Appendix P. 2015 Hydrology Master Plan and Preliminary WQMP

Appendix

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MILL CREEK SPA HYDROLOGY MASTER PLAN

CITY OF CHINO

CHINO AGRICULTURAL PRESERVE AREA

Prepared for:

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Prepared under the Supervision of:

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TABLE OF CONTENTS

PAGE

INTRODUCTION

The Study Area is comprised of an approximately 273-acre area, bounded by Chino Corona Road on the north, Cucamonga Avenue on the west, Prado Reservoir to the south, and Mill Creek to the east. The site will be re-graded to create building pads for future single family residential home sites. The proposed Mill Creek Farming SPA is proposed to be graded in a manner so as to "raise" the development portion of the study area above the Prado Flood Control Basin's "High Water Elevation" of 566.

The purpose of this report is to update the hydrology from a previous report prepared by Huitt-Zollars in January of 2008. This report examines the preliminary hydrology for the proposed development and will be used for planning purposes prior to final site design. Preliminary alignments, and sizes for backbone storm facilities are recommended herein for planning purposes. We have included preliminary storm drain hydraulics using WSPG for the backbone storm drains lines.

The results compare the runoff of the built-out condition of the study area based on the Chino General Plan and the Mill Creek Farming SPA development and the runoff of the existing undeveloped condition of the developed area of the site. This site will not be accepting any offsite flows from neighboring developments to the north as was previously planned. All offsite flows from the north are now directed to water quality basins east of the site.

METHODOLOGY

The hydrology calculations presented in this study are based upon the San Bernardino County Hydrology Manuel. Subareas were determined based on the proposed grading of the site. A link-node model was created for each subarea, with flow path length and elevations shown for the upstream and downstream nodes for the subarea. Peak 100-year flowrates were determined for each subarea using the CivilDesign Corporation rational method hydrology software. The results of those calculations are shown on the site hydrology map included with this report. The developed and existing condition hydrology maps are included with this report.

Rational method hydrology calculations have been prepared for the development. Soil Type "C" was used in the models for the existing and proposed conditions. A saturated soil condition was assumed for 100 year calculations. The models also use a one hour intensity of 1.22" for the 100-year event and 0.5" for the 2 year event.

The existing condition is an undeveloped area with average to poor cover. It is made of 4 main basins within the site boundary. Basins E1, E2, and E3 are directed to ponding areas within the site. In a large storm event these basins will spill out of the site boundaries to the west and south of the site. Basin E4 drains to Mill Creek that runs along the east side of the property boundary.

The developed basins have been delineated into 3 main tributary areas Basins A, B, and C. The majority of the runoff will be directed to a retention basin on the southwest side of the project (Basin A) and to a basin (Basin B) on the east side of the project and will then be discharged to the east side of the project into Mill Creek running along the East side of the Property.

Model Results

The rational method flows presented in this report are undetained flows. In final design, the detention basin will be sized and outlet peak flows at or below peak flow levels that would be generated from the site in the undeveloped condition. The peak 100-year and 2-year routed flows for the developed condition are summarized below:

Rational Method Routed Peak Flows

Basin A Design Flows

Design Point	Elevation (Ft)	Tc100 (Min.)	100-year Flow (CFS)	2-year Flow (CFS)
90-100	530	19.7	72.2	n/a
101	535	19.7	30.4	10.0
120	535	12.0	52.8	17.8
140	555	15.2	95.2	31.9
160-150	535	23.3	7.0	2.2
151-150	535	11.5	7.3	2.6

Basin B Design Flows

Design Point	Elevation (Ft)	Tc100 (Min.)	100-year Flow (CFS)	2-year Flow (CFS)
198	541	12.31	93.44	32.4
300	540	29.77	47.50	13.4
400	540	10.17	23.16	8.5
500	540	12.18	14.82	5.2

Condition Flows

Design Point	100-year Flow (CFS)
201	110
101	86.7
300	51
510	172.6
505	198.7
600	211.9

PRADO BASIN DISCUSSION

A major feature of the development of the project area is the relationship of the proposed development area both horizontally and vertically in relationship to the Army Corps of Engineers (ACOE) – Prado Basin area. In the early 1940's, the ACOE obtained an inundation easement to the 556' contour elevation across the Mill Creek property. As a part of the ongoing Prado Dam enhancement project, the ACOE has determined they require additional storage volume based on the existing 566' contour elevation in the project area. We have calculated the existing storage volume on a one-foot incremental basis on the Mill Creek property from an elevation of 509' up to 566'. Based on our proposed grading for TTM 18846, we have calculated the proposed storage volume on a one-foot incremental basis on the Mill Creek property from an elevation of 509' up to 566'. We increase the total potential storage volume on the Mill Creek property to 106% of the baseline existing condition storage volume number. We have included a table that compares the storage volume for the existing and developed condition on an incremental foot basis in Appendix J. Neither the storage volume for the WQMP basins or the dead storage volume in Basin A are included in the net storage volume for the proposed condition.

BASIN A & B DISCUSSION

Basin A on the west side of the property has a total storage volume of 204.7 acre-feet from a bottom elevation of 530' to 545'. The 100-year 24-hour unit hydrograph calculations for Basin A show a total volume of 47.5 acre-feet., which is 23% of the available storage volume. A summary of the basin volumetrics is included in Appendix H: "Basin A -Unit Hydrograph Calculations".

Basin B is currently an outlet location for basins B-1 and B-2 that are sized for water quality purposes. Basin B is currently graded to maximize the volume needed for ACOE storage purposes. Should detention be required at this location, it will be sized and designed in final design.

CONCLUSION

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Based on the calculations and proposed improvements, onsite flows can be conveyed to suitable points of disposal, and the proposed TTM development will not impact offsite property. The proposed grading for TTM 18846 will result in a net increase of approximately 5% in the ACOE storage volume for Prado Basin over the existing base line condition for the site. Basin A has sufficient dead storage capacity to handle the 100-year storm flows from the design tributary area. Basin B has sufficient storage capacity to handle the 100-year storm flows from the design tributary area, and will drain out to Basin C and thence Mill Creek.

APPENDIX A: 100-YEAR DEVELOPED CONDITION MODEL OUTPUT

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/11/15

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100 YEAR
RANCHO MIRAMONTE
BASIN A100

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 105.000 to Point/Station 104.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.052(In/Hr)
Initial subarea data:
Initial area flow distance = 575.000(Ft.)
Top (of initial area) elevation = 571.500(Ft.)
Bottom (of initial area) elevation = 570.500(Ft.)
Difference in elevation = 1.000(Ft.)
Slope = 0.00174 s(%)= 0.17
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.667 min.
Rainfall intensity = 2.841(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.883
Subarea runoff = 7.629(CFS)
Total initial stream area = 3.040(Ac.)
Pervious area fraction = 0.200

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Initial area Fm value =    0.052(In/Hr)


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Process from Point/Station      104.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   570.500(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   820.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     16.340(CFS)
Depth of flow =   0.601(Ft.), Average velocity =   2.917(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    5.07(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.000(Ft.)
Flow velocity =   2.92(Ft/s)
Travel time =    4.68 min.     TC =   19.35  min.
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Rainfall intensity =      2.406(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =     17.323(CFS) for    8.940(Ac.)
Total runoff =     24.952(CFS)
Effective area this stream =       11.98(Ac.)
Total Study Area (Main Stream No. 1) =       11.98(Ac.)
Area averaged Fm value =    0.091(In/Hr)
Street flow at end of street =     24.952(CFS)
Half street flow at end of street =     24.952(CFS)
Depth of flow =   0.691(Ft.), Average velocity =   3.456(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    9.57(Ft.)
Flow width (from curb towards crown)=  14.000(Ft.)
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Process from Point/Station      103.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   567.000(Ft.)
Downstream point/station elevation =   562.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.952(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    24.952(CFS)
Normal flow depth in pipe =   13.00(In.)
Flow top width inside pipe =   20.40(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.96(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    19.46 min.


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Process from Point/Station      103.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Time of concentration =    19.46 min.
Rainfall intensity =      2.398(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =      5.423(CFS) for    2.580(Ac.)
Total runoff =     30.376(CFS)
Effective area this stream =       14.56(Ac.)
Total Study Area (Main Stream No. 1) =       14.56(Ac.)
Area averaged Fm value =    0.080(In/Hr)


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Process from Point/Station      102.000 to Point/Station      101.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =   300.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.376(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    30.376(CFS)
Normal flow depth in pipe =   14.20(In.)
Flow top width inside pipe =   14.69(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.31(Ft/s)
Travel time through pipe =    0.25 min.
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Time of concentration (TC) =    19.70 min.


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Process from Point/Station      101.000 to Point/Station       90.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    19.70 min.
Rainfall intensity =      2.380(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.863
Subarea runoff =     18.383(CFS) for    9.190(Ac.)
Total runoff =     48.759(CFS)
Effective area this stream =       23.75(Ac.)
Total Study Area (Main Stream No. 1) =       23.75(Ac.)
Area averaged Fm value =    0.099(In/Hr)


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Process from Point/Station       90.000 to Point/Station      100.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
PARK subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.8500     Max loss rate(Fm)=     0.222(In/Hr)
Time of concentration =    19.70 min.
Rainfall intensity =      2.380(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.847
Subarea runoff =     23.437(CFS) for   12.070(Ac.)
Total runoff =     72.196(CFS)
Effective area this stream =       35.82(Ac.)
Total Study Area (Main Stream No. 1) =       35.82(Ac.)
Area averaged Fm value =    0.140(In/Hr)
End of computations, Total Study Area =           35.82 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.667
Area averaged SCS curve number =  71.6
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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/08/15

BASIN A200
100 YEAR
RANCO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 124.000 to Point/Station 123.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.105(In/Hr)
Initial subarea data:
Initial area flow distance = 344.000(Ft.)
Top (of initial area) elevation = 570.500(Ft.)
Bottom (of initial area) elevation = 567.000(Ft.)
Difference in elevation = 3.500(Ft.)
Slope = 0.01017 s(%)= 1.02
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.683 min.
Rainfall intensity = 3.645(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff = 9.622(CFS)
Total initial stream area = 3.020(Ac.)
Pervious area fraction = 0.400

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Initial area Fm value =    0.105(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      121.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   567.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   344.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     18.530(CFS)
Depth of flow =   0.667(Ft.), Average velocity =   2.734(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    8.34(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.000(Ft.)
Flow velocity =   2.73(Ft/s)
Travel time =    2.10 min.     TC =   11.78  min.
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Rainfall intensity =      3.240(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     17.752(CFS) for    6.680(Ac.)
Total runoff =     27.374(CFS)
Effective area this stream =        9.70(Ac.)
Total Study Area (Main Stream No. 1) =        9.70(Ac.)
Area averaged Fm value =    0.105(In/Hr)
Street flow at end of street =     27.374(CFS)
Half street flow at end of street =     27.374(CFS)
Depth of flow =   0.766(Ft.), Average velocity =   3.196(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =   13.31(Ft.)
Flow width (from curb towards crown)=  14.000(Ft.)
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Process from Point/Station      122.000 to Point/Station      121.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Time of concentration =    11.78 min.
Rainfall intensity =      3.240(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     11.853(CFS) for    4.200(Ac.)
Total runoff =     39.226(CFS)
Effective area this stream =       13.90(Ac.)
Total Study Area (Main Stream No. 1) =       13.90(Ac.)
Area averaged Fm value =    0.105(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      121.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Time of concentration =    11.78 min.
Rainfall intensity =      3.240(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     13.546(CFS) for    4.800(Ac.)
Total runoff =     52.772(CFS)
Effective area this stream =       18.70(Ac.)
Total Study Area (Main Stream No. 1) =       18.70(Ac.)
Area averaged Fm value =    0.105(In/Hr)


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Process from Point/Station      121.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   566.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =   315.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    52.772(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    52.772(CFS)
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Normal flow depth in pipe = 15.42(In.)
Flow top width inside pipe = 23.00(In.)
Critical depth could not be calculated.
Pipe flow velocity = 24.75(Ft/s)
Travel time through pipe = 0.21 min.
Time of concentration (TC) = 11.99 min.
End of computations, Total Study Area = 18.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.400
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/11/15

SUBAREA A300
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 148.000 to Point/Station 145.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.105(In/Hr)
Initial subarea data:
Initial area flow distance = 524.000(Ft.)
Top (of initial area) elevation = 572.000(Ft.)
Bottom (of initial area) elevation = 568.000(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00763 s(%)= 0.76
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.136 min.
Rainfall intensity = 3.183(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff = 13.824(CFS)
Total initial stream area = 4.990(Ac.)
Pervious area fraction = 0.400

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Initial area Fm value =    0.105(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      3.183(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      2.358(CFS) for    0.830(Ac.)
Total runoff =     16.182(CFS)
Effective area this stream =        5.82(Ac.)
Total Study Area (Main Stream No. 1) =        5.82(Ac.)
Area averaged Fm value =    0.093(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      145.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.820(Ac.)
Runoff from this stream =     16.182(CFS)
Time of concentration =   12.14 min.
Rainfall intensity =     3.183(In/Hr)
Area averaged loss rate (Fm) =    0.0934(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3572
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      149.000 to Point/Station      145.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Initial subarea data:
Initial area flow distance =   634.000(Ft.)
Top (of initial area) elevation =   573.000(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
```

```
Difference in elevation =     5.000(Ft.)
Slope =    0.00789  s(%)=       0.79
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.012 min.
Rainfall intensity =      3.052(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
Subarea runoff =     22.392(CFS)
Total initial stream area =        8.440(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.105(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      149.000 to Point/Station      145.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      8.440(Ac.)
Runoff from this stream =     22.392(CFS)
Time of concentration =   13.01 min.
Rainfall intensity =     3.052(In/Hr)
Area averaged loss rate (Fm) =    0.1046(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     16.18     5.820     12.14    0.093      3.183
2     22.39     8.440     13.01    0.105      3.052
Qmax(1) =
         1.000 *    1.000 *    16.182) +
         1.044 *    0.933 *    22.392) + =      37.990
Qmax(2) =
         0.958 *    1.000 *    16.182) +
         1.000 *    1.000 *    22.392) + =      37.892

Total of 2 main streams to confluence:
Flow rates before confluence point:
      17.182      23.392
Maximum flow rates at confluence using above data:
       37.990       37.892
Area of streams before confluence:
        5.820        8.440
Effective area values after confluence:
       13.692       14.260


Results of confluence:
Total flow rate =     37.990(CFS)
Time of concentration =    12.136 min.
Effective stream area after confluence  =     13.692(Ac.)
Study area average Pervious fraction(Ap) =  0.383
Study area average soil loss rate(Fm) =    0.100(In/Hr)
Study area total =      14.26(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      147.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      3.183(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     11.135(CFS) for    4.020(Ac.)
Total runoff =     49.125(CFS)
Effective area this stream =       17.71(Ac.)
Total Study Area (Main Stream No. 1) =       18.28(Ac.)
Area averaged Fm value =    0.101(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      146.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      3.183(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =     13.437(CFS) for    4.850(Ac.)
Total runoff =     62.562(CFS)
Effective area this stream =       22.56(Ac.)
Total Study Area (Main Stream No. 1) =       23.13(Ac.)
Area averaged Fm value =    0.102(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      145.000 to Point/Station      144.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
_____________________________________________________________________________
Top of street segment elevation =   568.000(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   747.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
```

```
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =     62.562(CFS)
Half street flow before street inlet =     31.281(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 2
Depth of flow =   0.941(Ft.), Average velocity =   2.128(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =     22.000(Ft.)
 Flow rate in gutter section of street = Qw =      4.336(CFS)
 Ratio of frontal flow to total flow = E0 =  0.1386
 Given curb inlet length  L =     14.000(Ft.)
Street slope is less than .5% , depth of flow indicates an orifice flow
condition exists for an opening height of    6.00(In.)
Using equation Qi = .67hL(2gd0)^.5
Total inlet flow capacity=     31.290(CFS)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 0.9167 right of way
            10.0000                 0.6667 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.1667 gutter/depression end
            14.0000                 0.2067 grade break
            32.0000                 0.5667 crown
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000
Note: Single inlet capacity is greater than 1/2 street flow

Pipe calculations for under street flow rate of     62.562(CFS)
Using a pipe slope =      0.500 %
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   747.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    62.562(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    62.562(CFS)
Normal flow depth in pipe =   30.56(In.)
Flow top width inside pipe =   37.39(In.)
Critical Depth =   29.76(In.)
Pipe flow velocity =      8.34(Ft/s)
Travel time through pipe =    1.49 min.
Time of concentration (TC) =    13.63 min.
Maximum flow rate of street inlet(s) =     62.562(CFS)
Maximum pipe flow capacity =     62.562(CFS)
```

```
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Rainfall intensity =      2.969(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.871
Subarea runoff =      2.038(CFS) for    2.410(Ac.)
Total runoff =     64.600(CFS)
Effective area this stream =       24.97(Ac.)
Total Study Area (Main Stream No. 1) =       25.54(Ac.)
Area averaged Fm value =    0.095(In/Hr)
Street flow at end of street =      2.038(CFS)
Half street flow at end of street =      1.019(CFS)
Depth of flow =   0.335(Ft.), Average velocity =   0.844(Ft/s)
Flow width (from curb towards crown)=  10.394(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      144.000 to Point/Station      143.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   567.000(Ft.)
End of street segment elevation =   566.500(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      2.038(CFS)
Half street flow before street inlet =      1.019(CFS)
Existing pipe flow before street inlet =     62.562(CFS)
Number of street inlets = 2
Depth of flow =   0.325(Ft.), Average velocity =   0.919(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      9.913(Ft.)
 Flow rate in gutter section of street = Qw =      0.582(CFS)
 Ratio of frontal flow to total flow = E0 =  0.5713
 Given curb inlet length  L =     14.000(Ft.)
Street slope is less than .5% , depth of flow indicates a weir flow
```

```
condition exists for an opening height of    8.00(In.)
Using equation Qweir = 2.3(1.25 for SI) (L + 1.8W)d^1.5)
Total inlet flow capacity=      7.497(CFS)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 0.9167 right of way
            10.0000                 0.6667 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.1667 gutter/depression end
            14.0000                 0.2067 grade break
            32.0000                 0.5667 crown
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000
Note: Single inlet capacity is greater than 1/2 street flow

Pipe calculations for under street flow rate of     64.600(CFS)
Using a pipe slope =      0.500 %
Upstream point/station elevation =   567.000(Ft.)
Downstream point/station elevation =   566.500(Ft.)
Pipe length  =   300.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    64.600(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    64.600(CFS)
Normal flow depth in pipe =   31.41(In.)
Flow top width inside pipe =   36.48(In.)
Critical Depth =   30.22(In.)
Pipe flow velocity =      8.38(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =    14.22 min.
Maximum flow rate of street inlet(s) =      2.038(CFS)
Maximum pipe flow capacity =     64.600(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Rainfall intensity =      2.894(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.870
Subarea runoff =      6.137(CFS) for    3.120(Ac.)
Total runoff =     70.737(CFS)
Effective area this stream =       28.09(Ac.)
Total Study Area (Main Stream No. 1) =       28.66(Ac.)
Area averaged Fm value =    0.096(In/Hr)
Street flow at end of street =      6.137(CFS)
Half street flow at end of street =      3.069(CFS)
Depth of flow =   0.440(Ft.), Average velocity =   1.192(Ft/s)
Flow width (from curb towards crown)=  15.646(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      143.000 to Point/Station      142.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   568.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   400.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      6.137(CFS)
Half street flow before street inlet =      3.069(CFS)
Existing pipe flow before street inlet =     64.600(CFS)
Number of street inlets = 2
Depth of flow =   0.377(Ft.), Average velocity =   1.810(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =     12.525(Ft.)
 Flow rate in gutter section of street = Qw =      1.424(CFS)
 Ratio of frontal flow to total flow = E0 =  0.4640
 Given curb inlet length  L =     27.000(Ft.)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 0.9167 right of way
            10.0000                 0.6667 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.1667 gutter/depression end
            14.0000                 0.2067 grade break
            32.0000                 0.5667 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     25.473(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0050
 Se = Equivalent Street x-slope including depression =  0.0200
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of     70.737(CFS)
Using a pipe slope =      1.000 %
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    70.737(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    70.737(CFS)
```

```
Normal flow depth in pipe =   27.80(In.)
Flow top width inside pipe =   35.29(In.)
Critical Depth =   32.02(In.)
Pipe flow velocity =     11.19(Ft/s)
Travel time through pipe =    0.60 min.
Time of concentration (TC) =    14.82 min.
Maximum flow rate of street inlet(s) =      6.137(CFS)
Maximum pipe flow capacity =     70.737(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.131(In/Hr)
Rainfall intensity =      2.823(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.867
Subarea runoff =     15.086(CFS) for    6.960(Ac.)
Total runoff =     85.823(CFS)
Effective area this stream =       35.05(Ac.)
Total Study Area (Main Stream No. 1) =       35.62(Ac.)
Area averaged Fm value =    0.103(In/Hr)
Street flow at end of street =     15.086(CFS)
Half street flow at end of street =      7.543(CFS)
Depth of flow =   0.486(Ft.), Average velocity =   2.248(Ft/s)
Flow width (from curb towards crown)=  17.970(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      142.000 to Point/Station      141.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   561.000(Ft.)
Downstream point/station elevation =   560.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    85.823(CFS)
Nearest computed pipe diameter  =     42.00(In.)
Calculated individual pipe flow  =    85.823(CFS)
Normal flow depth in pipe =   29.81(In.)
Flow top width inside pipe =   38.12(In.)
Critical Depth =   34.62(In.)
Pipe flow velocity =     11.74(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    14.96 min.


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Process from Point/Station      142.000 to Point/Station      141.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     35.052(Ac.)
```

```
Runoff from this stream =     85.823(CFS)
Time of concentration =   14.96 min.
Rainfall intensity =     2.807(In/Hr)
Area averaged loss rate (Fm) =    0.1026(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3924
Program is now starting with Main Stream No. 2


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Process from Point/Station      152.000 to Point/Station      151.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
Initial subarea data:
Initial area flow distance =   690.000(Ft.)
Top (of initial area) elevation =   571.000(Ft.)
Bottom (of initial area) elevation =   567.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00580  s(%)=       0.58
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.314 min.
Rainfall intensity =      2.883(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff =      9.601(CFS)
Total initial stream area =        3.840(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.105(In/Hr)


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Process from Point/Station      151.000 to Point/Station      141.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   561.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.601(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =     9.601(CFS)
Normal flow depth in pipe =   16.97(In.)
Flow top width inside pipe =   21.85(In.)
Critical Depth =   13.29(In.)
Pipe flow velocity =      4.04(Ft/s)
Travel time through pipe =    1.65 min.
Time of concentration (TC) =    15.96 min.


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Process from Point/Station      151.000 to Point/Station      141.000
**** CONFLUENCE OF MAIN STREAMS ****
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```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.840(Ac.)
Runoff from this stream =      9.601(CFS)
Time of concentration =   15.96 min.
Rainfall intensity =     2.700(In/Hr)
Area averaged loss rate (Fm) =    0.1046(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     85.82    35.052     14.96    0.103      2.807
2      9.60     3.840     15.96    0.105      2.700
Qmax(1) =
         1.000 *    1.000 *    85.823) +
         1.041 *    0.937 *     9.601) + =      95.192
Qmax(2) =
         0.960 *    1.000 *    85.823) +
         1.000 *    1.000 *     9.601) + =      92.026

Total of 2 main streams to confluence:
Flow rates before confluence point:
      86.823      10.601
Maximum flow rates at confluence using above data:
       95.192       92.026
Area of streams before confluence:
       35.052        3.840
Effective area values after confluence:
       38.651       38.892


Results of confluence:
Total flow rate =     95.192(CFS)
Time of concentration =    14.963 min.
Effective stream area after confluence  =     38.651(Ac.)
Study area average Pervious fraction(Ap) =  0.393
Study area average soil loss rate(Fm) =    0.103(In/Hr)
Study area total =      38.89(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      141.000 to Point/Station      140.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   561.000(Ft.)
Downstream point/station elevation =   555.000(Ft.)
Pipe length  =   250.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    95.192(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    95.192(CFS)
Normal flow depth in pipe =   27.23(In.)
Flow top width inside pipe =   30.90(In.)
Critical depth could not be calculated.
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```
Pipe flow velocity =     16.59(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =    15.21 min.


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Process from Point/Station      141.000 to Point/Station      140.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     95.125(CFS)
therefore the upstream flow rate of Q =     95.192(CFS) is being used
Time of concentration =    15.21 min.
Rainfall intensity =      2.779(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.867
Subarea runoff =      0.000(CFS) for    0.850(Ac.)
Total runoff =     95.192(CFS)
Effective area this stream =       39.50(Ac.)
Total Study Area (Main Stream No. 1) =       40.31(Ac.)
Area averaged Fm value =    0.103(In/Hr)
End of computations, Total Study Area =           40.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.406
Area averaged SCS curve number =  69.2
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 03/08/15

SUBAREA BASIN A400
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 162.000 to Point/Station 161.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.129(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 575.000(Ft.)

```
      Bottom (of initial area) elevation =   549.000(Ft.)
      Difference in elevation =    26.000(Ft.)
      Slope =    0.02600  s(%)=       2.60
      TC = k(0.706)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =   23.217 min.
      Rainfall intensity =      2.157(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.846
      Subarea runoff =      2.920(CFS)
      Total initial stream area =        1.600(Ac.)
      Pervious area fraction = 1.000
      Initial area Fm value =    0.129(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      161.000 to Point/Station
160.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      COMMERCIAL subarea type
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=
0.026(In/Hr)
      Time of concentration =    23.22 min.
      Rainfall intensity =      2.157(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with
modified
      rational method)(Q=KCIA) is C = 0.871
      Subarea runoff =      4.122(CFS) for    2.150(Ac.)
      Total runoff =      7.043(CFS)
      Effective area this stream =        3.75(Ac.)
      Total Study Area (Main Stream No. 1) =        3.75(Ac.)
      Area averaged Fm value =    0.070(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      160.000 to Point/Station
150.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   545.000(Ft.)
      Downstream point/station elevation =   535.000(Ft.)
      Pipe length  =    50.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =     7.043(CFS)
```

Nearest computed pipe diameter = 9.00(In.)
Calculated individual pipe flow = 7.043(CFS)
Normal flow depth in pipe = 7.02(In.)
Flow top width inside pipe = 7.46(In.)
Critical depth could not be calculated.
Pipe flow velocity = 19.06(Ft/s)
Travel time through pipe = 0.04 min.
Time of concentration (TC) = 23.26 min.
End of computations, Total Study Area = 3.75 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.484
Area averaged SCS curve number = 73.3

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/11/15

SUBAREA A500
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 171.000 to Point/Station 170.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.026(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 566.000(Ft.)
Bottom (of initial area) elevation = 553.000(Ft.)
Difference in elevation = 13.000(Ft.)
Slope = 0.01300 s(%)= 1.30
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.484 min.
Rainfall intensity = 3.290(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
Subarea runoff = 3.760(CFS)
Total initial stream area = 1.280(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.026(In/Hr)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      170.000 to Point/Station      150.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   553.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.760(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.760(CFS)
Normal flow depth in pipe =    3.84(In.)
Flow top width inside pipe =    8.90(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.91(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    11.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      151.000 to Point/Station      150.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    11.52 min.
Rainfall intensity =      3.283(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =      3.569(CFS) for    1.260(Ac.)
Total runoff =      7.329(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.077(In/Hr)
End of computations, Total Study Area =            2.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.546
Area averaged SCS curve number =  74.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1

Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B100
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 205.000 to Point/Station 204.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.105(In/Hr)
Initial subarea data:
Initial area flow distance = 436.000(Ft.)
Top (of initial area) elevation = 572.000(Ft.)
Bottom (of initial area) elevation = 568.500(Ft.)

```
      Difference in elevation =     3.500(Ft.)
      Slope =    0.00803  s(%)=       0.80
      TC = k(0.374)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =   11.162 min.
      Rainfall intensity =      3.347(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.872
      Subarea runoff =      8.899(CFS)
      Total initial stream area =        3.050(Ac.)
      Pervious area fraction = 0.400
      Initial area Fm value =    0.105(In/Hr)


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      Process from Point/Station      206.000 to Point/Station
204.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Time of concentration =    11.16 min.
      Rainfall intensity =      3.347(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.872
      Subarea runoff =      9.133(CFS) for    3.130(Ac.)
      Total runoff =     18.032(CFS)
      Effective area this stream =        6.18(Ac.)
      Total Study Area (Main Stream No. 1) =        6.18(Ac.)
      Area averaged Fm value =    0.105(In/Hr)


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      Process from Point/Station      150.000 to Point/Station
204.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      COMMERCIAL subarea type
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
```

```
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
      Time of concentration =    11.16 min.
      Rainfall intensity =      3.347(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.874
      Subarea runoff =      1.733(CFS) for    0.580(Ac.)
      Total runoff =     19.765(CFS)
      Effective area this stream =        6.76(Ac.)
      Total Study Area (Main Stream No. 1) =        6.76(Ac.)
      Area averaged Fm value =    0.098(In/Hr)


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      Process from Point/Station      204.000 to Point/Station
203.000
      **** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
      ____________________________________________________________________
_____
      Top of street segment elevation =   568.500(Ft.)
      End of street segment elevation =   567.000(Ft.)
      Length of street segment  =   100.000(Ft.)
      Height of curb above gutter flowline  =    8.0(In.)
      Width of half street (curb to crown)  =  22.000(Ft.)
      Distance from crown to crossfall grade break  =  18.000(Ft.)
      Slope from gutter to grade break (v/hz) =   0.020
      Slope from grade break to crown (v/hz)  =   0.020
      Street flow is on [2] side(s) of the street
      Distance from curb to property line  =  10.000(Ft.)
      Slope from curb to property line (v/hz) =   0.025
      Gutter width =   2.000(Ft.)
      Gutter hike from flowline =  2.000(In.)
       Manning's N in gutter =  0.0150
       Manning's N from gutter to grade break =  0.0150
       Manning's N from grade break to crown =  0.0150

      Street Inlet Calculations:
      Street flow before street inlet =     19.765(CFS)
      Half street flow before street inlet =      9.883(CFS)
      Existing pipe flow before street inlet =      0.000(CFS)
      Number of street inlets = 2
      Depth of flow =   0.680(Ft.), Average velocity =   3.699(Ft/s)
      U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet
calculations:
       Street flow half width at start of inlet =     15.150(Ft.)
       Flow rate in gutter section of street = Qw =      4.876(CFS)
       Ratio of frontal flow to total flow = E0 =  0.4934
       Given curb inlet length  L =     14.000(Ft.)

      Half street cross section data points at curb inlet:
                  X-coordinate (Ft.)   Y-coordinate (Ft.)
                   0.0000              1.1667 right of way
```

```
           10.0000              0.9167 top of curb
           10.0000              0.0000 flow line
           12.0000              0.4167 gutter/depression end
           14.0000              0.4567 grade break
           32.0000              0.8167 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     24.883(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0150
 Se = Equivalent Street x-slope including depression =  0.0817
 Gutter depression depth =      3.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  0.7743

Pipe calculations for under street flow rate of     15.304(CFS)
Using a pipe slope =      1.500 %
Upstream point/station elevation =   568.500(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.304(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    15.304(CFS)
Normal flow depth in pipe =   14.06(In.)
Flow top width inside pipe =   19.75(In.)
Critical Depth =   17.37(In.)
Pipe flow velocity =      8.94(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    11.35 min.
Maximum flow rate of street inlet(s) =     15.304(CFS)
Maximum pipe flow capacity =     15.304(CFS)
Remaining flow in street below inlet =      4.461(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Rainfall intensity =      3.313(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.875
Subarea runoff =      0.982(CFS) for    0.400(Ac.)
Total runoff =     20.747(CFS)
Effective area this stream =        7.16(Ac.)
Total Study Area (Main Stream No. 1) =        7.16(Ac.)
Area averaged Fm value =    0.094(In/Hr)
Street flow at end of street =      5.443(CFS)
Half street flow at end of street =      2.721(CFS)
Depth of flow =   0.315(Ft.), Average velocity =   2.684(Ft/s)
Flow width (from curb towards crown)=   9.419(Ft.)
```

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      Process from Point/Station      203.000 to Point/Station
202.000
      **** CONFLUENCE OF MINOR STREAMS ****
      ____________________________________________________________________
_____
      Along Main Stream number: 1 in normal stream number 1
      Stream flow area =      7.160(Ac.)
      Runoff from this stream =     20.747(CFS)
      Time of concentration =   11.35 min.
      Rainfall intensity =     3.313(In/Hr)
      Area averaged loss rate (Fm) =    0.0939(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.3589


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      207.000 to Point/Station
203.000
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________________
_____
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Initial subarea data:
      Initial area flow distance =   394.000(Ft.)
      Top (of initial area) elevation =   571.200(Ft.)
      Bottom (of initial area) elevation =   568.000(Ft.)
      Difference in elevation =     3.200(Ft.)
      Slope =    0.00812  s(%)=       0.81
      TC = k(0.374)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =   10.694 min.
      Rainfall intensity =      3.434(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.873
      Subarea runoff =      6.472(CFS)
      Total initial stream area =        2.160(Ac.)
      Pervious area fraction = 0.400
      Initial area Fm value =    0.105(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      203.000 to Point/Station
202.000
```

```
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________
_____
      Upstream point/station elevation =   568.000(Ft.)
      Downstream point/station elevation =   567.500(Ft.)
      Pipe length  =    50.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =     6.472(CFS)
      Nearest computed pipe diameter  =     18.00(In.)
      Calculated individual pipe flow  =     6.472(CFS)
      Normal flow depth in pipe =   10.22(In.)
      Flow top width inside pipe =   17.83(In.)
      Critical Depth =   11.80(In.)
      Pipe flow velocity =      6.25(Ft/s)
      Travel time through pipe =    0.13 min.
      Time of concentration (TC) =    10.83 min.


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      203.000 to Point/Station
202.000
      **** CONFLUENCE OF MINOR STREAMS ****
      ____________________________________________________________
_____
      Along Main Stream number: 1 in normal stream number 2
      Stream flow area =      2.160(Ac.)
      Runoff from this stream =      6.472(CFS)
      Time of concentration =   10.83 min.
      Rainfall intensity =     3.408(In/Hr)
      Area averaged loss rate (Fm) =    0.1046(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.4000


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      Process from Point/Station      208.000 to Point/Station
203.000
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________
_____
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Initial subarea data:
      Initial area flow distance =   540.000(Ft.)
      Top (of initial area) elevation =   572.000(Ft.)
      Bottom (of initial area) elevation =   569.000(Ft.)
```

```
     Difference in elevation =     3.000(Ft.)
     Slope =    0.00556  s(%)=       0.56
     TC = k(0.374)*[(length^3)/(elevation change)]^0.2
     Initial area time of concentration =   13.088 min.
     Rainfall intensity =      3.042(In/Hr) for a   100.0 year storm
     Effective runoff coefficient used for area (Q=KCIA) is C = 0.869
     Subarea runoff =      7.454(CFS)
     Total initial stream area =        2.820(Ac.)
     Pervious area fraction = 0.400
     Initial area Fm value =    0.105(In/Hr)


     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
     Process from Point/Station      203.000 to Point/Station
202.000
     **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
     ____________________________________________________________________
_____
     Upstream point/station elevation =   569.000(Ft.)
     Downstream point/station elevation =   568.500(Ft.)
     Pipe length  =    50.00(Ft.)   Manning's N = 0.013
     No. of pipes = 1  Required pipe flow  =     7.454(CFS)
     Nearest computed pipe diameter  =     18.00(In.)
     Calculated individual pipe flow  =     7.454(CFS)
     Normal flow depth in pipe =   11.20(In.)
     Flow top width inside pipe =   17.45(In.)
     Critical Depth =   12.70(In.)
     Pipe flow velocity =      6.45(Ft/s)
     Travel time through pipe =    0.13 min.
     Time of concentration (TC) =    13.22 min.


