DRAINAGE STUDY AND HYDRAULIC CALCULATIONS

PREPARED FOR:

MONEY SAMRA
TRUCK SERVICE CENTER

MEMORIAL DRIVE

CITY OF NEWBERRY SPRINGS
COUNTY OF SAN BERNARDINO

PREPARED BY:

SITETECH, INC.
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HIGHLAND CA 92346
PO BOX 592
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[Signature]

BERNHARD K. MAYER  R.C.E. 36866  02/26/2018

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STATE OF CALIFORNIA  CIVIL
NO. 36866  Exp. 6-30-18
SUMMARY

INTRODUCTION
The project is a new commercial development on 5.08 acres of a vacant lot covered with compacted gravel and a portion covered in asphalt. Site located in the City of Newberry Springs, County of San Bernardino. A Truck Service Center with a parking lot and a compacted gravel Impound Yard are proposed. The project will add approximately 94,000 sq. ft. or of impervious surface (including but not limited to: roof areas, walkways, parking lot and entry ways). The purpose of this study is to determine the rate of storm water runoff which will flow through the property during a 100-Year storm event and determine any mitigations which are necessary to protect the proposed development during a 100-Year Storm. This study will also determine the difference in runoff volume between the existing and proposed site conditions.

EXISTING WATERSHED DESCRIPTION
In its existing condition runoff from the north half of the sitesheet flows easterly to the northeast corner of the site and outlets onto Memorial Drive. Runoff from the south half of the site sheet flows easterly to the southeast corner of the site and outlets onto the adjacent property.

PROPOSED WATERSHED DESCRIPTION
In the developed condition runoff from the northwesterly portion of the site will flow southwesterly through a series of Curb & Gutters which will convey the runoff to an infiltration basin located at the westerly most corner of the site. Overflow runoff from the westerly basin will flow over a rock spillway and onto a rock splash pad before leaving the site. Runoff from the southeasterly portion of the developed site will flow easterly through a series of Concrete V-Gutter and Curb & Gutters which will convey the runoff to an infiltration basin located at the Southeast corner of the site. Overflow runoff will flow over a rock spillway and onto a rock splash pad before leaving the site.

METHODOLOGY - RATIONAL METHOD
The following scenario was modeled:

Existing and Developed Condition, 100-year storm & 2-year Storm

Rainfall depth was derived from the San Bernardino County Flood Control & Water Conservation District Hydrology Manual's isohyetal maps and precipitation frequency Atlas, NOAA Atlas 14.

Rational Method computations were performed using Advanced Engineering Software (aes), ver. 15.0, based on the Hydrology Manual. Discharge was calculated by the software, based on user input of rainfall, soil type, acreage, and land use parameters.

Printouts of the rational method calculations, as well as applicable plates from the Manual, are included in this report.
CONCLUSIONS

This drainage study and the calculations presented herein demonstrate the following:

TOTAL RUNOFF LEAVING THE SITE:

EXISTING:  
Q2(NODE 110) = 2.05 C.F.S.  
Q2(NODE 210) = 2.01 C.F.S.  
Q2(NODE 310) = 0.98 C.F.S.  
Q2(TOTAL) = 4.51 C.F.S.  
Q100(NODE 110) = 9.71 C.F.S.  
Q100(NODE 210) = 9.15 C.F.S.  
Q100(NODE 310) = 3.57 C.F.S.  
Q100(TOTAL) = 22.43 C.F.S.

PROPOSED:  
Q2(NODE 130) = 1.93 C.F.S.  
Q2(NODE 240) = 5.50 C.F.S.  
Q2(TOTAL) = 7.43 C.F.S.  
Q100(NODE 130) = 7.02 C.F.S.  
Q100(NODE 240) = 20.95 C.F.S.  
Q100(TOTAL) = 27.97 C.F.S.
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2008 Advanced Engineering Software (aes)
Ver. 15.0 Release Date: 04/01/2008 License ID 1524

Analysis prepared by:

SITETECH, INC.

*************************** DESCRIPTION OF STUDY ***************************
STEENO DESIGN – NEWBERRY SPRINGS
MEMORIAL DRIVE
EXISTING CONDITION
2 YEAR – 1 HOUR DESIGN STORM

FILE NAME: SDMP2E.DAT
TIME/DATE OF STUDY: 08:36 02/26/2018

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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

USER SPECIFIED STORM EVENT(YEAR) = 2.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*
SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.4940

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

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

<table>
<thead>
<tr>
<th>NO.</th>
<th>FT</th>
<th>(FT)</th>
<th>FT</th>
<th>FT</th>
<th>FT</th>
<th>FT</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30.0</td>
<td>20.0</td>
<td>0.018/0.018/0.020</td>
<td>0.67</td>
<td>2.00</td>
<td>0.0313</td>
<td>0.187</td>
</tr>
</tbody>
</table>

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/3)
   *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
   *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH(FEET) = 781.00
ELEVATION DATA: UPSTREAM(FEET) = 1792.00 DOWNSTREAM( FEET) = 1787.00

Tc = K*[(LENGTH ** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 16.244
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.233
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"3-4 DWELLINGS/ACRE" C 2.55 0.57 0.600 69 16.24
SUBAREA AVERAGE PERVERSIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF(CFS) = 2.05
TOTAL AREA(ACRES) = 2.55 PEAK FLOW RATE(CFS) = 2.05

******************************************************
FLOW PROCESS FROM NODE 200.00 TO NODE 210.00 IS CODE = 21
******************************************************

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

INITIAL SUBAREA FLOW-LENGTH( FEET) = 504.00
ELEVATION DATA: UPSTREAM( FEET) = 1791.00 DOWNSTREAM( FEET) = 1787.90

Tc = K*[(LENGTH ** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 13.743
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 1.386
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"3-4 DWELLINGS/ACRE" C 2.13 0.57 0.600 69 13.74
SUBAREA AVERAGE PERVERSIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF(CFS) = 2.01
TOTAL AREA(ACRES) = 2.13 PEAK FLOW RATE(CFS) = 2.01

******************************************************
FLOW PROCESS FROM NODE 300.00 TO NODE 310.00 IS CODE = 21
******************************************************

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

INITIAL SUBAREA FLOW-LENGTH( FEET) = 302.00
ELEVATION DATA: UPSTREAM( FEET) = 1791.80 DOWNSTREAM( FEET) = 1788.00

Tc = K*[(LENGTH ** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.160
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.188
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL C 0.51 0.57 0.100 69 7.16
SUBAREA AVERAGE PERVERSIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.98
TOTAL AREA(ACRES) = 0.51 PEAK FLOW RATE(CFS) = 0.98
END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 0.5  TC (MIN.) = 7.16
EFFECTIVE AREA (ACRES) = 0.51  AREA-AVERAGED Fm (INCH/HR) = 0.06
AREA-AVERAGED Fp (INCH/HR) = 0.57  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE (CFS) = 0.98

END OF RATIONAL METHOD ANALYSIS
Analysis prepared by:

SITETECH, INC.

