APPENDIX I

CONCEPTUAL DRAINAGE STUDY

Prepared for:

Orange County Transportation Authority
Agreement C-6-1108

Transit Security & Operations Center (TSOC)

1512-20 W. Lincoln Ave, Anaheim, California

APN 250-111-03 & 250-122-12

Conceptual Drainage Study

September 8, 2017

Prepared by:

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Rancho Cucamonga, CA 91730-8566
STV Project No. 4018849

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1. EXECUTIVE SUMMARY

This report concludes the findings for the existing drainage condition, design considerations, methodology, and the sustainable drainage resolutions for the proposed Transit Security and Operation Center (TSOC), which is located at 1512-1520 W. Lincoln Avenue, Anaheim. The results of this report can be used as the basis to facilitate final drainage design of the facility site.

The project site was found to be located within Zone X (flood depth being less than 1' in a 100-yr storm event or area protected by levees) defined by Federal Emergency Management Agency (FEMA), per Flood Insurance Rate Map (FIRM) 06059C0133J (see Appendix A).

The gross project site area is 2.85 acres with 18% imperviousness before the proposed development. The soil beneath the site was classified as Hydrologic Soil Group B, which means that the site soil has a moderate infiltration or transmission rates when thoroughly wetted.

The existing drainage pattern will remain unchanged and will continue to discharge to the existing drainage system on Lincoln Avenue. However, the proposed development is anticipated to significantly increase the impervious area from 18% to approximately 90%. According to the Small Area Unit Hydrograph analysis attached in Appendix D, the project run-off volume would be 16% higher than the existing conditions and will cause a Hydrologic Conditions of Concern (HCOC). Therefore, the use of onsite retention facility is expected such that the ultimate stormwater discharge volume would not exceed 5% of the existing site discharge per the hydromodification requirements defined in the Orange County's Model WQMP.

2-year and 100-year hydrologic analyses were conducted for both the existing condition and conceptual study. The 2-year model was used to check against

hydromodification requirements and the 100-year model was used to evaluate the drainage impact caused by the proposed development.

The project has assumed that all uninfluenced existing drainage facilities were properly designed and fully functional. This report addresses only the impact caused by the proposed improvements within the defined site area. OCTA is not responsible for the other known or unknown offsite area drainage issues.

2. EXISTING AND PROPOSED DRAINAGE CONDITIONS

2.1 Project Description

The new OCTA TSOC is located at 1512-20 W. Lincoln Ave, Anaheim with combined site area of 2.85 ac. The new facility will provide the following functions with improved efficiency and space for future expansion:

- Operations Training (Bus)
- Central Communications (Bus)
- Field Operations (Bus)
- Transit Police Cervices (Bus, Paratransit & Rail)
- Emergency Operations Center (Agency-wide)
- File Storage

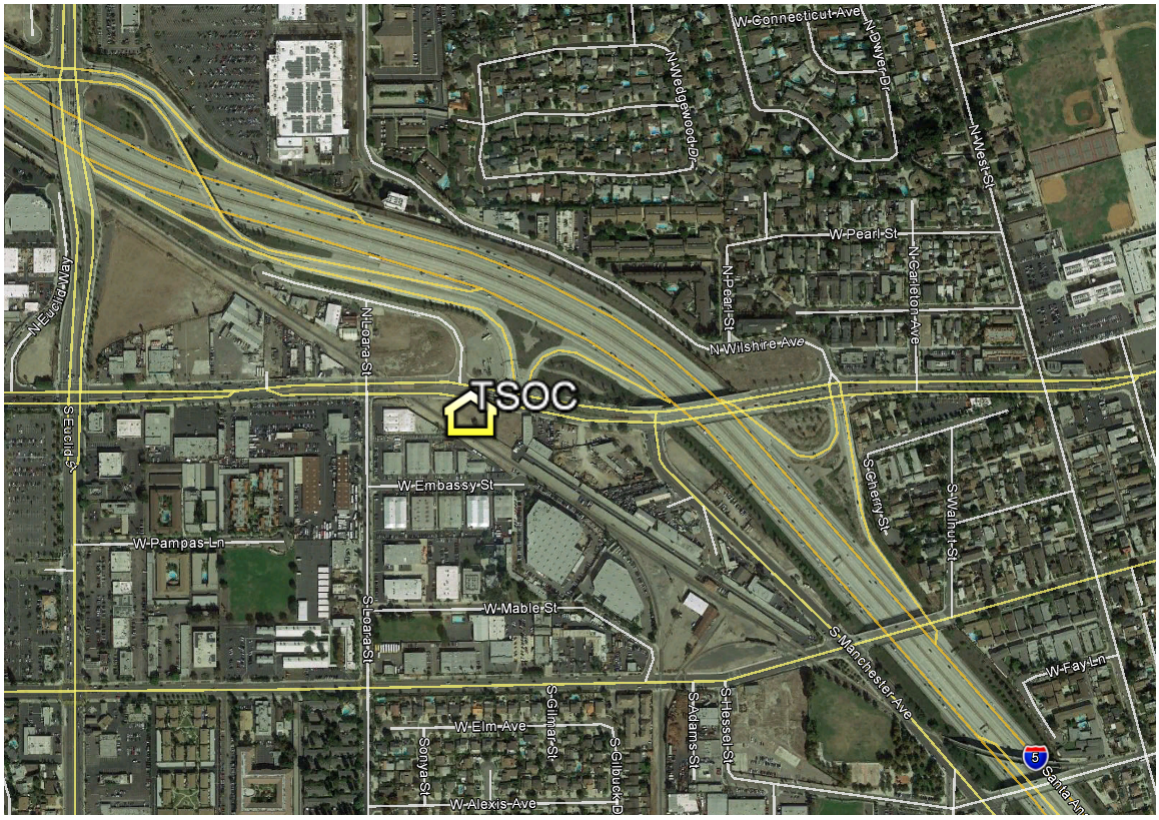


Figure 2.1.1 – Vicinity Map

2.2 Existing Drainage Condition

The project site consists of two properties (APN 250-111-03 & 250-122-12). The site abuts the existing Union Pacific Railroad right-of-way and is bounded by Lincoln Avenue and Manchester Avenue. No significant offsite run-on was observed.

The existing onsite drainage direction is from south to north by means of surface flow. Surface discharge currently drains to Lincoln Ave and flows to a sump catch basin (see Drainage Map for Existing Condition in Appendix C). The catch basin connects to the existing 3' x 3' RCB owned by the City of Anaheim, which discharges to the Orange County Flood Control District's facility B01P01, as shown in Figure 2.2.1.

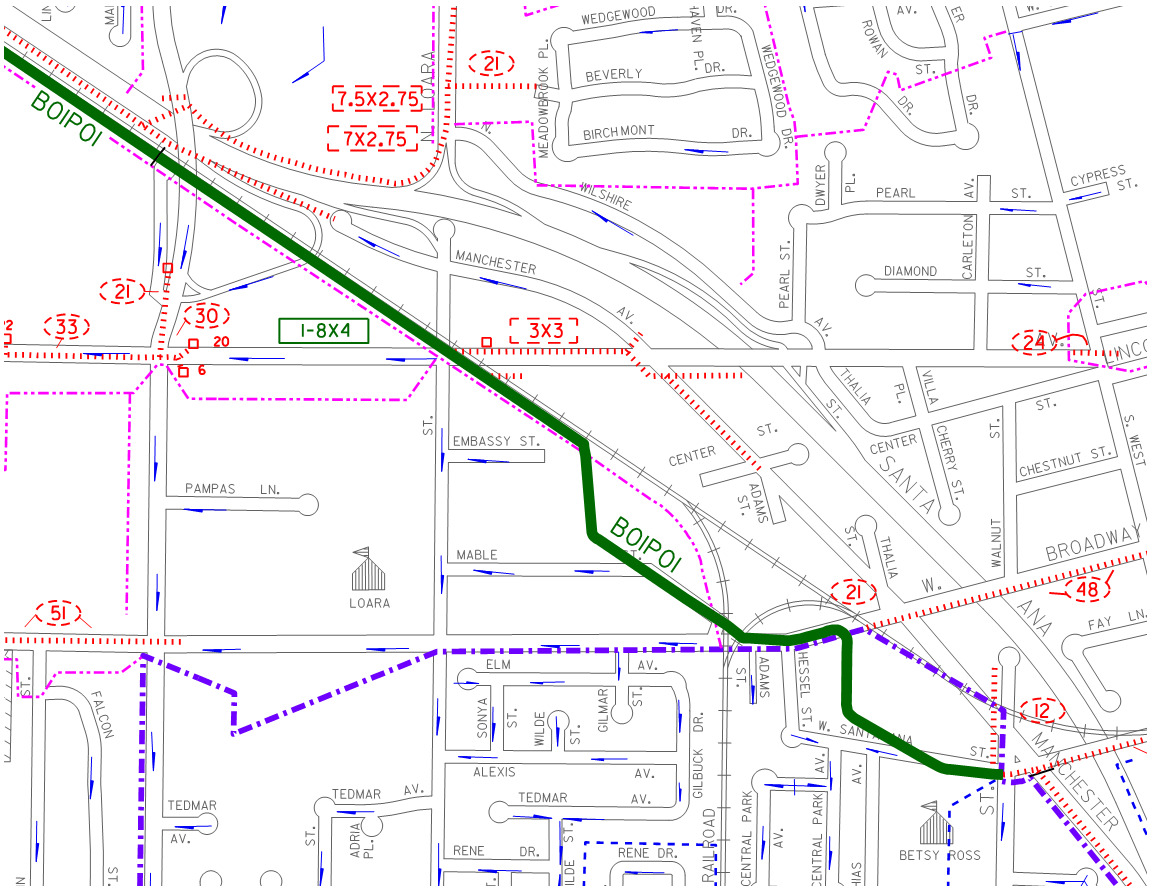


Figure 2.2.1 – Existing Drainage Systems Nearby

The project site was found to be located near Federal Emergency Management Agency (FEMA) Special Flood Hazard Area (SFHA) per the current FIRM 06059C0133J (see Appendix A).

2.3 Conceptual Drainage Design

Surface Drainage

The proposed development will utilize gutter and ribbon drain to convey onsite concentrated flow. At some locations where flood width or pond depth becomes a concern, drainage inlets shall be proposed to help control the surface water amount such that the proposed building facility will be at least 1' above a 100-year storm event.