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+++++
     Process from Point/Station      203.000 to Point/Station
202.000
     **** CONFLUENCE OF MINOR STREAMS ****
     ____________________________________________________________________
_____
     Along Main Stream number: 1 in normal stream number 3
     Stream flow area =      2.820(Ac.)
     Runoff from this stream =      7.454(CFS)
     Time of concentration =   13.22 min.
     Rainfall intensity =     3.024(In/Hr)
     Area averaged loss rate (Fm) =    0.1046(In/Hr)
     Area averaged Pervious ratio (Ap) = 0.4000
     Summary of stream data:

     Stream Flow rate    Area    TC     Fm       Rainfall Intensity
      No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1     20.75     7.160     11.35    0.094      3.313
2      6.47     2.160     10.83    0.105      3.408
3      7.45     2.820     13.22    0.105      3.024
Qmax(1) =
         1.000 *    1.000 *    20.747) +
         0.971 *    1.000 *     6.472) +
         1.099 *    0.859 *     7.454) + =      34.069
Qmax(2) =
         1.029 *    0.954 *    20.747) +
         1.000 *    1.000 *     6.472) +
         1.132 *    0.819 *     7.454) + =      33.759
Qmax(3) =
         0.910 *    1.000 *    20.747) +
         0.884 *    1.000 *     6.472) +
         1.000 *    1.000 *     7.454) + =      32.054

Total of 3 streams to confluence:
Flow rates before confluence point:
      20.747       6.472       7.454
Maximum flow rates at confluence using above data:
       34.069       33.759       32.054
Area of streams before confluence:
        7.160        2.160        2.820
Effective area values after confluence:
       11.741       11.301       12.140
Results of confluence:
Total flow rate =     34.069(CFS)
Time of concentration =    11.349 min.
Effective stream area after confluence =     11.741(Ac.)
Study area average Pervious fraction(Ap) =  0.376
Study area average soil loss rate(Fm) =    0.098(In/Hr)
Study area total (this main stream) =      12.14(Ac.)


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+++++
Process from Point/Station      202.000 to Point/Station
201.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
_____________________________________________________________________
_____
Top of street segment elevation =   568.500(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   180.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

Slope from curb to property line (v/hz) = 0.025
Gutter width = 2.000(Ft.)
Gutter hike from flowline = 2.000(In.)
Manning's N in gutter = 0.0150
Manning's N from gutter to grade break = 0.0150
Manning's N from grade break to crown = 0.0150

Street Inlet Calculations:
Street flow before street inlet = 4.838(CFS)
Half street flow before street inlet = 2.419(CFS)
Existing pipe flow before street inlet = 29.230(CFS)
Number of street inlets = 2
Depth of flow = 0.546(Ft.), Average velocity = 2.210(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 8.474(Ft.)
Flow rate in gutter section of street = Qw = 1.900(CFS)
Ratio of frontal flow to total flow = E0 = 0.7855
Given curb inlet length L = 14.000(Ft.)

Half street cross section data points at curb inlet:

X-coordinate (Ft.)	Y-coordinate (Ft.)	
0.0000	1.1667	right of way
10.0000	0.9167	top of curb
10.0000	0.0000	flow line
12.0000	0.4167	gutter/depression end
14.0000	0.4567	grade break
32.0000	0.8167	crown

Length required for total flow interception = Lt
Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 = 9.254(Ft.)
where Manning's n = 0.0150 and Slope = street slope = 0.0083
Se = Equivalent Street x-slope including depression = 0.1182
Gutter depression depth = 3.000(In.)
Gutter depression width = 2.000(Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 1.0000

Pipe calculations for under street flow rate of 34.069(CFS)
Using a pipe slope = 0.833 %
Upstream point/station elevation = 568.500(Ft.)
Downstream point/station elevation = 567.000(Ft.)
Pipe length = 180.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 34.069(CFS)
Nearest computed pipe diameter = 30.00(In.)
Calculated individual pipe flow = 34.069(CFS)
Normal flow depth in pipe = 22.45(In.)
Flow top width inside pipe = 26.03(In.)
Critical Depth = 23.81(In.)
Pipe flow velocity = 8.64(Ft/s)
Travel time through pipe = 0.35 min.
Time of concentration (TC) = 11.70 min.
Maximum flow rate of street inlet(s) = 4.838(CFS)
Maximum pipe flow capacity = 34.069(CFS)

```
      Remaining flow in street below inlet =      0.000(CFS)
       Adding area flow to street
      COMMERCIAL subarea type
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
      Rainfall intensity =      3.254(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.874
      Subarea runoff =      0.616(CFS) for    0.460(Ac.)
      Total runoff =     34.685(CFS)
      Effective area this stream =       12.20(Ac.)
      Total Study Area (Main Stream No. 1) =       12.60(Ac.)
      Area averaged Fm value =    0.096(In/Hr)
      Street flow at end of street =      0.616(CFS)
      Half street flow at end of street =      0.308(CFS)
      Depth of flow =   0.182(Ft.), Average velocity =   1.518(Ft/s)
      Flow width (from curb towards crown)=   2.760(Ft.)


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      Process from Point/Station      201.000 to Point/Station
200.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   567.000(Ft.)
      Downstream point/station elevation =   566.500(Ft.)
      Pipe length  =    60.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    34.685(CFS)
      Nearest computed pipe diameter  =     30.00(In.)
      Calculated individual pipe flow  =    34.685(CFS)
      Normal flow depth in pipe =   22.83(In.)
      Flow top width inside pipe =   25.59(In.)
      Critical Depth =   24.02(In.)
      Pipe flow velocity =      8.66(Ft/s)
      Travel time through pipe =    0.12 min.
      Time of concentration (TC) =    11.81 min.


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      Process from Point/Station      210.000 to Point/Station
200.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
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```
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Time of concentration =    11.81 min.
      Rainfall intensity =      3.235(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.873
      Subarea runoff =     10.468(CFS) for    3.790(Ac.)
      Total runoff =     45.152(CFS)
      Effective area this stream =       15.99(Ac.)
      Total Study Area (Main Stream No. 1) =       16.39(Ac.)
      Area averaged Fm value =    0.098(In/Hr)


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      Process from Point/Station      209.000 to Point/Station
200.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Time of concentration =    11.81 min.
      Rainfall intensity =      3.235(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.873
      Subarea runoff =      8.621(CFS) for    3.060(Ac.)
      Total runoff =     53.774(CFS)
      Effective area this stream =       19.05(Ac.)
      Total Study Area (Main Stream No. 1) =       19.45(Ac.)
      Area averaged Fm value =    0.099(In/Hr)


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      Process from Point/Station      200.000 to Point/Station
199.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
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      Upstream point/station elevation =   566.500(Ft.)
      Downstream point/station elevation =   565.000(Ft.)
      Pipe length  =   100.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    53.774(CFS)
      Nearest computed pipe diameter  =     33.00(In.)
      Calculated individual pipe flow  =    53.774(CFS)
      Normal flow depth in pipe =   22.97(In.)
      Flow top width inside pipe =   30.36(In.)
      Critical Depth =   28.75(In.)
      Pipe flow velocity =     12.20(Ft/s)
      Travel time through pipe =    0.14 min.
      Time of concentration (TC) =    11.95 min.


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      Process from Point/Station      200.000 to Point/Station
199.000
      **** CONFLUENCE OF MAIN STREAMS ****
      ____________________________________________________________________
_____
      The following data inside Main Stream is listed:
      In Main Stream number: 1
      Stream flow area =     19.051(Ac.)
      Runoff from this stream =     53.774(CFS)
      Time of concentration =   11.95 min.
      Rainfall intensity =     3.213(In/Hr)
      Area averaged loss rate (Fm) =    0.0988(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.3778
      Program is now starting with Main Stream No. 2


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      Process from Point/Station      222.000 to Point/Station
221.000
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________________
_____
      APARTMENT subarea type
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
      Initial subarea data:
      Initial area flow distance =   690.000(Ft.)
      Top (of initial area) elevation =   570.500(Ft.)
      Bottom (of initial area) elevation =   568.000(Ft.)
      Difference in elevation =     2.500(Ft.)
```

```
      Slope =    0.00362  s(%)=       0.36
      TC = k(0.324)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =   13.623 min.
      Rainfall intensity =      2.970(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.884
      Subarea runoff =     10.607(CFS)
      Total initial stream area =        4.040(Ac.)
      Pervious area fraction = 0.200
      Initial area Fm value =    0.052(In/Hr)


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      Process from Point/Station      221.000 to Point/Station
214.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   568.500(Ft.)
      Downstream point/station elevation =   568.000(Ft.)
      Pipe length  =    50.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    10.607(CFS)
      Nearest computed pipe diameter  =     21.00(In.)
      Calculated individual pipe flow  =    10.607(CFS)
      Normal flow depth in pipe =   12.56(In.)
      Flow top width inside pipe =   20.59(In.)
      Critical Depth =   14.55(In.)
      Pipe flow velocity =      7.06(Ft/s)
      Travel time through pipe =    0.12 min.
      Time of concentration (TC) =    13.74 min.


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      Process from Point/Station      215.000 to Point/Station
214.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      COMMERCIAL subarea type
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
      Time of concentration =    13.74 min.
      Rainfall intensity =      2.954(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.885
      Subarea runoff =      2.131(CFS) for    0.830(Ac.)
```

```
      Total runoff =     12.739(CFS)
      Effective area this stream =        4.87(Ac.)
      Total Study Area (Main Stream No. 2) =       24.32(Ac.)
      Area averaged Fm value =    0.048(In/Hr)


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      Process from Point/Station      214.000 to Point/Station
212.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   568.200(Ft.)
      Downstream point/station elevation =   567.000(Ft.)
      Pipe length  =   400.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    12.739(CFS)
      Nearest computed pipe diameter  =     27.00(In.)
      Calculated individual pipe flow  =    12.739(CFS)
      Normal flow depth in pipe =   17.46(In.)
      Flow top width inside pipe =   25.81(In.)
      Critical Depth =   14.87(In.)
      Pipe flow velocity =      4.68(Ft/s)
      Travel time through pipe =    1.42 min.
      Time of concentration (TC) =    15.16 min.


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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      Process from Point/Station      213.000 to Point/Station
212.000
      **** CONFLUENCE OF MINOR STREAMS ****
      ____________________________________________________________________
_____
      Along Main Stream number: 2 in normal stream number 1
      Stream flow area =      4.870(Ac.)
      Runoff from this stream =     12.739(CFS)
      Time of concentration =   15.16 min.
      Rainfall intensity =     2.785(In/Hr)
      Area averaged loss rate (Fm) =    0.0478(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.1830


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      218.000 to Point/Station
217.000
      **** INITIAL AREA EVALUATION ****
      ____________________________________________________________________
_____
      COMMERCIAL subarea type
      Decimal fraction soil group A = 0.000
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```
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
      Initial subarea data:
      Initial area flow distance =   489.000(Ft.)
      Top (of initial area) elevation =   568.000(Ft.)
      Bottom (of initial area) elevation =   566.000(Ft.)
      Difference in elevation =     2.000(Ft.)
      Slope =    0.00409  s(%)=       0.41
      TC = k(0.304)*[(length^3)/(elevation change)]^0.2
      Initial area time of concentration =   10.871 min.
      Rainfall intensity =      3.400(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
      Subarea runoff =      3.128(CFS)
      Total initial stream area =        1.030(Ac.)
      Pervious area fraction = 0.100
      Initial area Fm value =    0.026(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      217.000 to Point/Station
216.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   566.000(Ft.)
      Downstream point/station elevation =   565.800(Ft.)
      Pipe length  =    30.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =     3.128(CFS)
      Nearest computed pipe diameter  =     15.00(In.)
      Calculated individual pipe flow  =     3.128(CFS)
      Normal flow depth in pipe =    8.31(In.)
      Flow top width inside pipe =   14.91(In.)
      Critical Depth =    8.54(In.)
      Pipe flow velocity =      4.48(Ft/s)
      Travel time through pipe =    0.11 min.
      Time of concentration (TC) =    10.98 min.


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      Process from Point/Station      220.000 to Point/Station
216.000
      **** SUBAREA FLOW ADDITION ****
      ____________________________________________________________________
_____
      RESIDENTIAL(8 - 10 dwl/acre)
      Decimal fraction soil group A = 0.000
```

```
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 69.00
      Adjusted SCS curve number for AMC 3 = 86.20
      Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.105(In/Hr)
      Time of concentration =    10.98 min.
      Rainfall intensity =      3.379(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.875
      Subarea runoff =     16.957(CFS) for    5.760(Ac.)
      Total runoff =     20.085(CFS)
      Effective area this stream =        6.79(Ac.)
      Total Study Area (Main Stream No. 2) =       31.11(Ac.)
      Area averaged Fm value =    0.093(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      216.000 to Point/Station
212.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   565.800(Ft.)
      Downstream point/station elevation =   565.000(Ft.)
      Pipe length  =   100.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    20.085(CFS)
      Nearest computed pipe diameter  =     24.00(In.)
      Calculated individual pipe flow  =    20.085(CFS)
      Normal flow depth in pipe =   19.50(In.)
      Flow top width inside pipe =   18.73(In.)
      Critical Depth =   19.31(In.)
      Pipe flow velocity =      7.34(Ft/s)
      Travel time through pipe =    0.23 min.
      Time of concentration (TC) =    11.21 min.


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      216.000 to Point/Station
212.000
      **** CONFLUENCE OF MINOR STREAMS ****
      ____________________________________________________________________
_____
      Along Main Stream number: 2 in normal stream number 2
      Stream flow area =      6.790(Ac.)
      Runoff from this stream =     20.085(CFS)
      Time of concentration =   11.21 min.
      Rainfall intensity =     3.338(In/Hr)
      Area averaged loss rate (Fm) =    0.0927(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.3545
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     12.74     4.870     15.16    0.048      2.785
2     20.08     6.790     11.21    0.093      3.338
Qmax(1) =
        1.000 *    1.000 *    12.739) +
        0.829 *    1.000 *    20.085) + =      29.397
Qmax(2) =
        1.202 *    0.739 *    12.739) +
        1.000 *    1.000 *    20.085) + =      31.406

Total of 2 streams to confluence:
Flow rates before confluence point:
      12.739      20.085
Maximum flow rates at confluence using above data:
       29.397       31.406
Area of streams before confluence:
        4.870        6.790
Effective area values after confluence:
       11.660       10.390
Results of confluence:
Total flow rate =     31.406(CFS)
Time of concentration =    11.209 min.
Effective stream area after confluence =     10.390(Ac.)
Study area average Pervious fraction(Ap) =  0.283
Study area average soil loss rate(Fm) =    0.074(In/Hr)
Study area total (this main stream) =      11.66(Ac.)


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+++++
     Process from Point/Station      212.000 to Point/Station
211.000
     **** SUBAREA FLOW ADDITION ****
     ____________________________________________________________________
_____
     COMMERCIAL subarea type
     Decimal fraction soil group A = 0.000
     Decimal fraction soil group B = 0.000
     Decimal fraction soil group C = 1.000
     Decimal fraction soil group D = 0.000
     SCS curve number for soil(AMC 2)  = 69.00
     Adjusted SCS curve number for AMC 3 = 86.20
     Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
     Time of concentration =    11.21 min.
     Rainfall intensity =      3.338(In/Hr) for a   100.0 year storm
     Effective runoff coefficient used for area,(total area with modified
     rational method)(Q=KCIA) is C = 0.881
```

```
      Subarea runoff =      1.263(CFS) for    0.720(Ac.)
      Total runoff =     32.669(CFS)
      Effective area this stream =       11.11(Ac.)
      Total Study Area (Main Stream No. 2) =       31.83(Ac.)
      Area averaged Fm value =    0.071(In/Hr)


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      Process from Point/Station      212.000 to Point/Station
211.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ____________________________________________________________________
_____
      Upstream point/station elevation =   565.000(Ft.)
      Downstream point/station elevation =   563.000(Ft.)
      Pipe length  =   400.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    32.669(CFS)
      Nearest computed pipe diameter  =     33.00(In.)
      Calculated individual pipe flow  =    32.669(CFS)
      Normal flow depth in pipe =   23.88(In.)
      Flow top width inside pipe =   29.51(In.)
      Critical Depth =   22.82(In.)
      Pipe flow velocity =      7.10(Ft/s)
      Travel time through pipe =    0.94 min.
      Time of concentration (TC) =    12.15 min.


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      Process from Point/Station      211.000 to Point/Station
199.000
      **** CONFLUENCE OF MAIN STREAMS ****
      ____________________________________________________________________
_____
      The following data inside Main Stream is listed:
      In Main Stream number: 2
      Stream flow area =     11.110(Ac.)
      Runoff from this stream =     32.669(CFS)
      Time of concentration =   12.15 min.
      Rainfall intensity =     3.181(In/Hr)
      Area averaged loss rate (Fm) =    0.0709(In/Hr)
      Area averaged Pervious ratio (Ap) = 0.2710
      Summary of stream data:

      Stream Flow rate    Area    TC     Fm       Rainfall Intensity
       No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


      1     53.77    19.051     11.95    0.099      3.213
      2     32.67    11.110     12.15    0.071      3.181
      Qmax(1) =
```

```
          1.000 *    1.000 *    53.774) +
          1.010 *    0.983 *    32.669) + =      86.233
     Qmax(2) =
          0.990 *    1.000 *    53.774) +
          1.000 *    1.000 *    32.669) + =      85.891

     Total of 2 main streams to confluence:
     Flow rates before confluence point:
          54.774      33.669
     Maximum flow rates at confluence using above data:
          86.233       85.891
     Area of streams before confluence:
          19.051       11.110
     Effective area values after confluence:
          29.978       30.161


     Results of confluence:
     Total flow rate =     86.233(CFS)
     Time of concentration =    11.948 min.
     Effective stream area after confluence  =     29.978(Ac.)
     Study area average Pervious fraction(Ap) =  0.338
     Study area average soil loss rate(Fm) =    0.089(In/Hr)
     Study area total =      30.16(Ac.)


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     Process from Point/Station      199.000 to Point/Station
223.000
     **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
     ____________________________________________________________________
_____
     Upstream point/station elevation =   563.000(Ft.)
     Downstream point/station elevation =   560.000(Ft.)
     Pipe length  =   200.00(Ft.)   Manning's N = 0.013
     No. of pipes = 1  Required pipe flow  =    86.233(CFS)
     Nearest computed pipe diameter  =     39.00(In.)
     Calculated individual pipe flow  =    86.233(CFS)
     Normal flow depth in pipe =   27.70(In.)
     Flow top width inside pipe =   35.38(In.)
     Critical Depth =   34.64(In.)
     Pipe flow velocity =     13.69(Ft/s)
     Travel time through pipe =    0.24 min.
     Time of concentration (TC) =    12.19 min.


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     Process from Point/Station      224.000 to Point/Station
223.000
     **** SUBAREA FLOW ADDITION ****
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_____
      UNDEVELOPED (average cover) subarea
      Decimal fraction soil group A = 0.000
      Decimal fraction soil group B = 0.000
      Decimal fraction soil group C = 1.000
      Decimal fraction soil group D = 0.000
      SCS curve number for soil(AMC 2)  = 79.00
      Adjusted SCS curve number for AMC 3 = 93.40
      Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
      Time of concentration =    12.19 min.
      Rainfall intensity =      3.174(In/Hr) for a   100.0 year storm
      Effective runoff coefficient used for area,(total area with modified
      rational method)(Q=KCIA) is C = 0.874
      Subarea runoff =      7.211(CFS) for    3.720(Ac.)
      Total runoff =     93.444(CFS)
      Effective area this stream =       33.70(Ac.)
      Total Study Area (Main Stream No. 1) =       35.55(Ac.)
      Area averaged Fm value =    0.093(In/Hr)


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      Process from Point/Station      223.000 to Point/Station
198.000
      **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
      ------------------------------------------------------------------
------
      Upstream point/station elevation =   560.000(Ft.)
      Downstream point/station elevation =   541.000(Ft.)
      Pipe length  =   200.00(Ft.)   Manning's N = 0.013
      No. of pipes = 1  Required pipe flow  =    93.444(CFS)
      Nearest computed pipe diameter  =     27.00(In.)
      Calculated individual pipe flow  =    93.444(CFS)
      Normal flow depth in pipe =   21.63(In.)
      Flow top width inside pipe =   21.55(In.)
      Critical depth could not be calculated.
      Pipe flow velocity =     27.36(Ft/s)
      Travel time through pipe =    0.12 min.
      Time of concentration (TC) =    12.31 min.
      End of computations, Total Study Area =           35.55 (Ac.)
      The following figures may
      be used for a unit hydrograph study of the same area.
      Note: These figures do not consider reduced effective area
      effects caused by confluences in the rational equation.

      Area averaged pervious area fraction(Ap) = 0.406
      Area averaged SCS curve number =  70.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B200
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 310.000 to Point/Station 309.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.052(In/Hr)
Initial subarea data:
Initial area flow distance = 460.000(Ft.)
Top (of initial area) elevation = 577.000(Ft.)
Bottom (of initial area) elevation = 573.000(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00870 s(%)= 0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.723 min.
Rainfall intensity = 3.636(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.887
Subarea runoff = 19.898(CFS)
Total initial stream area = 6.170(Ac.)
Pervious area fraction = 0.200

```
Initial area Fm value =    0.052(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      307.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   573.000(Ft.)
Downstream point elevation =   568.000(Ft.)
Channel length thru subarea  =   700.000(Ft.)
Channel base width      =  200.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =     26.289(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     26.289(CFS)
Depth of flow =   0.137(Ft.), Average velocity =   0.953(Ft/s)
Channel flow top width =  201.649(Ft.)
Flow Velocity =    0.95(Ft/s)
Travel time  =   12.25 min.
Time of concentration =   21.97 min.
Critical depth =      0.081(Ft.)
 Adding area flow to channel
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Rainfall intensity =      2.229(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.879
Subarea runoff =     12.705(CFS) for   10.470(Ac.)
Total runoff =     32.603(CFS)
Effective area this stream =       16.64(Ac.)
Total Study Area (Main Stream No. 1) =       16.64(Ac.)
Area averaged Fm value =    0.052(In/Hr)
Depth of flow =   0.156(Ft.), Average velocity =   1.038(Ft/s)
Critical depth =      0.094(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      303.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   572.000(Ft.)
Downstream point elevation =   566.500(Ft.)
Channel length thru subarea  =   800.000(Ft.)
Channel base width      =  200.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =     36.391(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    5.000(Ft.)
```

```
Flow(q) thru subarea =     36.391(CFS)
Depth of flow =   0.102(Ft.), Average velocity =   1.785(Ft/s)
Channel flow top width =  201.219(Ft.)
Flow Velocity =    1.79(Ft/s)
Travel time  =    7.47 min.
Time of concentration =   29.44 min.
Critical depth =      0.101(Ft.)
 Adding area flow to channel
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Rainfall intensity =      1.870(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.875
Subarea runoff =      7.500(CFS) for    7.870(Ac.)
Total runoff =     40.103(CFS)
Effective area this stream =       24.51(Ac.)
Total Study Area (Main Stream No. 1) =       24.51(Ac.)
Area averaged Fm value =    0.052(In/Hr)
Depth of flow =   0.108(Ft.), Average velocity =   1.855(Ft/s)
Critical depth =      0.107(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   566.500(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    40.103(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    40.103(CFS)
Normal flow depth in pipe =   24.00(In.)
Flow top width inside pipe =   24.00(In.)
Critical Depth =   25.57(In.)
Pipe flow velocity =      9.52(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    29.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     24.510(Ac.)
Runoff from this stream =     40.103(CFS)
Time of concentration =   29.52 min.
Rainfall intensity =     1.867(In/Hr)
Area averaged loss rate (Fm) =    0.0523(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      304.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Initial subarea data:
Initial area flow distance =   550.000(Ft.)
Top (of initial area) elevation =   574.000(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01091  s(%)=       1.09
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.364 min.
Rainfall intensity =      3.719(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.894
Subarea runoff =      3.988(CFS)
Total initial stream area =        1.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.026(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =   310.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.988(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.988(CFS)
Normal flow depth in pipe =    9.86(In.)
Flow top width inside pipe =   14.24(In.)
Critical Depth =    9.69(In.)
Pipe flow velocity =      4.66(Ft/s)
Travel time through pipe =    1.11 min.
Time of concentration (TC) =    10.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.200(Ac.)
Runoff from this stream =      3.988(CFS)
Time of concentration =   10.47 min.
Rainfall intensity =     3.477(In/Hr)
```

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Area averaged loss rate (Fm) =    0.0262(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Initial subarea data:
Initial area flow distance =   745.000(Ft.)
Top (of initial area) elevation =   569.000(Ft.)
Bottom (of initial area) elevation =   566.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00403  s(%)=       0.40
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.905 min.
Rainfall intensity =      3.068(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =      5.748(CFS)
Total initial stream area =        2.100(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.026(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.100(Ac.)
Runoff from this stream =      5.748(CFS)
Time of concentration =   12.90 min.
Rainfall intensity =     3.068(In/Hr)
Area averaged loss rate (Fm) =    0.0262(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     40.10    24.510     29.52    0.052      1.867
2      3.99     1.200     10.47    0.026      3.477
3      5.75     2.100     12.90    0.026      3.068
Qmax(1) =
         1.000 *    1.000 *    40.103) +
         0.533 *    1.000 *     3.988) +
         0.605 *    1.000 *     5.748) + =      45.709
Qmax(2) =
```

```
         1.887 *    0.355 *    40.103) +
         1.000 *    1.000 *     3.988) +
         1.135 *    0.812 *     5.748) + =      36.127
Qmax(3) =
         1.662 *    0.437 *    40.103) +
         0.881 *    1.000 *     3.988) +
         1.000 *    1.000 *     5.748) + =      38.388

Total of 3 streams to confluence:
Flow rates before confluence point:
      40.103       3.988       5.748
Maximum flow rates at confluence using above data:
       45.709       36.127       38.388
Area of streams before confluence:
       24.510        1.200        2.100
Effective area values after confluence:
       27.810       11.598       14.013
Results of confluence:
Total flow rate =     45.709(CFS)
Time of concentration =    29.525 min.
Effective stream area after confluence =     27.810(Ac.)
Study area average Pervious fraction(Ap) =  0.188
Study area average soil loss rate(Fm) =    0.049(In/Hr)
Study area total (this main stream) =      27.81(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      301.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   566.000(Ft.)
Downstream point/station elevation =   550.000(Ft.)
Pipe length  =   220.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    45.709(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    45.709(CFS)
Normal flow depth in pipe =   15.49(In.)
Flow top width inside pipe =   22.96(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.31(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    29.70 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      301.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    29.70 min.
```

```
Rainfall intensity =      1.860(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.874
Subarea runoff =      1.791(CFS) for    1.390(Ac.)
Total runoff =     47.501(CFS)
Effective area this stream =       29.20(Ac.)
Total Study Area (Main Stream No. 1) =       29.20(Ac.)
Area averaged Fm value =    0.053(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      300.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   550.000(Ft.)
Downstream point/station elevation =   540.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    47.501(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    47.501(CFS)
Normal flow depth in pipe =   16.31(In.)
Flow top width inside pipe =   17.49(In.)
Critical depth could not be calculated.
Pipe flow velocity =     23.70(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    29.77 min.
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN A300
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 403.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.052(In/Hr)
Initial subarea data:
Initial area flow distance = 205.000(Ft.)
Top (of initial area) elevation = 571.000(Ft.)
Bottom (of initial area) elevation = 569.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00976 s(%)= 0.98
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.877 min.
Rainfall intensity = 4.475(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.889
Subarea runoff = 9.036(CFS)
Total initial stream area = 2.270(Ac.)
Pervious area fraction = 0.200

```
Initial area Fm value =    0.052(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      401.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   569.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   520.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =   0.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =     16.154(CFS)
Depth of flow =   0.466(Ft.), Average velocity =   2.688(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.964(Ft.)
Flow velocity =   2.69(Ft/s)
Travel time =    3.22 min.     TC =   10.10  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.052(In/Hr)
Rainfall intensity =      3.553(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.887
Subarea runoff =     14.123(CFS) for    5.080(Ac.)
Total runoff =     23.159(CFS)
Effective area this stream =        7.35(Ac.)
Total Study Area (Main Stream No. 1) =        7.35(Ac.)
Area averaged Fm value =    0.052(In/Hr)
Street flow at end of street =     23.159(CFS)
Half street flow at end of street =     11.580(CFS)
Depth of flow =   0.522(Ft.), Average velocity =   2.862(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    1.10(Ft.)
Flow width (from curb towards crown)=  19.766(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      400.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
```

Upstream point/station elevation = 569.000(Ft.)
Downstream point/station elevation = 540.000(Ft.)
Pipe length = 120.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 23.159(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 23.159(CFS)
Normal flow depth in pipe = 9.50(In.)
Flow top width inside pipe = 14.45(In.)
Critical depth could not be calculated.
Pipe flow velocity = 28.24(Ft/s)
Travel time through pipe = 0.07 min.
Time of concentration (TC) = 10.17 min.
End of computations, Total Study Area = 7.35 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B400
100 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.220 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 503.000 to Point/Station 502.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.026(In/Hr)
Initial subarea data:
Initial area flow distance = 205.000(Ft.)
Top (of initial area) elevation = 571.000(Ft.)
Bottom (of initial area) elevation = 569.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00976 s(%)= 0.98
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.452 min.
Rainfall intensity = 4.650(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.895
Subarea runoff = 6.991(CFS)
Total initial stream area = 1.680(Ac.)
Pervious area fraction = 0.100

```
Initial area Fm value =    0.026(In/Hr)


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Process from Point/Station      502.000 to Point/Station      501.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   569.000(Ft.)
Downstream point elevation =   566.000(Ft.)
Channel length thru subarea  =   480.000(Ft.)
Channel base width      =  100.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =     10.946(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     10.946(CFS)
Depth of flow =   0.077(Ft.), Average velocity =   1.414(Ft/s)
Channel flow top width =  100.925(Ft.)
Flow Velocity =    1.41(Ft/s)
Travel time  =    5.66 min.
Time of concentration =   12.11 min.
Critical depth =      0.072(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Adjusted SCS curve number for AMC 3 = 86.20
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.026(In/Hr)
Rainfall intensity =      3.187(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.893
Subarea runoff =      7.829(CFS) for    3.530(Ac.)
Total runoff =     14.820(CFS)
Effective area this stream =        5.21(Ac.)
Total Study Area (Main Stream No. 1) =        5.21(Ac.)
Area averaged Fm value =    0.026(In/Hr)
Depth of flow =   0.092(Ft.), Average velocity =   1.595(Ft/s)
Critical depth =      0.088(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      500.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   560.000(Ft.)
Downstream point/station elevation =   540.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.820(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    14.820(CFS)
Normal flow depth in pipe =    9.16(In.)
Flow top width inside pipe =   10.20(In.)
Critical depth could not be calculated.
```

Pipe flow velocity =   23.05(Ft/s)
Travel time through pipe =   0.07 min.
Time of concentration (TC) =   12.18 min.
End of computations, Total Study Area =   5.21 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 69.0

APPENDIX B: 2-YEAR DEVELOPED CONDITION MODEL OUTPUT

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/08/15

BASIN A100
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 105.000 to Point/Station 104.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.110(In/Hr)
Initial subarea data:
Initial area flow distance = 575.000(Ft.)
Top (of initial area) elevation = 571.500(Ft.)
Bottom (of initial area) elevation = 570.500(Ft.)
Difference in elevation = 1.000(Ft.)
Slope = 0.00174 s(%)= 0.17
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 14.667 min.
Rainfall intensity = 1.164(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.815
Subarea runoff = 2.886(CFS)
Total initial stream area = 3.040(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.110(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =   570.500(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   820.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      5.474(CFS)
Depth of flow =   0.407(Ft.), Average velocity =   2.082(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.000(Ft.)
Flow velocity =   2.08(Ft/s)
Travel time =    6.56 min.     TC =   21.23  min.
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Rainfall intensity =      0.933(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.715
Subarea runoff =      5.106(CFS) for    8.940(Ac.)
Total runoff =      7.992(CFS)
Effective area this stream =       11.98(Ac.)
Total Study Area (Main Stream No. 1) =       11.98(Ac.)
Area averaged Fm value =    0.191(In/Hr)
Street flow at end of street =      7.992(CFS)
Half street flow at end of street =      7.992(CFS)
Depth of flow =   0.455(Ft.), Average velocity =   2.419(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  14.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   567.000(Ft.)
```

```
Downstream point/station elevation =   562.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.992(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.992(CFS)
Normal flow depth in pipe =    7.97(In.)
Flow top width inside pipe =   14.97(In.)
Critical Depth =   13.37(In.)
Pipe flow velocity =     12.07(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    21.37 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      102.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    21.37 min.
Rainfall intensity =      0.929(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.738
Subarea runoff =      1.991(CFS) for    2.580(Ac.)
Total runoff =      9.982(CFS)
Effective area this stream =       14.56(Ac.)
Total Study Area (Main Stream No. 1) =       14.56(Ac.)
Area averaged Fm value =    0.167(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      101.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =   300.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.982(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     9.982(CFS)
Normal flow depth in pipe =    9.19(In.)
Flow top width inside pipe =   10.17(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.46(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    21.69 min.
End of computations, Total Study Area =           14.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.305
Area averaged SCS curve number =  69.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/08/15

BASIN A200
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 124.000 to Point/Station 123.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.219(In/Hr)
Initial subarea data:
Initial area flow distance = 344.000(Ft.)
Top (of initial area) elevation = 570.500(Ft.)
Bottom (of initial area) elevation = 567.000(Ft.)
Difference in elevation = 3.500(Ft.)
Slope = 0.01017 s(%)= 1.02
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.683 min.
Rainfall intensity = 1.494(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.768
Subarea runoff = 3.464(CFS)
Total initial stream area = 3.020(Ac.)
Pervious area fraction = 0.400
Initial area Fm value = 0.219(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      121.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =   567.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   344.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  14.000(Ft.)
Distance from crown to crossfall grade break  =  12.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =   4.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      6.380(CFS)
Depth of flow =   0.450(Ft.), Average velocity =   1.970(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.000(Ft.)
Flow velocity =   1.97(Ft/s)
Travel time =    2.91 min.     TC =   12.59  min.
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Rainfall intensity =      1.276(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.745
Subarea runoff =      5.760(CFS) for    6.680(Ac.)
Total runoff =      9.225(CFS)
Effective area this stream =        9.70(Ac.)
Total Study Area (Main Stream No. 1) =        9.70(Ac.)
Area averaged Fm value =    0.219(In/Hr)
Street flow at end of street =      9.225(CFS)
Half street flow at end of street =      9.225(CFS)
Depth of flow =   0.513(Ft.), Average velocity =   2.242(Ft/s)
Warning: depth of flow exceeds top of curb
Note:  depth of flow exceeds top of street crown.
Distance that curb overflow reaches into property =    0.63(Ft.)
Flow width (from curb towards crown)=  14.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      121.000
**** SUBAREA FLOW ADDITION ****
```

```
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    12.59 min.
Rainfall intensity =      1.276(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.745
Subarea runoff =      3.994(CFS) for    4.200(Ac.)
Total runoff =     13.219(CFS)
Effective area this stream =       13.90(Ac.)
Total Study Area (Main Stream No. 1) =       13.90(Ac.)
Area averaged Fm value =    0.219(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      121.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    12.59 min.
Rainfall intensity =      1.276(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.745
Subarea runoff =      4.565(CFS) for    4.800(Ac.)
Total runoff =     17.783(CFS)
Effective area this stream =       18.70(Ac.)
Total Study Area (Main Stream No. 1) =       18.70(Ac.)
Area averaged Fm value =    0.219(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   566.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =   315.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.783(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    17.783(CFS)
Normal flow depth in pipe =   10.90(In.)
Flow top width inside pipe =   13.37(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.63(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    12.87 min.
```