************************ DESCRIPTION OF STUDY ************************

STEENO DESIGN - NEWBERRY SPRINGS
MEMORIAL DRIVE
EXISTING CONDITION

100 YEAR - 1 HOUR DESIGN STORM

FILE NAME: SDMR100E.DAT
TIME/DATE OF STUDY: 08:36 02/26/2018

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.7600

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

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

<table>
<thead>
<tr>
<th>NO.</th>
<th>SIDE</th>
<th>CROWN TO STREET-CROSSFALL</th>
<th>STREET-CROSSFALL</th>
<th>CURB</th>
<th>GUTTER-GEOMETRIES</th>
<th>MANNING</th>
<th>WIDTH</th>
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<th>OUT-</th>
<th>PARK-</th>
<th>HEIGHT</th>
<th>WIDTH</th>
<th>LIP</th>
<th>MIKE</th>
<th>FACTOR</th>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 100.00 TO NODE 110.00 IS CODE = 21

RATIONAL METHOD INITIAL SUBAREA ANALYSIS

**USE TIME-OF-CONCENTRATION NOMOGRAPh FOR INITIAL SUBAREA**

INITIAL SUBAREA FLOW-LENGTH(FT) = 781.00
ELEVATION DATA: UPSTREAM(_FEET) = 1792.00 DOWNSTREAM(_FEET) = 1787.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 16.244
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.393
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"3-4 DWELLINGS/ACRE" C 2.55 0.27 0.600 86 16.24
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF(CFS) = 9.71
TOTAL AREA(ACRES) = 2.55 PEAK FLOW RATE(CFS) = 9.71

*****************************************************************************
FLOW PROCESS FROM NODE 200.00 TO NODE 210.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH(Feet) = 504.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.00 DOWNSTREAM(Feet) = 1787.90

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 13.743
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.938
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"3-4 DWELLINGS/ACRE" C 2.13 0.27 0.600 86 13.74
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.600
SUBAREA RUNOFF(CFS) = 9.15
TOTAL AREA(ACRES) = 2.13 PEAK FLOW RATE(CFS) = 9.15

*****************************************************************************
FLOW PROCESS FROM NODE 300.00 TO NODE 310.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH(Feet) = 302.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.80 DOWNSTREAM(Feet) = 1788.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.160
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 7.794
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 C 0.51 0.27 0.100 86 7.16
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 3.57
TOTAL AREA(ACRES) = 0.51 PEAK FLOW RATE(CFS) = 3.57
END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 0.5  TC (MIN.) = 7.16
EFFECTIVE AREA (ACRES) = 0.51  AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.27  AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE (CFS) = 3.57

END OF RATIONAL METHOD ANALYSIS
FILE NAME: SMDR2P.DAT  
TIME/DATE OF STUDY: 08:32 02/26/2018  

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  

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

USER SPECIFIED STORM EVENT(YEAR) = 2.00  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*  

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000  
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 4.940  

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

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

<table>
<thead>
<tr>
<th>NO.</th>
<th>(FT)</th>
<th>(FT)</th>
<th>SIDE / SIDE/ WAY</th>
<th>(FT)</th>
<th>(FT)</th>
<th>(FT)</th>
<th>(FT)</th>
<th>(n)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>30.0</td>
<td>20.0</td>
<td>0.018/0.018/0.020</td>
<td>0.67</td>
<td>2.00</td>
<td>0.0313</td>
<td>0.167</td>
<td>0.0150</td>
<td></td>
</tr>
</tbody>
</table>

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

FLOW PROCESS FROM NODE 100.00 TO NODE 120.00 IS CODE = 21  

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

INITIAL SUBAREA FLOW-LENGTH(FEET) = 110.00
ELEVATION DATA: UPSTREAM(FEET) = 1791.80 DOWNSTREAM(FEET) = 1788.50

Tc = K*(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.813

SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS Tc</th>
<th>CN (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td></td>
<td></td>
<td>0.14</td>
<td>0.57</td>
<td>0.100</td>
<td>0.06</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.35

TOTAL AREA(ACRES) = 0.14 PEAK FLOW RATE(CFS) = 0.35

FLOW PROCESS FROM NODE 120.00 TO NODE 120.00 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.) = 5.00
RAINFALL INTENSITY(INCH/HR) = 2.81
AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.57
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 0.14
TOTAL STREAM AREA(ACRES) = 0.14
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.35

FLOW PROCESS FROM NODE 110.00 TO NODE 120.00 IS CODE = 21

<<<<<<RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<<<

INITIAL SUBAREA FLOW-LENGTH(Feet) = 128.00
ELEVATION DATA: UPSTREAM(Feet) = 1792.00 DOWNSTREAM(Feet) = 1788.50

Tc = K*(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
* 2 YEAR RAINFALL INTENSITY(INCH/HR) = 2.813

SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS Tc</th>
<th>CN (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
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<td></td>
<td>0.64</td>
<td>0.57</td>
<td>0.100</td>
<td>0.06</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 1.59

TOTAL AREA(ACRES) = 0.64 PEAK FLOW RATE(CFS) = 1.59

FLOW PROCESS FROM NODE 120.00 TO NODE 120.00 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.) = 5.00
RAINFALL INTENSITY (INCH/HR) = 2.81
AREA-AVERAGED Fm (INCH/HR) = 0.06
AREA-AVERAGED Fp (INCH/HR) = 0.57
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA (ACRES) = 0.64
TOTAL STREAM AREA (ACRES) = 0.64
PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.59

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
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</thead>
<tbody>
<tr>
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<td>0.35</td>
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<td>0.57(0.06)</td>
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<td>0.1</td>
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</tr>
<tr>
<td>2</td>
<td>1.59</td>
<td>5.00</td>
<td>2.813</td>
<td>0.57(0.06)</td>
<td>0.1</td>
<td>0.6</td>
<td>110.00</td>
</tr>
</tbody>
</table>

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

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.93</td>
<td>5.00</td>
<td>2.813</td>
<td>0.57(0.06)</td>
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<td>0.8</td>
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<tr>
<td>2</td>
<td>1.93</td>
<td>5.00</td>
<td>2.813</td>
<td>0.57(0.06)</td>
<td>0.1</td>
<td>0.8</td>
<td>110.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 1.93
Tc (MIN.) = 5.00
EFFECTIVE AREA (ACRES) = 0.8
AREA-AVERAGED Fm (INCH/HR) = 0.06
AREA-AVERAGED Fp (INCH/HR) = 0.57
AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 0.8
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 120.00 = 128.00 FEET.

