Rider Distribution Center II
Design Review/Case No: 19-00004
City of Perris, Riverside County, California

Preliminary Drainage Study

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SECTION 1 - SUMMARY

PURPOSE

The purpose of this report is to document the hydrologic and hydraulic analyses performed in support of the Rider Distribution Center II project located in the City of Perris, County of Riverside, California. The project site is located on the corner of Rider Street to the South and Redlands Avenue to the West. The Perris Valley Storm Drain is located directly to the East of the project site. The project proposes to build an industrial warehouse on approximately 37 acres. This report will summarize the hydrology and hydraulic analyses that were completed to determine the necessary drainage improvements required for the project to safely convey runoff through the site.

The scope of this report will include the following:

- Determine the peak 100-year and 10-year flow rates for the developed condition using the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Rational Method.
- Determine the required storm drain facilities, alignment, and sizes required to flood protect the project site.
- Determine the necessary basin area and volume required for water quality treatment.
- Preparation of a preliminary report summarizing the hydrology and hydraulic results.

DESCRIPTION OF WATERSHED

As previously described, the project is proposing to construct an industrial warehouse on approximately 37 acres. Existing elevations across the site vary from 1445 at the northwest corner to 1434 at the southeast corner (NAVD88 datum). The site is relatively flat and currently slopes at approximately 0.2%. The existing drainage pattern for the site is characterized by sheet flows that follow the approximate slope to the southeast corner of the project site. The sheet flow discharges southeasterly towards Rider Street where a portion of it pools at the southeast corner and some continues to flow along Rider Street and into a catch basin at the center of the bridge.

The project is located within the Perris Valley Commerce Center Specific Plan (PVCCSP), and it is associated within the Perris Valley Master Drainage Plan (MDP). The backbone drainage facility for this area is the existing storm drain Line-A-B (RFCF&WCD MS 94. No. 4-0-00537). The design of the Line-A-B storm drain system accounts for the fully developed condition of the tributary watershed it serves. As-built plans and excerpts from the approved drainage report have been provided in Appendix C.

PROPOSED CONDITIONS

The project site will be encompassed by existing streets on the west and south side of the property and prevent any runoff from the streets to impact it. On the east side of the property, where the Perris Valley Strom Drain (PVSD) is located, there is an access road that serves as a ridge line/ berm; it prevents any normal runoff in the PVSD from encroaching on the project site. However, there is a natural ridgeline within the Metropolitan Water District (MWD) right-of-way to the north side of the project boundary that splits half of its discharge to the north and the other half to the south. The site is projected to receive approximately 5.8 cfs of off-site sheet flows. The project proposes to use wall openings to convey the offsite runoff onsite. Off-site flows are proposed to be conveyed using the on-site storm drain system.

On-site flows generated by the proposed project will be collected and conveyed using a combination of surface flows, curb and gutter, ribbon gutter, and storm drain lines to the proposed on-site bio-retention basin. The site essentially breaks down into 8 subareas. Area-1 and Area-2 (approximately 16.9 acres) surface flows into 2 low points and share the same storm drain system, Line-A. Area-OS-1 and Area-OS-2 (approximately 2.7 acres) sheet flow towards the proposed screen wall. The screen wall provides wall openings to allow offsite flows to be treated onsite for water quality. Area-3 and Area-4 (approximately

16.6 acres) also surface flows the runoff into 2 low points on the south side of the project site and conveys the runoff westerly using a storm drain system, Line-B. Line-A and Line-B drain the storm water into WQ Basin A, a bio-retention basin. Area-5 sheet flows to a curb cut and spills into WQ Basin A. WQ Basin A will utilize a 2.5 foot section of media (1.5' of amended soil media and 1' of gravel) to filter the runoff for water quality treatment. Low flows infiltrate down through the 2.5 foot section of designed media and into the perforated underdrain pipes within the gravel layer, which directly discharge into the proposed Outlet Structure A. The top of grate will be 0.5 feet above the basin bottom in order to retain and treat the required water quality volume as determined in the Preliminary Water Quality Management Plan (PWQMP). The storm water runoff will pond to the water quality height of 1435.0 before it's discharged into the proposed Outlet Structure A. Outlet Structure A will discharge into an existing line, Lateral A-B-2. Lateral A-B-2 conveys storm water into the Perris Valley Storm Drain Channel.

METHODOLOGY

HYDROLOGY

Hydrologic calculations were performed in accordance with the RCFC&WCD Hydrology Manual, dated April 1978. The Rational Method was utilized in determining peak flow rates.

The hydrological parameters, including rainfall values and soil types were derived from the RCFC&WCD Hydrology Manual. The isohyetal maps and soil map have been included in Section 2. The land use was assumed to be commercial for the developed as recommended in the hydrology manual.

Rational Method calculations were performed using a computer program developed by CivilDesign Corporation and Joseph E. Bonadiman and Associates Inc. The computer program is commonly referred to as CivilD which incorporates the hydrological parameters outlined in the RCFC&WCD Hydrology Manual.

The Rational Method was used to determine the peak flow rates used to size and design the subsurface storm drain systems to convey on-site flows to the proposed basin. The flow rates were computed by generating a hydrologic "link-node" model in which the overall area is divided into separate drainage sub-areas, each tributary to a concentration point (node) determined by the proposed layout and grading.

HYDRAULICS

Based on the results from the Rational Method Hydrology, a steady state hydraulic analysis of the storm drain system was performed to size/ analyze on-site subsurface storm drain systems. The facilities were analyzed under the established 100-year flow rates. The computer program, Water Surface and Pressure Gradient (WSPG) from CivilDesign, Corp. Version 14.06 (originally Los Angeles County Flood Control District Program F0515P) was used to analyze the system. For additional information and results, see Appendix A.

Normal depth calculations and inlet calculations were performed using the Hydraulic Toolbox 4.1 Software developed by Federal Highway Administration (FHWA) in cooperation with Aquaveo. For results, see Appendix B.

Water quality basin calculations were performed using spreadsheets that were created by RCFC&WCD. Preliminary calculations and additional details can be found in the Preliminary WQMP (P-WQMP). In addition, copies of the P-WQMP calculations have been included in Appendix B.

FIG. 1 VICINITY MAP

FIG. 2 USGS TOPOGRAPHY MAP

FIG. 3 AERIAL PHOTOGRAPH

FIG. 4 RECEIVING WATERBODIES

FIG. 5 SOILS MAP



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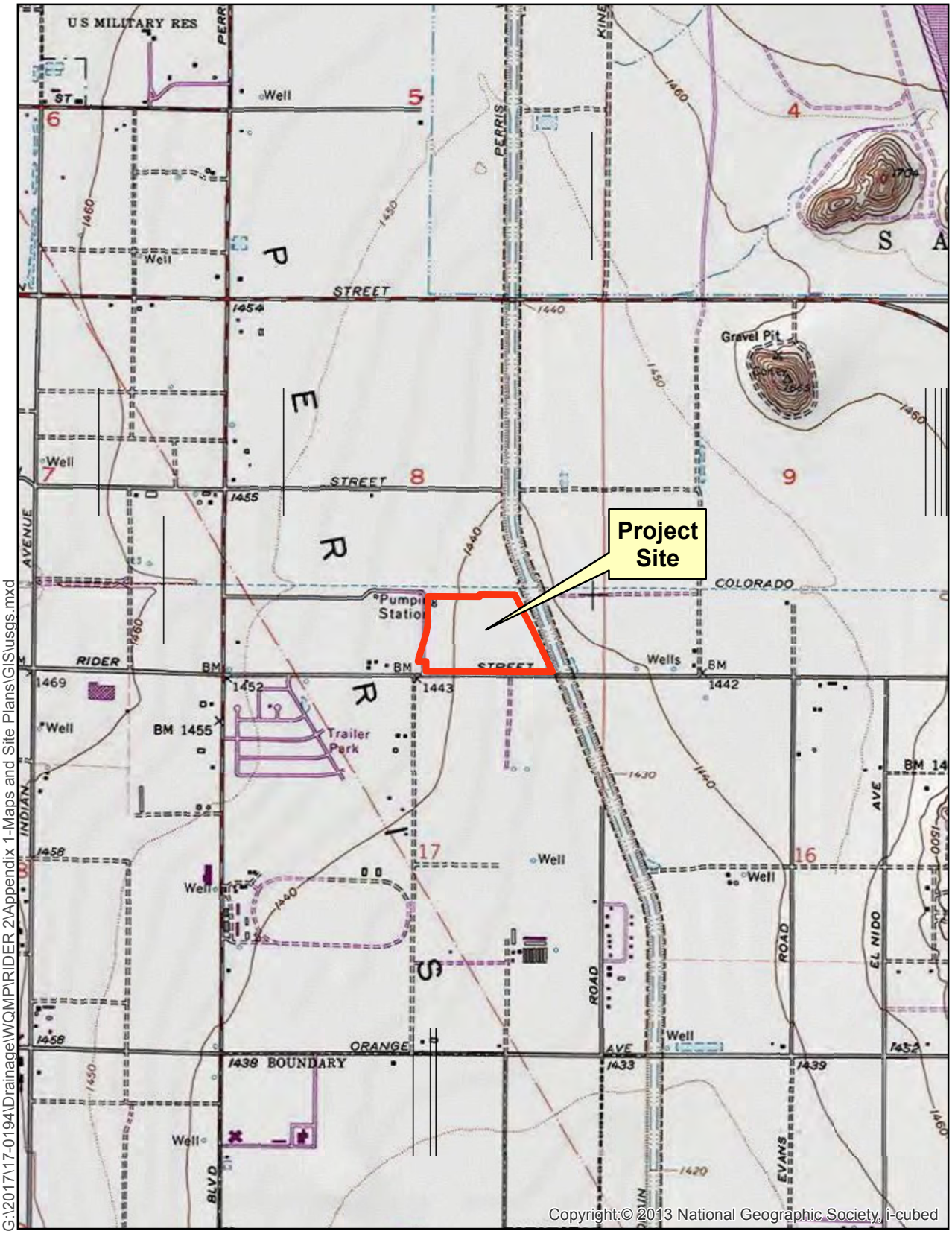
FIGURE 1: VICINITY MAP



G:\2017\17-0194\Drainage\WQMP\RIDER 2\Appendix 1-Maps and Site Plans\GIS\usgs.mxd

Sources: ESRI / USGS 7.5min Quad
DRGs: PERRIS

Figure 2. USGS Topography Map

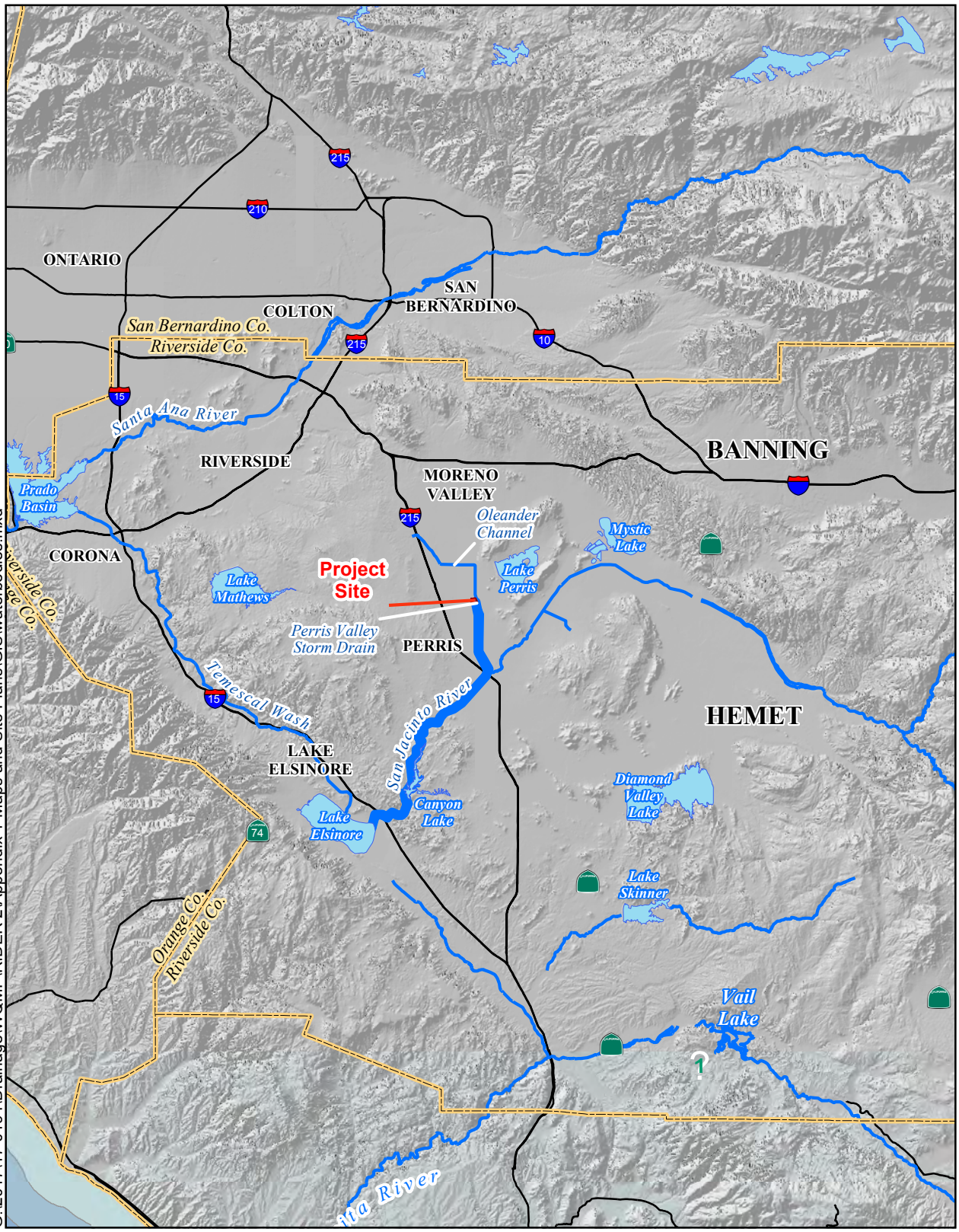
0 1,000 2,000
Feet



Sources: County of Riverside GIS, 2013; Eagle Aerial, April 2012.

Figure 3. Aerial Photograph

0 400 800 Feet



G:\2017\17-0194\Drainage\WQMP\RIDER 2\Appendix 1-Maps and Site Plans\GIS\waterbodies.mxd

Sources: USGS 30 Meter DEM;
USGS Digital Line Graph

Figure 4. Receiving Waterbodies

0 2 4 6
Miles

Flowpath



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Eagle Aerial, April 2010;
Riverside County GIS, 2012
RCFC&WCD Hydology Manual Plate C-1.30

N
W E
S

0 500 1,000
Feet

Soils Map

SECTION 2 - HYDROLOGY ANALYSIS

HYDROLOGY PARAMETERS

The RCFC&WCD Hydrology Manual was used to determine several of the hydrological parameters. The following rainfall depths were utilized in the hydrology analyses, which were obtained from the standard intensity-duration curve for Perris Valley from the manual:

Table 1 – Precipitation Values

	Duration
Storm Event	1-Hour (inches)
10-Year	0.45
100-Year	1.2

The value for slope of intensity was determined to be 0.45. The same rainfall data that was used in the drainage report for the design of Line-A-B. The standard intensity-duration curve for Perris (Plate D-4.1)

Based on the Plate C-1.30 (Perris) in the RCFC&WCD Hydrology Manual, the project site is comprised of soil type C. The soils map is included in Appendix A.

The cover type was determined based on the proposed use of the site and utilizing Plates D-5.5 and D-5.6 from the Hydrology Manual. The commercial landscaping cover type was used to represent the developed condition and the undeveloped "poor" condition was used to represent the offsite areas. The table below summarizes the runoff index values and recommended values for percentage each category of impervious cover:

Table 2 – Cover Type

Cover Type	Soil Group A	Soil Group B	Soil Group C	Soil Group D	Percentage of Impervious Cover
Commercial Landscaping	32	56	69	75	90
Undeveloped Poor	67	78	86	89	0

ON-SITE RATIONAL METHOD HYDROLOGY

The rational method was used to determine peak flow rates in order to adequately size the proposed subsurface storm drains and associated inlets used to convey on-site flows through the site and into the existing Line-A-B storm drain. The project site area was divided into 6 subareas.

Area-1 and Area-2 (approximately 16.9 acres) surface flows into 2 low points on the north side of the project and share the same storm drain system, Line-A. Area-OS-1 and Area-OS-2 (approximately 2.7

acres) also surface flow into these low points. A 100-year peak flow of 44.0 cfs is generated by these four sub areas. The runoff will be conveyed around the building towards Area-6 using Line-A.

Area-3 and Area-4 (approximately 16.6 acres) also surface flows the runoff into 2 low points on the south side of the project site and conveys the runoff westerly using a storm drain system, Line-B. A 100-year peak flow of 38.4 cfs is generated by these two sub areas. The runoff will be conveyed westerly towards Area-6.

Area-5 (approximately 1.7 acres) sheet flows into a curb cut and spill into Area-6. A 100-year peak flow of 3.5 cfs is generated by this sub area. The runoff will be conveyed westerly towards Area-6.

A peak 100 year flow rate of 88.0 cfs is generated by the site, including the off-site areas and basin area. An emergency escape route will be provided capable of bypassing the peak 100 year flow rate.

The following table summarizes the rational method results at key points:

Table 3 – Rational Method Results

Point of Interest	10-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
On-site Hydrology		
Node 101-Line-A Runoff generated from Area-1	12.4	19.8
Node 102-Line-A Runoff generated from Area-2	11.5	18.4
Node 102-Line-A Total Runoff conveyed to Line-A	27.4	44.0
Node 201-Line-B Runoff generated from Area-3	13.0	20.8
Node 202-Line-B Runoff generated from Area-4	10.9	17.6
Node 202-Line-B Total Runoff conveyed to Line-B	24.0	38.4
Node 301 Runoff generated from Area-5	2.1	3.5
Node 103 Runoff generated from Area-6	1.9	3.5
Total flow tributary for the project	54.5	87.8
Off-site Hydrology		
Node 101 Runoff generated from OS-1	2.4	4.0
Node 102 Runoff generated from OS-2	1.1	1.8

The rational method output files and hydrology map have been included in Appendix A.

SECTION 3 - HYDRAULIC ANALYSIS

ON-SITE STORM DRAIN FACILITIES

The project proposes two subsurface storm drain systems to convey on-site flows. The runoff will discharge into Outlet Structure A. The runoff from Outlet Structure A discharges into Lateral A-B-2 and then connects to an existing 8'W x 7'H RCB storm drain, Line-A-B. It then drains into the Perris Valley Storm Drain Channel.

A brief summary of each system has been provided and the results of the hydraulic analyses are included at the end of the section. The peak flow rates determined during the 100-year rational method on-site hydrology analysis were utilized to evaluate the proposed storm drain systems.

Outlet Structure A

The outlet structure was sized using the peak 100-year flow rate of 87.8 cfs. A weir calculation was utilized to size the Basin-A outlet. A grated inlet with 5 grates is proposed to handle the 100-year overflow. Based on a peak flow rate of 87.8 cfs, a total of 1.0-feet of head is required to bypass the 100-year flow rate resulting in a water surface elevation of 1435.7 feet. The calculation has been included in Appendix B.

Line-A (Onsite)

The north portion of the project site will surface flow to two low points in the north side of the truck court and be collected by Line-A. Line-A, a 30-inch HDPE storm drain that transitions into a 42-inch HDPE storm drain. Line-A proposes to convey the 100-year peak flow rate to Basin-A. A normal depth calculation was used to determine the appropriate size for Line-A. A hydraulic model for Line-A will be provided during final engineering to further access the storm drain design.

Line-B (Onsite)

The south portion of the project site will surface flow to two low points in the south side of the truck court and be collected by Line-B. Line-B, a 30-inch HDPE storm drain that transitions into a 36-inch HDPE storm drain. Line-B proposes to convey the 100-year peak flow rate to Basin-A. A normal depth calculation was used to determine the appropriate size for Line-B. A hydraulic model for Line-B will be provided during final engineering to further access the storm drain design.

Lateral A-B-2 (Offsite)

Lateral A-B-2 is an existing 24" reinforced concrete pipe (RCP) with a concrete bulkhead. Since the project proposes to discharge at one singular point, the junction structure will be redesigned to accommodate 87.8 cfs. A normal depth calculation was used to determine the appropriate size for Lateral A-B-2. Lateral A-B-2 will be a 54" RCP storm drain. A hydraulic model for Lateral A-B-2 will be provided during final engineering to further access the storm drain design. The previously approved hydraulic calculations for Lateral A-B-2 show that the project area, along with the offsite areas, were considered for sizing the storm drain Line-And that it was assumed to be commercial. Refer to Appendix C.

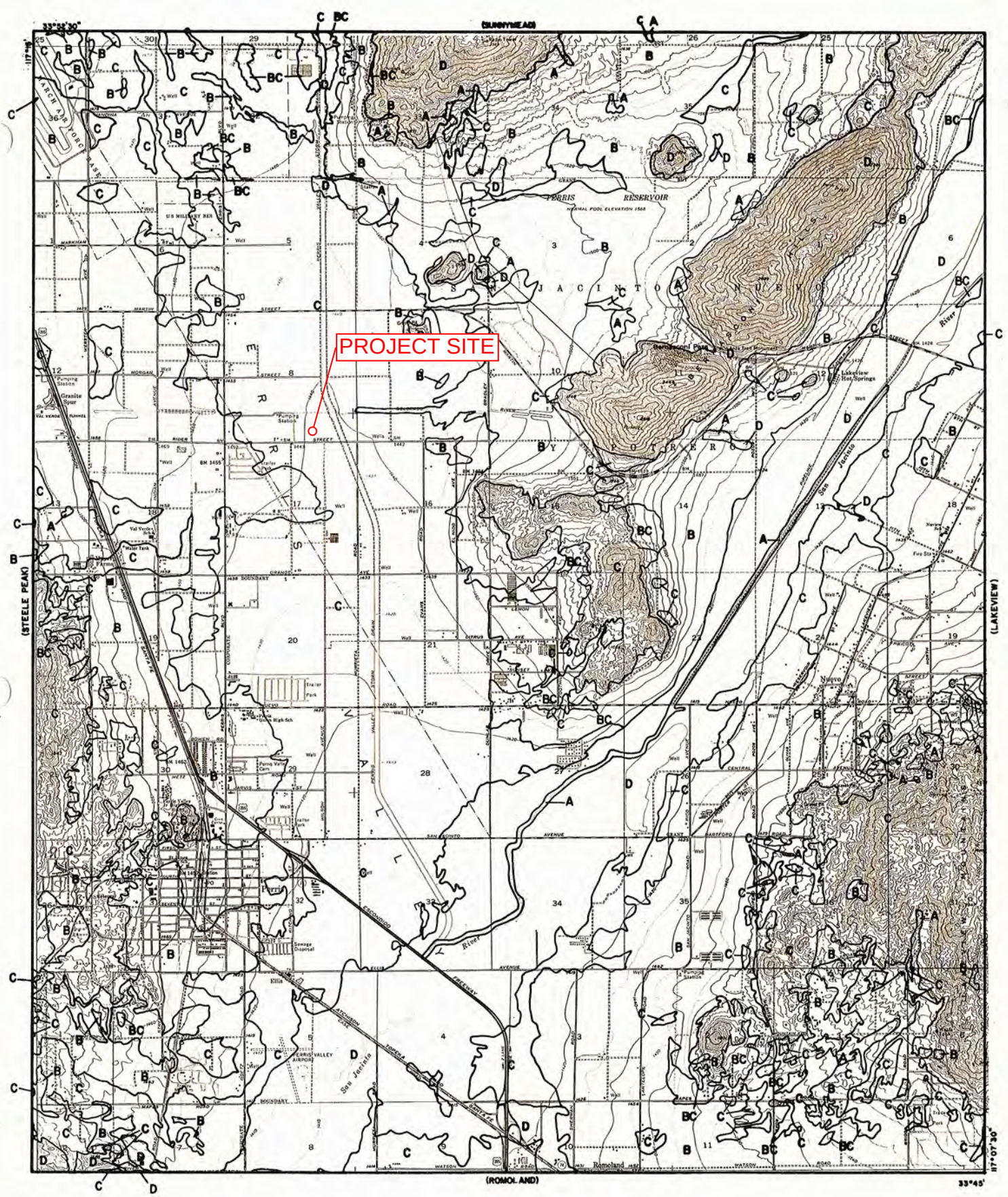
SECTION 4 - CONCLUSION

Based on the analyses and results of this report, the following conclusions were derived from the hydrology and hydraulic results:

- The proposed on-site subsurface storm drain systems will adequately convey flows to the basin and provide flood protection for the 100-year storm event.
- The proposed basins will adequately treat on-site flows.
- The proposed project will not impact flooding conditions to upstream or downstream properties.

APPENDIX A – HYDROLOGY

HYDROLOGY PARAMETERS



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

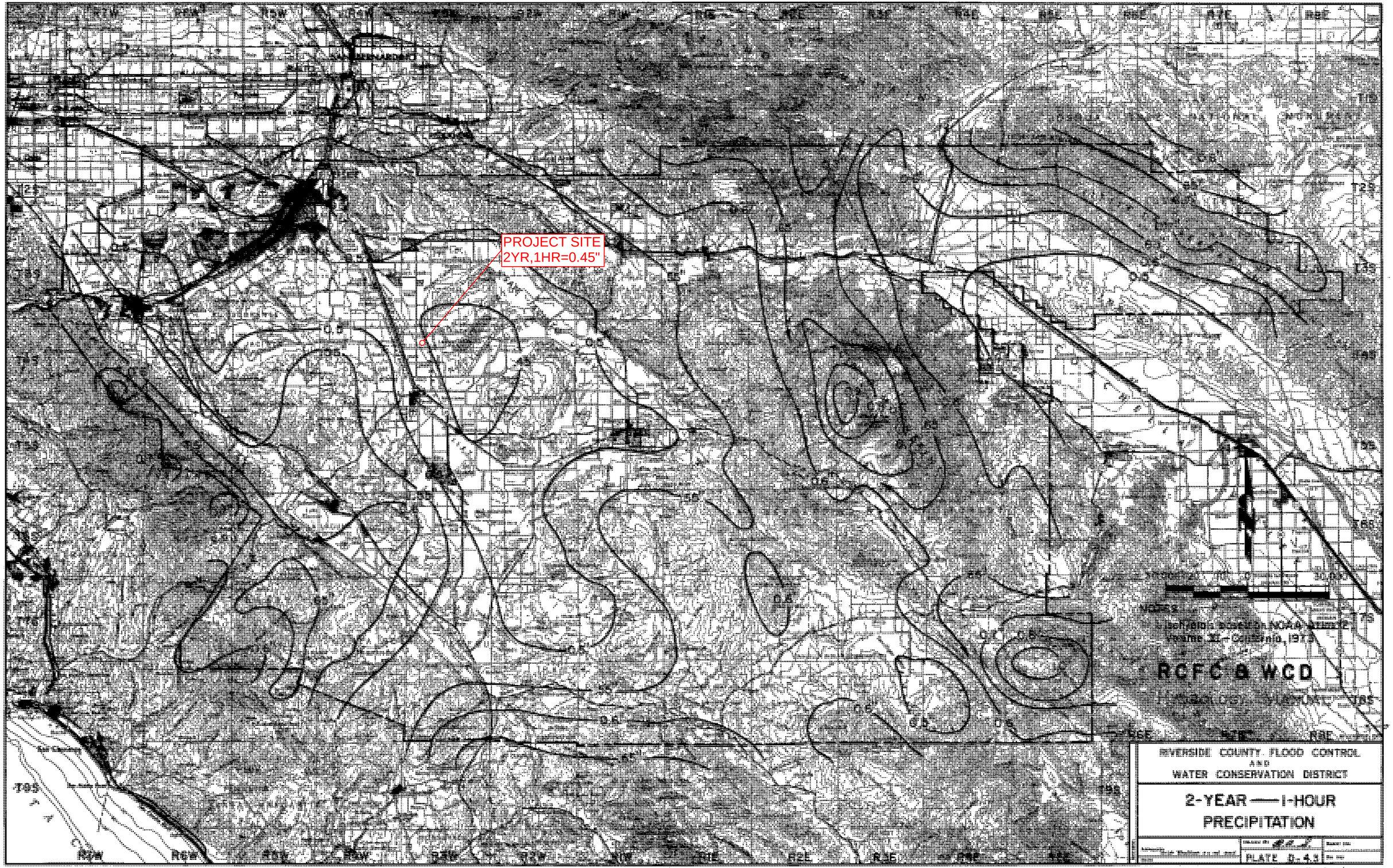
RCFC&WCD

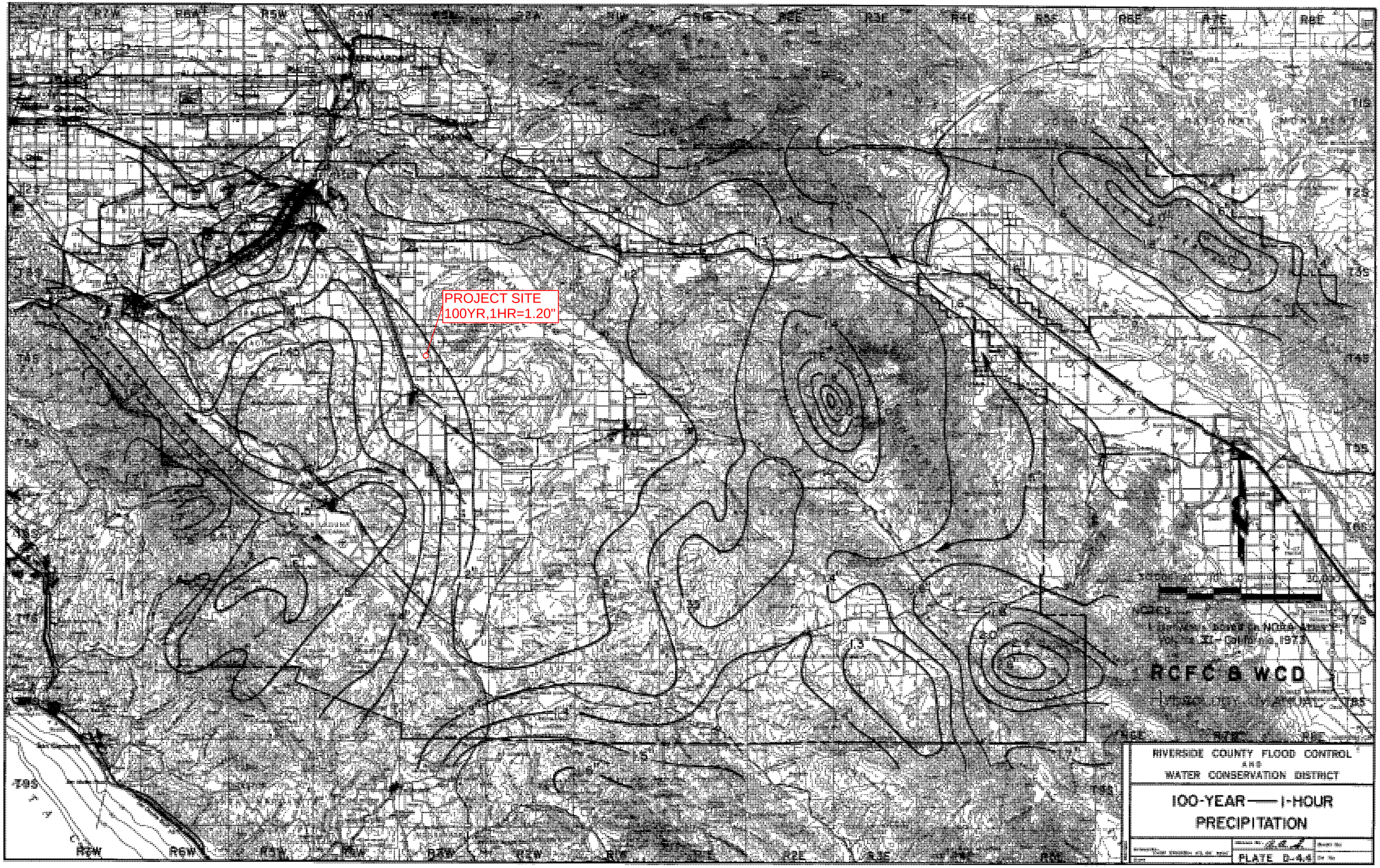
HYDROLOGY MANUAL

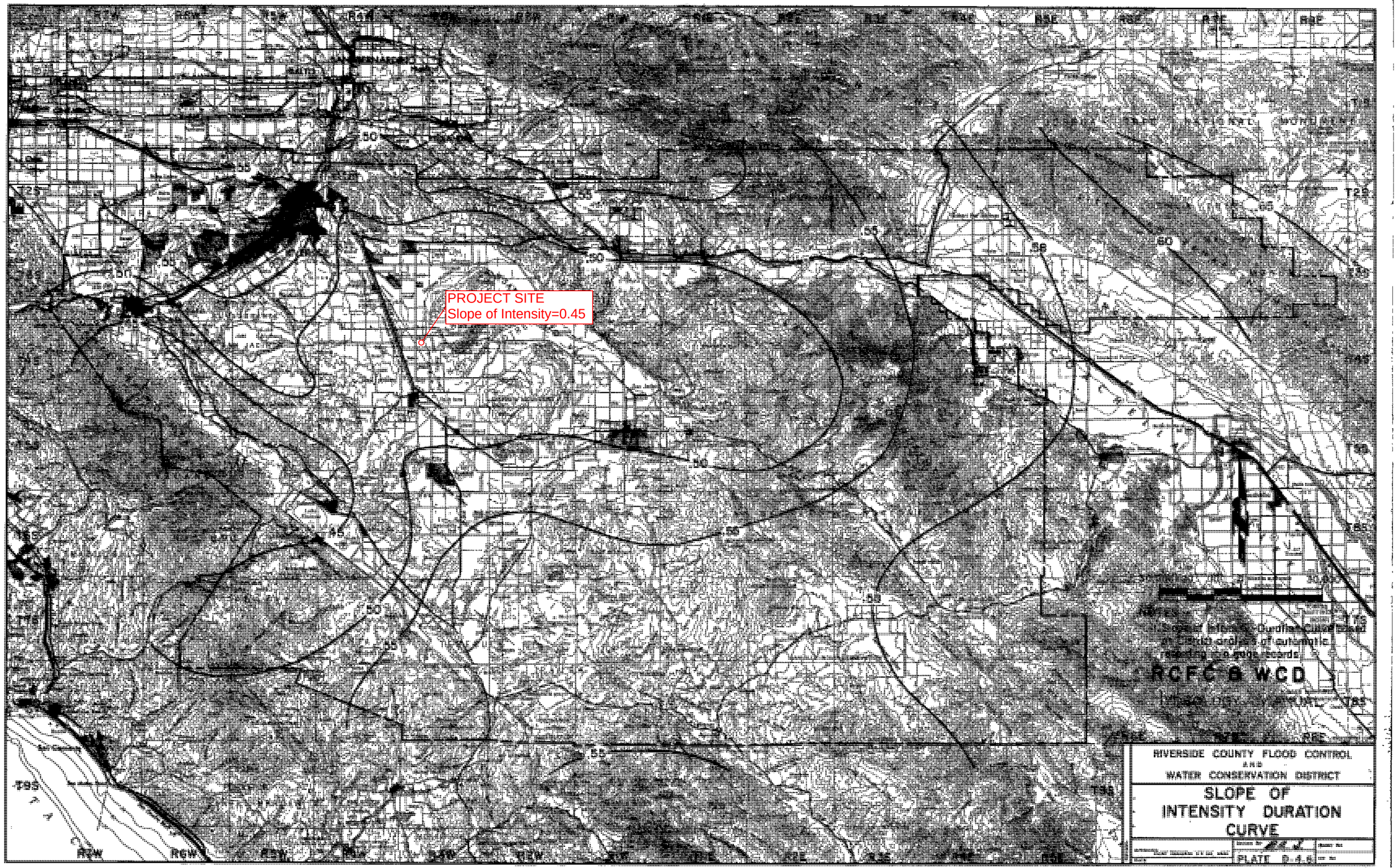
0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR PERRIS

PLATE C-1.30


PROJECT SITE
2YR,1HR=0.45"
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 1-HOUR
PRECIPITATION
PLATE D-4.3
RCFC & WCD


PROJECT SITE
100YR,1HR=1.20"
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
100-YEAR — 1-HOUR
PRECIPITATION
PLATE D-4.4
RCFC & WCD


PROJECT SITE
Slope of Intensity=0.45
RCFC & WCD
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
SLOPE OF
INTENSITY DURATION
CURVE
PLATE D-4.6

10-YEAR PROPOSED ONSITE HYDROLOGY (RATIONAL METHOD)

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
Rational Hydrology Study Date: 08/26/19 File:PROP10.out

17-0357 RIDER DISTRIBUTION CENTER II
RATIONAL METHOD HYDROLOGY - ONSITE/OFFSITE FLOWS
10 YEAR STORM EVENT
FN: PROP10.OUT MJS

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

English (in-lb) Units used in input data file

Program License Serial Number 4010

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 10.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.450(In.)
100 year, 1 hour precipitation = 1.200(In.)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.759(In/Hr)
Slope of intensity duration curve = 0.4500

++

Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 688.000(Ft.)
Top (of initial area) elevation = 1447.300(Ft.)
Bottom (of initial area) elevation = 1440.800(Ft.)
Difference in elevation = 6.500(Ft.)
Slope = 0.00945 s(percent)= 0.94
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.401 min.
Rainfall intensity = 1.669(In/Hr) for a 10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.876
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 12.431(CFS)
Total initial stream area = 8.500(Ac.)
Pervious area fraction = 0.100

++

Process from Point/Station 401.000 to Point/Station 401.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 86.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 10.40 min.
Rainfall intensity = 1.669(In/Hr) for a 10.0 year storm
Subarea runoff = 2.393(CFS) for 1.800(Ac.)

Total runoff = 14.824(CFS) Total area = 10.300(Ac.)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1437.900(Ft.)
Downstream point/station elevation = 1436.400(Ft.)
Pipe length = 512.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 14.824(CFS)
Nearest computed pipe diameter = 27.00(In.)
Calculated individual pipe flow = 14.824(CFS)
Normal flow depth in pipe = 18.54(In.)
Flow top width inside pipe = 25.05(In.)
Critical Depth = 16.09(In.)
Pipe flow velocity = 5.09(Ft/s)
Travel time through pipe = 1.68 min.
Time of concentration (TC) = 12.08 min.

++
Process from Point/Station 102.000 to Point/Station 102.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Runoff Coefficient = 0.875
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 12.08 min.
Rainfall intensity = 1.561(In/Hr) for a 10.0 year storm
Subarea runoff = 11.470(CFS) for 8.400(Ac.)
Total runoff = 26.294(CFS) Total area = 18.700(Ac.)

++
Process from Point/Station 402.000 to Point/Station 402.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.790
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 86.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 12.08 min.
Rainfall intensity = 1.561(In/Hr) for a 10.0 year storm
Subarea runoff = 1.110(CFS) for 0.900(Ac.)
Total runoff = 27.404(CFS) Total area = 19.600(Ac.)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1436.400(Ft.)
Downstream point/station elevation = 1434.000(Ft.)
Pipe length = 887.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 27.404(CFS)
Nearest computed pipe diameter = 33.00(In.)
Calculated individual pipe flow = 27.404(CFS)
Normal flow depth in pipe = 24.94(In.)
Flow top width inside pipe = 28.36(In.)
Critical Depth = 20.86(In.)
Pipe flow velocity = 5.69(Ft/s)
Travel time through pipe = 2.60 min.
Time of concentration (TC) = 14.67 min.

++
Process from Point/Station 102.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.600(Ac.)
Runoff from this stream =     27.404(CFS)
Time of concentration =   14.67 min.
Rainfall intensity =     1.430(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   635.000(Ft.)
Top (of initial area) elevation =  1447.300(Ft.)
Bottom (of initial area) elevation =  1440.700(Ft.)
Difference in elevation =     6.600(Ft.)
Slope =    0.01039  s(percent)=       1.04
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.883 min.
Rainfall intensity =      1.708(In/Hr) for a    10.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     13.026(CFS)
Total initial stream area =        8.700(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1437.100(Ft.)
Downstream point/station elevation =  1435.500(Ft.)
Pipe length  =   539.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    13.026(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    13.026(CFS)
Normal flow depth in pipe =   19.17(In.)
Flow top width inside pipe =   19.24(In.)
Critical Depth =   15.58(In.)
Pipe flow velocity =      4.84(Ft/s)
Travel time through pipe =    1.85 min.
Time of concentration (TC) =    11.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.875
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.74 min.
Rainfall intensity =      1.581(In/Hr) for a    10.0 year storm
Subarea runoff =      9.270(CFS) for      6.700(Ac.)
Total runoff =     22.295(CFS)  Total area =      15.400(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1435.500(Ft.)
Downstream point/station elevation =  1434.000(Ft.)
Pipe length  =   491.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    22.295(CFS)
Nearest computed pipe diameter  =     30.00(In.)
```

Calculated individual pipe flow = 22.295(CFS)
Normal flow depth in pipe = 22.41(In.)
Flow top width inside pipe = 26.09(In.)
Critical Depth = 19.29(In.)
Pipe flow velocity = 5.67(Ft/s)
Travel time through pipe = 1.44 min.
Time of concentration (TC) = 13.18 min.

++
Process from Point/Station 202.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 15.400(Ac.)
Runoff from this stream = 22.295(CFS)
Time of concentration = 13.18 min.
Rainfall intensity = 1.500(In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	27.404	14.67	1.430
2	22.295	13.18	1.500

Largest stream flow has longer time of concentration
Qp = 27.404 + sum of
Qb Ia/Ib
22.295 * 0.953 = 21.244
Qp = 48.648

Total of 2 main streams to confluence:
Flow rates before confluence point:
27.404 22.295
Area of streams before confluence:
19.600 15.400

Results of confluence:
Total flow rate = 48.648(CFS)
Time of concentration = 14.674 min.
Effective stream area after confluence = 35.000(Ac.)

++
Process from Point/Station 301.000 to Point/Station 103.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Runoff Coefficient = 0.873
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 14.67 min.
Rainfall intensity = 1.430(In/Hr) for a 10.0 year storm
Subarea runoff = 3.996(CFS) for 3.200(Ac.)
Total runoff = 52.644(CFS) Total area = 38.200(Ac.)

++
Process from Point/Station 103.000 to Point/Station 103.000
**** SUBAREA FLOW ADDITION ****

USER INPUT of soil data for subarea
Runoff Coefficient = 0.634
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 14.67 min.
Rainfall intensity = 1.430(In/Hr) for a 10.0 year storm
Subarea runoff = 1.813(CFS) for 2.000(Ac.)

PROP10

Total runoff = 54.457(CFS) Total area = 40.200(Ac.)
End of computations, total study area = 40.20 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.205
Area averaged RI index number = 70.1

100-YEAR PROPOSED ONSITE HYDROLOGY (RATIONAL METHOD)

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2004 Version 7.0
Rational Hydrology Study Date: 08/26/19 File:PROP100.out

17-0357 RIDER DISTRIBUTION CENTER II
RATIONAL METHOD HYDROLOGY - ONSITE/OFFSITE FLOWS
100 YEAR STORM EVENT
FN: PROP100.OUT MJS

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

English (in-lb) Units used in input data file

Program License Serial Number 4010

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation = 0.450(In.)
100 year, 1 hour precipitation = 1.200(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.200(In/Hr)
Slope of intensity duration curve = 0.4500

++
Process from Point/Station 100.000 to Point/Station 101.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 688.000(Ft.)
Top (of initial area) elevation = 1447.300(Ft.)
Bottom (of initial area) elevation = 1440.800(Ft.)
Difference in elevation = 6.500(Ft.)
Slope = 0.00945 s(percent)= 0.94
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.401 min.
Rainfall intensity = 2.640(In/Hr) for a 100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.883
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Initial subarea runoff = 19.825(CFS)
Total initial stream area = 8.500(Ac.)
Pervious area fraction = 0.100

++
Process from Point/Station 401.000 to Point/Station 401.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.832
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 86.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 10.40 min.
Rainfall intensity = 2.640(In/Hr) for a 100.0 year storm
Subarea runoff = 3.952(CFS) for 1.800(Ac.)

Total runoff = 23.777(CFS) Total area = 10.300(Ac.)

++
Process from Point/Station 101.000 to Point/Station 102.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1437.900(Ft.)
Downstream point/station elevation = 1436.400(Ft.)
Pipe length = 512.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 23.777(CFS)
Nearest computed pipe diameter = 30.00(In.)
Calculated individual pipe flow = 23.777(CFS)
Normal flow depth in pipe = 24.28(In.)
Flow top width inside pipe = 23.57(In.)
Critical Depth = 19.92(In.)
Pipe flow velocity = 5.59(Ft/s)
Travel time through pipe = 1.53 min.
Time of concentration (TC) = 11.93 min.

++
Process from Point/Station 102.000 to Point/Station 102.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Runoff Coefficient = 0.883
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 11.93 min.
Rainfall intensity = 2.482(In/Hr) for a 100.0 year storm
Subarea runoff = 18.402(CFS) for 8.400(Ac.)
Total runoff = 42.180(CFS) Total area = 18.700(Ac.)

++
Process from Point/Station 402.000 to Point/Station 402.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.828
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 86.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 11.93 min.
Rainfall intensity = 2.482(In/Hr) for a 100.0 year storm
Subarea runoff = 1.849(CFS) for 0.900(Ac.)
Total runoff = 44.029(CFS) Total area = 19.600(Ac.)

++
Process from Point/Station 102.000 to Point/Station 103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 1436.400(Ft.)
Downstream point/station elevation = 1434.000(Ft.)
Pipe length = 887.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 44.029(CFS)
Nearest computed pipe diameter = 39.00(In.)
Calculated individual pipe flow = 44.029(CFS)
Normal flow depth in pipe = 30.23(In.)
Flow top width inside pipe = 32.56(In.)
Critical Depth = 25.38(In.)
Pipe flow velocity = 6.38(Ft/s)
Travel time through pipe = 2.32 min.
Time of concentration (TC) = 14.25 min.

++
Process from Point/Station 102.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

```
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     19.600(Ac.)
Runoff from this stream =     44.029(CFS)
Time of concentration =   14.25 min.
Rainfall intensity =     2.292(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
Initial area flow distance =   635.000(Ft.)
Top (of initial area) elevation =  1447.300(Ft.)
Bottom (of initial area) elevation =  1440.700(Ft.)
Difference in elevation =     6.600(Ft.)
Slope =    0.01039  s(percent)=       1.04
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.883 min.
Rainfall intensity =      2.702(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     20.771(CFS)
Total initial stream area =        8.700(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1437.100(Ft.)
Downstream point/station elevation =  1435.500(Ft.)
Pipe length  =   539.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    20.771(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    20.771(CFS)
Normal flow depth in pipe =   21.40(In.)
Flow top width inside pipe =   27.13(In.)
Critical Depth =   18.59(In.)
Pipe flow velocity =      5.54(Ft/s)
Travel time through pipe =    1.62 min.
Time of concentration (TC) =    11.50 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      202.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.883
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.50 min.
Rainfall intensity =      2.523(In/Hr) for a   100.0 year storm
Subarea runoff =     14.924(CFS) for      6.700(Ac.)
Total runoff =     35.695(CFS)  Total area =      15.400(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      103.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =  1435.500(Ft.)
Downstream point/station elevation =  1434.000(Ft.)
Pipe length  =   491.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    35.695(CFS)
Nearest computed pipe diameter  =     36.00(In.)
```

Calculated individual pipe flow = 35.695(CFS)
Normal flow depth in pipe = 26.53(In.)
Flow top width inside pipe = 31.70(In.)
Critical Depth = 23.32(In.)
Pipe flow velocity = 6.39(Ft/s)
Travel time through pipe = 1.28 min.
Time of concentration (TC) = 12.78 min.

++
Process from Point/Station 202.000 to Point/Station 103.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area = 15.400(Ac.)
Runoff from this stream = 35.695(CFS)
Time of concentration = 12.78 min.
Rainfall intensity = 2.406(In/Hr)
Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	44.029	14.25	2.292
2	35.695	12.78	2.406

Largest stream flow has longer time of concentration
Qp = 44.029 + sum of
Qb Ia/Ib
35.695 * 0.952 = 33.998
Qp = 78.027

Total of 2 main streams to confluence:
Flow rates before confluence point:
44.029 35.695
Area of streams before confluence:
19.600 15.400

Results of confluence:
Total flow rate = 78.027(CFS)
Time of concentration = 14.246 min.
Effective stream area after confluence = 35.000(Ac.)

++
Process from Point/Station 301.000 to Point/Station 103.000
**** SUBAREA FLOW ADDITION ****

COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 0.100; Impervious fraction = 0.900
Time of concentration = 14.25 min.
Rainfall intensity = 2.292(In/Hr) for a 100.0 year storm
Subarea runoff = 6.464(CFS) for 3.200(Ac.)
Total runoff = 84.490(CFS) Total area = 38.200(Ac.)

++
Process from Point/Station 103.000 to Point/Station 103.000
**** SUBAREA FLOW ADDITION ****

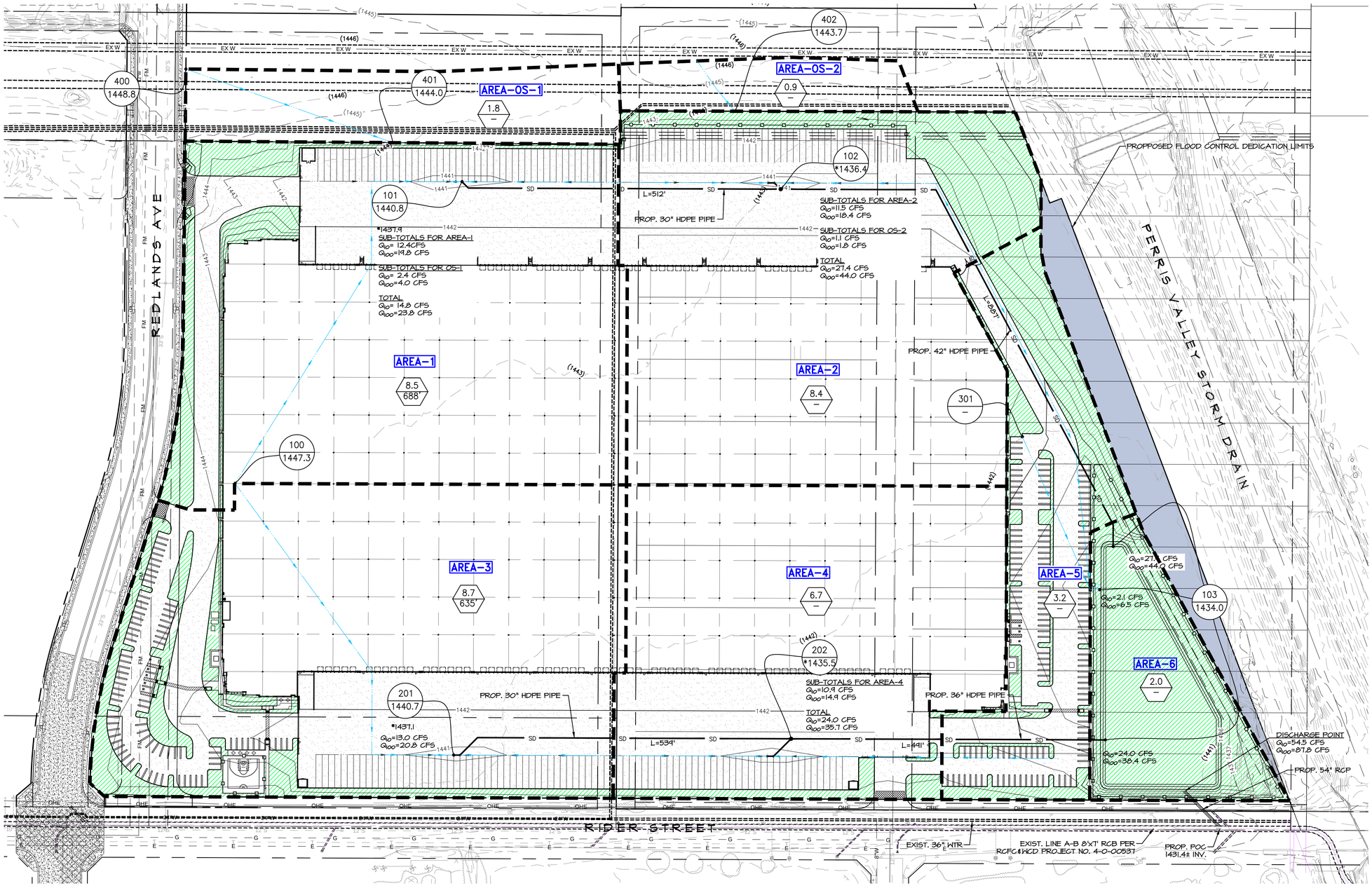
USER INPUT of soil data for subarea
Runoff Coefficient = 0.714
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 69.00
Pervious area fraction = 1.000; Impervious fraction = 0.000
Time of concentration = 14.25 min.
Rainfall intensity = 2.292(In/Hr) for a 100.0 year storm
Subarea runoff = 3.271(CFS) for 2.000(Ac.)

PROP100

Total runoff = 87.761(CFS) Total area = 40.200(Ac.)
End of computations, total study area = 40.20 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.205
Area averaged RI index number = 70.1

RATIONAL METHOD HYDROLOGY MAP



CITY OF PERRIS

ON-SITE RATIONAL METHOD HYDROLOGY MAP
RIDER DISTRIBUTION CENTER II
PX-XXXX

SCALE:	1"=80'	W.O.	17-0357
DATE:	8/26/19	SHEET	1
DESIGNED:	MJS	OF	1 SHEETS
CHECKED:	CRC		
PLN CK REF:		DWG. NO.	
F.B.			

ALBERT A. WEBB ASSOCIATES
ENGINEERING CONSULTANTS
3788 McCRAY STREET
RIVERSIDE CA. 92506
PH. (951) 686-1070
FAX (951) 788-1256

G:\2017\17-0357\DRAINAGE\HYDROLOGY\DWG FOLDER\17-0357-PHYD-RATIONAL.DWG 8/26/2019 10:17:02 AM

MITRS

APPENDIX B – HYDRAULICS

OUTLET STRUCTURE-A

Weir Inlet
Ponding Depth Calculation

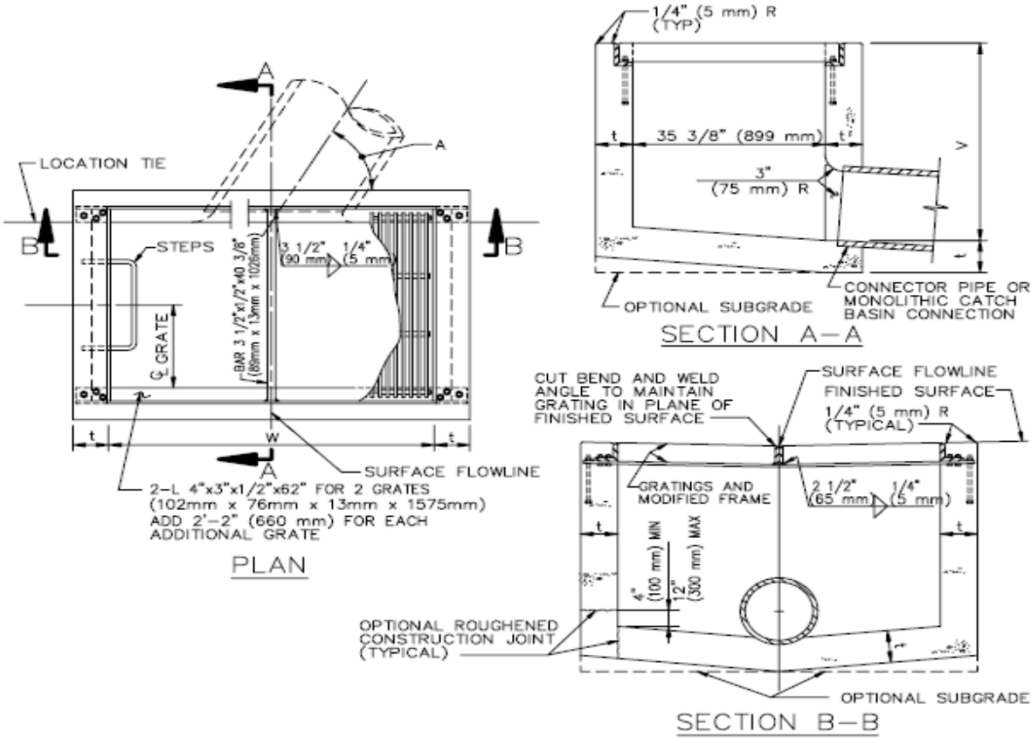
Designer:	MJS
Date:	6/4/2018
Project:	Rider II
Location:	Outlet Structure for WQ Basin-A

OUTLET STRUCTURE PONDING DEPTH SPPWC 305-3

DISCHARGE (cfs)		87.8	
NUMBER OF GRATES		5	
LENGTH (ft)		27.479	
WEIR COEFFICIENT	C	3	
WEIR LENGTH	L	27.479	ft^2
HEAD	h	1.04	ft
Flow	Q	87.80	cfs

$$Q = C L (h)^{3/2}$$

Top of Weir Elevation: 1434.7
Water Surface Elevation: 1435.7



LINE-A

Hydraulic Analysis Report

Project Data

Project Title: Rider Distribution Center II

Designer:

Project Date: Thursday, October 26, 2017

Project Units: U.S. Customary Units

Notes:

Channel Analysis: LINE A: NODE 101 TO NODE 102

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 23.8000 cfs

Result Parameters

Depth: 2.0009 ft

Area of Flow: 4.2116 ft^2

Wetted Perimeter: 5.5380 ft

Hydraulic Radius: 0.7605 ft

Average Velocity: 5.6510 ft/s

Top Width: 1.9987 ft

Froude Number: 0.6860

Critical Depth: 1.6614 ft

Critical Velocity: 6.8708 ft/s

Critical Slope: 0.0047 ft/ft

Critical Top Width: 2.36 ft

Calculated Max Shear Stress: 0.3746 lb/ft^2

Calculated Avg Shear Stress: 0.1424 lb/ft^2

Channel Analysis: LINE A: NODE 102 TO NODE 103

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 3.5000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 44.0000 cfs

Result Parameters

Depth: 2.2344 ft

Area of Flow: 6.4842 ft^2

Wetted Perimeter: 6.4795 ft

Hydraulic Radius: 1.0007 ft

Average Velocity: 6.7858 ft/s

Top Width: 3.3632 ft

Froude Number: 0.8612

Critical Depth: 2.0679 ft

Critical Velocity: 7.4362 ft/s

Critical Slope: 0.0038 ft/ft

Critical Top Width: 3.44 ft

Calculated Max Shear Stress: 0.4183 lb/ft^2

Calculated Avg Shear Stress: 0.1873 lb/ft^2

LINE-B

Hydraulic Analysis Report

Project Data

Project Title: Rider Distribution Center II

Designer:

Project Date: Thursday, October 26, 2017

Project Units: U.S. Customary Units

Notes:

Channel Analysis: LINE B: NODE 201 TO NODE 202

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 2.5000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 20.8000 cfs

Result Parameters

Depth: 1.7780 ft

Area of Flow: 3.7341 ft^2

Wetted Perimeter: 5.0173 ft

Hydraulic Radius: 0.7442 ft

Average Velocity: 5.5703 ft/s

Top Width: 2.2660 ft

Froude Number: 0.7647

Critical Depth: 1.5491 ft

Critical Velocity: 6.5105 ft/s

Critical Slope: 0.0044 ft/ft

Critical Top Width: 2.43 ft

Calculated Max Shear Stress: 0.3328 lb/ft^2

Calculated Avg Shear Stress: 0.1393 lb/ft^2

Channel Analysis: LINE B: NODE 202 TO NODE 103

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 3.0000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0120

Flow: 38.4000 cfs

Result Parameters

Depth: 2.3823 ft

Area of Flow: 6.0193 ft^2

Wetted Perimeter: 6.5988 ft

Hydraulic Radius: 0.9122 ft

Average Velocity: 6.3794 ft/s

Top Width: 2.4262 ft

Froude Number: 0.7137

Critical Depth: 2.0156 ft

Critical Velocity: 7.6038 ft/s

Critical Slope: 0.0045 ft/ft

Critical Top Width: 2.82 ft

Calculated Max Shear Stress: 0.4460 lb/ft^2

Calculated Avg Shear Stress: 0.1708 lb/ft^2

LATERAL A-B-2

Hydraulic Analysis Report

Project Data

Project Title: Rider Distribution Center II

Designer:

Project Date: Thursday, October 26, 2017

Project Units: U.S. Customary Units

Notes:

Channel Analysis: LATERAL AB-2

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 4.5000 ft

Longitudinal Slope: 0.0030 ft/ft

Manning's n: 0.0130

Flow: 87.8000 cfs

Result Parameters

Depth: 3.0870 ft

Area of Flow: 11.6301 ft^2

Wetted Perimeter: 8.7839 ft

Hydraulic Radius: 1.3240 ft

Average Velocity: 7.5494 ft/s

Top Width: 4.1770 ft

Froude Number: 0.7973

Critical Depth: 2.7466 ft

Critical Velocity: 8.6345 ft/s

Critical Slope: 0.0042 ft/ft

Critical Top Width: 4.39 ft

Calculated Max Shear Stress: 0.5779 lb/ft^2

Calculated Avg Shear Stress: 0.2479 lb/ft^2

WATER QUALITY CALCULATIONS FOR BASIN

*See Preliminary-WQMP for additional details

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Albert A. Webb Associates	Date	5/30/2018
Designed by	MJS	Case No	PX-XXXX
Company Project Number/Name	Rider II		

BMP Identification

BMP NAME / ID: Basin A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85} = 0.63 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
L-A	*164840*	*Ornamental Landscaping*	*0.1*	*0.11*	*18207.9*			
R-A	*822000*	*Roofs*	*1*	*0.89*	*733224*			
H-A	*582475*	*Concrete or Asphalt*	*1*	*0.89*	*519567.7*			
BMP-A	*54865*	*Ornamental Landscaping*	*0.1*	*0.11*	*6060.3*			
OS-A	*118925*	*Natural (C Soil)*	*0.3*	*0.23*	*26777.9*			

Bioretention Facility - Design Procedure	BMP ID: Basin A	Legend:	Required Entries / Calculated Cells

Company Name:	Albert A. Webb Associates	Date:	5/30/2018
Designed by:	MJS	County/City Case No.:	PX-XXX

Design Volume

Enter the area tributary to this feature	A_T=	40	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	68,500	ft^3

Type of Bioretention Facility Design

(●) Side slopes required (parallel to parking spaces or adjacent to walkways)

( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	50.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.34	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	51,273	ft^2
Proposed Surface Area	A=	54,865	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	2	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:		Other	

Notes:

APPENDIX C – REFERENCES

MS 94
PC # 10

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING

HYDROLOGY & HYDRAULIC CALCULATIONS

FOR

RIDER STREET STORM DRAIN
REINFORCED CONCRETE BOX
(MS94)
PERRIS VALLEY AREA DRAINAGE PLAN LINE "A-B"
PERRIS, CALIFORNIA 92571

PREPARED FOR

FIRST INDUSTRIAL REALTY TRUST - IRVINE
114 PACIFICA #220
IRVINE, CA 92618
(949) 486-1970

JUNE 10, 2009
REVISED SEPTEMBER 4, 2009
REVISED FEBRUARY 23, 2010

RECEIVED
JUN 09 2010
RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
DEVELOPMENT REVIEW/PLAN CHECK

JOB NO. 2702F

RECEIVED
OCT 06 2010
RIVERSIDE COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
DEVELOPMENT REVIEW/PLAN CHECK

PREPARED BY

THIENES ENGINEERING
14349 FIRESTONE BLVD.
LA MIRADA, CALIFORNIA 90638
(714) 521-4811

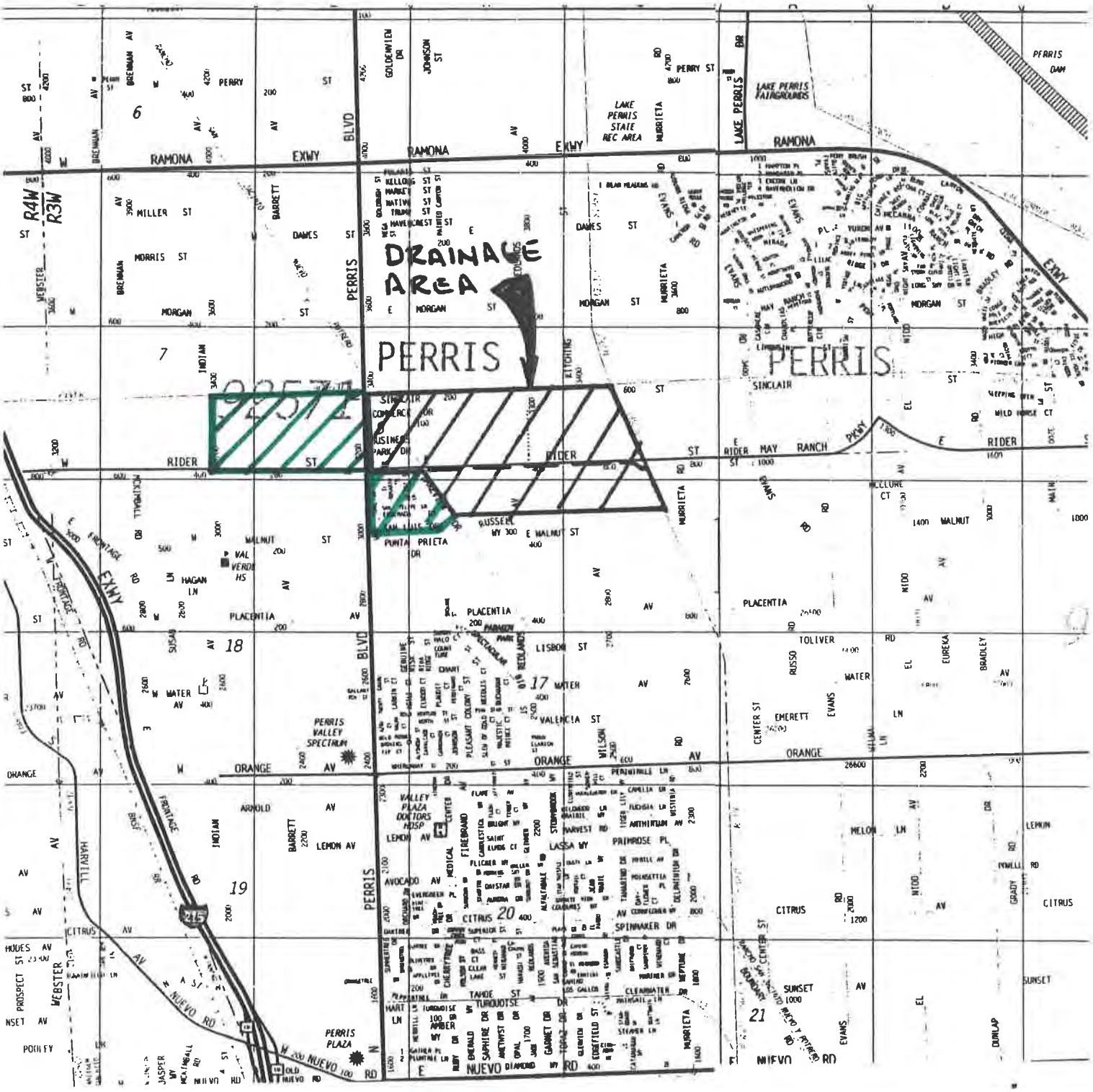

DRAINAGE AREA
PERRIS
PERRIS
RAMONA EXWY
RIDER ST
ORANGE AV
NUEVO RD
PERRIS BLVD
LAKE PERRIS STATE REC AREA
LAKE PERRIS FAIRGROUNDS
PERRIS DAM
PERRIS VALLEY SPECTRUM
PERRIS PLAZA
VALLEY PLAZA DOCTORS HOSP
VAL VERDE HS
R4W
R3W
215

FIGURE 1

DISCUSSION

This study covers the drainage area tributary to the Perris Valley Area Drainage Plan Line Number "A-B". Tributary area was determined from the Perris Valley Area Drainage Plan. Topography from Riverside County Flood Control quad sheets (Sections 7,8,17 & 18 of T.4S, R.3W) and survey information supports the drainage from the Perris Valley Area Drainage Plan.

Hydrology

Under existing conditions, areas west of Perris Boulevard drain to a small basin at the southwest corner of Perris Boulevard and Rider Street. The adjacent residential area and Perris Boulevard south of Rider Street drain in a southerly direction toward Placentia Avenue. A ridge and channel just north of Sinclair Street supports the northerly drainage boundary. There are areas south of Rider Street between Redlands Avenue and the Perris Valley Storm Channel that do not currently drain to Rider Street (this area appears to drain directly to the Channel). However, to be consistent with the Perris Valley Area Drainage Plan this area is added to the Rider Street storm drain.

Recent topography and field review also shows that an area south of Rider Street between Perris Boulevard and Lakeview is also tributary to Rider Street and has been incorporated into the Master Drainage Plan.

A hydrologic model was established using the original Master Plan as well as incorporating several proposed commercial developments within the drainage area. Also added to the hydrologic model is an area at the northwest corner of Perris Boulevard and Rider Street (approximately 71.4 acres). Per the Perris Valley Area Drainage Plan, this area is tabled to the "H" system, not Rider Street. However, both the City and County are agreeable to the addition of this area to Line "A-B". To accommodate the additional flow, the proposed storm drain was changed to an appropriately sized box culvert. Total drainage area is approximately 284 acres.

Runoff generally drains to Rider Street to a proposed storm drain. The drain traverses easterly and ultimately discharges to the Perris Valley Storm Channel. The 100-year peak flow rate tributary to the Channel from the storm drain is approximately 483 cfs. Runoff from the areas west of Perris Boulevard were modeled using the same areas, elevations and flow lengths from the Perris Valley Master Plan for Lateral "H-1" (see reference calculations in Appendix "D").

Runoff from areas north of Sinclair Street drain to an existing channel within the Sinclair Street right-of-way. The existing channel appears to end at Redlands Avenue. Here, recent survey shows that runoff in the channel will spillover the northerly side of the channel and sheet flow to the north. Topography suggests that flow would then cross over Redlands Avenue and then continue easterly toward the Perris Valley Storm Channel. Hydraulic calculations support that flow north of Sinclair Street would be unable to flow south to the Rider Street Storm drain. This is consistent with the Perris Valley Area Drainage Plan.

Riverside County Rational Method program (AES Software) was used for the hydrology calculations. The site is composed primarily of soil type "C" per the Riverside County Hydrology Manual. Please see Appendix "A" for hydrology calculations.

Hydraulics

Hydraulic calculations were computed using WSPG program. The hydraulic control (for the mainline) was the water surface elevation in the ultimate condition Channel when future improvements are complete (the channel will be considerably wider and deeper). This water surface elevation is approximately 1433 taken from the Master Drainage Plan for the Perris Valley Channel (from October 1989).

Hydraulic control for the laterals was determined by using the energy grade line (E.G.L.) in the mainline and subtracting the velocity head associated with each lateral. The County requested that the laterals each include a wall entrance loss (WE card in the WSPG program). A 180" pipe was assumed at the wall entrance to create a velocity close to zero (to approximately model ponding upstream at the headwall).

Flow intercepted by the flowby catch basins between Lakeview Drive and Redlands Avenue was added directly to the mainline peak flow rate for a conservative flow in the box culvert. At the sump catch basins, the remaining flow was added to yield the rational method peak flow at this location. Please see Appendix "B" for hydraulic calculations.

Catch basins

Catch basins will be added along Rider Street between Lakeview Drive and Redlands Avenue. These basins correspond to required street improvements for a project site on the south side of Rider Street. Rider Street east of Redlands Avenue is not fully improved at this time (no curb and gutter). Therefore, no catch basins have been proposed east of Redlands Avenue.

There are four flowby catch basins located on both the north and south side of Rider Street. The flow not intercepted at each of these basins can be intercepted in the sump basins located upstream of Redlands Avenue. Please see Appendix "C" for catch basin calculations.

```
**************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-99 Advanced Engineering Software (aes)
             Ver. 1.5A Release Date: 01/01/99  License ID 1435

                          Analysis prepared by:

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                            LA MIRADA CA 90638
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 ************************** DESCRIPTION OF STUDY **************************
* CITY OF PERRIS                                                          *
* MASTER PLAN HYDROLOGY FOR LINE "A-B"                                    *
* 100-YEAR COMMERCIAL DEVELOPMENT WITH AREA WEST OF PERRIS BLVD.          *
 **************************************************************************

  FILE NAME: C:\XDRIVE\2702\2702F\BOX2.DAT
  TIME/DATE OF STUDY: 13:18 08/26/2009
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.450
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.4500
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: CONSIDER ALL CONFLUENCE STREAM COMBINATIONS
        FOR ALL DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)   (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00  0.0313  0.167  0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE       1.00 TO NODE       2.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   850.00
  UPSTREAM ELEVATION =   1472.00
  DOWNSTREAM ELEVATION =   1464.00
  ELEVATION DIFFERENCE =      8.00
  TC = 0.303*[(  850.00**3)/(     8.00)]**.2 =   11.445
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.529
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8736
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =     19.22
  TOTAL AREA(ACRES) =      8.70   TOTAL RUNOFF(CFS) =     19.22

**************************************************************************
  FLOW PROCESS FROM NODE       2.00 TO NODE       3.00 IS CODE =  61
--------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
==========================================================================
  UPSTREAM ELEVATION(FEET) = 1464.00  DOWNSTREAM ELEVATION(FEET) = 1460.00
  STREET LENGTH(FEET) =   900.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 20.00
```

DATA FROM LAT H-1 HYDROLOGY

```
 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      44.44
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
        NOTE: STREET FLOW EXCEEDS TOP OF CURB.
        THE FOLLOWING STREET FLOW RESULTS ARE BASED ON THE ASSUMPTION
        THAT NEGLIBLE FLOW OCCURS OUTSIDE OF THE STREET CHANNEL.
        THAT IS, ALL FLOW ALONG THE PARKWAY, ETC., IS NEGLECTED.
   STREET FLOW DEPTH(FEET) =  0.70
   HALFSTREET FLOOD WIDTH(FEET) =   20.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.20
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.23
 STREET FLOW TRAVEL TIME(MIN.) =   4.68   Tc(MIN.) =  16.13
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.167
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8707
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   26.60      SUBAREA RUNOFF(CFS) =   50.20
 TOTAL AREA(ACRES) =   35.30        PEAK FLOW RATE(CFS) =      69.42

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.80   HALFSTREET FLOOD WIDTH(FEET) =  20.00
 FLOW VELOCITY(FEET/SEC.) =  3.83   DEPTH*VELOCITY(FT*FT/SEC.) =   3.07
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  900.0 FT WITH ELEVATION-DROP =   4.0 FT, IS   54.3 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE      3.00
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =  1750.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1460.00  DOWNSTREAM(FEET) =  1452.00
 FLOW LENGTH(FEET) =  1300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.05
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     69.42
 PIPE TRAVEL TIME(MIN.) =   2.39    Tc(MIN.) =  18.52
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =  3050.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.037
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8694
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =   36.10   SUBAREA RUNOFF(CFS) =   63.92
 TOTAL AREA(ACRES) =    71.40   TOTAL RUNOFF(CFS) =  133.34
 TC(MIN) =  18.52

****************************************************************************
 FLOW PROCESS FROM NODE      4.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1442.02  DOWNSTREAM(FEET) =  1438.71
 FLOW LENGTH(FEET) =  1104.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  47.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.06
 ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    133.34
 PIPE TRAVEL TIME(MIN.) =   2.28    Tc(MIN.) =  20.80
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    113.00 =  4154.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================
```

DATA FROM LAT. H-1 HYDROLOGY
SEE REFERENCE MATERIAL

```
****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
       ASSUMED INITIAL SUBAREA UNIFORM
       DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   780.00
 UPSTREAM ELEVATION =   1454.50
 DOWNSTREAM ELEVATION =   1450.50
 ELEVATION DIFFERENCE =      4.00
 TC = 0.303*[(  780.00**3)/(     4.00)]**.2 =   12.486
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.432
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8729
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =     12.74
 TOTAL AREA(ACRES) =      6.00   TOTAL RUNOFF(CFS) =     12.74

****************************************************************************
 FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1450.50  DOWNSTREAM ELEVATION(FEET) = 1448.50
 STREET LENGTH(FEET) =   450.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 28.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  23.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      19.11
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.56
   HALFSTREET FLOOD WIDTH(FEET) =   19.96
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.29
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.28
 STREET FLOW TRAVEL TIME(MIN.) =   3.28   Tc(MIN.) =  15.76
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.190
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8807
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    6.60      SUBAREA RUNOFF(CFS) =   12.73
 TOTAL AREA(ACRES) =   12.60        PEAK FLOW RATE(CFS) =      25.47

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.60   HALFSTREET FLOOD WIDTH(FEET) =  22.29
 FLOW VELOCITY(FEET/SEC.) =  2.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.49
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  1230.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1448.50  DOWNSTREAM ELEVATION(FEET) = 1446.00
 STREET LENGTH(FEET) =   475.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 28.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  23.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      31.81
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.63
   HALFSTREET FLOOD WIDTH(FEET) =   23.55
```

```
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.77
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.74
 STREET FLOW TRAVEL TIME(MIN.) =   2.86   Tc(MIN.) =  18.62
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.032
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8795
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    7.10      SUBAREA RUNOFF(CFS) =   12.69
 TOTAL AREA(ACRES) =   19.70        PEAK FLOW RATE(CFS) =      38.15

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.66   HALFSTREET FLOOD WIDTH(FEET) =  25.26
 FLOW VELOCITY(FEET/SEC.) =  2.90   DEPTH*VELOCITY(FT*FT/SEC.) =   1.93
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =  1705.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1442.00  DOWNSTREAM(FEET) =  1440.00
 FLOW LENGTH(FEET) =   450.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.92
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     38.15
 PIPE TRAVEL TIME(MIN.) =   1.08    Tc(MIN.) =  19.70
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  2155.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.981
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8791
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   13.70   SUBAREA RUNOFF(CFS) =   23.85
 TOTAL AREA(ACRES) =    33.40   TOTAL RUNOFF(CFS) =   62.01
 TC(MIN) =  19.70

****************************************************************************
 FLOW PROCESS FROM NODE    104.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1440.00  DOWNSTREAM(FEET) =  1438.20
 FLOW LENGTH(FEET) =   400.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  32.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.78
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     62.01
 PIPE TRAVEL TIME(MIN.) =   0.86    Tc(MIN.) =  20.56
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    124.00 =  2555.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   840.00
 UPSTREAM ELEVATION =   1454.50
 DOWNSTREAM ELEVATION =   1448.00
 ELEVATION DIFFERENCE =      6.50
 TC = 0.303*[(  840.00**3)/(     6.50)]**.2 =   11.846
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.490
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8733
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =      6.31
 TOTAL AREA(ACRES) =      2.90   TOTAL RUNOFF(CFS) =      6.31
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1448.00  DOWNSTREAM ELEVATION(FEET) = 1445.36
 STREET LENGTH(FEET) =   500.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.98
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.50
   HALFSTREET FLOOD WIDTH(FEET) =   17.00
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.27
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.13
 STREET FLOW TRAVEL TIME(MIN.) =   3.68   Tc(MIN.) =  15.52
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.205
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8710
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    1.34
 TOTAL AREA(ACRES) =    3.60        PEAK FLOW RATE(CFS) =       7.65

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.51   HALFSTREET FLOOD WIDTH(FEET) =  17.63
 FLOW VELOCITY(FEET/SEC.) =  2.32   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =  1340.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.205
 MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8275
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =    9.60   SUBAREA RUNOFF(CFS) =   17.52
 TOTAL AREA(ACRES) =    13.20   TOTAL RUNOFF(CFS) =   25.17
 TC(MIN) =  15.52

****************************************************************************
 FLOW PROCESS FROM NODE    112.00 TO NODE    113.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1439.30  DOWNSTREAM(FEET) =  1438.71
 FLOW LENGTH(FEET) =    35.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.28
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     25.17
 PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =  15.58
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    113.00 =  1375.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
    1       25.17     15.58        2.201        13.20
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    113.00 =  1375.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
```

```
    1      133.34    20.80       1.933       71.40
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    113.00 =  4154.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF       Tc      INTENSITY
 NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
    1      125.02      15.58        2.201
    2      155.44      20.80        1.933

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    155.44   Tc(MIN.) =   20.80
 TOTAL AREA(ACRES) =     84.60

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    113.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    113.00 TO NODE    122.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1438.71  DOWNSTREAM(FEET) =  1438.66
 FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  63.0 INCH PIPE IS  48.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.75
 ESTIMATED PIPE DIAMETER(INCH) =  63.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    155.44
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  20.83
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    122.00 =  4169.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  20.83
 RAINFALL INTENSITY(INCH/HR) =   1.93
 TOTAL STREAM AREA(ACRES) =   84.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    155.44

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    121.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
       ASSUMED INITIAL SUBAREA UNIFORM
       DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   740.00
 UPSTREAM ELEVATION =   1453.40
 DOWNSTREAM ELEVATION =   1448.00
 ELEVATION DIFFERENCE =      5.40
 TC = 0.303*[(  740.00**3)/(     5.40)]**.2 =   11.393
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.534
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8737
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =      5.98
 TOTAL AREA(ACRES) =      2.70   TOTAL RUNOFF(CFS) =      5.98

****************************************************************************
 FLOW PROCESS FROM NODE    121.00 TO NODE    122.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1448.00  DOWNSTREAM ELEVATION(FEET) = 1445.19
 STREET LENGTH(FEET) =   500.00   CURB HEIGHT(INCHES) =  8.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  27.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
```

```
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.26
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.52
   HALFSTREET FLOOD WIDTH(FEET) =   17.95
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.42
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.25
 STREET FLOW TRAVEL TIME(MIN.) =   3.44   Tc(MIN.) =  14.83
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.251
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8811
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    2.30      SUBAREA RUNOFF(CFS) =     4.56
 TOTAL AREA(ACRES) =    5.00        PEAK FLOW RATE(CFS) =      10.54

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  19.79
 FLOW VELOCITY(FEET/SEC.) =  2.57   DEPTH*VELOCITY(FT*FT/SEC.) =   1.42
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    122.00 =  1240.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    123.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1442.48  DOWNSTREAM(FEET) =  1438.66
 FLOW LENGTH(FEET) =    42.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.87
 ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     10.54
 PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =  14.88
 LONGEST FLOWPATH FROM NODE    120.00 TO NODE    123.00 =  1282.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    123.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.88
 RAINFALL INTENSITY(INCH/HR) =   2.25
 TOTAL STREAM AREA(ACRES) =    5.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.54

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc      INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       125.02    15.61        2.200         84.60
     1       155.44    20.83        1.932         84.60
     2        10.54    14.88        2.248          5.00

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc      INTENSITY
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)
     1       129.70    14.88        2.248
     2       135.33    15.61        2.200
     3       164.50    20.83        1.932

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    164.50   Tc(MIN.) =   20.83
 TOTAL AREA(ACRES) =     89.60
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    123.00 =  4169.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    123.00 TO NODE    124.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1438.66  DOWNSTREAM(FEET) =  1437.97
 FLOW LENGTH(FEET) =   231.00   MANNING'S N =  0.013
```

```
 DEPTH OF FLOW IN  66.0 INCH PIPE IS  49.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.54
 ESTIMATED PIPE DIAMETER(INCH) =  66.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    164.50
 PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =  21.28
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    124.00 =  4400.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1       129.70    15.36        2.216        89.60
     2       135.33    16.09        2.170        89.60
     3       164.50    21.28        1.913        89.60
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    124.00 =  4400.00 FEET.

 ** MEMORY BANK #  2 CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1        62.01    20.56        1.943        33.40
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    124.00 =  2555.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF        Tc       INTENSITY
 NUMBER      (CFS)      (MIN.)    (INCH/HOUR)
     1      176.02       15.36        2.216
     2      183.85       16.09        2.170
     3      220.91       20.56        1.943
     4      225.55       21.28        1.913

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    225.55   Tc(MIN.) =   21.28
 TOTAL AREA(ACRES) =    123.00

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    124.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 2 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    132.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1437.94  DOWNSTREAM(FEET) =  1435.69
 FLOW LENGTH(FEET) =   746.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  72.0 INCH PIPE IS  58.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.14
 ESTIMATED PIPE DIAMETER(INCH) =  72.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    225.55
 PIPE TRAVEL TIME(MIN.) =   1.36    Tc(MIN.) =  22.64
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    132.00 =  5146.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    132.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  22.64
 RAINFALL INTENSITY(INCH/HR) =   1.86
 TOTAL STREAM AREA(ACRES) =  123.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    225.55

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    131.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
```

```
 INITIAL SUBAREA FLOW-LENGTH =   980.00
 UPSTREAM ELEVATION =   1446.00
 DOWNSTREAM ELEVATION =   1442.64
 ELEVATION DIFFERENCE =      3.36
 TC = 0.303*[(  980.00**3)/(     3.36)]**.2 =   14.827
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.251
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8811
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      1.98
 TOTAL AREA(ACRES) =      1.00   TOTAL RUNOFF(CFS) =      1.98

****************************************************************************
 FLOW PROCESS FROM NODE    131.00 TO NODE    132.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1436.35  DOWNSTREAM(FEET) =  1435.69
 FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.86
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      1.98
 PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =  14.92
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    132.00 =  1014.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    132.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.92
 RAINFALL INTENSITY(INCH/HR) =   2.24
 TOTAL STREAM AREA(ACRES) =    1.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.98

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       176.02    16.80         2.128         123.00
     1       183.85    17.49         2.089         123.00
     1       220.91    21.92         1.888         123.00
     1       225.55    22.64         1.860         123.00
     2         1.98    14.92         2.244           1.00

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       158.81    14.92         2.244
     2       177.90    16.80         2.128
     3       185.69    17.49         2.089
     4       222.58    21.92         1.888
     5       227.19    22.64         1.860

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    227.19   Tc(MIN.) =   22.64
 TOTAL AREA(ACRES) =    124.00
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    132.00 =  5146.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1435.69  DOWNSTREAM(FEET) =  1435.66
 FLOW LENGTH(FEET) =    12.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  75.0 INCH PIPE IS  60.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.54
 ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    227.19
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  22.67
 LONGEST FLOWPATH FROM NODE      1.00 TO NODE    142.00 =  5158.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  22.67
 RAINFALL INTENSITY(INCH/HR) =   1.86
 TOTAL STREAM AREA(ACRES) =  124.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    227.19

****************************************************************************
 FLOW PROCESS FROM NODE    140.00 TO NODE    141.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
       ASSUMED INITIAL SUBAREA UNIFORM
       DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   980.00
 UPSTREAM ELEVATION =   1446.00
 DOWNSTREAM ELEVATION =   1442.70
 ELEVATION DIFFERENCE =      3.30
 TC = 0.303*[(  980.00**3)/(     3.30)]**.2 =   14.880
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.247
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8811
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      8.32
 TOTAL AREA(ACRES) =      4.20   TOTAL RUNOFF(CFS) =      8.32

****************************************************************************
 FLOW PROCESS FROM NODE    141.00 TO NODE    142.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1439.47  DOWNSTREAM(FEET) =  1435.66
 FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  17.61
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      8.32
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  14.91
 LONGEST FLOWPATH FROM NODE    140.00 TO NODE    142.00 =  1007.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    142.00 TO NODE    142.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.91
 RAINFALL INTENSITY(INCH/HR) =   2.25
 TOTAL STREAM AREA(ACRES) =    4.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.32

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       158.81     14.95         2.243         124.00
     1       177.90     16.82         2.127         124.00
     1       185.69     17.52         2.088         124.00
     1       222.58     21.94         1.887         124.00
     1       227.19     22.67         1.860         124.00
     2         8.32     14.91         2.246           4.20

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       166.67     14.91         2.246
     2       167.12     14.95         2.243
     3       185.77     16.82         2.127
     4       193.43     17.52         2.088
```

```
    5       229.56    21.94       1.887
    6       234.08    22.67       1.860

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    234.08   Tc(MIN.) =   22.67
  TOTAL AREA(ACRES) =    128.20
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE    142.00 =  5158.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    142.00 TO NODE    154.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1435.66  DOWNSTREAM(FEET) =  1435.42
  FLOW LENGTH(FEET) =    82.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  75.0 INCH PIPE IS  57.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.23
  ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    234.08
  PIPE TRAVEL TIME(MIN.) =   0.15    Tc(MIN.) =  22.82
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE    154.00 =  5240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE     80.00 TO NODE     81.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS MOBILE HOME PARK
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   670.00
  UPSTREAM ELEVATION =   1454.50
  DOWNSTREAM ELEVATION =   1450.00
  ELEVATION DIFFERENCE =      4.50
  TC = 0.336*[(  670.00**3)/(     4.50)]**.2 =   12.337
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.445
  MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8325
  SOIL CLASSIFICATION IS "B"
  SUBAREA RUNOFF(CFS) =      5.90
  TOTAL AREA(ACRES) =      2.90   TOTAL RUNOFF(CFS) =      5.90

****************************************************************************
  FLOW PROCESS FROM NODE     81.00 TO NODE     82.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 1450.00  DOWNSTREAM ELEVATION(FEET) = 1448.20
  STREET LENGTH(FEET) =   680.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 18.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.35
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   16.86
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.73
  STREET FLOW TRAVEL TIME(MIN.) =   7.17   Tc(MIN.) =  19.51
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.989
  MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8224
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =    4.20      SUBAREA RUNOFF(CFS) =    6.87
  TOTAL AREA(ACRES) =    7.10        PEAK FLOW RATE(CFS) =      12.77
```

```
 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  18.20
 FLOW VELOCITY(FEET/SEC.) =  1.74   DEPTH*VELOCITY(FT*FT/SEC.) =   0.88
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE     82.00 =  1350.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     82.00 TO NODE     92.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1448.20  DOWNSTREAM ELEVATION(FEET) = 1447.40
 STREET LENGTH(FEET) =   400.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.42
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.54
   HALFSTREET FLOOD WIDTH(FEET) =   19.91
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.67
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.90
 STREET FLOW TRAVEL TIME(MIN.) =   4.00   Tc(MIN.) =  23.51
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.829
 MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8181
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =    2.20      SUBAREA RUNOFF(CFS) =    3.29
 TOTAL AREA(ACRES) =    9.30        PEAK FLOW RATE(CFS) =      16.07

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  20.70
 FLOW VELOCITY(FEET/SEC.) =  1.73   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE     92.00 =  1750.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     92.00 TO NODE     92.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  23.51
 RAINFALL INTENSITY(INCH/HR) =   1.83
 TOTAL STREAM AREA(ACRES) =    9.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.07

****************************************************************************
 FLOW PROCESS FROM NODE     90.00 TO NODE     91.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS MOBILE HOME PARK
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   700.00
 UPSTREAM ELEVATION =   1451.00
 DOWNSTREAM ELEVATION =   1448.50
 ELEVATION DIFFERENCE =      2.50
 TC = 0.336*[(  700.00**3)/(     2.50)]**.2 =   14.246
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.292
 MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8294
 SOIL CLASSIFICATION IS "B"
 SUBAREA RUNOFF(CFS) =      3.99
 TOTAL AREA(ACRES) =      2.10   TOTAL RUNOFF(CFS) =      3.99

****************************************************************************
 FLOW PROCESS FROM NODE     91.00 TO NODE     92.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
```

```
 UPSTREAM ELEVATION(FEET) = 1448.50  DOWNSTREAM ELEVATION(FEET) = 1447.40
 STREET LENGTH(FEET) =   500.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.43
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.41
   HALFSTREET FLOOD WIDTH(FEET) =   14.12
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.29
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
 STREET FLOW TRAVEL TIME(MIN.) =   6.48   Tc(MIN.) =  20.73
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.936
 MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8210
 SOIL CLASSIFICATION IS "B"
 SUBAREA AREA(ACRES) =    1.80      SUBAREA RUNOFF(CFS) =    2.86
 TOTAL AREA(ACRES) =    3.90        PEAK FLOW RATE(CFS) =       6.85

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.49
 FLOW VELOCITY(FEET/SEC.) =  1.36   DEPTH*VELOCITY(FT*FT/SEC.) =   0.59
 LONGEST FLOWPATH FROM NODE     90.00 TO NODE     92.00 =  1200.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     92.00 TO NODE     92.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  20.73
 RAINFALL INTENSITY(INCH/HR) =   1.94
 TOTAL STREAM AREA(ACRES) =    3.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.85

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1        16.07     23.51         1.829          9.30
     2         6.85     20.73         1.936          3.90

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1        21.02     20.73        1.936
     2        22.54     23.51        1.829

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     22.54   Tc(MIN.) =   23.51
 TOTAL AREA(ACRES) =     13.20
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE     92.00 =  1750.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     92.00 TO NODE     93.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) = 1447.40  DOWNSTREAM ELEVATION(FEET) = 1447.00
 STREET LENGTH(FEET) =   120.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 18.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  13.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =    0.0149
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =    0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      22.62
   ***STREET FLOWING FULL***
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.57
   HALFSTREET FLOOD WIDTH(FEET) =   21.31
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.30
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.30
 STREET FLOW TRAVEL TIME(MIN.) =   0.87   Tc(MIN.) =  24.38
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.800
 MOBILE HOME PARK DEVELOPMENT RUNOFF COEFFICIENT = .8438
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.15
 TOTAL AREA(ACRES) =   13.30       PEAK FLOW RATE(CFS) =      22.69

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  21.37
 FLOW VELOCITY(FEET/SEC.) =  2.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.31
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE     93.00 =  1870.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     93.00 TO NODE    151.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1442.00  DOWNSTREAM(FEET) =  1438.00
 FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.16
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     22.69
 PIPE TRAVEL TIME(MIN.) =   0.55    Tc(MIN.) =  24.93
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    151.00 =  2170.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     93.00 TO NODE    151.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.782
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8774
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    4.40   SUBAREA RUNOFF(CFS) =    6.88
 TOTAL AREA(ACRES) =    17.70   TOTAL RUNOFF(CFS) =   29.57
 TC(MIN) =  24.93

****************************************************************************
 FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1438.00  DOWNSTREAM(FEET) =  1437.20
 FLOW LENGTH(FEET) =   330.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.14
 ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     29.57
 PIPE TRAVEL TIME(MIN.) =   1.07    Tc(MIN.) =  26.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    152.00 =  2500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    151.00 TO NODE    152.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.748
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8770
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    3.60   SUBAREA RUNOFF(CFS) =    5.52
 TOTAL AREA(ACRES) =    21.30   TOTAL RUNOFF(CFS) =   35.09
 TC(MIN) =  26.00

****************************************************************************
 FLOW PROCESS FROM NODE    152.00 TO NODE    153.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1437.20  DOWNSTREAM(FEET) =  1435.70
 FLOW LENGTH(FEET) =   730.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.01
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     35.09
 PIPE TRAVEL TIME(MIN.) =   2.43    Tc(MIN.) =  28.43
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    153.00 =  3230.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    152.00 TO NODE    153.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.680
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8763
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    9.70   SUBAREA RUNOFF(CFS) =   14.28
 TOTAL AREA(ACRES) =    31.00   TOTAL RUNOFF(CFS) =   49.37
 TC(MIN) =  28.43

****************************************************************************
 FLOW PROCESS FROM NODE    153.00 TO NODE    154.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1435.70  DOWNSTREAM(FEET) =  1435.39
 FLOW LENGTH(FEET) =   100.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  31.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.43
 ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     49.37
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =  28.68
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    154.00 =  3330.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1        49.20    25.94        1.750        31.00
     2        49.37    28.68        1.673        31.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    154.00 =  3330.00 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1       166.67    15.07        2.235       128.20
     2       167.12    15.11        2.232       128.20
     3       185.77    16.98        2.118       128.20
     4       193.43    17.68        2.080       128.20
     5       229.56    22.09        1.881       128.20
     6       234.08    22.82        1.854       128.20
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE    154.00 =     0.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
     1      195.25      15.07        2.235
     2      195.78      15.11        2.232
     3      217.98      16.98        2.118
     4      226.96      17.68        2.080
     5      271.47      22.09        1.881
     6      277.35      22.82        1.854
     7      270.14      25.94        1.750
     8      260.53      28.68        1.673

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    277.35   Tc(MIN.) =   22.82
 TOTAL AREA(ACRES) =    159.20

****************************************************************************
 FLOW PROCESS FROM NODE    154.00 TO NODE    154.00 IS CODE =  12
```

```
------------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
==============================================================================

******************************************************************************
 FLOW PROCESS FROM NODE     154.00 TO NODE     162.00 IS CODE =  31
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1435.39  DOWNSTREAM(FEET) =  1434.53
 FLOW LENGTH(FEET) =   287.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  78.0 INCH PIPE IS  63.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.61
 ESTIMATED PIPE DIAMETER(INCH) =  78.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    277.35
 PIPE TRAVEL TIME(MIN.) =   0.50    Tc(MIN.) =  23.31
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    162.00 =  3617.00 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  23.31
 RAINFALL INTENSITY(INCH/HR) =   1.84
 TOTAL STREAM AREA(ACRES) =  159.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    277.35

******************************************************************************
 FLOW PROCESS FROM NODE     160.00 TO NODE     161.00 IS CODE =  21
------------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   400.00
 UPSTREAM ELEVATION =   1443.40
 DOWNSTREAM ELEVATION =   1441.93
 ELEVATION DIFFERENCE =      1.47
 TC = 0.303*[(  400.00**3)/(     1.47)]**.2 =   10.218
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.662
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8835
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      1.65
 TOTAL AREA(ACRES) =      0.70   TOTAL RUNOFF(CFS) =      1.65

******************************************************************************
 FLOW PROCESS FROM NODE     161.00 TO NODE     162.00 IS CODE =  31
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1435.91  DOWNSTREAM(FEET) =  1434.53
 FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.27
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      1.65
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  10.30
 LONGEST FLOWPATH FROM NODE     160.00 TO NODE    162.00 =   434.00 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE     162.00 TO NODE     162.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  10.30
 RAINFALL INTENSITY(INCH/HR) =   2.65
 TOTAL STREAM AREA(ACRES) =    0.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.65

 ** CONFLUENCE DATA **
```

```
 STREAM     RUNOFF      Tc      INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1      195.25    15.61       2.200        159.20
     1      195.78    15.65       2.197        159.20
     1      217.98    17.51       2.089        159.20
     1      226.96    18.19       2.053        159.20
     1      271.47    22.59       1.862        159.20
     1      277.35    23.31       1.836        159.20
     1      270.14    26.44       1.735        159.20
     1      260.53    29.18       1.660        159.20
     2        1.65    10.30       2.652          0.70

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1      130.45    10.30       2.652
     2      196.62    15.61       2.200
     3      197.14    15.65       2.197
     4      219.28    17.51       2.089
     5      228.23    18.19       2.053
     6      272.63    22.59       1.862
     7      278.49    23.31       1.836
     8      271.22    26.44       1.735
     9      261.56    29.18       1.660

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    278.49   Tc(MIN.) =   23.31
 TOTAL AREA(ACRES) =    159.90
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    162.00 =  3617.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    162.00 TO NODE    172.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1434.53  DOWNSTREAM(FEET) =  1434.49
 FLOW LENGTH(FEET) =    14.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  81.0 INCH PIPE IS  61.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.58
 ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    278.49
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  23.34
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    172.00 =  3631.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    172.00 TO NODE    172.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  23.34
 RAINFALL INTENSITY(INCH/HR) =   1.84
 TOTAL STREAM AREA(ACRES) =  159.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    278.49

****************************************************************************
 FLOW PROCESS FROM NODE    170.00 TO NODE    171.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   500.00
 UPSTREAM ELEVATION =   1444.00
 DOWNSTREAM ELEVATION =   1441.86
 ELEVATION DIFFERENCE =      2.14
 TC = 0.303*[(  500.00**3)/(     2.14)]**.2 =   10.836
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.592
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8831
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      5.04
 TOTAL AREA(ACRES) =      2.20   TOTAL RUNOFF(CFS) =      5.04

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    171.00 TO NODE    172.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1438.73  DOWNSTREAM(FEET) =  1434.49
 FLOW LENGTH(FEET) =    30.00   MANNING'S N =  0.013
 ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.55
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      5.04
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  10.87
 LONGEST FLOWPATH FROM NODE    170.00 TO NODE    172.00 =   530.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    172.00 TO NODE    172.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  10.87
 RAINFALL INTENSITY(INCH/HR) =   2.59
 TOTAL STREAM AREA(ACRES) =    2.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.04

 ** CONFLUENCE DATA **
 STREAM      RUNOFF      Tc      INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       130.45    10.33        2.649        159.90
     1       196.62    15.63        2.198        159.90
     1       197.14    15.68        2.195        159.90
     1       219.28    17.53        2.088        159.90
     1       228.23    18.22        2.052        159.90
     1       272.63    22.61        1.862        159.90
     1       278.49    23.34        1.835        159.90
     1       271.22    26.46        1.734        159.90
     1       261.56    29.21        1.659        159.90
     2         5.04    10.87        2.589          2.20

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF      Tc      INTENSITY
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)
     1       135.23    10.33       2.649
     2       141.71    10.87       2.589
     3       200.89    15.63       2.198
     4       201.41    15.68       2.195
     5       223.34    17.53       2.088
     6       232.22    18.22       2.052
     7       276.25    22.61       1.862
     8       282.06    23.34       1.835
     9       274.60    26.46       1.734
    10       264.79    29.21       1.659

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    282.06   Tc(MIN.) =   23.34
 TOTAL AREA(ACRES) =    162.10
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    172.00 =  3631.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    172.00 TO NODE    182.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1434.49  DOWNSTREAM(FEET) =  1434.03
 FLOW LENGTH(FEET) =   155.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  81.0 INCH PIPE IS  61.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.76
 ESTIMATED PIPE DIAMETER(INCH) =  81.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    282.06
 PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =  23.60
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    182.00 =  3786.00 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  23.60
 RAINFALL INTENSITY(INCH/HR) =   1.83
 TOTAL STREAM AREA(ACRES) =  162.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    282.06

****************************************************************************
 FLOW PROCESS FROM NODE    180.00 TO NODE    181.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =  1000.00
 UPSTREAM ELEVATION =   1446.00
 DOWNSTREAM ELEVATION =   1443.00
 ELEVATION DIFFERENCE =      3.00
 TC = 0.303*[( 1000.00**3)/(     3.00)]**.2 =   15.352
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.216
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8808
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     15.42
 TOTAL AREA(ACRES) =      7.90   TOTAL RUNOFF(CFS) =     15.42

****************************************************************************
 FLOW PROCESS FROM NODE    181.00 TO NODE    182.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1434.86  DOWNSTREAM(FEET) =  1434.03
 FLOW LENGTH(FEET) =    58.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.59
 ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     15.42
 PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =  15.46
 LONGEST FLOWPATH FROM NODE    180.00 TO NODE    182.00 =  1058.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    182.00 TO NODE    182.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  15.46
 RAINFALL INTENSITY(INCH/HR) =   2.21
 TOTAL STREAM AREA(ACRES) =    7.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.42

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       135.23     10.65         2.613         162.10
     1       141.71     11.18         2.556         162.10
     1       200.89     15.92         2.180         162.10
     1       201.41     15.96         2.177         162.10
     1       223.34     17.82         2.072         162.10
     1       232.22     18.49         2.038         162.10
     1       276.25     22.88         1.852         162.10
     1       282.06     23.60         1.826         162.10
     1       274.60     26.73         1.727         162.10
     1       264.79     29.48         1.652         162.10
     2        15.42     15.46         2.209           7.90

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       145.85     10.65         2.613
```

```
     2      152.86    11.18       2.556
     3      210.54    15.46       2.209
     4      216.11    15.92       2.180
     5      216.62    15.96       2.177
     6      237.81    17.82       2.072
     7      246.45    18.49       2.038
     8      289.18    22.88       1.852
     9      294.81    23.60       1.826
    10      286.65    26.73       1.727
    11      276.32    29.48       1.652

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    294.81   Tc(MIN.) =   23.60
 TOTAL AREA(ACRES) =    170.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    182.00 =  3786.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    182.00 TO NODE    195.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1434.03  DOWNSTREAM(FEET) =  1433.93
 FLOW LENGTH(FEET) =    23.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  75.0 INCH PIPE IS  59.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.27
 ESTIMATED PIPE DIAMETER(INCH) =  75.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    294.81
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  23.64
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    195.00 =  3809.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  23.64
 RAINFALL INTENSITY(INCH/HR) =   1.82
 TOTAL STREAM AREA(ACRES) =  170.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    294.81

****************************************************************************
 FLOW PROCESS FROM NODE    190.00 TO NODE    191.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   430.00
 UPSTREAM ELEVATION =   1445.00
 DOWNSTREAM ELEVATION =   1439.50
 ELEVATION DIFFERENCE =      5.50
 TC = 0.303*[(  430.00**3)/(     5.50)]**.2 =    8.196
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.939
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8848
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     13.00
 TOTAL AREA(ACRES) =      5.00   TOTAL RUNOFF(CFS) =     13.00

****************************************************************************
 FLOW PROCESS FROM NODE    191.00 TO NODE    192.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1436.50  DOWNSTREAM(FEET) =  1435.80
 FLOW LENGTH(FEET) =   465.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.54
 ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     13.00
 PIPE TRAVEL TIME(MIN.) =   2.19    Tc(MIN.) =  10.39
 LONGEST FLOWPATH FROM NODE    190.00 TO NODE    192.00 =   895.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    191.00 TO NODE    192.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.642
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8834
SOIL CLASSIFICATION IS "C"
SUBAREA AREA(ACRES) =    6.20   SUBAREA RUNOFF(CFS) =   14.47
TOTAL AREA(ACRES) =    11.20   TOTAL RUNOFF(CFS) =   27.47
TC(MIN) =  10.39

****************************************************************************
FLOW PROCESS FROM NODE    192.00 TO NODE    193.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1435.80  DOWNSTREAM(FEET) =  1435.50
FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  42.0 INCH PIPE IS  30.7 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.64
ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     27.47
PIPE TRAVEL TIME(MIN.) =   1.37    Tc(MIN.) =  11.76
LONGEST FLOWPATH FROM NODE    190.00 TO NODE    193.00 =  1195.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    192.00 TO NODE    193.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.499
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8826
SOIL CLASSIFICATION IS "C"
SUBAREA AREA(ACRES) =    5.80   SUBAREA RUNOFF(CFS) =   12.79
TOTAL AREA(ACRES) =    17.00   TOTAL RUNOFF(CFS) =   40.26
TC(MIN) =  11.76

****************************************************************************
FLOW PROCESS FROM NODE    193.00 TO NODE    194.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1435.50  DOWNSTREAM(FEET) =  1434.20
FLOW LENGTH(FEET) =   960.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  45.0 INCH PIPE IS  34.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.46
ESTIMATED PIPE DIAMETER(INCH) =  45.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     40.26
PIPE TRAVEL TIME(MIN.) =   3.59    Tc(MIN.) =  15.35
LONGEST FLOWPATH FROM NODE    190.00 TO NODE    194.00 =  2155.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    193.00 TO NODE    194.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.216
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8809
SOIL CLASSIFICATION IS "C"
SUBAREA AREA(ACRES) =   13.10   SUBAREA RUNOFF(CFS) =   25.58
TOTAL AREA(ACRES) =    30.10   TOTAL RUNOFF(CFS) =   65.84
TC(MIN) =  15.35

****************************************************************************
FLOW PROCESS FROM NODE    193.00 TO NODE    194.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.216
UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7085
SOIL CLASSIFICATION IS "C"
SUBAREA AREA(ACRES) =    3.90   SUBAREA RUNOFF(CFS) =    6.12
TOTAL AREA(ACRES) =    34.00   TOTAL RUNOFF(CFS) =   71.96
TC(MIN) =  15.35

****************************************************************************
FLOW PROCESS FROM NODE    194.00 TO NODE    195.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
```

```
 ELEVATION DATA: UPSTREAM(FEET) =  1434.20  DOWNSTREAM(FEET) =  1433.96
 FLOW LENGTH(FEET) =   250.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  60.0 INCH PIPE IS  45.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.54
 ESTIMATED PIPE DIAMETER(INCH) =  60.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     71.96
 PIPE TRAVEL TIME(MIN.) =   0.92    Tc(MIN.) =  16.26
 LONGEST FLOWPATH FROM NODE    190.00 TO NODE    195.00 =  2405.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    195.00 TO NODE    195.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  16.26
 RAINFALL INTENSITY(INCH/HR) =   2.16
 TOTAL STREAM AREA(ACRES) =   34.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     71.96

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       145.85    10.69        2.608        170.00
    1       152.86    11.22        2.552        170.00
    1       210.54    15.50        2.206        170.00
    1       216.11    15.96        2.178        170.00
    1       216.62    16.00        2.175        170.00
    1       237.81    17.85        2.071        170.00
    1       246.45    18.53        2.036        170.00
    1       289.18    22.92        1.850        170.00
    1       294.81    23.64        1.825        170.00
    1       286.65    26.77        1.726        170.00
    1       276.32    29.51        1.651        170.00
    2        71.96    16.26        2.159         34.00

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       193.14    10.69        2.608
    2       202.52    11.22        2.552
    3       279.13    15.50        2.206
    4       286.72    15.96        2.178
    5       287.42    16.00        2.175
    6       288.60    16.26        2.159
    7       306.81    17.85        2.071
    8       314.31    18.53        2.036
    9       350.85    22.92        1.850
   10       355.63    23.64        1.825
   11       344.16    26.77        1.726
   12       331.36    29.51        1.651

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    355.63   Tc(MIN.) =   23.64
 TOTAL AREA(ACRES) =    204.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    195.00 =  3809.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    195.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1433.93  DOWNSTREAM(FEET) =  1432.66
 FLOW LENGTH(FEET) =   423.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  87.0 INCH PIPE IS  67.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.33
 ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    355.63
 PIPE TRAVEL TIME(MIN.) =   0.68    Tc(MIN.) =  24.32
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    202.00 =  4232.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =   1
```

```
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  24.32
 RAINFALL INTENSITY(INCH/HR) =   1.80
 TOTAL STREAM AREA(ACRES) =  204.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    355.63

****************************************************************************
 FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
------------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
       ASSUMED INITIAL SUBAREA UNIFORM
       DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   780.00
 UPSTREAM ELEVATION =   1443.50
 DOWNSTREAM ELEVATION =   1441.00
 ELEVATION DIFFERENCE =      2.50
 TC = 0.303*[(  780.00**3)/(     2.50)]**.2 =   13.717
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.331
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8816
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     14.80
 TOTAL AREA(ACRES) =      7.20   TOTAL RUNOFF(CFS) =     14.80

****************************************************************************
 FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1434.22  DOWNSTREAM(FEET) =  1432.66
 FLOW LENGTH(FEET) =    54.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.05
 ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     14.80
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  13.80
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =   834.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  13.80
 RAINFALL INTENSITY(INCH/HR) =   2.33
 TOTAL STREAM AREA(ACRES) =    7.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     14.80

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1      193.14    11.48        2.525        204.00
     1      202.52    12.00        2.476        204.00
     1      279.13    16.23        2.161        204.00
     1      286.72    16.68        2.135        204.00
     1      287.42    16.72        2.133        204.00
     1      288.60    16.98        2.118        204.00
     1      306.81    18.57        2.034        204.00
     1      314.31    19.23        2.002        204.00
     1      350.85    23.60        1.826        204.00
     1      355.63    24.32        1.802        204.00
     1      344.16    27.45        1.706        204.00
     1      331.36    30.21        1.634        204.00
     2       14.80    13.80        2.325          7.20

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1      205.46    11.48       2.525
     2      215.39    12.00       2.476
     3      252.04    13.80       2.325
     4      292.88    16.23       2.161
     5      300.31    16.68       2.135
     6      300.99    16.72       2.133
     7      302.08    16.98       2.118
     8      319.76    18.57       2.034
     9      327.06    19.23       2.002
    10      362.47    23.60       1.826
    11      367.10    24.32       1.802
    12      355.02    27.45       1.706
    13      341.76    30.21       1.634

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    367.10   Tc(MIN.) =   24.32
  TOTAL AREA(ACRES) =    211.20
  LONGEST FLOWPATH FROM NODE     80.00 TO NODE    202.00 =  4232.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    212.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1432.66  DOWNSTREAM(FEET) =  1431.42
  FLOW LENGTH(FEET) =   413.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  87.0 INCH PIPE IS  69.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.34
  ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =    367.10
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =  24.98
  LONGEST FLOWPATH FROM NODE     80.00 TO NODE    212.00 =  4645.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    212.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  24.98
  RAINFALL INTENSITY(INCH/HR) =   1.78
  TOTAL STREAM AREA(ACRES) =  211.20
  PEAK FLOW RATE(CFS) AT CONFLUENCE =    367.10

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH =   800.00
  UPSTREAM ELEVATION =   1442.00
  DOWNSTREAM ELEVATION =   1440.00
  ELEVATION DIFFERENCE =      2.00
  TC = 0.303*[(  800.00**3)/(     2.00)]**.2 =   14.562
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.269
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8812
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =     13.80
  TOTAL AREA(ACRES) =      6.90   TOTAL RUNOFF(CFS) =     13.80

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    212.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1432.85  DOWNSTREAM(FEET) =  1431.42
  FLOW LENGTH(FEET) =    44.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     13.80
  PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =  14.63
  LONGEST FLOWPATH FROM NODE    210.00 TO NODE    212.00 =   844.00 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    212.00 TO NODE    212.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.63
 RAINFALL INTENSITY(INCH/HR) =   2.26
 TOTAL STREAM AREA(ACRES) =    6.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.80

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       205.46     12.24         2.453         211.20
     1       215.39     12.76         2.409         211.20
     1       252.04     14.53         2.271         211.20
     1       292.88     16.93         2.120         211.20
     1       300.31     17.37         2.096         211.20
     1       300.99     17.42         2.094         211.20
     1       302.08     17.68         2.080         211.20
     1       319.76     19.25         2.001         211.20
     1       327.06     19.91         1.971         211.20
     1       362.47     24.27         1.803         211.20
     1       367.10     24.98         1.780         211.20
     1       355.02     28.12         1.688         211.20
     1       341.76     30.88         1.618         211.20
     2        13.80     14.63         2.265           6.90

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       217.01     12.24         2.453
     2       227.43     12.76         2.409
     3       265.75     14.53         2.271
     4       266.78     14.63         2.265
     5       305.80     16.93         2.120
     6       313.08     17.37         2.096
     7       313.75     17.42         2.094
     8       314.75     17.68         2.080
     9       331.95     19.25         2.001
    10       339.07     19.91         1.971
    11       373.45     24.27         1.803
    12       377.94     24.98         1.780
    13       365.30     28.12         1.688
    14       351.62     30.88         1.618

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    377.94   Tc(MIN.) =   24.98
 TOTAL AREA(ACRES) =    218.10
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    212.00 =  4645.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    212.00 TO NODE    223.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1431.42  DOWNSTREAM(FEET) =  1431.38
 FLOW LENGTH(FEET) =    13.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  87.0 INCH PIPE IS  71.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.48
 ESTIMATED PIPE DIAMETER(INCH) =  87.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    377.94
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  25.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    223.00 =  4658.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  25.00
```

```
 RAINFALL INTENSITY(INCH/HR) =   1.78
 TOTAL STREAM AREA(ACRES) =  218.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    377.94

****************************************************************************
 FLOW PROCESS FROM NODE    220.00 TO NODE    221.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   920.00
 UPSTREAM ELEVATION =   1445.00
 DOWNSTREAM ELEVATION =   1442.50
 ELEVATION DIFFERENCE =      2.50
 TC = 0.303*[(  920.00**3)/(     2.50)]**.2 =   15.145
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.230
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8809
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     19.64
 TOTAL AREA(ACRES) =     10.00   TOTAL RUNOFF(CFS) =     19.64

****************************************************************************
 FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1442.50  DOWNSTREAM(FEET) =  1440.00
 FLOW LENGTH(FEET) =   560.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.78
 ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     19.64
 PIPE TRAVEL TIME(MIN.) =   1.61    Tc(MIN.) =  16.76
 LONGEST FLOWPATH FROM NODE    220.00 TO NODE    222.00 =  1480.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    221.00 TO NODE    222.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.130
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8802
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =   10.90   SUBAREA RUNOFF(CFS) =   20.44
 TOTAL AREA(ACRES) =    20.90   TOTAL RUNOFF(CFS) =   40.08
 TC(MIN) =  16.76

****************************************************************************
 FLOW PROCESS FROM NODE    222.00 TO NODE    223.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1431.47  DOWNSTREAM(FEET) =  1431.40
 FLOW LENGTH(FEET) =    21.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.30
 ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     40.08
 PIPE TRAVEL TIME(MIN.) =   0.06    Tc(MIN.) =  16.82
 LONGEST FLOWPATH FROM NODE    220.00 TO NODE    223.00 =  1501.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    223.00 TO NODE    223.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  16.82
 RAINFALL INTENSITY(INCH/HR) =   2.13
 TOTAL STREAM AREA(ACRES) =   20.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     40.08

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
```

```
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1      217.01     12.27        2.451        218.10
    1      227.43     12.78        2.407        218.10
    1      265.75     14.56        2.270        218.10
    1      266.78     14.65        2.263        218.10
    1      305.80     16.96        2.119        218.10
    1      313.08     17.40        2.095        218.10
    1      313.75     17.44        2.093        218.10
    1      314.75     17.70        2.079        218.10
    1      331.95     19.27        2.000        218.10
    1      339.07     19.93        1.970        218.10
    1      373.45     24.29        1.803        218.10
    1      377.94     25.00        1.779        218.10
    1      365.30     28.14        1.687        218.10
    1      351.62     30.90        1.618        218.10
    2       40.08     16.82        2.127         20.90

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
    1       246.25     12.27       2.451
    2       257.89     12.78       2.407
    3       300.45     14.56       2.270
    4       301.69     14.65       2.263
    5       343.35     16.82       2.127
    6       345.73     16.96       2.119
    7       352.56     17.40       2.095
    8       353.18     17.44       2.093
    9       353.92     17.70       2.079
   10       369.65     19.27       2.000
   11       376.19     19.93       1.970
   12       407.42     24.29       1.803
   13       411.47     25.00       1.779
   14       397.09     28.14       1.687
   15       382.10     30.90       1.618

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    411.47   Tc(MIN.) =   25.00
 TOTAL AREA(ACRES) =    239.00
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    223.00 =  4658.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    223.00 TO NODE    232.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1431.38  DOWNSTREAM(FEET) =  1430.00
 FLOW LENGTH(FEET) =   459.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  93.0 INCH PIPE IS  70.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.77
 ESTIMATED PIPE DIAMETER(INCH) =  93.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    411.47
 PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =  25.72
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    232.00 =  5117.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    232.00 TO NODE    232.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  25.72
 RAINFALL INTENSITY(INCH/HR) =   1.76
 TOTAL STREAM AREA(ACRES) =  239.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    411.47

****************************************************************************
 FLOW PROCESS FROM NODE    230.00 TO NODE    231.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   900.00
```

```
 UPSTREAM ELEVATION =   1440.00
 DOWNSTREAM ELEVATION =   1438.00
 ELEVATION DIFFERENCE =      2.00
 TC = 0.303*[(  900.00**3)/(     2.00)]**.2 =   15.629
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8807
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     15.68
 TOTAL AREA(ACRES) =      8.10   TOTAL RUNOFF(CFS) =     15.68

****************************************************************************
 FLOW PROCESS FROM NODE    231.00 TO NODE    232.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1430.94  DOWNSTREAM(FEET) =  1430.54
 FLOW LENGTH(FEET) =    40.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.62
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     15.68
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =  15.72
 LONGEST FLOWPATH FROM NODE    230.00 TO NODE    232.00 =   940.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    232.00 TO NODE    232.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  15.72
 RAINFALL INTENSITY(INCH/HR) =   2.19
 TOTAL STREAM AREA(ACRES) =    8.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.68

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       246.25     13.08         2.381        239.00
     1       257.89     13.58         2.342        239.00
     1       300.45     15.33         2.217        239.00
     1       301.69     15.42         2.211        239.00
     1       343.35     17.56         2.086        239.00
     1       345.73     17.70         2.079        239.00
     1       352.56     18.14         2.056        239.00
     1       353.18     18.18         2.054        239.00
     1       353.92     18.44         2.041        239.00
     1       369.65     20.01         1.967        239.00
     1       376.19     20.66         1.939        239.00
     1       407.42     25.01         1.779        239.00
     1       411.47     25.72         1.757        239.00
     1       397.09     28.86         1.668        239.00
     1       382.10     31.63         1.601        239.00
     2        15.68     15.72         2.193          8.10

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       259.30     13.08         2.381
     2       271.44     13.58         2.342
     3       315.74     15.33         2.217
     4       317.08     15.42         2.211
     5       323.02     15.72         2.193
     6       358.27     17.56         2.086
     7       360.60     17.70         2.079
     8       367.26     18.14         2.056
     9       367.86     18.18         2.054
    10       368.51     18.44         2.041
    11       383.72     20.01         1.967
    12       390.06     20.66         1.939
    13       420.14     25.01         1.779
    14       424.04     25.72         1.757
    15       409.02     28.86         1.668
    16       393.54     31.63         1.601
```

```
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    424.04   Tc(MIN.) =   25.72
 TOTAL AREA(ACRES) =    247.10
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    232.00 =  5117.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    232.00 TO NODE    242.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1429.50  DOWNSTREAM(FEET) =  1429.46
 FLOW LENGTH(FEET) =    12.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  90.0 INCH PIPE IS  72.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  11.15
 ESTIMATED PIPE DIAMETER(INCH) =  90.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    424.04
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  25.73
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    242.00 =  5129.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    242.00 TO NODE    242.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  25.73
 RAINFALL INTENSITY(INCH/HR) =   1.76
 TOTAL STREAM AREA(ACRES) =  247.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    424.04

****************************************************************************
 FLOW PROCESS FROM NODE    240.00 TO NODE    241.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   800.00
 UPSTREAM ELEVATION =   1442.00
 DOWNSTREAM ELEVATION =   1440.00
 ELEVATION DIFFERENCE =      2.00
 TC = 0.303*[(  800.00**3)/(     2.00)]**.2 =   14.562
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.269
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8812
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =     13.40
 TOTAL AREA(ACRES) =      6.70   TOTAL RUNOFF(CFS) =     13.40

****************************************************************************
 FLOW PROCESS FROM NODE    241.00 TO NODE    242.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1440.00  DOWNSTREAM(FEET) =   1438.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   550.00   CHANNEL SLOPE =  0.0036
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =     13.40
 FLOW VELOCITY(FEET/SEC) =   2.14   FLOW DEPTH(FEET) =   0.83
 TRAVEL TIME(MIN.) =   4.28   Tc(MIN.) =  18.85
 LONGEST FLOWPATH FROM NODE    240.00 TO NODE    242.00 =  1350.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    241.00 TO NODE    242.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.021
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8794
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    6.40   SUBAREA RUNOFF(CFS) =   11.37
 TOTAL AREA(ACRES) =    13.10   TOTAL RUNOFF(CFS) =   24.77
 TC(MIN) =  18.85

****************************************************************************
```

```
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  26.42
 RAINFALL INTENSITY(INCH/HR) =   1.74
 TOTAL STREAM AREA(ACRES) =  260.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    445.57

****************************************************************************
 FLOW PROCESS FROM NODE    250.00 TO NODE    251.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
       ASSUMED INITIAL SUBAREA UNIFORM
       DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   770.00
 UPSTREAM ELEVATION =   1440.00
 DOWNSTREAM ELEVATION =   1439.00
 ELEVATION DIFFERENCE =      1.00
 TC = 0.303*[(  770.00**3)/(     1.00)]**.2 =   16.349
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.154
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8804
 SOIL CLASSIFICATION IS "C"
 SUBAREA RUNOFF(CFS) =      8.91
 TOTAL AREA(ACRES) =      4.70   TOTAL RUNOFF(CFS) =      8.91

****************************************************************************
 FLOW PROCESS FROM NODE    251.00 TO NODE    252.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   1439.00  DOWNSTREAM(FEET) =   1438.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   500.00   CHANNEL SLOPE =  0.0020
 CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
 CHANNEL FLOW THRU SUBAREA(CFS) =      8.91
 FLOW VELOCITY(FEET/SEC) =   1.53   FLOW DEPTH(FEET) =   0.79
 TRAVEL TIME(MIN.) =   5.43   Tc(MIN.) =  21.78
 LONGEST FLOWPATH FROM NODE    250.00 TO NODE    252.00 =  1270.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    251.00 TO NODE    262.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.893
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8784
 SOIL CLASSIFICATION IS "C"
 SUBAREA AREA(ACRES) =    5.90   SUBAREA RUNOFF(CFS) =    9.81
 TOTAL AREA(ACRES) =    10.60   TOTAL RUNOFF(CFS) =   18.73
 TC(MIN) =  21.78

****************************************************************************
 FLOW PROCESS FROM NODE    252.00 TO NODE    252.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  21.78
 RAINFALL INTENSITY(INCH/HR) =   1.89
 TOTAL STREAM AREA(ACRES) =   10.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     18.73

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       276.53     13.88         2.319         260.20
     1       289.31     14.37         2.283         260.20
     1       335.92     16.09         2.170         260.20
     1       337.38     16.18         2.164         260.20
     1       343.70     16.47         2.147         260.20
     1       381.38     18.30         2.048         260.20
     1       383.88     18.44         2.041         260.20
     1       391.12     18.87         2.019         260.20
     1       391.78     18.92         2.017         260.20
```

```
    1      392.77    19.18        2.005        260.20
    1      389.85    19.57        1.987        260.20
    1      407.82    20.74        1.936        260.20
    1      413.82    21.38        1.909        260.20
    1      441.95    25.73        1.756        260.20
    1      445.57    26.42        1.736        260.20
    1      429.46    29.58        1.650        260.20
    1      413.16    32.35        1.585        260.20
    2       18.73    21.78        1.893         10.60

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
    1       288.46    13.88        2.319
    2       301.67    14.37        2.283
    3       349.75    16.09        2.170
    4       351.29    16.18        2.164
    5       357.87    16.47        2.147
    6       397.11    18.30        2.048
    7       399.73    18.44        2.041
    8       407.35    18.87        2.019
    9       408.05    18.92        2.017
   10       409.26    19.18        2.005
   11       406.68    19.57        1.987
   12       425.65    20.74        1.936
   13       432.20    21.38        1.909
   14       429.13    21.78        1.893
   15       459.32    25.73        1.756
   16       462.73    26.42        1.736
   17       445.78    29.58        1.650
   18       428.83    32.35        1.585

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =    462.73   Tc(MIN.) =   26.42
 TOTAL AREA(ACRES) =    270.80
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    252.00 =  5612.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    252.00 TO NODE    262.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  1427.76  DOWNSTREAM(FEET) =  1427.73
 FLOW LENGTH(FEET) =    12.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN 102.0 INCH PIPE IS  74.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.40
 ESTIMATED PIPE DIAMETER(INCH) = 102.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    462.73
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  26.44
 LONGEST FLOWPATH FROM NODE     80.00 TO NODE    262.00 =  5624.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    262.00 TO NODE    262.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  26.44
 RAINFALL INTENSITY(INCH/HR) =   1.74
 TOTAL STREAM AREA(ACRES) =  270.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    462.73

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    261.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
 INITIAL SUBAREA FLOW-LENGTH =   900.00
 UPSTREAM ELEVATION =   1439.50
 DOWNSTREAM ELEVATION =   1438.00
 ELEVATION DIFFERENCE =      1.50
 TC = 0.303*[(  900.00**3)/(     1.50)]**.2 =   16.554
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.142
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8803
SOIL CLASSIFICATION IS "C"
SUBAREA RUNOFF(CFS) =     24.89
TOTAL AREA(ACRES) =     13.20   TOTAL RUNOFF(CFS) =     24.89

****************************************************************************
FLOW PROCESS FROM NODE    261.00 TO NODE    262.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1428.46  DOWNSTREAM(FEET) =  1427.73
FLOW LENGTH(FEET) =    47.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.91
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     24.89
PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =  16.63
LONGEST FLOWPATH FROM NODE    260.00 TO NODE    262.00 =   947.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    262.00 TO NODE    262.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  16.63
RAINFALL INTENSITY(INCH/HR) =   2.14
TOTAL STREAM AREA(ACRES) =   13.20
PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.89

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1       288.46     13.90         2.317        270.80
    1       301.67     14.39         2.281        270.80
    1       349.75     16.11         2.168        270.80
    1       351.29     16.20         2.163        270.80
    1       357.87     16.49         2.146        270.80
    1       397.11     18.32         2.047        270.80
    1       399.73     18.46         2.040        270.80
    1       407.35     18.89         2.018        270.80
    1       408.05     18.94         2.016        270.80
    1       409.26     19.20         2.004        270.80
    1       406.68     19.59         1.986        270.80
    1       425.65     20.75         1.935        270.80
    1       432.20     21.40         1.908        270.80
    1       429.13     21.80         1.893        270.80
    1       459.32     25.75         1.756        270.80
    1       462.73     26.44         1.735        270.80
    1       445.78     29.60         1.649        270.80
    1       428.83     32.37         1.584        270.80
    2        24.89     16.63         2.138         13.20

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

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1       309.27     13.90         2.317
    2       323.21     14.39         2.281
    3       373.86     16.11         2.168
    4       375.54     16.20         2.163
    5       382.55     16.49         2.146
    6       385.49     16.63         2.138
    7       420.94     18.32         2.047
    8       423.49     18.46         2.040
    9       430.85     18.89         2.018
   10       431.53     18.94         2.016
   11       432.60     19.20         2.004
   12       429.80     19.59         1.986
   13       448.18     20.75         1.935
   14       454.42     21.40         1.908
   15       451.17     21.80         1.893
   16       479.77     25.75         1.756
   17       482.94     26.44         1.735
```

```
    18      464.98    29.60       1.649
    19      447.28    32.37       1.584

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =    482.94   Tc(MIN.) =   26.44
  TOTAL AREA(ACRES) =    284.00
  LONGEST FLOWPATH FROM NODE     80.00 TO NODE    262.00 =  5624.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =    284.00  TC(MIN.) =     26.44
  PEAK FLOW RATE(CFS)    =    482.94
  *** PEAK FLOW RATE TABLE ***
        Q(CFS)   Tc(MIN.)
  1      309.27      13.90
  2      323.21      14.39
  3      373.86      16.11
  4      375.54      16.20
  5      382.55      16.49
  6      385.49      16.63
  7      420.94      18.32
  8      423.49      18.46
  9      430.85      18.89
 10      431.53      18.94
 11      432.60      19.20
 12      429.80      19.59
 13      448.18      20.75
 14      454.42      21.40
 15      451.17      21.80
 16      479.77      25.75
 17      482.94      26.44
 18      464.98      29.60
 19      447.28      32.37
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

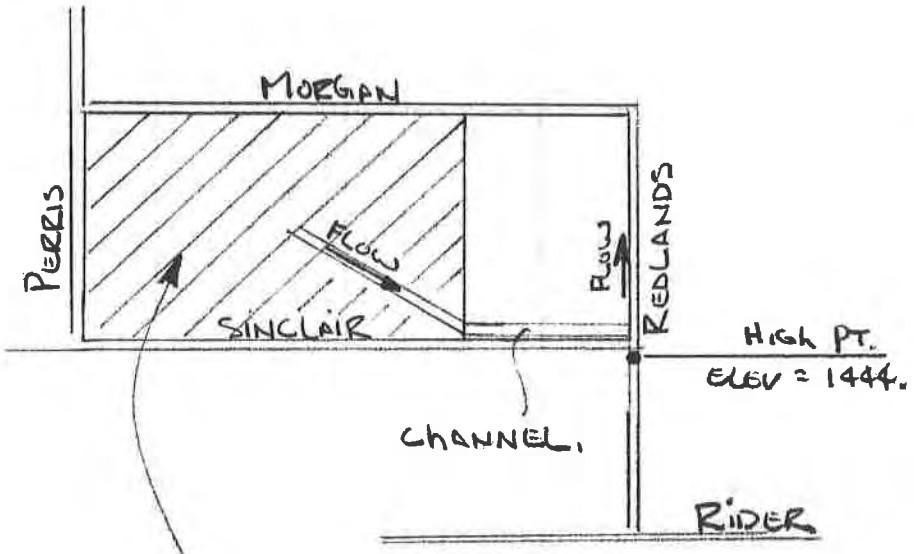
TRACT No. _____

Thienes Engineering, Inc.

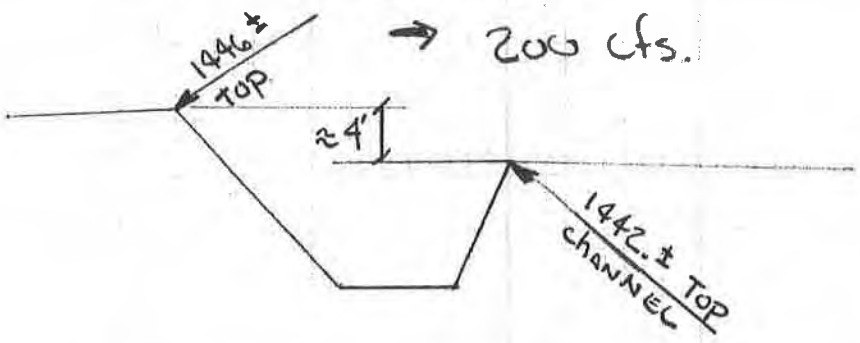
CIVIL ENGINEERING • LAND SURVEYING

subject	by	date	job no.	sheet of

SINCLAIR CHANNEL SPILLOVER



ASSUMED DRAINAGE AREA TO CHANNEL
≈ 80 AC. ASSUME 2.5 cfs/AC
→ 200 cfs.



APPROX. ELEV. OF SPILLOVER TO REDLANDS FOR RUNOFF TO GO SOUTH TOWARD RIDER
= 1444. (SEE FOLLOWING TOPO).

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subject	by	date	job no.	sheet of

USE WEIR EQUATION TO DETERMINE LENGTH of WEIR TO PASS 200 cfs TO the North

$Q = 3Lh^{3/2}$

USE $Q = 200$

$h = 1$ (LEAVES APPROX. 1' TIL SPILLOVER SOUTH.

$L = \frac{200}{3(1)^{3/2}} = 66.7'$ NORTH SIDE of CHANNEL HAS AT LEAST 250' LENGTH TO SPILLOVER.

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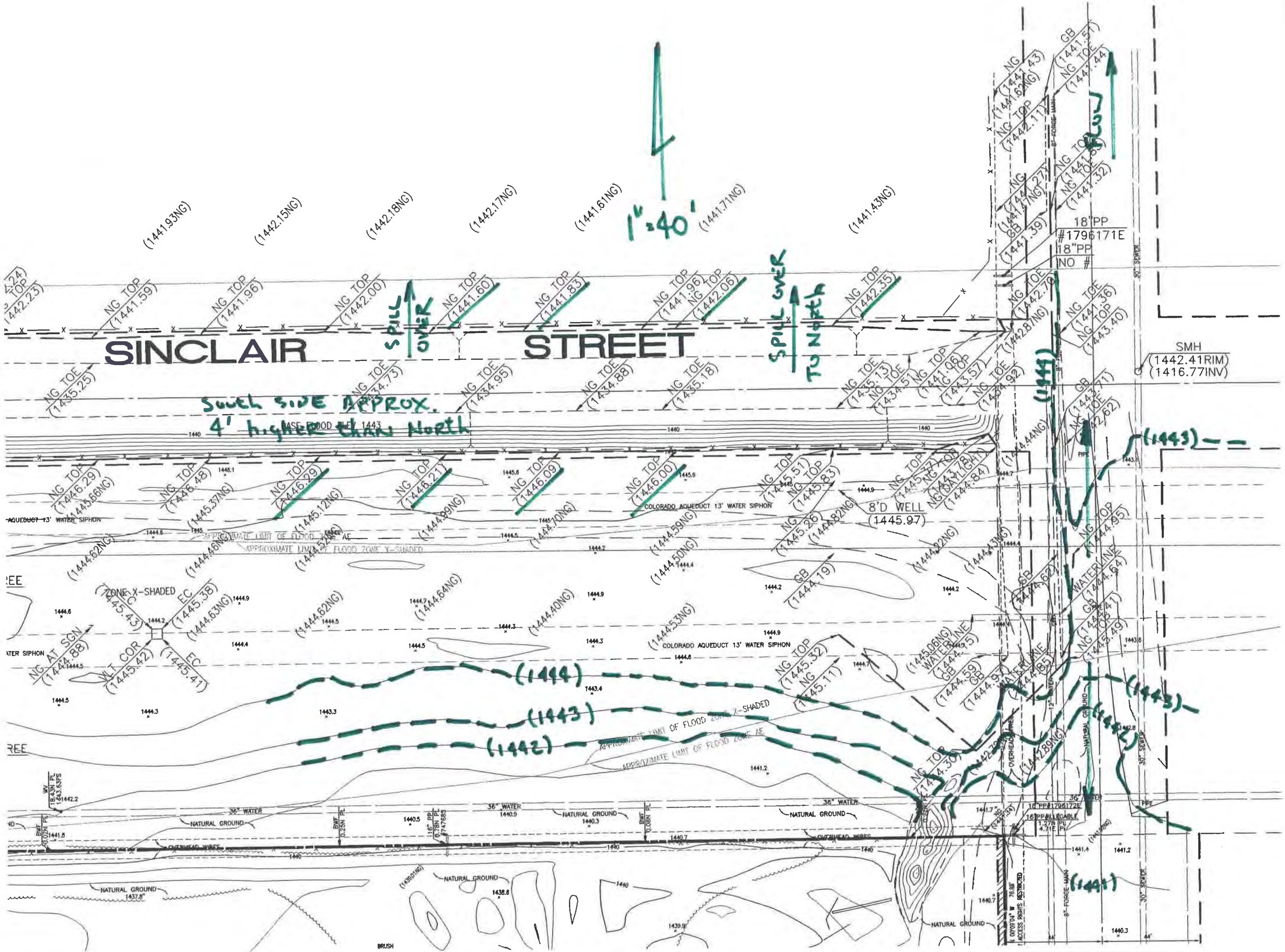

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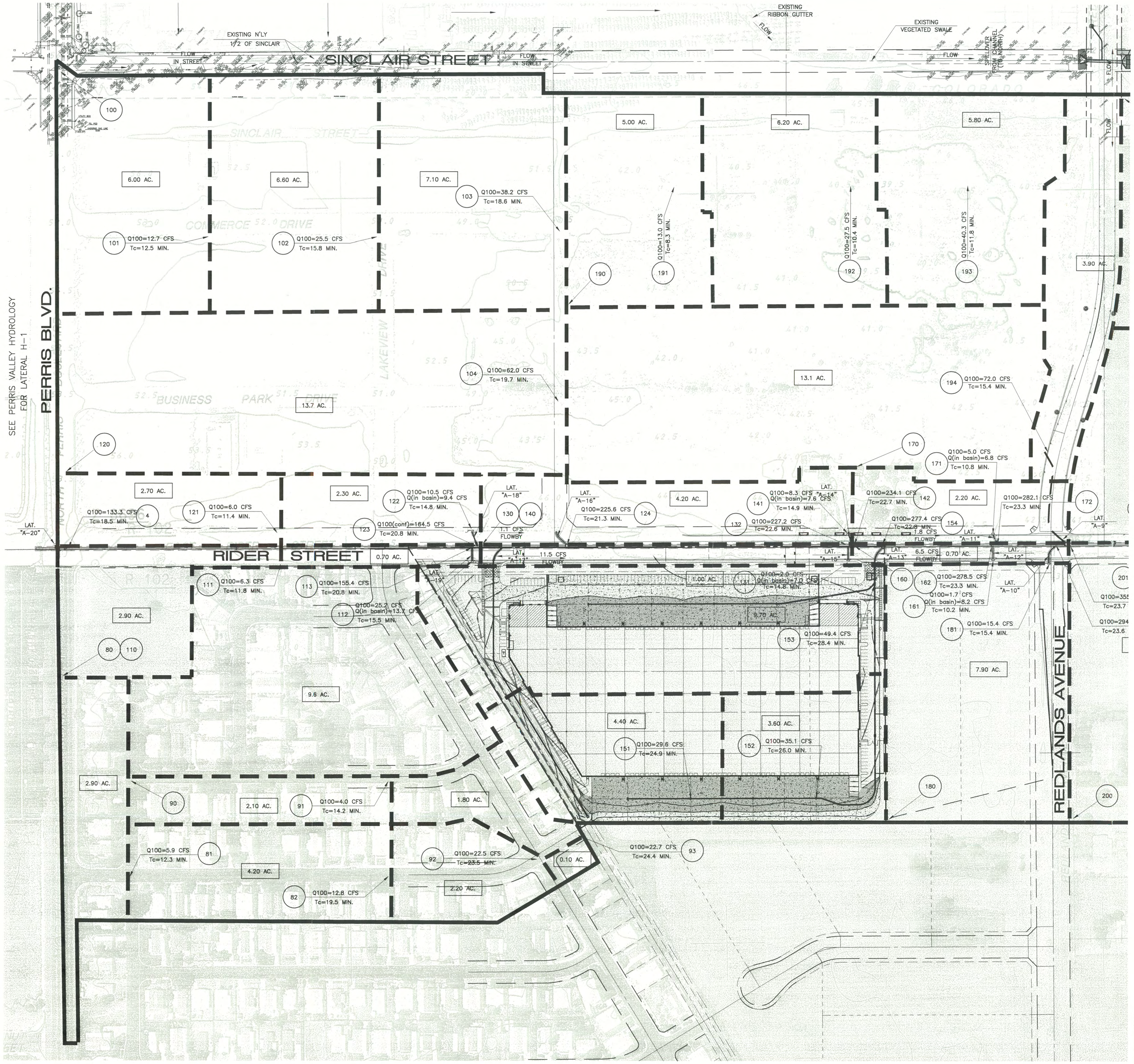

LEGEND

	PROJECT BOUNDARY
	SUBAREA BOUNDARY
1.00 AC.	SUBAREA AREA
100	NODE NUMBER
	ANTICIPATED PONDING AREA

0 50 100 200 300

SCALE:1"=100'

Last Update: 8/26/09
O:\2700-2799\2702\2702-hyd-mtd-box.dwg

CITY OF PERRIS
PUBLIC WORKS DEPARTMENT

HYDROLOGY MAP PROPOSED CONDITIONS

PERRIS VALLEY MDP LINE A-B (RIDER ST.)

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by
Date
Checked by
Date
Designed by
Date
Checked by
Date

Aproved by Date

Public Works Director R.C.E. 28129

Sheet 1 of 2 Sheets

2702/ 1 OF 2 SHEET

AutoCAD File: O:\2700-2799\2702\2702-hyd-std-box.dwg Plotted at: Fri Sep 04 10:44:58 2009

SEE SHEET NO. 1

OFFSITE RUNOFF SHEET FLOWS EAST

OFFSITE RUNOFF SHEET FLOWS EAST

FROM CHANNEL (TO NORTH)

SINCLAIR STREET

EXISTING BERM

EXISTING BERM

FLOW

FLOW

AQUEDUCT

SINCLAIR STREET

220

240

250

3.90 AC.

10.0 AC.

6.70 AC.

4.70 AC.

241 Q100=13.4 CFS Tc=14.6 MIN.

251 Q100=8.9 CFS Tc=16.3 MIN.

221 Q100=19.6 CFS Tc=15.1 MIN.

5.90 AC.

10.9 AC.

6.40 AC.

.0 CFS
MIN.

8 CFS

Q100=24.8 CFS
Q100(conf)=445.6 CFS
Tc=25.7 MIN.
242

Q100)=482.9 CFS
Tc=26.4 MIN.
262

222 Q100=40.1 CFS Tc=16.8 MIN.

Q100=282.1 CFS
Tc=23.3 MIN.
172

202 Q100=367.1 CFS Tc=24.3 MIN.

212 Q100=377.9 CFS Tc=25.0 MIN.

232 Q100)=424.0 CFS Tc=25.7 MIN.

252 Q100=18.7 CFS
Q100(conf)=462.7 CFS
Tc=26.4 MIN.

LAT. "A-9"

LAT. "A-6"

LAT. "A-3"

LAT. "A-2"

PERRIS VALLEY CHANNEL

LAT. "A-12"

LAT. "A-8"

LAT. "A-7"

LAT. "A-5"

LAT. "A-4"

RIDER STREET

201 Q100=14.8 CFS Tc=13.7 MIN.

211 Q100=13.8 CFS Tc=14.6 MIN.

Q100=411.4 CFS
Tc=25.0 MIN.
223

Q100=15.7 CFS
Tc=15.6 MIN.
231

261 Q100=24.9 CFS Tc=16.6 MIN.

LAT. "A-1"

LAT. "A-10"

Q100=355.6 CFS
Tc=23.7 MIN.
195

5.4 CFS
4 MIN.

Q100=294.8 CFS
Tc=23.6 MIN.
182

6.90 AC.

7.20 AC.

8.10 AC.

13.2 AC.

AC.

REDLANDS AVENUE

200

210

230

260

LEGEND

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- 1.00 AC. SUBAREA AREA
- (100) NODE NUMBER
- ANTICIPATED PONDING AREA

0 50 100 200 300

SCALE:1"=100'

Last Update: 8/26/09
O:\2700-2799\2702\2702-hyd-mtd-box.dwg

AutoCAD File: O:\2700-2799\2702\2702-hyd-mtd-box.dwg Plotted at: Fri Sep 04 10:51:52 2009

CITY OF PERRIS
PUBLIC WORKS DEPARTMENT

HYDROLOGY MAP PROPOSED CONDITIONS

PERRIS VALLEY MDP LINE A-B (RIDER ST.)

2702/ 2 OF 2 SHEET

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Aproved by _____ Date _____

Public Works Director R.C.E. 28129

Sheet 2 of 2 Sheets