End of computations, Total Study Area = 18.70 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.400
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/11/15

SUBAREA A300
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 148.000 to Point/Station 145.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.219(In/Hr)
Initial subarea data:
Initial area flow distance = 524.000(Ft.)
Top (of initial area) elevation = 572.000(Ft.)
Bottom (of initial area) elevation = 568.000(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00763 s(%)= 0.76
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.136 min.
Rainfall intensity = 1.304(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.749
Subarea runoff = 4.874(CFS)
Total initial stream area = 4.990(Ac.)
Pervious area fraction = 0.400
Initial area Fm value = 0.219(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      1.304(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.765
Subarea runoff =      0.933(CFS) for    0.830(Ac.)
Total runoff =      5.807(CFS)
Effective area this stream =        5.82(Ac.)
Total Study Area (Main Stream No. 1) =        5.82(Ac.)
Area averaged Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      150.000 to Point/Station      145.000
**** CONFLUENCE OF MAIN STREAMS ****
----------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.820(Ac.)
Runoff from this stream =      5.807(CFS)
Time of concentration =   12.14 min.
Rainfall intensity =     1.304(In/Hr)
Area averaged loss rate (Fm) =    0.1957(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3572
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      149.000 to Point/Station      145.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Initial subarea data:
Initial area flow distance =   634.000(Ft.)
Top (of initial area) elevation =   573.000(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
Difference in elevation =     5.000(Ft.)
Slope =    0.00789  s(%)=       0.79
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =   13.012 min.
Rainfall intensity =      1.251(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.742
Subarea runoff =      7.838(CFS)
Total initial stream area =        8.440(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.219(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      149.000 to Point/Station      145.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      8.440(Ac.)
Runoff from this stream =      7.838(CFS)
Time of concentration =   13.01 min.
Rainfall intensity =     1.251(In/Hr)
Area averaged loss rate (Fm) =    0.2192(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      5.81     5.820     12.14    0.196      1.304
2      7.84     8.440     13.01    0.219      1.251
Qmax(1) =
         1.000 *    1.000 *     5.807) +
         1.052 *    0.933 *     7.838) + =      13.496
Qmax(2) =
         0.952 *    1.000 *     5.807) +
         1.000 *    1.000 *     7.838) + =      13.366

Total of 2 main streams to confluence:
Flow rates before confluence point:
       6.807       8.838
Maximum flow rates at confluence using above data:
       13.496       13.366
Area of streams before confluence:
        5.820        8.440
Effective area values after confluence:
       13.692       14.260


Results of confluence:
Total flow rate =     13.496(CFS)
Time of concentration =    12.136 min.
Effective stream area after confluence  =     13.692(Ac.)
Study area average Pervious fraction(Ap) =  0.383
Study area average soil loss rate(Fm) =    0.210(In/Hr)
Study area total =      14.26(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      147.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      1.304(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =      3.922(CFS) for    4.020(Ac.)
Total runoff =     17.418(CFS)
Effective area this stream =       17.71(Ac.)
Total Study Area (Main Stream No. 1) =       18.28(Ac.)
Area averaged Fm value =    0.212(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      146.000 to Point/Station      145.000
**** SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    12.14 min.
Rainfall intensity =      1.304(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.753
Subarea runoff =      4.737(CFS) for    4.850(Ac.)
Total runoff =     22.155(CFS)
Effective area this stream =       22.56(Ac.)
Total Study Area (Main Stream No. 1) =       23.13(Ac.)
Area averaged Fm value =    0.213(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      145.000 to Point/Station      144.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
----------------------------------------------------------------------
Top of street segment elevation =   568.000(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   747.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
```

```
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =     22.155(CFS)
Half street flow before street inlet =     11.078(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 2
Depth of flow =   0.651(Ft.), Average velocity =   1.626(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =     22.000(Ft.)
 Flow rate in gutter section of street = Qw =      2.260(CFS)
 Ratio of frontal flow to total flow = E0 =  0.2040
 Given curb inlet length  L =     14.000(Ft.)
Street slope is less than .5% , depth of flow indicates an orifice flow
condition exists for an opening height of    6.00(In.)
Using equation Qi = .67hL(2gd0)^.5
Total inlet flow capacity=     23.819(CFS)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 0.9167 right of way
            10.0000                 0.6667 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.1667 gutter/depression end
            14.0000                 0.2067 grade break
            32.0000                 0.5667 crown
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000
Note: Single inlet capacity is greater than 1/2 street flow

Pipe calculations for under street flow rate of     22.155(CFS)
Using a pipe slope =      0.500 %
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   747.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.155(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    22.155(CFS)
Normal flow depth in pipe =   19.64(In.)
Flow top width inside pipe =   28.53(In.)
Critical Depth =   19.20(In.)
Pipe flow velocity =      6.51(Ft/s)
Travel time through pipe =    1.91 min.
Time of concentration (TC) =    14.05 min.
Maximum flow rate of street inlet(s) =     22.155(CFS)
Maximum pipe flow capacity =     22.155(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Rainfall intensity =      1.195(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.751
Subarea runoff =      0.246(CFS) for    2.410(Ac.)
Total runoff =     22.401(CFS)
Effective area this stream =       24.97(Ac.)
Total Study Area (Main Stream No. 1) =       25.54(Ac.)
Area averaged Fm value =    0.198(In/Hr)
Street flow at end of street =      0.246(CFS)
Half street flow at end of street =      0.123(CFS)
Depth of flow =   0.181(Ft.), Average velocity =   0.609(Ft/s)
Flow width (from curb towards crown)=   2.736(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      144.000 to Point/Station      143.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   567.000(Ft.)
End of street segment elevation =   566.500(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      0.246(CFS)
Half street flow before street inlet =      0.123(CFS)
Existing pipe flow before street inlet =     22.155(CFS)
Number of street inlets = 2
Depth of flow =   0.169(Ft.), Average velocity =   0.720(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      2.092(Ft.)
 Flow rate in gutter section of street = Qw =      0.123(CFS)
 Ratio of frontal flow to total flow = E0 =  1.0000
 Given curb inlet length  L =     14.000(Ft.)
Street slope is less than .5% , depth of flow indicates a weir flow
condition exists for an opening height of    8.00(In.)
Using equation Qweir = 2.3(1.25 for SI) (L + 1.8W)d^1.5)
Total inlet flow capacity=      2.800(CFS)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
```

```
            0.0000                0.9167 right of way
           10.0000                0.6667 top of curb
           10.0000                0.0000 flow line
           12.0000                0.1667 gutter/depression end
           14.0000                0.2067 grade break
           32.0000                0.5667 crown
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000
Note: Single inlet capacity is greater than 1/2 street flow

Pipe calculations for under street flow rate of     22.401(CFS)
Using a pipe slope =      0.500 %
Upstream point/station elevation =   567.000(Ft.)
Downstream point/station elevation =   566.500(Ft.)
Pipe length  =   300.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.401(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    22.401(CFS)
Normal flow depth in pipe =   19.78(In.)
Flow top width inside pipe =   28.44(In.)
Critical Depth =   19.34(In.)
Pipe flow velocity =      6.52(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =    14.82 min.
Maximum flow rate of street inlet(s) =      0.246(CFS)
Maximum pipe flow capacity =     22.401(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Rainfall intensity =      1.157(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.744
Subarea runoff =      1.792(CFS) for    3.120(Ac.)
Total runoff =     24.192(CFS)
Effective area this stream =       28.09(Ac.)
Total Study Area (Main Stream No. 1) =       28.66(Ac.)
Area averaged Fm value =    0.200(In/Hr)
Street flow at end of street =      1.792(CFS)
Half street flow at end of street =      0.896(CFS)
Depth of flow =   0.314(Ft.), Average velocity =   0.892(Ft/s)
Flow width (from curb towards crown)=   9.366(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      143.000 to Point/Station      142.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   568.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   400.000(Ft.)
```

```
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      1.792(CFS)
Half street flow before street inlet =      0.896(CFS)
Existing pipe flow before street inlet =     22.401(CFS)
Number of street inlets = 2
Depth of flow =   0.272(Ft.), Average velocity =   1.372(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      7.255(Ft.)
 Flow rate in gutter section of street = Qw =      0.647(CFS)
 Ratio of frontal flow to total flow = E0 =  0.7220
 Given curb inlet length  L =     27.000(Ft.)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 0.9167 right of way
            10.0000                 0.6667 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.1667 gutter/depression end
            14.0000                 0.2067 grade break
            32.0000                 0.5667 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     15.188(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0050
 Se = Equivalent Street x-slope including depression =  0.0200
 Gutter depression depth =      0.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of     24.192(CFS)
Using a pipe slope =      1.000 %
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.192(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    24.192(CFS)
Normal flow depth in pipe =   17.95(In.)
Flow top width inside pipe =   25.49(In.)
Critical Depth =   20.65(In.)
Pipe flow velocity =      8.62(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =    15.59 min.
Maximum flow rate of street inlet(s) =      1.792(CFS)
```

```
Maximum pipe flow capacity =     24.192(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
RESIDENTIAL(5 - 7 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.5000     Max loss rate(Fm)=     0.274(In/Hr)
Rainfall intensity =      1.122(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.728
Subarea runoff =      4.435(CFS) for    6.960(Ac.)
Total runoff =     28.627(CFS)
Effective area this stream =       35.05(Ac.)
Total Study Area (Main Stream No. 1) =       35.62(Ac.)
Area averaged Fm value =    0.215(In/Hr)
Street flow at end of street =      4.435(CFS)
Half street flow at end of street =      2.217(CFS)
Depth of flow =   0.345(Ft.), Average velocity =   1.677(Ft/s)
Flow width (from curb towards crown)=  10.934(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      142.000 to Point/Station      141.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   561.000(Ft.)
Downstream point/station elevation =   560.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    28.627(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    28.627(CFS)
Normal flow depth in pipe =   20.48(In.)
Flow top width inside pipe =   23.11(In.)
Critical Depth =   22.30(In.)
Pipe flow velocity =      8.84(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    15.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      142.000 to Point/Station      141.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     35.052(Ac.)
Runoff from this stream =     28.627(CFS)
Time of concentration =   15.78 min.
Rainfall intensity =     1.114(In/Hr)
Area averaged loss rate (Fm) =    0.2150(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3924
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      152.000 to Point/Station      151.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Initial subarea data:
Initial area flow distance =   690.000(Ft.)
Top (of initial area) elevation =   571.000(Ft.)
Bottom (of initial area) elevation =   567.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.00580  s(%)=       0.58
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.314 min.
Rainfall intensity =      1.181(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.733
Subarea runoff =      3.326(CFS)
Total initial stream area =        3.840(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.219(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      151.000 to Point/Station      141.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   561.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.326(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     3.326(CFS)
Normal flow depth in pipe =   10.39(In.)
Flow top width inside pipe =   17.78(In.)
Critical Depth =    8.34(In.)
Pipe flow velocity =      3.15(Ft/s)
Travel time through pipe =    2.12 min.
Time of concentration (TC) =    16.43 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      151.000 to Point/Station      141.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      3.840(Ac.)
Runoff from this stream =      3.326(CFS)
Time of concentration =   16.43 min.
Rainfall intensity =     1.087(In/Hr)
Area averaged loss rate (Fm) =    0.2192(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

Summary of stream data:

Stream No.	Flow rate (CFS)	Area (Ac.)	TC (min)	Fm (In/Hr)	Rainfall Intensity (In/Hr)
1	28.63	35.052	15.78	0.215	1.114
2	3.33	3.840	16.43	0.219	1.087

```
Qmax(1) =
         1.000 *    1.000 *    28.627) +
         1.031 *    0.960 *     3.326) + =      31.919
Qmax(2) =
         0.970 *    1.000 *    28.627) +
         1.000 *    1.000 *     3.326) + =      31.096
```

Total of 2 main streams to confluence:
Flow rates before confluence point:
29.627 4.326
Maximum flow rates at confluence using above data:
31.919 31.096
Area of streams before confluence:
35.052 3.840
Effective area values after confluence:
38.738 38.892

Results of confluence:
Total flow rate = 31.919(CFS)
Time of concentration = 15.778 min.
Effective stream area after confluence = 38.738(Ac.)
Study area average Pervious fraction(Ap) = 0.393
Study area average soil loss rate(Fm) = 0.215(In/Hr)
Study area total = 38.89(Ac.)

++
Process from Point/Station 141.000 to Point/Station 140.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 561.000(Ft.)
Downstream point/station elevation = 555.000(Ft.)
Pipe length = 250.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 31.919(CFS)
Nearest computed pipe diameter = 24.00(In.)
Calculated individual pipe flow = 31.919(CFS)
Normal flow depth in pipe = 17.98(In.)
Flow top width inside pipe = 20.81(In.)
Critical Depth = 22.67(In.)
Pipe flow velocity = 12.64(Ft/s)
Travel time through pipe = 0.33 min.
Time of concentration (TC) = 16.11 min.

++
Process from Point/Station 141.000 to Point/Station 140.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q = 31.410(CFS)
therefore the upstream flow rate of Q = 31.919(CFS) is being used
Time of concentration = 16.11 min.
Rainfall intensity = 1.101(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.721
Subarea runoff = 0.000(CFS) for 0.850(Ac.)
Total runoff = 31.919(CFS)
Effective area this stream = 39.59(Ac.)
Total Study Area (Main Stream No. 1) = 40.31(Ac.)
Area averaged Fm value = 0.219(In/Hr)
End of computations, Total Study Area = 40.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.406
Area averaged SCS curve number = 69.2

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/08/15

SUBAREA BASIN A400
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 162.000 to Point/Station 161.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 570.000(Ft.)
Bottom (of initial area) elevation = 549.000(Ft.)
Difference in elevation = 21.000(Ft.)
Slope = 0.02100 s(%)= 2.10
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 24.230 min.
Rainfall intensity = 0.861(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.496
Subarea runoff = 0.684(CFS)
Total initial stream area = 1.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.387(In/Hr)

```
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Process from Point/Station      161.000 to Point/Station      160.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    24.23 min.
Rainfall intensity =      0.861(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.695
Subarea runoff =      1.561(CFS) for    2.150(Ac.)
Total runoff =      2.245(CFS)
Effective area this stream =        3.75(Ac.)
Total Study Area (Main Stream No. 1) =        3.75(Ac.)
Area averaged Fm value =    0.196(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      160.000 to Point/Station      150.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   544.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.245(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     2.245(CFS)
Normal flow depth in pipe =    4.63(In.)
Flow top width inside pipe =    5.03(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.79(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    24.29 min.
End of computations, Total Study Area =            3.75 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.484
Area averaged SCS curve number =  73.3
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/11/15

SUBAREA A500
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 171.000 to Point/Station 170.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.055(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 566.000(Ft.)
Bottom (of initial area) elevation = 553.000(Ft.)
Difference in elevation = 13.000(Ft.)
Slope = 0.01300 s(%)= 1.30
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.484 min.
Rainfall intensity = 1.348(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.863
Subarea runoff = 1.490(CFS)
Total initial stream area = 1.280(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.055(In/Hr)

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Process from Point/Station      170.000 to Point/Station      150.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   553.000(Ft.)
Downstream point/station elevation =   535.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.490(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     1.490(CFS)
Normal flow depth in pipe =    2.79(In.)
Flow top width inside pipe =    5.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.62(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    11.53 min.


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Process from Point/Station      151.000 to Point/Station      150.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    11.53 min.
Rainfall intensity =      1.345(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.753
Subarea runoff =      1.082(CFS) for    1.260(Ac.)
Total runoff =      2.573(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.219(In/Hr)
End of computations, Total Study Area =            2.54 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.546
Area averaged SCS curve number =  74.0
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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B100
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 205.000 to Point/Station 204.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.4000 Max loss rate(Fm)= 0.219(In/Hr)
Initial subarea data:
Initial area flow distance = 436.000(Ft.)
Top (of initial area) elevation = 572.000(Ft.)
Bottom (of initial area) elevation = 568.500(Ft.)
Difference in elevation = 3.500(Ft.)
Slope = 0.00803 s(%)= 0.80
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.162 min.
Rainfall intensity = 1.372(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.756
Subarea runoff = 3.163(CFS)
Total initial stream area = 3.050(Ac.)
Pervious area fraction = 0.400
Initial area Fm value = 0.219(In/Hr)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    11.16 min.
Rainfall intensity =      1.372(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.756
Subarea runoff =      3.246(CFS) for    3.130(Ac.)
Total runoff =      6.410(CFS)
Effective area this stream =        6.18(Ac.)
Total Study Area (Main Stream No. 1) =        6.18(Ac.)
Area averaged Fm value =    0.219(In/Hr)


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Process from Point/Station      150.000 to Point/Station      204.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    11.16 min.
Rainfall intensity =      1.372(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.765
Subarea runoff =      0.687(CFS) for    0.580(Ac.)
Total runoff =      7.097(CFS)
Effective area this stream =        6.76(Ac.)
Total Study Area (Main Stream No. 1) =        6.76(Ac.)
Area averaged Fm value =    0.205(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      203.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
_____________________________________________________________________________
Top of street segment elevation =   568.500(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   100.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
```

```
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      7.097(CFS)
Half street flow before street inlet =      3.548(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 2
Depth of flow =   0.556(Ft.), Average velocity =   3.007(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      8.963(Ft.)
 Flow rate in gutter section of street = Qw =      2.698(CFS)
 Ratio of frontal flow to total flow = E0 =  0.7602
 Given curb inlet length  L =     14.000(Ft.)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 1.1667 right of way
            10.0000                 0.9167 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.4167 gutter/depression end
            14.0000                 0.4567 grade break
            32.0000                 0.8167 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =     13.178(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0150
 Se = Equivalent Street x-slope including depression =  0.1150
 Gutter depression depth =      3.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of      7.097(CFS)
Using a pipe slope =      1.500 %
Upstream point/station elevation =   568.500(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.097(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.097(CFS)
Normal flow depth in pipe =   11.09(In.)
Flow top width inside pipe =   13.17(In.)
Critical Depth =   12.79(In.)
Pipe flow velocity =      7.29(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =    11.39 min.
Maximum flow rate of street inlet(s) =      7.097(CFS)
Maximum pipe flow capacity =      7.097(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
COMMERCIAL subarea type
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Rainfall intensity =      1.355(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.769
Subarea runoff =      0.367(CFS) for    0.400(Ac.)
Total runoff =      7.464(CFS)
Effective area this stream =        7.16(Ac.)
Total Study Area (Main Stream No. 1) =        7.16(Ac.)
Area averaged Fm value =    0.197(In/Hr)
Street flow at end of street =      0.367(CFS)
Half street flow at end of street =      0.184(CFS)
Depth of flow =   0.129(Ft.), Average velocity =   1.844(Ft/s)
Flow width (from curb towards crown)=   2.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      7.160(Ac.)
Runoff from this stream =      7.464(CFS)
Time of concentration =   11.39 min.
Rainfall intensity =     1.355(In/Hr)
Area averaged loss rate (Fm) =    0.1967(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3589


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      207.000 to Point/Station      203.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Initial subarea data:
Initial area flow distance =   394.000(Ft.)
Top (of initial area) elevation =   571.200(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
Difference in elevation =     3.200(Ft.)
Slope =    0.00812  s(%)=       0.81
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.694 min.
Rainfall intensity =      1.407(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.760
Subarea runoff =      2.310(CFS)
Total initial stream area =        2.160(Ac.)
Pervious area fraction = 0.400
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Initial area Fm value =    0.219(In/Hr)


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Process from Point/Station      203.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   567.500(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.310(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.310(CFS)
Normal flow depth in pipe =    7.03(In.)
Flow top width inside pipe =   11.82(In.)
Critical Depth =    7.81(In.)
Pipe flow velocity =      4.83(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    10.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.160(Ac.)
Runoff from this stream =      2.310(CFS)
Time of concentration =   10.87 min.
Rainfall intensity =     1.394(In/Hr)
Area averaged loss rate (Fm) =    0.2192(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      203.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Initial subarea data:
Initial area flow distance =   540.000(Ft.)
Top (of initial area) elevation =   572.000(Ft.)
Bottom (of initial area) elevation =   569.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00556  s(%)=       0.56
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.088 min.
Rainfall intensity =      1.247(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.742
Subarea runoff =      2.608(CFS)
Total initial stream area =        2.820(Ac.)
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Pervious area fraction = 0.400
Initial area Fm value =    0.219(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   569.000(Ft.)
Downstream point/station elevation =   568.500(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.608(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.608(CFS)
Normal flow depth in pipe =    7.63(In.)
Flow top width inside pipe =   11.55(In.)
Critical Depth =    8.30(In.)
Pipe flow velocity =      4.95(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    13.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      202.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.820(Ac.)
Runoff from this stream =      2.608(CFS)
Time of concentration =   13.26 min.
Rainfall intensity =     1.237(In/Hr)
Area averaged loss rate (Fm) =    0.2192(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      7.46     7.160     11.39    0.197      1.355
2      2.31     2.160     10.87    0.219      1.394
3      2.61     2.820     13.26    0.219      1.237
Qmax(1) =
         1.000 *    1.000 *     7.464) +
         0.967 *    1.000 *     2.310) +
         1.116 *    0.859 *     2.608) + =      12.198
Qmax(2) =
         1.034 *    0.954 *     7.464) +
         1.000 *    1.000 *     2.310) +
         1.154 *    0.820 *     2.608) + =      12.136
Qmax(3) =
         0.898 *    1.000 *     7.464) +
         0.867 *    1.000 *     2.310) +
         1.000 *    1.000 *     2.608) + =      11.314

Total of 3 streams to confluence:
Flow rates before confluence point:
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       7.464       2.310       2.608
Maximum flow rates at confluence using above data:
       12.198       12.136       11.314
Area of streams before confluence:
        7.160        2.160        2.820
Effective area values after confluence:
       11.743       11.302       12.140
Results of confluence:
Total flow rate =     12.198(CFS)
Time of concentration =    11.391 min.
Effective stream area after confluence =     11.743(Ac.)
Study area average Pervious fraction(Ap) =  0.376
Study area average soil loss rate(Fm) =    0.206(In/Hr)
Study area total (this main stream) =      12.14(Ac.)


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Process from Point/Station      202.000 to Point/Station      201.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
________________________________________________________________________
Top of street segment elevation =   568.500(Ft.)
End of street segment elevation =   567.000(Ft.)
Length of street segment  =   180.000(Ft.)
Height of curb above gutter flowline  =    8.0(In.)
Width of half street (curb to crown)  =  22.000(Ft.)
Distance from crown to crossfall grade break  =  18.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150

Street Inlet Calculations:
Street flow before street inlet =      0.183(CFS)
Half street flow before street inlet =      0.092(CFS)
Existing pipe flow before street inlet =     12.014(CFS)
Number of street inlets = 2
Depth of flow =   0.161(Ft.), Average velocity =   1.470(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      2.000(Ft.)
 Flow rate in gutter section of street = Qw =      0.092(CFS)
 Ratio of frontal flow to total flow = E0 =  1.0000
 Given curb inlet length  L =     14.000(Ft.)

Half street cross section data points at curb inlet:
             X-coordinate (Ft.)   Y-coordinate (Ft.)
             0.0000                 1.1667 right of way
            10.0000                 0.9167 top of curb
            10.0000                 0.0000 flow line
            12.0000                 0.4167 gutter/depression end
            14.0000                 0.4567 grade break
            32.0000                 0.8167 crown
```

```
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =      2.070(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0083
 Se = Equivalent Street x-slope including depression =  0.1450
 Gutter depression depth =      3.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  1.0000

Pipe calculations for under street flow rate of     12.198(CFS)
Using a pipe slope =      0.833 %
Upstream point/station elevation =   568.500(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   180.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.198(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.198(CFS)
Normal flow depth in pipe =   14.79(In.)
Flow top width inside pipe =   19.17(In.)
Critical Depth =   15.62(In.)
Pipe flow velocity =      6.74(Ft/s)
Travel time through pipe =    0.45 min.
Time of concentration (TC) =    11.84 min.
Maximum flow rate of street inlet(s) =      0.183(CFS)
Maximum pipe flow capacity =     12.198(CFS)
Remaining flow in street below inlet =      0.000(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Rainfall intensity =      1.324(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.764
Subarea runoff =      0.147(CFS) for    0.460(Ac.)
Total runoff =     12.344(CFS)
Effective area this stream =       12.20(Ac.)
Total Study Area (Main Stream No. 1) =       12.60(Ac.)
Area averaged Fm value =    0.200(In/Hr)
Street flow at end of street =      0.147(CFS)
Half street flow at end of street =      0.073(CFS)
Depth of flow =   0.102(Ft.), Average velocity =   1.176(Ft/s)
Flow width (from curb towards crown)=   2.000(Ft.)


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Process from Point/Station      201.000 to Point/Station      200.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   567.000(Ft.)
Downstream point/station elevation =   566.500(Ft.)
Pipe length  =    60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.344(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    12.344(CFS)
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Normal flow depth in pipe =   14.93(In.)
Flow top width inside pipe =   19.04(In.)
Critical Depth =   15.70(In.)
Pipe flow velocity =      6.76(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    11.98 min.


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Process from Point/Station      210.000 to Point/Station      200.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    11.98 min.
Rainfall intensity =      1.314(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.760
Subarea runoff =      3.628(CFS) for    3.790(Ac.)
Total runoff =     15.972(CFS)
Effective area this stream =       15.99(Ac.)
Total Study Area (Main Stream No. 1) =       16.39(Ac.)
Area averaged Fm value =    0.205(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      209.000 to Point/Station      200.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    11.98 min.
Rainfall intensity =      1.314(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.758
Subarea runoff =      3.016(CFS) for    3.060(Ac.)
Total runoff =     18.988(CFS)
Effective area this stream =       19.05(Ac.)
Total Study Area (Main Stream No. 1) =       19.45(Ac.)
Area averaged Fm value =    0.207(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      199.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   566.500(Ft.)
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Downstream point/station elevation =   565.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.988(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    18.988(CFS)
Normal flow depth in pipe =   16.83(In.)
Flow top width inside pipe =   16.76(In.)
Critical Depth =   18.88(In.)
Pipe flow velocity =      9.20(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =    12.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      199.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.053(Ac.)
Runoff from this stream =     18.988(CFS)
Time of concentration =   12.17 min.
Rainfall intensity =     1.303(In/Hr)
Area averaged loss rate (Fm) =    0.2070(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3778
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      222.000 to Point/Station      221.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.110(In/Hr)
Initial subarea data:
Initial area flow distance =   690.000(Ft.)
Top (of initial area) elevation =   570.500(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
Difference in elevation =     2.500(Ft.)
Slope =    0.00362  s(%)=       0.36
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.623 min.
Rainfall intensity =      1.217(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.819
Subarea runoff =      4.027(CFS)
Total initial stream area =        4.040(Ac.)
Pervious area fraction = 0.200
Initial area Fm value =    0.110(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      221.000 to Point/Station      214.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   568.500(Ft.)
Downstream point/station elevation =   568.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.027(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.027(CFS)
Normal flow depth in pipe =    8.58(In.)
Flow top width inside pipe =   14.84(In.)
Critical Depth =    9.74(In.)
Pipe flow velocity =      5.55(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    13.77 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      215.000 to Point/Station      214.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    13.77 min.
Rainfall intensity =      1.209(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.825
Subarea runoff =      0.833(CFS) for    0.830(Ac.)
Total runoff =      4.860(CFS)
Effective area this stream =        4.87(Ac.)
Total Study Area (Main Stream No. 2) =       24.32(Ac.)
Area averaged Fm value =    0.100(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      214.000 to Point/Station      212.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________
Upstream point/station elevation =   568.200(Ft.)
Downstream point/station elevation =   567.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.860(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     4.860(CFS)
Normal flow depth in pipe =   12.68(In.)
Flow top width inside pipe =   16.43(In.)
Critical Depth =   10.17(In.)
Pipe flow velocity =      3.65(Ft/s)
Travel time through pipe =    1.83 min.
Time of concentration (TC) =    15.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

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Process from Point/Station      213.000 to Point/Station      212.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.870(Ac.)
Runoff from this stream =      4.860(CFS)
Time of concentration =   15.60 min.
Rainfall intensity =     1.122(In/Hr)
Area averaged loss rate (Fm) =    0.1002(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1830


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      218.000 to Point/Station      217.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   489.000(Ft.)
Top (of initial area) elevation =   568.000(Ft.)
Bottom (of initial area) elevation =   566.000(Ft.)
Difference in elevation =     2.000(Ft.)
Slope =    0.00409  s(%)=       0.41
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.871 min.
Rainfall intensity =      1.394(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.865
Subarea runoff =      1.241(CFS)
Total initial stream area =        1.030(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      217.000 to Point/Station      216.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
____________________________________________________________________________
Upstream point/station elevation =   566.000(Ft.)
Downstream point/station elevation =   565.800(Ft.)
Pipe length  =    30.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.241(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.241(CFS)
Normal flow depth in pipe =    6.80(In.)
Flow top width inside pipe =    7.74(In.)
Critical Depth =    6.15(In.)
Pipe flow velocity =      3.47(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    11.01 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      216.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.219(In/Hr)
Time of concentration =    11.01 min.
Rainfall intensity =      1.383(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.774
Subarea runoff =      6.021(CFS) for    5.760(Ac.)
Total runoff =      7.262(CFS)
Effective area this stream =        6.79(Ac.)
Total Study Area (Main Stream No. 2) =       31.11(Ac.)
Area averaged Fm value =    0.194(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      216.000 to Point/Station      212.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   565.800(Ft.)
Downstream point/station elevation =   565.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.262(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     7.262(CFS)
Normal flow depth in pipe =   11.88(In.)
Flow top width inside pipe =   17.05(In.)
Critical Depth =   12.53(In.)
Pipe flow velocity =      5.87(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    11.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      216.000 to Point/Station      212.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      6.790(Ac.)
Runoff from this stream =      7.262(CFS)
Time of concentration =   11.30 min.
Rainfall intensity =     1.362(In/Hr)
Area averaged loss rate (Fm) =    0.1942(In/Hr)
Area averaged Pervious ratio (Ap) = 0.3545
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1      4.86     4.870     15.60    0.100      1.122
2      7.26     6.790     11.30    0.194      1.362
Qmax(1) =
         1.000 *    1.000 *     4.860) +
         0.795 *    1.000 *     7.262) + =      10.631
Qmax(2) =
         1.234 *    0.724 *     4.860) +
         1.000 *    1.000 *     7.262) + =      11.607

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.860       7.262
Maximum flow rates at confluence using above data:
       10.631       11.607
Area of streams before confluence:
        4.870        6.790
Effective area values after confluence:
       11.660       10.317
Results of confluence:
Total flow rate =     11.607(CFS)
Time of concentration =    11.299 min.
Effective stream area after confluence =     10.317(Ac.)
Study area average Pervious fraction(Ap) =  0.283
Study area average soil loss rate(Fm) =    0.155(In/Hr)
Study area total (this main stream) =      11.66(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      211.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Time of concentration =    11.30 min.
Rainfall intensity =      1.362(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.802
Subarea runoff =      0.444(CFS) for    0.720(Ac.)
Total runoff =     12.051(CFS)
Effective area this stream =       11.04(Ac.)
Total Study Area (Main Stream No. 2) =       31.83(Ac.)
Area averaged Fm value =    0.148(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      212.000 to Point/Station      211.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   565.000(Ft.)
Downstream point/station elevation =   563.000(Ft.)
Pipe length  =   400.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.051(CFS)
```

```
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    12.051(CFS)
Normal flow depth in pipe =   15.56(In.)
Flow top width inside pipe =   22.92(In.)
Critical Depth =   14.96(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    1.19 min.
Time of concentration (TC) =    12.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      211.000 to Point/Station      199.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     11.037(Ac.)
Runoff from this stream =     12.051(CFS)
Time of concentration =   12.49 min.
Rainfall intensity =     1.282(In/Hr)
Area averaged loss rate (Fm) =    0.1484(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2709
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     18.99    19.053     12.17    0.207      1.303
2     12.05    11.037     12.49    0.148      1.282
Qmax(1) =
         1.000 *    1.000 *    18.988) +
         1.018 *    0.974 *    12.051) + =      30.937
Qmax(2) =
         0.981 *    1.000 *    18.988) +
         1.000 *    1.000 *    12.051) + =      30.684

Total of 2 main streams to confluence:
Flow rates before confluence point:
      19.988      13.051
Maximum flow rates at confluence using above data:
       30.937       30.684
Area of streams before confluence:
       19.053       11.037
Effective area values after confluence:
       29.803       30.091


Results of confluence:
Total flow rate =     30.937(CFS)
Time of concentration =    12.165 min.
Effective stream area after confluence  =     29.803(Ac.)
Study area average Pervious fraction(Ap) =  0.339
Study area average soil loss rate(Fm) =    0.186(In/Hr)
Study area total =      30.09(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      199.000 to Point/Station      223.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   563.000(Ft.)
Downstream point/station elevation =   560.000(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    30.937(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    30.937(CFS)
Normal flow depth in pipe =   18.54(In.)
Flow top width inside pipe =   25.05(In.)
Critical Depth =   23.06(In.)
Pipe flow velocity =     10.64(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    12.48 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      224.000 to Point/Station      223.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    12.48 min.
Rainfall intensity =      1.283(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =      1.495(CFS) for    3.720(Ac.)
Total runoff =     32.432(CFS)
Effective area this stream =       33.52(Ac.)
Total Study Area (Main Stream No. 1) =       35.55(Ac.)
Area averaged Fm value =    0.208(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      223.000 to Point/Station      198.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   560.000(Ft.)
Downstream point/station elevation =   541.000(Ft.)
Pipe length  =   200.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    32.432(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    32.432(CFS)
Normal flow depth in pipe =   12.50(In.)
Flow top width inside pipe =   20.61(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.72(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    12.63 min.
End of computations, Total Study Area =           35.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.406
Area averaged SCS curve number = 70.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B200
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 310.000 to Point/Station 309.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.110(In/Hr)
Initial subarea data:
Initial area flow distance = 460.000(Ft.)
Top (of initial area) elevation = 577.000(Ft.)
Bottom (of initial area) elevation = 573.000(Ft.)
Difference in elevation = 4.000(Ft.)
Slope = 0.00870 s(%)= 0.87
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.723 min.
Rainfall intensity = 1.490(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.834
Subarea runoff = 7.665(CFS)
Total initial stream area = 6.170(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.110(In/Hr)

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      309.000 to Point/Station      307.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   573.000(Ft.)
Downstream point elevation =   568.000(Ft.)
Channel length thru subarea  =   700.000(Ft.)
Channel base width      =  200.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =      8.893(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      8.893(CFS)
Depth of flow =   0.072(Ft.), Average velocity =   0.619(Ft/s)
Channel flow top width =  200.861(Ft.)
Flow Velocity =    0.62(Ft/s)
Travel time  =   18.86 min.
Time of concentration =   28.58 min.
Critical depth =      0.040(Ft.)
 Adding area flow to channel
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.110(In/Hr)
Rainfall intensity =      0.780(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.774
Subarea runoff =      2.377(CFS) for   10.470(Ac.)
Total runoff =     10.043(CFS)
Effective area this stream =       16.64(Ac.)
Total Study Area (Main Stream No. 1) =       16.64(Ac.)
Area averaged Fm value =    0.110(In/Hr)
Depth of flow =   0.077(Ft.), Average velocity =   0.649(Ft/s)
Critical depth =      0.043(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      306.000 to Point/Station      303.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   572.000(Ft.)
Downstream point elevation =   566.500(Ft.)
Channel length thru subarea  =   800.000(Ft.)
Channel base width      =  200.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =     10.805(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     10.805(CFS)
Depth of flow =   0.049(Ft.), Average velocity =   1.100(Ft/s)
```

```
Channel flow top width =  200.589(Ft.)
Flow Velocity =    1.10(Ft/s)
Travel time  =   12.13 min.
Time of concentration =   40.71 min.
Critical depth =      0.045(Ft.)
 Adding area flow to channel
RESIDENTIAL(11+ dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.110(In/Hr)
Rainfall intensity =      0.631(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.744
Subarea runoff =      1.460(CFS) for    7.870(Ac.)
Total runoff =     11.502(CFS)
Effective area this stream =       24.51(Ac.)
Total Study Area (Main Stream No. 1) =       24.51(Ac.)
Area averaged Fm value =    0.110(In/Hr)
Depth of flow =   0.051(Ft.), Average velocity =   1.127(Ft/s)
Critical depth =      0.047(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   566.500(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =    50.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.502(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    11.502(CFS)
Normal flow depth in pipe =   13.27(In.)
Flow top width inside pipe =   20.26(In.)
Critical Depth =   15.18(In.)
Pipe flow velocity =      7.18(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    40.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     24.510(Ac.)
Runoff from this stream =     11.502(CFS)
Time of concentration =   40.83 min.
Rainfall intensity =     0.630(In/Hr)
Area averaged loss rate (Fm) =    0.1096(In/Hr)
Area averaged Pervious ratio (Ap) = 0.2000


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Process from Point/Station      305.000 to Point/Station      304.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   550.000(Ft.)
Top (of initial area) elevation =   574.000(Ft.)
Bottom (of initial area) elevation =   568.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01091  s(%)=       1.09
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.364 min.
Rainfall intensity =      1.524(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.868
Subarea runoff =      1.587(CFS)
Total initial stream area =        1.200(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   568.000(Ft.)
Downstream point/station elevation =   566.000(Ft.)
Pipe length  =   310.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.587(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.587(CFS)
Normal flow depth in pipe =    6.38(In.)
Flow top width inside pipe =   11.98(In.)
Critical Depth =    6.42(In.)
Pipe flow velocity =      3.74(Ft/s)
Travel time through pipe =    1.38 min.
Time of concentration (TC) =    10.75 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      304.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.200(Ac.)
Runoff from this stream =      1.587(CFS)
Time of concentration =   10.75 min.
Rainfall intensity =     1.403(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Initial subarea data:
Initial area flow distance =   745.000(Ft.)
Top (of initial area) elevation =   569.000(Ft.)
Bottom (of initial area) elevation =   566.000(Ft.)
Difference in elevation =     3.000(Ft.)
Slope =    0.00403  s(%)=       0.40
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.905 min.
Rainfall intensity =      1.257(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.861
Subarea runoff =      2.273(CFS)
Total initial stream area =        2.100(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.055(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      311.000 to Point/Station      302.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.100(Ac.)
Runoff from this stream =      2.273(CFS)
Time of concentration =   12.90 min.
Rainfall intensity =     1.257(In/Hr)
Area averaged loss rate (Fm) =    0.0548(In/Hr)
Area averaged Pervious ratio (Ap) = 0.1000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     11.50    24.510     40.83    0.110      0.630
2      1.59     1.200     10.75    0.055      1.403
3      2.27     2.100     12.90    0.055      1.257
Qmax(1) =
         1.000 *    1.000 *    11.502) +
         0.427 *    1.000 *     1.587) +
         0.478 *    1.000 *     2.273) + =      13.266
Qmax(2) =
         2.486 *    0.263 *    11.502) +
         1.000 *    1.000 *     1.587) +
         1.121 *    0.833 *     2.273) + =      11.236
Qmax(3) =
         2.205 *    0.316 *    11.502) +
```

```
         0.892 *    1.000 *     1.587) +
         1.000 *    1.000 *     2.273) + =      11.706

Total of 3 streams to confluence:
Flow rates before confluence point:
      11.502       1.587       2.273
Maximum flow rates at confluence using above data:
       13.266       11.236       11.706
Area of streams before confluence:
       24.510        1.200        2.100
Effective area values after confluence:
       27.810        9.401       11.047
Results of confluence:
Total flow rate =     13.266(CFS)
Time of concentration =    40.826 min.
Effective stream area after confluence =     27.810(Ac.)
Study area average Pervious fraction(Ap) =  0.188
Study area average soil loss rate(Fm) =    0.103(In/Hr)
Study area total (this main stream) =      27.81(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      301.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   566.000(Ft.)
Downstream point/station elevation =   550.000(Ft.)
Pipe length  =   220.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.266(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    13.266(CFS)
Normal flow depth in pipe =    9.80(In.)
Flow top width inside pipe =   14.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.63(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =    41.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      301.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    41.06 min.
Rainfall intensity =      0.628(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.733
Subarea runoff =      0.168(CFS) for    1.390(Ac.)
Total runoff =     13.434(CFS)
Effective area this stream =       29.20(Ac.)
```

```
Total Study Area (Main Stream No. 1) =       29.20(Ac.)
Area averaged Fm value =    0.117(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      300.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________________
Upstream point/station elevation =   550.000(Ft.)
Downstream point/station elevation =   540.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.434(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    13.434(CFS)
Normal flow depth in pipe =    8.87(In.)
Flow top width inside pipe =   14.75(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.76(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    41.15 min.
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B300
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 403.000 to Point/Station 402.000
**** INITIAL AREA EVALUATION ****

APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.2000 Max loss rate(Fm)= 0.110(In/Hr)
Initial subarea data:
Initial area flow distance = 205.000(Ft.)
Top (of initial area) elevation = 571.000(Ft.)
Bottom (of initial area) elevation = 569.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00976 s(%)= 0.98
TC = k(0.324)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.877 min.
Rainfall intensity = 1.834(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.846
Subarea runoff = 3.523(CFS)
Total initial stream area = 2.270(Ac.)
Pervious area fraction = 0.200
Initial area Fm value = 0.110(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      401.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
Top of street segment elevation =   569.000(Ft.)
End of street segment elevation =   566.000(Ft.)
Length of street segment  =   520.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =   0.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      6.040(CFS)
Depth of flow =   0.354(Ft.), Average velocity =   2.125(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.379(Ft.)
Flow velocity =   2.12(Ft/s)
Travel time =    4.08 min.     TC =   10.96  min.
 Adding area flow to street
APARTMENT subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.2000     Max loss rate(Fm)=     0.110(In/Hr)
Rainfall intensity =      1.387(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.829
Subarea runoff =      4.927(CFS) for    5.080(Ac.)
Total runoff =      8.450(CFS)
Effective area this stream =        7.35(Ac.)
Total Study Area (Main Stream No. 1) =        7.35(Ac.)
Area averaged Fm value =    0.110(In/Hr)
Street flow at end of street =      8.450(CFS)
Half street flow at end of street =      4.225(CFS)
Depth of flow =   0.388(Ft.), Average velocity =   2.300(Ft/s)
Flow width (from curb towards crown)=  13.078(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      400.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________________________
Upstream point/station elevation =   569.000(Ft.)
Downstream point/station elevation =   540.000(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
```

