA(ACRES) =      29.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      46.22

****************************************************************************
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```
  FLOW PROCESS FROM NODE    230.00 TO NODE    231.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   870.00
  ELEVATION DATA: UPSTREAM(FEET) =    978.00  DOWNSTREAM(FEET) =    960.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.898
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.273
  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        2.70      0.74     0.100    52    9.90
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        6.60      0.74     0.700    52   14.26
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.526
  SUBAREA RUNOFF(CFS) =     24.13
  TOTAL AREA(ACRES) =      9.30   PEAK FLOW RATE(CFS) =     24.13

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    231.00 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.) =    9.90
  RAINFALL INTENSITY(INCH/HR) =   3.27
  AREA-AVERAGED Fm(INCH/HR) =  0.39
  AREA-AVERAGED Fp(INCH/HR) =  0.74
  AREA-AVERAGED Ap =  0.53
  EFFECTIVE STREAM AREA(ACRES) =       9.30
  TOTAL STREAM AREA(ACRES) =       9.30
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      24.13

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       45.29   17.63    2.315  0.32( 0.23) 0.71      23.6     220.00
      1       46.22   23.07    1.970  0.33( 0.24) 0.73      29.2     210.00
      2       24.13    9.90    3.273  0.74( 0.39) 0.53       9.3     230.00

  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       61.25    9.90    3.273  0.47( 0.30) 0.64      22.6     230.00
     2       61.40   17.63    2.315  0.42( 0.28) 0.66      32.9     220.00
     3       59.45   23.07    1.970  0.40( 0.27) 0.68      38.5     210.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      61.40    Tc(MIN.) =    17.63
  EFFECTIVE AREA(ACRES) =      32.94   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =       38.5
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    231.00 =    2295.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    231.00 TO NODE    232.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    960.00  DOWNSTREAM(FEET) =    936.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1025.00   CHANNEL SLOPE =  0.0234
  CHANNEL FLOW THRU SUBAREA(CFS) =      61.40
  FLOW VELOCITY(FEET/SEC) =   6.29 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.72   Tc(MIN.) =   20.35
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    232.00 =    3320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    232.00 TO NODE    232.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   20.35
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.124
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        9.00      0.74     0.700    52
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         B        2.00      0.42     0.700    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.68
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =   11.00      SUBAREA RUNOFF(CFS) =   16.29
  EFFECTIVE AREA(ACRES) =     43.94   AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.49  AREA-AVERAGED Ap =  0.67
  TOTAL AREA(ACRES) =       49.5       PEAK FLOW RATE(CFS) =      71.07

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
     1       74.72   12.62    2.829  0.54( 0.36) 0.66      33.6     230.00
     2       71.07   20.35    2.124  0.49( 0.33) 0.67      43.9     220.00
     3       67.73   25.81    1.841  0.47( 0.32) 0.68      49.5     210.00
  NEW PEAK FLOW DATA ARE:
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```
  PEAK FLOW RATE(CFS) =      74.72  Tc(MIN.) =   12.62
  AREA-AVERAGED Fm(INCH/HR) =  0.36  AREA-AVERAGED Fp(INCH/HR) =  0.54
  AREA-AVERAGED Ap =  0.66  EFFECTIVE AREA(ACRES) =      33.57

****************************************************************************
  FLOW PROCESS FROM NODE    240.00 TO NODE    241.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   880.00
  ELEVATION DATA: UPSTREAM(FEET) =    958.00  DOWNSTREAM(FEET) =    945.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.636
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.134
  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      0.74     0.100    52   10.64
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     12.67
  TOTAL AREA(ACRES) =      4.60   PEAK FLOW RATE(CFS) =     12.67

