

Hydrology Report

Mercado Apartments

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San Diego, CA, 92113

Prepared for:

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January 23, 2023

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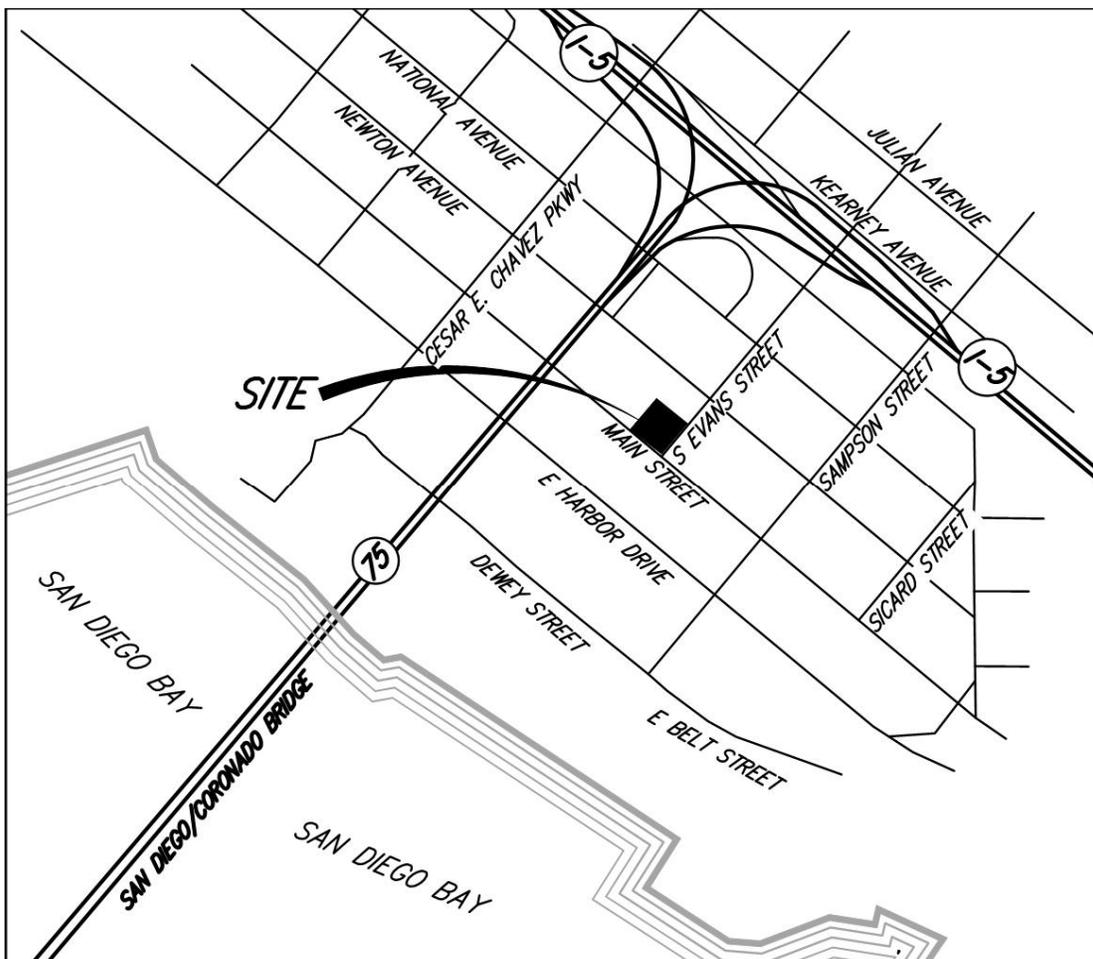
1.0 Project Description

1.1 Project Purpose

This project proposes to remove the existing apartment complex and build new apartments with a center courtyard, a play yard and amenities.

1.2 Project Location and Vicinity Map

This project is located in the City of San Diego near the I-75 and I-5 interchange at the intersection of Main Street and South Evans Street.



2.0 Description of Watershed

2.1 Pre-Development and Existing Conditions

The existing site consists primarily of apartment buildings and a parking lot. The parking lot slopes generally to the southwest between 0.5% and 2%. Flows from the parking lot either go to a southerly D-25 that outlets water to the street or enter a storm drain system that outlets at another D-25 at the west corner of the project. Offsite street flows follow the gutter flow line and all water from the site confluences at one main POC at the west corner of the site.

2.2 Post-Development Conditions

The proposed site consists of apartment buildings, a center plaza and various landscaped areas around the project. Water from the roof is captured with roof drains and is conveyed by either area drains or sheet flow to one of 4 biofiltration basins. All other water that falls on the site will be routed to the biofiltration basins through area drains or sheet flow as well. Water in the biofiltration basin flows through the basin's media, and when water exceeds the basin capacity it overtops a catch basin where it is piped to one of three outlets that lead to the street. From here, all three of the outlets flow along the existing gutter and confluence at the POC at the west corner of the site.

2.3 Hydrologic Unit Contribution

This Project lies within the San Diego Bay Watershed of the San Diego Mesa Hydrologic Unit (908.2).

3.0 Methodology

3.1 Hydrology Software

The main program is the “San Diego County Rational Hydrology Program” by CIVILCADD/CIVILDESIGN Engineering Software, 1991-2004 Version 7.4, referred 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.

3.2 Routing Software

AutoCad 2015 Hydraflow Hydrograph extension is used in this step to allow the proposed water quality treatment ponds to be used as flow control facilities. The hydrograph developed from the rational method is then manually entered into this software and routed into a detention pond.

3.3 Soils Type Determination

See appendix E for more the Soil Group determination map information. The area on and around this site does not have a soil type classification because of its urban status. Because of this, a soil type “D” was used because it is the most common soil type found closest to the site.

3.4 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.

4.0 Calculations

4.1 Determine Project Watershed

To determine if the proposed project will have a negative impact of the downstream facilities, the proposed site design must ensure that the peak flow from the 100-year storm are equal to or less than the existing peak flow conditions.

4.2 Calculate Runoff Coefficient

The proposed project and offsite runoff area is believed to be primarily within hydraulic soil group D.

To determine the runoff coefficient “C” for this study, Table 3-1 of the San Diego Hydrology Manual is utilized. The percent impervious for each area and a soil type D was used to calculate the “C” value for each node in both the existing and the proposed conditions.

For the proposed condition, the “C” value for the buildings and middle courtyard was calculated using the maximum impervious percentage in the table of 95% and a soil type D. For the rest of the site, the percent impervious for the non-roof areas was calculated and the appropriate “C” value using the percent impervious and soil type D was used. Please refer to the calculations in Appendix D and Table 3-1 in the San Diego Hydrology manual for the runoff coefficient used for each node.

4.3 Calculate Storm Flows Using the Rational Method

The Rational Method (RM) is used to determine the maximum runoff rate from the 100-year storm event. The RM application is highly effective in urban and rural watersheds for the design of storm drains and small drainage structures. Application of the rational method is based on a simple formula that relates runoff producing potential of the watershed drainage area (A), runoff coefficient (C) rainfall intensity (I) for a particular length of time (T_c), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. Thus the following equation is used:

$$Q = CIA$$

Where:

Q	=	peak discharge, in cubic feet per second (cfs)
C	=	runoff coefficient
I	=	average rainfall intensity for a duration equal to T_c
T_c	=	time of concentration (note: if the computed T_c is less than 5 minutes, then use 5 minutes for computing the peak discharge, Q)
A	=	Drainage area contributing to the design location, in acres

A summary table of the pre- and post- development flows at the POC is shown below. Since all post-development flows are less than the pre-development flows, the site will not have a negative impact on the downstream facilities.

100 Year Runoff Flows	
Pre-Development	7.661 CFS
Post-Development	5.700 CFS

5.0 Other Studies

5.1 Storm Water Quality Management Plan (SWQMP)

Please see the Storm Water Quality Management Plan that was submitted with the Precise Grading Plan and Report.

6.0 Summary/Conclusion

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, 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 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 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.

Because the project is not located within or discharges to navigable waters, water of the United States, or federal jurisdictional wetlands, as defined by the Clean Water Act, no 401/404 permit is required.

The analysis of the 100-year storm event shows that this project will effectively convey the resulting runoff in the mitigated condition.

7.0 References

County of San Diego, Department of Public Works, Flood Control Section, June 2003 San Diego County Hydrology Manual

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

ENGINEER OF WORK

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

Project Number: 21061

Robert D. Dentino, RCE 45629
Registration Expires: December 31, 2024

Date

9.0 Attachments

Attachment A – Pre & Post Development Hydrology Maps

Attachment B - Figures and Tables from the SD Hydrology Manual 2003

Attachment C - Watershed Information

Watershed Map, Soils Index Map, Rainfall Isopluvial Maps

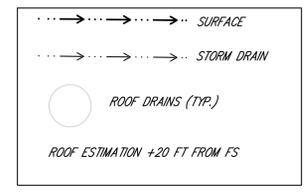
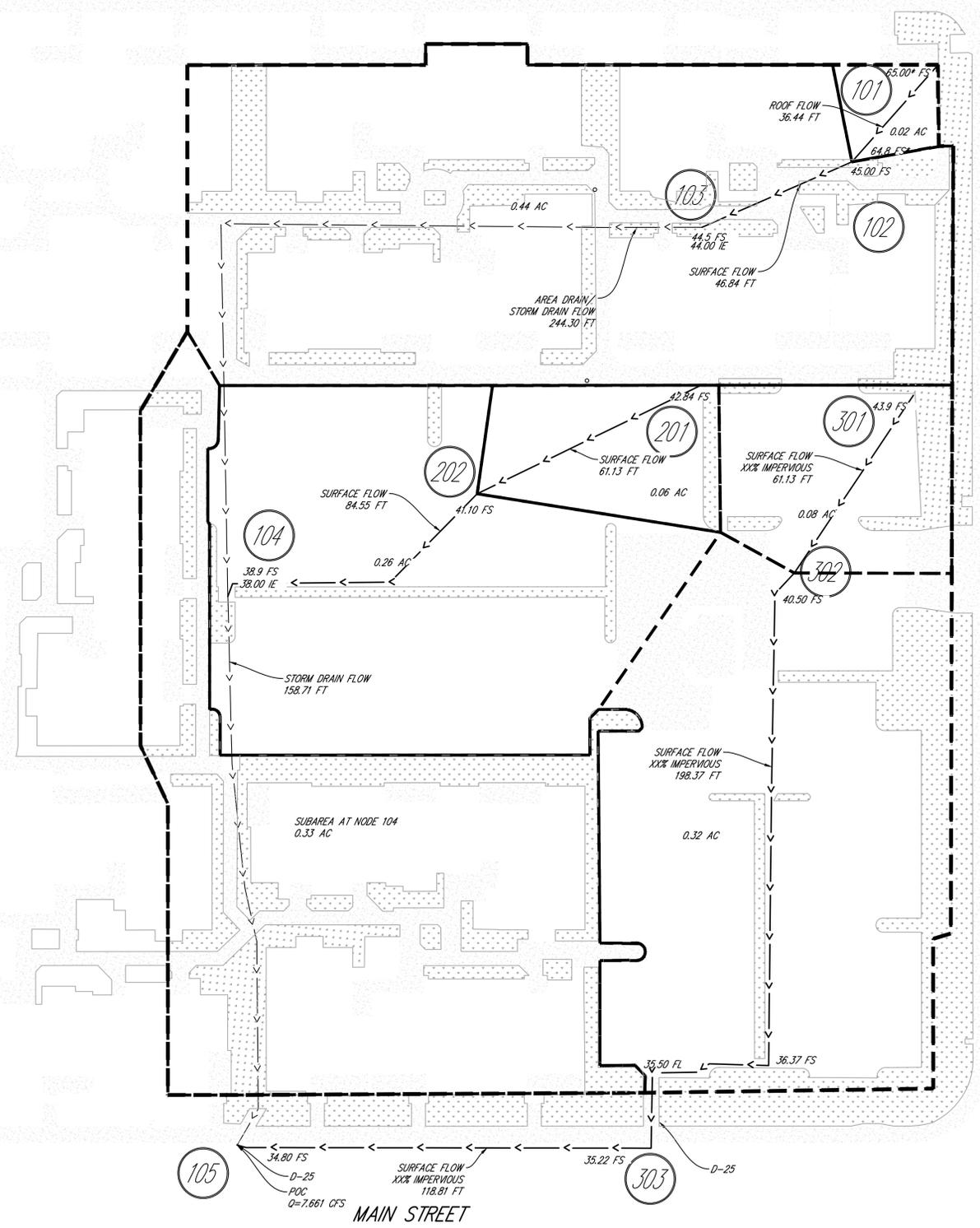
Attachment D - Rational Method Runoff Calculations

Attachment E – Soils Group Determination

End of Report

Attachment A – Pre & Post Development Hydrology Maps

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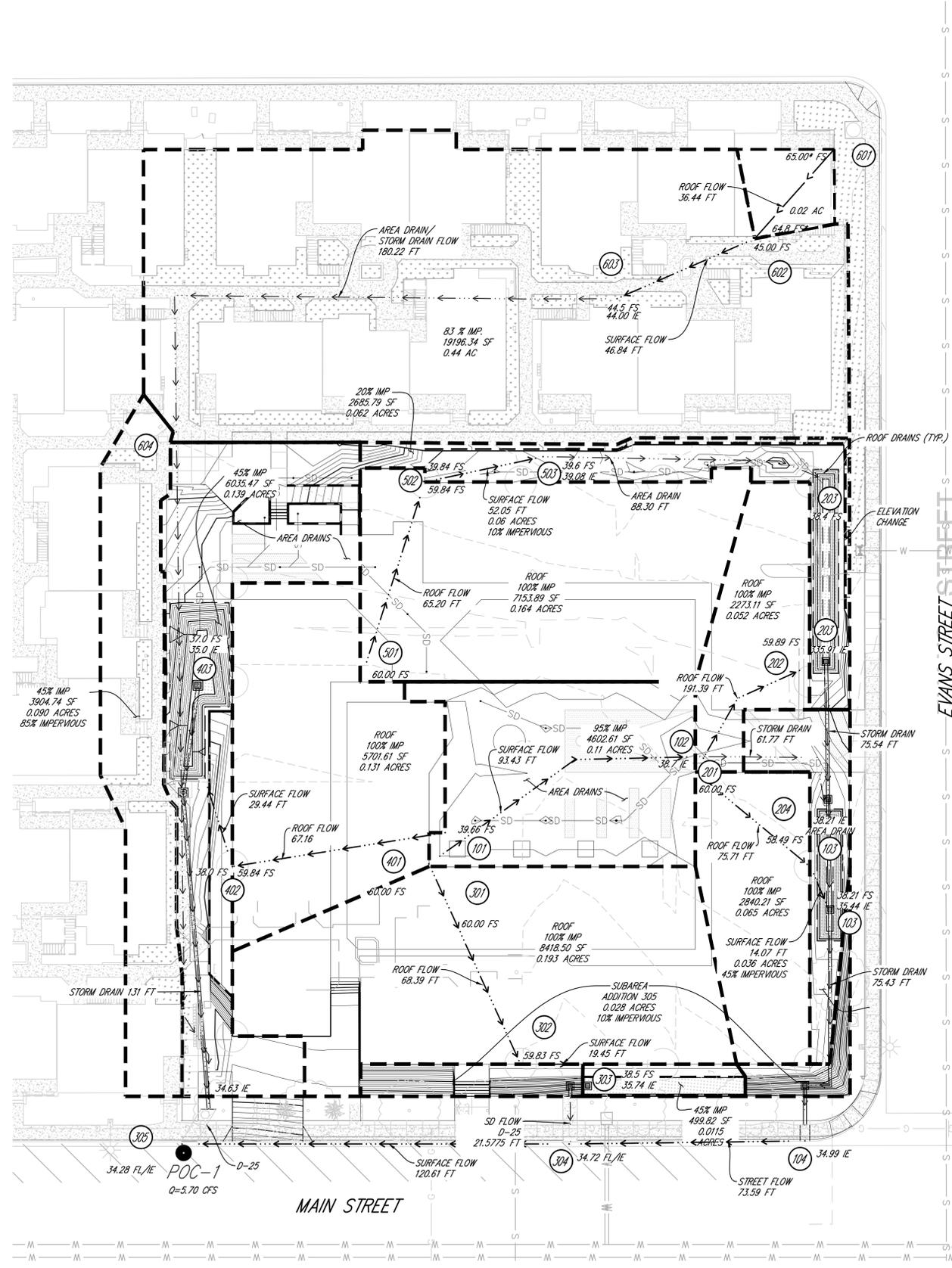


EVANS STREET



PRE-DEVELOPMENT
EXHIBIT
MERCADO

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- - - - - SURFACE
 - - - - - STORM DRAIN
 ○ ROOF DRAINS (TYP.)
 ROOF ESTIMATION +20 FT FROM FS
 P6 = 2.5"
 P24 = 4.0"