FLOW PROCESS FROM NODE 120.00 TO NODE 130.00 IS CODE = 51

>>IMAGE trapezoidal CH CHANNEL FLOW<<<

<<< TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<

ELEVATION DATA: UPSTREAM (FEET) = 1788.00 DOWNSTREAM (FEET) = 1787.90
CHANNEL LENGTH THRU SUBAREA (FEET) = 68.00 CHANNEL SLOPE = 0.0015
CHANNEL BASE (FEET) = 10.00 "T" FACTOR = 3.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH (FEET) = 1.00
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 2.326
SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL POOR COVER
"BARREN" C 0.06 0.18 1.000 91
SUBAREA AVERAGE Pervious LOSS RATE, Fp (INCH/HR) = 0.18
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 1.99
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 0.73
AVERAGE FLOW DEPTH (FEET) = 0.25 TRAVEL TIME (MIN.) = 1.56
Tc (MIN.) = 6.56
SUBAREA AREA (ACRES) = 0.06 SUBAREA RUNOFF (CFS) = 0.12
EFFECTIVE AREA (ACRES) = 0.84 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED $F_p$ (INCH/HR) = 0.40    AREA-AVERAGED $A_p$ = 0.16
TOTAL AREA (ACRES) = 0.8    PEAK FLOW RATE (CFS) = 1.93
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH (FEET) = 0.25    FLOW VELOCITY (FEET/SEC.) = 0.72
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 130.00 = 196.00 FEET.

************************************************************************************
FLOW PROCESS FROM NODE 200.00 TO NODE 220.00 IS CODE = 21

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

INITIAL SUBAREA FLOW-LENGTH (FEET) = 377.00
ELEVATION DATA: UPSTREAM (FEET) = 1791.30    DOWNSTREAM (FEET) = 1787.60

$T_c = K \times (\text{LENGTH}^{*3.00}) / (\text{ELEVATION CHANGE})^{*0.20}$
SUBAREA ANALYSIS USED MINIMUM $T_c$ (MIN.) = 8.223
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.986
SUBAREA $T_c$ AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCs SOIL</th>
<th>AREA</th>
<th>$F_p$ (INCH/HR)</th>
<th>$A_p$</th>
<th>SCS</th>
<th>$T_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>C</td>
<td>1.22</td>
<td>0.57</td>
<td>0.100</td>
<td>69</td>
<td>8.22</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERSIOUS LOSS RATE, $F_p$ (INCH/HR) = 0.57
SUBAREA AVERAGE PERSIOUS AREA FRACTION, $A_p$ = 0.100
SUBAREA RUNOFF (CFS) = 2.12
TOTAL AREA (ACRES) = 1.22    PEAK FLOW RATE (CFS) = 2.12

************************************************************************************
FLOW PROCESS FROM NODE 220.00 TO NODE 220.00 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.) = 8.22
RAINFALL INTENSITY (INCH/HR) = 1.99
AREA-AVERAGED $F_m$ (INCH/HR) = 0.06
AREA-AVERAGED $F_p$ (INCH/HR) = 0.57
AREA-AVERAGED $A_p$ = 0.10
EFFECTIVE STREAM AREA (ACRES) = 1.22
TOTAL STREAM AREA (ACRES) = 1.22
PEAK FLOW RATE (CFS) AT CONFLUENCE = 2.12

************************************************************************************
FLOW PROCESS FROM NODE 210.00 TO NODE 220.00 IS CODE = 21

.Iterator Method Initial Subarea Analysis<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPh FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 467.00
ELEVATION DATA: UPSTREAM (FEET) = 1791.00    DOWNSTREAM (FEET) = 1787.60

$T_c = K \times (\text{LENGTH}^{*3.00}) / (\text{ELEVATION CHANGE})^{*0.20}$
SUBAREA ANALYSIS USED MINIMUM $T_c$ (MIN.) = 9.510
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.794
SUBAREA Tc AND LOSS RATE DATA (AMC II):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/SCS SOIL</th>
<th>AREA GROUP</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>SCS CN</th>
<th>Tc (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>C</td>
<td>0.75</td>
<td>0.57</td>
<td>0.100</td>
<td>69</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.57
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 1.17
TOTAL AREA(ACRES) = 0.75 PEAK FLOW RATE(CFS) = 1.17

FLOW PROCESS FROM NODE 220.00 TO NODE 220.00 IS CODE = 1

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

>> Designate Independent Stream for Confluence

> And Compute Various Confluent Stream Values

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

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 9.51
RAINFALL INTENSITY(INCH/HR) = 1.79
AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.57
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 0.75
TOTAL STREAM AREA(ACRES) = 0.75
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.17

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity Fp(Fm)</th>
<th>Ap (INCH/HR)</th>
<th>Ae (INCH/HR)</th>
<th>HEADWATER AREA (ACRES)</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.12</td>
<td>8.22</td>
<td>1.986</td>
<td>0.57(0.06)</td>
<td>0.10</td>
<td>1.2</td>
<td>200.00</td>
</tr>
<tr>
<td>2</td>
<td>1.17</td>
<td>9.51</td>
<td>1.794</td>
<td>0.57(0.06)</td>
<td>0.10</td>
<td>0.8</td>
<td>210.00</td>
</tr>
</tbody>
</table>

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

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity Fp(Fm)</th>
<th>Ap (INCH/HR)</th>
<th>Ae (INCH/HR)</th>
<th>HEADWATER AREA (ACRES)</th>
<th>NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.24</td>
<td>8.22</td>
<td>1.986</td>
<td>0.57(0.06)</td>
<td>0.10</td>
<td>1.9</td>
<td>200.00</td>
</tr>
<tr>
<td>2</td>
<td>3.08</td>
<td>9.51</td>
<td>1.794</td>
<td>0.57(0.06)</td>
<td>0.10</td>
<td>2.0</td>
<td>210.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 3.24 Tc(MIN.) = 8.22
EFFECTIVE AREA(ACRES) = 1.87 AREA-AVERAGED Fm(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.57 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 2.0
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 220.00 = 467.00 FEET.

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

FLOW PROCESS FROM NODE 220.00 TO NODE 240.00 IS CODE = 51

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

>> Compute Trapezoidal Channel Flow

> Traveltime Thru Subarea (Existing Element)

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

ELEVATION DATA: UPSTREAM(Feet) = 1787.60 DOWNSTREAM(Feet) = 1787.20
CHANNEL LENGTH THRU SUBAREA(Feet) = 83.00 CHANNEL SLOPE = 0.0048
CHANNEL BASE(Feet) = 0.10 "Z" FACTOR = 4.000
MANNING'S FACTOR = 0.015    MAXIMUM DEPTH FEET = 1.00
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.908

SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE / SCS SOIL AREA Fp Ap SCS LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
NATURAL FAIR COVER  "CHAPARRAL, BROADLEAF"  C 0.20 0.47 1.000 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.47
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.37
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 2.85
AVERAGE FLOW DEPTH (FEET) = 0.53 TRAVEL TIME (MIN.) = 0.48
Tc (MIN.) = 8.71
SUBAREA AREA (ACRES) = 0.20 SUBAREA RUNOFF (CFS) = 0.26
EFFECTIVE AREA (ACRES) = 2.07 AREA-AVERAGED Fm (INCH/HR) = 0.10
AREA-AVERAGED Fp (INCH/HR) = 0.52 AREA-AVERAGED Ap = 0.19
TOTAL AREA (ACRES) = 2.2 PEAK FLOW RATE (CFS) = 3.37

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH (FEET) = 0.53 FLOW VELOCITY (FEET/SEC.) = 2.85
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 240.00 = 550.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 240.00 TO NODE 240.00 IS CODE = 1
******************************************************************************