****************************************************************************
  FLOW PROCESS FROM NODE    241.00 TO NODE    242.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  945.00  DOWNSTREAM ELEVATION(FEET) =  938.00
  STREET LENGTH(FEET) =   630.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   5.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  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) =      47.61
    ***STREET FLOWING FULL***
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.59
    HALFSTREET FLOOD WIDTH(FEET) =   24.70
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.18
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.48
  STREET FLOW TRAVEL TIME(MIN.) =   2.51   Tc(MIN.) =   13.15
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  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.760
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A       28.80      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =   28.80      SUBAREA RUNOFF(CFS) =   69.62
  EFFECTIVE AREA(ACRES) =     33.40    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       33.4        PEAK FLOW RATE(CFS) =      80.73

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.69   HALFSTREET FLOOD WIDTH(FEET) =  29.46
  FLOW VELOCITY(FEET/SEC.) =  4.88   DEPTH*VELOCITY(FT*FT/SEC.) =   3.36
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  630.0 FT WITH ELEVATION-DROP =   7.0 FT, IS   83.1 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    242.00
  LONGEST FLOWPATH FROM NODE    240.00 TO NODE    242.00 =    1510.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    242.00 TO NODE    243.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    938.00  DOWNSTREAM(FEET) =    918.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1500.00   CHANNEL SLOPE =  0.0133
  CHANNEL FLOW THRU SUBAREA(CFS) =      80.73
  FLOW VELOCITY(FEET/SEC) =   5.14 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.86   Tc(MIN.) =   18.01
  LONGEST FLOWPATH FROM NODE    240.00 TO NODE    243.00 =    3010.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    243.00 TO NODE    243.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   18.01
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.285
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        3.20      0.74     0.100    52
  NATURAL FAIR COVER
  "GRASS"                    A        4.30      0.50     1.000    70
  NATURAL FAIR COVER
  "GRASS"                    B        0.31      0.27     1.000    86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.50
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.631
  SUBAREA AREA(ACRES) =    7.81      SUBAREA RUNOFF(CFS) =   13.86
  EFFECTIVE AREA(ACRES) =     41.21   AREA-AVERAGED Fm(INCH/HR) =  0.12
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.60  AREA-AVERAGED Ap =  0.20
  TOTAL AREA(ACRES) =       41.2       PEAK FLOW RATE(CFS) =      80.73
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    250.00 TO NODE    251.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   932.00
  ELEVATION DATA: UPSTREAM(FEET) =    960.00  DOWNSTREAM(FEET) =    935.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.917
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.667
  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
  "2 DWELLINGS/ACRE"         A        7.10      0.74     0.700    52   13.92
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         B        3.40      0.42     0.700    76   13.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.64
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =     20.98
  TOTAL AREA(ACRES) =     10.50   PEAK FLOW RATE(CFS) =     20.98

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    261.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   990.00
  ELEVATION DATA: UPSTREAM(FEET) =    945.00  DOWNSTREAM(FEET) =    937.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   38.688
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.444
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    A        1.53      0.66     1.000    58   38.69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.66
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.08
  TOTAL AREA(ACRES) =      1.53   PEAK FLOW RATE(CFS) =      1.08

****************************************************************************
  FLOW PROCESS FROM NODE    261.00 TO NODE    262.00 IS CODE =  52
```

```
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    937.00  DOWNSTREAM(FEET) =    920.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1500.00   CHANNEL SLOPE =  0.0113
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.08
  FLOW VELOCITY(FEET/SEC) =   1.62 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =  15.42   Tc(MIN.) =   54.11
  LONGEST FLOWPATH FROM NODE    260.00 TO NODE    262.00 =    2490.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    262.00 TO NODE    262.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   54.11
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.181
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL GOOD COVER
  "GRASS"                    A        2.33      0.66     1.000    58
  NATURAL GOOD COVER
  "GRASS"                    B        0.73      0.36     1.000    80
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.59
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    3.06      SUBAREA RUNOFF(CFS) =    1.63
  EFFECTIVE AREA(ACRES) =      4.59   AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.61  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        4.6       PEAK FLOW RATE(CFS) =       2.35

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   900.00
  ELEVATION DATA: UPSTREAM(FEET) =    935.00  DOWNSTREAM(FEET) =    904.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   27.867
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  1.759
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL GOOD COVER
  "GRASS"                    B        0.27      0.36     1.000    80   27.87
  NATURAL GOOD COVER
  "GRASS"                    A        8.60      0.66     1.000    58   27.87
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.65
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      8.86
  TOTAL AREA(ACRES) =      8.87   PEAK FLOW RATE(CFS) =      8.86

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =   22.45   RAINFALL INTENSITY(INCH/HR) =  2.00
  EFFECTIVE AREA(ACRES) =   238.66
  TOTAL AREA(ACRES) =   245.20        PEAK FLOW RATE(CFS) =    363.68
  AREA-AVERAGED Fm(INCH/HR) =   0.34  AREA-AVERAGED Fp(INCH/HR) =   0.48
  AREA-AVERAGED Ap =  0.70
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
         CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   22.45
  RAINFALL INTENSITY(INCH/HR) =   2.00
  AREA-AVERAGED Fm(INCH/HR) =  0.34
  AREA-AVERAGED Fp(INCH/HR) =  0.48
  AREA-AVERAGED Ap =  0.70
  EFFECTIVE STREAM AREA(ACRES) =     238.66
  TOTAL STREAM AREA(ACRES) =     245.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     363.68

****************************************************************************
  FLOW PROCESS FROM NODE    251.00 TO NODE    106.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =   13.92   RAINFALL INTENSITY(INCH/HR) =  2.67
  EFFECTIVE AREA(ACRES) =    10.50
  TOTAL AREA(ACRES) =    10.50        PEAK FLOW RATE(CFS) =     20.98
  AREA-AVERAGED Fm(INCH/HR) =   0.45  AREA-AVERAGED Fp(INCH/HR) =   0.64
  AREA-AVERAGED Ap =  0.70
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
         CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
```

```
==============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.92
  RAINFALL INTENSITY(INCH/HR) =   2.67
  AREA-AVERAGED Fm(INCH/HR) =  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.64
  AREA-AVERAGED Ap =  0.70
  EFFECTIVE STREAM AREA(ACRES) =      10.50
  TOTAL STREAM AREA(ACRES) =      10.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      20.98

******************************************************************************
  FLOW PROCESS FROM NODE    243.00 TO NODE    106.00 IS CODE =   7
------------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =   18.01   RAINFALL INTENSITY(INCH/HR) =  2.29
  EFFECTIVE AREA(ACRES) =    41.20
  TOTAL AREA(ACRES) =    41.20        PEAK FLOW RATE(CFS) =     80.73
  AREA-AVERAGED Fm(INCH/HR) =   0.12  AREA-AVERAGED Fp(INCH/HR) =   0.60
  AREA-AVERAGED Ap =  0.20
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
         CONFLUENCE ANALYSES.

******************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
------------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.01
  RAINFALL INTENSITY(INCH/HR) =   2.29
  AREA-AVERAGED Fm(INCH/HR) =  0.12
  AREA-AVERAGED Fp(INCH/HR) =  0.60
  AREA-AVERAGED Ap =  0.20
  EFFECTIVE STREAM AREA(ACRES) =      41.20
  TOTAL STREAM AREA(ACRES) =      41.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      80.73

******************************************************************************
  FLOW PROCESS FROM NODE    262.00 TO NODE    106.00 IS CODE =   7
------------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN.) =   54.11   RAINFALL INTENSITY(INCH/HR) =  1.18
  EFFECTIVE AREA(ACRES) =     4.60
  TOTAL AREA(ACRES) =     4.60        PEAK FLOW RATE(CFS) =      2.35
  AREA-AVERAGED Fm(INCH/HR) =   0.61  AREA-AVERAGED Fp(INCH/HR) =   0.61
```

