PRELIMINARY DRAINAGE STUDY ADDENDUM
TO
ADDRESS COUNTY COMMENTS
FROM MARCH, 2009 TO DATE
FOR
Tentative Tract Map No. 18255
Joshua Tree, California

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REPORT

Purpose of this report

The purpose of this report is to address March 2009, and subsequent staff comments on the “Preliminary Drainage Study for Tentative Tract Map 18225” originally dated October 2007, with subsequent revisions. The comments addressed are as follows:

Item 1 Basin Routing, Summary, please refer to the end of this section of an expanded report for Item 1

County Comments
Basin Routing Calculations to be for rational method Q100 on-site & off-site, with post development routed flow less than 80% of pre-development values.
Using Rainfall intensity curve slope of 0.7
Using desert hydrology to determine CN number
Using AMC III for 100 year flood analysis.

Also use the rational method, except at basins, where inlet and outlet hydrographs are to be created for basin routing purposes.

Summary results

For the easterly drainage areas, Off-site Area 1 + Basin B + On-site Area 1+ Basin C

Predevelopment Q100 = 247 cfs
Post development Q100 = 104 cfs, 42% of predevelopment flow < 80%, ok

For the westerly drainage area, On-site Area 2 + Basin A

Predevelopment Q100 = 46 cfs
Post development Q100 = 18.4 cfs, 40% of predevelopment flow < 80%, ok
Item 2 Storm water Channel down stream discharge

County comments
For the two storm water channels proposed through the project, obtain drainage easement letters from downstream owner if sheet flows are being concentrated into channel flows at the discharge location.
Down stream discharge velocities exceeding non-erosive velocity limit, for the two storm water channels.

Results
The proposed Channel down stream outlets have been flared so that storm water flow can return to approximate predevelopment velocities, and to a sheet flow condition.
Please note that the downstream property receives these storm flows via an existing reasonable well defined wash on the downstream property that appears to be approximately 500 feet wide. It appears the wash was formed as the result of erosion, and presumably it would continue to be subject to erosion.
We performed a pre and post development HEC RAS analysis of Q100 year bulked flow through each channel. The results are as follows:

Channel 1 (for off-site area 3 runoff)
Q100 bulked = 361 cfs
Pre development discharge velocity = 5.8 cfs
Post development discharge velocity = 5.7 cfs
Pre development flood width is approximately = 113 feet
Post development flood with is approximately = 115 feet

Channel 2 (for off-site area 2 runoff)
Q100 bulked = 760 cfs
Pre development discharge velocity = 1.6 cfs
Post development discharge velocity = 1.5 cfs
Pre development flood width is approximately = 337 feet
Post development flood with is approximately = 344 feet

Hence it appears pre and post development Channel 1 & 2 downstream discharge characteristics will be similar.
Item 3 Channel 1 upstream backflow

County comment
Check for possible flooding effect on APN 0601-492-05 where natural drainage course meets improved Channel 1 on the west property line.

Results/response
The improved Channel 1 has a larger cross-sectional area than the natural drainage course at the west property line, and a comparable slope. So backflow should not occur.
Also the portion of Channel 1 west edge that runs along the westerly property line in intended to be at existing grade to allow flood waters to sheet flow over the side of and into the channel. This is so as not to obstruct sheet flow patterns in the upstream area.
In reviewing the HEC RAS analysis flood widths at the westerly line junction, pre and post development, they appear comparable.

Item 4 Alta Loma CMP Culvert

County Comment
Size box culvert under Alta Loma Drive for 1.5 x Q100 for bulking.

Result/response
The culvert was conceptually sized for a bulked flow of 760 cfs using FlowMaster. The proposed culvert size is projected to be in the range of (4) 66 inch diameter Corrugated Metal Pipes (CMP) (at 2% minimum flow slope), after taking into account inlet & outlet losses.
Also as per a recent meeting with County staff, we added the following note to the Tentative Tract Map, “CMP Culvert Note, Alternative dipped road crossing with low flow culverts may be utilized in place of the box culverts indicated hereon. Traffic sight distance must be considered for any dip sections in the street.”
Also we now indicate (4) 66” diameter CMP culverts with a headwall on the upstream side on the Tentative Tract Map.

Item 5 Labeled Drainage Lot FF:

County comment
Lot FF is labeled as drainage lot, what is the deposition of this lot?

Response
We now label this as a landscape lot only on the Tentative Tract Map (TTM).
Item 6 Lot T street crossing Channel 2

County comment
Discuss how Lot T is crossing over Channel 2 and its affect on drainage.

Response
The street crossing through Channel 2 is an ‘at grade’ crossing (Arizona crossing) and should not meaningfully affect drainage in the channel. The crossing detail is attached.

Item 7 WSPG for 42" RCP storm drain

County comment
Revise WSPG for added flows.

Summary response
The storm drain has been conceptually sized during the Q100 rational method routing in On-site Area 1. A WSPG analysis should be run at a later date for final pipe line design and construction purposes.

Item 8 Blue Line Stream

Terra Nova has handled this as a separate item.
Expanded Report for Item 1

Item 1 Basin Routing

County Comments
Basin Routing Calculations to be for rational method Q100 on-site & off-site, with post development routed flow less than 80% of pre-development values.
Using Rainfall intensity curve slope of 0.7
Using desert hydrology to determine CN number
Using AMC III for 100 year flood analysis.

Also using the rational method, except at basins, where inlet and outlet hydrographs are to be created for basin routing purposes.

Methodology

The Rational Method pre & post development Q100 flows were computed using the ‘San Bernardino County Rational Method Hydrology Program’ by CIVILCADD/CIVILDESIGN Engineering software.

Basin Inlet hydrographs were constructed using the computed CIVILCAD program rational Q100 flow directed to the basin as the basin inflow hydrgaph peak flow, also the computed time of concentration Tc for the peak flow, and a run-off volume of Tributary area x Rainfall depth x 0.9.
For Basins A & C where there are two inlet pipes, the two individual pipe hydrographs are combined into one hydrograph for routing purposes through the Basin.

Hydrographs were routed through each basin using the Hydraflow program by intelisolve.

The following was done for the continuation of the downstream rational method computation in Onsite Area 1 after routing Off-site area 1 flow through Basin B. The computed peak outflow value from Basin B was used to start the On-site Area A rational method routing, with the input upstream ‘effective’ Off-site Area 1 area to make the program work calculated using the equation A = Q/0.9(I-Fm), which was derived from Q=0.9(I-Fm)A.

Results

For the easterly drainage areas, Off-site Area 1 + Basin B + On-site Area 1 + Basin C

Pre development
Off-site Area 1 + Onsite Area 1 Q100 = 247 cfs

*Post development*

Off-site Area 1 Q100= 158 cfs, Tc= 25.5 min.
Runoff volume = 0.9 x 1.3" x 76.9 acres = 7.5 acre-feet
Refer to Basin B inflow hydrograph, and basin routing printouts
Basin B outflow Q100= 55 cfs
Onsite Area 1 rational method starting effective upstream area = 48.8 acres for Q100 = 55 cfs
Refer to rational method exhibit and printouts
On-site Area 1,
West Pipe into Basin C Q100=126 cfs
East Pipe into Basin C Q100= 76.8 cfs
Runoff volume for inlet hydrograph = 0.9 x 1.25’ x 114.2 acres = 10.7 acre-feet
Combining hydrographs, Peak Q100= 201 cfs, Tc = 14.2 min.
Refer to individual and combined hydrographs, and basin routing printouts. 
**Basin C outflow Q100= 104 cfs.**

Hence:
Predevelopment Q100 = 247 cfs

Post development Q100 = 104 cfs, 42% of predevelopment flow < 80%, ok

*For the westerly drainage area, On-site Area 2 + Basin A*

*Predevelopment*

On-site Area 2 Q100 = 46 cfs

*Post development*

On-site Area 2,
West Pipe into Basin A Q100= 13.6 cfs
East Pipe into Basin A Q100= 43.7 cfs
Combined hydrograph peak Q100= 54.4 cfs, Tc= 14 min.
Runoff volume = 0.9 x 1.25”x 18.14 acres = 1.7 acre-feet
Refer to individual and combined hydrographs, and basin routing printouts. 
**Basin A outflow Q100= 18.4 cfs.**

Hence:
Pre development Q100 = 46 cfs

Post development Q100 = 18.4 cfs, 40% of predevelopment flow < 80%, ok
Reference Material
ITEM-1 Basin Routing Backup Data
For Basin-B
“Offsite -1”, Pre Development
Rational Method Analysis
San Bernardino County Rational Hydrology Program  
(Hydrology Manual Date - August 1986)  
CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0  
Rational Hydrology Study  Date: 03/08/11

PRE DEV OFFSITE-1
TR 18255
Q100 1HR
RATIONAL METHOD

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0  
Computed rainfall intensity:  
Storm year = 100.00 1 hour rainfall = 1.300 (In.)  
Slope used for rainfall intensity curve b = 0.7000  
Soil antecedent moisture condition (AMC) = 3

+-----------------------------------------------
| Process from Point/Station 1.000 to Point/Station 2.000 |
| **** INITIAL AREA EVALUATION **** |
+-----------------------------------------------

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000 (Ft.)
Top (of initial area) elevation = 3569.000 (Ft.)
Bottom (of initial area) elevation = 3458.000 (Ft.)
Difference in elevation = 111.000 (Ft.)
Slope = 0.11100  s(%) = 11.10
TC = k(0.525)*((length^3)/(elevation change))^0.2
Initial area time of concentration = 12.915 min.
Rainfall intensity = 3.810 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q = KIA) is C = 0.882
Subarea runoff = 29.228 (CFS)
Total initial stream area = 8.700 (Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.077 (In/Hr)

+-----------------------------------------------
| Process from Point/Station 2.000 to Point/Station 3.000 |
| **** IRREGULAR CHANNEL FLOW TRAVEL TIME **** |
+-----------------------------------------------

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.391 (Ft.), Average velocity = 4.631 (Ft/s)
!!Warning: Water is above left or right bank elevations

+-----------------------------------------------
| Information entered for subchannel number 1 |
| Point number 'X' coordinate 'Y' coordinate |
| 1 | 0.00 | 0.00 |
| 2 | 355.00 | 5.00 |
| 3 | 710.00 | 0.00 |
| Manning's 'N' friction factor = 0.030 |
+-----------------------------------------------

Sub-Channel flow = 50.297 (CFS)
  flow top width = 55.536 (Ft.)
  velocity = 4.631 (Ft/s)
  area = 10.860 (Sq. Ft.)
  Froude number = 1.846
Upstream point elevation = 3458.000(Ft.)
Downstream point elevation = 3385.000(Ft.)
Flow length = 947.660(Ft.)
Travel time = 3.41 min.
Time of concentration = 16.33 min.
Depth of flow = 0.391(Ft.)
Average velocity = 4.631(Ft/s)
Total irregular channel flow = 50.297(CFS)
Irregular channel normal depth above invert elev. = 0.391(Ft.)
Average velocity of channel(s) = 4.631(Ft/s)

WARNING: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 3.233(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KClA) is C = 0.879
Subarea runoff = 42.077(CFS) for 16.400(Ac.)
Total runoff = 71.305(CFS)
Effective area this stream = 25.10(Ac.)
Total Study Area (Main Stream No. 1) = 25.10(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.446(Ft.), Average velocity = 5.054(Ft/s)

WARNING: Water is above left or right bank elevations

====================================================================================================
Process from Point/Station 3.000 to Point/Station 4.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.469(Ft.), Average velocity = 5.260(Ft/s)

WARNING: Water is above left or right bank elevations

******* Irregular Channel Data **********

-------------------------------------------------------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 378.00 5.00
3 756.00 0.00

Manning's 'N' friction factor = 0.030

-------------------------------------------------------------------------------------------------------------------------------
Sub-Channel flow = 87.578(CFS)
' ' flow top width = 70.955(Ft.)
' ' velocity= 5.260(Ft/s)
' ' area = 16.649(Sq.Ft)
' ' Froude number = 1.914
Upstream point elevation = 3385.000(Ft.)
Downstream point elevation = 3313.000(Ft.)
Flow length = 923.810(Ft.)
Travel time = 2.93 min.
Time of concentration = 19.25 min.
Depth of flow = 0.469(Ft.)
Average velocity = 5.260(Ft/s)
Total irregular channel flow = 87.578(CFS)
Irregular channel normal depth above invert elev. = 0.469(Ft.)
Average velocity of channel(s) = 5.260(Ft/s)

WARNING: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 2.881 (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 = 32.490 (CFS) for 16.030 (Ac.)
Total runoff = 103.794 (CFS)
Effective area this stream = 41.13 (Ac.)
Total Study Area (Main Stream No. 1) = 41.13 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.500 (Ft.), Average velocity = 5.489 (Ft/s)

!!Warning: Water is above left or right bank elevations

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Process from Point/Station 4.000 to Point/Station 5.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.523 (Ft.), Average velocity = 5.376 (Ft/s)

!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data ********

Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 399.50 5.00
3 799.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 117.333 (CFS)
flow top width = 83.518 (Ft.)
velocity = 5.376 (Ft/s)
area = 21.825 (Sq.Ft)
Proude number = 1.853
Upstream point elevation = 3313.000 (Ft.)
Downstream point elevation = 3253.000 (Ft.)
Flow length = 850.890 (Ft.)
Travel time = 2.64 min.
Time of concentration = 21.89 min.
Depth of flow = 0.523 (Ft.)
Average velocity = 5.376 (Ft/s)
Total irregular channel flow = 117.332 (CFS)
Irregular channel normal depth above invert elev. = 0.523 (Ft.)
Average velocity of channel(s) = 5.376 (Ft/s)

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 2.633 (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 = 27.023 (CFS) for 15.730 (Ac.)
Total runoff = 130.817 (CFS)
Effective area this stream = 56.86 (Ac.)
Total Study Area (Main Stream No. 1) = 56.86 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.544 (Ft.), Average velocity = 5.524 (Ft/s)

!!Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++-------------------------------------
Process from Point/Station 5.000 to Point/Station 6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.559 (Ft.), Average velocity = 5.491 (Ft/s)

!!Warning: Water is above left or right bank elevations
******** Irregular Channel Data **********

Information entered for subchannel number 1:
Point number | 'X' coordinate | 'Y' coordinate |
--------------|----------------|----------------|
1             | 0.00           | 0.00           |
2             | 408.50         | 5.00           |
3             | 817.00         | 0.00           |
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 140.310 (CFS)
' ' flow top width = 91.379 (Ft.)
' ' velocity = 5.491 (Ft/s)
' ' area = 25.551 (Sq.Ft.)
' ' Froude number = 1.830

Upstream point elevation = 3253.000 (Ft.)
Downstream point elevation = 3200.000 (Ft.)
Flow length = 788.420 (Ft.)
Travel time = 2.39 min.
Time of concentration = 24.28 min.
Depth of flow = 0.559 (Ft.)
Average velocity = 5.491 (Ft/s)
Total irregular channel flow = 140.309 (CFS)
Irregular channel normal depth above invert elev. = 0.559 (Ft.)
Average velocity of channel(s) = 5.491 (Ft/s)

!!Warning: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000
Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 2.449 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KClA) is C = 0.872
Subarea runoff = 18.889 (CFS) for 13.270 (Ac.)
Total runoff = 149.706 (CFS)
Effective area this stream = 70.13 (Ac.)
Total Study Area (Main Stream No. 1) = 70.13 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.573 (Ft.), Average velocity = 5.581 (Ft/s)

!!Warning: Water is above left or right bank elevations

Process from Point/Station 6.000 to Point/Station 7.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.699 (Ft.), Average velocity = 3.635 (Ft/s)

!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data **********
Time of concentration = 25.54 min.
Depth of flow = 0.699(Ft.)
Average velocity = 3.635(Ft/s)
Total irregular channel flow = 154.024(CFS)
Irregular channel normal depth above invert elev. = 0.699(Ft.)
Average velocity of channel(s) = 3.635(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel.
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.5
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.364(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method) (Q=KClA) is C = 0.871
Subarea runoff = 8.543(CFS) for 6.760(Ac.)
Total runoff = 158.249(CFS)
Effective area this stream = 76.89(Ac.)
Total Study Area (Main Stream No. 1) = 76.89(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.706(Ft.), Average velocity = 3.659(Ft/s)
!!Warning: Water is above left or right bank elevations

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 6.000 to Point/Station 7.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 76.890(Ac.)
Runoff from this stream = 158.249(CFS)
Time of concentration = 25.54 min.
Rainfall intensity = 2.364(In/Hr)
Area averaged loss rate (Fm) = 0.077(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream Area</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>158.25</td>
<td>76.890</td>
<td>25.54</td>
<td>0.077</td>
</tr>
<tr>
<td>Qmax(1)</td>
<td>1.000 * 1.000 * 158.249)</td>
<td>158.249</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total of 1 streams to confluence:
Flow rates before confluence point:
158.249
Maximum flow rates at confluence using above data:
158.249
Area of streams before confluence:
76.890
Effective area values after confluence:
76.890
Results of confluence:
Total flow rate = 158.249(CFS)
Time of concentration = 25.541 min.
Effective stream area after confluence = 76.890(Ac.)
Study area average Pervious fraction(Ap) = 1.000
Study area average soil loss rate(Fm) = 0.077(In/Hr)
Study area total (this main stream) = 76.89(Ac.)
End of computations, Total Study Area = 76.89 (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 = 83.5
Routing Analysis for Basin "B"
Hydrograph Plot

Hyd. No. 1
RATIONAL HG

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 158.00 cfs
Time interval = 5 min

Hydrograph Volume = 327,750 cu ft

---

RATIONAL HG
Hyd. No. 1 -- 100 Yr

Q (cfs)

0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00

0 25 50 75

Time (min)

---

Hyd No. 1
Hydrograph Plot

Hyd. No. 2
BASIN-B ROUTING HYDG

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 1
Reservoir name = DET BASIN-B

Peak discharge = 55.04 cfs
Time interval = 5 min
Max. Elevation = 3175.62 ft
Max. Storage = 212,277 cuft

Storage Indication method used.

Hydrograph Volume = 308,712 cuft

BASIN-B ROUTING HYDG

Q (cfs)

Q (cfs)

0.00 0.8 1.7 2.5 3.3 4.2 5.0 5.8 6.7 7.5

0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00

Hyd No. 2
Hyd No. 1

Req. Stor = 212,277 cuft
Hyd. No. 2

BASIN-B ROUTING HYDG

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 1
Reservoir name = DET BASIN-B

Peak discharge = 55.04 cfs
Time interval = 5 min
Max. Elevation = 3175.62 ft
Max. Storage = 212,277 cuft

Storage Indication method used.