EVANS STREETS STREET

ALLEY

MAIN STREET



SCALE 1"=20'

POST-DEVELOPMENT EXHIBIT MERCADO

Attachment B - Figures and Tables from the SD Hydrology Manual 2003

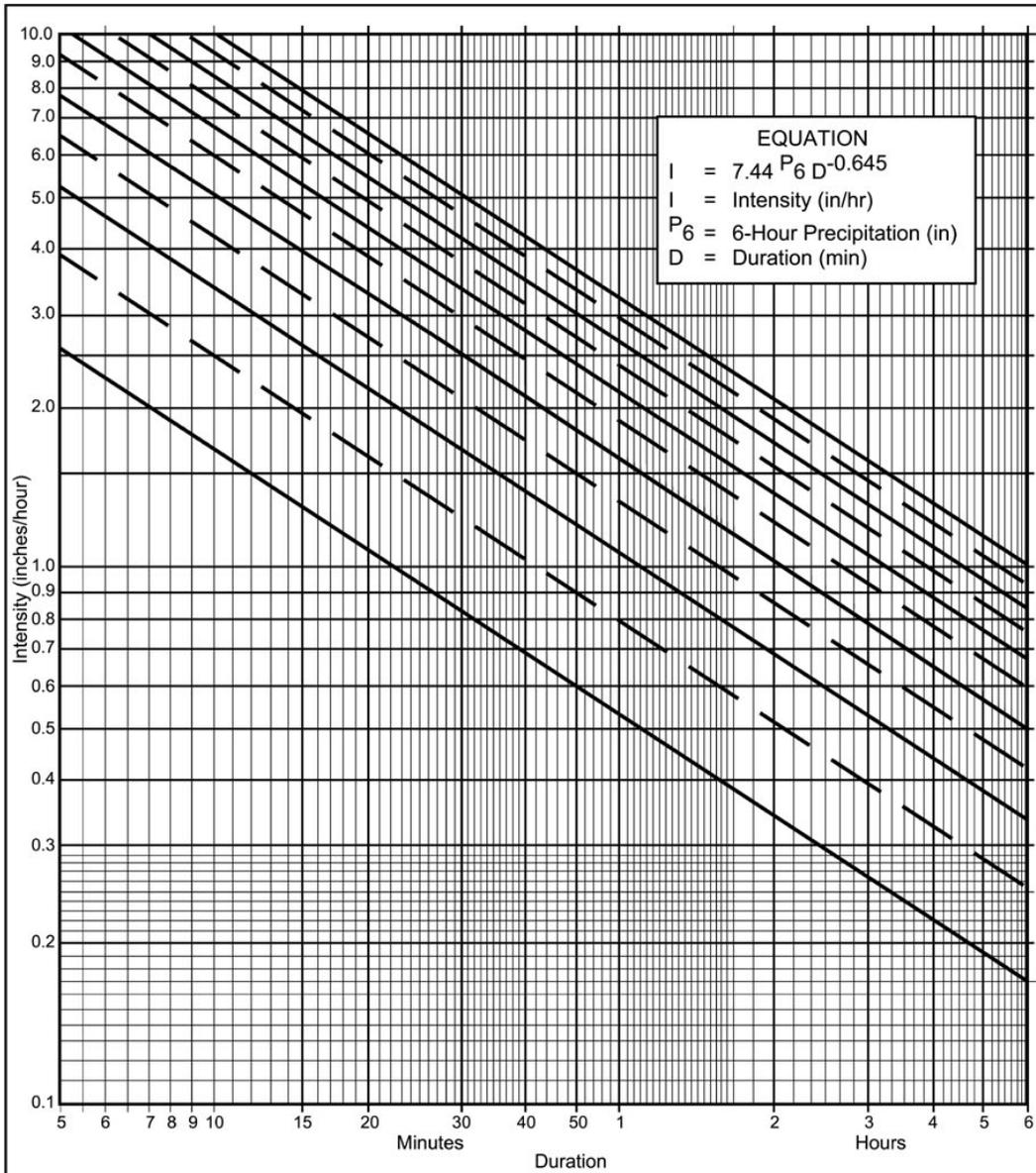
**Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use		Runoff Coefficient "C"				
		% IMPER.	Soil Type			
NRCS Elements	County Elements			A	B	C
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



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 applicable 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											
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

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

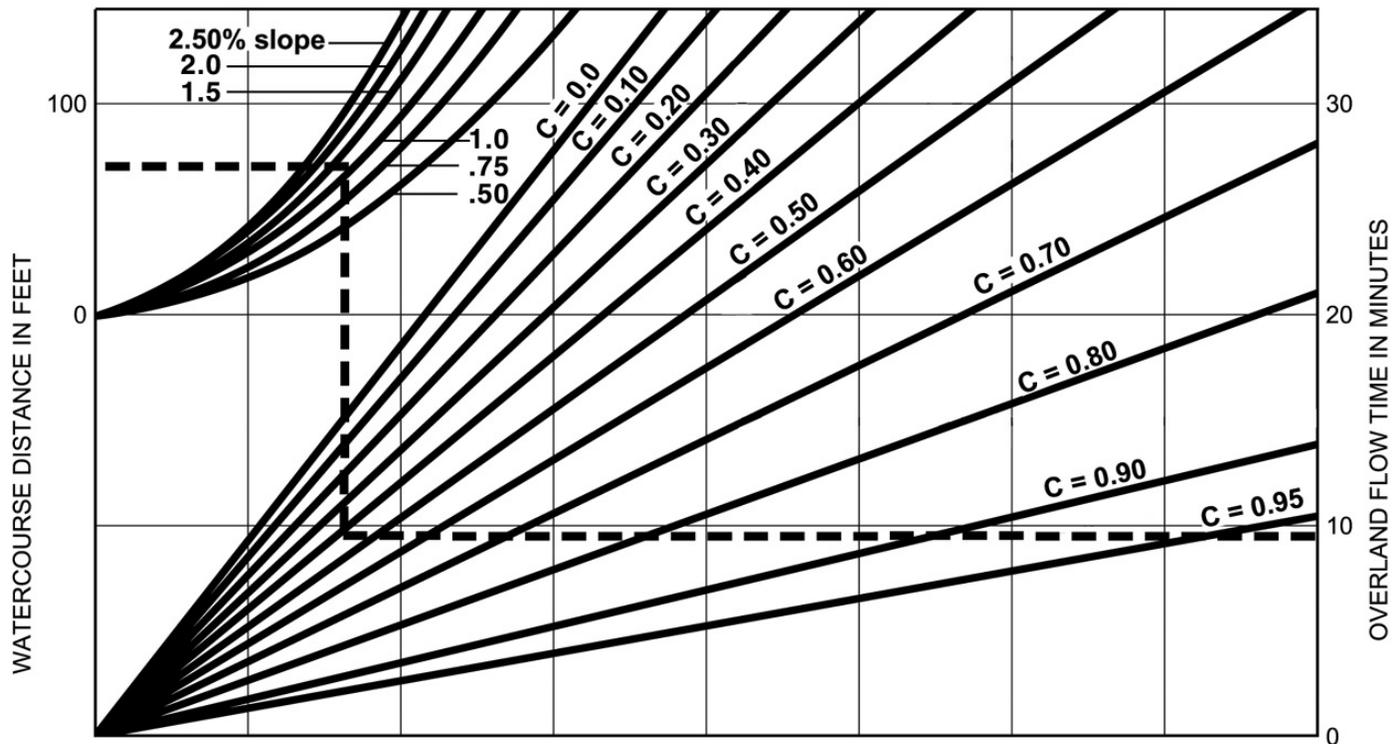
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the “Regulating Agency” when submitted with a detailed study.

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										
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



EXAMPLE:

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

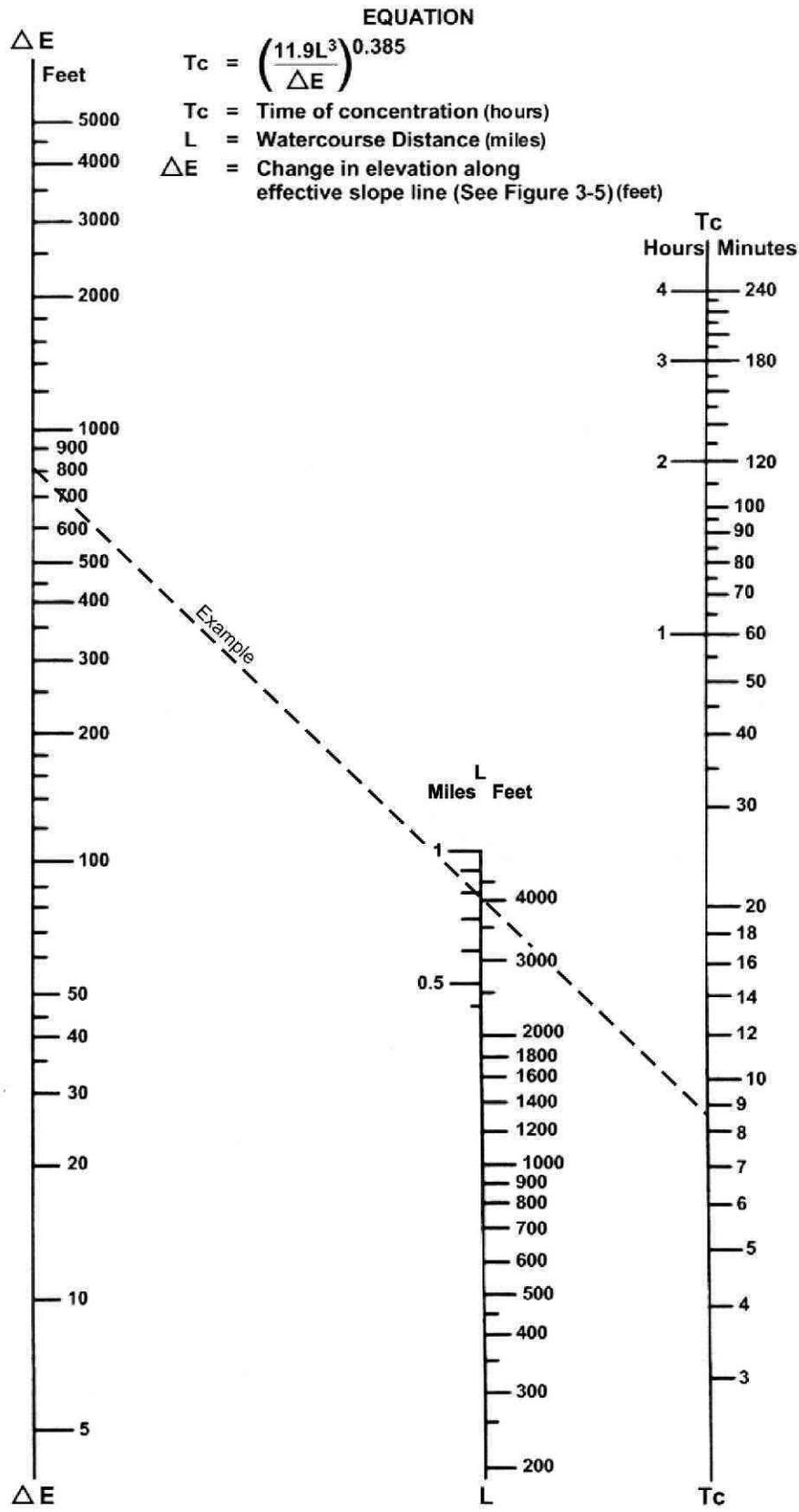
$$T = \frac{1.8 (1.1-C) \sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

F I G U R E



Rational Formula - Overland Time of Flow Nomograph

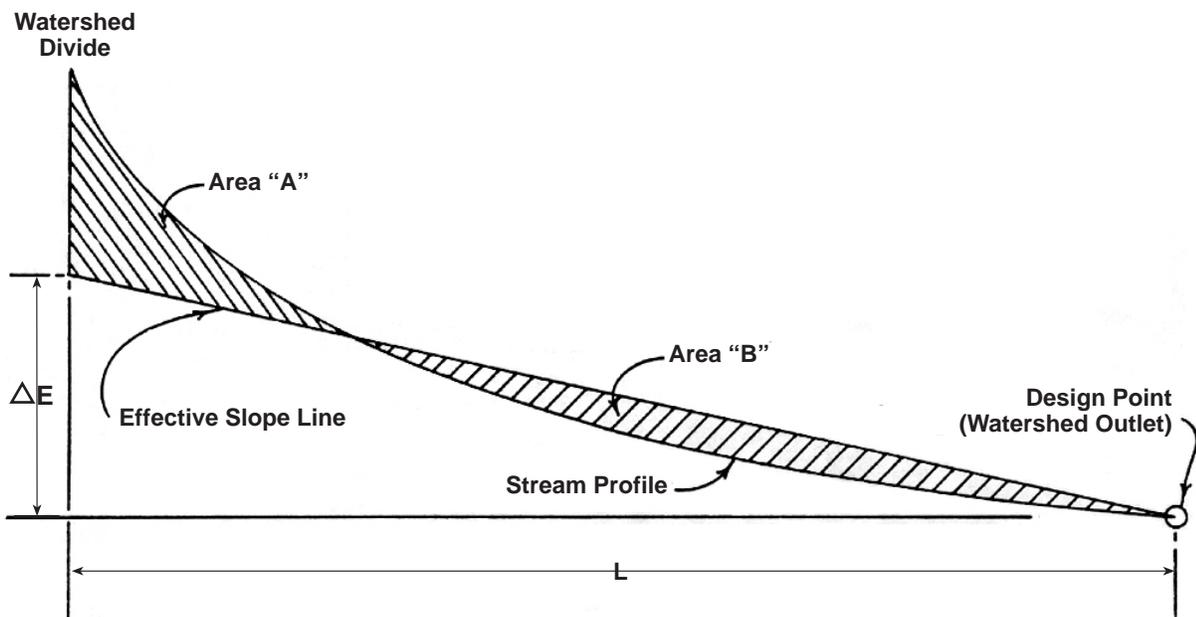
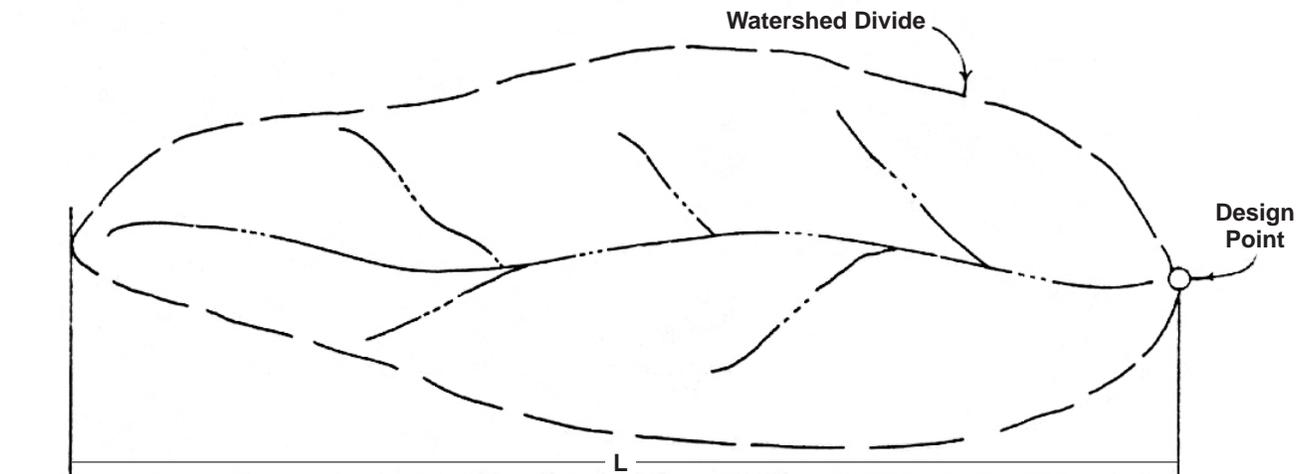


SOURCE: California Division of Highways (1941) and Kirpich (1940)

**Nomograph for Determination of
Time of Concentration (T_c) or Travel Time (T_t) for Natural Watersheds**

F I G U R E

3-4



Area "A" = Area "B"