```
  AREA-AVERAGED Ap =  1.00
  NOTE: EFFECTIVE AREA IS USED AS THE TOTAL CONTRIBUTING AREA FOR ALL
        CONFLUENCE ANALYSES.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  4
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  4 ARE:
  TIME OF CONCENTRATION(MIN.) =   54.11
  RAINFALL INTENSITY(INCH/HR) =   1.18
  AREA-AVERAGED Fm(INCH/HR) =  0.61
  AREA-AVERAGED Fp(INCH/HR) =  0.61
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       4.60
  TOTAL STREAM AREA(ACRES) =       4.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.35

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       20.98   13.92    2.667  0.64( 0.45) 0.70      10.5     251.00
      2      363.68   22.45    2.002  0.48( 0.34) 0.70     238.7     106.00
      3       80.73   18.01    2.285  0.60( 0.12) 0.20      41.2     243.00
      4        2.35   54.11    1.181  0.61( 0.61) 1.00       4.6     262.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  4 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      412.03   13.92    2.667  0.50( 0.31) 0.62     191.5     251.00
      2      441.70   18.01    2.285  0.50( 0.31) 0.62     244.7     243.00
      3      450.90   22.45    2.002  0.49( 0.31) 0.63     292.3     106.00
      4      233.29   54.11    1.181  0.49( 0.31) 0.63     295.0     262.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     450.90    Tc(MIN.) =    22.45
  EFFECTIVE AREA(ACRES) =     292.27   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.49  AREA-AVERAGED Ap =  0.63
  TOTAL AREA(ACRES) =      301.5
  LONGEST FLOWPATH FROM NODE    243.00 TO NODE    106.00 =    1945.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =      301.5  TC(MIN.) =     22.45
  EFFECTIVE AREA(ACRES) =    292.27  AREA-AVERAGED Fm(INCH/HR)=  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.49  AREA-AVERAGED Ap = 0.631
  PEAK FLOW RATE(CFS)   =     450.90
```

** PEAK FLOW RATE TABLE **

| STREAM NUMBER | Q (CFS) | Tc (MIN.) | Intensity (INCH/HR) | Fp(Fm) (INCH/HR) | Ap | Ae (ACRES) | HEADWATER NODE |
|---|---|---|---|---|---|---|---|
| 1 | 412.03 | 13.92 | 2.667 | 0.50( 0.31) | 0.62 | 191.5 | 251.00 |
| 2 | 441.70 | 18.01 | 2.285 | 0.50( 0.31) | 0.62 | 244.7 | 243.00 |
| 3 | 450.90 | 22.45 | 2.002 | 0.49( 0.31) | 0.63 | 292.3 | 106.00 |
| 4 | 233.29 | 54.11 | 1.181 | 0.49( 0.31) | 0.63 | 295.0 | 262.00 |

==========
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END OF RATIONAL METHOD ANALYSIS

# APPENDIX B
## Point Precipitation

7/3/2019 Precipitation Frequency Data Server

**NOAA Atlas 14, Volume 6, Version 2**
**Location name: Grand Terrace, California, USA***
**Latitude: 34.0392°, Longitude: -117.3291°**
**Elevation: 973.99 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]**

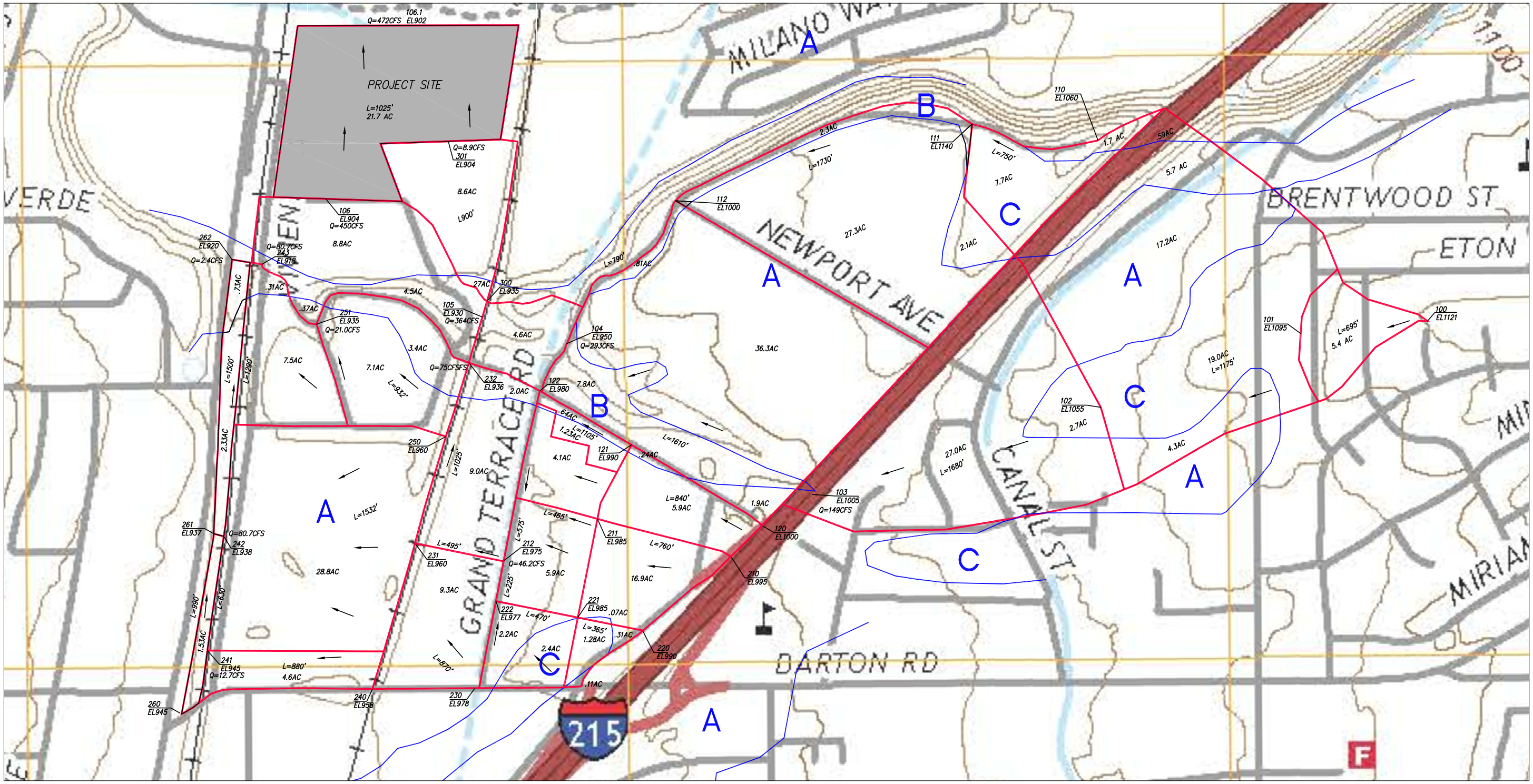
| Duration | Average recurrence interval (years) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 25 | 50 | 100 | 200 | 500 | 1000 |
| 5-min | 0.095 (0.079-0.115) | 0.121 (0.101-0.147) | 0.157 (0.130-0.191) | 0.186 (0.153-0.228) | 0.226 (0.179-0.287) | 0.257 (0.200-0.333) | 0.289 (0.219-0.384) | 0.322 (0.237-0.441) | 0.368 (0.260-0.526) | 0.404 (0.275-0.599) |
| 10-min | 0.136 (0.113-0.165) | 0.174 (0.145-0.211) | 0.224 (0.186-0.273) | 0.266 (0.219-0.327) | 0.323 (0.257-0.411) | 0.368 (0.286-0.478) | 0.414 (0.314-0.551) | 0.461 (0.340-0.633) | 0.527 (0.372-0.754) | 0.579 (0.395-0.858) |
| 15-min | 0.164 (0.137-0.199) | 0.210 (0.175-0.255) | 0.271 (0.225-0.330) | 0.322 (0.265-0.395) | 0.391 (0.311-0.497) | 0.445 (0.346-0.578) | 0.500 (0.379-0.666) | 0.558 (0.411-0.765) | 0.638 (0.450-0.912) | 0.700 (0.477-1.04) |
| 30-min | 0.249 (0.208-0.302) | 0.319 (0.266-0.387) | 0.412 (0.342-0.501) | 0.488 (0.402-0.600) | 0.593 (0.472-0.754) | 0.675 (0.525-0.877) | 0.759 (0.576-1.01) | 0.847 (0.624-1.16) | 0.968 (0.683-1.39) | 1.06 (0.724-1.58) |