Hydrograph Volume = 308,712 cuft

BASIN-B ROUTING HYDG

Hyd. No. 2 – 100 Yr

Time (hrs)

Elev (ft)
Pond Report

Hydraflo Hydrographs by Intelisolve

Pond No. 1 - DET BASIN-B

Pond Data
Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuft)</th>
<th>Total storage (cuft)</th>
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<tbody>
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<td>0.00</td>
<td>3171.00</td>
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<td>60,065</td>
<td>293,736</td>
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Culvert / Orifice Structures

<table>
<thead>
<tr>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
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<tr>
<td>Rise (in)</td>
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<td>Span (in)</td>
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<td>Invert El. (ft)</td>
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<td>Length (ft)</td>
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<td>.000</td>
<td>.000</td>
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Weir Structures

<table>
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<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
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<tbody>
<tr>
<td>Crest Len (ft)</td>
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<td>Weir Type</td>
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<tr>
<td>Multi-Stage</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.
ITEM-1 Basin Routing Backup Data
For Basin-C
“Offsite-1+Onsite Area-1”, Pre Development Rational Method Analysis
San Bernardino County Rational Hydrology Program
(Hydrology Manual Date - August 1986)
CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study
Date: 03/08/11

PRE DEV OFFSITE-1+ONSITE AREA-1
TR 18255
Q100 1HR
RATIONAL METHOD

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

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Process from Point/Station 1.000 to Point/Station 2.000

**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 3569.000(Ft.)
Bottom (of initial area) elevation = 3458.000(Ft.)
Difference in elevation = 111.000(Ft.)
Slope = 0.1100  s(%) = 11.10
TC = k(0.525)*(length^3)/(elevation change)^0.2
Initial area time of concentration = 12.915 min.
Rainfall intensity = 3.810(In/Hr) for a 100.0 year storm
Effective runoff coefficient for area (Q=KCI) is C = 0.882
Subarea runoff = 29.261(CFS)
Total initial stream area = 8.710(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.077(In/Hr)

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Process from Point/Station 2.000 to Point/Station 3.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.375(Ft.), Average velocity = 4.506(Ft/s)
!! Warning: Water is above left or right bank elevations

******* Irregular Channel Data *********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
   1 0.00 0.00
   2 395.00 5.00
   3 790.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 50.179(CFS)
  flow top width = 59.320(Ft.)
  velocity = 4.506(Ft/s)
  area = 11.136(Sq.Ft.)
  Froude number = 1.833
Upstream point elevation = 3458.000(Ft.)
Downstream point elevation = 3385.000(Ft.)
Flow length = 948.000(Ft.)
Travel time = 3.51 min.
Time of concentration = 16.42 min.
Depth of flow = 0.375(Ft.)
Average velocity = 4.506(Ft/s)
Total irregular channel flow = 50.179(CFS)
Irregular channel normal depth above invert elev. = 0.375(Ft.)
Average velocity of channel(s) = 4.506(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 3.220(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KClA) is C = 0.879
Subarea runoff = 41.772(CFS) for 16.400(Ac.)
Total runoff = 71.034(CFS)
Effective area this stream = 25.11(Ac.)
Total Study Area (Main Stream No. 1) = 25.11(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.428(Ft.), Average velocity = 4.915(Ft/s)
!!Warning: Water is above left or right bank elevations

*********************************************************
Process from Point/Station 3.000 to Point/Station 4.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)

Depth of flow = 0.472(Ft.), Average velocity = 5.286(Ft/s)
!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data *********

------------------------------------------------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 370.00 5.00
3 740.00 3.00
Manning's 'N' friction factor = 0.030
------------------------------------------------------------------------------------------------------------------------
Sub-Channel flow = 87.302(CFS)
' ' flow top width = 69.918(Ft.)
' ' velocity= 5.286(Ft/s)
' ' area = 16.515(Sq.Ft)
' ' Froude number = 1.917
Upstream point elevation = 3385.000(Ft.)
Downstream point elevation = 3313.000(Ft.)
Flow length = 923.000(Ft.)
Travel time = 2.91 min.
Time of concentration = 19.33 min.
Depth of flow = 0.472(Ft.)
Average velocity = 5.286(Ft/s)
Total irregular channel flow = 87.302(CFS)
Irregular channel normal depth above invert elev. = 0.472(Ft.)
Average velocity of channel(s) = 5.286(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.873(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=Kcia) is C = 0.876
Subarea runoff = 32.480(CFS) for 16.030(Ac.)
Total runoff = 103.514(CFS)
Effective area this stream = 41.14(Ac.)
Total Study Area (Main Stream No. 1) = 41.14(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.504(Ft.), Average velocity = 5.516(Ft/s)
!!Warning: Water is above left or right bank elevations

+-----------------------------------------------+
| Process from Point/Station 4.000 to Point/Station 5.000 |
| **** IRREGULAR CHANNEL FLOW TRAVEL TIME **** |
+-----------------------------------------------+

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.518(Ft.), Average velocity = 5.344(Ft/s)
!!Warning: Water is above left or right bank elevations

+-----------------------------------------------+
| Information entered for subchannel number 1 : |
| Point number 'X' coordinate 'Y' coordinate |
| 1 0.00 0.00 |
| 2 408.00 5.00 |
| 3 816.00 0.00 |
| Manning's 'N' friction factor = 0.030 |
| Sub-Channel flow = 117.000(CFS) |
| ' flow top width = 84.536(Ft.) |
| ' velocity = 5.344(Ft/s) |
| ' area = 21.895(Sq.Ft.) |
| ' Froude number = 1.850 |
| Upstream point elevation = 3313.000(Ft.) |
| Downstream point elevation = 3253.000(Ft.) |
| Flow length = 551.000(Ft.) |
| Travel time = 2.65 min. |
| Time of concentration = 21.99 min. |
| Depth of flow = 0.518(Ft.) |
| Average velocity = 5.344(Ft/s) |
| Total irregular channel flow = 116.999(CFS) |
| Irregular channel normal depth above invert elev. = 0.518(Ft.) |
| Average velocity of channel[s] = 5.344(Ft/s) |
| !!Warning: Water is above left or right bank elevations |
| Adding area flow to channel |
| UNDEVELOPED (poor cover) subarea |
| Decimal fraction soil group A = 0.000 |
| Decimal fraction soil group B = 0.500 |
| Decimal fraction soil group C = 0.000 |
| Decimal fraction soil group D = 0.500 |
| SCS curve number for soil(AMC 2) = 63.50 |
| Adjusted SCS curve number for AMC 3 = 96.10 |
| Pervious ratio(Ap) = 1.0000 |
| Max loss rate(Fm) = 0.077(In/Hr) |
| Rainfall intensity = 2.625(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 = 26.917(CFS) for 15.730(Ac.) |
| Total runoff = 130.430(CFS) |
| Effective area this stream = 56.87(Ac.) |
| Total Study Area (Main Stream No. 1) = 56.87(Ac.) |
| Area averaged Fm value = 0.077(In/Hr) |
| Depth of flow = 0.540(Ft.), Average velocity = 5.491(Ft/s) |
| !!Warning: Water is above left or right bank elevations |

+-----------------------------------------------+
| Process from Point/Station 5.000 to Point/Station 6.000 |
| **** IRREGULAR CHANNEL FLOW TRAVEL TIME **** |
+-----------------------------------------------+

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.587(Ft.), Average velocity = 5.190(Ft/s)
!!Warning: Water is above left or right bank elevations
Irregular Channel Data

Information entered for subchannel number 1:

- Point number: 
  1: 'X' coordinate = 0.00, 'Y' coordinate = 0.00
  2: 'X' coordinate = 395.00, 'Y' coordinate = 5.00
  3: 'X' coordinate = 790.00, 'Y' coordinate = 0.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 141.463 (CFS)
  flow top width = 92.807 (Ft.)
  velocity = 5.190 (Ft/s)
  area = 27.257 (Sq.Ft.)
  Froude number = 1.688
Upstream point elevation = 3253.000 (Ft.)
Downstream point elevation = 3203.000 (Ft.)
Flow length = 889.000 (Ft.)
Travel time = 2.85 min.
Time of concentration = 24.84 min.
Depth of flow = 0.587 (Ft.)
Average velocity = 5.190 (Ft/s)
Total irregular channel flow = 141.463 (CFS)
Irregular channel normal depth above invert elev. = 0.587 (Ft.)
Average velocity of channel(s) = 5.190 (Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000
Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 2.410 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) Q=RCIA) is C = 0.891
Subarea runoff = 22.006 (CFS) for 15.720 (Ac.)
Total runoff = 152.436 (CFS)
Effective area this stream = 72.59 (Ac.)
Total Study Area (Main Stream No. 1) = 72.59 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.604 (Ft.), Average velocity = 5.288 (Ft/s)

!!Warning: Water is above left or right bank elevations

++++++ ++ IRREGULAR CHANNEL FLOW TRAVEL TIME ++++

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.568 (Ft.), Average velocity = 5.311 (Ft/s)

!!Warning: Water is above left or right bank elevations

Information entered for subchannel number 1:

- Point number: 
  1: 'X' coordinate = 0.00, 'Y' coordinate = 0.00
  2: 'X' coordinate = 477.00, 'Y' coordinate = 5.00
  3: 'X' coordinate = 394.00, 'Y' coordinate = 0.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 163.464 (CFS)
  flow top width = 108.376 (Ft.)
  velocity = 5.311 (Ft/s)
  area = 30.779 (Sq.Ft.)
  Froude number = 1.756
Upstream point elevation = 3203.000 (Ft.)
Downstream point elevation = 3161.000 (Ft.)
Flow length = 682.000 (Ft.)
Travel time = 2.14 min.
Time of concentration = 26.98 min.
Depth of flow = 0.568(Ft.)
Average velocity = 5.311(Ft/s)
Total irregular channel flow = 163.463(CFS)
Irregular channel normal depth above invert elev. = 0.568(Ft.)
Average velocity of channel(s) = 5.311(Ft/s)

!!Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.275(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCI) is C = 0.870
Subarea runoff = 21.967(CFS) for 15.580(Ac.)
Total runoff = 174.402(CFS)
Effective area this stream = 88.17(Ac.)
Total Study Area (Main Stream No. 1) = 88.17(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.582(Ft.), Average velocity = 5.398(Ft/s)

!!Warning: Water is above left or right bank elevations

******************************************************************************
Process from Point/Station 7.000 to Point/Station 8.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.565(Ft.), Average velocity = 5.320(Ft/s)

!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data **********

-----------------------------
Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
  1    0.00    0.00
  2    539.00  5.00
  3   1078.00  0.00

Manning's 'N' friction factor = 0.030

-----------------------------
Sub-Channel flow = 182.819(CFS)
  flow top width = 121.726(Ft.)
  velocity = 5.320(Ft/s)
  area = 34.363(Sq.Ft.)
  Froude number = 1.765
Upstream point elevation = 3161.000(Ft.)
Downstream point elevation = 3122.000(Ft.)
Flow length = 626.000(Ft.)
Travel time = 1.96 min.
Time of concentration = 28.94 min.
Depth of flow = 0.565(Ft.)
Average velocity = 5.320(Ft/s)
Total irregular channel flow = 182.818(CFS)
Irregular channel normal depth above invert elev. = 0.565(Ft.)
Average velocity of channel(s) = 5.320(Ft/s)

!!Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.140(In/Hr)
Rainfall intensity = 2.166(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCI) is C = 0.864
Subarea runoff = 16.744(CFS) for 13.930(Ac.)
Total runoff = 191.146(CFS)
Effective area this stream = 102.10(Ac.)
Total Study Area (Main Stream No. 1) = 102.10(Ac.)
Area averaged Fm value = 0.085(In/Hr)
Depth of flow = 0.574(Ft.), Average velocity = 5.380(Ft/s)
!!Warning: Water is above left or right bank elevations

Process from Point/Station 8.000 to Point/Station 9.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.511(Ft.), Average velocity = 4.692(Ft/s)
!!Warning: Water is above left or right bank elevations

**** Irregular Channel Data ********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
1 0.00 0.00
2 815.00 5.00
3 1630.00 0.00
Manning’s 'N' friction factor = 0.030

Sub-Channel flow = 199.998(CFS)
  flow top width = 166.716(Ft.)
  velocity= 4.692(Ft/s)
  area = 42.629(Sq.Ft)
  Froude number = 1.635
Upstream point elevation = 3122.000(Ft.)
Downstream point elevation = 3100.000(Ft.)
Flow length = 398.000(Ft.)
Travel time = 1.41 min.
Time of concentration = 30.36 min.
Depth of flow = 0.511(Ft.)
Average velocity = 4.692(Ft/s)
Total irregular channel flow = 199.996(CFS)
Average velocity of channel(s) = 4.692(Ft/s)
!!Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Rainfall intensity = 2.095(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCI =) is C = 0.861
Subarea runoff = 17.635(CFS) for 13.740(Ac.)
Total runoff = 208.781(CFS)
Effective area this stream = 115.84(Ac.)
Total Study Area (Main Stream No. 1) = 115.84(Ac.)
Area averaged Fm value = 0.092(In/Hr)
Depth of flow = 0.520(Ft.), Average velocity = 4.742(Ft/s)
!!Warning: Water is above left or right bank elevations

Process from Point/Station 9.000 to Point/Station 10.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.548(Ft.), Average velocity = 4.833(Ft/s)
!!Warning: Water is above left or right bank elevations

**** Irregular Channel Data ********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
1 0.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 216.967(CFS)
  flow top width = 163.898(Ft.)
  velocity = 4.833(Ft/s)
  area = 44.891(Sq.Ft)
  Froude number = 1.627

Upstream point elevation = 3100.000(Ft.)
Downstream point elevation = 3078.000(Ft.)
Flow length = 411.000(Ft.)
Travel time = 1.42 min.
Time of concentration = 31.77 min.
Depth of flow = 0.548(Ft.)
Average velocity = 4.833(Ft/s)
Total irregular channel flow = 216.966(CFS)
Irregular channel normal depth above invert elev. = 0.548(Ft.)
Average velocity of channel(s) = 4.833(Ft/s)
!!Warning: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
PerVIOUS ratio(Ap) = 0.0000 Max loss rate(Fm) = 0.140(In/Hr)
Rainfall intensity = 2.029(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 = 16.303(CFS) for 13.630(Ac.)
Total runoff = 225.084(CFS)
Effective area this stream = 129.47(Ac.)
Total Study Area (Main Stream No. 1) = 129.47(Ac.)
Area averaged Fm value = 0.097(In/Hr)
Depth of flow = 0.555(Ft.), Average velocity = 4.878(Ft/s)
!!Warning: Water is above left or right bank elevations

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Process from Point/Station 10.000 to Point/Station 11.000
** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
-------------------------------
Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.585(Ft.), Average velocity = 5.523(Ft/s)
!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data **********

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
  1  0.00  0.00
  2  615.00  5.00
  3  1230.00  0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 232.238(CFS)
  flow top width = 143.839(Ft.)
  velocity = 5.523(Ft/s)
  area = 42.052(Sq.Ft)
  Froude number = 1.800
Upstream point elevation = 3078.000(Ft.)
Downstream point elevation = 3055.000(Ft.)
Flow length = 359.000(Ft.)
Travel time = 1.08 min.
Time of concentration = 32.86 min.
Depth of flow = 0.585(Ft.)
Average velocity = 5.523(Ft/s)
Total irregular channel flow = 232.238(CFS)
Irregular channel normal depth above invert elev. = 0.585(Ft.)
Average velocity of channel(s) = 5.523(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.140(In/Hr)
Rainfall intensity = 1.982(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.854
Subarea runoff = 14.256(CFS) for 11.910(Ac.)
Total runoff = 239.340(CFS)
Effective area this stream = 141.38(Ac.)
Total Study Area (Main Stream No. 1) = 141.38(Ac.)
Area averaged Fm value = 0.101(In/Hr)
Depth of flow = 0.591(Ft.), Average velocity = 5.564(Ft/s)
!!Warning: Water is above left or right bank elevations

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 11.000 to Point/Station 12.000
***** IRREGULAR CHANNEL FLOW TRAVEL TIME *****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.691(Ft.), Average velocity = 5.949(Ft/s)
!!Warning: Water is above left or right bank elevations

Irregular Channel Data

Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 428.00 5.00
3 856.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 243.240(CFS)
' ' flow top width = 118.316(Ft.)
' ' velocity = 5.949(Ft/s)
' ' area = 40.884(Sq.Ft)
' ' Froude number = 1.784
Upstream point elevation = 3055.000(Ft.)
Downstream point elevation = 3024.000(Ft.)
Flow length = 521.000(Ft.)
Travel time = 1.46 min.
Time of concentration = 34.32 min.
Depth of flow = 0.691(Ft.)
Average velocity = 5.949(Ft/s)
Total irregular channel flow = 243.239(CFS)
Irregular channel normal depth above invert elev. = 0.691(Ft.)
Average velocity of channel(s) = 5.949(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.140(In/Hr)
Rainfall intensity = 1.922(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.852
Subarea runoff = 7.730(CFS) for 9.530(Ac.)
Total runoff = 247.071(CFS)
Effective area this stream = 150.91(Ac.)
Total Study Area (Main Stream No. 1) = 150.91(Ac.)
Area averaged Fm value = 0.103(In/Hr)
Depth of flow = 0.695(Ft.), Average velocity = 5.973(Ft/s)
Warning: Water is above left or right bank elevations

Process from Point/Station 11.000 to Point/Station 12.000

**** CONfluence OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 150.910(Ac.)
Runoff from this stream = 247.071(CFS)
Time of concentration = 34.32 min.
Rainfall intensity = 1.922(In/Hr)
Area averaged loss rate (Fm) = 0.103(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>247.07</td>
<td>150.910</td>
<td>34.32</td>
<td>0.103</td>
<td>1.922</td>
</tr>
</tbody>
</table>

Qmax(1) = 1.000 * 1.000 * 247.071) + = 247.071

Total of 1 streams to confluence:
Flow rates before confluence point: 247.071
Maximum flow rates at confluence using above data: 247.071
Area of streams before confluence: 150.910
Effective area values after confluence: 150.910

Results of confluence:
Total flow rate = 247.071(CFS)
Time of concentration = 34.316 min.
Effective stream area after confluence = 150.910(Ac.)
Study area average Pervious fraction (Ap) = 1.000
Study area average soil loss rate (Fm) = 0.103(In/Hr)
Study area total (this main stream) = 150.91(Ac.)
End of computations, Total Study Area = 150.91 (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 = 81.2
“Onsite Area-1”, Post Development Rational Method Analysis
San Bernardino County Rational Hydrology Program
(Hydrology Manual Date - August 1986)
CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 03/08/11

POST DEB AREA-1, DEB-5 TO DEB-19
TR 18255
Q100 1 HR
RATIONAL METHOD

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

Process from Point/Station 10.000 to Point/Station 20.000

*** USER DEFINED FLOW INFORMATION AT A POINT ***

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 1.329(In/Hr) for a 100.0 year storm
User specified values are as follows:
TC = 55.00 min. Rain intensity = 1.33(In/Hr)
Total area this stream = 48.80(Ac.)
Total Study Area (Main Stream No. 1) = 48.80(Ac.)
Total runoff = 55.04(CFS)

Process from Point/Station 20.000 to Point/Station 30.000

*** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ***

Top of street segment elevation = 3171.000(Ft.)
End of street segment elevation = 3150.000(Ft.)
Length of street segment = 402.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hke from flowline = 1.500(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 = 56.955(CFS)
Depth of flow = 0.450(Ft.), Average velocity = 9.044(Ft/s)
Note: depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 15.000(Ft.)
Flow velocity = 9.04(Ft/s)
Travel time = 0.74 min. TC = 55.74 min.
Adding area flow to street
RESIDENTIAL(3 = 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.00
Pervious ratio $(Ap) = 0.6000$  Max loss rate $(Fm) = 0.264$ (In/Hr)
Rainfall intensity = 1.316 (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 = 3.651 (CFS) for 4.500 (Ac.)
Total runoff = 58.691 (CFS)
Effective area this stream = 53.30 (Ac.)
Total Study Area (Main Stream No. 1) = 53.30 (Ac.)
Area averaged $Fm$ value = 0.093 (In/Hr)
Street flow at end of street = 58.691 (CFS)
Half street flow at end of street = 29.345 (CFS)
Depth of flow = 0.454 (Ft.), Average velocity = 9.153 (Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000 (Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 30.000 to Point/Station 40.000
*** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION  ****

Top of street segment elevation = 3150.000 (Ft.)
End of street segment elevation = 3121.000 (Ft.)
Length of street segment = 530.000 (Ft.)
Height of curb above gutter flowline = 6.0 (In.)
Width of half street (curb to crown) = 15.000 (Ft.)
Distance from crown to crossfall grade break = 13.500 (Ft.)
Slope from gutter to grade break (v/hz) = 0.083
Slope from grade break to crown (v/hz) = 0.020
Street flow is on (2) sides of the street
Distance from curb to property line = 6.000 (Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500 (Ft.)
Gutter hike from flowline = 1.500 (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 = 60.493 (CFS)
Depth of flow = 0.455 (Ft.), Average velocity = 9.394 (Ft/s)
Note: depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 15.000 (Ft.)
Flow velocity = 9.39 (Ft/s)
Travel time = 0.94 min.  TC = 56.68 min.
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio $(Ap) = 0.6000$  Max loss rate $(Fm) = 0.264$ (In/Hr)
Rainfall intensity = 1.301 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (total area with modified rational method) $(Q=KCIA)$ is $C = 0.827$
Subarea runoff = 3.418 (CFS) for 4.450 (Ac.)
Total runoff = 62.108 (CFS)
Effective area this stream = 57.75 (Ac.)
Total Study Area (Main Stream No. 1) = 57.75 (Ac.)
Area averaged $Fm$ value = 0.106 (In/Hr)
Street flow at end of street = 62.108 (CFS)
Half street flow at end of street = 31.054 (CFS)
Depth of flow = 0.458 (Ft.), Average velocity = 9.492 (Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000 (Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 40.000 to Point/Station 45.000
*** CONFLUENCE OF MINOR STREAMS  ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 57.750 (Ac.)
Runoff from this stream = 62.108 (CFS)
Time of concentration = 56.68 min.
Rainfall intensity = 1.301 (In/Hr)
Area averaged loss rate $(Fm) = 0.1058$ (In/Hr)
Area averaged Pervious ratio $(Ap) = 0.9380$
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream Area Flow rate</th>
<th>TC</th>
<th>Fm</th>
<th>Rainfall Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>(Ac.)</td>
<td>(CFS)</td>
<td>(min)</td>
</tr>
<tr>
<td>1</td>
<td>62.11</td>
<td>57.750</td>
<td>56.68</td>
</tr>
<tr>
<td>Qmax(1) =</td>
<td>1.000 *</td>
<td>1.000 *</td>
<td>62.108</td>
</tr>
</tbody>
</table>

Total of 1 streams to confluence:
Flow rates before confluence point: 62.108
Maximum flow rates at confluence using above data: 62.108
Area of streams before confluence: 57.750
Effective area values after confluence: 57.750
Results of confluence:
Total flow rate = 62.108(CFS)
Time of concentration = 56.681 min.
Effective stream area after confluence = 57.750(Ac.)
Study area average Pervious fraction(Ap) = 0.938
Study area average soil loss rate(Fm) = 0.106(In/Hr)
Study area total (this main stream) = 57.750(Ac.)