>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<
******************************************************************************
TOTAL NUMBER OF STREAMS = 2
TIME OF CONCENTRATION (MIN.) = 8.71
RAINFALL INTENSITY (INCH/HR) = 1.91
AREA-AVERAGED Fm (INCH/HR) = 0.10
AREA-AVERAGED Fp (INCH/HR) = 0.52
AREA-AVERAGED Ap = 0.19
EFFECTIVE STREAM AREA (ACRES) = 2.07
TOTAL STREAM AREA (ACRES) = 2.17
PEAK FLOW RATE (CFS) AT CONFLUENCE = 3.37
******************************************************************************

FLOW PROCESS FROM NODE 230.00 TO NODE 240.00 IS CODE = 21

******************************************************************************

>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS <<<
USE TIME-OF-CONCENTRATION NOMOGRAP FOR INITIAL SUBAREA <<<
INITIAL SUBAREA FLOW LENGTH (FEET) = 310.00
ELEVATION DATA: UPSTREAM (FEET) = 1791.20 DOWNSTREAM (FEET) = 1787.20

Tc = K * [(LENGTH * 3.00) / (ELEVATION CHANGE)] * 0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 12.433
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.487
SUBAREA Tc AND LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE / SCS SOIL AREA Fp Ap SCS Tc LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
NATURAL POOR COVER  "BARE"  C 1.95 0.18 1.000 91 12.43
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.18
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
SUBAREA RUNOFF (CFS) = 2.29
TOTAL AREA (ACRES) = 1.95 PEAK FLOW RATE (CFS) = 2.29

FLOW PROCESS FROM NODE 240.00 TO NODE 240.00 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.) = 12.43
RAINFALL INTENSITY (INCH/HR) = 1.49
AREA-AVERAGED Fm (INCH/HR) = 0.18
AREA-AVERAGED Fp (INCH/HR) = 0.18
AREA-AVERAGED Ap = 1.00
EFFECTIVE STREAM AREA (ACRES) = 1.95
TOTAL STREAM AREA (ACRES) = 1.95
PEAK FLOW RATE (CFS) AT CONFLUENCE = 2.29

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity (INCH/HR)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (ACRES)</th>
<th>Ae (NODE)</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.37</td>
<td>8.71</td>
<td>1.908</td>
<td>0.52(0.10)</td>
<td>0.19</td>
<td>2.1</td>
<td>200.00</td>
</tr>
<tr>
<td>2</td>
<td>3.20</td>
<td>10.00</td>
<td>1.731</td>
<td>0.52(0.09)</td>
<td>0.18</td>
<td>2.2</td>
<td>210.00</td>
</tr>
<tr>
<td>2</td>
<td>2.29</td>
<td>12.43</td>
<td>1.487</td>
<td>0.18(0.18)</td>
<td>1.00</td>
<td>2.0</td>
<td>230.00</td>
</tr>
</tbody>
</table>

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO

CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity (INCH/HR)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (ACRES)</th>
<th>Ae (NODE)</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.50</td>
<td>8.71</td>
<td>1.908</td>
<td>0.25(0.13)</td>
<td>0.51</td>
<td>3.4</td>
<td>200.00</td>
</tr>
<tr>
<td>2</td>
<td>5.39</td>
<td>10.00</td>
<td>1.731</td>
<td>0.25(0.13)</td>
<td>0.53</td>
<td>3.7</td>
<td>210.00</td>
</tr>
<tr>
<td>3</td>
<td>5.01</td>
<td>12.43</td>
<td>1.487</td>
<td>0.24(0.14)</td>
<td>0.57</td>
<td>4.1</td>
<td>230.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 5.50 Tc (MIN.) = 8.71
EFFECTIVE AREA (ACRES) = 3.43 AREA-AVERAGED Fm (INCH/HR) = 0.13
AREA-AVERAGED Fp (INCH/HR) = 0.25 AREA-AVERAGED Ap = 0.51
TOTAL AREA (ACRES) = 4.1
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 240.00 = 550.00 FEET.

FLOW PROCESS FROM NODE 240.00 TO NODE 250.00 IS CODE = 51

>> >>> COMPUTE TRAPEZOIDAL CHANNEL FLOW <<< <<<
>> >>> TRAVEL TIME THRU SUBAREA (EXISTING ELEMENT) <<< <<<

ELEVATION DATA: UPSTREAM (FEET) = 1787.20 DOWNSTREAM (FEET) = 1787.10
CHANNEL LENGTH THRU SUBAREA (FEET) = 145.00 CHANNEL SLOPE = 0.0007
CHANNEL BASE (FEET) = 20.00 "Z" FACTOR = 3.000
MANNING'S FACTOR = 0.030 MAXIMUM DEPTH (FEET) = 1.50
* 2 YEAR RAINFALL INTENSITY (INCH/HR) = 1.499
SUBAREA LOSS RATE DATA (AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
"BARREN" C 0.23 0.18 1.000 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, $F_p$(INCH/HR) = 0.18
SUBAREA AVERAGE PERVIOUS AREA FRACTION, $A_p$ = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 5.63
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 0.68
AVERAGE FLOW DEPTH(FEET) = 0.39 TRAVEL TIME(MIN.) = 3.58
$T_c$(MIN.) = 12.29
SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = 0.27
EFFECTIVE AREA(ACRES) = 3.66 AREA-AVERAGED $F_m$(INCH/HR) = 0.13
AREA-AVERAGED $F_p$(INCH/HR) = 0.25 AREA-AVERAGED $A_p$ = 0.54
TOTAL AREA(ACRES) = 4.3 PEAK FLOW RATE(CFS) = 5.50
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.39 FLOW VELOCITY(FEET/SEC.) = 0.66
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 250.00 = 695.00 FEET.

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 4.3 $T_c$(MIN.) = 12.29
EFFECTIVE AREA(ACRES) = 3.66 AREA-AVERAGED $F_m$(INCH/HR) = 0.13
AREA-AVERAGED $F_p$(INCH/HR) = 0.25 AREA-AVERAGED $A_p$ = 0.541
PEAK FLOW RATE(CFS) = 5.50

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>$Q$ (CFS)</th>
<th>$T_c$ (MIN.)</th>
<th>$I$ (INCH/HR)</th>
<th>$F_p$(INCH/HR)</th>
<th>$A_p$</th>
<th>$A_e$</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.50</td>
<td>12.29</td>
<td>1.499</td>
<td>0.25 (0.13)</td>
<td>0.54</td>
<td></td>
<td>3.7</td>
</tr>
<tr>
<td>2</td>
<td>5.39</td>
<td>13.64</td>
<td>1.393</td>
<td>0.24 (0.13)</td>
<td>0.55</td>
<td>4.0</td>
<td>210.00</td>
</tr>
<tr>
<td>3</td>
<td>5.01</td>
<td>16.13</td>
<td>1.239</td>
<td>0.23 (0.14)</td>
<td>0.59</td>
<td>4.3</td>
<td>230.00</td>
</tr>
</tbody>
</table>

END OF RATIONAL METHOD ANALYSIS
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)  
(c) Copyright 1983-2008 Advanced Engineering Software (aes)  
Ver. 15.0 Release Date: 04/01/2008 License ID 1524

Analysis prepared by:  
SITETECH, INC.