| 60-min | 0.364 (0.304-0.442) | 0.467 (0.388-0.566) | 0.602 (0.500-0.733) | 0.714 (0.587-0.876) | 0.867 (0.689-1.10) | 0.987 (0.768-1.28) | 1.11 (0.842-1.48) | 1.24 (0.912-1.70) | 1.42 (0.999-2.02) | 1.55 (1.06-2.30) |
| 2-hr | 0.518 (0.431-0.628) | 0.661 (0.550-0.802) | 0.851 (0.706-1.03) | 1.01 (0.828-1.24) | 1.22 (0.970-1.55) | 1.39 (1.08-1.80) | 1.56 (1.18-2.07) | 1.73 (1.28-2.38) | 1.98 (1.40-2.83) | 2.17 (1.48-3.21) |
| 3-hr | 0.637 (0.531-0.772) | 0.813 (0.676-0.986) | 1.05 (0.867-1.27) | 1.24 (1.02-1.52) | 1.50 (1.19-1.90) | 1.70 (1.32-2.21) | 1.91 (1.45-2.54) | 2.12 (1.56-2.91) | 2.42 (1.71-3.46) | 2.65 (1.81-3.93) |
| 6-hr | 0.892 (0.743-1.08) | 1.14 (0.947-1.38) | 1.46 (1.21-1.78) | 1.73 (1.42-2.12) | 2.09 (1.66-2.66) | 2.37 (1.84-3.08) | 2.66 (2.01-3.54) | 2.95 (2.17-4.05) | 3.36 (2.37-4.80) | 3.68 (2.50-5.45) |
| 12-hr | 1.18 (0.985-1.43) | 1.51 (1.26-1.84) | 1.94 (1.61-2.37) | 2.30 (1.89-2.82) | 2.78 (2.21-3.53) | 3.14 (2.44-4.08) | 3.52 (2.67-4.68) | 3.90 (2.88-5.35) | 4.43 (3.13-6.34) | 4.84 (3.30-7.17) |
| 24-hr | 1.58 (1.39-1.82) | 2.02 (1.79-2.34) | 2.61 (2.30-3.02) | 3.09 (2.70-3.60) | 3.73 (3.16-4.50) | 4.22 (3.51-5.20) | 4.72 (3.83-5.95) | 5.24 (4.13-6.78) | 5.93 (4.49-8.00) | 6.47 (4.73-9.02) |
| 2-day | 1.92 (1.70-2.21) | 2.50 (2.21-2.89) | 3.27 (2.88-3.78) | 3.89 (3.40-4.54) | 4.74 (4.01-5.71) | 5.40 (4.48-6.64) | 6.06 (4.91-7.64) | 6.75 (5.32-8.74) | 7.68 (5.82-10.4) | 8.41 (6.16-11.7) |
| 3-day | 2.04 (1.81-2.36) | 2.71 (2.40-3.13) | 3.59 (3.17-4.16) | 4.32 (3.78-5.04) | 5.32 (4.51-6.41) | 6.10 (5.06-7.50) | 6.90 (5.59-8.69) | 7.73 (6.09-10.0) | 8.86 (6.71-12.0) | 9.76 (7.14-13.6) |
| 4-day | 2.19 (1.94-2.52) | 2.93 (2.59-3.38) | 3.92 (3.46-4.53) | 4.74 (4.14-5.52) | 5.87 (4.97-7.07) | 6.75 (5.60-8.30) | 7.66 (6.20-9.65) | 8.61 (6.79-11.1) | 9.92 (7.51-13.4) | 11.0 (8.02-15.3) |
| 7-day | 2.52 (2.23-2.91) | 3.40 (3.00-3.92) | 4.56 (4.02-5.28) | 5.52 (4.83-6.44) | 6.86 (5.81-8.27) | 7.91 (6.56-9.73) | 8.99 (7.28-11.3) | 10.1 (7.98-13.1) | 11.7 (8.85-15.8) | 12.9 (9.46-18.0) |