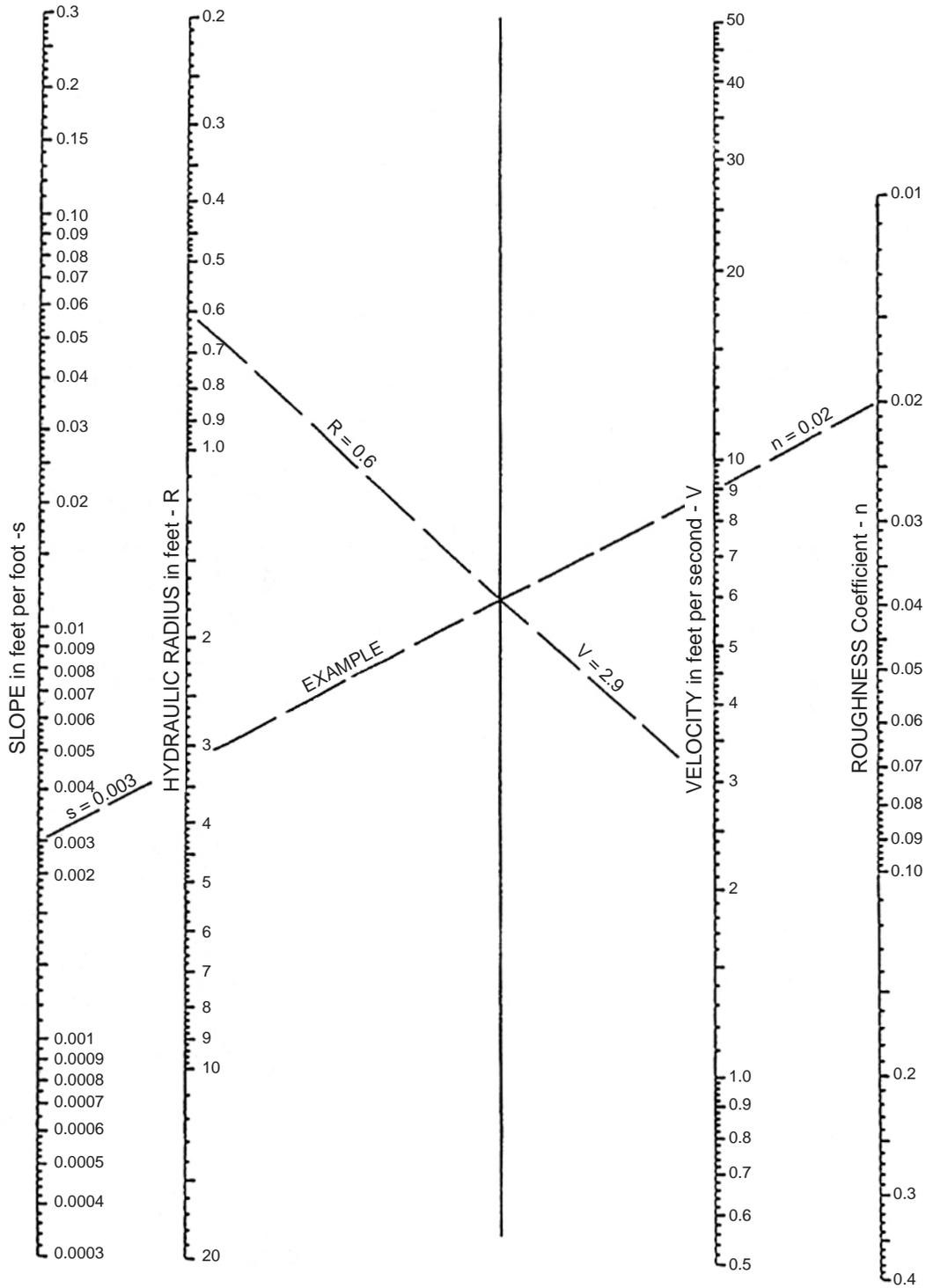
SOURCE: California Division of Highways (1941) and Kirpich (1940)

FIGURE

3-5

Computation of Effective Slope for Natural Watersheds

EQUATION: $V = \frac{1.49}{n} R^{2/3} s^{1/2}$



SOURCE: USDOT, FHWA, HDS-3 (1961)

Manning's Equation Nomograph

FIGURE

3-7

Attachment C - Watershed Information

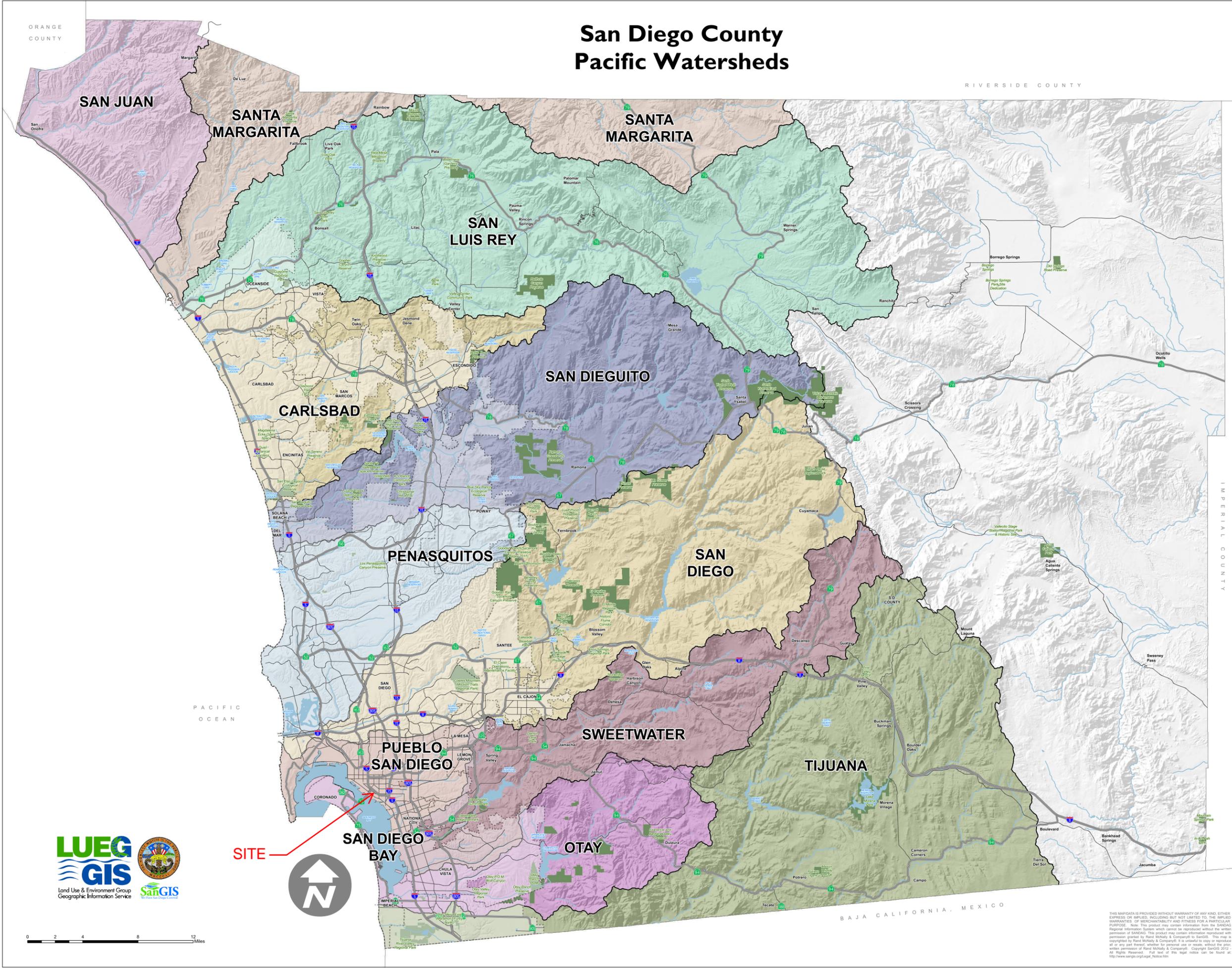
Watershed Map, Soils Index Map, Rainfall Isopluvial Maps

San Diego County Pacific Watersheds

ORANGE COUNTY

RIVERSIDE COUNTY

IMPERIAL COUNTY



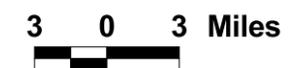
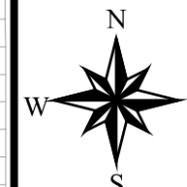
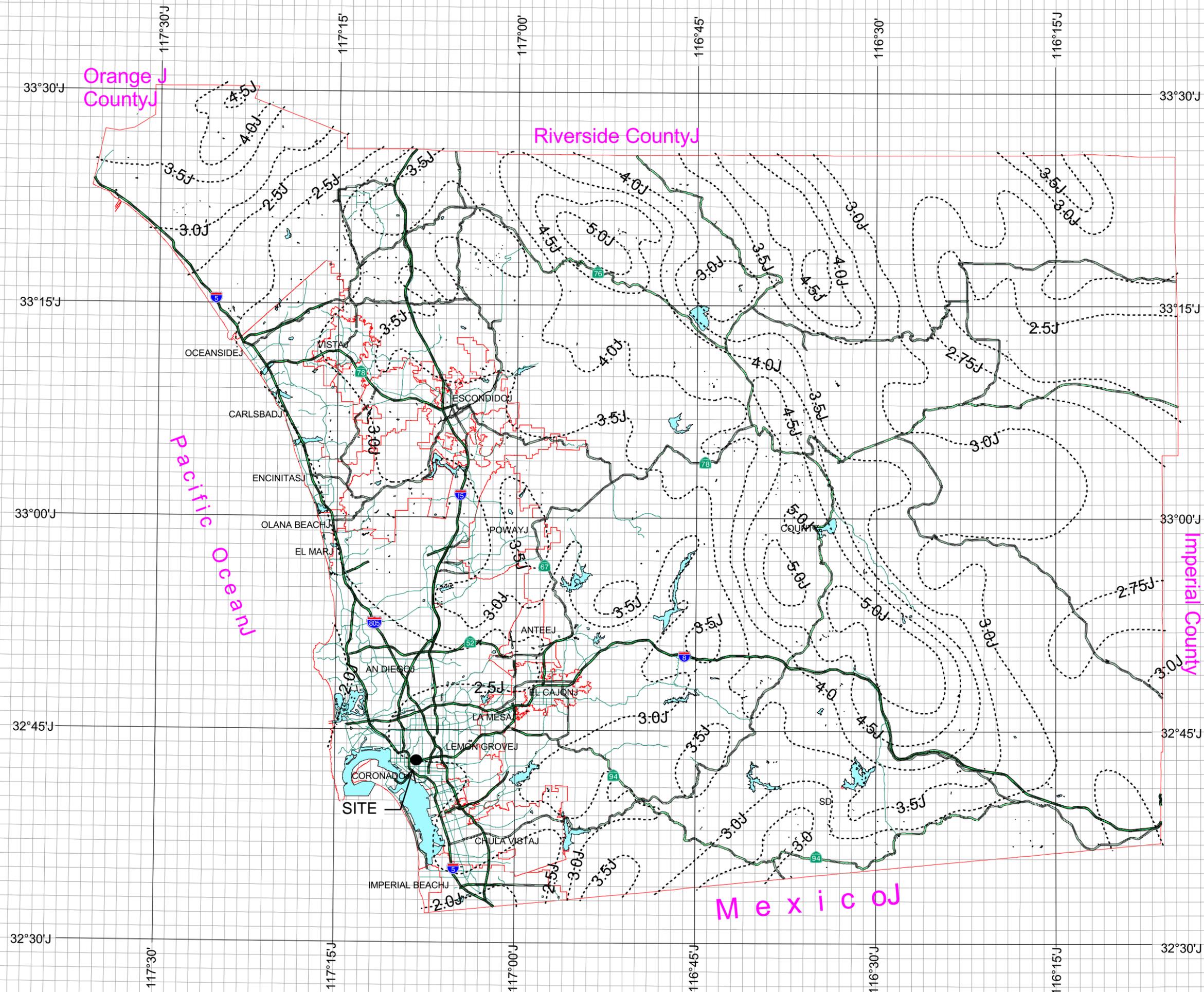
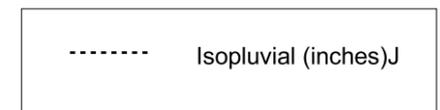
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County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours



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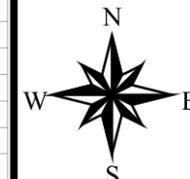
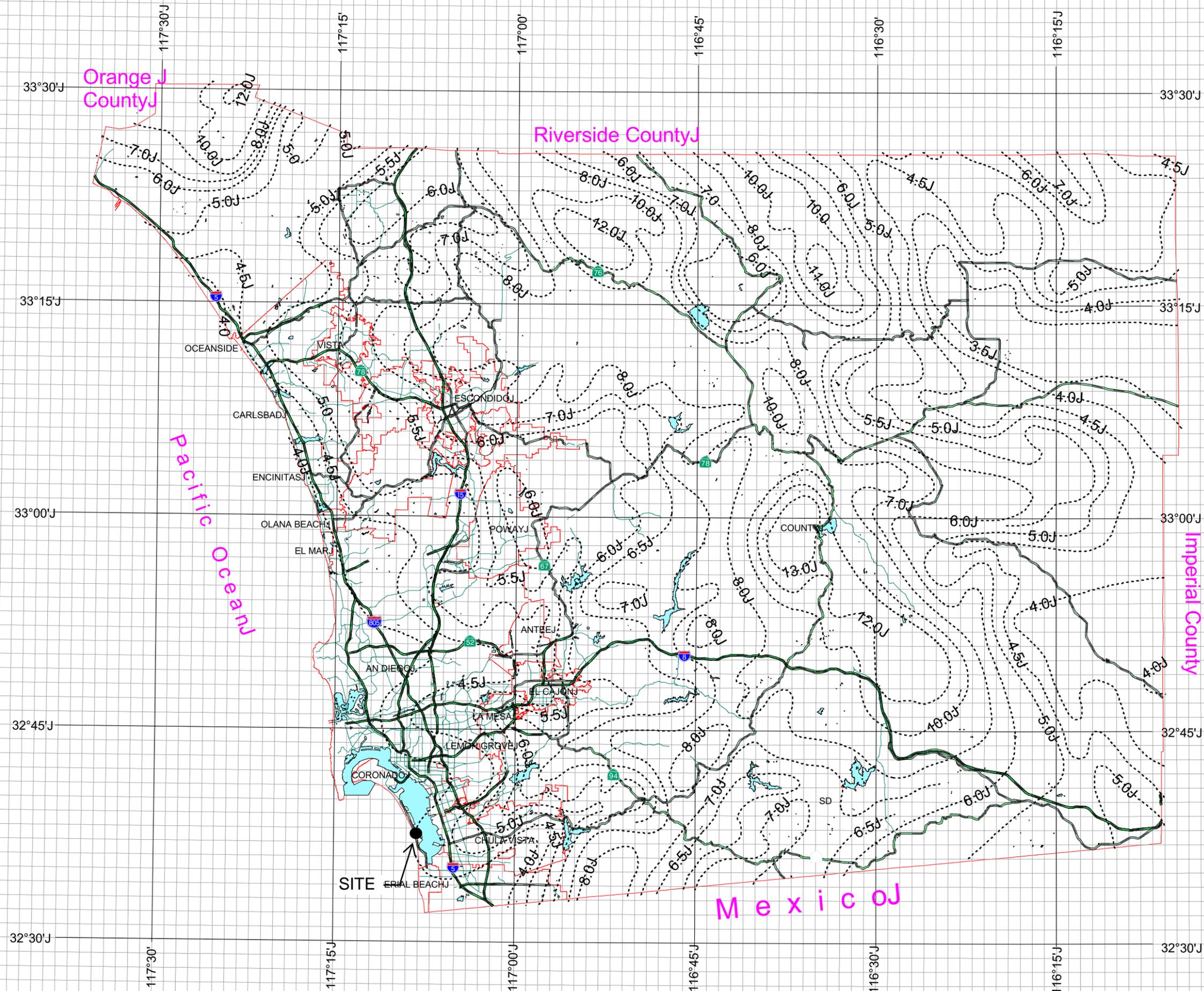
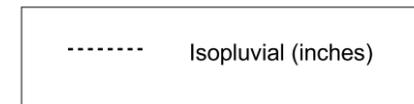
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County of San Diego Hydrology Manual



Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours



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Attachment D - Rational Method Runoff Calculations

Pre Development Calculations

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: 07/22/21

MERCADO APARTMENTS

PRE-DEVELOPMENT
 HYDROLOGY Q100 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) = 2.500
 24 hour precipitation(inches) = 4.000
 P6/P24 = 62.5%
 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
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Initial subarea total flow distance = 36.440(Ft.)
 Highest elevation = 65.000(Ft.)
 Lowest elevation = 64.800(Ft.)
 Elevation difference = 0.200(Ft.) Slope = 0.549 %
 Top 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
 General Commercial