Roof Drainage

Roof stormwater should be collected in a controlled manner. If an inclined roof will be proposed for the building structure, rain gutter can be utilized to intercept the nuisance flow from the roof. Concrete down spouts or rip-rap may also be utilized at landscaped areas to minimize splash effect. At where a roof drain needs to discharge near a pedestrian access, curb outlet or direct connection to onsite drainage system shall be considered to minimize excessive sheet flow on side walk or parking lot.

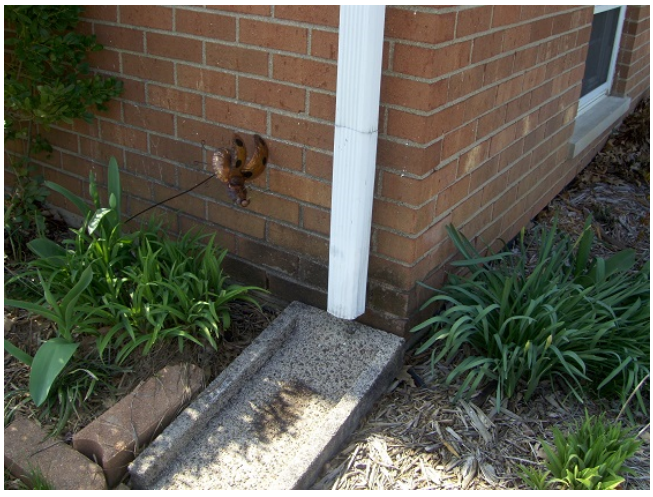


Figure 2.3.1 – Typical Concrete Down Spout at Landscaped Area

Figure 2.3.2 – Typical Roof Drain Curb Outlet at Sidewalk

Onsite Infiltration

The soil below the project site is classified as Hydrologic Soil Group (HSG) “B” with moderate infiltration rates per Orange County Hydrology Manual, which may favor onsite infiltration for flow attenuation or stormwater treatment purposes. If open basin is not an option, an underground infiltration system may be considered to address hydromodification issues.

Figure 2.3.3 – Typical Underground Infiltration Chambers

3. METHODOLOGY

3.1 Hydrology

All hydrologic calculations performed for the project are in conformance with the Rational Method described in *Orange County Hydrology Manual (1986)*. Advanced Engineering Software (AES) HydroWin 2016 was utilized to perform Time of Concentration calculation, channel routing and peak discharge calculations.

The hydrologic models have adopted a HSG “B” per the soil map (see Appendix B) attached in the hydrology manual.

Regression equation from *Mean Precipitation Intensities for Non-mountainous Areas* (Hydrology Manual Fig B-3) was used to calculate the rainfall intensities in 10-year and 100-year analyses. Soil Loss Rate calculation was based on the approach as stated in Hydrology Manual Section C. Antecedent Moisture Content (AMC) I was adopted for the 2-year analysis and AMC III was adopted for the 100-year analysis, per the hydrology manual recommendation. The 2-year model was used to check against hydromodification requirements and the 100-year model was used to evaluate the drainage impact caused by the proposed development.

Small Area Unit Hydrograph Method per *Appendix J in Orange County Hydrology Manual* was utilized to estimate the project site run-off volume. 2-year 24-hour design storm was used to check against hydromodification requirements as defined in *Orange County Model WQMP*. The drainage map and the results of the hydrology calculation have been included in Appendix C and Appendix D, respectively.

3.2 Hydraulic Design Criteria

The project site drainage design will comply with Appendix G Section G401.5 (Storm drainage) of the *2016 California Building Code* and *City of Anaheim Municipal Code*. The following criteria were established for code compliance:

Onsite Pipe System – Since there is no specific requirement from the City regarding design storm event used for pipe design, the project has adopted a storm event such that the proposed storm drain can intercept sufficient surface flow and the water depth onsite will not cause any objectionable flood hazard.

10-year design storm event can be used for hydraulic capacity calculation such that hydraulic grade line (HGL) will be at least 6" below the site finished grade.

Onsite Catch Basin Inlet – 100-year design storm event will be used to check against the catch basin inlet capacity. The 100-yr surface flow or pond elevation shall be kept at a minimum 1 foot lower than the facility finished floor elevation.

4. SUMMARY

	2-yr Existing Conditions	2-yr Conceptual Study	100-yr Existing Conditions	100-yr Conceptual Study
Area (ac)	2.85			
Time of Concentration (min)	22.88	7.92	17.45	7.17
% change		-65%		-59%
Runoff (cfs)	0.98	3.67	7.03	10.34
% change		274%		47%
Runoff Volume (ac-ft)	0.06	0.28		
Runoff Volume (CF)	2614	12197		
% change		367%		

Table 4.1 – Hydrology Model Results Summary

Assumption

The conceptual study was conducted based on an assumed drainage concept which was illustrated in the Drainage Map – Conceptual Study attached in Appendix C. All conceptual design and elevations presented are subject to change in final engineering.

Drainage Impact

The results show that the time of concentration will be approximately 59% to 65% faster than the existing conditions. The runoff discharge rates increase 274% and 47% in 2-yr storm event and 100-yr storm event respectively. It is noted that the site soil was found to be HSG “B”, which means that the soil beneath the site has a moderate infiltration rates to absorb surface flow during the dry conditions. More stormwater will become direct run-off when the site soil becomes saturated and it explains why there is a different degree of percentage increase between the low-flow and peak-flow storm events.

In addition, the major drainage impact will result from the significant increase of impervious area, which will contribute more stormwater run-off during the peak flow event.

In the conceptual study, the calculated 2-year 24-hour run-off volume is 12197 CF, which is 367% higher than the existing conditions and will cause a Hydrologic Conditions of Concern (HCOC). The HCOC shall be addressed in the final engineering stage by preparing a project specific Water Quality Management Plan.

Hydrologic Conditions of Concern

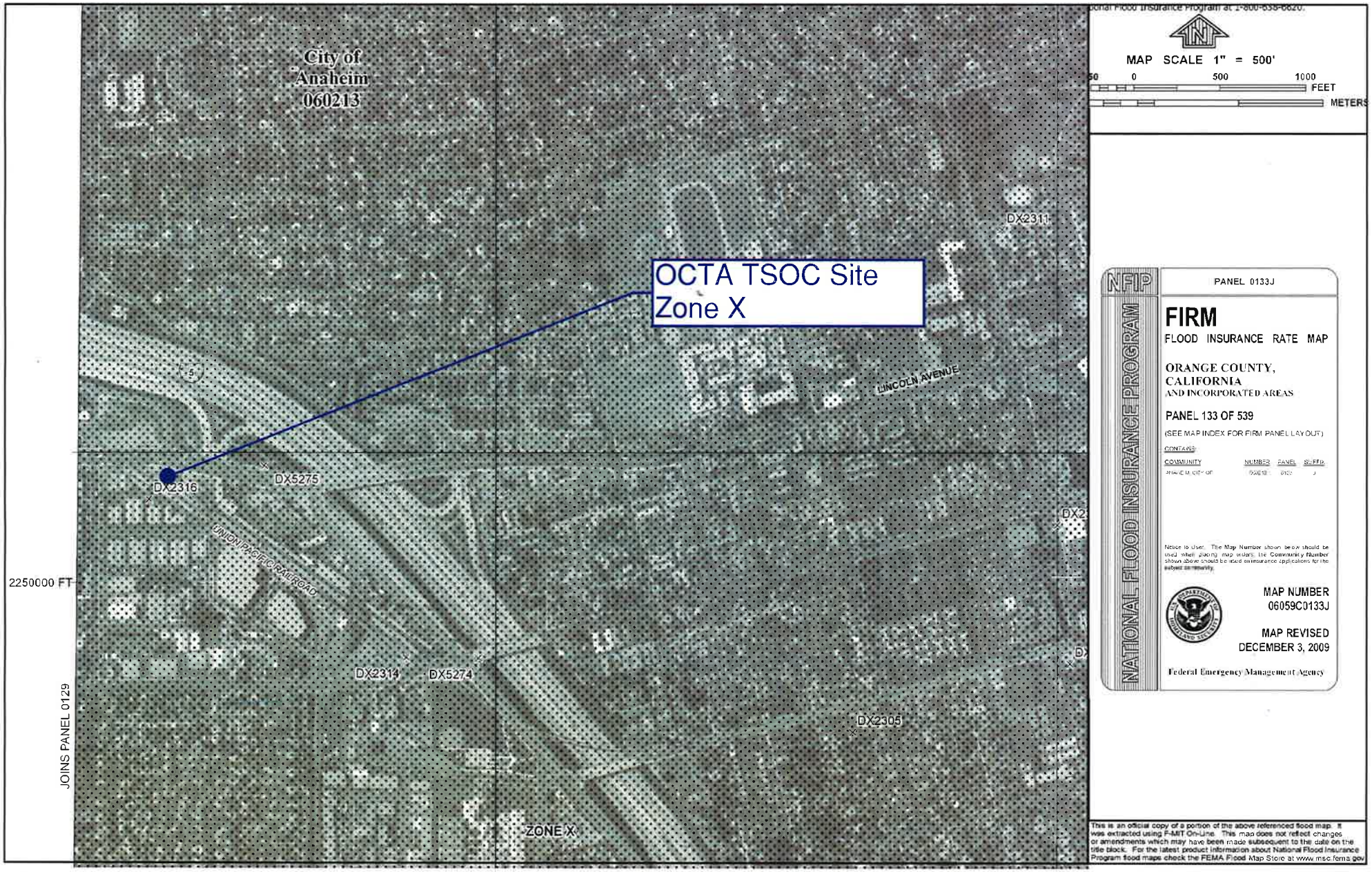
According to the County's Model WQMP, in the North Orange County permit area, HCOCs are considered to exist if any streams located downstream from the project are determined to be potentially susceptible to hydromodification impacts and either of the following conditions exists:

- Post-development runoff volume for the 2-yr, 24-hr storm exceeds the pre-development runoff volume for the 2-yr, 24-hr storm by more than 5 percent;

