HYDROLOGY / HYDRAULICS STUDY

FOR THE:
Questhaven 76 Lot Residential Subdivision
Near 1058 San Elijo Road
San Marcos, CA 92078
APNs 223-080-46-00, 223-070-07-00, & 223-070-08-00

PREPARED FOR:
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Project No: 17-047

ORIGINAL REPORT PREPARATION DATE:
May 04, 2020

REVISION DATE(S):
March 16, 2021
August 4, 2021

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION

1.1 Purpose of Study

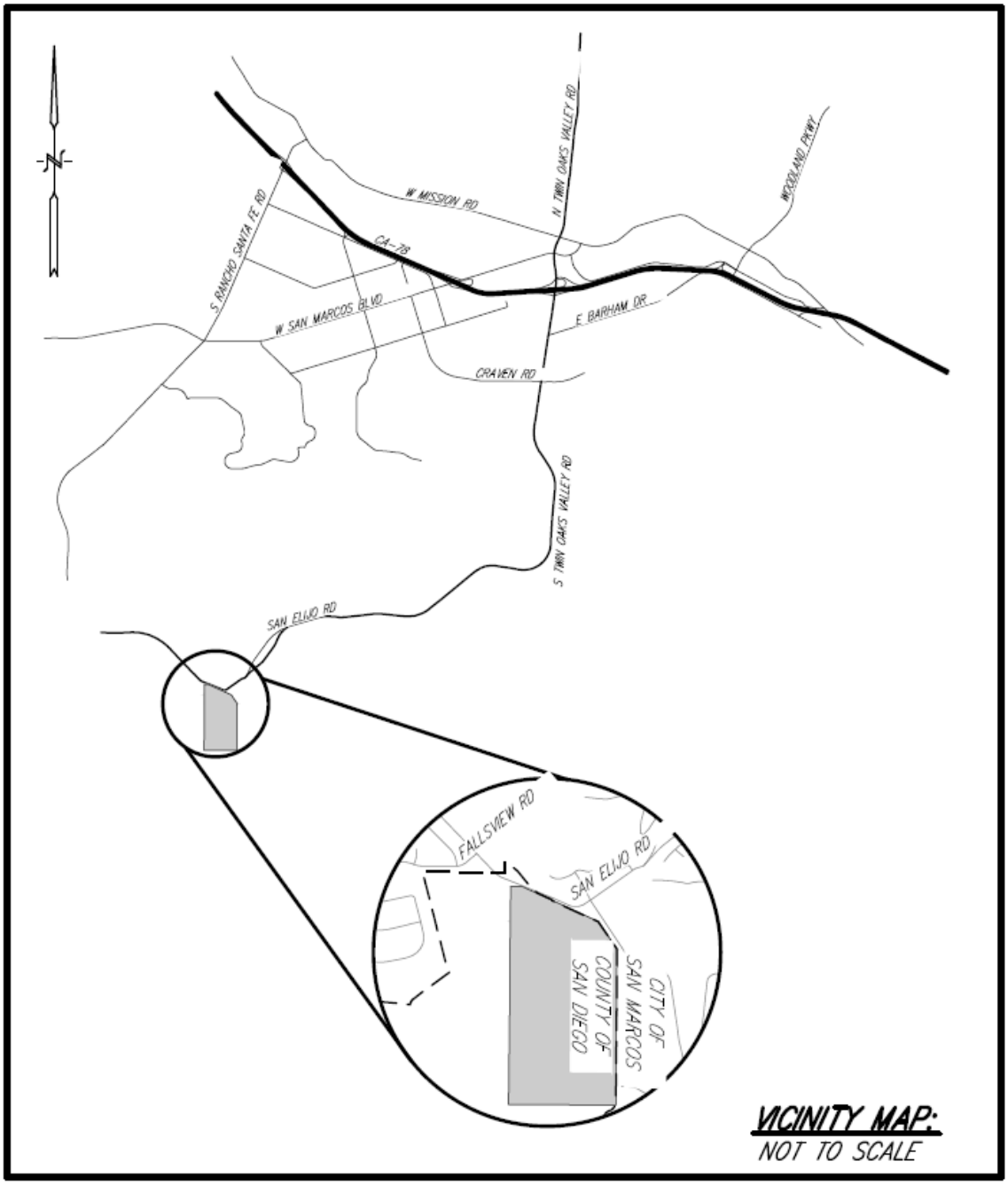
The purpose of this study is to support the grading design for a 76 lot subdivision on a 89 acre parcel of land located in the jurisdictional boundary of the County of San Diego. This study will demonstrate that the post-development 100-year peak runoff will not exceed existing peak runoff rates.

1.2 Project Description

The project proposes to grade a portion of the undeveloped 89-acre site into 76 residential building lots. The project includes the construction of private access streets, utilities, open space areas, and stormwater improvements. The project is limited to the creation of buildable lots only. The improvement of individual lots will be permitted separately.

2.0 VICINITY MAP

The project is located on the southern side of San Elijo Road just east of Falls View Road, and west of the former waste recycling center.



3.0 DESCRIPTION OF WATERSHED

3.1 Pre-Development Topography and Drainage Patterns

The project site is composed entirely of undeveloped natural terrain. The site is tributary to two distinct hydrologic subareas of the Carlsbad Hydrologic Unit. The average slope of the pre-development conditions is determined by following the County standard S-1 and is calculated as 18% for the project overall.

Approximately 34 acres of the discharge from the southern portion of the site starts near the southern limits of the drainage basin and flows mainly in a northeasterly direction. As the northeasterly follows meet the eastern limits of the property, the discharge from the site enters an unnamed tributary of the Escondido Creek flowing in a southerly direction along the eastern property line. The point where the discharge leaves the site is identified as POC-1.

The remaining 45 acres of the southern tributary area flows in a northerly direction where it meets a natural channel flowing in a north westerly direction to a point where it leaves the site along the western boundary. This point is identified as POC-2. After reaching POC-2, the flows continue along their existing offsite flow path in a natural channel until they meet San Elijo road and continue to San Marcos Creek.

Approximately 3 acres of the site along the north eastern portion of the site into an existing brow ditch that carries the water in an easterly direction along the property line and discharge directly to the public storm drain system along San Elijo Road. This point of discharge is identified as POC-3.

The remaining approximately 1 acre of the north western frontage of the site along San Elijo Road flows into two brow ditches that flow westerly and enter the public storm drain system along San Elijo Road tributary to San Marcos Creek. This point is identified as POC-4.

A pre-developed drainage map can be found as Attachment 2 in this report.

3.2 Post-Development Topography and Drainage Patterns

The site is graded such that the distribution of discharge from the site to the respective POCs will remain balanced as much as possible. The area of the project to the southwest will remain open space and will be directed to flow separately from the flow from the developed portions of the site until discharging to the respective POC. The developed portions of the site will all be directed to a stormwater treatment facility. Multiple treatment facilities will be located onsite. The parts of the site that serve as access to the building lots, and the lots themselves will be directed to combination of biofiltration and flow detention facilities. The remainder of the project on the westerly access road, will be treated with Green Street methods (tree wells) sized to meet pollutant treatment and hydromodification goals.

A post-developed drainage map can be found as Attachment 2 in this report.

3.3 Hydrologic Unit Contribution

The project is in the Carlsbad Hydrologic Unit and is bisected by the boundary line between the Batiquitos subarea of the San Marcos hydrologic area (904.51), and the San Elijo subarea of the Escondido Creek hydrologic area (904.61). The northern portion of the site is tributary to San Marcos Creek, and the southern portion of the site is tributary to Escondido Creek.

A map showing the project location with respect to the hydrologic basin areas can be found in Attachment 2 in this report.

4.0 METHODOLOGY

This report is prepared in accordance with the 2003 San Diego County Hydrology Manual (Hydrology Manual). Based on the overall tributary study area, calculations are based on the Rational Method.

4.1 Hydrology Software

The main program is the "San Diego County Rational Hydrology Program" by CIVILCADD/CIVILDESIGN Engineering Software, 1991-2004 Version 7.4, refereed hereafter as "CIVILD". This program specifically utilizes the methods prescribed in the County of San Diego Hydrology Manual and is one of the approved programs for the use in the San Diego area.

4.2 Soils Type Determination

The soils type for the project was determined by mapping the project limits on the EPA Web Soil Survey website. The Web Soil Survey indicates that the entire site is composed of type "D" soils. By observation, Appendix A of the Hydrology Manual supports the use of soil type D in the calculations.

4.3 Isopluvial Value Determination

The isopluvial values for the 100-year 6 hour and 24-hour storm events were determined by plotting the projects location on the respective exhibits from appendix B of the Hydrology Manual.

5.0 CALCULATIONS

5.1 Determination of Drainage Area Parameters

The drainage area parameters are determined by delineating the extents and flow direction of runoff from each of the pre and post development drainage areas and measuring the respective changes in elevation, flow length and drainage area acreage. See Attachment 2 of this report for the respective drainage area exhibits.

5.2 Runoff Coefficient

The runoff coefficients for each of the drainage areas are taken from Table 3-1 of the Hydrology Manual. This table gives values for the runoff coefficient "C" using the total impervious percentage and soil type. The soil type for this site is D, and all values were chosen from Table 3-1 accordingly.

For areas conveying water that has drained through the graded lots, it was found that the total percent impervious is 44%. This value includes roadways and assumes 5,000 sqft of impervious area to be built on each lot. With this information, we can find that our "C" value is 0.60. This value is also represented by the land use category Medium Density Residential (10.9 DU/A or Less). Given that there are only around 3 lots per acre in these sections, we can assume that this value is appropriate to represent most of the site.

The offsite, undeveloped, and pervious graded areas are all 0% impervious. For these areas, the "C" value of 0.35 is used. This is also associated with the category of Undisturbed Natural Terrain (Natural) Permanent Open Space, which is also representative of these areas since they will not be developed.

The driveway section at the northeastern side of the site was calculated to be 80% pervious. For both the pre and post conditions, the "C" value was assigned as 0.79.

The driveway area near the northwestern corner of the site was also given a "C" value based on the percent impervious. This area also includes the biofiltration basin and some contributing graded area. The total impervious percentage is around 28 percent. Because of this, the appropriate "C" value of 0.52 was given.

Table 3-1 is included in the CivilD software and the values chosen based on the program input parameters. Following this, the values used vary depending on the parameters described above and can be found in Attachment 1.

5.3 Manning Roughness Coefficient

Three values for the Manning Roughness Coefficient are used in the hydrology calculations. One for the overland flow travel time calculations, second for the pipe flow friction factor, and third for the street section/gutter flow calculations.

For the overland flow travel times, the n factor is based on section 4.2.1.1 of the Hydrology Manual which describes the basin n factor is the visually estimated mean of the n values (roughness values from Manning's formula) of all the channels within the basin area. n = 0.030: is described as "Drainage area is generally rolling, with rounded ridges and moderate side slopes. Watercourses meander in fairly straight, unimproved channels with some boulders and lodged debris. Ground cover includes scattered brush and grasses. No drainage improvements exist in the area. This was compared to the Hydraulic Design Manual Table A-5, C factors for natural channels which supports the value of 0.030.

For the closed conduit calculations, the value for the roughness coefficient is taken from the Hydraulic Design Manual Table A-2. It is assumed that pipe material of Smooth Plastic Pipe (HPDE and PVC), Spiral Rib Pipe, Reinforced Concrete Pipe (RCP), or a similar material will be used on the project. The Manning's n factor for this class of pipe material is 0.013.

For the paved street surfaces and the gutter flow calculations, a value of 0.013 is used. This is taken from the hydraulic design manual, Table A-1 and Table A-3.

5.4 Rational Method Calculation Summary

The peak runoff values for the 100-year storm are calculated according to the Hydrology Manual rational method. The calculations are performed using the CivilD software. A summary of the initial calculations is summarized in the table below:

Summary Peak 100-Year Runoff

	Pre Area	Post Area	Pre T_c	Post T_c	Pre Q	Post Q	Increase
Basin	(ac)	(ac)	(min)	(min)	(cfs)	(cfs)	(post-pre) (cfs)
POC-1	36.05	38.56	11.33	10.17	55.43	52.50	-2.93
POC-2	44.68	42.98	12.54	9.84	68.31	66.72	-1.59
POC-3	4.98	4.43	5.44	13.21	11.81	11.60	-0.21
POC-4	1.09	0.72	11.51	6.02	1.76	1.75	-0.01

The following table is a summary of the velocity at various nodes where the water discharges to a POC. These values can be found in Attachment 3. All for all values where the velocity is erosive, a riprap energy dissapator will be used to lower it to a non-erosive velocity.

Summary V_{100} for Nodes Discharging to POC

	Starting Node ID	Ending Node ID	Velocity (FPS)
Pre-Development	102	103	7.4
	202	203	6.38
	302	303	7.013
	402	403	5.24
	502	503	5.56
Post-Development	104	105	5.99
	506	105	3.01
	2002	105	5.71
	1302	1008	5.99
	604	1008	34.04
	1107	1008	13.89
	1403	1404	4.41
	1701	1404	6.087
	1203	1404	4.78
	1902	1404	1.74
	1803	1804	1.67
	2103	1804	0.65

Discharge points with erosive velocities will be fitted with a riprap energy dissipater to bring the velocity down to an acceptable rate.

For runoff coefficient values and intensity values for each POC, please refer to section 5.2 and Attachment 3.

CivilD data and output files can be found in Attachment 3 of this report.

By observation of the results in the summary table, the grading of the site, assuming that the site is used for a medium density residential use, will result in a decrease in the 100-year peak flow runoff value for each respective POC. Both POC-3 and POC-4 are both ultimately tributary to San Marcos Creek. POC-4 enters a public drainage pipe and is directed immediately across San Elijo and is discharged to a natural lined channel. POC-3 enters another public storm drain branch which discharges to a point downstream and in the same channel as POC-4.

6.0 CONCLUSION

Based on the results of this report, the project does not increase the 100-year peak flow rate of stormwater discharge from the site. The project meets the County of San Diego standards for peak flow control and therefore can concluded that this project will not impact the existing downstream storm drainage facilities.

The proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site. No significant alteration of any stream or river will occur on this site due to grading operations. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream.

The proposed project does not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. No significant alteration of drainage patterns will occur on this project. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream and all discharge is back to the existing POCs and discharge points.

The proposed project does not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. The flows from the project leave the site at less than predeveloped rates per the mitigated flow rates shown.

The proposed project does not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. No housing is proposed and no FIRM identified flood hazard areas are located on the parcel.

The proposed project does not place structures within a 100-year flood hazard area which would impede or redirect flood flows. No FIRM identified flood hazard areas are located on the parcel.

The proposed project does not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. No levees or dams are proposed and all runoff is being mitigated in properly designed flow control basins with redundancies. This will be noted in the conclusion.

7.0 REFERENCES

County of San Diego Hydrology Manual, June 2003
San Diego County Hydraulic Design Manual, July 2014

8.0 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 City of San Marcos is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

ENGINEER OF WORK
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Tel – (760)745-8118
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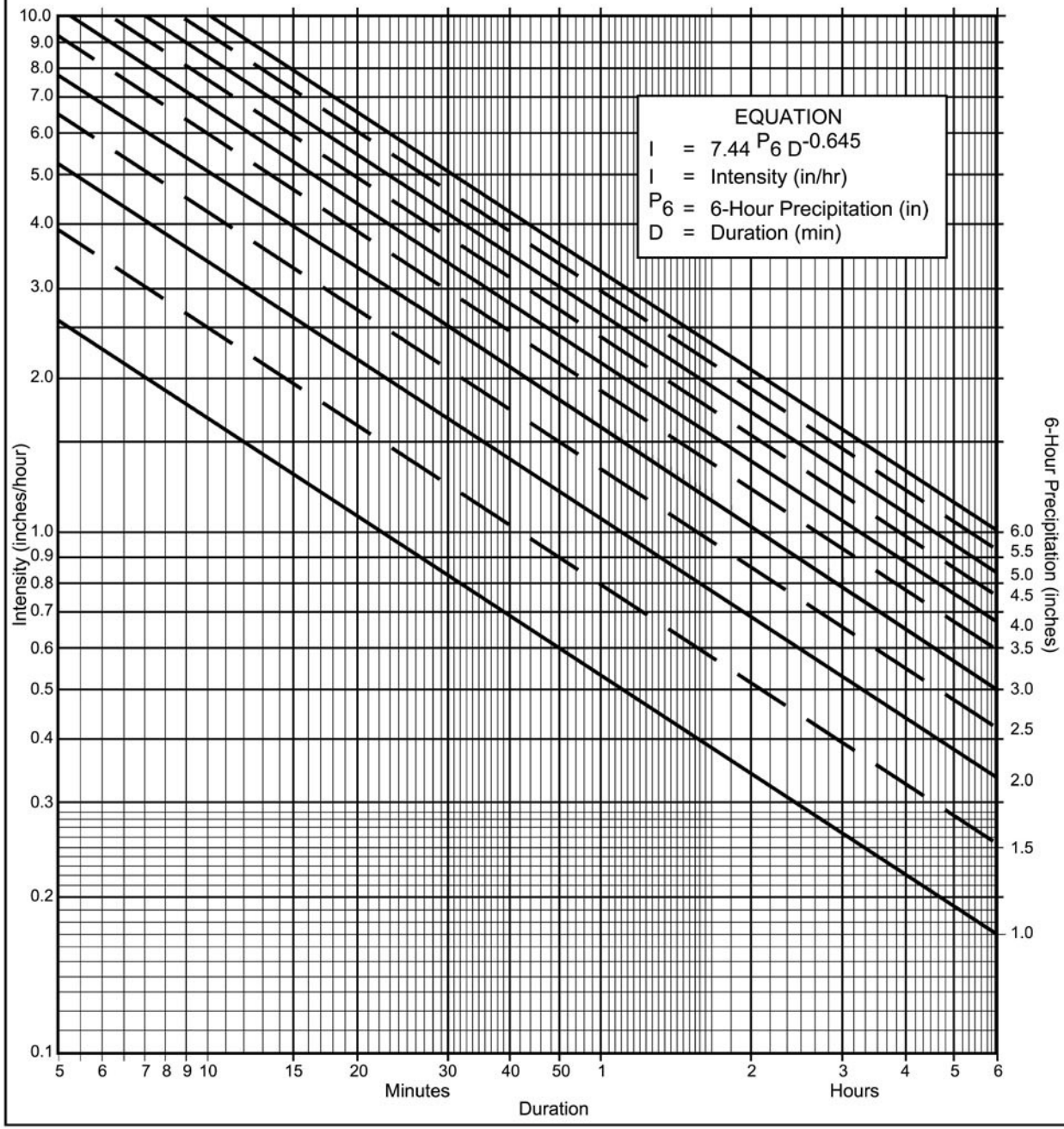
Project Number: 19-032

_____ _____

Robert D. Dentino, RCE 45629 Date
Registration Expire: December 31, 2022

ATTACHMENT 1



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

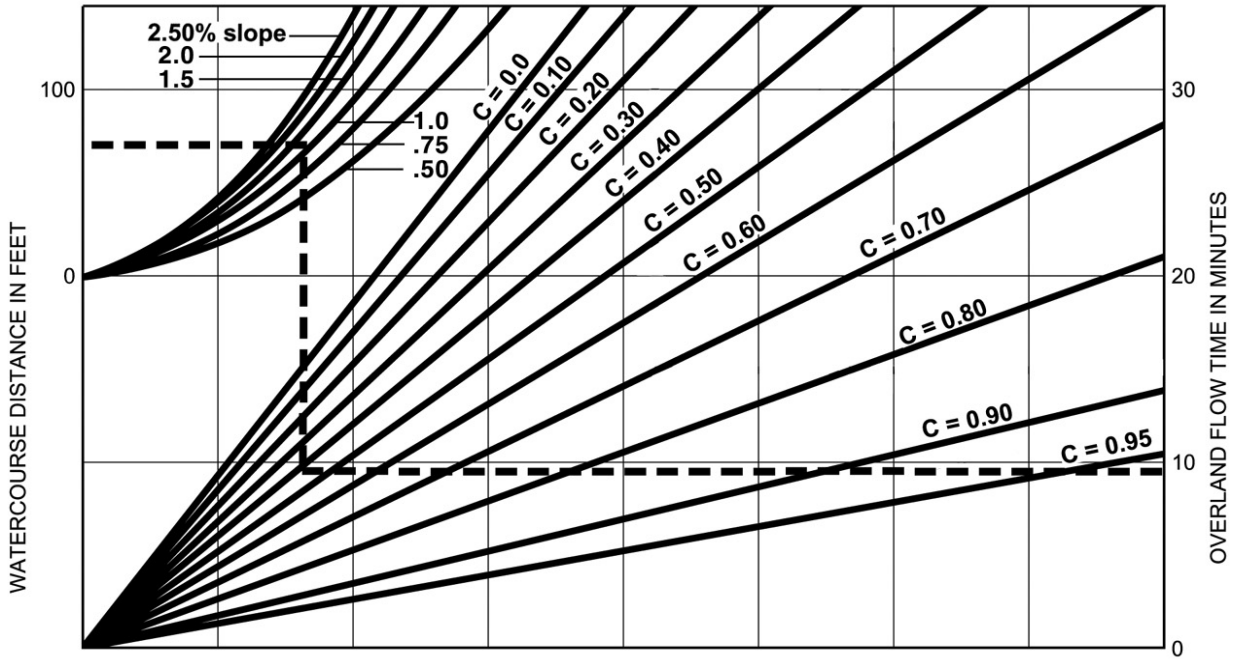
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

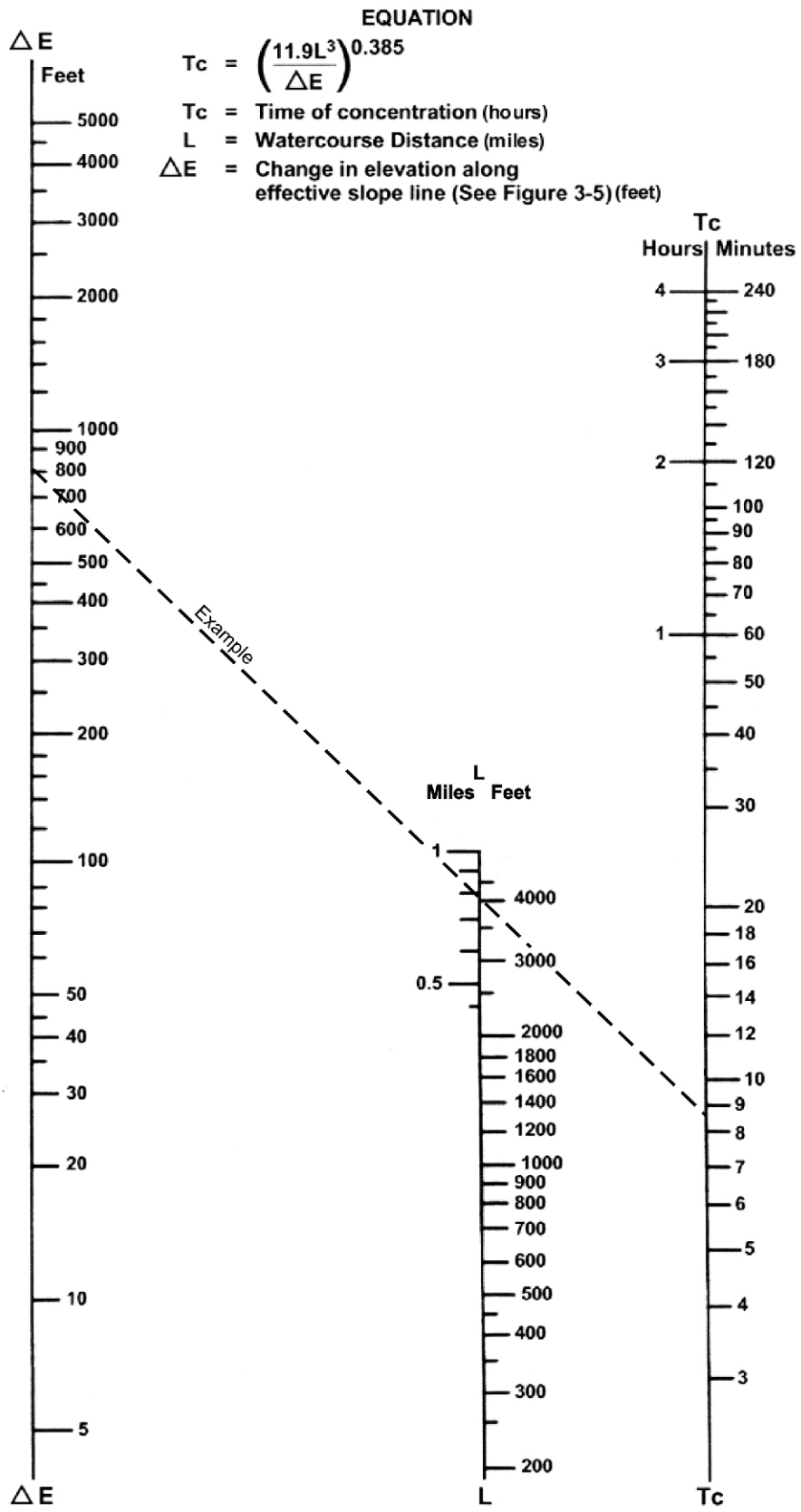
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE

3-3

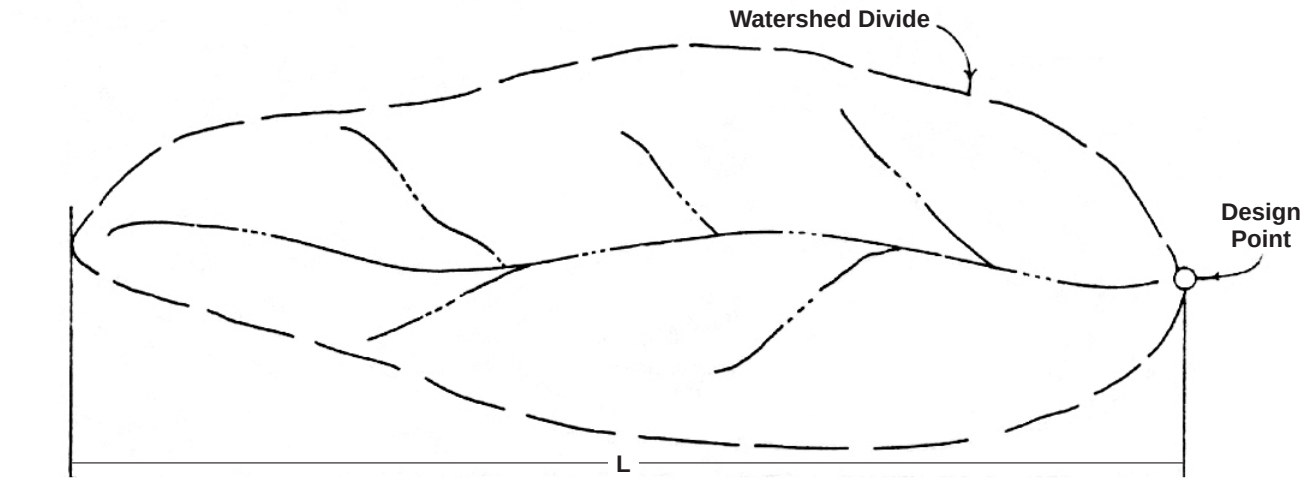
Rational Formula - Overland Time of Flow Nomograph