In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.49 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8200) * (50.000^{.5}) / (0.500^{(1/3)})] = 4.49$
 Calculated TC of 4.490 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.108(CFS)
 Total initial stream area = 0.020(Ac.)

```

67 Process from Point/Station 102.000 to Point/Station 103.000
68 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
69
70 Estimated mean flow rate at midpoint of channel = 1.296(CFS)
71 Depth of flow = 0.160(Ft.), Average velocity = 1.899(Ft/s)
72 ***** Irregular Channel Data *****
73 -----
74 Information entered for subchannel number 1 :
75 Point number 'X' coordinate 'Y' coordinate
76 1 0.00 0.50
77 2 10.00 0.00
78 3 20.00 0.30
79 4 30.00 0.50
80 Manning's 'N' friction factor = 0.015
81 -----
82 Sub-Channel flow = 1.296(CFS)
83 ' ' flow top width = 8.533(Ft.)
84 ' ' velocity = 1.899(Ft/s)
85 ' ' area = 0.683(Sq.Ft)
86 ' ' Froude number = 1.183
87
88 Upstream point elevation = 45.000(Ft.)
89 Downstream point elevation = 44.500(Ft.)
90 Flow length = 46.840(Ft.)
91 Travel time = 0.41 min.
92 Time of concentration = 4.90 min.
93 Depth of flow = 0.160(Ft.)
94 Average velocity = 1.899(Ft/s)
95 Total irregular channel flow = 1.296(CFS)
96 Irregular channel normal depth above invert elev. = 0.160(Ft.)
97 Average velocity of channel(s) = 1.899(Ft/s)
98 Adding area flow to channel
99 Calculated TC of 4.901 minutes is less than 5 minutes,
100 resetting TC to 5.0 minutes for rainfall intensity calculations
101 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
102 Decimal fraction soil group A = 0.000
103 Decimal fraction soil group B = 0.000
104 Decimal fraction soil group C = 0.000
105 Decimal fraction soil group D = 1.000
106 [COMMERCIAL area type ]
107 (General Commercial )
108 Impervious value, Ai = 0.850
109 Sub-Area C Value = 0.820
110 Rainfall intensity = 6.587(In/Hr) for a 100.0 year storm
111 Effective runoff coefficient used for total area
112 (Q=KCIA) is C = 0.820 CA = 0.377
113 Subarea runoff = 2.377(CFS) for 0.440(Ac.)
114 Total runoff = 2.485(CFS) Total area = 0.460(Ac.)
115 Depth of flow = 0.204(Ft.), Average velocity = 2.235(Ft/s)
116
117
118 +-----+
119 Process from Point/Station 103.000 to Point/Station 104.000
120 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
121
122 Upstream point/station elevation = 44.000(Ft.)
123 Downstream point/station elevation = 38.000(Ft.)
124 Pipe length = 244.30(Ft.) Slope = 0.0246 Manning's N = 0.012
125 No. of pipes = 1 Required pipe flow = 2.485(CFS)
126 Nearest computed pipe diameter = 9.00(In.)
127 Calculated individual pipe flow = 2.485(CFS)
128 Normal flow depth in pipe = 6.58(In.)
129 Flow top width inside pipe = 7.98(In.)
130 Critical Depth = 8.30(In.)
131 Pipe flow velocity = 7.18(Ft/s)
132 Travel time through pipe = 0.57 min.

```

```

133 Time of concentration (TC) = 5.47 min.
134
135
136 ++++++
137 Process from Point/Station 104.000 to Point/Station 104.000
138 **** CONFLUENCE OF MINOR STREAMS ****
139
140 -----
141 Along Main Stream number: 1 in normal stream number 1
142 Stream flow area = 0.460(Ac.)
143 Runoff from this stream = 2.485(CFS)
144 Time of concentration = 5.47 min.
145 Rainfall intensity = 6.217(In/Hr)
146
147 ++++++
148 Process from Point/Station 201.000 to Point/Station 202.000
149 **** INITIAL AREA EVALUATION ****
150
151 -----
152 Decimal fraction soil group A = 0.000
153 Decimal fraction soil group B = 0.000
154 Decimal fraction soil group C = 0.000
155 Decimal fraction soil group D = 1.000
156 [COMMERCIAL area type ]
157 (General Commercial )
158 Impervious value, Ai = 0.850
159 Sub-Area C Value = 0.820
160 Initial subarea total flow distance = 61.130(Ft.)
161 Highest elevation = 42.840(Ft.)
162 Lowest elevation = 41.100(Ft.)
163 Elevation difference = 1.740(Ft.) Slope = 2.846 %
164 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
165 The maximum overland flow distance is 85.00 (Ft)
166 for the top area slope value of 2.85 %, in a development type of
167 General Commercial
168 In Accordance With Figure 3-3
169 Initial Area Time of Concentration = 3.28 minutes
170 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
171 TC = [1.8*(1.1-0.8200)*( 85.000^.5)]/( 2.850^(1/3)]= 3.28
172 Calculated TC of 3.277 minutes is less than 5 minutes,
173 resetting TC to 5.0 minutes for rainfall intensity calculations
174 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
175 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
176 Subarea runoff = 0.324(CFS)
177 Total initial stream area = 0.060(Ac.)
178
179 ++++++
180 Process from Point/Station 202.000 to Point/Station 104.000
181 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
182
183 -----
184 Estimated mean flow rate at midpoint of channel = 1.026(CFS)
185 Depth of flow = 0.110(Ft.), Average velocity = 2.288(Ft/s)
186 ***** Irregular Channel Data *****
187 -----
188 Information entered for subchannel number 1 :
189 Point number 'X' coordinate 'Y' coordinate
190 1 0.00 0.60
191 2 5.00 0.50
192 3 5.10 0.00
193 4 20.00 0.20
194 5 40.00 0.50
195 Manning's 'N' friction factor = 0.015
196 -----
197 Sub-Channel flow = 1.026(CFS)
198 ' ' flow top width = 8.185(Ft.)
199 ' ' velocity= 2.288(Ft/s)

```

```

199      '      '      area =      0.448(Sq.Ft)
200      '      '      Froude number =      1.723
201
202      Upstream point elevation =      41.100(Ft.)
203      Downstream point elevation =      38.900(Ft.)
204      Flow length =      84.550(Ft.)
205      Travel time =      0.62 min.
206      Time of concentration =      3.89 min.
207      Depth of flow =      0.110(Ft.)
208      Average velocity =      2.288(Ft/s)
209      Total irregular channel flow =      1.026(CFS)
210      Irregular channel normal depth above invert elev. =      0.110(Ft.)
211      Average velocity of channel(s) =      2.288(Ft/s)
212      Adding area flow to channel
213      Calculated TC of      3.893 minutes is less than 5 minutes,
214      resetting TC to 5.0 minutes for rainfall intensity calculations
215      Rainfall intensity (I) =      6.587(In/Hr) for a      100.0 year storm
216      Decimal fraction soil group A = 0.000
217      Decimal fraction soil group B = 0.000
218      Decimal fraction soil group C = 0.000
219      Decimal fraction soil group D = 1.000
220      [COMMERCIAL area type      ]
221      (General Commercial      )
222      Impervious value, Ai = 0.850
223      Sub-Area C Value = 0.820
224      Rainfall intensity =      6.587(In/Hr) for a      100.0 year storm
225      Effective runoff coefficient used for total area
226      (Q=KCIA) is C = 0.820 CA =      0.262
227      Subarea runoff =      1.404(CFS) for      0.260(Ac.)
228      Total runoff =      1.728(CFS) Total area =      0.320(Ac.)
229      Depth of flow =      0.133(Ft.), Average velocity =      2.607(Ft/s)
230
231
232      *****
233      Process from Point/Station      104.000 to Point/Station      104.000
234      **** SUBAREA FLOW ADDITION ****
235
236      Calculated TC of      3.893 minutes is less than 5 minutes,
237      resetting TC to 5.0 minutes for rainfall intensity calculations
238      Rainfall intensity (I) =      6.587(In/Hr) for a      100.0 year storm
239      Decimal fraction soil group A = 0.000
240      Decimal fraction soil group B = 0.000
241      Decimal fraction soil group C = 0.000
242      Decimal fraction soil group D = 1.000
243      [COMMERCIAL area type      ]
244      (General Commercial      )
245      Impervious value, Ai = 0.850
246      Sub-Area C Value = 0.820
247      Time of concentration =      3.89 min.
248      Rainfall intensity =      6.587(In/Hr) for a      100.0 year storm
249      Effective runoff coefficient used for total area
250      (Q=KCIA) is C = 0.820 CA =      0.533
251      Subarea runoff =      1.782(CFS) for      0.330(Ac.)
252      Total runoff =      3.511(CFS) Total area =      0.650(Ac.)
253
254
255      *****
256      Process from Point/Station      104.000 to Point/Station      104.000
257      **** CONFLUENCE OF MINOR STREAMS ****
258
259      Along Main Stream number: 1 in normal stream number 2
260      Stream flow area =      0.650(Ac.)
261      Runoff from this stream =      3.511(CFS)
262      Time of concentration =      3.89 min.
263      Rainfall intensity =      6.587(In/Hr)
264      Summary of stream data:

```

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	2.485	5.47	6.217
2	3.511	3.89	6.587
Qmax(1) =			
	1.000 *	1.000 *	2.485) +
	0.944 *	1.000 *	3.511) + = 5.798
Qmax(2) =			
	1.000 *	0.712 *	2.485) +
	1.000 *	1.000 *	3.511) + = 5.280

Total of 2 streams to confluence:
 Flow rates before confluence point:
 2.485 3.511
 Maximum flow rates at confluence using above data:
 5.798 5.280
 Area of streams before confluence:
 0.460 0.650
 Results of confluence:
 Total flow rate = 5.798(CFS)
 Time of concentration = 5.468 min.
 Effective stream area after confluence = 1.110(Ac.)

 Process from Point/Station 104.000 to Point/Station 105.000
 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation = 38.000(Ft.)
 Downstream point/station elevation = 34.800(Ft.)
 Pipe length = 158.71(Ft.) Slope = 0.0202 Manning's N = 0.012
 No. of pipes = 1 Required pipe flow = 5.798(CFS)
 Nearest computed pipe diameter = 15.00(In.)
 Calculated individual pipe flow = 5.798(CFS)
 Normal flow depth in pipe = 8.23(In.)
 Flow top width inside pipe = 14.93(In.)
 Critical Depth = 11.70(In.)
 Pipe flow velocity = 8.41(Ft/s)
 Travel time through pipe = 0.31 min.
 Time of concentration (TC) = 5.78 min.

 Process from Point/Station 105.000 to Point/Station 105.000
 **** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
 Stream flow area = 1.110(Ac.)
 Runoff from this stream = 5.798(CFS)
 Time of concentration = 5.78 min.
 Rainfall intensity = 5.997(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
 [COMMERCIAL area type]
 (General Commercial)

```

331 Impervious value, Ai = 0.850
332 Sub-Area C Value = 0.820
333 Initial subarea total flow distance = 61.130(Ft.)
334 Highest elevation = 43.900(Ft.)
335 Lowest elevation = 40.500(Ft.)
336 Elevation difference = 3.400(Ft.) Slope = 5.562 %
337 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
338 The maximum overland flow distance is 90.00 (Ft)
339 for the top area slope value of 5.56 %, in a development type of
340 General Commercial
341 In Accordance With Figure 3-3
342 Initial Area Time of Concentration = 2.70 minutes
343 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
344 TC = [1.8*(1.1-0.8200)*( 90.000^.5)/(( 5.560^(1/3))]= 2.70
345 Calculated TC of 2.699 minutes is less than 5 minutes,
346 resetting TC to 5.0 minutes for rainfall intensity calculations
347 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
348 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
349 Subarea runoff = 0.432(CFS)
350 Total initial stream area = 0.080(Ac.)
351
352
353 *****
354 Process from Point/Station 302.000 to Point/Station 303.000
355 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
356
357 -----
358 Estimated mean flow rate at midpoint of channel = 1.296(CFS)
359 Depth of flow = 0.252(Ft.), Average velocity = 2.086(Ft/s)
360 ***** Irregular Channel Data *****
361 -----
362 Information entered for subchannel number 1 :
363 Point number 'X' coordinate 'Y' coordinate
364 1 0.00 0.50
365 2 20.00 0.20
366 3 21.50 0.00
367 4 23.00 0.20
368 5 40.00 0.50
369 Manning's 'N' friction factor = 0.015
370 -----
371 Sub-Channel flow = 1.296(CFS)
372 ' ' flow top width = 9.395(Ft.)
373 ' ' velocity= 2.086(Ft/s)
374 ' ' area = 0.621(Sq.Ft)
375 ' ' Froude number = 1.430
376
377 Upstream point elevation = 40.500(Ft.)
378 Downstream point elevation = 35.220(Ft.)
379 Flow length = 317.180(Ft.)
380 Travel time = 2.53 min.
381 Time of concentration = 5.23 min.
382 Depth of flow = 0.252(Ft.)
383 Average velocity = 2.086(Ft/s)
384 Total irregular channel flow = 1.296(CFS)
385 Irregular channel normal depth above invert elev. = 0.252(Ft.)
386 Average velocity of channel(s) = 2.086(Ft/s)
387 Adding area flow to channel
388 Rainfall intensity (I) = 6.396(In/Hr) for a 100.0 year storm
389 Decimal fraction soil group A = 0.000
390 Decimal fraction soil group B = 0.000
391 Decimal fraction soil group C = 0.000
392 Decimal fraction soil group D = 1.000
393 [COMMERCIAL area type ]
394 (General Commercial )
395 Impervious value, Ai = 0.850
396 Sub-Area C Value = 0.820
397 Rainfall intensity = 6.396(In/Hr) for a 100.0 year storm

```

```

397 Effective runoff coefficient used for total area
398 (Q=KCIA) is C = 0.820 CA = 0.328
399 Subarea runoff = 1.666(CFS) for 0.320(Ac.)
400 Total runoff = 2.098(CFS) Total area = 0.400(Ac.)
401 Depth of flow = 0.281(Ft.), Average velocity = 2.226(Ft/s)
402
403
404 ++++++
405 Process from Point/Station 303.000 to Point/Station 105.000
406 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
407
-----
408 Depth of flow = 0.275(Ft.), Average velocity = 1.544(Ft/s)
409 ***** Irregular Channel Data *****
410
-----
411 Information entered for subchannel number 1 :
412 Point number 'X' coordinate 'Y' coordinate
413 1 0.00 0.60
414 2 2.00 0.50
415 3 2.10 0.00
416 4 20.00 0.50
417 Manning's 'N' friction factor = 0.015
418
-----
419 Sub-Channel flow = 2.098(CFS)
420 ' ' flow top width = 9.890(Ft.)
421 ' ' velocity = 1.544(Ft/s)
422 ' ' area = 1.359(Sq.Ft)
423 ' ' Froude number = 0.734
424
425 Upstream point elevation = 35.220(Ft.)
426 Downstream point elevation = 34.800(Ft.)
427 Flow length = 118.810(Ft.)
428 Travel time = 1.28 min.
429 Time of concentration = 6.52 min.
430 Depth of flow = 0.275(Ft.)
431 Average velocity = 1.544(Ft/s)
432 Total irregular channel flow = 2.098(CFS)
433 Irregular channel normal depth above invert elev. = 0.275(Ft.)
434 Average velocity of channel(s) = 1.544(Ft/s)
435
436
437 ++++++
438 Process from Point/Station 105.000 to Point/Station 105.000
439 **** CONFLUENCE OF MINOR STREAMS ****
440
-----
441 Along Main Stream number: 1 in normal stream number 2
442 Stream flow area = 0.400(Ac.)
443 Runoff from this stream = 2.098(CFS)
444 Time of concentration = 6.52 min.
445 Rainfall intensity = 5.553(In/Hr)
446 Summary of stream data:
447
448 Stream Flow rate TC Rainfall Intensity
449 No. (CFS) (min) (In/Hr)
450
451
452 1 5.798 5.78 5.997
453 2 2.098 6.52 5.553
454 Qmax(1) =
455 1.000 * 1.000 * 5.798) +
456 1.000 * 0.888 * 2.098) + = 7.661
457 Qmax(2) =
458 0.926 * 1.000 * 5.798) +
459 1.000 * 1.000 * 2.098) + = 7.467
460
461 Total of 2 streams to confluence:
462 Flow rates before confluence point:

```

```
463          5.798          2.098
464 Maximum flow rates at confluence using above data:
465          7.661          7.467
466 Area of streams before confluence:
467          1.110          0.400
468 Results of confluence:
469 Total flow rate =          7.661(CFS)
470 Time of concentration =          5.783 min.
471 Effective stream area after confluence =          1.510(Ac.)
472 End of computations, total study area =          1.510 (Ac.)
473
474
475
```

Post Development Calculations

Used as a user defined input at node 305.