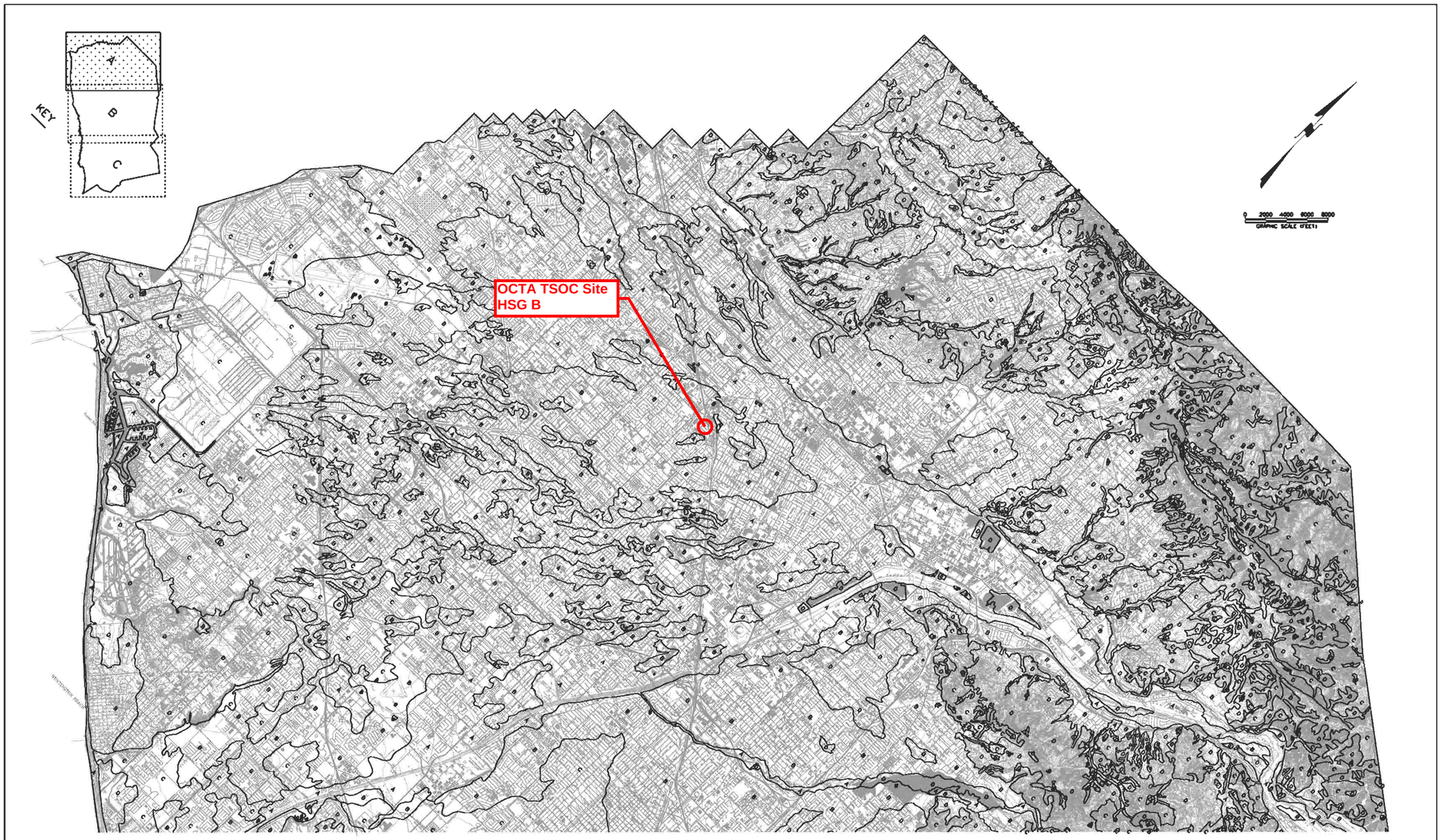
- Time of concentration of post-development runoff for the 2-yr, 24-hr storm event exceeds the time of concentration of the pre-development condition for the 2-yr, 24-hr storm event by more than 5 percent (in consideration that modifications in the time of concentration due to LID retention and biotreatment BMPs are acceptable)."

With the definitions above, the proposed development 2-yr 24-hour runoff is 274% higher than the existing conditions. Therefore, HCOC exists and mitigation will be required. If a volume based mitigation method will be proposed, it needs to retain the Design Capture Volume as defined in the County's Model WQMP. Hydromodification requirements and detail calculation should be included in the project specific WQMP in final engineering.

APPENDIX A – Flood Insurance Rate Map


City of
Anaheim
060213
OCTA TSOC Site
Zone X
DX2311
LINCOLN AVENUE
DX2316
DX5275
UNION PACIFIC RAILROAD
DX2314
DX5274
DX2305
ZONE X
2250000 FT
JOINS PANEL 0129
MAP SCALE 1" = 500'
0
500
1000
FEET
METERS
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0133J
FIRM
FLOOD INSURANCE RATE MAP
ORANGE COUNTY,
CALIFORNIA
AND INCORPORATED AREAS
PANEL 133 OF 539
(SEE MAP INDEX FOR FIRM PANEL LAY OUT)
CONTAINS:
COMMUNITY
NUMBER
PANEL
SUFFIX
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
06059C0133J
MAP REVISED
DECEMBER 3, 2009
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX B – Soil Map



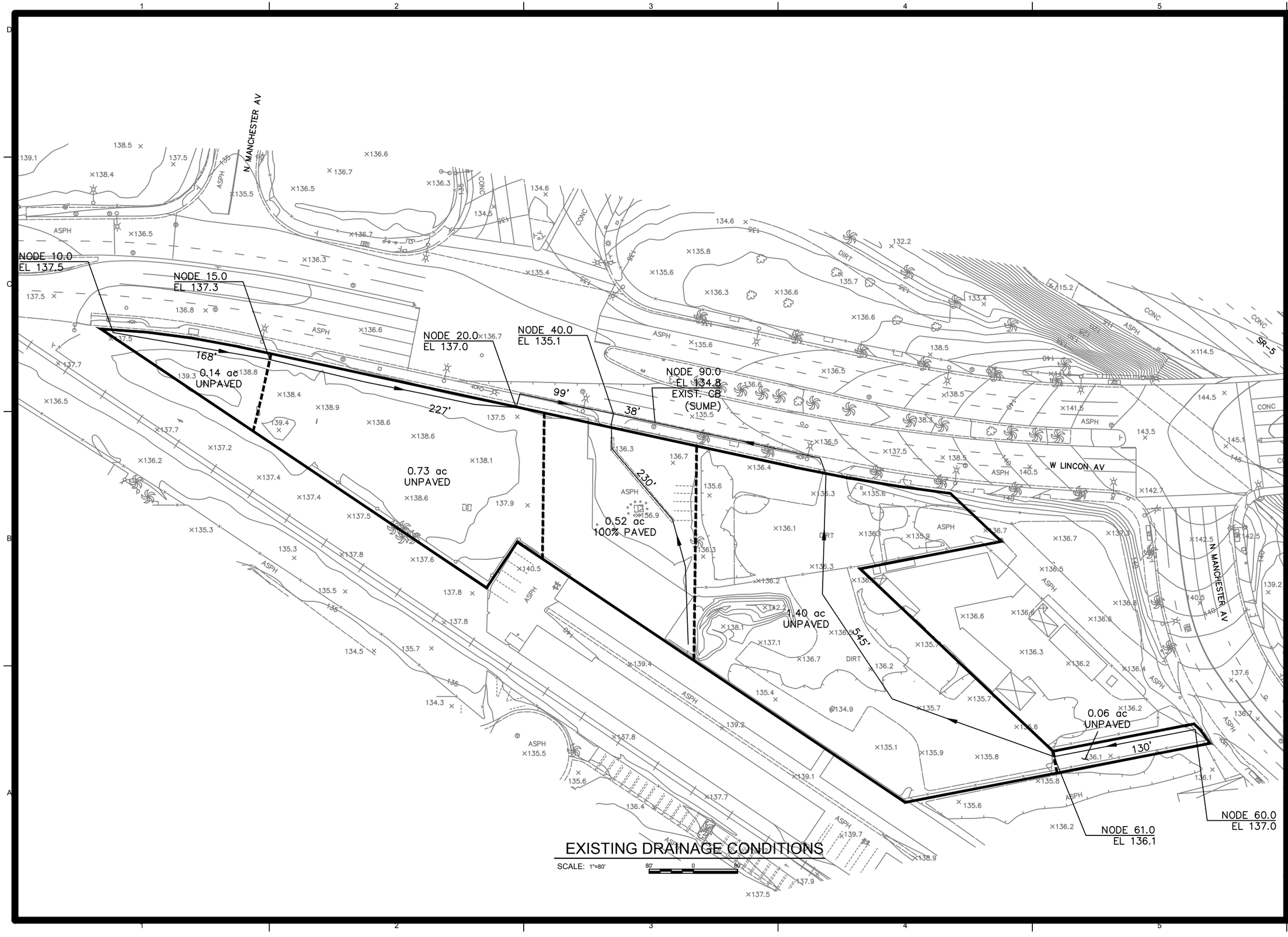
ORANGE COUNTY
HYDROLOGY MANUAL

LEGEND
A B C D HYDROLOGIC SOIL GROUPS
HYDROLOGIC SOIL GROUP BOUNDARY

SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA, USDA, SOIL CONSERVATION SERVICE, 1978.

