Appendix G2

Hydrology/Hydraulics Study For TPM 37547
Clinton Keith Road

Hydrology/Hydraulics Study

For: TPM 37547

Clinton Keith Road

DEVELOPMENT NO. **TPM 37547**
DESIGN REVIEW NO.

Prepared for:
CURCI, LLC, A CALIFORNIA LIMITED PARTNERSHIP
P.O. BOX 890700
MURRIETA, CA 92589-0700
PHONE: (951) 676-6614
FAX: (951) 830-2661
CONTACT: ALLAN DAVIS

Prepared by:
Excel Engineering
440 State Place
Escondido, CA 92029
Telephone: (760) 745 8118

Hydrology/Hydraulics Study Preparation Date: JUNE 7 2018
Revision Dates:

ROBERT D. DENTINO, RCE 45629
Registration Expire: December 31, 2018

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1.0 PURPOSE OF STUDY

The purpose of this study is to support the development of a commercial project. Calculations presented here establish pre-development and post development storm runoff, and assist in the sizing of proposed drainage improvements. Calculations will demonstrate that post developed peak runoff will not exceed pre-developed peak runoff, therefore insuring no negative impacts to downstream storm drain systems and adjacent properties. Runoff from both private and public improvements will be addressed by this report.

2.0 PROJECT DESCRIPTION

The project proposes to create 6 separate legal parcels with 6 buildings, occupied with varying shops and convenience stores. The site improvements include parking, private drive isles, wet and dry utilities, storm drain, and water quality improvements.

3.0 VICINITY MAP

The project site is located in the City of Murrieta, northeast of Clinton Keith and Antelope Road as shown on the Vicinity Map. Please see Attachment A- Vicinity map.

4.0 SITE MAP

See Attachment B – Site map

5.0 DESCRIPTION OF WATERSHED

5.1 Existing Conditions Topography

There is an active mining/ grading operation on the project site and the operation has altered the surface topography and drainage patterns. For the purpose of this study, we will use the original topography of the site before the mining operation altered the scenery. This insures that no diversion of flow will happen.

There are three distinct basins on site. Basin 1 is a hilly area that runoff is intercepted by Antelope road and drains to south to an existing public stormdrain that was built as part of the improvement Track No.08-327804. Basin 2 sheet flows to I-215 NB On-ramp, and intercepted by a concrete ditch and directed to an existing open channel adjacent to I-215.

Please note that there are active projects directly east. The mentioned active projects are known as “The Vineyard” PM 36493 and “Costco” TPM 37511.

Attachment D, found later in this report, contains the natural condition Watershed Topographic Map.

5.2 Post-Development Project Topography

At 100 percent buildout, the site will be more than 80 percent impervious. When brought to grade the site will become much flatter than its natural condition. At 100 percent buildout, all impervious areas will drain to onsite bioretention basins before eventually existing the project site. The proposed grades & improvements are such that the drainage patterns to the 1 POC are maintained. There are three distinct basins on site. Basin 1 (Parcel 2, 3, 4 and 5) drains to BMP-1 from the 2/3 of the site draining north to the south. Basin 2 (Parcel 1) drains to BMP-2 to the north of the site, Basin 3 (Parcel 6) located on southeast of the site drains to BMP-3. All the impervious area are directed to BMPs and directed to an existing public stormdrain that was built as part of the improvement Track No.08-327804.

6.0 METHODOLOGY

This study complies with the April 1978 Riverside County Flood Control & Water Conservation District Hydrology

6.1 Hydrology Software

The "Rational" module of the CIVILCADD/CIVIL DESIGN engineering software version 9.0 was use hereon. See Attachment H.

6.2 Hydraulics Software

Hydroflow Storm Sewers Extension for Autodesk/Autocad./Civil3D will be used to analyze and size private storm drain pipes.

8.0 CALCULATIONS

8.1 Analyze 100 Year 1 Hour Storm using The Rational Method

Peaks flows for both the pre-developed and post developed conditions using Civil and the rational method. Peak flows were established at POC 1. Soil type D was used based on USDA Natural Water Resource Conservation Service website. Intensity-Duration data was taken for Plate D-4.1 and the post developed land use assumes commercial development. Table 4 below summarizes the results. Detailed CivilD input-output data can be found in Attachment F of this report.

SUMMARY OF THE 100 YEAR 1 HOUR STORM @ POC 1 - AMC=2			
	PRE-DEVPT PEAK RUNOFF	POST-DEVPT PEAK RUNOFF	UNITS
Q	29.64	27.42	CFS
A	13.64	13.96	ACRES
T_C	15.60	16	MINUTES

9 SUMMARY

The hydrologic analysis indicated that post developed runoff will not exceed pre-developed runoff, even with the big increase in impervious areas. This will insure no negative impacts to downstream drainage systems, or properties as a result of this development.

10.0 REFERENCES

Riverside County Flood Control Water Conservation District, Flood Control Section, April 1978 Hydrology Manual.

Merritt, S.F., 1983. Standard Handbook for Civil Engineers. Third Edition, Mc Graw – Hill 21-29.

Minton, G.R. 2005.Revisiting Design Criteria for Stormwater Treatment Systems. Stormwater Magazine March/April 2005 Issue.

11.0 DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions codes, and that the design is consistent with current design.

I understand that the check of the project drawings and specifications by the Riverside County is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK
Excel Engineering
440 State Place
Escondido, CA 92029
Tel – (760)745-8118
Fax – (760)745-1890