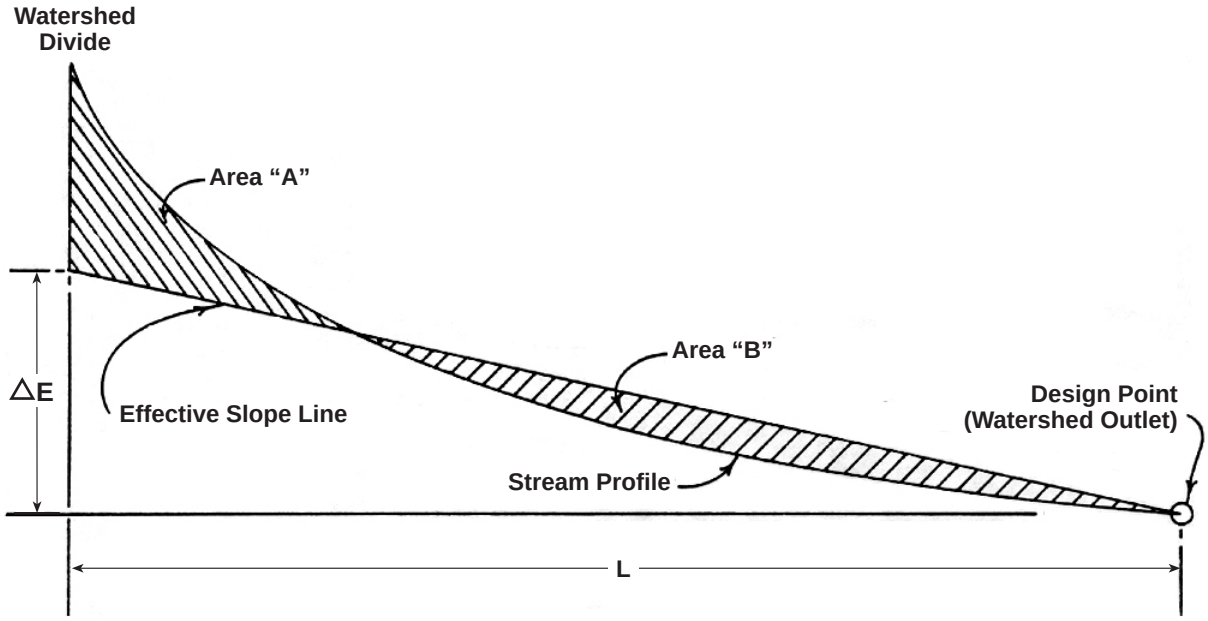


SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE 3-4

Nomograph for Determination of
Time of Concentration (Tc) or Travel Time (Tt) for Natural Watersheds





Area "A" = Area "B"

SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

Computation of Effective Slope for Natural Watersheds

3-5

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

Table A-2 Average Manning Roughness Coefficients for Closed Conduits[3]

Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe and Pipe Arch	
2-3/8 x 1/2 inch Corrugations	
Unlined	0.024
Half Lined	
Full Flow	0.018
d/D>=0.60	0.016
d/D<0.60	0.013
Fully Lined	0.013
3 x 1 inch Corrugations	0.027
6 x 2 inch Corrugations	0.032
Spiral Rib Pipe	0.013
Helically Wound Pipe	
18-inch	0.015
24-inch	0.017
30-inch	0.019
36-inch	0.021
42-inch	0.022
48-inch	0.023
Plastic Pipe (HPDE and PVC)	
Smooth	0.013
Corrugated	0.024
Vitrified Clay Pipe	0.014
Cast-Iron Pipe (Uncoated)	0.013
Steel Pipe	0.011
Brick	0.017
Cast-In-Place Concrete Pipe	
Rough Wood Forms	0.017
Smooth Wood or Steel Forms	0.014

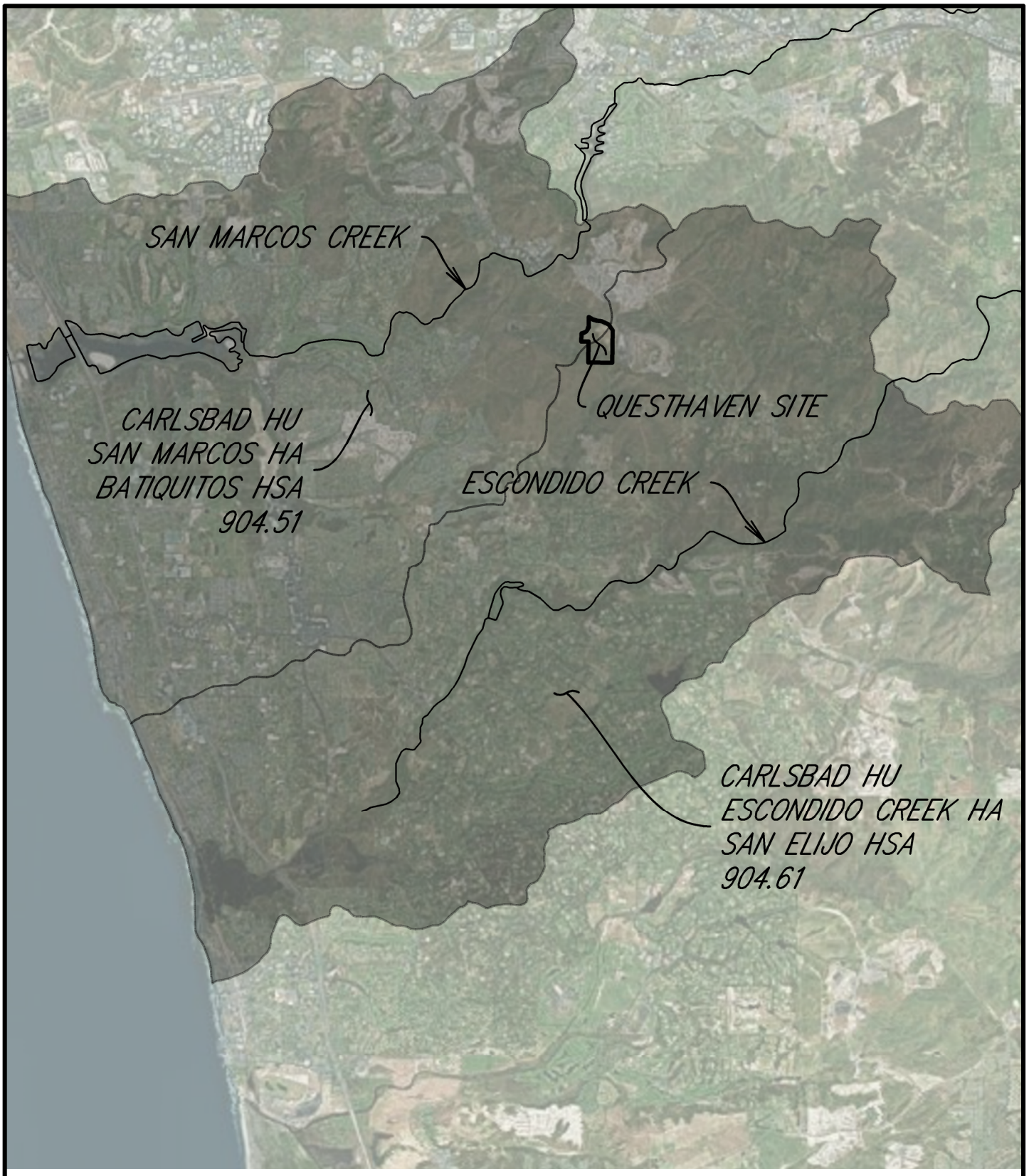
[3] Based on materials and workmanship required by standard specifications.

Table A-5

Table A-5 Average Manning Roughness Coefficients for Natural Channels

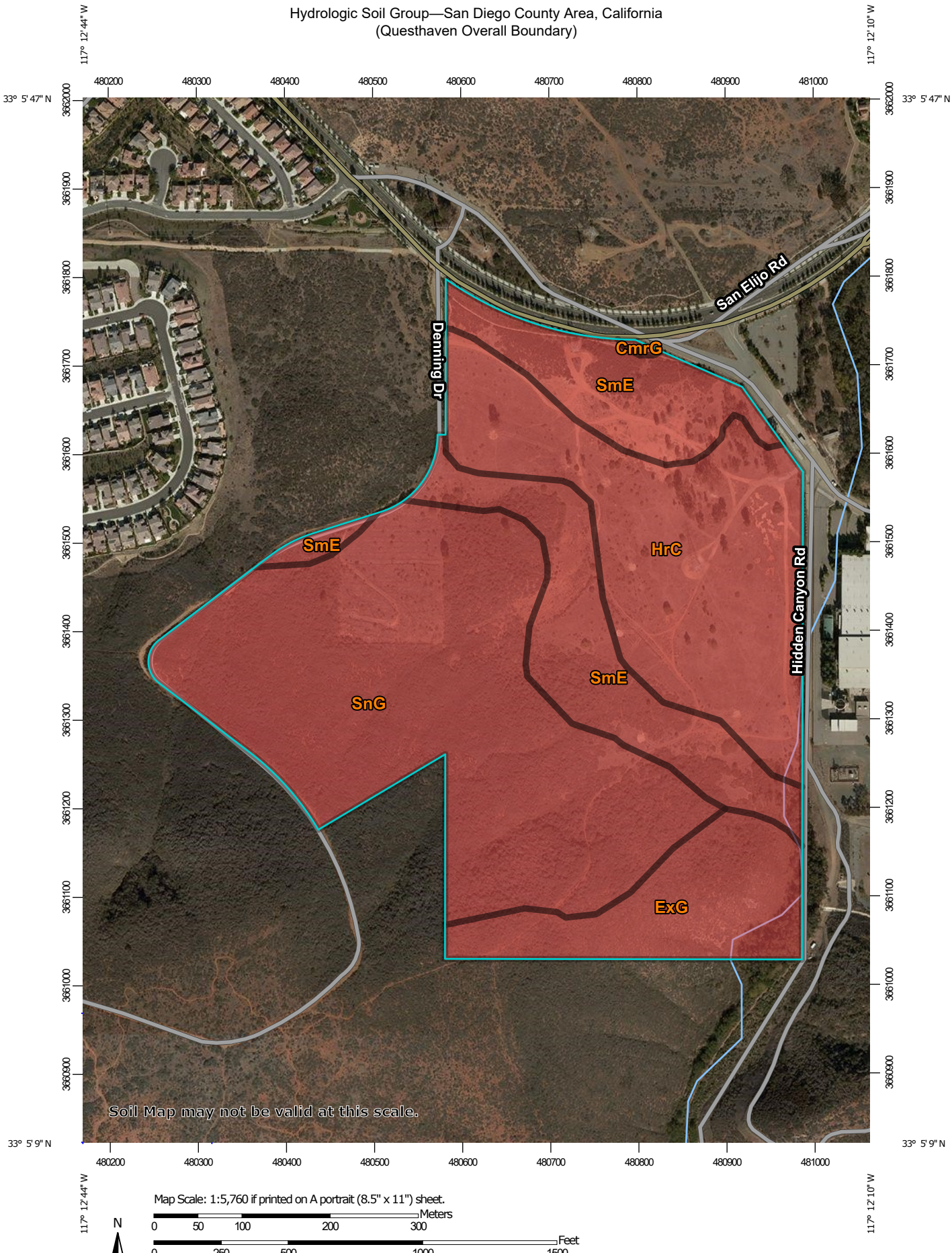
Minor Streams (Surface Width at Flood Stage < 100 ft)	
Fairly Regular Section	
(A) Some Grass and Weeds, Little or No Brush	0.030
(B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height	0.040
(C) Some Weeds, Light Brush on Banks	0.040
(D) Some Weeds, Heavy Brush on Banks	0.060
(E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By	0.015
Irregular Section, with Pools, Slight Channel Meander	
Channels (A) to (E) Above, Increase All Values By	0.015
Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage	
(A) Bottom, Gravel, Cobbles and Few Boulders	0.050
(B) Bottom, Cobbles with Large Boulders	0.060
Flood Plains (Adjacent To Natural Streams)	
Pasture, No Brush	
(A) Short Grass	0.030
(B) High Grass	0.040
Cultivated Areas	
(A) No Crop	0.040
(B) Mature Row Crops	0.040
(C) Mature Field Crops	0.050
Heavy Weeds, Scattered Brush	0.050
Light Brush and Trees	0.060
Medium To Dense Brush	0.090
Dense Willows	0.170
Cleared Land with Tree Stumps, 100-150 Per Acre	0.060
Heavy Stand of Timber, Little Undergrowth	
(A) Flood Depth below Branches	0.110
(B) Flood Depth Reaches Branches	0.140

ATTACHMENT 2



QUESTHAVEN HYDROLOGIC AREAS

Hydrologic Soil Group—San Diego County Area, California
(Questhaven Overall Boundary)



Map Scale: 1:5,760 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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 1:24,000.

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: San Diego County Area, California
Survey Area Data: Version 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

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
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes	D	0.1	0.1%
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes	D	9.5	10.6%
HrC	Huerhuero loam, 2 to 9 percent slopes	D	22.4	25.1%
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes	D	18.8	21.0%
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes	D	38.5	43.1%
Totals for Area of Interest			**89.2**	**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

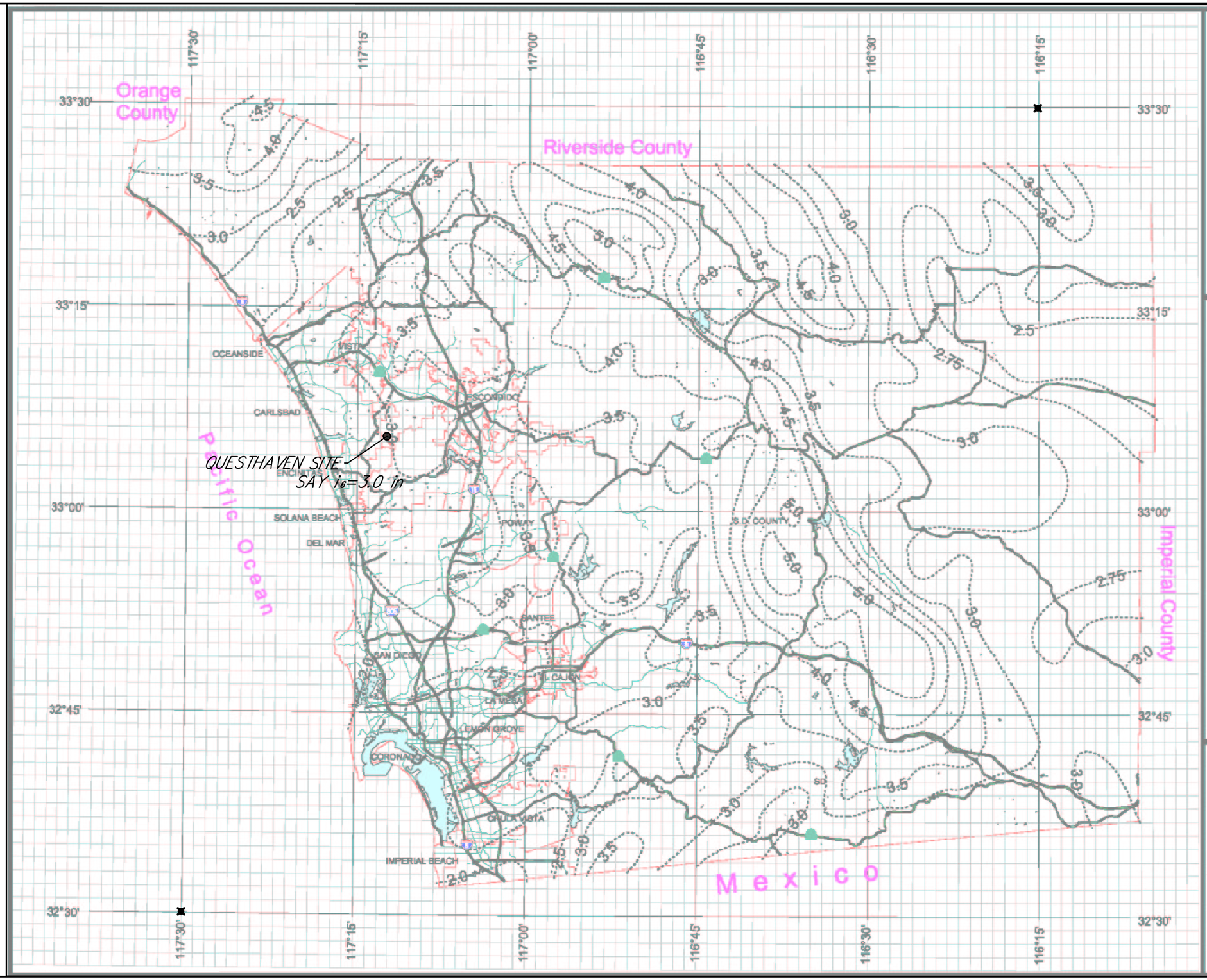
Tie-break Rule: Higher

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



DPW GIS — Department of Public Works Geographic Information Services

SanGIS — We Have San Diego Covered!

N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Orange County

Riverside County

Imperial County

Pacific Ocean

Mexico

QUESTHAVEN SITE
SAY i_{24}=5.2 in

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

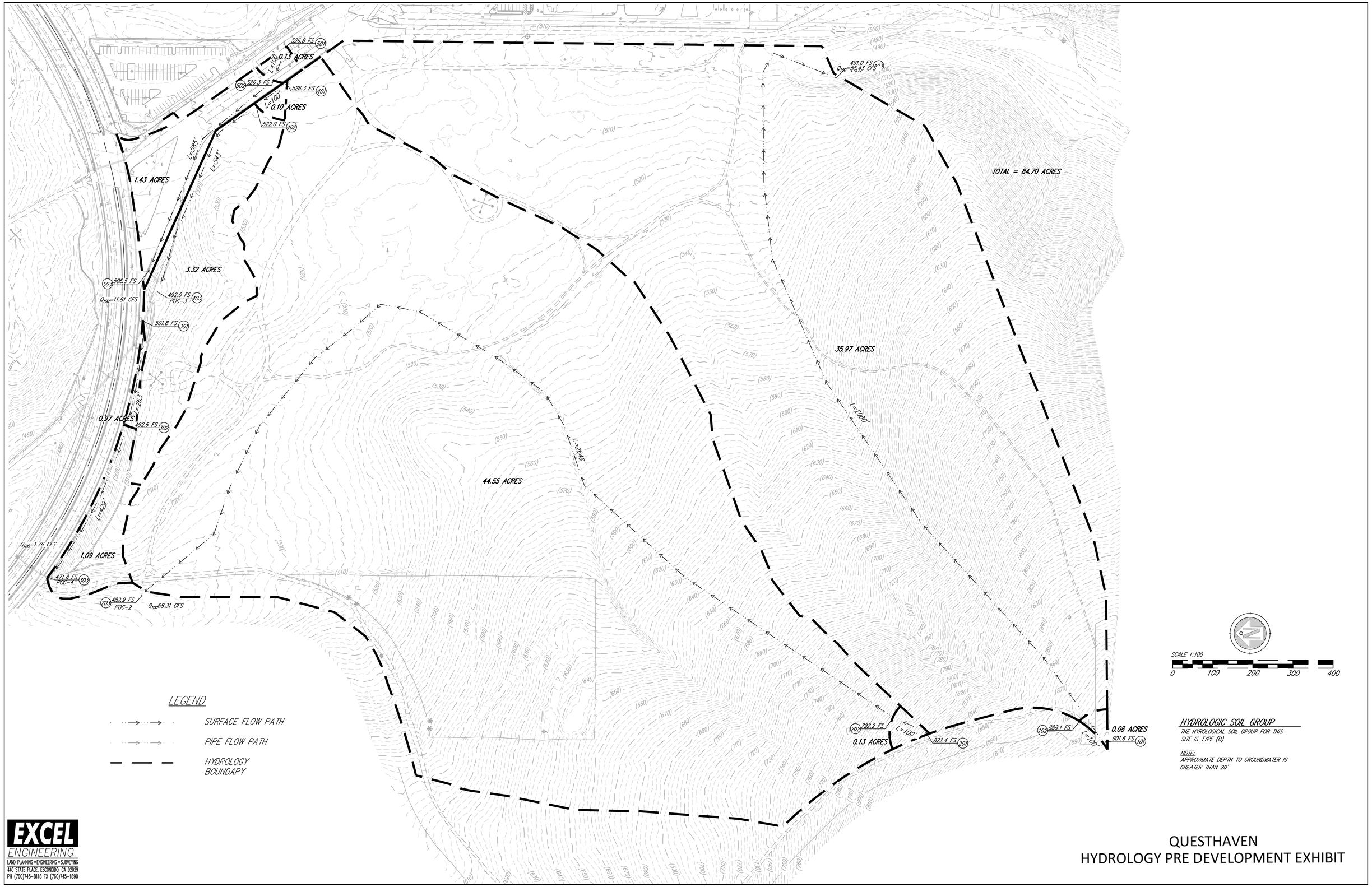
117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

QUESTHAVEN
HYDROLOGY PRE DEVELOPMENT EXHIBIT

SAN PASQUAL ROAD (PUBLIC)

POC 1
Q_{100}=52.50 CFS

POC 2
Q_{100}=66.72 CFS

POC 3
Q_{100}=11.60 CFS

POC 4
Q_{100}=1.75 CFS

TOTAL = 84.60 AC

LEGEND

- SURFACE FLOW PATH
- PIPE FLOW PATH
- HYDROLOGY BOUNDARY
- PROPOSED IMPERVIOUS ROADWAY

SCALE 1:100

0 100 200 300 400

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QUESTHAVEN
POST-DEVELOPMENT HYDROLOGY EXHIBIT

ATTACHMENT 3

POC 1
PRE-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/17/21
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  901.600(Ft.)
Lowest elevation =  888.100(Ft.)
Elevation difference =   13.500(Ft.) Slope = 13.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  13.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.67 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  13.500^(1/3)]=   5.67
Rainfall intensity (I) =      7.289(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.204(CFS)
Total initial stream area =        0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =     29.714(CFS)
Depth of flow =   0.309(Ft.), Average velocity =   6.229(Ft/s)
    ******* Irregular Channel Data ***********
--------------------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =     29.714(CFS)
  '     '    flow top width =     30.888(Ft.)
  '     '    velocity=    6.229(Ft/s)
  '     '    area =      4.770(Sq.Ft)
  '     '    Froude number =     2.793

Upstream point elevation =   888.100(Ft.)
Downstream point elevation =   491.000(Ft.)
Flow length =  2080.000(Ft.)
Travel time  =    5.57 min.
Time of concentration =   11.23 min.
Depth of flow =   0.309(Ft.)
Average velocity =   6.229(Ft/s)
Total irregular channel flow =    29.714(CFS)
Irregular channel normal depth above invert elev. =   0.309(Ft.)
Average velocity of channel(s) =   6.229(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.689(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.689(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     12.618
Subarea runoff =     58.959(CFS) for     35.970(Ac.)
Total runoff =     59.163(CFS)  Total area =      36.050(Ac.)
Depth of flow =   0.400(Ft.), Average velocity =   7.399(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      103.000
**** 6 HOUR HYDROGRAPH ****
________________________________________________________________________
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003