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA
PLATE A

APPENDIX C – Drainage Maps



OCTA

CONSULTANTS

STV 100 Years

1055 West Seventh Street
Suite 3150
Los Angeles, CA 90017
Tel: (213) 482-9444
Fax: (213)482-5278

SEALS

PROJECT IDENTIFICATION

PRELIMINARY ENGINEERING
OCTA - TRANSIT SECURITY &
OPERATIONS CENTER

MARK	DATE	DESCRIPTION	BY

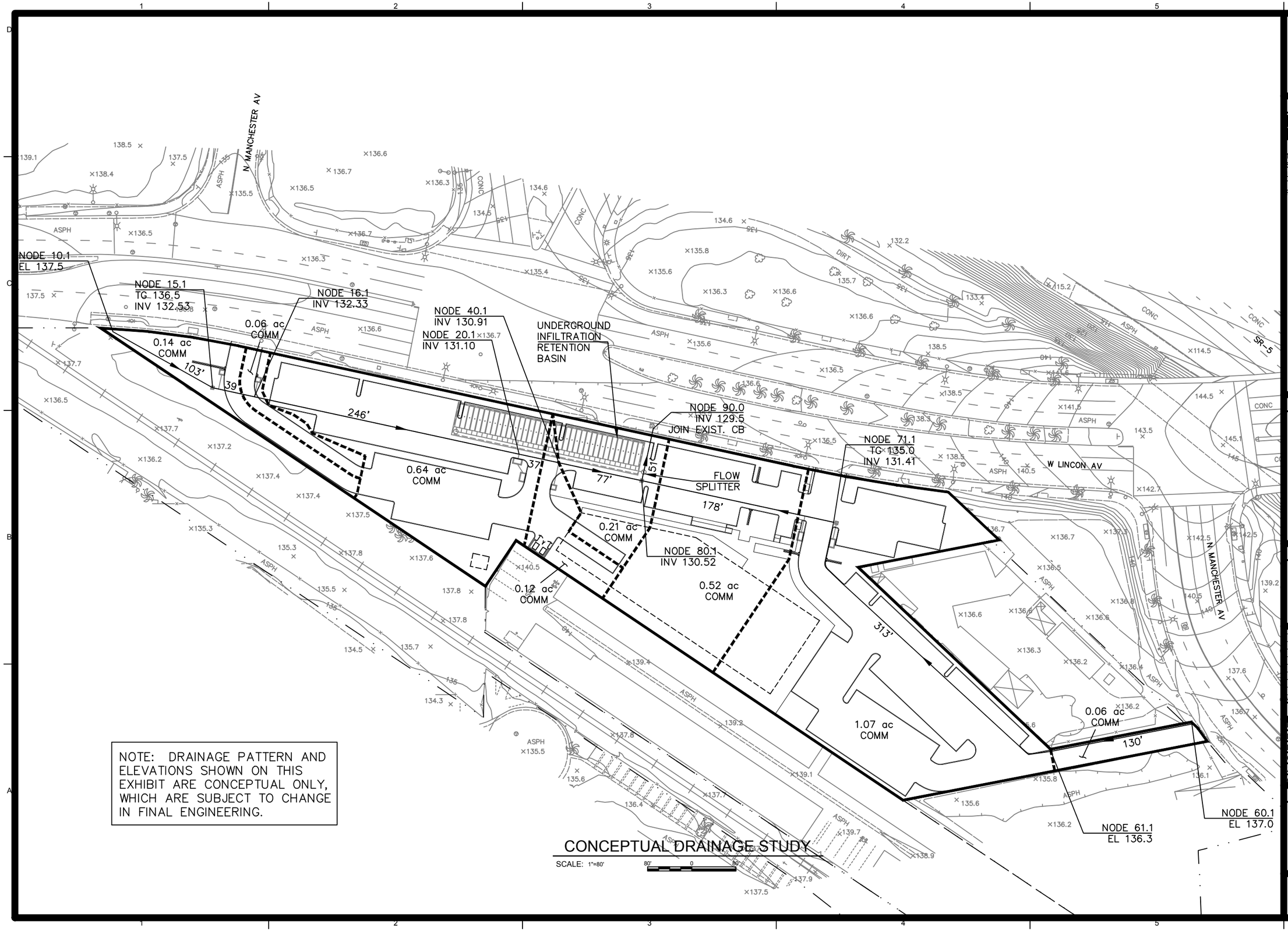
ISSUE BLOCK

PROJECT NO.: 4018849
DESIGNED BY: -
DRAWN BY: -
CHECKED BY: -
APPROVED BY: -
COPYRIGHT: -

SHEET TITLE

DRAINAGE MAP EXISTING CONDITIONS

DWG NO:	SHT NO:
-	-



NOTE: DRAINAGE PATTERN AND ELEVATIONS SHOWN ON THIS EXHIBIT ARE CONCEPTUAL ONLY, WHICH ARE SUBJECT TO CHANGE IN FINAL ENGINEERING.

CONCEPTUAL DRAINAGE STUDY

SCALE: 1"=80' 80' 0 80'

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SHEET TITLE

DRAINAGE MAP CONCEPTUAL STUDY

DWG NO: -

SHT NO: -

APPENDIX D – Hydrology Calculation

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
         (c) Copyright 1983-2016 Advanced Engineering Software (aes)
             Ver. 23.0  Release Date: 07/01/2016  License ID 1613

                          Analysis prepared by:

                                 STV Inc.
                           9130 Anaheim Pl, Ste 210
                          Rancho Cucamonga, CA 91730


 ************************* DESCRIPTION OF STUDY *************************
* OCTA TSOC                                                             *
* Exist Drainage Conditions                                             *
* 2-yr storm event analysis                                             *
 ************************************************************************

  FILE NAME: TSOC2E.DAT
  TIME/DATE OF STUDY: 19:53 09/04/2017
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I 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 0.0313 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

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                      AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.19
         30-MINUTES         0.40
          1-HOUR            0.53
          3-HOUR            0.89
          6-HOUR            1.22
         24-HOUR            2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     15.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   168.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.50  DOWNSTREAM(FEET) =    137.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.673
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.175
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
```

```
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                    B        0.14      0.30     1.000    56   15.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.11
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.11

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     20.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    137.30
  DOWNSTREAM NODE ELEVATION(FEET) =    137.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   227.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.160
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0350
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   0.20
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.970
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  URBAN POOR COVER
  "TURF"                    B        0.73      0.30     1.000    56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.30
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.61
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =    6.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   6.20   Tc(MIN.) =   21.87
  SUBAREA AREA(ACRES) =    0.73       SUBAREA RUNOFF(CFS) =    0.44
  EFFECTIVE AREA(ACRES) =    0.87     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       0.52

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
             ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOOD WIDTH(FEET) =    6.00
  FLOW VELOCITY(FEET/SEC.) =   1.07   DEPTH*VELOCITY(FT*FT/SEC) =   0.21
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     395.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     40.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  137.00  DOWNSTREAM ELEVATION(FEET) =  135.10
  STREET LENGTH(FEET) =    99.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  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) =       0.74
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.22
    HALFSTREET FLOOD WIDTH(FEET) =    3.22
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.59
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.57
  STREET FLOW TRAVEL TIME(MIN.) =   0.64   Tc(MIN.) =   22.51
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.955
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        0.52      0.30     0.100    36
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    0.43
  EFFECTIVE AREA(ACRES) =      1.39    AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       0.95

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.24   HALFSTREET FLOOD WIDTH(FEET) =   4.53
  FLOW VELOCITY(FEET/SEC.) =  2.51   DEPTH*VELOCITY(FT*FT/SEC.) =   0.61
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     40.00 =     494.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     90.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  135.10  DOWNSTREAM ELEVATION(FEET) =  134.80
  STREET LENGTH(FEET) =    38.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  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) =       0.95
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    6.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.69
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.47
  STREET FLOW TRAVEL TIME(MIN.) =   0.38   Tc(MIN.) =   22.88
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  0.946
  SUBAREA AREA(ACRES) =    0.00      SUBAREA RUNOFF(CFS) =    0.00
  EFFECTIVE AREA(ACRES) =      1.39    AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       0.95
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   6.41
  FLOW VELOCITY(FEET/SEC.) =  1.69   DEPTH*VELOCITY(FT*FT/SEC.) =   0.47
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     90.00 =     532.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     90.00 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.) =   22.88
  RAINFALL INTENSITY(INCH/HR) =   0.95
  AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.66
  EFFECTIVE STREAM AREA(ACRES) =       1.39
  TOTAL STREAM AREA(ACRES) =       1.39
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.95

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   130.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.00  DOWNSTREAM(FEET) =    136.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.947
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.525
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  URBAN POOR COVER
  "TURF"                      B        0.06      0.30     1.000    56    9.95
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.07
  TOTAL AREA(ACRES) =      0.06   PEAK FLOW RATE(CFS) =      0.07

****************************************************************************
  FLOW PROCESS FROM NODE     61.00 TO NODE     90.00 IS CODE =  62
----------------------------------------------------------------------------
  ** WARNING: Computed Flowrate is less than 0.1 cfs,
               Routing Algorithm is UNAVAILABLE.

****************************************************************************
  FLOW PROCESS FROM NODE     61.00 TO NODE     90.00 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.) =    9.95
  RAINFALL INTENSITY(INCH/HR) =   1.53
  AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       0.06
  TOTAL STREAM AREA(ACRES) =       0.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       0.07

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        0.95   22.88    0.946  0.30( 0.20) 0.66       1.4      10.00
      2        0.07    9.95    1.525  0.30( 0.30) 1.00       0.1      60.00

  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        0.80    9.95    1.525  0.30( 0.21) 0.69       0.7      60.00
      2        0.98   22.88    0.946  0.30( 0.20) 0.68       1.4      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       0.98    Tc(MIN.) =    22.88
  EFFECTIVE AREA(ACRES) =       1.45   AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.68
  TOTAL AREA(ACRES) =       1.4
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     90.00 =     532.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.4  TC(MIN.) =     22.88
  EFFECTIVE AREA(ACRES) =      1.45  AREA-AVERAGED Fm(INCH/HR)=  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.677
  PEAK FLOW RATE(CFS)   =       0.98

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        0.80    9.95    1.525  0.30( 0.21) 0.69       0.7      60.00
      2        0.98   22.88    0.946  0.30( 0.20) 0.68       1.4      10.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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                          Analysis prepared by:

                                 STV Inc.
                           9130 Anaheim Pl, Ste 210
                          Rancho Cucamonga, CA 91730


 ************************* DESCRIPTION OF STUDY *************************
* OCTA TSOC                                                             *
* Conceptual Drainage Study                                             *
* 2-yr storm event analysis                                             *
 ************************************************************************

  FILE NAME: TSOC2.DAT
  TIME/DATE OF STUDY: 19:54 09/04/2017
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *DATA BANK RAINFALL USED*
  *ANTECEDENT MOISTURE CONDITION (AMC) I 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

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                      AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.19
         30-MINUTES         0.40
          1-HOUR            0.53
          3-HOUR            0.89
          6-HOUR            1.22
         24-HOUR            2.05
  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.10 TO NODE     15.10 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.50  DOWNSTREAM(FEET) =    136.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.264
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL               B        0.14      0.30      0.100    36    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.28

****************************************************************************
  FLOW PROCESS FROM NODE     15.10 TO NODE     16.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   132.53  DOWNSTREAM(FEET) =   132.33
  FLOW LENGTH(FEET) =    39.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   1.98
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      0.28
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =    5.33
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     16.10 =     142.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     15.10 TO NODE     16.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    5.33
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.182
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL               B        0.06      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.06      SUBAREA RUNOFF(CFS) =     0.12
  EFFECTIVE AREA(ACRES) =      0.20   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.2       PEAK FLOW RATE(CFS) =       0.39

****************************************************************************
  FLOW PROCESS FROM NODE     16.10 TO NODE     20.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   132.33  DOWNSTREAM(FEET) =   131.10
  FLOW LENGTH(FEET) =   246.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   2.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.19
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      0.39
  PIPE TRAVEL TIME(MIN.) =   1.87    Tc(MIN.) =    7.20
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     20.10 =     388.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.10 TO NODE     20.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.20
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.836
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL               B        0.64      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.64      SUBAREA RUNOFF(CFS) =     1.04
  EFFECTIVE AREA(ACRES) =      0.84   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.8       PEAK FLOW RATE(CFS) =       1.37

****************************************************************************
  FLOW PROCESS FROM NODE     20.10 TO NODE     40.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   131.10  DOWNSTREAM(FEET) =   130.91
  FLOW LENGTH(FEET) =    37.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.18
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.37
  PIPE TRAVEL TIME(MIN.) =   0.19    Tc(MIN.) =    7.39
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     40.10 =     425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.10 TO NODE     40.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.39
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.808
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.12      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.19
  EFFECTIVE AREA(ACRES) =      0.96   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.0       PEAK FLOW RATE(CFS) =       1.54

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   130.91  DOWNSTREAM(FEET) =   130.52
  FLOW LENGTH(FEET) =    77.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.26
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.54
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =    7.79
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     80.10 =     502.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.79
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.755
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.21      0.30     0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.21      SUBAREA RUNOFF(CFS) =    0.33
  EFFECTIVE AREA(ACRES) =      1.17   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.2       PEAK FLOW RATE(CFS) =       1.82

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 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.) =    7.79
  RAINFALL INTENSITY(INCH/HR) =   1.76
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.17
  TOTAL STREAM AREA(ACRES) =       1.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.82

****************************************************************************
  FLOW PROCESS FROM NODE     60.10 TO NODE     61.10 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   130.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.00  DOWNSTREAM(FEET) =    136.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.056
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  2.028
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.06      0.30      0.100    36    6.06
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.11
  TOTAL AREA(ACRES) =      0.06   PEAK FLOW RATE(CFS) =      0.11

********************************************************************************
  FLOW PROCESS FROM NODE     61.10 TO NODE     71.10 IS CODE =  91
--------------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
  UPSTREAM NODE ELEVATION(FEET) =    136.30
  DOWNSTREAM NODE ELEVATION(FEET) =    135.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   313.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.160
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   0.50
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.534
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.07      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.81
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.38
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =   10.32
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.79   Tc(MIN.) =    9.85
  SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    1.45
  EFFECTIVE AREA(ACRES) =    1.13     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       1.53

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.24   FLOOD WIDTH(FEET) =   18.05
  FLOW VELOCITY(FEET/SEC.) =   1.35   DEPTH*VELOCITY(FT*FT/SEC) =   0.32
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     71.10 =     443.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   131.41  DOWNSTREAM(FEET) =   130.52
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.25
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.53
  PIPE TRAVEL TIME(MIN.) =   0.91    Tc(MIN.) =   10.76
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     80.10 =     621.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   10.76
  *   2 YEAR RAINFALL INTENSITY(INCH/HR) =  1.458
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.52      0.30      0.100    36
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
```

```
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    0.67
  EFFECTIVE AREA(ACRES) =      1.65   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.6       PEAK FLOW RATE(CFS) =       2.12

****************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 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.) =   10.76
  RAINFALL INTENSITY(INCH/HR) =   1.46
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.65
  TOTAL STREAM AREA(ACRES) =       1.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.12

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        1.82    7.79    1.755  0.30( 0.03) 0.10       1.2      10.10
      2        2.12   10.76    1.458  0.30( 0.03) 0.10       1.6      60.10

  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        3.67    7.79    1.755  0.30( 0.03) 0.10       2.4      10.10
      2        3.62   10.76    1.458  0.30( 0.03) 0.10       2.8      60.10

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.67    Tc(MIN.) =     7.79
  EFFECTIVE AREA(ACRES) =       2.36   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       2.8
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     80.10 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     80.10 TO NODE     90.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   130.52  DOWNSTREAM(FEET) =   129.50
  FLOW LENGTH(FEET) =    51.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   5.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.65
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.67
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =    7.92
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     90.00 =     672.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       2.8  TC(MIN.) =      7.92
  EFFECTIVE AREA(ACRES) =      2.36  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =       3.67

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        3.67    7.92    1.739  0.30( 0.03) 0.10       2.4      10.10
      2        3.62   10.89    1.448  0.30( 0.03) 0.10       2.8      60.10
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

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**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
           (Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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            Ver. 23.0  Release Date: 07/01/2016  License ID 1613

                          Analysis prepared by:

                                 STV Inc.
                           9130 Anaheim Pl, Ste 210
                          Rancho Cucamonga, CA 91730


 ************************* DESCRIPTION OF STUDY *************************
* OCTA TSOC                                                             *
* Exist Drainage Conditions                                             *
* 100-yr storm event analysis                                           *
 ************************************************************************

  FILE NAME: TSOC100E.DAT
  TIME/DATE OF STUDY: 00:20 09/04/2017
==========================================================================
  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
  *DATA BANK RAINFALL USED*
  *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 0.0313 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

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                      AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
         30-MINUTES         1.09
          1-HOUR            1.45
          3-HOUR            2.43
          6-HOUR            3.36
         24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     15.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   168.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.50  DOWNSTREAM(FEET) =    137.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.673
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.215
  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.)
  URBAN POOR COVER
  "TURF"                    B        0.14      0.30     1.000    90   15.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.37
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.37

****************************************************************************
  FLOW PROCESS FROM NODE     15.00 TO NODE     20.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    137.30
  DOWNSTREAM NODE ELEVATION(FEET) =    137.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   227.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.160
  PAVEMENT LIP(FEET) =  0.030   MANNING'S N = .0350
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   0.20
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.048
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  URBAN POOR COVER
  "TURF"                    B        0.73      0.30     1.000    90
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.48
  AVERAGE FLOW DEPTH(FEET) =   0.20   FLOOD WIDTH(FEET) =    6.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.53   Tc(MIN.) =   17.20
  SUBAREA AREA(ACRES) =    0.73       SUBAREA RUNOFF(CFS) =    1.81
  EFFECTIVE AREA(ACRES) =    0.87     AREA-AVERAGED Fm(INCH/HR) =   0.30
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        0.9         PEAK FLOW RATE(CFS) =       2.15

         ==>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
             NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
             AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
             ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.20   FLOOD WIDTH(FEET) =    6.00
  FLOW VELOCITY(FEET/SEC.) =   4.39   DEPTH*VELOCITY(FT*FT/SEC) =   0.88
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     20.00 =     395.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     40.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  137.00  DOWNSTREAM ELEVATION(FEET) =  135.10
  STREET LENGTH(FEET) =    99.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  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) =       2.85
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.33
    HALFSTREET FLOOD WIDTH(FEET) =    9.28
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.95
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
  STREET FLOW TRAVEL TIME(MIN.) =   0.56   Tc(MIN.) =   17.76
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.993
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        0.52      0.30     0.100    76
```

```
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.39
  EFFECTIVE AREA(ACRES) =      1.39    AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       3.50

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  10.27
  FLOW VELOCITY(FEET/SEC.) =  3.08   DEPTH*VELOCITY(FT*FT/SEC.) =   1.06
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     40.00 =     494.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     90.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  135.10  DOWNSTREAM ELEVATION(FEET) =  134.80
  STREET LENGTH(FEET) =    38.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.018
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

  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) =       3.50
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.39
    HALFSTREET FLOOD WIDTH(FEET) =   12.54
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.19
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.85
  STREET FLOW TRAVEL TIME(MIN.) =   0.29   Tc(MIN.) =   18.05
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.965
  SUBAREA AREA(ACRES) =    0.00      SUBAREA RUNOFF(CFS) =    0.00
  EFFECTIVE AREA(ACRES) =      1.39    AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =        1.4        PEAK FLOW RATE(CFS) =       3.50
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  12.54
  FLOW VELOCITY(FEET/SEC.) =  2.19   DEPTH*VELOCITY(FT*FT/SEC.) =   0.85
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     90.00 =     532.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     90.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   18.05
  RAINFALL INTENSITY(INCH/HR) =   2.97
  AREA-AVERAGED Fm(INCH/HR) =  0.20
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.66
  EFFECTIVE STREAM AREA(ACRES) =       1.39
  TOTAL STREAM AREA(ACRES) =       1.39
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.50

****************************************************************************
  FLOW PROCESS FROM NODE     60.00 TO NODE     61.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   130.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.00  DOWNSTREAM(FEET) =    136.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.947
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.172
  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.)
URBAN POOR COVER
"TURF"                     B        0.06      0.30      1.000    90    9.95
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA RUNOFF(CFS) =      0.21
TOTAL AREA(ACRES) =      0.06   PEAK FLOW RATE(CFS) =      0.21

****************************************************************************
FLOW PROCESS FROM NODE     61.00 TO NODE     90.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  136.10  DOWNSTREAM ELEVATION(FEET) =  134.80
STREET LENGTH(FEET) =   545.00   CURB HEIGHT(INCHES) =  8.0
STREET HALFWIDTH(FEET) = 30.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.018
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.018