Project Number: 17-053

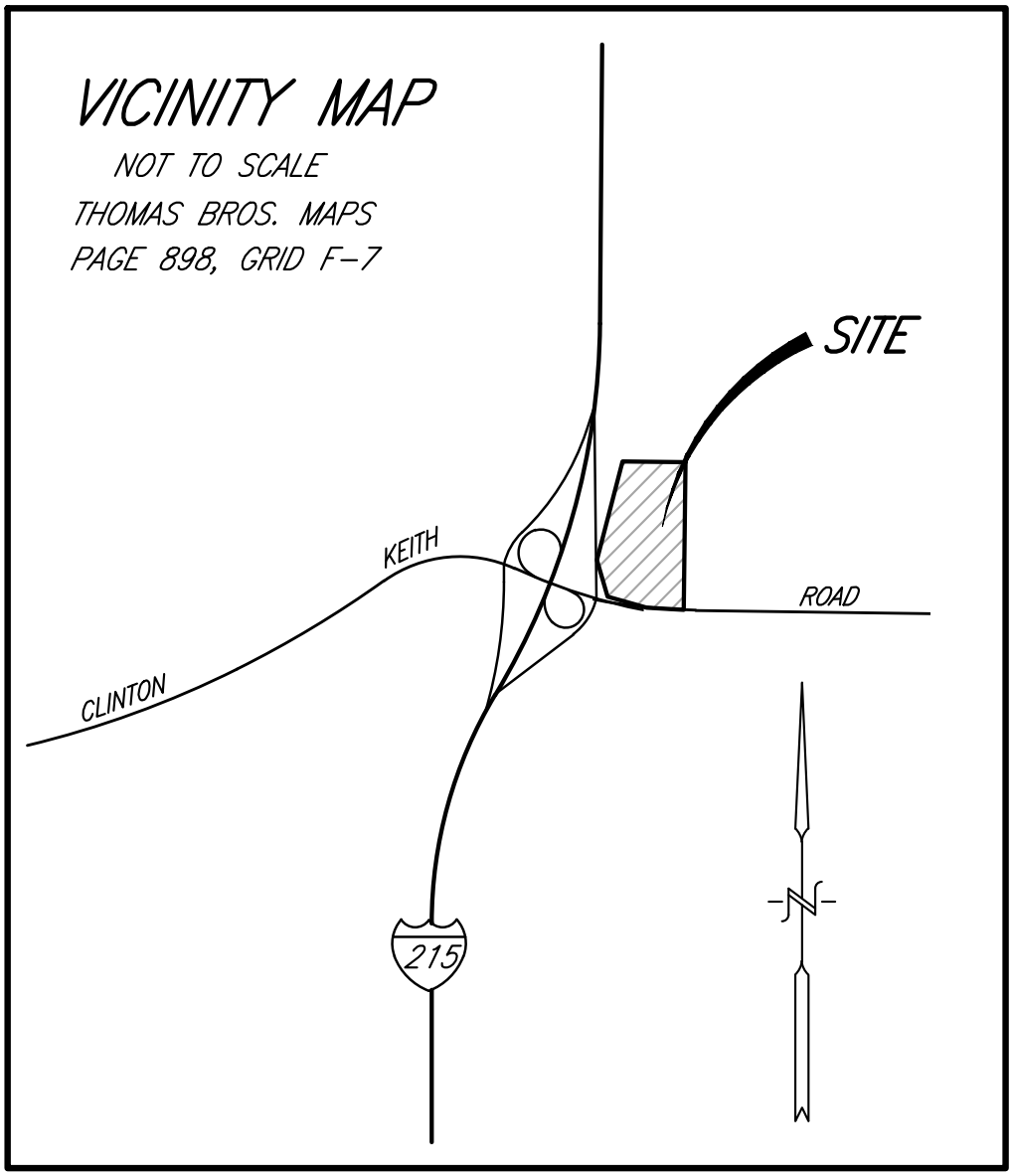
_____ _____

Robert D. Dentino, RCE 45629 Date
Registration Expire: December 31, 2018

ATTACHMENTS

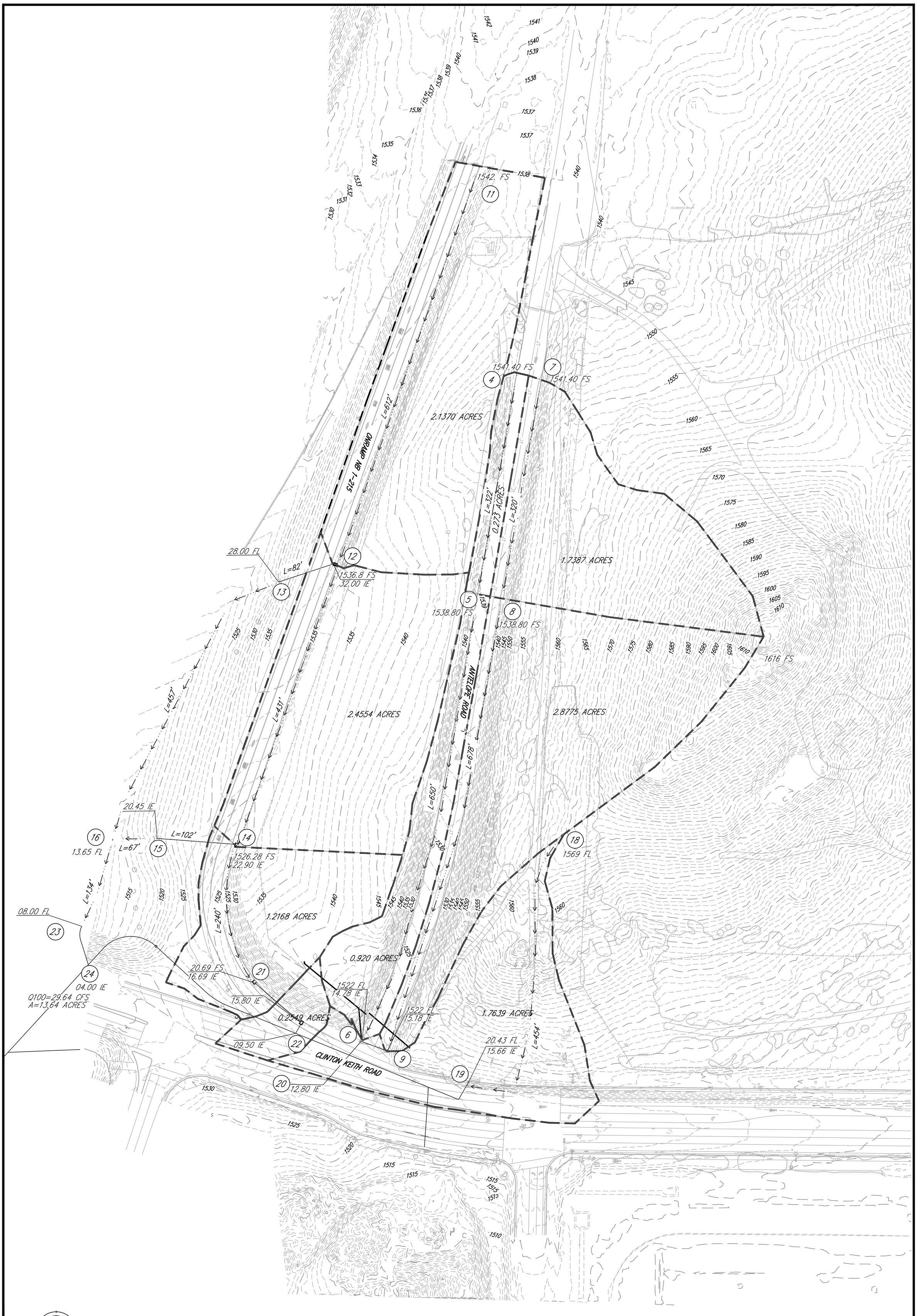
ATTACHMENT A

VICINITY MAP



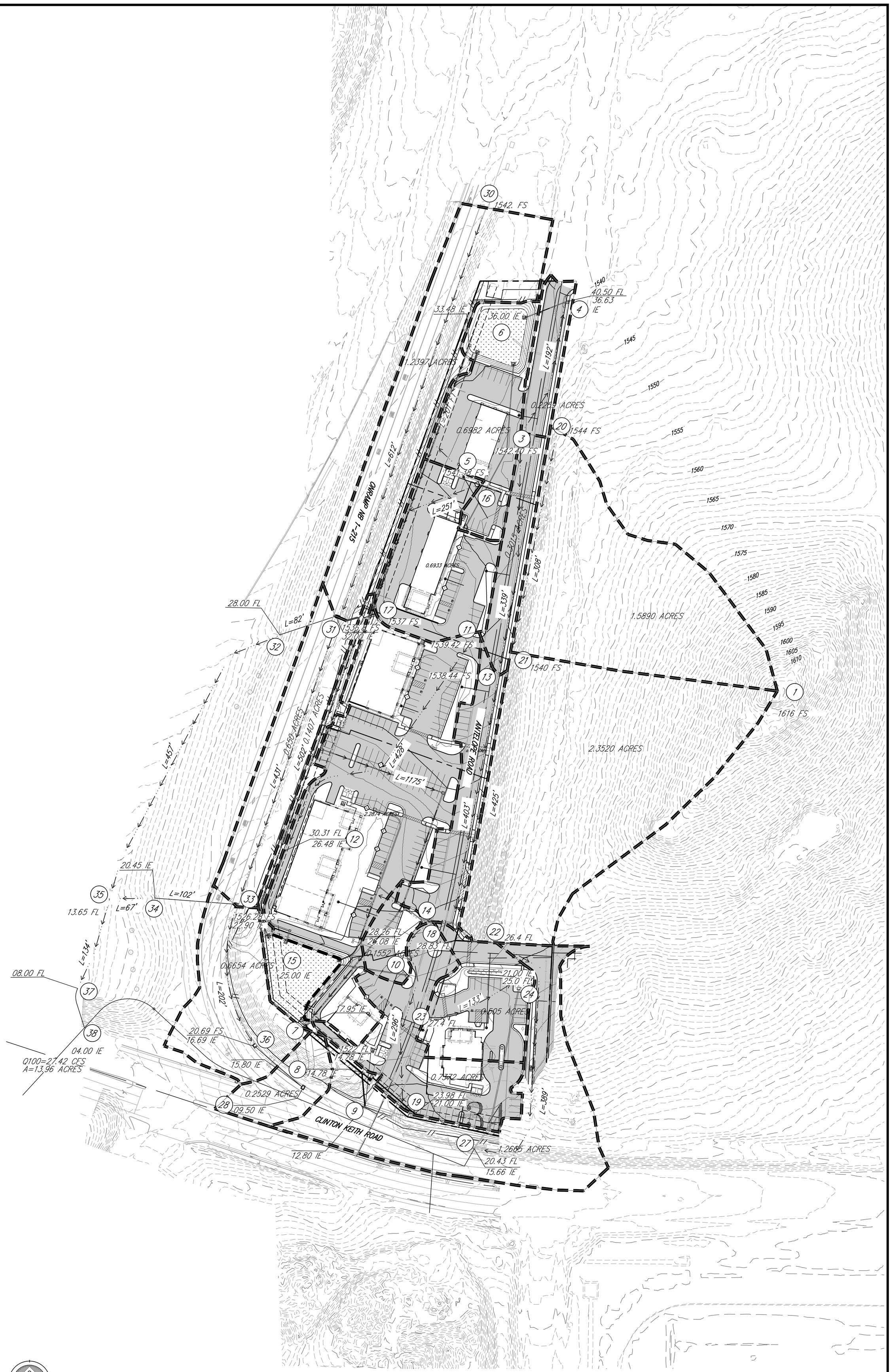
ATTACHMENT B

SITE MAP



CURCI
PRE-DEVELOPMENT CONDITION MAP

V:\17\17053\engineering\TM\CURRENT\STORM\HYD\RATIONAL\17053 pre-dev hydrology map.dwg 6/11/2018 7:38 AM ORIGINAL PLOT SIZE: ----



CURCI
POST-DEVELOPMENT CONDITION MAP

V:\17\17053\engineering\TM\CURRENT\STORM\HYD\RATIONAL\post-dev hydrology map.dwg 6/9/2018 11:36 AM ORIGINAL PLOT SIZE: ----

ATTACHMENT C

FIGURES & TABLES FROM THE RCFC & WCD HYDROLOGY MANUAL

RAINFALL INTENSITY—INCHES PER HOUR

MIRA LOMA			MURRIETA - TEMECULA & RANCHO CALIFORNIA			NORCO			PALM SPRINGS			PERRIS VALLEY		
DURATION MINUTES	FREQUENCY 10 YEAR	FREQUENCY 100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	FREQUENCY 100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	FREQUENCY 100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	FREQUENCY 100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	FREQUENCY 100 YEAR
5	2.84	4.48	5	3.45	5.10	5	2.77	4.16	5	4.23	6.76	5	2.64	3.78
6	2.58	4.07	6	3.12	4.61	6	2.53	3.79	6	3.80	6.08	6	2.41	3.46
7	2.37	3.75	7	2.87	4.24	7	2.34	3.51	7	3.48	5.56	7	2.24	3.21
8	2.21	3.49	8	2.67	3.94	8	2.19	3.29	8	3.22	5.15	8	2.09	3.01
9	2.08	3.28	9	2.50	3.69	9	2.07	3.10	9	3.01	4.81	9	1.98	2.84
10	1.96	3.10	10	2.36	3.48	10	1.96	2.94	10	2.83	4.52	10	1.88	2.69
11	1.87	2.95	11	2.24	3.30	11	1.87	2.80	11	2.67	4.28	11	1.79	2.57
12	1.78	2.82	12	2.13	3.15	12	1.79	2.68	12	2.54	4.07	12	1.72	2.46
13	1.71	2.70	13	2.04	3.01	13	1.72	2.58	13	2.43	3.88	13	1.65	2.37
14	1.64	2.60	14	1.96	2.89	14	1.66	2.48	14	2.33	3.72	14	1.59	2.29
15	1.58	2.50	15	1.89	2.79	15	1.60	2.40	15	2.23	3.58	15	1.54	2.21
16	1.53	2.42	16	1.82	2.69	16	1.55	2.32	16	2.15	3.44	16	1.49	2.14
17	1.48	2.34	17	1.76	2.60	17	1.50	2.25	17	2.08	3.32	17	1.45	2.08
18	1.44	2.27	18	1.71	2.52	18	1.46	2.19	18	2.01	3.22	18	1.41	2.02
19	1.40	2.21	19	1.66	2.45	19	1.42	2.13	19	1.95	3.12	19	1.37	1.97
20	1.36	2.15	20	1.61	2.38	20	1.39	2.08	20	1.89	3.03	20	1.34	1.92
22	1.29	2.04	22	1.53	2.26	22	1.32	1.98	22	1.79	2.86	22	1.28	1.83
24	1.24	1.95	24	1.46	2.15	24	1.26	1.90	24	1.70	2.72	24	1.22	1.75
26	1.18	1.87	26	1.39	2.06	26	1.22	1.82	26	1.62	2.60	26	1.18	1.69
28	1.14	1.80	28	1.34	1.98	28	1.17	1.76	28	1.56	2.49	28	1.13	1.63
30	1.10	1.73	30	1.29	1.90	30	1.13	1.70	30	1.49	2.39	30	1.10	1.57
32	1.06	1.67	32	1.24	1.84	32	1.10	1.64	32	1.44	2.30	32	1.06	1.52
34	1.03	1.62	34	1.20	1.78	34	1.06	1.59	34	1.39	2.22	34	1.03	1.48
36	1.00	1.57	36	1.17	1.72	36	1.03	1.55	36	1.34	2.15	36	1.00	1.44
38	.97	1.53	38	1.13	1.67	38	1.01	1.51	38	1.30	2.09	38	.98	1.40
40	.94	1.49	40	1.10	1.62	40	.98	1.47	40	1.27	2.02	40	.95	1.37
45	.89	1.40	45	1.03	1.52	45	.92	1.39	45	1.18	1.89	45	.90	1.29
50	.84	1.32	50	.97	1.44	50	.88	1.31	50	1.11	1.78	50	.85	1.22
55	.80	1.26	55	.92	1.36	55	.84	1.25	55	1.05	1.68	55	.81	1.17
60	.76	1.20	60	.88	1.30	60	.80	1.20	60	1.00	1.60	60	.78	1.12
65	.73	1.15	65	.84	1.24	65	.77	1.15	65	.95	1.53	65	.75	1.08
70	.70	1.11	70	.81	1.19	70	.74	1.11	70	.91	1.46	70	.72	1.04
75	.68	1.07	75	.78	1.15	75	.72	1.07	75	.88	1.41	75	.70	1.00
80	.65	1.03	80	.75	1.11	80	.69	1.04	80	.85	1.35	80	.68	.97
85	.63	1.00	85	.73	1.07	85	.67	1.01	85	.82	1.31	85	.66	.94
SLOPE = .530			SLOPE = .550			SLOPE = .500			SLOPE = .580			SLOPE = .490		

STANDARD
INTENSITY-DURATION
CURVES DATA

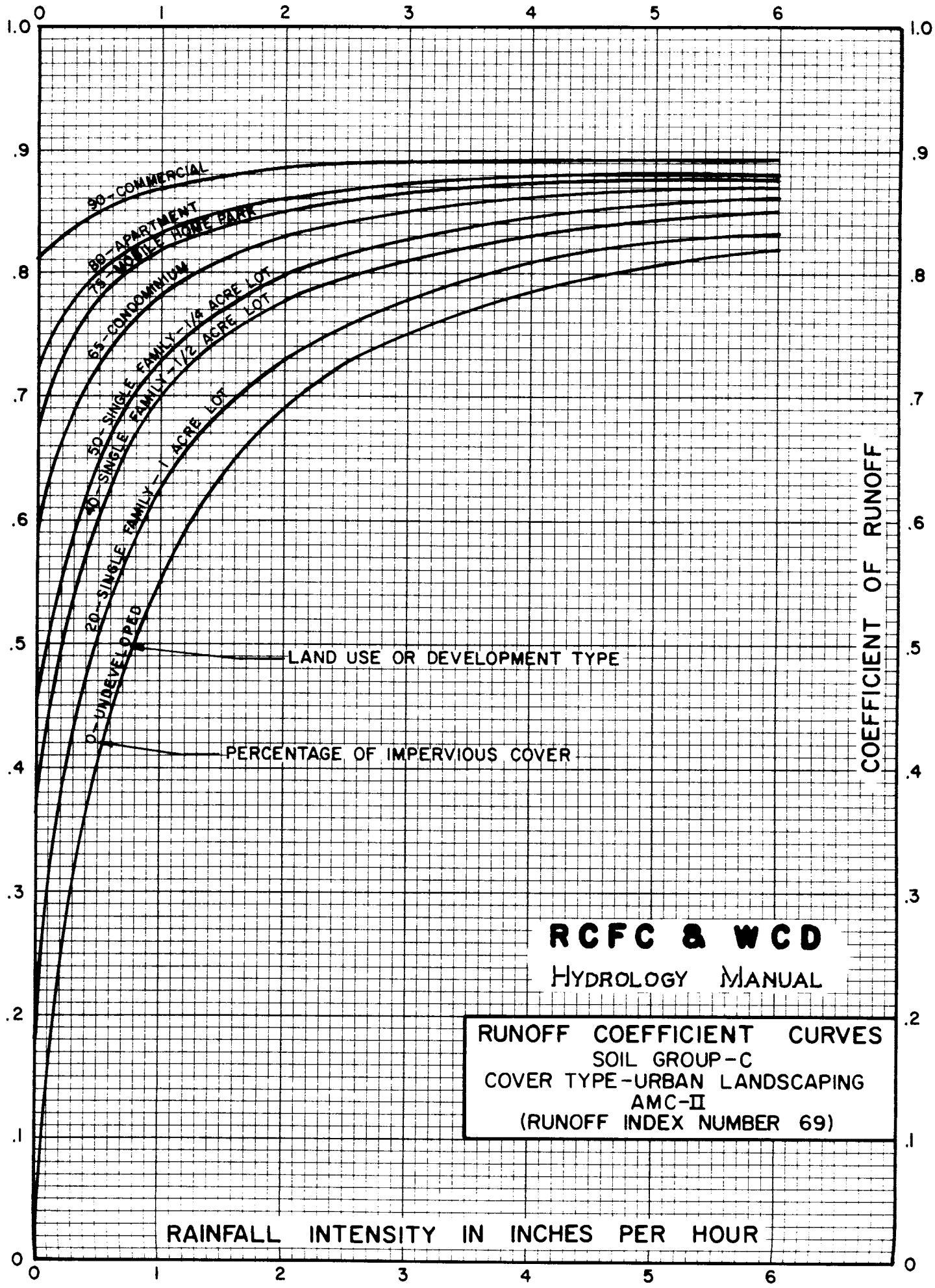
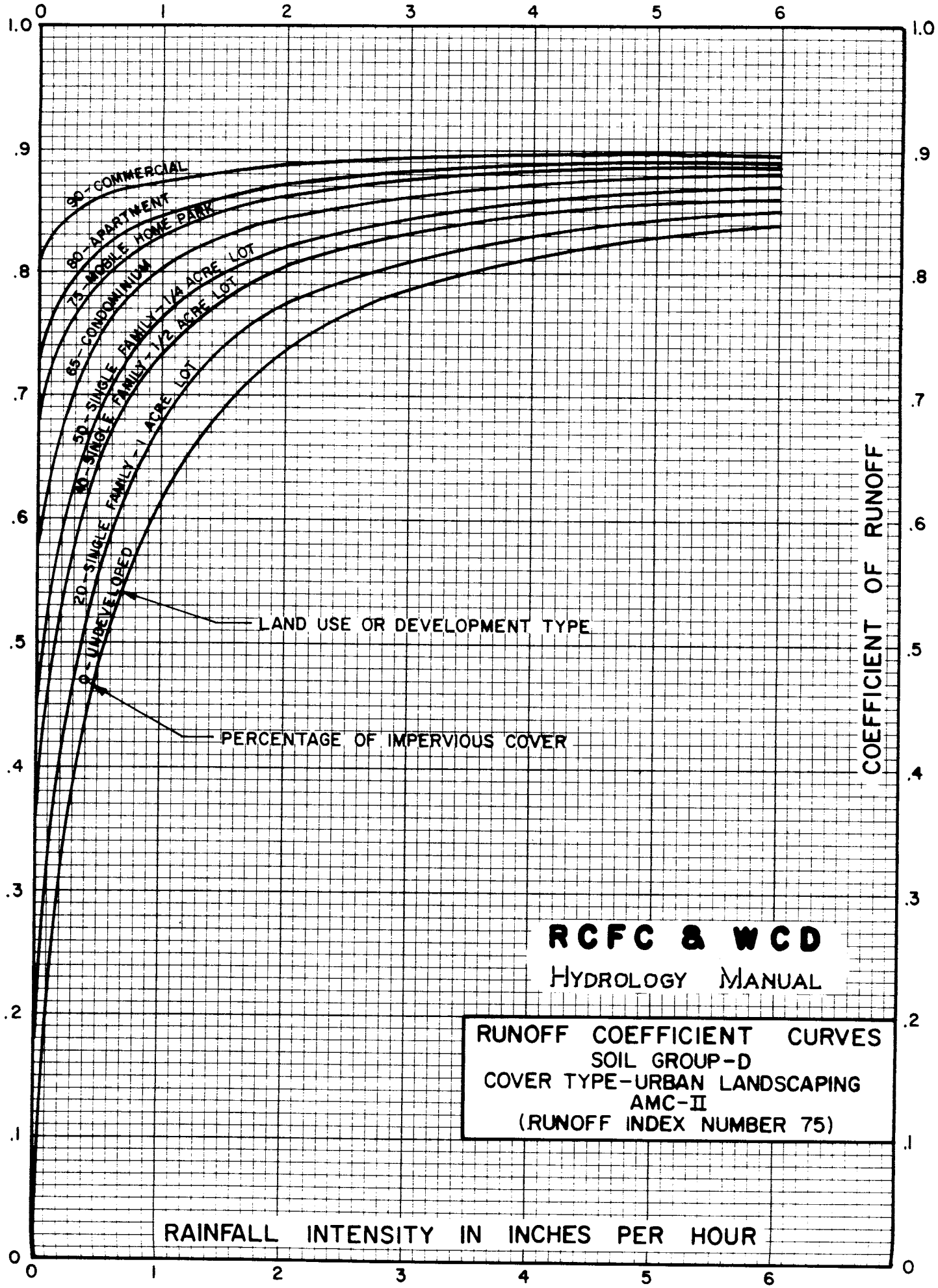