No. of pipes = 1 Required pipe flow =   8.450(CFS)
Nearest computed pipe diameter =   12.00(In.)
Calculated individual pipe flow =   8.450(CFS)
Normal flow depth in pipe =   5.88(In.)
Flow top width inside pipe =   12.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =   22.10(Ft/s)
Travel time through pipe =   0.09 min.
Time of concentration (TC) =   11.05 min.
End of computations, Total Study Area =   7.35 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged SCS curve number = 69.0

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 03/09/15

SUBAREA BASIN B400
2 YEAR
RANCHO MIRAMONTE

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 503.000 to Point/Station 502.000
**** INITIAL AREA EVALUATION ****

COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fm)= 0.055(In/Hr)
Initial subarea data:
Initial area flow distance = 205.000(Ft.)
Top (of initial area) elevation = 571.000(Ft.)
Bottom (of initial area) elevation = 569.000(Ft.)
Difference in elevation = 2.000(Ft.)
Slope = 0.00976 s(%)= 0.98
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.452 min.
Rainfall intensity = 1.906(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.874
Subarea runoff = 2.798(CFS)
Total initial stream area = 1.680(Ac.)
Pervious area fraction = 0.100
Initial area Fm value = 0.055(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      501.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   569.000(Ft.)
Downstream point elevation =   566.000(Ft.)
Channel length thru subarea  =   480.000(Ft.)
Channel base width      =  100.000(Ft.)
Slope or 'Z' of left channel bank =   6.000
Slope or 'Z' of right channel bank =   6.000
Estimated mean flow rate at midpoint of channel =      4.017(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      4.017(CFS)
Depth of flow =   0.042(Ft.), Average velocity =   0.948(Ft/s)
Channel flow top width =  100.507(Ft.)
Flow Velocity =    0.95(Ft/s)
Travel time  =    8.44 min.
Time of concentration =   14.89 min.
Critical depth =      0.037(Ft.)
 Adding area flow to channel
COMMERCIAL subarea type
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.055(In/Hr)
Rainfall intensity =      1.154(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =      2.355(CFS) for    3.530(Ac.)
Total runoff =      5.154(CFS)
Effective area this stream =        5.21(Ac.)
Total Study Area (Main Stream No. 1) =        5.21(Ac.)
Area averaged Fm value =    0.055(In/Hr)
Depth of flow =   0.049(Ft.), Average velocity =   1.047(Ft/s)
Critical depth =      0.043(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      500.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   560.000(Ft.)
Downstream point/station elevation =   540.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.154(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     5.154(CFS)
Normal flow depth in pipe =    5.53(In.)
Flow top width inside pipe =    8.76(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.10(Ft/s)
Travel time through pipe =    0.09 min.
```

Time of concentration (TC) = 14.98 min.
End of computations, Total Study Area = 5.21 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number = 69.0

APPENDIX C: 100-YEAR EXISTING CONDITION MODEL OUTPUT

Existing Cond
100-year
Basins E1
E2
E3
E4

San B l Hydrology Program

(August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology
Basin E1 - Existing Condition
100-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.600 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 204.000 to Point/Station 203.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.129(In/Hr)
Initial subarea data:
Initial area flow distance = 773.000(Ft.)
Top (of initial area) elevation = 576.500(Ft.)
Bottom (of initial area) elevation = 555.000(Ft.)
Difference in elevation = 21.500(Ft.)
Slope = 0.02781 s(%)= 2.78
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 20.664 min.
Rainfall intensity = 3.033(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.862
Subarea runoff = 19.239(CFS)
Total initial stream area = 7.360(Ac.)
Pervious area fraction = 1.000

```
Initial area Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      201.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   555.000(Ft.)
Downstream point elevation =   544.000(Ft.)
Channel length thru subarea  =   983.000(Ft.)
Channel base width       =   20.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     52.555(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     52.555(CFS)
Depth of flow =   0.638(Ft.), Average velocity =   3.552(Ft/s)
Channel flow top width =   26.380(Ft.)
Flow Velocity =    3.55(Ft/s)
Travel time  =    4.61 min.
Time of concentration =   25.28 min.
Critical depth =      0.570(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.688(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.857
Subarea runoff =     66.576(CFS) for   29.900(Ac.)
Total runoff =     85.815(CFS)
Effective area this stream =       37.26(Ac.)
Total Study Area (Main Stream No. 1) =       37.26(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   0.845(Ft.), Average velocity =   4.191(Ft/s)
Critical depth =      0.773(Ft.)
End of computations, Total Study Area =          37.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E2
Existing Condition
100-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.600 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 103.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.129(In/Hr)
Initial subarea data:
Initial area flow distance = 939.000(Ft.)
Top (of initial area) elevation = 564.000(Ft.)
Bottom (of initial area) elevation = 549.000(Ft.)
Difference in elevation = 15.000(Ft.)
Slope = 0.01597 s(%)= 1.60
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 24.957 min.
Rainfall intensity = 2.708(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.857
Subarea runoff = 12.514(CFS)
Total initial stream area = 5.390(Ac.)
Pervious area fraction = 1.000

```
Initial area Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      101.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   549.000(Ft.)
Downstream point elevation =   545.700(Ft.)
Channel length thru subarea  =   752.000(Ft.)
Channel base width       =   25.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =     42.359(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    6.000(Ft.)
Flow(q) thru subarea =     42.359(CFS)
Depth of flow =   0.633(Ft.), Average velocity =   2.137(Ft/s)
Channel flow top width =   37.655(Ft.)
Flow Velocity =    2.14(Ft/s)
Travel time  =    5.87 min.
Time of concentration =   30.82 min.
Critical depth =      0.422(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.386(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.851
Subarea runoff =     59.592(CFS) for   30.100(Ac.)
Total runoff =     72.106(CFS)
Effective area this stream =       35.49(Ac.)
Total Study Area (Main Stream No. 1) =       35.49(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   0.851(Ft.), Average velocity =   2.530(Ft/s)
Critical depth =      0.586(Ft.)
End of computations, Total Study Area =           35.49 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E3
Existing Condition
100-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.600 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 302.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.129(In/Hr)
Initial subarea data:
Initial area flow distance = 700.000(Ft.)
Top (of initial area) elevation = 579.500(Ft.)
Bottom (of initial area) elevation = 556.000(Ft.)
Difference in elevation = 23.500(Ft.)
Slope = 0.03357 s(%)= 3.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.127 min.
Rainfall intensity = 3.177(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.864
Subarea runoff = 19.232(CFS)
Total initial stream area = 7.010(Ac.)
Pervious area fraction = 1.000

```
Initial area Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      300.000
**** SUBAREA FLOW ADDITION ****
-------------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    19.13 min.
Rainfall intensity =      3.177(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.864
Subarea runoff =     31.880(CFS) for   11.620(Ac.)
Total runoff =     51.112(CFS)
Effective area this stream =       18.63(Ac.)
Total Study Area (Main Stream No. 1) =       18.63(Ac.)
Area averaged Fm value =    0.129(In/Hr)
End of computations, Total Study Area =           18.63 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E4
Existing Condition
100-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.600 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 406.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.129(In/Hr)
Initial subarea data:
Initial area flow distance = 542.000(Ft.)
Top (of initial area) elevation = 564.000(Ft.)
Bottom (of initial area) elevation = 563.000(Ft.)
Difference in elevation = 1.000(Ft.)
Slope = 0.00185 s(%)= 0.18
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 30.846 min.
Rainfall intensity = 2.385(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.851
Subarea runoff = 6.742(CFS)
Total initial stream area = 3.320(Ac.)
Pervious area fraction = 1.000

```
Initial area Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      404.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   563.000(Ft.)
Downstream point elevation =   546.000(Ft.)
Channel length thru subarea  =   833.000(Ft.)
Channel base width       =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     16.374(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     16.374(CFS)
Depth of flow =   0.397(Ft.), Average velocity =   3.439(Ft/s)
Channel flow top width =   13.972(Ft.)
Flow Velocity =    3.44(Ft/s)
Travel time  =    4.04 min.
Time of concentration =   34.88 min.
Critical depth =      0.406(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.215(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =     19.194(CFS) for   10.490(Ac.)
Total runoff =     25.936(CFS)
Effective area this stream =       13.81(Ac.)
Total Study Area (Main Stream No. 1) =       13.81(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   0.516(Ft.), Average velocity =   4.000(Ft/s)
Critical depth =      0.539(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      410.000 to Point/Station      404.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    34.88 min.
```

```
Rainfall intensity =      2.215(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.848
Subarea runoff =     28.208(CFS) for   15.020(Ac.)
Total runoff =     54.143(CFS)
Effective area this stream =       28.83(Ac.)
Total Study Area (Main Stream No. 1) =       28.83(Ac.)
Area averaged Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      403.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   546.000(Ft.)
Downstream point elevation =   538.000(Ft.)
Channel length thru subarea  =   724.000(Ft.)
Channel base width       =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =     77.489(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     77.489(CFS)
Depth of flow =   0.761(Ft.), Average velocity =   3.686(Ft/s)
Channel flow top width =   35.228(Ft.)
Flow Velocity =    3.69(Ft/s)
Travel time  =    3.27 min.
Time of concentration =   38.16 min.
Critical depth =      0.688(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.099(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.845
Subarea runoff =     46.594(CFS) for   27.970(Ac.)
Total runoff =    100.737(CFS)
Effective area this stream =       56.80(Ac.)
Total Study Area (Main Stream No. 1) =       56.80(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   0.877(Ft.), Average velocity =   3.990(Ft/s)
Critical depth =      0.805(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      403.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    38.16 min.
Rainfall intensity =      2.099(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.845
Subarea runoff =     29.441(CFS) for   16.600(Ac.)
Total runoff =    130.178(CFS)
Effective area this stream =       73.40(Ac.)
Total Study Area (Main Stream No. 1) =       73.40(Ac.)
Area averaged Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   538.000(Ft.)
Downstream point/station elevation =   537.000(Ft.)
Pipe length  =    66.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   130.178(CFS)
Nearest computed pipe diameter  =     45.00(In.)
Calculated individual pipe flow  =   130.178(CFS)
Normal flow depth in pipe =   32.58(In.)
Flow top width inside pipe =   40.23(In.)
Critical Depth =   40.68(In.)
Pipe flow velocity =     15.19(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    38.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      401.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   537.000(Ft.)
Downstream point elevation =   535.500(Ft.)
Channel length thru subarea  =   370.000(Ft.)
Channel base width       =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =    134.639(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    134.639(CFS)
Depth of flow =   1.329(Ft.), Average velocity =   3.042(Ft/s)
Channel flow top width =   46.587(Ft.)
Flow Velocity =    3.04(Ft/s)
Travel time  =    2.03 min.
Time of concentration =   40.26 min.
Critical depth =      0.953(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      2.033(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.843
Subarea runoff =      8.845(CFS) for    7.720(Ac.)
Total runoff =    139.023(CFS)
Effective area this stream =       81.12(Ac.)
Total Study Area (Main Stream No. 1) =       81.12(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   1.351(Ft.), Average velocity =   3.070(Ft/s)
Critical depth =      0.969(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      420.000 to Point/Station      401.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Time of concentration =    40.26 min.
Rainfall intensity =      2.033(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.843
Subarea runoff =     32.922(CFS) for   19.210(Ac.)
Total runoff =    171.945(CFS)
Effective area this stream =      100.33(Ac.)
Total Study Area (Main Stream No. 1) =      100.33(Ac.)
Area averaged Fm value =    0.129(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      510.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   535.500(Ft.)
Downstream point elevation =   520.000(Ft.)
Channel length thru subarea  =   794.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =    179.939(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    179.939(CFS)
Depth of flow =   1.027(Ft.), Average velocity =   5.788(Ft/s)
```

```
Channel flow top width =   40.540(Ft.)
Flow Velocity =    5.79(Ft/s)
Travel time  =    2.29 min.
Time of concentration =   42.54 min.
Critical depth =      1.125(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      1.967(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.841
Subarea runoff =     15.934(CFS) for   13.250(Ac.)
Total runoff =    187.878(CFS)
Effective area this stream =      113.58(Ac.)
Total Study Area (Main Stream No. 1) =      113.58(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   1.051(Ft.), Average velocity =   5.862(Ft/s)
Critical depth =      1.148(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      505.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   520.000(Ft.)
Downstream point elevation =   515.000(Ft.)
Channel length thru subarea  =  1051.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =    198.333(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =   10.000(Ft.)
Flow(q) thru subarea =    198.333(CFS)
Depth of flow =   1.554(Ft.), Average velocity =   3.592(Ft/s)
Channel flow top width =   51.077(Ft.)
Flow Velocity =    3.59(Ft/s)
Travel time  =    4.88 min.
Time of concentration =   47.42 min.
Critical depth =      1.188(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      1.843(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
```

```
rational method)(Q=KCIA) is C = 0.837
Subarea runoff =     20.846(CFS) for   21.730(Ac.)
Total runoff =    208.725(CFS)
Effective area this stream =      135.31(Ac.)
Total Study Area (Main Stream No. 1) =      135.31(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   1.594(Ft.), Average velocity =   3.643(Ft/s)
Critical depth =      1.219(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      600.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   515.000(Ft.)
Downstream point elevation =   507.000(Ft.)
Channel length thru subarea  =  1009.000(Ft.)
Channel base width       =   20.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =    214.079(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =   10.000(Ft.)
Flow(q) thru subarea =    214.079(CFS)
Depth of flow =   1.549(Ft.), Average velocity =   4.982(Ft/s)
Channel flow top width =   35.488(Ft.)
Flow Velocity =    4.98(Ft/s)
Travel time  =    3.38 min.
Time of concentration =   50.80 min.
Critical depth =      1.359(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Adjusted SCS curve number for AMC 3 = 93.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.129(In/Hr)
Rainfall intensity =      1.768(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.835
Subarea runoff =     10.629(CFS) for   13.350(Ac.)
Total runoff =    219.353(CFS)
Effective area this stream =      148.66(Ac.)
Total Study Area (Main Stream No. 1) =      148.66(Ac.)
Area averaged Fm value =    0.129(In/Hr)
Depth of flow =   1.569(Ft.), Average velocity =   5.019(Ft/s)
Critical depth =      1.375(Ft.)
End of computations, Total Study Area =          148.66 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

APPENDIX D: 2-YEAR EXISTING CONDITION MODEL

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology
Basin E1 - Existing Condition
2-year flow rates

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 204.000 to Point/Station 203.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 773.000(Ft.)
Top (of initial area) elevation = 576.500(Ft.)
Bottom (of initial area) elevation = 555.000(Ft.)
Difference in elevation = 21.500(Ft.)
Slope = 0.02781 s(%)= 2.78
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 20.664 min.
Rainfall intensity = 0.948(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.533
Subarea runoff = 3.717(CFS)
Total initial stream area = 7.360(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.387(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      201.000
**** IMPROVED CHANNEL TRAVEL TIME ****

------------------------------------------------------------------------------
Upstream point elevation =   555.000(Ft.)
Downstream point elevation =   544.000(Ft.)
Channel length thru subarea  =   983.000(Ft.)
Channel base width       =   20.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      8.202(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      8.202(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   1.814(Ft/s)
Channel flow top width =   22.145(Ft.)
Flow Velocity =    1.81(Ft/s)
Travel time  =    9.03 min.
Time of concentration =   29.69 min.
Critical depth =      0.172(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Rainfall intensity =      0.763(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.444
Subarea runoff =      8.885(CFS) for   29.900(Ac.)
Total runoff =     12.602(CFS)
Effective area this stream =       37.26(Ac.)
Total Study Area (Main Stream No. 1) =       37.26(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.277(Ft.), Average velocity =   2.130(Ft/s)
Critical depth =      0.227(Ft.)
End of computations, Total Study Area =           37.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E2
Existing Condition
2-year flow rates

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 103.000 to Point/Station 102.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 939.000(Ft.)
Top (of initial area) elevation = 564.000(Ft.)
Bottom (of initial area) elevation = 549.000(Ft.)
Difference in elevation = 15.000(Ft.)
Slope = 0.01597 s(%)= 1.60
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 24.957 min.
Rainfall intensity = 0.846(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.489
Subarea runoff = 2.230(CFS)
Total initial stream area = 5.390(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.387(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      101.000
**** IMPROVED CHANNEL TRAVEL TIME ****

------------------------------------------------------------------------------
Upstream point elevation =   549.000(Ft.)
Downstream point elevation =   545.700(Ft.)
Channel length thru subarea  =   752.000(Ft.)
Channel base width       =   25.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =      5.701(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    6.000(Ft.)
Flow(q) thru subarea =      5.701(CFS)
Depth of flow =   0.198(Ft.), Average velocity =   1.064(Ft/s)
Channel flow top width =   28.969(Ft.)
Flow Velocity =    1.06(Ft/s)
Travel time  =   11.78 min.
Time of concentration =   36.73 min.
Critical depth =      0.115(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Rainfall intensity =      0.671(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.381
Subarea runoff =      6.856(CFS) for   30.100(Ac.)
Total runoff =      9.086(CFS)
Effective area this stream =       35.49(Ac.)
Total Study Area (Main Stream No. 1) =       35.49(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.261(Ft.), Average velocity =   1.261(Ft/s)
Critical depth =      0.156(Ft.)
End of computations, Total Study Area =           35.49 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E3
Existing Condition
2-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 302.000 to Point/Station 301.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 700.000(Ft.)
Top (of initial area) elevation = 579.500(Ft.)
Bottom (of initial area) elevation = 556.000(Ft.)
Difference in elevation = 23.500(Ft.)
Slope = 0.03357 s(%)= 3.36
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 19.127 min.
Rainfall intensity = 0.993(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.549
Subarea runoff = 3.824(CFS)
Total initial stream area = 7.010(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.387(In/Hr)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      300.000
**** SUBAREA FLOW ADDITION ****
```

```
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    19.13 min.
Rainfall intensity =      0.993(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.549
Subarea runoff =      6.339(CFS) for   11.620(Ac.)
Total runoff =     10.162(CFS)
Effective area this stream =       18.63(Ac.)
Total Study Area (Main Stream No. 1) =       18.63(Ac.)
Area averaged Fm value =    0.387(In/Hr)
End of computations, Total Study Area =           18.63 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  79.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 06/04/13

Chino Hydrology - Basin E4
Existing Condition
2-year flows

Program License Serial Number 6288

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.500 (In.)
Slope used for rainfall intensity curve b = 0.6000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 406.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 79.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.387(In/Hr)
Initial subarea data:
Initial area flow distance = 542.000(Ft.)
Top (of initial area) elevation = 564.000(Ft.)
Bottom (of initial area) elevation = 563.000(Ft.)
Difference in elevation = 1.000(Ft.)
Slope = 0.00185 s(%)= 0.18
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 30.846 min.
Rainfall intensity = 0.745(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.433
Subarea runoff = 1.071(CFS)
Total initial stream area = 3.320(Ac.)
Pervious area fraction = 1.000

```
Initial area Fm value =    0.387(In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      405.000 to Point/Station      404.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   563.000(Ft.)
Downstream point elevation =   546.000(Ft.)
Channel length thru subarea  =   833.000(Ft.)
Channel base width       =   10.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =      2.199(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      2.199(CFS)
Depth of flow =   0.123(Ft.), Average velocity =   1.683(Ft/s)
Channel flow top width =   11.230(Ft.)
Flow Velocity =    1.68(Ft/s)
Travel time  =    8.25 min.
Time of concentration =   39.09 min.
Critical depth =      0.112(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Rainfall intensity =      0.647(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.362
Subarea runoff =      2.158(CFS) for   10.490(Ac.)
Total runoff =      3.229(CFS)
Effective area this stream =       13.81(Ac.)
Total Study Area (Main Stream No. 1) =       13.81(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.154(Ft.), Average velocity =   1.941(Ft/s)
Critical depth =      0.145(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      410.000 to Point/Station      404.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    39.09 min.
Rainfall intensity =      0.647(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
```

```
rational method)(Q=KCIA) is C = 0.362
Subarea runoff =      3.512(CFS) for   15.020(Ac.)
Total runoff =      6.742(CFS)
Effective area this stream =       28.83(Ac.)
Total Study Area (Main Stream No. 1) =       28.83(Ac.)
Area averaged Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      403.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   546.000(Ft.)
Downstream point elevation =   538.000(Ft.)
Channel length thru subarea  =   724.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =      8.522(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      8.522(CFS)
Depth of flow =   0.217(Ft.), Average velocity =   1.768(Ft/s)
Channel flow top width =   24.348(Ft.)
Flow Velocity =    1.77(Ft/s)
Travel time  =    6.83 min.
Time of concentration =   45.92 min.
Critical depth =      0.172(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Rainfall intensity =      0.587(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.307
Subarea runoff =      3.498(CFS) for   27.970(Ac.)
Total runoff =     10.240(CFS)
Effective area this stream =       56.80(Ac.)
Total Study Area (Main Stream No. 1) =       56.80(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.242(Ft.), Average velocity =   1.887(Ft/s)
Critical depth =      0.195(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      403.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    45.92 min.
Rainfall intensity =      0.587(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.307
Subarea runoff =      2.993(CFS) for   16.600(Ac.)
Total runoff =     13.232(CFS)
Effective area this stream =       73.40(Ac.)
Total Study Area (Main Stream No. 1) =       73.40(Ac.)
Area averaged Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   538.000(Ft.)
Downstream point/station elevation =   537.000(Ft.)
Pipe length  =    66.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.232(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    13.232(CFS)
Normal flow depth in pipe =   12.68(In.)
Flow top width inside pipe =   20.54(In.)
Critical Depth =   16.26(In.)
Pipe flow velocity =      8.71(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =   46.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      401.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------------
Upstream point elevation =   537.000(Ft.)
Downstream point elevation =   535.500(Ft.)
Channel length thru subarea  =   370.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =     13.276(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     13.276(CFS)
Depth of flow =   0.376(Ft.), Average velocity =   1.488(Ft/s)
Channel flow top width =   27.513(Ft.)
Flow Velocity =    1.49(Ft/s)
Travel time  =    4.15 min.
Time of concentration =   50.19 min.
Critical depth =      0.230(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     12.397(CFS)
therefore the upstream flow rate of Q =     13.232(CFS) is being used
Rainfall intensity =      0.557(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.275
Subarea runoff =      0.000(CFS) for    7.720(Ac.)
Total runoff =     13.232(CFS)
Effective area this stream =       81.12(Ac.)
Total Study Area (Main Stream No. 1) =       81.12(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.375(Ft.), Average velocity =   1.486(Ft/s)
Critical depth =      0.230(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      420.000 to Point/Station      401.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
Time of concentration =    50.19 min.
Rainfall intensity =      0.557(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.275
Subarea runoff =      2.100(CFS) for   19.210(Ac.)
Total runoff =     15.332(CFS)
Effective area this stream =      100.33(Ac.)
Total Study Area (Main Stream No. 1) =      100.33(Ac.)
Area averaged Fm value =    0.387(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      510.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   535.500(Ft.)
Downstream point elevation =   520.000(Ft.)
Channel length thru subarea  =   794.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =     15.364(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     15.364(CFS)
Depth of flow =   0.260(Ft.), Average velocity =   2.618(Ft/s)
Channel flow top width =   25.194(Ft.)
Flow Velocity =    2.62(Ft/s)
Travel time  =    5.05 min.
```