+-------------------------------------------------------------------------------------------------+
+-initial area evaluation-*

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.6000
Max loss rate(Fm) = 0.264(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 3203.000(Ft.)
Bottom (of initial area) elevation = 3139.000(Ft.)
Difference in elevation = 64.000(Ft.)
Slope = 0.064000 s(%) = 6.40
TC = k(0.412)[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.315 min.
Rainfall intensity = 4.018(In/Intesity) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.841
Subarea runoff = 23.045(CFS)
Total initial stream area = 6.820(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.264(In/Hr)

+-------------------------------------------------------------------------------------------------+
+process from point/station-*

Process from Point/Station 50.000 to Point/Station 60.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 3139.000(Ft.)
End of street segment elevation = 3124.000(Ft.)
Length of street segment = 434.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/Hz) = 0.093
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 = 6.000(Ft.)
Slope from curb to property line (v/Hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(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 = 34.274(CFS)
Depth of flow = 0.415(Ft.), Average velocity = 6.527(Ft/s)
Note: depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 15,000(Ft.)
Flow velocity = 6.53(Ft/s)
Travel time = 1.11 min. TC = 12.42 min.
Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimial fraction soil group A = 0.000
Decimial fraction soil group B = 1.000
Decimial fraction soil group C = 0.000
Decimial fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.6000
Max loss rate(Fm)= 0.264(In/Hr)
Rainfall intensity = 3.764(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=RCIA) is C = 0.837
Subarea runoff = 22.347(CFS) for 7.590(Ac.)
Total runoff = 45.392(CFS)
Effective area this stream = 14.41(Ac.)
Total Study Area (Main Stream No. 1) = 72.16(Ac.)
Area averaged Fm value = 0.264(In/Hr)
Street flow at end of street = 45.392(CFS)
Half street flow at end of street = 22.696(CFS)
Depth of flow = 0.448(Ft.), Average velocity = 7.297(Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000(Ft.)

Process from Point/Station 70,000 to Point/Station 80,000
**** STREET INLET + AREA + PIPE TRAVEL TIME ****

<table>
<thead>
<tr>
<th>Top of street segment elevation</th>
<th>3124.000(Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End of street segment elevation</td>
<td>3121.000(Ft.)</td>
</tr>
<tr>
<td>Length of street segment</td>
<td>439.000(Ft.)</td>
</tr>
<tr>
<td>Height of curb above gutter flowline</td>
<td>6.0(In.)</td>
</tr>
<tr>
<td>Width of half street (curb to crown)</td>
<td>15.000(Ft.)</td>
</tr>
<tr>
<td>Distance from crown to crossfall grade break</td>
<td>13.500(Ft.)</td>
</tr>
<tr>
<td>Slope from gutter to grade break (v/Hz)</td>
<td>0.083</td>
</tr>
<tr>
<td>Slope from grade break to crown (v/Hz)</td>
<td>0.020</td>
</tr>
<tr>
<td>Street flow is on [2] side(s) of the street</td>
<td></td>
</tr>
<tr>
<td>Discharge from curb to property line</td>
<td>6.000(Ft.)</td>
</tr>
<tr>
<td>Slope from curb to property line (v/Hz)</td>
<td>0.020</td>
</tr>
<tr>
<td>Gutter width</td>
<td>1.500(Ft.)</td>
</tr>
<tr>
<td>Gutter rise from flowline</td>
<td>1.500(In.)</td>
</tr>
<tr>
<td>Manning's N in gutter</td>
<td>0.0130</td>
</tr>
<tr>
<td>Manning's N from gutter to grade break</td>
<td>0.0130</td>
</tr>
<tr>
<td>Manning's N from grade break to crown</td>
<td>0.0130</td>
</tr>
</tbody>
</table>

Street Inlet Calculations:
Street flow before street inlet = 45.392(CFS)
Half street flow before street inlet = 22.696(CFS)
Existing pipe flow before street inlet = 0.000(CFS)
Number of street inlets = 2
Depth of flow = 0.761(Ft.), Average velocity = 4.016(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 15.000(Ft.)
Flow rate in gutter section of street = Qw = 3.113(CFS)
Ratio of frontal flow to total flow = R0 = 0.1372
Given curb inlet length L = 4.000(Ft.)

Half street cross section data points at curb inlet:
<table>
<thead>
<tr>
<th>X-coordinate (Ft.)</th>
<th>Y-coordinate (Ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0000</td>
<td>0.7867 right of way</td>
</tr>
<tr>
<td>6.0000</td>
<td>0.6667 top of curb</td>
</tr>
<tr>
<td>6.0000</td>
<td>0.0000 flow line</td>
</tr>
<tr>
<td>7.5000</td>
<td>0.2917 gutter/depression end</td>
</tr>
<tr>
<td>7.5000</td>
<td>0.2917 grade break</td>
</tr>
<tr>
<td>21.0000</td>
<td>0.5617 crown</td>
</tr>
</tbody>
</table>

Length required for total flow interception = Lt
Lt = 0.6 * 0.42 * Slope^0.3 * (1/(n*Se))^-0.6 = 27.184(Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0068
Se = Equivalent Street x-slope including depression = 0.0982
Gutter depression depth = 2.000(In.)
Gutter depression width = 1.500(Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.2491
Pipe calculations for under street flow rate of 11.308(CFS)
Using a pipe slope = 0.714 %
Upstream point/station elevation = 3124.000(Ft.)
Downstream point/station elevation = 3121.000(Ft.)
Pipe length = 439.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 11.308(CFS)
Normalized computed pipe diameter = 21.00(In.)
Calculated individual pipe flow = 11.308(CFS)
Normal flow depth in pipe = 14.79(In.)
Flow top width inside pipe = 19.17(In.)
Critical Depth = 15.04(In.)
Pipe flow velocity = 6.24(Ft/s)
Travel time through pipe = 1.17 min.
Time of concentration (TC) = 13.60 min.
Maximum flow rate of street inlet(s) = 11.308(CFS)
Maximum pipe flow capacity = 11.308(CFS)
Remaining flow in street below inlet = 34.084(CFS)
Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm) = 0.264(In/Hr)
Rainfall intensity = 3.534(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method) (Q=KCIA) is C = 0.833
Subarea runoff = 5.989(CFS) for 3.050(Ac.)
Total runoff = 51.381(CFS)
Effective area this stream = 17.46(Ac.)
Total Study Area (Main Stream No. 1) = 75.21(Ac.)
Area averaged Fm value = 0.264(In/Hr)
Street flow at end of street = 40.074(CFS)
Half street flow at end of street = 20.037(CFS)
Depth of flow = 0.572(Ft.), Average velocity = 3.921(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 = 3.61(Ft.)
Flow width (from curb towards crown) = 15.000(Ft.)

+------------------------------------------------------------------+
| Process from Point/Station 80.000 to Point/Station 85.000     |
+------------------------------------------------------------------+
| **** CONFLUENCE OF MINOR STREAMS ****                             |
+------------------------------------------------------------------+

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 17.460(Ac.)
Runoff from this stream = 51.381(CFS)
Time of concentration = 13.60 min.
Rainfall intensity = 3.534(In/Hr)
Area averaged loss rate (Fm) = 0.2640(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>62.11</td>
<td>57.750</td>
<td>56.68</td>
<td>0.106</td>
<td>1.301</td>
</tr>
<tr>
<td>2</td>
<td>51.38</td>
<td>17.460</td>
<td>13.60</td>
<td>0.264</td>
<td>3.534</td>
</tr>
</tbody>
</table>

Qmax(1) =
1.000 * 1.000 * 62.108 + 0.317 * 1.000 * 51.381 = 78.401
Qmax(2) =
2.869 * 0.240 * 62.108 + 1.000 * 1.000 * 51.381 = 94.117

Total of 2 streams to confluence:
Flow rates before confluence point:
62.108 51.381
Maximum flow rates at confluence using above data:
78.401 94.117
Area of streams before confluence:
57.750 17.460
Effective area values after confluence:

75.210
31.312

Results of confluence:
Total flow rate = 94.117(CFS)
Time of concentration = 13.596 min.
Effective stream area after confluence = 31.312(Ac.)
Study area average Pervious fraction(Ap) = 0.860
Study area average soil loss rate(fm) = 0.143(In/Hr)
Study area total (this main stream) = 75.21(Ac.)

Process from Point/Station 90.000 to Point/Station 100.000
*** STREET INLET + AREA + PIPE TRAVEL TIME ***

Top of street segment elevation = 3121.000(Ft.)
End of street segment elevation = 3096.000(Ft.)
Length of street segment = 459.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(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

Street Inlet Calculations:
Street flow before street inlet = 82.809(CFS)
Half street flow before street inlet = 41.404(CFS)
Existing pipe flow before street inlet = 11.308(CFS)
Number of street inlets = 2
Depth of flow = 0.669(Ft.), Average velocity = 10.574(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 15.000(Ft.)
Flow rate in gutter section of street = Qw = 10.107(CFS)
Ratio of frontal flow to total flow = E0 = 0.2441
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 0.7867 right of way
6.0000 0.6667 top of curb
6.0000 0.0000 flow line
7.5000 0.2917 gutter/depression end
7.5000 0.2917 grade break
21.0000 0.5617 crown

Length required for total flow interception = Lt
Lt = Qw * 0.42 * Slope^0.3 = (1/2^n)*0.5 = 60.906(Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0545
Se = Equivalent Street x-slope including depression = 0.1101
Gutter depression depth = 2.000(In.)
Gutter depression width = 1.500(Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.3751

Pipe calculations for under street flow rate of 42.368(CFS)
Using a pipe slope = 5.155 %
Upstream point/station elevation = 3121.000(Ft.)
Downstream point/station elevation = 3096.000(Ft.)
Pipe length = 459.000(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 42.368(CFS)
Nearest computed pipe diameter = 24.00(In.)
Calculated individual pipe flow = 42.368(CFS)
Normal flow depth in pipe = 16.62(In.)
Flow top width inside pipe = 22.15(In.)
Critical depth could not be calculated.
Pipe flow velocity = 18.26(Ft/s)
Travel time through pipe = 0.42 min.
Time of concentration (TC) = 14.01 min.
Maximum flow rate of street inlet(s) = 31.060(CFS)
Maximum pipe flow capacity = 42.368(CFS)
Remaining flow in street below inlet = 51.749(CFS)
Adding area flow to street

RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000  Max loss rate (Fm) = 0.264 (In/Hr)
Rainfall intensity = 3.459 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q = K.CIA) is C = 0.859
Subarea runoff = 13.191 (CFS) for 4.810 (Ac.)
Total runoff = 107.308 (CFS)
Effective area this stream = 36.12 (Ac.)
Total Study Area (Main Stream No. 1) = 80.02 (Ac.)
Area averaged Fm value = 0.159 (In/Hr)
Street flow at end of street = 64.939 (CFS)
Half street flow at end of street = 32.470 (CFS)
Depth of flow = 0.465 (Ft), Average velocity = 9.648 (Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000 (Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 100.000 to Point/Station 110.000
**** STREET INLET + AREA + PIPE TRAVEL TIME ****

Top of street segment elevation = 3096.000 (Ft.)
End of street segment elevation = 3075.000 (Ft.)
Length of street segment = 374.000 (Ft.)
Height of street segment = 6.0 (In.)
Width of half street (curb to crown) = 15.000 (Ft.)
Distance from crown to crossfall grade break = 13.500 (Ft.)
Slope from gutter to grade break (v/ft) = 0.083
Slope from grade break to crown (v/ft) = 0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line = 6.000 (Ft.)
Slope from curb to property line (v/ft) = 0.020
Gutter width = 1.500 (Ft.)
Gutter hike from flowline = 1.500 (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

Street Inlet Calculations:
Street flow before street inlet = 64.939 (CFS)
Half street flow before street inlet = 32.470 (CFS)
Existing pipe flow before street inlet = 42.360 (CFS)
Number of street inlets = 2
Depth of flow = 0.622 (Ft.), Average velocity = 9.692 (Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 15.000 (Ft.)
Flow rate in gutter section of street = QW = 9.045 (CFS)
Ratio of frontal flow to total flow = RO = 0.2786
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  0.7867 right of way
6.0000  0.6667 top of curb
6.0000  0.0000 flow line
7.5000  0.2917 gutter/depression end
7.5000  0.2917 grade break
21.0000  0.5617 crown

Length required for total flow interception = Lt
Lt = 0.6 * Q^0.42 * Slope^-3 * (L/n^3)^0.6 = 54.372 (Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0561
Se = Equivalent Street x-slope including depression = 0.1140
Gutter depression depth = 2.000 (In.)
Gutter depression width = 1.500 (Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.4148

Pipe calculations for under street flow rate of 69.308 (CFS)
Using a pipe slope = 5.585 %
Upstream point/station elevation = 3096.000 (Ft.)
Downstream point/station elevation = 3075.000 (Ft.)
Pipe length = 374.00(Ft.)  Manning’s N = 0.013
No. of pipes = 1  Required pipe flow = 69.308(CFS)
Nearest computed pipe diameter = 27.00(In.)
Calculated individual pipe flow = 69.308(CFS)
Normal flow depth in pipe = 20.95(In.)
Flow top width inside pipe = 22.51(In.)
Critical depth could not be calculated.
Pipe flow velocity = 20.94(Ft/s)
Travel time through pipe = 0.30 min.
Time of concentration (TC) = 14.31 min.
Maximum flow rate of street inlet(s) = 26.940(CFS)
Maximum pipe flow capacity = 69.308(CFS)
Remaining flow in street below inlet = 38.000(CFS)
Adding area flow to street RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000  Max loss rate (Fm) = 0.264(In/Hr)
Rainfall intensity = 3.409(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified ratio is) Q=KCIA)
Subarea runoff = 11.576(CFS) for 4.670(Ac.)
Total runoff = 118.884(CFS)
Effective area this stream = 40.79(Ac.)
Total Study Area (Main Stream No. 1) = 84.69(Ac.)
Area averaged Fm value = 0.171(In/Hr)
Street flow at end of street = 49.576(CFS)
Half street flow at end of street = 24.788(CFS)
Depth of flow = 0.429(Ft.), Average velocity = 8.748(Ft/s)
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000(Ft.)

******************************************************************************
Process from Point/Station 110.000 to Point/Station 120.000

**** STREET INLET + AREA + PIPE TRAVEL TIME ****

Top of street segment elevation = 3075.000(Ft.)
End of street segment elevation = 3052.000(Ft.)
Length of street segment = 417.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(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

Street Inlet Calculations:
Street flow before street inlet = 49.576(CFS)
Half street flow before street inlet = 24.788(CFS)
Existing pipe flow before street inlet = 69.308(CFS)
Number of street inlets = 2
Depth of flow = 0.589(Ft.), Average velocity = 8.660(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 15.000(Ft.)
Flow rate in gutter section of street = Qw = 7.922(CFS)
Ratio of frontal flow to total flow = E0 = 0.3196
Given curb inlet length L = 21.000(Ft.)

Half street cross section data points at curb inlet:
X-coordinate (Ft.)  Y-coordinate (Ft.)
0.0000  0.7867 right of way
6.0000  0.6667 top of curb
6.0000  0.0000 flow line
7.5000  0.2917 gutter/depression end
7.5000  0.2917 grade break
Length required for total flow interception = \( L_t \)
\[
L_t = 0.6 \times Q^{0.42} \times \text{Slope}^{0.3} \times (1/n^*Se)^{-0.6} = 47.161 \text{ (Ft.)}
\]
where Manning's \( n = 0.0130 \) and \( \text{Slope} = \text{street slope} = 0.0552 \)
\( Se = \text{Equivalent Street x-slope including depression} = 0.1185 \)
Gutter depression depth = 2.000\( (\text{In.}) \)
Gutter depression width = 1.500\( (\text{Ft.}) \)
Efficiency = \( 1 - (1-L/Lt)^{1.8} = 0.6538 \)

Pipe calculations for under street flow rate of 101.720\( (\text{CFS}) \)
Using a pipe slope = 6.047 \%
Upstream point/station elevation = 3075.000\( (\text{Ft.}) \)
Downstream point/station elevation = 3052.000\( (\text{Ft.}) \)
Pipe length = 417.00\( (\text{Ft.}) \) Manning's \( N = 0.013 \)
No. of pipes = 1 Required pipe flow = 101.720\( (\text{CFS}) \)
Nearest computed pipe diameter = 33.00\( (\text{In.}) \)
Calculated individual pipe flow = 101.720\( (\text{CFS}) \)
Normal flow depth in pipe = 21.96\( (\text{In.}) \)
Flow top width inside pipe = 31.14\( (\text{In.}) \)
Critical depth could not be calculated.
Pipe flow velocity = 24.22\( (\text{Ft/s}) \)
Travel time through pipe = 0.29 \text{ min.}
Time of concentration (TC) = 14.60 \text{ min.}
Maximum flow rate of street inlet(s) = 32.412\( (\text{CFS}) \)
Maximum pipe flow capacity = 101.720\( (\text{CFS}) \)
Remaining flow in street below inlet = 17.163\( (\text{CFS}) \)
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio\( (Ap) = 0.6000 \)
Max loss rate\( (Fm) = 0.264 \text{ (In/Hr)} \)
Rainfall intensity\( (I) = 3.362 \text{ (In/Hr)} \) for a 100.0 year storm
Effective runoff coefficient used for area,\( (total \text{ area with modified rational method}) = 0.852 \)
Subarea runoff = 7.195\( (\text{CFS}) \)

Total runoff = 126.079\( (\text{CFS}) \)
Effective area this stream = 43.99\( (\text{Ac.}) \)
Total study area (Main Stream No. 11 = 87.89\( (\text{Ac.}) \)
Area averaged \( Fm \) value = 0.178\( (\text{In/Hr}) \)

Street flow at end of street = 24.359\( (\text{CFS}) \)
Half street flow at end of street = 12.179\( (\text{CFS}) \)
Depth of flow = 0.354\( (\text{Ft.}) \), Average velocity = 6.944\( (\text{Ft/s}) \)

Flow width \( (\text{from curb towards crown}) = 12.972 \text{ (Ft.)} \)

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Process from Point/Station 120.000 to Point/Station 130.000

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**PIPEFLOW TRAVEL TIME (Program estimated size)**

Upstream point/station elevation = 3046.000\( (\text{Ft.}) \)
Downstream point/station elevation = 3020.000\( (\text{Ft.}) \)
Pipe length = 248.00\( (\text{Ft.}) \) Manning's \( N = 0.013 \)
No. of pipes = 1 Required pipe flow = 126.079\( (\text{CFS}) \)
Nearest computed pipe diameter = 30.00\( (\text{In.}) \)
Calculated individual pipe flow = 126.079\( (\text{CFS}) \)
Normal flow depth in pipe = 23.34\( (\text{In.}) \)
Flow top width inside pipe = 24.93\( (\text{In.}) \)
Critical depth could not be calculated.
Pipe flow velocity = 30.79\( (\text{Ft/s}) \)
Travel time through pipe = 0.13 \text{ min.}
Time of concentration (TC) = 14.73 \text{ min.}

---

Process from Point/Station 130.000 to Point/Station 135.000

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**CONfluence of Minor Streams**

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 43.992\( (\text{Ac.}) \)
Runoff from this stream = 126.079\( (\text{CFS}) \)
Time of concentration = 14.73 \text{ min.}
Rainfall intensity = 3.340\( (\text{In/Hr}) \)
Area averaged loss rate \( (Fm) = 0.1775 \text{ (In/Hr)} \)
Area averaged Pervious ratio \( (Ap) = 0.7847 \)
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>126.08</td>
<td>43.992</td>
<td>14.73</td>
<td>0.178</td>
<td>3.340</td>
</tr>
<tr>
<td>Qmax(1)</td>
<td></td>
<td></td>
<td>1.000</td>
<td>1.000</td>
<td>126.079 + 126.079 = 252.158</td>
</tr>
</tbody>
</table>

Total of 1 streams to confluence:
Flow rates before confluence point: 126.079
Maximum flow rates at confluence using above data: 126.079
Area of streams before confluence: 43.992
Effective area values after confluence: 43.992

Results of confluence:
Total flow rate = 126.079(CFS)
Time of concentration = 14.733 min.
Effective stream area after confluence = 43.992(Ac.)
Study area average Pervious fraction (Ap) = 0.785
Study area average soil loss rate (Fm) = 0.178(In/Hr)
Study area total (this main stream) = 43.992(Ac.)

+-------------------------------------------------------------------------------------------------------+
| Process from Point/Station 200.000 to Point/Station 210.000                                        |
| *** INITIAL AREA EVALUATION ***                                                                       |
+-------------------------------------------------------------------------------------------------------+

RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000 Max loss rate (Fm) = 0.264(In/Hr)
Initial subarea data:
Initial area flow distance = 600.000(Ft.)
Top (of initial area) elevation = 3124.000(Ft.)
Bottom (of initial area) elevation = 3111.000(Ft.)
Difference in elevation = 13.000(Ft.)
Slope = 0.02167 m = 2.17
TC = k(0.412) * [(length)'3'] / (elevation change)']^0.2
Initial area time of concentration = 11.455 min.
Rainfall intensity = 3.984(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q = KxI) is C = 0.840
Subarea runoff = 11.919(CFS)
Total initial stream area = 3.560(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.264(In/Hr)

+-------------------------------------------------------------------------------------------------------+
| Process from Point/Station 210.000 to Point/Station 220.000                                        |
| *** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ***                                            |
+-------------------------------------------------------------------------------------------------------+

Top of street segment elevation = 3111.000(Ft.)
End of street segment elevation = 3104.000(Ft.)
Length of street segment = 242.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(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 = 18.813(CFS)
Depth of flow = 0.361(Ft.), Average velocity = 5.108(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 13.305(Ft.)
Flow velocity = 5.11(Ft/s)
Travel time = 0.79 min. TC = 12.24 min.
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.600
Max loss rate (Fm) = 0.264(In/Hr)
Rainfall intensity = 3.802(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCI A) is C = 0.838
Subarea runoff = 13.621(CFS) for 4.460(Ac.)
Total runoff = 25.540(CFS)
Effective area this stream = 8.02(Ac.)
Total Study Area (Main Stream No. 1) = 95.91(Ac.)
Area averaged Fm value = 0.264(In/Hr)
Street flow at end of street = 25.540(CFS)
Half street flow at end of street = 12.770(CFS)
Depth of flow = 0.395(Ft.), Average velocity = 5.504(Ft/s)
Flow width (from curb towards crown) = 14.996(Ft.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 220.000 to Point/Station 230.000
**** STREET INLET + AREA + PIPE TRAVEL TIME ****

Top of ofstreet segment elevation = 3104.000(Ft.)
End of street segment elevation = 3073.000(Ft.)
Length of street segment = 550.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter hike from flowline = 1.500(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

Street Inlet Calculations:
Street flow before street inlet = 25.540(CFS)
Half street flow before street inlet = 12.770(CFS)
Existing pipe flow before street inlet = 0.000(CFS)
Number of street inlets = 2
Depth of offlow = 0.514(Ft.), Average velocity = 7.165(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 12.594(Ft.)
Flow rate in gutter section of street = Qw = 5.720(CFS)
Ratio of frontal flow to total flow = E0 = 0.4479
Given curb inlet length = 7.000(Ft.)

Half street cross section data points at curb inlet:
X-coordinate (Ft.) Y-coordinate (Ft.)
0.0000 0.7867 right of way
6.0000 0.6667 top of curb
6.0000 0.0000 flow line
7.5000 0.2917 gutter/depression end
7.5000 0.2917 grade break
21.0000 0.5617 crown

Length required for total flow interception = L
L = .6 * Qo * .42 * Slope: .3 * (1/n*Se): .6 = 33.560(Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0564
Se = Equivalent Street x-slope including depression = 0.1328
Gutter depression depth = 2.000(In.)
Gutter depression width = 1.500(Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.3437

Pipe calculations for under street flow rate of 8.777(CFS)
Using a pipe slope  5.818 %
Upstream point/station elevation  3104.000(Ft.)
Downstream point/station elevation  3073.000(Ft.)
Pipe length  550.00(Ft.)  Manning's N  0.013
No. of pipes  1  Required pipe flow  8.777(CFS)
Nearest computed pipe diameter  15.00(In.)
Calculated individual pipe flow  8.777(CFS)
Normal flow depth in pipe  8.05(In.)
Flow top width inside pipe  14.96(In.)
Critical Depth  13.77(In.)
Pipe flow velocity  13.07(Ft/s)
Travel time through pipe  0.70 min.
Time of concentration (TC)  12.95 min.
Maximum flow rate of street inlet(s)  8.777(CFS)
Maximum pipe flow capacity  8.777(CFS)
Remaining flow in street below inlet  16.763(CFS)

Adding area flow to street

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A  0.000
Decimal fraction soil group B  1.000
Decimal fraction soil group C  0.000
Decimal fraction soil group D  0.000
SCS curve number for soil(AMC 2)  56.00
Adjusted SCS curve number for AMC 3  75.80
Pervious ratio(Ap)  0.6000
Max loss rate(Fm)=  0.264(In/Hr)
Rainfall intensity  3.657(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=K CIA) is C  0.835
Subarea runoff  18.067(CFS) for  6.260(Ac.)
Total runoff  43.607(CFS)

Effective area this stream  14.28(Ac.)
Total Study Area (Main Stream No. 1)  102.17(Ac.)
Area averaged Fm value  0.264(In/Hr)
Street flow at end of street  34.830(CFS)
Half street flow at end of street  17.415(CFS)
Depth of flow  0.392(Ft.), Average velocity  7.640(Ft/s)
Flow width (from curb towards crown)  14.860(Ft.)

========================================

Process from Point/Station  230.000 to Point/Station  230.000
========================================

**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A  0.000
Decimal fraction soil group B  1.000
Decimal fraction soil group C  0.000
Decimal fraction soil group D  0.000
SCS curve number for soil(AMC 2)  56.00
Adjusted SCS curve number for AMC 3  75.80
Pervious ratio(Ap)  0.6000
Max loss rate(Fm)=  0.264(In/Hr)

Time of concentration  12.95 min.
Rainfall intensity  3.657(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=K CIA) is C  0.835
Subarea runoff  10.138(CFS) for  3.320(Ac.)
Total runoff  53.745(CFS)

Effective area this stream  17.60(Ac.)
Total Study Area (Main Stream No. 1)  105.49(Ac.)
Area averaged Fm value  0.264(In/Hr)

========================================

Process from Point/Station  230.000 to Point/Station  240.000
========================================

**** STREET INLET + AREA + PIPE TRAVEL TIME ****

Top of street segment elevation  3073.000(Ft.)
End of street segment elevation  3041.000(Ft.)
Length of street segment  596.000(Ft.)
Height of curb above gutter flowline  6.0(In.)
Width of half street (curb to crown)  15.000(Ft.)
Distance from crown to crossfall grade break  13.500(Ft.)
Slope from gutter to grade break (v/Hz)  0.083
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  6.000(Ft.)
Slope from curb to property line (v/Hz)  0.020
Gutter width  1.500(Ft.)
Gutter hike from flowline = 1.500( Ft. )
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

Street Inlet Calculations:
Street flow before street inlet = 44.968 (CFS)
Half street flow before street inlet = 22.484 (CFS)
Existing pipe flow before street inlet = 8.777 (CFS)
Number of street inlets = 2
Depth of flow = 0.580 (Ft.), Average velocity = 8.264 (Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 15,000 (Ft.)
Flow rate in gutter section of street = Qw = 7.516 (CFS)
Ratio of frontal flow to total flow = E0 = 0.3343
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  - 0.7867 right of way
6.0000  - 0.6667 top of curb
6.0000  - 0.0000 flow line
7.5000  - 0.2917 gutter depression end
7.5000  - 0.2917 grade break
21.0000  - 0.5617 crown
Length required for total flow interception = Lt
Lt = 0.6 * 0.42 * Slope^3 * (1/(n*Se)^0.6 = 44.538 (Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0537
Se = Equivalent Street x-slope including depression = 0.1201
Gutter depression depth = 2.000 (In.)
Gutter depression width = 1.500 (Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.4930

Pipe calculations for under street flow rate of 30.947 (CFS)
Using a pipe slope = 5.307 %
Upstream point/station elevation = 3073.000 (Ft.)
Downstream point/station elevation = 3041.000 (Ft.)
Pipe length = 596.00 (Ft.)
Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 30.947 (CFS)
Nearest computed pipe diameter = 21.00 (In.)
Calculated individual pipe flow = 30.947 (CFS)
Normal flow depth in pipe = 14.84 (In.)
Flow top width inside pipe = 19.13 (In.)
Critical depth could not be calculated.
Pipe flow velocity = 17.03 (Ft/s)
Travel time through pipe = 0.58 min.
Time of concentration (TC) = 13.53 min.
Maximum flow rate of street inlet(s) = 22.170 (CFS)
Maximum pipe flow capacity = 30.947 (CFS)
Remaining flow in street below inlet = 22.798 (CFS)

Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000
Max. loss rate (Fm) = 0.264 (In/Hr)
Rainfall intensity = 3.946 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KClA) ia C = 0.833
Subarea runoff = 8.430 (CFS) for 3.450 (Ac.)
Total runoff = 62.175 (CFS)
Effective area this stream = 21.05 (Ac.)
Total Study Area (Main Stream No. 1) = 108.94 (Ac.)
Area averaged Fm value = 0.264 (In/Hr)
Street flow at end of street = 31.228 (CFS)
Half street flow at end of street = 15.614 (CFS)
Depth of flow = 0.383 (Ft.), Average velocity = 7.303 (Ft/s)
Flow width (from curb towards crown) = 14.376 (Ft.)

+++++++++++++++++++++++++++++++ Process from Point/Station 240.000 to Point/Station 240.000

**** SUBAREA FLOW ADDITION ****
RESIDENTIAL [3 - 4 dwl/acre]
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000
Max loss rate (Fm) = 0.264 (In/Hr)
Time of concentration = 13.53 min.
Rainfall intensity = 3.546 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=K CIA) is C = 0.833
Subarea runoff = 12.287 (CFS) for 4.160 (Ac.)
Total runoff = 74.463 (CFS)
Effective area this stream = 25.21 (Ac.)
Total Study Area (Main Stream No. 1) = 113.10 (Ac.)
Area averaged Fm value = 0.264 (In/Hr)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 240.000 to Point/Station 250.000
**** STREET INLET + AREA + PIPE TRAVEL TIME ****

Top of street segment elevation = 3041.000 (Ft.)
End of street segment elevation = 3023.000 (Ft.)
Length of street segment = 248.000 (Ft.)
Height of curb above gutter flowline = 6.0 (In.)
Width of half street (curb to crown) = 15.000 (Ft.)
Distance from crown to crossfall grade break = 13.500 (Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000 (Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500 (Ft.)
Gutter hike from flowline = 1.500 (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

Street Inlet Calculations:
Street flow before street inlet = 43.516 (CFS)
Half street flow before street inlet = 21.758 (CFS)
Existing pipe flow before street inlet = 30.947 (CFS)
Number of street inlets = 2
Depth of flow = 0.561 (Ft.), Average velocity = 8.943 (Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
Street flow half width at start of inlet = 14.956 (Ft.)
Flow rate in gutter section of street = Qw = 0.023 (CFS)
Ratio of frontal flow to total flow = E0 = 0.3688
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 0.7867 right of way
6.0000 0.6667 top of curb
6.0000 0.0000 flow line
7.5000 0.2917 gutter/depression end
7.5000 0.2917 grade break
21.0000 0.5617 crown
Length required for total flow interception = Lt
Lt = .6 * Qw*0.42 * Slope^.3 * (1/(n*Se))^0.6 = 47.188 (Ft.)
where Manning's n = 0.0130 and Slope = street slope = 0.0026
Se = Equivalent Street x-slope including depression = 0.1240
Gutter depression depth = 2.000 (In.)
Gutter depression width = 1.500 (Ft.)
Efficiency = 1 - (1-L/Lt)^1.8 = 0.4693

Pipe calculations for under street flow rate of 51.368 (CFS)
Using a pipe slope = 7.031 %
Upstream point/station elevation = 3041.000 (Ft.)
Downstream point/station elevation = 3023.000 (Ft.)
Pipe length = 248.00 (Ft.)
Manning's N = 0.013
No. of pipes = 1
Required pipe flow = 51.368 (CFS)
Nearest computed pipe diameter = 24.00 (In.)
Calculated individual pipe flow = 51.368 (CFS)
Normal flow depth in pipe = 17.11 (In.)
Flow top width inside pipe = 21.72 (In.)
Critical depth could not be calculated.
Pipe flow velocity = 21.46 (Ft/s)
Travel time through pipe = 0.19 min.
Time of concentration (TC) = 13.72 min.
Maximum flow rate of street inlet(s) = 20.421 (CFS)
Maximum pipe flow capacity = 51.368 (CFS)
Remaining flow in street below inlet = 23.095 (CFS)
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000 Max loss rate (Fm) = 0.264 (In/Hr)
Rainfall intensity = 3.511 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q-KCIA) is C = 0.832
Subarea runoff = 2.422 (CFS) for 1.100 (Ac.)
Total runoff = 76.885 (CFS)
Effective area this stream = 26.31 (Ac.)
Total Study Area (Main Stream No. 1) = 114.20 (Ac.)
Area averaged Fm value = 0.264 (In/Hr)
Street flow at end of street = 25.517 (CFS)
Half street flow at end of street = 12.759 (CFS)
Depth of flow = 0.345 (Ft.), Average velocity = 7.791 (Ft/s)
Flow width (from curb towards crown) = 12.515 (Ft.)

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

Process from Point/Station 250.000 to Point/Station 260.000

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3017.000 (Ft.)
Downstream point/station elevation = 3015.000 (Ft.)
Pipe length = 292.00 (Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 76.885 (CFS)
Nearest computed pipe diameter = 42.00 (In.)
Calculated individual pipe flow = 76.885 (CFS)
Normal flow depth in pipe = 31.83 (In.)
Flow top width inside pipe = 35.99 (In.)
Critical Depth = 32.91 (In.)
Pipe flow velocity = 9.82 (Ft/s)
Travel time through pipe = 0.50 min.
Time of concentration (TC) = 14.22 min.

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

Process from Point/Station 260.000 to Point/Station 265.000

**** CONfluence OF MINOr STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area = 26.310 (Ac.)
Runoff from this stream = 76.885 (CFS)
Time of concentration = 14.22 min.
Rainfall intensity = 3.425 (In/Hr)
Area averaged loss rate (Fm) = 0.2640 (In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream Area</th>
<th>Flow rate</th>
<th>TC</th>
<th>Fm</th>
<th>Rainfall Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>(Ac.)</td>
<td>(CFS)</td>
<td>(In/Hr)</td>
<td>(In/Hr)</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------</td>
<td>----</td>
<td>-------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1</td>
<td>126.08</td>
<td>43.992</td>
<td>14.73</td>
<td>0.178</td>
</tr>
<tr>
<td>2</td>
<td>76.89</td>
<td>26.310</td>
<td>14.22</td>
<td>0.264</td>
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<tr>
<td>Qmax(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.000</td>
<td>1.000</td>
<td>126.079</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.973</td>
<td>1.000</td>
<td>76.885</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qmax(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.027</td>
<td>0.965</td>
<td>126.079</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.000</td>
<td>1.000</td>
<td>76.885</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total of 2 streams to confluence:
Flow rates before confluence point:
126.079
76.885
Maximum flow rates at confluence using above data:
200.912  201.796
Area of streams before confluence:
43.992   26.310
Effective area values after confluence:
70.302   68.762
Results of confluence:
Total flow rate = 201.796 (CFS)
Time of concentration = 14.218 min.
Effective stream area after confluence = 68.762 (Ac.)
Study area average Pervious fraction (Ap) = 0.716
Study area average soil loss rate (Fm) = 0.210 (In/Hr)
Study area total (this main stream) = 70.30 (Ac.)
End of computations, Total Study Area = 114.20 (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) = 0.771
Area averaged SCS curve number = 67.8
Routing Analysis for Basin"C"
Hydrograph Plot

Hyd. No. 1
RATIONAL HYDG

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 201.79 cfs
Time interval = 2 min

Hydrograph Volume = 466,619 cuft
Hydrograph Plot

Hydraflow Hydrographs by intelsolve

Tuesday, Mar 8 2011, 2:42 PM

Hyd. No. 2

DET BASIN-C ROUTING HY

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 1
Reservoir name = DETENSION BASIN-C

Peak discharge = 104.16 cfs
Time interval = 2 min
Max. Elevation = 3020.86 ft
Max. Storage = 324,654 cuft

Storage Indication method used.

Hydrograph Volume = 240,498 cuft

DET BASIN-C ROUTING HY

Hyd. No. 2 – 100 Yr

Q (cfs)

210.00
200.00
190.00
180.00
170.00
160.00
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00

0.00 0.3 0.7 1.0 1.3 1.7 2.0 2.3 2.7 3.0 3.3 3.7 4.0

Time (hrs)

Q (cfs)

210.00
200.00
190.00
180.00
170.00
160.00
150.00
140.00
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00

0.00 0.3 0.7 1.0 1.3 1.7 2.0 2.3 2.7 3.0 3.3 3.7 4.0

Hyd No. 2

Hyd No. 1

Req. Stor = 324,654 cuft
Hydrograph Plot

Hyd. No. 2

DET BASIN-C ROUTING HY

<table>
<thead>
<tr>
<th>Hydrograph type</th>
<th>Reservoir</th>
<th>Peak discharge</th>
<th>104.16 cfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm frequency</td>
<td>100 yrs</td>
<td>Time interval</td>
<td>2 min</td>
</tr>
<tr>
<td>Inflow hyd. No.</td>
<td>1</td>
<td>Max. Elevation</td>
<td>3020.86 ft</td>
</tr>
<tr>
<td>Reservoir name</td>
<td>DETENSION BASIN-C</td>
<td>Max. Storage</td>
<td>324,654 cuft</td>
</tr>
</tbody>
</table>

Storage Indication method used.

Hydrograph Volume = 240,498 cuft

DET BASIN-C ROUTING HY

Elev. (ft)

Hyd. No. 2 -- 100 Yr

Time (hrs)

1. DETENSION BASIN-C
Pond Report

Hydraflow Hydrographs by Intelisolve

Tuesday, Mar 8 2011, 2:43 PM

Pond No. 1 - DETENTION BASIN-C

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuft)</th>
<th>Total storage (cuft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>3014.00</td>
<td>17,049</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.00</td>
<td>3015.00</td>
<td>186,300</td>
<td>101,675</td>
<td>101,675</td>
</tr>
<tr>
<td>2.00</td>
<td>3016.00</td>
<td>20,274</td>
<td>103,287</td>
<td>204,962</td>
</tr>
<tr>
<td>3.00</td>
<td>3017.00</td>
<td>21,980</td>
<td>21,127</td>
<td>226,089</td>
</tr>
<tr>
<td>4.00</td>
<td>3018.00</td>
<td>23,748</td>
<td>22,864</td>
<td>248,953</td>
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<td>5.00</td>
<td>3019.00</td>
<td>25,578</td>
<td>24,663</td>
<td>273,616</td>
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<tr>
<td>6.00</td>
<td>3020.00</td>
<td>27,464</td>
<td>26,521</td>
<td>300,137</td>
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<tr>
<td>7.00</td>
<td>3021.00</td>
<td>29,417</td>
<td>28,441</td>
<td>328,577</td>
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</table>

Culvert / Orifice Structures

<table>
<thead>
<tr>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise (in)</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Span (in)</td>
<td>30.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Invert El. (ft)</td>
<td>3017.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>132.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>1.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>N-Value</td>
<td>0.013</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Orif. Coeff.</td>
<td>0.60</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>n/a</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Weir Structures

<table>
<thead>
<tr>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest Len (ft)</td>
<td>90.00</td>
<td>0.00</td>
<td>0.00</td>
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<td>Crest El. (ft)</td>
<td>3020.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Weir Coeff.</td>
<td>3.33</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Weir Type</td>
<td>Rect</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Exfiltration = 0.000 in/hr (Contour) Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.

Stage / Discharge

Stage (ft)

0.00 10.00 20.00 30.00 40.00 50.00 60.00 70.00 80.00 90.00 100.00 110.00 120.00 130.00 140.00 150.00

Discharge (cfs)

8.00 6.00 4.00 2.00 0.00

Total Q
DETECTION BASIN-C

132.0 LF of 30.0 in @ 1.50%
CulvA - Inv. 3017.00

Front View
NTS - Looking Downstream

(100 yr)

Schematic only. Not for construction.
ITEM-1 Basin Routing Backup Data
For Basin-A
"Onsite Area-2", Pre Development
Rational Method Analysis
San Bernardino County Rational Hydrology Program  
(Hydrology Manual Date - August 1986)  
CIVILCA/DVCIVILDESIGN Engineering Software, (C) 1989-2004 Version 7.0  
Rational Hydrology Study  
Date: 03/08/11  
Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

************************************************************
Process from Point/Station 1.000 to Point/Station 2.000

**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000  Max loss rate(Fm) = 0.140(In/Hr)

Initial subarea data:
Initial area flow distance = 928.000(Ft.)
Top (of initial area) elevation = 3210.000(Ft.)
Bottom (of initial area) elevation = 3165.000(Ft.)
Difference in elevation = 45.000(Ft.)
Slope = 0.04849  s(%) = 4.85
Tc = k(0.525)*{(length^3)/(elevation change)}^0.2
Initial area time of concentration = 14.793 min.

Rainfall intensity = 3.331(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=RCIA) is C = 0.862
Subarea runoff = 28.518(CFS)
Total initial stream area = 9.930(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

***************************************************************
Process from Point/Station 2.000 to Point/Station 3.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.246(Ft.), Average velocity = 3.037(Ft/s)

!!Warning: Water is above left or right bank elevations

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

Information entered for subchannel number 1:

Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 175.00 1.00
3 553.00 4.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 16.020(CFS)
\begin{itemize}
  \item flow top width = 42.969(Ft.)
  \item velocity= 3.037(Ft/s)
  \item area = 5.275(Sq.Ft)
  \item Froude number = 1.527
\end{itemize}
Information entered for subchannel number 2:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 58.00 1.00
3 530.00 4.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 5.309(CFS)
' ' flow top width = 14.241(Ft.)
' ' velocity= 3.037(Ft/s)
' ' area = 1.748(Sq.Ft)
' ' Froude number = 1.527

Information entered for subchannel number 3:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 175.00 1.00
3 390.00 5.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 16.020(CFS)
' ' flow top width = 42.969(Ft.)
' ' velocity= 3.037(Ft/s)
' ' area = 5.275(Sq.Ft)
' ' Froude number = 1.527
Upstream point elevation = 3165.000(Ft.)
Downstream point elevation = 3135.000(Ft.)
Flow length = 487.000(Ft.)
Travel time = 2.67 min.
Time of concentration = 17.47 min.
Depth of flow = 0.246(Ft.)
Average velocity = 3.037(Ft/s)
Total irregular channel flow = 37.349(CFS)
Irregular channel normal depth above invert elev. = 0.246(Ft.)
Average velocity of channel(s) = 3.037(Ft/s)

!! WARNING: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Api) = 1.0000 Max loss rate(Fm) = 0.140(In/HR)
Rainfall intensity = 2.965(In/HR) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method) Q=RC/I is C = 0.858
Subarea runoff = 17.609(CFS) for 8.210(Ac.)
Total runoff = 46.128(CFS)
Effective area this stream = 18.14(Ac.)
Total Study Area (Main Stream No. 1) = 18.14(Ac.)
Area averaged Fm value = 0.140(In/HR)
Depth of flow = 0.266(Ft.), Average velocity = 3.201(Ft/s)

!! WARNING: Water is above left or right bank elevations
End of computations, Total Study Area = 18.14 (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(Api) = 1.000
Area averaged SCS curve number = 78.0
"Onsite Area-2", Post Development Rational Method Analysis
San Bernardino County Rational Hydrology Program
(Hydrology Manual Date - August 1986)
CIVILCAD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study  Date: 03/08/11

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

POST DEV AREA-Z, DEV-1
TR 18255
Q100 1HR
RATIONAL METHOD
-------------------------------------------------------------------

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1,250 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

Process from Point/Station  400,000.000 to Point/Station  410,000.000

**** INITIAL AREA EVALUATION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm) = 0.264(In/Hr)
Initial subarea data:
Initial area flow distance = 325,000(Ft.)
Top (of initial area) elevation = 3168.000(Ft.)
Bottom (of initial area) elevation = 3159.000(Ft.)
Difference in elevation = 9.000(Ft.)
Slope = 0.02769 s(%) = 2.77
TC = k(0.412)^[length^3]/elevation change]^0.2
Initial area time of concentration = 8.535 min.
Rainfall intensity = 4.895(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KClA) is C = 0.851
Subarea runoff = 13.630(CFS)
Total initial stream area = 3.270(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.264(In/Hr)

Process from Point/Station  410,000.000 to Point/Station  420,000.000

**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3154.000(Ft.)
Downstream point/station elevation = 3128.000(Ft.)
Pipe length = 257.00(Ft.)  Manning's N = 0.013
No. of pipes = 1  Required pipe flow = 13.630(CFS)
Nearest computed pipe diameter = 15.00(In.)
Calculated individual pipe flow = 13.630(CFS)
Normal flow depth in pipe = 8.93(In.)
Flow top width inside pipe = 14.72(In.)
Critical depth could not be calculated.
Pipe flow velocity = 17.91(Ft/s)
Travel time through pipe = 0.24 min.
Time of concentration (TC) = 8.77 min.

Process from Point/Station  420,000.000 to Point/Station  425,000.000

**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 3.270(Ac.)
Runoff from this stream = 13.630(CFS)
Time of concentration = 8.77 min.
Rainfall intensity = 4.802(In/Hr)
Area averaged loss rate (Fm) = 0.2640(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000

Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13.63</td>
<td>3.270</td>
<td>8.77</td>
<td>0.264</td>
<td>4.802</td>
</tr>
</tbody>
</table>

\[ Q_{\text{max}}(1) = 1.000 \times 1.000 \times 13.630 + = 13.630 \]

Total of 1 streams to confluence:
Flow rates before confluence point:
13.630
Maximum flow rates at confluence using above data:
13.630
Area of streams before confluence:
3.270
Effective area values after confluence:
3.270

Results of confluence:
Total flow rate = 13.630 (CFS)
Time of concentration = 8.774 min.
Effective stream area after confluence = 3.270 (Ac.)
Study area average Pervious fraction (Ap) = 0.600
Study area average soil loss rate (Fm) = 0.264 (In/Hr)
Study area total (this main stream) = 3.27 (Ac.)
End of computations, Total Study Area = 3.27 (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) = 0.600
Area averaged SCS curve number = 56.0
San Bernardino County Rational Hydrology Program  
(Hydrology Manual Date - August 1986)  
CIVILCAD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0 
Rational Hydrology Study  
Date: 03/08/11

POST DEV AREA-2, DEV-2 TO DEV-4 
TR 18255 
Q100 1HR 
RATIONAL METHOD 

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0 
Computed rainfall intensity:
Storm year = 100.00  1 hour rainfall = 1.250 (In.)
Slope used for rainfall intensity curve b = 0.7000 
Soil antecedent moisture condition (AMC) = 3

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station  300.000 to Point/Station  310.000

*** INITIAL AREA EVALUATION ***

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000 
Decimal fraction soil group B = 1.000 
Decimal fraction soil group C = 0.000 
Decimal fraction soil group D = 0.000 
SCS curve number for soil(AMC 2) = 56.00 
Adjusted SCS curve number for AMC 3 = 75.80 
Pervious ratio(Ap) = 0.6000  Max loss rate(Fm) = 0.264 (In/Hr)

Initial subarea data:
Initial area flow distance = 644.000(Ft.)
Top (of initial area) elevation = 3180.000(Ft.)
Bottom (of initial area) elevation = 3169.000(Ft.)
Difference in elevation = 11.000(Ft.)
Slope = 0.01708 a($) = 1.71
TC = k(0.412) * [(length^3)/(elevation change)] ^0.2
Initial area time of concentration = 12.358 min.
Rainfall intensity = 3.778(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KClA) is C = 0.837
Subarea runoff = 12.935(CFS)
Total initial stream area = 4.090(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.264(In/Hr)

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station  310.000 to Point/Station  320.000

*** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ***

Top of street segment elevation = 3169.000(Ft.)
End of street segment elevation = 3155.000(Ft.)
Length of street segment = 255.000(Ft.)
Height of curb above gutter flowline = 6.0(In.)
Width of half street (curb to crown) = 15.000(Ft.)
Distance from crown to crossfall grade break = 13.500(Ft.)
Slope from gutter to grade break (v/hz) = 0.083
Street flow is on [2] side(s) of the street
Distance from curb to property line = 6.000(Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500(Ft.)
Gutter rise from flowline = 1.500(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 = 24.097(CFS)
Depth of flow = 0.354(Ft.), Average velocity = 6.913(Ft/s)
Streamflow hydraulics at midpoint of street travel:
Halfstreet flow width = 12.929(Ft.)
Flow velocity = 6.91(Ft/s)
Travel time = 0.61 min.  TC = 12.97 min.
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil (AMC 2) = 56.00
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000 Max loss rate (Fm) = 0.264 (In/Hr)
Rainfall intensity = 3.652 (In/Hr) for \( t = 100.0 \) year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q = KCIA) is \( C = 0.835 \)
Subarea runoff = 22.159 (CFS) for 7.420 (Ac.)
Total runoff = 35.093 (CFS)
Effective area this stream = 11.51 (Ac.)
Total Study Area (Main Stream No. 1) = 11.51 (Ac.)
Area averaged Fm value = 0.264 (In/Hr)
Street flow at end of street = 35.093 (CFS)
Half street flow at end of street = 17.547 (CFS)
Depth of flow = 0.395 (Ft.), Average velocity = 7.578 (Ft/s)
Flow width (from curb towards crown) = 14.980 (Ft.)

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station = 320.000 to Point/Station = 330.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation = 3155.000 (Ft.)
End of street segment elevation = 3141.000 (Ft.)
Length of street segment = 290.000 (Ft.)
Height of curb above gutter flowline = 6.0 (In.)
Width of half street (curb to crown) = 15.000 (Ft.)
Distance from crown to crossfall grade break = 13.500 (Ft.)
Slope from gutter to grade break (v/hz) = 0.083
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 = 6.000 (Ft.)
Slope from curb to property line (v/hz) = 0.020
Gutter width = 1.500 (Ft.)
Gutter rise from flowline = 1.500 (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 = 39.465 (CFS)
Depth of flow = 0.413 (Ft.), Average velocity = 7.635 (Ft/s)
Note: depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width = 15.000 (Ft.)
Flow velocity = 7.63 (Ft/s)
Travel time = 0.63 min.
TC = 13.61 min.
Adding area flow to street
RESIDENTIAL (3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
Adjusted SCS curve number for AMC 3 = 75.80
Pervious ratio (Ap) = 0.6000 Max loss rate (Fm) = 0.264 (In/Hr)
Rainfall intensity = 3.532 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q = KCIA) is \( C = 0.833 \)
Subarea runoff = 8.641 (CFS) for 3.360 (Ac.)
Total runoff = 43.735 (CFS)
Effective area this stream = 14.87 (Ac.)
Total Study Area (Main Stream No. 1) = 14.87 (Ac.)
Area averaged Fm value = 0.264 (In/Hr)
Street flow at end of street = 43.735 (CFS)
Half street flow at end of street = 21.867 (CFS)
Depth of flow = 0.424 (Ft.), Average velocity = 7.953 (Ft/s)
Rainfall intensity = 3.652 (In/Hr) for a 100.0 year storm
Note: depth of flow exceeds top of street crown.
Flow width (from curb towards crown) = 15.000 (Ft.)

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station = 330.000 to Point/Station = 340.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 3136.000 (Ft.)
Downstream point/station elevation = 3128.000(Ft.)
Pipe length = 79.00(Ft.) Manning's N = 0.013
No. of pipes = 1 Required pipe flow = 43.735(CFS)
Nearest computed pipe diameter = 21.00(In.)
Calculated individual pipe flow = 43.735(CFS)
Normal flow depth in pipe = 15.12(In.)
Flow top width inside pipe = 18.86(In.)
Critical depth could not be calculated.
Pipe flow velocity = 23.61(Ft/s)
Travel time through pipe = 0.06 min.
Time of concentration (TC) = 13.66 min.

--------------------------------------------------------------------------------
Process from Point/Station 340.000 to Point/Station 345.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area = 14.870(Ac.)
Runoff from this stream = 43.735(CFS)
Time of concentration = 13.66 min.
Rainfall intensity = 3.522(In/Hr)
Area averaged loss rate (Fm) = 0.2640(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>43.73</td>
<td>14.870</td>
<td>13.66</td>
<td>0.264</td>
<td>3.522</td>
</tr>
</tbody>
</table>

Qmax(1) = 1.000 * 1.000 * 43.735 = 43.735

Total of 1 streams to confluence:
Flow rates before confluence point:
43.735
Maximum flow rates at confluence using above data:
43.735
Area of streams before confluence:
14.870
Effective area values after confluence:
14.870

Results of confluence:
Total flow rate = 43.735(CFS)
Time of concentration = 13.662 min.
Effective stream area after confluence = 14.870(Ac.)
Study area average Pervious fraction(Ap) = 0.600
Study area average soil loss rate(Fm) = 0.264(In/Hr)
Study area total (this main stream) = 14.87(Ac.)
End of computations, Total Study Area = 14.87 (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) = 0.600
Area averaged SCS curve number = 56.9
Routing Analysis for Basin"A"
Hydrograph Plot

Hyd. No. 1
HYDG DEV2-DEV4

Hydrograph type = Manual
Storm frequency = 100 yrs

Peak discharge = 43.74 cfs
Time interval = 2 min

Hydrograph Volume = 60,517 cu ft
Hyd. No. 2

HYDG DEV-1

Hydrograph type  = Manual
Storm frequency  = 100 yrs

Peak discharge  = 13.63 cfs
Time interval   = 2 min

Hydrograph Volume = 13,540 cuft
Hydrograph Plot

Hyd. No. 3

COM HYDG

Hydrograph type = Combine
Storm frequency = 100 yrs
Inflow hyds. = 1, 2

Peak discharge = 54.43 cfs
Time interval = 2 min

Hydrograph Volume = 74,057 cuft
Hydrograph Plot

Hyd. No. 4
BASIN-A ROUTING HYDG

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 3
Reservoir name = DET BASIN-A

Peak discharge = 18.35 cfs
Time interval = 2 min
Max. Elevation = 3128.62 ft
Max. Storage = 51,228 cuft

Storage Indication method used.

Hydrograph Volume = 53,437 cuft

BASIN-A ROUTING HYDG

Q (cfs)

Hyd. No. 4 – 100 Yr

Q (cfs)

Time (hrs)

0.00 0.3 0.7 1.0 1.3 1.7 2.0 2.3 2.7 3.0 3.3 3.7

Hyd No. 4  Hyd No. 3  Req. Stor = 51,228 cuft
Hydrograph Plot

Hyd. No. 4
BASIN-A ROUTING HYDG

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Inflow hyd. No. = 3
Reservoir name = DET BASIN-A

Peak discharge = 18.35 cfs
Time interval = 2 min
Max. Elevation = 3128.62 ft
Max. Storage = 51,228 cuft

Storage Indication method used.

Hydrograph Volume = 53,437 cuft

BASIN-A ROUTING HYDG

Hyd. No. 4 -- 100 Yr
Pond Report

Hydraflow Hydrographs by Intelisolve

Wednesday, Mar 2 2011, 9:58 AM

Pond No. 1 - DET BASIN-A

Pond Data

Pond storage is based on known contour areas. Average end area method used.

Stage / Storage Table

<table>
<thead>
<tr>
<th>Stage (ft)</th>
<th>Elevation (ft)</th>
<th>Contour area (sqft)</th>
<th>Incr. Storage (cuft)</th>
<th>Total storage (cuft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>3125.00</td>
<td>11,732</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.00</td>
<td>3126.00</td>
<td>13,038</td>
<td>12,385</td>
<td>12,385</td>
</tr>
<tr>
<td>2.00</td>
<td>3127.00</td>
<td>14,371</td>
<td>13,705</td>
<td>26,090</td>
</tr>
<tr>
<td>3.00</td>
<td>3128.00</td>
<td>15,730</td>
<td>15,051</td>
<td>41,140</td>
</tr>
<tr>
<td>4.00</td>
<td>3129.00</td>
<td>17,114</td>
<td>16,422</td>
<td>57,562</td>
</tr>
<tr>
<td>5.00</td>
<td>3130.00</td>
<td>18,525</td>
<td>17,820</td>
<td>75,382</td>
</tr>
</tbody>
</table>

Culvert / Orifice Structures

<table>
<thead>
<tr>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise (in)</td>
<td>= 18.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Span (in)</td>
<td>= 18.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>No. Barrels</td>
<td>= 2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Invert El. (ft)</td>
<td>= 3126.60</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>= 64.22</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Slope (%)</td>
<td>= 0.93</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>N-Value</td>
<td>= .013</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Orif. Coeff.</td>
<td>= 0.60</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>= n/a</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Weir Structures

<table>
<thead>
<tr>
<th>[A]</th>
<th>[B]</th>
<th>[C]</th>
<th>[D]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crest Len (ft)</td>
<td>= 0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Crest El. (ft)</td>
<td>= 0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Weir Coeff.</td>
<td>= 0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Weir Type</td>
<td>= ---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Multi-Stage</td>
<td>= No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Exfiltration = 0.000 in/hr (Contour)  Tailwater Elev. = 0.00 ft

Note: Culvert/Orifice outflows have been analyzed under inlet and outlet control.
DET BASIN-A

Top of pond
Elev. 3130.00

64.2 LF of 18.0 in @ 0.33%
CulvA - Inv. 3126.60

Front View
NTS - Looking Downstream

Schematic only. Not for construction.
ITEM-2 Storm Water Channel Analysis Backup Data
For Channel-1
“Offsite-3”, Pre Development Rational Method Analysis
San Bernardino County Rational Hydrology Program
(Hydrology Manual Date - August 1986)
CIVILCAD/CIVILEDSM Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study
Date: 03/08/11

PRE DEV OFFSITE-3
TR 18255
RATIONAL METHOD
Q100 1HR

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+----------------------------------+
| Process from Point/Station       |
| 1.000 to Point/Station           |
| 2.000                            |
| **** INITIAL AREA EVALUATION ****|
+----------------------------------+

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 93.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000  Max loss rate(Fm)= 0.077(In/Hr)
Initial subarea data:
Initial area flow distance = 978.250(Ft.)
Top (of initial area) elevation = 3983.000(Ft.)
Bottom (of initial area) elevation = 3589.000(Ft.)
Difference in elevation = 394.000(Ft.)
Slope = 0.40276 s(%) = 40.28
TC = k(0.525) * (length^3)/(elevation change)^0.2
Initial area time of concentration = 9.893 min.
Rainfall intensity = 4.591(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=RCIA) is C = 0.885
Subarea runoff = 36.728(CFS)
Total initial stream area = 9.040(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.077(In/Hr)

+----------------------------------+
| Process from Point/Station       |
| 2.000 to Point/Station           |
| 3.000                            |
| **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****|
+----------------------------------+

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.351(Ft.), Average velocity = 6.208(Ft/s)
!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data *********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
1  0.00  0.00
2  427.50  5.00
3  855.00  0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 65.487(CFS)
' ' flow top width = 60.063(Ft.)
' ' velocity= 6.208(Ft/s)
' ' area = 10.549(Sq.Ft)
' ' Froude number = 2.611
Upstream point elevation = 3589.000(Ft.)
Downstream point elevation = 3458.000(Ft.)
Flow length = 820.130(Ft.)
Travel time = 2.20 min.
Time of concentration = 12.09 min.
Depth of flow = 0.351(Ft.)
Average velocity = 6.208(Ft/s)
Total irregular channel flow = 65.486(CFS)
Irregular channel normal depth above invert elev. = 0.351(Ft.)
Average velocity of channel(s) = 6.208(Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 3.969(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method) (Q=KCTA) is C = 0.883
Subarea runoff = 57.450(CFS) for 17.710(Ac.)
Total runoff = 94.178(CFS)
Effective area this stream = 26.75(Ac.)
Total Study Area (Main Stream No. 1) = 26.75(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.403(Ft.), Average velocity = 6.798(Ft/s)

!!Warning: Water is above left or right bank elevations

*****************************************************
Process from Point/Station 3.000 to Point/Station 4.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.471(Ft.), Average velocity = 5.627(Ft/s)

!!Warning: Water is above left or right bank elevations

*****************************************
Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 459.00 5.00
3 918.00 0.00
Manning's 'n' friction factor = 0.030

Sub-Channel flow = 114.732(CFS)
' ' flow top width = 86.525(Ft.)
' ' velocity= 5.627(Ft/s)
' ' area = 20.388(Sq.Ft)
' ' Froude number = 2.043

Upstream point elevation = 3458.000(Ft.)
Downstream point elevation = 3376.000(Ft.)
Flow length = 924.620(Ft.)
Travel time = 2.74 min.
Time of concentration = 14.83 min.
Depth of flow = 0.471(Ft.)
Average velocity = 5.627(Ft/s)
Total irregular channel flow = 114.731(CFS)
Irregular channel normal depth above invert elev. = 0.471(Ft.)
Average velocity of channel(s) = 5.627(Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 3.458 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCIA) is C = 0.880
Subarea runoff = 41.011 (CFS) for 17.680 (Ac.)
Total runoff = 135.189 (CFS)
Effective area this stream = 44.43 (Ac.)
Total Study Area (Main Stream No. 1) = 44.43 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.501 (Ft.), Average velocity = 5.863 (Ft/s)
!! Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++++++++++++++++++++++++++++ 
Process from Point/Station 4.000 to Point/Station 5.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME **** 

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.510 (Ft.), Average velocity = 6.027 (Ft/s)
!! Warning: Water is above left or right bank elevations

****** Irregular Channel Data **********

Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 490.00 5.00
3 980.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 153.748 (CFS)
' ' flow top width = 99.997 (Ft.)
' ' velocity = 6.027 (Ft/s)
' ' area = 25.509 (Sq.Ft.)
' ' Froude number = 2.103

Upstream point elevation = 3376.000 (Ft.)
Downstream point elevation = 3309.000 (Ft.)
Flow length = 732.020 (Ft.)
Travel time = 2.02 min.
Time of concentration = 16.86 min.
Depth of flow = 0.510 (Ft.)
Average velocity = 6.027 (Ft/s)
Total irregular channel flow = 153.748 (CFS)
Irregular channel normal depth above invert elev. = 0.510 (Ft.)
Average velocity of channel(s) = 6.027 (Ft/s)
!! Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 63.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000
Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 3.162 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCIA) is C = 0.878
Subarea runoff = 37.047 (CFS) for 17.610 (Ac.)
Total runoff = 172.236 (CFS)
Effective area this stream = 62.04 (Ac.)
Total Study Area (Main Stream No. 1) = 62.04 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.532 (Ft.), Average velocity = 6.201 (Ft/s)
!! Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++++++++++++++++++++++++++++ 
Process from Point/Station 5.000 to Point/Station 6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME **** 

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.563 (Ft.), Average velocity = 5.407 (Ft/s)
!! Warning: Water is above left or right bank elevations


******** Irregular Channel Data **********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
   1           0.00          0.00
   2          546.00          5.00
   3         1092.00          0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 187.224(CFS)
   ' flow top width = 122.977(Ft.)
   ' velocity= 5.408(Ft/s)
   ' area = 34.623(Sq.Ft)
   ' Froude number = 1.796

Upstream point elevation = 3309.000(Ft.)
Downstream point elevation = 3263.000(Ft.)
Flow length = 712.180(Ft.)
Travel time = 2.20 min.
Time of concentration = 19.05 min.
Depth of flow = 0.563(Ft.)
Average velocity = 5.407(Ft/s)
Total irregular channel flow = 187.224(CFS)
Irregular channel normal depth above invert elev. = 0.563(Ft.)
Average velocity of channel(s) = 5.407(Ft/s)
!!Warning: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000  Max loss rate(Fm)= 0.077(In/Hr)
Rainfall intensity = 2.902(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCIA) is C = 0.876
Subarea runoff = 29.898(CFS) for 17.460(Ac.)
Total runoff = 202.134(CFS)
Effective area this stream = 79.50(Ac.)
Total Study Area (Main Stream No. 1) = 79.50(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.579(Ft.), Average velocity = 5.512(Ft/s)
!!Warning: Water is above left or right bank elevations

END

******** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.587(Ft.), Average velocity = 5.613(Ft/s)
!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data **********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
   1           0.00          0.00
   2          554.50          5.00
   3         1109.00          0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 214.124(CFS)
   ' flow top width = 130.088(Ft.)
   ' velocity= 5.613(Ft/s)
   ' area = 38.149(Sq.Ft)
   ' Froude number = 1.827

Upstream point elevation = 3263.000(Ft.)
Downstream point elevation = 3230.000(Ft.)
Flow length = 500.700(Ft.)
Travel time = 1.49 min.
Time of concentration = 20.54 min.
Depth of flow = 0.587(Ft.)
Average velocity = 5.613(Ft/s)
Total irregular channel flow = 214.123(CFS)
Irregular channel normal depth above invert elev. = 0.587(Ft.)
Average velocity of channel(s) = 5.613(Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 2.753(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 = 23.927(CFS) for 14.350(Ac.)
Total runoff = 226.060(CFS)
Effective area this stream = 93.85(Ac.)
Total Study Area (Main Stream No. 1) = 93.85(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.599(Ft.), Average velocity = 5.689(Ft/s)

!!Warning: Water is above left or right bank elevations

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 7.000 to Point/Station 8.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.629(Ft.), Average velocity = 5.900(Ft/s)

!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data

------------------------------------------------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 494.00 5.00
3 998.00 0.00
Manning's 'N' friction factor = 0.030
------------------------------------------------------------------------------------------------------------------------
Sub-Channel flow = 232.887(CFS)
' ' flow top width = 125.524(Ft.)
' ' velocity = 5.900(Ft/s)
' ' area = 39.470(Sq.Ft)
' ' Froude number = 1.854

Upstream point elevation = 3230.000(Ft.)
Downstream point elevation = 3200.000(Ft.)
Flow length = 452.040(Ft.)
Travel time = 1.28 min.
Time of concentration = 21.82 min.
Depth of flow = 0.629(Ft.)
Average velocity = 5.900(Ft/s)
Total irregular channel flow = 232.886(CFS)
Irregular channel normal depth above invert elev. = 0.629(Ft.)
Average velocity of channel(s) = 5.900(Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 2.639(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 = 13.565(CFS) for 10.050(Ac.)
Total runoff = 239.625(CFS)
Effective area this stream = 103.90(Ac.)
Total Study Area (Main Stream No. 1) = 103.90(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.636(Ft.), Average velocity = 5.943(Ft/s)
!!Warning: Water is above left or right bank elevations

+--------------------------------------------------------------------------------------------------+
Process from Point/Station 8.000 to Point/Station 9.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
+--------------------------------------------------------------------------------------------------+
Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.707(Ft.), Average velocity = 4.588(Ft/s)
!!Warning: Water is above left or right bank elevations
+++++ Irregular Channel Data ++++
+--------------------------------------------------------------------------------------------------+
Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 523.00 5.00
3 1046.00 0.00
Manning's 'N' friction factor = 0.030
+--------------------------------------------------------------------------------------------------+
Sub-Channel flow = 240.053(CFS)
' ' flow top width = 147.958(Ft.)
' ' velocity= 4.588(Ft/s)
' ' area = 52.322(Sq.Ft)
' ' Froude number = 1.360
+--------------------------------------------------------------------------------------------------+
Upstream point elevation = 3200.000(Ft.)
Downstream point elevation = 3173.000(Ft.)
Flow length = 786.970(Ft.)
Travel time = 2.86 min.
Time of concentration = 24.68 min.
Depth of flow = 0.707(Ft.)
Average velocity = 4.588(Ft/s)
Total irregular channel flow = 240.053(CFS)
Irregular channel normal depth above invert elev. = 0.707(Ft.)
Average velocity of channel(s) = 4.588(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.421(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 = 0.760(CFS) for 10.020(Ac.)
Total runoff = 240.386(CFS)
Effective area this stream = 113.92(Ac.)
Total Study Area (Main Stream No. 1) = 113.92(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.708(Ft.), Average velocity = 4.590(Ft/s)
!!Warning: Water is above left or right bank elevations

+--------------------------------------------------------------------------------------------------+
Process from Point/Station 8.000 to Point/Station 9.000
**** CONFLUENCE OF MINOR STREAMS ****
+--------------------------------------------------------------------------------------------------+
Along Main Stream number: 1 in normal stream number 1
Stream flow area = 113.920(Ac.)
Runoff from this stream = 240.386(CFS)
Time of concentration = 24.68 min.
Rainfall intensity = 2.421 (In/Hr)
Area averaged loss rate \((Fm) = 0.0768 (In/Hr)\)
Area averaged Pervious ratio \((Ap) = 1.000\)

Summary of stream data:

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<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
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\[ Q_{\text{max}}(1) = 1.000 \times 1.000 \times 240.386 + = 240.386 \]

Total of 1 streams to confluence:
Flow rates before confluence point:
240.386
Maximum flow rates at confluence using above data:
240.386
Area of streams before confluence:
113.920
Effective area values after confluence:
113.920
Results of confluence:
Total flow rate = 240.386 (CFS)
Time of concentration = 24.675 min.
Effective stream area after confluence = 113.920 (Ac.)
Study area average Pervious fraction \((Ap) = 1.000\)
Study area average soil loss rate \((Fm) = 0.077 (In/Hr)\)
Study area total (this main stream) = 113.920 (Ac.)
End of computations, Total Study Area = 113.920 (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 = 83.5
Hecras Analysis
Channel “1”
Pre and Post Development
PROJECT DATA
Project Title: 07014
Project File: PRECHANNEL1.prj
Run Date and Time: 3/7/2011 3:47:35 PM
Project in English units
Project Description:
******** Autodesk, Inc. HEC-2 Input Data file ********
***************
Minimum Data Input **************

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

PLAN DATA
Plan Title: Imported Plan 01
Plan File: C:\PRECHANNEL1.p01

Geometry Title: Imported Geom 01
Geometry File: C:\PRECHANNEL1.g01

Flow Title: Imported Flow 01
Flow File: C:\PRECHANNEL1.f01

Plan Summary Information:
Number of Cross Sections = 9  Multiple Openings = 0
Culverts = 0  Inline Structures = 0
Bridges = 0  Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA
Flow Title: Imported Flow 01
Flow File: C:\PRECHANNEL1.f01

Flow Data (cfs)

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<th>RS</th>
<th>PF 1</th>
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Boundary Conditions

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GEOMETRY DATA

Geometry Title: Imported Geom 01
Geometry File: C:\PRECHANNEL1.g01

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1
RS: 9

INPUT

Description:
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Manning's n Values

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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 301.06 171.47 151.84 134.56 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1
RS: 8

INPUT

Description:
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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
0 270.45 159.94 147.9 137.74 .1 .3

CROSS SECTION

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REACH: Reach-1
RS: 7

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Manning's n Values | num= 3
| Sta n Val | Sta n Val | Sta n Val |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |

Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 | RS: 6

INPUT
Description:
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<td>315.28</td>
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</table>

Manning's n Values | num= 3
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| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |

Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 | RS: 5

INPUT
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</tr>
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Manning's n Values | num= 3
| Sta n Val | Sta n Val | Sta n Val |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |
| 0.03       | 0.03       | 0.03       |

Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |
| 0.30106    | 115.8   | 145.6   | 175.18  | .1          | .3     |

CROSS SECTION
### PRECHANNEL1.rep

**RIVER: RIVER-1**
**REACH: Reach-1**  RS: 4

#### INPUT

**Description:**
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</thead>
<tbody>
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<td>158.72</td>
<td>3141.01</td>
<td>165.32</td>
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<tbody>
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<td>207.98</td>
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<td>234.45</td>
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<td>274.21</td>
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<th>Sta n Val</th>
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<th>Bank Sta: Left</th>
<th>Right</th>
<th>Lengths: Left Channel</th>
<th>Right</th>
<th>Coeff Contr.</th>
<th>Expan.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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### CROSS SECTION

**RIVER: RIVER-1**
**REACH: Reach-1**  RS: 3

#### INPUT

**Description:**
Station Elevation Data  num= 50

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<td>3132.87</td>
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<th>Sta n Val</th>
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<th>Right</th>
<th>Coeff Contr.</th>
<th>Expan.</th>
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### CROSS SECTION

**RIVER: RIVER-1**
**REACH: Reach-1**  RS: 2

#### INPUT

**Description:**
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<th>Sta n Val</th>
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<th>Right</th>
<th>Coeff Contr.</th>
<th>Expan.</th>
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<td>.3</td>
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CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1
RS: 1

INPUT
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23.3 3124.4 35.8 3124.31 40.17 3124.23 43.29 3124.2 49.21 3124
65.11 3123.54 71.26 3123.38 75.86 3123.3 80.36 3123.3 83.27 3123.23
110.03 3123.12 115.16 3123.06 121.68 3122.71 124.51 3122.73 132.64 3123
141.16 3123 143.64 3122.52 144.33 3122.34 144.98 3122 146.3 3121.87
152.82 3121.86 161.63 3122 174.05 3123 174.38 3123.18 175.15 3123.37
178.19 3124 185.65 3124.56 191.14 3125 196.13 3125.34 203.3 3126.2
208.05 3126.59 211.91 3126.94 222.8 3127.77 227.2 3128 227.47 3127.98
232.01 3127.98 243.69 3127.8 245.69 3127.84 252.54 3127.74 256.94 3127.7
263.85 3127.55 267.42 3127.49 287.72 3127 294.96 3126.81 300 3126.7

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
0 .03 0 .03 300 .03

Bank Sta: Left 0 Right 3 Lengths: Left Channel 0 Right .1 Coeff Contr. Expan .3

SUMMARY OF MANNING'S N VALUES
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SUMMARY OF REACH LENGTHS
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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
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Pre-Developed Channel-1, 100 yrs, 1 hr.
PROJECT DATA
Project Title: 07014
Project File: POSTCHANNEL1.prl
Run Date and Time: 3/7/2011 11:12:27 AM

Project in English units

Project Description:
****** Autodesk, Inc. HEC-2 Input Data file ******

Minimum Data Input  **********

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

PLAN DATA

Plan Title: Imported Plan 01
Plan File: C:\POSTCHANNEL1.p01

Geometry Title: Imported Geom 01
Geometry File: C:\POSTCHANNEL1.g01

Flow Title: Imported Flow 01
Flow File: C:\POSTCHANNEL1.f01

Plan Summary Information:
Number of: Cross Sections = 8  Multiple Openings = 0
Culverts = 0  Inline Structures = 0
Bridges = 0  Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Imported Flow 01
Flow File: C:\POSTCHANNEL1.f01

Flow Data (cfs)
River Reach RS PF 1
RIVER-1 Reach-1 8 361
Boundary Conditions

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GEOMETRY DATA

Geometry Title: Imported Geom 01
Geometry File: C:\POSTCHANNEL1.g01

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 8

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Bank Sta: Left | Right
Lengths: Left Channel | Right Coeff Contr. Expan.
78.75 | 150 | 187.54 | 142.67 | 207.62 | .1 | .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 7

INPUT Description:
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Bank Sta: Left | Right
Lengths: Left Channel | Right Coeff Contr. Expan.
75.38 | 150 | 149.98 | 150 | .02 | .1 | .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 6

INPUT Description:
### CROSS SECTION

**RIVER: RIVER-1**

#### REACH: Reach-1

**RS: 5**

**INPUT Description:**

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**Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.**

| 75.55 150 | 130.4 149.04 167.74 | .1 .3 |

**CROSS SECTION**
RIVER: RIVER-1
REACH: Reach-1  RS: 3

INPUT
Description:
Station Elevation Data num= 50
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26.64 3145 28.4 3144.1 28.66 3144 35.3 3140.72 35.71 3140.66
36.37 3140.4 37.55 3140.23 39.82 3140 40.49 3140 41.62 3139.9
42.94 3139.88 44.36 3139.81 45.78 3139.7 47.2 3139.64 48.62 3139.53
49.43 3139.4 50.03 3139.39 51.45 3139.22 52.83 3139 58.85 3135
66.45 3135 71.45 3134.8 71.62 3134.82 75.23 3134.82 80.12 3134.83
80.9 3134.8 84.82 3135 91.52 3135 92.97 3135.97 93.08 3136
94.51 3137 97.5 3139 98.54 3139.04 99.02 3139.39 99.67 3139.6
100.45 3139.62 101.86 3139.79 104.61 3140 111.16 3140.15 116.88 3140.21
121.66 3140.2 127.22 3140.13 136.68 3139.93 141.56 3139.85 150.18 3139.74

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
75.23 150.18 182.3 141.07 111.89 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 2

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Description:
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13.29 3133.05 14.09 3133 21.78 3133 25.91 3130 30.39 3129
36.43 3129 46.29 3128.58 47.98 3128.6 53.94 3128.65 59.72 3128.62
67.09 3128.63 74.19 3128.65 74.83 3128.7 75.79 3128.66 81.12 3129
87.62 3129 89.58 3129.2 90.94 3129.3 94.09 3129.6 101.7 3130.28
103.23 3130.4 106.61 3130.8 107.63 3131 109.88 3131.35 110.54 3131.4
112.77 3131.7 117.78 3131.72 117.07 3131.91 119.27 3132 126.69 3132
130.83 3132.65 139.98 3133.1 146.12 3133.39 148.09 3133.52 153.71 3134
158.69 3134.5 159.85 3134.52 161.04 3134.7 165.45 3134.87 173.91 3134.8
175.74 3134.76 192.12 3134.5 204.79 3134.25 213.29 3134.06 214.98 3134.01

Manning's n Values num= 3
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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
21.78 214.98 184.39 150.31 125.15 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 1

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27.61 3124.34 34.87 3124.3 46.14 3124.07 57.6 3123.74 69.49 3123.43
76.5 3123.3 84.14 3123.25 89.99 3123.23 90.96 3123.2 100.95 3123.2
111.36 3123.15 117.46 3123 120.99 3122.85 121.12 3122.9 128.84 3123
141.46 3122.3 142.86 3122.44 146.27 3122 150.03 3122 157.22 3122
160.29 3122.07 163.99 3122.21 167.27 3122.42 169.71 3122.62 170.28 3122.6
173.67 3123 176.71 3124 181.28 3124.34 196.14 3125.5 201.39 3126
208.03 3126.76 212.91 3127.2 214.88 3127.32 222.41 3128 232.16 3128
236.43 3128.1 242.86 3128.07 250.57 3128.01 265.65 3127.73 276.89 3127.47
279.08 3127.4 284.53 3127.3 299.77 3127.16 299.55 3126.97 300 3127

Manning's n Values num= 3
Sta n Val Sta n Val Sta n Val
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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
Page 4
### SUMMARY OF MANNING'S N VALUES

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### SUMMARY OF REACH LENGTHS

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### SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

**River:** RIVER-1

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Post-developed channel-1, 100 yrs 1 hr.
ITEM-2 Storm Water Channel Analysis Backup Data
For Channel-2
“Offsite-2”, Pre Development Rational Method Analysis
San Bernardino County Rational Hydrology Program
(Hydrology Manual Date = August 1986)
CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 7.0
Rational Hydrology Study Date: 03/08/11

PREDEV OFFSITE 2
TR 18255
RATIONAL METHOD
Q100 1HR

Program License Serial Number 4004

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

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.300 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

+-------------------------------------------------------------------------------------------------------------+
| Process from Point/Station | 1.000 to Point/Station | 2.000 |
+-------------------------------------------------------------------------------------------------------------+

**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)

Initial subarea data:
Initial area flow distance = 652.310 (Ft.)
Top (of initial area) elevation = 4468.000 (Ft.)
Bottom (of initial area) elevation = 4260.000 (Ft.)
Difference in elevation = 188.000 (Ft.)
Slope = 0.28821  s(%) = 28.82
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.995 min.
Rainfall intensity = 4.907 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=RC1A) is C = 0.886
Subarea runoff = 42.953 (CFS)
Total initial stream area = 9.880 (Ac.)
Pervious area fraction = 1.000
Pervious area Fm value = 0.077 (In/Hr)

+-------------------------------------------------------------------------------------------------------------+
| Process from Point/Station | 2.000 to Point/Station | 3.000 |
+-------------------------------------------------------------------------------------------------------------+

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.320 (Ft.), Average velocity = 4.947 (Ft/s)
!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data **********

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
  1           0.00            0.00
  2           764.00          5.00
  3           1528.00         0.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 77.201 (CFS)
  flow top width = 97.665 (Ft.)
  velocity = 4.947 (Ft/s)
  area = 15.606 (Sq.Ft)
  Froude number = 2.181
Upstream point elevation = 4280.000(Ft.)
Downstream point elevation = 4220.000(Ft.)
Flow length = 521.610(Ft.)
Travel time = 1.76 min.
Time of concentration = 10.75 min.
Depth of flow = 0.320(Ft.)
Average velocity = 4.947(Ft/s)
Total irregular channel flow = 77.201(CFS)
Irregular channel normal depth above invert elev. = 0.320(Ft.)
Average velocity of channel(s) = 4.947(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000
Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 4.331(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=KCl)+ is C = 0.884
Subarea runoff = 68.428(CFS) for 19.210(Ac.)
Total runoff = 111.381(CFS)
Effective area this stream = 29.09(Ac.)
Total Study Area (Main Stream No. 1) = 29.09(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.367(Ft.), Average velocity = 5.422(Ft/s)
!!Warning: Water is above left or right bank elevations

Process from Point/Station 3.000 to Point/Station 4.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.331(Ft.), Average velocity = 7.121(Ft/s)
!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data **********

Information entered for subchannel number 1 :
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 912.00 0.00
3 1824.00 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 142.020(CFS)
  ' flow top width = 120.629(Ft.)
  ' velocity= 7.121(Ft/s)
  ' area = 19.944(Sq.Ft)
  ' Froude number = 3.086

Upstream point elevation = 4220.000(Ft.)
Downstream point elevation = 4120.000(Ft.)
Flow length = 439.080(Ft.)
Travel time = 1.03 min.
Time of concentration = 11.78 min.
Depth of flow = 0.331(Ft.)
Average velocity = 7.121(Ft/s)
Total irregular channel flow = 142.019(CFS)
Irregular channel normal depth above invert elev. = 0.331(Ft.)
Average velocity of channel(s) = 7.121(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 4.063 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCIA) is C = 0.883
Subarea runoff = 61.180 (CFS) for 19.010 (Ac.)
Total runoff = 172.561 (CFS)
Effective area this stream = 48.10 (Ac.)
Total Study Area (Main Stream No. 1) = 48.10 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.356 (Ft.), Average velocity = 7.476 (Ft/s)
!!Warning: Water is above left or right bank elevations

+------------------------------------------------------------------+
Process from Point/Station 4.000 to Point/Station 5.000
+------------------------------------------------------------------+
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.328 (Ft.), Average velocity = 9.813 (Ft/s)
!!Warning: Water is above left or right bank elevations

+------------------------------------------------------------------+
Information entered for subchannel number 1
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 955.50 5.00
3 1911.00 0.00
Manning's 'N' friction factor = 0.030
+------------------------------------------------------------------+
Sub-Channel flow = 201.421 (CFS)
  ' flow top width = 125.262 (Ft.)
  ' velocity = 9.813 (Ft/s)
  ' area = 20.527 (Sq.Ft)
  ' Froude number = 4.272
Upstream point elevation = 4120.00 (Ft.)
Downstream point elevation = 3925.00 (Ft.)
Flow length = 445.570 (Ft.)
Travel time = 0.76 min.
Time of concentration = 12.54 min.
Depth of flow = 0.328 (Ft.)
Average velocity = 9.813 (Ft/s)
Total irregular channel flow = 201.419 (CFS)
Irregular channel normal depth above invert elev. = 0.328 (Ft.)
Average velocity of channel(s) = 9.813 (Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 63.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 3.890 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=KCIA) is C = 0.882
Subarea runoff = 57.630 (CFS) for 18.980 (Ac.)
Total runoff = 230.191 (CFS)
Effective area this stream = 67.08 (Ac.)
Total Study Area (Main Stream No. 1) = 67.08 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.345 (Ft.), Average velocity = 10.146 (Ft/s)
!!Warning: Water is above left or right bank elevations

+------------------------------------------------------------------+
Process from Point/Station 5.000 to Point/Station 6.000
+------------------------------------------------------------------+
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.350(Ft.), Average velocity = 10.750(Ft/s)

!!Warning: Water is above left or right bank elevations

***** Irregular Channel Data  ************

Information entered for subchannel number 1:

Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 972.50 5.00
3 1945.00 0.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 255.786(CFS)

' flow top width = 136.055(Ft.)
' velocity = 10.750(Ft/s)
' area = 23.793(Sq.Ft)
' Froude number = 4.530

Upstream point elevation = 3925.000(Ft.)
Downstream point elevation = 3666.000(Ft.)
Flow length = 537.710(Ft.)
Travel time = 0.83 min.
Time of concentration = 13.37 min.

Depth of flow = 0.350(Ft.)
Average velocity = 10.750(Ft/s)
Total irregular channel flow = 255.786(CFS)
Irregular channel normal depth above invert elev. = 0.350(Ft.)
Average velocity of channel(s) = 10.750(Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500

Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500

SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
PerVIOUS ratio(Ap) = 1.0000
Max loss rate(Fm)= 0.077(In/Hr)
Rainfall intensity = 3.718(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 = 51.136(CFS) for 18.760(Ac.)
Total runoff = 281.327(CFS)
Effective area this stream = 85.84(Ac.)
Total Study Area (Main Stream No. 1) = 85.84(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.362(Ft.), Average velocity = 11.009(Ft/s)

!!Warning: Water is above left or right bank elevations

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Process from Point/Station 6.000 to Point/Station 7.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)

Depth of flow = 0.449(Ft.), Average velocity = 7.561(Ft/s)

!!Warning: Water is above left or right bank elevations

***** Irregular Channel Data  ************

Information entered for subchannel number 1:

Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 1082.50 5.00
3 1999.99 0.00

Manning's 'N' friction factor = 0.030

Sub-Channel flow = 304.979(CFS)

' flow top width = 179.632(Ft.)
' velocity = 7.561(Ft/s)
' area = 40.335(Sq.Ft)
' Froude number = 2.812
Upstream point elevation = 3666.000(Ft.)
Downstream point elevation = 3603.000(Ft.)
Flow length = 368.990 (Ft.)
Travel time = 0.81 min.
Time of concentration = 14.18 min.
Depth of flow = 0.449 (Ft.)
Average velocity = 7.561 (Ft/s)
Total irregular channel flow = 304.978 (CFS)
Irregular channel normal depth above invert elev. = 0.449 (Ft.)
Average velocity of channel(s) = 7.561 (Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 3.568 (In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=RCIA) is C = 0.681
Subarea runoff = 47.245 (CFS) for 18.740 (Ac.)
Total runoff = 328.572 (CFS)
Effective area this stream = 104.58 (Ac.)
Total Study Area (Main Stream No. 1) = 104.58 (Ac.)
Area averaged Fm value = 0.077 (In/Hr)
Depth of flow = 0.462 (Ft.), Average velocity = 7.703 (Ft/s)

!!Warning: Water is above left or right bank elevations

******************************************************************************
Process from Point/Station 7.000 to Point/Station 8.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000 (CFS)
Depth of flow = 0.524 (Ft.), Average velocity = 6.354 (Ft/s)

!!Warning: Water is above left or right bank elevations

******** Irregular Channel Data ********

--------------------------------------------------------------------------------
Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 1000.00 5.00
3 1999.99 0.00
Manning's 'N' friction factor = 0.030
--------------------------------------------------------------------------------
Sub-Channel flow = 348.618 (CFS)
' ' flow top width = 209.510 (Ft.)
' ' velocity= 6.354 (Ft/s)
' ' area = 54.868 (Sq.Ft)
' ' Froude number = 2.188

Upstream point elevation = 3603.000 (Ft.)
Downstream point elevation = 3566.000 (Ft.)
Flow length = 376.780 (Ft.)
Travel time = 0.99 min.
Time of concentration = 15.17 min.
Depth of flow = 0.524 (Ft.)
Average velocity = 6.354 (Ft/s)
Total irregular channel flow = 348.615 (CFS)
Irregular channel normal depth above invert elev. = 0.524 (Ft.)
Average velocity of channel(s) = 6.354 (Ft/s)

!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077 (In/Hr)
Rainfall intensity = 3.403(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=RCIA) is C = 0.880
Subarea runoff = 40.011(CFS) for 18.530(Ac.)
Total runoff = 368.583(CFS)
Effective area this stream = 123.11(Ac.)
Total Study Area (Main Stream No. 1) = 123.11(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.535(Ft.), Average velocity = 6.443(Ft/s)
!!Warning: Water is above left or right bank elevations

Process from Point/Station 8.000 to Point/Station 9.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.525(Ft.), Average velocity = 7.043(Ft/s)
!!Warning: Water is above left or right bank elevations

**** Irregular Channel Data ********

Information entered for subchannel number 1:

Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 1000.00 5.00
3 1999.99 0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 388.896(CFS)
  ' ' flow top width = 210.182(Ft.)
  ' ' velocity = 7.043(Ft/s)
  ' ' area = 55.221(Sq.Ft.)
  ' ' Froude number = 2.421

Upstream point elevation = 3566.000(Ft.)
Downstream point elevation = 3527.000(Ft.)
Flow length = 324.640(Ft.)
Travel time = 0.77 min.
Time of concentration = 15.94 min.
Depth of flow = 0.525(Ft.)
Average velocity = 7.043(Ft/s)
Total irregular channel flow = 388.893(CFS)
Irregular channel normal depth above invert elev. = 0.525(Ft.)
Average velocity of channel(s) = 7.043(Ft/s)
!!Warning: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000 Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 3.288(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified rational method) (Q=RCIA) is C = 0.879
Subarea runoff = 40.559(CFS) for 18.470(Ac.)
Total runoff = 409.142(CFS)
Effective area this stream = 141.58(Ac.)
Total Study Area (Main Stream No. 1) = 141.58(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.536(Ft.), Average velocity = 7.132(Ft/s)
!!Warning: Water is above left or right bank elevations

Process from Point/Station 9.000 to Point/Station 10.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.603(Ft.), Average velocity = 5.845(Ft/s)
!!Warning: Water is above left or right bank elevations
Irregular Channel Data

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
1  0.00  0.00
2  1000.00  5.00
3  1999.99  0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 424.785(CFS)
  ' flow top width = 241.121(Ft.)
  ' velocity= 5.845(Ft/s)
  ' area = 72.675(Sq.Ft)
  ' Froude number = 1.876
Upstream point elevation = 3527.000(Ft.)
Downstream point elevation = 3500.000(Ft.)
Flow length = 391.840(Ft.)
Travel time = 1.12 min.
Time of concentration = 17.06 min.
Depth of flow = 0.603(Ft.)
Average velocity = 5.845(Ft/s)
Total irregular channel flow = 424.784(CFS)
Irregular channel normal depth above invert elev. = 0.603(Ft.)
Average velocity of channel(s) = 5.845(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000  Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 3.135(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.878
Subarea runoff = 31.194(CFS) for 18.380(Ac.)
Total runoff = 440.336(CFS)
Effective area this stream = 159.96(Ac.)
Total Study Area (Main Stream No. 1) = 159.96(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.611(Ft.), Average velocity = 5.898(Ft/s)
!!Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 10.000 to Point/Station 11.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.663(Ft.), Average velocity = 6.611(Ft/s)
!!Warning: Water is above left or right bank elevations

Irregular Channel Data

Information entered for subchannel number 1:
Point number  'X' coordinate  'Y' coordinate
1  0.00  0.00
2  775.00  5.00
3  1550.00  0.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 449.942(CFS)
  ' flow top width = 205.420(Ft.)
  ' velocity= 6.611(Ft/s)
  ' area = 68.060(Sq.Ft)
  ' Froude number = 2.024
Upstream point elevation = 3500.000(Ft.)
Downstream point elevation = 3450.000(Ft.)
Flow length = 643.520(Ft.)
Travel time = 1.62 min.
Time of concentration = 18.68 min.
Depth of flow = 0.663(Ft.)
Average velocity = 6.611(Ft/s)
Total irregular channel flow = 449.942(CFS)
Irregular channel normal depth above invert elev. = 0.663(Ft.)
Average velocity of channel(s) = 6.611(Ft/s)

!!Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500

SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.942(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area,(total area with modified rational method) (Q=KCTA) is C = 0.877
Subarea runoff = 19.148(CFS) for 18.210(Ac.)
Total runoff = 459.483(CFS)
Effective area this stream = 178.17(Ac.)
Total Study Area (Main Stream No. 1) = 178.17(Ac.)
Area averaged Fm value = 0.077(In/Hr)

Depth of flow = 0.668(Ft.), Average velocity = 6.646(Ft/s)

!!Warning: Water is above left or right bank elevations

########################################################################

Process from Point/Station 11.000 to Point/Station 12.000

**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)

Depth of flow = 0.750(Ft.), Average velocity = 6.984(Ft/s)

!!Warning: Water is above left or right bank elevations

****** Irregular Channel Data **********

Information entered for subchannel number 1:

Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 595.50 5.00
3 1191.00 0.00

Manning's 'N' friction factor = 0.030

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

Sub-Channel flow = 468.201(CFS)

' ' flow top width = 178.707(Ft.)
' ' velocity = 6.984(Ft/s)
' ' area = 67.037(Sq.Ft)
' ' Froude number = 2.010

Upstream point elevation = 3450.000(Ft.)
Downstream point elevation = 3400.000(Ft.)
Flow length = 680.350(Ft.)
Travel time = 1.62 min.
Time of concentration = 20.30 min.
Depth of flow = 0.750(Ft.)
Average velocity = 6.984(Ft/s)
Total irregular channel flow = 468.199(CFS)
Irregular channel normal depth above invert elev. = 0.750(Ft.)
Average velocity of channel(s) = 6.984(Ft/s)

!!Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500

SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10

Pervious ratio(Ap) = 1.0000 Max loss rate(Fm) = 0.077(In/Hr)
Rainfall intensity = 2.776(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 = 17.371(CFS) for 18.160(Ac.)
Total runoff = 476.854(CFS)
Effective area this stream = 196.33(Ac.)
Total Study Area (Main Stream No. 1) = 196.33(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.755(Ft.), Average velocity = 7.016(Ft/s)
!!Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 12.000 to Point/Station 13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.821(Ft.), Average velocity = 7.160(Ft/s)
!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data ***********
-------------------------------------------------------------
Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 499.75 5.00
3 999.50 0.00
Manning's 'N' friction factor = 0.030
-------------------------------------------------------------
Sub-Channel flow = 481.785(CFS)
' flow top width = 164.020(Ft.)
' velocity = 7.160(Ft/s)
' area = 67.290(Sq.Ft)
' Froude number = 1.970

Upstream point elevation = 3400.000(Ft.)
Downstream point elevation = 3341.000(Ft.)
Flow length = 860.770(Ft.)
Travel time = 2.00 min.
Time of concentration = 22.31 min.
Depth of flow = 0.821(Ft.)
Average velocity = 7.160(Ft/s)
Total irregular channel flow = 481.784(CFS)
Irregular channel normal depth above invert elev. = 0.821(Ft.)
Average velocity of channel(s) = 7.160(Ft/s)
!!Warning: Water is above left or right bank elevations
Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio (Ap) = 1.0000 Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 2.599(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 = 9.788(CFS) for 18.090(Ac.)
Total runoff = 486.642(CFS)
Effective area this stream = 214.42(Ac.)
Total Study Area (Main Stream No. 1) = 214.42(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.824(Ft.), Average velocity = 7.178(Ft/s)
!!Warning: Water is above left or right bank elevations

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station 13.000 to Point/Station 14.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.873(Ft.), Average velocity = 7.507(Ft/s)
!!Warning: Water is above left or right bank elevations

******* Irregular Channel Data ***********
Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 429.00 5.00
3 858.00 3.00
Manning's 'N' friction factor = 0.030

Sub-Channel flow = 490.520(CFS)
  ' ' flow top width = 149.748(Ft.)
  ' ' velocity= 7.507(Ft/s)
  ' ' area = 65.340(Sq.Ft)
  ' ' Froude number = 2.003

Upstream point elevation = 3341.000(Ft.)
Downstream point elevation = 3275.000(Ft.)
Flow length = 950.810(Ft.)
Travel time = 2.11 min.
Time of concentration = 24.42 min.
Depth of flow = 0.873(Ft.)
Average velocity = 7.507(Ft/s)
Total irregular channel flow = 490.520(CFS)
Irregular channel normal depth above invert elev. = 0.873(Ft.)
Average velocity of channel(s) = 7.507(Ft/s)
!!Warning: Water is above left or right bank elevations

Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000  Max loss rate(Fm)= 0.077(In/Hr)
Rainfall intensity = 2.439(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area,(total area with modified rational method)(Q=RCIA) is C = 0.872
Subarea runoff = 7.687(CFS) for 18.080(Ac.)
Total runoff = 494.329(CFS)
Effective area this stream = 232.50(Ac.)
Total Study Area (Main Stream No. 1) = 232.50(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.875(Ft.), Average velocity = 7.522(Ft/s)
!!Warning: Water is above left or right bank elevations

+-------------------------------------------------------------------------------------------------+
| Process from Point/Station 14.000 to Point/Station 15.000                                      |
| **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****                                                  |
+-------------------------------------------------------------------------------------------------+

Estimated mean flow rate at midpoint of channel = 0.000(CFS)
Depth of flow = 0.898(Ft.), Average velocity = 7.187(Ft/s)
!!Warning: Water is above left or right bank elevations

+-------------------------------------------------------------------------------------------------+
| Information entered for subchannel number 1:                                                |
| Point number 'X' coordinate 'Y' coordinate                                                    |
| 1 0.00 0.00                                                                                   |
| 2 429.00 5.00                                                                               |
| 3 858.00 3.00                                                                               |
| Manning's 'N' friction factor = 0.030                                                         |
+-------------------------------------------------------------------------------------------------+
| Sub-Channel flow = 496.907(CFS)                                                              |
|  ' ' flow top width = 154.039(Ft.)                                                           |
|  ' ' velocity= 7.187(Ft/s)                                                                   |
|  ' ' area = 69.138(Sq.Ft)                                                                    |
|  ' ' Froude number = 1.891                                                                    |
+-------------------------------------------------------------------------------------------------+
Upstream point elevation = 3275.000(Ft.)
Downstream point elevation = 3229.000(Ft.)
Flow length = 750.770(Ft.)
Travel time = 1.74 min.
Time of concentration = 26.16 min.
Depth of flow = 0.898(Ft.)
Average velocity = 7.187(Ft/s)
Total irregular channel flow = 496.908(CFS)
Irregular channel normal depth above invert elev. = 0.898(Ft.)
Average velocity of channel(s) = 7.187(Ft/s)

!! Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.510

SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10

R pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 2.324(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (total area with modified rational method) (Q=KCl) is C = 0.870

Subarea runoff = 5.106(CFS) for 14.400(Ac.)

Total runoff = 499.434(CFS)

Effective area this stream = 246.90(Ac.)

Total Study Area (Main Stream No. 1) = 246.90(Ac.)

Area averaged Fm value = 0.077(In/Hr)

Depth of flow = 0.899(Ft.), Average velocity = 7.196(Ft/s)

!! Warning: Water is above left or right bank elevations

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

****** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

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

Estimated mean flow rate at midpoint of channel = 0.000(CFS)

Depth of flow = 0.884(Ft.), Average velocity = 6.585(Ft/s)

!! Warning: Water is above left or right bank elevations

****** Irregular Channel Data **********

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

Information entered for subchannel number 1:
Point number 'X' coordinate 'Y' coordinate
1 0.00 0.00
2 489.00 5.00
3 978.00 0.00

Manning's 'N' friction factor = 0.030

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

Sub-Channel flow = 503.078(CFS)

' '  flow top width = 172.883(Ft.)
' ' velocity = 6.585(Ft/s)
' ' area = 76.402(Sq.Ft)
' ' Froude number = 1.746

Upstream point elevation = 3229.000(Ft.)
Downstream point elevation = 3200.000(Ft.)
Flow length = 552.390(Ft.)
Travel time = 1.40 min.
Time of concentration = 27.56 min.

Depth of flow = 0.884(Ft.)
Average velocity = 6.585(Ft/s)
Total irregular channel flow = 503.078(CFS)
Irregular channel normal depth above invert elev. = 0.884(Ft.)
Average velocity of channel(s) = 6.585(Ft/s)

!! Warning: Water is above left or right bank elevations

Adding area flow to channel

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500

SCS curve number for soil (AMC 2) = 83.50
Adjusted SCS curve number for AMC 3 = 96.10

Pervious ratio (Ap) = 1.0000  Max loss rate (Fm) = 0.077(In/Hr)
Rainfall intensity = 2.241(In/Hr) for a 100.0 year storm

Effective runoff coefficient used for area (total area with modified rational method) (Q=KCl) is C = 0.869
Subarea runoff = 7.206(CFS) for 13.190(Ac.)
Total runoff = 506.641(CFS)
Effective area this stream = 260.09(Ac.)
Total Study Area (Main Stream No. 1) = 260.09(Ac.)
Area averaged Fm value = 0.077(In/Hr)
Depth of flow = 0.886(Ft.), Average velocity = 6.596(Ft/s)
!!Warning: Water is above left or right bank elevations

+---------------------------------------------------------------------
Process from Point/Station 15.000 to Point/Station 16.000
+---------------------------------------------------------------------

**** CONFLUENCE OF MINOR STREAMS ****
Along Main Stream number: 1 in normal stream number 1
Stream flow area = 260.090(Ac.)
Runoff from this stream = 506.641(CFS)
Time of concentration = 27.56 min.
Rainfall intensity = 2.241(In/Hr)
Area averaged loss rate (Fm) = 0.0768(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

<table>
<thead>
<tr>
<th>Stream No.</th>
<th>Area (Ac.)</th>
<th>Flow rate (CFS)</th>
<th>TC (min)</th>
<th>Fm (In/Hr)</th>
<th>Rainfall Intensity (In/Hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>506.64</td>
<td>260.090</td>
<td>27.56</td>
<td>0.077</td>
<td>2.241</td>
</tr>
</tbody>
</table>

Qmax(1) = 1.000 * 1.000 * 506.641 + = 506.641

Total of 1 streams to confluence:
Flow rates before confluence point:
506.641
Maximum flow rates at confluence using above data:
506.641
Area of streams before confluence:
260.090
Effective area values after confluence:
260.090
Results of confluence:
Total flow rate = 506.641(CFS)
Time of concentration = 27.557 min.
Effective stream area after confluence = 260.090(Ac.)
Study area average Pervious fraction (Ap) = 1.000
Study area average soil loss rate (Fm) = 0.077(In/Hr)
Study area total (this main stream) = 260.09(Ac.)
End of computations, Total Study Area = 260.09 (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 = 83.5
Hecras Analysis
Channel “2”
Pre and Post Analysis
Project in English units

---

**PROJECT DATA**

Project Title: 07014
Project File: PRECHANNEL2.prj
Run Date and Time: 3/7/2011 5:20:42 PM

---

**PLAN DATA**

Plan Title: Imported Plan 01
Plan File: C:\PRECHANNEL2.p01

Geometry Title: Imported Geom 01
Geometry File: C:\PRECHANNEL2.g01

Flow Title: Imported Flow 01
Flow File: C:\PRECHANNEL2.f01

---

**Plan Summary Information**

Number of Cross Sections = 11  Multiple Openings = 0
Culverts = 0  Inline Structures = 0  Bridges = 0  Lateral Structures = 0

---

**Computational Information**

Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

---

**Computation Options**

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

---

**FLOW DATA**

Flow Title: Imported Flow 01
Flow File: C:\PRECHANNEL2.f01

Flow Data (cfs)

<table>
<thead>
<tr>
<th>River</th>
<th>Reach</th>
<th>RS</th>
<th>PF 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIVER-1</td>
<td>Reach-1</td>
<td>11</td>
<td>760</td>
</tr>
</tbody>
</table>
Boundary Conditions

