HUITT-ZOLLARS

HUITT-ZOLLARS, INC. ı 2603 Main Street ı Suite 400 ı Irvine, CA 92614-4250 ı 949.988.5815 phone ı 949.988.5820 fax ı huitt-zollars.com

Memorandum

DATE: January 2, 2023

TO: City of Chino, Development Services

FROM: David White

SUBJECT: PL20-0004 – Preliminary Offsite Drainage Study

PROJECT NO.: R310158.01

Introduction

Pursuant to the DRC Level 2C Comments dated June 8, 2021 from the City of Chino Engineering Department and follow up letter dated June 9, 2021 from the City Engineer, Huitt-Zollars has prepared this Offsite Drainage Study on behalf of Golden West Management (PAMA Management). The study focused on the following objectives:

1. Determine the capacity of East End Avenue and Philadelphia Street to carry storm water per City of Chino Standards and Specifications.
2. Analyze the runoff from upstream properties and determine its potential impacts to the subject property.
3. Identify Master Plan of Drainage updates, if applicable, based on the findings of 1 and 2.

As part of the development of the Industrial Warehouse Development Project on the subject site, street improvements are proposed on the west half of East End Avenue and north half of Philadelphia Street along the project frontage. This includes pavement widening, 8" curb & gutter, and sidewalk. The majority of East End Avenue north of the project site has existing curb & gutter on both sides of the street. The curb to curb width is 76' with 36' on the west half and 40' on the east half.

Philadelphia Street has existing improvements on both sides of the street east of East End Avenue. The curb to curb width is 72'. There are no improvements along the project frontage or west of the subject site on either side of Philadelphia Street. The ultimate curb to curb width is 72' with a 16' parkway.

Analysis of the City of Chino's Master Plan of Drainage and storm drain plans indicate an existing 33" storm drain conveys runoff from the intersection of East End Avenue and Philadelphia Street to the San Antonio Creek Channel.

The hydrologic criteria used in this study was: runoff from 10-year storm event does not flood inside traffic lanes, 25-year runoff does not exceed top of curb, and the 100-year runoff will not exceed the ultimate right-of-way.

The drainage map is included as Attachment 1, the plan for the existing 33" storm drain is included as Attachment 2, the hydraulic calculations are included as Attachment 3, and the hydrology calculations are included as Attachment 4.

Hydrologic Analysis

The drainage area tributary to the intersection of East End Avenue and Philadelphia Street was delineated using a combination of Google imagery, record maps, and field visits. The drainage area is approximately 56 acres and consists mostly of East End Avenue extending north to Phillips Blvd and a portion of residential area adjacent to East End Avenue comprised largely of the gated Sullivan Ranch. The limited extent of the drainage area can be attributed to a few factors. One is that flows on the western half of East End Avenue coming southward are redirected at Francis Street to a channel that takes flows directly to the San Antonio Creek Channel. Also, the majority of the area west of East End Avenue between Philadelphia Street and Francis Street drains directly to the channel. Lastly, a system of north-south cross gutters at most major intersections east of the project area diverts flows southward to the large System 11 storm drain system parallel to the Pomona Freeway rather than westward to San Antonio Creek Channel. These factors kept the resulting tributary flows within a manageable range.

After the delineation of the drainage area into smaller sub drainage areas, peak discharges were determined at each of the corresponding hydrologic nodes using the AES rational method consistent with the San Bernardino County Hydrology Manual. Soils in the area fell under Hydrologic Soil Group A according to the City of Chino Master Plan of Drainage and USGS soil survey indicating high to moderate infiltration potential. Land Uses in the area included residential (2 DU/acre) and commercial for the streets and industrial complexes.

Storm intensities for the 10, 25, and 100-year storm events were derived from the NOAA Atlas 14 website and can be seen in the following table:

Storm Event	Intensity (in/hr)
10 year	0.95 in/hr
25 year	1.17 in/hr
100 year	1.53 in/hr

Hydraulic Analysis

Once street and surface flows were calculated, they were analyzed for hydraulic feasibility. The half street cross sections for East End and Philadelphia were plotted in Flowmaster to determine the maximum half street flow capacity. These were determined to be 62.8 cfs for East End and 49.3 cfs for Philadelphia at the right of way (ROW) and 24.1 cfs for East End and 19.9 cfs for Philadelphia at the top of curb (TC). For East End these are well above the projected maximum 100-year half street flows of 14.3 cfs and 17.9 cfs found approaching the intersection of East End Avenue and Philadelphia Street, indicating that there is no immediate need for upstream catch basins or storm drain pipe to dewater East End Avenue. For Philadelphia Street, the runoff between nodes 303 and 106 is contained within the public right of way utilizing a combination of pipe flow and surface flow.

Next, WSPG was run to determine the maximum capacity of the existing 33” storm drain, which was designed for Q25 as indicated on the plan. The storm drain appears to continue east to Humboldt although the County does not have the improvement plans for this reach, which was installed after the original segment per City of Chino plan A-757. Through trial and error, the capacity of the storm drain was calculated to be approximately 57 cfs before water levels begin to rise above the existing grates at the intersection. This is less than the 25-year flow of 72.9 cfs from the rational method, suggesting that the existing pipe infrastructure is inadequate for larger storm events. During larger storm events as the water level rises, ponding will be localized around the east grate and will spill over the crown of Philadelphia and continue south on East End. The ponding will not affect East End Avenue or the subject property since the crown of Philadelphia is less than a foot above the grate elevation.

HUITT-ZOLLARS

Conclusion

This preliminary offsite drainage study was prepared to determine the impacts of upstream runoff, from both private properties and public streets, on the subject property and assess whether storm drain infrastructure improvements would be required to protect the subject property after development.

We have concluded there is no private off-site runoff impacting the subject property from the other properties north or west of the subject property. The runoff from those lots either sheets flows directly towards the channel or is directed to East End Avenue.

Furthermore, based on the hydrology and hydraulic results, East End Avenue has more than enough capacity to carry the tributary runoff from Philips Blvd. to Philadelphia Street. New curb & gutter is being installed along the project frontage to protect the property and the depth of flow in East End Avenue will be below the top of curb during a Q_{100} storm. There is no runoff tributary to Philadelphia Street along the project frontage. Philadelphia has a high point midway between East End and the Channel so there will be negligible runoff in the gutter. Philadelphia Street east of East End is conveying runoff to the intersection via surface and storm drain. It is estimated that the pipe will carry 32 cfs and the rest will be carried in the street. The follow table summarizes the calculated flows and capacities for both streets.

	Q100 capacity	Q100 flows	Q25 capacity	Q250 flows
East End	62.8	17.9	24.1	13.2
Philadelphia	49.3	*40	19.9	*12

*assuming 32 cfs is being conveyed in the existing storm drain

The hydrology calculations did not include the subject property as part of the area tributary to the intersection because the site will no longer contribute surface flows to the intersection. Once developed the subject site will provide water quality treatment and storm mitigation and the resulting reduced discharge will enter the existing 33” storm drain directly via private storm drain line C as depicted on the map.

Runoff in excess of the capacity of the existing 33” storm drain will pond at the northeast corner of the intersection and sheet flow across the crown of Philadelphia and continue south on East End Avenue, which the street can adequately convey. This is an existing condition and is not impacted by the development of the 3.6 acre subject property.

Based on the foregoing results and conclusions, additional storm drain infrastructure is not warranted since there are no impacts to the subject property from upstream runoff and the subject property does not impact downstream runoff.

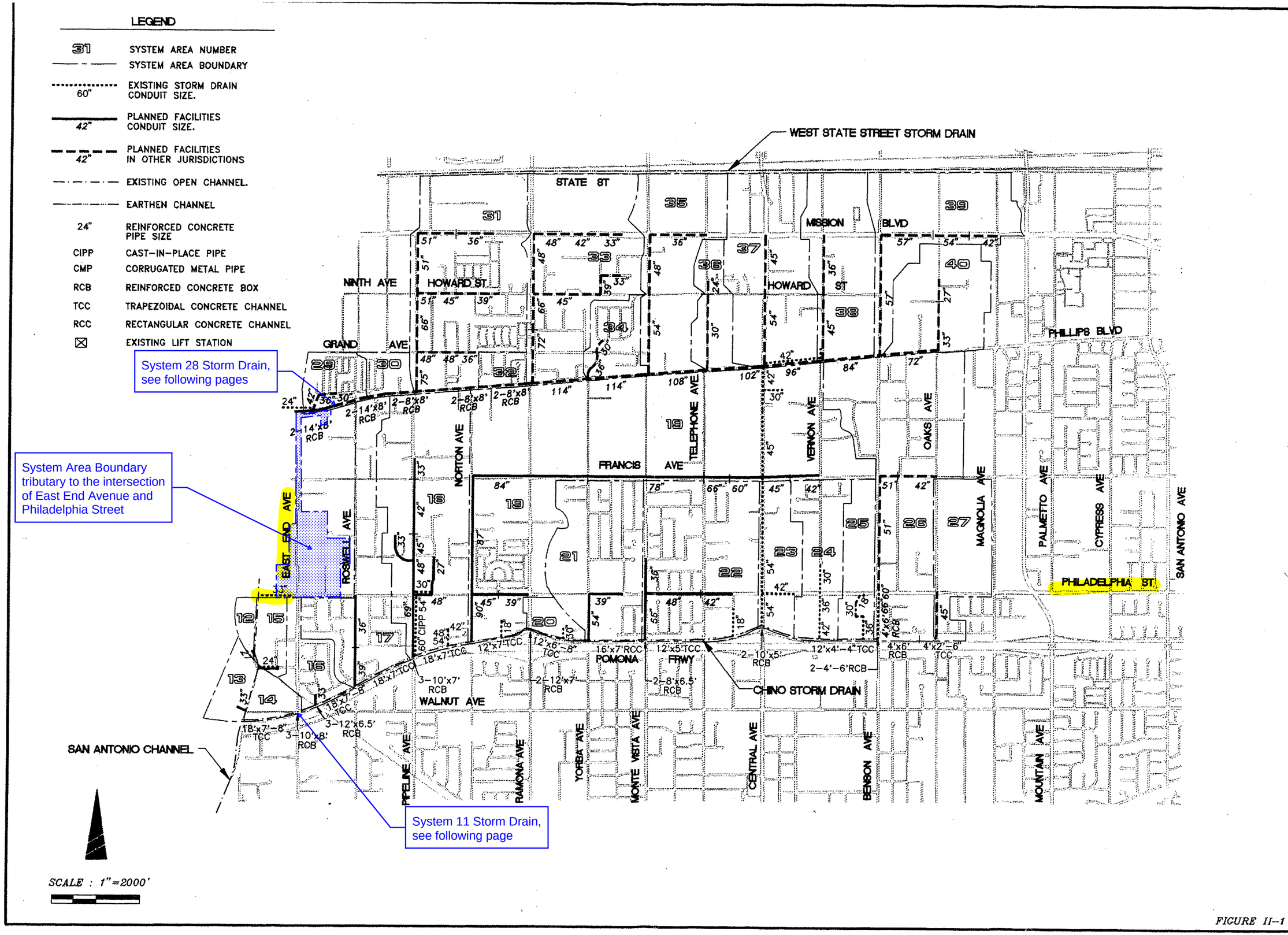


FIGURE II-1

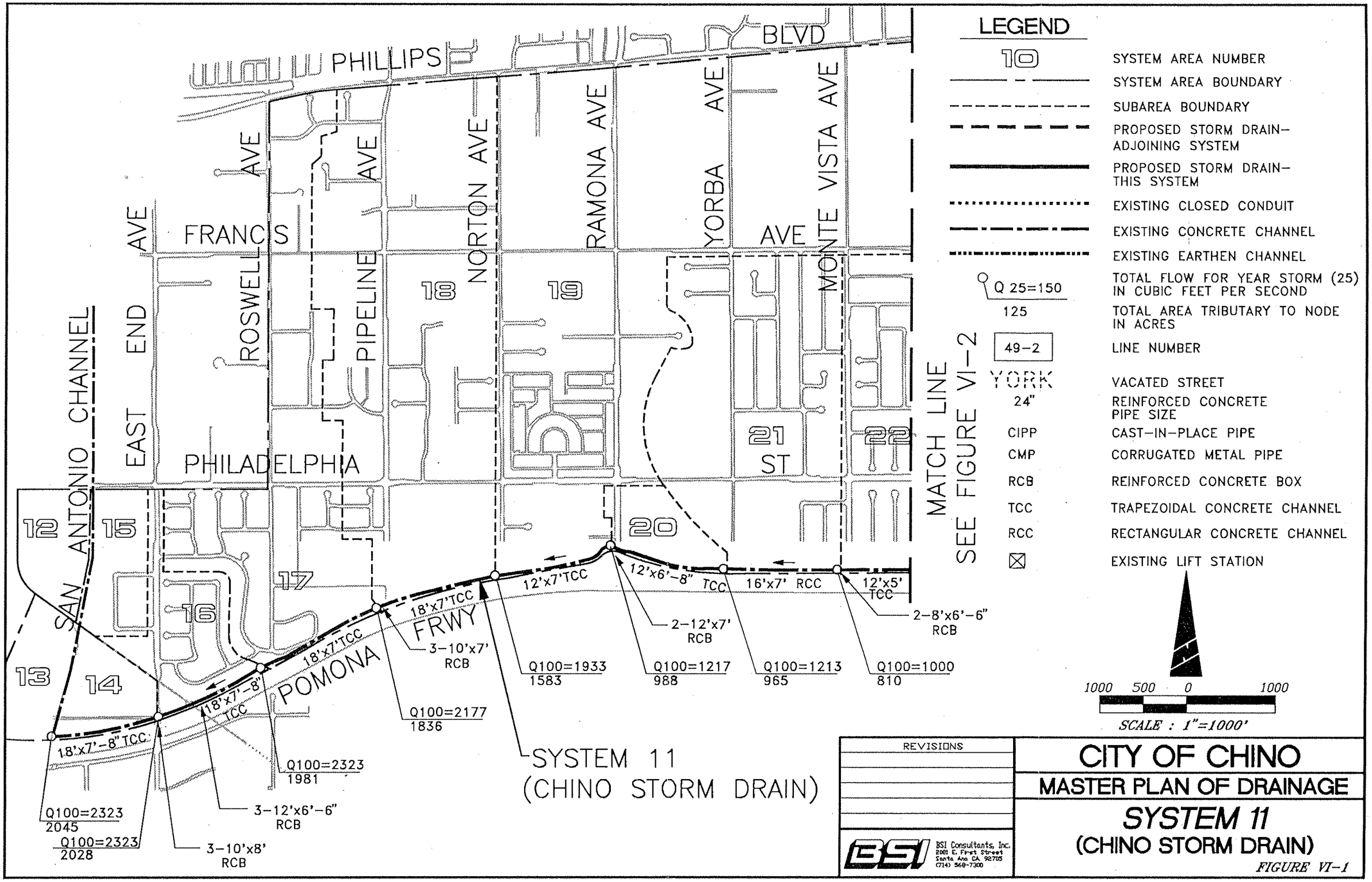
MASTER PLAN OF DRAINAGE

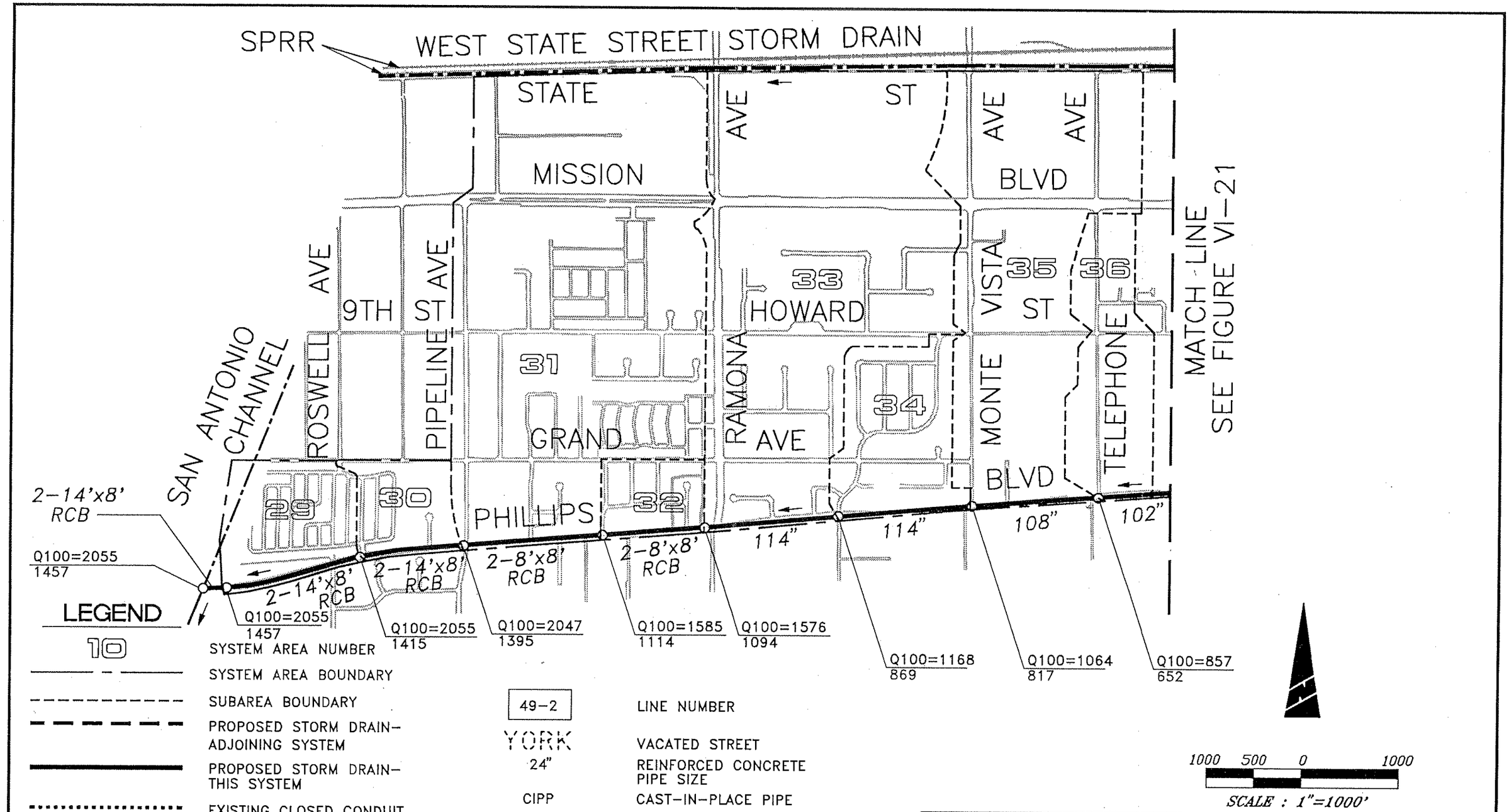
FACILITIES MAP
NORTHERN BASIN

BSI Consultants, Inc.
2001 E. First Street
Santa Ana CA 92705
(714) 569-7300

CITY OF CHINO
CHINO, CALIFORNIA

Description	Date	Initial
Revisions		


LEGEND
10
SYSTEM AREA NUMBER
SYSTEM AREA BOUNDARY
SUBAREA BOUNDARY
PROPOSED STORM DRAIN– ADJOINING SYSTEM
PROPOSED STORM DRAIN– THIS SYSTEM
EXISTING CLOSED CONDUIT
EXISTING CONCRETE CHANNEL
EXISTING EARTHEN CHANNEL
Q 25=150
125
TOTAL FLOW FOR YEAR STORM (25) IN CUBIC FEET PER SECOND
TOTAL AREA TRIBUTARY TO NODE IN ACRES
49–2
LINE NUMBER
YORK
24"
VACATED STREET
REINFORCED CONCRETE PIPE SIZE
CIPP
CAST–IN–PLACE PIPE
CMP
CORRUGATED METAL PIPE
RCB
REINFORCED CONCRETE BOX
TCC
TRAPEZOIDAL CONCRETE CHANNEL
RCC
RECTANGULAR CONCRETE CHANNEL
EXISTING LIFT STATION
1000 500 0 1000
SCALE : 1"=1000'
PHILLIPS BLVD
FRANCIS AVE
ROSWELL AVE
PIPELINE AVE
NORTON AVE
RAMONA AVE
YORBA AVE
MONTE VISTA AVE
EAST END AVE
PHILADELPHIA
21 ST
SAN ANTONIO CHANNEL
POMONA FRWY
MATCH LINE
SEE FIGURE VI–2
12
13
14
15
16
17
18
19
20
21
22
18'x7'–8" TCC
18'x7'TCC
12'x7'TCC
12'x6'–8" TCC
16'x7' RCC
12'x5' TCC
3–10'x7' RCB
2–12'x7' RCB
2–8'x6'–6" RCB
Q100=1933
1583
Q100=1217
988
Q100=1213
965
Q100=1000
810
Q100=2177
1836
Q100=2323
1981
3–12'x6'–6" RCB
Q100=2323
2045
Q100=2323
2028
3–10'x8' RCB
SYSTEM 11
(CHINO STORM DRAIN)
REVISIONS
BSI Consultants, Inc.
2001 E. First Street
Santa Ana CA 92705
(714) 560-7300
CITY OF CHINO
MASTER PLAN OF DRAINAGE
SYSTEM 11
(CHINO STORM DRAIN)
FIGURE VI–1


SPRR
WEST STATE STREET STORM DRAIN
STATE
MISSION
AVE
ST
AVE
AVE
BLVD
MATCH LINE
SEE FIGURE VI-21
AVE
9TH
ST
AVE
33
HOWARD
VISTA
35
36
ST
SAN ANTONIO CHANNEL
ROSWELL
PIPELINE
31
RAMONA
34
MONTE
TELEPHONE
GRAND
AVE
BLVD
2-14'x8' RCB
29
30
PHILLIPS
32
114"
114"
108"
102"
Q100=2055
1457
2-14'x8' RCB
2-14'x8' RCB
2-8'x8' RCB
2-8'x8' RCB
Q100=2055
1457
Q100=2055
1415
Q100=2047
1395
Q100=1585
1114
Q100=1576
1094
Q100=1168
869
Q100=1064
817
Q100=857
652
LEGEND
10
SYSTEM AREA NUMBER
SYSTEM AREA BOUNDARY
SUBAREA BOUNDARY
PROPOSED STORM DRAIN-ADJOINING SYSTEM
PROPOSED STORM DRAIN-THIS SYSTEM
EXISTING CLOSED CONDUIT
EXISTING CONCRETE CHANNEL
EXISTING EARTHEN CHANNEL
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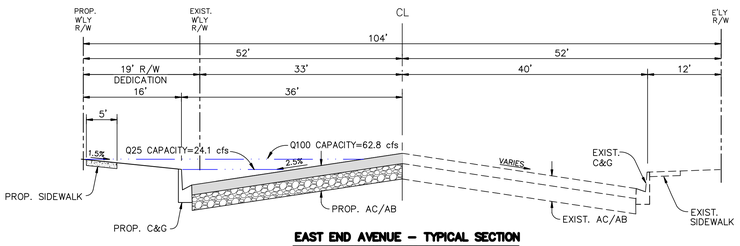
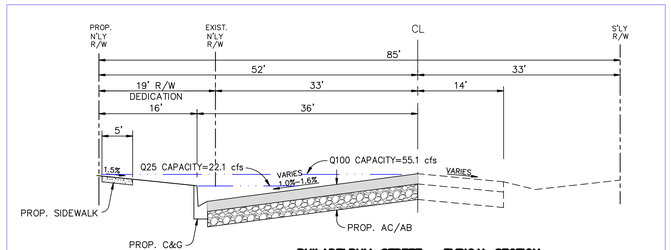
RCB
REINFORCED CONCRETE BOX
TCC
TRAPEZOIDAL CONCRETE CHANNEL
RCC
RECTANGULAR CONCRETE CHANNEL
EXISTING LIFT STATION
1000 500 0 1000
SCALE : 1"=1000'
REVISIONS
BSI Consultants, Inc.
8001 E. First Street
Santa Ana CA 92705
(714) 568-7300
CITY OF CHINO
MASTER PLAN OF DRAINAGE
SYSTEM 28
FIGURE VI-20

HUITT-ZOLLARS, INC. ı 2603 Main Street ı Suite 400 ı Irvine, CA 92614-4250 ı 949.988.5815 phone ı 949.988.5820 fax ı huitt-zollars.com

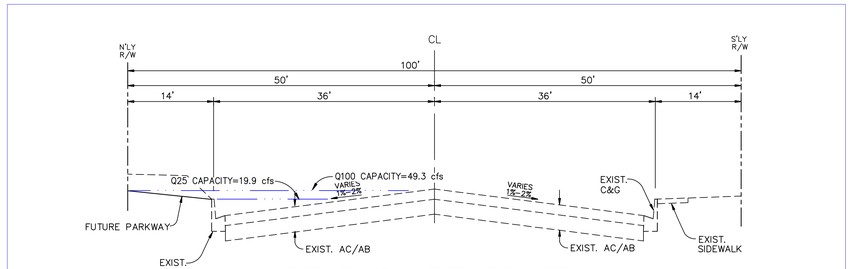
Attachment 1 – PAMA Offsite Drainage Exhibit



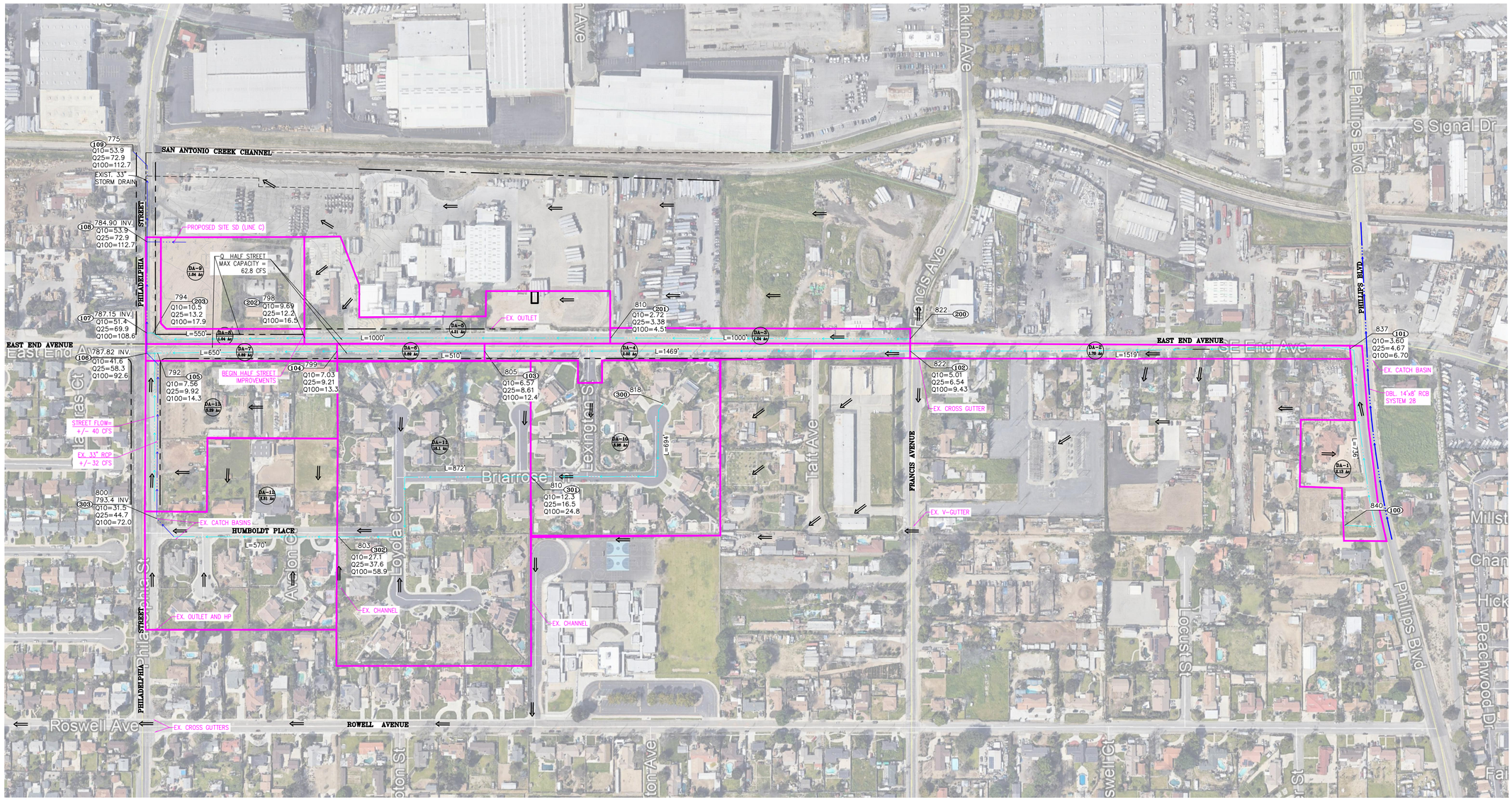
EAST END AVENUE – TYPICAL SECTION
SECONDARY ARTERIAL
N.T.S.



PHILADELPHIA STREET – TYPICAL SECTION
SECONDARY ARTERIAL
N.T.S.



EXISTING PHILADELPHIA STREET – TYPICAL SECTION
E/O EAST END AVENUE
N.T.S.



LEGEND

- NO. — HYDROLOGY MODEL NODE NUMBER
- A-1 / 3.96 — TRIBUTARY AREA IN ACRES
- 656' — LENGTH OF FLOW
- DRAINAGE BOUNDARY
- STREET FLOW LINE
- PIPE FLOW LINE
- FLOW DIRECTION

N

150 0 75 150 300
SCALE 1"= 150'

HUITT-ZOLLARS

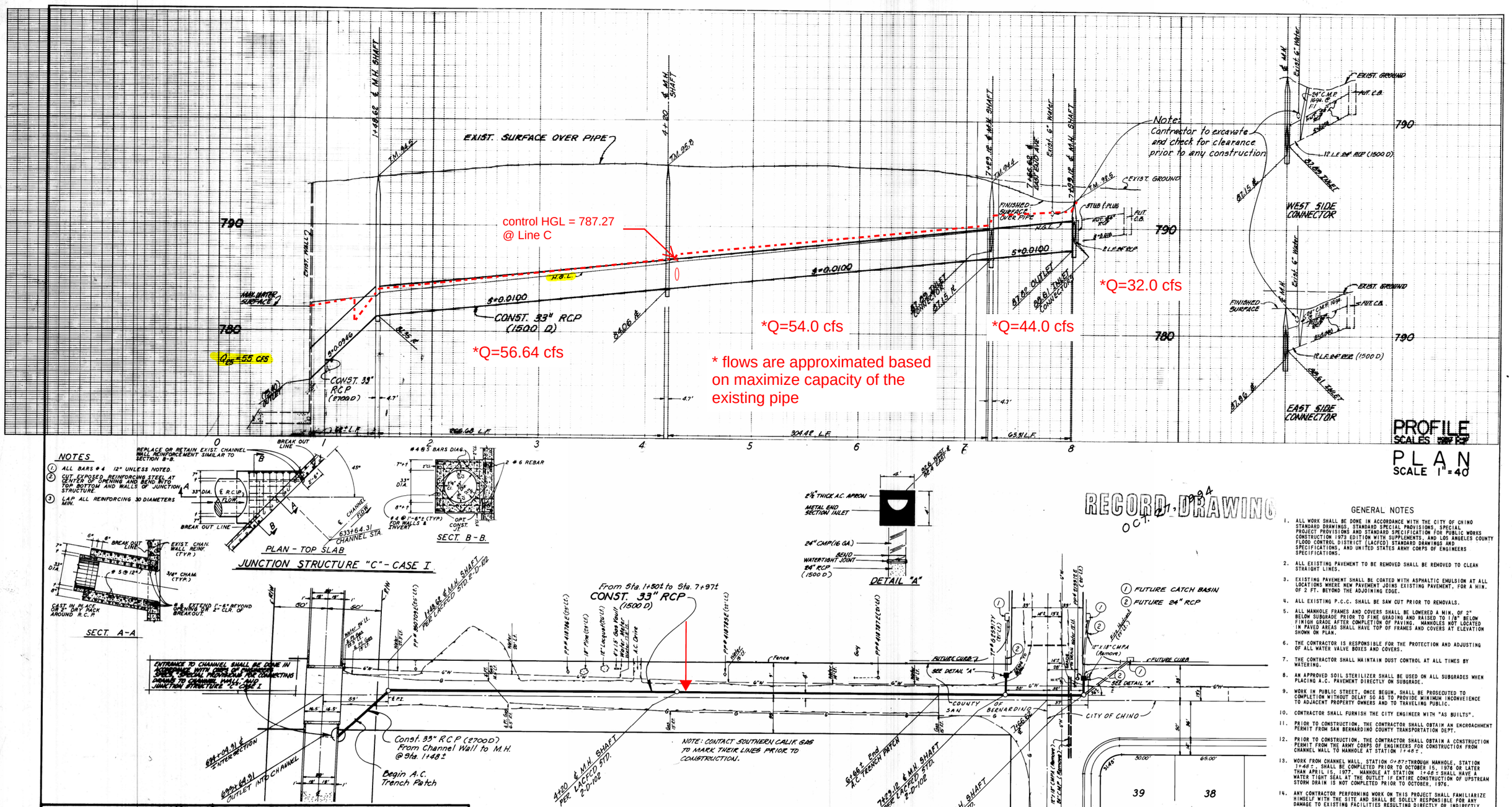
Huitt-Zollars, Inc. Ontario
3990 CONCOURS, SUITE 330 • ONTARIO, CALIFORNIA 91764 • (909) 941-7799

COUNTY OF SAN BERNARDINO

EXISTING OFF-SITE DRAINAGE MAP FOR PHILADELPHIA AND EAST END COUNTY OF SAN BERNARDINO

SHEET 1 NO. 1

Attachment 2 – City of Chino Existing 33” RCP Plan and Profile



RECORD DRAWING
OCT. 21, 1994

NOTES

1. ALL BARS #4 12" UNLESS NOTED.
2. CUT EXPOSED REINFORCING STEEL AT CENTER OF OPENING AND BEND INTO TOP BOTTOM AND WALLS OF JUNCTION STRUCTURE.
3. LAP ALL REINFORCING 30 DIAMETERS MIN.

JUNCTION STRUCTURE "C" - CASE I

ESTIMATE OF QUANTITIES

ITEM	DESCRIPTION	QUANTITY	UNIT	REMARKS
1.	33" RCP (1500 D)	639	LF	
2.	MANHOLE PER LACFCD STD. 2-D-102	4	EA	
3.	24" CMP (16 GA.)	12	LF	
4.	24" RCP (1500 D)	28	LF	
5.	METAL END SECTION INLETS	2	EA	
6.	CONNECTION TO CONCRETE CHANNEL	Lump Sum	L.S.	
7.	2½" THICK A.C. APRON	38	SF	
8.	A.C. TRENCH PATCH	560	LF	
9.	33" RCP (2700 D)	62	LF	
10.	Adjust M.H. To Grade	4	Ea	

NOTE: ARMY CORPS DATUM = 3.25'± + CITY OF CHINO DATUM

GENERAL NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CITY OF CHINO STANDARD DRAWINGS, STANDARD SPECIAL PROVISIONS, SPECIAL PROJECT PROVISIONS AND STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION 1973 EDITION WITH SUPPLEMENTS, AND LOS ANGELES COUNTY FLOOD CONTROL DISTRICT (LACFCD) STANDARD DRAWINGS AND SPECIFICATIONS, AND UNITED STATES ARMY CORPS OF ENGINEERS SPECIFICATIONS.
2. ALL EXISTING PAVEMENT TO BE REMOVED SHALL BE REMOVED TO CLEAN STRAIGHT LINES.
3. EXISTING PAVEMENT SHALL BE COATED WITH ASPHALTIC EMULSION AT ALL LOCATIONS WHERE NEW PAVEMENT JOINS EXISTING PAVEMENT, FOR A MIN. OF 2 FT. BEYOND THE ADJOINING EDGE.
4. ALL EXISTING P.C.C. SHALL BE SAW CUT PRIOR TO REMOVALS.
5. ALL MANHOLE FRAMES AND COVERS SHALL BE LOWERED A MIN. OF 2" BELOW SUBGRADE PRIOR TO FINE GRADING AND RAISED TO 1/8" BELOW FINISH GRADE AFTER COMPLETION OF PAVING. MANHOLES NOT LOCATED IN PAVED AREAS SHALL HAVE TOP OF FRAMES AND COVERS AT ELEVATION SHOWN ON PLAN.
6. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION AND ADJUSTING OF ALL WATER VALVE BOXES AND COVERS.
7. THE CONTRACTOR SHALL MAINTAIN DUST CONTROL AT ALL TIMES BY WATERING.
8. AN APPROVED SOIL STERILIZER SHALL BE USED ON ALL SUBGRADES WHEN PLACING A.C. PAVEMENT DIRECTLY ON SUBGRADE.
9. WORK IN PUBLIC STREET, ONCE BEGUN, SHALL BE PROSECUTED TO COMPLETION WITHOUT DELAY SO AS TO PROVIDE MINIMUM INCONVEIENCE TO ADJACENT PROPERTY OWNERS AND TO TRAVELING PUBLIC.
10. CONTRACTOR SHALL FURNISH THE CITY ENGINEER WITH "AS BUILTS".
11. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN AN ENCROACHMENT PERMIT FROM SAN BERNARDINO COUNTY TRANSPORTATION DEPT.
12. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN A CONSTRUCTION PERMIT FROM THE ARMY CORPS OF ENGINEERS FOR CONSTRUCTION FROM CHANNEL WALL TO MANHOLE AT STATION 1+48±.
13. WORK FROM CHANNEL WALL STATION 0+97± THROUGH MANHOLE, STATION 1+48±, SHALL BE COMPLETED PRIOR TO OCTOBER 15, 1976 OR LATER THAN APRIL 15, 1977. MANHOLE AT STATION 1+48± SHALL HAVE A WATER TIGHT SEAL AT THE OUTLET IF ENTIRE CONSTRUCTION OF UPSTREAM STORM DRAIN IS NOT COMPLETED PRIOR TO OCTOBER, 1976.
14. ANY CONTRACTOR PERFORMING WORK ON THIS PROJECT SHALL FAMILIARIZE HIMSELF WITH THE SITE AND SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE TO EXISTING FACILITIES RESULTING DIRECTLY OR INDIRECTLY FROM HIS OPERATIONS, WHETHER OR NOT SUCH FACILITIES ARE SHOWN ON THESE PLANS.