Time of Concentration =  11.23
Basin Area =    36.05 Acres
6 Hour Rainfall =  3.000 Inches
Runoff Coefficient =  0.350
Peak Discharge =    59.16 CFS
     Time (Min)     Discharge (CFS)
       0               0.000
       11               2.255
       22               2.300
       33               2.400
       44               2.454
       55               2.572
       66               2.636
       77               2.779
       88               2.858
       99               3.035
       110               3.135
       121               3.361
```

132	3.491
143	3.795
154	3.974
165	4.408
176	4.674
187	5.358
198	5.809
209	7.101
220	8.088
231	11.875
242	16.732
253	59.163
264	9.525
275	6.373
286	4.986
297	4.177
308	3.635
319	3.243
330	2.943
341	2.705
352	2.511
363	2.349

++

6 - H O U R S T O R M

R u n o f f H y d r o g r a p h

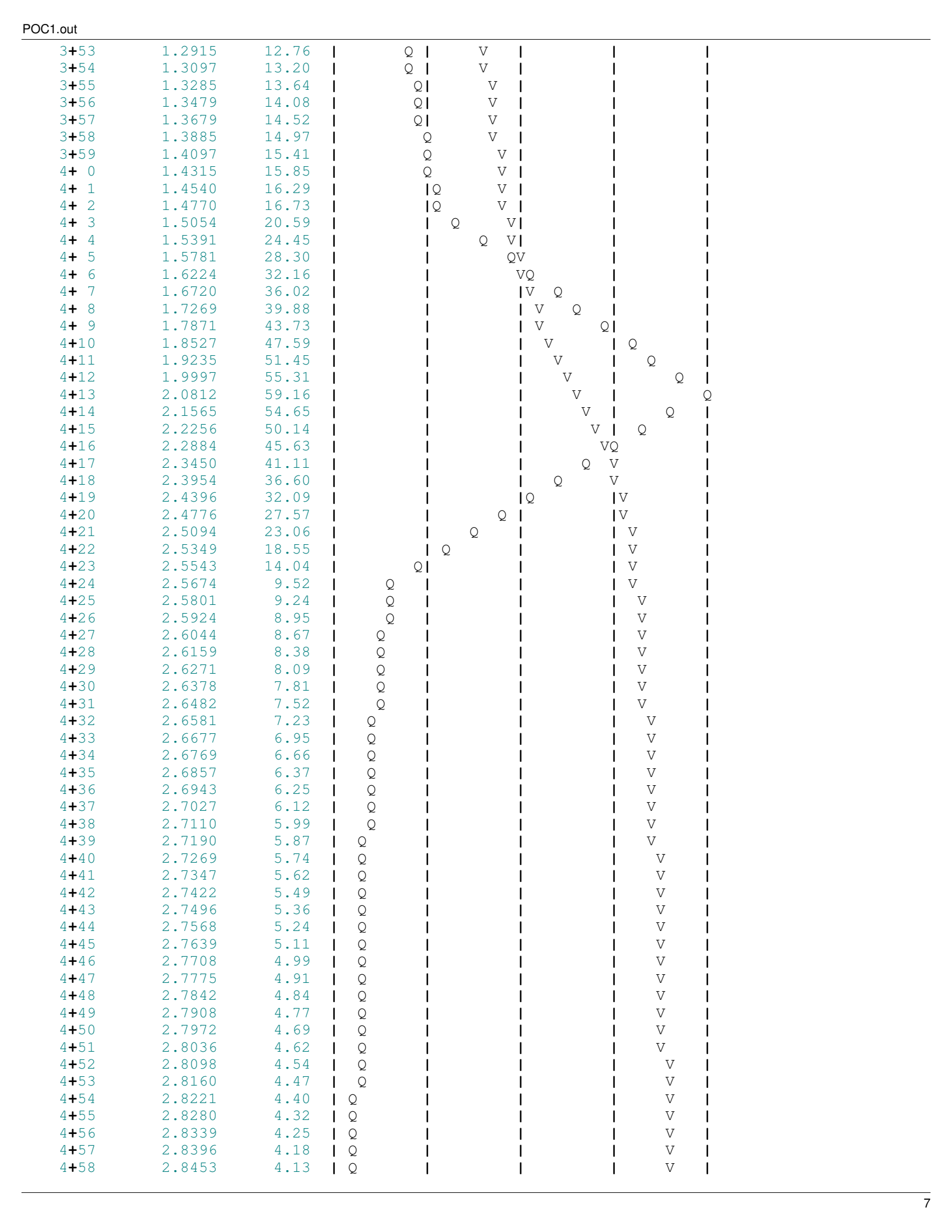
Hydrograph in 1 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	14.8	29.6	44.4	59.2
0+ 0	0.0000	0.00	Q	|	|	|	|
0+ 1	0.0003	0.20	Q	|	|	|	|
0+ 2	0.0008	0.41	Q	|	|	|	|
0+ 3	0.0017	0.61	Q	|	|	|	|
0+ 4	0.0028	0.82	Q	|	|	|	|
0+ 5	0.0042	1.02	Q	|	|	|	|
0+ 6	0.0059	1.23	Q	|	|	|	|
0+ 7	0.0079	1.43	Q	|	|	|	|
0+ 8	0.0102	1.64	VQ	|	|	|	|
0+ 9	0.0127	1.84	VQ	|	|	|	|
0+10	0.0155	2.05	VQ	|	|	|	|
0+11	0.0186	2.25	VQ	|	|	|	|
0+12	0.0217	2.26	VQ	|	|	|	|
0+13	0.0249	2.26	VQ	|	|	|	|
0+14	0.0280	2.27	VQ	|	|	|	|
0+15	0.0311	2.27	VQ	|	|	|	|
0+16	0.0342	2.28	VQ	|	|	|	|
0+17	0.0374	2.28	VQ	|	|	|	|
0+18	0.0405	2.28	VQ	|	|	|	|
0+19	0.0437	2.29	VQ	|	|	|	|
0+20	0.0468	2.29	VQ	|	|	|	|
0+21	0.0500	2.30	VQ	|	|	|	|
0+22	0.0532	2.30	VQ	|	|	|	|
0+23	0.0564	2.31	VQ	|	|	|	|
0+24	0.0595	2.32	VQ	|	|	|	|
0+25	0.0628	2.33	VQ	|	|	|	|
0+26	0.0660	2.34	VQ	|	|	|	|
0+27	0.0692	2.35	VQ	|	|	|	|
0+28	0.0724	2.35	VQ	|	|	|	|
0+29	0.0757	2.36	VQ	|	|	|	|
0+30	0.0790	2.37	|Q	|	|	|	|
0+31	0.0822	2.38	|Q	|	|	|	|
0+32	0.0855	2.39	|Q	|	|	|	|
0+33	0.0888	2.40	|Q	|	|	|	|
0+34	0.0922	2.40	|Q	|	|	|	|

```
    0+35        0.0955      2.41  |Q        |         |         |         |
    0+36        0.0988      2.41  |Q        |         |         |         |
    0+37        0.1021      2.42  |Q        |         |         |         |
    0+38        0.1055      2.42  |Q        |         |         |         |
    0+39        0.1088      2.43  |Q        |         |         |         |
    0+40        0.1122      2.43  |Q        |         |         |         |
    0+41        0.1155      2.44  |Q        |         |         |         |
    0+42        0.1189      2.44  |Q        |         |         |         |
    0+43        0.1223      2.45  |Q        |         |         |         |
    0+44        0.1257      2.45  |Q        |         |         |         |
    0+45        0.1290      2.46  |Q        |         |         |         |
    0+46        0.1325      2.48  |Q        |         |         |         |
    0+47        0.1359      2.49  |Q        |         |         |         |
    0+48        0.1393      2.50  |Q        |         |         |         |
    0+49        0.1428      2.51  |Q        |         |         |         |
    0+50        0.1462      2.52  |Q        |         |         |         |
    0+51        0.1497      2.53  |Q        |         |         |         |
    0+52        0.1532      2.54  |Q        |         |         |         |
    0+53        0.1567      2.55  |QV       |         |         |         |
    0+54        0.1603      2.56  |QV       |         |         |         |
    0+55        0.1638      2.57  |QV       |         |         |         |
    0+56        0.1674      2.58  |QV       |         |         |         |
    0+57        0.1709      2.58  |QV       |         |         |         |
    0+58        0.1745      2.59  |QV       |         |         |         |
    0+59        0.1781      2.60  |QV       |         |         |         |
    1+ 0        0.1816      2.60  |QV       |         |         |         |
    1+ 1        0.1852      2.61  |QV       |         |         |         |
    1+ 2        0.1888      2.61  |QV       |         |         |         |
    1+ 3        0.1924      2.62  |QV       |         |         |         |
    1+ 4        0.1961      2.62  |QV       |         |         |         |
    1+ 5        0.1997      2.63  |QV       |         |         |         |
    1+ 6        0.2033      2.64  |QV       |         |         |         |
    1+ 7        0.2070      2.65  |QV       |         |         |         |
    1+ 8        0.2106      2.66  |QV       |         |         |         |
    1+ 9        0.2143      2.68  |QV       |         |         |         |
    1+10        0.2180      2.69  |QV       |         |         |         |
    1+11        0.2217      2.70  |QV       |         |         |         |
    1+12        0.2255      2.71  |QV       |         |         |         |
    1+13        0.2292      2.73  |QV       |         |         |         |
    1+14        0.2330      2.74  |QV       |         |         |         |
    1+15        0.2368      2.75  |Q V      |         |         |         |
    1+16        0.2406      2.77  |Q V      |         |         |         |
    1+17        0.2444      2.78  |Q V      |         |         |         |
    1+18        0.2483      2.79  |Q V      |         |         |         |
    1+19        0.2521      2.79  |Q V      |         |         |         |
    1+20        0.2560      2.80  |Q V      |         |         |         |
    1+21        0.2598      2.81  |Q V      |         |         |         |
    1+22        0.2637      2.81  |Q V      |         |         |         |
    1+23        0.2676      2.82  |Q V      |         |         |         |
    1+24        0.2715      2.83  |Q V      |         |         |         |
    1+25        0.2754      2.84  |Q V      |         |         |         |
    1+26        0.2793      2.84  |Q V      |         |         |         |
    1+27        0.2833      2.85  |Q V      |         |         |         |
    1+28        0.2872      2.86  |Q V      |         |         |         |
    1+29        0.2912      2.87  |Q V      |         |         |         |
    1+30        0.2951      2.89  |Q V      |         |         |         |
    1+31        0.2991      2.91  |Q V      |         |         |         |
    1+32        0.3032      2.92  |Q V      |         |         |         |
    1+33        0.3072      2.94  |Q V      |         |         |         |
    1+34        0.3113      2.95  |Q V      |         |         |         |
    1+35        0.3154      2.97  | Q V     |         |         |         |
    1+36        0.3195      2.99  | Q V     |         |         |         |
    1+37        0.3236      3.00  | Q V     |         |         |         |
    1+38        0.3278      3.02  | Q V     |         |         |         |
    1+39        0.3320      3.04  | Q V     |         |         |         |
    1+40        0.3362      3.04  | Q V     |         |         |         |
```

1+41	0.3404	3.05	Q V			
1+42	0.3446	3.06	Q V			
1+43	0.3488	3.07	Q V			
1+44	0.3530	3.08	Q V			
1+45	0.3573	3.09	Q V			
1+46	0.3616	3.10	Q V			
1+47	0.3659	3.11	Q V			
1+48	0.3701	3.12	Q V			
1+49	0.3745	3.13	Q V			
1+50	0.3788	3.13	Q V			
1+51	0.3831	3.16	Q V			
1+52	0.3875	3.18	Q V			
1+53	0.3919	3.20	Q V			
1+54	0.3963	3.22	Q V			
1+55	0.4008	3.24	Q V			
1+56	0.4053	3.26	Q V			
1+57	0.4098	3.28	Q V			
1+58	0.4143	3.30	Q V			
1+59	0.4189	3.32	Q V			
2+ 0	0.4235	3.34	Q V			
2+ 1	0.4281	3.36	Q V			
2+ 2	0.4328	3.37	Q V			
2+ 3	0.4374	3.38	Q V			
2+ 4	0.4421	3.40	Q V			
2+ 5	0.4468	3.41	Q V			
2+ 6	0.4515	3.42	Q V			
2+ 7	0.4563	3.43	Q V			
2+ 8	0.4610	3.44	Q V			
2+ 9	0.4658	3.46	Q V			
2+10	0.4705	3.47	Q V			
2+11	0.4753	3.48	Q V			
2+12	0.4801	3.49	Q V			
2+13	0.4850	3.52	Q V			
2+14	0.4899	3.55	Q V			
2+15	0.4948	3.57	Q V			
2+16	0.4998	3.60	Q V			
2+17	0.5048	3.63	Q V			
2+18	0.5098	3.66	Q V			
2+19	0.5149	3.68	Q V			
2+20	0.5200	3.71	Q V			
2+21	0.5251	3.74	Q V			
2+22	0.5303	3.77	Q V			
2+23	0.5355	3.79	Q V			
2+24	0.5408	3.81	Q V			
2+25	0.5461	3.83	Q V			
2+26	0.5514	3.84	Q V			
2+27	0.5567	3.86	Q V			
2+28	0.5620	3.88	Q V			
2+29	0.5674	3.89	Q V			
2+30	0.5728	3.91	Q V			
2+31	0.5782	3.93	Q V			
2+32	0.5836	3.94	Q V			
2+33	0.5891	3.96	Q V			
2+34	0.5945	3.97	Q V			
2+35	0.6001	4.01	Q V			
2+36	0.6056	4.05	Q V			
2+37	0.6113	4.09	Q V			
2+38	0.6170	4.13	Q V			
2+39	0.6227	4.17	Q V			
2+40	0.6285	4.21	Q V			
2+41	0.6344	4.25	Q V			
2+42	0.6403	4.29	Q V			
2+43	0.6462	4.33	Q V			
2+44	0.6523	4.37	Q V			
2+45	0.6583	4.41	Q V			
2+46	0.6644	4.43	Q V			

2+47	0.6706	4.46	Q V			
2+48	0.6767	4.48	Q V			
2+49	0.6829	4.50	Q V			
2+50	0.6892	4.53	Q V			
2+51	0.6954	4.55	Q V			
2+52	0.7018	4.58	Q V			
2+53	0.7081	4.60	Q V			
2+54	0.7145	4.63	Q V			
2+55	0.7209	4.65	Q V			
2+56	0.7273	4.67	Q V			
2+57	0.7338	4.74	Q V			
2+58	0.7404	4.80	Q V			
2+59	0.7471	4.86	Q V			
3+ 0	0.7539	4.92	Q V			
3+ 1	0.7608	4.98	Q V			
3+ 2	0.7677	5.05	Q V			
3+ 3	0.7748	5.11	Q V			
3+ 4	0.7819	5.17	Q V			
3+ 5	0.7891	5.23	Q V			
3+ 6	0.7964	5.30	Q V			
3+ 7	0.8038	5.36	Q V			
3+ 8	0.8112	5.40	Q V			
3+ 9	0.8187	5.44	Q V			
3+10	0.8263	5.48	Q V			
3+11	0.8339	5.52	Q V			
3+12	0.8415	5.56	Q V			
3+13	0.8492	5.60	Q V			
3+14	0.8570	5.65	Q V			
3+15	0.8649	5.69	Q V			
3+16	0.8727	5.73	Q V			
3+17	0.8807	5.77	Q V			
3+18	0.8887	5.81	Q V			
3+19	0.8969	5.93	Q V			
3+20	0.9052	6.04	Q V			
3+21	0.9137	6.16	Q V			
3+22	0.9223	6.28	Q V			
3+23	0.9311	6.40	Q V			
3+24	0.9401	6.51	Q V			
3+25	0.9492	6.63	Q V			
3+26	0.9585	6.75	Q V			
3+27	0.9680	6.87	Q V			
3+28	0.9776	6.98	Q V			
3+29	0.9874	7.10	Q V			
3+30	0.9973	7.19	Q V			
3+31	1.0073	7.28	Q V			
3+32	1.0175	7.37	Q V			
3+33	1.0277	7.46	Q V			
3+34	1.0381	7.55	Q V			
3+35	1.0487	7.64	Q V			
3+36	1.0593	7.73	Q V			
3+37	1.0701	7.82	Q V			
3+38	1.0810	7.91	Q V			
3+39	1.0920	8.00	Q V			
3+40	1.1031	8.09	Q V			
3+41	1.1147	8.43	Q V			
3+42	1.1268	8.78	Q V			
3+43	1.1394	9.12	Q V			
3+44	1.1524	9.47	Q V			
3+45	1.1659	9.81	Q V			
3+46	1.1799	10.15	Q V			
3+47	1.1944	10.50	Q V			
3+48	1.2093	10.84	Q V			
3+49	1.2247	11.19	Q V			
3+50	1.2406	11.53	Q V			
3+51	1.2570	11.88	Q V			
3+52	1.2739	12.32	Q V			



3+53	1.2915	12.76	Q	V			
3+54	1.3097	13.20	Q	V			
3+55	1.3285	13.64	Q	V			
3+56	1.3479	14.08	Q	V			
3+57	1.3679	14.52	Q	V			
3+58	1.3885	14.97	Q	V			
3+59	1.4097	15.41	Q	V			
4+ 0	1.4315	15.85	Q	V			
4+ 1	1.4540	16.29	Q	V			
4+ 2	1.4770	16.73	Q	V			
4+ 3	1.5054	20.59	Q	V			
4+ 4	1.5391	24.45	Q	V			
4+ 5	1.5781	28.30	QV				
4+ 6	1.6224	32.16	VQ				
4+ 7	1.6720	36.02	V	Q			
4+ 8	1.7269	39.88	V	Q			
4+ 9	1.7871	43.73	V	Q			
4+10	1.8527	47.59	V	Q			
4+11	1.9235	51.45	V	Q			
4+12	1.9997	55.31	V	Q			
4+13	2.0812	59.16	V	Q			
4+14	2.1565	54.65	V	Q			
4+15	2.2256	50.14	V	Q			
4+16	2.2884	45.63	VQ				
4+17	2.3450	41.11	Q	V			
4+18	2.3954	36.60	Q	V			
4+19	2.4396	32.09	Q	V			
4+20	2.4776	27.57	Q	V			
4+21	2.5094	23.06	Q	V			
4+22	2.5349	18.55	Q	V			
4+23	2.5543	14.04	Q	V			
4+24	2.5674	9.52	Q	V			
4+25	2.5801	9.24	Q	V			
4+26	2.5924	8.95	Q	V			
4+27	2.6044	8.67	Q	V			
4+28	2.6159	8.38	Q	V			
4+29	2.6271	8.09	Q	V			
4+30	2.6378	7.81	Q	V			
4+31	2.6482	7.52	Q	V			
4+32	2.6581	7.23	Q	V			
4+33	2.6677	6.95	Q	V			
4+34	2.6769	6.66	Q	V			
4+35	2.6857	6.37	Q	V			
4+36	2.6943	6.25	Q	V			
4+37	2.7027	6.12	Q	V			
4+38	2.7110	5.99	Q	V			
4+39	2.7190	5.87	Q	V			
4+40	2.7269	5.74	Q	V			
4+41	2.7347	5.62	Q	V			
4+42	2.7422	5.49	Q	V			
4+43	2.7496	5.36	Q	V			
4+44	2.7568	5.24	Q	V			
4+45	2.7639	5.11	Q	V			
4+46	2.7708	4.99	Q	V			
4+47	2.7775	4.91	Q	V			
4+48	2.7842	4.84	Q	V			
4+49	2.7908	4.77	Q	V			
4+50	2.7972	4.69	Q	V			
4+51	2.8036	4.62	Q	V			
4+52	2.8098	4.54	Q	V			
4+53	2.8160	4.47	Q	V			
4+54	2.8221	4.40	Q	V			
4+55	2.8280	4.32	Q	V			
4+56	2.8339	4.25	Q	V			
4+57	2.8396	4.18	Q	V			
4+58	2.8453	4.13	Q	V			

```
    4+59        2.8509       4.08  | Q        |          |          |     V    |
    5+ 0        2.8565       4.03  | Q        |          |          |     V    |
    5+ 1        2.8619       3.98  | Q        |          |          |     V    |
    5+ 2        2.8674       3.93  | Q        |          |          |     V    |
    5+ 3        2.8727       3.88  | Q        |          |          |     V    |
    5+ 4        2.8780       3.83  | Q        |          |          |     V    |
    5+ 5        2.8832       3.78  | Q        |          |          |      V   |
    5+ 6        2.8883       3.73  | Q        |          |          |      V   |
    5+ 7        2.8934       3.68  | Q        |          |          |      V   |
    5+ 8        2.8984       3.64  | Q        |          |          |      V   |
    5+ 9        2.9034       3.60  | Q        |          |          |      V   |
    5+10        2.9083       3.56  | Q        |          |          |      V   |
    5+11        2.9131       3.53  | Q        |          |          |      V   |
    5+12        2.9180       3.49  | Q        |          |          |      V   |
    5+13        2.9227       3.46  | Q        |          |          |      V   |
    5+14        2.9274       3.42  | Q        |          |          |      V   |
    5+15        2.9321       3.39  | Q        |          |          |      V   |
    5+16        2.9367       3.35  | Q        |          |          |      V   |
    5+17        2.9413       3.31  | Q        |          |          |      V   |
    5+18        2.9458       3.28  | Q        |          |          |      V   |
    5+19        2.9503       3.24  | Q        |          |          |      V   |
    5+20        2.9547       3.22  | Q        |          |          |      V   |
    5+21        2.9591       3.19  | Q        |          |          |      V   |
    5+22        2.9634       3.16  | Q        |          |          |       V  |
    5+23        2.9677       3.13  | Q        |          |          |       V  |
    5+24        2.9720       3.11  | Q        |          |          |       V  |
    5+25        2.9763       3.08  | Q        |          |          |       V  |
    5+26        2.9805       3.05  | Q        |          |          |       V  |
    5+27        2.9846       3.02  | Q        |          |          |       V  |
    5+28        2.9888       3.00  | Q        |          |          |       V  |
    5+29        2.9929       2.97  | Q        |          |          |       V  |
    5+30        2.9969       2.94  |Q         |          |          |       V  |
    5+31        3.0009       2.92  |Q         |          |          |       V  |
    5+32        3.0049       2.90  |Q         |          |          |       V  |
    5+33        3.0089       2.88  |Q         |          |          |       V  |
    5+34        3.0128       2.86  |Q         |          |          |       V  |
    5+35        3.0167       2.84  |Q         |          |          |       V  |
    5+36        3.0206       2.81  |Q         |          |          |       V  |
    5+37        3.0245       2.79  |Q         |          |          |       V  |
    5+38        3.0283       2.77  |Q         |          |          |       V  |
    5+39        3.0321       2.75  |Q         |          |          |       V  |
    5+40        3.0358       2.73  |Q         |          |          |       V  |
    5+41        3.0395       2.71  |Q         |          |          |        V|
    5+42        3.0432       2.69  |Q         |          |          |        V|
    5+43        3.0469       2.67  |Q         |          |          |        V|
    5+44        3.0506       2.65  |Q         |          |          |        V|
    5+45        3.0542       2.63  |Q         |          |          |        V|
    5+46        3.0578       2.62  |Q         |          |          |        V|
    5+47        3.0614       2.60  |Q         |          |          |        V|
    5+48        3.0649       2.58  |Q         |          |          |        V|
    5+49        3.0685       2.56  |Q         |          |          |        V|
    5+50        3.0720       2.55  |Q         |          |          |        V|
    5+51        3.0755       2.53  |Q         |          |          |        V|
    5+52        3.0789       2.51  |Q         |          |          |        V|
    5+53        3.0824       2.50  |Q         |          |          |        V|
    5+54        3.0858       2.48  |Q         |          |          |        V|
    5+55        3.0892       2.47  |Q         |          |          |        V|
    5+56        3.0926       2.45  |Q         |          |          |        V|
    5+57        3.0959       2.44  |Q         |          |          |        V|
    5+58        3.0993       2.42  |Q         |          |          |        V|
    5+59        3.1026       2.41  |Q         |          |          |        V|
    6+ 0        3.1059       2.39  |Q         |          |          |        V|
    6+ 1        3.1091       2.38  |Q         |          |          |        V|
    6+ 2        3.1124       2.36  |Q         |          |          |        V|
    6+ 3        3.1156       2.35  |Q         |          |          |         V
------------------------------------------------------------------------------
```

```
End of computations, total study area =          36.050 (Ac.)
```

POC 1
POST-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/11/21
--------------------------------------------------------------------------
Questhaven Project
Job Number 19-038
POC-1 User Defined Input
Post-development Calculations
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      402.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   74.000(Ft.)
Highest elevation =  521.600(Ft.)
Lowest elevation =  521.400(Ft.)
Elevation difference =    0.200(Ft.) Slope =  0.270 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.27 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.85 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.270^(1/3)]=   9.85
The initial area total distance of   74.00 (Ft.) entered leaves a
remaining distance of   24.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.88 minutes
for a distance of  24.00 (Ft.) and a slope of  0.27 %
with an elevation difference of   0.06(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.880 Minutes
Tt=[(11.9*0.0045^3)/(  0.06)]^.385=  0.88
Total initial area Ti =   9.85 minutes from Figure 3-3 formula plus
  0.88 minutes from the Figure 3-4 formula =  10.73 minutes
```

```
Rainfall intensity (I) =      4.831(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.188(CFS)
Total initial stream area =        0.065(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      402.000 to Point/Station      403.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Depth of flow =   0.094(Ft.), Average velocity =   0.862(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.188(CFS)
  '     '    flow top width =      4.676(Ft.)
  '     '    velocity=    0.862(Ft/s)
  '     '    area =      0.219(Sq.Ft)
  '     '    Froude number =     0.702

Upstream point elevation =   521.400(Ft.)
Downstream point elevation =   519.620(Ft.)
Flow length =    99.000(Ft.)
Travel time  =    1.91 min.
Time of concentration =   12.64 min.
Depth of flow =   0.094(Ft.)
Average velocity =   0.862(Ft/s)
Total irregular channel flow =     0.188(CFS)
Irregular channel normal depth above invert elev. =   0.094(Ft.)
Average velocity of channel(s) =   0.862(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      403.000 to Point/Station      404.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   519.620(Ft.)
End of street segment elevation =   511.820(Ft.)
Length of street segment  =   508.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.492(CFS)
Depth of flow =   0.169(Ft.), Average velocity =   2.863(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   9.408(Ft.)
Flow velocity =   2.86(Ft/s)
Travel time =    2.96 min.     TC =   15.60  min.
 Adding area flow to street
Rainfall intensity (I) =      3.795(In/Hr) for a   100.0 year storm
```

```
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      3.795(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.286
Subarea runoff =      4.691(CFS) for      2.078(Ac.)
Total runoff =      4.879(CFS)  Total area =       2.143(Ac.)
Street flow at end of street =      4.879(CFS)
Half street flow at end of street =      4.879(CFS)
Depth of flow =   0.221(Ft.), Average velocity =   3.398(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      504.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
______________________________________________________________________________
Upstream point/station elevation =   506.000(Ft.)
Downstream point/station elevation =   505.800(Ft.)
Pipe length  =    29.00(Ft.) Slope =   0.0069  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.879(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.243(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.544(Ft.)
 Minor friction loss =      0.899(Ft.)  K-factor =   1.50
Pipe flow velocity =      6.21(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    15.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      404.000 to Point/Station      504.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.143(Ac.)
Runoff from this stream =      4.879(CFS)
Time of concentration =   15.68 min.
Rainfall intensity =     3.782(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      501.000 to Point/Station      502.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   76.000(Ft.)
Highest elevation =  522.000(Ft.)
Lowest elevation =  521.980(Ft.)
Elevation difference =    0.020(Ft.) Slope =  0.026 %
```

```
Top of Initial Area Slope adjusted by User to  0.100 %
Bottom of Initial Area Slope adjusted by User to  0.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.10 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  13.71 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.100^(1/3)]=  13.71
The initial area total distance of   76.00 (Ft.) entered leaves a
remaining distance of   26.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.37 minutes
for a distance of  26.00 (Ft.) and a slope of  0.10 %
with an elevation difference of   0.03(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.371 Minutes
Tt=[(11.9*0.0049^3)/(  0.03)]^.385=  1.37
Total initial area Ti =  13.71 minutes from Figure 3-3 formula plus
  1.37 minutes from the Figure 3-4 formula =  15.08 minutes
Rainfall intensity (I) =      3.878(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.465(CFS)
Total initial stream area =        0.200(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      502.000 to Point/Station      503.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Depth of flow =   0.121(Ft.), Average velocity =   1.269(Ft/s)
    ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =      0.465(CFS)
  '     '    flow top width =      6.055(Ft.)
  '     '    velocity=    1.269(Ft/s)
  '     '    area =      0.367(Sq.Ft)
  '     '    Froude number =     0.909

Upstream point elevation =   521.980(Ft.)
Downstream point elevation =   519.270(Ft.)
Flow length =    98.000(Ft.)
Travel time  =    1.29 min.
Time of concentration =   16.37 min.
Depth of flow =   0.121(Ft.)
Average velocity =   1.269(Ft/s)
Total irregular channel flow =     0.465(CFS)
Irregular channel normal depth above invert elev. =   0.121(Ft.)
Average velocity of channel(s) =   1.269(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      503.000 to Point/Station      504.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   519.270(Ft.)
End of street segment elevation =   511.820(Ft.)
Length of street segment  =   511.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
```

```
 Width of half street (curb to crown)  =  12.000(Ft.)
 Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
 Gutter hike from flowline =  0.125(In.)
  Manning's N in gutter =  0.0130
  Manning's N from gutter to grade break =  0.0130
  Manning's N from grade break to crown =  0.0130
 Estimated mean flow rate at midpoint of street =      4.428(CFS)
 Depth of flow =   0.215(Ft.), Average velocity =   3.246(Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width =  11.742(Ft.)
 Flow velocity =   3.25(Ft/s)
 Travel time =    2.62 min.     TC =   18.99  min.
  Adding area flow to street
 Rainfall intensity (I) =      3.342(In/Hr) for a   100.0 year storm
 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
 [MEDIUM DENSITY RESIDENTIAL                  ]
 (10.9 DU/A or Less      )
 Impervious value, Ai = 0.450
 Sub-Area C Value = 0.600
 Rainfall intensity =      3.342(In/Hr) for a   100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.600  CA =      2.484
 Subarea runoff =      7.836(CFS) for      3.940(Ac.)
 Total runoff =      8.302(CFS)  Total area =       4.140(Ac.)
 Street flow at end of street =      8.302(CFS)
 Half street flow at end of street =      8.302(CFS)
 Depth of flow =   0.269(Ft.), Average velocity =   4.131(Ft/s)
 Note:  depth of flow exceeds top of street crown.
 Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station      503.000 to Point/Station      504.000
 **** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________________
 Along Main Stream number: 1 in normal stream number 2
 Stream flow area =      4.140(Ac.)
 Runoff from this stream =      8.302(CFS)
 Time of concentration =   18.99 min.
 Rainfall intensity =     3.342(In/Hr)
 Summary of stream data:

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


 1        4.879     15.68             3.782
 2        8.302     18.99             3.342
 Qmax(1) =
        1.000 *    1.000 *     4.879) +
        1.000 *    0.825 *     8.302) + =      11.731
 Qmax(2) =
        0.884 *    1.000 *     4.879) +
        1.000 *    1.000 *     8.302) + =      12.613

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