90-COMMERCIAL
80-APARTMENT
75-MOBILE HOME PARK
65-CONDOMINIUM
50-SINGLE FAMILY-1/4 ACRE LOT
40-SINGLE FAMILY-1/2 ACRE LOT
20-SINGLE FAMILY-1 ACRE LOT
0-UNDEVELOPED
LAND USE OR DEVELOPMENT TYPE
PERCENTAGE OF IMPERVIOUS COVER
COEFFICIENT OF RUNOFF
RAINFALL INTENSITY IN INCHES PER HOUR
RCFC & WCD
HYDROLOGY MANUAL
RUNOFF COEFFICIENT CURVES
SOIL GROUP-C
COVER TYPE-URBAN LANDSCAPING
AMC-II
(RUNOFF INDEX NUMBER 69)

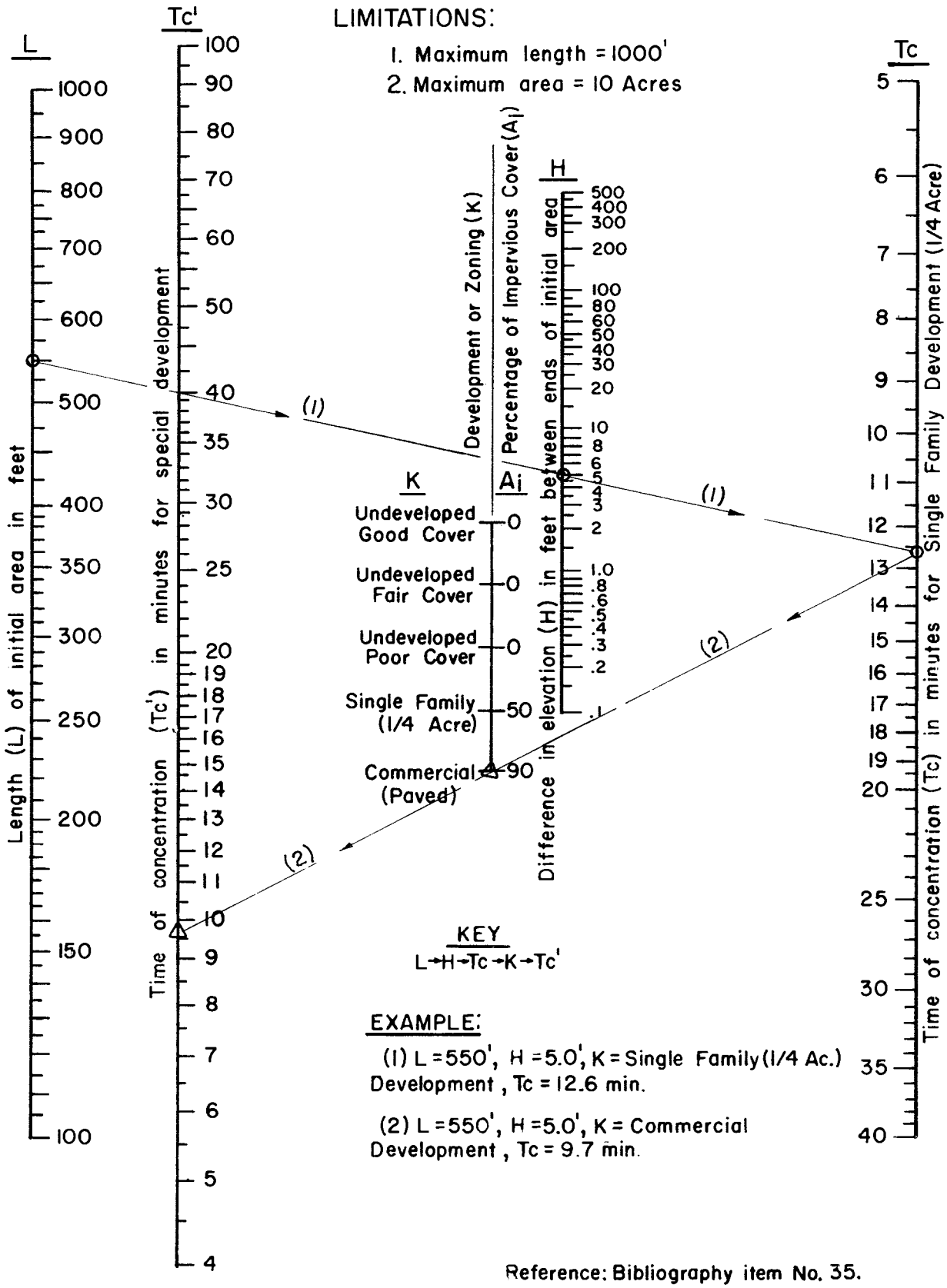
PLATE D-5.3



RCFC & WCD

HYDROLOGY MANUAL

RUNOFF COEFFICIENT CURVES
SOIL GROUP-D
COVER TYPE-URBAN LANDSCAPING
AMC-II
(RUNOFF INDEX NUMBER 75)



LIMITATIONS:

1. Maximum length = 1000'
2. Maximum area = 10 Acres

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (1/4 Ac.) Development, Tc = 12.6 min.

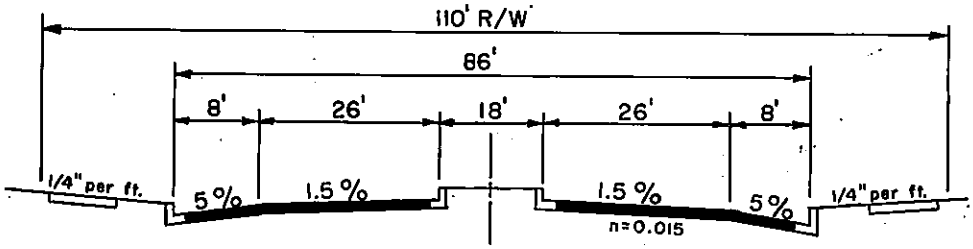
(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

Reference: Bibliography item No. 35.

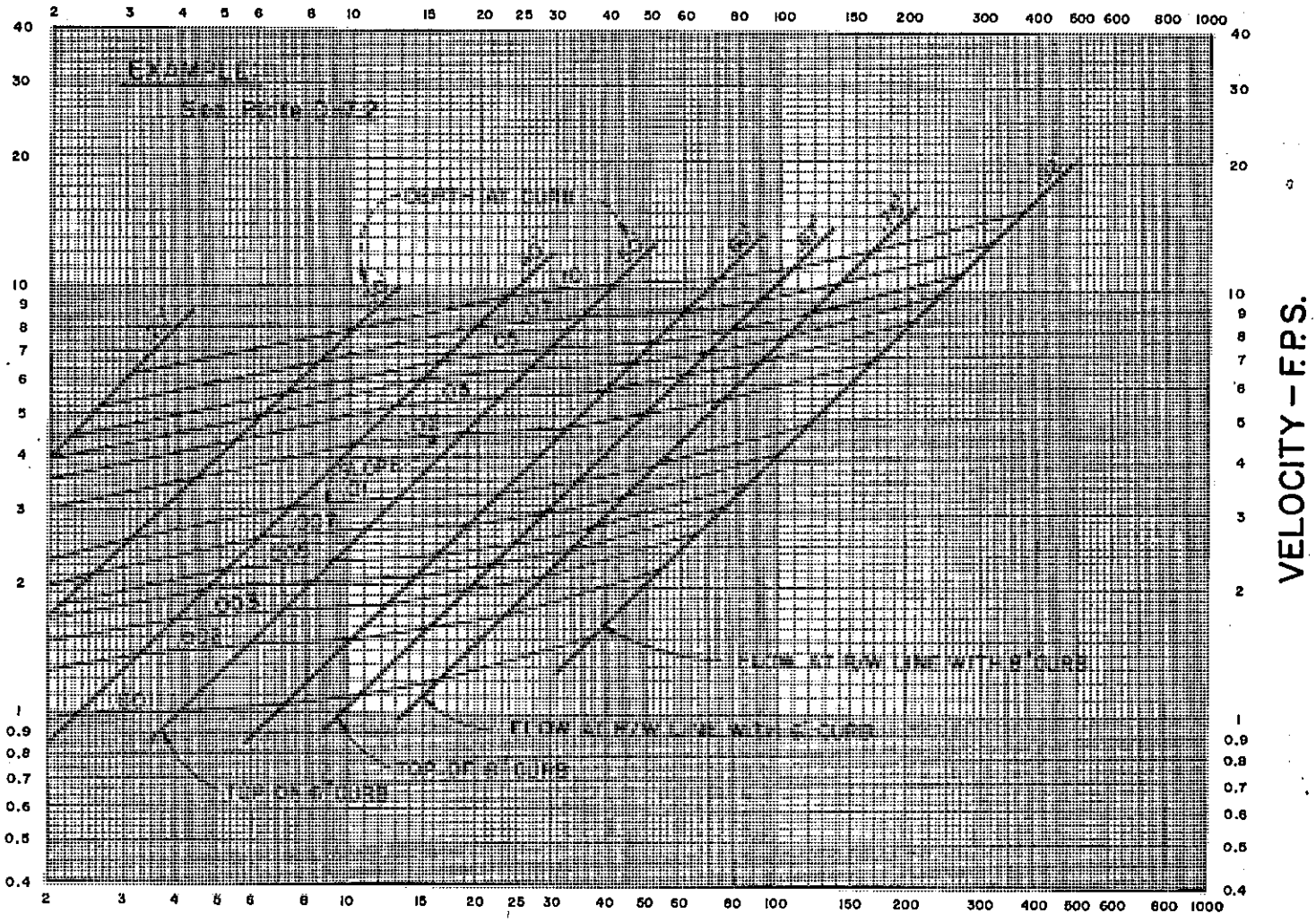
RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA



TYPICAL SECTION



NOTE:

Flow does not top the crown of this section until d_w = 1.45 feet (6 inch curb).

RCFC & WCD

HYDROLOGY MANUAL

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

VELOCITY DISCHARGE CURVES
COUNTY STANDARD No. 100
86' ROADWAY 6" & 8" CURBS

REVISED	DRAWN BY: R.A.S.	SHEET No.
APPROVED: CHIEF ENGINEER R.E. NO. 8888	CHECKED BY: R.V.P. R.A.T.	
DATE	DATE DRAWN: JAN. 77	DR. No

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

RCFC & WCD

HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.

RCFC & WCD

HYDROLOGY MANUAL

RUNOFF INDEX NUMBERS FOR PERVIOUS AREA

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD

HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

RUNOFF COEFFICIENT CURVE DATA

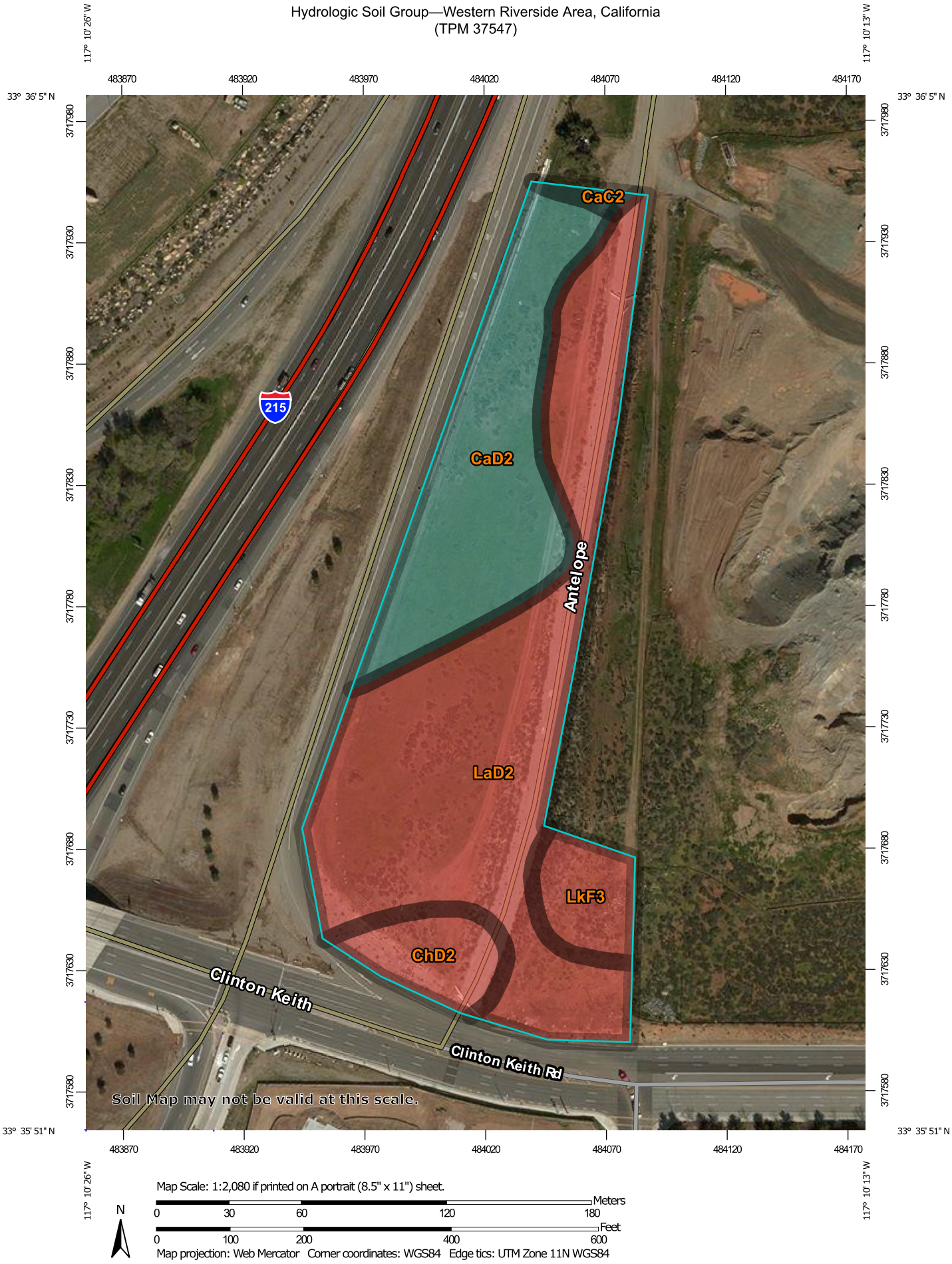
The data in the following tables may be used to develop runoff coefficient (C) curves for any combination of runoff index (RI) number and antecedent mositure condition (AMC). For an RI number with an AMC of II (from Plate D-5.5) enter the tables on the following pages and plot the "C" curve data directly on Plate D-5.8. "C" curve data is given for even RI numbers only, but values may easily be interpolated for odd RI numbers.

For an AMC of I or III enter the tabulation on this page with the RI for AMC II, and read the appropriate RI for AMC I or III. Use this revised RI to enter the tables on the following pages to determine "C". For example if RI = 40 for AMC II, then RI = 22 for AMC I and RI = 60 for AMC III.

AMC ADJUSTMENT RELATIONSHIPS

RI FOR AMC II	RI FOR OTHER AMC CONDITIONS: AMC I	AMC III	RI FOR AMC II	RI FOR OTHER AMC CONDITIONS: AMC I	AMC III
10	--	22	55	35	74
11	--	24	56	36	75
12	--	25	57	37	75
13	--	27	58	38	76
14	--	28	59	39	77
15	--	30	60	40	78
16	--	31	61	41	78
17	--	33	62	42	79
18	--	34	63	43	80
19	--	36	64	44	81
20	--	37	65	45	82
21	10	38	66	46	82
22	10	39	67	47	83
23	11	41	68	48	84
24	11	42	69	50	84
25	12	43	70	51	85
26	12	44	71	52	86
27	13	46	72	53	86
28	14	47	73	54	87
29	14	49	74	55	88
30	15	50	75	57	88
31	16	51	76	58	89
32	16	52	77	59	89
33	17	53	78	60	90
34	18	54	79	62	91
35	18	55	80	63	91
36	19	56	81	64	92
37	20	57	82	66	92
38	21	58	83	67	93
39	21	59	84	68	93
40	22	60	85	70	94
41	23	61	86	72	94
42	24	62	87	73	95
43	25	63	88	75	95
44	25	64	89	76	96
45	26	65	90	78	96
46	27	66	91	80	97
47	28	67	92	81	97
48	29	68	93	83	98
49	30	69	94	85	98
50	31	70	95	87	98
51	31	70	96	89	99
52	32	71	97	91	99
53	33	72	98	94	99
54	34	73	99	97	--

Hydrologic Soil Group—Western Riverside Area, California
(TPM 37547)



Map Scale: 1:2,080 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 10, Sep 12, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 24, 2015—Feb 26, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CaC2	Cajalco fine sandy loam, 2 to 8 percent slopes, eroded	C	0.0	0.6%
CaD2	Cajalco fine sandy loam, 8 to 15 percent slopes, eroded	C	2.1	28.7%
ChD2	Cieneba sandy loam, 8 to 15 percent slopes, eroded	D	0.5	6.8%
LaD2	Las Posas loam, 8 to 15 percent slopes, eroded	D	4.3	57.7%
LkF3	Las Posas rocky loam, 15 to 50 percent slopes, severely eroded	D	0.5	6.2%
Totals for Area of Interest			**7.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

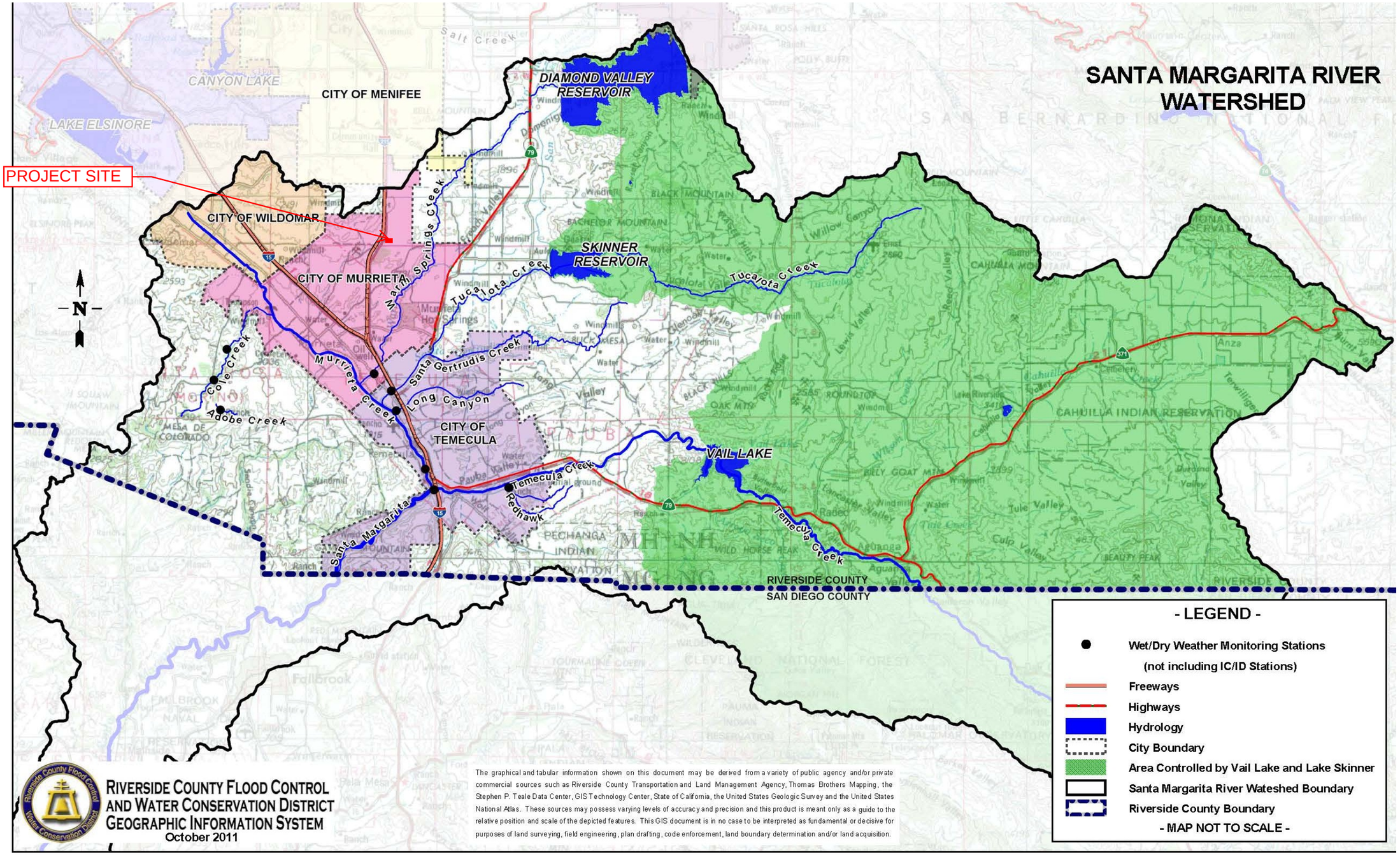
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ATTACHMENT D

WATERSHED INFORMATION- TOPOGRAPHIC MAPS

Figure 2. Watershed Map of Upper Santa Margarita River



ATTACHMENT E

RATIONAL METHOD PRE & POST DEVELOPED 100 YEAR, I HOUR STORM ANALYSIS FOR STORM DRAIN AND PEAK FLOWS

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
        Rational Hydrology Study        Date: 06/08/18  File:17053PREPOC1.out
------------------------------------------------------------------------
PRE-DEVELOPMENT CALCS - POC-1
100 YEAR STORM EVENT - RATIONAL METHOD
17053 CURCII CK-17
FILENAME: 17053PREPOC1.RRV
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********
 English (in-lb) Units used in input data file
------------------------------------------------------------------------
Program License Serial Number 6332
------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

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

Standard intensity-duration curves data (Plate D-4.1)
For the [ Murrieta,Tmc,Rnch CaNorco ] area used.
10 year storm 10 minute intensity =  2.360(In/Hr)
10 year storm 60 minute intensity =  0.880(In/Hr)
100 year storm 10 minute intensity =  3.480(In/Hr)
100 year storm 60 minute intensity =  1.300(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   322.000(Ft.)
Top (of initial area) elevation =    41.400(Ft.)
Bottom (of initial area) elevation =    38.800(Ft.)
Difference in elevation =     2.600(Ft.)
Slope =    0.00807  s(percent)=       0.81
TC = k(0.390)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.299 min.
Rainfall intensity =      3.427(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.848
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Initial subarea runoff =      0.794(CFS)
Total initial stream area =        0.273(Ac.)
Pervious area fraction = 0.500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Process from Point/Station        5.000 to Point/Station        6.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      1.935(CFS)
Depth of flow =   0.150(Ft.), Average velocity =   3.810(Ft/s)
       ******* Irregular Channel Data ***********
-------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             18.00              0.40
```

```
Manning's 'N' friction factor =   0.011
----------------------------------------------------------------
Sub-Channel flow  =      1.935(CFS)
  '     '       flow top width =      6.762(Ft.)
  '     '    velocity=    3.810(Ft/s)
  '     '       area =      0.508(Sq.Ft)
  '     '       Froude number =     2.450

Upstream point elevation =    38.800(Ft.)
Downstream point elevation =    22.000(Ft.)
Flow length =   650.000(Ft.)
Travel time  =    2.84 min.
Time of concentration =   13.14 min.
Depth of flow =   0.150(Ft.)
Average velocity =   3.810(Ft/s)
Total irregular channel flow =     1.935(CFS)
Irregular channel normal depth above invert elev. =   0.150(Ft.)
Average velocity of channel(s) =   3.810(Ft/s)
 Adding area flow to channel
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.807
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Rainfall intensity =      2.997(In/Hr) for a   100.0 year storm
Subarea runoff =      2.225(CFS) for      0.920(Ac.)
Total runoff =      3.019(CFS)        Total area =       1.193(Ac.)
Depth of flow =   0.178(Ft.), Average velocity =   4.258(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.193(Ac.)
Runoff from this stream =      3.019(CFS)
Time of concentration =   13.14 min.
Rainfall intensity =     2.997(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   320.000(Ft.)
Top (of initial area) elevation =    41.400(Ft.)
Bottom (of initial area) elevation =    38.800(Ft.)
Difference in elevation =     2.600(Ft.)
Slope =    0.00813  s(percent)=       0.81
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.628 min.
Rainfall intensity =      3.063(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.809
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      4.308(CFS)
Total initial stream area =        1.739(Ac.)
Pervious area fraction = 0.800


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Process from Point/Station        8.000 to Point/Station        9.000
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**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.591(CFS)
Depth of flow =   0.253(Ft.), Average velocity =   5.278(Ft/s)
       ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              0.50
       2              0.00              0.00
       3             18.00              0.40
Manning's 'N' friction factor =   0.011
-------------------------------------------------------------------
Sub-Channel flow  =      7.591(CFS)
  '     '       flow top width =     11.378(Ft.)
  '     '    velocity=    5.278(Ft/s)
  '     '       area =      1.438(Sq.Ft)
  '     '       Froude number =     2.616

Upstream point elevation =    38.800(Ft.)
Downstream point elevation =    22.000(Ft.)
Flow length =   678.000(Ft.)
Travel time  =    2.14 min.
Time of concentration =   14.77 min.
Depth of flow =   0.253(Ft.)
Average velocity =   5.278(Ft/s)
Total irregular channel flow =     7.591(CFS)
Irregular channel normal depth above invert elev. =   0.253(Ft.)
Average velocity of channel(s) =   5.278(Ft/s)
 Adding area flow to channel
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.802
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Rainfall intensity =      2.810(In/Hr) for a   100.0 year storm
Subarea runoff =      6.482(CFS) for      2.877(Ac.)
Total runoff =     10.791(CFS)        Total area =       4.616(Ac.)
Depth of flow =   0.288(Ft.), Average velocity =   5.763(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
_____________________________________________________________________
Upstream point/station elevation =    15.180(Ft.)
Downstream point/station elevation =    14.780(Ft.)
Pipe length  =    38.50(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.791(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    10.791(CFS)
Normal flow depth in pipe =   14.88(In.)
Flow top width inside pipe =   13.62(In.)
Critical Depth =   15.12(In.)
Pipe flow velocity =      6.91(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =    14.86 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.616(Ac.)
Runoff from this stream =     10.791(CFS)
Time of concentration =   14.86 min.
Rainfall intensity =     2.801(In/Hr)
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Summary of stream data:

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


1        3.019     13.14                 2.997
2       10.791     14.86                 2.801
Largest stream flow has longer time of concentration
Qp =     10.791 + sum of
          Qb         Ia/Ib
           3.019 *    0.935 =      2.821
Qp =     13.612

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.019      10.791
Area of streams before confluence:
        1.193        4.616
Results of confluence:
Total flow rate =     13.612(CFS)
Time of concentration =    14.862 min.
Effective stream area after confluence =      5.809(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    14.780(Ft.)
Downstream point/station elevation =    12.800(Ft.)
Pipe length  =    26.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =    13.612(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    13.612(CFS)
Normal flow depth in pipe =    9.45(In.)
Flow top width inside pipe =   17.98(In.)
Critical Depth =   16.44(In.)
Pipe flow velocity =     14.50(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    14.89 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.809(Ac.)
Runoff from this stream =     13.612(CFS)
Time of concentration =   14.89 min.
Rainfall intensity =     2.798(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   454.000(Ft.)
Top (of initial area) elevation =    69.000(Ft.)
Bottom (of initial area) elevation =    20.430(Ft.)
Difference in elevation =    48.570(Ft.)
Slope =    0.10698  s(percent)=      10.70
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.674 min.
Rainfall intensity =      3.766(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.824
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      5.474(CFS)
Total initial stream area =        1.764(Ac.)
Pervious area fraction = 0.800


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    15.660(Ft.)
Downstream point/station elevation =    12.800(Ft.)
Pipe length  =   199.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.474(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     5.474(CFS)
Normal flow depth in pipe =    7.31(In.)
Flow top width inside pipe =   22.09(In.)
Critical Depth =    9.90(In.)
Pipe flow velocity =      6.76(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =     9.16 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       20.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.764(Ac.)
Runoff from this stream =      5.474(CFS)
Time of concentration =    9.16 min.
Rainfall intensity =     3.654(In/Hr)
Summary of stream data:

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


1       13.612     14.89                 2.798
2        5.474      9.16                 3.654
Largest stream flow has longer time of concentration
Qp =     13.612 + sum of
          Qb         Ia/Ib
           5.474 *    0.766 =      4.192
Qp =     17.803

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.612       5.474
Area of streams before confluence:
        5.809        1.764
Results of confluence:
Total flow rate =     17.803(CFS)
Time of concentration =    14.892 min.
Effective stream area after confluence =      7.573(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    12.800(Ft.)
Downstream point/station elevation =     9.500(Ft.)
Pipe length  =    84.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.803(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    17.803(CFS)
Normal flow depth in pipe =   10.51(In.)
```

```
Flow top width inside pipe =   23.81(In.)
Critical Depth =   18.24(In.)
Pipe flow velocity =     13.45(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    15.00 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       22.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      7.573(Ac.)
Runoff from this stream =     17.803(CFS)
Time of concentration =   15.00 min.
Rainfall intensity =     2.787(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   240.000(Ft.)
Top (of initial area) elevation =    26.280(Ft.)
Bottom (of initial area) elevation =    20.690(Ft.)
Difference in elevation =     5.590(Ft.)
Slope =    0.02329  s(percent)=       2.33
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.118 min.
Rainfall intensity =      3.664(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.822
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      3.666(CFS)
Total initial stream area =        1.217(Ac.)
Pervious area fraction = 0.800


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    16.690(Ft.)
Downstream point/station elevation =    15.800(Ft.)
Pipe length  =    87.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.666(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     3.666(CFS)
Normal flow depth in pipe =    7.29(In.)
Flow top width inside pipe =   17.67(In.)
Critical Depth =    8.77(In.)
Pipe flow velocity =      5.46(Ft/s)
Travel time through pipe =    0.27 min.
Time of concentration (TC) =     9.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.821
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
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```
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Time of concentration =     9.38 min.
Rainfall intensity =      3.607(In/Hr) for a   100.0 year storm
Subarea runoff =      0.755(CFS) for      0.255(Ac.)
Total runoff =      4.421(CFS)        Total area =       1.472(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       22.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.472(Ac.)
Runoff from this stream =      4.421(CFS)
Time of concentration =    9.38 min.
Rainfall intensity =     3.607(In/Hr)
Summary of stream data:

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


1       17.803     15.00                 2.787
2        4.421      9.38                 3.607
Largest stream flow has longer time of concentration
Qp =     17.803 + sum of
          Qb         Ia/Ib
           4.421 *    0.773 =      3.416
Qp =     21.220

Total of 2 streams to confluence:
Flow rates before confluence point:
      17.803       4.421
Area of streams before confluence:
        7.573        1.472
Results of confluence:
Total flow rate =     21.220(CFS)
Time of concentration =    14.996 min.
Effective stream area after confluence =      9.045(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =     9.500(Ft.)
Downstream point/station elevation =     4.000(Ft.)
Pipe length  =   359.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.220(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    21.220(CFS)
Normal flow depth in pipe =   13.52(In.)
Flow top width inside pipe =   29.85(In.)
Critical Depth =   18.77(In.)
Pipe flow velocity =      9.88(Ft/s)
Travel time through pipe =    0.61 min.
Time of concentration (TC) =    15.60 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       24.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      9.045(Ac.)
Runoff from this stream =     21.220(CFS)
Time of concentration =   15.60 min.
Rainfall intensity =     2.727(In/Hr)
Program is now starting with Main Stream No. 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   612.000(Ft.)
Top (of initial area) elevation =    42.000(Ft.)
Bottom (of initial area) elevation =    36.800(Ft.)
Difference in elevation =     5.200(Ft.)
Slope =    0.00850  s(percent)=       0.85
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.222 min.
Rainfall intensity =      2.669(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.776
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.730
Decimal fraction soil group D = 0.270
RI index for soil(AMC 2)  =  70.62
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      4.427(CFS)
Total initial stream area =        2.137(Ac.)
Pervious area fraction = 0.800


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    32.000(Ft.)
Downstream point/station elevation =    28.000(Ft.)
Pipe length  =    82.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.427(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     4.427(CFS)
Normal flow depth in pipe =    5.33(In.)
Flow top width inside pipe =   16.43(In.)
Critical Depth =    9.69(In.)
Pipe flow velocity =     10.11(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    16.36 min.


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Process from Point/Station       13.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    28.000(Ft.)
Downstream point elevation =    13.650(Ft.)
Channel length thru subarea  =   457.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.025
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =      4.427(CFS)
Depth of flow =   0.297(Ft.), Average velocity =   4.144(Ft/s)
Channel flow top width =    4.189(Ft.)
Flow Velocity =    4.14(Ft/s)
Travel time  =    1.84 min.
Time of concentration =   18.19 min.

Sub-Channel No. 1 Critical depth =      0.375(Ft.)
  '     '       '     Critical flow top width =      4.500(Ft.)
  '     '       '     Critical flow velocity=    3.148(Ft/s)
  '     '       '     Critical flow area =      1.406(Sq.Ft)
```

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Process from Point/Station       16.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      2.137(Ac.)
Runoff from this stream =      4.427(CFS)
Time of concentration =   18.19 min.
Rainfall intensity =     2.506(In/Hr)


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Process from Point/Station       12.000 to Point/Station       14.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   431.000(Ft.)
Top (of initial area) elevation =    36.800(Ft.)
Bottom (of initial area) elevation =    26.280(Ft.)
Difference in elevation =    10.520(Ft.)
Slope =    0.02441  s(percent)=       2.44
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.416 min.
Rainfall intensity =      3.238(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.811
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.100
Decimal fraction soil group D = 0.900
RI index for soil(AMC 2)  =  74.40
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      6.444(CFS)
Total initial stream area =        2.455(Ac.)
Pervious area fraction = 0.800


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Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    22.900(Ft.)
Downstream point/station elevation =    20.450(Ft.)
Pipe length  =   102.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.444(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     6.444(CFS)
Normal flow depth in pipe =    7.88(In.)
Flow top width inside pipe =   17.86(In.)
Critical Depth =   11.77(In.)
Pipe flow velocity =      8.68(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =    11.61 min.


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Process from Point/Station       15.000 to Point/Station       16.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.141(Ft.), Average velocity =   3.234(Ft/s)
       ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            200.00              1.00
Manning's 'N' friction factor =   0.025
-----------------------------------------------------------------
Sub-Channel flow  =      6.444(CFS)
  '     '       flow top width =     28.233(Ft.)
  '     '    velocity=    3.234(Ft/s)
```

```
  '     '       area =      1.993(Sq.Ft)
  '     '       Froude number =     2.145

Upstream point elevation =    20.450(Ft.)
Downstream point elevation =    13.650(Ft.)
Flow length =    67.000(Ft.)
Travel time  =    0.35 min.
Time of concentration =   11.96 min.
Depth of flow =   0.141(Ft.)
Average velocity =   3.234(Ft/s)
Total irregular channel flow =     6.444(CFS)
Irregular channel normal depth above invert elev. =   0.141(Ft.)
Average velocity of channel(s) =   3.234(Ft/s)


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Process from Point/Station       16.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      2.455(Ac.)
Runoff from this stream =      6.444(CFS)
Time of concentration =   11.96 min.
Rainfall intensity =     3.157(In/Hr)
Summary of stream data:

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


1        4.427     18.19                 2.506
2        6.444     11.96                 3.157
Largest stream flow has longer or shorter time of concentration
Qp =      6.444 + sum of
         Qa          Tb/Ta
          4.427 *    0.657 =      2.909
Qp =      9.354

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.427       6.444
Area of streams before confluence:
        2.137        2.455
Results of confluence:
Total flow rate =      9.354(CFS)
Time of concentration =    11.957 min.
Effective stream area after confluence =      4.592(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       23.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.191(Ft.), Average velocity =   2.553(Ft/s)
       ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            200.00              1.00
Manning's 'N' friction factor =   0.025
-------------------------------------------------------------------
Sub-Channel flow  =      9.354(CFS)
  '     '       flow top width =     38.279(Ft.)
  '     '    velocity=    2.553(Ft/s)
  '     '       area =      3.663(Sq.Ft)
  '     '       Froude number =     1.455

Upstream point elevation =    13.650(Ft.)
Downstream point elevation =     8.000(Ft.)
```

```
Flow length =   134.000(Ft.)
Travel time  =    0.87 min.
Time of concentration =   12.83 min.
Depth of flow =   0.191(Ft.)
Average velocity =   2.553(Ft/s)
Total irregular channel flow =     9.354(CFS)
Irregular channel normal depth above invert elev. =   0.191(Ft.)
Average velocity of channel(s) =   2.553(Ft/s)


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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 =     8.000(Ft.)
Downstream point/station elevation =     4.000(Ft.)
Pipe length  =    54.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     9.354(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     9.354(CFS)
Normal flow depth in pipe =    6.32(In.)
Flow top width inside pipe =   21.14(In.)
Critical Depth =   13.11(In.)
Pipe flow velocity =     14.15(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    12.90 min.


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Process from Point/Station       24.000 to Point/Station       24.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.592(Ac.)
Runoff from this stream =      9.354(CFS)
Time of concentration =   12.90 min.
Rainfall intensity =     3.028(In/Hr)
Summary of stream data:

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


1       21.220     15.60               2.727
2        9.354     12.90               3.028
Largest stream flow has longer time of concentration
Qp =     21.220 + sum of
          Qb         Ia/Ib
           9.354 *    0.901 =      8.423
Qp =     29.643

Total of 2 main streams to confluence:
Flow rates before confluence point:
      21.220       9.354
Area of streams before confluence:
        9.045        4.592


Results of confluence:
Total flow rate =     29.643(CFS)
Time of concentration =    15.602 min.
Effective stream area after confluence  =     13.637(Ac.)
End of computations, total study area =           13.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.794
Area averaged RI index number =  74.2
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                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
       Rational Hydrology Study        Date: 06/07/18  File:17053BMP1.out
------------------------------------------------------------------------
RUNOFF TO BMP-1 ULTIMATELY TO POC-1
POST DEVELOPMENT 100 YEAR STORM EVENT
POC-1
FILENAME:17053BMP1.RRV
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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

------------------------------------------------------------------------
Program License Serial Number 6332
------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

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

Standard intensity-duration curves data (Plate D-4.1)
For the [ Murrieta,Tmc,Rnch CaNorco ] area used.
10 year storm 10 minute intensity =  2.360(In/Hr)
10 year storm 60 minute intensity =  0.880(In/Hr)
100 year storm 10 minute intensity =  3.480(In/Hr)
100 year storm 60 minute intensity =  1.300(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500

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Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   428.000(Ft.)
Top (of initial area) elevation =    39.420(Ft.)
Bottom (of initial area) elevation =    30.310(Ft.)
Difference in elevation =     9.110(Ft.)
Slope =    0.02129  s(percent)=       2.13
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.313 min.
Rainfall intensity =      4.137(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.891
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      8.432(CFS)
Total initial stream area =        2.287(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       12.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    26.480(Ft.)
Downstream point/station elevation =    25.000(Ft.)
Pipe length  =   148.50(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.432(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     8.432(CFS)
Normal flow depth in pipe =   12.22(In.)
Flow top width inside pipe =   16.81(In.)
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Critical Depth =   13.49(In.)
Pipe flow velocity =      6.60(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =     7.69 min.


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Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.287(Ac.)
Runoff from this stream =      8.432(CFS)
Time of concentration =    7.69 min.
Rainfall intensity =     4.025(In/Hr)


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Process from Point/Station       16.000 to Point/Station       17.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   251.000(Ft.)
Top (of initial area) elevation =    41.380(Ft.)
Bottom (of initial area) elevation =    37.000(Ft.)
Difference in elevation =     4.380(Ft.)
Slope =    0.01745  s(percent)=       1.75
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.147 min.
Rainfall intensity =      4.552(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.892
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.814(CFS)
Total initial stream area =        0.693(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       17.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    37.000(Ft.)
Downstream point elevation =    25.000(Ft.)
Channel length thru subarea  =   502.000(Ft.)
Channel base width     =    0.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      3.100(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      3.100(CFS)
Depth of flow =   0.391(Ft.), Average velocity =   5.059(Ft/s)
Channel flow top width =    3.131(Ft.)
Flow Velocity =    5.06(Ft/s)
Travel time  =    1.65 min.
Time of concentration =    7.80 min.

Sub-Channel No. 1 Critical depth =      0.516(Ft.)
  '     '       '     Critical flow top width =      4.000(Ft.)
  '     '       '     Critical flow velocity=    2.918(Ft/s)
  '     '       '     Critical flow area =      1.063(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.891
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
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Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      3.993(In/Hr) for a   100.0 year storm
Subarea runoff =      0.502(CFS) for      0.141(Ac.)
Total runoff =      3.315(CFS)       Total area =       0.834(Ac.)
Depth of flow =   0.401(Ft.), Average velocity =   5.145(Ft/s)

Sub-Channel No. 1 Critical depth =      0.527(Ft.)
  '     '       '     Critical flow top width =      4.000(Ft.)
  '     '       '     Critical flow velocity=    2.988(Ft/s)
  '     '       '     Critical flow area =      1.109(Sq.Ft)


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Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.834(Ac.)
Runoff from this stream =      3.315(CFS)
Time of concentration =    7.80 min.
Rainfall intensity =     3.993(In/Hr)


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Process from Point/Station        3.000 to Point/Station       13.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   339.000(Ft.)
Top (of initial area) elevation =    42.400(Ft.)
Bottom (of initial area) elevation =    38.440(Ft.)
Difference in elevation =     3.960(Ft.)
Slope =    0.01168  s(percent)=       1.17
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.511 min.
Rainfall intensity =      4.077(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.891
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.093(CFS)
Total initial stream area =        0.301(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       13.000 to Point/Station       14.000
**** STREET INLET + AREA  + PIPE  TRAVEL TIME ****
______________________________________________________________________
Top of street segment elevation =    38.440(Ft.)
End of street segment elevation =    28.260(Ft.)
Length of street segment  =   403.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
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Street Inlet Calculations:
Street flow before street inlet =      1.093(CFS)
Half street flow before street inlet =      1.093(CFS)
Existing pipe flow before street inlet =      0.000(CFS)
Number of street inlets = 1
Depth of flow =   0.359(Ft.), Average velocity =   4.247(Ft/s)
U.S. DOT Hydraulic Engineering Circular No. 12 curb inlet calculations:
 Street flow half width at start of inlet =      2.000(Ft.)
 Flow rate in gutter section of street = Qw =      1.093(CFS)
 Ratio of frontal flow to total flow = E0 =  1.0000
 Given curb inlet length  L =      4.000(Ft.)

Half street cross section data points at curb inlet:
                X-coordinate (Ft.)   Y-coordinate (Ft.)
               0.0000                1.0833 right of way
              10.0000                0.8333 top of curb
              10.0000                0.0000 flow line
              12.0000                0.5000 gutter/depression end
              12.0000                0.5000 grade break
              40.0000                1.0600 crown
 Length required for total flow interception = Lt
 Lt = .6 * Q^0.42 * Slope^.3 * (1/(n*Se)^.6 =      7.029(Ft.)
 where Manning's n = 0.0150 and Slope = street slope =  0.0253
 Se = Equivalent Street x-slope including depression =  0.1867
 Gutter depression depth =      4.000(In.)
 Gutter depression width =      2.000(Ft.)
 Efficiency = 1 - (1-L/Lt)^1.8 =  0.7803

Pipe calculations for under street flow rate of      0.853(CFS)
Using a pipe slope =      2.526 %
Upstream point/station elevation =    38.440(Ft.)
Downstream point/station elevation =    28.260(Ft.)
Pipe length  =   403.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.853(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.853(CFS)
Normal flow depth in pipe =    4.70(In.)
Flow top width inside pipe =    4.94(In.)
Critical Depth =    5.44(In.)
Pipe flow velocity =      5.17(Ft/s)
Travel time through pipe =    1.30 min.
Time of concentration (TC) =     8.81 min.
Maximum flow rate of street inlet(s) =      0.853(CFS)
Maximum pipe flow capacity =      0.853(CFS)
Remaining flow in street below inlet =      0.240(CFS)
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      3.734(In/Hr) for a   100.0 year storm
Subarea runoff =      1.510(CFS) for      0.454(Ac.)
Total runoff =      2.603(CFS)        Total area =       0.755(Ac.)
Street flow at end of street =      1.750(CFS)
Half street flow at end of street =      1.750(CFS)
Depth of flow =   0.262(Ft.), Average velocity =   2.997(Ft/s)
Flow width (from curb towards crown)=   6.762(Ft.)


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Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    26.070(Ft.)
Downstream point/station elevation =    25.000(Ft.)
Pipe length  =   187.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.603(CFS)
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Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.603(CFS)
Normal flow depth in pipe =    7.09(In.)
Flow top width inside pipe =   17.59(In.)
Critical Depth =    7.33(In.)
Pipe flow velocity =      4.03(Ft/s)
Travel time through pipe =    0.77 min.
Time of concentration (TC) =     9.58 min.


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Process from Point/Station       10.000 to Point/Station       15.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.58 min.
Rainfall intensity =      3.565(In/Hr) for a   100.0 year storm
Subarea runoff =      0.492(CFS) for      0.155(Ac.)
Total runoff =      3.095(CFS)        Total area =       0.910(Ac.)


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Process from Point/Station       15.000 to Point/Station       15.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      0.910(Ac.)
Runoff from this stream =      3.095(CFS)
Time of concentration =    9.58 min.
Rainfall intensity =     3.565(In/Hr)
Summary of stream data:

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

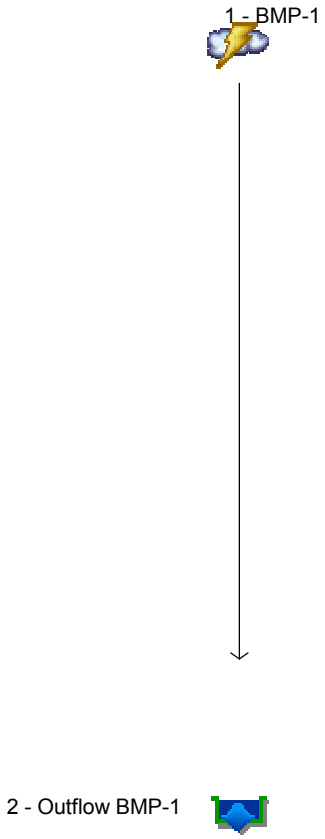

1        8.432      7.69                 4.025
2        3.315      7.80                 3.993
3        3.095      9.58                 3.565
Largest stream flow has longer or shorter time of concentration
Qp =      8.432 + sum of
          Qa          Tb/Ta
           3.315 *    0.986 =      3.268
          Qa          Tb/Ta
           3.095 *    0.802 =      2.482
Qp =     14.182

Total of 3 streams to confluence:
Flow rates before confluence point:
       8.432       3.315       3.095
Area of streams before confluence:
        2.287        0.834        0.910
Results of confluence:
Total flow rate =     14.182(CFS)
Time of concentration =     7.688 min.
Effective stream area after confluence =      4.031(Ac.)
End of computations, total study area =            4.03 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	Origin	Description
1	Rational	BMP-1
2	Reservoir	Outflow BMP-1

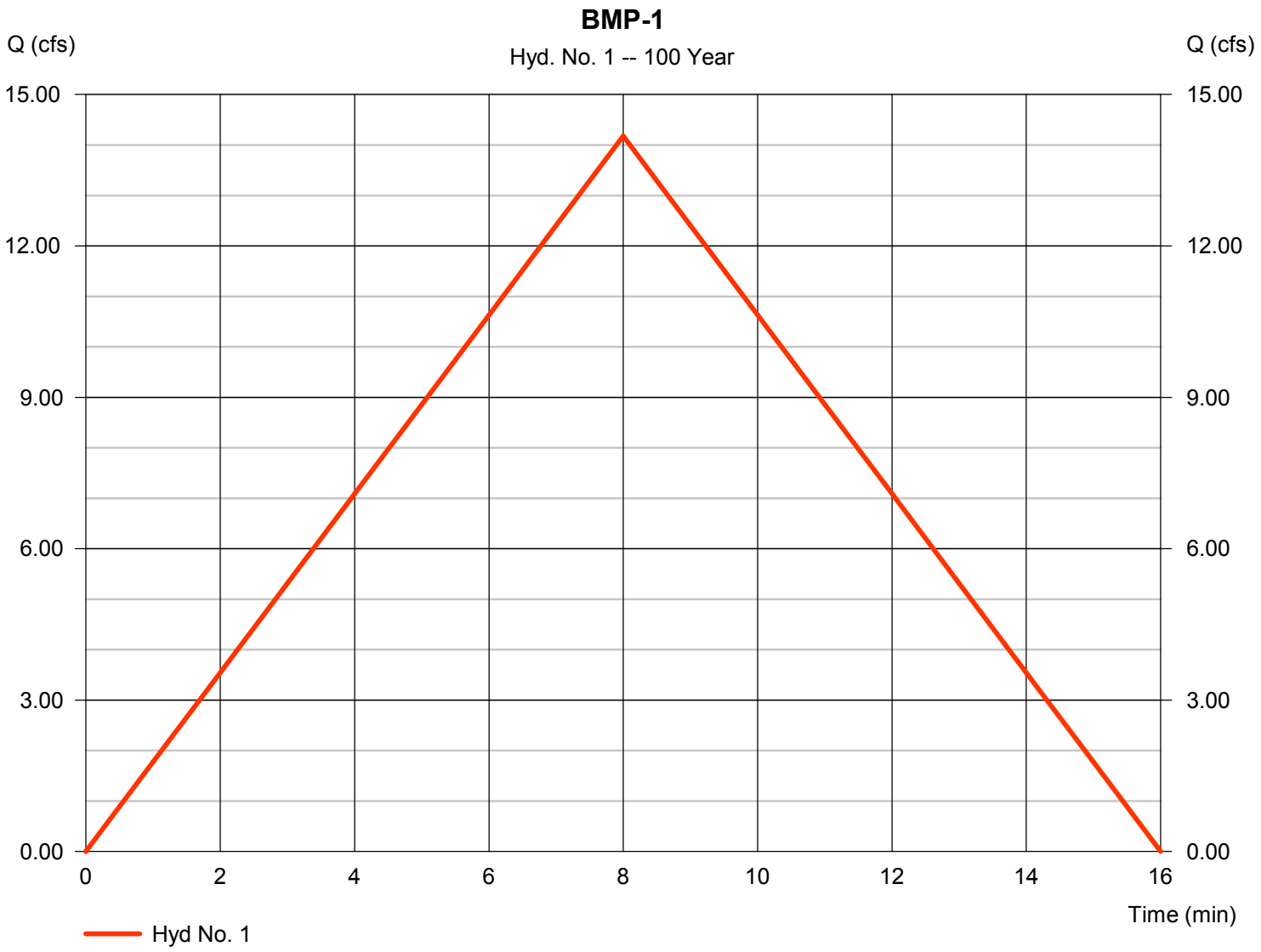
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 06 / 7 / 2018

Hyd. No. 1

BMP-1

Hydrograph type	=	Rational	Peak discharge	=	14.18 cfs
Storm frequency	=	100 yrs	Time to peak	=	8 min
Time interval	=	1 min	Hyd. volume	=	6,804 cuft
Drainage area	=	4.033 ac	Runoff coeff.	=	0.9
Intensity	=	3.905 in/hr	Tc by User	=	8.00 min
IDF Curve	=	Murrieta - Temecula.IDF	Asc/Rec limb fact	=	1/1



Hydrograph Report

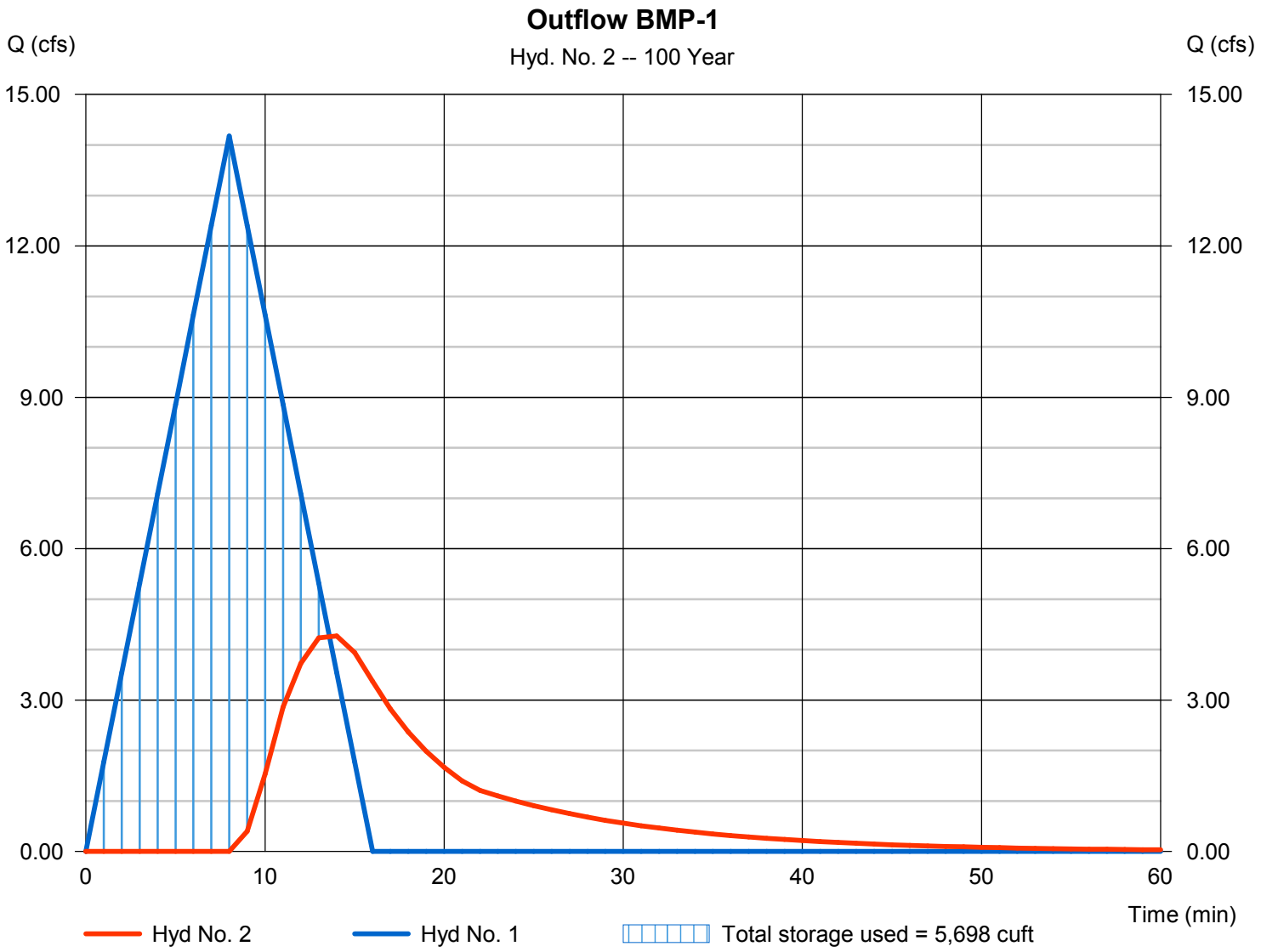
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 06 / 7 / 2018

Hyd. No. 2

Outflow BMP-1

Hydrograph type	= Reservoir	Peak discharge	= 4.271 cfs
Storm frequency	= 100 yrs	Time to peak	= 14 min
Time interval	= 1 min	Hyd. volume	= 2,866 cuft
Inflow hyd. No.	= 1 - BMP-1	Max. Elevation	= 1525.73 ft
Reservoir name	= BMP-1	Max. Storage	= 5,698 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Thursday, 06 / 7 / 2018

Pond No. 1 - BMP-1

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1525.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1525.00	7,343	0	0
1.00	1526.00	8,422	7,876	7,876

Culvert / Orifice Structures

		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	18.00	0.00	0.00	0.00
Span (in)	=	18.00	0.00	0.00	0.00
No. Barrels	=	1	0	0	0
Invert El. (ft)	=	1521.00	0.00	0.00	0.00
Length (ft)	=	5.00	0.00	0.00	0.00
Slope (%)	=	1.00	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	No	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	12.00	0.00	0.00	0.00
Crest El. (ft)	=	1525.50	0.00	0.00	0.00
Weir Coeff.	=	3.33	3.33	3.33	3.33
Weir Type	=	1	---	---	---
Multi-Stage	=	Yes	No	No	No

Exfil.(in/hr)	=	0.000 (by Contour)
TW Elev. (ft)	=	0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1525.00	0.00	---	---	---	0.00	---	---	---	---	---	0.000
0.10	788	1525.10	15.34 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.20	1,575	1525.20	15.34 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.30	2,363	1525.30	15.34 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.40	3,150	1525.40	15.34 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.50	3,938	1525.50	15.34 ic	---	---	---	0.00	---	---	---	---	---	0.000
0.60	4,725	1525.60	15.34 ic	---	---	---	1.26	---	---	---	---	---	1.261
0.70	5,513	1525.70	15.34 ic	---	---	---	3.57	---	---	---	---	---	3.570
0.80	6,300	1525.80	15.34 ic	---	---	---	6.56	---	---	---	---	---	6.560
0.90	7,088	1525.90	15.34 ic	---	---	---	10.10	---	---	---	---	---	10.10
1.00	7,876	1526.00	15.34 ic	---	---	---	14.13	---	---	---	---	---	14.13

Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Monday, 01 / 29 / 2018

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	0.0000	0.0000	0.0000	--------
3	0.0000	0.0000	0.0000	--------
5	0.0000	0.0000	0.0000	--------
10	8.4804	0.1000	0.5531	--------
25	0.0000	0.0000	0.0000	--------
50	0.0000	0.0000	0.0000	--------
100	12.3083	0.1000	0.5488	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	3.44	2.36	1.89	1.61	1.43	1.29	1.18	1.10	1.03	0.97	0.92	0.88
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	5.03	3.46	2.77	2.37	2.10	1.90	1.75	1.62	1.52	1.44	1.36	1.30

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	0.00	2.20	0.00	3.30	4.25	5.77	6.80	0.00
SCS 6-Hr	0.00	1.80	0.00	0.00	2.60	0.00	0.00	0.00
Huff-1st	0.00	1.55	0.00	2.75	4.00	5.38	6.50	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	1.55	0.00	2.75	4.00	5.38	6.50	0.00
Custom	0.00	1.75	0.00	2.80	3.90	5.25	6.00	0.00

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
        Rational Hydrology Study        Date: 06/07/18  File:17053BMP2.out
----------------------------------------------------------------------
RUNOFF TO BMP-2 ULTIMATELY TO POC-1
POST-DEVELOPMENT 100 YEAR STORM EVENT
POC-1
FILENAME: 17053BMP2.RRV
----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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

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

Program License Serial Number 6332

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

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

Standard intensity-duration curves data (Plate D-4.1)
For the [ Murrieta,Tmc,Rnch CaNorco ] area used.
10 year storm 10 minute intensity =  2.360(In/Hr)
10 year storm 60 minute intensity =  0.880(In/Hr)
100 year storm 10 minute intensity =  3.480(In/Hr)
100 year storm 60 minute intensity =  1.300(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   192.000(Ft.)
Top (of initial area) elevation =    42.400(Ft.)
Bottom (of initial area) elevation =    40.500(Ft.)
Difference in elevation =     1.900(Ft.)
Slope =    0.00990  s(percent)=       0.99
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.185 min.
Rainfall intensity =      4.536(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.892
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      0.910(CFS)
Total initial stream area =        0.225(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    36.630(Ft.)
Downstream point/station elevation =    36.000(Ft.)
Pipe length  =    59.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.910(CFS)
```

```
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     0.910(CFS)
Normal flow depth in pipe =    4.07(In.)
Flow top width inside pipe =   11.36(In.)
Critical Depth =    4.79(In.)
Pipe flow velocity =      3.88(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     6.44 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.225(Ac.)
Runoff from this stream =      0.910(CFS)
Time of concentration =    6.44 min.
Rainfall intensity =     4.437(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        6.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   201.000(Ft.)
Top (of initial area) elevation =    41.380(Ft.)
Bottom (of initial area) elevation =    36.000(Ft.)
Difference in elevation =     5.380(Ft.)
Slope =    0.02677  s(percent)=       2.68
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    5.163 min.
Rainfall intensity =      5.010(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.122(CFS)
Total initial stream area =        0.698(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.698(Ac.)
Runoff from this stream =      3.122(CFS)
Time of concentration =    5.16 min.
Rainfall intensity =     5.010(In/Hr)
Summary of stream data:

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


1        0.910      6.44                 4.437
2        3.122      5.16                 5.010
Largest stream flow has longer or shorter time of concentration
Qp =      3.122 + sum of
          Qa          Tb/Ta
           0.910 *    0.802 =      0.730
Qp =      3.852

Total of 2 streams to confluence:
Flow rates before confluence point:
```

```
       0.910       3.122
Area of streams before confluence:
        0.225        0.698
Results of confluence:
Total flow rate =      3.852(CFS)
Time of concentration =     5.163 min.
Effective stream area after confluence =      0.923(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        7.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    36.000(Ft.)
Downstream point/station elevation =    17.950(Ft.)
Pipe length  =  1174.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.852(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.852(CFS)
Normal flow depth in pipe =    8.67(In.)
Flow top width inside pipe =   10.74(In.)
Critical Depth =   10.00(In.)
Pipe flow velocity =      6.34(Ft/s)
Travel time through pipe =    3.09 min.
Time of concentration (TC) =     8.25 min.
End of computations, total study area =            0.92 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged RI index number =  75.0
```

```
        Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2014 Version 9.0
        Rational Hydrology Study        Date: 06/07/18  File:17053POSTPOC1.out
------------------------------------------------------------------------
POST-DEVELOPMENT 100 YEAR STORM EVENT
POC-1
FILE:17053POC1.RRV

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

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

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

Program License Serial Number 6332

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

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

Standard intensity-duration curves data (Plate D-4.1)
For the [ Murrieta,Tmc,Rnch CaNorco ] area used.
10 year storm 10 minute intensity =  2.360(In/Hr)
10 year storm 60 minute intensity =  0.880(In/Hr)
100 year storm 10 minute intensity =  3.480(In/Hr)
100 year storm 60 minute intensity =  1.300(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.300(In/Hr)
Slope of intensity duration curve = 0.5500


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
Rainfall intensity =      5.099(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
User specified values are as follows:
TC =   5.00 min.  Rain intensity =       5.10(In/Hr)
Total area =         0.92(Ac.)  Total runoff =      3.85(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        7.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    33.480(Ft.)
Downstream point/station elevation =    17.950(Ft.)
Pipe length  =  1175.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.852(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     3.852(CFS)
Normal flow depth in pipe =    9.26(In.)
Flow top width inside pipe =   10.08(In.)
Critical Depth =   10.00(In.)
Pipe flow velocity =      5.93(Ft/s)
Travel time through pipe =    3.30 min.
```

```
Time of concentration (TC) =     8.30 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        7.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.923(Ac.)
Runoff from this stream =      3.852(CFS)
Time of concentration =    8.30 min.
Rainfall intensity =     3.858(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station        7.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
______________________________________________________________________
Rainfall intensity =      4.027(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.891
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
User specified values are as follows:
TC =   7.68 min.  Rain intensity =       4.03(In/Hr)
Total area =         4.04(Ac.)  Total runoff =      4.28(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        7.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.036(Ac.)
Runoff from this stream =      4.278(CFS)
Time of concentration =    7.68 min.
Rainfall intensity =     4.027(In/Hr)
Summary of stream data:

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


1        3.852      8.30                 3.858
2        4.278      7.68                 4.027
Largest stream flow has longer or shorter time of concentration
Qp =      4.278 + sum of
          Qa          Tb/Ta
           3.852 *    0.925 =      3.563
Qp =      7.841

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.852       4.278
Area of streams before confluence:
        0.923        4.036
Results of confluence:
Total flow rate =      7.841(CFS)
Time of concentration =     7.680 min.
Effective stream area after confluence =      4.959(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        7.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    17.950(Ft.)
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Downstream point/station elevation =    14.780(Ft.)
Pipe length  =   102.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.841(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     7.841(CFS)
Normal flow depth in pipe =    8.18(In.)
Flow top width inside pipe =   17.93(In.)
Critical Depth =   13.01(In.)
Pipe flow velocity =     10.05(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =     7.85 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.959(Ac.)
Runoff from this stream =      7.841(CFS)
Time of concentration =    7.85 min.
Rainfall intensity =     3.979(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       19.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   296.000(Ft.)
Top (of initial area) elevation =    28.830(Ft.)
Bottom (of initial area) elevation =    23.980(Ft.)
Difference in elevation =     4.850(Ft.)
Slope =    0.01639  s(percent)=       1.64
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.649 min.
Rainfall intensity =      4.359(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.892
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.865(CFS)
Total initial stream area =        0.737(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station        8.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    21.000(Ft.)
Downstream point/station elevation =    14.780(Ft.)
Pipe length  =    89.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.865(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.865(CFS)
Normal flow depth in pipe =    4.54(In.)
Flow top width inside pipe =   11.64(In.)
Critical Depth =    8.71(In.)
Pipe flow velocity =     10.52(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =     6.79 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        8.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
```

```
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.737(Ac.)
Runoff from this stream =      2.865(CFS)
Time of concentration =    6.79 min.
Rainfall intensity =     4.309(In/Hr)
Summary of stream data:

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


1        7.841      7.85                 3.979
2        2.865      6.79                 4.309
Largest stream flow has longer time of concentration
Qp =      7.841 + sum of
          Qb         Ia/Ib
           2.865 *    0.923 =      2.645
Qp =     10.486

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.841       2.865
Area of streams before confluence:
        4.959        0.737
Results of confluence:
Total flow rate =     10.486(CFS)
Time of concentration =     7.849 min.
Effective stream area after confluence =      5.696(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    14.780(Ft.)
Downstream point/station elevation =    12.800(Ft.)
Pipe length  =    66.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    10.486(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    10.486(CFS)
Normal flow depth in pipe =    9.80(In.)
Flow top width inside pipe =   17.93(In.)
Critical Depth =   14.93(In.)
Pipe flow velocity =     10.66(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     7.95 min.


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Process from Point/Station        9.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      5.696(Ac.)
Runoff from this stream =     10.486(CFS)
Time of concentration =    7.95 min.
Rainfall intensity =     3.950(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       20.000 to Point/Station       21.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   308.000(Ft.)
Top (of initial area) elevation =    44.000(Ft.)
Bottom (of initial area) elevation =    40.000(Ft.)
Difference in elevation =     4.000(Ft.)
Slope =    0.01299  s(percent)=       1.30
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =   12.502 min.
Rainfall intensity =      3.080(In/Hr) for a   100.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.854
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      4.181(CFS)
Total initial stream area =        1.589(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station       21.000 to Point/Station       22.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      7.190(CFS)
Depth of flow =   0.655(Ft.), Average velocity =   8.376(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2              2.00              0.00
       3              4.00              1.00
Manning's 'N' friction factor =   0.014
----------------------------------------------------------------
Sub-Channel flow  =      7.190(CFS)
  '     '       flow top width =      2.621(Ft.)
  '     '    velocity=    8.376(Ft/s)
  '     '       area =      0.858(Sq.Ft)
  '     '       Froude number =     2.579

Upstream point elevation =    40.000(Ft.)
Downstream point elevation =    26.400(Ft.)
Flow length =   425.000(Ft.)
Travel time  =    0.85 min.
Time of concentration =   13.35 min.
Depth of flow =   0.655(Ft.)
Average velocity =   8.376(Ft/s)
Total irregular channel flow =     7.190(CFS)
Irregular channel normal depth above invert elev. =   0.655(Ft.)
Average velocity of channel(s) =   8.376(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.853
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.971(In/Hr) for a   100.0 year storm
Subarea runoff =      5.959(CFS) for      2.352(Ac.)
Total runoff =     10.140(CFS)       Total area =       3.941(Ac.)
Depth of flow =   0.745(Ft.), Average velocity =   9.128(Ft/s)


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Process from Point/Station       22.000 to Point/Station       27.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =     11.653(CFS)
Depth of flow =   0.340(Ft.), Average velocity =   3.723(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
```

```
       1              0.00              0.50
       2              0.00              0.00
       3             27.00              0.50
Manning's 'N' friction factor =   0.015
----------------------------------------------------------------
Sub-Channel flow  =     11.653(CFS)
  '     '       flow top width =     18.385(Ft.)
  '     '    velocity=    3.723(Ft/s)
  '     '       area =      3.130(Sq.Ft)
  '     '       Froude number =     1.590

Upstream point elevation =    26.400(Ft.)
Downstream point elevation =    20.430(Ft.)
Flow length =   389.000(Ft.)
Travel time  =    1.74 min.
Time of concentration =   15.09 min.
Depth of flow =   0.340(Ft.)
Average velocity =   3.723(Ft/s)
Total irregular channel flow =    11.653(CFS)
Irregular channel normal depth above invert elev. =   0.340(Ft.)
Average velocity of channel(s) =   3.723(Ft/s)
 Adding area flow to channel
SINGLE FAMILY (1/4 Acre Lot)
Runoff Coefficient = 0.838
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.500; Impervious fraction =  0.500
Rainfall intensity =      2.778(In/Hr) for a   100.0 year storm
Subarea runoff =      2.946(CFS) for      1.266(Ac.)
Total runoff =     13.087(CFS)        Total area =       5.207(Ac.)
Depth of flow =   0.356(Ft.), Average velocity =   3.833(Ft/s)


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Process from Point/Station       27.000 to Point/Station       27.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      5.207(Ac.)
Runoff from this stream =     13.087(CFS)
Time of concentration =   15.09 min.
Rainfall intensity =     2.778(In/Hr)


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Process from Point/Station       23.000 to Point/Station       24.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   133.000(Ft.)
Top (of initial area) elevation =    27.400(Ft.)
Bottom (of initial area) elevation =    25.000(Ft.)
Difference in elevation =     2.400(Ft.)
Slope =    0.01805  s(percent)=       1.80
TC = k(0.300)*[(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 =      5.099(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      2.299(CFS)
Total initial stream area =        0.505(Ac.)
```

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Pervious area fraction = 0.100


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Process from Point/Station       24.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    25.000(Ft.)
Downstream point/station elevation =    21.000(Ft.)
Pipe length  =   125.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.299(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     2.299(CFS)
Normal flow depth in pipe =    4.98(In.)
Flow top width inside pipe =   11.83(In.)
Critical Depth =    7.79(In.)
Pipe flow velocity =      7.45(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =     5.28 min.


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Process from Point/Station       27.000 to Point/Station       27.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.505(Ac.)
Runoff from this stream =      2.299(CFS)
Time of concentration =    5.28 min.
Rainfall intensity =     4.949(In/Hr)
Summary of stream data:

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


1       13.087     15.09                 2.778
2        2.299      5.28                 4.949
Largest stream flow has longer time of concentration
Qp =     13.087 + sum of
          Qb         Ia/Ib
           2.299 *    0.561 =      1.290
Qp =     14.377

Total of 2 streams to confluence:
Flow rates before confluence point:
      13.087       2.299
Area of streams before confluence:
        5.207        0.505
Results of confluence:
Total flow rate =     14.377(CFS)
Time of concentration =    15.089 min.
Effective stream area after confluence =      5.712(Ac.)


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Process from Point/Station       27.000 to Point/Station        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    15.660(Ft.)
Downstream point/station elevation =    12.800(Ft.)
Pipe length  =   199.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.377(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    14.377(CFS)
Normal flow depth in pipe =   12.42(In.)
Flow top width inside pipe =   23.99(In.)
Critical Depth =   16.41(In.)
Pipe flow velocity =      8.76(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =    15.47 min.
```

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Process from Point/Station        9.000 to Point/Station        9.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      5.712(Ac.)
Runoff from this stream =     14.377(CFS)
Time of concentration =   15.47 min.
Rainfall intensity =     2.740(In/Hr)
Summary of stream data:

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


1       10.486      7.95               3.950
2       14.377     15.47               2.740
Largest stream flow has longer time of concentration
Qp =     14.377 + sum of
          Qb         Ia/Ib
          10.486 *    0.694 =      7.273
Qp =     21.650

Total of 2 main streams to confluence:
Flow rates before confluence point:
      10.486      14.377
Area of streams before confluence:
        5.696        5.712


Results of confluence:
Total flow rate =     21.650(CFS)
Time of concentration =    15.468 min.
Effective stream area after confluence  =     11.408(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       28.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    12.800(Ft.)
Downstream point/station elevation =     9.500(Ft.)
Pipe length  =    84.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    21.650(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    21.650(CFS)
Normal flow depth in pipe =   11.75(In.)
Flow top width inside pipe =   23.99(In.)
Critical Depth =   19.97(In.)
Pipe flow velocity =     14.15(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    15.57 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       28.000 to Point/Station       28.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     11.408(Ac.)
Runoff from this stream =     21.650(CFS)
Time of concentration =   15.57 min.
Rainfall intensity =     2.730(In/Hr)


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Process from Point/Station       33.000 to Point/Station       36.000
**** INITIAL AREA EVALUATION ****
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____________________________________________________________________
Initial area flow distance =   202.000(Ft.)
Top (of initial area) elevation =    26.280(Ft.)
Bottom (of initial area) elevation =    20.690(Ft.)
Difference in elevation =     5.590(Ft.)
Slope =    0.02767  s(percent)=       2.77
TC = k(0.480)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.222 min.
Rainfall intensity =      3.879(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1 Acre Lot)
Runoff Coefficient = 0.826
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.800; Impervious fraction =  0.200
Initial subarea runoff =      2.131(CFS)
Total initial stream area =        0.665(Ac.)
Pervious area fraction = 0.800


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Process from Point/Station       36.000 to Point/Station       28.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
____________________________________________________________________
Upstream point/station elevation =    20.690(Ft.)
Downstream point/station elevation =     9.500(Ft.)
Pipe length  =   104.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.131(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.131(CFS)
Normal flow depth in pipe =    3.04(In.)
Flow top width inside pipe =   13.48(In.)
Critical Depth =    6.61(In.)
Pipe flow velocity =     10.82(Ft/s)
Travel time through pipe =    0.16 min.
Time of concentration (TC) =     8.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       28.000 to Point/Station       28.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.665(Ac.)
Runoff from this stream =      2.131(CFS)
Time of concentration =    8.38 min.
Rainfall intensity =     3.838(In/Hr)
Summary of stream data:

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


1       21.650     15.57                 2.730
2        2.131      8.38                 3.838
Largest stream flow has longer time of concentration
Qp =     21.650 + sum of
          Qb         Ia/Ib
           2.131 *    0.711 =      1.516
Qp =     23.166

Total of 2 streams to confluence:
Flow rates before confluence point:
      21.650       2.131
Area of streams before confluence:
       11.408        0.665
Results of confluence:
Total flow rate =     23.166(CFS)
Time of concentration =    15.567 min.
```

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Effective stream area after confluence =     12.073(Ac.)


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Process from Point/Station       28.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =     9.500(Ft.)
Downstream point/station elevation =     4.000(Ft.)
Pipe length  =   359.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.166(CFS)
Given pipe size =     30.00(In.)
Calculated individual pipe flow  =    23.166(CFS)
Normal flow depth in pipe =   14.23(In.)
Flow top width inside pipe =   29.96(In.)
Critical Depth =   19.66(In.)
Pipe flow velocity =     10.11(Ft/s)
Travel time through pipe =    0.59 min.
Time of concentration (TC) =    16.16 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       38.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.073(Ac.)
Runoff from this stream =     23.166(CFS)
Time of concentration =   16.16 min.
Rainfall intensity =     2.675(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       30.000 to Point/Station       31.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   612.000(Ft.)
Top (of initial area) elevation =    42.000(Ft.)
Bottom (of initial area) elevation =    36.800(Ft.)
Difference in elevation =     5.200(Ft.)
Slope =    0.00850  s(percent)=       0.85
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.194 min.
Rainfall intensity =      2.873(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.828
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.600; Impervious fraction =  0.400
Initial subarea runoff =      2.948(CFS)
Total initial stream area =        1.240(Ac.)
Pervious area fraction = 0.600


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Process from Point/Station       31.000 to Point/Station       32.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =    32.000(Ft.)
Downstream point/station elevation =    28.000(Ft.)
Pipe length  =    82.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.948(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     2.948(CFS)
Normal flow depth in pipe =    4.33(In.)
Flow top width inside pipe =   15.39(In.)
```

```
Critical Depth =    7.83(In.)
Pipe flow velocity =      9.00(Ft/s)
Travel time through pipe =    0.15 min.
Time of concentration (TC) =    14.35 min.


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Process from Point/Station       32.000 to Point/Station       35.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    28.000(Ft.)
Downstream point elevation =    13.650(Ft.)
Channel length thru subarea  =   457.000(Ft.)
Channel base width     =    3.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    4.000(Ft.)
Flow(q) thru subarea =      2.948(CFS)
Depth of flow =   0.174(Ft.), Average velocity =   5.052(Ft/s)
Channel flow top width =    3.697(Ft.)
Flow Velocity =    5.05(Ft/s)
Travel time  =    1.51 min.
Time of concentration =   15.85 min.

Sub-Channel No. 1 Critical depth =      0.289(Ft.)
  '     '       '     Critical flow top width =      4.156(Ft.)
  '     '       '     Critical flow velocity=    2.850(Ft/s)
  '     '       '     Critical flow area =      1.034(Sq.Ft)



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Process from Point/Station       35.000 to Point/Station       35.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      1.240(Ac.)
Runoff from this stream =      2.948(CFS)
Time of concentration =   15.85 min.
Rainfall intensity =     2.703(In/Hr)


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Process from Point/Station       31.000 to Point/Station       33.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   428.000(Ft.)
Top (of initial area) elevation =    36.800(Ft.)
Bottom (of initial area) elevation =    26.280(Ft.)
Difference in elevation =    10.520(Ft.)
Slope =    0.02096  s(percent)=       2.10
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.946 min.
Rainfall intensity =      3.314(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.836
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  75.00
Pervious area fraction =  0.600; Impervious fraction =  0.400
Initial subarea runoff =      1.801(CFS)
Total initial stream area =        0.650(Ac.)
Pervious area fraction = 0.600


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Process from Point/Station       33.000 to Point/Station       34.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
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```
Upstream point/station elevation =    22.900(Ft.)
Downstream point/station elevation =    20.450(Ft.)
Pipe length  =   102.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.801(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     1.801(CFS)
Normal flow depth in pipe =    4.04(In.)
Flow top width inside pipe =   15.02(In.)
Critical Depth =    6.06(In.)
Pipe flow velocity =      6.07(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    11.23 min.


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Process from Point/Station       34.000 to Point/Station       35.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.088(Ft.), Average velocity =   2.351(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            200.00              1.00
Manning's 'N' friction factor =   0.025
----------------------------------------------------------------
Sub-Channel flow  =      1.801(CFS)
  '     '       flow top width =     17.504(Ft.)
  '     '    velocity=    2.351(Ft/s)
  '     '       area =      0.766(Sq.Ft)
  '     '       Froude number =     1.981

Upstream point elevation =    20.450(Ft.)
Downstream point elevation =    13.650(Ft.)
Flow length =    67.000(Ft.)
Travel time  =    0.47 min.
Time of concentration =   11.70 min.
Depth of flow =   0.088(Ft.)
Average velocity =   2.351(Ft/s)
Total irregular channel flow =     1.801(CFS)
Irregular channel normal depth above invert elev. =   0.088(Ft.)
Average velocity of channel(s) =   2.351(Ft/s)


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Process from Point/Station       35.000 to Point/Station       35.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      0.650(Ac.)
Runoff from this stream =      1.801(CFS)
Time of concentration =   11.70 min.
Rainfall intensity =     3.194(In/Hr)
Summary of stream data:

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


1        2.948     15.85                 2.703
2        1.801     11.70                 3.194
Largest stream flow has longer time of concentration
Qp =      2.948 + sum of
          Qb         Ia/Ib
           1.801 *    0.846 =      1.524
Qp =      4.472

Total of 2 streams to confluence:
```

```
Flow rates before confluence point:
       2.948       1.801
Area of streams before confluence:
        1.240        0.650
Results of confluence:
Total flow rate =      4.472(CFS)
Time of concentration =    15.853 min.
Effective stream area after confluence =      1.890(Ac.)


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Process from Point/Station       35.000 to Point/Station       37.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Depth of flow =   0.145(Ft.), Average velocity =   2.123(Ft/s)
       ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
       1              0.00              1.00
       2            100.00              0.00
       3            200.00              1.00
Manning's 'N' friction factor =   0.025
----------------------------------------------------------------
Sub-Channel flow  =      4.472(CFS)
  '     '       flow top width =     29.026(Ft.)
  '     '    velocity=    2.123(Ft/s)
  '     '       area =      2.106(Sq.Ft)
  '     '       Froude number =     1.389

Upstream point elevation =    13.650(Ft.)
Downstream point elevation =     8.000(Ft.)
Flow length =   134.000(Ft.)
Travel time  =    1.05 min.
Time of concentration =   16.91 min.
Depth of flow =   0.145(Ft.)
Average velocity =   2.123(Ft/s)
Total irregular channel flow =     4.472(CFS)
Irregular channel normal depth above invert elev. =   0.145(Ft.)
Average velocity of channel(s) =   2.123(Ft/s)


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Process from Point/Station       37.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________
Upstream point/station elevation =     8.000(Ft.)
Downstream point/station elevation =     4.000(Ft.)
Pipe length  =    54.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.472(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     4.472(CFS)
Normal flow depth in pipe =    4.38(In.)
Flow top width inside pipe =   18.54(In.)
Critical Depth =    8.91(In.)
Pipe flow velocity =     11.41(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    16.98 min.


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Process from Point/Station       38.000 to Point/Station       38.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      1.890(Ac.)
Runoff from this stream =      4.472(CFS)
Time of concentration =   16.98 min.
Rainfall intensity =     2.603(In/Hr)
Summary of stream data:
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Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       23.166     16.16               2.675
2        4.472     16.98               2.603
Largest stream flow has longer or shorter time of concentration
Qp =     23.166 + sum of
          Qa          Tb/Ta
           4.472 *    0.951 =      4.255
Qp =     27.421

Total of 2 main streams to confluence:
Flow rates before confluence point:
      23.166       4.472
Area of streams before confluence:
       12.073        1.890


Results of confluence:
Total flow rate =     27.421(CFS)
Time of concentration =    16.159 min.
Effective stream area after confluence  =     13.963(Ac.)
End of computations, total study area =           13.96 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.491
Area averaged RI index number =  79.0
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