SPECIAL NOTE FROM PRIVATE ENGINEER TO CONTRACTOR

Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this Project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineer harmless from any and all liability, real or alleged, in connection with the performance of work on this Project, excepting for liability arising from the sole negligence of the Owner or the Engineer.

THE EAST "X" STREET
CHINO, CALIF., 91710
W. R. Hughes 2-1-77
R.E. 21102 DATE

MARK	BY	REVISION	APP'D

BENCH MARK NO. 248 ELEV. 772.55
LOCATION: CITY OF CHINO
SPIKE IN EAST CURB OF ROSWELL AVENUE 40' NORTH OF NORTH B.C.R. AT NORTHEAST CORNER OF ROSWELL AVENUE AND MAXON PLACE.

APPROVED BY	DATE	CITY ENGINEER'S STAFF	DATE
TRAFFIC		DRAWN BY	
WATER		CHECKED BY	
SEWER		CHECKED BY	
LIGHTS		RECOMMENDED BY DKC 2/25/77	

APPROVED BY
ASSISTANT CITY ENGINEER
DATE 3/3/77

City of Chino Engineering Department

STORM DRAIN PLAN
WEST OF EAST END AVENUE
PHILADELPHIA STREET

JOB NO.
Sht. 1 of 1
DWG. NO. AA - 757

75-18V

Attachment 3 – Hydraulics: Flowmaster (Street Capacity), WSPG (HGL)

East End Ave - half street capacity at ROW

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01070	ft/ft
Normal Depth	0.91	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.24
0+16	@ FL	-0.91
0+18	@ gutter lip	-0.72
0+52	@ C/L	0.13

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, 0.13)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	62.83	ft³/s
Elevation Range	-0.91 to 0.13 ft	
Flow Area	13.89	ft²
Wetted Perimeter	47.40	ft
Hydraulic Radius	0.29	ft
Top Width	46.80	ft
Normal Depth	0.91	ft
Critical Depth	1.00	ft

East End Ave - half street capacity at ROW

Results

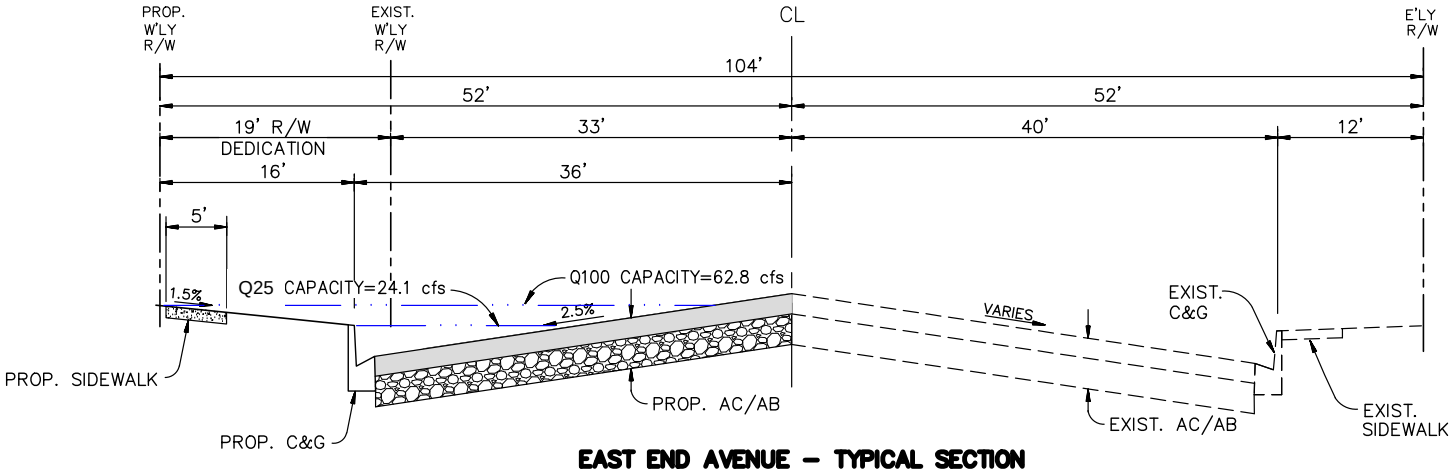
Critical Slope	0.00468	ft/ft
Velocity	4.52	ft/s
Velocity Head	0.32	ft
Specific Energy	1.23	ft
Froude Number	1.46	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.91	ft
Critical Depth	1.00	ft
Channel Slope	0.01070	ft/ft
Critical Slope	0.00468	ft/ft



EAST END AVENUE – TYPICAL SECTION
SECONDARY ARTERIAL
N.T.S.

East End Ave - half street capacity at TC

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01070	ft/ft
Normal Depth	0.67	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.24
0+16	@ FL	-0.91
0+18	@ gutter lip	-0.72
0+52	@ C/L	0.13

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, 0.13)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	24.13	ft³/s
Elevation Range	-0.91 to 0.13 ft	
Flow Area	5.73	ft²
Wetted Perimeter	21.79	ft
Hydraulic Radius	0.26	ft
Top Width	21.20	ft
Normal Depth	0.67	ft
Critical Depth	0.77	ft

East End Ave - half street capacity at ROW

Results

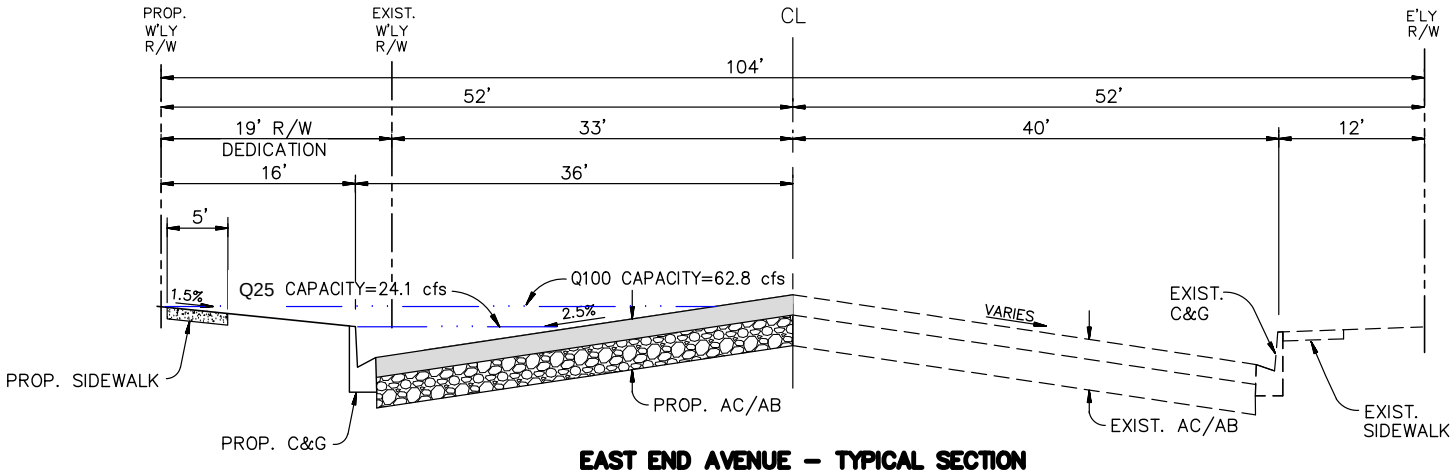
Critical Slope	0.00525	ft/ft
Velocity	4.21	ft/s
Velocity Head	0.28	ft
Specific Energy	0.95	ft
Froude Number	1.43	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.77	ft
Channel Slope	0.01070	ft/ft
Critical Slope	0.00525	ft/ft



EAST END AVENUE – TYPICAL SECTION
SECONDARY ARTERIAL
N.T.S.

Philadelphia St. (west of East End) - half street capacity at ROW

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.88	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.21
0+16	@ FL	-0.88
0+18	@ gutter lip	-0.69
0+52	@ C/L	-0.18

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, -0.18)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	55.14	ft³/s
Elevation Range	-0.88 to 0.00 ft	
Flow Area	18.02	ft²
Wetted Perimeter	52.77	ft
Hydraulic Radius	0.34	ft
Top Width	52.00	ft
Normal Depth	0.88	ft
Critical Depth	0.86	ft

Philadelphia St. (west of East End) - half street capacity at ROW

Results

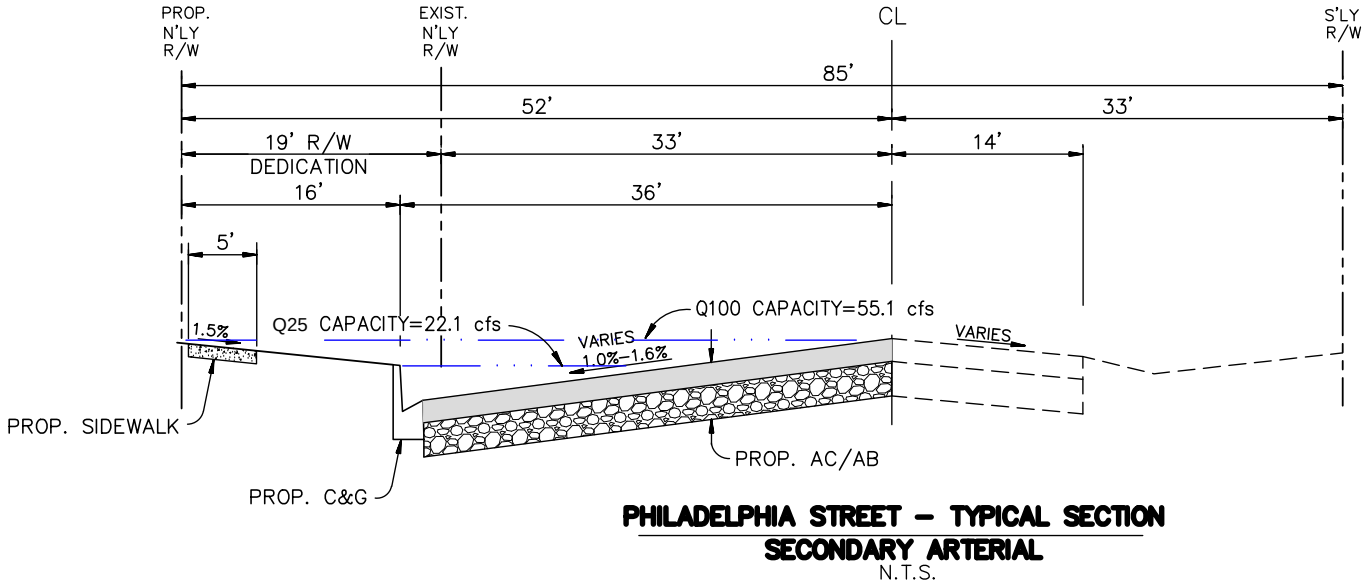
Critical Slope		0.00482	ft/ft
Velocity		3.06	ft/s
Velocity Head		0.15	ft
Specific Energy		1.03	ft
Froude Number		0.92	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	0.86	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00482	ft/ft



Philadelphia St. (west of East End) - half street capacity at TC

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.67	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.21
0+16	@ FL	-0.88
0+18	@ gutter lip	-0.69
0+52	@ C/L	-0.18

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, -0.18)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	22.16	ft³/s
Elevation Range	-0.88 to 0.00 ft	
Flow Area	8.81	ft²
Wetted Perimeter	34.59	ft
Hydraulic Radius	0.25	ft
Top Width	34.00	ft
Normal Depth	0.67	ft
Critical Depth	0.64	ft

Philadelphia St. (west of East End) - half street capacity at TC

Results

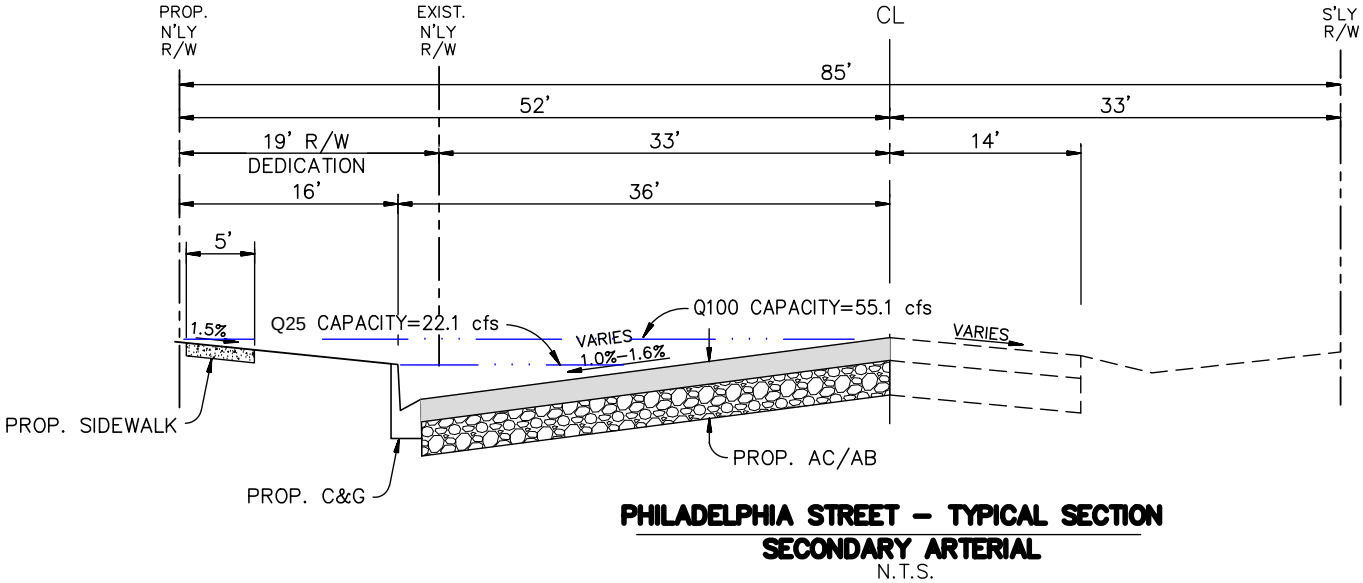
Critical Slope	0.00536	ft/ft
Velocity	2.52	ft/s
Velocity Head	0.10	ft
Specific Energy	0.77	ft
Froude Number	0.87	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.64	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00536	ft/ft



Philadelphia St. (east of East End) - half street capacity at ROW

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00320	ft/ft
Normal Depth	0.88	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.21
0+16	@ FL	-0.88
0+18	@ gutter lip	-0.69
0+52	@ C/L	-0.18

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, -0.18)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	49.31	ft³/s
Elevation Range	-0.88 to 0.00 ft	
Flow Area	18.02	ft²
Wetted Perimeter	52.77	ft
Hydraulic Radius	0.34	ft
Top Width	52.00	ft
Normal Depth	0.88	ft
Critical Depth	0.83	ft

Philadelphia St. (east of East End) - half street capacity at ROW

Results

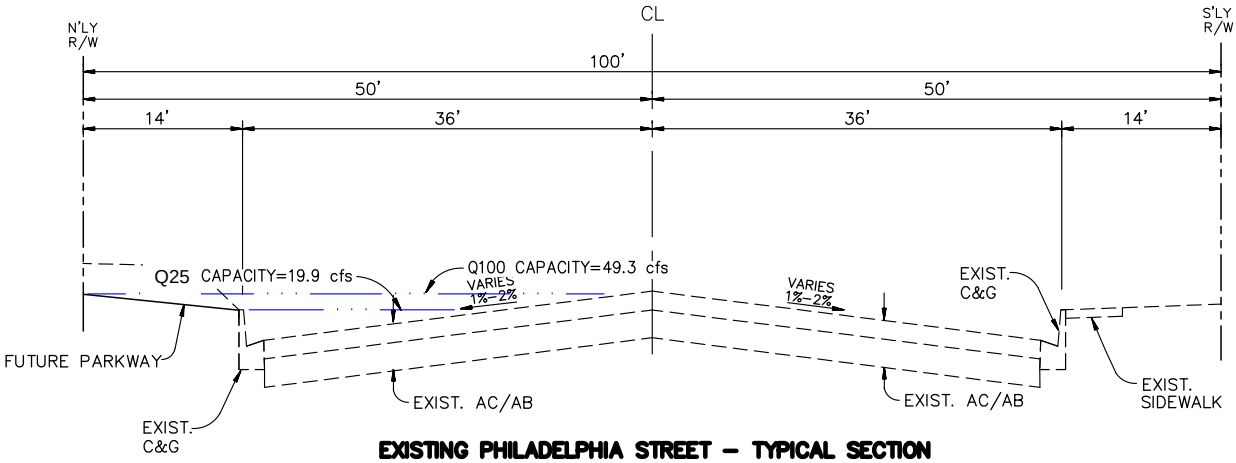
Critical Slope		0.00489	ft/ft
Velocity		2.74	ft/s
Velocity Head		0.12	ft
Specific Energy		1.00	ft
Froude Number		0.82	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	0.83	ft
Channel Slope	0.00320	ft/ft
Critical Slope	0.00489	ft/ft



EXISTING PHILADELPHIA STREET – TYPICAL SECTION
E/O EAST END AVENUE
N.T.S.

Philadelphia St. (east of East End) - half street capacity at TC

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00320	ft/ft
Normal Depth	0.67	ft

Section Definitions

Station (ft)		Elevation (ft)
0+00	@ R/W	0.00
0+16	@ TC	-0.21
0+16	@ FL	-0.88
0+18	@ gutter lip	-0.69
0+52	@ C/L	-0.18

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+52, -0.18)	0.015

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	19.82	ft³/s
Elevation Range	-0.88 to 0.00 ft	
Flow Area	8.81	ft²
Wetted Perimeter	34.59	ft
Hydraulic Radius	0.25	ft
Top Width	34.00	ft
Normal Depth	0.67	ft
Critical Depth	0.62	ft

Philadelphia St. (east of East End) - half street capacity at TC

Results

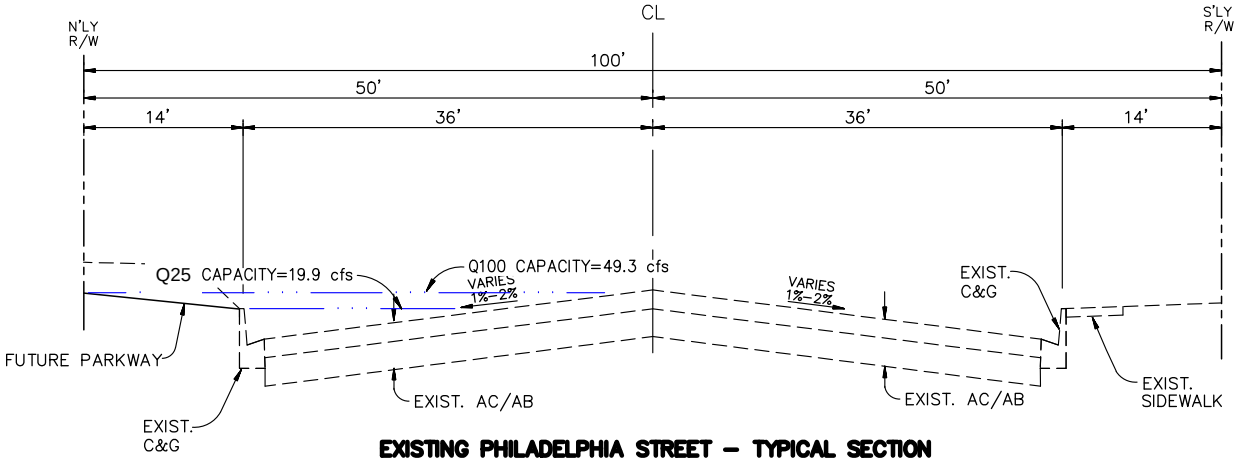
Critical Slope		0.00544	ft/ft
Velocity		2.25	ft/s
Velocity Head		0.08	ft
Specific Energy		0.75	ft
Froude Number		0.78	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.62	ft
Channel Slope	0.00320	ft/ft
Critical Slope	0.00544	ft/ft



EXISTING PHILADELPHIA STREET – TYPICAL SECTION
E/O EAST END AVENUE
N.T.S.

```
T1 PAMA East End Ave and Philadelphia                                        0
T2 33" Storm Drain
T3 RSK 08/13/21
SO    087.000 775.400  1                           782.300
R     148.620 781.350  1      .013                                  .000  45.000 1
R     430.000 784.060  1      .013                                  .000  00.000 0
JX    432.000 784.100  1  2   .013    2.640          784.900         90.0         .000
R     727.120 787.130  1      .013                                  .000    .000 0
JX    731.120 787.170  1  3   .013   10.000          787.890         90.0         .000
R     797.120 787.800  1      .013                                  .000    .000 0
JX    801.120 787.840  1  3   .013   12.000          788.610         90.0         .000
R    1386.130 793.420  1      .013                                  .000    .000 0
SH   1386.130 793.420  1
CD   1  4   1    .000   2.750     .000  .000  .000   .00
CD   2  4   1    .000   1.000     .000  .000  .000   .00
CD   3  4   1    .000   2.000     .000  .000  .000   .00
Q            32.000   .0
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Program Package Serial Number: 1404

WATER SURFACE PROFILE LISTING Date: 8-16-2021 Time:11: 1: 0

PAMA East End Ave and Philadelphia
33" Storm Drain
RSK 08/13/21

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
87.000	775.400	6.900	782.300	56.64	9.54	1.41	783.71	.00	2.44	.00	2.750	.000	.00	1 .0
38.583	.0966					.0115	.44	6.90	.00	1.11	.013	.00	.00	PIPE
125.583	779.126	3.817	782.943	56.64	9.54	1.41	784.35	.00	2.44	.00	2.750	.000	.00	1 .0
HYDRAULIC JUMP														
125.583	779.126	1.542	780.667	56.64	16.52	4.24	784.91	.00	2.44	2.73	2.750	.000	.00	1 .0
.752	.0966					.0310	.02	1.54	2.60	1.11	.013	.00	.00	PIPE
126.335	779.198	1.553	780.751	56.64	16.37	4.16	784.91	.00	2.44	2.73	2.750	.000	.00	1 .0
4.677	.0966					.0289	.14	1.55	2.56	1.11	.013	.00	.00	PIPE
131.012	779.650	1.615	781.265	56.64	15.61	3.78	785.05	.00	2.44	2.71	2.750	.000	.00	1 .0
3.916	.0966					.0256	.10	1.62	2.38	1.11	.013	.00	.00	PIPE
134.928	780.028	1.681	781.709	56.64	14.89	3.44	785.15	.00	2.44	2.68	2.750	.000	.00	1 .0
3.284	.0966					.0226	.07	1.68	2.20	1.11	.013	.00	.00	PIPE
138.212	780.345	1.751	782.096	56.64	14.19	3.13	785.22	.00	2.44	2.65	2.750	.000	.00	1 .0
2.750	.0966					.0201	.06	1.75	2.04	1.11	.013	.00	.00	PIPE
140.962	780.611	1.825	782.436	56.64	13.53	2.84	785.28	.00	2.44	2.60	2.750	.000	.00	1 .0
2.281	.0966					.0179	.04	1.83	1.88	1.11	.013	.00	.00	PIPE
143.243	780.831	1.904	782.735	56.64	12.90	2.58	785.32	.00	2.44	2.54	2.750	.000	.00	1 .0
1.848	.0966					.0159	.03	1.90	1.73	1.11	.013	.00	.00	PIPE

Program Package Serial Number: 1404

WATER SURFACE PROFILE LISTING Date: 8-16-2021 Time:11: 1: 0

PAMA East End Ave and Philadelphia
33" Storm Drain
RSK 08/13/21

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
145.090	781.009	1.990	782.999	56.64	12.30	2.35	785.35	.00	2.44	2.46	2.750	.000	.00	1 .0
1.465	.0966					.0142	.02	1.99	1.58	1.11	.013	.00	.00	PIPE
146.555	781.151	2.083	783.234	56.64	11.73	2.14	785.37	.00	2.44	2.36	2.750	.000	.00	1 .0
1.089	.0966					.0128	.01	2.08	1.44	1.11	.013	.00	.00	PIPE
147.644	781.256	2.186	783.442	56.64	11.18	1.94	785.38	.00	2.44	2.22	2.750	.000	.00	1 .0
.713	.0966					.0116	.01	2.19	1.30	1.11	.013	.00	.00	PIPE
148.357	781.325	2.302	783.627	56.64	10.66	1.77	785.39	.00	2.44	2.03	2.750	.000	.00	1 .0
.263	.0966					.0106	.00	2.30	1.16	1.11	.013	.00	.00	PIPE
148.620	781.350	2.441	783.791	56.64	10.16	1.60	785.39	.00	2.44	1.74	2.750	.000	.00	1 .0
85.456	.0096					.0101	.86	2.44	1.00	2.75	.013	.00	.00	PIPE
234.076	782.173	2.626	784.799	56.64	9.69	1.46	786.26	.00	2.44	1.14	2.750	.000	.00	1 .0
98.495	.0096					.0104	1.03	2.63	.75	2.75	.013	.00	.00	PIPE
332.571	783.122	2.750	785.872	56.64	9.54	1.41	787.28	.00	2.44	.00	2.750	.000	.00	1 .0
97.429	.0096					.0112	1.09	2.75	.00	2.75	.013	.00	.00	PIPE
430.000	784.060	2.929	786.989	56.64	9.54	1.41	788.40	.00	2.44	.00	2.750	.000	.00	1 .0
JUNCT STR	.0200					.0109	.02	2.93	.00		.013	.00	.00	PIPE
432.000	784.100	3.168	787.268	54.00	9.09	1.28	788.55	.00	2.40	.00	2.750	.000	.00	1 .0
295.120	.0103					.0104	3.08	3.17	.00	2.27	.013	.00	.00	PIPE

WATER SURFACE PROFILE LISTING Date: 8-16-2021 Time:11: 1: 0

PAMA East End Ave and Philadelphia
33" Storm Drain
RSK 08/13/21

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
727.120	787.130	3.215	790.345	54.00	9.09	1.28	791.63	.00	2.40	.00	2.750	.000	.00	1 .0
JUNCT STR	.0100					.0087	.03	3.21	.00		.013	.00	.00	PIPE
731.120	787.170	4.072	791.242	44.00	7.41	.85	792.09	.00	2.20	.00	2.750	.000	.00	1 .0
66.000	.0095					.0069	.46	4.07	.00	1.95	.013	.00	.00	PIPE
797.120	787.800	3.899	791.699	44.00	7.41	.85	792.55	.00	2.20	.00	2.750	.000	.00	1 .0
JUNCT STR	.0100					.0053	.02	3.90	.00		.013	.00	.00	PIPE
801.120	787.840	4.683	792.523	32.00	5.39	.45	792.97	.00	1.88	.00	2.750	.000	.00	1 .0
328.921	.0095					.0036	1.19	4.68	.00	1.57	.013	.00	.00	PIPE
1130.041	790.977	2.750	793.727	32.00	5.39	.45	794.18	.00	1.88	.00	2.750	.000	.00	1 .0
34.036	.0095					.0034	.12	2.75	.00	1.57	.013	.00	.00	PIPE
1164.077	791.302	2.495	793.797	32.00	5.65	.50	794.29	.00	1.88	1.59	2.750	.000	.00	1 .0
15.816	.0095					.0033	.05	2.50	.53	1.57	.013	.00	.00	PIPE
1179.893	791.453	2.347	793.800	32.00	5.93	.55	794.35	.00	1.88	1.94	2.750	.000	.00	1 .0
9.588	.0095					.0036	.03	2.35	.63	1.57	.013	.00	.00	PIPE
1189.481	791.544	2.246	793.791	32.00	6.16	.59	794.38	.00	1.88	2.13	2.750	.000	.00	1 .0
HYDRAULIC JUMP														
1189.481	791.544	1.566	793.111	32.00	9.16	1.30	794.41	.00	1.88	2.72	2.750	.000	.00	1 .0
22.545	.0095					.0095	.22	1.57	1.42	1.57	.013	.00	.00	PIPE

PAMA East End Ave and Philadelphia
33" Storm Drain
RSK 08/13/21

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1212.026	791.759	1.566	793.326	32.00	9.16	1.30	794.63	.00	1.88	2.72	2.750	.000	.00	1 .0
103.884	.0095					.0093	.96	1.57	1.42	1.57	.013	.00	.00	PIPE
1315.910	792.750	1.597	794.347	32.00	8.94	1.24	795.59	.00	1.88	2.71	2.750	.000	.00	1 .0
45.003	.0095					.0085	.38	1.60	1.37	1.57	.013	.00	.00	PIPE
1360.913	793.180	1.661	794.841	32.00	8.53	1.13	795.97	.00	1.88	2.69	2.750	.000	.00	1 .0
16.357	.0095					.0075	.12	1.66	1.27	1.57	.013	.00	.00	PIPE
1377.270	793.336	1.730	795.066	32.00	8.13	1.03	796.09	.00	1.88	2.66	2.750	.000	.00	1 .0
6.997	.0095					.0066	.05	1.73	1.18	1.57	.013	.00	.00	PIPE
1384.267	793.402	1.803	795.205	32.00	7.75	.93	796.14	.00	1.88	2.61	2.750	.000	.00	1 .0
1.863	.0095					.0059	.01	1.80	1.09	1.57	.013	.00	.00	PIPE
1386.130	793.420	1.882	795.302	32.00	7.39	.85	796.15	.00	1.88	2.56	2.750	.000	.00	1 .0

Attachment 4 – Hydrology: AES (Rational Method)

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
         (c) Copyright 1983-2014 Advanced Engineering Software (aes)
             Ver. 21.0  Release Date: 06/01/2014  License ID 1202

                           Analysis prepared by:

                            Huitt-Zollars, Inc.
                      2603 Main Street, Irvine CA. 92614
                                Suite 400
                               949-988-5815

 ************************** DESCRIPTION OF STUDY **************************
* PAMA INDUSTRIAL - PHILADELPHIA ST AT EAST END AVE                        *
* RATIONAL METHOD 10 YEAR STORM EVENT                                      *
* RYAN KIM HC 08/12/21                                                     *
 ***************************************************************************

  FILE NAME: PAMA10_A.DAT
  TIME/DATE OF STUDY: 10:45 08/12/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.9490

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   41.0     34.0    0.025/0.025/ ---    0.67    2.00 0.0313 0.167 0.0130
  2   30.0     23.0    0.020/0.020/ ---    0.50    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.67 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   736.00
  ELEVATION DATA: UPSTREAM(FEET) =    840.00  DOWNSTREAM(FEET) =    837.00
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.811
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.397
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        1.53      0.98     0.700    32   18.46
  COMMERCIAL                 A        0.60      0.98     0.100    32   12.81
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.531
  SUBAREA RUNOFF(CFS) =      3.60
  TOTAL AREA(ACRES) =      2.13   PEAK FLOW RATE(CFS) =      3.60

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  837.00  DOWNSTREAM ELEVATION(FEET) =  822.00
  STREET LENGTH(FEET) =  1519.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.41
    HALFSTREET FLOOD WIDTH(FEET) =   10.57
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.10
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.28
  STREET FLOW TRAVEL TIME(MIN.) =   8.15   Tc(MIN.) =   20.96
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.783
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        1.70      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    2.58
  EFFECTIVE AREA(ACRES) =      3.83    AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       5.01

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  10.65
  FLOW VELOCITY(FEET/SEC.) =  3.14   DEPTH*VELOCITY(FT*FT/SEC.) =   1.30
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    2255.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
```

```
==============================================================================
  UPSTREAM ELEVATION(FEET) =  822.00  DOWNSTREAM ELEVATION(FEET) =  805.00
  STREET LENGTH(FEET) =  1469.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.28
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   11.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.51
  STREET FLOW TRAVEL TIME(MIN.) =   7.04   Tc(MIN.) =   28.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.499
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        2.02      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.02      SUBAREA RUNOFF(CFS) =    2.55
  EFFECTIVE AREA(ACRES) =      5.85    AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.26
  TOTAL AREA(ACRES) =        5.9        PEAK FLOW RATE(CFS) =       6.57

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  11.56
  FLOW VELOCITY(FEET/SEC.) =  3.55   DEPTH*VELOCITY(FT*FT/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    3724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  805.00  DOWNSTREAM ELEVATION(FEET) =  799.00
  STREET LENGTH(FEET) =   510.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.99
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.44
    HALFSTREET FLOOD WIDTH(FEET) =   11.86
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.60
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.60
  STREET FLOW TRAVEL TIME(MIN.) =   2.36   Tc(MIN.) =   30.36
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.428
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.69      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    0.83
  EFFECTIVE AREA(ACRES) =      6.54    AREA-AVERAGED Fm(INCH/HR) =  0.23
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.24
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =       7.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  11.86
  FLOW VELOCITY(FEET/SEC.) =  3.62   DEPTH*VELOCITY(FT*FT/SEC.) =   1.61
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    4234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  799.00  DOWNSTREAM ELEVATION(FEET) =  792.00
  STREET LENGTH(FEET) =   650.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   12.47
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.54
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.63
  STREET FLOW TRAVEL TIME(MIN.) =   3.06   Tc(MIN.) =   33.42
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.348
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.89      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.89      SUBAREA RUNOFF(CFS) =    1.00
  EFFECTIVE AREA(ACRES) =      7.43    AREA-AVERAGED Fm(INCH/HR) =  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.22
  TOTAL AREA(ACRES) =        7.4        PEAK FLOW RATE(CFS) =       7.56

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.46   HALFSTREET FLOOD WIDTH(FEET) =  12.47
  FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   1.64
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  MAINLINE Tc(MIN.) =   33.42
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.348
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        5.29      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    5.29      SUBAREA RUNOFF(CFS) =    3.17
  EFFECTIVE AREA(ACRES) =     12.72   AREA-AVERAGED Fm(INCH/HR) =  0.41
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.42
  TOTAL AREA(ACRES) =       12.7       PEAK FLOW RATE(CFS) =      10.73

******************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  10
------------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

******************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   694.00
  ELEVATION DATA: UPSTREAM(FEET) =    818.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.644
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.212
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.96      0.98     0.700    32   14.64
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =     12.33
  TOTAL AREA(ACRES) =      8.96   PEAK FLOW RATE(CFS) =     12.33

******************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  803.00
  STREET LENGTH(FEET) =   872.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.09
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```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.48
    HALFSTREET FLOOD WIDTH(FEET) =   17.67
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.25
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.56
  STREET FLOW TRAVEL TIME(MIN.) =   4.47   Tc(MIN.) =   19.11
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.885
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A       16.10      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =   16.10      SUBAREA RUNOFF(CFS) =   17.43
  EFFECTIVE AREA(ACRES) =     25.06    AREA-AVERAGED Fm(INCH/HR) =  0.68
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       25.1        PEAK FLOW RATE(CFS) =      27.13

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  19.51
  FLOW VELOCITY(FEET/SEC.) =  3.46   DEPTH*VELOCITY(FT*FT/SEC.) =   1.79
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  803.00  DOWNSTREAM ELEVATION(FEET) =  800.00
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      31.16
    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) =  0.57
    HALFSTREET FLOOD WIDTH(FEET) =   22.35
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.05
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.75
  STREET FLOW TRAVEL TIME(MIN.) =   3.12   Tc(MIN.) =   22.23
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.722
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.61      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    8.61      SUBAREA RUNOFF(CFS) =    8.05
```

```
  EFFECTIVE AREA(ACRES) =     33.67    AREA-AVERAGED Fm(INCH/HR) =  0.68
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       33.7        PEAK FLOW RATE(CFS) =      31.50

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  22.40
  FLOW VELOCITY(FEET/SEC.) =  3.07   DEPTH*VELOCITY(FT*FT/SEC.) =   1.76
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    2136.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   793.40  DOWNSTREAM(FEET) =   787.82
  FLOW LENGTH(FEET) =   673.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.35
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      31.50
  PIPE TRAVEL TIME(MIN.) =   1.34    Tc(MIN.) =   23.57
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       31.50   23.57    1.662  0.98( 0.68) 0.70      33.7     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.73   33.42    1.348  0.98( 0.41) 0.42      12.7     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       41.60   23.57    1.662  0.98( 0.63) 0.64      42.6     300.00
      2       32.13   33.42    1.348  0.97( 0.61) 0.62      46.4     100.00
    TOTAL AREA(ACRES) =        46.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       41.60  Tc(MIN.) =   23.572
  EFFECTIVE AREA(ACRES) =     42.64  AREA-AVERAGED Fm(INCH/HR) =  0.63
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       46.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.82  DOWNSTREAM(FEET) =   787.15
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.48
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      41.60
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   23.69
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    822.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.669
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.535
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        1.24      0.98     0.100    32   11.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.72
  TOTAL AREA(ACRES) =      1.24   PEAK FLOW RATE(CFS) =      2.72

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  798.00
  STREET LENGTH(FEET) =  1000.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.48
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.43
    HALFSTREET FLOOD WIDTH(FEET) =   11.41
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.59
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.56
  STREET FLOW TRAVEL TIME(MIN.) =   4.64   Tc(MIN.) =   16.31
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.073
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        4.21      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.21      SUBAREA RUNOFF(CFS) =    7.49
  EFFECTIVE AREA(ACRES) =      5.45    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.4        PEAK FLOW RATE(CFS) =       9.69

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  13.54
  FLOW VELOCITY(FEET/SEC.) =  3.92   DEPTH*VELOCITY(FT*FT/SEC.) =   1.91
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    2000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  798.00  DOWNSTREAM ELEVATION(FEET) =  794.00
  STREET LENGTH(FEET) =   550.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.53
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.54
    HALFSTREET FLOOD WIDTH(FEET) =   15.52
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.30
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.77
  STREET FLOW TRAVEL TIME(MIN.) =   2.78   Tc(MIN.) =   19.09
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.887
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        1.04      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    1.67
  EFFECTIVE AREA(ACRES) =      6.49    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =      10.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.53   HALFSTREET FLOOD WIDTH(FEET) =  15.44
```

```
  FLOW VELOCITY(FEET/SEC.) =  3.31   DEPTH*VELOCITY(FT*FT/SEC.) =   1.77
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    107.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       10.45   19.09    1.887  0.98( 0.10) 0.10       6.5     200.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    107.00 =    2550.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       41.60   23.69    1.657  0.98( 0.63) 0.64      42.6     300.00
      2       32.13   33.55    1.345  0.97( 0.61) 0.62      46.4     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       51.42   19.09    1.887  0.98( 0.54) 0.56      40.8     200.00
      2       50.71   23.69    1.657  0.97( 0.56) 0.57      49.1     300.00
      3       39.41   33.55    1.345  0.98( 0.55) 0.56      52.9     100.00
    TOTAL AREA(ACRES) =        52.9

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       51.42  Tc(MIN.) =   19.090
  EFFECTIVE AREA(ACRES) =     40.85  AREA-AVERAGED Fm(INCH/HR) =  0.54
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.56
  TOTAL AREA(ACRES) =       52.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.15  DOWNSTREAM(FEET) =   784.90
  FLOW LENGTH(FEET) =   315.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.83
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      51.42
  PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =   19.68
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    5269.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
```

```
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  MAINLINE Tc(MIN.) =   19.68
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.852
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        3.60      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    5.69
  EFFECTIVE AREA(ACRES) =     44.45   AREA-AVERAGED Fm(INCH/HR) =  0.51
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.52
  TOTAL AREA(ACRES) =       56.5       PEAK FLOW RATE(CFS) =      53.87

******************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   784.90  DOWNSTREAM(FEET) =   775.00
  FLOW LENGTH(FEET) =   332.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.55
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      53.87
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   20.04
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =    5601.00 FEET.
==============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       56.5  TC(MIN.) =     20.04
  EFFECTIVE AREA(ACRES) =     44.45  AREA-AVERAGED Fm(INCH/HR)=  0.51
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap = 0.519
  PEAK FLOW RATE(CFS)   =      53.87

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       53.87   20.04    1.832  0.98( 0.51) 0.52      44.4     200.00
      2       52.60   24.65    1.618  0.97( 0.52) 0.54      52.7     300.00
      3       41.33   34.56    1.321  0.98( 0.52) 0.53      56.5     100.00
==============================================================================
==============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

↑

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****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1202

                           Analysis prepared by:

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                      2603 Main Street, Irvine CA. 92614
                                 Suite 400
                               949-988-5815

 ************************** DESCRIPTION OF STUDY **************************
* PAMA EAST END AVE PHILADELPHIA ST                                        *
* RATIONAL METHOD 25 YEAR STORM EVENT                                      *
* RYAN KIM HC 08/09/21                                                     *
 ***************************************************************************

  FILE NAME: PAMA25_A.DAT
  TIME/DATE OF STUDY: 01:05 08/09/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.1700

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   41.0     34.0    0.025/0.025/ ---    0.67    2.00 0.0313 0.167 0.0130
  2   30.0     23.0    0.020/0.020/ ---    0.50    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.67 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   736.00
  ELEVATION DATA: UPSTREAM(FEET) =    840.00  DOWNSTREAM(FEET) =    837.00
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.811
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.955
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        1.53      0.98     0.700    32   18.46
  COMMERCIAL                 A        0.60      0.98     0.100    32   12.81
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.531
  SUBAREA RUNOFF(CFS) =      4.67
  TOTAL AREA(ACRES) =      2.13   PEAK FLOW RATE(CFS) =      4.67

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  837.00  DOWNSTREAM ELEVATION(FEET) =  822.00
  STREET LENGTH(FEET) =  1519.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.31
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.44
    HALFSTREET FLOOD WIDTH(FEET) =   11.79
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.29
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.46
  STREET FLOW TRAVEL TIME(MIN.) =   7.69   Tc(MIN.) =   20.50
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.228
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        1.70      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    3.26
  EFFECTIVE AREA(ACRES) =      3.83    AREA-AVERAGED Fm(INCH/HR) =  0.33
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       6.54

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  11.94
  FLOW VELOCITY(FEET/SEC.) =  3.33   DEPTH*VELOCITY(FT*FT/SEC.) =   1.49
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    2255.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
```

```
==============================================================================
  UPSTREAM ELEVATION(FEET) =  822.00  DOWNSTREAM ELEVATION(FEET) =  805.00
  STREET LENGTH(FEET) =  1469.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.16
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.47
    HALFSTREET FLOOD WIDTH(FEET) =   12.70
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.72
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.73
  STREET FLOW TRAVEL TIME(MIN.) =   6.59   Tc(MIN.) =   27.09
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.885
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        2.02      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.02      SUBAREA RUNOFF(CFS) =    3.25
  EFFECTIVE AREA(ACRES) =      5.85    AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.26
  TOTAL AREA(ACRES) =        5.9        PEAK FLOW RATE(CFS) =       8.61

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.47   HALFSTREET FLOOD WIDTH(FEET) =  13.01
  FLOW VELOCITY(FEET/SEC.) =  3.75   DEPTH*VELOCITY(FT*FT/SEC.) =   1.78
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    3724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  805.00  DOWNSTREAM ELEVATION(FEET) =  799.00
  STREET LENGTH(FEET) =   510.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.14
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.48
    HALFSTREET FLOOD WIDTH(FEET) =   13.24
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.86
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.85
  STREET FLOW TRAVEL TIME(MIN.) =   2.20   Tc(MIN.) =   29.29
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.799
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.69      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    1.06
  EFFECTIVE AREA(ACRES) =      6.54    AREA-AVERAGED Fm(INCH/HR) =  0.23
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.24
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =       9.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  13.31
  FLOW VELOCITY(FEET/SEC.) =  3.85   DEPTH*VELOCITY(FT*FT/SEC.) =   1.85
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    4234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  799.00  DOWNSTREAM ELEVATION(FEET) =  792.00
  STREET LENGTH(FEET) =   650.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.85
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   13.92
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.79
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.88
  STREET FLOW TRAVEL TIME(MIN.) =   2.86   Tc(MIN.) =   32.16
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.701
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.89      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.89      SUBAREA RUNOFF(CFS) =    1.28
  EFFECTIVE AREA(ACRES) =      7.43    AREA-AVERAGED Fm(INCH/HR) =  0.22
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.22
  TOTAL AREA(ACRES) =        7.4        PEAK FLOW RATE(CFS) =       9.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  14.00
  FLOW VELOCITY(FEET/SEC.) =  3.77   DEPTH*VELOCITY(FT*FT/SEC.) =   1.88
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  MAINLINE Tc(MIN.) =   32.16
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  1.701
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        5.29      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    5.29      SUBAREA RUNOFF(CFS) =    4.85
  EFFECTIVE AREA(ACRES) =     12.72   AREA-AVERAGED Fm(INCH/HR) =  0.41
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.42
  TOTAL AREA(ACRES) =       12.7       PEAK FLOW RATE(CFS) =      14.77

******************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  10
------------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

******************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   694.00
  ELEVATION DATA: UPSTREAM(FEET) =    818.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.644
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.727
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.96      0.98     0.700    32   14.64
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =     16.49
  TOTAL AREA(ACRES) =      8.96   PEAK FLOW RATE(CFS) =     16.49

******************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  803.00
  STREET LENGTH(FEET) =   872.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      28.60
```

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    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) =  0.52
    HALFSTREET FLOOD WIDTH(FEET) =   19.90
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.51
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.84
  STREET FLOW TRAVEL TIME(MIN.) =   4.14   Tc(MIN.) =   18.79
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.348
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A       16.10      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =   16.10      SUBAREA RUNOFF(CFS) =   24.14
  EFFECTIVE AREA(ACRES) =     25.06    AREA-AVERAGED Fm(INCH/HR) =  0.68
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       25.1        PEAK FLOW RATE(CFS) =      37.57

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  22.12
  FLOW VELOCITY(FEET/SEC.) =  3.75   DEPTH*VELOCITY(FT*FT/SEC.) =   2.13
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  872.0 FT WITH ELEVATION-DROP =   7.0 FT, IS   25.9 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    302.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  803.00  DOWNSTREAM ELEVATION(FEET) =  800.00
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.29
    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) =  0.63
    HALFSTREET FLOOD WIDTH(FEET) =   25.35
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.31
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.09
  STREET FLOW TRAVEL TIME(MIN.) =   2.87   Tc(MIN.) =   21.66
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.156
  SUBAREA LOSS RATE DATA(AMC  II):
```

```
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.61      0.98     0.700    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    8.61      SUBAREA RUNOFF(CFS) =   11.42
  EFFECTIVE AREA(ACRES) =     33.67    AREA-AVERAGED Fm(INCH/HR) =  0.68
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       33.7        PEAK FLOW RATE(CFS) =      44.65

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.64   HALFSTREET FLOOD WIDTH(FEET) =  25.63
  FLOW VELOCITY(FEET/SEC.) =  3.34   DEPTH*VELOCITY(FT*FT/SEC.) =   2.13
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    2136.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   793.40  DOWNSTREAM(FEET) =   787.82
  FLOW LENGTH(FEET) =   673.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.99
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      44.65
  PIPE TRAVEL TIME(MIN.) =   1.25    Tc(MIN.) =   22.91
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       44.65   22.91    2.085  0.98( 0.68) 0.70      33.7     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       14.77   32.16    1.701  0.98( 0.41) 0.42      12.7     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       58.31   22.91    2.085  0.98( 0.62) 0.64      42.7     300.00
      2       47.20   32.16    1.701  0.97( 0.61) 0.62      46.4     100.00
    TOTAL AREA(ACRES) =        46.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       58.31  Tc(MIN.) =   22.908
  EFFECTIVE AREA(ACRES) =     42.73  AREA-AVERAGED Fm(INCH/HR) =  0.62
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       46.4
```

```
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.82  DOWNSTREAM(FEET) =   787.15
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.20
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      58.31
  PIPE TRAVEL TIME(MIN.) =   0.11    Tc(MIN.) =   23.02
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    822.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.669
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  3.125
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        1.24      0.98     0.100    32   11.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.38
  TOTAL AREA(ACRES) =      1.24   PEAK FLOW RATE(CFS) =      3.38

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  798.00
  STREET LENGTH(FEET) =  1000.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
```

```
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.10
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   12.55
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.74
  STREET FLOW TRAVEL TIME(MIN.) =   4.42   Tc(MIN.) =   16.09
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.577
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        4.21      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.21      SUBAREA RUNOFF(CFS) =    9.40
  EFFECTIVE AREA(ACRES) =      5.45    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.4        PEAK FLOW RATE(CFS) =      12.16

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  14.83
  FLOW VELOCITY(FEET/SEC.) =  4.15   DEPTH*VELOCITY(FT*FT/SEC.) =   2.15
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    2000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  798.00  DOWNSTREAM ELEVATION(FEET) =  794.00
  STREET LENGTH(FEET) =   550.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.22
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.57
    HALFSTREET FLOOD WIDTH(FEET) =   16.97
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.00
  STREET FLOW TRAVEL TIME(MIN.) =   2.62   Tc(MIN.) =   18.71
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.354
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        1.04      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
```

```
  SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    2.11
  EFFECTIVE AREA(ACRES) =      6.49    AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =      13.18

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  16.97
  FLOW VELOCITY(FEET/SEC.) =  3.49   DEPTH*VELOCITY(FT*FT/SEC.) =   2.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    107.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       13.18   18.71    2.354  0.98( 0.10) 0.10       6.5     200.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    107.00 =    2550.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       58.31   23.02    2.079  0.98( 0.62) 0.64      42.7     300.00
      2       47.20   32.28    1.697  0.97( 0.61) 0.62      46.4     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       69.54   18.71    2.354  0.97( 0.54) 0.56      41.2     200.00
      2       69.88   23.02    2.079  0.98( 0.56) 0.57      49.2     300.00
      3       56.54   32.28    1.697  0.98( 0.55) 0.56      52.9     100.00
    TOTAL AREA(ACRES) =        52.9

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       69.88  Tc(MIN.) =   23.022
  EFFECTIVE AREA(ACRES) =     49.22  AREA-AVERAGED Fm(INCH/HR) =  0.56
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.57
  TOTAL AREA(ACRES) =       52.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.15  DOWNSTREAM(FEET) =   784.90
  FLOW LENGTH(FEET) =   315.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.66
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =      69.88
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =   23.57
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    5269.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   23.57
  *  25 YEAR RAINFALL INTENSITY(INCH/HR) =  2.050
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        3.60      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    6.33
  EFFECTIVE AREA(ACRES) =     52.82   AREA-AVERAGED Fm(INCH/HR) =  0.52
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap =  0.54
  TOTAL AREA(ACRES) =       56.5       PEAK FLOW RATE(CFS) =      72.52

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       72.92   19.25    2.314  0.97( 0.51) 0.52      44.8     200.00
      2       72.52   23.57    2.050  0.98( 0.52) 0.54      52.8     300.00
      3       59.09   32.85    1.679  0.98( 0.52) 0.53      56.5     100.00
  NEW PEAK FLOW DATA ARE:
  PEAK FLOW RATE(CFS) =      72.92  Tc(MIN.) =   19.25
  AREA-AVERAGED Fm(INCH/HR) =  0.51  AREA-AVERAGED Fp(INCH/HR) =  0.97
  AREA-AVERAGED Ap =  0.52  EFFECTIVE AREA(ACRES) =      44.82

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   784.90  DOWNSTREAM(FEET) =   775.00
  FLOW LENGTH(FEET) =   332.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.72
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      72.92
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =   19.58
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =    5601.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       56.5  TC(MIN.) =     19.58
  EFFECTIVE AREA(ACRES) =     44.82  AREA-AVERAGED Fm(INCH/HR)=  0.51
  AREA-AVERAGED Fp(INCH/HR) =  0.97  AREA-AVERAGED Ap = 0.519
  PEAK FLOW RATE(CFS)   =      72.92

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       72.92   19.58    2.291  0.97( 0.51) 0.52      44.8     200.00
      2       72.52   23.90    2.033  0.98( 0.52) 0.54      52.8     300.00
      3       59.09   33.20    1.669  0.98( 0.52) 0.53      56.5     100.00
============================================================================
```

==========
END OF RATIONAL METHOD ANALYSIS

🡅

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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             Ver. 21.0  Release Date: 06/01/2014  License ID 1202

                           Analysis prepared by:

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                                Suite 400
                               949-988-5815

 ************************** DESCRIPTION OF STUDY **************************
* PAMA EAST END AVE PHILADELPHIA ST                                        *
* RATIONAL METHOD 100 YEAR STORM EVENT                                     *
* RYAN KIM HC 08/12/21                                                     *
 ***************************************************************************

  FILE NAME: PAMAH_A.DAT
  TIME/DATE OF STUDY: 10:49 08/12/2021
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                     --*TIME-OF-CONCENTRATION MODEL*--

  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
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.5400

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

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   41.0     34.0    0.025/0.025/ ---    0.67    2.00 0.0313 0.167 0.0130
  2   30.0     23.0    0.020/0.020/ ---    0.50    1.50 0.0313 0.125 0.0130

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.67 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   736.00
  ELEVATION DATA: UPSTREAM(FEET) =    840.00  DOWNSTREAM(FEET) =    837.00
```

```
  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.811
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.889
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        1.53      0.74     0.700    52   18.46
  COMMERCIAL                 A        0.60      0.74     0.100    52   12.81
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.531
  SUBAREA RUNOFF(CFS) =      6.70
  TOTAL AREA(ACRES) =      2.13   PEAK FLOW RATE(CFS) =      6.70

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  837.00  DOWNSTREAM ELEVATION(FEET) =  822.00
  STREET LENGTH(FEET) =  1519.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.93
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.49
    HALFSTREET FLOOD WIDTH(FEET) =   13.62
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.58
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.75
  STREET FLOW TRAVEL TIME(MIN.) =   7.08   Tc(MIN.) =   19.89
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.987
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        1.70      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.70      SUBAREA RUNOFF(CFS) =    4.46
  EFFECTIVE AREA(ACRES) =      3.83    AREA-AVERAGED Fm(INCH/HR) =  0.25
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.34
  TOTAL AREA(ACRES) =        3.8        PEAK FLOW RATE(CFS) =       9.43

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  13.92
  FLOW VELOCITY(FEET/SEC.) =  3.62   DEPTH*VELOCITY(FT*FT/SEC.) =   1.80
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    2255.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
```

```
==============================================================================
  UPSTREAM ELEVATION(FEET) =  822.00  DOWNSTREAM ELEVATION(FEET) =  805.00
  STREET LENGTH(FEET) =  1469.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.68
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.52
    HALFSTREET FLOOD WIDTH(FEET) =   14.68
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.06
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.09
  STREET FLOW TRAVEL TIME(MIN.) =   6.03   Tc(MIN.) =   25.91
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.549
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        2.02      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    2.02      SUBAREA RUNOFF(CFS) =    4.50
  EFFECTIVE AREA(ACRES) =      5.85    AREA-AVERAGED Fm(INCH/HR) =  0.19
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.26
  TOTAL AREA(ACRES) =        5.9        PEAK FLOW RATE(CFS) =      12.41

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  15.06
  FLOW VELOCITY(FEET/SEC.) =  4.12   DEPTH*VELOCITY(FT*FT/SEC.) =   2.16
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    3724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  805.00  DOWNSTREAM ELEVATION(FEET) =  799.00
  STREET LENGTH(FEET) =   510.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.15
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.53
    HALFSTREET FLOOD WIDTH(FEET) =   15.37
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.20
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.24
  STREET FLOW TRAVEL TIME(MIN.) =   2.02   Tc(MIN.) =   27.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.436
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.69      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    1.47
  EFFECTIVE AREA(ACRES) =      6.54    AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.24
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =      13.29

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.53   HALFSTREET FLOOD WIDTH(FEET) =  15.44
  FLOW VELOCITY(FEET/SEC.) =  4.20   DEPTH*VELOCITY(FT*FT/SEC.) =   2.25
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    4234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  799.00  DOWNSTREAM ELEVATION(FEET) =  792.00
  STREET LENGTH(FEET) =   650.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.18
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.55
    HALFSTREET FLOOD WIDTH(FEET) =   16.13
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.13
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.28
  STREET FLOW TRAVEL TIME(MIN.) =   2.62   Tc(MIN.) =   30.56
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.308
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        0.89      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.89      SUBAREA RUNOFF(CFS) =    1.79
  EFFECTIVE AREA(ACRES) =      7.43    AREA-AVERAGED Fm(INCH/HR) =  0.17
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.22
  TOTAL AREA(ACRES) =        7.4        PEAK FLOW RATE(CFS) =      14.33

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  16.21
  FLOW VELOCITY(FEET/SEC.) =  4.14   DEPTH*VELOCITY(FT*FT/SEC.) =   2.29
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  MAINLINE Tc(MIN.) =   30.56
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.308
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        5.29      0.74     0.700    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    5.29      SUBAREA RUNOFF(CFS) =    8.52
  EFFECTIVE AREA(ACRES) =     12.72   AREA-AVERAGED Fm(INCH/HR) =  0.31
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.42
  TOTAL AREA(ACRES) =       12.7       PEAK FLOW RATE(CFS) =      22.84

******************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  10
------------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

******************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   694.00
  ELEVATION DATA: UPSTREAM(FEET) =    818.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.644
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.589
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.96      0.74     0.700    52   14.64
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA RUNOFF(CFS) =     24.76
  TOTAL AREA(ACRES) =      8.96   PEAK FLOW RATE(CFS) =     24.76

******************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  62
------------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
==============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  803.00
  STREET LENGTH(FEET) =   872.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.73
```

```
    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) =  0.60
    HALFSTREET FLOOD WIDTH(FEET) =   23.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.89
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.32
  STREET FLOW TRAVEL TIME(MIN.) =   3.74   Tc(MIN.) =   18.38
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.132
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A       16.10      0.74     0.700    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =   16.10      SUBAREA RUNOFF(CFS) =   37.85
  EFFECTIVE AREA(ACRES) =     25.06    AREA-AVERAGED Fm(INCH/HR) =  0.52
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       25.1        PEAK FLOW RATE(CFS) =      58.92

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.65   HALFSTREET FLOOD WIDTH(FEET) =  26.30
  FLOW VELOCITY(FEET/SEC.) =  4.19   DEPTH*VELOCITY(FT*FT/SEC.) =   2.73
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  872.0 FT WITH ELEVATION-DROP =   7.0 FT, IS   39.6 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    302.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =    1566.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  803.00  DOWNSTREAM ELEVATION(FEET) =  800.00
  STREET LENGTH(FEET) =   570.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  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
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      68.13
    ***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) =  0.73
    HALFSTREET FLOOD WIDTH(FEET) =   30.00
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.71
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.70
  STREET FLOW TRAVEL TIME(MIN.) =   2.56   Tc(MIN.) =   20.94
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.896
```

```
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  RESIDENTIAL
  "2 DWELLINGS/ACRE"         A        8.61      0.74     0.700    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.700
  SUBAREA AREA(ACRES) =    8.61      SUBAREA RUNOFF(CFS) =   18.42
  EFFECTIVE AREA(ACRES) =     33.67    AREA-AVERAGED Fm(INCH/HR) =  0.52
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.70
  TOTAL AREA(ACRES) =       33.7        PEAK FLOW RATE(CFS) =      72.03

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.74   HALFSTREET FLOOD WIDTH(FEET) =  30.00
  FLOW VELOCITY(FEET/SEC.) =  3.80   DEPTH*VELOCITY(FT*FT/SEC.) =   2.81
  *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
         AND L =  570.0 FT WITH ELEVATION-DROP =   3.0 FT, IS   22.5 CFS,
         WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    303.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =    2136.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     303.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   793.40  DOWNSTREAM(FEET) =   787.82
  FLOW LENGTH(FEET) =   673.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  31.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.07
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      72.03
  PIPE TRAVEL TIME(MIN.) =   1.11    Tc(MIN.) =   22.05
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       72.03   22.05    2.808  0.74( 0.52) 0.70      33.7     300.00
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    106.00 =    2809.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       22.84   30.56    2.308  0.74( 0.31) 0.42      12.7     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       92.63   22.05    2.808  0.74( 0.48) 0.64      42.8     300.00
      2       79.16   30.56    2.308  0.74( 0.46) 0.62      46.4     100.00
    TOTAL AREA(ACRES) =        46.4

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
```

```
  PEAK FLOW RATE(CFS) =       92.63  Tc(MIN.) =   22.053
  EFFECTIVE AREA(ACRES) =     42.85  AREA-AVERAGED Fm(INCH/HR) =  0.48
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.64
  TOTAL AREA(ACRES) =       46.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    4884.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    106.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.82  DOWNSTREAM(FEET) =   787.15
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  42.0 INCH PIPE IS  33.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.36
  ESTIMATED PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      92.63
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   22.16
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =    822.00  DOWNSTREAM(FEET) =    810.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.669
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.113
  SUBAREA Tc AND LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 A        1.24      0.74     0.100    52   11.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      4.51
  TOTAL AREA(ACRES) =      1.24   PEAK FLOW RATE(CFS) =      4.51

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  810.00  DOWNSTREAM ELEVATION(FEET) =  798.00
```

```
  STREET LENGTH(FEET) =  1000.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.50
    HALFSTREET FLOOD WIDTH(FEET) =   14.23
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.02
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.03
  STREET FLOW TRAVEL TIME(MIN.) =   4.15   Tc(MIN.) =   15.81
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.428
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        4.21      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    4.21      SUBAREA RUNOFF(CFS) =   12.71
  EFFECTIVE AREA(ACRES) =      5.45    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        5.4        PEAK FLOW RATE(CFS) =      16.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  16.74
  FLOW VELOCITY(FEET/SEC.) =  4.47   DEPTH*VELOCITY(FT*FT/SEC.) =   2.53
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    2000.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  798.00  DOWNSTREAM ELEVATION(FEET) =  794.00
  STREET LENGTH(FEET) =   550.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 41.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  34.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.025
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.025

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0130

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.89
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.63
    HALFSTREET FLOOD WIDTH(FEET) =   19.10
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.77
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.36
  STREET FLOW TRAVEL TIME(MIN.) =   2.43   Tc(MIN.) =   18.24
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.146
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                A        1.04      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    2.88
  EFFECTIVE AREA(ACRES) =      6.49    AREA-AVERAGED Fm(INCH/HR) =  0.07
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.5        PEAK FLOW RATE(CFS) =      17.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.63   HALFSTREET FLOOD WIDTH(FEET) =  19.18
  FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   2.36
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    2550.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    107.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       17.94   18.24    3.146  0.74( 0.07) 0.10       6.5     200.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    107.00 =    2550.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       92.63   22.16    2.800  0.74( 0.48) 0.64      42.8     300.00
      2       79.16   30.66    2.304  0.74( 0.46) 0.62      46.4     100.00
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      105.58   18.24    3.146  0.74( 0.41) 0.56      41.8     200.00
      2      108.55   22.16    2.800  0.74( 0.42) 0.57      49.3     300.00
      3       92.18   30.66    2.304  0.74( 0.42) 0.56      52.9     100.00
    TOTAL AREA(ACRES) =        52.9

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      108.55  Tc(MIN.) =   22.156
  EFFECTIVE AREA(ACRES) =     49.34  AREA-AVERAGED Fm(INCH/HR) =  0.42
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.57
  TOTAL AREA(ACRES) =       52.9
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    4954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   787.15  DOWNSTREAM(FEET) =   784.90
```

```
  FLOW LENGTH(FEET) =   315.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  48.0 INCH PIPE IS  36.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.68
  ESTIMATED PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     108.55
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =   22.65
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    5269.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   22.65
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.763
  SUBAREA LOSS RATE DATA(AMC III):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 A        3.60      0.74     0.100    52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    3.60      SUBAREA RUNOFF(CFS) =    8.71
  EFFECTIVE AREA(ACRES) =     52.94   AREA-AVERAGED Fm(INCH/HR) =  0.40
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap =  0.54
  TOTAL AREA(ACRES) =       56.5       PEAK FLOW RATE(CFS) =     112.65

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   784.90  DOWNSTREAM(FEET) =   775.00
  FLOW LENGTH(FEET) =   332.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  26.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.65
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     112.65
  PIPE TRAVEL TIME(MIN.) =   0.30    Tc(MIN.) =   22.94
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =    5601.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       56.5  TC(MIN.) =     22.94
  EFFECTIVE AREA(ACRES) =     52.94  AREA-AVERAGED Fm(INCH/HR)=  0.40
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.537
  PEAK FLOW RATE(CFS)   =     112.65

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1      110.66   19.04    3.066  0.74( 0.39) 0.52      45.4     200.00
      2      112.65   22.94    2.742  0.74( 0.40) 0.54      52.9     300.00
      3       95.95   31.49    2.267  0.74( 0.39) 0.53      56.5     100.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

↑