```
       4.879       8.302
Maximum flow rates at confluence using above data:
      11.731      12.613
Area of streams before confluence:
       2.143       4.140
Results of confluence:
Total flow rate =     12.613(CFS)
Time of concentration =    18.992 min.
Effective stream area after confluence =      6.283(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      505.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   505.800(Ft.)
Downstream point/station elevation =   503.250(Ft.)
Pipe length  =   126.00(Ft.) Slope =   0.0202  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    12.613(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    12.613(CFS)
Normal flow depth in pipe =   10.44(In.)
Flow top width inside pipe =   23.80(In.)
Critical Depth =   15.32(In.)
Pipe flow velocity =      9.62(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    19.21 min.
End of computations, total study area =           6.283 (Ac.)
```

```
         San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/17/21
--------------------------------------------------------------------------
Questhaven Project
Job Number 19-038
POC-1 Main
Post-development Calculations
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
___________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   76.000(Ft.)
Highest elevation =  551.000(Ft.)
Lowest elevation =  534.000(Ft.)
Elevation difference =   17.000(Ft.) Slope = 22.368 %
Top of Initial Area Slope adjusted by User to 22.400 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  22.40 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.19 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*( 100.000^.5)/(  22.400^(1/3)]=   3.19
Calculated TC of    3.193 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.237(CFS)
Total initial stream area =        0.050(Ac.)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Process from Point/Station      202.000 to Point/Station      203.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =   0.130(Ft.), Average velocity =   0.560(Ft/s)
    ******* Irregular Channel Data ***********
--------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
--------------------------------------------------------------
Sub-Channel flow  =      0.237(CFS)
  '     '    flow top width =      6.510(Ft.)
  '     '    velocity=    0.560(Ft/s)
  '     '    area =      0.424(Sq.Ft)
  '     '    Froude number =     0.386

Upstream point elevation =   534.200(Ft.)
Downstream point elevation =   533.800(Ft.)
Flow length =    82.000(Ft.)
Travel time  =    2.44 min.
Time of concentration =    5.64 min.
Depth of flow =   0.130(Ft.)
Average velocity =   0.560(Ft/s)
Total irregular channel flow =     0.237(CFS)
Irregular channel normal depth above invert elev. =   0.130(Ft.)
Average velocity of channel(s) =   0.560(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      204.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   534.000(Ft.)
End of street segment elevation =   528.800(Ft.)
Length of street segment  =   528.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      4.468(CFS)
Depth of flow =   0.231(Ft.), Average velocity =   2.870(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   2.87(Ft/s)
Travel time =    3.07 min.     TC =    8.70  min.
 Adding area flow to street
Rainfall intensity (I) =      5.529(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
```

```
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      5.529(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.584
Subarea runoff =      8.521(CFS) for      2.590(Ac.)
Total runoff =      8.758(CFS)  Total area =       2.640(Ac.)
Street flow at end of street =      8.758(CFS)
Half street flow at end of street =      8.758(CFS)
Depth of flow =   0.296(Ft.), Average velocity =   3.749(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   523.280(Ft.)
Downstream point/station elevation =   522.700(Ft.)
Pipe length  =    29.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.758(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.068(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      1.752(Ft.)
 Minor friction loss =      2.896(Ft.)  K-factor =   1.50
Pipe flow velocity =     11.15(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     8.74 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.640(Ac.)
Runoff from this stream =      8.758(CFS)
Time of concentration =    8.74 min.
Rainfall intensity =     5.511(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   93.000(Ft.)
Highest elevation =  533.330(Ft.)
Lowest elevation =  532.810(Ft.)
Elevation difference =    0.520(Ft.) Slope =  0.559 %
Top of Initial Area Slope adjusted by User to  0.500 %
Bottom of Initial Area Slope adjusted by User to  0.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.50 %, in a development type of
 10.9 DU/A or Less
```

```
In Accordance With Figure 3-3
Initial Area Time of Concentration =   8.02 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.500^(1/3)]=   8.02
The initial area total distance of   93.00 (Ft.) entered leaves a
remaining distance of   43.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.09 minutes
for a distance of  43.00 (Ft.) and a slope of  0.50 %
with an elevation difference of   0.22(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.087 Minutes
Tt=[(11.9*0.0081^3)/(  0.22)]^.385=  1.09
Total initial area Ti =   8.02 minutes from Figure 3-3 formula plus
  1.09 minutes from the Figure 3-4 formula =   9.11 minutes
Rainfall intensity (I) =      5.370(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.445(CFS)
Total initial stream area =        0.138(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   532.810(Ft.)
End of street segment elevation =   528.780(Ft.)
Length of street segment  =   465.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.450(CFS)
Depth of flow =   0.188(Ft.), Average velocity =   2.302(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.388(Ft.)
Flow velocity =   2.30(Ft/s)
Travel time =    3.37 min.     TC =   12.47  min.
 Adding area flow to street
Rainfall intensity (I) =      4.384(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      4.384(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.001
Subarea runoff =      3.942(CFS) for      1.530(Ac.)
Total runoff =      4.387(CFS)  Total area =       1.668(Ac.)
Street flow at end of street =      4.387(CFS)
Half street flow at end of street =      4.387(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.742(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.668(Ac.)
Runoff from this stream =      4.387(CFS)
Time of concentration =   12.47 min.
Rainfall intensity =     4.384(In/Hr)
Summary of stream data:

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


1         8.758       8.74              5.511
2         4.387      12.47              4.384
Qmax(1) =
       1.000 *    1.000 *     8.758) +
       1.000 *    0.701 *     4.387) + =      11.834
Qmax(2) =
       0.795 *    1.000 *     8.758) +
       1.000 *    1.000 *     4.387) + =      11.353

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.758       4.387
Maximum flow rates at confluence using above data:
       11.834       11.353
Area of streams before confluence:
        2.640        1.668
Results of confluence:
Total flow rate =     11.834(CFS)
Time of concentration =     8.745 min.
Effective stream area after confluence =      4.308(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      505.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   522.700(Ft.)
Downstream point/station elevation =   503.250(Ft.)
Pipe length  =   297.00(Ft.) Slope =   0.0655  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.834(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
    18.596(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =     32.757(Ft.)
 Minor friction loss =      5.288(Ft.)  K-factor =   1.50
Pipe flow velocity =     15.07(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =     9.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      505.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.308(Ac.)
Runoff from this stream =     11.834(CFS)
Time of concentration =    9.07 min.
```

```
Rainfall intensity =     5.382(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      401.000 to Point/Station      505.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity (I) =      3.342(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =  18.99 min.  Rain intensity =       3.34(In/Hr)
Total area =        6.280(Ac.)  Total runoff =    12.613(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      504.000 to Point/Station      505.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.280(Ac.)
Runoff from this stream =     12.613(CFS)
Time of concentration =   18.99 min.
Rainfall intensity =     3.342(In/Hr)
Summary of stream data:

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


1       11.834       9.07             5.382
2       12.613      18.99             3.342
Qmax(1) =
       1.000 *    1.000 *    11.834) +
       1.000 *    0.478 *    12.613) + =      17.861
Qmax(2) =
       0.621 *    1.000 *    11.834) +
       1.000 *    1.000 *    12.613) + =      19.962

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.834      12.613
Maximum flow rates at confluence using above data:
       17.861       19.962
Area of streams before confluence:
        4.308        6.280
Results of confluence:
Total flow rate =     19.962(CFS)
Time of concentration =    18.990 min.
Effective stream area after confluence =     10.588(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      506.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   503.250(Ft.)
Downstream point/station elevation =   497.000(Ft.)
Pipe length  =   257.00(Ft.) Slope =   0.0243  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.962(CFS)
```

```
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    19.962(CFS)
Normal flow depth in pipe =   12.93(In.)
Flow top width inside pipe =   23.93(In.)
Critical Depth =   19.26(In.)
Pipe flow velocity =     11.58(Ft/s)
Travel time through pipe =    0.37 min.
Time of concentration (TC) =    19.36 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      505.000 to Point/Station      506.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     10.588(Ac.)
Runoff from this stream =     19.962(CFS)
Time of concentration =   19.36 min.
Rainfall intensity =     3.301(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1501.000 to Point/Station     1502.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  522.450(Ft.)
Lowest elevation =  513.780(Ft.)
Elevation difference =    8.670(Ft.) Slope =  8.670 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.67 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.38 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*( 100.000^.5)/(   8.670^(1/3)]=   4.38
Calculated TC of    4.381 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =     7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.474(CFS)
Total initial stream area =       0.100(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1502.000 to Point/Station      506.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      4.460(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   2.270(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             10.00              0.00
    3             50.00              1.00
```

```
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      4.460(CFS)
  '      '    flow top width =     14.015(Ft.)
  '      '    velocity=    2.270(Ft/s)
  '      '    area =      1.964(Sq.Ft)
  '      '    Froude number =     1.069

Upstream point elevation =   513.250(Ft.)
Downstream point elevation =   498.970(Ft.)
Flow length =   494.000(Ft.)
Travel time  =    3.63 min.
Time of concentration =    8.01 min.
Depth of flow =   0.280(Ft.)
Average velocity =   2.270(Ft/s)
Total irregular channel flow =     4.460(CFS)
Irregular channel normal depth above invert elev. =   0.280(Ft.)
Average velocity of channel(s) =   2.270(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.834(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.834(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.356  CA =      1.437
Subarea runoff =      7.908(CFS) for      3.934(Ac.)
Total runoff =      8.382(CFS)  Total area =       4.034(Ac.)
Depth of flow =   0.355(Ft.), Average velocity =   2.658(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1502.000 to Point/Station      506.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      4.034(Ac.)
Runoff from this stream =      8.382(CFS)
Time of concentration =    8.01 min.
Rainfall intensity =     5.834(In/Hr)
Summary of stream data:

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


1       19.962     19.36             3.301
2        8.382      8.01             5.834
Qmax(1) =
       1.000 *    1.000 *    19.962) +
       0.566 *    1.000 *     8.382) + =      24.706
Qmax(2) =
       1.000 *    0.414 *    19.962) +
       1.000 *    1.000 *     8.382) + =      16.639

Total of 2 streams to confluence:
Flow rates before confluence point:
      19.962       8.382
Maximum flow rates at confluence using above data:
       24.706       16.639
Area of streams before confluence:
```

```
       10.588        4.034
Results of confluence:
Total flow rate =     24.706(CFS)
Time of concentration =    19.360 min.
Effective stream area after confluence =     14.622(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      105.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Depth of flow =   0.565(Ft.), Average velocity =   3.092(Ft/s)
    ******* Irregular Channel Data ***********
----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             15.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
----------------------------------------------------------------
Sub-Channel flow  =     24.706(CFS)
  '     '    flow top width =     28.266(Ft.)
  '     '    velocity=    3.092(Ft/s)
  '     '    area =      7.990(Sq.Ft)
  '     '    Froude number =     1.025

Upstream point elevation =   498.970(Ft.)
Downstream point elevation =   492.050(Ft.)
Flow length =   329.000(Ft.)
Travel time  =    1.77 min.
Time of concentration =   21.13 min.
Depth of flow =   0.565(Ft.)
Average velocity =   3.092(Ft/s)
Total irregular channel flow =    24.706(CFS)
Irregular channel normal depth above invert elev. =   0.565(Ft.)
Average velocity of channel(s) =   3.092(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      506.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     14.622(Ac.)
Runoff from this stream =     24.706(CFS)
Time of concentration =   21.13 min.
Rainfall intensity =     3.120(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   85.000(Ft.)
Highest elevation =  901.600(Ft.)
Lowest elevation =  888.100(Ft.)
Elevation difference =   13.500(Ft.) Slope = 15.882 %
```

```
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  15.88 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.37 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  15.882^(1/3)]=   5.37
Rainfall intensity (I) =      7.548(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.185(CFS)
Total initial stream area =        0.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     18.568(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   6.110(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     18.568(CFS)
  '     '    flow top width =     24.654(Ft.)
  '     '    velocity=    6.110(Ft/s)
  '     '    area =      3.039(Sq.Ft)
  '     '    Froude number =     3.067

Upstream point elevation =   888.100(Ft.)
Downstream point elevation =   542.800(Ft.)
Flow length =  1392.000(Ft.)
Travel time  =    3.80 min.
Time of concentration =    9.17 min.
Depth of flow =   0.247(Ft.)
Average velocity =   6.110(Ft/s)
Total irregular channel flow =    18.568(CFS)
Irregular channel normal depth above invert elev. =   0.247(Ft.)
Average velocity of channel(s) =   6.110(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.346(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.346(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      6.895
Subarea runoff =     36.676(CFS) for     19.630(Ac.)
Total runoff =     36.861(CFS)  Total area =      19.700(Ac.)
Depth of flow =   0.319(Ft.), Average velocity =   7.252(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
```

```
Upstream point/station elevation =   541.900(Ft.)
Downstream point/station elevation =   521.180(Ft.)
Pipe length  =   461.00(Ft.) Slope =   0.0449  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    36.861(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    36.861(CFS)
Normal flow depth in pipe =   15.77(In.)
Flow top width inside pipe =   22.78(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.83(Ft/s)
Travel time through pipe =    0.46 min.
Time of concentration (TC) =     9.62 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Depth of flow =   0.351(Ft.), Average velocity =   5.985(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------------------
Sub-Channel flow  =     36.861(CFS)
  '     '    flow top width =     35.097(Ft.)
  '     '    velocity=    5.985(Ft/s)
  '     '    area =      6.159(Sq.Ft)
  '     '    Froude number =     2.518

Upstream point elevation =   521.180(Ft.)
Downstream point elevation =   492.050(Ft.)
Flow length =   196.000(Ft.)
Travel time  =    0.55 min.
Time of concentration =   10.17 min.
Depth of flow =   0.351(Ft.)
Average velocity =   5.985(Ft/s)
Total irregular channel flow =    36.861(CFS)
Irregular channel normal depth above invert elev. =   0.351(Ft.)
Average velocity of channel(s) =   5.985(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     19.700(Ac.)
Runoff from this stream =     36.861(CFS)
Time of concentration =   10.17 min.
Rainfall intensity =     5.000(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2001.000 to Point/Station     2002.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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
```

```
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  693.950(Ft.)
Lowest elevation =  673.820(Ft.)
Elevation difference =   20.130(Ft.) Slope = 20.130 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  20.13 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  20.130^(1/3)]=   4.96
Calculated TC of    4.963 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.194(CFS)
Total initial stream area =        0.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2002.000 to Point/Station      105.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      4.503(CFS)
Depth of flow =   0.193(Ft.), Average velocity =   4.834(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      4.503(CFS)
  '     '    flow top width =      9.652(Ft.)
  '     '    velocity=    4.834(Ft/s)
  '     '    area =      0.932(Sq.Ft)
  '     '    Froude number =     2.742

Upstream point elevation =   673.820(Ft.)
Downstream point elevation =   492.050(Ft.)
Flow length =   844.000(Ft.)
Travel time  =    2.91 min.
Time of concentration =    7.87 min.
Depth of flow =   0.193(Ft.)
Average velocity =   4.834(Ft/s)
Total irregular channel flow =     4.503(CFS)
Irregular channel normal depth above invert elev. =   0.193(Ft.)
Average velocity of channel(s) =   4.834(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.898(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.898(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      1.484
Subarea runoff =      8.559(CFS) for      4.170(Ac.)
Total runoff =      8.753(CFS)  Total area =       4.240(Ac.)
Depth of flow =   0.248(Ft.), Average velocity =   5.708(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2002.000 to Point/Station      105.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      4.240(Ac.)
Runoff from this stream =      8.753(CFS)
Time of concentration =    7.87 min.
Rainfall intensity =     5.898(In/Hr)
Summary of stream data:

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


1       24.706     21.13             3.120
2       36.861     10.17             5.000
3        8.753      7.87             5.898
Qmax(1) =
       1.000 *    1.000 *    24.706) +
       0.624 *    1.000 *    36.861) +
       0.529 *    1.000 *     8.753) + =      52.333
Qmax(2) =
       1.000 *    0.481 *    24.706) +
       1.000 *    1.000 *    36.861) +
       0.848 *    1.000 *     8.753) + =      56.170
Qmax(3) =
       1.000 *    0.373 *    24.706) +
       1.000 *    0.774 *    36.861) +
       1.000 *    1.000 *     8.753) + =      46.489

Total of 3 streams to confluence:
Flow rates before confluence point:
      24.706      36.861       8.753
Maximum flow rates at confluence using above data:
       52.333       56.170       46.489
Area of streams before confluence:
       14.622       19.700        4.240
Results of confluence:
Total flow rate =     56.170(CFS)
Time of concentration =    10.170 min.
Effective stream area after confluence =     38.562(Ac.)
End of computations, total study area =          38.562 (Ac.)
```

POC 2
PRE-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 02/09/21
--------------------------------------------------------------------------
Questhaven Project
Job Number 19-038
POC-2
Pre-development Calculations
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  822.400(Ft.)
Lowest elevation =  792.200(Ft.)
Elevation difference =   30.200(Ft.) Slope = 30.200 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.20 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.34 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  30.200^(1/3)]=   4.34
Calculated TC of    4.335 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.360(CFS)
Total initial stream area =        0.130(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      203.000
```

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

_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =     34.367(CFS)
Depth of flow =   0.358(Ft.), Average velocity =   5.374(Ft/s)
    ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =     34.367(CFS)
  '     '    flow top width =     35.762(Ft.)
  '     '    velocity=    5.374(Ft/s)
  '     '    area =      6.395(Sq.Ft)
  '     '    Froude number =     2.240

Upstream point elevation =   792.200(Ft.)
Downstream point elevation =   482.900(Ft.)
Flow length =  2646.000(Ft.)
Travel time  =    8.21 min.
Time of concentration =   12.54 min.
Depth of flow =   0.358(Ft.)
Average velocity =   5.374(Ft/s)
Total irregular channel flow =    34.367(CFS)
Irregular channel normal depth above invert elev. =   0.358(Ft.)
Average velocity of channel(s) =   5.374(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.368(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.368(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     15.638
Subarea runoff =     67.946(CFS) for     44.550(Ac.)
Total runoff =     68.306(CFS)  Total area =      44.680(Ac.)
Depth of flow =   0.463(Ft.), Average velocity =   6.381(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      203.000 to Point/Station      203.000
**** 6 HOUR HYDROGRAPH ****
_____________________________________________________________________
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003


Time of Concentration =  12.54
Basin Area =    44.68 Acres
6 Hour Rainfall =  3.000 Inches
Runoff Coefficient =  0.350
Peak Discharge =    68.31 CFS
     Time (Min)     Discharge (CFS)
       0               0.000
       12              2.812
       24              2.875
       36              3.013
       48              3.089
```

60	3.256
72	3.349
84	3.556
96	3.673
108	3.939
120	4.091
132	4.447
144	4.657
156	5.164
168	5.477
180	6.278
192	6.807
204	8.320
216	9.477
228	13.915
240	19.606
252	68.306
264	11.161
276	7.467
288	5.843
300	4.894
312	4.259
324	3.800
336	3.449
348	3.170
360	2.942
372	2.752

++

6 - H O U R S T O R M

R u n o f f H y d r o g r a p h

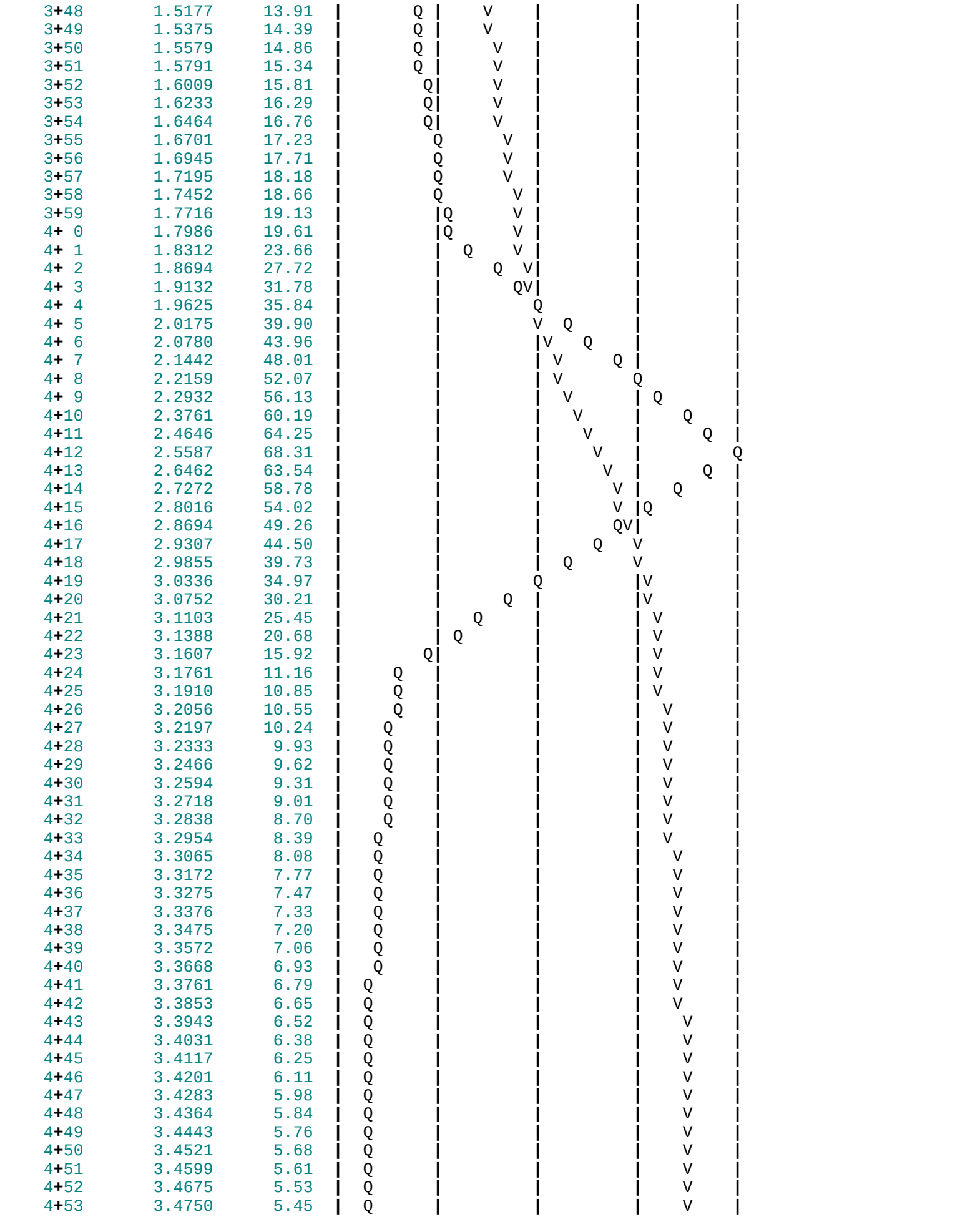
Hydrograph in 1 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.1	34.2	51.2	68.3
0+ 0	0.0000	0.00	Q	|	|	|	|
0+ 1	0.0003	0.23	Q	|	|	|	|
0+ 2	0.0010	0.47	Q	|	|	|	|
0+ 3	0.0019	0.70	Q	|	|	|	|
0+ 4	0.0032	0.94	Q	|	|	|	|
0+ 5	0.0048	1.17	Q	|	|	|	|
0+ 6	0.0068	1.41	Q	|	|	|	|
0+ 7	0.0090	1.64	Q	|	|	|	|
0+ 8	0.0116	1.87	VQ	|	|	|	|
0+ 9	0.0145	2.11	VQ	|	|	|	|
0+10	0.0178	2.34	VQ	|	|	|	|
0+11	0.0213	2.58	VQ	|	|	|	|
0+12	0.0252	2.81	VQ	|	|	|	|
0+13	0.0291	2.82	VQ	|	|	|	|
0+14	0.0329	2.82	VQ	|	|	|	|
0+15	0.0368	2.83	VQ	|	|	|	|
0+16	0.0407	2.83	VQ	|	|	|	|
0+17	0.0447	2.84	VQ	|	|	|	|
0+18	0.0486	2.84	VQ	|	|	|	|
0+19	0.0525	2.85	VQ	|	|	|	|
0+20	0.0564	2.85	VQ	|	|	|	|
0+21	0.0604	2.86	VQ	|	|	|	|
0+22	0.0643	2.86	VQ	|	|	|	|
0+23	0.0683	2.87	VQ	|	|	|	|
0+24	0.0722	2.88	VQ	|	|	|	|
0+25	0.0762	2.89	VQ	|	|	|	|
0+26	0.0802	2.90	VQ	|	|	|	|
0+27	0.0842	2.91	VQ	|	|	|	|
0+28	0.0882	2.92	VQ	|	|	|	|
0+29	0.0923	2.93	VQ	|	|	|	|

```
    0+30       0.0963      2.94  VQ        |         |         |         |
    0+31       0.1004      2.96  |Q        |         |         |         |
    0+32       0.1045      2.97  |Q        |         |         |         |
    0+33       0.1086      2.98  |Q        |         |         |         |
    0+34       0.1127      2.99  |Q        |         |         |         |
    0+35       0.1168      3.00  |Q        |         |         |         |
    0+36       0.1210      3.01  |Q        |         |         |         |
    0+37       0.1251      3.02  |Q        |         |         |         |
    0+38       0.1293      3.03  |Q        |         |         |         |
    0+39       0.1335      3.03  |Q        |         |         |         |
    0+40       0.1377      3.04  |Q        |         |         |         |
    0+41       0.1419      3.05  |Q        |         |         |         |
    0+42       0.1461      3.05  |Q        |         |         |         |
    0+43       0.1503      3.06  |Q        |         |         |         |
    0+44       0.1545      3.06  |Q        |         |         |         |
    0+45       0.1587      3.07  |Q        |         |         |         |
    0+46       0.1630      3.08  |Q        |         |         |         |
    0+47       0.1672      3.08  |Q        |         |         |         |
    0+48       0.1715      3.09  |Q        |         |         |         |
    0+49       0.1757      3.10  |Q        |         |         |         |
    0+50       0.1800      3.12  |Q        |         |         |         |
    0+51       0.1844      3.13  |Q        |         |         |         |
    0+52       0.1887      3.14  |Q        |         |         |         |
    0+53       0.1930      3.16  |Q        |         |         |         |
    0+54       0.1974      3.17  |QV       |         |         |         |
    0+55       0.2018      3.19  |QV       |         |         |         |
    0+56       0.2062      3.20  |QV       |         |         |         |
    0+57       0.2106      3.21  |QV       |         |         |         |
    0+58       0.2151      3.23  |QV       |         |         |         |
    0+59       0.2195      3.24  |QV       |         |         |         |
    1+ 0       0.2240      3.26  |QV       |         |         |         |
    1+ 1       0.2285      3.26  |QV       |         |         |         |
    1+ 2       0.2330      3.27  |QV       |         |         |         |
    1+ 3       0.2375      3.28  |QV       |         |         |         |
    1+ 4       0.2421      3.29  |QV       |         |         |         |
    1+ 5       0.2466      3.29  |QV       |         |         |         |
    1+ 6       0.2512      3.30  |QV       |         |         |         |
    1+ 7       0.2557      3.31  |QV       |         |         |         |
    1+ 8       0.2603      3.32  |QV       |         |         |         |
    1+ 9       0.2649      3.33  |QV       |         |         |         |
    1+10       0.2695      3.33  |QV       |         |         |         |
    1+11       0.2741      3.34  |QV       |         |         |         |
    1+12       0.2787      3.35  |QV       |         |         |         |
    1+13       0.2833      3.37  |QV       |         |         |         |
    1+14       0.2880      3.38  |QV       |         |         |         |
    1+15       0.2927      3.40  |Q V      |         |         |         |
    1+16       0.2974      3.42  | QV      |         |         |         |
    1+17       0.3021      3.44  | QV      |         |         |         |
    1+18       0.3069      3.45  | QV      |         |         |         |
    1+19       0.3116      3.47  | QV      |         |         |         |
    1+20       0.3164      3.49  | QV      |         |         |         |
    1+21       0.3213      3.50  | QV      |         |         |         |
    1+22       0.3261      3.52  | QV      |         |         |         |
    1+23       0.3310      3.54  | QV      |         |         |         |
    1+24       0.3359      3.56  | QV      |         |         |         |
    1+25       0.3408      3.57  | QV      |         |         |         |
    1+26       0.3457      3.58  | QV      |         |         |         |
    1+27       0.3507      3.59  | QV      |         |         |         |
    1+28       0.3556      3.60  | QV      |         |         |         |
    1+29       0.3606      3.60  | QV      |         |         |         |
    1+30       0.3656      3.61  | QV      |         |         |         |
    1+31       0.3706      3.62  | QV      |         |         |         |
    1+32       0.3756      3.63  | QV      |         |         |         |
    1+33       0.3806      3.64  | QV      |         |         |         |
    1+34       0.3856      3.65  | QV      |         |         |         |
    1+35       0.3907      3.66  | Q V     |         |         |         |
```

```
 1+36      0.3957      3.67  | Q V    |        |        |        |
 1+37      0.4008      3.70  | Q V    |        |        |        |
 1+38      0.4059      3.72  | Q V    |        |        |        |
 1+39      0.4111      3.74  | Q V    |        |        |        |
 1+40      0.4163      3.76  | Q V    |        |        |        |
 1+41      0.4215      3.78  | Q V    |        |        |        |
 1+42      0.4267      3.81  | Q V    |        |        |        |
 1+43      0.4320      3.83  | Q V    |        |        |        |
 1+44      0.4373      3.85  | Q V    |        |        |        |
 1+45      0.4426      3.87  | Q V    |        |        |        |
 1+46      0.4480      3.89  | Q V    |        |        |        |
 1+47      0.4534      3.92  | Q V    |        |        |        |
 1+48      0.4588      3.94  | Q V    |        |        |        |
 1+49      0.4642      3.95  | Q V    |        |        |        |
 1+50      0.4697      3.96  | Q V    |        |        |        |
 1+51      0.4752      3.98  | Q V    |        |        |        |
 1+52      0.4807      3.99  | Q V    |        |        |        |
 1+53      0.4862      4.00  | Q  V   |        |        |        |
 1+54      0.4917      4.01  | Q  V   |        |        |        |
 1+55      0.4973      4.03  | Q  V   |        |        |        |
 1+56      0.5028      4.04  | Q  V   |        |        |        |
 1+57      0.5084      4.05  | Q  V   |        |        |        |
 1+58      0.5140      4.07  | Q  V   |        |        |        |
 1+59      0.5196      4.08  | Q  V   |        |        |        |
 2+ 0      0.5253      4.09  | Q  V   |        |        |        |
 2+ 1      0.5309      4.12  | Q  V   |        |        |        |
 2+ 2      0.5367      4.15  | Q  V   |        |        |        |
 2+ 3      0.5424      4.18  | Q  V   |        |        |        |
 2+ 4      0.5482      4.21  | Q  V   |        |        |        |
 2+ 5      0.5541      4.24  | Q  V   |        |        |        |
 2+ 6      0.5599      4.27  | Q  V   |        |        |        |
 2+ 7      0.5659      4.30  | Q  V   |        |        |        |
 2+ 8      0.5718      4.33  | Q  V   |        |        |        |
 2+ 9      0.5778      4.36  | Q  V   |        |        |        |
 2+10      0.5839      4.39  | Q   V  |        |        |        |
 2+11      0.5900      4.42  | Q   V  |        |        |        |
 2+12      0.5961      4.45  | Q   V  |        |        |        |
 2+13      0.6022      4.46  | Q   V  |        |        |        |
 2+14      0.6084      4.48  | Q   V  |        |        |        |
 2+15      0.6146      4.50  | Q   V  |        |        |        |
 2+16      0.6208      4.52  | Q   V  |        |        |        |
 2+17      0.6271      4.53  | Q   V  |        |        |        |
 2+18      0.6333      4.55  | Q   V  |        |        |        |
 2+19      0.6396      4.57  | Q   V  |        |        |        |
 2+20      0.6459      4.59  | Q   V  |        |        |        |
 2+21      0.6523      4.60  | Q   V  |        |        |        |
 2+22      0.6587      4.62  | Q   V  |        |        |        |
 2+23      0.6650      4.64  | Q   V  |        |        |        |
 2+24      0.6715      4.66  | Q   V  |        |        |        |
 2+25      0.6779      4.70  | Q   V  |        |        |        |
 2+26      0.6845      4.74  | Q    V |        |        |        |
 2+27      0.6910      4.78  | Q    V |        |        |        |
 2+28      0.6977      4.83  | Q    V |        |        |        |
 2+29      0.7044      4.87  | Q    V |        |        |        |
 2+30      0.7112      4.91  | Q    V |        |        |        |
 2+31      0.7180      4.95  | Q    V |        |        |        |
 2+32      0.7249      5.00  | Q    V |        |        |        |
 2+33      0.7318      5.04  | Q    V |        |        |        |
 2+34      0.7388      5.08  | Q    V |        |        |        |
 2+35      0.7459      5.12  | Q    V |        |        |        |
 2+36      0.7530      5.16  |  Q   V |        |        |        |
 2+37      0.7601      5.19  |  Q   V |        |        |        |
 2+38      0.7673      5.22  |  Q   V |        |        |        |
 2+39      0.7745      5.24  |  Q   V |        |        |        |
 2+40      0.7818      5.27  |  Q    V|        |        |        |
 2+41      0.7891      5.29  |  Q    V|        |        |        |
```

```
    2+42        0.7964       5.32   |   Q     V |           |           |           |
    2+43        0.8038       5.35   |   Q     V |           |           |           |
    2+44        0.8112       5.37   |   Q     V |           |           |           |
    2+45        0.8186       5.40   |   Q     V |           |           |           |
    2+46        0.8261       5.42   |   Q     V |           |           |           |
    2+47        0.8336       5.45   |   Q     V |           |           |           |
    2+48        0.8411       5.48   |   Q     V |           |           |           |
    2+49        0.8488       5.54   |   Q     V |           |           |           |
    2+50        0.8565       5.61   |   Q     V |           |           |           |
    2+51        0.8643       5.68   |   Q     V |           |           |           |
    2+52        0.8722       5.74   |   Q     V |           |           |           |
    2+53        0.8802       5.81   |   Q      V|           |           |           |
    2+54        0.8883       5.88   |   Q      V|           |           |           |
    2+55        0.8965       5.94   |   Q      V|           |           |           |
    2+56        0.9048       6.01   |   Q      V|           |           |           |
    2+57        0.9132       6.08   |   Q      V|           |           |           |
    2+58        0.9216       6.14   |   Q      V|           |           |           |
    2+59        0.9302       6.21   |   Q      V|           |           |           |
    3+ 0        0.9388       6.28   |   Q      V|           |           |           |
    3+ 1        0.9475       6.32   |   Q      V|           |           |           |
    3+ 2        0.9563       6.37   |   Q      V|           |           |           |
    3+ 3        0.9651       6.41   |   Q      V|           |           |           |
    3+ 4        0.9740       6.45   |   Q       V           |           |           |
    3+ 5        0.9830       6.50   |   Q       V           |           |           |
    3+ 6        0.9920       6.54   |   Q       V           |           |           |
    3+ 7        1.0011       6.59   |   Q       V           |           |           |
    3+ 8        1.0102       6.63   |   Q       V           |           |           |
    3+ 9        1.0194       6.67   |   Q       V           |           |           |
    3+10        1.0286       6.72   |   Q       V           |           |           |
    3+11        1.0380       6.76   |   Q       V           |           |           |
    3+12        1.0473       6.81   |   Q       V           |           |           |
    3+13        1.0569       6.93   |    Q      V           |           |           |
    3+14        1.0666       7.06   |    Q      |V          |           |           |
    3+15        1.0765       7.19   |    Q      |V          |           |           |
    3+16        1.0866       7.31   |    Q      |V          |           |           |
    3+17        1.0968       7.44   |    Q      |V          |           |           |
    3+18        1.1072       7.56   |    Q      |V          |           |           |
    3+19        1.1178       7.69   |    Q      |V          |           |           |
    3+20        1.1286       7.82   |    Q      |V          |           |           |
    3+21        1.1395       7.94   |    Q      |V          |           |           |
    3+22        1.1507       8.07   |    Q      |V          |           |           |
    3+23        1.1619       8.19   |    Q      |V          |           |           |
    3+24        1.1734       8.32   |    Q      | V         |           |           |
    3+25        1.1850       8.42   |    Q      | V         |           |           |
    3+26        1.1967       8.51   |    Q      | V         |           |           |
    3+27        1.2086       8.61   |     Q     | V         |           |           |
    3+28        1.2206       8.71   |     Q     | V         |           |           |
    3+29        1.2327       8.80   |     Q     | V         |           |           |
    3+30        1.2449       8.90   |     Q     | V         |           |           |
    3+31        1.2573       8.99   |     Q     | V         |           |           |
    3+32        1.2699       9.09   |     Q     |  V        |           |           |
    3+33        1.2825       9.19   |     Q     |  V        |           |           |
    3+34        1.2953       9.28   |     Q     |  V        |           |           |
    3+35        1.3082       9.38   |     Q     |  V        |           |           |
    3+36        1.3213       9.48   |     Q     |  V        |           |           |
    3+37        1.3348       9.85   |     Q     |  V        |           |           |
    3+38        1.3489      10.22   |     Q     |  V        |           |           |
    3+39        1.3635      10.59   |      Q    |   V       |           |           |
    3+40        1.3786      10.96   |      Q    |   V       |           |           |
    3+41        1.3942      11.33   |      Q    |   V       |           |           |
    3+42        1.4103      11.70   |      Q    |   V       |           |           |
    3+43        1.4269      12.07   |       Q   |   V       |           |           |
    3+44        1.4440      12.44   |       Q   |   V       |           |           |
    3+45        1.4617      12.81   |       Q   |    V      |           |           |
    3+46        1.4798      13.18   |       Q   |    V      |           |           |
    3+47        1.4985      13.55   |       Q   |    V      |           |           |
```



3+48	1.5177	13.91	Q	V				
3+49	1.5375	14.39	Q	V				
3+50	1.5579	14.86	Q	V				
3+51	1.5791	15.34	Q	V				
3+52	1.6009	15.81	Q	V				
3+53	1.6233	16.29	Q	V				
3+54	1.6464	16.76	Q	V				
3+55	1.6701	17.23	Q	V				
3+56	1.6945	17.71	Q	V				
3+57	1.7195	18.18	Q	V				
3+58	1.7452	18.66	Q	V				
3+59	1.7716	19.13	Q	V				
4+ 0	1.7986	19.61	Q	V				
4+ 1	1.8312	23.66	Q	V				
4+ 2	1.8694	27.72	Q	V				
4+ 3	1.9132	31.78	QV					
4+ 4	1.9625	35.84	Q					
4+ 5	2.0175	39.90	V	Q				
4+ 6	2.0780	43.96	V	Q				
4+ 7	2.1442	48.01	V	Q				
4+ 8	2.2159	52.07	V	Q				
4+ 9	2.2932	56.13	V	Q				
4+10	2.3761	60.19	V	Q				
4+11	2.4646	64.25	V	Q				
4+12	2.5587	68.31	V	Q				
4+13	2.6462	63.54	V	Q				
4+14	2.7272	58.78	V	Q				
4+15	2.8016	54.02	V	Q				
4+16	2.8694	49.26	QV					
4+17	2.9307	44.50	Q	V				
4+18	2.9855	39.73	Q	V				
4+19	3.0336	34.97	Q	V				
4+20	3.0752	30.21	Q	V				
4+21	3.1103	25.45	Q	V				
4+22	3.1388	20.68	Q	V				
4+23	3.1607	15.92	Q	V				
4+24	3.1761	11.16	Q	V				
4+25	3.1910	10.85	Q	V				
4+26	3.2056	10.55	Q	V				
4+27	3.2197	10.24	Q	V				
4+28	3.2333	9.93	Q	V				
4+29	3.2466	9.62	Q	V				
4+30	3.2594	9.31	Q	V				
4+31	3.2718	9.01	Q	V				
4+32	3.2838	8.70	Q	V				
4+33	3.2954	8.39	Q	V				
4+34	3.3065	8.08	Q	V				
4+35	3.3172	7.77	Q	V				
4+36	3.3275	7.47	Q	V				
4+37	3.3376	7.33	Q	V				
4+38	3.3475	7.20	Q	V				
4+39	3.3572	7.06	Q	V				
4+40	3.3668	6.93	Q	V				
4+41	3.3761	6.79	Q	V				
4+42	3.3853	6.65	Q	V				
4+43	3.3943	6.52	Q	V				
4+44	3.4031	6.38	Q	V				
4+45	3.4117	6.25	Q	V				
4+46	3.4201	6.11	Q	V				
4+47	3.4283	5.98	Q	V				
4+48	3.4364	5.84	Q	V				
4+49	3.4443	5.76	Q	V				
4+50	3.4521	5.68	Q	V				
4+51	3.4599	5.61	Q	V				
4+52	3.4675	5.53	Q	V				
4+53	3.4750	5.45	Q	V				

```
 4+54      3.4824      5.37  |  Q      |         |         |    V    |
 4+55      3.4897      5.29  |  Q      |         |         |    V    |
 4+56      3.4968      5.21  |  Q      |         |         |     V   |
 4+57      3.5039      5.13  |  Q      |         |         |     V   |
 4+58      3.5109      5.05  | Q       |         |         |     V   |
 4+59      3.5177      4.97  | Q       |         |         |     V   |
 5+ 0      3.5244      4.89  | Q       |         |         |     V   |
 5+ 1      3.5311      4.84  | Q       |         |         |     V   |
 5+ 2      3.5377      4.79  | Q       |         |         |     V   |
 5+ 3      3.5442      4.74  | Q       |         |         |     V   |
 5+ 4      3.5507      4.68  | Q       |         |         |     V   |
 5+ 5      3.5571      4.63  | Q       |         |         |     V   |
 5+ 6      3.5634      4.58  | Q       |         |         |     V   |
 5+ 7      3.5696      4.52  | Q       |         |         |     V   |
 5+ 8      3.5757      4.47  | Q       |         |         |     V   |
 5+ 9      3.5818      4.42  | Q       |         |         |     V   |
 5+10      3.5878      4.37  | Q       |         |         |      V  |
 5+11      3.5938      4.31  | Q       |         |         |      V  |
 5+12      3.5997      4.26  | Q       |         |         |      V  |
 5+13      3.6055      4.22  | Q       |         |         |      V  |
 5+14      3.6112      4.18  | Q       |         |         |      V  |
 5+15      3.6169      4.14  | Q       |         |         |      V  |
 5+16      3.6226      4.11  | Q       |         |         |      V  |
 5+17      3.6282      4.07  | Q       |         |         |      V  |
 5+18      3.6337      4.03  | Q       |         |         |      V  |
 5+19      3.6392      3.99  | Q       |         |         |      V  |
 5+20      3.6447      3.95  | Q       |         |         |      V  |
 5+21      3.6501      3.91  | Q       |         |         |      V  |
 5+22      3.6554      3.88  | Q       |         |         |      V  |
 5+23      3.6607      3.84  | Q       |         |         |      V  |
 5+24      3.6659      3.80  | Q       |         |         |      V  |
 5+25      3.6711      3.77  | Q       |         |         |      V  |
 5+26      3.6763      3.74  | Q       |         |         |      V  |
 5+27      3.6814      3.71  | Q       |         |         |      V  |
 5+28      3.6865      3.68  | Q       |         |         |       V |
 5+29      3.6915      3.65  | Q       |         |         |       V |
 5+30      3.6965      3.62  | Q       |         |         |       V |
 5+31      3.7015      3.59  | Q       |         |         |       V |
 5+32      3.7064      3.57  | Q       |         |         |       V |
 5+33      3.7112      3.54  | Q       |         |         |       V |
 5+34      3.7161      3.51  | Q       |         |         |       V |
 5+35      3.7209      3.48  | Q       |         |         |       V |
 5+36      3.7256      3.45  | Q       |         |         |       V |
 5+37      3.7303      3.43  | Q       |         |         |       V |
 5+38      3.7350      3.40  |Q        |         |         |       V |
 5+39      3.7397      3.38  |Q        |         |         |       V |
 5+40      3.7443      3.36  |Q        |         |         |       V |
 5+41      3.7489      3.33  |Q        |         |         |       V |
 5+42      3.7534      3.31  |Q        |         |         |       V |
 5+43      3.7580      3.29  |Q        |         |         |       V |
 5+44      3.7625      3.26  |Q        |         |         |       V |
 5+45      3.7669      3.24  |Q        |         |         |       V |
 5+46      3.7713      3.22  |Q        |         |         |       V |
 5+47      3.7757      3.19  |Q        |         |         |       V |
 5+48      3.7801      3.17  |Q        |         |         |       V |
 5+49      3.7845      3.15  |Q        |         |         |        V|
 5+50      3.7888      3.13  |Q        |         |         |        V|
 5+51      3.7931      3.11  |Q        |         |         |        V|
 5+52      3.7973      3.09  |Q        |         |         |        V|
 5+53      3.8016      3.08  |Q        |         |         |        V|
 5+54      3.8058      3.06  |Q        |         |         |        V|
 5+55      3.8099      3.04  |Q        |         |         |        V|
 5+56      3.8141      3.02  |Q        |         |         |        V|
 5+57      3.8182      3.00  |Q        |         |         |        V|
 5+58      3.8223      2.98  |Q        |         |         |        V|
 5+59      3.8264      2.96  |Q        |         |         |        V|
```

```
    6+ 0       3.8305      2.94  |Q        |         |         |        V|
    6+ 1       3.8345      2.93  |Q        |         |         |        V|
    6+ 2       3.8385      2.91  |Q        |         |         |        V|
    6+ 3       3.8425      2.89  |Q        |         |         |        V|
    6+ 4       3.8465      2.88  |Q        |         |         |        V|
    6+ 5       3.8504      2.86  |Q        |         |         |        V|
    6+ 6       3.8543      2.85  |Q        |         |         |        V|
    6+ 7       3.8582      2.83  |Q        |         |         |        V|
    6+ 8       3.8621      2.82  |Q        |         |         |        V|
    6+ 9       3.8660      2.80  |Q        |         |         |        V|
    6+10       3.8698      2.78  |Q        |         |         |        V|
    6+11       3.8736      2.77  |Q        |         |         |        V|
    6+12       3.8774      2.75  |Q        |         |         |         V
-------------------------------------------------------------------------


    End of computations, total study area =          44.680 (Ac.)
```

POC 2
POST-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/11/21
--------------------------------------------------------------------------
Questhaven Project
Job Number 19-038
POC-2 User Defined Inut
Post-development Calculations
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   92.000(Ft.)
Highest elevation =  822.400(Ft.)
Lowest elevation =  791.500(Ft.)
Elevation difference =   30.900(Ft.) Slope = 33.587 %
Top of Initial Area Slope adjusted by User to 30.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.90 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.30 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  30.900^(1/3)]=   4.30
Calculated TC of    4.302 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.332(CFS)
Total initial stream area =        0.120(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
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```
Process from Point/Station      602.000 to Point/Station      603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     12.435(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   4.995(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     12.435(CFS)
  '     '    flow top width =     22.313(Ft.)
  '     '    velocity=    4.995(Ft/s)
  '     '    area =      2.489(Sq.Ft)
  '     '    Froude number =     2.636

Upstream point elevation =   791.500(Ft.)
Downstream point elevation =   545.060(Ft.)
Flow length =  1301.000(Ft.)
Travel time  =    4.34 min.
Time of concentration =    8.64 min.
Depth of flow =   0.223(Ft.)
Average velocity =   4.995(Ft/s)
Total irregular channel flow =    12.435(CFS)
Irregular channel normal depth above invert elev. =   0.223(Ft.)
Average velocity of channel(s) =   4.995(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.553(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.553(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      4.406
Subarea runoff =     24.139(CFS) for     12.470(Ac.)
Total runoff =     24.471(CFS)  Total area =      12.590(Ac.)
Depth of flow =   0.288(Ft.), Average velocity =   5.917(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      604.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

------------------------------------------------------------------------
Upstream point/station elevation =   545.060(Ft.)
Downstream point/station elevation =   502.700(Ft.)
Pipe length  =   834.00(Ft.) Slope =   0.0508  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.471(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    24.471(CFS)
Normal flow depth in pipe =   11.72(In.)
Flow top width inside pipe =   23.99(In.)
Critical Depth =   20.98(In.)
Pipe flow velocity =     16.06(Ft/s)
Travel time through pipe =    0.87 min.
Time of concentration (TC) =     9.51 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      604.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.590(Ac.)
Runoff from this stream =     24.471(CFS)
Time of concentration =    9.51 min.
Rainfall intensity =     5.222(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1601.000 to Point/Station     1602.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   98.000(Ft.)
Highest elevation =  518.500(Ft.)
Lowest elevation =  517.460(Ft.)
Elevation difference =    1.040(Ft.) Slope =  1.061 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.06 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  11.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  70.000^.5)/(   1.060^(1/3)]=  11.08
Rainfall intensity (I) =      4.732(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.282(CFS)
Total initial stream area =        0.170(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1602.000 to Point/Station     1603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      1.659(CFS)
Depth of flow =   0.165(Ft.), Average velocity =   1.225(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.659(CFS)
  '     '    flow top width =     16.461(Ft.)
  '     '    velocity=    1.225(Ft/s)
  '     '    area =      1.355(Sq.Ft)
  '     '    Froude number =     0.752

Upstream point elevation =   517.460(Ft.)
Downstream point elevation =   510.080(Ft.)
Flow length =   432.000(Ft.)
Travel time  =    5.88 min.
```

```
Time of concentration =   16.96 min.
Depth of flow =   0.165(Ft.)
Average velocity =   1.225(Ft/s)
Total irregular channel flow =     1.659(CFS)
Irregular channel normal depth above invert elev. =   0.165(Ft.)
Average velocity of channel(s) =   1.225(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.596(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.596(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.826
Subarea runoff =      2.688(CFS) for      2.190(Ac.)
Total runoff =      2.970(CFS)  Total area =       2.360(Ac.)
Depth of flow =   0.205(Ft.), Average velocity =   1.417(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1603.000 to Point/Station     1604.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   510.080(Ft.)
Downstream point/station elevation =   507.290(Ft.)
Pipe length  =   132.00(Ft.) Slope =   0.0211  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.970(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     2.970(CFS)
Normal flow depth in pipe =    4.88(In.)
Flow top width inside pipe =   19.31(In.)
Critical Depth =    7.20(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    0.34 min.
Time of concentration (TC) =    17.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1604.000 to Point/Station     1605.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      3.823(CFS)
Depth of flow =   0.413(Ft.), Average velocity =   1.120(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             20.00              0.00
    3             40.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      3.823(CFS)
  '     '    flow top width =     16.528(Ft.)
  '     '    velocity=    1.120(Ft/s)
  '     '    area =      3.415(Sq.Ft)
  '     '    Froude number =     0.434

Upstream point elevation =   507.290(Ft.)
Downstream point elevation =   506.850(Ft.)
Flow length =   105.000(Ft.)
```

```
 Travel time  =    1.56 min.
 Time of concentration =   18.86 min.
 Depth of flow =   0.413(Ft.)
 Average velocity =   1.120(Ft/s)
 Total irregular channel flow =     3.823(CFS)
 Irregular channel normal depth above invert elev. =   0.413(Ft.)
 Average velocity of channel(s) =   1.120(Ft/s)
  Adding area flow to channel
 Rainfall intensity (I) =      3.357(In/Hr) for a   100.0 year storm
 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
 [UNDISTURBED NATURAL TERRAIN                ]
 (Permanent Open Space    )
 Impervious value, Ai = 0.000
 Sub-Area C Value = 0.350
 Rainfall intensity =      3.357(In/Hr) for a   100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.350  CA =      1.369
 Subarea runoff =      1.625(CFS) for      1.550(Ac.)
 Total runoff =      4.595(CFS)  Total area =       3.910(Ac.)
 Depth of flow =   0.443(Ft.), Average velocity =   1.172(Ft/s)


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station     1605.000 to Point/Station      604.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****
 ------------------------------------------------------------------------
 Upstream point/station elevation =   506.850(Ft.)
 Downstream point/station elevation =   502.710(Ft.)
 Pipe length  =   207.00(Ft.) Slope =   0.0200  Manning's N = 0.012
 No. of pipes = 1  Required pipe flow  =     4.595(CFS)
 Given pipe size =     24.00(In.)
 Calculated individual pipe flow  =     4.595(CFS)
 Normal flow depth in pipe =    5.90(In.)
 Flow top width inside pipe =   20.67(In.)
 Critical Depth =    9.04(In.)
 Pipe flow velocity =      7.66(Ft/s)
 Travel time through pipe =    0.45 min.
 Time of concentration (TC) =    19.31 min.


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station      604.000 to Point/Station      604.000
 **** CONFLUENCE OF MINOR STREAMS ****
 ------------------------------------------------------------------------
 Along Main Stream number: 1 in normal stream number 2
 Stream flow area =      3.910(Ac.)
 Runoff from this stream =      4.595(CFS)
 Time of concentration =   19.31 min.
 Rainfall intensity =     3.307(In/Hr)
 Summary of stream data:

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


 1       24.471      9.51             5.222
 2        4.595     19.31             3.307
 Qmax(1) =
        1.000 *    1.000 *    24.471) +
        1.000 *    0.492 *     4.595) + =      26.733
 Qmax(2) =
        0.633 *    1.000 *    24.471) +
        1.000 *    1.000 *     4.595) + =      20.090
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
      24.471       4.595
Maximum flow rates at confluence using above data:
       26.733       20.090
Area of streams before confluence:
       12.590        3.910
Results of confluence:
Total flow rate =     26.733(CFS)
Time of concentration =     9.508 min.
Effective stream area after confluence =     16.500(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station     1008.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   502.710(Ft.)
Downstream point/station elevation =   492.280(Ft.)
Pipe length  =   682.00(Ft.) Slope =   0.0153  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.733(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
   400.406(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =    383.850(Ft.)
 Minor friction loss =     26.985(Ft.)  K-factor =   1.50
Pipe flow velocity =     34.04(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =     9.84 min.
End of computations, total study area =          16.500 (Ac.)
```

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        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/17/21
--------------------------------------------------------------------------




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

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1001.000 to Point/Station     1002.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =  114.000(Ft.)
Highest elevation =  523.100(Ft.)
Lowest elevation =  523.000(Ft.)
Elevation difference =    0.100(Ft.) Slope =  0.088 %
Top of Initial Area Slope adjusted by User to  0.001 %
Bottom of Initial Area Slope adjusted by User to  0.001 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.00 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  63.64 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.001^(1/3)]=  63.64
The initial area total distance of  114.00 (Ft.) entered leaves a
remaining distance of   64.00 (Ft.)
Using Figure 3-4, the travel time for this distance is  16.16 minutes
for a distance of  64.00 (Ft.) and a slope of  0.00 %
with an elevation difference of   0.00(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =   16.157 Minutes
Tt=[(11.9*0.0121^3)/(  0.00)]^.385= 16.16
```

```
Total initial area Ti =  63.64 minutes from Figure 3-3 formula plus
 16.16 minutes from the Figure 3-4 formula =  79.80 minutes
Rainfall intensity (I) =      1.324(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.072(CFS)
Total initial stream area =        0.090(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1002.000 to Point/Station     1003.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   523.000(Ft.)
End of street segment elevation =   516.390(Ft.)
Length of street segment  =   734.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      0.734(CFS)
Depth of flow =   0.113(Ft.), Average velocity =   1.720(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.643(Ft.)
Flow velocity =   1.72(Ft/s)
Travel time =    7.11 min.     TC =   86.91  min.
 Adding area flow to street
Rainfall intensity (I) =      1.253(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      1.253(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.182
Subarea runoff =      1.410(CFS) for      1.880(Ac.)
Total runoff =      1.481(CFS)  Total area =       1.970(Ac.)
Street flow at end of street =      1.481(CFS)
Half street flow at end of street =      1.481(CFS)
Depth of flow =   0.152(Ft.), Average velocity =   2.056(Ft/s)
Flow width (from curb towards crown)=   8.573(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1003.000 to Point/Station     1004.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   512.000(Ft.)
Downstream point/station elevation =   510.920(Ft.)
Pipe length  =    54.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.481(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     1.481(CFS)
Normal flow depth in pipe =    3.52(In.)
```

```
Flow top width inside pipe =   16.97(In.)
Critical depth could not be calculated.
Pipe flow velocity =      5.19(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    87.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1003.000 to Point/Station     1004.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.970(Ac.)
Runoff from this stream =      1.481(CFS)
Time of concentration =   87.08 min.
Rainfall intensity =     1.252(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      801.000 to Point/Station      802.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   77.000(Ft.)
Highest elevation =  530.000(Ft.)
Lowest elevation =  529.900(Ft.)
Elevation difference =    0.100(Ft.) Slope =  0.130 %
Top of Initial Area Slope adjusted by User to  0.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.10 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  13.71 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.100^(1/3)]=  13.71
Rainfall intensity (I) =      4.124(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.322(CFS)
Total initial stream area =        0.130(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      802.000 to Point/Station      803.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Top of street segment elevation =   530.000(Ft.)
End of street segment elevation =   517.390(Ft.)
Length of street segment  =   653.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
```

```
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.971(CFS)
Depth of flow =   0.173(Ft.), Average velocity =   3.261(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   9.622(Ft.)
Flow velocity =   3.26(Ft/s)
Travel time =    3.34 min.     TC =   17.05  min.
 Adding area flow to street
Rainfall intensity (I) =      3.583(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      3.583(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.553
Subarea runoff =      5.242(CFS) for      2.458(Ac.)
Total runoff =      5.564(CFS)  Total area =       2.588(Ac.)
Street flow at end of street =      5.564(CFS)
Half street flow at end of street =      5.564(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   3.836(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      803.000 to Point/Station     1004.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   511.420(Ft.)
Downstream point/station elevation =   510.920(Ft.)
Pipe length  =    25.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.564(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     1.278(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.609(Ft.)
 Minor friction loss =      1.169(Ft.)  K-factor =   1.50
Critical depth could not be calculated.
Pipe flow velocity =      7.08(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    17.11 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      803.000 to Point/Station     1004.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.588(Ac.)
Runoff from this stream =      5.564(CFS)
Time of concentration =   17.11 min.
Rainfall intensity =     3.575(In/Hr)
Summary of stream data:

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

```
1        1.481     87.08             1.252
2        5.564     17.11             3.575
Qmax(1) =
       1.000 *    1.000 *     1.481) +
       0.350 *    1.000 *     5.564) + =       3.429
Qmax(2) =
       1.000 *    0.196 *     1.481) +
       1.000 *    1.000 *     5.564) + =       5.855

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.481       5.564
Maximum flow rates at confluence using above data:
        3.429        5.855
Area of streams before confluence:
        1.970        2.588
Results of confluence:
Total flow rate =      5.855(CFS)
Time of concentration =    17.107 min.
Effective stream area after confluence =      4.558(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1004.000 to Point/Station     1005.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   510.920(Ft.)
Downstream point/station elevation =   510.340(Ft.)
Pipe length  =    29.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.855(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =     5.855(CFS)
Normal flow depth in pipe =    7.85(In.)
Flow top width inside pipe =   17.85(In.)
Critical Depth =   11.21(In.)
Pipe flow velocity =      7.91(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =    17.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1004.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.558(Ac.)
Runoff from this stream =      5.855(CFS)
Time of concentration =   17.17 min.
Rainfall intensity =     3.567(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      701.000 to Point/Station      702.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  557.000(Ft.)
Lowest elevation =  530.000(Ft.)
```

```
Elevation difference =   27.000(Ft.) Slope = 27.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.00 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.00 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*( 100.000^.5)/(  27.000^(1/3)]=   3.00
Calculated TC of    3.000 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.451(CFS)
Total initial stream area =        0.095(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      702.000 to Point/Station      703.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =   0.144(Ft.), Average velocity =   0.874(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.451(CFS)
  '     '    flow top width =      7.178(Ft.)
  '     '    velocity=    0.874(Ft/s)
  '     '    area =      0.515(Sq.Ft)
  '     '    Froude number =     0.575

Upstream point elevation =   530.000(Ft.)
Downstream point elevation =   528.630(Ft.)
Flow length =   131.000(Ft.)
Travel time  =    2.50 min.
Time of concentration =    5.50 min.
Depth of flow =   0.144(Ft.)
Average velocity =   0.874(Ft/s)
Total irregular channel flow =     0.451(CFS)
Irregular channel normal depth above invert elev. =   0.144(Ft.)
Average velocity of channel(s) =   0.874(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      703.000 to Point/Station     1005.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   528.630(Ft.)
End of street segment elevation =   516.750(Ft.)
Length of street segment  =   702.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
```

```
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      6.630(CFS)
Depth of flow =   0.241(Ft.), Average velocity =   3.952(Ft/s)
Note:  depth of flow exceeds top of street crown.
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.000(Ft.)
Flow velocity =   3.95(Ft/s)
Travel time =    2.96 min.     TC =    8.46  min.
 Adding area flow to street
Rainfall intensity (I) =      5.632(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      5.632(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      2.289
Subarea runoff =     12.440(CFS) for      3.720(Ac.)
Total runoff =     12.891(CFS)  Total area =       3.815(Ac.)
Street flow at end of street =     12.891(CFS)
Half street flow at end of street =     12.891(CFS)
Depth of flow =   0.310(Ft.), Average velocity =   5.145(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  12.000(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      703.000 to Point/Station     1005.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.815(Ac.)
Runoff from this stream =     12.891(CFS)
Time of concentration =    8.46 min.
Rainfall intensity =     5.632(In/Hr)
Summary of stream data:

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


1        5.855     17.17             3.567
2       12.891      8.46             5.632
Qmax(1) =
       1.000 *    1.000 *     5.855) +
       0.633 *    1.000 *    12.891) + =      14.020
Qmax(2) =
       1.000 *    0.493 *     5.855) +
       1.000 *    1.000 *    12.891) + =      15.775

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.855      12.891
Maximum flow rates at confluence using above data:
       14.020       15.775
Area of streams before confluence:
        4.558        3.815
Results of confluence:
Total flow rate =     15.775(CFS)
Time of concentration =     8.457 min.
```

```
 Effective stream area after confluence =      8.373(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1005.000 to Point/Station     1006.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   510.340(Ft.)
Downstream point/station elevation =   490.000(Ft.)
Pipe length  =    30.00(Ft.) Slope =   0.6780  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.775(CFS)
Given pipe size =     18.00(In.)
Calculated individual pipe flow  =    15.775(CFS)
Normal flow depth in pipe =    5.20(In.)
Flow top width inside pipe =   16.32(In.)
Critical Depth =   17.05(In.)
Pipe flow velocity =     37.22(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     8.47 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1005.000 to Point/Station     1006.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.373(Ac.)
Runoff from this stream =     15.775(CFS)
Time of concentration =    8.47 min.
Rainfall intensity =     5.626(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      901.000 to Point/Station      902.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   76.000(Ft.)
Highest elevation =  518.000(Ft.)
Lowest elevation =  517.900(Ft.)
Elevation difference =    0.100(Ft.) Slope =  0.132 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.13 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  12.50 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.132^(1/3)]=  12.50
The initial area total distance of   76.00 (Ft.) entered leaves a
remaining distance of   26.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.23 minutes
for a distance of  26.00 (Ft.) and a slope of  0.13 %
with an elevation difference of   0.03(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.232 Minutes
Tt=[(11.9*0.0049^3)/(  0.03)]^.385=  1.23
Total initial area Ti =  12.50 minutes from Figure 3-3 formula plus
  1.23 minutes from the Figure 3-4 formula =  13.73 minutes
```

```
Rainfall intensity (I) =      4.120(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.277(CFS)
Total initial stream area =        0.112(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      902.000 to Point/Station      903.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Depth of flow =   0.097(Ft.), Average velocity =   1.171(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.277(CFS)
  '     '    flow top width =      4.861(Ft.)
  '     '    velocity=    1.171(Ft/s)
  '     '    area =      0.236(Sq.Ft)
  '     '    Froude number =     0.936

Upstream point elevation =   518.000(Ft.)
Downstream point elevation =   515.160(Ft.)
Flow length =    90.000(Ft.)
Travel time  =    1.28 min.
Time of concentration =   15.01 min.
Depth of flow =   0.097(Ft.)
Average velocity =   1.171(Ft/s)
Total irregular channel flow =     0.277(CFS)
Irregular channel normal depth above invert elev. =   0.097(Ft.)
Average velocity of channel(s) =   1.171(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      903.000 to Point/Station     1006.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Top of street segment elevation =   515.160(Ft.)
End of street segment elevation =   490.000(Ft.)
Length of street segment  =   642.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      3.276(CFS)
Depth of flow =   0.156(Ft.), Average velocity =   4.354(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.758(Ft.)
Flow velocity =   4.35(Ft/s)
Travel time =    2.46 min.     TC =   17.47  min.
 Adding area flow to street
Rainfall intensity (I) =      3.527(In/Hr) for a   100.0 year storm
```

```
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      3.527(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.759
Subarea runoff =      5.928(CFS) for      2.820(Ac.)
Total runoff =      6.205(CFS)  Total area =       2.932(Ac.)
Street flow at end of street =      6.205(CFS)
Half street flow at end of street =      6.205(CFS)
Depth of flow =   0.202(Ft.), Average velocity =   5.116(Ft/s)
Flow width (from curb towards crown)=  11.080(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      903.000 to Point/Station     1006.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.932(Ac.)
Runoff from this stream =      6.205(CFS)
Time of concentration =   17.47 min.
Rainfall intensity =     3.527(In/Hr)
Summary of stream data:

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


1       15.775      8.47             5.626
2        6.205     17.47             3.527
Qmax(1) =
       1.000 *    1.000 *    15.775) +
       1.000 *    0.485 *     6.205) + =      18.784
Qmax(2) =
       0.627 *    1.000 *    15.775) +
       1.000 *    1.000 *     6.205) + =      16.095

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.775       6.205
Maximum flow rates at confluence using above data:
       18.784       16.095
Area of streams before confluence:
        8.373        2.932
Results of confluence:
Total flow rate =     18.784(CFS)
Time of concentration =     8.471 min.
Effective stream area after confluence =     11.305(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1006.000 to Point/Station     1007.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   490.000(Ft.)
Downstream point/station elevation =   486.820(Ft.)
Pipe length  =   159.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    18.784(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    18.784(CFS)
```

```
Normal flow depth in pipe =   13.22(In.)
Flow top width inside pipe =   23.88(In.)
Critical Depth =   18.71(In.)
Pipe flow velocity =     10.59(Ft/s)
Travel time through pipe =    0.25 min.
Time of concentration (TC) =     8.72 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1006.000 to Point/Station     1007.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     11.305(Ac.)
Runoff from this stream =     18.784(CFS)
Time of concentration =    8.72 min.
Rainfall intensity =     5.521(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1101.000 to Point/Station     1102.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   86.000(Ft.)
Highest elevation =  524.090(Ft.)
Lowest elevation =  518.000(Ft.)
Elevation difference =    6.090(Ft.) Slope =  7.081 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.08 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.69 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*( 100.000^.5)/(   7.081^(1/3)]=   4.69
Calculated TC of    4.687 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =     7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.654(CFS)
Total initial stream area =       0.138(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1102.000 to Point/Station     1103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------------
Depth of flow =   0.252(Ft.), Average velocity =   0.411(Ft/s)
    ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             25.00              0.00
    3             50.00              1.00
Manning's 'N' friction factor =   0.030
-------------------------------------------------------------------
Sub-Channel flow  =      0.654(CFS)
```

```
   '      '    flow top width =     12.623(Ft.)
   '      '    velocity=    0.411(Ft/s)
   '      '    area =      1.593(Sq.Ft)
   '      '    Froude number =     0.204

 Upstream point elevation =   518.000(Ft.)
 Downstream point elevation =   517.900(Ft.)
 Flow length =    92.000(Ft.)
 Travel time  =    3.73 min.
 Time of concentration =    8.42 min.
 Depth of flow =   0.252(Ft.)
 Average velocity =   0.411(Ft/s)
 Total irregular channel flow =     0.654(CFS)
 Irregular channel normal depth above invert elev. =   0.252(Ft.)
 Average velocity of channel(s) =   0.411(Ft/s)


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station     1103.000 to Point/Station     1104.000
 **** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
 ----------------------------------------------------------------------
 Top of street segment elevation =   518.000(Ft.)
 End of street segment elevation =   490.000(Ft.)
 Length of street segment  =   680.000(Ft.)
 Height of curb above gutter flowline  =    6.0(In.)
 Width of half street (curb to crown)  =  12.000(Ft.)
 Distance from crown to crossfall grade break  =  10.500(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 =   1.500(Ft.)
 Gutter hike from flowline =  0.125(In.)
  Manning's N in gutter =  0.0130
  Manning's N from gutter to grade break =  0.0130
  Manning's N from grade break to crown =  0.0130
 Estimated mean flow rate at midpoint of street =      4.027(CFS)
 Depth of flow =   0.168(Ft.), Average velocity =   4.673(Ft/s)
 Streetflow hydraulics at midpoint of street travel:
 Halfstreet flow width =   9.362(Ft.)
 Flow velocity =   4.67(Ft/s)
 Travel time =    2.43 min.     TC =   10.85  min.
  Adding area flow to street
 Rainfall intensity (I) =     4.797(In/Hr) for a   100.0 year storm
 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
 [MEDIUM DENSITY RESIDENTIAL                 ]
 (10.9 DU/A or Less      )
 Impervious value, Ai = 0.450
 Sub-Area C Value = 0.600
 Rainfall intensity =     4.797(In/Hr) for a   100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.600  CA =     1.525
 Subarea runoff =      6.659(CFS) for      2.403(Ac.)
 Total runoff =     7.313(CFS)  Total area =      2.541(Ac.)
 Street flow at end of street =     7.313(CFS)
 Half street flow at end of street =     7.313(CFS)
 Depth of flow =   0.214(Ft.), Average velocity =   5.431(Ft/s)
 Flow width (from curb towards crown)=  11.667(Ft.)


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station     1104.000 to Point/Station     1007.000
```

```
**** PIPEFLOW TRAVEL TIME (User specified size) ****

------------------------------------------------------------------------
Upstream point/station elevation =   490.000(Ft.)
Downstream point/station elevation =   486.820(Ft.)
Pipe length  =   124.00(Ft.) Slope =   0.0256  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.313(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.063(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      5.223(Ft.)
 Minor friction loss =      2.020(Ft.)  K-factor =   1.50
Pipe flow velocity =      9.31(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    11.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1104.000 to Point/Station     1007.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.541(Ac.)
Runoff from this stream =      7.313(CFS)
Time of concentration =   11.07 min.
Rainfall intensity =     4.735(In/Hr)
Summary of stream data:

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


1       18.784      8.72             5.521
2        7.313     11.07             4.735
Qmax(1) =
       1.000 *    1.000 *    18.784) +
       1.000 *    0.788 *     7.313) + =      24.546
Qmax(2) =
       0.858 *    1.000 *    18.784) +
       1.000 *    1.000 *     7.313) + =      23.421

Total of 2 streams to confluence:
Flow rates before confluence point:
      18.784       7.313
Maximum flow rates at confluence using above data:
       24.546       23.421
Area of streams before confluence:
       11.305        2.541
Results of confluence:
Total flow rate =     24.546(CFS)
Time of concentration =     8.721 min.
Effective stream area after confluence =     13.846(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1007.000 to Point/Station     1008.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   486.820(Ft.)
Downstream point/station elevation =   483.110(Ft.)
Pipe length  =    70.00(Ft.) Slope =   0.0530  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.546(CFS)
Given pipe size =     18.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.605(Ft.)  at the headworks or inlet of the pipe(s)
```

```
 Pipe friction loss =      3.821(Ft.)
 Minor friction loss =      4.494(Ft.)  K-factor =   1.50
Pipe flow velocity =     13.89(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     8.80 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1007.000 to Point/Station     1008.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     13.846(Ac.)
Runoff from this stream =     24.546(CFS)
Time of concentration =    8.80 min.
Rainfall intensity =     5.487(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station     1008.000
**** USER DEFINED FLOW INFORMATION AT A POINT ****
------------------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity (I) =      5.108(In/Hr) for a   100.0 year storm
User specified values are as follows:
TC =   9.84 min.  Rain intensity =       5.11(In/Hr)
Total area =       16.500(Ac.)  Total runoff =    26.733(CFS)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station     1008.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     16.500(Ac.)
Runoff from this stream =     26.733(CFS)
Time of concentration =    9.84 min.
Rainfall intensity =     5.108(In/Hr)
Summary of stream data:

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


1       24.546      8.80             5.487
2       26.733      9.84             5.108
Qmax(1) =
       1.000 *    1.000 *    24.546) +
       1.000 *    0.895 *    26.733) + =      48.467
Qmax(2) =
       0.931 *    1.000 *    24.546) +
       1.000 *    1.000 *    26.733) + =      49.581

Total of 2 streams to confluence:
Flow rates before confluence point:
      24.546      26.733
Maximum flow rates at confluence using above data:
       48.467       49.581
Area of streams before confluence:
```

```
       13.846       16.500
Results of confluence:
Total flow rate =     49.581(CFS)
Time of concentration =     9.840 min.
Effective stream area after confluence =     30.346(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1301.000 to Point/Station     1302.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  100.000(Ft.)
Highest elevation =  772.500(Ft.)
Lowest elevation =  745.000(Ft.)
Elevation difference =   27.500(Ft.) Slope = 27.500 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  27.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.47 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  27.500^(1/3)]=   4.47
Calculated TC of    4.473 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =     7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.304(CFS)
Total initial stream area =       0.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1302.000 to Point/Station     1008.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     10.313(CFS)
Depth of flow =   0.319(Ft.), Average velocity =   5.057(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             20.00              0.00
    3             40.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     10.313(CFS)
  '     '    flow top width =     12.773(Ft.)
  '     '    velocity=    5.057(Ft/s)
  '     '    area =      2.039(Sq.Ft)
  '     '    Froude number =     2.230

Upstream point elevation =   745.000(Ft.)
Downstream point elevation =   483.110(Ft.)
Flow length =  2173.000(Ft.)
Travel time  =    7.16 min.
Time of concentration =   11.63 min.
Depth of flow =   0.319(Ft.)
```

```
Average velocity =   5.057(Ft/s)
Total irregular channel flow =    10.313(CFS)
Irregular channel normal depth above invert elev. =   0.319(Ft.)
Average velocity of channel(s) =   5.057(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.584(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.584(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      4.420
Subarea runoff =     19.961(CFS) for     12.520(Ac.)
Total runoff =     20.266(CFS)  Total area =      12.630(Ac.)
Depth of flow =   0.411(Ft.), Average velocity =   5.987(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1008.000 to Point/Station     1008.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 3
Stream flow area =     12.630(Ac.)
Runoff from this stream =     20.266(CFS)
Time of concentration =   11.63 min.
Rainfall intensity =     4.584(In/Hr)
Summary of stream data:

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


1       24.546      8.80             5.487
2       26.733      9.84             5.108
3       20.266     11.63             4.584
Qmax(1) =
       1.000 *    1.000 *    24.546) +
       1.000 *    0.895 *    26.733) +
       1.000 *    0.757 *    20.266) + =      63.804
Qmax(2) =
       0.931 *    1.000 *    24.546) +
       1.000 *    1.000 *    26.733) +
       1.000 *    0.846 *    20.266) + =      66.721
Qmax(3) =
       0.835 *    1.000 *    24.546) +
       0.898 *    1.000 *    26.733) +
       1.000 *    1.000 *    20.266) + =      64.769

Total of 3 streams to confluence:
Flow rates before confluence point:
      24.546      26.733      20.266
Maximum flow rates at confluence using above data:
       63.804       66.721       64.769
Area of streams before confluence:
       13.846       16.500       12.630
Results of confluence:
Total flow rate =     66.721(CFS)
Time of concentration =     9.840 min.
Effective stream area after confluence =     42.976(Ac.)
End of computations, total study area =          42.976 (Ac.)
```

POC 3
PRE-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2014 Version 9.0

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/11/21
--------------------------------------------------------------------------
Questhaven Project
Job Number 19-038
POC-2 User Defined Inut
Post-development Calculations
--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      601.000 to Point/Station      602.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   92.000(Ft.)
Highest elevation =  822.400(Ft.)
Lowest elevation =  791.500(Ft.)
Elevation difference =   30.900(Ft.) Slope = 33.587 %
Top of Initial Area Slope adjusted by User to 30.900 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  30.90 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.30 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(  30.900^(1/3)]=   4.30
Calculated TC of    4.302 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.332(CFS)
Total initial stream area =        0.120(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      602.000 to Point/Station      603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****

------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =     12.435(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   4.995(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =     12.435(CFS)
  '     '    flow top width =     22.313(Ft.)
  '     '    velocity=    4.995(Ft/s)
  '     '    area =      2.489(Sq.Ft)
  '     '    Froude number =     2.636

Upstream point elevation =   791.500(Ft.)
Downstream point elevation =   545.060(Ft.)
Flow length =  1301.000(Ft.)
Travel time  =    4.34 min.
Time of concentration =    8.64 min.
Depth of flow =   0.223(Ft.)
Average velocity =   4.995(Ft/s)
Total irregular channel flow =    12.435(CFS)
Irregular channel normal depth above invert elev. =   0.223(Ft.)
Average velocity of channel(s) =   4.995(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      5.553(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      5.553(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      4.406
Subarea runoff =     24.139(CFS) for     12.470(Ac.)
Total runoff =     24.471(CFS)  Total area =      12.590(Ac.)
Depth of flow =   0.288(Ft.), Average velocity =   5.917(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      604.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****

------------------------------------------------------------------------
Upstream point/station elevation =   545.060(Ft.)
Downstream point/station elevation =   502.700(Ft.)
Pipe length  =   834.00(Ft.) Slope =   0.0508  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.471(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    24.471(CFS)
Normal flow depth in pipe =   11.72(In.)
Flow top width inside pipe =   23.99(In.)
Critical Depth =   20.98(In.)
Pipe flow velocity =     16.06(Ft/s)
Travel time through pipe =    0.87 min.
Time of concentration (TC) =     9.51 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      603.000 to Point/Station      604.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.590(Ac.)
Runoff from this stream =     24.471(CFS)
Time of concentration =    9.51 min.
Rainfall intensity =     5.222(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1601.000 to Point/Station     1602.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   98.000(Ft.)
Highest elevation =  518.500(Ft.)
Lowest elevation =  517.460(Ft.)
Elevation difference =    1.040(Ft.) Slope =  1.061 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of   1.06 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  11.08 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  70.000^.5)/(   1.060^(1/3)]=  11.08
Rainfall intensity (I) =      4.732(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.282(CFS)
Total initial stream area =        0.170(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1602.000 to Point/Station     1603.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
----------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      1.659(CFS)
Depth of flow =   0.165(Ft.), Average velocity =   1.225(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             50.00              0.00
    3            100.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      1.659(CFS)
  '     '    flow top width =     16.461(Ft.)
  '     '    velocity=    1.225(Ft/s)
  '     '    area =      1.355(Sq.Ft)
  '     '    Froude number =     0.752

Upstream point elevation =   517.460(Ft.)
Downstream point elevation =   510.080(Ft.)
Flow length =   432.000(Ft.)
Travel time  =    5.88 min.
```

```
Time of concentration =   16.96 min.
Depth of flow =   0.165(Ft.)
Average velocity =   1.225(Ft/s)
Total irregular channel flow =     1.659(CFS)
Irregular channel normal depth above invert elev. =   0.165(Ft.)
Average velocity of channel(s) =   1.225(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      3.596(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.596(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.826
Subarea runoff =      2.688(CFS) for      2.190(Ac.)
Total runoff =      2.970(CFS)  Total area =       2.360(Ac.)
Depth of flow =   0.205(Ft.), Average velocity =   1.417(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1603.000 to Point/Station     1604.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   510.080(Ft.)
Downstream point/station elevation =   507.290(Ft.)
Pipe length  =   132.00(Ft.) Slope =   0.0211  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.970(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =     2.970(CFS)
Normal flow depth in pipe =    4.88(In.)
Flow top width inside pipe =   19.31(In.)
Critical Depth =    7.20(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    0.34 min.
Time of concentration (TC) =    17.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1604.000 to Point/Station     1605.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      3.823(CFS)
Depth of flow =   0.413(Ft.), Average velocity =   1.120(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             20.00              0.00
    3             40.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      3.823(CFS)
  '     '    flow top width =     16.528(Ft.)
  '     '    velocity=    1.120(Ft/s)
  '     '    area =      3.415(Sq.Ft)
  '     '    Froude number =     0.434

Upstream point elevation =   507.290(Ft.)
Downstream point elevation =   506.850(Ft.)
Flow length =   105.000(Ft.)
```

```
 Travel time  =    1.56 min.
 Time of concentration =   18.86 min.
 Depth of flow =   0.413(Ft.)
 Average velocity =   1.120(Ft/s)
 Total irregular channel flow =     3.823(CFS)
 Irregular channel normal depth above invert elev. =   0.413(Ft.)
 Average velocity of channel(s) =   1.120(Ft/s)
  Adding area flow to channel
 Rainfall intensity (I) =      3.357(In/Hr) for a   100.0 year storm
 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
 [UNDISTURBED NATURAL TERRAIN                ]
 (Permanent Open Space    )
 Impervious value, Ai = 0.000
 Sub-Area C Value = 0.350
 Rainfall intensity =      3.357(In/Hr) for a   100.0 year storm
 Effective runoff coefficient used for total area
 (Q=KCIA) is C = 0.350  CA =      1.369
 Subarea runoff =      1.625(CFS) for      1.550(Ac.)
 Total runoff =      4.595(CFS)  Total area =       3.910(Ac.)
 Depth of flow =   0.443(Ft.), Average velocity =   1.172(Ft/s)


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station     1605.000 to Point/Station      604.000
 **** PIPEFLOW TRAVEL TIME (User specified size) ****
 ------------------------------------------------------------------------
 Upstream point/station elevation =   506.850(Ft.)
 Downstream point/station elevation =   502.710(Ft.)
 Pipe length  =   207.00(Ft.) Slope =   0.0200  Manning's N = 0.012
 No. of pipes = 1  Required pipe flow  =     4.595(CFS)
 Given pipe size =     24.00(In.)
 Calculated individual pipe flow  =     4.595(CFS)
 Normal flow depth in pipe =    5.90(In.)
 Flow top width inside pipe =   20.67(In.)
 Critical Depth =    9.04(In.)
 Pipe flow velocity =      7.66(Ft/s)
 Travel time through pipe =    0.45 min.
 Time of concentration (TC) =    19.31 min.


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station      604.000 to Point/Station      604.000
 **** CONFLUENCE OF MINOR STREAMS ****
 ------------------------------------------------------------------------
 Along Main Stream number: 1 in normal stream number 2
 Stream flow area =      3.910(Ac.)
 Runoff from this stream =      4.595(CFS)
 Time of concentration =   19.31 min.
 Rainfall intensity =     3.307(In/Hr)
 Summary of stream data:

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


 1       24.471      9.51             5.222
 2        4.595     19.31             3.307
 Qmax(1) =
        1.000 *    1.000 *    24.471) +
        1.000 *    0.492 *     4.595) + =      26.733
 Qmax(2) =
        0.633 *    1.000 *    24.471) +
        1.000 *    1.000 *     4.595) + =      20.090
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
      24.471       4.595
Maximum flow rates at confluence using above data:
       26.733       20.090
Area of streams before confluence:
       12.590        3.910
Results of confluence:
Total flow rate =     26.733(CFS)
Time of concentration =     9.508 min.
Effective stream area after confluence =     16.500(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      604.000 to Point/Station     1008.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   502.710(Ft.)
Downstream point/station elevation =   492.280(Ft.)
Pipe length  =   682.00(Ft.) Slope =   0.0153  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.733(CFS)
Given pipe size =     12.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
   400.406(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =    383.850(Ft.)
 Minor friction loss =     26.985(Ft.)  K-factor =   1.50
Pipe flow velocity =     34.04(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =     9.84 min.
End of computations, total study area =          16.500 (Ac.)
```

POC 3
POST-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/15/21
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 *********   Hydrology Study Control Information **********

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Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1401.000 to Point/Station     1402.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Initial subarea total flow distance  =   96.000(Ft.)
Highest elevation =  523.100(Ft.)
Lowest elevation =  522.900(Ft.)
Elevation difference =    0.200(Ft.) Slope =  0.208 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.21 %, in a development type of
 10.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  10.71 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6000)*(  50.000^.5)/(   0.210^(1/3)]=  10.71
The initial area total distance of   96.00 (Ft.) entered leaves a
remaining distance of   46.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.60 minutes
for a distance of  46.00 (Ft.) and a slope of  0.21 %
with an elevation difference of   0.10(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.599 Minutes
Tt=[(11.9*0.0087^3)/(  0.10)]^.385=  1.60
Total initial area Ti =  10.71 minutes from Figure 3-3 formula plus
  1.60 minutes from the Figure 3-4 formula =  12.31 minutes
```

```
Rainfall intensity (I) =      4.422(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.371(CFS)
Total initial stream area =        0.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1402.000 to Point/Station     1403.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   523.000(Ft.)
End of street segment elevation =   517.000(Ft.)
Length of street segment  =   195.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      2.418(CFS)
Depth of flow =   0.144(Ft.), Average velocity =   3.683(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.193(Ft.)
Flow velocity =   3.68(Ft/s)
Travel time =    0.88 min.     TC =   13.19  min.
 Adding area flow to street
Rainfall intensity (I) =      4.228(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(10.9 DU/A or Less      )
Impervious value, Ai = 0.450
Sub-Area C Value = 0.600
Rainfall intensity =      4.228(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.600  CA =      1.044
Subarea runoff =      4.043(CFS) for      1.600(Ac.)
Total runoff =      4.414(CFS)  Total area =       1.740(Ac.)
Street flow at end of street =      4.414(CFS)
Half street flow at end of street =      4.414(CFS)
Depth of flow =   0.185(Ft.), Average velocity =   4.289(Ft/s)
Flow width (from curb towards crown)=  10.217(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1403.000 to Point/Station     1404.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   517.000(Ft.)
Downstream point/station elevation =   500.000(Ft.)
Pipe length  =   181.00(Ft.) Slope =   0.0939  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.414(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     4.414(CFS)
Normal flow depth in pipe =    5.31(In.)
Flow top width inside pipe =   11.92(In.)
Critical Depth =   10.57(In.)
```

```
Pipe flow velocity =     13.16(Ft/s)
Travel time through pipe =    0.23 min.
Time of concentration (TC) =    13.42 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1404.000 to Point/Station     1404.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.740(Ac.)
Runoff from this stream =      4.414(CFS)
Time of concentration =   13.42 min.
Rainfall intensity =     4.182(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1701.000 to Point/Station     1702.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
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
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =   95.000(Ft.)
Highest elevation =  526.780(Ft.)
Lowest elevation =  524.920(Ft.)
Elevation difference =    1.860(Ft.) Slope =  1.958 %
Top of Initial Area Slope adjusted by User to  1.000 %
Bottom of Initial Area Slope adjusted by User to  1.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.00 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.21 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.000^(1/3)]=   3.21
The initial area total distance of   95.00 (Ft.) entered leaves a
remaining distance of   35.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.71 minutes
for a distance of  35.00 (Ft.) and a slope of  1.00 %
with an elevation difference of   0.35(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.710 Minutes
Tt=[(11.9*0.0066^3)/(  0.35)]^.385=  0.71
Total initial area Ti =   3.21 minutes from Figure 3-3 formula plus
  0.71 minutes from the Figure 3-4 formula =   3.92 minutes
Calculated TC of    3.917 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      7.904(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.523(CFS)
Total initial stream area =        0.076(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1702.000 to Point/Station     1404.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      3.861(CFS)
Depth of flow =   0.222(Ft.), Average velocity =   5.219(Ft/s)
```

```
    ******* Irregular Channel Data **********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             10.00              0.50
    3             10.10              0.00
    4             25.00              0.50
Manning's 'N' friction factor =   0.012
------------------------------------------------------------------
Sub-Channel flow  =      3.861(CFS)
  '     '    flow top width =      6.662(Ft.)
  '     '    velocity=    5.219(Ft/s)
  '     '    area =      0.740(Sq.Ft)
  '     '    Froude number =     2.760

Upstream point elevation =   524.920(Ft.)
Downstream point elevation =   505.000(Ft.)
Flow length =   577.000(Ft.)
Travel time  =    1.84 min.
Time of concentration =    5.76 min.
Depth of flow =   0.222(Ft.)
Average velocity =   5.219(Ft/s)
Total irregular channel flow =     3.861(CFS)
Irregular channel normal depth above invert elev. =   0.222(Ft.)
Average velocity of channel(s) =   5.219(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      7.215(In/Hr) for a   100.0 year storm
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
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Rainfall intensity =      7.215(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.795  CA =      0.990
Subarea runoff =      6.623(CFS) for      1.170(Ac.)
Total runoff =      7.146(CFS)  Total area =       1.246(Ac.)
Depth of flow =   0.280(Ft.), Average velocity =   6.087(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1404.000 to Point/Station     1404.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.246(Ac.)
Runoff from this stream =      7.146(CFS)
Time of concentration =    5.76 min.
Rainfall intensity =     7.215(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1201.000 to Point/Station     1202.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
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
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
```

```
 Sub-Area C Value = 0.790
 Initial subarea total flow distance  =   94.000(Ft.)
 Highest elevation =  526.780(Ft.)
 Lowest elevation =  526.450(Ft.)
 Elevation difference =    0.330(Ft.) Slope =  0.351 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 50.00 (Ft)
 for the top area slope value of   0.35 %, in a development type of
  43.0 DU/A or Less
 In Accordance With Figure 3-3
 Initial Area Time of Concentration =   5.59 minutes
 TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
 TC = [1.8*(1.1-0.7900)*(  50.000^.5)/(   0.351^(1/3)]=   5.59
 The initial area total distance of   94.00 (Ft.) entered leaves a
 remaining distance of   44.00 (Ft.)
 Using Figure 3-4, the travel time for this distance is   1.27 minutes
 for a distance of  44.00 (Ft.) and a slope of  0.35 %
 with an elevation difference of   0.15(Ft.) from the end of the top area
 Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
  =    1.268 Minutes
 Tt=[(11.9*0.0083^3)/(  0.15)]^.385=  1.27
 Total initial area Ti =   5.59 minutes from Figure 3-3 formula plus
   1.27 minutes from the Figure 3-4 formula =   6.86 minutes
 Rainfall intensity (I) =      6.445(In/Hr) for a   100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
 Subarea runoff =      0.356(CFS)
 Total initial stream area =        0.070(Ac.)


 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station     1202.000 to Point/Station     1203.000
 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
 ________________________________________________________________________
 Estimated mean flow rate at midpoint of channel =      1.204(CFS)
 Depth of flow =   0.135(Ft.), Average velocity =   4.376(Ft/s)
     ******* Irregular Channel Data ***********
 ------------------------------------------------------------------
 Information entered for subchannel number 1 :
 Point number      'X' coordinate     'Y' coordinate
     1              0.00              1.00
     2             10.00              0.50
     3             10.10              0.00
     4             25.00              0.50
 Manning's 'N' friction factor =   0.012
 ------------------------------------------------------------------
 Sub-Channel flow  =      1.204(CFS)
   '      '    flow top width =      4.063(Ft.)
   '      '    velocity=    4.376(Ft/s)
   '      '    area =      0.275(Sq.Ft)
   '      '    Froude number =     2.964

 Upstream point elevation =   526.450(Ft.)
 Downstream point elevation =   514.480(Ft.)
 Flow length =   255.000(Ft.)
 Travel time  =    0.97 min.
 Time of concentration =    7.83 min.
 Depth of flow =   0.135(Ft.)
 Average velocity =   4.376(Ft/s)
 Total irregular channel flow =     1.204(CFS)
 Irregular channel normal depth above invert elev. =   0.135(Ft.)
 Average velocity of channel(s) =   4.376(Ft/s)
  Adding area flow to channel
 Rainfall intensity (I) =      5.917(In/Hr) for a   100.0 year storm
 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
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Rainfall intensity =      5.917(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.790  CA =      0.332
Subarea runoff =      1.607(CFS) for      0.350(Ac.)
Total runoff =      1.963(CFS)  Total area =       0.420(Ac.)
Depth of flow =   0.163(Ft.), Average velocity =   4.945(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1203.000 to Point/Station     1404.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   493.500(Ft.)
Downstream point/station elevation =   489.000(Ft.)
Pipe length  =   418.00(Ft.) Slope =   0.0108  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.963(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.963(CFS)
Normal flow depth in pipe =    6.22(In.)
Flow top width inside pipe =   11.99(In.)
Critical Depth =    7.17(In.)
Pipe flow velocity =      4.78(Ft/s)
Travel time through pipe =    1.46 min.
Time of concentration (TC) =     9.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1404.000 to Point/Station     1404.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      0.420(Ac.)
Runoff from this stream =      1.963(CFS)
Time of concentration =    9.29 min.
Rainfall intensity =     5.300(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1901.000 to Point/Station     1902.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                 ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =   92.000(Ft.)
Highest elevation =  519.900(Ft.)
Lowest elevation =  513.500(Ft.)
Elevation difference =    6.400(Ft.) Slope =  6.957 %
Top of Initial Area Slope adjusted by User to  6.100 %
Bottom of Initial Area Slope adjusted by User to  6.100 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.10 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.39 minutes
```

```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   6.100^(1/3)]=   7.39
The initial area total distance of   92.00 (Ft.) entered leaves a
remaining distance of    0.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.27 minutes
for a distance of   0.00 (Ft.) and a slope of  6.10 %
with an elevation difference of   0.15(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.268 Minutes
Tt=[(11.9*0.0000^3)/(  0.15)]^.385=  1.27
Total initial area Ti =   7.39 minutes from Figure 3-3 formula plus
  1.27 minutes from the Figure 3-4 formula =   8.66 minutes
Rainfall intensity (I) =      5.548(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.117(CFS)
Total initial stream area =       0.060(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1902.000 to Point/Station     1404.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.845(CFS)
Depth of flow =   0.194(Ft.), Average velocity =   1.502(Ft/s)
    ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
    1              0.00              1.00
    2             15.00              0.00
    3             30.00              1.00
Manning's 'N' friction factor =   0.030
------------------------------------------------------------------
Sub-Channel flow  =      0.845(CFS)
  '     '    flow top width =      5.810(Ft.)
  '     '    velocity=    1.502(Ft/s)
  '     '    area =      0.563(Sq.Ft)
  '     '    Froude number =     0.850

Upstream point elevation =   513.500(Ft.)
Downstream point elevation =   505.000(Ft.)
Flow length =   410.000(Ft.)
Travel time  =    4.55 min.
Time of concentration =   13.21 min.
Depth of flow =   0.194(Ft.)
Average velocity =   1.502(Ft/s)
Total irregular channel flow =     0.845(CFS)
Irregular channel normal depth above invert elev. =   0.194(Ft.)
Average velocity of channel(s) =   1.502(Ft/s)
 Adding area flow to channel
Rainfall intensity (I) =      4.225(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.225(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.357
Subarea runoff =      1.392(CFS) for      0.960(Ac.)
Total runoff =      1.508(CFS)  Total area =       1.020(Ac.)
Depth of flow =   0.241(Ft.), Average velocity =   1.736(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1404.000 to Point/Station     1404.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 4
Stream flow area =      1.020(Ac.)
Runoff from this stream =      1.508(CFS)
Time of concentration =   13.21 min.
Rainfall intensity =     4.225(In/Hr)
Summary of stream data:

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


1        4.414     13.42             4.182
2        7.146      5.76             7.215
3        1.963      9.29             5.300
4        1.508     13.21             4.225
Qmax(1) =
       1.000 *    1.000 *     4.414) +
       0.580 *    1.000 *     7.146) +
       0.789 *    1.000 *     1.963) +
       0.990 *    1.000 *     1.508) + =      11.598
Qmax(2) =
       1.000 *    0.429 *     4.414) +
       1.000 *    1.000 *     7.146) +
       1.000 *    0.620 *     1.963) +
       1.000 *    0.436 *     1.508) + =      10.916
Qmax(3) =
       1.000 *    0.692 *     4.414) +
       0.735 *    1.000 *     7.146) +
       1.000 *    1.000 *     1.963) +
       1.000 *    0.703 *     1.508) + =      11.331
Qmax(4) =
       1.000 *    0.984 *     4.414) +
       0.586 *    1.000 *     7.146) +
       0.797 *    1.000 *     1.963) +
       1.000 *    1.000 *     1.508) + =      11.602

Total of 4 streams to confluence:
Flow rates before confluence point:
       4.414       7.146       1.963       1.508
Maximum flow rates at confluence using above data:
       11.598       10.916       11.331       11.602
Area of streams before confluence:
        1.740        1.246        0.420        1.020
Results of confluence:
Total flow rate =     11.602(CFS)
Time of concentration =    13.207 min.
Effective stream area after confluence =      4.426(Ac.)
End of computations, total study area =          4.426 (Ac.)
```

POC 4
PRE-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/15/21
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 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** INITIAL AREA EVALUATION ****
__________________________________________________________________________
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  263.000(Ft.)
Highest elevation =  501.800(Ft.)
Lowest elevation =  492.600(Ft.)
Elevation difference =    9.200(Ft.) Slope =  3.498 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   3.50 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =   8.89 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*( 100.000^.5)/(   3.500^(1/3)]=   8.89
The initial area total distance of  263.00 (Ft.) entered leaves a
remaining distance of  163.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.43 minutes
for a distance of 163.00 (Ft.) and a slope of  3.50 %
with an elevation difference of   5.71(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.434 Minutes
Tt=[(11.9*0.0309^3)/(  5.71)]^.385=  1.43
Total initial area Ti =   8.89 minutes from Figure 3-3 formula plus
  1.43 minutes from the Figure 3-4 formula =  10.33 minutes
```

```
Rainfall intensity (I) =      4.951(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.168(CFS)
Total initial stream area =        0.097(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   492.600(Ft.)
Downstream point elevation =   471.800(Ft.)
Channel length thru subarea  =   429.000(Ft.)
Channel base width  =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      0.996(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.996(CFS)
Depth of flow =   0.228(Ft.), Average velocity =   6.014(Ft/s)
Channel flow top width =    0.955(Ft.)
Flow Velocity =    6.01(Ft/s)
Travel time  =    1.19 min.
Time of concentration =   11.51 min.
Critical depth =      0.383(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.615(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      4.615(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.381
Subarea runoff =      1.591(CFS) for      0.992(Ac.)
Total runoff =      1.759(CFS)  Total area =       1.089(Ac.)
Depth of flow =   0.310(Ft.), Average velocity =   7.013(Ft/s)
Critical depth =      0.520(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      302.000
**** 6 HOUR HYDROGRAPH ****
________________________________________________________________________
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003


Time of Concentration =  11.51
Basin Area =     1.09 Acres
6 Hour Rainfall =  3.000 Inches
Runoff Coefficient =  0.350
Peak Discharge =     1.76 CFS
     Time (Min)     Discharge (CFS)
       0               0.000
       11              0.068
       22              0.069
       33              0.072
       44              0.074
       55              0.078
       66              0.080
```

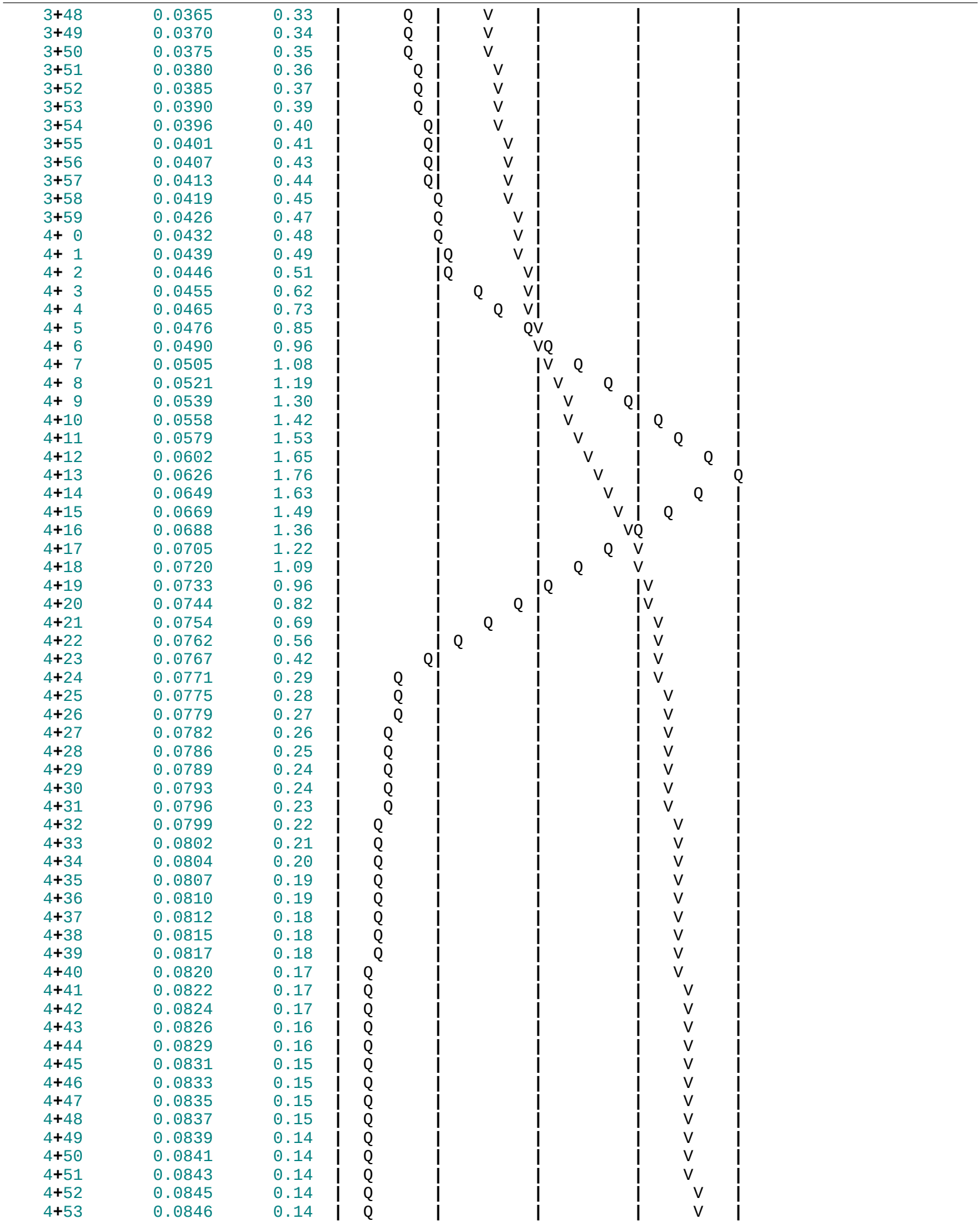
```
          77                0.084
          88                0.086
          99                0.092
          110               0.095
          121               0.102
          132               0.105
          143               0.115
          154               0.120
          165               0.133
          176               0.141
          187               0.162
          198               0.175
          209               0.214
          220               0.244
          231               0.359
          242               0.505
          253               1.759
          264               0.288
          275               0.193
          286               0.151
          297               0.126
          308               0.110
          319               0.098
          330               0.089
          341               0.082
          352               0.076
          363               0.071
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    6 - H O U R    S T O R M
                R u n o f f     H y d r o g r a p h
  ------------------------------------------------------------------------
              Hydrograph in   1   Minute intervals ((CFS))

    ----------------------------------------------------------------------
 Time(h+m) Volume Ac.Ft   Q(CFS)  0        0.4       0.9       1.3       1.8
 ----------------------------------------------------------------------------
   0+ 0       0.0000      0.00  Q         |         |         |         |
   0+ 1       0.0000      0.01  Q         |         |         |         |
   0+ 2       0.0000      0.01  Q         |         |         |         |
   0+ 3       0.0001      0.02  Q         |         |         |         |
   0+ 4       0.0001      0.02  Q         |         |         |         |
   0+ 5       0.0001      0.03  Q         |         |         |         |
   0+ 6       0.0002      0.04  Q         |         |         |         |
   0+ 7       0.0002      0.04  Q         |         |         |         |
   0+ 8       0.0003      0.05  VQ        |         |         |         |
   0+ 9       0.0004      0.06  VQ        |         |         |         |
   0+10       0.0005      0.06  VQ        |         |         |         |
   0+11       0.0006      0.07  VQ        |         |         |         |
   0+12       0.0007      0.07  VQ        |         |         |         |
   0+13       0.0008      0.07  VQ        |         |         |         |
   0+14       0.0008      0.07  VQ        |         |         |         |
   0+15       0.0009      0.07  VQ        |         |         |         |
   0+16       0.0010      0.07  VQ        |         |         |         |
   0+17       0.0011      0.07  VQ        |         |         |         |
   0+18       0.0012      0.07  VQ        |         |         |         |
   0+19       0.0013      0.07  VQ        |         |         |         |
   0+20       0.0014      0.07  VQ        |         |         |         |
   0+21       0.0015      0.07  VQ        |         |         |         |
   0+22       0.0016      0.07  VQ        |         |         |         |
   0+23       0.0017      0.07  VQ        |         |         |         |
   0+24       0.0018      0.07  VQ        |         |         |         |
   0+25       0.0019      0.07  VQ        |         |         |         |
   0+26       0.0020      0.07  VQ        |         |         |         |
   0+27       0.0021      0.07  VQ        |         |         |         |
   0+28       0.0022      0.07  VQ        |         |         |         |
   0+29       0.0023      0.07  VQ        |         |         |         |
```

```
    0+30       0.0024      0.07  |Q        |         |         |         |
    0+31       0.0025      0.07  |Q        |         |         |         |
    0+32       0.0026      0.07  |Q        |         |         |         |
    0+33       0.0027      0.07  |Q        |         |         |         |
    0+34       0.0028      0.07  |Q        |         |         |         |
    0+35       0.0029      0.07  |Q        |         |         |         |
    0+36       0.0030      0.07  |Q        |         |         |         |
    0+37       0.0031      0.07  |Q        |         |         |         |
    0+38       0.0032      0.07  |Q        |         |         |         |
    0+39       0.0033      0.07  |Q        |         |         |         |
    0+40       0.0034      0.07  |Q        |         |         |         |
    0+41       0.0035      0.07  |Q        |         |         |         |
    0+42       0.0036      0.07  |Q        |         |         |         |
    0+43       0.0037      0.07  |Q        |         |         |         |
    0+44       0.0038      0.07  |Q        |         |         |         |
    0+45       0.0039      0.07  |Q        |         |         |         |
    0+46       0.0040      0.07  |Q        |         |         |         |
    0+47       0.0041      0.08  |Q        |         |         |         |
    0+48       0.0042      0.08  |Q        |         |         |         |
    0+49       0.0043      0.08  |Q        |         |         |         |
    0+50       0.0044      0.08  |Q        |         |         |         |
    0+51       0.0045      0.08  |Q        |         |         |         |
    0+52       0.0046      0.08  |Q        |         |         |         |
    0+53       0.0047      0.08  |QV       |         |         |         |
    0+54       0.0048      0.08  |QV       |         |         |         |
    0+55       0.0049      0.08  |QV       |         |         |         |
    0+56       0.0051      0.08  |QV       |         |         |         |
    0+57       0.0052      0.08  |QV       |         |         |         |
    0+58       0.0053      0.08  |QV       |         |         |         |
    0+59       0.0054      0.08  |QV       |         |         |         |
    1+ 0       0.0055      0.08  |QV       |         |         |         |
    1+ 1       0.0056      0.08  |QV       |         |         |         |
    1+ 2       0.0057      0.08  |QV       |         |         |         |
    1+ 3       0.0058      0.08  |QV       |         |         |         |
    1+ 4       0.0059      0.08  |QV       |         |         |         |
    1+ 5       0.0060      0.08  |QV       |         |         |         |
    1+ 6       0.0061      0.08  |QV       |         |         |         |
    1+ 7       0.0063      0.08  |QV       |         |         |         |
    1+ 8       0.0064      0.08  |QV       |         |         |         |
    1+ 9       0.0065      0.08  |QV       |         |         |         |
    1+10       0.0066      0.08  |QV       |         |         |         |
    1+11       0.0067      0.08  |QV       |         |         |         |
    1+12       0.0068      0.08  |QV       |         |         |         |
    1+13       0.0069      0.08  |QV       |         |         |         |
    1+14       0.0070      0.08  |Q V      |         |         |         |
    1+15       0.0072      0.08  |Q V      |         |         |         |
    1+16       0.0073      0.08  |Q V      |         |         |         |
    1+17       0.0074      0.08  |Q V      |         |         |         |
    1+18       0.0075      0.08  |Q V      |         |         |         |
    1+19       0.0076      0.08  |Q V      |         |         |         |
    1+20       0.0077      0.08  |Q V      |         |         |         |
    1+21       0.0078      0.08  |Q V      |         |         |         |
    1+22       0.0080      0.09  |Q V      |         |         |         |
    1+23       0.0081      0.09  |Q V      |         |         |         |
    1+24       0.0082      0.09  |Q V      |         |         |         |
    1+25       0.0083      0.09  |Q V      |         |         |         |
    1+26       0.0084      0.09  |Q V      |         |         |         |
    1+27       0.0086      0.09  |Q V      |         |         |         |
    1+28       0.0087      0.09  |Q V      |         |         |         |
    1+29       0.0088      0.09  |Q V      |         |         |         |
    1+30       0.0089      0.09  |Q V      |         |         |         |
    1+31       0.0090      0.09  |Q V      |         |         |         |
    1+32       0.0092      0.09  | QV      |         |         |         |
    1+33       0.0093      0.09  | QV      |         |         |         |
    1+34       0.0094      0.09  | Q V     |         |         |         |
    1+35       0.0095      0.09  | Q V     |         |         |         |
```

```
   1+36       0.0097      0.09  | Q V     |         |         |         |
   1+37       0.0098      0.09  | Q V     |         |         |         |
   1+38       0.0099      0.09  | Q V     |         |         |         |
   1+39       0.0100      0.09  | Q V     |         |         |         |
   1+40       0.0102      0.09  | Q V     |         |         |         |
   1+41       0.0103      0.09  | Q V     |         |         |         |
   1+42       0.0104      0.09  | Q V     |         |         |         |
   1+43       0.0105      0.09  | Q V     |         |         |         |
   1+44       0.0107      0.09  | Q V     |         |         |         |
   1+45       0.0108      0.09  | Q V     |         |         |         |
   1+46       0.0109      0.09  | Q V     |         |         |         |
   1+47       0.0111      0.09  | Q V     |         |         |         |
   1+48       0.0112      0.09  | Q V     |         |         |         |
   1+49       0.0113      0.09  | Q V     |         |         |         |
   1+50       0.0114      0.09  | Q V     |         |         |         |
   1+51       0.0116      0.10  | Q V     |         |         |         |
   1+52       0.0117      0.10  | Q V     |         |         |         |
   1+53       0.0118      0.10  | Q  V    |         |         |         |
   1+54       0.0120      0.10  | Q  V    |         |         |         |
   1+55       0.0121      0.10  | Q  V    |         |         |         |
   1+56       0.0122      0.10  | Q  V    |         |         |         |
   1+57       0.0124      0.10  | Q  V    |         |         |         |
   1+58       0.0125      0.10  | Q  V    |         |         |         |
   1+59       0.0127      0.10  | Q  V    |         |         |         |
   2+ 0       0.0128      0.10  | Q  V    |         |         |         |
   2+ 1       0.0129      0.10  | Q  V    |         |         |         |
   2+ 2       0.0131      0.10  | Q  V    |         |         |         |
   2+ 3       0.0132      0.10  | Q  V    |         |         |         |
   2+ 4       0.0134      0.10  | Q  V    |         |         |         |
   2+ 5       0.0135      0.10  | Q  V    |         |         |         |
   2+ 6       0.0136      0.10  | Q  V    |         |         |         |
   2+ 7       0.0138      0.10  | Q  V    |         |         |         |
   2+ 8       0.0139      0.10  | Q  V    |         |         |         |
   2+ 9       0.0141      0.10  | Q   V   |         |         |         |
   2+10       0.0142      0.10  | Q   V   |         |         |         |
   2+11       0.0144      0.11  | Q   V   |         |         |         |
   2+12       0.0145      0.11  | Q   V   |         |         |         |
   2+13       0.0147      0.11  | Q   V   |         |         |         |
   2+14       0.0148      0.11  | Q   V   |         |         |         |
   2+15       0.0149      0.11  | Q   V   |         |         |         |
   2+16       0.0151      0.11  | Q   V   |         |         |         |
   2+17       0.0152      0.11  | Q   V   |         |         |         |
   2+18       0.0154      0.11  | Q   V   |         |         |         |
   2+19       0.0156      0.11  | Q   V   |         |         |         |
   2+20       0.0157      0.11  | Q   V   |         |         |         |
   2+21       0.0159      0.11  | Q   V   |         |         |         |
   2+22       0.0160      0.11  | Q   V   |         |         |         |
   2+23       0.0162      0.11  | Q   V   |         |         |         |
   2+24       0.0163      0.12  | Q   V   |         |         |         |
   2+25       0.0165      0.12  | Q    V  |         |         |         |
   2+26       0.0167      0.12  | Q    V  |         |         |         |
   2+27       0.0168      0.12  | Q    V  |         |         |         |
   2+28       0.0170      0.12  | Q    V  |         |         |         |
   2+29       0.0171      0.12  | Q    V  |         |         |         |
   2+30       0.0173      0.12  | Q    V  |         |         |         |
   2+31       0.0175      0.12  | Q    V  |         |         |         |
   2+32       0.0176      0.12  | Q    V  |         |         |         |
   2+33       0.0178      0.12  | Q    V  |         |         |         |
   2+34       0.0180      0.12  | Q    V  |         |         |         |
   2+35       0.0181      0.12  | Q    V  |         |         |         |
   2+36       0.0183      0.12  | Q    V  |         |         |         |
   2+37       0.0185      0.12  | Q    V  |         |         |         |
   2+38       0.0186      0.12  | Q    V  |         |         |         |
   2+39       0.0188      0.13  | Q     V |         |         |         |
   2+40       0.0190      0.13  | Q     V |         |         |         |
   2+41       0.0192      0.13  | Q     V |         |         |         |
```

```
   2+42       0.0193      0.13  | Q     V |         |         |         |
   2+43       0.0195      0.13  | Q     V |         |         |         |
   2+44       0.0197      0.13  |  Q    V |         |         |         |
   2+45       0.0199      0.13  |  Q    V |         |         |         |
   2+46       0.0201      0.13  |  Q    V |         |         |         |
   2+47       0.0203      0.13  |  Q    V |         |         |         |
   2+48       0.0204      0.14  |  Q    V |         |         |         |
   2+49       0.0206      0.14  |  Q    V |         |         |         |
   2+50       0.0208      0.14  |  Q    V |         |         |         |
   2+51       0.0210      0.14  |  Q    V |         |         |         |
   2+52       0.0212      0.14  |  Q     V|         |         |         |
   2+53       0.0214      0.14  |  Q     V|         |         |         |
   2+54       0.0216      0.14  |  Q     V|         |         |         |
   2+55       0.0218      0.14  |  Q     V|         |         |         |
   2+56       0.0220      0.14  |  Q     V|         |         |         |
   2+57       0.0222      0.14  |  Q     V|         |         |         |
   2+58       0.0224      0.14  |  Q     V|         |         |         |
   2+59       0.0226      0.15  |  Q     V|         |         |         |
   3+ 0       0.0228      0.15  |  Q     V|         |         |         |
   3+ 1       0.0230      0.15  |  Q     V|         |         |         |
   3+ 2       0.0232      0.15  |  Q     V|         |         |         |
   3+ 3       0.0234      0.15  |  Q     V|         |         |         |
   3+ 4       0.0236      0.16  |  Q      V         |         |         |
   3+ 5       0.0238      0.16  |  Q      V         |         |         |
   3+ 6       0.0241      0.16  |  Q      V         |         |         |
   3+ 7       0.0243      0.16  |  Q      V         |         |         |
   3+ 8       0.0245      0.16  |  Q      V         |         |         |
   3+ 9       0.0247      0.16  |  Q      V         |         |         |
   3+10       0.0250      0.17  |  Q      V         |         |         |
   3+11       0.0252      0.17  |  Q      V         |         |         |
   3+12       0.0254      0.17  |  Q      V         |         |         |
   3+13       0.0257      0.17  |  Q      V         |         |         |
   3+14       0.0259      0.17  |  Q      |V        |         |         |
   3+15       0.0261      0.17  |  Q      |V        |         |         |
   3+16       0.0264      0.17  |  Q      |V        |         |         |
   3+17       0.0266      0.17  |  Q      |V        |         |         |
   3+18       0.0268      0.18  |  Q      |V        |         |         |
   3+19       0.0271      0.18  |   Q     |V        |         |         |
   3+20       0.0273      0.18  |   Q     |V        |         |         |
   3+21       0.0276      0.19  |   Q     |V        |         |         |
   3+22       0.0279      0.19  |   Q     |V        |         |         |
   3+23       0.0281      0.19  |   Q     | V       |         |         |
   3+24       0.0284      0.20  |   Q     | V       |         |         |
   3+25       0.0287      0.20  |   Q     | V       |         |         |
   3+26       0.0290      0.20  |   Q     | V       |         |         |
   3+27       0.0292      0.21  |   Q     | V       |         |         |
   3+28       0.0295      0.21  |   Q     | V       |         |         |
   3+29       0.0298      0.21  |   Q     | V       |         |         |
   3+30       0.0301      0.22  |   Q     | V       |         |         |
   3+31       0.0304      0.22  |    Q    | V       |         |         |
   3+32       0.0307      0.22  |    Q    |  V      |         |         |
   3+33       0.0310      0.23  |    Q    |  V      |         |         |
   3+34       0.0314      0.23  |    Q    |  V      |         |         |
   3+35       0.0317      0.23  |    Q    |  V      |         |         |
   3+36       0.0320      0.23  |    Q    |  V      |         |         |
   3+37       0.0323      0.24  |    Q    |  V      |         |         |
   3+38       0.0327      0.24  |    Q    |  V      |         |         |
   3+39       0.0330      0.24  |    Q    |   V     |         |         |
   3+40       0.0333      0.24  |    Q    |   V     |         |         |
   3+41       0.0337      0.25  |    Q    |   V     |         |         |
   3+42       0.0340      0.27  |     Q   |   V     |         |         |
   3+43       0.0344      0.28  |     Q   |   V     |         |         |
   3+44       0.0348      0.29  |     Q   |   V     |         |         |
   3+45       0.0352      0.30  |     Q   |    V    |         |         |
   3+46       0.0356      0.31  |     Q   |    V    |         |         |
   3+47       0.0361      0.32  |      Q  |    V    |         |         |
```



```
    4+54        0.0848      0.13  |  Q       |          |          |      V   |
    4+55        0.0850      0.13  | Q        |          |          |      V   |
    4+56        0.0852      0.13  | Q        |          |          |      V   |
    4+57        0.0854      0.13  | Q        |          |          |      V   |
    4+58        0.0855      0.12  | Q        |          |          |      V   |
    4+59        0.0857      0.12  | Q        |          |          |      V   |
    5+ 0        0.0859      0.12  | Q        |          |          |      V   |
    5+ 1        0.0860      0.12  | Q        |          |          |      V   |
    5+ 2        0.0862      0.12  | Q        |          |          |      V   |
    5+ 3        0.0864      0.12  | Q        |          |          |      V   |
    5+ 4        0.0865      0.12  | Q        |          |          |      V   |
    5+ 5        0.0867      0.11  | Q        |          |          |       V  |
    5+ 6        0.0868      0.11  | Q        |          |          |       V  |
    5+ 7        0.0870      0.11  | Q        |          |          |       V  |
    5+ 8        0.0871      0.11  | Q        |          |          |       V  |
    5+ 9        0.0873      0.11  | Q        |          |          |       V  |
    5+10        0.0874      0.11  | Q        |          |          |       V  |
    5+11        0.0876      0.11  | Q        |          |          |       V  |
    5+12        0.0877      0.11  | Q        |          |          |       V  |
    5+13        0.0879      0.10  | Q        |          |          |       V  |
    5+14        0.0880      0.10  | Q        |          |          |       V  |
    5+15        0.0881      0.10  | Q        |          |          |       V  |
    5+16        0.0883      0.10  | Q        |          |          |       V  |
    5+17        0.0884      0.10  | Q        |          |          |       V  |
    5+18        0.0886      0.10  | Q        |          |          |       V  |
    5+19        0.0887      0.10  | Q        |          |          |       V  |
    5+20        0.0888      0.10  | Q        |          |          |       V  |
    5+21        0.0890      0.10  | Q        |          |          |       V  |
    5+22        0.0891      0.10  | Q        |          |          |        V |
    5+23        0.0892      0.09  | Q        |          |          |        V |
    5+24        0.0894      0.09  | Q        |          |          |        V |
    5+25        0.0895      0.09  | Q        |          |          |        V |
    5+26        0.0896      0.09  | Q        |          |          |        V |
    5+27        0.0897      0.09  | Q        |          |          |        V |
    5+28        0.0899      0.09  | Q        |          |          |        V |
    5+29        0.0900      0.09  | Q        |          |          |        V |
    5+30        0.0901      0.09  | Q        |          |          |        V |
    5+31        0.0902      0.09  | Q        |          |          |        V |
    5+32        0.0903      0.09  |Q         |          |          |        V |
    5+33        0.0905      0.09  |Q         |          |          |        V |
    5+34        0.0906      0.09  |Q         |          |          |        V |
    5+35        0.0907      0.09  |Q         |          |          |        V |
    5+36        0.0908      0.08  |Q         |          |          |        V |
    5+37        0.0909      0.08  |Q         |          |          |        V |
    5+38        0.0911      0.08  |Q         |          |          |        V |
    5+39        0.0912      0.08  |Q         |          |          |        V |
    5+40        0.0913      0.08  |Q         |          |          |        V |
    5+41        0.0914      0.08  |Q         |          |          |         V|
    5+42        0.0915      0.08  |Q         |          |          |         V|
    5+43        0.0916      0.08  |Q         |          |          |         V|
    5+44        0.0917      0.08  |Q         |          |          |         V|
    5+45        0.0918      0.08  |Q         |          |          |         V|
    5+46        0.0919      0.08  |Q         |          |          |         V|
    5+47        0.0921      0.08  |Q         |          |          |         V|
    5+48        0.0922      0.08  |Q         |          |          |         V|
    5+49        0.0923      0.08  |Q         |          |          |         V|
    5+50        0.0924      0.08  |Q         |          |          |         V|
    5+51        0.0925      0.08  |Q         |          |          |         V|
    5+52        0.0926      0.08  |Q         |          |          |         V|
    5+53        0.0927      0.08  |Q         |          |          |         V|
    5+54        0.0928      0.07  |Q         |          |          |         V|
    5+55        0.0929      0.07  |Q         |          |          |         V|
    5+56        0.0930      0.07  |Q         |          |          |         V|
    5+57        0.0931      0.07  |Q         |          |          |         V|
    5+58        0.0932      0.07  |Q         |          |          |         V|
    5+59        0.0933      0.07  |Q         |          |          |         V|
```

```
    6+ 0       0.0934      0.07  |Q        |         |         |        V|
    6+ 1       0.0935      0.07  |Q        |         |         |        V|
    6+ 2       0.0936      0.07  |Q        |         |         |        V|
    6+ 3       0.0937      0.07  |Q        |         |         |         V
-------------------------------------------------------------------------


    End of computations, total study area =           1.089 (Ac.)
```

POC 4
POST-DEVELOPMENT

```
        San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2019 Version 9.1

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
    Rational Hydrology Study        Date: 03/16/21
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--------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

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


Program License Serial Number 6332

--------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.200
P6/P24 =    57.7%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1801.000 to Point/Station     1802.000
**** INITIAL AREA EVALUATION ****
____________________________________________________________________________
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
[MEDIUM DENSITY RESIDENTIAL                 ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Initial subarea total flow distance  =   70.000(Ft.)
Highest elevation =  494.950(Ft.)
Lowest elevation =  489.000(Ft.)
Elevation difference =    5.950(Ft.) Slope =  8.500 %
Top of Initial Area Slope adjusted by User to  8.000 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.00 %, in a development type of
 4.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.22 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5200)*( 100.000^.5)/(   8.000^(1/3)]=   5.22
Rainfall intensity (I) =      7.688(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.520
Subarea runoff =      0.240(CFS)
Total initial stream area =        0.060(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1802.000 to Point/Station     1803.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
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```
Top of street segment elevation =   489.000(Ft.)
End of street segment elevation =   478.200(Ft.)
Length of street segment  =   137.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  12.000(Ft.)
Distance from crown to crossfall grade break  =  10.500(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 [2] 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 =   1.500(Ft.)
Gutter hike from flowline =  0.125(In.)
 Manning's N in gutter =  0.0130
 Manning's N from gutter to grade break =  0.0130
 Manning's N from grade break to crown =  0.0130
Estimated mean flow rate at midpoint of street =      0.879(CFS)
Depth of flow =   0.057(Ft.), Average velocity =   3.356(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.817(Ft.)
Flow velocity =   3.36(Ft/s)
Travel time =    0.68 min.     TC =    5.90  min.
 Adding area flow to street
Rainfall intensity (I) =      7.104(In/Hr) for a   100.0 year storm
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
[MEDIUM DENSITY RESIDENTIAL                  ]
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.520
Rainfall intensity =      7.104(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.520  CA =      0.239
Subarea runoff =      1.459(CFS) for      0.400(Ac.)
Total runoff =      1.699(CFS)  Total area =       0.460(Ac.)
Street flow at end of street =      1.699(CFS)
Half street flow at end of street =      0.850(CFS)
Depth of flow =   0.076(Ft.), Average velocity =   3.994(Ft/s)
Flow width (from curb towards crown)=   4.769(Ft.)


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Process from Point/Station     1803.000 to Point/Station     1804.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   476.372(Ft.)
Downstream point/station elevation =   475.500(Ft.)
Pipe length  =    44.00(Ft.) Slope =   0.0198  Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     1.699(CFS)
Given pipe size =     12.00(In.)
Calculated individual pipe flow  =     1.699(CFS)
Normal flow depth in pipe =    4.61(In.)
Flow top width inside pipe =   11.67(In.)
Critical Depth =    6.65(In.)
Pipe flow velocity =      6.12(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =     6.02 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1803.000 to Point/Station     1804.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------------
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Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.460(Ac.)
Runoff from this stream =      1.699(CFS)
Time of concentration =    6.02 min.
Rainfall intensity =     7.012(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2101.000 to Point/Station     2102.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Initial subarea total flow distance  =  145.000(Ft.)
Highest elevation =  497.300(Ft.)
Lowest elevation =  493.740(Ft.)
Elevation difference =    3.560(Ft.) Slope =  2.455 %
Top of Initial Area Slope adjusted by User to  0.150 %
Bottom of Initial Area Slope adjusted by User to  0.150 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.15 %, in a development type of
 Permanent Open Space
In Accordance With Figure 3-3
Initial Area Time of Concentration =  17.97 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3500)*(  50.000^.5)/(   0.150^(1/3)]=  17.97
The initial area total distance of  145.00 (Ft.) entered leaves a
remaining distance of   95.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.18 minutes
for a distance of  95.00 (Ft.) and a slope of  0.15 %
with an elevation difference of   0.14(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.182 Minutes
Tt=[(11.9*0.0180^3)/(  0.14)]^.385=  3.18
Total initial area Ti =  17.97 minutes from Figure 3-3 formula plus
  3.18 minutes from the Figure 3-4 formula =  21.15 minutes
Rainfall intensity (I) =      3.118(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.350
Subarea runoff =      0.073(CFS)
Total initial stream area =        0.067(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2102.000 to Point/Station     2103.000
**** IMPROVED CHANNEL TRAVEL TIME ****
----------------------------------------------------------------------
Upstream point elevation =   493.740(Ft.)
Downstream point elevation =   490.000(Ft.)
Channel length thru subarea  =    67.000(Ft.)
Channel base width  =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =      0.098(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.098(CFS)
Depth of flow =   0.057(Ft.), Average velocity =   3.087(Ft/s)
Channel flow top width =    0.614(Ft.)
Flow Velocity =    3.09(Ft/s)
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```
Travel time  =    0.36 min.
Time of concentration =   21.51 min.
Critical depth =      0.099(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.084(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Rainfall intensity =      3.084(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.039
Subarea runoff =      0.048(CFS) for      0.045(Ac.)
Total runoff =      0.121(CFS)  Total area =       0.112(Ac.)
Depth of flow =   0.065(Ft.), Average velocity =   3.318(Ft/s)
Critical depth =      0.113(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2103.000 to Point/Station     1804.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   490.000(Ft.)
Downstream point elevation =   477.090(Ft.)
Channel length thru subarea  =   247.000(Ft.)
Channel base width  =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.000
Slope or 'Z' of right channel bank =   1.000
Manning's 'N'    = 0.150
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      0.121(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   0.652(Ft/s)
Channel flow top width =    0.996(Ft.)
Flow Velocity =    0.65(Ft/s)
Travel time  =    6.32 min.
Time of concentration =   27.83 min.
Critical depth =      0.113(Ft.)


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Process from Point/Station     1804.000 to Point/Station     1804.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________________
Rainfall intensity (I) =      2.612(In/Hr) for a   100.0 year storm
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
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.350
Time of concentration =    27.83 min.
Rainfall intensity =      2.612(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =      0.092
Subarea runoff =      0.119(CFS) for      0.150(Ac.)
Total runoff =      0.240(CFS)  Total area =       0.262(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     2103.000 to Point/Station     1804.000
```

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

____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.262(Ac.)
Runoff from this stream =      0.240(CFS)
Time of concentration =   27.83 min.
Rainfall intensity =     2.612(In/Hr)
Summary of stream data:

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


1        1.699      6.02             7.012
2        0.240     27.83             2.612
Qmax(1) =
       1.000 *    1.000 *     1.699) +
       1.000 *    0.216 *     0.240) + =       1.751
Qmax(2) =
       0.373 *    1.000 *     1.699) +
       1.000 *    1.000 *     0.240) + =       0.873

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.699       0.240
Maximum flow rates at confluence using above data:
        1.751        0.873
Area of streams before confluence:
        0.460        0.262
Results of confluence:
Total flow rate =      1.751(CFS)
Time of concentration =     6.020 min.
Effective stream area after confluence =      0.722(Ac.)
End of computations, total study area =          0.722 (Ac.)
```

End of Report