******************************************************************************  
DESCRIPTION OF STUDY  
******************************************************************************

STEENO DESIGN – NEWBERRY SPRINGS  
MEMORIAL DRIVE  
PROPOSED CONDITION  
100 YEAR – 1 HOUR DESIGN STORM

******************************************************************************  
FILE NAME: SDNR100P.DAT  
TIME/DATE OF STUDY: 08:35 02/26/2018

******************************************************************************

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

******************************************************************************

--*TIME-OF-CONCENTRATION MODEL*-  

USER SPECIFIED STORM EVENT(YEAR) = 100.00  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
*USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000  
USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.7600

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

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

<table>
<thead>
<tr>
<th>NO.</th>
<th>FT</th>
<th>IN-</th>
<th>OUT-/PARK-</th>
<th>SIDE/ WAY</th>
<th>CURB GUTTER-GEOMETRIES: MANNING</th>
<th>STREET-CROSSFALL</th>
<th>WIDTH CROSSFALL</th>
<th>CURB GUTTER (FT)</th>
<th>GUTTER (FT)</th>
<th>LIP (FT)</th>
<th>HIKE FACTOR</th>
<th>LIP FACTOR (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>20</td>
<td>0.018/0.018/0.020</td>
<td>0.67</td>
<td>2.00</td>
<td>0.0313</td>
<td>0.167</td>
<td>0.0150</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

******************************************************************************

FLOW PROCESS FROM NODE 100.00 TO NODE 120.00 IS CODE = 21

******************************************************************************

>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<

USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 110.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.80 DOWNSTREAM(Feet) = 1788.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 10.022

SUBAREA Tc AND LOSS RATE DATA(AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>C</td>
<td>0.14</td>
<td>0.27</td>
<td>0.100</td>
<td>86</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

SUBAREA RUNOFF(CFS) = 1.26

TOTAL AREA(ACRES) = 0.14 PEAK FLOW RATE(CFS) = 1.26

*******************************************************************************************

FLOW PROCESS FROM NODE 120.00 TO NODE 120.00 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.) = 5.00

RAINFALL INTENSITY(INCH/HR) = 10.02

AREA-AVERAGED Fp(INCH/HR) = 0.03

AREA-AVERAGED Ap = 0.10

EFFECTIVE STREAM AREA(ACRES) = 0.14

TOTAL STREAM AREA(ACRES) = 0.14

PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.26

*******************************************************************************************

FLOW PROCESS FROM NODE 110.00 TO NODE 120.00 IS CODE = 21

*******************************************************************************/

>>> RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(Feet) = 128.00

ELEVATION DATA: UPSTREAM(Feet) = 1792.00 DOWNSTREAM(Feet) = 1788.50

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 10.022

SUBAREA Tc AND LOSS RATE DATA(AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/ LAND USE</th>
<th>SCS SOIL GROUP</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL</td>
<td>C</td>
<td>0.64</td>
<td>0.27</td>
<td>0.100</td>
<td>86</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 5.76

TOTAL AREA(ACRES) = 0.64 PEAK FLOW RATE(CFS) = 5.76

*******************************************************************************************

FLOW PROCESS FROM NODE 120.00 TO NODE 120.00 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.) = 5.00
RAINFALL INTENSITY (INCH/HR) = 10.02
AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.27
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA (ACRES) = 0.64
TOTAL STREAM AREA (ACRES) = 0.64
PEAK FLOW RATE (CFS) AT CONFLUENCE = 5.76

** CONFLUENCE DATA **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc(MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.26</td>
<td>5.00</td>
<td>10.022</td>
<td>0.27(0.03)</td>
<td>0.10</td>
<td>0.1</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>5.76</td>
<td>5.00</td>
<td>10.022</td>
<td>0.27(0.03)</td>
<td>0.10</td>
<td>0.6</td>
<td>110.00</td>
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</tbody>
</table>

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

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc(MIN.)</th>
<th>Intensity</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae</th>
<th>HEADWATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.02</td>
<td>5.00</td>
<td>10.022</td>
<td>0.27(0.03)</td>
<td>0.10</td>
<td>0.8</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>7.02</td>
<td>5.00</td>
<td>10.022</td>
<td>0.27(0.03)</td>
<td>0.10</td>
<td>0.8</td>
<td>110.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 7.02  Tc(MIN.) = 5.00
EFFECTIVE AREA (ACRES) = 0.78  AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp (INCH/HR) = 0.27  AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 0.8
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 120.00 = 128.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 120.00 TO NODE 130.00 IS CODE = 51
******************************************************************************

ELEVATION DATA: UPSTREAM(Feet) = 1788.00  DOWNSTREAM(Feet) = 1787.90
CHANNEL LENGTH THRU SUBAREA(Feet) = 68.00  CHANNEL SLOPE = 0.0015
CHANNEL BASE(Feet) = 10.00  "2" FACTOR = 3.000
MANNING'S FACTOR = 0.030  MAXIMUM DEPTH(Feet) = 1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 8.831
SUBAREA LOSS RATE DATA (AMC Iii):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
"BARREN" 0.06 0.06 1.000 98
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.06
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 7.25
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 1.14
AVERAGE FLOW DEPTH (FEET) = 0.54  TRAVEL TIME(MIN.) = 0.99
Tc(MIN.) = 5.99
SUBAREA AREA (ACRES) = 0.06  SUBAREA RUNOFF (CFS) = 0.47
EFFECTIVE AREA (ACRES) = 0.84  AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.18 AREA-AVERAGED Ap = 0.16
TOTAL AREA(ACRES) = 0.8 PEAK FLOW RATE(CFS) = 7.02
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.53 FLOW VELOCITY(FEET/SEC.) = 1.14
LONGEST FLOWPATH FROM NODE 110.00 TO NODE 130.00 = 196.00 FEET.

<html>
<head></head>
<body>

FLOW PROCESS FROM NODE 200.00 TO NODE 220.00 IS CODE = 21

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

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

INITIAL SUBAREA FLOW-LENGTH(Feet) = 377.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.30 DOWNSTREAM(Feet) = 1787.60

Tc = K*(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.223
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 7.074
SUBAREA Tc AND LOSS RATE DATA(AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/</th>
<th>SCS SOIL AREA</th>
<th>Fp</th>
<th>Ap</th>
<th>Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMERCIAL LAND USE</td>
<td>GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>1.22</td>
<td>0.27</td>
<td>0.100</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 7.74
TOTAL AREA(ACRES) = 1.22 PEAK FLOW RATE(CFS) = 7.74

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

FLOW PROCESS FROM NODE 220.00 TO NODE 220.00 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.) = 8.22
RAINFALL INTENSITY(INCH/HR) = 7.07
AREA-AVERAGED Fp(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.27
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 1.22
TOTAL STREAM AREA(ACRES) = 1.22
PEAK FLOW RATE(CFS) AT CONFLUENCE = 7.74