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: 10/29/21

 MERCADO APARTMENTS
 POST-DEVELOPMENT
 HYDROLOGYQ100 CALCULATIONS
 NORTH SIDE

***** 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) = 2.500
 24 hour precipitation(inches) = 4.000
 P6/P24 = 62.5%
 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
 [COMMERCIAL area type]
 (General Commercial)
 Impervious value, Ai = 0.850
 Sub-Area C Value = 0.820
 Initial subarea total flow distance = 36.440(Ft.)
 Highest elevation = 65.000(Ft.)
 Lowest elevation = 64.800(Ft.)
 Elevation difference = 0.200(Ft.) Slope = 0.549 %
 Top 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
 General Commercial

In Accordance With Figure 3-3
 Initial Area Time of Concentration = 4.49 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8200) * (50.000^{.5}) / (0.500^{(1/3)})] = 4.49$
 Calculated TC of 4.490 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.820
 Subarea runoff = 0.108(CFS)
 Total initial stream area = 0.020(Ac.)

```

67 Process from Point/Station      602.000 to Point/Station      603.000
68 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
69
70 Estimated mean flow rate at midpoint of channel =      1.296(CFS)
71 Depth of flow = 0.160(Ft.), Average velocity = 1.899(Ft/s)
72 ***** Irregular Channel Data *****
73 -----
74 Information entered for subchannel number 1 :
75 Point number      'X' coordinate      'Y' coordinate
76 1                0.00                0.50
77 2                10.00               0.00
78 3                20.00               0.30
79 4                30.00               0.50
80 Manning's 'N' friction factor = 0.015
81 -----
82 Sub-Channel flow = 1.296(CFS)
83 ' ' flow top width = 8.533(Ft.)
84 ' ' velocity= 1.899(Ft/s)
85 ' ' area = 0.683(Sq.Ft)
86 ' ' Froude number = 1.183
87
88 Upstream point elevation = 45.000(Ft.)
89 Downstream point elevation = 44.500(Ft.)
90 Flow length = 46.840(Ft.)
91 Travel time = 0.41 min.
92 Time of concentration = 4.90 min.
93 Depth of flow = 0.160(Ft.)
94 Average velocity = 1.899(Ft/s)
95 Total irregular channel flow = 1.296(CFS)
96 Irregular channel normal depth above invert elev. = 0.160(Ft.)
97 Average velocity of channel(s) = 1.899(Ft/s)
98 Adding area flow to channel
99 Calculated TC of 4.901 minutes is less than 5 minutes,
100 resetting TC to 5.0 minutes for rainfall intensity calculations
101 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
102 Decimal fraction soil group A = 0.000
103 Decimal fraction soil group B = 0.000
104 Decimal fraction soil group C = 0.000
105 Decimal fraction soil group D = 1.000
106 [COMMERCIAL area type ]
107 (General Commercial )
108 Impervious value, Ai = 0.850
109 Sub-Area C Value = 0.820
110 Rainfall intensity = 6.587(In/Hr) for a 100.0 year storm
111 Effective runoff coefficient used for total area
112 (Q=KCIA) is C = 0.820 CA = 0.377
113 Subarea runoff = 2.377(CFS) for 0.440(Ac.)
114 Total runoff = 2.485(CFS) Total area = 0.460(Ac.)
115 Depth of flow = 0.204(Ft.), Average velocity = 2.235(Ft/s)
116
117
118 +-----+
119 Process from Point/Station      603.000 to Point/Station      305.000
120 **** PIPEFLOW TRAVEL TIME (Program estimated size) ****
121 -----
122 Upstream point/station elevation = 44.000(Ft.)
123 Downstream point/station elevation = 38.000(Ft.)
124 Pipe length = 244.30(Ft.) Slope = 0.0246 Manning's N = 0.012
125 No. of pipes = 1 Required pipe flow = 2.485(CFS)
126 Nearest computed pipe diameter = 9.00(In.)
127 Calculated individual pipe flow = 2.485(CFS)
128 Normal flow depth in pipe = 6.58(In.)
129 Flow top width inside pipe = 7.98(In.)
130 Critical Depth = 8.30(In.)
131 Pipe flow velocity = 7.18(Ft/s)
132 Travel time through pipe = 0.57 min.

```

```
133 Time of concentration (TC) = 5.47 min.
134
135
136 ++++++
137 Process from Point/Station 305.000 to Point/Station 305.000
138 **** SUBAREA FLOW ADDITION ****
139
140 Rainfall intensity (I) = 6.217(In/Hr) for a 100.0 year storm
141 Decimal fraction soil group A = 0.000
142 Decimal fraction soil group B = 0.000
143 Decimal fraction soil group C = 0.000
144 Decimal fraction soil group D = 1.000
145 [COMMERCIAL area type ]
146 (General Commercial )
147 Impervious value, Ai = 0.850
148 Sub-Area C Value = 0.820
149 Time of concentration = 5.47 min.
150 Rainfall intensity = 6.217(In/Hr) for a 100.0 year storm
151 Effective runoff coefficient used for total area
152 (Q=KCIA) is C = 0.820 CA = 0.451
153 Subarea runoff = 0.319(CFS) for 0.090(Ac.)
154 Total runoff = 2.804(CFS) Total area = 0.550(Ac.)
155 End of computations, total study area = 0.550 (Ac.)
156
157
158
```

Post Development Calculations

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: 12/09/21

***** 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) = 2.500
 24 hour precipitation(inches) = 4.000
 P6/P24 = 62.5%
 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
 [INDUSTRIAL area type]
 (General Industrial)
 Impervious value, Ai = 0.950
 Sub-Area C Value = 0.870
 Initial subarea total flow distance = 191.390(Ft.)
 Highest elevation = 60.000(Ft.)
 Lowest elevation = 56.170(Ft.)
 Elevation difference = 3.830(Ft.) Slope = 2.001 %
 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
 The maximum overland flow distance is 70.00 (Ft)
 for the top area slope value of 2.00 %, in a development type of
 General Industrial
 In Accordance With Figure 3-3
 Initial Area Time of Concentration = 2.75 minutes
 $TC = [1.8 * (1.1 - C) * distance(Ft.)^{.5} / (% slope^{(1/3)})]$
 $TC = [1.8 * (1.1 - 0.8700) * (70.000^{.5}) / (2.000^{(1/3)})] = 2.75$
 Calculated TC of 2.749 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
 Subarea runoff = 0.298(CFS)
 Total initial stream area = 0.052(Ac.)

 Process from Point/Station 202.000 to Point/Station 203.000

```

67      **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
68
69      Depth of flow = 0.082(Ft.), Average velocity = 10.965(Ft/s)
70      ***** Irregular Channel Data *****
71      -----
72      Information entered for subchannel number 1 :
73      Point number      'X' coordinate      'Y' coordinate
74      1                  0.00                  0.25
75      2                  1.00                  0.00
76      3                  2.00                  0.25
77      Manning's 'N' friction factor = 0.013
78      -----
79      Sub-Channel flow = 0.298(CFS)
80      '      '      flow top width = 0.659(Ft.)
81      '      '      velocity= 10.965(Ft/s)
82      '      '      area = 0.027(Sq.Ft)
83      '      '      Froude number = 9.518
84
85      Upstream point elevation = 59.980(Ft.)
86      Downstream point elevation = 39.790(Ft.)
87      Flow length = 30.000(Ft.)
88      Travel time = 0.05 min.
89      Time of concentration = 2.79 min.
90      Depth of flow = 0.082(Ft.)
91      Average velocity = 10.965(Ft/s)
92      Total irregular channel flow = 0.298(CFS)
93      Irregular channel normal depth above invert elev. = 0.082(Ft.)
94      Average velocity of channel(s) = 10.965(Ft/s)
95
96
97      +-----+
98      Process from Point/Station 203.000 to Point/Station 203.000
99      **** CONFLUENCE OF MINOR STREAMS ****
100
101      Along Main Stream number: 1 in normal stream number 1
102      Stream flow area = 0.052(Ac.)
103      Runoff from this stream = 0.298(CFS)
104      Time of concentration = 2.79 min.
105      Rainfall intensity = 6.587(In/Hr)
106
107
108      +-----+
109      Process from Point/Station 501.000 to Point/Station 502.000
110      **** INITIAL AREA EVALUATION ****
111
112      Decimal fraction soil group A = 0.000
113      Decimal fraction soil group B = 0.000
114      Decimal fraction soil group C = 0.000
115      Decimal fraction soil group D = 1.000
116      [INDUSTRIAL area type ]
117      (General Industrial )
118      Impervious value, Ai = 0.950
119      Sub-Area C Value = 0.870
120      Initial subarea total flow distance = 65.200(Ft.)
121      Highest elevation = 60.000(Ft.)
122      Lowest elevation = 59.840(Ft.)
123      Elevation difference = 0.160(Ft.) Slope = 0.245 %
124      INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
125      The maximum overland flow distance is 50.00 (Ft)
126      for the top area slope value of 0.25 %, in a development type of
127      General Industrial
128      In Accordance With Figure 3-3
129      Initial Area Time of Concentration = 4.65 minutes
130      TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3))
131      TC = [1.8*(1.1-0.8700)*( 50.000^.5)]/( 0.250^(1/3))= 4.65
132      Calculated TC of 4.647 minutes is less than 5 minutes,

```

```

133   resetting TC to 5.0 minutes for rainfall intensity calculations
134   Rainfall intensity (I) =      6.587(In/Hr) for a  100.0 year storm
135   Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
136   Subarea runoff =      0.940(CFS)
137   Total initial stream area =      0.164(Ac.)
138
139
140   ++++++
141   Process from Point/Station      502.000 to Point/Station      503.000
142   **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
143
144   !!Warning: Water is above left or right bank elevations
145   !!Warning: Water is above left or right bank elevations
146   !!Warning: Water is above left or right bank elevations
147   Estimated mean flow rate at midpoint of channel =      0.984(CFS)
148   Depth of flow =  0.714(Ft.), Average velocity =  0.338(Ft/s)
149   !!Warning: Water is above left or right bank elevations
150   ***** Irregular Channel Data *****
151   -----
152   Information entered for subchannel number 1 :
153   Point number      'X' coordinate      'Y' coordinate
154       1              0.00              0.70
155       2              4.00              0.00
156       3              8.00              0.70
157   Manning's 'N' friction factor =  0.150
158   -----
159   Sub-Channel flow =      0.984(CFS)
160   '   '   flow top width =      8.000(Ft.)
161   '   '   velocity=      0.338(Ft/s)
162   '   '   area =      2.910(Sq.Ft)
163   '   '   Froude number =      0.099
164
165   Upstream point elevation =      39.840(Ft.)
166   Downstream point elevation =      39.600(Ft.)
167   Flow length =      52.400(Ft.)
168   Travel time =      2.58 min.
169   Time of concentration =      7.23 min.
170   Depth of flow =  0.714(Ft.)
171   Average velocity =  0.338(Ft/s)
172   Total irregular channel flow =      0.984(CFS)
173   Irregular channel normal depth above invert elev. =  0.714(Ft.)
174   Average velocity of channel(s) =  0.338(Ft/s)
175   !!Warning: Water is above left or right bank elevations
176   Adding area flow to channel
177   Rainfall intensity (I) =      5.193(In/Hr) for a  100.0 year storm
178   Decimal fraction soil group A = 0.000
179   Decimal fraction soil group B = 0.000
180   Decimal fraction soil group C = 0.000
181   Decimal fraction soil group D = 1.000
182   [LOW DENSITY RESIDENTIAL      ]
183   (2.0 DU/A or Less      )
184   Impervious value, Ai = 0.200
185   Sub-Area C Value = 0.460
186   The area added to the existing stream causes a
187   a lower flow rate of Q =      0.889(CFS)
188   therefore the upstream flow rate of Q =      0.940(CFS) is being used
189   Rainfall intensity =      5.193(In/Hr) for a  100.0 year storm
190   Effective runoff coefficient used for total area
191   (Q=KCIA) is C = 0.758 CA =  0.171
192   Subarea runoff =      0.000(CFS) for      0.062(Ac.)
193   Total runoff =      0.940(CFS) Total area =      0.226(Ac.)
194   Depth of flow =  0.704(Ft.), Average velocity =  0.332(Ft/s)
195   !!Warning: Water is above left or right bank elevations
196
197
198   ++++++

```

199 Process from Point/Station 503.000 to Point/Station 203.000
 200 **** PIPEFLOW TRAVEL TIME (User specified size) ****

202 Upstream point/station elevation = 39.083(Ft.)
 203 Downstream point/station elevation = 38.400(Ft.)
 204 Pipe length = 88.30(Ft.) Slope = 0.0077 Manning's N = 0.012
 205 No. of pipes = 1 Required pipe flow = 0.940(CFS)
 206 Given pipe size = 6.00(In.)
 207 NOTE: Normal flow is pressure flow in user selected pipe size.
 208 The approximate hydraulic grade line above the pipe invert is
 209 1.961(Ft.) at the headworks or inlet of the pipe(s)
 210 Pipe friction loss = 2.110(Ft.)
 211 Minor friction loss = 0.534(Ft.) K-factor = 1.50
 212 Pipe flow velocity = 4.79(Ft/s)
 213 Travel time through pipe = 0.31 min.
 214 Time of concentration (TC) = 7.54 min.

215
 216
 217 +-----+
 218 Process from Point/Station 203.000 to Point/Station 203.000
 219 **** CONFLUENCE OF MINOR STREAMS ****

221 Along Main Stream number: 1 in normal stream number 2
 222 Stream flow area = 0.226(Ac.)
 223 Runoff from this stream = 0.940(CFS)
 224 Time of concentration = 7.54 min.
 225 Rainfall intensity = 5.055(In/Hr)
 226 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	0.298	2.79	6.587
2	0.940	7.54	5.055

234 Qmax(1) =
 235 1.000 * 1.000 * 0.298) +
 236 1.000 * 0.371 * 0.940) + = 0.646
 237 Qmax(2) =
 238 0.767 * 1.000 * 0.298) +
 239 1.000 * 1.000 * 0.940) + = 1.169

240
 241 Total of 2 streams to confluence:
 242 Flow rates before confluence point:
 243 0.298 0.940
 244 Maximum flow rates at confluence using above data:
 245 0.646 1.169
 246 Area of streams before confluence:
 247 0.052 0.226
 248 Results of confluence:
 249 Total flow rate = 1.169(CFS)
 250 Time of concentration = 7.537 min.
 251 Effective stream area after confluence = 0.278(Ac.)

252
 253
 254 +-----+
 255 Process from Point/Station 203.000 to Point/Station 103.000
 256 **** PIPEFLOW TRAVEL TIME (User specified size) ****

258 Upstream point/station elevation = 35.910(Ft.)
 259 Downstream point/station elevation = 35.450(Ft.)
 260 Pipe length = 75.43(Ft.) Slope = 0.0061 Manning's N = 0.013
 261 No. of pipes = 1 Required pipe flow = 1.169(CFS)
 262 Given pipe size = 12.00(In.)
 263 Calculated individual pipe flow = 1.169(CFS)
 264 Normal flow depth in pipe = 5.43(In.)

```

265 Flow top width inside pipe = 11.94(In.)
266 Critical Depth = 5.47(In.)
267 Pipe flow velocity = 3.39(Ft/s)
268 Travel time through pipe = 0.37 min.
269 Time of concentration (TC) = 7.91 min.
270
271
272 +-----+
273 Process from Point/Station 103.000 to Point/Station 103.000
274 **** CONFLUENCE OF MINOR STREAMS ****
275
276 Along Main Stream number: 1 in normal stream number 1
277 Stream flow area = 0.278(Ac.)
278 Runoff from this stream = 1.169(CFS)
279 Time of concentration = 7.91 min.
280 Rainfall intensity = 4.901(In/Hr)
281
282
283 +-----+
284 Process from Point/Station 101.000 to Point/Station 102.000
285 **** INITIAL AREA EVALUATION ****
286
287 Decimal fraction soil group A = 0.000
288 Decimal fraction soil group B = 0.000
289 Decimal fraction soil group C = 0.000
290 Decimal fraction soil group D = 1.000
291 [INDUSTRIAL area type ]
292 (General Industrial )
293 Impervious value, Ai = 0.950
294 Sub-Area C Value = 0.870
295 Initial subarea total flow distance = 93.430(Ft.)
296 Highest elevation = 39.660(Ft.)
297 Lowest elevation = 39.250(Ft.)
298 Elevation difference = 0.410(Ft.) Slope = 0.439 %
299 Top of Initial Area Slope adjusted by User to 0.500 %
300 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
301 The maximum overland flow distance is 50.00 (Ft)
302 for the top area slope value of 0.50 %, in a development type of
303 General Industrial
304 In Accordance With Figure 3-3
305 Initial Area Time of Concentration = 3.69 minutes
306 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
307 TC = [1.8*(1.1-0.8700)*( 50.000^.5)/( 0.500^(1/3)]= 3.69
308 Calculated TC of 3.688 minutes is less than 5 minutes,
309 resetting TC to 5.0 minutes for rainfall intensity calculations
310 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
311 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
312 Subarea runoff = 0.630(CFS)
313 Total initial stream area = 0.110(Ac.)
314
315
316 +-----+
317 Process from Point/Station 102.000 to Point/Station 103.000
318 **** PIPEFLOW TRAVEL TIME (User specified size) ****
319
320 Upstream point/station elevation = 38.700(Ft.)
321 Downstream point/station elevation = 38.200(Ft.)
322 Pipe length = 61.77(Ft.) Slope = 0.0081 Manning's N = 0.012
323 No. of pipes = 1 Required pipe flow = 0.630(CFS)
324 Given pipe size = 8.00(In.)
325 Calculated individual pipe flow = 0.630(CFS)
326 Normal flow depth in pipe = 4.17(In.)
327 Flow top width inside pipe = 7.99(In.)
328 Critical Depth = 4.48(In.)
329 Pipe flow velocity = 3.43(Ft/s)
330 Travel time through pipe = 0.30 min.