```
Time of concentration =   55.25 min.
Critical depth =      0.254(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     14.175(CFS)
therefore the upstream flow rate of Q =     15.332(CFS) is being used
Rainfall intensity =      0.525(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.238
Subarea runoff =      0.000(CFS) for   13.250(Ac.)
Total runoff =     15.332(CFS)
Effective area this stream =      113.58(Ac.)
Total Study Area (Main Stream No. 1) =      113.58(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.259(Ft.), Average velocity =   2.616(Ft/s)
Critical depth =      0.252(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      505.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   520.000(Ft.)
Downstream point elevation =   515.000(Ft.)
Channel length thru subarea  =  1051.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =     15.378(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =   10.000(Ft.)
Flow(q) thru subarea =     15.378(CFS)
Depth of flow =   0.390(Ft.), Average velocity =   1.648(Ft/s)
Channel flow top width =   27.807(Ft.)
Flow Velocity =    1.65(Ft/s)
Travel time  =   10.63 min.
Time of concentration =   65.87 min.
Critical depth =      0.254(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     10.476(CFS)
therefore the upstream flow rate of Q =     15.332(CFS) is being used
Rainfall intensity =      0.473(In/Hr) for a     2.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.164
Subarea runoff =      0.000(CFS) for   21.730(Ac.)
Total runoff =     15.332(CFS)
Effective area this stream =      135.31(Ac.)
Total Study Area (Main Stream No. 1) =      135.31(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.390(Ft.), Average velocity =   1.647(Ft/s)
Critical depth =      0.252(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      600.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   515.000(Ft.)
Downstream point elevation =   507.000(Ft.)
Channel length thru subarea  =  1009.000(Ft.)
Channel base width      =   20.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     15.380(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =   10.000(Ft.)
Flow(q) thru subarea =     15.380(CFS)
Depth of flow =   0.344(Ft.), Average velocity =   2.056(Ft/s)
Channel flow top width =   23.444(Ft.)
Flow Velocity =    2.06(Ft/s)
Travel time  =    8.18 min.
Time of concentration =   74.05 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 79.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.387(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      7.220(CFS)
therefore the upstream flow rate of Q =     15.332(CFS) is being used
Rainfall intensity =      0.441(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.110
Subarea runoff =      0.000(CFS) for   13.350(Ac.)
Total runoff =     15.332(CFS)
Effective area this stream =      148.66(Ac.)
Total Study Area (Main Stream No. 1) =      148.66(Ac.)
Area averaged Fm value =    0.387(In/Hr)
Depth of flow =   0.344(Ft.), Average velocity =   2.053(Ft/s)
Critical depth =      0.258(Ft.)
End of computations, Total Study Area =          148.66 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.
```

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 79.0

APPENDIX E: DEVELOPED CONDITION HYDROLOGY MAP

APPENDIX F: EXISTING HYDROLOGY MAP

APPENDIX G: BASIN A – UNIT HYDROGRAPH CALCULATIONS

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/11/15

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN A
2 YEAR 24 HR HYDROGRAPH
RANCHO MIRAMONTE

Storm Event Year = 2

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 2		
35.82	1	0.48
18.70	1	0.48
40.31	1	0.48
3.75	1	0.48
2.54	1	0.48
Rainfall data for year 2		
101.12	6	1.20
Rainfall data for year 2		
101.12	24	2.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
71.6	71.6	35.82	0.354	0.507	0.667	0.338
69.0	69.0	18.70	0.185	0.548	0.400	0.219
69.2	69.2	40.31	0.399	0.545	0.406	0.221

73.3	73.3	3.75	0.037	0.480	0.484	0.233
74.0	74.0	2.54	0.025	0.469	0.546	0.256

Area-averaged adjusted loss rate Fm (In/Hr) = 0.264

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
23.89	0.236	71.6	71.6	3.97	0.141
11.93	0.118	98.0	98.0	0.20	0.887
7.48	0.074	69.0	69.0	4.49	0.108
11.22	0.111	98.0	98.0	0.20	0.887
16.37	0.162	69.2	69.2	4.45	0.111
23.94	0.237	98.0	98.0	0.20	0.887
1.81	0.018	73.3	73.3	3.64	0.164
1.94	0.019	98.0	98.0	0.20	0.887
1.39	0.014	74.0	74.0	3.51	0.175
1.15	0.011	98.0	98.0	0.20	0.887

Area-averaged catchment yield fraction, Y = 0.505
Area-averaged low loss fraction, Yb = 0.495
User entry of time of concentration = 0.295 (hours)
++
Watershed area = 101.12(Ac.)
Catchment Lag time = 0.236 hours
Unit interval = 30.000 minutes
Unit interval percentage of lag time = 211.8644
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.264(In/Hr)
Average low loss rate fraction (Yb) = 0.495 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.178(In)
Computed peak 30-minute rainfall = 0.364(In)
Specified peak 1-hour rainfall = 0.480(In)
Computed peak 3-hour rainfall = 0.842(In)
Specified peak 6-hour rainfall = 1.200(In)
Specified peak 24-hour rainfall = 2.000(In)

Rainfall depth area reduction factors:
Using a total area of 101.12(Ac.) (Ref: fig. E-4)

5-minute factor = 0.995 Adjusted rainfall = 0.177(In)
30-minute factor = 0.995 Adjusted rainfall = 0.362(In)
1-hour factor = 0.995 Adjusted rainfall = 0.478(In)
3-hour factor = 0.999 Adjusted rainfall = 0.841(In)
6-hour factor = 1.000 Adjusted rainfall = 1.200(In)
24-hour factor = 1.000 Adjusted rainfall = 2.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 203.82 (CFS))	
1	44.268	90.228
2	88.969	91.109
3	97.179	16.732
4	100.000	5.750

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.3620	0.0255
2	0.4777	0.0163
3	0.5887	0.0171
4	0.6827	0.0148
5	0.7659	0.0133
6	0.8413	0.0121
7	0.9104	0.0112
8	0.9748	0.0104
9	1.0354	0.0099
10	1.0927	0.0094
11	1.1474	0.0089
12	1.1996	0.0086
13	1.2355	0.0059
14	1.2698	0.0056
15	1.3025	0.0054
16	1.3338	0.0051
17	1.3640	0.0049
18	1.3930	0.0048
19	1.4211	0.0046
20	1.4482	0.0045
21	1.4745	0.0043
22	1.5000	0.0042
23	1.5247	0.0041
24	1.5489	0.0040
25	1.5723	0.0039
26	1.5952	0.0038
27	1.6176	0.0037
28	1.6394	0.0036
29	1.6608	0.0035
30	1.6816	0.0034
31	1.7021	0.0034
32	1.7221	0.0033
33	1.7418	0.0032
34	1.7610	0.0032
35	1.7800	0.0031
36	1.7985	0.0031
37	1.8168	0.0030
38	1.8347	0.0030
39	1.8524	0.0029
40	1.8698	0.0029
41	1.8869	0.0028
42	1.9037	0.0028
43	1.9203	0.0027
44	1.9366	0.0027
45	1.9527	0.0027
46	1.9686	0.0026
47	1.9843	0.0026
48	1.9997	0.0026

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0155	0.0077	0.0078
2	0.0158	0.0078	0.0080
3	0.0161	0.0080	0.0082
4	0.0165	0.0082	0.0083
5	0.0169	0.0084	0.0085
6	0.0173	0.0086	0.0087
7	0.0177	0.0088	0.0089
8	0.0182	0.0090	0.0092
9	0.0186	0.0092	0.0094
10	0.0192	0.0095	0.0097

11	0.0197	0.0098	0.0099
12	0.0203	0.0101	0.0103
13	0.0210	0.0104	0.0106
14	0.0217	0.0107	0.0109
15	0.0224	0.0111	0.0113
16	0.0233	0.0115	0.0118
17	0.0242	0.0120	0.0122
18	0.0253	0.0125	0.0128
19	0.0264	0.0131	0.0133
20	0.0277	0.0137	0.0140
21	0.0292	0.0145	0.0148
22	0.0309	0.0153	0.0156
23	0.0330	0.0163	0.0166
24	0.0353	0.0175	0.0178
25	0.0526	0.0261	0.0266
26	0.0564	0.0279	0.0285
27	0.0612	0.0303	0.0309
28	0.0674	0.0334	0.0340
29	0.0767	0.0380	0.0387
30	0.0902	0.0446	0.0455
31	0.1063	0.0527	0.0537
32	0.1925	0.0953	0.0972
33	0.2899	0.1318	0.1580
34	0.0858	0.0425	0.0433
35	0.0654	0.0324	0.0330
36	0.0552	0.0273	0.0279
37	0.0346	0.0171	0.0174
38	0.0304	0.0150	0.0153
39	0.0273	0.0135	0.0138
40	0.0249	0.0123	0.0126
41	0.0230	0.0114	0.0116
42	0.0214	0.0106	0.0108
43	0.0201	0.0100	0.0102
44	0.0190	0.0094	0.0096
45	0.0180	0.0089	0.0091
46	0.0171	0.0085	0.0087
47	0.0164	0.0081	0.0083
48	0.0157	0.0078	0.0079

Total soil rain loss = 0.98(In)
Total effective rainfall = 1.02(In)
Peak flow rate in flood hydrograph = 24.27(CFS)

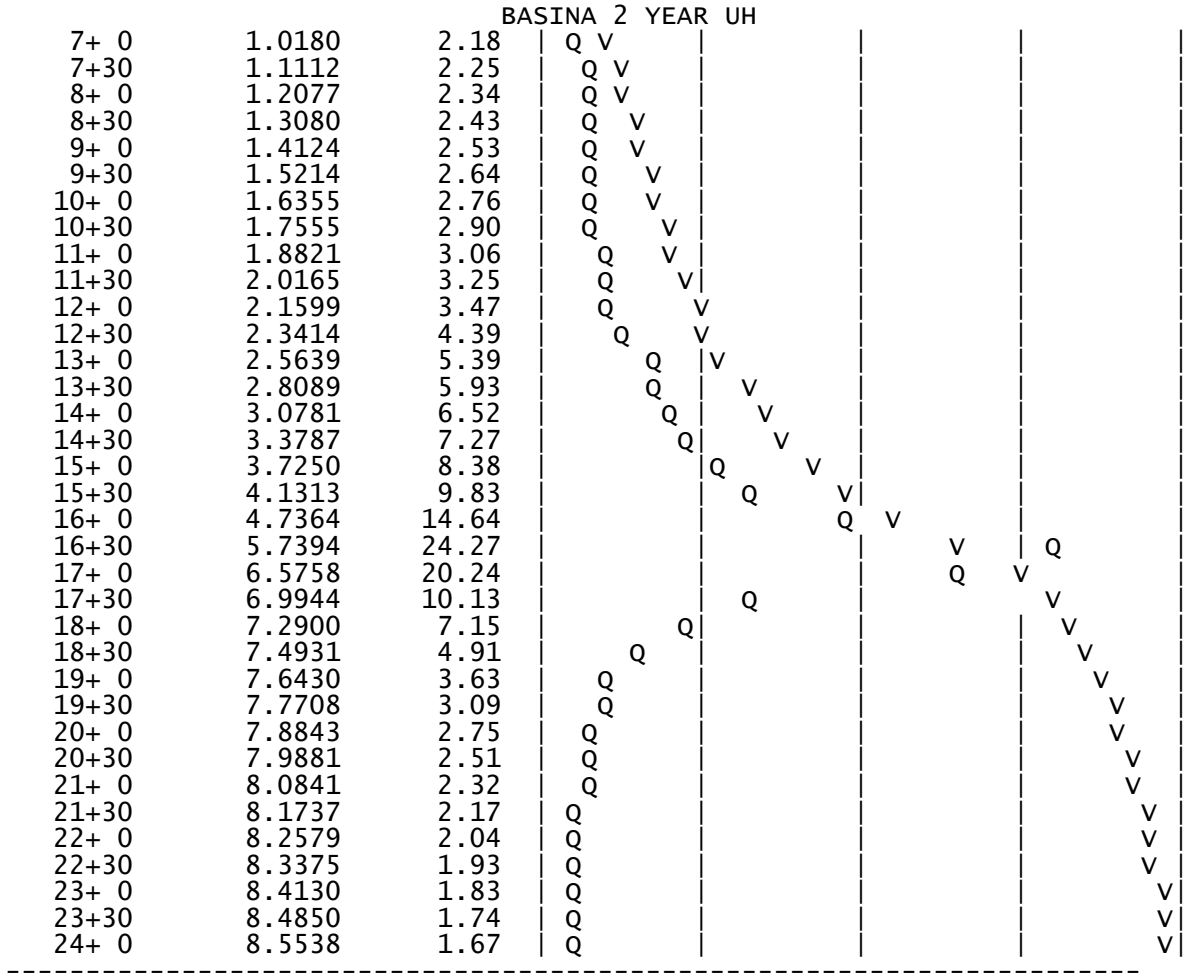
++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 30 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+30	0.0292	0.71	Q				
1+ 0	0.0884	1.43	VQ				
1+30	0.1542	1.59	V Q				
2+ 0	0.2234	1.67	VQ				
2+30	0.2940	1.71	|VQ				
3+ 0	0.3663	1.75	|VQ				
3+30	0.4403	1.79	| Q				
4+ 0	0.5162	1.84	| Q				
4+30	0.5940	1.88	| Q				
5+ 0	0.6739	1.93	| QV				
5+30	0.7561	1.99	| QV				
6+ 0	0.8407	2.05	| QV				
6+30	0.9280	2.11	| Q V				

BASINA 2 YEAR UH



BASINA 100 YEAR UH

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/12/15

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN A
100 year unit hydrograph
RANCHO MIRAMONTE

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
35.82	1	1.22
18.70	1	1.22
40.31	1	1.22
3.75	1	1.22
2.54	1	1.22
Rainfall data for year 100		
101.12	6	1.20
Rainfall data for year 100		
101.12	24	1.22

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
71.6	88.3	35.82	0.354	0.224	0.667	0.149
69.0	86.2	18.70	0.185	0.262	0.400	0.105
69.2	86.4	40.31	0.399	0.259	0.406	0.105

73.3	89.6	3.75	0.037	0.199	0.484	0.096
74.0	90.2	2.54	0.025	0.189	0.546	0.103

Area-averaged adjusted loss rate Fm (In/Hr) = 0.120

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
23.89	0.236	71.6	88.3	1.33	0.791
11.93	0.118	98.0	98.0	0.20	0.963
7.48	0.074	69.0	86.2	1.60	0.755
11.22	0.111	98.0	98.0	0.20	0.963
16.37	0.162	69.2	86.4	1.58	0.758
23.94	0.237	98.0	98.0	0.20	0.963
1.81	0.018	73.3	89.6	1.16	0.814
1.94	0.019	98.0	98.0	0.20	0.963
1.39	0.014	74.0	90.2	1.09	0.824
1.15	0.011	98.0	98.0	0.20	0.963

Area-averaged catchment yield fraction, Y = 0.869
Area-averaged low loss fraction, Yb = 0.131
User entry of time of concentration = 0.295 (hours)
++
Watershed area = 101.12(Ac.)
Catchment Lag time = 0.236 hours
Unit interval = 30.000 minutes
Unit interval percentage of lag time = 211.8644
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.120(In/Hr)
Average low loss rate fraction (Yb) = 0.131 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.452(In)
Computed peak 30-minute rainfall = 0.925(In)
Specified peak 1-hour rainfall = 1.220(In)
Computed peak 3-hour rainfall = 1.220(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.500(In)

Note: user specified rainfall values used.
Rainfall depth area reduction factors:
Using a total area of 101.12(Ac.) (Ref: fig. E-4)

5-minute factor = 0.995 Adjusted rainfall = 0.449(In)
30-minute factor = 0.995 Adjusted rainfall = 0.920(In)
1-hour factor = 0.995 Adjusted rainfall = 1.214(In)
3-hour factor = 0.999 Adjusted rainfall = 1.219(In)
6-hour factor = 1.000 Adjusted rainfall = 2.999(In)
24-hour factor = 1.000 Adjusted rainfall = 6.499(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 203.82 (CFS))	
1	44.268	90.228
2	88.969	91.109
3	97.179	16.732

4	100.000	5.750

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.9202	0.0647
2	1.2142	0.0415
3	1.2161	0.0003
4	1.2174	0.0002
5	1.2184	0.0002
6	1.2193	0.0001
7	1.4895	0.0459
8	1.7715	0.0478
9	2.0642	0.0495
10	2.3668	0.0511
11	2.6786	0.0526
12	2.9991	0.0540
13	3.1360	0.0225
14	3.2684	0.0218
15	3.3966	0.0211
16	3.5211	0.0205
17	3.6423	0.0200
18	3.7603	0.0195
19	3.8754	0.0190
20	3.9879	0.0186
21	4.0980	0.0182
22	4.2057	0.0178
23	4.3113	0.0175
24	4.4149	0.0171
25	4.5166	0.0168
26	4.6165	0.0165
27	4.7147	0.0163
28	4.8114	0.0160
29	4.9065	0.0158
30	5.0002	0.0155
31	5.0925	0.0153
32	5.1835	0.0151
33	5.2732	0.0149
34	5.3618	0.0147
35	5.4492	0.0145
36	5.5355	0.0143
37	5.6208	0.0141
38	5.7050	0.0140
39	5.7883	0.0138
40	5.8706	0.0137
41	5.9521	0.0135
42	6.0326	0.0134
43	6.1123	0.0132
44	6.1912	0.0131
45	6.2693	0.0130
46	6.3467	0.0128
47	6.4233	0.0127
48	6.4992	0.0126

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0760	0.0099	0.0661
2	0.0771	0.0101	0.0670
3	0.0782	0.0102	0.0680
4	0.0794	0.0104	0.0691
5	0.0807	0.0105	0.0702
6	0.0820	0.0107	0.0713
7	0.0834	0.0109	0.0725
8	0.0849	0.0111	0.0738
9	0.0865	0.0113	0.0752

BASINA 100 YEAR UH

10	0.0882	0.0115	0.0766
11	0.0900	0.0118	0.0782
12	0.0919	0.0120	0.0799
13	0.0939	0.0123	0.0816
14	0.0961	0.0126	0.0836
15	0.0985	0.0129	0.0856
16	0.1011	0.0132	0.0879
17	0.1039	0.0136	0.0903
18	0.1070	0.0140	0.0930
19	0.1104	0.0144	0.0960
20	0.1143	0.0149	0.0993
21	0.1185	0.0155	0.1030
22	0.1234	0.0161	0.1072
23	0.1289	0.0169	0.1121
24	0.1354	0.0177	0.1177
25	0.3190	0.0417	0.2773
26	0.3057	0.0400	0.2658
27	0.2910	0.0380	0.2529
28	0.2742	0.0358	0.2384
29	0.0009	0.0001	0.0008
30	0.0012	0.0002	0.0011
31	0.0866	0.0113	0.0753
32	0.4893	0.0601	0.4291
33	0.6402	0.0601	0.5801
34	0.0011	0.0001	0.0010
35	0.2798	0.0366	0.2432
36	0.3101	0.0405	0.2696
37	0.1333	0.0174	0.1158
38	0.1218	0.0159	0.1058
39	0.1130	0.0148	0.0982
40	0.1060	0.0139	0.0921
41	0.1002	0.0131	0.0871
42	0.0954	0.0125	0.0829
43	0.0912	0.0119	0.0793
44	0.0876	0.0115	0.0762
45	0.0844	0.0110	0.0734
46	0.0816	0.0107	0.0709
47	0.0790	0.0103	0.0687
48	0.0767	0.0100	0.0667

Total soil rain loss = 0.82(In)
Total effective rainfall = 5.68(In)
Peak flow rate in flood hydrograph = 92.70(CFS)

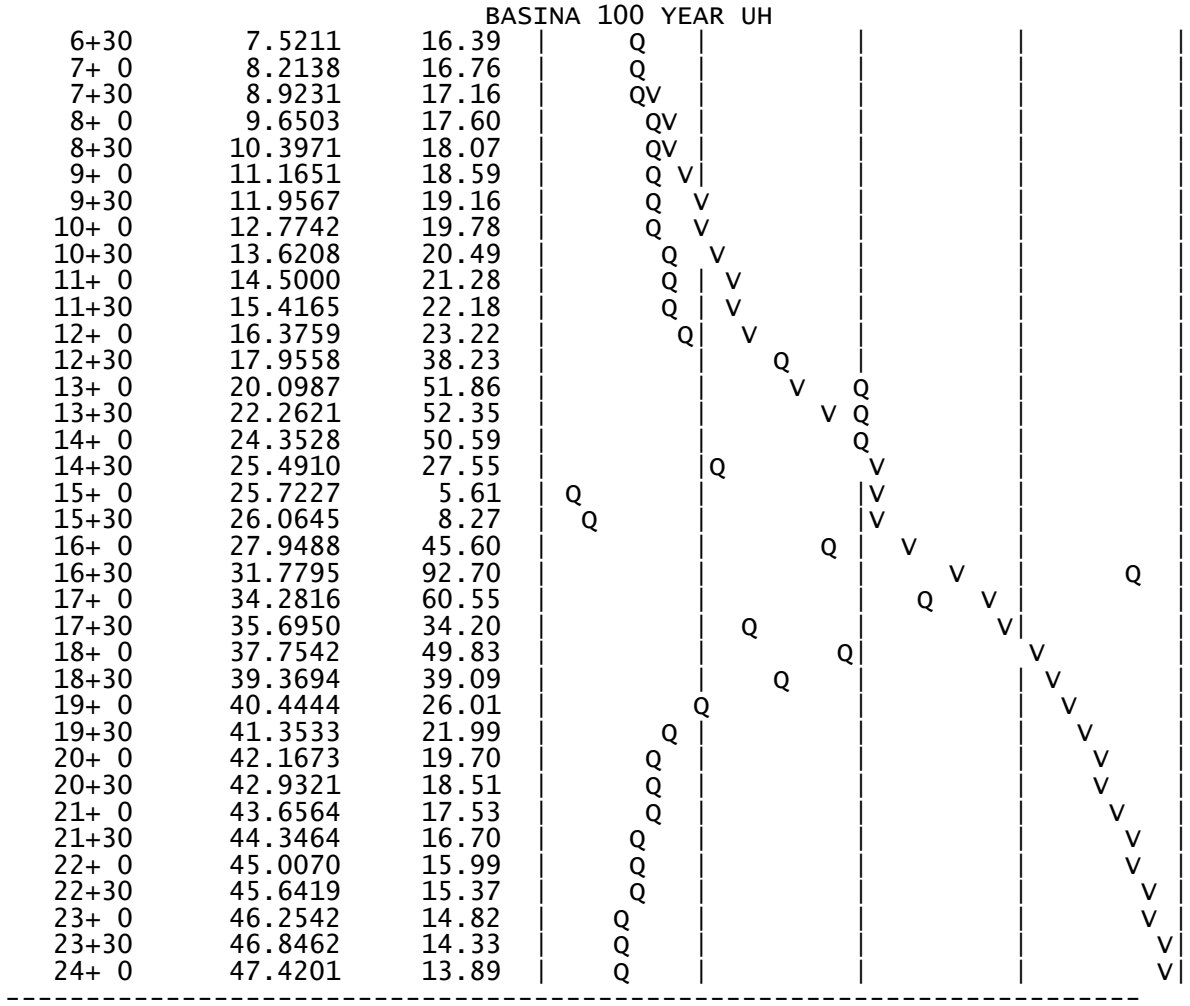
++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 30 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	25.0	50.0	75.0	100.0
0+30	0.2463	5.96	V Q	|	|	|	|
1+ 0	0.7450	12.07	V Q	|	|	|	|
1+30	1.2966	13.35	V Q	|	|	|	|
2+ 0	1.8721	13.93	|V Q	|	|	|	|
2+30	2.4566	14.14	| V Q	|	|	|	|
3+ 0	3.0505	14.37	| V Q	|	|	|	|
3+30	3.6543	14.61	| V Q	|	|	|	|
4+ 0	4.2686	14.87	| V Q	|	|	|	|
4+30	4.8940	15.13	| V Q	|	|	|	|
5+ 0	5.5311	15.42	| V Q	|	|	|	|
5+30	6.1807	15.72	| VQ	|	|	|	|
6+ 0	6.8438	16.05	| VQ	|	|	|	|

BASINA 100 YEAR UH



APPENDIX H: BASIN B – UNIT HYDROGRAPHS

BASINB-1 2 YEAR UH

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/10/15

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN B1
2 YEAR UNIT HYDROGRAPH 24 HOUR STORM
RANCHO MIRAMONTE

Storm Event Year = 2

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 2		
29.20	1	0.50
7.35	1	0.50
5.21	1	0.50
Rainfall data for year 2		
29.20	6	1.20
7.35	6	1.20
5.21	6	1.20
Rainfall data for year 2		
29.20	24	2.00
7.35	24	2.00
5.21	24	2.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	29.20	0.699	0.548	0.190	0.104

BASINB-1 2 YEAR UH

69.0	69.0	7.35	0.176	0.548	0.200	0.110
69.0	69.0	5.21	0.125	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.099

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
5.55	0.133	69.0	69.0	4.49	0.108
23.65	0.566	98.0	98.0	0.20	0.887
1.47	0.035	69.0	69.0	4.49	0.108
5.88	0.141	98.0	98.0	0.20	0.887
0.52	0.012	69.0	69.0	4.49	0.108
4.69	0.112	98.0	98.0	0.20	0.887

Area-averaged catchment yield fraction, Y = 0.747
Area-averaged low loss fraction, Yb = 0.253
User entry of time of concentration = 0.540 (hours)
++
Watershed area = 41.76(Ac.)
Catchment Lag time = 0.432 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 19.2901
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.099(In/Hr)
Average low loss rate fraction (Yb) = 0.253 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.237(In)
Computed peak 30-minute rainfall = 0.406(In)
Specified peak 1-hour rainfall = 0.500(In)
Computed peak 3-hour rainfall = 0.855(In)
Specified peak 6-hour rainfall = 1.200(In)
Specified peak 24-hour rainfall = 2.000(In)

Rainfall depth area reduction factors:
Using a total area of 41.76(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.237(In)
30-minute factor = 0.998 Adjusted rainfall = 0.405(In)
1-hour factor = 0.998 Adjusted rainfall = 0.499(In)
3-hour factor = 1.000 Adjusted rainfall = 0.855(In)
6-hour factor = 1.000 Adjusted rainfall = 1.200(In)
24-hour factor = 1.000 Adjusted rainfall = 2.000(In)

U n i t H y d r o g r a p h
++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 505.03 (CFS))	
1	0.944	4.769
2	4.246	16.675
3	10.392	31.037
4	23.829	67.862
5	40.957	86.503
6	53.094	61.294
7	61.260	41.245
8	67.075	29.367
9	71.724	23.477
10	75.446	18.797

11	78.589	15.875
12	81.156	12.965
13	83.341	11.036
14	85.300	9.891
15	87.066	8.921
16	88.581	7.649
17	89.796	6.138
18	90.904	5.596
19	91.928	5.170
20	92.843	4.623
21	93.693	4.290
22	94.401	3.576
23	95.057	3.312
24	95.678	3.136
25	96.188	2.575
26	96.689	2.530
27	97.101	2.083
28	97.449	1.754
29	97.777	1.661
30	97.991	1.076
31	98.183	0.974
32	98.392	1.052
33	98.623	1.168
34	98.855	1.169
35	99.086	1.169
36	99.318	1.169
37	99.521	1.027
38	99.646	0.632
39	99.767	0.609
40	99.887	0.609
41	100.000	0.569

Total soil rain loss = 0.45(In)
Total effective rainfall = 1.55(In)
Peak flow rate in flood hydrograph = 28.58(CFS)

++

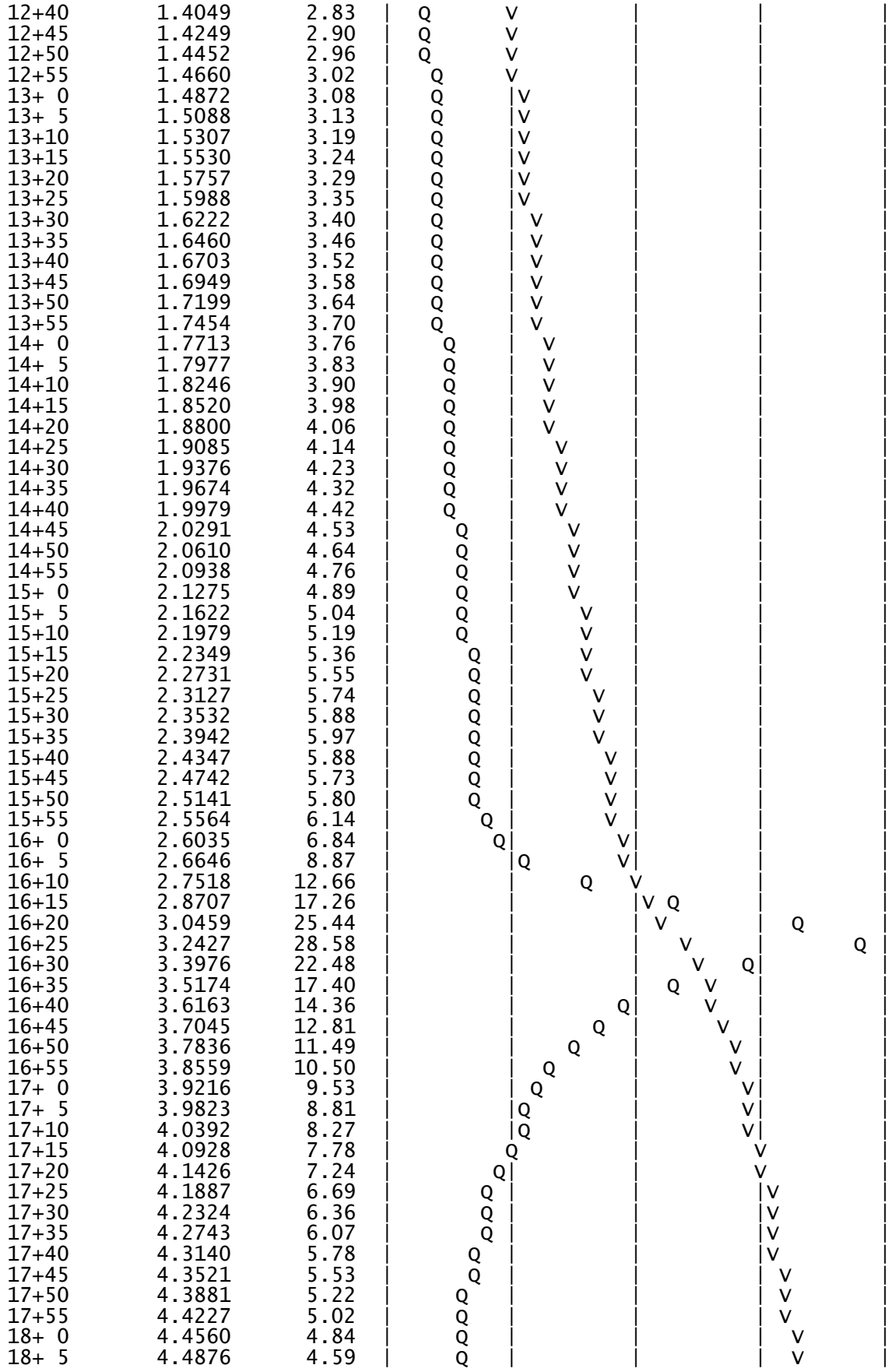
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0001	0.01	Q				
0+10	0.0003	0.04	Q				
0+15	0.0010	0.10	Q				
0+20	0.0026	0.23	Q				
0+25	0.0054	0.40	Q				
0+30	0.0089	0.52	Q				
0+35	0.0130	0.60	Q				
0+40	0.0175	0.65	Q				
0+45	0.0223	0.70	Q				
0+50	0.0274	0.74	Q				
0+55	0.0327	0.77	VQ				
1+ 0	0.0383	0.80	VQ				
1+ 5	0.0439	0.82	VQ				
1+10	0.0497	0.85	VQ				
1+15	0.0557	0.87	VQ				
1+20	0.0618	0.88	VQ				
1+25	0.0680	0.90	VQ				
1+30	0.0742	0.91	VQ				
1+35	0.0806	0.92	VQ				

1+40	0.0871	0.94	VQ	|	|	|	|
1+45	0.0936	0.95	VQ	|	|	|	|
1+50	0.1002	0.96	VQ	|	|	|	|
1+55	0.1069	0.97	VQ	|	|	|	|
2+ 0	0.1136	0.98	VQ	|	|	|	|
2+ 5	0.1204	0.99	VQ	|	|	|	|
2+10	0.1272	0.99	VQ	|	|	|	|
2+15	0.1341	1.00	VQ	|	|	|	|
2+20	0.1411	1.01	|Q	|	|	|	|
2+25	0.1481	1.02	|Q	|	|	|	|
2+30	0.1551	1.02	|Q	|	|	|	|
2+35	0.1622	1.03	|Q	|	|	|	|
2+40	0.1693	1.03	|Q	|	|	|	|
2+45	0.1765	1.04	|Q	|	|	|	|
2+50	0.1837	1.05	|Q	|	|	|	|
2+55	0.1909	1.05	|Q	|	|	|	|
3+ 0	0.1982	1.06	|Q	|	|	|	|
3+ 5	0.2055	1.06	|Q	|	|	|	|
3+10	0.2129	1.07	|Q	|	|	|	|
3+15	0.2203	1.07	|Q	|	|	|	|
3+20	0.2277	1.08	|Q	|	|	|	|
3+25	0.2352	1.09	|Q	|	|	|	|
3+30	0.2427	1.09	|Q	|	|	|	|
3+35	0.2502	1.09	|Q	|	|	|	|
3+40	0.2578	1.10	|Q	|	|	|	|
3+45	0.2654	1.10	|Q	|	|	|	|
3+50	0.2730	1.11	|QV	|	|	|	|
3+55	0.2807	1.11	|QV	|	|	|	|
4+ 0	0.2884	1.12	|QV	|	|	|	|
4+ 5	0.2961	1.12	|QV	|	|	|	|
4+10	0.3039	1.13	|QV	|	|	|	|
4+15	0.3117	1.13	|QV	|	|	|	|
4+20	0.3195	1.14	|QV	|	|	|	|
4+25	0.3273	1.14	|QV	|	|	|	|
4+30	0.3352	1.15	|QV	|	|	|	|
4+35	0.3432	1.15	|QV	|	|	|	|
4+40	0.3511	1.16	|QV	|	|	|	|
4+45	0.3591	1.16	|QV	|	|	|	|
4+50	0.3671	1.17	|QV	|	|	|	|
4+55	0.3752	1.17	|QV	|	|	|	|
5+ 0	0.3833	1.18	|QV	|	|	|	|
5+ 5	0.3915	1.18	|QV	|	|	|	|
5+10	0.3996	1.19	|QV	|	|	|	|
5+15	0.4078	1.19	|Q V	|	|	|	|
5+20	0.4161	1.20	|Q V	|	|	|	|
5+25	0.4244	1.20	|Q V	|	|	|	|
5+30	0.4327	1.21	|Q V	|	|	|	|
5+35	0.4411	1.22	|Q V	|	|	|	|
5+40	0.4495	1.22	|Q V	|	|	|	|
5+45	0.4579	1.23	|Q V	|	|	|	|
5+50	0.4664	1.23	|Q V	|	|	|	|
5+55	0.4750	1.24	|Q V	|	|	|	|
6+ 0	0.4835	1.24	|Q V	|	|	|	|
6+ 5	0.4922	1.25	|Q V	|	|	|	|
6+10	0.5008	1.26	|Q V	|	|	|	|
6+15	0.5095	1.26	|Q V	|	|	|	|
6+20	0.5183	1.27	|Q V	|	|	|	|
6+25	0.5271	1.28	|Q V	|	|	|	|
6+30	0.5359	1.28	|Q V	|	|	|	|
6+35	0.5448	1.29	|Q V	|	|	|	|
6+40	0.5537	1.30	|Q V	|	|	|	|
6+45	0.5627	1.30	|Q V	|	|	|	|
6+50	0.5717	1.31	|Q V	|	|	|	|
6+55	0.5808	1.32	|Q V	|	|	|	|
7+ 0	0.5899	1.32	|Q V	|	|	|	|
7+ 5	0.5991	1.33	|Q V	|	|	|	|

7+10	0.6083	1.34	Q V			
7+15	0.6176	1.35	Q V			
7+20	0.6269	1.35	Q V			
7+25	0.6363	1.36	Q V			
7+30	0.6457	1.37	Q V			
7+35	0.6552	1.38	Q V			
7+40	0.6648	1.39	Q V			
7+45	0.6744	1.39	Q V			
7+50	0.6840	1.40	Q V			
7+55	0.6938	1.41	Q V			
8+ 0	0.7035	1.42	Q V			
8+ 5	0.7134	1.43	Q V			
8+10	0.7233	1.44	Q V			
8+15	0.7332	1.45	Q V			
8+20	0.7432	1.46	Q V			
8+25	0.7533	1.46	Q V			
8+30	0.7635	1.47	Q V			
8+35	0.7737	1.48	Q V			
8+40	0.7840	1.49	Q V			
8+45	0.7943	1.50	Q V			
8+50	0.8048	1.51	Q V			
8+55	0.8152	1.52	Q V			
9+ 0	0.8258	1.53	Q V			
9+ 5	0.8364	1.54	Q V			
9+10	0.8472	1.56	Q V			
9+15	0.8579	1.57	Q V			
9+20	0.8688	1.58	Q V			
9+25	0.8798	1.59	Q V			
9+30	0.8908	1.60	Q V			
9+35	0.9019	1.61	Q V			
9+40	0.9131	1.62	Q V			
9+45	0.9243	1.64	Q V			
9+50	0.9357	1.65	Q V			
9+55	0.9472	1.66	Q V			
10+ 0	0.9587	1.68	Q V			
10+ 5	0.9703	1.69	Q V			
10+10	0.9821	1.70	Q V			
10+15	0.9939	1.72	Q V			
10+20	1.0058	1.73	Q V			
10+25	1.0178	1.75	Q V			
10+30	1.0300	1.76	Q V			
10+35	1.0422	1.78	Q V			
10+40	1.0545	1.79	Q V			
10+45	1.0670	1.81	Q V			
10+50	1.0795	1.82	Q V			
10+55	1.0922	1.84	Q V			
11+ 0	1.1050	1.86	Q V			
11+ 5	1.1179	1.88	Q V			
11+10	1.1310	1.89	Q V			
11+15	1.1441	1.91	Q V			
11+20	1.1574	1.93	Q V			
11+25	1.1708	1.95	Q V			
11+30	1.1844	1.97	Q V			
11+35	1.1981	1.99	Q V			
11+40	1.2120	2.01	Q V			
11+45	1.2260	2.03	Q V			
11+50	1.2401	2.06	Q V			
11+55	1.2544	2.08	Q V			
12+ 0	1.2689	2.10	Q V			
12+ 5	1.2836	2.13	Q V			
12+10	1.2986	2.18	Q V			
12+15	1.3142	2.26	Q V			
12+20	1.3306	2.38	Q V			
12+25	1.3481	2.54	Q V			
12+30	1.3664	2.66	Q V			
12+35	1.3854	2.75	Q V			



12+40	1.4049	2.83	Q V
12+45	1.4249	2.90	Q V
12+50	1.4452	2.96	Q V
12+55	1.4660	3.02	Q V
13+ 0	1.4872	3.08	Q |V
13+ 5	1.5088	3.13	Q |V
13+10	1.5307	3.19	Q |V
13+15	1.5530	3.24	Q |V
13+20	1.5757	3.29	Q |V
13+25	1.5988	3.35	Q |V
13+30	1.6222	3.40	Q | V
13+35	1.6460	3.46	Q | V
13+40	1.6703	3.52	Q | V
13+45	1.6949	3.58	Q | V
13+50	1.7199	3.64	Q | V
13+55	1.7454	3.70	Q | V
14+ 0	1.7713	3.76	Q | V
14+ 5	1.7977	3.83	Q | V
14+10	1.8246	3.90	Q | V
14+15	1.8520	3.98	Q | V
14+20	1.8800	4.06	Q | V
14+25	1.9085	4.14	Q | V
14+30	1.9376	4.23	Q | V
14+35	1.9674	4.32	Q | V
14+40	1.9979	4.42	Q | V
14+45	2.0291	4.53	Q | V
14+50	2.0610	4.64	Q | V
14+55	2.0938	4.76	Q | V
15+ 0	2.1275	4.89	Q | V
15+ 5	2.1622	5.04	Q | V
15+10	2.1979	5.19	Q | V
15+15	2.2349	5.36	Q | V
15+20	2.2731	5.55	Q | V
15+25	2.3127	5.74	Q | V
15+30	2.3532	5.88	Q | V
15+35	2.3942	5.97	Q | V
15+40	2.4347	5.88	Q | V
15+45	2.4742	5.73	Q | V
15+50	2.5141	5.80	Q | V
15+55	2.5564	6.14	Q | V
16+ 0	2.6035	6.84	Q | V
16+ 5	2.6646	8.87	Q | V
16+10	2.7518	12.66	Q V
16+15	2.8707	17.26	V Q
16+20	3.0459	25.44	V Q
16+25	3.2427	28.58	V Q
16+30	3.3976	22.48	V Q
16+35	3.5174	17.40	Q V
16+40	3.6163	14.36	Q V
16+45	3.7045	12.81	Q V
16+50	3.7836	11.49	Q V
16+55	3.8559	10.50	Q V
17+ 0	3.9216	9.53	Q V
17+ 5	3.9823	8.81	Q V
17+10	4.0392	8.27	Q V
17+15	4.0928	7.78	Q V
17+20	4.1426	7.24	Q V
17+25	4.1887	6.69	Q |V
17+30	4.2324	6.36	Q |V
17+35	4.2743	6.07	Q |V
17+40	4.3140	5.78	Q |V
17+45	4.3521	5.53	Q | V
17+50	4.3881	5.22	Q | V
17+55	4.4227	5.02	Q | V
18+ 0	4.4560	4.84	Q | V
18+ 5	4.4876	4.59	Q | V

18+10	4.5181	4.42	Q			V
18+15	4.5467	4.16	Q			V
18+20	4.5734	3.88	Q			V
18+25	4.5983	3.62	Q			V
18+30	4.6212	3.32	Q			V
18+35	4.6429	3.15	Q			V
18+40	4.6639	3.05	Q			V
18+45	4.6844	2.98	Q			V
18+50	4.7043	2.88	Q			V
18+55	4.7235	2.79	Q			V
19+ 0	4.7422	2.71	Q			V
19+ 5	4.7600	2.59	Q			V
19+10	4.7768	2.43	Q			V
19+15	4.7930	2.36	Q			V
19+20	4.8088	2.29	Q			V
19+25	4.8240	2.21	Q			V
19+30	4.8380	2.03	Q			V
19+35	4.8516	1.98	Q			V
19+40	4.8649	1.93	Q			V
19+45	4.8779	1.89	Q			V
19+50	4.8906	1.85	Q			V
19+55	4.9031	1.81	Q			V
20+ 0	4.9153	1.77	Q			V
20+ 5	4.9272	1.73	Q			V
20+10	4.9389	1.70	Q			V
20+15	4.9504	1.67	Q			V
20+20	4.9618	1.64	Q			V
20+25	4.9729	1.61	Q			V
20+30	4.9838	1.59	Q			V
20+35	4.9946	1.56	Q			V
20+40	5.0052	1.54	Q			V
20+45	5.0157	1.52	Q			V
20+50	5.0260	1.50	Q			V
20+55	5.0361	1.47	Q			V
21+ 0	5.0461	1.45	Q			V
21+ 5	5.0560	1.43	Q			V
21+10	5.0657	1.41	Q			V
21+15	5.0754	1.40	Q			V
21+20	5.0849	1.38	Q			V
21+25	5.0942	1.36	Q			V
21+30	5.1035	1.35	Q			V
21+35	5.1127	1.33	Q			V
21+40	5.1217	1.32	Q			V
21+45	5.1307	1.30	Q			V
21+50	5.1396	1.29	Q			V
21+55	5.1484	1.28	Q			V
22+ 0	5.1571	1.26	Q			V
22+ 5	5.1657	1.25	Q			V
22+10	5.1742	1.24	Q			V
22+15	5.1826	1.23	Q			V
22+20	5.1910	1.21	Q			V
22+25	5.1993	1.20	Q			V
22+30	5.2075	1.19	Q			V
22+35	5.2156	1.18	Q			V
22+40	5.2236	1.17	Q			V
22+45	5.2316	1.16	Q			V
22+50	5.2395	1.15	Q			V
22+55	5.2474	1.14	Q			V
23+ 0	5.2551	1.13	Q			V
23+ 5	5.2629	1.12	Q			V
23+10	5.2705	1.11	Q			V
23+15	5.2781	1.10	Q			V
23+20	5.2856	1.09	Q			V
23+25	5.2931	1.08	Q			V
23+30	5.3005	1.07	Q			V
23+35	5.3078	1.07	Q			V

BASINB-1 2 YEAR UH

23+40	5.3151	1.06	|Q	|	|	|	V|
23+45	5.3223	1.05	|Q	|	|	|	V|
23+50	5.3295	1.04	|Q	|	|	|	V|
23+55	5.3366	1.03	|Q	|	|	|	V|
24+ 0	5.3437	1.03	|Q	|	|	|	V|

BASINB-2 2 YEAR UH

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/10/15

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN B-2 UNIT HYDROGRAPH
2 YEAR 24 HR STORM
RANCHO MIRAMONTE

Storm Event Year = 2

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

	Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 2	35.55	1	0.48
Rainfall data for year 2	35.55	6	1.20
Rainfall data for year 2	35.55	24	2.00

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
70.0	70.0	35.55	1.000	0.532	0.406	0.216

Area-averaged adjusted loss rate Fm (In/Hr) = 0.216

********* Area-Averaged low loss rate fraction, Yb **********

Area	Area	SCS CN	SCS CN	S	Pervious

BASINB-2 2 YEAR UH

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
14.43	0.406	70.0	70.0	4.29	0.120
21.12	0.594	98.0	98.0	0.20	0.887

Area-averaged catchment yield fraction, Y = 0.576
Area-averaged low loss fraction, Yb = 0.424
User entry of time of concentration = 0.210 (hours)
++
Watershed area = 35.55(Ac.)
Catchment Lag time = 0.168 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 49.4854
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.216(In/Hr)
Average low loss rate fraction (Yb) = 0.424 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.178(In)
Computed peak 30-minute rainfall = 0.364(In)
Specified peak 1-hour rainfall = 0.480(In)
Computed peak 3-hour rainfall = 0.842(In)
Specified peak 6-hour rainfall = 1.200(In)
Specified peak 24-hour rainfall = 2.000(In)

Rainfall depth area reduction factors:
Using a total area of 35.55(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.177(In)
30-minute factor = 0.998 Adjusted rainfall = 0.363(In)
1-hour factor = 0.998 Adjusted rainfall = 0.479(In)
3-hour factor = 1.000 Adjusted rainfall = 0.842(In)
6-hour factor = 1.000 Adjusted rainfall = 1.200(In)
24-hour factor = 1.000 Adjusted rainfall = 2.000(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 429.93 (CFS))	
1	3.895	16.748
2	29.905	111.824
3	60.095	129.795
4	73.423	57.303
5	81.171	33.310
6	86.350	22.266
7	89.979	15.602
8	92.596	11.252
9	94.600	8.614
10	96.121	6.542
11	97.251	4.856
12	97.988	3.171
13	98.524	2.302
14	99.117	2.550
15	99.607	2.107
16	100.000	1.691

Total soil rain loss = 0.79(In)
Total effective rainfall = 1.21(In)
Peak flow rate in flood hydrograph = 27.14(CFS)

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BASINB-2 2 YEAR UH
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0002	0.02	Q				
0+10	0.0015	0.19	Q				
0+15	0.0041	0.38	Q				
0+20	0.0073	0.47	Q				
0+25	0.0109	0.52	Q				
0+30	0.0147	0.55	Q				
0+35	0.0187	0.58	Q				
0+40	0.0228	0.60	Q				
0+45	0.0270	0.61	Q				
0+50	0.0313	0.62	Q				
0+55	0.0356	0.63	Q				
1+ 0	0.0400	0.64	Q				
1+ 5	0.0445	0.64	Q				
1+10	0.0489	0.65	Q				
1+15	0.0535	0.66	Q				
1+20	0.0580	0.66	Q				
1+25	0.0626	0.66	Q				
1+30	0.0671	0.67	Q				
1+35	0.0717	0.67	Q				
1+40	0.0764	0.67	Q				
1+45	0.0810	0.67	Q				
1+50	0.0856	0.67	Q				
1+55	0.0903	0.68	QV				
2+ 0	0.0950	0.68	QV				
2+ 5	0.0997	0.68	QV				
2+10	0.1044	0.68	QV				
2+15	0.1091	0.69	QV				
2+20	0.1139	0.69	QV				
2+25	0.1186	0.69	QV				
2+30	0.1234	0.70	QV				
2+35	0.1282	0.70	QV				
2+40	0.1331	0.70	QV				
2+45	0.1379	0.70	QV				
2+50	0.1428	0.71	QV				
2+55	0.1476	0.71	QV				
3+ 0	0.1525	0.71	QV				
3+ 5	0.1575	0.71	QV				
3+10	0.1624	0.72	QV				
3+15	0.1674	0.72	QV				
3+20	0.1723	0.72	QV				
3+25	0.1773	0.73	QV				
3+30	0.1824	0.73	Q V				
3+35	0.1874	0.73	Q V				
3+40	0.1925	0.73	Q V				
3+45	0.1975	0.74	Q V				
3+50	0.2026	0.74	Q V				
3+55	0.2078	0.74	Q V				
4+ 0	0.2129	0.75	Q V				
4+ 5	0.2181	0.75	|QV				
4+10	0.2233	0.75	|QV				
4+15	0.2285	0.76	|QV				
4+20	0.2337	0.76	|QV				
4+25	0.2390	0.76	|QV				
4+30	0.2443	0.77	|QV				
4+35	0.2496	0.77	|QV				
4+40	0.2549	0.77	|QV				
4+45	0.2603	0.78	|QV				
4+50	0.2657	0.78	|QV				

4+55	0.2711	0.78	Q V				