| 10-day | 2.74 (2.43-3.16) | 3.71 (3.28-4.28) | 4.99 (4.40-5.78) | 6.06 (5.30-7.07) | 7.54 (6.39-9.09) | 8.71 (7.23-10.7) | 9.91 (8.03-12.5) | 11.2 (8.81-14.5) | 12.9 (9.78-17.4) | 14.3 (10.5-20.0) |
| 20-day | 3.33 (2.95-3.84) | 4.54 (4.01-5.24) | 6.15 (5.43-7.12) | 7.50 (6.56-8.75) | 9.38 (7.95-11.3) | 10.9 (9.02-13.4) | 12.4 (10.1-15.6) | 14.0 (11.1-18.2) | 16.3 (12.3-22.0) | 18.1 (13.3-25.3) |
| 30-day | 3.95 (3.50-4.55) | 5.39 (4.77-6.23) | 7.34 (6.47-8.49) | 8.97 (7.85-10.5) | 11.2 (9.53-13.6) | 13.1 (10.8-16.1) | 14.9 (12.1-18.8) | 16.9 (13.4-21.9) | 19.7 (14.9-26.6) | 22.0 (16.1-30.6) |
| 45-day | 4.72 (4.18-5.44) | 6.45 (5.70-7.44) | 8.79 (7.75-10.2) | 10.8 (9.40-12.5) | 13.5 (11.4-16.3) | 15.7 (13.0-19.3) | 18.0 (14.6-22.7) | 20.4 (16.1-26.4) | 23.8 (18.0-32.1) | 26.6 (19.4-37.1) |
| 60-day | 5.50 (4.87-6.34) | 7.50 (6.63-8.65) | 10.2 (8.99-11.8) | 12.5 (10.9-14.5) | 15.7 (13.3-18.9) | 18.2 (15.1-22.4) | 20.8 (16.9-26.3) | 23.7 (18.7-30.6) | 27.6 (20.9-37.3) | 30.8 (22.6-43.0) |

[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.

# APPENDIX C
# Hydrology Map




LEGEND:

SUB-AREA BOUNDARY

SOIL GROUP BOUNDARY

100 YEAR PEAK FLOW RATE FROM SUB-AREA — 24.0 CFS

NODE NUMBER — 245
ELEVATION — EL1020

NORTH
SCALE: 1"= 250'

250' 0' 250' 500' 750'
GRAPHIC SCALE: 1" = 250'

| REVISIONS | | |
|---|---|---|
| DATE | NOTES | APP. |
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REGISTERED PROFESSIONAL ENGINEER
DAVID B. RAGLAND
REG. NO. 35985
EXP. 6/30/20
CIVIL
STATE OF CALIFORNIA

DAVID B. RAGLAND R.C.E. 35985 DATE

TRANSTECH
413 MACKAY DRIVE.
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(909) 384-7464

CITY OF GRAND TERRACE

GRAND TERRACE FLEET YARDS
HYDROLOGY MAP

| DRAWN BY: | DATE: | SCALE: | SHEET: | JOB NO. |
|---|---|---|---|---|
| G.D.A.. | 06/27/2019 | 1"= 100' | 1 OF 1 | 17164 |