```

```

331 Time of concentration (TC) = 3.99 min.
332
333
334 ++++++
335 Process from Point/Station 103.000 to Point/Station 103.000
336 **** CONFLUENCE OF MINOR STREAMS ****
337
338 Along Main Stream number: 1 in normal stream number 2
339 Stream flow area = 0.110(Ac.)
340 Runoff from this stream = 0.630(CFS)
341 Time of concentration = 3.99 min.
342 Rainfall intensity = 6.587(In/Hr)
343
344
345 ++++++
346 Process from Point/Station 201.000 to Point/Station 204.000
347 **** INITIAL AREA EVALUATION ****
348
349 Decimal fraction soil group A = 0.000
350 Decimal fraction soil group B = 0.000
351 Decimal fraction soil group C = 0.000
352 Decimal fraction soil group D = 1.000
353 [INDUSTRIAL area type ]
354 (General Industrial )
355 Impervious value, Ai = 0.950
356 Sub-Area C Value = 0.870
357 Initial subarea total flow distance = 75.710(Ft.)
358 Highest elevation = 60.000(Ft.)
359 Lowest elevation = 58.490(Ft.)
360 Elevation difference = 1.510(Ft.) Slope = 1.994 %
361 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
362 The maximum overland flow distance is 70.00 (Ft)
363 for the top area slope value of 2.00 %, in a development type of
364 General Industrial
365 In Accordance With Figure 3-3
366 Initial Area Time of Concentration = 2.75 minutes
367 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
368 TC = [1.8*(1.1-0.8700)*( 70.000^.5)]/( 2.000^(1/3)]= 2.75
369 Calculated TC of 2.749 minutes is less than 5 minutes,
370 resetting TC to 5.0 minutes for rainfall intensity calculations
371 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
372 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
373 Subarea runoff = 0.372(CFS)
374 Total initial stream area = 0.065(Ac.)
375
376
377 ++++++
378 Process from Point/Station 204.000 to Point/Station 103.000
379 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
380
381 Estimated mean flow rate at midpoint of channel = 0.476(CFS)
382 Depth of flow = 0.075(Ft.), Average velocity = 16.973(Ft/s)
383 ***** Irregular Channel Data *****
384 -----
385 Information entered for subchannel number 1 :
386 Point number 'X' coordinate 'Y' coordinate
387 1 0.00 0.40
388 2 2.00 0.00
389 3 4.00 0.40
390 Manning's 'N' friction factor = 0.012
391 -----
392 Sub-Channel flow = 0.476(CFS)
393 ' ' flow top width = 0.749(Ft.)
394 ' ' velocity= 16.974(Ft/s)
395 ' ' area = 0.028(Sq.Ft)
396 ' ' Froude number = 15.460

```

397
 398 Upstream point elevation = 59.880(Ft.)
 399 Downstream point elevation = 38.210(Ft.)
 400 Flow length = 14.070(Ft.)
 401 Travel time = 0.01 min.
 402 Time of concentration = 2.76 min.
 403 Depth of flow = 0.075(Ft.)
 404 Average velocity = 16.973(Ft/s)
 405 Total irregular channel flow = 0.476(CFS)
 406 Irregular channel normal depth above invert elev. = 0.075(Ft.)
 407 Average velocity of channel(s) = 16.973(Ft/s)
 408 Adding area flow to channel
 409 Calculated TC of 2.763 minutes is less than 5 minutes,
 410 resetting TC to 5.0 minutes for rainfall intensity calculations
 411 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
 412 Decimal fraction soil group A = 0.000
 413 Decimal fraction soil group B = 0.000
 414 Decimal fraction soil group C = 0.000
 415 Decimal fraction soil group D = 1.000
 416 [MEDIUM DENSITY RESIDENTIAL]
 417 (14.5 DU/A or Less)
 418 Impervious value, Ai = 0.500
 419 Sub-Area C Value = 0.630
 420 Rainfall intensity = 6.587(In/Hr) for a 100.0 year storm
 421 Effective runoff coefficient used for total area
 422 (Q=KCIA) is C = 0.784 CA = 0.079
 423 Subarea runoff = 0.149(CFS) for 0.036(Ac.)
 424 Total runoff = 0.522(CFS) Total area = 0.101(Ac.)
 425 Depth of flow = 0.078(Ft.), Average velocity = 17.371(Ft/s)
 426
 427

428 *****
 429 Process from Point/Station 103.000 to Point/Station 103.000
 430 **** CONFLUENCE OF MINOR STREAMS ****
 431

432 Along Main Stream number: 1 in normal stream number 3
 433 Stream flow area = 0.101(Ac.)
 434 Runoff from this stream = 0.522(CFS)
 435 Time of concentration = 2.76 min.
 436 Rainfall intensity = 6.587(In/Hr)
 437 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	1.169	7.91	4.901
2	0.630	3.99	6.587
3	0.522	2.76	6.587

446 Qmax(1) =
 447 1.000 * 1.000 * 1.169) +
 448 0.744 * 1.000 * 0.630) +
 449 0.744 * 1.000 * 0.522) + = 2.026

450 Qmax(2) =
 451 1.000 * 0.504 * 1.169) +
 452 1.000 * 1.000 * 0.630) +
 453 1.000 * 1.000 * 0.522) + = 1.742

454 Qmax(3) =
 455 1.000 * 0.349 * 1.169) +
 456 1.000 * 0.693 * 0.630) +
 457 1.000 * 1.000 * 0.522) + = 1.367
 458

459 Total of 3 streams to confluence:
 460 Flow rates before confluence point:
 461 1.169 0.630 0.522
 462 Maximum flow rates at confluence using above data:

```

463          2.026          1.742          1.367
464 Area of streams before confluence:
465          0.278          0.110          0.101
466 Results of confluence:
467 Total flow rate =          2.026(CFS)
468 Time of concentration =          7.908 min.
469 Effective stream area after confluence =          0.489(Ac.)
470
471
472 +-----+
473 Process from Point/Station          103.000 to Point/Station          104.000
474 **** PIPEFLOW TRAVEL TIME (User specified size) ****
475
476 Upstream point/station elevation =          35.440(Ft.)
477 Downstream point/station elevation =          34.990(Ft.)
478 Pipe length =          75.40(Ft.) Slope =          0.0060 Manning's N =          0.012
479 No. of pipes =          1 Required pipe flow =          2.026(CFS)
480 Given pipe size =          12.00(In.)
481 Calculated individual pipe flow =          2.026(CFS)
482 Normal flow depth in pipe =          7.25(In.)
483 Flow top width inside pipe =          11.74(In.)
484 Critical Depth =          7.28(In.)
485 Pipe flow velocity =          4.08(Ft/s)
486 Travel time through pipe =          0.31 min.
487 Time of concentration (TC) =          8.22 min.
488
489
490 +-----+
491 Process from Point/Station          104.000 to Point/Station          304.000
492 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
493
494 Depth of flow =          0.318(Ft.), Average velocity =          1.979(Ft/s)
495 ***** Irregular Channel Data *****
496 -----
497 Information entered for subchannel number 1 :
498 Point number      'X' coordinate      'Y' coordinate
499      1              0.00              0.50
500      2              10.00             0.00
501      3              10.10             0.50
502      4              15.00             0.60
503 Manning's 'N' friction factor =          0.013
504 -----
505 Sub-Channel flow =          2.026(CFS)
506   '   '   flow top width =          6.431(Ft.)
507   '   '   velocity=          1.979(Ft/s)
508   '   '   area =          1.024(Sq.Ft)
509   '   '   Froude number =          0.874
510
511 Upstream point elevation =          34.990(Ft.)
512 Downstream point elevation =          34.720(Ft.)
513 Flow length =          73.590(Ft.)
514 Travel time =          0.62 min.
515 Time of concentration =          8.84 min.
516 Depth of flow =          0.318(Ft.)
517 Average velocity =          1.979(Ft/s)
518 Total irregular channel flow =          2.026(CFS)
519 Irregular channel normal depth above invert elev. =          0.318(Ft.)
520 Average velocity of channel(s) =          1.979(Ft/s)
521
522
523 +-----+
524 Process from Point/Station          304.000 to Point/Station          304.000
525 **** CONFLUENCE OF MINOR STREAMS ****
526
527 Along Main Stream number: 1 in normal stream number 1
528 Stream flow area =          0.489(Ac.)

```

```

529 Runoff from this stream = 2.026(CFS)
530 Time of concentration = 8.84 min.
531 Rainfall intensity = 4.562(In/Hr)
532
533
534 *****
535 Process from Point/Station 301.000 to Point/Station 302.000
536 **** INITIAL AREA EVALUATION ****
537
538 Decimal fraction soil group A = 0.000
539 Decimal fraction soil group B = 0.000
540 Decimal fraction soil group C = 0.000
541 Decimal fraction soil group D = 1.000
542 [INDUSTRIAL area type ]
543 (General Industrial )
544 Impervious value, Ai = 0.950
545 Sub-Area C Value = 0.870
546 Initial subarea total flow distance = 68.390(Ft.)
547 Highest elevation = 60.000(Ft.)
548 Lowest elevation = 59.830(Ft.)
549 Elevation difference = 0.170(Ft.) Slope = 0.249 %
550 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
551 The maximum overland flow distance is 50.00 (Ft)
552 for the top area slope value of 0.25 %, in a development type of
553 General Industrial
554 In Accordance With Figure 3-3
555 Initial Area Time of Concentration = 4.65 minutes
556 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
557 TC = [1.8*(1.1-0.8700)*( 50.000^.5)/( 0.250^(1/3)]= 4.65
558 Calculated TC of 4.647 minutes is less than 5 minutes,
559 resetting TC to 5.0 minutes for rainfall intensity calculations
560 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
561 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
562 Subarea runoff = 1.106(CFS)
563 Total initial stream area = 0.193(Ac.)
564
565
566 *****
567 Process from Point/Station 302.000 to Point/Station 303.000
568 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
569
570 Estimated mean flow rate at midpoint of channel = 1.140(CFS)
571 Depth of flow = 0.106(Ft.), Average velocity = 16.783(Ft/s)
572 ***** Irregular Channel Data *****
573 -----
574 Information entered for subchannel number 1 :
575 Point number 'X' coordinate 'Y' coordinate
576 1 0.00 0.25
577 2 1.00 0.00
578 3 3.00 0.25
579 Manning's 'N' friction factor = 0.013
580 -----
581 Sub-Channel flow = 1.140(CFS)
582 ' ' flow top width = 1.277(Ft.)
583 ' ' velocity= 16.784(Ft/s)
584 ' ' area = 0.068(Sq.Ft)
585 ' ' Froude number = 12.822
586
587 Upstream point elevation = 59.830(Ft.)
588 Downstream point elevation = 38.500(Ft.)
589 Flow length = 19.400(Ft.)
590 Travel time = 0.02 min.
591 Time of concentration = 4.67 min.
592 Depth of flow = 0.106(Ft.)
593 Average velocity = 16.783(Ft/s)
594 Total irregular channel flow = 1.140(CFS)

```

595 Irregular channel normal depth above invert elev. = 0.106(Ft.)
 596 **Average** velocity of channel(s) = 16.783(Ft/s)
 597 Adding area flow to channel
 598 Calculated TC of 4.666 minutes is less than 5 minutes,
 599 resetting TC to 5.0 minutes for rainfall intensity calculations
 600 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
 601 Decimal fraction soil group A = 0.000
 602 Decimal fraction soil group B = 0.000
 603 Decimal fraction soil group C = 0.000
 604 Decimal fraction soil group D = 1.000
 605 [MEDIUM DENSITY RESIDENTIAL]
 606 (10.9 DU/A or Less)
 607 Impervious value, Ai = 0.450
 608 Sub-Area C Value = 0.600
 609 Rainfall intensity = 6.587(In/Hr) for a 100.0 year storm
 610 Effective runoff coefficient used for total area
 611 (Q=KCIA) is C = 0.854 CA = 0.175
 612 Subarea runoff = 0.047(CFS) for 0.012(Ac.)
 613 Total runoff = 1.153(CFS) Total area = 0.205(Ac.)
 614 Depth of flow = 0.107(Ft.), **Average** velocity = 16.831(Ft/s)

617 +-----+
 618 Process from Point/Station 303.000 to Point/Station 304.000
 619 **** PIPEFLOW TRAVEL TIME (User specified size) ****

621 Upstream point/station elevation = 35.740(Ft.)
 622 Downstream point/station elevation = 34.720(Ft.)
 623 Pipe **length** = 21.60(Ft.) Slope = 0.0472 Manning's N = 0.013
 624 No. of pipes = 1 Required pipe flow = 1.153(CFS)
 625 Given pipe size = 6.00(In.)
 626 Calculated individual pipe flow = 1.153(CFS)
 627 Normal flow depth in pipe = 4.65(In.)
 628 Flow top width inside pipe = 5.01(In.)
 629 Critical depth could not be calculated.
 630 Pipe flow velocity = 7.06(Ft/s)
 631 Travel time through pipe = 0.05 min.
 632 Time of concentration (TC) = 4.72 min.

635 +-----+
 636 Process from Point/Station 304.000 to Point/Station 304.000
 637 **** CONFLUENCE OF MINOR STREAMS ****

639 Along Main Stream number: 1 in normal stream number 2
 640 Stream flow area = 0.205(Ac.)
 641 Runoff from this stream = 1.153(CFS)
 642 Time of concentration = 4.72 min.
 643 Rainfall intensity = 6.587(In/Hr)
 644 Summary of stream data:

Stream No.	Flow rate (CFS)	TC (min)	Rainfall Intensity (In/Hr)
1	2.026	8.84	4.562
2	1.153	4.72	6.587
Qmax(1) =			
	1.000 *	1.000 *	2.026) +
	0.693 *	1.000 *	1.153) + = 2.825
Qmax(2) =			
	1.000 *	0.534 *	2.026) +
	1.000 *	1.000 *	1.153) + = 2.235