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) =       1.96
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.39
  HALFSTREET FLOOD WIDTH(FEET) =   12.62
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.21
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.47
STREET FLOW TRAVEL TIME(MIN.) =   7.51   Tc(MIN.) =   17.45
* 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.023
SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
URBAN POOR COVER
"TURF"                     B        1.40      0.30      1.000    90
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
SUBAREA AREA(ACRES) =    1.40      SUBAREA RUNOFF(CFS) =    3.43
EFFECTIVE AREA(ACRES) =      1.46    AREA-AVERAGED Fm(INCH/HR) =  0.30
AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  1.00
TOTAL AREA(ACRES) =        1.5        PEAK FLOW RATE(CFS) =       3.58

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.37
FLOW VELOCITY(FEET/SEC.) =  1.38   DEPTH*VELOCITY(FT*FT/SEC.) =   0.63
LONGEST FLOWPATH FROM NODE     60.00 TO NODE     90.00 =     675.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     61.00 TO NODE     90.00 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.) =   17.45
RAINFALL INTENSITY(INCH/HR) =   3.02
AREA-AVERAGED Fm(INCH/HR) =  0.30
AREA-AVERAGED Fp(INCH/HR) =  0.30
AREA-AVERAGED Ap =  1.00
EFFECTIVE STREAM AREA(ACRES) =       1.46
TOTAL STREAM AREA(ACRES) =       1.46
PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.58

** CONFLUENCE DATA **
 STREAM       Q      Tc   Intensity   Fp(Fm)      Ap      Ae     HEADWATER
 NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
    1        3.50   18.05    2.965  0.30( 0.20) 0.66       1.4      10.00
    2        3.58   17.45    3.023  0.30( 0.30) 1.00       1.5      60.00

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        7.03   17.45    3.023  0.30( 0.25) 0.84       2.8      60.00
      2        7.00   18.05    2.965  0.30( 0.25) 0.84       2.8      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.03    Tc(MIN.) =    17.45
  EFFECTIVE AREA(ACRES) =       2.80   AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.84
  TOTAL AREA(ACRES) =        2.8
  LONGEST FLOWPATH FROM NODE     60.00 TO NODE     90.00 =     675.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.8  TC(MIN.) =     17.45
  EFFECTIVE AREA(ACRES) =      2.80  AREA-AVERAGED Fm(INCH/HR)=  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.839
  PEAK FLOW RATE(CFS)   =       7.03

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)    NODE
      1        7.03   17.45    3.023  0.30( 0.25) 0.84       2.8      60.00
      2        7.00   18.05    2.965  0.30( 0.25) 0.84       2.8      10.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