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

FLOW PROCESS FROM NODE 210.00 TO NODE 220.00 IS CODE = 21

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

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

INITIAL SUBAREA FLOW-LENGTH(Feet) = 467.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.00 DOWNSTREAM(Feet) = 1787.60

Tc = K*(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.510
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.390

</body>
</html>
SUBAREA Tc AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECMAL) CN (MIN.)
COMMERCIAL C 0.75 0.27 0.100 86 9.51

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.27
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF (CFS) = 4.29
TOTAL AREA (ACRES) = 0.75 PEAK FLOW RATE (CFS) = 4.29

******************************************************************************
FLOW PROCESS FROM NODE 220.00 TO NODE 220.00 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.) = 9.51
RAINFALL INTENSITY (INCH/HR) = 6.39
AREA-AVERAGED Fm(INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.27
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA (ACRES) = 0.75
TOTAL STREAM AREA (ACRES) = 0.75
PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.29

** CONFLUENCE DATA **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 7.74 8.22 7.074 0.27(0.03) 0.10 1.2 200.00
2 4.29 9.51 6.390 0.27(0.03) 0.10 0.8 210.00

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 11.85 8.22 7.074 0.27(0.03) 0.10 1.9 200.00
2 11.28 9.51 6.390 0.27(0.03) 0.10 2.0 210.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE (CFS) = 11.85 Tc (MIN.) = 8.22
EFFECTIVE AREA (ACRES) = 1.87 AREA-AVERAGED Fm (INCH/HR) = 0.03
AREA-AVERAGED Fp(INCH/HR) = 0.27 AREA-AVERAGED Ap = 0.10
TOTAL AREA (ACRES) = 2.0
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 220.00 = 467.00 FEET.

******************************************************************************
FLOW PROCESS FROM NODE 220.00 TO NODE 240.00 IS CODE = 51
******************************************************************************

>>> COMPUTE TRAPEZOIDAL CHANNEL FLOW <<<<
>>> TRAVEL TIME THRU SUBAREA (EXISTING ELEMENT) <<<<
******************************************************************************
ELEVATION DATA: UPSTREAM (FEET) = 1787.60 DOWNSTREAM (FEET) = 1787.20
CHANNEL LENGTH THRU SUBAREA (FEET) = 83.00 CHANNEL SLOPE = 0.0048
CHANNEL BASE (FEET) = 0.10 "Z" FACTOR = 4.000
MANNING'S FACTOR = 0.015  MAXIMUM DEPTH(FEET) = 1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.869

SUBAREA LOSS RATE DATA(AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND USE</td>
<td>GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATURAL POOR COVER</td>
<td>&quot;CHAPARRAL, BROADLEAF&quot;</td>
<td>0.20</td>
<td>0.21</td>
<td>1.000</td>
<td>91</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, \( F_p \) (INCH/HR) = 0.21
SUBAREA AVERAGE PERVIOUS AREA FRACTION, \( A_p \) = 1.000
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 12.45
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(Feet/Sec.) = 3.91
AVERAGE FLOW DEPTH(Feet) = 0.88  TRAVEL TIME(MIN.) = 0.35
\( T_c \) (MIN.) = 8.58
SUBAREA AREA(ACRES) = 0.20  SUBAREA RUNOFF(CFS) = 1.20
EFFECTIVE AREA(ACRES) = 2.07  AREA-AVERAGED \( F_m \) (INCH/HR) = 0.04
AREA-AVERAGED \( F_p \) (INCH/HR) = 0.24  AREA-AVERAGED \( A_p \) = 0.19
TOTAL AREA(ACRES) = 2.2  PEAK FLOW RATE(CFS) = 12.70

END OF SUBAREA CHANNEL FLOW HYdraulics:
DEPTH(Feet) = 0.88  FLOW VELOCITY(Feet/Sec.) = 3.97
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 240.00 = 550.00 FEET.

FLOW PROCESS FROM NODE 240.00 TO NODE 240.00 IS CODE = 1

END OF SUBAREA CHANNEL FLOW HYdraulics:

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 8.58
RAINFALL INTENSITY(INCH/HR) = 6.87
AREA-AVERAGED \( F_m \) (INCH/HR) = 0.04
AREA-AVERAGED \( F_p \) (INCH/HR) = 0.24
AREA-AVERAGED \( A_p \) = 0.19
EFFECTIVE STREAM AREA(ACRES) = 2.07
TOTAL STREAM AREA(ACRES) = 2.17
PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.70

FLOW PROCESS FROM NODE 230.00 TO NODE 240.00 IS CODE = 21

RATIONAL METHOD INITIAL SUBAREA ANALYSIS

INITIAL SUBAREA FLOW-LENGTH(Feet) = 310.00
ELEVATION DATA: UPSTREAM(Feet) = 1791.20  DOWNSTREAM(Feet) = 1787.20

\( T_c = K \times (\text{LENGTH}^2 / \text{ELEVATION CHANGE}) \times 0.20 \)
SUBAREA ANALYSIS USED MINIMUM \( T_c \) (MIN.) = 12.433
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.297
SUBAREA \( T_c \) AND LOSS RATE DATA(AMC III):

<table>
<thead>
<tr>
<th>DEVELOPMENT TYPE/</th>
<th>SCS SOIL</th>
<th>AREA (ACRES)</th>
<th>Fp (INCH/HR)</th>
<th>Ap (DECIMAL)</th>
<th>CN (MIN.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND USE</td>
<td>GROUP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NATURAL POOR COVER</td>
<td>&quot;BARREN&quot;</td>
<td>1.95</td>
<td>0.06</td>
<td>1.000</td>
<td>98 12.43</td>
</tr>
</tbody>
</table>

SUBAREA AVERAGE PERVIOUS LOSS RATE, \( F_p \) (INCH/HR) = 0.06
SUBAREA AVERAGE PERVIOUS AREA FRACTION, \( A_p \) = 1.000
SUBAREA RUNOFF (CFS) = 9.19  
TOTAL AREA (ACRES) = 1.95  PEAK FLOW RATE (CFS) = 9.19  

FLOW PROCESS FROM NODE 240.00 TO NODE 240.00 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.) = 12.43  
RAINFALL INTENSITY (INCH/HR) = 5.30  
AREA-AVERAGED Fm (INCH/HR) = 0.06  
AREA-AVERAGED Fp (INCH/HR) = 0.06  
AREA-AVERAGED Ap = 1.00  
EFFECTIVE STREAM AREA (ACRES) = 1.95  
TOTAL STREAM AREA (ACRES) = 1.95  
PEAK FLOW RATE (CFS) AT CONFLUENCE = 9.19  

** CONFLUENCE DATA **  
<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity (INCH/HR)</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae (ACRES)</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.70</td>
<td>8.58</td>
<td>6.869</td>
<td>0.24</td>
<td>0.04</td>
<td>0.19</td>
<td>2.1 200.00</td>
</tr>
<tr>
<td>1</td>
<td>12.08</td>
<td>9.87</td>
<td>6.228</td>
<td>0.24</td>
<td>0.04</td>
<td>0.18</td>
<td>2.2 210.00</td>
</tr>
<tr>
<td>2</td>
<td>9.19</td>
<td>12.43</td>
<td>5.297</td>
<td>0.06</td>
<td>0.06</td>
<td>1.00</td>
<td>2.0 230.00</td>
</tr>
</tbody>
</table>

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

** PEAK FLOW RATE TABLE **  
<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>Tc (MIN.)</th>
<th>Intensity (INCH/HR)</th>
<th>Fp (Fm)</th>
<th>Ap</th>
<th>Ae (ACRES)</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.95</td>
<td>8.58</td>
<td>6.869</td>
<td>0.10</td>
<td>0.05</td>
<td>0.51</td>
<td>3.4 200.00</td>
</tr>
<tr>
<td>2</td>
<td>20.66</td>
<td>9.87</td>
<td>6.228</td>
<td>0.10</td>
<td>0.05</td>
<td>0.52</td>
<td>3.7 210.00</td>
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<tr>
<td>3</td>
<td>19.45</td>
<td>12.43</td>
<td>5.297</td>
<td>0.09</td>
<td>0.05</td>
<td>0.57</td>
<td>4.1 230.00</td>
</tr>
</tbody>
</table>

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE (CFS) = 20.95  Tc (MIN.) = 8.58  
EFFECTIVE AREA (ACRES) = 3.41  AREA-AVERAGED Fm (INCH/HR) = 0.05  
AREA-AVERAGED Fp (INCH/HR) = 0.10  AREA-AVERAGED Ap = 0.51  
TOTAL AREA (ACRES) = 4.1  
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 240.00 = 550.00 FEET.  

FLOW PROCESS FROM NODE 240.00 TO NODE 250.00 IS CODE = 51  

>> COMPUTE TRAPEZOIDAL CHANNEL FLOW <<<<  
>> TRAVEL TIME THRU SUBAREA (EXISTING ELEMENT) <<<<  

ELEVATION DATA:  
UPSTREAM (FEET) = 1787.20  DOWNSTREAM (FEET) = 1787.10  
CHANNEL LENGTH THRU SUBAREA (FEET) = 145.00  CHANNEL SLOPE = 0.0007  
CHANNEL BASE (FEET) = 20.00  "Z" FACTOR = 3.000  
MANNING'S FACTOR = 0.030  MAXIMUM DEPTH (FEET) = 1.50  
* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 5.849  
SUBAREA LOSS RATE DATA (AMC III):  
DEVELOPMENT TYPE/SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
"BARREN"  C  0.23  0.06  1.000  98
SUBAREA AVERAGE PERVIOUS LOSS RATE, \( Fp(\text{INCH/HR}) = 0.06 \)
SUBAREA AVERAGE PERVIOUS AREA FRACTION, \( Ap = 1.000 \)
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 21.54
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.09
AVERAGE FLOW DEPTH(FEET) = 0.87 TRAVEL TIME(MIN.) = 2.21
\( Tc(\text{MIN.}) = 10.79 \)
SUBAREA AREA(ACRES) = 0.23 SUBAREA RUNOFF(CFS) = 1.20
EFFECTIVE AREA(ACRES) = 3.64 AREA-AVERAGED \( Fm(\text{INCH/HR}) = 0.05 \)
AREA-AVERAGED \( Fp(\text{INCH/HR}) = 0.10 \) AREA-AVERAGED \( Ap = 0.54 \)
TOTAL AREA(ACRES) = 4.3 PEAK FLOW RATE(CFS) = 20.95
NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.86 FLOW VELOCITY(FEET/SEC.) = 1.08
LONGEST FLOWPATH FROM NODE 210.00 TO NODE 250.00 = 695.00 FEET.

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 4.3 \( Tc(\text{MIN.}) = 10.79 \)
EFFECTIVE AREA(ACRES) = 3.64 AREA-AVERAGED \( Fm(\text{INCH/HR}) = 0.05 \)
AREA-AVERAGED \( Fp(\text{INCH/HR}) = 0.10 \) AREA-AVERAGED \( Ap = 0.538 \)
PEAK FLOW RATE(CFS) = 20.95

** PEAK FLOW RATE TABLE **

<table>
<thead>
<tr>
<th>STREAM NUMBER</th>
<th>Q (CFS)</th>
<th>( Tc ) (MIN.)</th>
<th>Intensity</th>
<th>( Fp(Fm) ) (INCH/HR)</th>
<th>( Ap ) (ACRES)</th>
<th>( Ae )</th>
<th>HEADWATER NODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.95</td>
<td>10.79</td>
<td>5.849</td>
<td>0.10 (0.05) 0.54</td>
<td>3.6</td>
<td>200.00</td>
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</tr>
<tr>
<td>2</td>
<td>20.66</td>
<td>12.09</td>
<td>5.401</td>
<td>0.09 (0.05) 0.55</td>
<td>3.9</td>
<td>210.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>19.45</td>
<td>14.71</td>
<td>4.709</td>
<td>0.09 (0.05) 0.59</td>
<td>4.3</td>
<td>230.00</td>
<td></td>
</tr>
</tbody>
</table>

END OF RATIONAL METHOD ANALYSIS
4\' WIDE BY 18\" DEEP CONCRETE V-GUTTER @ 0.50\% (NODE 220-240)

Given Input Data:
Shape ........................................... Trapezoidal
Solving for ................................. Depth of Flow
Flowrate ..................................... 12.7000 cfs
Slope ........................................... 0.0050 ft/cf
Manning's n .................................. 0.0130
Height ......................................... 18.0000 in
Bottom width ............................... 0.0000 in
Left slope ................................... 0.7500 ft/cf \(V/H\)
Right slope .................................. 0.7500 ft/cf \(V/H\)

Computed Results:
Depth ......................................... 16.0474 in
Velocity ...................................... 5.3262 fps
Full Flowrate ............................... 17.2497 cfs
Flow area ..................................... 2.3844 ft\(^2\)
Flow perimeter .............................. 53.4914 in
Hydraulic radius ............................ 6.4190 in
Top width .................................... 42.7931 in
Area ........................................... 3.0000 ft\(^2\)
Perimeter ..................................... 60.0000 in
Percent full .................................. 89.1524 \%

CAPACITY IN CURB & GUTTER (6" CURB @ 0.50\% GRADE)