5+ 0	0.2765	0.79	Q V				
5+ 5	0.2819	0.79	Q V				
5+10	0.2874	0.80	Q V				
5+15	0.2929	0.80	Q V				
5+20	0.2985	0.80	Q V				
5+25	0.3040	0.81	Q V				
5+30	0.3096	0.81	Q V				
5+35	0.3152	0.82	Q V				
5+40	0.3209	0.82	Q V				
5+45	0.3265	0.82	Q V				
5+50	0.3322	0.83	Q V				
5+55	0.3380	0.83	Q V				
6+ 0	0.3437	0.84	Q V				
6+ 5	0.3495	0.84	Q V				
6+10	0.3553	0.84	Q V				
6+15	0.3612	0.85	Q V				
6+20	0.3671	0.85	Q V				
6+25	0.3730	0.86	Q V				
6+30	0.3789	0.86	Q V				
6+35	0.3849	0.87	Q V				
6+40	0.3909	0.87	Q V				
6+45	0.3969	0.88	Q V				
6+50	0.4030	0.88	Q V				
6+55	0.4091	0.89	Q V				
7+ 0	0.4152	0.89	Q V				
7+ 5	0.4214	0.90	Q V				
7+10	0.4276	0.90	Q V				
7+15	0.4339	0.91	Q V				
7+20	0.4402	0.91	Q V				
7+25	0.4465	0.92	Q V				
7+30	0.4528	0.92	Q V				
7+35	0.4592	0.93	Q V				
7+40	0.4657	0.93	Q V				
7+45	0.4721	0.94	Q V				
7+50	0.4787	0.95	Q V				
7+55	0.4852	0.95	Q V				
8+ 0	0.4918	0.96	Q V				
8+ 5	0.4984	0.96	Q V				
8+10	0.5051	0.97	Q V				
8+15	0.5118	0.98	Q V				
8+20	0.5186	0.98	Q V				
8+25	0.5254	0.99	Q V				
8+30	0.5323	1.00	Q V				
8+35	0.5392	1.00	Q V				
8+40	0.5462	1.01	Q V				
8+45	0.5532	1.02	Q V				
8+50	0.5602	1.02	Q V				
8+55	0.5673	1.03	Q V				
9+ 0	0.5745	1.04	Q V				
9+ 5	0.5817	1.05	Q V				
9+10	0.5889	1.05	Q V				
9+15	0.5962	1.06	Q V				
9+20	0.6036	1.07	Q V				
9+25	0.6110	1.08	Q V				
9+30	0.6185	1.09	Q V				
9+35	0.6261	1.09	Q V				
9+40	0.6337	1.10	Q V				
9+45	0.6413	1.11	Q V				
9+50	0.6490	1.12	Q V				
9+55	0.6568	1.13	Q V				
10+ 0	0.6647	1.14	Q V				
10+ 5	0.6726	1.15	Q V				
10+10	0.6806	1.16	Q V				
10+15	0.6886	1.17	Q V				
10+20	0.6967	1.18	Q V				

10+25	0.7049	1.19	|Q V |	|	|	|
10+30	0.7132	1.20	|Q V |	|	|	|
10+35	0.7216	1.21	|Q V |	|	|	|
10+40	0.7300	1.22	|Q V |	|	|	|
10+45	0.7385	1.23	|Q V |	|	|	|
10+50	0.7471	1.25	|Q V |	|	|	|
10+55	0.7557	1.26	|Q V |	|	|	|
11+ 0	0.7645	1.27	|Q V |	|	|	|
11+ 5	0.7733	1.28	|Q V |	|	|	|
11+10	0.7823	1.30	|Q V |	|	|	|
11+15	0.7913	1.31	|Q V |	|	|	|
11+20	0.8004	1.32	|Q V |	|	|	|
11+25	0.8096	1.34	|Q V|	|	|	|
11+30	0.8189	1.35	|Q V|	|	|	|
11+35	0.8284	1.37	|Q V|	|	|	|
11+40	0.8379	1.38	|Q V|	|	|	|
11+45	0.8475	1.40	|Q V|	|	|	|
11+50	0.8573	1.42	|Q V|	|	|	|
11+55	0.8672	1.43	|Q V|	|	|	|
12+ 0	0.8771	1.45	|Q V|	|	|	|
12+ 5	0.8874	1.49	|Q V|	|	|	|
12+10	0.8989	1.66	| Q V|	|	|	|
12+15	0.9117	1.86	| Q V |	|	|	|
12+20	0.9252	1.96	| Q V |	|	|	|
12+25	0.9392	2.03	| Q V |	|	|	|
12+30	0.9535	2.08	| Q V |	|	|	|
12+35	0.9681	2.13	| Q V |	|	|	|
12+40	0.9831	2.17	| Q V |	|	|	|
12+45	0.9982	2.20	| Q |V |	|	|	|
12+50	1.0136	2.24	| Q |V |	|	|	|
12+55	1.0293	2.27	| Q |V |	|	|	|
13+ 0	1.0451	2.30	| Q |V |	|	|	|
13+ 5	1.0612	2.34	| Q |V |	|	|	|
13+10	1.0775	2.37	| Q |V |	|	|	|
13+15	1.0941	2.40	| Q | V |	|	|	|
13+20	1.1109	2.44	| Q | V |	|	|	|
13+25	1.1279	2.47	| Q | V |	|	|	|
13+30	1.1452	2.51	| Q | V |	|	|	|
13+35	1.1627	2.55	| Q | V |	|	|	|
13+40	1.1806	2.59	| Q | V |	|	|	|
13+45	1.1986	2.63	| Q | V |	|	|	|
13+50	1.2170	2.67	| Q | V |	|	|	|
13+55	1.2357	2.71	| Q | V |	|	|	|
14+ 0	1.2547	2.76	| Q | V |	|	|	|
14+ 5	1.2741	2.81	| Q | V |	|	|	|
14+10	1.2939	2.87	| Q | V |	|	|	|
14+15	1.3140	2.93	| Q | V |	|	|	|
14+20	1.3346	2.99	| Q | V |	|	|	|
14+25	1.3556	3.05	| Q | V |	|	|	|
14+30	1.3771	3.12	| Q | V |	|	|	|
14+35	1.3991	3.20	| Q | V |	|	|	|
14+40	1.4217	3.27	| Q | V |	|	|	|
14+45	1.4448	3.36	| Q | V |	|	|	|
14+50	1.4686	3.45	| Q | V |	|	|	|
14+55	1.4931	3.55	| Q | V |	|	|	|
15+ 0	1.5183	3.67	| Q | V |	|	|	|
15+ 5	1.5444	3.79	| Q | V |	|	|	|
15+10	1.5715	3.93	| Q | V |	|	|	|
15+15	1.5995	4.08	| Q | V |	|	|	|
15+20	1.6288	4.25	| Q | V |	|	|	|
15+25	1.6591	4.40	| Q | V |	|	|	|
15+30	1.6891	4.35	| Q | V |	|	|	|
15+35	1.7185	4.28	| Q | V|	|	|	|
15+40	1.7493	4.46	| Q | V|	|	|	|
15+45	1.7822	4.78	| Q | V|	|	|	|
15+50	1.8186	5.29	| Q | V |	|	|	|

BASINB-2 2 YEAR UH

15+55	1.8602	6.04	
16+ 0	1.9122	7.54	
16+ 5	1.9975	12.39	
16+10	2.1768	26.04	
16+15	2.3637	27.14	
16+20	2.4732	15.89	
16+25	2.5511	11.32	
16+30	2.6137	9.09	
16+35	2.6670	7.74	
16+40	2.7130	6.68	
16+45	2.7538	5.91	
16+50	2.7901	5.27	
16+55	2.8227	4.73	
17+ 0	2.8519	4.24	
17+ 5	2.8788	3.92	
17+10	2.9047	3.76	
17+15	2.9289	3.52	
17+20	2.9515	3.28	
17+25	2.9715	2.90	
17+30	2.9907	2.78	
17+35	3.0092	2.69	
17+40	3.0271	2.60	
17+45	3.0444	2.52	
17+50	3.0612	2.44	
17+55	3.0776	2.38	
18+ 0	3.0936	2.32	
18+ 5	3.1090	2.24	
18+10	3.1230	2.03	
18+15	3.1354	1.81	
18+20	3.1470	1.68	
18+25	3.1580	1.60	
18+30	3.1686	1.53	
18+35	3.1787	1.47	
18+40	3.1886	1.43	
18+45	3.1981	1.38	
18+50	3.2074	1.35	
18+55	3.2164	1.31	
19+ 0	3.2252	1.28	
19+ 5	3.2338	1.25	
19+10	3.2423	1.23	
19+15	3.2506	1.20	
19+20	3.2587	1.18	
19+25	3.2666	1.16	
19+30	3.2745	1.14	
19+35	3.2822	1.12	
19+40	3.2897	1.10	
19+45	3.2972	1.08	
19+50	3.3046	1.07	
19+55	3.3118	1.05	
20+ 0	3.3189	1.04	
20+ 5	3.3260	1.02	
20+10	3.3329	1.01	
20+15	3.3398	0.99	
20+20	3.3465	0.98	
20+25	3.3532	0.97	
20+30	3.3598	0.96	
20+35	3.3663	0.94	
20+40	3.3727	0.93	
20+45	3.3790	0.92	
20+50	3.3853	0.91	
20+55	3.3915	0.90	
21+ 0	3.3976	0.89	
21+ 5	3.4037	0.88	
21+10	3.4097	0.87	
21+15	3.4156	0.86	
21+20	3.4215	0.85	

BASINB-2 2 YEAR UH

21+25	3.4273	0.84	|Q	|	|	|	V |
21+30	3.4330	0.83	|Q	|	|	|	V |
21+35	3.4387	0.83	|Q	|	|	|	V |
21+40	3.4444	0.82	|Q	|	|	|	V |
21+45	3.4499	0.81	|Q	|	|	|	V |
21+50	3.4555	0.80	|Q	|	|	|	V |
21+55	3.4609	0.79	|Q	|	|	|	V |
22+ 0	3.4664	0.79	|Q	|	|	|	V |
22+ 5	3.4717	0.78	|Q	|	|	|	V |
22+10	3.4771	0.77	|Q	|	|	|	V |
22+15	3.4823	0.77	|Q	|	|	|	V |
22+20	3.4876	0.76	|Q	|	|	|	V |
22+25	3.4927	0.75	|Q	|	|	|	V |
22+30	3.4979	0.75	Q	|	|	|	V |
22+35	3.5030	0.74	Q	|	|	|	V |
22+40	3.5080	0.73	Q	|	|	|	V|
22+45	3.5130	0.73	Q	|	|	|	V|
22+50	3.5180	0.72	Q	|	|	|	V|
22+55	3.5229	0.72	Q	|	|	|	V|
23+ 0	3.5278	0.71	Q	|	|	|	V|
23+ 5	3.5327	0.70	Q	|	|	|	V|
23+10	3.5375	0.70	Q	|	|	|	V|
23+15	3.5423	0.69	Q	|	|	|	V|
23+20	3.5470	0.69	Q	|	|	|	V|
23+25	3.5517	0.68	Q	|	|	|	V|
23+30	3.5564	0.68	Q	|	|	|	V|
23+35	3.5610	0.67	Q	|	|	|	V|
23+40	3.5657	0.67	Q	|	|	|	V|
23+45	3.5702	0.66	Q	|	|	|	V|
23+50	3.5748	0.66	Q	|	|	|	V|
23+55	3.5793	0.65	Q	|	|	|	V|
24+ 0	3.5838	0.65	Q	|	|	|	V|

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/12/15

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN B1
100 YEAR 24 HR UNIT HYDROGRAPH
RANCHO MIRAMONTE

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
29.20	1	1.22
7.35	1	1.22
5.21	1	1.22
Rainfall data for year 100		
41.76	6	3.00
Rainfall data for year 100		
41.76	24	6.50

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******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	86.2	29.20	0.699	0.262	0.190	0.050
69.0	86.2	7.35	0.176	0.262	0.200	0.052
69.0	86.2	5.21	0.125	0.262	0.100	0.026

Area-averaged adjusted loss rate Fm (In/Hr) = 0.047

********* Area-Averaged low loss rate fraction, Yb **********

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
5.55	0.133	69.0	86.2	1.60	0.755
23.65	0.566	98.0	98.0	0.20	0.963
1.47	0.035	69.0	86.2	1.60	0.755
5.88	0.141	98.0	98.0	0.20	0.963
0.52	0.012	69.0	86.2	1.60	0.755
4.69	0.112	98.0	98.0	0.20	0.963

Area-averaged catchment yield fraction, Y = 0.926
Area-averaged low loss fraction, Yb = 0.074
User entry of time of concentration = 0.540 (hours)
++
Watershed area = 41.76(Ac.)
Catchment Lag time = 0.432 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 19.2901
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.047(In/Hr)
Average low loss rate fraction (Yb) = 0.074 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.452(In)
Computed peak 30-minute rainfall = 0.925(In)
Specified peak 1-hour rainfall = 1.220(In)
Computed peak 3-hour rainfall = 2.118(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.500(In)

Rainfall depth area reduction factors:
Using a total area of 41.76(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.451(In)
30-minute factor = 0.998 Adjusted rainfall = 0.923(In)
1-hour factor = 0.998 Adjusted rainfall = 1.218(In)
3-hour factor = 1.000 Adjusted rainfall = 2.118(In)

6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.500(In)

U n i t H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 505.03 (CFS))		
1	0.944	4.769
2	4.246	16.675
3	10.392	31.037
4	23.829	67.862
5	40.957	86.503
6	53.094	61.294
7	61.260	41.245
8	67.075	29.367
9	71.724	23.477
10	75.446	18.797
11	78.589	15.875
12	81.156	12.965
13	83.341	11.036
14	85.300	9.891
15	87.066	8.921
16	88.581	7.649
17	89.796	6.138
18	90.904	5.596
19	91.928	5.170
20	92.843	4.623
21	93.693	4.290
22	94.401	3.576
23	95.057	3.312
24	95.678	3.136
25	96.188	2.575
26	96.689	2.530
27	97.101	2.083
28	97.449	1.754
29	97.777	1.661
30	97.991	1.076
31	98.183	0.974
32	98.392	1.052
33	98.623	1.168
34	98.855	1.169
35	99.086	1.169
36	99.318	1.169
37	99.521	1.027
38	99.646	0.632
39	99.767	0.609
40	99.887	0.609
41	100.000	0.569

Total soil rain loss = 0.44(In)
Total effective rainfall = 6.06(In)
Peak flow rate in flood hydrograph = 68.62(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0004	0.06	Q				
0+10	0.0021	0.25	Q				
0+15	0.0063	0.61	Q				
0+20	0.0160	1.41	Q				
0+25	0.0326	2.42	VQ				
0+30	0.0543	3.14	VQ				
0+35	0.0792	3.63	V Q				
0+40	0.1066	3.98	V Q				
0+45	0.1359	4.26	V Q				
0+50	0.1668	4.49	V Q				
0+55	0.1991	4.68	V Q				
1+ 0	0.2325	4.85	V Q				
1+ 5	0.2668	4.99	V Q				
1+10	0.3020	5.11	V Q				
1+15	0.3381	5.23	V Q				
1+20	0.3748	5.33	V Q				
1+25	0.4121	5.42	V Q				
1+30	0.4499	5.49	V Q				
1+35	0.4883	5.57	V Q				
1+40	0.5271	5.64	V Q				
1+45	0.5663	5.70	|V Q				
1+50	0.6060	5.76	|V Q				
1+55	0.6460	5.81	|V Q				
2+ 0	0.6864	5.86	|V Q				
2+ 5	0.7270	5.91	|V Q				
2+10	0.7680	5.95	|V Q				
2+15	0.8093	5.99	|V Q				
2+20	0.8507	6.03	|V Q				
2+25	0.8925	6.06	|V Q				
2+30	0.9344	6.09	|V Q				
2+35	0.9765	6.12	|V Q				
2+40	1.0188	6.14	|V Q				
2+45	1.0614	6.17	| VQ				
2+50	1.1041	6.20	| VQ				
2+55	1.1470	6.23	| VQ				
3+ 0	1.1902	6.26	| VQ				

3+ 5	1.2335	6.29	VQ				
3+10	1.2770	6.32	VQ				
3+15	1.3207	6.34	VQ				
3+20	1.3646	6.37	VQ				
3+25	1.4086	6.39	VQ				
3+30	1.4527	6.41	VQ				
3+35	1.4970	6.43	VQ				
3+40	1.5414	6.45	VQ				
3+45	1.5859	6.46	Q				
3+50	1.6305	6.48	Q				
3+55	1.6753	6.50	Q				
4+ 0	1.7202	6.52	Q				
4+ 5	1.7652	6.54	Q				
4+10	1.8104	6.56	Q				
4+15	1.8557	6.58	Q				
4+20	1.9011	6.60	Q				
4+25	1.9467	6.62	Q				
4+30	1.9924	6.64	Q				
4+35	2.0383	6.66	Q				
4+40	2.0843	6.68	Q				
4+45	2.1304	6.70	QV				
4+50	2.1767	6.72	QV				
4+55	2.2231	6.74	QV				
5+ 0	2.2696	6.76	QV				
5+ 5	2.3164	6.78	QV				
5+10	2.3632	6.80	QV				
5+15	2.4102	6.83	QV				
5+20	2.4574	6.85	QV				
5+25	2.5047	6.87	QV				
5+30	2.5522	6.89	QV				
5+35	2.5998	6.92	QV				
5+40	2.6476	6.94	Q V				
5+45	2.6956	6.96	Q V				
5+50	2.7437	6.99	Q V				
5+55	2.7919	7.01	QV				
6+ 0	2.8404	7.03	QV				
6+ 5	2.8890	7.06	QV				
6+10	2.9378	7.08	QV				
6+15	2.9867	7.11	QV				
6+20	3.0359	7.13	QV				
6+25	3.0852	7.16	QV				
6+30	3.1347	7.19	QV				
6+35	3.1843	7.21	Q V				
6+40	3.2342	7.24	Q V				
6+45	3.2842	7.26	Q V				
6+50	3.3344	7.29	Q V				
6+55	3.3848	7.32	Q V				
7+ 0	3.4354	7.35	Q V				
7+ 5	3.4862	7.38	Q V				
7+10	3.5372	7.40	Q V				
7+15	3.5884	7.43	Q V				
7+20	3.6398	7.46	Q V				

7+25	3.6914	7.49	Q V				
7+30	3.7432	7.52	Q V				
7+35	3.7952	7.55	Q V				
7+40	3.8474	7.58	Q V				
7+45	3.8999	7.61	Q V				
7+50	3.9525	7.65	Q V				
7+55	4.0054	7.68	Q V				
8+ 0	4.0585	7.71	Q V				
8+ 5	4.1118	7.74	Q V				
8+10	4.1654	7.78	Q V				
8+15	4.2192	7.81	Q V				
8+20	4.2732	7.85	Q V				
8+25	4.3275	7.88	Q V				
8+30	4.3820	7.92	Q V				
8+35	4.4368	7.95	Q V				
8+40	4.4918	7.99	Q V				
8+45	4.5471	8.03	Q V				
8+50	4.6026	8.06	Q V				
8+55	4.6584	8.10	Q V				
9+ 0	4.7145	8.14	Q V				
9+ 5	4.7708	8.18	Q V				
9+10	4.8274	8.22	Q V				
9+15	4.8843	8.26	Q V				
9+20	4.9415	8.30	Q V				
9+25	4.9989	8.34	Q V				
9+30	5.0567	8.39	Q V				
9+35	5.1148	8.43	Q V				
9+40	5.1731	8.47	Q V				
9+45	5.2318	8.52	Q V				
9+50	5.2908	8.57	Q V				
9+55	5.3501	8.61	Q V				
10+ 0	5.4098	8.66	Q V				
10+ 5	5.4697	8.71	Q V				
10+10	5.5300	8.76	Q V				
10+15	5.5907	8.81	Q V				
10+20	5.6517	8.86	Q V				
10+25	5.7131	8.91	Q V				
10+30	5.7748	8.96	Q V				
10+35	5.8370	9.02	Q V				
10+40	5.8994	9.07	Q V				
10+45	5.9623	9.13	Q V				
10+50	6.0256	9.19	Q V				
10+55	6.0893	9.25	Q V				
11+ 0	6.1534	9.31	Q V				
11+ 5	6.2179	9.37	Q V				
11+10	6.2829	9.43	Q V				
11+15	6.3483	9.50	Q V				
11+20	6.4141	9.56	Q V				
11+25	6.4804	9.63	Q V				
11+30	6.5472	9.70	Q V				
11+35	6.6145	9.77	Q V				
11+40	6.6823	9.84	Q V				

11+45	6.7505	9.91	Q	V			
11+50	6.8193	9.99	Q	V			
11+55	6.8887	10.07	Q	V			
12+ 0	6.9585	10.15	Q	V			
12+ 5	7.0289	10.22	Q	V			
12+10	7.0996	10.27	Q	V			
12+15	7.1705	10.29	Q	V			
12+20	7.2409	10.23	Q	V			
12+25	7.3107	10.14	Q	V			
12+30	7.3803	10.10	Q	V			
12+35	7.4499	10.11	Q	V			
12+40	7.5198	10.15	Q	V			
12+45	7.5901	10.20	Q	V			
12+50	7.6608	10.27	Q	V			
12+55	7.7320	10.35	Q	V			
13+ 0	7.8039	10.43	Q	V			
13+ 5	7.8764	10.53	Q	V			
13+10	7.9496	10.63	Q	V			
13+15	8.0236	10.74	Q	V			
13+20	8.0984	10.86	Q	V			
13+25	8.1740	10.98	Q	V			
13+30	8.2506	11.12	Q	V			
13+35	8.3281	11.26	Q	V			
13+40	8.4066	11.40	Q	V			
13+45	8.4862	11.56	Q	V			
13+50	8.5670	11.72	Q	V			
13+55	8.6489	11.89	Q	V			
14+ 0	8.7320	12.07	Q	V			
14+ 5	8.8165	12.27	Q	V			
14+10	8.9024	12.47	Q	V			
14+15	8.9897	12.69	Q	V			
14+20	9.0787	12.92	Q	V			
14+25	9.1694	13.17	Q	V			
14+30	9.2619	13.43	Q	V			
14+35	9.3563	13.71	Q	V			
14+40	9.4527	14.00	Q	V			
14+45	9.5514	14.32	Q	V			
14+50	9.6523	14.66	Q	V			
14+55	9.7558	15.02	Q	V			
15+ 0	9.8619	15.42	Q	V			
15+ 5	9.9711	15.85	Q	V			
15+10	10.0835	16.32	Q	V			
15+15	10.1994	16.84	Q	V			
15+20	10.3194	17.42	Q	V			
15+25	10.4434	18.01	Q	V			
15+30	10.5714	18.58	Q	V			
15+35	10.7031	19.11	Q	V			
15+40	10.8368	19.42	Q	V			
15+45	10.9728	19.74	Q	V			
15+50	11.1145	20.57	Q	V			
15+55	11.2664	22.07	Q	V			
16+ 0	11.4356	24.56	Q	V			

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16+ 5      11.6404     29.73  |         |     Q   | V       |         |
16+10      11.9039     38.26  |         |         |QV       |         |
16+15      12.2360     48.23  |         |         |  V   Q  |         |
16+20      12.6731     63.46  |         |         |   V     |     Q   |
16+25      13.1456     68.62  |         |         |   V     |        Q|
16+30      13.5369     56.81  |         |         |    V    | Q       |
16+35      13.8562     46.36  |         |         |     Q   |         |
16+40      14.1289     39.60  |         |         | Q   V   |         |
16+45      14.3744     35.65  |         |         Q      V  |         |
16+50      14.5971     32.34  |         |       Q |      V  |         |
16+55      14.8020     29.75  |         |      Q  |       V |         |
17+ 0      14.9903     27.35  |         |    Q    |       V |         |
17+ 5      15.1657     25.46  |         |   Q     |       V |         |
17+10      15.3307     23.96  |         |  Q      |        V|         |
17+15      15.4864     22.61  |         | Q       |        V|         |
17+20      15.6324     21.21  |         | Q       |        V|         |
17+25      15.7691     19.84  |         |Q        |        V|         |
17+30      15.8993     18.91  |         Q         |         V         |
17+35      16.0239     18.09  |         Q         |         V         |
17+40      16.1428     17.27  |        Q|         |         V         |
17+45      16.2569     16.56  |        Q|         |         V         |
17+50      16.3655     15.77  |        Q|         |         |V        |
17+55      16.4700     15.18  |       Q |         |         |V        |
18+ 0      16.5709     14.64  |       Q |         |         |V        |
18+ 5      16.6674     14.02  |       Q |         |         |V        |
18+10      16.7611     13.61  |      Q  |         |         |V        |
18+15      16.8515     13.12  |      Q  |         |         |V        |
18+20      16.9394     12.77  |      Q  |         |         | V       |
18+25      17.0259     12.56  |      Q  |         |         | V       |
18+30      17.1098     12.18  |     Q   |         |         | V       |
18+35      17.1922     11.97  |     Q   |         |         | V       |
18+40      17.2736     11.82  |     Q   |         |         | V       |
18+45      17.3540     11.68  |     Q   |         |         | V       |
18+50      17.4332     11.50  |     Q   |         |         |  V      |
18+55      17.5112     11.31  |     Q   |         |         |  V      |
19+ 0      17.5877     11.11  |     Q   |         |         |  V      |
19+ 5      17.6624     10.85  |     Q   |         |         |  V      |
19+10      17.7348     10.52  |     Q   |         |         |  V      |
19+15      17.8059     10.33  |    Q    |         |         |  V      |
19+20      17.8757     10.14  |    Q    |         |         |  V      |
19+25      17.9441      9.93  |    Q    |         |         |   V     |
19+30      18.0099      9.56  |    Q    |         |         |   V     |
19+35      18.0747      9.40  |    Q    |         |         |   V     |
19+40      18.1385      9.27  |    Q    |         |         |   V     |
19+45      18.2015      9.15  |    Q    |         |         |   V     |
19+50      18.2637      9.03  |    Q    |         |         |   V     |
19+55      18.3251      8.92  |    Q    |         |         |   V     |
20+ 0      18.3858      8.81  |    Q    |         |         |   V     |
20+ 5      18.4457      8.71  |   Q     |         |         |   V     |
20+10      18.5050      8.61  |   Q     |         |         |    V    |
20+15      18.5637      8.52  |   Q     |         |         |    V    |
20+20      18.6217      8.42  |   Q     |         |         |    V    |
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  20+25      18.6791      8.34  |    Q     |          |          |     V    |
  20+30      18.7359      8.25  |    Q     |          |          |     V    |
  20+35      18.7922      8.17  |    Q     |          |          |     V    |
  20+40      18.8479      8.09  |    Q     |          |          |     V    |
  20+45      18.9031      8.02  |    Q     |          |          |     V    |
  20+50      18.9578      7.94  |    Q     |          |          |     V    |
  20+55      19.0121      7.87  |    Q     |          |          |      V   |
  21+ 0      19.0658      7.80  |    Q     |          |          |      V   |
  21+ 5      19.1191      7.74  |    Q     |          |          |      V   |
  21+10      19.1719      7.67  |    Q     |          |          |      V   |
  21+15      19.2243      7.61  |    Q     |          |          |      V   |
  21+20      19.2763      7.55  |    Q     |          |          |      V   |
  21+25      19.3278      7.49  |    Q     |          |          |      V   |
  21+30      19.3790      7.43  |    Q     |          |          |      V   |
  21+35      19.4297      7.37  |    Q     |          |          |      V   |
  21+40      19.4801      7.31  |    Q     |          |          |      V   |
  21+45      19.5300      7.26  |    Q     |          |          |       V  |
  21+50      19.5796      7.20  |    Q     |          |          |       V  |
  21+55      19.6289      7.15  |    Q     |          |          |       V  |
  22+ 0      19.6778      7.10  |    Q     |          |          |       V  |
  22+ 5      19.7263      7.05  |    Q     |          |          |       V  |
  22+10      19.7745      7.00  |   Q      |          |          |       V  |
  22+15      19.8224      6.95  |   Q      |          |          |       V  |
  22+20      19.8699      6.90  |   Q      |          |          |       V  |
  22+25      19.9172      6.86  |   Q      |          |          |       V  |
  22+30      19.9641      6.81  |   Q      |          |          |       V  |
  22+35      20.0107      6.77  |   Q      |          |          |       V  |
  22+40      20.0571      6.73  |   Q      |          |          |        V |
  22+45      20.1031      6.69  |   Q      |          |          |        V |
  22+50      20.1489      6.65  |   Q      |          |          |        V |
  22+55      20.1944      6.60  |   Q      |          |          |        V |
  23+ 0      20.2396      6.57  |   Q      |          |          |        V |
  23+ 5      20.2845      6.53  |   Q      |          |          |        V |
  23+10      20.3292      6.49  |   Q      |          |          |        V |
  23+15      20.3737      6.45  |   Q      |          |          |        V |
  23+20      20.4178      6.42  |   Q      |          |          |        V |
  23+25      20.4618      6.38  |   Q      |          |          |        V |
  23+30      20.5055      6.34  |   Q      |          |          |        V |
  23+35      20.5489      6.31  |   Q      |          |          |        V |
  23+40      20.5921      6.28  |   Q      |          |          |         V|
  23+45      20.6351      6.24  |   Q      |          |          |         V|
  23+50      20.6779      6.21  |   Q      |          |          |         V|
  23+55      20.7204      6.18  |   Q      |          |          |         V|
  24+ 0      20.7628      6.15  |   Q      |          |          |         V|
-------------------------------------------------------------------------
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BASINB-2 100 YEAR UH

U n i t H y d r o g r a p h A n a l y s i s

Study date 03/12/15

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6288

BASIN B-2 UNIT HYDROGRAPH
100 YEAR 24 HOUR
RANCHO MIRAMONTE

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
35.55	1	1.22
Rainfall data for year 100		
35.55	6	3.00
Rainfall data for year 100		
35.55	24	6.50

++

******** Area-averaged max loss rate, Fm ********

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
70.0	87.0	35.55	1.000	0.247	0.406	0.100

Area-averaged adjusted loss rate Fm (In/Hr) = 0.100

********* Area-Averaged low loss rate fraction, Yb **********

Area	Area	SCS CN	SCS CN	S	Pervious

BASINB-2 100 YEAR UH

(Ac.)	Fract	(AMC2)	(AMC3)		Yield Fr
14.43	0.406	70.0	87.0	1.49	0.769
21.12	0.594	98.0	98.0	0.20	0.963

Area-averaged catchment yield fraction, Y = 0.884
Area-averaged low loss fraction, Yb = 0.116
User entry of time of concentration = 0.210 (hours)

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Watershed area = 35.55(Ac.)
Catchment Lag time = 0.168 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 49.4854
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.100(In/Hr)
Average low loss rate fraction (Yb) = 0.116 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.452(In)
Computed peak 30-minute rainfall = 0.925(In)
Specified peak 1-hour rainfall = 1.220(In)
Computed peak 3-hour rainfall = 2.118(In)
Specified peak 6-hour rainfall = 3.000(In)
Specified peak 24-hour rainfall = 6.500(In)

Rainfall depth area reduction factors:
Using a total area of 35.55(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.451(In)
30-minute factor = 0.998 Adjusted rainfall = 0.923(In)
1-hour factor = 0.998 Adjusted rainfall = 1.218(In)
3-hour factor = 1.000 Adjusted rainfall = 2.118(In)
6-hour factor = 1.000 Adjusted rainfall = 3.000(In)
24-hour factor = 1.000 Adjusted rainfall = 6.500(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 429.93 (CFS))	
1	3.895	16.748
2	29.905	111.824
3	60.095	129.795
4	73.423	57.303
5	81.171	33.310
6	86.350	22.266
7	89.979	15.602
8	92.596	11.252
9	94.600	8.614
10	96.121	6.542
11	97.251	4.856
12	97.988	3.171
13	98.524	2.302
14	99.117	2.550
15	99.607	2.107
16	100.000	1.691

Total soil rain loss = 0.69(In)
Total effective rainfall = 5.81(In)
Peak flow rate in flood hydrograph = 82.04(CFS)

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BASINB-2 100 YEAR UH
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	22.5	45.0	67.5	90.0
0+ 5	0.0013	0.19	Q				
0+10	0.0112	1.43	Q				
0+15	0.0310	2.88	VQ				
0+20	0.0553	3.53	VQ				
0+25	0.0822	3.91	VQ				
0+30	0.1108	4.16	VQ				
0+35	0.1408	4.35	VQ				
0+40	0.1716	4.48	VQ				
0+45	0.2032	4.59	V Q				
0+50	0.2354	4.67	V Q				
0+55	0.2680	4.74	V Q				
1+ 0	0.3010	4.78	V Q				
1+ 5	0.3342	4.82	V Q				
1+10	0.3676	4.86	V Q				
1+15	0.4014	4.90	V Q				
1+20	0.4353	4.93	|VQ				
1+25	0.4693	4.94	|VQ				
1+30	0.5034	4.95	|VQ				
1+35	0.5376	4.96	|VQ				
1+40	0.5719	4.98	|VQ				
1+45	0.6062	4.99	|VQ				
1+50	0.6407	5.00	|VQ				
1+55	0.6752	5.01	|VQ				
2+ 0	0.7098	5.03	|VQ				
2+ 5	0.7445	5.04	|VQ				
2+10	0.7793	5.05	|VQ				
2+15	0.8142	5.07	|VQ				
2+20	0.8492	5.08	|VQ				
2+25	0.8843	5.09	| Q				
2+30	0.9195	5.11	| Q				
2+35	0.9547	5.12	| Q				
2+40	0.9901	5.13	| Q				
2+45	1.0256	5.15	| Q				
2+50	1.0611	5.16	| Q				
2+55	1.0968	5.18	| Q				
3+ 0	1.1325	5.19	| Q				
3+ 5	1.1684	5.21	| Q				
3+10	1.2043	5.22	| Q				
3+15	1.2404	5.23	| Q				
3+20	1.2765	5.25	| Q				
3+25	1.3128	5.26	| QV				
3+30	1.3491	5.28	| QV				
3+35	1.3856	5.29	| QV				
3+40	1.4222	5.31	| QV				
3+45	1.4588	5.33	| QV				
3+50	1.4956	5.34	| QV				
3+55	1.5325	5.36	| QV				
4+ 0	1.5695	5.37	| QV				
4+ 5	1.6066	5.39	| QV				
4+10	1.6439	5.41	| QV				
4+15	1.6812	5.42	| QV				
4+20	1.7187	5.44	| QV				
4+25	1.7562	5.46	| Q V				
4+30	1.7939	5.47	| Q V				
4+35	1.8317	5.49	| Q V				
4+40	1.8697	5.51	| Q V				
4+45	1.9077	5.52	| Q V				
4+50	1.9459	5.54	| Q V				

4+55	1.9842	5.56	Q V			
5+ 0	2.0226	5.58	Q V			
5+ 5	2.0611	5.60	Q V			
5+10	2.0998	5.62	Q V			
5+15	2.1386	5.63	Q V			
5+20	2.1775	5.65	Q V			
5+25	2.2166	5.67	Q V			
5+30	2.2558	5.69	Q V			
5+35	2.2951	5.71	Q V			
5+40	2.3346	5.73	Q V			
5+45	2.3742	5.75	Q V			
5+50	2.4139	5.77	Q V			
5+55	2.4538	5.79	Q V			
6+ 0	2.4938	5.81	Q V			
6+ 5	2.5340	5.83	Q V			
6+10	2.5743	5.85	Q V			
6+15	2.6148	5.87	Q V			
6+20	2.6554	5.90	Q V			
6+25	2.6961	5.92	Q V			
6+30	2.7371	5.94	Q V			
6+35	2.7781	5.96	Q V			
6+40	2.8193	5.99	Q V			
6+45	2.8607	6.01	Q V			
6+50	2.9023	6.03	Q V			
6+55	2.9440	6.06	Q V			
7+ 0	2.9858	6.08	Q V			
7+ 5	3.0279	6.10	Q V			
7+10	3.0701	6.13	Q V			
7+15	3.1125	6.15	Q V			
7+20	3.1550	6.18	Q V			
7+25	3.1977	6.20	Q V			
7+30	3.2406	6.23	Q V			
7+35	3.2837	6.26	Q V			
7+40	3.3270	6.28	Q V			
7+45	3.3704	6.31	Q V			
7+50	3.4141	6.34	Q V			
7+55	3.4579	6.36	Q V			
8+ 0	3.5019	6.39	Q V			
8+ 5	3.5462	6.42	Q V			
8+10	3.5906	6.45	Q V			
8+15	3.6352	6.48	Q V			
8+20	3.6801	6.51	Q V			
8+25	3.7251	6.54	Q V			
8+30	3.7703	6.57	Q V			
8+35	3.8158	6.60	Q V			
8+40	3.8615	6.63	Q V			
8+45	3.9074	6.67	Q V			
8+50	3.9535	6.70	Q V			
8+55	3.9999	6.73	Q V			
9+ 0	4.0465	6.77	Q V			
9+ 5	4.0933	6.80	Q V			
9+10	4.1404	6.84	Q V			
9+15	4.1877	6.87	Q V			
9+20	4.2353	6.91	Q V			
9+25	4.2831	6.94	Q V			
9+30	4.3312	6.98	Q V			
9+35	4.3795	7.02	Q V			
9+40	4.4281	7.06	Q V			
9+45	4.4770	7.10	Q V			
9+50	4.5262	7.14	Q V			
9+55	4.5756	7.18	Q V			
10+ 0	4.6253	7.22	Q V			
10+ 5	4.6754	7.26	Q V			
10+10	4.7257	7.31	Q V			
10+15	4.7763	7.35	Q V			
10+20	4.8272	7.40	Q V			

10+25	4.8785	7.44	Q	V				
10+30	4.9301	7.49	Q	V				
10+35	4.9820	7.54	Q	V				
10+40	5.0342	7.59	Q	V				
10+45	5.0868	7.64	Q	V				
10+50	5.1397	7.69	Q	V				
10+55	5.1930	7.74	Q	V				
11+ 0	5.2467	7.79	Q	V				
11+ 5	5.3008	7.85	Q	V				
11+10	5.3552	7.90	Q	V				
11+15	5.4100	7.96	Q	V				
11+20	5.4653	8.02	Q	V				
11+25	5.5209	8.08	Q	V				
11+30	5.5770	8.14	Q	V				
11+35	5.6335	8.20	Q	V				
11+40	5.6905	8.27	Q	V				
11+45	5.7479	8.34	Q	V				
11+50	5.8057	8.40	Q	V				
11+55	5.8641	8.47	Q	V				
12+ 0	5.9230	8.55	Q	V				
12+ 5	5.9821	8.59	Q	V				
12+10	6.0402	8.44	Q	V				
12+15	6.0970	8.25	Q	V				
12+20	6.1536	8.21	Q	V				
12+25	6.2103	8.23	Q	V				
12+30	6.2672	8.27	Q	V				
12+35	6.3246	8.33	Q	V				
12+40	6.3825	8.40	Q	V				
12+45	6.4409	8.48	Q	V				
12+50	6.4999	8.57	Q	V				
12+55	6.5595	8.66	Q	V				
13+ 0	6.6199	8.76	Q	V				