♀

```
**************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                          Analysis prepared by:

                                 STV Inc.
                           9130 Anaheim Pl, Ste 210
                          Rancho Cucamonga, CA 91730


 ************************* DESCRIPTION OF STUDY *************************
* OCTA TSOC                                                             *
* Conceptual Drainage Study                                             *
* 100-yr storm event analysis                                           *
 ************************************************************************

  FILE NAME: TSOC100.DAT
  TIME/DATE OF STUDY: 19:10 09/04/2017
========================================================================
  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
  *DATA BANK RAINFALL USED*
  *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 0.0313 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

  UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:
    WATERSHED LAG = 0.80 * Tc
    USED "VALLEY UNDEVELOPED" S-GRAPH FOR DEVELOPMENTS OF
    2 UNITS/ACRE AND LESS; AND "VALLEY DEVELOPED" S-GRAPH
    FOR DEVELOPMENTS OF 3-4 UNITS/ACRE AND MORE.
    SIERRA MADRE DEPTH-AREA FACTORS USED.
                      AREA-AVERAGED
          DURATION    RAINFALL(INCH)
          5-MINUTES         0.52
         30-MINUTES         1.09
          1-HOUR            1.45
          3-HOUR            2.43
          6-HOUR            3.36
         24-HOUR            5.63
*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD*


**************************************************************************
  FLOW PROCESS FROM NODE     10.10 TO NODE     15.10 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   103.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.50  DOWNSTREAM(FEET) =    136.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.187
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
```

```
     LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                B        0.14      0.30      0.100    76    5.00
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.78
  TOTAL AREA(ACRES) =      0.14   PEAK FLOW RATE(CFS) =      0.78

****************************************************************************
  FLOW PROCESS FROM NODE     15.10 TO NODE     16.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   132.53  DOWNSTREAM(FEET) =   132.33
  FLOW LENGTH(FEET) =    39.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.70
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.78
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    5.24
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     16.10 =     142.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     15.10 TO NODE     16.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    5.24
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  6.023
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        0.06      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.06      SUBAREA RUNOFF(CFS) =     0.32
  EFFECTIVE AREA(ACRES) =      0.20   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.2       PEAK FLOW RATE(CFS) =       1.08

****************************************************************************
  FLOW PROCESS FROM NODE     16.10 TO NODE     20.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   132.33  DOWNSTREAM(FEET) =   131.10
  FLOW LENGTH(FEET) =   246.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.94
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.08
  PIPE TRAVEL TIME(MIN.) =   1.40    Tc(MIN.) =    6.64
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     20.10 =     388.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.10 TO NODE     20.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.64
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.261
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
     LAND USE              GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                B        0.64      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =     0.64      SUBAREA RUNOFF(CFS) =     3.01
  EFFECTIVE AREA(ACRES) =      0.84   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        0.8       PEAK FLOW RATE(CFS) =       3.95

****************************************************************************
  FLOW PROCESS FROM NODE     20.10 TO NODE     40.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =   131.10  DOWNSTREAM(FEET) =   130.91
  FLOW LENGTH(FEET) =    37.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.23
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.95
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =    6.78
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     40.10 =     425.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     20.10 TO NODE     40.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    6.78
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.196
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.12      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.12      SUBAREA RUNOFF(CFS) =    0.56
  EFFECTIVE AREA(ACRES) =      0.96   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.0       PEAK FLOW RATE(CFS) =       4.46

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   130.91  DOWNSTREAM(FEET) =   130.52
  FLOW LENGTH(FEET) =    77.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.33
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.46
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =    7.08
  LONGEST FLOWPATH FROM NODE     10.10 TO NODE     80.10 =     502.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    7.08
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.070
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  B        0.21      0.30     0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.21      SUBAREA RUNOFF(CFS) =    0.95
  EFFECTIVE AREA(ACRES) =      1.17   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.2       PEAK FLOW RATE(CFS) =       5.31

****************************************************************************
  FLOW PROCESS FROM NODE     40.10 TO NODE     80.10 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.) =    7.08
  RAINFALL INTENSITY(INCH/HR) =   5.07
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.17
  TOTAL STREAM AREA(ACRES) =       1.17
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.31

****************************************************************************
  FLOW PROCESS FROM NODE     60.10 TO NODE     61.10 IS CODE =  21
----------------------------------------------------------------------------
```

```
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   130.00
  ELEVATION DATA: UPSTREAM(FEET) =    137.00  DOWNSTREAM(FEET) =    136.30

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.056
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  5.544
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 B        0.06      0.30      0.100    76    6.06
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.06   PEAK FLOW RATE(CFS) =      0.30

********************************************************************************
  FLOW PROCESS FROM NODE     61.10 TO NODE     71.10 IS CODE =  91
--------------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
================================================================================
  UPSTREAM NODE ELEVATION(FEET) =    136.30
  DOWNSTREAM NODE ELEVATION(FEET) =    135.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   313.00
  "V" GUTTER WIDTH(FEET) =   4.00   GUTTER HIKE(FEET) =  0.160
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   0.50
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.203
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        1.07      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.27
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.39
  AVERAGE FLOW DEPTH(FEET) =   0.26   FLOOD WIDTH(FEET) =   22.95
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.76   Tc(MIN.) =    9.82
  SUBAREA AREA(ACRES) =    1.07      SUBAREA RUNOFF(CFS) =    4.02
  EFFECTIVE AREA(ACRES) =    1.13     AREA-AVERAGED Fm(INCH/HR) =   0.03
  AREA-AVERAGED Fp(INCH/HR) =   0.30  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       4.24

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.31   FLOOD WIDTH(FEET) =   31.71
  FLOW VELOCITY(FEET/SEC.) =   1.50   DEPTH*VELOCITY(FT*FT/SEC) =   0.46
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     71.10 =     443.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 IS CODE =  41
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   131.41  DOWNSTREAM(FEET) =   130.52
  FLOW LENGTH(FEET) =   178.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   9.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.26
  GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.24
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =   10.52
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     80.10 =     621.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN.) =   10.52
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.041
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 B        0.52      0.30      0.100    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.30
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
```

```
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.88
  EFFECTIVE AREA(ACRES) =      1.65   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        1.6       PEAK FLOW RATE(CFS) =       5.96

****************************************************************************
  FLOW PROCESS FROM NODE     71.10 TO NODE     80.10 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.) =   10.52
  RAINFALL INTENSITY(INCH/HR) =   4.04
  AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.65
  TOTAL STREAM AREA(ACRES) =       1.65
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.96

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        5.31    7.08    5.070  0.30( 0.03) 0.10       1.2      10.10
      2        5.96   10.52    4.041  0.30( 0.03) 0.10       1.6      60.10

  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       10.34    7.08    5.070  0.30( 0.03) 0.10       2.3      10.10
      2       10.18   10.52    4.041  0.30( 0.03) 0.10       2.8      60.10

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      10.34    Tc(MIN.) =     7.08
  EFFECTIVE AREA(ACRES) =       2.28   AREA-AVERAGED Fm(INCH/HR) =  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =       2.8
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     80.10 =     621.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     80.10 TO NODE     90.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   130.52  DOWNSTREAM(FEET) =   129.50
  FLOW LENGTH(FEET) =    51.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.92
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.34
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =    7.17
  LONGEST FLOWPATH FROM NODE     60.10 TO NODE     90.00 =     672.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       2.8  TC(MIN.) =      7.17
  EFFECTIVE AREA(ACRES) =      2.28  AREA-AVERAGED Fm(INCH/HR)=  0.03
  AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      10.34

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.34    7.17    5.031  0.30( 0.03) 0.10       2.3      10.10
      2       10.18   10.61    4.020  0.30( 0.03) 0.10       2.8      60.10
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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OCFCD	Small Area Runoff Hydrograph Calculations	Project: OCTA TSOC		Sheet
Hydrology Manual	Loss Rate Calculation Worksheet	By: RW	Date: 9/4/2017	
Section C		Checked:	Date:	1 of 2

LOSS RATE DATA

[1] Soil Group (Plate A, B, or C)	[2] Pervious Area Soil Cover Type	[3] Curve Number (AMC II) (Figure C-3)	[4] AMC	[5] Adj CN Based on AMC (Table C.1)	[6] "S" (Formula C.2)	[7] Initial Abstract. Ia (Formula C.1)	[8] Design Storm (year)	[9] P24 (in) (Fig B-1)	[10] Subarea Aj (ac)	[11] 24-hr Yield Fraction Yj (Formula C.3)	[12] Yj * Aj (ac) [11] x [10]	[13] Max. Loss Rate / Soil F_p (in/hr) (Table C.2)	[14] Pervious Fration a_p / Land Use (Fig. C-4)	[15] Area Max Loss Rate Fm (in/hr) (Formula C.7)
B	Urban - Turf Poor Cover	74	I	56	7.86	1.57	2	2.05	0.14	0.01	0.00	0.3	1	0.3
B	Urban - Turf Poor Cover	74	I	56	7.86	1.57	2	2.05	0.73	0.01	0.01	0.3	1	0.3
B	Industrial	98	I	36	17.78	3.56	2	2.05	0.52	0	0.00	0.3	0.1	0.03
B	Urban - Turf Poor Cover	74	I	56	7.86	1.57	2	2.05	1.4	0.01	0.01	0.3	1	0.3
B	Urban - Turf Poor Cover	74	I	56	7.86	1.57	2	2.05	0.06	0.01	0.00	0.3	1	0.3
								∑[10]=	2.85	∑[12]=	0.02		∑[15]=	1.23

Loss Rate Calculation Summary

Scenario = Existing Conditions

Design Storm Event = 2 -year

2-yr 24-hr Rainfall Intensity (I) = 0.0854 in/hr

Weighted Avg 24-hr yield fraction (Y) = ∑[12] / ∑[10] = 0.01

Low Loss Fraction (Y_L) = 1 - Y = **0.99**

Adjusted Low Loss Rate (F*)= Y_L * I = **0.0845** in/hr

Weighted Avg Catchment Max. Loss Rate (Fm) = 0.2507 in/hr

Note: [11] has zero value when [7] is greater than [9] (i.e. Ia > P24)

OCFCD Hydrology Manual Section C	Small Area Runoff Hydrograph Calculations Loss Rate Calculation Worksheet	Project: OCTA TSOC	By: RW	Date: 9/4/2017	Checked:	Date:	Sheet 2 of 2

LOSS RATE DATA

[1] Soil Group (Plate A, B, or C)	[2] Pervious Area Soil Cover Type	[3] Curve Number (AMC II) (Figure C-3)	[4] AMC	[5] Adj CN Based on AMC (Table C.1)	[6] "S" (Formula C.2)	[7] Initial Abstract. Ia (Formula C.1)	[8] Design Storm (year)	[9] P24 (in) (Fig B-1)	[10] Subarea Aj (ac)	[11] 24-hr Yield Fraction Yj (Formula C.3)	[12] Yj * Aj (ac) [11] x [10]	[13] Max. Loss Rate / Soil F_p (in/hr) (Table C.2)	[14] Pervious Fration a_p / Land Use (Fig. C-4)	[15] Area Max Loss Rate Fm (in/hr) (Formula C.7)
B	Commercial	56	I	36	17.78	3.56	2	2.05	2.85	0	0.00	0.3	0.1	0.03
								∑[10]=	2.85	∑[12]=	0		∑[15]=	0.03

Loss Rate Calculation Summary

Scenario = Conceptual Study

Design Storm Event = 2 -year

2-yr 24-hr Rainfall Intensity (I) = 0.0854 in/hr

Weighted Avg 24-hr yield fraction (Y) = ∑[12] / ∑[10] = 0

Low Loss Fraction (Y_L) = 1 - Y = **1**

Adjusted Low Loss Rate (F*)= Y_L * I = **0.0854** in/hr

Weighted Avg Catchment Max. Loss Rate (Fm) = 0.03 in/hr

Note: [11] has zero value when [7] is greater than [9] (i.e. Ia > P24)

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**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==========================================================================
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                          Analysis prepared by:

                                 STV Inc.
                             9130 Anaheim Place
                                 Suite 210
                           Rancho Cucamonga, CA 91730

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 Problem Descriptions:
  OCTA TSOC
  Existing Drainage Conditions
  2-year run-off volume
--------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    2.85
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.251
    LOW LOSS FRACTION = 0.990
    TIME OF CONCENTRATION(MIN.) = 22.88
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

--------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.06
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.42

**************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.37      0.0000      0.00  Q         .         .         .         .
  0.75      0.0000      0.00  Q         .         .         .         .
  1.13      0.0001      0.00  Q         .         .         .         .
  1.51      0.0001      0.00  Q         .         .         .         .
  1.89      0.0001      0.00  Q         .         .         .         .
  2.27      0.0001      0.00  Q         .         .         .         .
  2.65      0.0002      0.00  Q         .         .         .         .
  3.03      0.0002      0.00  Q         .         .         .         .
  3.42      0.0002      0.00  Q         .         .         .         .
  3.80      0.0003      0.00  Q         .         .         .         .
  4.18      0.0003      0.00  Q         .         .         .         .
  4.56      0.0003      0.00  Q         .         .         .         .
  4.94      0.0004      0.00  Q         .         .         .         .
  5.32      0.0004      0.00  Q         .         .         .         .
  5.70      0.0004      0.00  Q         .         .         .         .
  6.09      0.0005      0.00  Q         .         .         .         .
  6.47      0.0005      0.00  Q         .         .         .         .
  6.85      0.0005      0.00  Q         .         .         .         .
  7.23      0.0006      0.00  Q         .         .         .         .
  7.61      0.0006      0.00  Q         .         .         .         .
  7.99      0.0006      0.00  Q         .         .         .         .
  8.37      0.0007      0.00  Q         .         .         .         .
  8.75      0.0007      0.00  Q         .         .         .         .
  9.14      0.0008      0.00  Q         .         .         .         .
  9.52      0.0008      0.00  Q         .         .         .         .
  9.90      0.0008      0.00  Q         .         .         .         .
 10.28      0.0009      0.00  Q         .         .         .         .
 10.66      0.0009      0.00  Q         .         .         .         .
 11.04      0.0010      0.00  Q         .         .         .         .
 11.42      0.0010      0.00  Q         .         .         .         .
 11.81      0.0011      0.00  Q         .         .         .         .
 12.19      0.0012      0.00  Q         .         .         .         .
 12.57      0.0012      0.00  Q         .         .         .         .
 12.95      0.0013      0.00  Q         .         .         .         .
 13.33      0.0014      0.00  Q         .         .         .         .
 13.71      0.0015      0.00  Q         .         .         .         .
 14.09      0.0016      0.00  Q         .         .         .         .
 14.47      0.0017      0.00  Q         .         .         .         .
 14.86      0.0018      0.00  Q         .         .         .         .
 15.24      0.0020      0.00  Q         .         .         .         .
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15.62	0.0021	0.01	Q	.	.	.	.
16.00	0.0045	0.15	Q	.	.	.	.
16.38	0.0346	1.76	.	Q	.	.	.
16.76	0.0624	0.01	Q	.	.	.	.
17.14	0.0626	0.00	Q	.	.	.	.
17.53	0.0627	0.00	Q	.	.	.	.
17.91	0.0628	0.00	Q	.	.	.	.
18.29	0.0629	0.00	Q	.	.	.	.
18.67	0.0629	0.00	Q	.	.	.	.
19.05	0.0630	0.00	Q	.	.	.	.
19.43	0.0630	0.00	Q	.	.	.	.
19.81	0.0631	0.00	Q	.	.	.	.
20.19	0.0631	0.00	Q	.	.	.	.
20.58	0.0632	0.00	Q	.	.	.	.
20.96	0.0632	0.00	Q	.	.	.	.
21.34	0.0632	0.00	Q	.	.	.	.
21.72	0.0633	0.00	Q	.	.	.	.
22.10	0.0633	0.00	Q	.	.	.	.
22.48	0.0633	0.00	Q	.	.	.	.
22.86	0.0634	0.00	Q	.	.	.	.
23.25	0.0634	0.00	Q	.	.	.	.
23.63	0.0634	0.00	Q	.	.	.	.
24.01	0.0634	0.00	Q	.	.	.	.
24.39	0.0635	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1441.4
10%	22.9
20%	22.9
30%	22.9
40%	22.9
50%	22.9
60%	22.9
70%	22.9
80%	22.9
90%	22.9

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******************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL
==============================================================================
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             Ver. 23.0  Release Date: 07/01/2016  License ID 1613

                          Analysis prepared by:

                                 STV Inc.
                              9130 Anaheim Place
                                  Suite 210
                            Rancho Cucamonga, CA 91730

******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  OCTA TSOC
  Conceptual Drainage Study
  2-yr run-off volume
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    2.85
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.030
    LOW LOSS FRACTION = 1.000
    TIME OF CONCENTRATION(MIN.) =  7.92
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    ORANGE COUNTY "VALLEY" RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =   2
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.40
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.53
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.89
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.22
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.05

------------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.28
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.20

******************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.03      0.0000      0.00  Q         .         .         .         .
  0.16      0.0000      0.01  Q         .         .         .         .
  0.29      0.0001      0.01  Q         .         .         .         .
  0.42      0.0002      0.01  Q         .         .         .         .
  0.56      0.0002      0.01  Q         .         .         .         .
  0.69      0.0003      0.01  Q         .         .         .         .
  0.82      0.0004      0.01  Q         .         .         .         .
  0.95      0.0005      0.01  Q         .         .         .         .
  1.08      0.0005      0.01  Q         .         .         .         .
  1.22      0.0006      0.01  Q         .         .         .         .
  1.35      0.0007      0.01  Q         .         .         .         .
  1.48      0.0008      0.01  Q         .         .         .         .
  1.61      0.0010      0.01  Q         .         .         .         .
  1.74      0.0011      0.01  Q         .         .         .         .
  1.88      0.0012      0.01  Q         .         .         .         .
  2.01      0.0013      0.01  Q         .         .         .         .
  2.14      0.0014      0.01  Q         .         .         .         .
  2.27      0.0016      0.01  Q         .         .         .         .
  2.40      0.0017      0.01  Q         .         .         .         .
  2.54      0.0019      0.01  Q         .         .         .         .
  2.67      0.0020      0.01  Q         .         .         .         .
  2.80      0.0022      0.01  Q         .         .         .         .
  2.93      0.0024      0.02  Q         .         .         .         .
  3.06      0.0025      0.02  Q         .         .         .         .
  3.20      0.0027      0.02  Q         .         .         .         .
  3.33      0.0029      0.02  Q         .         .         .         .
  3.46      0.0031      0.02  Q         .         .         .         .
  3.59      0.0033      0.02  Q         .         .         .         .
  3.72      0.0035      0.02  Q         .         .         .         .
  3.86      0.0037      0.02  Q         .         .         .         .
  3.99      0.0039      0.02  Q         .         .         .         .
  4.12      0.0042      0.02  Q         .         .         .         .
  4.25      0.0044      0.02  Q         .         .         .         .
  4.38      0.0046      0.02  Q         .         .         .         .
  4.52      0.0049      0.02  Q         .         .         .         .
  4.65      0.0052      0.02  Q         .         .         .         .
  4.78      0.0054      0.02  Q         .         .         .         .
  4.91      0.0057      0.03  Q         .         .         .         .
  5.04      0.0060      0.03  Q         .         .         .         .
  5.18      0.0063      0.03  Q         .         .         .         .
```

5.31	0.0066	0.03	Q	.	.	.	.
5.44	0.0069	0.03	Q	.	.	.	.
5.57	0.0072	0.03	Q	.	.	.	.
5.70	0.0075	0.03	Q	.	.	.	.
5.84	0.0079	0.03	Q	.	.	.	.
5.97	0.0082	0.03	Q	.	.	.	.
6.10	0.0086	0.03	Q	.	.	.	.
6.23	0.0089	0.03	Q	.	.	.	.
6.36	0.0093	0.04	Q	.	.	.	.
6.50	0.0097	0.04	Q	.	.	.	.
6.63	0.0101	0.04	Q	.	.	.	.
6.76	0.0105	0.04	Q	.	.	.	.
6.89	0.0109	0.04	Q	.	.	.	.
7.02	0.0113	0.04	Q	.	.	.	.
7.16	0.0118	0.04	Q	.	.	.	.
7.29	0.0122	0.04	Q	.	.	.	.
7.42	0.0127	0.04	Q	.	.	.	.
7.55	0.0132	0.04	Q	.	.	.	.
7.68	0.0137	0.05	Q	.	.	.	.
7.82	0.0142	0.05	Q	.	.	.	.
7.95	0.0147	0.05	Q	.	.	.	.
8.08	0.0152	0.05	Q	.	.	.	.
8.21	0.0158	0.05	Q	.	.	.	.
8.34	0.0163	0.05	Q	.	.	.	.
8.48	0.0169	0.05	Q	.	.	.	.
8.61	0.0175	0.05	Q	.	.	.	.
8.74	0.0181	0.06	Q	.	.	.	.
8.87	0.0187	0.06	Q	.	.	.	.
9.00	0.0194	0.06	Q	.	.	.	.
9.14	0.0200	0.06	Q	.	.	.	.
9.27	0.0207	0.06	Q	.	.	.	.
9.40	0.0214	0.06	Q	.	.	.	.
9.53	0.0221	0.07	Q	.	.	.	.
9.66	0.0228	0.07	Q	.	.	.	.
9.80	0.0236	0.07	Q	.	.	.	.
9.93	0.0243	0.07	Q	.	.	.	.
10.06	0.0251	0.07	Q	.	.	.	.
10.19	0.0260	0.08	Q	.	.	.	.
10.32	0.0268	0.08	Q	.	.	.	.
10.46	0.0277	0.08	Q	.	.	.	.
10.59	0.0286	0.08	Q	.	.	.	.
10.72	0.0295	0.08	Q	.	.	.	.
10.85	0.0304	0.09	Q	.	.	.	.
10.98	0.0314	0.09	Q	.	.	.	.
11.12	0.0324	0.09	Q	.	.	.	.
11.25	0.0334	0.10	Q	.	.	.	.
11.38	0.0345	0.10	Q	.	.	.	.
11.51	0.0356	0.10	Q	.	.	.	.
11.64	0.0367	0.11	Q	.	.	.	.
11.78	0.0379	0.11	Q	.	.	.	.
11.91	0.0391	0.11	Q	.	.	.	.
12.04	0.0403	0.12	Q	.	.	.	.
12.17	0.0418	0.16	Q	.	.	.	.
12.30	0.0436	0.17	Q	.	.	.	.
12.44	0.0455	0.17	Q	.	.	.	.
12.57	0.0474	0.18	Q	.	.	.	.
12.70	0.0493	0.18	Q	.	.	.	.
12.83	0.0513	0.19	Q	.	.	.	.
12.96	0.0534	0.19	Q	.	.	.	.
13.10	0.0556	0.20	Q	.	.	.	.
13.23	0.0578	0.21	Q	.	.	.	.
13.36	0.0601	0.21	Q	.	.	.	.
13.49	0.0625	0.22	Q	.	.	.	.
13.62	0.0649	0.23	Q	.	.	.	.
13.76	0.0675	0.24	Q	.	.	.	.
13.89	0.0702	0.25	Q	.	.	.	.
14.02	0.0730	0.26	.Q	.	.	.	.
14.15	0.0759	0.28	.Q	.	.	.	.
14.28	0.0791	0.30	.Q	.	.	.	.
14.42	0.0825	0.31	.Q	.	.	.	.
14.55	0.0860	0.34	.Q	.	.	.	.
14.68	0.0897	0.35	.Q	.	.	.	.
14.81	0.0937	0.38	.Q	.	.	.	.
14.94	0.0979	0.40	.Q	.	.	.	.
15.08	0.1025	0.44	.Q	.	.	.	.
15.21	0.1074	0.46	.Q	.	.	.	.
15.34	0.1128	0.53	. Q	.	.	.	.
15.47	0.1185	0.52	. Q	.	.	.	.
15.60	0.1245	0.59	. Q	.	.	.	.
15.74	0.1314	0.68	. Q	.	.	.	.
15.87	0.1407	1.02	. Q	.	.	.	.
16.00	0.1539	1.41	. Q	.	.	.	.
16.13	0.1856	4.39	.	.	Q	.	.
16.26	0.2140	0.81	. Q	.	.	.	.
16.40	0.2213	0.53	. Q	.	.	.	.
16.53	0.2269	0.49	.Q	.	.	.	.
16.66	0.2318	0.42	.Q	.	.	.	.
16.79	0.2361	0.36	.Q	.	.	.	.

16.92	0.2398	0.32	.Q	.	.	.	.
17.06	0.2432	0.29	.Q	.	.	.	.
17.19	0.2462	0.26	.Q	.	.	.	.
17.32	0.2489	0.24	Q	.	.	.	.
17.45	0.2513	0.22	Q	.	.	.	.
17.58	0.2536	0.20	Q	.	.	.	.
17.72	0.2558	0.19	Q	.	.	.	.
17.85	0.2578	0.18	Q	.	.	.	.
17.98	0.2597	0.17	Q	.	.	.	.
18.11	0.2614	0.14	Q	.	.	.	.
18.24	0.2627	0.11	Q	.	.	.	.
18.38	0.2639	0.10	Q	.	.	.	.
18.51	0.2650	0.10	Q	.	.	.	.
18.64	0.2660	0.09	Q	.	.	.	.
18.77	0.2670	0.09	Q	.	.	.	.
18.90	0.2679	0.08	Q	.	.	.	.
19.04	0.2688	0.08	Q	.	.	.	.
19.17	0.2696	0.07	Q	.	.	.	.
19.30	0.2703	0.07	Q	.	.	.	.
19.43	0.2711	0.07	Q	.	.	.	.
19.56	0.2718	0.06	Q	.	.	.	.
19.70	0.2724	0.06	Q	.	.	.	.
19.83	0.2730	0.06	Q	.	.	.	.
19.96	0.2736	0.05	Q	.	.	.	.
20.09	0.2742	0.05	Q	.	.	.	.
20.22	0.2747	0.05	Q	.	.	.	.
20.36	0.2752	0.04	Q	.	.	.	.
20.49	0.2757	0.04	Q	.	.	.	.
20.62	0.2762	0.04	Q	.	.	.	.
20.75	0.2766	0.04	Q	.	.	.	.
20.88	0.2770	0.04	Q	.	.	.	.
21.02	0.2774	0.03	Q	.	.	.	.
21.15	0.2778	0.03	Q	.	.	.	.
21.28	0.2781	0.03	Q	.	.	.	.
21.41	0.2784	0.03	Q	.	.	.	.
21.54	0.2787	0.03	Q	.	.	.	.
21.68	0.2790	0.03	Q	.	.	.	.
21.81	0.2793	0.02	Q	.	.	.	.
21.94	0.2796	0.02	Q	.	.	.	.
22.07	0.2798	0.02	Q	.	.	.	.
22.20	0.2800	0.02	Q	.	.	.	.
22.34	0.2802	0.02	Q	.	.	.	.
22.47	0.2804	0.02	Q	.	.	.	.
22.60	0.2806	0.02	Q	.	.	.	.
22.73	0.2808	0.02	Q	.	.	.	.
22.86	0.2810	0.01	Q	.	.	.	.
23.00	0.2811	0.01	Q	.	.	.	.
23.13	0.2813	0.01	Q	.	.	.	.
23.26	0.2814	0.01	Q	.	.	.	.
23.39	0.2815	0.01	Q	.	.	.	.
23.52	0.2816	0.01	Q	.	.	.	.
23.66	0.2817	0.01	Q	.	.	.	.
23.79	0.2818	0.01	Q	.	.	.	.
23.92	0.2819	0.01	Q	.	.	.	.
24.05	0.2819	0.01	Q	.	.	.	.
24.18	0.2819	0.00	Q	.	.	.	.

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1441.4
10%	87.1
20%	23.8
30%	15.8
40%	7.9
50%	7.9
60%	7.9
70%	7.9
80%	7.9
90%	7.9