<table>
<thead>
<tr>
<th>MEASURED VALUES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPTH OF FLOW IN CURB</td>
<td>0.500 ft</td>
</tr>
<tr>
<td>FRICTION FACTOR (N)</td>
<td>0.015</td>
</tr>
<tr>
<td>CURB HEIGHT</td>
<td>0.500 in</td>
</tr>
<tr>
<td>CL TO RIGHT-OFF-WAY</td>
<td>33.000 ft</td>
</tr>
<tr>
<td>CL TO CURB WIDTH</td>
<td>33.000 ft</td>
</tr>
<tr>
<td>GUTTER WIDTH</td>
<td>1.500 ft</td>
</tr>
<tr>
<td>GUTTER DEPTH</td>
<td>0.125 ft</td>
</tr>
<tr>
<td>PAVEMENT LIP</td>
<td>0.020 ft</td>
</tr>
<tr>
<td>SLOPE OF STREET (S)</td>
<td>0.0050 ft/ft</td>
</tr>
<tr>
<td>CURB FACE SLOPE</td>
<td>3.0000 ft/ft</td>
</tr>
<tr>
<td>X-SLOPE OF PAVEMENT</td>
<td>0.0150 ft/ft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CALCULATED VALUES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WIDTH OF FLOW IN STREET</td>
<td>25.181 ft</td>
</tr>
<tr>
<td>WETTED PERIMETER (P)</td>
<td>25.722 ft</td>
</tr>
<tr>
<td>FLOW AREA (A)</td>
<td>4.899 sf</td>
</tr>
<tr>
<td>HYDRAULIC RADIUS (R)</td>
<td>0.190 ft</td>
</tr>
<tr>
<td>VELOCITY (V)</td>
<td>2.319 ft/s</td>
</tr>
<tr>
<td>FLOW RATE (Q) HALF WIDTH</td>
<td>11.359 cfs</td>
</tr>
</tbody>
</table>
REFERENCE MAPS
**NOAA Atlas 14, Volume 6, Version 2**  
Location name: Newberry Springs, California, USA  
Latitude: 34.8173°, Longitude: -116.6075°  
Elevation: 1792.39 ft**

* source: ESRI Maps  
** source: JEGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dotz, Sarah Hein, Lillian Hiner, Kacungu Maitara, Deborah Martin, Sandra Pavlovic, Ishani Ray, Carl Toppejak, Dale Unruh, Fungun Yan, Michael Yeula, Tan Zhao, Geoffrey Bennett, Daniel Brewor, Li-Chuan Chen, Tye Parzyjlock, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

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

<table>
<thead>
<tr>
<th>Duration</th>
<th>Average recurrence interval (years)</th>
<th>1</th>
<th>2</th>
<th>5</th>
<th>10</th>
<th>25</th>
<th>50</th>
<th>100</th>
<th>250</th>
<th>500</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-min</td>
<td>0.088</td>
<td>0.104</td>
<td>0.157</td>
<td>0.230</td>
<td>0.298</td>
<td>0.358</td>
<td>0.416</td>
<td>0.482</td>
<td>0.676</td>
<td>0.910</td>
<td>0.957</td>
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<tr>
<td>10-min</td>
<td>0.113</td>
<td>0.176</td>
<td>0.229</td>
<td>0.329</td>
<td>0.428</td>
<td>0.509</td>
<td>0.596</td>
<td>0.691</td>
<td>0.828</td>
<td>0.941</td>
<td>0.978</td>
</tr>
<tr>
<td>15-min</td>
<td>0.152</td>
<td>0.221</td>
<td>0.272</td>
<td>0.361</td>
<td>0.458</td>
<td>0.546</td>
<td>0.634</td>
<td>0.721</td>
<td>0.835</td>
<td>1.00</td>
<td>1.14</td>
</tr>
<tr>
<td>30-min</td>
<td>0.246</td>
<td>0.368</td>
<td>0.472</td>
<td>0.622</td>
<td>0.756</td>
<td>0.901</td>
<td>1.048</td>
<td>1.215</td>
<td>1.484</td>
<td>1.863</td>
<td>2.23</td>
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<tr>
<td>60-min</td>
<td>0.365</td>
<td>0.553</td>
<td>0.759</td>
<td>0.964</td>
<td>1.166</td>
<td>1.362</td>
<td>1.627</td>
<td>1.971</td>
<td>2.407</td>
<td>3.408</td>
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<tr>
<td>2-hr</td>
<td>0.582</td>
<td>0.907</td>
<td>1.351</td>
<td>1.861</td>
<td>2.506</td>
<td>3.297</td>
<td>4.142</td>
<td>5.047</td>
<td>6.289</td>
<td>8.410</td>
<td>10.52</td>
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<tr>
<td>3-hr</td>
<td>0.851</td>
<td>1.360</td>
<td>2.104</td>
<td>2.975</td>
<td>4.051</td>
<td>5.264</td>
<td>6.602</td>
<td>8.056</td>
<td>10.08</td>
<td>13.08</td>
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<td>12-hr</td>
<td>1.571</td>
<td>2.607</td>
<td>4.679</td>
<td>7.604</td>
<td>11.12</td>
<td>15.44</td>
<td>19.52</td>
<td>24.45</td>
<td>31.45</td>
<td>41.20</td>
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<td>11.15</td>
<td>17.48</td>
<td>25.43</td>
<td>34.89</td>
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<td>58.98</td>
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<tr>
<td>1-day</td>
<td>2.512</td>
<td>4.562</td>
<td>9.316</td>
<td>15.42</td>
<td>23.67</td>
<td>34.88</td>
<td>49.13</td>
<td>64.49</td>
<td>83.52</td>
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<td>12.09</td>
<td>19.87</td>
<td>31.19</td>
<td>45.89</td>
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<td>7.390</td>
<td>15.33</td>
<td>25.82</td>
<td>40.12</td>
<td>58.20</td>
<td>79.47</td>
<td>105.01</td>
<td>137.55</td>
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<td>3.796</td>
<td>8.839</td>
<td>19.68</td>
<td>33.13</td>
<td>50.18</td>
<td>72.27</td>
<td>100.43</td>
<td>136.83</td>
<td>182.10</td>
<td>242.13</td>
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<tr>
<td>20-day</td>
<td>4.203</td>
<td>11.29</td>
<td>27.37</td>
<td>48.07</td>
<td>71.62</td>
<td>102.80</td>
<td>142.52</td>
<td>194.42</td>
<td>260.54</td>
<td>353.39</td>
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<td>37.45</td>
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<td>143.20</td>
<td>201.65</td>
<td>279.42</td>
<td>390.50</td>
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<td>47.63</td>
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<td>400.00</td>
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<td>243.00</td>
<td>333.00</td>
<td>450.00</td>
<td>600.00</td>
<td>800.00</td>
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</tr>
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PFD Tabular:  |  |  |  |  |  |  |  |  |  |  |  |

*PFD Graphical:  |  |  |  |  |  |  |  |  |  |  |  |

*Masses & Aerials:  |  |  |  |  |  |  |  |  |  |  |  |

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=34.8173&lon=-116.6075&d... 10/10/2017
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.8173°, Longitude: -116.6075°

Average recurrence interval (years)

<table>
<thead>
<tr>
<th>Interval (years)</th>
<th>Line Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>5</td>
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<td>10</td>
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</tr>
<tr>
<td>25</td>
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</tr>
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Average recurrence interval (years)

<table>
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<th>Line Color</th>
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<tr>
<td>10-min</td>
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</tr>
<tr>
<td>15-min</td>
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<td>30-min</td>
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</tr>
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<td>1-hr</td>
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</tr>
<tr>
<td>3-hr</td>
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</tr>
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<td>45-day</td>
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</tbody>
</table>

NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Tue Oct 10 22:20:03 2017

Back to Top
FIGURE C-II

SOUTHCENTRAL AREA FOR HYDROLOGIC SOILS GROUP MAP