659 Total of 2 streams to confluence:
 660 Flow rates before confluence point:

```

661          2.026          1.153
662 Maximum flow rates at confluence using above data:
663          2.825          2.235
664 Area of streams before confluence:
665          0.489          0.205
666 Results of confluence:
667 Total flow rate =          2.825(CFS)
668 Time of concentration =          8.835 min.
669 Effective stream area after confluence =          0.694(Ac.)
670
671
672 *****
673 Process from Point/Station          304.000 to Point/Station          305.000
674 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
675
676 -----
677 Depth of flow =          0.381(Ft.), Average velocity =          1.927(Ft/s)
678          ***** Irregular Channel Data *****
679 -----
680 Information entered for subchannel number 1 :
681 Point number          'X' coordinate          'Y' coordinate
682          1              0.00              0.50
683          2              10.00             0.00
684          3              10.10             0.50
685          4              15.00             0.60
686 Manning's 'N' friction factor =          0.015
687 -----
688 Sub-Channel flow =          2.825(CFS)
689          '   '   flow top width =          7.695(Ft.)
690          '   '   velocity=          1.927(Ft/s)
691          '   '   area =          1.466(Sq.Ft)
692          '   '   Froude number =          0.778
693
694 Upstream point elevation =          34.720(Ft.)
695 Downstream point elevation =          34.280(Ft.)
696 Flow length =          120.610(Ft.)
697 Travel time =          1.04 min.
698 Time of concentration =          9.88 min.
699 Depth of flow =          0.381(Ft.)
700 Average velocity =          1.927(Ft/s)
701 Total irregular channel flow =          2.825(CFS)
702 Irregular channel normal depth above invert elev. =          0.381(Ft.)
703 Average velocity of channel(s) =          1.927(Ft/s)
704
705 *****
706 Process from Point/Station          305.000 to Point/Station          305.000
707 **** CONFLUENCE OF MINOR STREAMS ****
708
709 -----
710 Along Main Stream number: 1 in normal stream number 1
711 Stream flow area =          0.694(Ac.)
712 Runoff from this stream =          2.825(CFS)
713 Time of concentration =          9.88 min.
714 Rainfall intensity =          4.246(In/Hr)
715
716 *****
717 Process from Point/Station          401.000 to Point/Station          402.000
718 **** INITIAL AREA EVALUATION ****
719
720 -----
721 Decimal fraction soil group A = 0.000
722 Decimal fraction soil group B = 0.000
723 Decimal fraction soil group C = 0.000
724 Decimal fraction soil group D = 1.000
725 [INDUSTRIAL area type          ]
726 (General Industrial          )
727 Impervious value, Ai = 0.950

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727 Sub-Area C Value = 0.870
728 Initial subarea total flow distance = 62.840(Ft.)
729 Highest elevation = 60.000(Ft.)
730 Lowest elevation = 59.840(Ft.)
731 Elevation difference = 0.160(Ft.) Slope = 0.255 %
732 INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
733 The maximum overland flow distance is 50.00 (Ft)
734 for the top area slope value of 0.25 %, in a development type of
735 General Industrial
736 In Accordance With Figure 3-3
737 Initial Area Time of Concentration = 4.65 minutes
738 TC = [1.8*(1.1-C)*distance(Ft.)^.5]/(% slope^(1/3)]
739 TC = [1.8*(1.1-0.8700)*( 50.000^.5)]/( 0.250^(1/3)]= 4.65
740 Calculated TC of 4.647 minutes is less than 5 minutes,
741 resetting TC to 5.0 minutes for rainfall intensity calculations
742 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
743 Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
744 Subarea runoff = 0.745(CFS)
745 Total initial stream area = 0.130(Ac.)
746
747
748 +-----+
749 Process from Point/Station 402.000 to Point/Station 403.000
750 **** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
751
752 -----
753 Estimated mean flow rate at midpoint of channel = 1.063(CFS)
754 Depth of flow = 0.213(Ft.), Average velocity = 4.676(Ft/s)
755 ***** Irregular Channel Data *****
756 -----
757 Information entered for subchannel number 1 :
758 Point number 'X' coordinate 'Y' coordinate
759 1 0.00 0.40
760 2 2.00 0.00
761 3 4.00 0.40
762 Manning's 'N' friction factor = 0.013
763 -----
764 Sub-Channel flow = 1.063(CFS)
765 ' ' flow top width = 2.133(Ft.)
766 ' ' velocity= 4.676(Ft/s)
767 ' ' area = 0.227(Sq.Ft)
768 ' ' Froude number = 2.523
769
770 Upstream point elevation = 38.000(Ft.)
771 Downstream point elevation = 37.000(Ft.)
772 Flow length = 29.440(Ft.)
773 Travel time = 0.10 min.
774 Time of concentration = 4.75 min.
775 Depth of flow = 0.213(Ft.)
776 Average velocity = 4.676(Ft/s)
777 Total irregular channel flow = 1.063(CFS)
778 Irregular channel normal depth above invert elev. = 0.213(Ft.)
779 Average velocity of channel(s) = 4.676(Ft/s)
780 Adding area flow to channel
781 Calculated TC of 4.752 minutes is less than 5 minutes,
782 resetting TC to 5.0 minutes for rainfall intensity calculations
783 Rainfall intensity (I) = 6.587(In/Hr) for a 100.0 year storm
784 Decimal fraction soil group A = 0.000
785 Decimal fraction soil group B = 0.000
786 Decimal fraction soil group C = 0.000
787 Decimal fraction soil group D = 1.000
788 [MEDIUM DENSITY RESIDENTIAL ]
789 (14.5 DU/A or Less )
790 Impervious value, Ai = 0.500
791 Sub-Area C Value = 0.630
792 Rainfall intensity = 6.587(In/Hr) for a 100.0 year storm
793 Effective runoff coefficient used for total area

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```

793      (Q=KCIA) is C = 0.746  CA =      0.201
794      Subarea runoff =      0.581(CFS) for      0.140(Ac.)
795      Total runoff =      1.326(CFS)  Total area =      0.270(Ac.)
796      Depth of flow =      0.232(Ft.), Average velocity =      4.941(Ft/s)
797
798
799      +-----+
800      Process from Point/Station      403.000 to Point/Station      305.000
801      **** PIPEFLOW TRAVEL TIME (User specified size) ****
802
803      Upstream point/station elevation =      35.000(Ft.)
804      Downstream point/station elevation =      34.280(Ft.)
805      Pipe length =      132.00(Ft.) Slope =      0.0055  Manning's N = 0.013
806      No. of pipes = 1  Required pipe flow =      1.326(CFS)
807      Given pipe size =      12.00(In.)
808      Calculated individual pipe flow =      1.326(CFS)
809      Normal flow depth in pipe =      6.03(In.)
810      Flow top width inside pipe =      12.00(In.)
811      Critical Depth =      5.84(In.)
812      Pipe flow velocity =      3.36(Ft/s)
813      Travel time through pipe =      0.66 min.
814      Time of concentration (TC) =      5.41 min.
815
816
817      +-----+
818      Process from Point/Station      305.000 to Point/Station      305.000
819      **** SUBAREA FLOW ADDITION ****
820
821      Rainfall intensity (I) =      6.262(In/Hr) for a      100.0 year storm
822      Decimal fraction soil group A = 0.000
823      Decimal fraction soil group B = 0.000
824      Decimal fraction soil group C = 0.000
825      Decimal fraction soil group D = 1.000
826      [LOW DENSITY RESIDENTIAL ]
827      (2.0 DU/A or Less )
828      Impervious value, Ai = 0.200
829      Sub-Area C Value = 0.460
830      Time of concentration =      5.41 min.
831      Rainfall intensity =      6.262(In/Hr) for a      100.0 year storm
832      Effective runoff coefficient used for total area
833      (Q=KCIA) is C = 0.719  CA =      0.214
834      Subarea runoff =      0.015(CFS) for      0.028(Ac.)
835      Total runoff =      1.341(CFS)  Total area =      0.298(Ac.)
836
837
838      +-----+
839      Process from Point/Station      305.000 to Point/Station      305.000
840      **** CONFLUENCE OF MINOR STREAMS ****
841
842      Along Main Stream number: 1 in normal stream number 2
843      Stream flow area =      0.298(Ac.)
844      Runoff from this stream =      1.341(CFS)
845      Time of concentration =      5.41 min.
846      Rainfall intensity =      6.262(In/Hr)
847
848
849      +-----+
850      Process from Point/Station      601.000 to Point/Station      305.000
851      **** USER DEFINED FLOW INFORMATION AT A POINT ****
852
853      User specified 'C' value of 0.820 given for subarea
854      Rainfall intensity (I) =      6.216(In/Hr) for a      100.0 year storm
855      User specified values are as follows:
856      TC =      5.47 min.  Rain intensity =      6.22(In/Hr)
857      Total area =      0.550(Ac.)  Total runoff =      2.804(CFS)
858

```

859
 860 ++++++
 861 Process from Point/Station 305.000 to Point/Station 305.000
 862 **** CONFLUENCE OF MINOR STREAMS ****

863
 864 Along Main Stream number: 1 in normal stream number 3
 865 Stream flow area = 0.550(Ac.)
 866 Runoff from this stream = 2.804(CFS)
 867 Time of concentration = 5.47 min.
 868 Rainfall intensity = 6.216(In/Hr)
 869 Summary of stream data:

870
 871 Stream Flow rate TC Rainfall Intensity
 872 No. (CFS) (min) (In/Hr)

873
 874
 875 1 2.825 9.88 4.246
 876 2 1.341 5.41 6.262
 877 3 2.804 5.47 6.216

878 Qmax(1) =
 879 1.000 * 1.000 * 2.825) +
 880 0.678 * 1.000 * 1.341) +
 881 0.683 * 1.000 * 2.804) + = 5.649

882 Qmax(2) =
 883 1.000 * 0.547 * 2.825) +
 884 1.000 * 1.000 * 1.341) +
 885 1.000 * 0.989 * 2.804) + = 5.659

886 Qmax(3) =
 887 1.000 * 0.554 * 2.825) +
 888 0.993 * 1.000 * 1.341) +
 889 1.000 * 1.000 * 2.804) + = 5.700

890
 891 Total of 3 streams to confluence:
 892 Flow rates before confluence point:
 893 2.825 1.341 2.804
 894 Maximum flow rates at confluence using above data:
 895 5.649 5.659 5.700
 896 Area of streams before confluence:
 897 0.694 0.298 0.550

898 Results of confluence:
 899 Total flow rate = 5.700(CFS)
 900 Time of concentration = 5.470 min.
 901 Effective stream area after confluence = 1.542(Ac.)

902
 903
 904 ++++++
 905 Process from Point/Station 305.000 to Point/Station 305.000
 906 **** 6 HOUR HYDROGRAPH ****

907
 908 ++++++
 909 Hydrograph Data - Section 6, San Diego County Hydrology manual, June 2003

910
 911
 912 Time of Concentration = 5.47
 913 Basin Area = 1.54 Acres
 914 6 Hour Rainfall = 2.500 Inches
 915 Runoff Coefficient = 0.799
 916 Peak Discharge = 5.70 CFS
 917 Time (Min) Discharge (CFS)
 918 0 0.000
 919 5 0.183
 920 10 0.185
 921 15 0.189
 922 20 0.190
 923 25 0.194
 924 30 0.196

925	35	0.200
926	40	0.202
927	45	0.206
928	50	0.209
929	55	0.213
930	60	0.216
931	65	0.221
932	70	0.224
933	75	0.229
934	80	0.232
935	85	0.239
936	90	0.242
937	95	0.249
938	100	0.253
939	105	0.260
940	110	0.265
941	115	0.273
942	120	0.278
943	125	0.288
944	130	0.293
945	135	0.305
946	140	0.311
947	145	0.325
948	150	0.332
949	155	0.348
950	160	0.357
951	165	0.376
952	170	0.387
953	175	0.411
954	180	0.424
955	185	0.455
956	190	0.472
957	195	0.513
958	200	0.538
959	205	0.596
960	210	0.632
961	215	0.725
962	220	0.786
963	225	0.961
964	230	1.094
965	235	1.606
966	240	2.263
967	245	5.700
968	250	1.288
969	255	0.862
970	260	0.674
971	265	0.565
972	270	0.492
973	275	0.439
974	280	0.398
975	285	0.366
976	290	0.340
977	295	0.318
978	300	0.299
979	305	0.283
980	310	0.269
981	315	0.257
982	320	0.245
983	325	0.236
984	330	0.227
985	335	0.218
986	340	0.211
987	345	0.204
988	350	0.198
989	355	0.192
990	360	0.187

991 365 0.182
 992 +-----+
 993 6 - H O U R S T O R M
 994 R u n o f f H y d r o g r a p h
 995 -----

Hydrograph in 1 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	1.4	2.8	4.3	5.7
1001	0+ 0	0.0000	0.00	Q				
1002	0+ 1	0.0001	0.04	Q				
1003	0+ 2	0.0002	0.07	Q				
1004	0+ 3	0.0003	0.11	Q				
1005	0+ 4	0.0005	0.15	VQ				
1006	0+ 5	0.0008	0.18	VQ				
1007	0+ 6	0.0010	0.18	VQ				
1008	0+ 7	0.0013	0.18	VQ				
1009	0+ 8	0.0015	0.18	VQ				
1010	0+ 9	0.0018	0.18	VQ				
1011	0+10	0.0020	0.19	VQ				
1012	0+11	0.0023	0.19	VQ				
1013	0+12	0.0025	0.19	VQ				
1014	0+13	0.0028	0.19	VQ				
1015	0+14	0.0031	0.19	VQ				
1016	0+15	0.0033	0.19	VQ				
1017	0+16	0.0036	0.19	VQ				
1018	0+17	0.0038	0.19	VQ				
1019	0+18	0.0041	0.19	VQ				
1020	0+19	0.0044	0.19	VQ				
1021	0+20	0.0046	0.19	VQ				
1022	0+21	0.0049	0.19	VQ				
1023	0+22	0.0051	0.19	VQ				
1024	0+23	0.0054	0.19	VQ				
1025	0+24	0.0057	0.19	VQ				
1026	0+25	0.0059	0.19	VQ				
1027	0+26	0.0062	0.19	Q				
1028	0+27	0.0065	0.19	Q				
1029	0+28	0.0068	0.20	Q				
1030	0+29	0.0070	0.20	Q				
1031	0+30	0.0073	0.20	Q				
1032	0+31	0.0076	0.20	Q				
1033	0+32	0.0078	0.20	Q				
1034	0+33	0.0081	0.20	Q				
1035	0+34	0.0084	0.20	Q				
1036	0+35	0.0087	0.20	Q				
1037	0+36	0.0089	0.20	Q				
1038	0+37	0.0092	0.20	Q				
1039	0+38	0.0095	0.20	Q				
1040	0+39	0.0098	0.20	Q				
1041	0+40	0.0100	0.20	Q				
1042	0+41	0.0103	0.20	Q				
1043	0+42	0.0106	0.20	Q				
1044	0+43	0.0109	0.20	Q				
1045	0+44	0.0112	0.21	Q				
1046	0+45	0.0115	0.21	Q				
1047	0+46	0.0117	0.21	Q				
1048	0+47	0.0120	0.21	QV				
1049	0+48	0.0123	0.21	QV				
1050	0+49	0.0126	0.21	QV				
1051	0+50	0.0129	0.21	QV				
1052	0+51	0.0132	0.21	QV				
1053	0+52	0.0135	0.21	QV				
1054	0+53	0.0138	0.21	QV				
1055	0+54	0.0140	0.21	QV				
1056	0+55	0.0143	0.21	QV				

1057	0+56	0.0146	0.21	QV
1058	0+57	0.0149	0.21	QV
1059	0+58	0.0152	0.21	QV
1060	0+59	0.0155	0.22	QV
1061	1+ 0	0.0158	0.22	QV
1062	1+ 1	0.0161	0.22	QV
1063	1+ 2	0.0164	0.22	QV
1064	1+ 3	0.0167	0.22	QV
1065	1+ 4	0.0170	0.22	QV
1066	1+ 5	0.0173	0.22	QV
1067	1+ 6	0.0176	0.22	QV
1068	1+ 7	0.0179	0.22	Q V
1069	1+ 8	0.0183	0.22	Q V
1070	1+ 9	0.0186	0.22	Q V
1071	1+10	0.0189	0.22	Q V
1072	1+11	0.0192	0.22	Q V
1073	1+12	0.0195	0.23	Q V
1074	1+13	0.0198	0.23	Q V
1075	1+14	0.0201	0.23	Q V
1076	1+15	0.0204	0.23	Q V
1077	1+16	0.0207	0.23	Q V
1078	1+17	0.0211	0.23	Q V
1079	1+18	0.0214	0.23	Q V
1080	1+19	0.0217	0.23	Q V
1081	1+20	0.0220	0.23	Q V
1082	1+21	0.0223	0.23	Q V
1083	1+22	0.0227	0.23	Q V
1084	1+23	0.0230	0.24	Q V
1085	1+24	0.0233	0.24	Q V
1086	1+25	0.0237	0.24	Q V
1087	1+26	0.0240	0.24	Q V
1088	1+27	0.0243	0.24	Q V
1089	1+28	0.0246	0.24	Q V
1090	1+29	0.0250	0.24	Q V
1091	1+30	0.0253	0.24	Q V
1092	1+31	0.0256	0.24	Q V
1093	1+32	0.0260	0.24	Q V
1094	1+33	0.0263	0.25	Q V
1095	1+34	0.0267	0.25	Q V
1096	1+35	0.0270	0.25	Q V
1097	1+36	0.0273	0.25	Q V
1098	1+37	0.0277	0.25	Q V
1099	1+38	0.0280	0.25	Q V
1100	1+39	0.0284	0.25	Q V
1101	1+40	0.0287	0.25	Q V
1102	1+41	0.0291	0.25	Q V
1103	1+42	0.0294	0.26	Q V
1104	1+43	0.0298	0.26	Q V
1105	1+44	0.0301	0.26	Q V
1106	1+45	0.0305	0.26	Q V
1107	1+46	0.0309	0.26	Q V
1108	1+47	0.0312	0.26	Q V
1109	1+48	0.0316	0.26	Q V
1110	1+49	0.0320	0.26	Q V
1111	1+50	0.0323	0.26	Q V
1112	1+51	0.0327	0.27	Q V
1113	1+52	0.0331	0.27	Q V
1114	1+53	0.0334	0.27	Q V
1115	1+54	0.0338	0.27	Q V
1116	1+55	0.0342	0.27	Q V
1117	1+56	0.0346	0.27	Q V
1118	1+57	0.0349	0.28	Q V
1119	1+58	0.0353	0.28	Q V
1120	1+59	0.0357	0.28	Q V
1121	2+ 0	0.0361	0.28	Q V
1122	2+ 1	0.0365	0.28	Q V

1123	2+ 2	0.0369	0.28	Q	V				
1124	2+ 3	0.0372	0.28	Q	V				
1125	2+ 4	0.0376	0.29	Q	V				
1126	2+ 5	0.0380	0.29	Q	V				
1127	2+ 6	0.0384	0.29	Q	V				
1128	2+ 7	0.0388	0.29	Q	V				
1129	2+ 8	0.0392	0.29	Q	V				
1130	2+ 9	0.0396	0.29	Q	V				
1131	2+10	0.0400	0.29	Q	V				
1132	2+11	0.0404	0.30	Q	V				
1133	2+12	0.0409	0.30	Q	V				
1134	2+13	0.0413	0.30	Q	V				
1135	2+14	0.0417	0.30	Q	V				
1136	2+15	0.0421	0.30	Q	V				
1137	2+16	0.0425	0.31	Q	V				
1138	2+17	0.0430	0.31	Q	V				
1139	2+18	0.0434	0.31	Q	V				
1140	2+19	0.0438	0.31	Q	V				
1141	2+20	0.0442	0.31	Q	V				
1142	2+21	0.0447	0.31	Q	V				
1143	2+22	0.0451	0.32	Q	V				
1144	2+23	0.0455	0.32	Q	V				
1145	2+24	0.0460	0.32	Q	V				
1146	2+25	0.0464	0.32	Q	V				
1147	2+26	0.0469	0.33	Q	V				
1148	2+27	0.0473	0.33	Q	V				
1149	2+28	0.0478	0.33	Q	V				
1150	2+29	0.0482	0.33	Q	V				
1151	2+30	0.0487	0.33	Q	V				
1152	2+31	0.0492	0.34	Q	V				
1153	2+32	0.0496	0.34	Q	V				
1154	2+33	0.0501	0.34	Q	V				
1155	2+34	0.0506	0.34	Q	V				
1156	2+35	0.0511	0.35	Q	V				
1157	2+36	0.0515	0.35	Q	V				
1158	2+37	0.0520	0.35	Q	V				
1159	2+38	0.0525	0.35	Q	V				
1160	2+39	0.0530	0.35	Q	V				
1161	2+40	0.0535	0.36	Q	V				
1162	2+41	0.0540	0.36	Q	V				
1163	2+42	0.0545	0.36	Q	V				
1164	2+43	0.0550	0.37	Q	V				
1165	2+44	0.0555	0.37	Q	V				
1166	2+45	0.0560	0.38	Q	V				
1167	2+46	0.0565	0.38	Q	V				
1168	2+47	0.0571	0.38	Q	V				
1169	2+48	0.0576	0.38	Q	V				
1170	2+49	0.0581	0.38	Q	V				
1171	2+50	0.0587	0.39	Q	V				
1172	2+51	0.0592	0.39	Q	V				
1173	2+52	0.0597	0.40	Q	V				
1174	2+53	0.0603	0.40	Q	V				
1175	2+54	0.0609	0.41	Q	V				
1176	2+55	0.0614	0.41	Q	V				
1177	2+56	0.0620	0.41	Q	V				
1178	2+57	0.0626	0.42	Q	V				
1179	2+58	0.0631	0.42	Q	V				
1180	2+59	0.0637	0.42	Q	V				
1181	3+ 0	0.0643	0.42	Q	V				
1182	3+ 1	0.0649	0.43	Q	V				
1183	3+ 2	0.0655	0.44	Q	V				
1184	3+ 3	0.0661	0.44	Q	V				
1185	3+ 4	0.0667	0.45	Q	V				
1186	3+ 5	0.0673	0.45	Q	V				
1187	3+ 6	0.0680	0.46	Q	V				
1188	3+ 7	0.0686	0.46	Q	V				

1189	3+ 8	0.0693	0.47	Q	V				
1190	3+ 9	0.0699	0.47	Q	V				
1191	3+10	0.0705	0.47	Q	V				
1192	3+11	0.0712	0.48	Q	V				
1193	3+12	0.0719	0.49	Q	V				
1194	3+13	0.0726	0.50	Q	V				
1195	3+14	0.0733	0.51	Q	V				
1196	3+15	0.0740	0.51	Q	V				
1197	3+16	0.0747	0.52	Q	V				
1198	3+17	0.0754	0.52	Q	V				
1199	3+18	0.0761	0.53	Q	V				
1200	3+19	0.0769	0.53	Q	V				
1201	3+20	0.0776	0.54	Q	V				
1202	3+21	0.0784	0.55	Q	V				
1203	3+22	0.0791	0.56	Q	V				
1204	3+23	0.0799	0.57	Q	V				
1205	3+24	0.0807	0.58	Q	V				
1206	3+25	0.0816	0.60	Q	V				
1207	3+26	0.0824	0.60	Q	V				
1208	3+27	0.0832	0.61	Q	V				
1209	3+28	0.0841	0.62	Q	V				
1210	3+29	0.0849	0.63	Q	V				
1211	3+30	0.0858	0.63	Q	V				
1212	3+31	0.0867	0.65	Q	V				
1213	3+32	0.0876	0.67	Q	V				
1214	3+33	0.0886	0.69	Q	V				
1215	3+34	0.0895	0.71	Q	V				
1216	3+35	0.0905	0.72	Q	V				
1217	3+36	0.0916	0.74	Q	V				
1218	3+37	0.0926	0.75	Q	V				
1219	3+38	0.0936	0.76	Q	V				
1220	3+39	0.0947	0.77	Q	V				
1221	3+40	0.0958	0.79	Q	V				
1222	3+41	0.0969	0.82	Q	V				
1223	3+42	0.0981	0.86	Q	V				
1224	3+43	0.0993	0.89	Q	V				
1225	3+44	0.1006	0.93	Q	V				
1226	3+45	0.1019	0.96	Q	V				
1227	3+46	0.1033	0.99	Q	V				
1228	3+47	0.1047	1.01	Q	V				
1229	3+48	0.1061	1.04	Q	V				
1230	3+49	0.1076	1.07	Q	V				
1231	3+50	0.1091	1.09	Q	V				
1232	3+51	0.1107	1.20	Q	V				
1233	3+52	0.1125	1.30	Q	V				
1234	3+53	0.1145	1.40	Q	V				
1235	3+54	0.1165	1.50	Q	V				
1236	3+55	0.1187	1.61	Q	V				
1237	3+56	0.1211	1.74	Q	V				
1238	3+57	0.1237	1.87	Q	V				
1239	3+58	0.1265	2.00	Q	V				
1240	3+59	0.1294	2.13	Q	V				
1241	4+ 0	0.1325	2.26	Q	V				
1242	4+ 1	0.1366	2.95	Q	V				
1243	4+ 2	0.1416	3.64	Q	V				
1244	4+ 3	0.1476	4.33	Q	V				
1245	4+ 4	0.1545	5.01	Q	V				
1246	4+ 5	0.1623	5.70	Q	V				
1247	4+ 6	0.1689	4.82	Q	V				
1248	4+ 7	0.1744	3.94	Q	V				
1249	4+ 8	0.1786	3.05	Q	V				
1250	4+ 9	0.1816	2.17	Q	V				
1251	4+10	0.1833	1.29	Q	V				
1252	4+11	0.1850	1.20	Q	V				
1253	4+12	0.1865	1.12	Q	V				
1254	4+13	0.1879	1.03	Q	V				

1255	4+14	0.1893	0.95				V
1256	4+15	0.1904	0.86				V
1257	4+16	0.1916	0.82				V
1258	4+17	0.1927	0.79				V
1259	4+18	0.1937	0.75				V
1260	4+19	0.1947	0.71				V
1261	4+20	0.1956	0.67				V
1262	4+21	0.1965	0.65				V
1263	4+22	0.1974	0.63				V
1264	4+23	0.1982	0.61				V
1265	4+24	0.1990	0.59				V
1266	4+25	0.1998	0.56				V
1267	4+26	0.2006	0.55				V
1268	4+27	0.2013	0.54				V
1269	4+28	0.2020	0.52				V
1270	4+29	0.2027	0.51				V
1271	4+30	0.2034	0.49				V
1272	4+31	0.2040	0.48				V
1273	4+32	0.2047	0.47				V
1274	4+33	0.2053	0.46				V
1275	4+34	0.2059	0.45				V
1276	4+35	0.2066	0.44				V
1277	4+36	0.2071	0.43				V
1278	4+37	0.2077	0.42				V
1279	4+38	0.2083	0.41				V
1280	4+39	0.2089	0.41				V
1281	4+40	0.2094	0.40				V
1282	4+41	0.2099	0.39				V
1283	4+42	0.2105	0.39				V
1284	4+43	0.2110	0.38				V
1285	4+44	0.2115	0.37				V
1286	4+45	0.2120	0.37				V
1287	4+46	0.2125	0.36				V
1288	4+47	0.2130	0.36				V
1289	4+48	0.2135	0.35				V
1290	4+49	0.2140	0.34				V
1291	4+50	0.2144	0.34				V
1292	4+51	0.2149	0.34				V
1293	4+52	0.2153	0.33				V
1294	4+53	0.2158	0.33				V
1295	4+54	0.2162	0.32				V
1296	4+55	0.2167	0.32				V
1297	4+56	0.2171	0.31				V
1298	4+57	0.2175	0.31				V
1299	4+58	0.2180	0.31				V
1300	4+59	0.2184	0.30				V
1301	5+ 0	0.2188	0.30				V
1302	5+ 1	0.2192	0.30				V
1303	5+ 2	0.2196	0.29				V
1304	5+ 3	0.2200	0.29				V
1305	5+ 4	0.2204	0.29				V
1306	5+ 5	0.2208	0.28				V
1307	5+ 6	0.2212	0.28				V
1308	5+ 7	0.2215	0.28				V
1309	5+ 8	0.2219	0.27				V
1310	5+ 9	0.2223	0.27				V
1311	5+10	0.2227	0.27				V
1312	5+11	0.2230	0.27				V
1313	5+12	0.2234	0.26				V
1314	5+13	0.2238	0.26				V
1315	5+14	0.2241	0.26				V
1316	5+15	0.2245	0.26				V
1317	5+16	0.2248	0.25				V
1318	5+17	0.2252	0.25				V
1319	5+18	0.2255	0.25				V
1320	5+19	0.2259	0.25				V

1321	5+20	0.2262	0.25	Q	V
1322	5+21	0.2265	0.24	Q	V
1323	5+22	0.2269	0.24	Q	V
1324	5+23	0.2272	0.24	Q	V
1325	5+24	0.2275	0.24	Q	V
1326	5+25	0.2278	0.24	Q	V
1327	5+26	0.2282	0.23	Q	V
1328	5+27	0.2285	0.23	Q	V
1329	5+28	0.2288	0.23	Q	V
1330	5+29	0.2291	0.23	Q	V
1331	5+30	0.2294	0.23	Q	V
1332	5+31	0.2297	0.22	Q	V
1333	5+32	0.2300	0.22	Q	V
1334	5+33	0.2303	0.22	Q	V
1335	5+34	0.2307	0.22	Q	V
1336	5+35	0.2310	0.22	Q	V
1337	5+36	0.2313	0.22	Q	V
1338	5+37	0.2315	0.22	Q	V
1339	5+38	0.2318	0.21	Q	V
1340	5+39	0.2321	0.21	Q	V
1341	5+40	0.2324	0.21	Q	V
1342	5+41	0.2327	0.21	Q	V
1343	5+42	0.2330	0.21	Q	V
1344	5+43	0.2333	0.21	Q	V
1345	5+44	0.2336	0.21	Q	V
1346	5+45	0.2339	0.20	Q	V
1347	5+46	0.2341	0.20	Q	V
1348	5+47	0.2344	0.20	Q	V
1349	5+48	0.2347	0.20	Q	V
1350	5+49	0.2350	0.20	Q	V
1351	5+50	0.2352	0.20	Q	V
1352	5+51	0.2355	0.20	Q	V
1353	5+52	0.2358	0.20	Q	V
1354	5+53	0.2360	0.19	Q	V
1355	5+54	0.2363	0.19	Q	V
1356	5+55	0.2366	0.19	Q	V
1357	5+56	0.2368	0.19	Q	V
1358	5+57	0.2371	0.19	Q	V
1359	5+58	0.2374	0.19	Q	V
1360	5+59	0.2376	0.19	Q	V
1361	6+ 0	0.2379	0.19	Q	V
1362	6+ 1	0.2381	0.19	Q	V
1363	6+ 2	0.2384	0.18	Q	V
1364	6+ 3	0.2386	0.18	Q	V
1365	6+ 4	0.2389	0.18	Q	V
1366	6+ 5	0.2391	0.18	Q	V

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1371

1372 End of computations, total study area = 1.542 (Ac.)

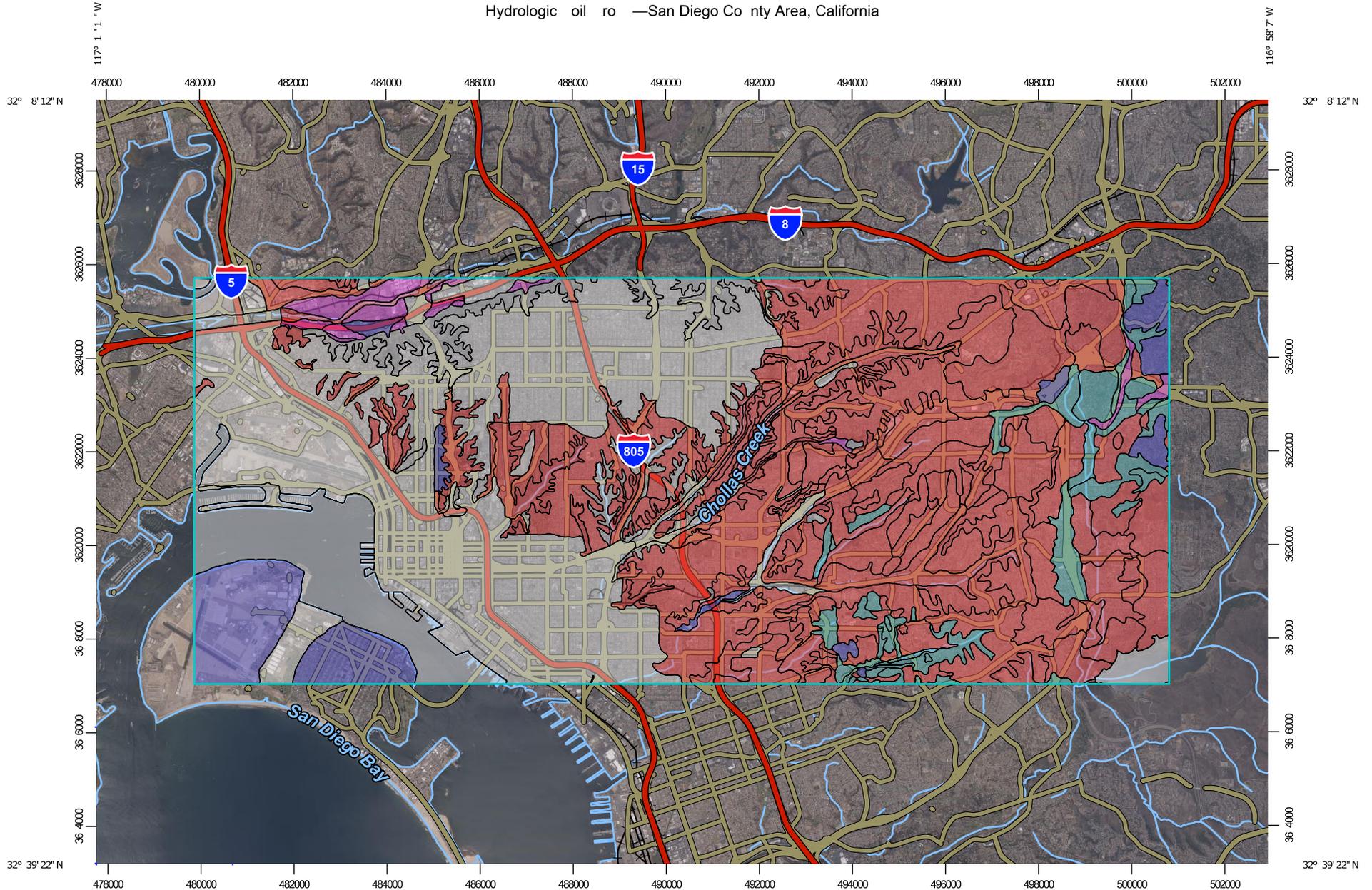
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Attachment E – Soils Group Determination

Hydrologic oil ro —San Diego Co nty Area, California



Map Scale: 1:115 000 if printed on A landscape (11" x 8.5") sheet.

0 500 3000 6000 9000 Meters

0 5000 10000 20000 30000 Feet

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

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Mapping Polygons

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

Soil Mapping Lines

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

Soil Mapping Points

-  A
-  A/D
-  /D
-  C

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

Water Features

 Stream and Canal

Transportation

-  Rail
-  Interstate Highway
-  US Route
-  Major Road
-  Local Road

Background

 Aerial Photography

MAP NOTES

The soil survey data that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet or map measurement.

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

Map 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, would 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 1, Sep 13, 2021

Soil map units are labeled (at a space allowed) or map scale 1:50,000 or larger.

Date(s) aerial image were photographed: Dec 7, 2014—Feb 2, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differ from the background imagery displayed on the map. As a result, some minor differences on the map may be evident.

End of Report