**River** | **Reach** | **Profile** | **Upstream** | **Downstream**
---|---|---|---|---
RIVER-1 | Reach-1 | PF 1 | Critical |  

**GEOMETRY DATA**

Geometry Title: Imported Geom 01
Geometry File: C:\PRECHANNEL2.g01

**CROSS SECTION**

**RIVER: RIVER-1**
**REACH: Reach-1**
**RS:** 11

**INPUT**
**Description:**

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<th>Station Elevation Data</th>
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<tbody>
<tr>
<td>Sta Elev</td>
<td>Sta Elev</td>
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<tr>
<td>0 3207.9</td>
<td>1.48 3207.9</td>
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<tr>
<td>25.83 3207</td>
<td>31.29 3206.1</td>
</tr>
<tr>
<td>50.22 3206</td>
<td>56.68 3206</td>
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<td>69.05 3205.98</td>
<td>71.87 3206</td>
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<tr>
<td>88.46 3206</td>
<td>96.49 3206</td>
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<tr>
<td>109.28 3206</td>
<td>109.5 3206.06</td>
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<tr>
<td>132.59 3206</td>
<td>144.8 3206</td>
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<tr>
<td>163.09 3206</td>
<td>164.69 3206</td>
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<td>178.22 3206</td>
<td>179.5 3206.62</td>
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<td>191.28 3207</td>
<td>37.37 199.5</td>
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<table>
<thead>
<tr>
<th>Manning's n Values</th>
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<tbody>
<tr>
<td>Sta n Val</td>
<td>Sta n Val</td>
</tr>
<tr>
<td>0</td>
<td>0.03 108.61</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Bank Sta: Left</th>
<th>Right</th>
<th>Lengths: Left Channel</th>
<th>Right</th>
<th>Coeff Contr.</th>
<th>Expan.</th>
</tr>
</thead>
<tbody>
<tr>
<td>108.65</td>
<td>216.16</td>
<td>125.36</td>
<td>108.36</td>
<td>106.47</td>
<td>.1</td>
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**CROSS SECTION**

**RIVER: RIVER-1**
**REACH: Reach-1**
**RS:** 10

**INPUT**
**Description:**

<table>
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<td>Sta Elev</td>
<td>Sta Elev</td>
</tr>
<tr>
<td>0 3201.6</td>
<td>7.06 3202</td>
</tr>
<tr>
<td>19.78 3202.4</td>
<td>24.47 3202.49</td>
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<tr>
<td>53.9 3202</td>
<td>56.05 3202</td>
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<tr>
<td>143.58 3199</td>
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<td>171.88 3199</td>
<td>274.56 3199</td>
</tr>
<tr>
<td>210.41 3200.69</td>
<td>215.31 3200.9</td>
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<td>230.18 3201.9</td>
<td>234.55 3202.14</td>
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<td>272.26 3202</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Manning's n Values</th>
<th>num= 3</th>
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</thead>
<tbody>
<tr>
<td>Sta n Val</td>
<td>Sta n Val</td>
</tr>
<tr>
<td>0</td>
<td>0.03 152.44</td>
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<table>
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<tr>
<th>Bank Sta: Left</th>
<th>Right</th>
<th>Lengths: Left Channel</th>
<th>Right</th>
<th>Coeff Contr.</th>
<th>Expan.</th>
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<tr>
<td>152.44</td>
<td>300.53</td>
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<td>132.31</td>
<td>.1</td>
</tr>
</tbody>
</table>

**CROSS SECTION**

**RIVER: RIVER-1**
**REACH: Reach-1**
**RS:** 9

**INPUT**
**Description:**

---
Station Elevation Data  num=  50
  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev
  0 3194.5 3194.5 3194.5 3194.5 3194.5 3194.5 3194.5 3194.5
  46.36 3194.4 60.37 3194.34 63.74 3194.3 72.39 3194.16 73.84 3194.12
  78.41 3194. 85.69 3193.79 88.73 3193.71 101.56 3193.28 107 3193.09
  108.13 3193.1 109.41 3193 114.36 3192.82 137.12 3192 144.83 3191.76
  146.75 3191.7 151.13 3191.36 152.4 3191.76 159.41 3192 163.62 3192.16
  163.98 3192.2 167.74 3192.24 174.75 3192 190.63 3192 191.48 3192.01
  191.62 3192 196.22 3192.22 197.66 3192.27 200.19 3192.39 208.99 3192.48
  223.38 3192.6 232.21 3192.68 238.28 3192.71 240.54 3192.72 252.35 3192.63
  256.1 3192.7 260.79 3192.8 265.88 3193 285.65 3193.82 289.98 3194
  290.55 3194 291.28 3194.08 291.81 3194.1 299.84 3194.49 300.91 3194.52

Manning's n Values  num=  3
  Sta  n Val  Sta  n Val  Sta  n Val
  0 .03 151.13 .03 300.91 .03

Bank Sta: Left  Right  Lengths: Left Channel  Right  Coeff Contr.  Expan.
  151.13 300.91 144.87 149.68 160.76 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 8

INPUT
Description:
Station Elevation Data  num=  50
  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev
  0 3184.6 1.73 3184.7 14.02 3184.93 25.93 3185.1 38.74 3185.09
  50.74 3185 55.14 3185 76.31 3185.68 88.1 3184.41 94.82 3184.32
  121.99 3184 123.43 3184 146.39 3183.66 156.99 3183.6 161.61 3183.63
  179.75 3183.63 183.03 3183.6 187.84 3183.43 196.06 3183 197.27 3182.82
  205.19 3182 207.38 3181.39 208.67 3181.25 211.91 3182 212.94 3182
  216.2 3182.9 217.23 3183.07 218.83 3183.1 226.25 3183.04 246.49 3182.99
  248.17 3182.92 253.73 3182.46 256.26 3182.4 261.42 3182.58 272.88 3182.65
  281.58 3182.57 291.65 3182.6 293.5 3182.54 297.75 3182.55 301.55 3182.63
  302.29 3182.7 311.15 3183 316.03 3183.23 326.02 3183.54 329.95 3183.68
  335.07 3183.8 342 3184 349.73 3184.18 357.7 3184.3 359.41 3184.3

Manning's n Values  num=  3
  Sta  n Val  Sta  n Val  Sta  n Val
  0 .03 179.75 .03 359.41 .03

Bank Sta: Left  Right  Lengths: Left Channel  Right  Coeff Contr.  Expan.
  179.75 359.41 175.06 158.27 145.63 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 7

INPUT
Description:
Station Elevation Data  num=  47
  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev  Sta  Elev
  0 3175.1 4.32 3175 13.98 3174.85 31.77 3174.56 49.94 3174.26
  55.53 3174.2 64.23 3174.2 66.9 3174.18 76.2 3174.01 76.35 3174.01
  78.78 3174 80.98 3173.99 81.17 3173.99 82.53 3174 100.08 3174.15
  108.76 3174.2 115.52 3174.34 125.23 3174.58 128.96 3174.57 131.02 3174.59
  134.66 3174.5 139.69 3174.36 142.89 3174.31 145.78 3174 150.06 3173.48
  156.84 3173 161.79 3172.73 166.3 3172.68 171.04 3172.74 175.74 3172.66
  186.6 3172.8 187.05 3172.82 188.59 3172.98 189.69 3173 188.82 3173
  196.23 3173.8 204.1 3173.9 207.05 3173.94 210.88 3174 241.98 3174.43
  248.45 3174.5 257.1 3174.53 266.79 3174.57 296.87 3174.74 298.43 3174.76
  300.05 3174.8 300.91 3174.84

Manning's n Values  num=  3
  Sta  n Val  Sta  n Val  Sta  n Val
  0 .03 156.84 .03 300.91 .03

Bank Sta: Left  Right  Lengths: Left Channel  Right  Coeff Contr.  Expan.
  156.84 300.91 146.82 156.27 190.73 .1 .3

CROSS SECTION
RIVER: RIVER-1
REACH: Reach-1  RS: 6

INPUT
Description:
Station Elevation Data  num= 50
  Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
  0  316.6  4.22 3166.08  11.74 3166.14  22.98 3166.11  46.55 3165.95
  48.26 3165.93  71.1 3165.7  76.85 3165.56  79.93 3165.5  88.51 3165.36
  104.74 3164.99  121.32 3164.57  129.79 3164.45  148.42 3164.31  153.62 3164.29
  159.71 3163.32  170.95 3164.41  183.26 3164.5  213.89 3164.74  221.25 3164.79
  245.54 3164.91  261.62 3164.9  264.53 3164.88  284.16 3164.61  287.96 3164.64
  291.59 3164.62  301.92 3164.79  307.3  3165  314.26 3165.25  320.35 3165.36
  321.66 3165.4  325.53 3165.43  342.66 3165.54  357.22 3165.5  361.43 3165.3
  364.88 3165.26  365.74 3165.23  369.38 3165.4  372.63 3165.64  374.67 3165.72
  377.73 3165.67  385.91 3165.64  390.65 3165.5  400.8 3165.46  406.59 3165.53
  413.93 3165.58  418.51 3165.7  428.3 3165.78  432.38 3165.89  439.53 3166

Manning's n Values  num= 3
  Sta n Val Sta n Val Sta n Val
  0  .03 221.25 .03 435.53 .03

Bank Sta:  Left  Right Lengths:  Left Channel  Right Coeff Contr. Expan.
  221.25 435.53 152.13 148.16 151.7 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 5

INPUT
Description:
Station Elevation Data  num= 50
  Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
  0  3157.4  6.87 3157.46  16.27 3157.37  31.17 3157.2  38 3157.04
  39.35 3157  45.43 3156.75  57.53 3156  60.15 3155.78  65.21 3155.46
  66.79 3155.4  28.98 3155.32  82.15 3155.26  99.45 3155.13  102.88 3155.11
  109.98 3155.2  122.46 3155.33  125.16 3155.34  133.02 3155.25  148.71 3155
  153.91 3154.9  156.54 3154.94  157.44 3155  164.39 3155.34  166.18 3155.4
  179.54 3155.51  181.74 3155.48  192.21 3155.51  197.33 3155.55  200.96 3155.6
  226.49 3155.71  230.1 3155.76  240.37 3155.82  243.73 3155.8  259.6 3155.04
  260.71 3156.05  271.28 3156.22  274.39 3156.2  276.54 3156.22  287.03 3156.11
  293.32 3156  310.81 3156.67  328.37 3155.3  333.43 3155.16  337.63 3155.19
  348.4 3155.53  355.88 3155.8  359.02 3155.86  364.32 3156  369.38 3156.15

Manning's n Values  num= 3
  Sta n Val Sta n Val Sta n Val
  0  .03 192.21 .03 369.38 .03

Bank Sta:  Left  Right Lengths:  Left Channel  Right Coeff Contr. Expan.
  192.21 369.38 158.53 152.97 161.5 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1  RS: 4

INPUT
Description:
Station Elevation Data  num= 50
  Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
  0  3147.1  1.4 3147.07  3.07 3147.08  24.59 3147  29.55 3146.99
  29.86 3147  51.4 3146.89  54.19 3146.85  61.11 3146.77  65.13 3146.66
  84.84 3146.3  91.38 3146.13  94.09 3146  98.72 3146  100.6 3146
  101.1 3145.9  101.61 3145.93  114.5 3145.54  119.5 3145.54  135.87 3145.46
  141.21 3145.4  146.33 3145.41  148.5 3145.36  151.07 3145.15  151.35 3145.17
  152.66 3145.2  158.84 3145.36  162.74 3145.53  177.77 3145.68  180.38 3145.77
  184.51 3146  186.5 3146.5  3146  186.63 3146  194.81 3146.24
  196.75 3146.2  198.05 3146.25  208.07 3146.44  218.87 3146.58  225.23 3146.62
  231.55 3146.7  234.25 3146.7  3147  265.69 3147.13  267.69 3147.16  268.89 3147.16
  269.76 3147.2  272.71 3147.18  274.93 3147.15  276.15 3147.13  277.2 3147.09

Manning's n Values  num= 3
  Sta n Val Sta n Val Sta n Val
  0  .03 141.21 .03 277.2 .03

Bank Sta:  Left  Right Lengths:  Left Channel  Right Coeff Contr. Expan.
CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1
RS: 3

INPUT
Description:
Station Elevation Data  num=  50
  Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
  0 3129.4 3129.42 28.62 3129.26 54.07 3129.78 3128.8
  84.59 3128.7 115.51 3128.15 125.48 3128 133.55 3127.96 146.9 3128.1
  170.54 3128.61 181.23 3128.88 189.56 3128.91 193.01 3128.87 202.63 3128
  208.59 3128 210.85 3128.12 218.46 3128.27 223.4 3128.1 231.43 3128
  242.58 3127.68 249.79 3127.62 264.64 3127.69 272.22 3127.58 277.45 3127.58
  293.68 3127.7 301.48 3127.73 321.36 3127.5 331.63 3127.24 334.2 3127.22
  339.08 3127.05 343.14 3127.15 349.51 3127.4 354.59 3127.45 356.68 3127.4
  361.4 3127.369.37 3127 373.98 3126.9 377.03 3127 395.01 3127.35
  416.85 3127.6 427.57 3127.84 454.29 3128.51 471.35 3128.8 486.97 3129
  513.95 3129.46 521.35 3129.5 536.34 3129.74 541.74 3129.78 557.97 3130

Manning's n Values  num=  3
  Sta  n Val Sta  n Val  Sta  n Val
  0 .03 293.68 .03 557.97 .03

Bank Sta: Left  Right
  293.68 557.97
Lengths: Left Channel  Right  Coeff Contr.  Expan.
  150.68 152.58 172.76 .1 .3

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1
RS: 2

INPUT
Description:
Station Elevation Data  num=  50
  Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
  0 3119.7 1.94 3119.72 6.61 3119.63 17.04 3119.47 26.09 3119.2
  31.13 3119 41.53 3118.64 57.11 3118.31 61.14 3118.3 77.42 3118
  95.46 3117.82 118.34 3117.75 131.11 3117.78 133.17 3117.79 142.28 3117.92
  143.23 3117.9 146.95 3118 167.36 3118.34 179.98 3118.52 192.54 3118.69
  206.53 3119 218.2 3119.24 220.5 3119.3 224.8 3119.22 226.38 3119.22
  236.4 3119 243.7 3118.81 248.85 3118.7 255.99 3118.69 277.63 3119
  279.18 3119 287.97 3119.07 295.01 3119 3118.87 3118.85 315.16 3118.8
  324.43 3118.85 346.32 3119.04 347.07 3119 355.74 3119 361.36 3119.1
  368.24 3119 387.38 3119.43 3119 387.76 3119.03 384.4 3119.2 387.14 3119.18
  401.47 3119.33 414.07 3119.45 432.42 3119.72 436.27 3119.7 446.62 3120
Manning's n Values

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Bank Sta: Left | Right

Lengths: Left | Channel | Right | Coeff | Contr | Expan.

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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

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**PRE-DEVELOPED CHANNEL-2, 100 YRS, 1 HR.**
PROJECT DATA
Project Title: 07014
Project File : POSTCHANNEL2.prj
Run Date and Time: 3/7/2011 9:22:37 PM

Project in English units

Project Description:
****** Autodesk, Inc. HEC-2 Input Data file ******
*************
Minimum Data Input  **********
*************

PLAN DATA
Plan Title: Imported Plan 01
Plan File : C:\POSTCHANNEL2.p01

Geometry Title: Imported Geom 01
Geometry File : C:\POSTCHANNEL2.g01

Flow Title : Imported Flow 01
Flow File : C:\POSTCHANNEL2.f01

Plan Summary Information:
Number of Cross Sections = 10 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA
Flow Title: Imported Flow 01
Flow File : C:\POSTCHANNEL2.f01

Flow Data (cfs)
River Reach RS PF
RIVER-1 Reach-1 10 750
## Boundary Conditions

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## GEOMETRY DATA

Geometry Title: Imported Geom 01  
Geometry File: C:\POSTCHANNEL2.g01

## CROSS SECTION

### RIVER: River-1  
REACH: Reach-1  
RS: 10

#### INPUT

### Description:

Station Elevation Data:  
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Manning's n Values:  
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Bank Sta: Left, Right  
Lengths: Left Channel, Right  
Coeff Contr, Expan.  
153.56 | 149.89 | 148.26 | .1 | .3

### CROSSED SECTION

#### RIVER: River-1  
REACH: Reach-1  
RS: 9

#### INPUT

### Description:

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Manning's n Values:  
num= 3

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<th>Sta n Val</th>
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Bank Sta: Left, Right  
Lengths: Left Channel, Right  
Coeff Contr, Expan.  
150 | 149.94 | 149.91 | .1 | .3

### CROSS SECTION

#### RIVER: River-1  
REACH: Reach-1  
RS: 8

#### INPUT

### Description:
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Manning's n Values num= 3

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Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. | 58.66 | 116.86 | 146.35 | 149.59 | 152.84 | .1 | .3 

### CROSS SECTION

**RIVER: RIVER-1**

**REACH: Reach-1**

**RS: 7**

**INPUT**

Description:

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<th>Elev</th>
<th>Sta</th>
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Manning's n Values num= 3

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Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. | 59.48 | 118.97 | 149.99 | 150.09 | 150.19 | .1 | .3 

### CROSS SECTION

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**REACH: Reach-1**

**RS: 6**

**INPUT**

Description:

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Manning's n Values num= 3

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Bank Sta: Left | Right | Lengths: Left Channel | Right | Coeff Contr. | Expan. | 60.66 | 120.98 | 150.49 | 150.09 | 149.63 | .1 | .3 

### CROSS SECTION
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**REACH: Reach-1**
**RS: 5**

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Bank Sta: Left  Right
Lengths: Left Channel  Right  Coeff Contr.  Expan.
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**CROSS SECTION**

**RIVER: RIVER-1**
**REACH: Reach-1**
**RS: 4**

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Manning's n Values  num= 3
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<th>Sta n Val</th>
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<td>.03 122.88</td>
<td>.03</td>
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</table>

Bank Sta: Left  Right
Lengths: Left Channel  Right  Coeff Contr.  Expan.
61.59 122.88 151.42 150.22 150.17 .1 .3

**CROSS SECTION**

**RIVER: RIVER-1**
**REACH: Reach-1**
**RS: 3**

**INPUT**
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Bank Sta: Left  Right
Lengths: Left Channel  Right  Coeff Contr.  Expan.
**CROSS SECTION**

**RIVER: RIVER-1**

**REACH: Reach-1**

**RS: 2**

**INPUT**

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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan. |
| 279.21 557.97 | 155.38 162.08 172.76 | .1 .3 |

**CROSS SECTION**

**RIVER: RIVER-1**

**REACH: Reach-1**

**RS: 1**

**INPUT**

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Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan. |
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**SUMMARY OF MANNING'S N VALUES**

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### SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

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*Post-Developed Channel-2, 100 yrs, 1 hr*
ITEM-4 Alta Loma Box Culvert
R.C.B. Culvert Sizing Calculation Sheet
Culvert Report  
Project Name: C:\Program Files\Hydraulic Tools\v105 60inch cmps.CSS

Total Discharge: 760.00 Cfs  
Tailwater Elevation: 3196.44 ft

Physical Data for Culvert #1

Culvert Type: Round Pipe-Steel  
Culvert Span: 5.50 ft  
Culvert Rise: 5.50 ft  
Culvert Area: 23.76 ft^2  
Culvert Upstream Elevation: 3196.80 ft  
Culvert Downstream Elevation: 3195.00 ft  
Culvert Length: 90.00 ft  
Culvert Slope: 0.020  
Number of Barrels: 4  
Entrance Condition: Headwall

Inlet Control Regression Coefficients:  
K = 0.0078  
M = 2.0000  
c = 0.0379  
Y = 0.6900

Outlet Control Parameters:  
Mannings Roughness Coefficient for Culvert Top and Sides: 0.028  
Mannings Roughness Coefficient for Culvert Bottom: 0.013  
Composite Mannings Roughness Coefficient: 0.024  
Entrance Loss Coefficient: 0.50

Hydraulic Results

Culvert Discharge: 760.00 Cfs  
Governing Headwater Elevation: 3202.87 ft  
Inlet Control Headwater Elevation: 6.07 ft  
Outlet Control Headwater Elevation: 6.02 ft  
Culvert Normal Depth: 3.93 ft  
Culvert Critical Depth: 3.86 ft  
Culvert Entrance Loss: 0.85 ft  
Culvert Friction Loss: 1.34 ft  
Culvert Exit Loss: 1.77 ft  
Culvert Exit Velocity: 10.67 ft/sec  
Pier Debris Width: 0.00 ft  
Inlet Control Condition: Unsubmerged Inlet  
Outlet Control Condition: M2 Drawdown Curve - Critical Depth as Control
Figures & Exhibits
RATIONAL METHOD

PFE, 2011
PRE-DEVELOPMENT
AREA DRAINAGE MAP, ONSITE AREA 2
TENTATIVE TRACT MAP NO. 18252
IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA