HYDROLOGY STUDY

Serrano Oaks
Clay St., 270-lf N/O Linares St.
Jurupa Valley, CA 91752

Prepared for:
Rexco Development
1285 Corona Point Cr., Ste. 102
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Date: September 26, 2022

Prepared under the supervision of:

_____
Kevin J. Richer
RCE 43714, Exp. 3/31/23

Table of Contents

Discussion

The purpose of this study is to determine the storm flows for the pre-developed condition and post-developed condition of the project site. The proposed project is located on a 4.13-acre site located on the east side of Clay St., approximately 270-lf northerly of the intersection with Linares Ave., in the City of Jurupa Valley. It is bounded to the west by Clay St., to the north and east by residential developments, and to the south by a commercial development.

The project site is currently undeveloped with poor natural grass coverage and no impervious surfaces. Site soils are characteristic of Soil Group B, per the Geotechnical Investigation of the project site. In its existing condition, the project site does not accept run-on from the adjacent properties. The existing drainage patterns of the site create two drainage areas. Drainage Area A consists of the westerly portion of the site. Storm water sheets across dirt and discharges into the right-of-way of Clay St. by sheeting across the westerly boundary of the site. Drainage Area B consists of the easterly portion of the project site. Storm water sheets across dirt and discharges across the southerly boundary of the site into the adjacent commercial development. Comingled flows of the project site and the existing adjacent commercial development discharge into the right-of-way of Clay St. downstream from said properties. Therefore, while the existing drainage patterns of the site create two drainage areas, all flows from the project site discharge into Clay St. downstream of the project site. See Pre-Developed Hydrology Map in Appendix B.

The project proposes to develop the site for multi-family residential use, and proposes to construct thirteen residential buildings, AC pavement, concrete sidewalks, concrete curbs, concrete gutters, fencing, a catch basin inlet, and an underground infiltration system. See Appendix D for the hydraulic design of the proposed storm drain system, and the design of the underground infiltration system. The developed site will be 20% pervious. A value of 0.20 has been used for Ap in the analysis of the proposed development to be conservative. Proposed drainage patterns will mimic the existing pattern, directing storm water runoff to the southwesterly corner of the site. The project site is one drainage area, directing storm water to a proposed underground infiltration system located at the southwesterly corner of the sits and discharging overflows into the right-of-way of Clay St. as in the existing condition. Drainage Area A1 consists of the easterly portion of the property. Storm water runoff sheets across proposed landscape and AC pavement to be intercepted by a proposed concrete gutter that coveys flows southerly and then westerly. Drainage Area A2 consists of the westerly portion of the property. Storm water runoff sheets across proposed landscape and AC pavement to be intercepted by a proposed concrete gutter that coveys flows southerly. At the southerly boundary of the project site,

subareas A1 and A2 confluence. A proposed landscape swale located along said boundary conveys flows westerly to a proposed inlet located at the southwesterly corner of the project site. The inlet discharges flows into a proposed storm drain pipe that then conveys flows to the proposed underground infiltration system. The underground system provides retention of storm water runoff by infiltration into native soils. Overflows of the underground system pond up in said inlet and are intercepted by a proposed underwalk drain that discharges overflow into the right-of-way of Clay St. as in the existing condition. See the Post-Developed Hydrology Map in Appendix C.

The discharge rates of the 10-year and 100-year storms have been determined for both the pre-developed and post-developed conditions of the project site utilizing the Rational Method in accordance with the Riverside County Hydrology Manual. See Appendix B and C, respectively. The proposed development will increase the volume of storm water runoff generated by the project site above that of the pre-developed condition. The increase in runoff volume due to the proposed development is calculated in accordance with the following formula:

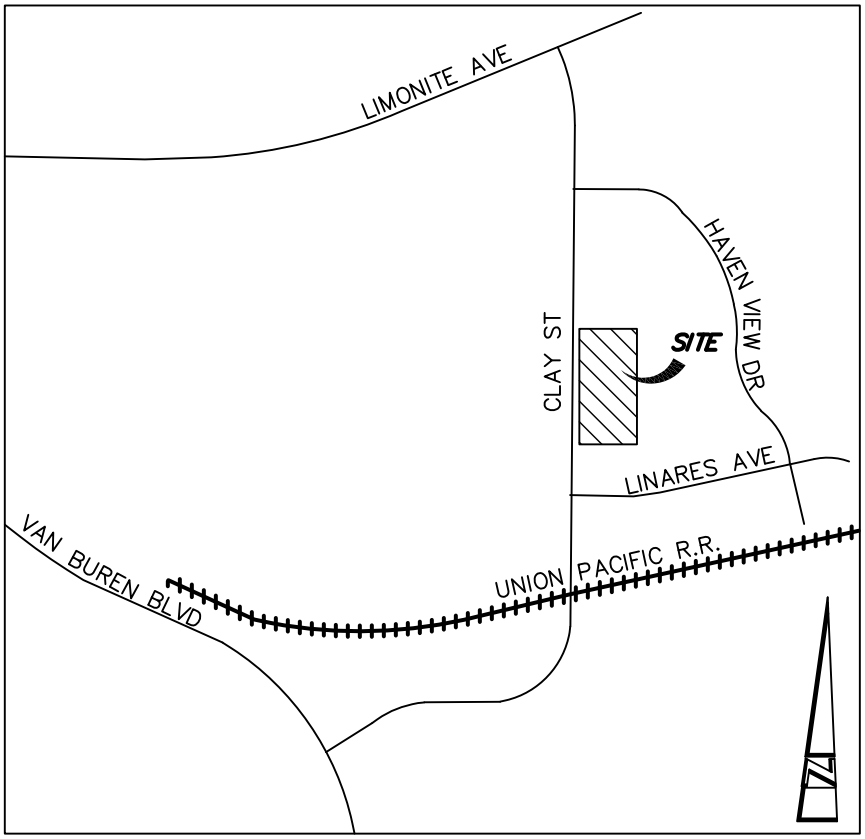
$$\Delta V = 1.5\ (\Delta Q)\ (T_{C,POST}*60)$$

To mitigate this, the proposed underground infiltration system will provide retention of storm water runoff. It has been designed in accordance with the Design Handbook for LID BMPs of Riverside County. See Appendix D. A summary is provided in the table below:

	Q_{PRE}	Q_{POST}	$T_{C,POST}$	ΔV	$V_{STORAGE}$
	(CFS)	(CFS)	(MIN)	(CF)	(CF)
2-YR	2.20	5.12	8.72	2,292	7,508
10-YR	4.57	7.83	8.51	2,497	
100-YR	7.60	11.82	8.09	3,073	

The storage capacity of the system ($V_{STORAGE}$) is more than the increase in storm water runoff volume (ΔV) generated by the proposed development of the site. Therefore, storm water discharging from the project site after development will be less than that of the existing condition of the site.

Appendix A



VICINITY MAP

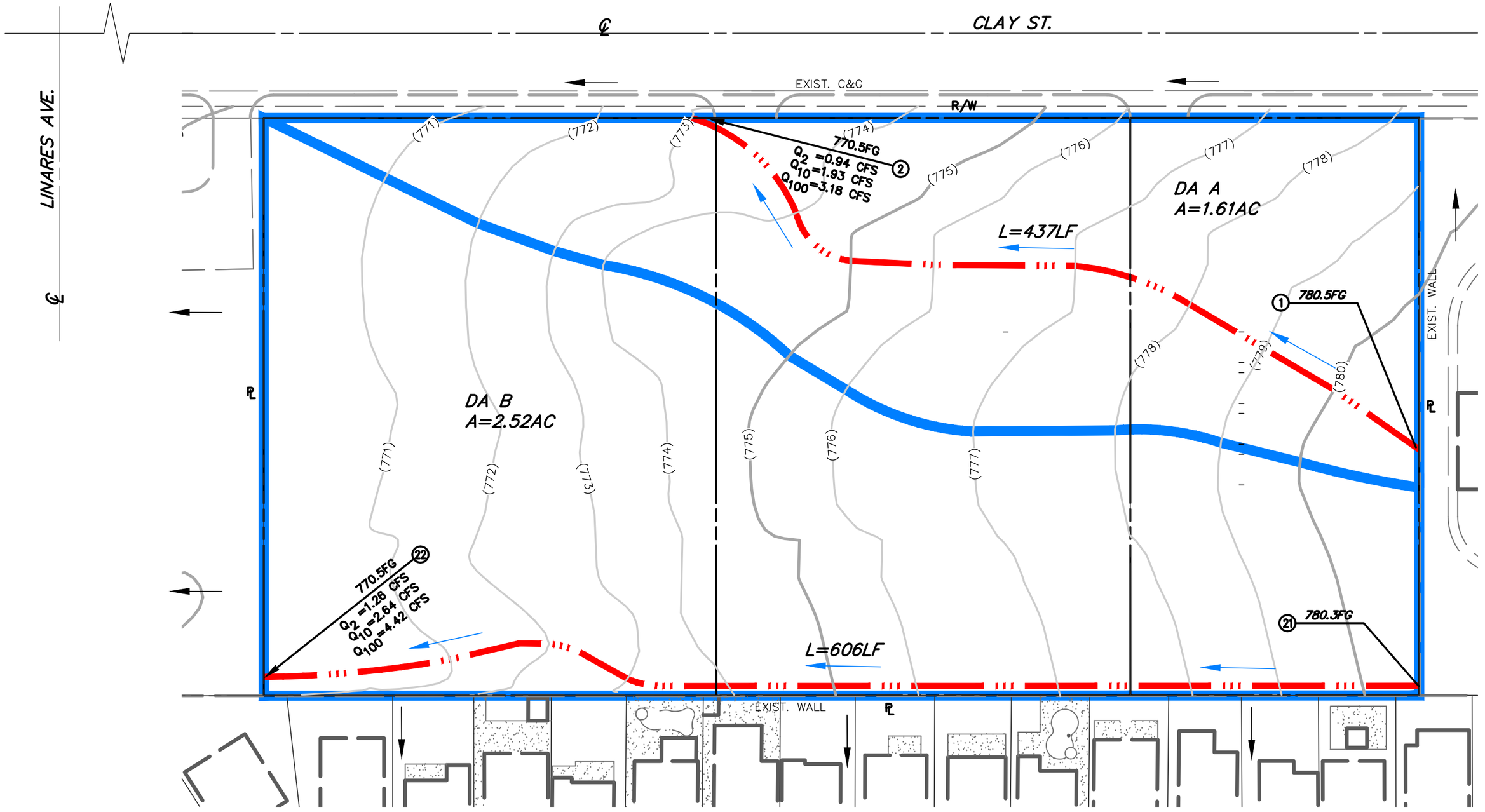
NTS

RAINFALL INTENSITY—INCHES PER HOUR

RIVERSIDE			RIVERSIDE (FOOTHILL AREAS)			RUBIDOUX			SAN JACINTO			SUN CITY		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	2.75	3.92	5	3.14	4.71	5	3.18	4.71	5	2.81	4.16	5	3.25	4.85
6	2.48	3.55	6	2.84	4.26	6	2.87	4.26	6	2.56	3.79	6	2.95	4.40
7	2.28	3.26	7	2.61	3.91	7	2.64	3.91	7	2.37	3.51	7	2.72	4.06
8	2.12	3.03	8	2.42	3.63	8	2.45	3.63	8	2.22	3.29	8	2.53	3.78
9	1.99	2.84	9	2.27	3.41	9	2.30	3.41	9	2.09	3.10	9	2.38	3.55
10	1.88	2.68	10	2.14	3.21	10	2.17	3.21	10	1.98	2.94	10	2.25	3.36
11	1.78	2.54	11	2.03	3.05	11	2.06	3.05	11	1.89	2.80	11	2.14	3.19
12	1.70	2.42	12	1.94	2.91	12	1.96	2.91	12	1.81	2.68	12	2.04	3.05
13	1.62	2.32	13	1.86	2.78	13	1.88	2.78	13	1.74	2.58	13	1.96	2.92
14	1.56	2.23	14	1.78	2.67	14	1.80	2.67	14	1.68	2.48	14	1.88	2.81
15	1.50	2.14	15	1.71	2.57	15	1.74	2.57	15	1.62	2.40	15	1.81	2.71
16	1.45	2.07	16	1.66	2.48	16	1.68	2.48	16	1.57	2.32	16	1.75	2.62
17	1.40	2.00	17	1.60	2.40	17	1.62	2.40	17	1.52	2.25	17	1.70	2.54
18	1.36	1.94	18	1.55	2.33	18	1.57	2.33	18	1.48	2.19	18	1.65	2.46
19	1.32	1.88	19	1.51	2.26	19	1.52	2.26	19	1.44	2.13	19	1.60	2.39
20	1.28	1.83	20	1.46	2.20	20	1.48	2.20	20	1.40	2.08	20	1.56	2.33
22	1.22	1.74	22	1.39	2.08	22	1.41	2.08	22	1.34	1.98	22	1.48	2.21
24	1.16	1.66	24	1.32	1.99	24	1.34	1.99	24	1.28	1.90	24	1.41	2.11
26	1.11	1.58	26	1.27	1.90	26	1.28	1.90	26	1.23	1.82	26	1.36	2.03
28	1.06	1.52	28	1.22	1.82	28	1.23	1.82	28	1.19	1.76	28	1.30	1.95
30	1.02	1.46	30	1.17	1.76	30	1.19	1.76	30	1.15	1.70	30	1.26	1.88
32	.99	1.41	32	1.13	1.70	32	1.14	1.70	32	1.11	1.64	32	1.21	1.81
34	.96	1.37	34	1.09	1.64	34	1.11	1.64	34	1.08	1.59	34	1.18	1.76
36	.93	1.32	36	1.06	1.59	36	1.07	1.59	36	1.05	1.55	36	1.14	1.70
38	.90	1.29	38	1.03	1.54	38	1.04	1.54	38	1.02	1.51	38	1.11	1.66
40	.87	1.25	40	1.00	1.50	40	1.01	1.50	40	.99	1.47	40	1.08	1.61
45	.82	1.17	45	.94	1.41	45	.95	1.41	45	.94	1.39	45	1.01	1.51
50	.77	1.11	50	.88	1.33	50	.90	1.33	50	.89	1.31	50	.96	1.43
55	.73	1.05	55	.84	1.26	55	.85	1.26	55	.85	1.25	55	.91	1.36
60	.70	1.00	60	.80	1.20	60	.81	1.20	60	.81	1.20	60	.87	1.30
65	.67	.96	65	.77	1.15	65	.78	1.15	65	.78	1.15	65	.83	1.25
70	.64	.92	70	.73	1.10	70	.74	1.10	70	.75	1.11	70	.80	1.20
75	.62	.88	75	.71	1.06	75	.72	1.06	75	.72	1.07	75	.77	1.15
80	.60	.85	80	.68	1.02	80	.69	1.02	80	.70	1.04	80	.75	1.12
85	.58	.83	85	.66	.99	85	.67	.99	85	.68	1.01	85	.72	1.08
SLOPE = .550			SLOPE = .550			SLOPE = .550			SLOPE = .500			SLOPE = .530		

STANDARD
INTENSITY—DURATION
CURVES DATA

Appendix B



LEGEND

- WATER SHED BOUNDARY
- SURFACE FLOW PATH
- PIPE FLOW PATH
- DIRECTION OF FLOW
- NODE

50 0 50 100 150

SCALE: 1"=50'

PRE-DEVELOPED HYDROLOGY MAP

SITE:

SERRANO OAKS
CLAY ST., 270–LF NO LINARES ST.
JURUPA VALLEY, CA 91752

PREPARED FOR:

REXCO DEVELOPMENT
1285 CORONA POINT CT., STE. 102
CORONA, CA 92879

JN6440

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/03/22 File:6440RUA2.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
2YR STORM
DA A

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

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

Program License Serial Number 5016

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

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.490(In/Hr)
Slope of intensity duration curve = 0.5500

++

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

Initial area flow distance = 437.000(Ft.)
Top (of initial area) elevation = 780.500(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)
Difference in elevation = 10.000(Ft.)
Slope = 0.02288 s(percent)= 2.29
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.840 min.
Rainfall intensity = 1.145(In/Hr) for a 2.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.512
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1) = 60.60
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 0.944(CFS)
Total initial stream area = 1.610(Ac.)
Pervious area fraction = 1.000

End of computations, total study area = 1.61 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 78.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/03/22 File:6440RUB2.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
2YR STORM
DA B

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

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

Program License Serial Number 5016

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

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.490(In/Hr)
Slope of intensity duration curve = 0.5500

++

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

Initial area flow distance = 606.000(Ft.)
Top (of initial area) elevation = 780.300(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)
Difference in elevation = 9.800(Ft.)
Slope = 0.01617 s(percent)= 1.62
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 15.686 min.
Rainfall intensity = 1.025(In/Hr) for a 2.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.488
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1) = 60.60
Pervious area fraction = 1.000; Impervious fraction = 0.000
Initial subarea runoff = 1.260(CFS)
Total initial stream area = 2.520(Ac.)
Pervious area fraction = 1.000

End of computations, total study area = 2.52 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number = 78.0

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/21/22 File:6440RUA10.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
10YR STORM
DA A

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

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

Program License Serial Number 5016

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

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

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.700(In/Hr)
Slope of intensity duration curve = 0.5500

++

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

Initial area flow distance = 437.000(Ft.)
Top (of initial area) elevation = 780.500(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)

```
Difference in elevation =    10.000(Ft.)
Slope =    0.02288  s(percent)=       2.29
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.840 min.
Rainfall intensity =      1.634(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.732
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  78.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      1.925(CFS)
Total initial stream area =        1.610(Ac.)
Pervious area fraction = 1.000
End of computations, total study area =            1.61 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
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Riverside County Rational Hydrology Program

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Rational Hydrology Study Date: 01/21/22 File:6440RUB10.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
10YR STORM
DA B

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

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

Program License Serial Number 5016

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

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

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.700(In/Hr)
Slope of intensity duration curve = 0.5500

++
Process from Point/Station 21.000 to Point/Station 22.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 606.000(Ft.)
Top (of initial area) elevation = 780.300(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)

```
Difference in elevation =     9.800(Ft.)
Slope =    0.01617  s(percent)=       1.62
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   15.686 min.
Rainfall intensity =      1.464(In/Hr) for a    10.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.716
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  78.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      2.642(CFS)
Total initial stream area =        2.520(Ac.)
Pervious area fraction = 1.000
End of computations, total study area =            2.52 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
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Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/21/22 File:6440RUA100.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA A

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

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

Program License Serial Number 5016

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

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.000(In/Hr)
Slope of intensity duration curve = 0.5500

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

Initial area flow distance = 437.000(Ft.)
Top (of initial area) elevation = 780.500(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)

```
Difference in elevation =    10.000(Ft.)
Slope =    0.02288  s(percent)=       2.29
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.840 min.
Rainfall intensity =      2.335(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  89.80
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      3.177(CFS)
Total initial stream area =        1.610(Ac.)
Pervious area fraction = 1.000
End of computations, total study area =            1.61 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/21/22 File:6440RUB100.out

JN6440 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA B

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

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

Program License Serial Number 5016

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

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.000(In/Hr)
Slope of intensity duration curve = 0.5500

++
Process from Point/Station 21.000 to Point/Station 22.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 606.000(Ft.)
Top (of initial area) elevation = 780.300(Ft.)
Bottom (of initial area) elevation = 770.500(Ft.)

```
Difference in elevation =     9.800(Ft.)
Slope =    0.01617  s(percent)=       1.62
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   15.686 min.
Rainfall intensity =      2.091(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.839
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  89.80
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      4.423(CFS)
Total initial stream area =        2.520(Ac.)
Pervious area fraction = 1.000
End of computations, total study area =            2.52 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  78.0
```

Appendix C

CLAY ST.

LINARES AVE.

PROP. UNDERWALK DRAIN

EXIST. C&G

R/W

DA A16
A=0.27AC

DA A15
A=0.27AC

DA A14
A=0.27AC

DA A13
A=0.27AC

DA A12
A=0.27AC

DA A11
A=0.28AC

DA A10
A=0.27AC

DA A9
A=0.28AC

DA A1
A=0.24AC

DA A2
A=0.24AC

DA A3
A=0.24AC

DA A4
A=0.25AC

DA A5
A=0.25AC

DA A6
A=0.25AC

DA A7
A=0.25AC

DA A8
A=0.25AC

DA A17
A=0.25AC

PROP. UNDERGROUND INFILTRATION SYSTEM

L=25LF
L=78LF
L=89LF
L=74LF
L=74LF
L=76LF
L=75LF
L=83LF
L=124LF
L=107LF
L=64LF
L=90LF
L=72LF
L=58LF
L=94LF
L=122LF

764.91INV
Q_2 =0.30 CFS (ADD A16)
Q_{10} =0.40 CFS (ADD A16)
Q_{100} =0.71 CFS (ADD A16)
Q_2 =0.28 CFS (ADD A17)
Q_{10} =0.44 CFS (ADD A17)
Q_{100} =0.86 CFS (ADD A17)
Q_2 =5.12 CFS (TOTAL)
Q_{10} =7.83 CFS (TOTAL)
Q_{100} =11.82 CFS (TOTAL)

765.65INV-12"Ø
765.32INV-18"Ø
Q_2 =4.64 CFS (CONFLUENCE)
Q_{10} =6.93 CFS (CONFLUENCE)
Q_{100} =10.45 CFS (CONFLUENCE)

767.78INV
Q_2 =0.36 CFS (ADD A13)
Q_{10} =0.55 CFS (ADD A14)
Q_{100} =0.82 CFS (ADD A14)
Q_2 =2.32 CFS (TOTAL)
Q_{10} =3.55 CFS (TOTAL)
Q_{100} =5.30 CFS (TOTAL)

769.28INV
Q_2 =0.36 CFS (ADD A12)
Q_{10} =0.55 CFS (ADD A13)
Q_{100} =0.84 CFS (ADD A13)
Q_2 =1.86 CFS (TOTAL)
Q_{10} =3.00 CFS (TOTAL)
Q_{100} =4.68 CFS (TOTAL)

770.02INV
Q_2 =0.37 CFS (ADD A12)
Q_{10} =0.57 CFS (ADD A12)
Q_{100} =0.86 CFS (ADD A12)
Q_2 =1.90 CFS (TOTAL)
Q_{10} =2.44 CFS (TOTAL)
Q_{100} =3.63 CFS (TOTAL)

770.54INV
Q_2 =0.41 CFS (ADD A10)
Q_{10} =0.61 CFS (ADD A11)
Q_{100} =0.93 CFS (ADD A11)
Q_2 =1.73 CFS (TOTAL)
Q_{10} =2.57 CFS (TOTAL)
Q_{100} =3.78 CFS (TOTAL)

771.58INV
Q_2 =0.40 CFS (ADD A10)
Q_{10} =0.60 CFS (ADD A10)
Q_{100} =0.90 CFS (ADD A10)
Q_2 =1.68 CFS (TOTAL)
Q_{10} =2.50 CFS (TOTAL)
Q_{100} =3.67 CFS (TOTAL)

777.02FS

776.24TG
772.24INV
Q_2 =0.43 CFS (A9)
Q_{10} =0.65 CFS (A9)
Q_{100} =0.97 CFS (A9)

776.90FS

770.38INV
Q_2 =0.32 CFS (ADD A5)
Q_{10} =0.48 CFS (ADD A5)
Q_{100} =0.72 CFS (ADD A5)
Q_2 =1.42 CFS (TOTAL)
Q_{10} =2.12 CFS (TOTAL)
Q_{100} =3.16 CFS (TOTAL)

776.65TG
772.03INV
Q_2 =0.33 CFS (ADD A1)
Q_{10} =0.51 CFS (ADD A1)
Q_{100} =0.75 CFS (ADD A1)
Q_2 =0.33 CFS (ADD A2)
Q_{10} =0.49 CFS (ADD A2)
Q_{100} =0.69 CFS (ADD A2)
Q_2 =0.98 CFS (TOTAL)
Q_{10} =1.51 CFS (TOTAL)
Q_{100} =2.22 CFS (TOTAL)

787.60INV
Q_2 =0.29 CFS (ADD A8)
Q_{10} =0.44 CFS (ADD A8)
Q_{100} =0.67 CFS (ADD A8)
Q_2 =2.52 CFS (TOTAL)
Q_{10} =3.86 CFS (TOTAL)
Q_{100} =5.77 CFS (TOTAL)

788.17INV-12"Ø
787.67INV-18"Ø
Q_2 =0.50 CFS (ADD A7)
Q_{10} =0.47 CFS (ADD A7)
Q_{100} =0.70 CFS (ADD A7)
Q_2 =2.23 CFS (TOTAL)
Q_{10} =3.41 CFS (TOTAL)
Q_{100} =5.10 CFS (TOTAL)

788.73INV
Q_2 =0.31 CFS (ADD A6)
Q_{10} =0.47 CFS (ADD A6)
Q_{100} =0.71 CFS (ADD A6)
Q_2 =1.83 CFS (TOTAL)
Q_{10} =2.80 CFS (TOTAL)
Q_{100} =4.26 CFS (TOTAL)

789.43INV
Q_2 =0.48 CFS (ADD A5)
Q_{10} =0.72 CFS (ADD A5)
Q_{100} =1.07 CFS (ADD A5)
Q_2 =2.47 CFS (TOTAL)
Q_{10} =3.69 CFS (TOTAL)
Q_{100} =5.61 CFS (TOTAL)

770.38INV
Q_2 =0.32 CFS (ADD A4)
Q_{10} =0.49 CFS (ADD A4)
Q_{100} =0.74 CFS (ADD A4)
Q_2 =1.31 CFS (TOTAL)
Q_{10} =1.99 CFS (TOTAL)
Q_{100} =2.98 CFS (TOTAL)

EXIST. WALL

EXIST. WALL

LEGEND
- WATER SHED BOUNDARY
- SURFACE FLOW PATH
- PIPE FLOW PATH
- DIRECTION OF FLOW
- NODE

20 0 20 40 60
SCALE: 1"=20'

LAND DEVELOPMENT DESIGN COMPANY, LLC
2313 E. Philadelphia St., Ste. F
Ontario, CA 91761
(909) 930-1466 • FAX (909) 930-1468
PLANNING • CIVIL • SURVEYING

BENCHMARK

REVISIONS:

PREPARED UNDER THE SUPERVISION OF:
KEVIN J. RICHER
R.C.E. 43714 LIC. EXP.3/31/23 DATE

APPROVED BY:
DATE

POST-DEVELOPED HYDROLOGY MAP

SITE
SERRANO OAKS
CLAY ST., 270-LF NO LINARES ST.
JURUPA VALLEY, CA 91752

PREPARED FOR
REXCO DEVELOPMENT
1285 CORONA POINTE COURT, SUITE 102
CORONA, CA 92879
951.898.1502

DATE: 09/26/22	JOB NO. 6440
DRAWN BY: JCQ	SCALE 1"=20'
DESIGNED BY:	SHEET 1 OF 1 SHEETS
CHECKED BY: KJR	

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/03/22 File:6440RD2.out

JN6440 RATIONAL STUDY
POST-DEVELOPED CONDITION
2YR STORM

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

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

Program License Serial Number 5016

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

Storm event (year) = 2.00 Antecedent Moisture Condition = 1

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 2.0
Calculated rainfall intensity data:
1 hour intensity = 0.490(In/Hr)
Slope of intensity duration curve = 0.5500

++
Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 124.000(Ft.)
Top (of initial area) elevation = 776.900(Ft.)
Bottom (of initial area) elevation = 776.030(Ft.)
Difference in elevation = 0.870(Ft.)
Slope = 0.00702 s(percent)= 0.70
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.989 min.
Rainfall intensity = 1.741(In/Hr) for a 2.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1) = 36.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 0.333(CFS)
Total initial stream area = 0.240(Ac.)
Pervious area fraction = 0.200

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.99 min.
Rainfall intensity =      1.741(In/Hr) for a     2.0 year storm
Subarea runoff =      0.333(CFS) for      0.240(Ac.)
Total runoff =      0.666(CFS)  Total area =       0.480(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   772.030(Ft.)
Downstream point/station elevation =   770.990(Ft.)
Pipe length  =   107.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     0.666(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.666(CFS)
Normal flow depth in pipe =    3.40(In.)
Flow top width inside pipe =   10.81(In.)
Critical Depth =    4.08(In.)
Pipe flow velocity =      3.64(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =     6.48 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.794
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.48 min.
Rainfall intensity =      1.668(In/Hr) for a     2.0 year storm
Subarea runoff =      0.318(CFS) for      0.240(Ac.)
Total runoff =      0.984(CFS)  Total area =       0.720(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   770.990(Ft.)
Downstream point/station elevation =   770.390(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     0.984(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.984(CFS)
```

```
Normal flow depth in pipe =    4.20(In.)
Flow top width inside pipe =   11.45(In.)
Critical Depth =    5.00(In.)
Pipe flow velocity =      4.01(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     6.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.793
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.74 min.
Rainfall intensity =      1.631(In/Hr) for a     2.0 year storm
Subarea runoff =      0.324(CFS) for      0.250(Ac.)
Total runoff =      1.307(CFS)  Total area =       0.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.390(Ft.)
Downstream point/station elevation =   769.450(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.307(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.307(CFS)
Normal flow depth in pipe =    4.76(In.)
Flow top width inside pipe =   11.74(In.)
Critical Depth =    5.80(In.)
Pipe flow velocity =      4.51(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =     7.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.792
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.08 min.
Rainfall intensity =      1.589(In/Hr) for a     2.0 year storm
Subarea runoff =      0.315(CFS) for      0.250(Ac.)
Total runoff =      1.622(CFS)  Total area =       1.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
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```
Upstream point/station elevation =   769.450(Ft.)
Downstream point/station elevation =   768.730(Ft.)
Pipe length  =    72.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.622(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.622(CFS)
Normal flow depth in pipe =    5.43(In.)
Flow top width inside pipe =   11.94(In.)
Critical Depth =    6.49(In.)
Pipe flow velocity =      4.70(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     7.33 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.791
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.33 min.
Rainfall intensity =      1.558(In/Hr) for a     2.0 year storm
Subarea runoff =      0.308(CFS) for      0.250(Ac.)
Total runoff =      1.930(CFS)  Total area =       1.470(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   768.730(Ft.)
Downstream point/station elevation =   768.170(Ft.)
Pipe length  =    58.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.930(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.930(CFS)
Normal flow depth in pipe =    6.06(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    7.11(In.)
Pipe flow velocity =      4.85(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =     7.53 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.791
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.53 min.
Rainfall intensity =      1.535(In/Hr) for a     2.0 year storm
Subarea runoff =      0.303(CFS) for      0.250(Ac.)
Total runoff =      2.233(CFS)  Total area =       1.720(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.670(Ft.)
Downstream point/station elevation =   767.600(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.233(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.233(CFS)
Normal flow depth in pipe =   11.30(In.)
Flow top width inside pipe =   17.40(In.)
Critical Depth =    6.76(In.)
Pipe flow velocity =      1.91(Ft/s)
Travel time through pipe =    0.82 min.
Time of concentration (TC) =     8.35 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       18.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.788
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.35 min.
Rainfall intensity =      1.450(In/Hr) for a     2.0 year storm
Subarea runoff =      0.286(CFS) for      0.250(Ac.)
Total runoff =      2.519(CFS)  Total area =       1.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.600(Ft.)
Downstream point/station elevation =   765.320(Ft.)
Pipe length  =   122.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.519(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.519(CFS)
Normal flow depth in pipe =    4.90(In.)
Flow top width inside pipe =   16.02(In.)
Critical Depth =    7.21(In.)
Pipe flow velocity =      6.47(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =     8.67 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.970(Ac.)
Runoff from this stream =      2.519(CFS)
Time of concentration =    8.67 min.
Rainfall intensity =     1.421(In/Hr)
```

```
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =    83.000(Ft.)
Top (of initial area) elevation =   777.020(Ft.)
Bottom (of initial area) elevation =   776.240(Ft.)
Difference in elevation =     0.780(Ft.)
Slope =    0.00940  s(percent)=       0.94
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Warning: TC computed to be less than 5 min.; program is assuming the
time of concentration is 5 minutes.
Initial area time of concentration =    5.000 min.
Rainfall intensity =      1.923(In/Hr) for a     2.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.801
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Initial subarea runoff =      0.431(CFS)
Total initial stream area =        0.280(Ac.)
Pervious area fraction = 0.200


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   772.240(Ft.)
Downstream point/station elevation =   771.680(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     0.431(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.431(CFS)
Normal flow depth in pipe =    2.91(In.)
Flow top width inside pipe =   10.29(In.)
Critical Depth =    3.25(In.)
Pipe flow velocity =      2.92(Ft/s)
Travel time through pipe =    0.43 min.
Time of concentration (TC) =     5.43 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.799
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.43 min.
Rainfall intensity =      1.838(In/Hr) for a     2.0 year storm
Subarea runoff =      0.396(CFS) for      0.270(Ac.)
Total runoff =      0.828(CFS)  Total area =       0.550(Ac.)
```

++
Process from Point/Station 23.000 to Point/Station 24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 771.680(Ft.)
Downstream point/station elevation = 770.540(Ft.)
Pipe length = 76.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 0.828(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 0.828(CFS)
Normal flow depth in pipe = 3.40(In.)
Flow top width inside pipe = 10.81(In.)
Critical Depth = 4.57(In.)
Pipe flow velocity = 4.52(Ft/s)
Travel time through pipe = 0.28 min.
Time of concentration (TC) = 5.71 min.

++
Process from Point/Station 24.000 to Point/Station 24.000
**** SUBAREA FLOW ADDITION ****

APARTMENT subarea type
Runoff Coefficient = 0.797
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1) = 36.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 5.71 min.
Rainfall intensity = 1.788(In/Hr) for a 2.0 year storm
Subarea runoff = 0.399(CFS) for 0.280(Ac.)
Total runoff = 1.227(CFS) Total area = 0.830(Ac.)

++
Process from Point/Station 24.000 to Point/Station 25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 770.540(Ft.)
Downstream point/station elevation = 770.020(Ft.)
Pipe length = 74.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 1.227(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 1.227(CFS)
Normal flow depth in pipe = 5.12(In.)
Flow top width inside pipe = 11.87(In.)
Critical Depth = 5.61(In.)
Pipe flow velocity = 3.84(Ft/s)
Travel time through pipe = 0.32 min.
Time of concentration (TC) = 6.03 min.

++
Process from Point/Station 25.000 to Point/Station 25.000
**** SUBAREA FLOW ADDITION ****

APARTMENT subarea type
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1) = 36.00
Pervious area fraction = 0.200; Impervious fraction = 0.800

```
Time of concentration =     6.03 min.
Rainfall intensity =      1.735(In/Hr) for a     2.0 year storm
Subarea runoff =      0.373(CFS) for      0.270(Ac.)
Total runoff =      1.600(CFS)  Total area =       1.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.020(Ft.)
Downstream point/station elevation =   769.280(Ft.)
Pipe length  =    74.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.600(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.600(CFS)
Normal flow depth in pipe =    5.38(In.)
Flow top width inside pipe =   11.94(In.)
Critical Depth =    6.44(In.)
Pipe flow velocity =      4.68(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     6.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.795
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.29 min.
Rainfall intensity =      1.695(In/Hr) for a     2.0 year storm
Subarea runoff =      0.364(CFS) for      0.270(Ac.)
Total runoff =      1.964(CFS)  Total area =       1.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   769.280(Ft.)
Downstream point/station elevation =   767.790(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.964(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.964(CFS)
Normal flow depth in pipe =    5.23(In.)
Flow top width inside pipe =   11.90(In.)
Critical Depth =    7.17(In.)
Pipe flow velocity =      5.98(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     6.54 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       27.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.794
```

```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.54 min.
Rainfall intensity =      1.659(In/Hr) for a     2.0 year storm
Subarea runoff =      0.356(CFS) for      0.270(Ac.)
Total runoff =      2.319(CFS)  Total area =       1.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   767.790(Ft.)
Downstream point/station elevation =   765.820(Ft.)
Pipe length  =    78.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.319(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.319(CFS)
Normal flow depth in pipe =    5.12(In.)
Flow top width inside pipe =   11.87(In.)
Critical Depth =    7.82(In.)
Pipe flow velocity =      7.27(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =     6.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.640(Ac.)
Runoff from this stream =      2.319(CFS)
Time of concentration =    6.72 min.
Rainfall intensity =     1.635(In/Hr)
Summary of stream data:

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


1        2.519      8.67                1.421
2        2.319      6.72                1.635
Largest stream flow has longer time of concentration
Qp =      2.519 + sum of
          Qb         Ia/Ib
           2.319 *    0.869 =      2.017
Qp =      4.536

Total of 2 main streams to confluence:
Flow rates before confluence point:
       2.519       2.319
Area of streams before confluence:
        1.970        1.640


Results of confluence:
Total flow rate =      4.536(CFS)
Time of concentration =     8.665 min.
Effective stream area after confluence  =      3.610(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   765.320(Ft.)
Downstream point/station elevation =   764.810(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     4.536(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.536(CFS)
Normal flow depth in pipe =    6.50(In.)
Flow top width inside pipe =   17.29(In.)
Critical Depth =    9.80(In.)
Pipe flow velocity =      7.88(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.787
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.72 min.
Rainfall intensity =      1.417(In/Hr) for a     2.0 year storm
Subarea runoff =      0.301(CFS) for      0.270(Ac.)
Total runoff =      4.837(CFS)  Total area =       3.880(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.787
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 1)  =  36.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.72 min.
Rainfall intensity =      1.417(In/Hr) for a     2.0 year storm
Subarea runoff =      0.279(CFS) for      0.250(Ac.)
Total runoff =      5.116(CFS)  Total area =       4.130(Ac.)
End of computations, total study area =            4.13 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged RI index number =  56.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/03/22 File:6440rd10.out

JN6440 RATIONAL STUDY
POST-DEVELOPED CONDITION
10YR STORM

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

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

Program License Serial Number 5016

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

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

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 10.0
Calculated rainfall intensity data:
1 hour intensity = 0.700(In/Hr)
Slope of intensity duration curve = 0.5500

++
Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 124.000(Ft.)
Top (of initial area) elevation = 776.900(Ft.)
Bottom (of initial area) elevation = 776.030(Ft.)
Difference in elevation = 0.870(Ft.)
Slope = 0.00702 s(percent)= 0.70
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.989 min.
Rainfall intensity = 2.486(In/Hr) for a 10.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 56.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 0.505(CFS)
Total initial stream area = 0.240(Ac.)
Pervious area fraction = 0.200

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       12.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.99 min.
Rainfall intensity =      2.486(In/Hr) for a    10.0 year storm
Subarea runoff =      0.505(CFS) for      0.240(Ac.)
Total runoff =      1.010(CFS)  Total area =       0.480(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   772.030(Ft.)
Downstream point/station elevation =   770.990(Ft.)
Pipe length  =   107.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.010(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.010(CFS)
Normal flow depth in pipe =    4.22(In.)
Flow top width inside pipe =   11.46(In.)
Critical Depth =    5.06(In.)
Pipe flow velocity =      4.10(Ft/s)
Travel time through pipe =    0.44 min.
Time of concentration (TC) =     6.42 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.42 min.
Rainfall intensity =      2.392(In/Hr) for a    10.0 year storm
Subarea runoff =      0.485(CFS) for      0.240(Ac.)
Total runoff =      1.496(CFS)  Total area =       0.720(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   770.990(Ft.)
Downstream point/station elevation =   770.390(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.496(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.496(CFS)
```

```
Normal flow depth in pipe =    5.28(In.)
Flow top width inside pipe =   11.91(In.)
Critical Depth =    6.22(In.)
Pipe flow velocity =      4.49(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     6.66 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.844
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.66 min.
Rainfall intensity =      2.345(In/Hr) for a    10.0 year storm
Subarea runoff =      0.495(CFS) for      0.250(Ac.)
Total runoff =      1.991(CFS)  Total area =       0.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.390(Ft.)
Downstream point/station elevation =   769.450(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.991(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.991(CFS)
Normal flow depth in pipe =    6.04(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    7.23(In.)
Pipe flow velocity =      5.03(Ft/s)
Travel time through pipe =    0.30 min.
Time of concentration (TC) =     6.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.843
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.96 min.
Rainfall intensity =      2.289(In/Hr) for a    10.0 year storm
Subarea runoff =      0.483(CFS) for      0.250(Ac.)
Total runoff =      2.473(CFS)  Total area =       1.220(Ac.)


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Process from Point/Station       15.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
```

Upstream point/station elevation = 769.450(Ft.)
Downstream point/station elevation = 768.730(Ft.)
Pipe length = 72.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 2.473(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 2.473(CFS)
Normal flow depth in pipe = 6.98(In.)
Flow top width inside pipe = 11.84(In.)
Critical Depth = 8.08(In.)
Pipe flow velocity = 5.22(Ft/s)
Travel time through pipe = 0.23 min.
Time of concentration (TC) = 7.19 min.

++
Process from Point/Station 16.000 to Point/Station 16.000
**** SUBAREA FLOW ADDITION ****

APARTMENT subarea type
Runoff Coefficient = 0.843
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 56.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 7.19 min.
Rainfall intensity = 2.248(In/Hr) for a 10.0 year storm
Subarea runoff = 0.474(CFS) for 0.250(Ac.)
Total runoff = 2.947(CFS) Total area = 1.470(Ac.)

++
Process from Point/Station 16.000 to Point/Station 17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

Upstream point/station elevation = 768.730(Ft.)
Downstream point/station elevation = 768.170(Ft.)
Pipe length = 58.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 2.947(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 2.947(CFS)
Normal flow depth in pipe = 7.95(In.)
Flow top width inside pipe = 11.35(In.)
Critical Depth = 8.83(In.)
Pipe flow velocity = 5.34(Ft/s)
Travel time through pipe = 0.18 min.
Time of concentration (TC) = 7.37 min.

++
Process from Point/Station 17.000 to Point/Station 17.000
**** SUBAREA FLOW ADDITION ****

APARTMENT subarea type
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 56.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 7.37 min.
Rainfall intensity = 2.218(In/Hr) for a 10.0 year storm
Subarea runoff = 0.467(CFS) for 0.250(Ac.)
Total runoff = 3.414(CFS) Total area = 1.720(Ac.)

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.670(Ft.)
Downstream point/station elevation =   767.600(Ft.)
Pipe length  =    94.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.414(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.119(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.085(Ft.)
 Minor friction loss =      0.104(Ft.)  K-factor =   1.80
Pipe flow velocity =      1.93(Ft/s)
Travel time through pipe =    0.81 min.
Time of concentration (TC) =     8.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       18.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.840
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.18 min.
Rainfall intensity =      2.094(In/Hr) for a    10.0 year storm
Subarea runoff =      0.440(CFS) for      0.250(Ac.)
Total runoff =      3.854(CFS)  Total area =       1.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.600(Ft.)
Downstream point/station elevation =   765.320(Ft.)
Pipe length  =   122.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.854(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.854(CFS)
Normal flow depth in pipe =    6.11(In.)
Flow top width inside pipe =   17.04(In.)
Critical Depth =    9.01(In.)
Pipe flow velocity =      7.30(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =     8.46 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      1.970(Ac.)
Runoff from this stream =      3.854(CFS)
Time of concentration =    8.46 min.
```

```
Rainfall intensity =     2.056(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
Initial area flow distance =    83.000(Ft.)
Top (of initial area) elevation =   777.020(Ft.)
Bottom (of initial area) elevation =   776.240(Ft.)
Difference in elevation =     0.780(Ft.)
Slope =    0.00940  s(percent)=       0.94
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Warning: TC computed to be less than 5 min.; program is assuming the
time of concentration is 5 minutes.
Initial area time of concentration =    5.000 min.
Rainfall intensity =      2.746(In/Hr) for a    10.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.850
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Initial subarea runoff =      0.654(CFS)
Total initial stream area =        0.280(Ac.)
Pervious area fraction = 0.200


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Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   772.240(Ft.)
Downstream point/station elevation =   771.680(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     0.654(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.654(CFS)
Normal flow depth in pipe =    3.60(In.)
Flow top width inside pipe =   11.00(In.)
Critical Depth =    4.04(In.)
Pipe flow velocity =      3.30(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =     5.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.849
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.38 min.
Rainfall intensity =      2.638(In/Hr) for a    10.0 year storm
Subarea runoff =      0.604(CFS) for      0.270(Ac.)
Total runoff =      1.258(CFS)  Total area =       0.550(Ac.)
```

++
Process from Point/Station 23.000 to Point/Station 24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____
Upstream point/station elevation = 771.680(Ft.)
Downstream point/station elevation = 770.540(Ft.)
Pipe length = 76.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 1.258(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 1.258(CFS)
Normal flow depth in pipe = 4.23(In.)
Flow top width inside pipe = 11.46(In.)
Critical Depth = 5.68(In.)
Pipe flow velocity = 5.09(Ft/s)
Travel time through pipe = 0.25 min.
Time of concentration (TC) = 5.63 min.

++
Process from Point/Station 24.000 to Point/Station 24.000
**** SUBAREA FLOW ADDITION ****
_____
APARTMENT subarea type
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 56.00
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 5.63 min.
Rainfall intensity = 2.573(In/Hr) for a 10.0 year storm
Subarea runoff = 0.611(CFS) for 0.280(Ac.)
Total runoff = 1.869(CFS) Total area = 0.830(Ac.)

++
Process from Point/Station 24.000 to Point/Station 25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____
Upstream point/station elevation = 770.540(Ft.)
Downstream point/station elevation = 770.020(Ft.)
Pipe length = 74.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 1.869(CFS)
Given pipe size = 12.00(In.)
Calculated individual pipe flow = 1.869(CFS)
Normal flow depth in pipe = 6.54(In.)
Flow top width inside pipe = 11.95(In.)
Critical Depth = 6.98(In.)
Pipe flow velocity = 4.27(Ft/s)
Travel time through pipe = 0.29 min.
Time of concentration (TC) = 5.92 min.

++
Process from Point/Station 25.000 to Point/Station 25.000
**** SUBAREA FLOW ADDITION ****
_____
APARTMENT subarea type
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2) = 56.00

```
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.92 min.
Rainfall intensity =      2.503(In/Hr) for a    10.0 year storm
Subarea runoff =      0.572(CFS) for      0.270(Ac.)
Total runoff =      2.441(CFS)  Total area =       1.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.020(Ft.)
Downstream point/station elevation =   769.280(Ft.)
Pipe length  =    74.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.441(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.441(CFS)
Normal flow depth in pipe =    6.93(In.)
Flow top width inside pipe =   11.86(In.)
Critical Depth =    8.03(In.)
Pipe flow velocity =      5.20(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =     6.15 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.846
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.15 min.
Rainfall intensity =      2.449(In/Hr) for a    10.0 year storm
Subarea runoff =      0.560(CFS) for      0.270(Ac.)
Total runoff =      3.001(CFS)  Total area =       1.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   769.280(Ft.)
Downstream point/station elevation =   767.790(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.001(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.001(CFS)
Normal flow depth in pipe =    6.70(In.)
Flow top width inside pipe =   11.92(In.)
Critical Depth =    8.92(In.)
Pipe flow velocity =      6.65(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     6.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       27.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
```

```
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.38 min.
Rainfall intensity =      2.402(In/Hr) for a    10.0 year storm
Subarea runoff =      0.548(CFS) for      0.270(Ac.)
Total runoff =      3.549(CFS)  Total area =       1.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.790(Ft.)
Downstream point/station elevation =   765.820(Ft.)
Pipe length  =    78.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.549(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.549(CFS)
Normal flow depth in pipe =    6.55(In.)
Flow top width inside pipe =   11.95(In.)
Critical Depth =    9.65(In.)
Pipe flow velocity =      8.09(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     6.54 min.


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Process from Point/Station       21.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.640(Ac.)
Runoff from this stream =      3.549(CFS)
Time of concentration =    6.54 min.
Rainfall intensity =     2.369(In/Hr)
Summary of stream data:

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


1        3.854      8.46                2.056
2        3.549      6.54                2.369
Largest stream flow has longer time of concentration
Qp =      3.854 + sum of
          Qb         Ia/Ib
           3.549 *    0.868 =      3.080
Qp =      6.934

Total of 2 main streams to confluence:
Flow rates before confluence point:
       3.854       3.549
Area of streams before confluence:
        1.970        1.640


Results of confluence:
Total flow rate =      6.934(CFS)
Time of concentration =     8.460 min.
Effective stream area after confluence  =      3.610(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   765.320(Ft.)
Downstream point/station elevation =   764.810(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     6.934(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.934(CFS)
Normal flow depth in pipe =    8.21(In.)
Flow top width inside pipe =   17.93(In.)
Critical Depth =   12.22(In.)
Pipe flow velocity =      8.83(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     8.51 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.839
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.51 min.
Rainfall intensity =      2.050(In/Hr) for a    10.0 year storm
Subarea runoff =      0.464(CFS) for      0.270(Ac.)
Total runoff =      7.398(CFS)  Total area =       3.880(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.839
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  56.00
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.51 min.
Rainfall intensity =      2.050(In/Hr) for a    10.0 year storm
Subarea runoff =      0.430(CFS) for      0.250(Ac.)
Total runoff =      7.828(CFS)  Total area =       4.130(Ac.)
End of computations, total study area =            4.13 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged RI index number =  56.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/03/22 File:6440RD100.out

JN6440 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM

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

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

Program License Serial Number 5016

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

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Riverside] area used.
10 year storm 10 minute intensity = 1.880(In/Hr)
10 year storm 60 minute intensity = 0.700(In/Hr)
100 year storm 10 minute intensity = 2.680(In/Hr)
100 year storm 60 minute intensity = 1.000(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.000(In/Hr)
Slope of intensity duration curve = 0.5500

++

Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance = 124.000(Ft.)
Top (of initial area) elevation = 776.900(Ft.)
Bottom (of initial area) elevation = 776.030(Ft.)
Difference in elevation = 0.870(Ft.)
Slope = 0.00702 s(percent)= 0.70
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 5.989 min.
Rainfall intensity = 3.552(In/Hr) for a 100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 74.80
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 0.750(CFS)
Total initial stream area = 0.240(Ac.)
Pervious area fraction = 0.200

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Process from Point/Station       12.000 to Point/Station       12.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.99 min.
Rainfall intensity =      3.552(In/Hr) for a   100.0 year storm
Subarea runoff =      0.750(CFS) for      0.240(Ac.)
Total runoff =      1.500(CFS)  Total area =       0.480(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   772.030(Ft.)
Downstream point/station elevation =   770.990(Ft.)
Pipe length  =   107.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.500(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.500(CFS)
Normal flow depth in pipe =    5.23(In.)
Flow top width inside pipe =   11.90(In.)
Critical Depth =    6.23(In.)
Pipe flow velocity =      4.56(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =     6.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
_____________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.38 min.
Rainfall intensity =      3.430(In/Hr) for a   100.0 year storm
Subarea runoff =      0.724(CFS) for      0.240(Ac.)
Total runoff =      2.224(CFS)  Total area =       0.720(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________________
Upstream point/station elevation =   770.990(Ft.)
Downstream point/station elevation =   770.390(Ft.)
Pipe length  =    64.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.224(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.224(CFS)
```

```
Normal flow depth in pipe =    6.67(In.)
Flow top width inside pipe =   11.93(In.)
Critical Depth =    7.65(In.)
Pipe flow velocity =      4.96(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =     6.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.60 min.
Rainfall intensity =      3.368(In/Hr) for a   100.0 year storm
Subarea runoff =      0.740(CFS) for      0.250(Ac.)
Total runoff =      2.964(CFS)  Total area =       0.970(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.390(Ft.)
Downstream point/station elevation =   769.450(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.964(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.964(CFS)
Normal flow depth in pipe =    7.76(In.)
Flow top width inside pipe =   11.47(In.)
Critical Depth =    8.86(In.)
Pipe flow velocity =      5.51(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     6.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.87 min.
Rainfall intensity =      3.294(In/Hr) for a   100.0 year storm
Subarea runoff =      0.723(CFS) for      0.250(Ac.)
Total runoff =      3.687(CFS)  Total area =       1.220(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
```

```
Upstream point/station elevation =   769.450(Ft.)
Downstream point/station elevation =   768.730(Ft.)
Pipe length  =    72.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.687(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.687(CFS)
Normal flow depth in pipe =    9.39(In.)
Flow top width inside pipe =    9.91(In.)
Critical Depth =    9.82(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =     7.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.08 min.
Rainfall intensity =      3.239(In/Hr) for a   100.0 year storm
Subarea runoff =      0.711(CFS) for      0.250(Ac.)
Total runoff =      4.398(CFS)  Total area =       1.470(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   768.730(Ft.)
Downstream point/station elevation =   768.170(Ft.)
Pipe length  =    58.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     4.398(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     0.485(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.753(Ft.)
 Minor friction loss =      0.292(Ft.)  K-factor =   0.60
Pipe flow velocity =      5.60(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     7.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.878
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.25 min.
Rainfall intensity =      3.196(In/Hr) for a   100.0 year storm
Subarea runoff =      0.701(CFS) for      0.250(Ac.)
```

Total runoff = 5.100(CFS) Total area = 1.720(Ac.)

++
Process from Point/Station 17.000 to Point/Station 18.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____
Upstream point/station elevation = 767.670(Ft.)
Downstream point/station elevation = 767.600(Ft.)
Pipe length = 94.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 5.100(CFS)
Given pipe size = 18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
0.351(Ft.) at the headworks or inlet of the pipe(s)
Pipe friction loss = 0.189(Ft.)
Minor friction loss = 0.233(Ft.) K-factor = 1.80
Pipe flow velocity = 2.89(Ft/s)
Travel time through pipe = 0.54 min.
Time of concentration (TC) = 7.80 min.

++
Process from Point/Station 18.000 to Point/Station 18.000
**** SUBAREA FLOW ADDITION ****
_____
APARTMENT subarea type
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 74.80
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration = 7.80 min.
Rainfall intensity = 3.072(In/Hr) for a 100.0 year storm
Subarea runoff = 0.674(CFS) for 0.250(Ac.)
Total runoff = 5.773(CFS) Total area = 1.970(Ac.)

++
Process from Point/Station 18.000 to Point/Station 19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____
Upstream point/station elevation = 767.600(Ft.)
Downstream point/station elevation = 765.320(Ft.)
Pipe length = 122.00(Ft.) Manning's N = 0.012
No. of pipes = 1 Required pipe flow = 5.773(CFS)
Given pipe size = 18.00(In.)
Calculated individual pipe flow = 5.773(CFS)
Normal flow depth in pipe = 7.59(In.)
Flow top width inside pipe = 17.78(In.)
Critical Depth = 11.12(In.)
Pipe flow velocity = 8.15(Ft/s)
Travel time through pipe = 0.25 min.
Time of concentration (TC) = 8.05 min.

++
Process from Point/Station 19.000 to Point/Station 19.000
**** CONFLUENCE OF MAIN STREAMS ****
_____
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area = 1.970(Ac.)
Runoff from this stream = 5.773(CFS)

```
Time of concentration =    8.05 min.
Rainfall intensity =     3.019(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Initial area flow distance =    83.000(Ft.)
Top (of initial area) elevation =   777.020(Ft.)
Bottom (of initial area) elevation =   776.240(Ft.)
Difference in elevation =     0.780(Ft.)
Slope =    0.00940  s(percent)=       0.94
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Warning: TC computed to be less than 5 min.; program is assuming the
time of concentration is 5 minutes.
Initial area time of concentration =    5.000 min.
Rainfall intensity =      3.922(In/Hr) for a   100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.882
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Initial subarea runoff =      0.968(CFS)
Total initial stream area =        0.280(Ac.)
Pervious area fraction = 0.200


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   772.240(Ft.)
Downstream point/station elevation =   771.680(Ft.)
Pipe length  =    75.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     0.968(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.968(CFS)
Normal flow depth in pipe =    4.43(In.)
Flow top width inside pipe =   11.58(In.)
Critical Depth =    4.95(In.)
Pipe flow velocity =      3.68(Ft/s)
Travel time through pipe =    0.34 min.
Time of concentration (TC) =     5.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.34 min.
Rainfall intensity =      3.783(In/Hr) for a   100.0 year storm
Subarea runoff =      0.900(CFS) for      0.270(Ac.)
Total runoff =      1.868(CFS)  Total area =       0.550(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   771.680(Ft.)
Downstream point/station elevation =   770.540(Ft.)
Pipe length  =    76.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.868(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.868(CFS)
Normal flow depth in pipe =    5.24(In.)
Flow top width inside pipe =   11.90(In.)
Critical Depth =    6.98(In.)
Pipe flow velocity =      5.67(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     5.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       24.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.56 min.
Rainfall intensity =      3.699(In/Hr) for a   100.0 year storm
Subarea runoff =      0.912(CFS) for      0.280(Ac.)
Total runoff =      2.780(CFS)  Total area =       0.830(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       25.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   770.540(Ft.)
Downstream point/station elevation =   770.020(Ft.)
Pipe length  =    74.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     2.780(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.780(CFS)
Normal flow depth in pipe =    8.57(In.)
Flow top width inside pipe =   10.85(In.)
Critical Depth =    8.58(In.)
Pipe flow velocity =      4.63(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     5.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       25.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
```

```
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     5.83 min.
Rainfall intensity =      3.605(In/Hr) for a   100.0 year storm
Subarea runoff =      0.857(CFS) for      0.270(Ac.)
Total runoff =      3.636(CFS)  Total area =       1.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   770.020(Ft.)
Downstream point/station elevation =   769.280(Ft.)
Pipe length  =    74.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     3.636(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.636(CFS)
Normal flow depth in pipe =    9.26(In.)
Flow top width inside pipe =   10.08(In.)
Critical Depth =    9.76(In.)
Pipe flow velocity =      5.59(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =     6.05 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
APARTMENT subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.05 min.
Rainfall intensity =      3.532(In/Hr) for a   100.0 year storm
Subarea runoff =      0.839(CFS) for      0.270(Ac.)
Total runoff =      4.475(CFS)  Total area =       1.370(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   769.280(Ft.)
Downstream point/station elevation =   767.790(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     4.475(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     4.475(CFS)
Normal flow depth in pipe =    8.87(In.)
Flow top width inside pipe =   10.54(In.)
Critical Depth =   10.62(In.)
Pipe flow velocity =      7.19(Ft/s)
Travel time through pipe =    0.21 min.
Time of concentration (TC) =     6.26 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       27.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
```

```
APARTMENT subarea type
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  74.80
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     6.26 min.
Rainfall intensity =      3.467(In/Hr) for a   100.0 year storm
Subarea runoff =      0.823(CFS) for      0.270(Ac.)
Total runoff =      5.298(CFS)  Total area =       1.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       27.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   767.790(Ft.)
Downstream point/station elevation =   765.820(Ft.)
Pipe length  =    78.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     5.298(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     5.298(CFS)
Normal flow depth in pipe =    8.60(In.)
Flow top width inside pipe =   10.81(In.)
Critical Depth =   11.17(In.)
Pipe flow velocity =      8.79(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =     6.40 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       19.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.640(Ac.)
Runoff from this stream =      5.298(CFS)
Time of concentration =    6.40 min.
Rainfall intensity =     3.423(In/Hr)
Summary of stream data:

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


1        5.773      8.05                3.019
2        5.298      6.40                3.423
Largest stream flow has longer time of concentration
Qp =      5.773 + sum of
          Qb         Ia/Ib
           5.298 *    0.882 =      4.673
Qp =     10.446

Total of 2 main streams to confluence:
Flow rates before confluence point:
       5.773       5.298
Area of streams before confluence:
        1.970        1.640


Results of confluence:
Total flow rate =     10.446(CFS)
Time of concentration =     8.047 min.
```

Effective stream area after confluence =   3.610(Ac.)

++
Process from Point/Station   19.000 to Point/Station   20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
____
Upstream point/station elevation =   765.320(Ft.)
Downstream point/station elevation =   764.810(Ft.)
Pipe length =   25.00(Ft.)   Manning's N = 0.012
No. of pipes = 1 Required pipe flow =   10.446(CFS)
Given pipe size =   18.00(In.)
Calculated individual pipe flow =   10.446(CFS)
Normal flow depth in pipe =   10.50(In.)
Flow top width inside pipe =   17.75(In.)
Critical Depth =   14.92(In.)
Pipe flow velocity =   9.77(Ft/s)
Travel time through pipe =   0.04 min.
Time of concentration (TC) =   8.09 min.

++
Process from Point/Station   20.000 to Point/Station   20.000
**** SUBAREA FLOW ADDITION ****
____
APARTMENT subarea type
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 74.80
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration =   8.09 min.
Rainfall intensity =   3.010(In/Hr) for a   100.0 year storm
Subarea runoff =   0.713(CFS) for   0.270(Ac.)
Total runoff =   11.159(CFS) Total area =   3.880(Ac.)

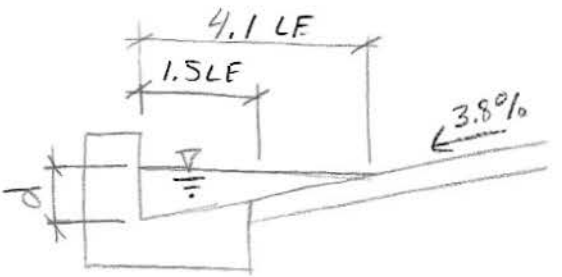
++
Process from Point/Station   20.000 to Point/Station   20.000
**** SUBAREA FLOW ADDITION ****
____
APARTMENT subarea type
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 74.80
Pervious area fraction = 0.200; Impervious fraction = 0.800
Time of concentration =   8.09 min.
Rainfall intensity =   3.010(In/Hr) for a   100.0 year storm
Subarea runoff =   0.660(CFS) for   0.250(Ac.)
Total runoff =   11.819(CFS) Total area =   4.130(Ac.)
End of computations, total study area =   4.13 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.200
Area averaged RI index number = 56.0

Appendix D

CURB & GUTTER CAPACITY

E'LY DRIVE AISLE



$Q_{100} = 0.75$ CFS

$\eta = 0.013$

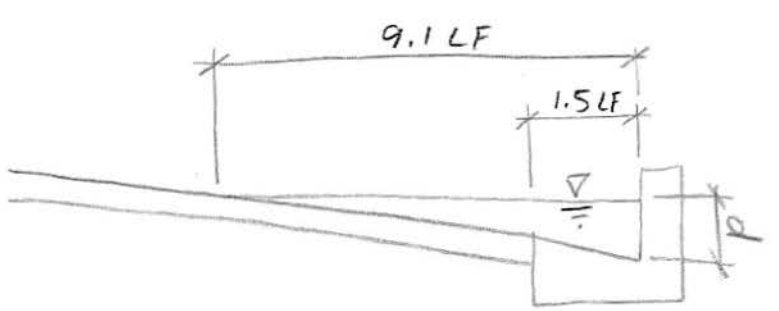
$S = 0.010$

TYPICAL SECTION
NTS

TRY $d = 2.5$ INCHES : $A = 0.357$ SF $WP = 4.301$ LF

$$Q = \left(\frac{1.486}{0.013}\right)\left(\frac{0.357}{4.301}\right)^{2/3}(0.010)^{1/2}(0.357) = 0.78 \text{ CFS} \sim 0.75 \text{ CFS}$$

W'LY DRIVE AISLE



$Q_{100} = 0.97$ CFS

$\eta = 0.013$

$S = 0.10$

TYPICAL SECTION
NTS

TRY $d = 2.5$ INCHES: $A = 0.602$ SF $WP = 9.275$ LF

$$Q = \left(\frac{1.486}{0.013}\right)\left(\frac{0.602}{9.275}\right)^{2/3}(0.010)^{1/2}(0.602) = 1.11 \text{ CFS} \sim 0.97 \text{ CFS}$$

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GRATE INLETS

PER KING'S MANUAL, ASSUME 25% CLOGGING

$$\frac{Q}{P} = 3.0\, H^{3/2} \qquad H \leq 0.4\ LF$$

NODES (12) TO (18)

$Q_{100} = 0.75$ CFS $\quad H = 0.208$ LF

$$P = \frac{0.75}{(75\%)(3.0)(0.208)^{3/2}} = 3.5\ LF \qquad S = \frac{3.5}{4} = 0.9\ LF \longrightarrow 18" \times 18" \text{ GRATE}$$

NODES (22) TO (27)

$Q_{100} = 0.97$ CFS $\quad H = 0.208$ LF

$$P = \frac{0.97}{(75\%)(3.0)(0.208)^{3/2}} = 4.5 \qquad S = \frac{4.5}{4} = 1.1\ LF \longrightarrow 18" \times 18" \text{ GRATE}$$

NODE (20)

$Q_{100} = 0.71 + 0.66 = 1.37$ CFS $\quad H = 0.208$ LF

$$P = \frac{1.37}{(3.0)(75\%)(0.208)^{3/2}} = 6.4\ LF \qquad S = \frac{6.4}{4} = 1.6\ LF \longrightarrow 24" \times 24" \text{ GRATE}$$

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PIPE DESIGN — PER KING'S MANUAL TABLE 6-2

NODE (12) TO (17)

Q_{100} = 4.40 CFS η = 0.012 S = 0.011 → 12" ϕ

NODE (17) TO (19)

Q_{100} = 5.77 CFS η = 0.012 S = 0.010 → 18" ϕ

NODE (19) TO (20)

Q_{100} = 10.45 CFS η = 0.012 S = 0.021 → 18" ϕ

NODE (22) TO (26)

Q_{100} = 3.63 CFS η = 0.012 S = 0.010 → 12" ϕ

NODE (26) TO (27)

Q_{100} = 4.48 CFS η = 0.012 S = 0.015 → 12" ϕ

NODE (27) TO (19)

Q_{100} = 5.30 CFS η = 0.012 S = 0.025 → 12" ϕ

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SYSTEM TO POINT OF OVERFLOW

$Q_{100} = 11.82$ CFS $\quad n = 0.012 \quad S = 0.010$ $\longrightarrow$ 18" ϕ

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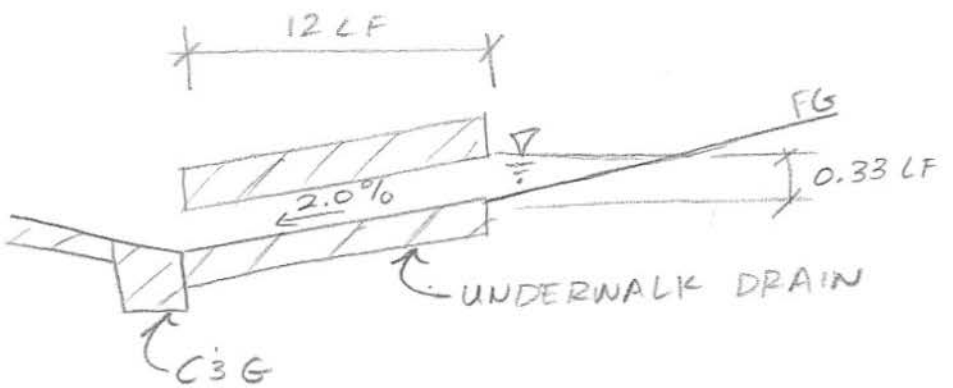
UNDERWALK DRAIN

PER KING'S MANUAL
TABLE 7-10

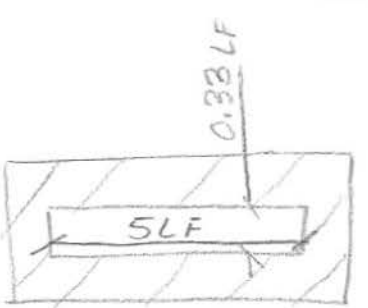
$$Q = \frac{k}{\eta} D^{8/3} S^{1/2}$$ OPEN CHANNEL FLOW

$Q_{100} = 11.82$ CFS $\quad \eta = 0.013 \quad S = 0.020$

$$K = \frac{(11.82)(0.013)}{(0.33^{8/3})(0.020^{1/2})} = 20.89 \qquad \frac{D}{b} = 0.066 \qquad b = 5.0 \text{ LF}$$



PROFILE
NTS



SECTION
NTS

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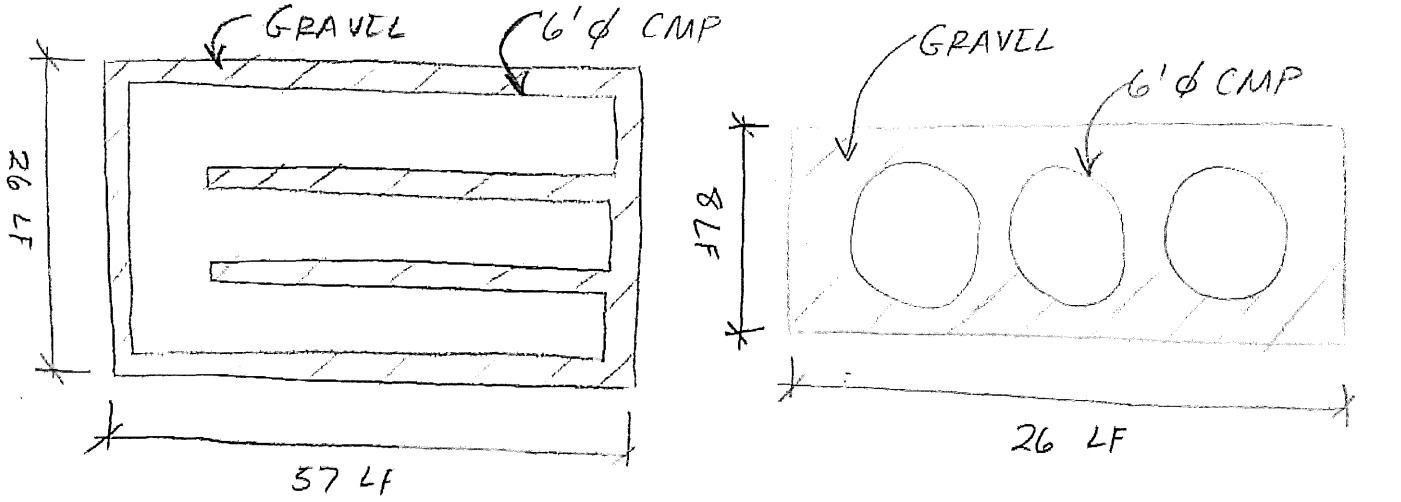

PLAN

SECTION

$V_{TRENCH} = (8LF)(26LF)(57LF) = 11,856\ CF$

$V_{PIPES} = \frac{\pi(6LF)^2}{4}(163\ LF) = 4,608.7\ CF$

$V_{GRAVEL} = (40\%)(11856 - 4608.7) = 2898.9\ CF$

$STORAGE = 4608.7 + 2898.9 = 7,508\ CF$

$P = \frac{5.3 + 7.0}{2} = 6.15\ IN/HR \quad FS = 3 \quad P_{DESIGN} = \frac{6.15}{3} = 2.05\ IN/HR$

$T_{MAX} = 72\ HRS$

$MAX.\ PONDING = (2.05/12)(72) = 12.3\ LF$

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