13+ 5	6.6809	8.87	Q	V				
13+10	6.7428	8.98	Q	V				
13+15	6.8054	9.10	Q	V				
13+20	6.8689	9.22	Q	V				
13+25	6.9333	9.35	Q	V				
13+30	6.9987	9.49	Q	V				
13+35	7.0650	9.63	Q	V				
13+40	7.1324	9.78	Q	V				
13+45	7.2009	9.94	Q	V				
13+50	7.2705	10.11	Q	V				
13+55	7.3413	10.28	Q	V				
14+ 0	7.4134	10.47	Q	V				
14+ 5	7.4869	10.66	Q	V				
14+10	7.5618	10.88	Q	V				
14+15	7.6383	11.10	Q	V				
14+20	7.7164	11.34	Q	V				
14+25	7.7962	11.59	Q	V				
14+30	7.8778	11.86	Q	V				
14+35	7.9614	12.14	Q	V				
14+40	8.0472	12.45	Q	V				
14+45	8.1352	12.78	Q	V				
14+50	8.2257	13.14	Q	V				
14+55	8.3189	13.53	Q	V				
15+ 0	8.4151	13.97	Q	V				
15+ 5	8.5145	14.44	Q	V				
15+10	8.6177	14.97	Q	V				
15+15	8.7249	15.56	Q	V				
15+20	8.8367	16.24	Q	V				
15+25	8.9528	16.85	Q	V				
15+30	9.0679	16.72	Q	V				
15+35	9.1819	16.55	Q	V				
15+40	9.3012	17.32	Q	V				
15+45	9.4293	18.60	Q	V				
15+50	9.5712	20.60	Q	V				

BASINB-2 100 YEAR UH

15+55	9.7339	23.63	Q V
16+ 0	9.9377	29.59	Q V
16+ 5	10.2417	44.13	Q V
16+10	10.7913	79.80	V Q
16+15	11.3563	82.04	V Q
16+20	11.7111	51.51	Q V
16+25	11.9727	37.99	Q V
16+30	12.1878	31.22	Q V
16+35	12.3743	27.09	Q V
16+40	12.5377	23.72	Q V
16+45	12.6836	21.18	Q V
16+50	12.8148	19.06	Q V
16+55	12.9337	17.25	Q V
17+ 0	13.0415	15.66	Q V
17+ 5	13.1416	14.53	Q V
17+10	13.2371	13.87	Q V
17+15	13.3266	13.00	Q V
17+20	13.4104	12.17	Q V
17+25	13.4864	11.02	Q V
17+30	13.5591	10.56	Q V
17+35	13.6292	10.18	Q V
17+40	13.6969	9.84	Q V
17+45	13.7625	9.53	Q V
17+50	13.8262	9.24	Q V
17+55	13.8881	8.99	Q V
18+ 0	13.9484	8.75	Q V
18+ 5	14.0074	8.57	Q V
18+10	14.0666	8.60	Q V
18+15	14.1264	8.68	Q V
18+20	14.1857	8.62	Q V
18+25	14.2445	8.53	Q V
18+30	14.3024	8.42	Q V
18+35	14.3597	8.31	Q V
18+40	14.4161	8.19	Q V
18+45	14.4718	8.08	Q V
18+50	14.5267	7.97	Q V
18+55	14.5809	7.87	Q V
19+ 0	14.6343	7.76	Q V
19+ 5	14.6871	7.66	Q V
19+10	14.7392	7.57	Q V
19+15	14.7907	7.47	Q V
19+20	14.8415	7.38	Q V
19+25	14.8918	7.29	Q V
19+30	14.9414	7.21	Q V
19+35	14.9905	7.13	Q V
19+40	15.0390	7.05	Q V
19+45	15.0870	6.97	Q V
19+50	15.1345	6.90	Q V
19+55	15.1815	6.82	Q V
20+ 0	15.2280	6.75	Q V
20+ 5	15.2741	6.69	Q V
20+10	15.3197	6.62	Q V
20+15	15.3649	6.56	Q V
20+20	15.4096	6.50	Q V
20+25	15.4540	6.44	Q V
20+30	15.4980	6.38	Q V
20+35	15.5415	6.33	Q V
20+40	15.5847	6.27	Q V
20+45	15.6276	6.22	Q V
20+50	15.6701	6.17	Q V
20+55	15.7122	6.12	Q V
21+ 0	15.7540	6.07	Q V
21+ 5	15.7955	6.02	Q V
21+10	15.8367	5.98	Q V
21+15	15.8775	5.93	Q V
21+20	15.9181	5.89	Q V

BASINB-2 100 YEAR UH

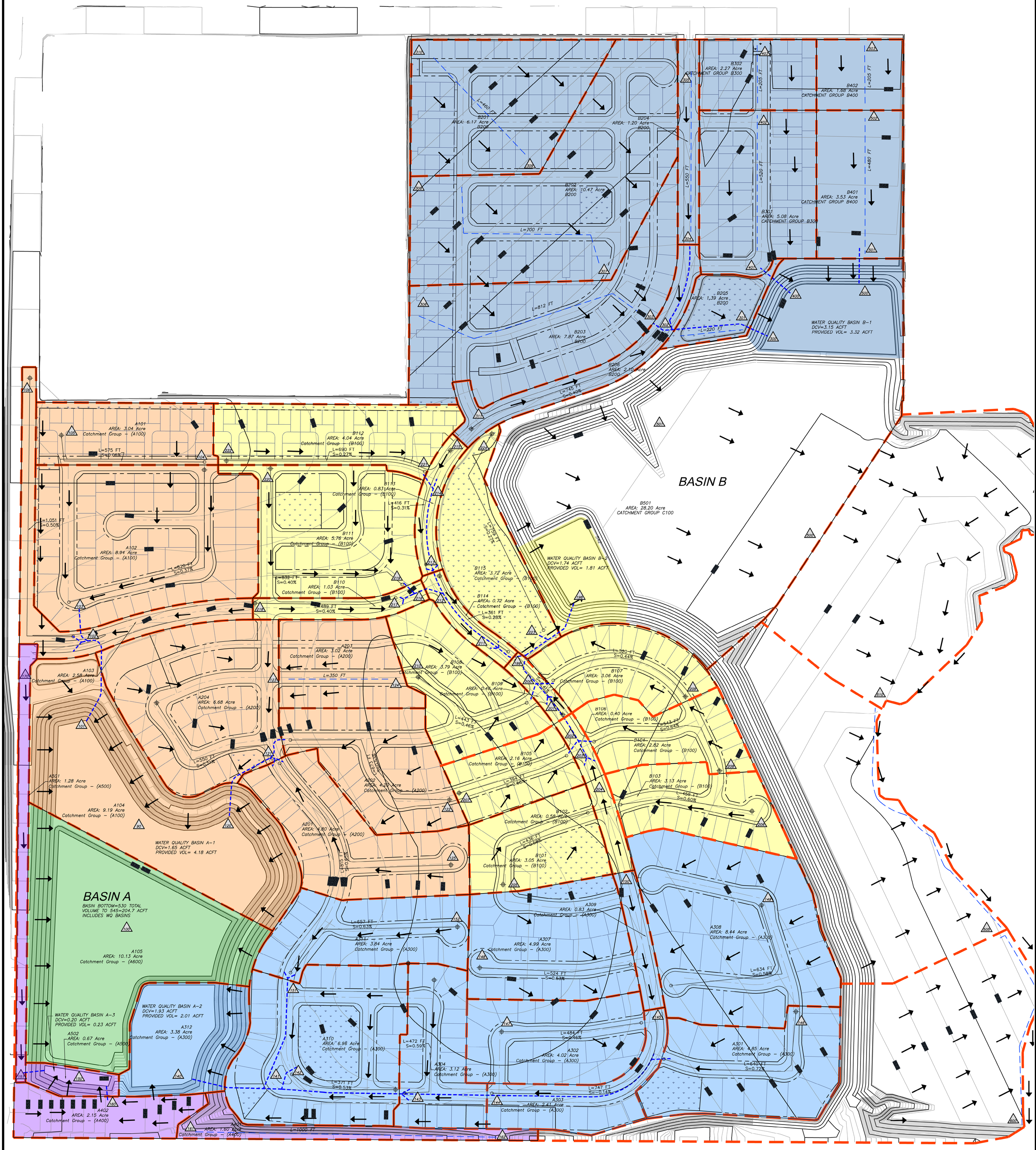
21+25	15.9583	5.85	Q				V
21+30	15.9983	5.80	Q				V
21+35	16.0380	5.76	Q				V
21+40	16.0774	5.72	Q				V
21+45	16.1165	5.68	Q				V
21+50	16.1554	5.65	Q				V
21+55	16.1940	5.61	Q				V
22+ 0	16.2324	5.57	Q				V
22+ 5	16.2705	5.54	Q				V
22+10	16.3084	5.50	Q				V
22+15	16.3460	5.47	Q				V
22+20	16.3835	5.43	Q				V
22+25	16.4206	5.40	Q				V
22+30	16.4576	5.37	Q				V
22+35	16.4943	5.33	Q				V
22+40	16.5309	5.30	Q				V
22+45	16.5672	5.27	Q				V
22+50	16.6033	5.24	Q				V
22+55	16.6392	5.21	Q				V
23+ 0	16.6749	5.18	Q				V
23+ 5	16.7104	5.16	Q				V
23+10	16.7457	5.13	Q				V
23+15	16.7809	5.10	Q				V
23+20	16.8158	5.07	Q				V
23+25	16.8506	5.05	Q				V
23+30	16.8852	5.02	Q				V
23+35	16.9196	5.00	Q				V
23+40	16.9538	4.97	Q				V
23+45	16.9879	4.95	Q				V
23+50	17.0218	4.92	Q				V
23+55	17.0555	4.90	Q				V
24+ 0	17.0891	4.87	Q				V

APPENDIX I: ACOE REPLACEMENT VOLUME SUMMARY

		Existing Condition			May-14 Proposed Condition			May-14 1' incerment	May-14 Overall
Contour Elevation	Basin Depth	Area (Acres)	Incremental volume (CY)	Volume (CY) Subtotal	Area (Acres)	Incremental volume (CY)	Volume (CY) Subtotal	proposed vs existing	proposed vs existing
509	1	0.4	354	354	0.4	369	369	104.24%	104.24%
510	2	0.5	569	923	0.7	589	958	103.51%	103.79%
511	3	0.9	1,139	2,062	1.2	1,160	2,118	101.84%	102.72%
512	4	1.4	1,825	3,887	1.7	1,837	3,955	100.66%	101.75%
513	5	2.2	2,728	6,615	2.2	2,748	6,703	100.73%	101.33%
514	6	2.5	3,443	10,058	2.6	3,469	10,172	100.76%	101.13%
515	7	3.0	4,182	14,240	3.5	4,215	14,387	100.79%	101.03%
516	8	4.3	5,470	19,710	4.6	5,490	19,877	100.37%	100.85%
517	9	5.3	7,081	26,791	5.7	7,167	27,044	101.21%	100.94%
518	10	6.7	9,061	35,852	6.9	9,122	36,166	100.67%	100.88%
519	11	7.9	11,171	47,023	9.6	12,652	48,818	113.26%	103.82%
520	12	8.6	12,442	59,465	13.2	17,110	65,928	137.52%	110.87%
521	13	9.4	13,665	73,130	17.4	23,309	89,237	170.57%	122.03%
522	14	10.3	14,992	88,122	23.1	31,101	120,338	207.45%	136.56%
523	15	10.9	16,247	104,369	27.3	38,368	158,706	236.15%	152.06%
524	16	11.6	17,241	121,610	30.5	44,509	203,215	258.16%	167.10%
525	17	12.5	18,671	140,281	33.9	50,258	253,473	269.18%	180.69%
526	18	14.7	21,345	161,626	65.9	56,195	309,668	263.27%	191.60%
527	19	17.5	25,630	187,256	70.1	63,341	373,009	247.14%	199.20%
528	20	20.1	30,358	217,614	72.5	69,367	442,376	228.50%	203.28%
529	21	22.0	33,085	250,699	75.0	72,903	515,279	220.35%	205.54%
530	22	23.3	35,699	286,398	76.8	75,867	591,146	212.52%	206.41%
531	23	25.3	38,493	324,891	80.6	100,353	691,499	260.70%	212.84%
532	24	28.5	42,753	367,644	82.7	103,241	794,740	241.48%	216.17%
533	25	33.8	50,870	418,514	84.8	105,813	900,553	208.01%	215.18%
534	26	36.0	55,856	474,370	86.3	107,846	1,008,399	193.08%	212.58%
535	27	37.7	58,570	532,940	88.2	109,832	1,118,231	187.52%	209.82%
536	28	39.9	61,694	594,634	89.9	112,196	1,230,427	181.86%	206.92%
537	29	42.5	65,593	660,227	91.4	114,013	1,344,440	173.82%	203.63%
538	30	44.0	69,039	729,266	92.5	115,632	1,460,072	167.49%	200.21%
539	31	45.4	71,387	800,653	93.7	116,454	1,576,526	163.13%	196.91%
540	32	46.6	73,412	874,065	94.8	117,205	1,693,731	159.65%	193.78%
541	33	48.5	75,951	950,016	95.8	123,278	1,817,009	162.31%	191.26%
542	34	50.4	79,055	1,029,071	96.8	124,265	1,941,274	157.19%	188.64%
543	35	52.2	81,845	1,110,916	97.7	125,152	2,066,426	152.91%	186.01%
544	36	53.9	84,531	1,195,447	98.7	125,895	2,192,321	148.93%	183.39%
545	37	56.1	87,574	1,283,021	99.7	126,754	2,319,075	144.74%	180.75%
546	38	60.9	94,058	1,377,079	101.2	161,656	2,480,731	171.87%	180.14%
547	39	66.1	100,577	1,477,656	102.1	163,327	2,644,058	162.39%	178.94%
548	40	71.8	108,979	1,586,635	103.5	164,924	2,808,982	151.34%	177.04%
549	41	82.7	123,894	1,710,529	104.6	166,417	2,975,399	134.32%	173.95%
550	42	90.4	137,710	1,848,239	105.6	167,912	3,143,311	121.93%	170.07%
551	43	97.8	150,047	1,998,286	108.6	171,913	3,315,224	114.57%	165.90%
552	44	105.1	161,901	2,160,187	109.7	173,353	3,488,577	107.07%	161.49%
553	45	113.4	174,749	2,334,936	110.9	174,796	3,663,373	100.03%	156.89%
554	46	120.7	187,076	2,522,012	112.0	176,239	3,839,612	94.21%	152.24%
555	47	127.5	198,386	2,720,398	113.2	177,631	4,017,243	89.54%	147.67%
556	48	135.1	209,891	2,930,289	114.3	178,769	4,196,012	85.17%	143.19%
557	49	143.0	222,477	3,152,766	115.3	179,548	4,375,560	80.70%	138.78%
558	50	157.7	245,137	3,397,903	116.2	180,604	4,556,164	73.67%	134.09%
559	51	167.8	260,963	3,658,866	117.2	181,951	4,738,115	69.72%	129.50%
560	52	177.7	277,342	3,936,208	118.3	183,301	4,921,416	66.09%	125.03%
561	53	187.0	293,376	4,229,584	119.7	185,231	5,106,647	63.14%	120.74%
562	54	195.8	307,233	4,536,817	121.6	187,480	5,294,127	61.02%	116.69%
563	55	205.1	321,861	4,858,678	123.4	189,736	5,483,863	58.95%	112.87%
564	56	217.5	339,189	5,197,867	124.8	191,984	5,675,847	56.60%	109.20%
565	57	229.8	361,467	5,559,334	126.5	194,072	5,869,919	53.69%	105.59%
566	58	239.1	377,021	5,936,355	129.0	195,885	6,065,804	51.96%	102.18%

43560

Kyle: 2-16-15 Worksheet					1' incerment	Overall
Area (sf)	Area (ac)	incermental volume (cy)	Volume (CY) Subtotal		proposed vs existing	proposed vs existing
13,689	0.31	354	354		100.00%	100.00%
4,430	0.10	569	923		100.00%	100.00%
17,349	0.40	1,139	2,062		100.00%	100.00%
21,642	0.50	1,825	3,887		100.00%	100.00%
28,170	0.65	2,728	6,615		100.00%	100.00%
19,733	0.45	3,443	10,058		100.00%	100.00%
16,801	0.39	4,182	14,240		100.00%	100.00%
27,529	0.63	5,470	19,710		100.00%	100.00%
68,923	1.58	7,081	26,791		100.00%	100.00%
53,614	1.23	9,061	35,852		100.00%	100.00%
119,372	2.74	12,529	48,381		112.16%	102.89%
139,530	3.20	16,989	71,595		136.55%	120.40%
193,734	4.45	23,214	101,816		169.88%	139.23%
250,778	5.76	30,221	140,505		201.58%	159.44%
187,698	4.31	38,689	189,621		238.13%	181.68%
157,437	3.61	49,116	248,551		284.88%	204.38%
143,761	3.30	58,930	324,947		315.62%	231.64%
179,843	4.13	76,396	419,805		357.91%	259.74%
206,845	4.75	94,858	519,820		370.11%	277.60%
92,417	2.12	100,015	622,044		329.45%	285.85%
97,110	2.23	102,224	726,794		308.97%	289.91%
69,687	1.60	104,750	833,663		293.43%	291.09%
1,036,594	23.80	106,869	942,643		277.63%	290.14%
66,045	1.52	108,980	1,053,626		254.91%	286.59%
89,194	2.05	110,983	1,166,564		218.17%	278.74%
51,958	1.19	112,938	1,281,371		202.19%	270.12%
68,224	1.57	114,807	1,398,415		196.02%	262.40%
299,144	6.87	117,044	1,517,174		189.72%	255.14%
78,132	1.79	118,759	1,637,428		181.05%	248.01%
42,940	0.99	120,254	1,758,382		174.18%	241.12%
31,396	0.72	120,954	1,879,956		169.43%	234.80%
30,046	0.69	121,574	2,002,179		165.61%	229.07%
178,099	4.09	122,223	2,125,179		160.92%	223.70%
39,994	0.92	123,000	2,255,102		155.59%	219.14%
33,520	0.77	129,923	2,385,611		158.74%	214.74%
3,161	0.07	130,509	2,516,824		154.39%	210.53%
38,786	0.89	131,213	2,676,709		149.83%	208.63%
54,331	1.25	159,885	2,838,247		169.99%	206.11%
44,428	1.02	161,538	3,001,230		160.61%	203.11%
41,052	0.94	162,983	3,165,722		149.55%	199.52%
40,971	0.94	164,492	3,331,314		132.77%	194.75%
38,539	0.88	165,592	3,501,174		120.25%	189.43%
123,749	2.84	169,860	3,672,602		113.20%	183.79%
33,790	0.78	171,428	3,845,477		105.88%	178.02%
39,834	0.91	172,875	4,019,615		98.93%	172.15%
34,587	0.79	174,138	4,195,062		93.08%	166.34%
40,153	0.92	175,447	4,371,905		88.44%	160.71%
29,585	0.68	176,843	4,549,779		84.25%	155.27%
27,778	0.64	177,874	4,728,670		79.95%	149.98%
27,729	0.64	178,891	4,908,597		72.98%	144.46%
27,943	0.64	179,927	5,089,541		68.95%	139.10%
30,598	0.70	180,944	5,271,515		65.24%	133.92%
29,130	0.67	181,974	5,454,479		62.03%	128.96%
63,658	1.46	182,964	5,638,458		59.55%	124.28%
67,443	1.55	183,979	5,823,437		57.16%	119.86%
48,542	1.11	184,979	6,009,476		54.54%	115.61%
46,726	1.07	186,039	6,196,695		51.47%	111.46%
2,133	0.05	187,219	6,383,914		49.66%	107.54%



Rational Method Routed Peak Flows

Basin A Design Flows

Design Point	Elevation (Ft)	Tc100 (Min.)	100-year Flow (CFS)	2-year Flow (CFS)
90-100	530	19.7	72.2	n/a
101	535	19.7	30.4	10.0
120	535	12.0	52.8	17.8
140	555	15.2	95.2	31.9
160-150	535	23.3	7.0	2.2
151-150	535	11.5	7.3	2.6

Basin B Design Flows

Design Point	Elevation (Ft)	Tc100 (Min.)	100-year Flow (CFS)	2-year Flow (CFS)
198	541	12.31	93.44	32.4
300	540	29.77	47.50	13.4
400	540	10.17	23.16	8.5
500	540	12.18	14.82	5.2

Existing Condition Flows

Design Point	100-year Flow (CFS)
201	110
101	86.7
300	51
510	172.6
505	198.7
600	211.9

LEGEND

- LINK NODE
- FLOW DIRECTION
- DRAINAGE AREA BOUNDARY
- PROPOSED STORM DRAIN PIPE
- L=800' — DRAINAGE PATH LENGTH / SUB AREA DRAINAGE PATH

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

REGISTERED PROFESSIONAL ENGINEER ROBERT MARK BEARD No. 39405 Exp. 12-31-15 CIVIL STATE OF CALIFORNIA

DATE: 03-12-15

DEVELOPED HYDROLOGY MAP

Preliminary Water Quality Management Plan (PWQMP)

For:

Mill Creek Farming Associates, LLC

TENTATIVE TRACT 18846

Prepared for:

Millcreek Farming Assoicates, LLC

1730 Evergreen Street

Duarte, CA 91010

(310) 300-5440

Prepared by:

RMB

8175 Limonite Avenue, Suite E

Jurupa Valley, CA 92509

(951) 317-2041

RMbeers777@hotmail.com

Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Millcreek Farming Associates, LLC by rmb Engineers. The WQMP is intended to comply with the requirements of the City of Chino and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

.

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Tentative Tract 18846	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			057-191-05-0000

Owner's Signature		
Owner Name: Joe Blum		
Title	Director of Development	
Company	Millcreek Farming Associates, LLC	
Address	1730 Evergreen Street, Duarte, CA 91010	
Email	jblum@butier.com	
Telephone #	(714) 448-0216	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	Tentative Tract 18846	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			057-191-05-0000

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Bob Beers		PE Stamp Below
Title	Professional Engineer	
Company	RMB	
Address	8175 Limonite Ave, Suite E, Jurupa Valley, CA 92509	
Email	Rmbeers777@hotmail.com	
Telephone #	(951) 317-2041	
Signature		
Date		

Table of Contents

Forms

Section 1Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Mill Creek Master Plan				
Project Owner Contact Name:	Joe Blum				
Mailing Address:	1730 Evergreen Street, Duarte, CA 91010	E-mail Address:	jblum@butier.com	Telephone:	(714) 448-0216
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	Tentative Tract 18846	
Additional Information/ Comments:	Subject Property is a portion of the Preserve Specific Plan				
Description of Project:	The property is located to the north of Prado Reservoir, with Mill Creek traversing the easterly edge of the property. The proposed project will have both attached and detached single-family residential development, with a zoning overlay allowing a small amount of commercial uses, a church, and an assisted living facility. The property is nominally 272-acres in size, with nominally 143-acres being built out as housing and streets, and nominally 128-acres remaining as active and passive open space. A master homeowners association will be formed for the project.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Large areas of the property have been used for agricultural and dairy purposes. In order to mitigate soil issues associated with these uses, some material may have to be removed due to high concentrations of organic material. That material will be removed, hauled offsite, and disposed of in accordance with local regulations. Mass grading of the site will address any issues associated with undocumented fills, low levels of organic material, and alluvium soils requiring over excavation and recompaction. Per the 2006 CWA Section 303{d) list of Water Quality Limited Segments for the Santa Ana Regional Board found in Attachment 6-1, the Mill Creek {Prado Area) is impaired due to nutrients, pathogens, and total suspended solids. Watershed Impact of project hydrological studies for the 2-year and 100-year frequency storm events have been prepared for the project. The proposed project has been designed to reduce runoff for both cases. The difference between flows for pre-development conditions versus post development conditions for the 2-year and 100-year frequency storms is greater than the flows calculated for Qbmp. The project includes two drainage areas shown as A and B. Drainage area A is being constructed with a large detention basin which is designed to detain 100% of the 24 hour 100-year storm event and draw down in less than 96 hours. Biofiltration water quality basins are being constructed in both A and B drainage areas which will treat the design capture volume (DCV) produced by the water quality storm event. Drainage Area B was designed to have positive drainage into Mill Creek and allow for additional storage for Prado Reservoir per direction of the Army Core of Engineers (ACOE). The eastern portion of Drainage Area B is developed similar to the existing conditions in that it drains directly into Mill Creek. Increases in runoff are not anticipated from the project. Basin A as well as the multiple water quality basins throughout the project will mitigate the runoff generated by the developed site to levels acceptable by the City and State Agencies. For this Preliminary Water Quality Management Plan (PWQMP) we have analyzed the 2-year, 24-hour storm using the methods contained in the San Bernardino County Hydrology Manual (1986} for the areas tributary to Basin A and Drainage Area B.				

	For the Basin A tributary area, in the existing condition, approximately 72.75-acres drains towards the southwest property line near Cucamonga Avenue. In the developed condition, approximately 101.2-acres of the site will drain into Basin A. There are five storm drain systems that outlet into Basin A. These storm drain lines will outlet into a series of pretreatment devices such as Vortech Units upstream of infiltration basins prior to discharging into Basin A. Basin A has a total storage volume of 204.7 acre-feet. The volume of a 100-year, 24-hour unit hydrograph for the areas tributary to Basin A is 47.4 acre- feet, which is only 23.2% of the total storage volume. We have not included an analysis of the existing condition unit hydrograph for the two-year storm event since there will be a 100% retention of the 2-year storm runoff volume within Basin A. We have included a 2-year, 24 hour unit hydrograph for the post-developed condition for reference. This volume is approximately 8.55-acre feet, which accounts for 4.2% of the total storage volume of Basin A. In the existing condition Drainage Area B consists of approximately 167.3 acres draining directly into Mill Creek. These areas are shown as E3 and E4 in the Existing Condition Hydrology Map. In order to provide water quality treatment to the developed areas in the proposed condition these areas have been broken down into separate Drainage Areas B and C. In the proposed condition the total drainage area from Drainage Area B and C is approximately 144.2 acres. The net effect of the proposed grading design is to reduce the footprint of the area that drains directly into Mill Creek or Prado Basin from 167.3-acres to 144.26-acres. In the proposed condition there are four storm drain systems that outlet into Basin B. These storm drains are designed to discharge into two separate water quality biofiltration basins as shown on the WQMP BMP location map in Attachment 6-1. The eastern portion of Drainage Area B consists of developed slopes with natural vegetation to mimic the existing conditions.

Section 2Project Description

2.1Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☒ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	8,660,163 sf	**3** Number of Dwelling Units:	up to 1,074	**4** SIC Code:	1521 (SFH)

5 Is Project going to be phased? Yes ☒ No ☐ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

6 Does Project include roads? Yes ☒ No ☐ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

2.2Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
A Homeowner's Association will be created and be responsible for the long-term maintenance of the project storm drain facilities.

2.3Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☒	N ☐	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3Site and Watershed Description

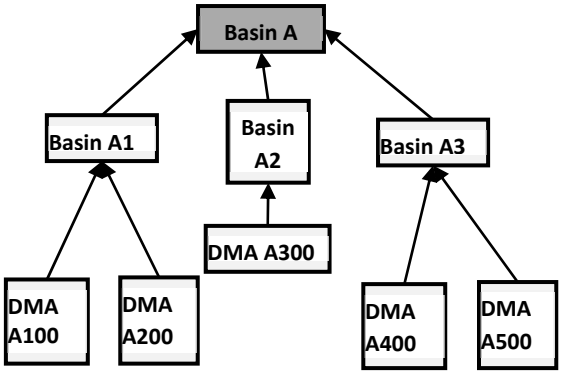
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.***

Form 3-1.1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 33.94	Longitude -117.625	Thomas Bros Map page 712 F4

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



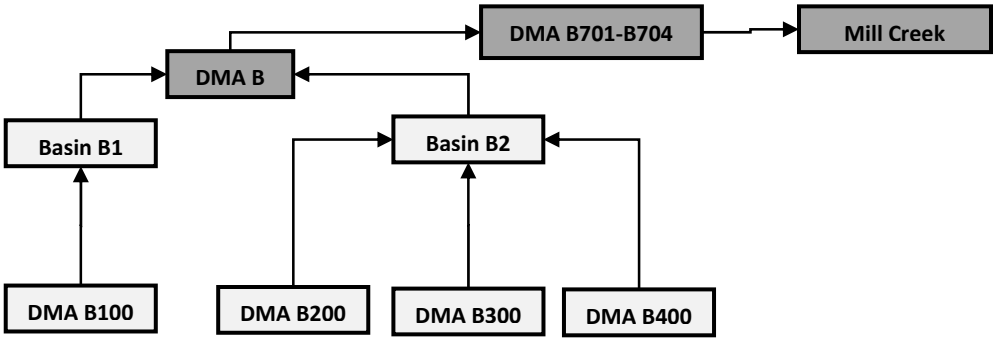
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DMA A100 and DMA A200 flows to Basin A1	DMA A100 (14.6 acres) and DMA A200 (18.7 acres) flow to water quality Basin A1 which flows to detention Basin A. Basin A detains 100% of the 100-year, 24-hour storm event.
DMA A300 flows to Basin A2	DMA A300 (39.5 acres) flows to water quality Basin A2 which flows to detention Basin A. Basin A detains 100% of the 100-year, 24-hour storm event.
DMA A400 and DMA A500 flow to Basin A3	DMA A400 (3.8 acres) and DMA A500 (1.3 acres) flow to water quality Basin A3 which flows to Basin A. Basin A detains 100% of the 100-year, 24-hour storm event.
DMA A600	DMA A600 consists of 10.3 acres and makes up the footprint of Basin A.

Form 3-1.2 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 33.94	Longitude -117.625	Thomas Bros Map page 712 F4

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DMA B100 Basin B1	DMA B100 (35.55 acres) flows north west within the developed area to the water quality basin B1. Basin B1 drains east through DMA B which drains into Mill Creek.
DMA B200, B300 and DMA B400 flow to Basin B2	DMA B200 (29.2 acres), B300 (7.35 acres), and B400 (5.21 acres) all flow southeast within the developed area to the water quality basin B2. Basin B2 drains southeast through DMA B which outlets into Mill Creek.
DMA B500	DMA B500 consists of 28.2 acres and makes up the footprint of the outfall to DMA B.
DMA B701, B702, B703, and B704	DMA B701 to B704 consists of 60.78 acres of developed open space similar to the existing condition. This flows directly into Mill Creek.

Form 3-2 Existing Hydrologic Characteristics for Project Drainage Area

For Drainage Area A's sub-watershed DMA, provide the following characteristics	DMA E1	DMA E2	DMA E3	DMA E4	DMA E5	DMA E6
1 DMA drainage area (ft^2)	1,623,046	1,545,944	811,523	4,261,340	1,560,864	654,316
2 Existing site impervious area (ft^2)	162,305	154,594	81,152	426,134	156,086	65,432
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	3	3	3	3	3	3
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	C	C	C	C	C	C
5 Longest flow path length (ft)	1,631	1,158	914	4,500	1,200	1,150
6 Longest flow path slope (ft/ft)	0.019	0.016	0.025	0.013	0.014	0.005
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	79	79	79	79	79	79
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	75	75	75	75	75	75

Form 3-3 Watershed Description for Project Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://sbcounty.permitrack.com/WAP See 'Drainage Facilities" link at this website*	Cucamonga Channel/Mill Creek (Prado Area) 801.25, Chino Creek Reach 1A, Santa Ana River Watershed Reach 5, 3, 2, and 1
Applicable TMDLs *Refer to Local Implementation Plan*	Pathogens
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Mill Creek (Prado Area) – Nutrients, Total Suspended Solids, Pathogens Santa Ana River Watershed Reach 5 – Nutrients, Pathogens Santa Ana River Watershed Reach 3 - Copper, Lead, Pathogens Santa Ana River Watershed Reach 2 – Indicator Bacteria
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	Riperian/Wetland
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	Mill Creek
Hydrologic Conditions of Concern	☒ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☐ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4Best Management Practices (BMP)

4.1Source Control BMP

4.1.1Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	The Developer will ensure the "Education of Property Owners" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2
N2	Activity Restrictions	☒	☐	The Developer will ensure the "Activity Restrictions" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2
N3	Landscape Management BMPs	☒	☐	The Developer will ensure the "Landscape Management" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2
N4	BMP Maintenance	☒	☐	The Developer will ensure the "BMP Maintenance" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	The Developer will ensure the "Title 22 CCR Compliance" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N6	Local Water Quality Ordinances	☒	☐	The Developer will ensure the “Local Water Quality Ordinances" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N7	Spill Contingency Plan	☒	☐	The Developer will ensure the 11Spill Contingency" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N8	Underground Storage Tank Compliance	☐	☒	There will be no underground storage tanks on property.
N9	Hazardous Materials Disclosure Compliance	☐	☒	There will be no hazardous material on property.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	The Developer will ensure the “uniform Fire Code Implementation" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N11	Litter/Debris Control Program	☒	☐	The Developer will ensure the "Liter/Debris Control Program" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N12	Employee Training	☒	☐	The Developer will ensure the "Employee Training" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N13	Housekeeping of Loading Docks	☐	☒	There are no housekeeping of loading docks within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of loading docks in order to protect water quality.
N14	Catch Basin Inspection Program	☒	☐	The Developer will ensure the "Catch Basin Inspection Program" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The Developer will ensure the "Street Sweeping Private Streets and Parking Lots" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	There are no other non-structural measures for Public Measures for Agency.
N17	Comply with all other applicable NPDES permits	☒	☐	The Developer will ensure compliance with all other applicable NPDES permits" for our specific project site. Detailed information on the implementation of this planned source permits control BMP will be determined and discussed in the Final WQMP, Section 3.2.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	The Developer will ensure the "Storm Drain Signage" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	There are no Outdoor Material Storage areas within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of outdoor material storage areas in order to protect water quality.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	The Developer will ensure the "Trash Storage Areas" BMP will be implemented for our specific project site. Detailed information on the implementation of this will be determined and discussed in the Final WQMP, Section 3.2.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	The Developer will ensure the "Efficient Irrigation" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	The Developer will ensure the "Finish grade of landscaped areas be at a minimum Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	The Developer will ensure the "Protect Slopes and Drainage" BMP will be implemented for our specific project site. Detailed information on the implementation of this planned source control BMP will be determined and discussed in the Final WQMP, Section 3.2.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	There will be no covered dock areas within the project.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	There are no maintenance bays or docks within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of maintenance bays or docks in order to protect water quality.

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	The owner shall prohibit vehicle-washing areas within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of vehicle-washing areas in order to protect water quality.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	There are no outdoor processing areas within the project site. Not a proposed use. The residents terms and tenant/occupant's lease terms will prohibit the use of outdoor processing areas in order to protect water quality.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	There are no equipment wash areas within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of equipment wash areas in order to project water quality.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	There are no fueling areas within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of fueling areas in order to project water quality.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	There are no existing hillsides within the project.
S14	Wash water control for food preparation areas	☐	☒	There are no food preparation areas within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of food preparation areas in order to protect water quality.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	There are no community car wash racks within the project site. Not a proposed land use. The residents terms and tenant/occupant's lease terms will prohibit the use of car wash areas in order to project water quality.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: THE PROJECT WILL MINIMIZE THE USE OF IMPERVIOUS SURFACES AND WILL MINIMIZE THE USE DECORATIVE CONCRETE IN THE LANDSCAPE DESIGN.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: ON-SITE SOILS ARE POORLY DRAINING AND HAVE RELATIVELY HIGH GROUNDWATER. IN THE PROPOSED CONDITION, BASINS A AND B ARE DESIGNED TO PROVIDE TREATMENT AND INCIDENTAL INFILTRATION TO THE EXTENT POSSIBLE. DUE TO EXISTING SOIL CONDITIONS INFILTRATION IS NOT FEASIBLE.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: IN PROPOSED CONDITION, BASIN A WILL DETAIN 100% OF THE 100-YEAR, 24-HOUR STORM.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: DRAINING INTO VEGETATED SWALES AND ULTIMATELY, BASINS A & B.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: APPROXIMATELY 47% OF THE SITE WILL REMAIN AS ACTIVE AND PASSIVE OPEN SPACE. CONSERVATION EASEMENTS OVER PORTIONS OF THE OPEN SPACE ALONG MILL CREEK WILL CONSERVE NATURAL OPEN SPACE AREAS.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: NEW LANDSCAPEING WILL BE PROPOSED IN ALL AREAS TO RE-ESTABLISH DISTURBED VEGETATION.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: BASIN BOTIOMS WILL HAVE AMENDED SOILS TO INCREASE INFILTRATION AND MINIMIZE COMPACTION.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation: THE DEVELOPMENT WILL USE VEGETATED DRAINAGE SWALES IN LIEU OF IMPERVIOUSLY LINED SWALES WHERE DETERMINED FEASIBLE DURING FINAL ENGINEERING DESIGN.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: STAKED OFF AREAS WILL BE DELINEATED IN LANDSCAPE DRAWINGS.

4.2Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi²), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA A100 and A200)

1 Project area DA 1 (ft^2): 1,450,984	**2** Imperviousness after applying preventative site design practices (Imp%): 0.60	**3** Runoff Coefficient (Rc): _0.419 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.5 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.740 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 71,890 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA A300)

1 Project area DA 1 (ft^2): 1,718,878	**2** Imperviousness after applying preventative site design practices (Imp%): 0.59	**3** Runoff Coefficient (Rc): _0.41 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.5 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.740 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 84,213 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA A400 and A500)

1 Project area DA 1 (ft^2): 222,156	**2** Imperviousness after applying preventative site design practices (Imp%): 0.49	**3** Runoff Coefficient (Rc): _0.33 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.5 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.740 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 9,134 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA B100)

1 Project area DA 1 (ft^2): 1,548,558	**2** Imperviousness after applying preventative site design practices (Imp%): 0.59	**3** Runoff Coefficient (Rc): _0.41 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.5 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.740 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 75,868 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DMA B200, B300, and B400)

1 Project area DA 1 (ft^2): 1,819,066	**2** Imperviousness after applying preventative site design practices (Imp%): 0.82	**3** Runoff Coefficient (Rc): _0.62 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.5 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.740 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 137,266 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of HCOC Assessment (DA A)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: http://sbcounty.permitrack.com/WAP

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 173,312 *Form 4.2-3 Item 12*	**2** 26.48 *Form 4.2-4 Item 6*	**3** 54.8 *Form 4.2-5 Item 5*
Post-developed	**4** 208,980 *Form 4.2-3 Item 13*	**5** 24.29 *Form 4.2-4 Item 7*	**6** 7.5 *Form 4.2-5 Item 6*
Difference	**7** *35,668* *Item 4 – Item 1*	**8** *2.19* *Item 2 – Item 5*	**9** *47.3* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *21 %* *Item 7 / Item 1*	**11** *8.2 %* *Item 8 / Item 2*	**12** *86 %* *Item 9 / Item 3*

Form 4.2-2 Summary of HCOC Assessment (DA B)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: http://sbcounty.permitrack.com/WAP

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 281,989 *Form 4.2-3 Item 12*	**2** 122.5 *Form 4.2-4 Item 6*	**3** 19.35 *Form 4.2-5 Item 5*
Post-developed	**4** 288,475 *Form 4.2-3 Item 13*	**5** 18.31 *Form 4.2-4 Item 7*	**6** 57.9 (*Form 4.2-5 Item 6)* **20.5** *(Basin Routed UH Method)*
Difference	**7** 6,487 *Item 4 – Item 1*	**8** 104.2 *Item 2 – Item 5*	**9** 1.15 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** 2.3 *%* *Item 7 / Item 1*	**11** 85 *%* *Item 8 / Item 2*	**12** 5.9*%* *Item 9 / Item 3*

Basins in area B have a total volume of 213,134 cf and will detain the difference between the post and pre-development. The peak discharge is also reduced to 20.5 cfs when routed through the basins.

Form 4.2-3 HCOC Assessment for Runoff Volume (DA A)

Weighted Curve Number Determination for: Pre-developed DA	DMA E1	DMA E2	DMA E3		
1a Land Cover type	Agricultural Dryland with Fair Cover				
2a Hydrologic Soil Group (HSG)	C	C	C		
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	1,623,045.6	1,545,944.4	811,522.8		
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	79	79	79		

Weighted Curve Number Determination for: Post-developed DA	DMA A100	DMA A200	DMA A300	DMA A400	DMA A500	DMA A600		
1b Land Cover type	Residential / Commercial Good Cover							
2b Hydrologic Soil Group (HSG)	C	C	C	C	C	C		
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	1,034,550	814,572	1,834,747	163,350	55,757	441,263		
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	82.3	82.3	82.3	82.3	82.3	77		

5 Pre-Developed area-weighted CN: 79	**7** Pre-developed soil storage capacity, S (in): 2.7 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.5 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 82	**8** Post-developed soil storage capacity, S (in): 2.2 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.43 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2.0
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 173,312
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 208,980
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 35,668
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-3 HCOC Assessment for Runoff Volume (DA B)

Weighted Curve Number Determination for: Pre-developed DA	DMA E4		DMA E5		DMA E6			
1a Land Cover type	Agricultural Dryland with Fair Cover							
2a Hydrologic Soil Group (HSG)	C		C		C			
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	4,261,340		1,560,864		654,316			
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	79		79		79			
Weighted Curve Number Determination for: Post-developed DA	DMA B100	DMA B200	DMA B300	DMA B400	DMA B701	DMA B702	DMA B703	DMA B704
1b Land Cover type	Residential / Commercial Good Cover				Open Brush Fair Cover			
2b Hydrologic Soil Group (HSG)	C	C	C	C	C	C	C	C
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	1,548,558	1,217,952	320,166	226,948	344,124	1,274,66	256,568	772,319
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	80	80	80	80	77	77	77	77

5 Pre-Developed area-weighted CN: 79	**7** Pre-developed soil storage capacity, S (in): 2.7 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.5 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 80	**8** Post-developed soil storage capacity, S (in): 2.5 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.5 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 2
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 281,989
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 288,475
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3): 7,937
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Time of concentration and peak runoff results were calculated using the computer program CivilD, a San Bernardino County approved hydrology program, and the San Bernardino County Hydrology Manual. Forms 4.2-4 and 4.2-5 have been modified from their original layout to summarize the results from the 2 year storm event analysis. Post-developed results in both Forms 4.2-4 and 4.2-5 were developed using the Rational method and don't include the proposed basin routing. Brief summaries are included after each form to summarize the results of the post-developed condition with the proposed basin routing. The results from the routed analysis are included to show the impacts of the proposed basins and show compliance with the HCOC requirements.

Form 4.2-4 HCOC Assessment for Time of Concentration (DA A)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA A *Use additional forms if there are more than 4 DMA*				Post-developed DA A *Use additional forms if there are more than 4 DMA*			
	DMA E1	DMA E2	DMA E3		DMA A100	DMA A200	DMA A300	DMA A400
1 Land cover	Agricultural Dryland with Fair Cover				Single Family Residential and Commercial			
2 Total time of concentration (min) T_c	13.26	26.48	19.21		21.84	12.94	22.26	24.29
3 Pre-developed time of concentration (min): 26.48								
4 Post-developed time of concentration (min): See next table								
5 Additional time of concentration needed to meet HCOC requirement (min): See next table $T_{C\text{-}HCOC}$ = *(Item 6 * 0.95) – Item 7*								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA A)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA A *Use additional forms if there are more than 4 DMA*				Post-developed DA A *Use additional forms if there are more than 4 DMA*			
					DMA A500	DMA A600		
1 Land cover					Single Family Residential and Commercial			
2 Total time of concentration (min) T_c					13.66	34.34		
3 Pre-developed time of concentration (min): 26.48								
4 Post-developed time of concentration (min): 24.29								
8 Additional time of concentration needed to meet HCOC requirement (min): 0.87 $T_{C\text{-}HCOC}$ *= (Item 6 * 0.95) – Item 7*								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA B)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA B *Use additional forms if there are more than 4 DMA*				Post-developed DA B *Use additional forms if there are more than 4 DMA*			
	DMA E4	DMA E5	DMA E6		DMA B100	DMA B200	DMA B300	DMA B400
4 Land cover	Agricultural Dryland with Fair Cover				Single Family Residential and Commercial			
5 Total time of concentration (min) T_c	122.5	60.17	71.06		15.19	20.47	11.09	16.77
6 Pre-developed time of concentration (min): 122.5								
7 Post-developed time of concentration (min): See next table								
8 Additional time of concentration needed to meet HCOC requirement (min): See next table $T_{C\text{-}HCOC}$ *= (Item 6 * 0.95) – Item 7*								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA B)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA B *Use additional forms if there are more than 4 DMA*				Post-developed DA B *Use additional forms if there are more than 4 DMA*			
					DMA B701	DMA B702	DMA B703	
1 Land cover					Single Family Residential and Commercial			
2 Total time of concentration (min) T_c					33.72	61.12	27.86	
3 Pre-developed time of concentration (min): 122.5								
4 Post-developed time of concentration (min): 18.31								
5 Additional time of concentration needed to meet HCOC requirement (min): 98.06 $T_{C\text{-}HCOC}$ *= (Item 3 * 0.95) – Item 4*								

Form 4.2-5 HCOC Assessment for Peak Runoff (DA A)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet			Post-developed DA to Project Outlet			
	DMA E1	DMA E2	DMA E3	DMA A100	DMA A200	DMA A300	DMA A400
1 Rainfall Intensity for storm duration equal to time of concentration (in/hr)	1.19	0.78	0.951	0.88	1.21	0.87	0.83
2 Drainage Area of each DMA (Acres)	43.21	35.49	18.63	23.75	18.70	42.12	3.75
3 Ratio of pervious area to total area	1.0	1.0	1.0	0.574	0.4	0.442	0.484
4 Peak Flow from DMA (cfs)	31.94	13.42	9.46	13.424	16.87	30.2	2.13
5 Peak runoff from pre-developed condition confluence analysis (cfs): 54.82							
6 Peak runoff from post-developed condition confluence analysis (cfs): See next table							
7 Peak runoff reduction needed to meet HCOC Requirement (cfs): See next table							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA A)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet			Post-developed DA to Project Outlet			
				DMA A500	DMA A600		
1 Rainfall Intensity for storm duration equal to time of concentration				1.17	0.67		
2 Drainage Area of each DMA (Acres)				1.28	10.13		
3 Ratio of pervious area to total area				0.1	1.0		
4 Peak Flow from DMA (cfs)				1.28	0.8		
5 Peak runoff from pre-developed condition confluence analysis (cfs): 54.82							
6 Peak runoff from post-developed condition confluence analysis (cfs): 7.5							
7 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0 $Q_{p\text{-}HCOC}$ = *(Item 6 * 0.95) – Item 5*							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA B)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet			Post-developed DA to Project Outlet			
	DMA E4	DMA E5	DMA E6	DMA B100	DMA B200	DMA B300	DMA B400
1 Rainfall Intensity for storm duration equal to time of concentration	0.313	0.479	0.434	1.094	0.915	1.235	1.03
2 Drainage Area of each DMA (Acres)	97.89	35.83	15.02	35.78	29.20	7.35	5.21
3 Ratio of pervious area to total area	1.0	1.0	1.0	0.45	0.1	.2	0.1
4 Peak Flow from DMA (cfs)	19.35	4.15	1.85	30.89	20.47	8.07	4.90
5 Peak runoff from pre-developed condition confluence analysis (cfs): 19.35							
6 Peak runoff from post-developed condition confluence analysis (cfs): See next table							
7 Peak runoff reduction needed to meet HCOC Requirement (cfs): See next table							

Form 4.2-5 HCOC Assessment for Peak Runoff (DA B)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet			Post-developed DA to Project Outlet			
				DMA B701	DMA B702	DMA B703	
1 Rainfall Intensity for storm duration equal to time of concentration				0.68	0.475	0.761	
2 Drainage Area of each DMA (Acres)				7.90	29.26	23.62	
3 Ratio of pervious area to total area				1.0	1.0	1.0	
4 Peak Flow from DMA (cfs)				2.69	5.82		
5 Peak runoff from pre-developed condition confluence analysis (cfs): 19.35							
6 Peak runoff from post-developed condition confluence analysis (cfs): 57.95							
7 Peak runoff reduction needed to meet HCOC Requirement (cfs): 38.6 $Q_{p\text{-}HCOC}$ = *(Item 6 * 0.95) – Item 5*							

All hydrology calculations are provided in the stand alone Hydrology Report for this project.

4.3Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒

Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒

(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☒ No ☐

If Yes, Provide basis: (attach)

6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒

See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒

If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

8 Any answer from Item 4 through Item 6 is "Yes": Yes ☒ No ☐

If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

9 All answers to Item 1 through Item 6 are "No":

Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ *=Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	$V_{retention}$ *=Sum of Item 12 for all BMPs*		

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) $V_{retention}$ = *Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): $V_{retention}$ =*Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ = *Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ = *Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ = *Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): $V_{retention}$ =*Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

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Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA A)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 164,852 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*			
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	3	3
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*			
16 Total Retention Volume from LID Infiltration BMPs: *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☐ No ☒ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA B)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 213,134 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*			
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*			
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*			
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*			
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity			
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*			
12 Gravel porosity			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*			
16 Total Retention Volume from LID Infiltration BMPs: *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes ☐ No ☒ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3):
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16

BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			

9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest and use BMPs? Yes ☐ No ☐

If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA A)

<table>
<tr><td colspan="2">1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 165,236 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</td><td colspan="2">List pollutants of concern Copy from Form 2.3-1.
Pathogens, Nutrients, Noxious Aquatic Plants, Sediment, Metals, Oil and Grease, Trash and Debris, Pesticides and Herbicides, and Organic Compounds</td></tr>
<tr><td rowspan="2">2 Biotreatment BMP Selected
(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</td><td>Volume-based biotreatment
Use Forms 4.3-6 and 4.3-7 to compute treated volume</td><td colspan="2">Flow-based biotreatment
Use Form 4.3-8 to compute treated volume</td></tr>
<tr><td>☒ Bioretention with underdrain
☐ Planter box with underdrain
☐ Constructed wetlands
☐ Wet extended detention
☐ Dry extended detention</td><td colspan="2">☐ Vegetated swale
☐ Vegetated filter strip
☐ Proprietary biotreatment</td></tr>
<tr><td colspan="2">3 Volume biotreated in volume based biotreatment BMP (ft^3): 271,263 Form 4.3-6 Item 15 + Form 4.3-7 Item 13</td><td>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): -106,027 Item 1 – Item 3</td><td>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% Item 4 / Item 1</td></tr>
<tr><td colspan="4">6 Flow-based biotreatment BMP capacity provided (cfs): NA Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)</td></tr>
<tr><td colspan="4">7 Metrics for MEP determination:
• Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</td></tr>
</table>

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA B)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 213,134 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.* Pathogens, Nutrients, Noxious Aquatic Plants, Sediment, Metals, Oil and Grease, Trash and Debris, Pesticides and Herbicides, and Organic Compounds	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☒ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 349,895 *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): -136,761 *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 0% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): NA *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (DA A) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(All basins are bioretention w/underdrain and include a conservative amended soil infiltration rate for the Preliminary WQMP. It is anticipated that basins will have an internal water storage zone for additional nutrient removal.)*	DA A DMA A100 and A200 Basin A-1	DA A DMA A300 Basin A-2	DA A DMA A400 and A500 Basin A-3
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	Pathogens, Nutrients, Sediment, Metals, Oil and Grease, Trash and Debris, Pesticides and Herbicides, and Organic Compounds		
2 Amended soil infiltration rate *Typical ~ 5.0*	2.5	2.5	2.5
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2	2	2
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	1.25	1.25	1.25
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48	48	48
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	5	5	5
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	1.5	1.5	1.5
8 Amended soil surface area (ft^2)	47,927	56,142	6,089
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	2	2	2
10 Amended soil porosity, *n*	0.35	0.35	0.35
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	2	2	2
12 Gravel porosity, *n*	0.35	0.35	0.35
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	3	3
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	118,020	138,249	14,994
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 271,263 cf *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-6 Volume Based Biotreatment (DA B) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(All basins are bioretention w/underdrain and include a conservative amended soil infiltration rate for the Preliminary WQMP. It is anticipated that basins will have an internal water storage zone for additional nutrient removal.)*	DA B DMA B100 Basin B-1	DA B DMA B200, B300, and B400 Basin B-2	
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	Pathogens, Nutrients, Sediment, Metals, Oil and Grease, Trash and Debris, Pesticides and Herbicides, and Organic Compounds		
2 Amended soil infiltration rate *Typical ~ 5.0*	2.5	2.5	
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2	2	
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	1.25	1.25	
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48	48	
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	5	5	
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	1.5	1.5	
8 Amended soil surface area (ft^2)	50,579	91,510	
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	2	2	
10 Amended soil porosity, *n*	0.35	0.35	
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	2	2	
12 Gravel porosity, *n*	0.35	0.35	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	3	
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	124,550	225,344	
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 349,895 cf *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item* $8_{forebay}$ *+ Item* 8_{basin}*) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item* $8_{forebay}$ *+ Item* 8_{basin}*) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w *= (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * Item 3^0.5)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2^2)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} *= (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate

1 Total LID DCV for the Project (ft^3): 378,370 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): NA *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): NA *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): NA *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 621,158 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): NA *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☐ No ☒
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☒ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA A)

1 Volume reduction needed for HCOC performance criteria (ft^3): 35,668 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 35,668 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☒ SEE DISCUSSION BELOW *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☒ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☒ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

Drainage Area A ultimately drains to Basin A which detains 8,917,723 cf. This volume is slowly released through an outlet riser to drain within 96 hours. Due to soil constraints the HCOC volume condition is not able to be met however the flow rate and time of concentration HCOC conditions are being met and mitigating for HCOC concerns for the post-developed conditions. Basin A has a total volume of 8,917,723 cf and will detain the entire

100 year storm volume and release it downstream through a low flow orifice riser within 96 hours. The following table has been inserted to show the average flow rate from the orifice at different water surface elevations. The total 100 year volume draining to Basin A is 2,141,250 cf and is 5' deep. In order to drain in 96 hours an average flow rate of 6.2 cfs is needed. As shown in the table below the flow rates up to a depth of 1.5' exceed 6.2 cfs and will not have any issue draining in 96 hours. During final design a stage storage curve will be included to show the exact time of draw down for the basin.

Orifice flow= CA(2gh)^1/2
Orifice C = 0.66
Pipe Dia (in) = 36"
Orifice 1 (inch) = 16" at bottom of basin

Stage	Discharge
Head (Feet)	Outlet 1 (cfs)
0	0.00
1	3.70
1.5	6.40
2	8.27
3	11.09
3.5	12.26
4	13.33
4.5	14.32
5	15.25

Form 4.3-10 Hydromodification Control BMPs (DA B)

1 Volume reduction needed for HCOC performance criteria (ft^3): 7,937 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 0 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): *0*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): 0 *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☒ SEE DISCUSSION BELOW *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☒ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒ SEE DISCUSSION BELOW
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

Drainage area B has been designed to treat the DCV, mitigate hydromodification impacts, and attenuate peak runoff through the incorporation of Basin B-1 and B-2. These basins reduce the 2-year peak runoff to be within 5.9% of the existing condition runoff. This exceeds the allowable increase by 0.9%. This will be addressed by incorporating LID BMPs throughout drainage area B. These BMPs will be addressed in detail in the Final Project WQMP. All hydrology calculations are provided in the stand alone Hydrology Report for this project.

4.4Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
SD-10	HOA	per BMP recommendation	per BMP recommendation
SD-12	HOA	per BMP recommendation	per BMP recommendation
SD-13	HOA	per BMP recommendation	per BMP recommendation
SD-32	HOA	per BMP recommendation	per BMP recommendation
TC-11	HOA	per BMP recommendation	per BMP recommendation
TC-22	HOA	per BMP recommendation	per BMP recommendation
TC-30	HOA	per BMP recommendation	per BMP recommendation
TC-31	HOA	per BMP recommendation	per BMP recommendation

Form 5-1 BMP Inspection and Maintenance (Continued)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
TC-50	HOA	per BMP recommendation	per BMP recommendation
TC-60	HOA	per BMP recommendation	per BMP recommendation
MP-51	HOA	per BMP recommendation	per BMP recommendation
MP-52	HOA	per BMP recommendation	per BMP recommendation

Section 6WQMP Attachments

6.1.Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3Post Construction

Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements