

PRELIMINARY HYDROLOGY AND HYDRAULIC ANALYSIS

FOR:

FULLERTON SHOPS AT FULLERTON TOWN CENTER
NORTHWEST CORNER OF ORANGETHORPE AVENUE AND LEMON STREET
CITY OF FULLERTON, CA
CASE NUMBER: ????
TRUXAW PROJECT NUMBER FTD15084

PREPARED FOR:

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Phoenix, AZ 85004
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PREPARED BY:

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PREPARED ON: OCT. 8, 20



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1.0 PURPOSE

This drainage study analyzes the existing and proposed hydrology characteristics for the Fullerton Town Center's improvements located at the southeast corner of Orangethorp avenue and Lemon street in the city of Fullerton, county of orange, at latitude and longitude of 33.8603° and -117.9209° respectively. The subject site is part of the Fullerton town center that bounds the northwest and south subject areas. The project area is bounded on the east by Lemon Street.

2.0 WATERSHED DESCRIPTION

The site is within Watershed A of the San Gabriel-Coyote Creek watershed and is underlain with Type B soil per the Orange County. The Fullerton town center property drains via a Local underground storm drain to Fullerton Creek Channel that joins Coyote Creek near the Orange County, LA county border. Coyote Cheek discharges to the San Gabriel River that ultimately discharges to the Pacific Ocean through Alamitos Bay.

2.1 EXISTING DRAINAGE

The project site is a portion of the Existing Fullerton Town center consisting of a parking lot, commercial buildings, and raised planters.

The Fullerton Town Center Runoff flow path passes through the proposed project area. A ridge running north to south divides the project area into two east and west drainage areas. The east drainage area discharges to Outfall 1, the West portion discharges to Outfall 2.

Outfall 1 discharges to Lemon Street and is located northeast of the project site. This outfall collects runoff from the east portion of the project site and offsite run on from northeast, west, and south of the project site.

Outfall 2 discharges to the onsite storm drain system connected to the city storm drain in Harbor Blvd. this outfall the west portion of the project area and offsite run on from the north, south, and west.

2.2 PROPOSED DRAINAGE

The proposed improvements will remove the existing parking and retail buildings before constructing a 5 story multifamily housing with retail spaces and a 5.5 story parking garage with new landscape areas and parking. Drainage from the site will discharge to one of three outfalls.

Outfall 1 discharge through the exiting connection to Lemon Street and collects runoff from the northeast portion of the site and offsite run on from the area to the northeast of the project area. Onsite run on is directed to underground detention for treatment. The offsite run on is bypassed around the treatment system to discharge directly to the outfall

Outfall 2 collects drainage from the northwest portion of the site and runs on from the northwest and southwest of the project site. Onsite runoff is conveyed to underground detention and treatment before discharging to the existing onsite storm drain. Offsite run on is bypassed around the treatment devices to discharge directly to the existing onsite storm drain

Outfall 3 collects run on from the carwash and parking lots southwest of the project site. Stormwater sheet flows to the proposed catch basin connected to the underground storm drain system that discharge to a proposed connection to the Lemon Street Storm Drain.

A small area dischrgees over landscape area to discharge to the Curb and Gutter of Lemon Street.

3.0 METHODOLOGY

For this study, all drainage runoffs have been calculated based on a 10-year storm for pipe sizing analysis and a 100-year storm event for building protection. Calculations are performed using the Advanced Engineering Software "Rational Method Hydrology Computer Program Package" for Orange County. This software is based on the Orange County Hydrology Manual dated August 1986, where the equation determines the peak flow:

$$[Q = 0.9 * (I - F_m) * A] \quad \text{Equation DB. from Hydrology Manual}$$

$$Q = \text{Flow Rate (cfs)}$$

$$I = \text{Rainfall Intensity } \left(\frac{\text{in}}{\text{hr}}\right)$$

$$F_m = a_p F_p = (\text{pervious area Fraction})(\text{Pervious Area infiltration rate})$$

4.0 SUMMARY

The site design ensures that stormwater runoff will not adversely affect the site's operation and ensure that danger to property and life is minimal and ensure that the existing drainage system is capable of carrying the proposed flows. The proposed improvements include an additional connection to the lemon street storm drain system.

4.1 PIPE SIZE CALCULATION

Runoff is directed by surface grading to trench drains and grated inlets connected to the underground storm drain system. Underground pipes are sized so that the pipes flow less than $\frac{3}{4}$ full during the 10-year peak storm event. See appendix D for Rational Method Calculations and pipe size calculations. See the proposed Hydrology Exhibit in Appendix B for pipe sizes.

The changes in flow at each outfall is described below

Outfall	10-year Storm			
	Ex Tc	Pr. Tc	Ex Q	Pr. Q
1	6.72	10.38	9.85	3.11
2	12.13	10.60	16.94	16.73
3	N/A	8.91	N/A	2.11

4.2 BUILDING PROTECTION

The site is designed to ensure that the 100-year storm event will not impact the proposed buildings. The proposed storm drain system is checked for the 100-year storm event. See appendix D for Rational Method Calculations and pipe size calculations. See the proposed Hydrology Exhibit in Appendix B for pipe sizes.

Outfall	10-year Storm			
	Ex Tc	Pr. Tc	Ex Q	Pr. Q
1	6.72	10.38	9.85	3.11
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3	N/A	8.91	N/A	2.11

APPENDIX A – LOCATION, VICINITY, AND SOIL MAPS

Location Map

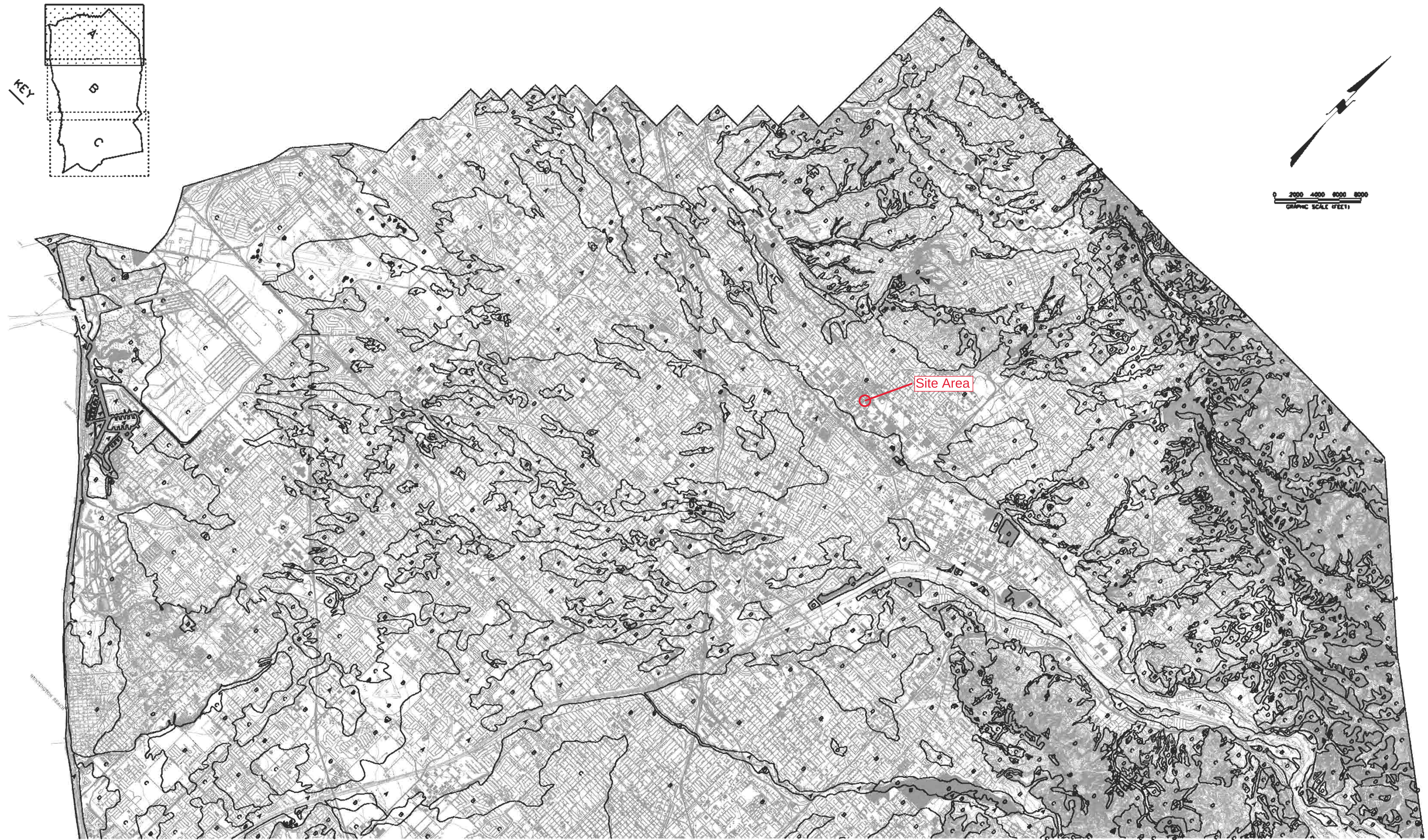


Google Earth

© 2020 Google



2000 ft



ORANGE COUNTY
HYDROLOGY MANUAL

LEGEND
A B C D HYDROLOGIC SOIL GROUPS
— HYDROLOGIC SOIL GROUP BOUNDARY

SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT
GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND
WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA,
USDA, SOIL CONSERVATION SERVICE, 1978.

HYDROLOGIC CLASSIFICATION OF SOILS
ORANGE COUNTY, CALIFORNIA
PLATE A

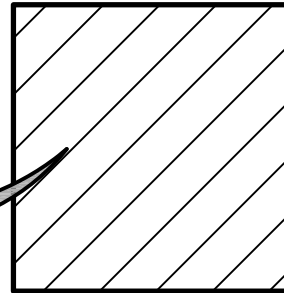
CITY OF

CHAPMAN AVENUE

EUCLID STREET

HARBOR BOULEVARD

SITE



LEMON STREET



ORANGE FWY

ORANGETHORPE AVENUE

RIVERSIDE FWY



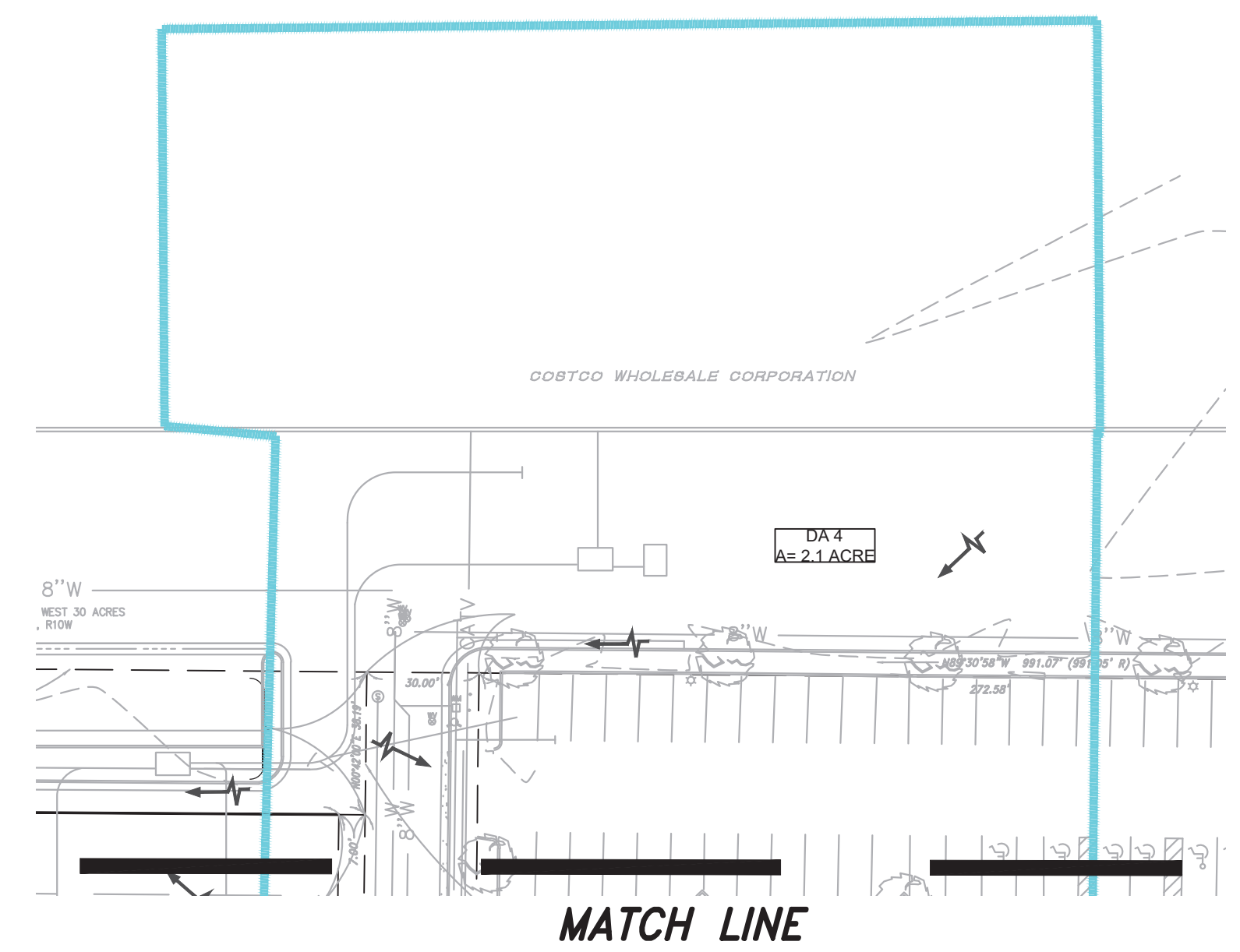
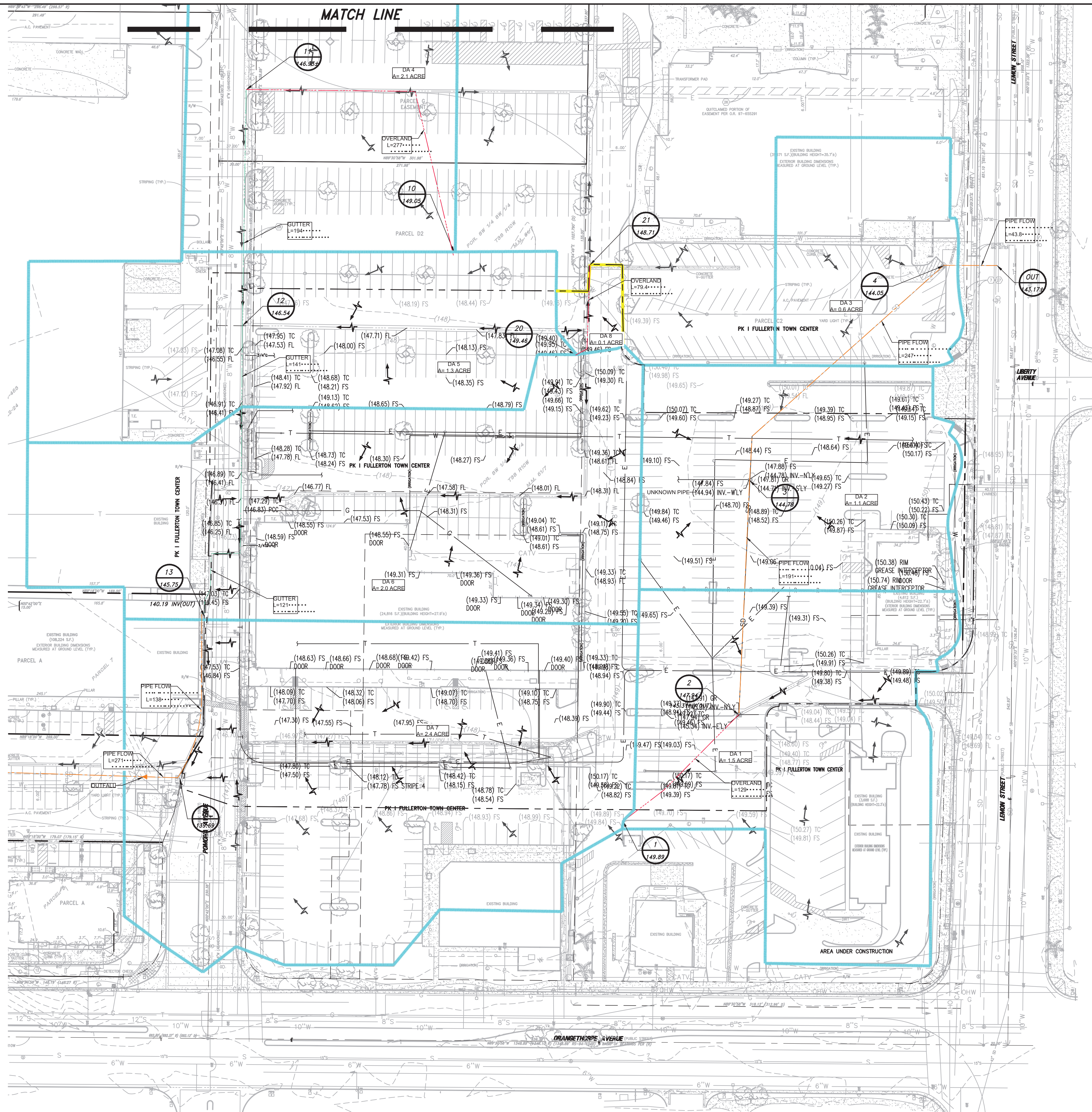
FULLERTON

VICINITY MAP

NOT TO SCALE



APPENDIX B - HYDROLOGY MAPS



- LEGEND**
- DRAINAGE AREA BOUNDARY
 - FLOW PATH—OVERLAND (INITIAL)
 - FLOW PATH PIPE
 - FLOW PATH GUTTER
 - LANDSCAPE AREA
 - 101
450
ELEV. CONCENTRATION POINT
 - 0.497 AREA IN ACRES
 - DIRECTION OF FLOW (ONSITE)
 - DIRECTION OF FLOW (OFFSITE)

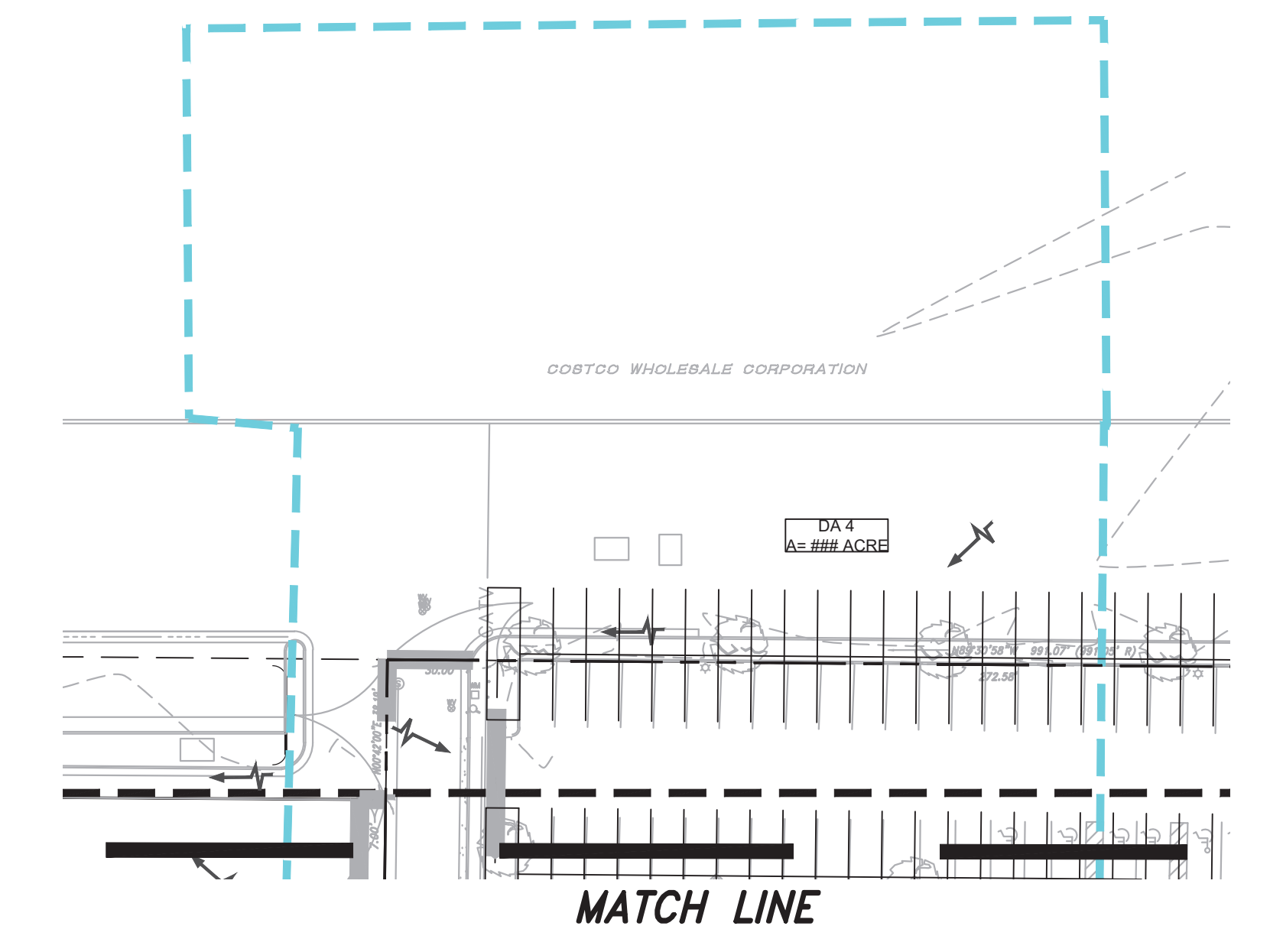
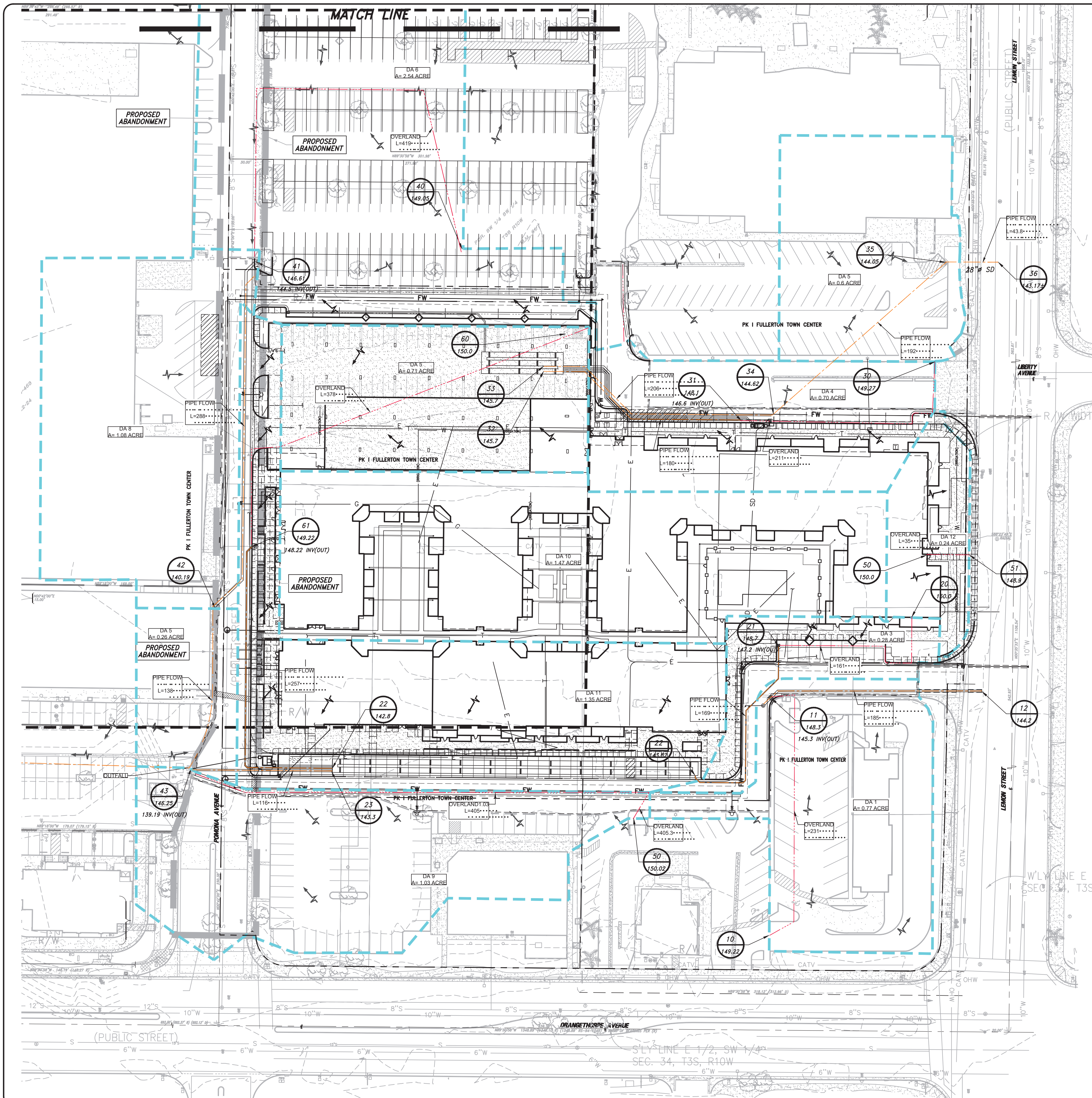
SOIL TYPE B

NO.		REVISIONS		DATE	

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EXISTING HYDROLOGY PLAN
FULLERTON
FULLERTON, CA

DATE: 10/8/2020
DRAWN BY: GJRA
CHECKED BY: CDB
JOB NO.: RDD15084
SHEET NO.: **1**
OF 2 SHEETS



- LEGEND**
- DRAINAGE AREA BOUNDARY
 - FLOW PATH-OVERLAND (INITIAL)
 - FLOW PATH PIPE
 - FLOW PATH GUTTER
 - LANDSCAPE AREA
 - CONCENTRATION POINT
 - AREA IN ACRES
 - DIRECTION OF FLOW (ONSITE)
 - DIRECTION OF FLOW (OFFSITE)

SOIL TYPE B

NO.

REVISIONS

DATE

Prepared by:

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EXISTING HYDROLOGY PLAN

FULLERTON

FULLERTON, CA

DATE

10/8/2020

DRAWN BY

GJRA

CHECKED BY

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JOB NO.

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1

OF 2 SHEETS

APPENDIX C – RAINFALL INTENSITY



NOAA Atlas 14, Volume 6, Version 2
Location name: Fullerton, California, USA*
Latitude: 33.8603°, Longitude: -117.9209°
Elevation: 157.21 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic,
 Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel
 Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.132 (0.111-0.159)	0.169 (0.141-0.204)	0.217 (0.181-0.263)	0.257 (0.212-0.314)	0.311 (0.248-0.394)	0.354 (0.276-0.458)	0.397 (0.302-0.527)	0.442 (0.326-0.604)	0.503 (0.355-0.719)	0.550 (0.375-0.817)
10-min	0.189 (0.159-0.228)	0.242 (0.202-0.292)	0.311 (0.260-0.377)	0.368 (0.304-0.450)	0.446 (0.356-0.565)	0.507 (0.396-0.656)	0.569 (0.432-0.756)	0.633 (0.467-0.866)	0.721 (0.509-1.03)	0.789 (0.537-1.17)
15-min	0.229 (0.192-0.276)	0.292 (0.245-0.353)	0.376 (0.314-0.456)	0.445 (0.368-0.544)	0.540 (0.431-0.683)	0.613 (0.478-0.793)	0.688 (0.523-0.914)	0.765 (0.565-1.05)	0.871 (0.615-1.25)	0.954 (0.650-1.42)
30-min	0.313 (0.263-0.378)	0.400 (0.335-0.483)	0.516 (0.430-0.624)	0.610 (0.504-0.745)	0.739 (0.590-0.936)	0.840 (0.655-1.09)	0.942 (0.717-1.25)	1.05 (0.774-1.44)	1.19 (0.843-1.71)	1.31 (0.890-1.94)
60-min	0.441 (0.370-0.532)	0.564 (0.472-0.680)	0.726 (0.605-0.878)	0.858 (0.710-1.05)	1.04 (0.830-1.32)	1.18 (0.922-1.53)	1.33 (1.01-1.76)	1.48 (1.09-2.02)	1.68 (1.19-2.40)	1.84 (1.25-2.73)
2-hr	0.637 (0.534-0.768)	0.815 (0.682-0.983)	1.05 (0.874-1.27)	1.24 (1.02-1.51)	1.50 (1.19-1.89)	1.69 (1.32-2.19)	1.89 (1.44-2.52)	2.10 (1.55-2.88)	2.38 (1.68-3.41)	2.60 (1.77-3.86)
3-hr	0.800 (0.670-0.965)	1.02 (0.856-1.24)	1.31 (1.10-1.59)	1.55 (1.28-1.89)	1.87 (1.49-2.37)	2.12 (1.65-2.74)	2.37 (1.80-3.14)	2.62 (1.93-3.59)	2.97 (2.09-4.24)	3.23 (2.20-4.80)
6-hr	1.13 (0.947-1.36)	1.44 (1.21-1.74)	1.85 (1.55-2.24)	2.19 (1.81-2.67)	2.64 (2.11-3.34)	2.98 (2.33-3.86)	3.33 (2.53-4.43)	3.69 (2.72-5.05)	4.18 (2.95-5.97)	4.55 (3.10-6.75)
12-hr	1.46 (1.23-1.77)	1.88 (1.57-2.26)	2.42 (2.02-2.93)	2.86 (2.37-3.50)	3.47 (2.77-4.39)	3.94 (3.07-5.09)	4.41 (3.35-5.86)	4.90 (3.62-6.71)	5.58 (3.94-7.97)	6.10 (4.15-9.05)
24-hr	2.01 (1.77-2.31)	2.59 (2.29-2.99)	3.36 (2.96-3.90)	4.00 (3.49-4.67)	4.87 (4.12-5.88)	5.55 (4.60-6.83)	6.24 (5.05-7.87)	6.97 (5.49-9.02)	7.95 (6.02-10.7)	8.73 (6.39-12.2)
2-day	2.40 (2.12-2.77)	3.15 (2.78-3.64)	4.13 (3.64-4.79)	4.94 (4.31-5.76)	6.03 (5.10-7.27)	6.87 (5.69-8.45)	7.72 (6.25-9.73)	8.60 (6.78-11.1)	9.79 (7.41-13.2)	10.7 (7.84-14.9)
3-day	2.68 (2.37-3.09)	3.56 (3.15-4.11)	4.72 (4.16-5.46)	5.65 (4.94-6.60)	6.92 (5.85-8.35)	7.89 (6.54-9.71)	8.87 (7.18-11.2)	9.87 (7.77-12.8)	11.2 (8.49-15.1)	12.3 (8.97-17.1)
4-day	2.86 (2.53-3.29)	3.83 (3.38-4.42)	5.09 (4.49-5.90)	6.12 (5.35-7.14)	7.50 (6.35-9.05)	8.56 (7.10-10.5)	9.63 (7.80-12.1)	10.7 (8.45-13.9)	12.2 (9.23-16.5)	13.3 (9.75-18.6)
7-day	3.25 (2.88-3.76)	4.36 (3.86-5.04)	5.82 (5.13-6.75)	7.02 (6.13-8.19)	8.64 (7.31-10.4)	9.88 (8.19-12.2)	11.2 (9.03-14.1)	12.5 (9.81-16.1)	14.2 (10.8-19.2)	15.6 (11.4-21.8)
10-day	3.50 (3.10-4.04)	4.71 (4.16-5.44)	6.30 (5.55-7.29)	7.60 (6.64-8.88)	9.39 (7.94-11.3)	10.8 (8.93-13.3)	12.2 (9.87-15.4)	13.7 (10.8-17.7)	15.7 (11.8-21.1)	17.2 (12.6-24.0)
20-day	4.15 (3.67-4.79)	5.62 (4.96-6.49)	7.58 (6.68-8.78)	9.22 (8.06-10.8)	11.5 (9.73-13.9)	13.3 (11.0-16.4)	15.1 (12.3-19.1)	17.1 (13.5-22.1)	19.8 (15.0-26.7)	21.9 (16.0-30.6)
30-day	4.88 (4.32-5.63)	6.63 (5.85-7.66)	8.99 (7.92-10.4)	11.0 (9.59-12.8)	13.8 (11.6-16.6)	16.0 (13.2-19.7)	18.3 (14.8-23.1)	20.7 (16.3-26.9)	24.2 (18.3-32.6)	26.9 (19.7-37.5)
45-day	5.72 (5.06-6.60)	7.77 (6.86-8.98)	10.6 (9.31-12.2)	12.9 (11.3-15.1)	16.3 (13.8-19.7)	19.0 (15.8-23.4)	21.8 (17.7-27.5)	24.9 (19.6-32.2)	29.1 (22.0-39.3)	32.6 (23.8-45.4)
60-day	6.60 (5.83-7.61)	8.92 (7.88-10.3)	12.1 (10.7-14.0)	14.9 (13.0-17.3)	18.7 (15.9-22.6)	21.9 (18.1-26.9)	25.2 (20.4-31.8)	28.8 (22.7-37.3)	33.8 (25.6-45.6)	37.9 (27.7-52.9)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



NOAA Atlas 14, Volume 6, Version 2
Location name: Fullerton, California, USA*
Latitude: 33.8603°, Longitude: -117.9209°
Elevation: 157.21 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.58 (1.33-1.91)	2.03 (1.69-2.45)	2.60 (2.17-3.16)	3.08 (2.54-3.77)	3.73 (2.98-4.73)	4.25 (3.31-5.50)	4.76 (3.62-6.32)	5.30 (3.91-7.25)	6.04 (4.26-8.63)	6.60 (4.50-9.80)
10-min	1.13 (0.954-1.37)	1.45 (1.21-1.75)	1.87 (1.56-2.26)	2.21 (1.82-2.70)	2.68 (2.14-3.39)	3.04 (2.38-3.94)	3.41 (2.59-4.54)	3.80 (2.80-5.20)	4.33 (3.05-6.19)	4.73 (3.22-7.03)
15-min	0.916 (0.768-1.10)	1.17 (0.980-1.41)	1.50 (1.26-1.82)	1.78 (1.47-2.18)	2.16 (1.72-2.73)	2.45 (1.91-3.17)	2.75 (2.09-3.66)	3.06 (2.26-4.19)	3.48 (2.46-4.99)	3.82 (2.60-5.66)
30-min	0.626 (0.526-0.756)	0.800 (0.670-0.966)	1.03 (0.860-1.25)	1.22 (1.01-1.49)	1.48 (1.18-1.87)	1.68 (1.31-2.17)	1.88 (1.43-2.50)	2.10 (1.55-2.87)	2.39 (1.69-3.42)	2.61 (1.78-3.88)
60-min	0.441 (0.370-0.532)	0.564 (0.472-0.680)	0.726 (0.605-0.878)	0.858 (0.710-1.05)	1.04 (0.830-1.32)	1.18 (0.922-1.53)	1.33 (1.01-1.76)	1.48 (1.09-2.02)	1.68 (1.19-2.40)	1.84 (1.25-2.73)
2-hr	0.318 (0.267-0.384)	0.408 (0.341-0.492)	0.524 (0.437-0.634)	0.618 (0.512-0.756)	0.748 (0.596-0.946)	0.846 (0.660-1.10)	0.947 (0.720-1.26)	1.05 (0.776-1.44)	1.19 (0.841-1.70)	1.30 (0.885-1.93)
3-hr	0.266 (0.223-0.321)	0.341 (0.285-0.411)	0.438 (0.365-0.529)	0.516 (0.427-0.630)	0.623 (0.497-0.788)	0.705 (0.550-0.912)	0.788 (0.599-1.05)	0.873 (0.644-1.19)	0.988 (0.697-1.41)	1.08 (0.733-1.60)
6-hr	0.189 (0.158-0.227)	0.241 (0.202-0.291)	0.310 (0.258-0.375)	0.365 (0.302-0.446)	0.440 (0.352-0.557)	0.498 (0.389-0.645)	0.556 (0.423-0.739)	0.616 (0.455-0.844)	0.697 (0.492-0.997)	0.760 (0.517-1.13)
12-hr	0.122 (0.102-0.146)	0.156 (0.130-0.188)	0.201 (0.167-0.243)	0.238 (0.196-0.290)	0.288 (0.230-0.364)	0.327 (0.255-0.423)	0.366 (0.278-0.486)	0.407 (0.300-0.557)	0.463 (0.327-0.662)	0.506 (0.345-0.751)
24-hr	0.084 (0.074-0.096)	0.108 (0.095-0.125)	0.140 (0.123-0.162)	0.167 (0.146-0.195)	0.203 (0.172-0.245)	0.231 (0.192-0.285)	0.260 (0.211-0.328)	0.290 (0.229-0.376)	0.331 (0.251-0.447)	0.364 (0.266-0.507)
2-day	0.050 (0.044-0.058)	0.066 (0.058-0.076)	0.086 (0.076-0.100)	0.103 (0.090-0.120)	0.126 (0.106-0.151)	0.143 (0.119-0.176)	0.161 (0.130-0.203)	0.179 (0.141-0.232)	0.204 (0.154-0.275)	0.223 (0.163-0.311)
3-day	0.037 (0.033-0.043)	0.049 (0.044-0.057)	0.066 (0.058-0.076)	0.079 (0.069-0.092)	0.096 (0.081-0.116)	0.110 (0.091-0.135)	0.123 (0.100-0.155)	0.137 (0.108-0.178)	0.156 (0.118-0.210)	0.170 (0.125-0.238)
4-day	0.030 (0.026-0.034)	0.040 (0.035-0.046)	0.053 (0.047-0.061)	0.064 (0.056-0.074)	0.078 (0.066-0.094)	0.089 (0.074-0.110)	0.100 (0.081-0.126)	0.112 (0.088-0.145)	0.127 (0.096-0.171)	0.139 (0.102-0.194)
7-day	0.019 (0.017-0.022)	0.026 (0.023-0.030)	0.035 (0.031-0.040)	0.042 (0.036-0.049)	0.051 (0.043-0.062)	0.059 (0.049-0.072)	0.066 (0.054-0.084)	0.074 (0.058-0.096)	0.085 (0.064-0.114)	0.093 (0.068-0.129)
10-day	0.015 (0.013-0.017)	0.020 (0.017-0.023)	0.026 (0.023-0.030)	0.032 (0.028-0.037)	0.039 (0.033-0.047)	0.045 (0.037-0.055)	0.051 (0.041-0.064)	0.057 (0.045-0.074)	0.065 (0.049-0.088)	0.072 (0.052-0.100)
20-day	0.009 (0.008-0.010)	0.012 (0.010-0.014)	0.016 (0.014-0.018)	0.019 (0.017-0.022)	0.024 (0.020-0.029)	0.028 (0.023-0.034)	0.032 (0.026-0.040)	0.036 (0.028-0.046)	0.041 (0.031-0.056)	0.046 (0.033-0.064)
30-day	0.007 (0.006-0.008)	0.009 (0.008-0.011)	0.012 (0.011-0.014)	0.015 (0.013-0.018)	0.019 (0.016-0.023)	0.022 (0.018-0.027)	0.025 (0.021-0.032)	0.029 (0.023-0.037)	0.034 (0.025-0.045)	0.037 (0.027-0.052)
45-day	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.010 (0.009-0.011)	0.012 (0.010-0.014)	0.015 (0.013-0.018)	0.018 (0.015-0.022)	0.020 (0.016-0.025)	0.023 (0.018-0.030)	0.027 (0.020-0.036)	0.030 (0.022-0.042)
60-day	0.005 (0.004-0.005)	0.006 (0.005-0.007)	0.008 (0.007-0.010)	0.010 (0.009-0.012)	0.013 (0.011-0.016)	0.015 (0.013-0.019)	0.018 (0.014-0.022)	0.020 (0.016-0.026)	0.023 (0.018-0.032)	0.026 (0.019-0.037)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
 Please refer to NOAA Atlas 14 document for more information.

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PF graphical

APPENDIX D – RATIONAL METHOD STUDY

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*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 18.2 Release Date: 05/08/2012 License ID 1537

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Analysis prepared by:

Joseph C. Truxaw and Associates, Inc.
Civil Engineers and Land Surveyors
1915 W. Orangewood Avenue, Suite 101
Orange, CA 92868

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***** DESCRIPTION OF STUDY *****
* Fullerton Shops at Fullerton Town Center *
* Northwest Corner of Orangethorpe Ave and Lemon Street *
* Existing 10-Year Storm *
*****

```

FILE NAME: 084EX10.DAT
TIME/DATE OF STUDY: 15:22 09/30/2020

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

```

*****
FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE = 21

```

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 129.00
ELEVATION DATA: UPSTREAM(FEET) = 149.89 DOWNSTREAM(FEET) = 147.94

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.000

* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 4.060

SUBAREA T_c AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	B	1.50	0.30	0.100	56	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.30

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

```

67 SUBAREA RUNOFF(CFS) = 5.44
68 TOTAL AREA(ACRES) = 1.50 PEAK FLOW RATE(CFS) = 5.44
69
70 *****
71 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 41
72 -----
73 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
74 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
75 =====
76 REPRESENTATIVE SLOPE = 0.0060
77 FLOW LENGTH(FEET) = 191.00 MANNING'S N = 0.013
78 DEPTH OF FLOW IN 21.0 INCH PIPE IS 9.9 INCHES
79 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.86
80 GIVEN PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
81 PIPE-FLOW(CFS) = 5.44
82 PIPE TRAVEL TIME(MIN.) = 0.66 Tc(MIN.) = 5.66
83 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 320.00 FEET.
84
85 *****
86 FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 IS CODE = 81
87 -----
88 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
89 =====
90 MAINLINE Tc(MIN.) = 5.66
91 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.783
92 SUBAREA LOSS RATE DATA(AMC II):
93 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
94 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
95 COMMERCIAL B 1.10 0.30 0.100 56
96 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
97 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
98 SUBAREA AREA(ACRES) = 1.10 SUBAREA RUNOFF(CFS) = 3.72
99 EFFECTIVE AREA(ACRES) = 2.60 AREA-AVERAGED Fm(INCH/HR) = 0.03
100 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
101 TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 8.78
102
103 *****
104 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 41
105 -----
106 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
107 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
108 =====
109 REPRESENTATIVE SLOPE = 0.0030
110 FLOW LENGTH(FEET) = 247.00 MANNING'S N = 0.013
111 DEPTH OF FLOW IN 24.0 INCH PIPE IS 15.2 INCHES
112 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.19
113 GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
114 PIPE-FLOW(CFS) = 8.78
115 PIPE TRAVEL TIME(MIN.) = 0.98 Tc(MIN.) = 6.64
116 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 567.00 FEET.
117
118 *****
119 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81
120 -----
121 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
122 =====
123 MAINLINE Tc(MIN.) = 6.64
124 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.451
125 SUBAREA LOSS RATE DATA(AMC II):
126 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
127 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
128 COMMERCIAL B 0.60 0.30 0.100 56
129 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
130 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
131 SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 1.85
132 EFFECTIVE AREA(ACRES) = 3.20 AREA-AVERAGED Fm(INCH/HR) = 0.03

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133 AREA-AVERAGED Fp (INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
134 TOTAL AREA (ACRES) = 3.2 PEAK FLOW RATE (CFS) = 9.85
135
136 *****
137 FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 41
138 -----
139 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
140 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
141 =====
142 REPRESENTATIVE SLOPE = 0.0200
143 FLOW LENGTH (FEET) = 43.80 MANNING'S N = 0.013
144 DEPTH OF FLOW IN 28.0 INCH PIPE IS 8.7 INCHES
145 PIPE-FLOW VELOCITY (FEET/SEC.) = 8.70
146 GIVEN PIPE DIAMETER (INCH) = 28.00 NUMBER OF PIPES = 1
147 PIPE-FLOW (CFS) = 9.85
148 PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 6.72
149 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 610.80 FEET.
150
151 *****
152 FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21
153 -----
154 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
155 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
156 =====
157 INITIAL SUBAREA FLOW-LENGTH (FEET) = 277.00
158 ELEVATION DATA: UPSTREAM (FEET) = 149.05 DOWNSTREAM (FEET) = 146.93
159
160 Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
161 SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 7.640
162 * 10 YEAR RAINFALL INTENSITY (INCH/HR) = 3.184
163 SUBAREA Tc AND LOSS RATE DATA (AMC II):
164 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
165 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
166 COMMERCIAL B 2.10 0.30 0.100 56 7.64
167 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.30
168 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
169 SUBAREA RUNOFF (CFS) = 5.96
170 TOTAL AREA (ACRES) = 2.10 PEAK FLOW RATE (CFS) = 5.96
171
172 *****
173 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 91
174 -----
175 >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
176 =====
177 REPRESENTATIVE SLOPE = 0.0020
178 CHANNEL LENGTH THRU SUBAREA (FEET) = 194.00
179 "V" GUTTER WIDTH (FEET) = 3.00 GUTTER HIKE (FEET) = 0.200
180 PAVEMENT LIP (FEET) = 0.010 MANNING'S N = .0150
181 PAVEMENT CROSSFALL (DECIMAL NOTATION) = 0.01000
182 MAXIMUM DEPTH (FEET) = 0.50
183 * 10 YEAR RAINFALL INTENSITY (INCH/HR) = 2.684
184 SUBAREA LOSS RATE DATA (AMC II):
185 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
186 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
187 COMMERCIAL B 1.30 0.30 0.100 56
188 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.30
189 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
190 TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 7.52
191 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY (FEET/SEC.) = 1.22
192 AVERAGE FLOW DEPTH (FEET) = 0.44 FLOOD WIDTH (FEET) = 48.43
193 "V" GUTTER FLOW TRAVEL TIME (MIN.) = 2.65 Tc (MIN.) = 10.29
194 SUBAREA AREA (ACRES) = 1.30 SUBAREA RUNOFF (CFS) = 3.11
195 EFFECTIVE AREA (ACRES) = 3.40 AREA-AVERAGED Fm (INCH/HR) = 0.03
196 AREA-AVERAGED Fp (INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
197 TOTAL AREA (ACRES) = 3.4 PEAK FLOW RATE (CFS) = 8.12
198

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199     END OF SUBAREA "V" GUTTER HYDRAULICS:
200     DEPTH(FEET) = 0.45    FLOOD WIDTH(FEET) = 50.01
201     FLOW VELOCITY(FEET/SEC.) = 1.24    DEPTH*VELOCITY(FT*FT/SEC) = 0.55
202     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 471.00 FEET.
203
204 *****
205     FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 91
206 -----
207     >>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<
208 =====
209     REPRESENTATIVE SLOPE = 0.0040
210     CHANNEL LENGTH THRU SUBAREA(FEET) = 141.00
211     "V" GUTTER WIDTH(FEET) = 3.00    GUTTER HIKE(FEET) = 0.200
212     PAVEMENT LIP(FEET) = 0.010    MANNING'S N = .0150
213     PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
214     MAXIMUM DEPTH(FEET) = 0.50
215     * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.498
216     SUBAREA LOSS RATE DATA(AMC II):
217         DEVELOPMENT TYPE/      SCS SOIL    AREA      Fp      Ap      SCS
218         LAND USE              GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
219     COMMERCIAL                B        2.00    0.30    0.100    56
220     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
221     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
222     TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 10.34
223     TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.71
224     AVERAGE FLOW DEPTH(FEET) = 0.43    FLOOD WIDTH(FEET) = 47.97
225     "V" GUTTER FLOW TRAVEL TIME(MIN.) = 1.38    Tc(MIN.) = 11.67
226     SUBAREA AREA(ACRES) = 2.00    SUBAREA RUNOFF(CFS) = 4.44
227     EFFECTIVE AREA(ACRES) = 5.40    AREA-AVERAGED Fm(INCH/HR) = 0.03
228     AREA-AVERAGED Fp(INCH/HR) = 0.30    AREA-AVERAGED Ap = 0.10
229     TOTAL AREA(ACRES) = 5.4    PEAK FLOW RATE(CFS) = 11.99
230
231     END OF SUBAREA "V" GUTTER HYDRAULICS:
232     DEPTH(FEET) = 0.45    FLOOD WIDTH(FEET) = 50.92
233     FLOW VELOCITY(FEET/SEC.) = 1.77    DEPTH*VELOCITY(FT*FT/SEC) = 0.79
234     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 612.00 FEET.
235
236 *****
237     FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 41
238 -----
239     >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
240     >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
241 =====
242     REPRESENTATIVE SLOPE = 0.0040
243     FLOW LENGTH(FEET) = 138.00    MANNING'S N = 0.013
244     DEPTH OF FLOW IN 24.0 INCH PIPE IS 17.2 INCHES
245     PIPE-FLOW VELOCITY(FEET/SEC.) = 4.99
246     GIVEN PIPE DIAMETER(INCH) = 24.00    NUMBER OF PIPES = 1
247     PIPE-FLOW(CFS) = 11.99
248     PIPE TRAVEL TIME(MIN.) = 0.46    Tc(MIN.) = 12.13
249     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 750.00 FEET.
250
251 *****
252     FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81
253 -----
254     >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
255 =====
256     MAINLINE Tc(MIN.) = 12.13
257     * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.443
258     SUBAREA LOSS RATE DATA(AMC II):
259         DEVELOPMENT TYPE/      SCS SOIL    AREA      Fp      Ap      SCS
260         LAND USE              GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN
261     COMMERCIAL                B        2.40    0.30    0.100    56
262     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
263     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
264     SUBAREA AREA(ACRES) = 2.40    SUBAREA RUNOFF(CFS) = 5.21

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265     EFFECTIVE AREA(ACRES) =          7.80    AREA-AVERAGED Fm(INCH/HR) =    0.03
266     AREA-AVERAGED Fp(INCH/HR) =    0.30    AREA-AVERAGED Ap =    0.10
267     TOTAL AREA(ACRES) =          7.8          PEAK FLOW RATE(CFS) =          16.94
268
269 +-----+
270 | Outfall to Onsite Storm Drain |
271 |                               |
272 |                               |
273 +-----+
274
275 *****
276     FLOW PROCESS FROM NODE      20.00 TO NODE      21.00 IS CODE =    21
277 -----
278     >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
279     >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
280 =====
281     INITIAL SUBAREA FLOW-LENGTH(FEET) =          79.40
282     ELEVATION DATA: UPSTREAM(FEET) =      149.46  DOWNSTREAM(FEET) =      148.71
283
284     Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
285     SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =          5.000
286     * 10 YEAR RAINFALL INTENSITY(INCH/HR) =          4.060
287     SUBAREA Tc AND LOSS RATE DATA(AMC II):
288     DEVELOPMENT TYPE/          SCS SOIL  AREA      Fp          Ap          SCS      Tc
289     LAND USE                GROUP    (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
290     COMMERCIAL              B         0.10     0.30     0.100     56   5.00
291     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =    0.30
292     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =    0.100
293     SUBAREA RUNOFF(CFS) =          0.36
294     TOTAL AREA(ACRES) =          0.10    PEAK FLOW RATE(CFS) =          0.36
295
296 +-----+
297 | Outfall to Site |
298 | |
299 | |
300 +-----+
301 =====
302     END OF STUDY SUMMARY:
303     TOTAL AREA(ACRES) =          0.1    TC(MIN.) =          5.00
304     EFFECTIVE AREA(ACRES) =          0.10    AREA-AVERAGED Fm(INCH/HR)=    0.03
305     AREA-AVERAGED Fp(INCH/HR) =    0.30    AREA-AVERAGED Ap =    0.100
306     PEAK FLOW RATE(CFS) =          0.36
307 =====
308 =====
309     END OF RATIONAL METHOD ANALYSIS
310
311 ERR
312
313

```

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*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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```

Analysis prepared by:

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Civil Engineers and Land Surveyors
1915 W. Orangewood Avenue, Suite 101
Orange, CA 92868

```

***** DESCRIPTION OF STUDY *****
* Fullerton Shops at Fullerton Town Center *
* Northwest Corner of Orangethorpe Ave and Lemon Street *
* Existing 100-Year Storm *
*****

```

FILE NAME: 084EX100.DAT
TIME/DATE OF STUDY: 07:43 10/01/2020

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 8.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
DATA BANK RAINFALL USED
ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK- SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MAN- NING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

```

*****
FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE = 21

```

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 129.00
ELEVATION DATA: UPSTREAM(FEET) = 149.89 DOWNSTREAM(FEET) = 147.94

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 5.000

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187

SUBAREA T_c AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	B	1.50	0.30	0.100	56	5.00

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.30

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

```

67 SUBAREA RUNOFF(CFS) = 8.31
68 TOTAL AREA(ACRES) = 1.50 PEAK FLOW RATE(CFS) = 8.31
69
70 *****
71 FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 41
72 -----
73 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
74 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
75 =====
76 REPRESENTATIVE SLOPE = 0.0060
77 FLOW LENGTH(FEET) = 191.00 MANNING'S N = 0.013
78 DEPTH OF FLOW IN 21.0 INCH PIPE IS 12.9 INCHES
79 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.37
80 GIVEN PIPE DIAMETER(INCH) = 21.00 NUMBER OF PIPES = 1
81 PIPE-FLOW(CFS) = 8.31
82 PIPE TRAVEL TIME(MIN.) = 0.59 Tc(MIN.) = 5.59
83 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 320.00 FEET.
84
85 *****
86 FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 IS CODE = 81
87 -----
88 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
89 =====
90 MAINLINE Tc(MIN.) = 5.59
91 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.803
92 SUBAREA LOSS RATE DATA(AMC II):
93 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
94 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
95 COMMERCIAL B 1.10 0.30 0.100 56
96 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
97 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
98 SUBAREA AREA(ACRES) = 1.10 SUBAREA RUNOFF(CFS) = 5.71
99 EFFECTIVE AREA(ACRES) = 2.60 AREA-AVERAGED Fm(INCH/HR) = 0.03
100 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
101 TOTAL AREA(ACRES) = 2.6 PEAK FLOW RATE(CFS) = 13.51
102
103 *****
104 FLOW PROCESS FROM NODE 3.00 TO NODE 4.00 IS CODE = 41
105 -----
106 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
107 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
108 =====
109 REPRESENTATIVE SLOPE = 0.0030
110 FLOW LENGTH(FEET) = 247.00 MANNING'S N = 0.013
111 ASSUME FULL-FLOWING PIPELINE
112 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.30
113 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
114 GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
115 PIPE-FLOW(CFS) = 13.51
116 PIPE TRAVEL TIME(MIN.) = 0.96 Tc(MIN.) = 6.55
117 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 567.00 FEET.
118
119 *****
120 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81
121 -----
122 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
123 =====
124 MAINLINE Tc(MIN.) = 6.55
125 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.300
126 SUBAREA LOSS RATE DATA(AMC II):
127 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
128 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
129 COMMERCIAL B 0.60 0.30 0.100 56
130 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
131 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
132 SUBAREA AREA(ACRES) = 0.60 SUBAREA RUNOFF(CFS) = 2.85

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133     EFFECTIVE AREA(ACRES) =      3.20     AREA-AVERAGED Fm(INCH/HR) =   0.03
134     AREA-AVERAGED Fp(INCH/HR) =   0.30     AREA-AVERAGED Ap =   0.10
135     TOTAL AREA(ACRES) =      3.2         PEAK FLOW RATE(CFS) =      15.18
136
137 *****
138     FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =   41
139 -----
140     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
141     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
142 =====
143     REPRESENTATIVE SLOPE =   0.0200
144     FLOW LENGTH(FEET) =   43.80     MANNING'S N =   0.013
145     DEPTH OF FLOW IN   28.0 INCH PIPE IS   10.9 INCHES
146     PIPE-FLOW VELOCITY(FEET/SEC.) =   9.81
147     GIVEN PIPE DIAMETER(INCH) =   28.00     NUMBER OF PIPES =    1
148     PIPE-FLOW(CFS) =      15.18
149     PIPE TRAVEL TIME(MIN.) =   0.07     Tc(MIN.) =   6.62
150     LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =      610.80 FEET.
151
152 *****
153     FLOW PROCESS FROM NODE      10.00 TO NODE      11.00 IS CODE =   21
154 -----
155     >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
156     >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
157 =====
158     INITIAL SUBAREA FLOW-LENGTH(FEET) =   277.00
159     ELEVATION DATA: UPSTREAM(FEET) =      149.05     DOWNSTREAM(FEET) =      146.93
160
161     Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
162     SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   7.640
163     * 100 YEAR RAINFALL INTENSITY(INCH/HR) =   4.853
164     SUBAREA Tc AND LOSS RATE DATA(AMC II):
165     DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS      Tc
166     LAND USE              GROUP      (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
167     COMMERCIAL            B          2.10      0.30      0.100      56      7.64
168     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =   0.30
169     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =   0.100
170     SUBAREA RUNOFF(CFS) =      9.12
171     TOTAL AREA(ACRES) =      2.10     PEAK FLOW RATE(CFS) =      9.12
172
173 *****
174     FLOW PROCESS FROM NODE      11.00 TO NODE      12.00 IS CODE =   91
175 -----
176     >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
177 =====
178     REPRESENTATIVE SLOPE =   0.0020
179     CHANNEL LENGTH THRU SUBAREA(FEET) =   194.00
180     "V" GUTTER WIDTH(FEET) =   3.00     GUTTER HIKE(FEET) =   0.200
181     PAVEMENT LIP(FEET) =   0.010     MANNING'S N =   .0150
182     PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
183     MAXIMUM DEPTH(FEET) =   0.50
184     * 100 YEAR RAINFALL INTENSITY(INCH/HR) =   4.141
185     SUBAREA LOSS RATE DATA(AMC II):
186     DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS
187     LAND USE              GROUP      (ACRES) (INCH/HR) (DECIMAL) CN
188     COMMERCIAL            B          1.30      0.30      0.100      56
189     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =   0.30
190     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =   0.100
191     TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.54
192     TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.33
193     AVERAGE FLOW DEPTH(FEET) =   0.48     FLOOD WIDTH(FEET) =   57.94
194     "V" GUTTER FLOW TRAVEL TIME(MIN.) =   2.44     Tc(MIN.) =   10.08
195     SUBAREA AREA(ACRES) =      1.30     SUBAREA RUNOFF(CFS) =      4.81
196     EFFECTIVE AREA(ACRES) =      3.40     AREA-AVERAGED Fm(INCH/HR) =   0.03
197     AREA-AVERAGED Fp(INCH/HR) =   0.30     AREA-AVERAGED Ap =   0.10
198     TOTAL AREA(ACRES) =      3.4         PEAK FLOW RATE(CFS) =      12.58

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199
200     END OF SUBAREA "V" GUTTER HYDRAULICS:
201     DEPTH(FEET) = 0.49    FLOOD WIDTH(FEET) = 59.98
202     FLOW VELOCITY(FEET/SEC.) = 1.35    DEPTH*VELOCITY(FT*FT/SEC) = 0.67
203     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 471.00 FEET.
204
205 *****
206     FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 91
207 -----
208     >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
209 =====
210     REPRESENTATIVE SLOPE = 0.0040
211     CHANNEL LENGTH THRU SUBAREA(FEET) = 141.00
212     "V" GUTTER WIDTH(FEET) = 3.00    GUTTER HIKE(FEET) = 0.200
213     PAVEMENT LIP(FEET) = 0.010    MANNING'S N = .0150
214     PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
215     MAXIMUM DEPTH(FEET) = 0.50
216     * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.871
217     SUBAREA LOSS RATE DATA(AMC II):
218     DEVELOPMENT TYPE/      SCS SOIL    AREA      Fp      Ap      SCS
219     LAND USE              GROUP    (ACRES)  (INCH/HR) (DECIMAL) CN
220     COMMERCIAL            B        2.00    0.30    0.100    56
221     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
222     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
223     TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 16.03
224     TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 1.87
225     AVERAGE FLOW DEPTH(FEET) = 0.48    FLOOD WIDTH(FEET) = 57.49
226     "V" GUTTER FLOW TRAVEL TIME(MIN.) = 1.26    Tc(MIN.) = 11.33
227     SUBAREA AREA(ACRES) = 2.00    SUBAREA RUNOFF(CFS) = 6.91
228     EFFECTIVE AREA(ACRES) = 5.40    AREA-AVERAGED Fm(INCH/HR) = 0.03
229     AREA-AVERAGED Fp(INCH/HR) = 0.30    AREA-AVERAGED Ap = 0.10
230     TOTAL AREA(ACRES) = 5.4    PEAK FLOW RATE(CFS) = 18.67
231
232     ==>>>ERROR:FLOW EXCEEDS CAPACITY OF CHANNEL WITH
233     NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM ALLOWABLE DEPTH.
234     AS AN APPROXIMATION, TRAVEL TIME CALCULATIONS ARE BASED
235     ON FLOW DEPTH EQUAL TO THE SPECIFIED MAXIMUM ALLOWABLE DEPTH.
236
237
238     END OF SUBAREA "V" GUTTER HYDRAULICS:
239     DEPTH(FEET) = 0.50    FLOOD WIDTH(FEET) = 61.00
240     FLOW VELOCITY(FEET/SEC.) = 1.94    DEPTH*VELOCITY(FT*FT/SEC) = 0.97
241     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 13.00 = 612.00 FEET.
242
243 *****
244     FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 41
245 -----
246     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
247     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
248 =====
249     REPRESENTATIVE SLOPE = 0.0040
250     FLOW LENGTH(FEET) = 138.00    MANNING'S N = 0.013
251     ASSUME FULL-FLOWING PIPELINE
252     PIPE-FLOW VELOCITY(FEET/SEC.) = 5.94
253     PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
254     GIVEN PIPE DIAMETER(INCH) = 24.00    NUMBER OF PIPES = 1
255     PIPE-FLOW(CFS) = 18.67
256     PIPE TRAVEL TIME(MIN.) = 0.39    Tc(MIN.) = 11.72
257     LONGEST FLOWPATH FROM NODE 10.00 TO NODE 14.00 = 750.00 FEET.
258
259 *****
260     FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 81
261 -----
262     >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
263 =====
264     MAINLINE Tc(MIN.) = 11.72

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265      * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.798
266      SUBAREA LOSS RATE DATA(AMC II):
267      DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS
268      LAND USE      GROUP      (ACRES)      (INCH/HR)      (DECIMAL)      CN
269      COMMERCIAL      B      2.40      0.30      0.100      56
270      SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
271      SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
272      SUBAREA AREA(ACRES) = 2.40      SUBAREA RUNOFF(CFS) = 8.14
273      EFFECTIVE AREA(ACRES) = 7.80      AREA-AVERAGED Fm(INCH/HR) = 0.03
274      AREA-AVERAGED Fp(INCH/HR) = 0.30      AREA-AVERAGED Ap = 0.10
275      TOTAL AREA(ACRES) = 7.8      PEAK FLOW RATE(CFS) = 26.45
276
277      *****
278      FLOW PROCESS FROM NODE      20.00 TO NODE      21.00 IS CODE = 21
279      -----
280      >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
281      >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
282      =====
283      INITIAL SUBAREA FLOW-LENGTH(FEET) = 79.40
284      ELEVATION DATA: UPSTREAM(FEET) = 149.46 DOWNSTREAM(FEET) = 148.71
285
286      Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
287      SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
288      * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
289      SUBAREA Tc AND LOSS RATE DATA(AMC II):
290      DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS      Tc
291      LAND USE      GROUP      (ACRES)      (INCH/HR)      (DECIMAL)      CN      (MIN.)
292      COMMERCIAL      B      0.10      0.30      0.100      56      5.00
293      SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
294      SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
295      SUBAREA RUNOFF(CFS) = 0.55
296      TOTAL AREA(ACRES) = 0.10      PEAK FLOW RATE(CFS) = 0.55
297      =====
298      END OF STUDY SUMMARY:
299      TOTAL AREA(ACRES) = 0.1 TC(MIN.) = 5.00
300      EFFECTIVE AREA(ACRES) = 0.10      AREA-AVERAGED Fm(INCH/HR) = 0.03
301      AREA-AVERAGED Fp(INCH/HR) = 0.30      AREA-AVERAGED Ap = 0.100
302      PEAK FLOW RATE(CFS) = 0.55
303      =====
304      =====
305      END OF RATIONAL METHOD ANALYSIS
306
307      RR
308
309

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
* Fullerton Shops at Fullerton Town Center *
* Northwest Corner of Orangethorpe Ave and Lemon Street *
* Proposed 10-Year Storm *
*****

FILE NAME: 084PR10.DAT
TIME/DATE OF STUDY: 09:50 10/01/2020
=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====
--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
*DATA BANK RAINFALL USED*
*ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
      WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
=== =====
39 1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150
40

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

*****
FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 231.00
ELEVATION DATA: UPSTREAM(FEET) = 149.22 DOWNSTREAM(FEET) = 148.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.096
* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.080
SUBAREA Tc AND LOSS RATE DATA(AMC II):
      DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
      LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
64 COMMERCIAL B 0.77 0.30 0.100 56 8.10
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

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67 SUBAREA RUNOFF(CFS) = 2.11
68 TOTAL AREA(ACRES) = 0.77 PEAK FLOW RATE(CFS) = 2.11
69
70 *****
71 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 31
72 -----
73 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
74 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
75 =====
76 REPRESENTATIVE SLOPE = 0.0060
77 FLOW LENGTH(FEET) = 185.00 MANNING'S N = 0.013
78 DEPTH OF FLOW IN 12.0 INCH PIPE IS 8.0 INCHES
79 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.79
80 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
81 PIPE-FLOW(CFS) = 2.11
82 PIPE TRAVEL TIME(MIN.) = 0.81 Tc(MIN.) = 8.91
83 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 416.00 FEET.
84
85 +-----+
86 | Outfall to Lemon Street Storm Drain |
87 +-----+
88
89 *****
90 FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21
91 -----
92 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
93 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
94 =====
95 INITIAL SUBAREA FLOW-LENGTH(FEET) = 161.00
96 ELEVATION DATA: UPSTREAM(FEET) = 150.00 DOWNSTREAM(FEET) = 148.70
97
98  $T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$ 
99 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.084
100 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 3.628
101 SUBAREA Tc AND LOSS RATE DATA(AMC II):
102 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
103 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
104 COMMERCIAL B 0.28 0.30 0.100 56 6.08
105 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
106 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
107 SUBAREA RUNOFF(CFS) = 0.91
108 TOTAL AREA(ACRES) = 0.28 PEAK FLOW RATE(CFS) = 0.91
109
110 *****
111 FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 41
112 -----
113 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
114 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
115 =====
116 REPRESENTATIVE SLOPE = 0.0200
117 FLOW LENGTH(FEET) = 169.00 MANNING'S N = 0.013
118 DEPTH OF FLOW IN 12.0 INCH PIPE IS 3.5 INCHES
119 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.76
120 GIVEN PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
121 PIPE-FLOW(CFS) = 0.91
122 PIPE TRAVEL TIME(MIN.) = 0.59 Tc(MIN.) = 6.68
123 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 330.00 FEET.
124
125 *****
126 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 10
127 -----
128 >>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
129 =====
130
131 *****
132 FLOW PROCESS FROM NODE 60.00 TO NODE 61.00 IS CODE = 21

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133 -----
134 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
135 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
136 =====
137 INITIAL SUBAREA FLOW-LENGTH(FEET) = 378.00
138 ELEVATION DATA: UPSTREAM(FEET) = 150.00 DOWNSTREAM(FEET) = 149.22
139
140  $T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$ 
141 SUBAREA ANALYSIS USED MINIMUM  $T_c$ (MIN.) = 11.245
142 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.551
143 SUBAREA  $T_c$  AND LOSS RATE DATA(AMC II):
144 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS  $T_c$ 
145 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
146 COMMERCIAL B 0.71 0.30 0.100 56 11.24
147 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
148 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
149 SUBAREA RUNOFF(CFS) = 1.61
150 TOTAL AREA(ACRES) = 0.71 PEAK FLOW RATE(CFS) = 1.61
151
152 *****
153 FLOW PROCESS FROM NODE 61.00 TO NODE 61.00 IS CODE = 81
154 -----
155 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
156 =====
157 MAINLINE  $T_c$ (MIN.) = 11.24
158 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.551
159 SUBAREA LOSS RATE DATA(AMC II):
160 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS
161 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
162 COMMERCIAL B 1.47 0.30 0.100 56
163 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
164 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
165 SUBAREA AREA(ACRES) = 1.47 SUBAREA RUNOFF(CFS) = 3.34
166 EFFECTIVE AREA(ACRES) = 2.18 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.03
167 AREA-AVERAGED  $F_p$ (INCH/HR) = 0.30 AREA-AVERAGED  $A_p$  = 0.10
168 TOTAL AREA(ACRES) = 2.2 PEAK FLOW RATE(CFS) = 4.95
169
170 *****
171 FLOW PROCESS FROM NODE 61.00 TO NODE 22.00 IS CODE = 31
172 -----
173 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
174 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
175 =====
176 REPRESENTATIVE SLOPE = 0.0210
177 FLOW LENGTH(FEET) = 257.00 MANNING'S N = 0.013
178 DEPTH OF FLOW IN 12.0 INCH PIPE IS 9.6 INCHES
179 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.31
180 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
181 PIPE-FLOW(CFS) = 4.95
182 PIPE TRAVEL TIME(MIN.) = 0.59  $T_c$ (MIN.) = 11.83
183 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
184
185 *****
186 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81
187 -----
188 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
189 =====
190 MAINLINE  $T_c$ (MIN.) = 11.83
191 * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.478
192 SUBAREA LOSS RATE DATA(AMC II):
193 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS
194 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
195 COMMERCIAL B 1.35 0.30 0.100 56
196 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
197 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
198 SUBAREA AREA(ACRES) = 1.35 SUBAREA RUNOFF(CFS) = 2.97

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209 EFFECTIVE AREA(ACRES) = 3.53 AREA-AVERAGED Fm(INCH/HR) = 0.03
210 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
201 TOTAL AREA(ACRES) = 3.5 PEAK FLOW RATE(CFS) = 7.78
202
203 *****
204 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 11
205 -----
206 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
207 =====
208
209 ** MAIN STREAM CONFLUENCE DATA **
210 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
211 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
212 1 7.78 11.83 2.478 0.30( 0.03) 0.10 3.5 60.00
213 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
214
215 ** MEMORY BANK # 1 CONFLUENCE DATA **
216 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
217 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
218 1 0.91 6.68 3.440 0.30( 0.03) 0.10 0.3 20.00
219 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 330.00 FEET.
220
221 ** PEAK FLOW RATE TABLE **
222 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
223 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
224 1 7.02 6.68 3.440 0.30( 0.03) 0.10 2.3 20.00
225 2 8.43 11.83 2.478 0.30( 0.03) 0.10 3.8 60.00
226 TOTAL AREA(ACRES) = 3.8
227
228 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
229 PEAK FLOW RATE(CFS) = 8.43 Tc(MIN.) = 11.831
230 EFFECTIVE AREA(ACRES) = 3.81 AREA-AVERAGED Fm(INCH/HR) = 0.03
231 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
232 TOTAL AREA(ACRES) = 3.8
233 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
234
235 *****
236 FLOW PROCESS FROM NODE 22.00 TO NODE 43.00 IS CODE = 31
237 -----
238 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
239 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
240 =====
241 REPRESENTATIVE SLOPE = 0.0350
242 FLOW LENGTH(FEET) = 116.00 MANNING'S N = 0.013
243 DEPTH OF FLOW IN 15.0 INCH PIPE IS 9.4 INCHES
244 PIPE-FLOW VELOCITY(FEET/SEC.) = 10.43
245 ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
246 PIPE-FLOW(CFS) = 8.43
247 PIPE TRAVEL TIME(MIN.) = 0.19 Tc(MIN.) = 12.02
248 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 43.00 = 751.00 FEET.
249
250 *****
251 FLOW PROCESS FROM NODE 43.00 TO NODE 43.00 IS CODE = 10
252 -----
253 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
254 =====
255
256 *****
257 FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 21
258 -----
259 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
260 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
261 =====
262 INITIAL SUBAREA FLOW-LENGTH(FEET) = 419.00
263 ELEVATION DATA: UPSTREAM(FEET) = 149.05 DOWNSTREAM(FEET) = 146.61
264

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265      Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
266      SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.522
267      * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.807
268      SUBAREA Tc AND LOSS RATE DATA(AMC II):
269      DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS      Tc
270      LAND USE      GROUP      (ACRES)      (INCH/HR)      (DECIMAL)      CN      (MIN.)
271      COMMERCIAL      B      2.54      0.30      0.100      56      9.52
272      SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
273      SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
274      SUBAREA RUNOFF(CFS) = 6.35
275      TOTAL AREA(ACRES) = 2.54      PEAK FLOW RATE(CFS) = 6.35
276
277      *****
278      FLOW PROCESS FROM NODE      41.00 TO NODE      42.00 IS CODE = 31
279      -----
280      >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
281      >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
282      =====
283      REPRESENTATIVE SLOPE = 0.0150
284      FLOW LENGTH(FEET) = 288.00      MANNING'S N = 0.013
285      DEPTH OF FLOW IN 15.0 INCH PIPE IS 10.4 INCHES
286      PIPE-FLOW VELOCITY(FEET/SEC.) = 7.01
287      ESTIMATED PIPE DIAMETER(INCH) = 15.00      NUMBER OF PIPES = 1
288      PIPE-FLOW(CFS) = 6.35
289      PIPE TRAVEL TIME(MIN.) = 0.68      Tc(MIN.) = 10.21
290      LONGEST FLOWPATH FROM NODE      40.00 TO NODE      42.00 = 707.00 FEET.
291
292      *****
293      FLOW PROCESS FROM NODE      42.00 TO NODE      42.00 IS CODE = 81
294      -----
295      >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
296      =====
297      MAINLINE Tc(MIN.) = 10.21
298      * 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.697
299      SUBAREA LOSS RATE DATA(AMC II):
300      DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS
301      LAND USE      GROUP      (ACRES)      (INCH/HR)      (DECIMAL)      CN
302      COMMERCIAL      B      1.08      0.30      0.100      56
303      SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
304      SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
305      SUBAREA AREA(ACRES) = 1.08      SUBAREA RUNOFF(CFS) = 2.59
306      EFFECTIVE AREA(ACRES) = 3.62      AREA-AVERAGED Fm(INCH/HR) = 0.03
307      AREA-AVERAGED Fp(INCH/HR) = 0.30      AREA-AVERAGED Ap = 0.10
308      TOTAL AREA(ACRES) = 3.6      PEAK FLOW RATE(CFS) = 8.69
309
310      *****
311      FLOW PROCESS FROM NODE      42.00 TO NODE      43.00 IS CODE = 41
312      -----
313      >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
314      >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
315      =====
316      REPRESENTATIVE SLOPE = 0.0070
317      FLOW LENGTH(FEET) = 138.00      MANNING'S N = 0.013
318      DEPTH OF FLOW IN 24.0 INCH PIPE IS 11.6 INCHES
319      PIPE-FLOW VELOCITY(FEET/SEC.) = 5.79
320      GIVEN PIPE DIAMETER(INCH) = 24.00      NUMBER OF PIPES = 1
321      PIPE-FLOW(CFS) = 8.69
322      PIPE TRAVEL TIME(MIN.) = 0.40      Tc(MIN.) = 10.60
323      LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 = 845.00 FEET.
324
325      *****
326      FLOW PROCESS FROM NODE      43.00 TO NODE      43.00 IS CODE = 11
327      -----
328      >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
329      =====
330

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331  ** MAIN STREAM CONFLUENCE DATA **
332  STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
333  NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
334  1           8.69   10.60   2.639  0.30( 0.03)  0.10      3.6      40.00
335  LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 =      845.00 FEET.
336
337  ** MEMORY BANK # 2 CONFLUENCE DATA **
338  STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
339  NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
340  1           7.02    6.87    3.384  0.30( 0.03)  0.10      2.3      20.00
341  2           8.43   12.02    2.456  0.30( 0.03)  0.10      3.8      60.00
342  LONGEST FLOWPATH FROM NODE      60.00 TO NODE      43.00 =      751.00 FEET.
343
344  ** PEAK FLOW RATE TABLE **
345  STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
346  NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
347  1          14.26    6.87    3.384  0.30( 0.03)  0.10      4.6      20.00
348  2          16.73   10.60    2.639  0.30( 0.03)  0.10      7.0      40.00
349  3          16.51   12.02    2.456  0.30( 0.03)  0.10      7.4      60.00
350  TOTAL AREA(ACRES) =      7.4
351
352  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
353  PEAK FLOW RATE(CFS) =      16.73  Tc(MIN.) =    10.604
354  EFFECTIVE AREA(ACRES) =      7.01  AREA-AVERAGED Fm(INCH/HR) =    0.03
355  AREA-AVERAGED Fp(INCH/HR) =    0.30  AREA-AVERAGED Ap =    0.10
356  TOTAL AREA(ACRES) =      7.4
357  LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 =      845.00 FEET.
358
359  +-----+
360  | Outfall to Site Storm Drain |
361  +-----+
362
363  *****
364  FLOW PROCESS FROM NODE      30.00 TO NODE      31.00 IS CODE =    21
365  -----
366  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
367  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
368  =====
369  INITIAL SUBAREA FLOW-LENGTH(FEET) =    211.00
370  ELEVATION DATA: UPSTREAM(FEET) =    149.27  DOWNSTREAM(FEET) =    148.10
371
372  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
373  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.308
374  * 10 YEAR RAINFALL INTENSITY(INCH/HR) =    3.266
375  SUBAREA Tc AND LOSS RATE DATA(AMC II):
376  DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS      Tc
377  LAND USE              GROUP  (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
378  COMMERCIAL            B      0.70    0.30    0.100    56    7.31
379  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =    0.30
380  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =    0.100
381  SUBAREA RUNOFF(CFS) =    2.04
382  TOTAL AREA(ACRES) =    0.70  PEAK FLOW RATE(CFS) =    2.04
383
384  *****
385  FLOW PROCESS FROM NODE      31.00 TO NODE      32.00 IS CODE =    31
386  -----
387  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
388  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
389  =====
390  REPRESENTATIVE SLOPE =    0.0050
391  FLOW LENGTH(FEET) =    180.00  MANNING'S N =    0.013
392  DEPTH OF FLOW IN 12.0 INCH PIPE IS    8.3 INCHES
393  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.50
394  ESTIMATED PIPE DIAMETER(INCH) =    12.00  NUMBER OF PIPES =    1
395  PIPE-FLOW(CFS) =    2.04
396  PIPE TRAVEL TIME(MIN.) =    0.86  Tc(MIN.) =    8.17

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397     LONGEST FLOWPATH FROM NODE      30.00 TO NODE      32.00 =      391.00 FEET.
398
399 *****
400     FLOW PROCESS FROM NODE      33.00 TO NODE      34.00 IS CODE =   31
401 -----
402     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
403     >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
404 =====
405     REPRESENTATIVE SLOPE =   0.0050
406     FLOW LENGTH(FEET) =   206.00   MANNING'S N =   0.013
407     DEPTH OF FLOW IN   12.0 INCH PIPE IS   8.3 INCHES
408     PIPE-FLOW VELOCITY(FEET/SEC.) =   3.50
409     ESTIMATED PIPE DIAMETER(INCH) =   12.00   NUMBER OF PIPES =    1
410     PIPE-FLOW(CFS) =       2.04
411     PIPE TRAVEL TIME(MIN.) =   0.98   Tc(MIN.) =   9.15
412     LONGEST FLOWPATH FROM NODE      30.00 TO NODE      34.00 =      597.00 FEET.
413
414 *****
415     FLOW PROCESS FROM NODE      34.00 TO NODE      35.00 IS CODE =   41
416 -----
417     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
418     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
419 =====
420     REPRESENTATIVE SLOPE =   0.0030
421     FLOW LENGTH(FEET) =   192.00   MANNING'S N =   0.013
422     DEPTH OF FLOW IN   24.0 INCH PIPE IS   6.7 INCHES
423     PIPE-FLOW VELOCITY(FEET/SEC.) =   2.86
424     GIVEN PIPE DIAMETER(INCH) =   24.00   NUMBER OF PIPES =    1
425     PIPE-FLOW(CFS) =       2.04
426     PIPE TRAVEL TIME(MIN.) =   1.12   Tc(MIN.) =  10.27
427     LONGEST FLOWPATH FROM NODE      30.00 TO NODE      35.00 =      789.00 FEET.
428
429 *****
430     FLOW PROCESS FROM NODE      35.00 TO NODE      35.00 IS CODE =   81
431 -----
432     >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
433 =====
434     MAINLINE Tc(MIN.) =   10.27
435     * 10 YEAR RAINFALL INTENSITY(INCH/HR) =   2.688
436     SUBAREA LOSS RATE DATA(AMC II):
437     DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS
438     LAND USE              GROUP      (ACRES)  (INCH/HR)  (DECIMAL)  CN
439     COMMERCIAL            B          0.60      0.30      0.100      56
440     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =   0.30
441     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =   0.100
442     SUBAREA AREA(ACRES) =   0.60      SUBAREA RUNOFF(CFS) =   1.44
443     EFFECTIVE AREA(ACRES) =   1.30      AREA-AVERAGED Fm(INCH/HR) =   0.03
444     AREA-AVERAGED Fp(INCH/HR) =   0.30      AREA-AVERAGED Ap =   0.10
445     TOTAL AREA(ACRES) =   1.3      PEAK FLOW RATE(CFS) =   3.11
446
447 *****
448     FLOW PROCESS FROM NODE      35.00 TO NODE      36.00 IS CODE =   41
449 -----
450     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
451     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
452 =====
453     REPRESENTATIVE SLOPE =   0.0200
454     FLOW LENGTH(FEET) =   43.80   MANNING'S N =   0.013
455     DEPTH OF FLOW IN   28.0 INCH PIPE IS   4.9 INCHES
456     PIPE-FLOW VELOCITY(FEET/SEC.) =   6.23
457     GIVEN PIPE DIAMETER(INCH) =   28.00   NUMBER OF PIPES =    1
458     PIPE-FLOW(CFS) =       3.11
459     PIPE TRAVEL TIME(MIN.) =   0.12   Tc(MIN.) =  10.38
460     LONGEST FLOWPATH FROM NODE      30.00 TO NODE      36.00 =      832.80 FEET.
461
462     +-----+

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463 | Outfall to Lemon Street Strom Drain |
464 +-----+
465 =====
466 END OF STUDY SUMMARY:
467 TOTAL AREA(ACRES)      =      1.3  TC(MIN.) =      10.38
468 EFFECTIVE AREA(ACRES) =      1.30  AREA-AVERAGED Fm(INCH/HR)=  0.03
469 AREA-AVERAGED Fp(INCH/HR) =  0.30  AREA-AVERAGED Ap = 0.100
470 PEAK FLOW RATE(CFS)   =      3.11
471 =====
472 =====
473 END OF RATIONAL METHOD ANALYSIS
474
475 RF
476
477
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*****
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 18.2 Release Date: 05/08/2012 License ID 1537

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***** DESCRIPTION OF STUDY *****
* Fullerton Shops at Fullerton Town Center *
* Northwest Corner of Orangethorpe Ave and Lemon Street *
* Proposed 100-Year Storm *
*****

FILE NAME: 084PR100.DAT
TIME/DATE OF STUDY: 18:29 10/08/2020
=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====
--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 6.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
*DATA BANK RAINFALL USED*
*ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING
      WIDTH CROSSFALL IN- / OUT-/PARK- HEIGHT WIDTH LIP HIKE FACTOR
NO. (FT) (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (FT) (n)
=== =====
39 1 30.0 20.0 0.018/0.018/0.020 0.67 2.00 0.0313 0.167 0.0150
40

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
   as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

*****
FLOW PROCESS FROM NODE 10.00 TO NODE 11.00 IS CODE = 21
-----
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 231.00
ELEVATION DATA: UPSTREAM(FEET) = 149.22 DOWNSTREAM(FEET) = 148.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.096
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.694
SUBAREA Tc AND LOSS RATE DATA(AMC II):
      DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
      LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
64 COMMERCIAL B 0.77 0.30 0.100 56 8.10
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

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67 SUBAREA RUNOFF(CFS) = 3.23
68 TOTAL AREA(ACRES) = 0.77 PEAK FLOW RATE(CFS) = 3.23
69
70 *****
71 FLOW PROCESS FROM NODE 11.00 TO NODE 12.00 IS CODE = 41
72 -----
73 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
74 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
75 =====
76 REPRESENTATIVE SLOPE = 0.0060
77 FLOW LENGTH(FEET) = 185.00 MANNING'S N = 0.013
78 ASSUME FULL-FLOWING PIPELINE
79 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.12
80 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
81 GIVEN PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
82 PIPE-FLOW(CFS) = 3.23
83 PIPE TRAVEL TIME(MIN.) = 0.75 Tc(MIN.) = 8.85
84 LONGEST FLOWPATH FROM NODE 10.00 TO NODE 12.00 = 416.00 FEET.
85
86 +-----+
87 | Outfall to Lemon Street |
88 +-----+
89
90 *****
91 FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21
92 -----
93 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
94 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
95 =====
96 INITIAL SUBAREA FLOW-LENGTH(FEET) = 161.00
97 ELEVATION DATA: UPSTREAM(FEET) = 150.00 DOWNSTREAM(FEET) = 148.70
98
99 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
100 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.084
101 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.529
102 SUBAREA Tc AND LOSS RATE DATA(AMC II):
103 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
104 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
105 COMMERCIAL B 0.28 0.30 0.100 56 6.08
106 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
107 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
108 SUBAREA RUNOFF(CFS) = 1.39
109 TOTAL AREA(ACRES) = 0.28 PEAK FLOW RATE(CFS) = 1.39
110
111 *****
112 FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 41
113 -----
114 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
115 >>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<
116 =====
117 REPRESENTATIVE SLOPE = 0.0200
118 FLOW LENGTH(FEET) = 169.00 MANNING'S N = 0.013
119 DEPTH OF FLOW IN 12.0 INCH PIPE IS 4.4 INCHES
120 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.38
121 GIVEN PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
122 PIPE-FLOW(CFS) = 1.39
123 PIPE TRAVEL TIME(MIN.) = 0.52 Tc(MIN.) = 6.61
124 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 330.00 FEET.
125
126 *****
127 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 10
128 -----
129 >>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<
130 =====
131
132 *****

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133 FLOW PROCESS FROM NODE 60.00 TO NODE 61.00 IS CODE = 21
134 -----
135 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
136 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
137 =====
138 INITIAL SUBAREA FLOW-LENGTH(FEET) = 378.00
139 ELEVATION DATA: UPSTREAM(FEET) = 150.00 DOWNSTREAM(FEET) = 149.22
140
141  $T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$ 
142 SUBAREA ANALYSIS USED MINIMUM  $T_c$ (MIN.) = 11.245
143 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.889
144 SUBAREA  $T_c$  AND LOSS RATE DATA(AMC II):
145 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS  $T_c$ 
146 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
147 COMMERCIAL B 0.71 0.30 0.100 56 11.24
148 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
149 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
150 SUBAREA RUNOFF(CFS) = 2.47
151 TOTAL AREA(ACRES) = 0.71 PEAK FLOW RATE(CFS) = 2.47
152
153 *****
154 FLOW PROCESS FROM NODE 61.00 TO NODE 61.00 IS CODE = 81
155 -----
156 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
157 =====
158 MAINLINE  $T_c$ (MIN.) = 11.24
159 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.889
160 SUBAREA LOSS RATE DATA(AMC II):
161 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS
162 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
163 COMMERCIAL B 1.47 0.30 0.100 56
164 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
165 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
166 SUBAREA AREA(ACRES) = 1.47 SUBAREA RUNOFF(CFS) = 5.11
167 EFFECTIVE AREA(ACRES) = 2.18 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.03
168 AREA-AVERAGED  $F_p$ (INCH/HR) = 0.30 AREA-AVERAGED  $A_p$  = 0.10
169 TOTAL AREA(ACRES) = 2.2 PEAK FLOW RATE(CFS) = 7.57
170
171 *****
172 FLOW PROCESS FROM NODE 61.00 TO NODE 22.00 IS CODE = 41
173 -----
174 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
175 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
176 =====
177 REPRESENTATIVE SLOPE = 0.0210
178 FLOW LENGTH(FEET) = 257.00 MANNING'S N = 0.013
179 ASSUME FULL-FLOWING PIPELINE
180 PIPE-FLOW VELOCITY(FEET/SEC.) = 9.64
181 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
182 GIVEN PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
183 PIPE-FLOW(CFS) = 7.57
184 PIPE TRAVEL TIME(MIN.) = 0.44  $T_c$ (MIN.) = 11.69
185 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
186
187 *****
188 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 81
189 -----
190 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
191 =====
192 MAINLINE  $T_c$ (MIN.) = 11.69
193 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.803
194 SUBAREA LOSS RATE DATA(AMC II):
195 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS
196 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
197 COMMERCIAL B 1.35 0.30 0.100 56
198 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30

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199 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
200 SUBAREA AREA(ACRES) = 1.35 SUBAREA RUNOFF(CFS) = 4.58
201 EFFECTIVE AREA(ACRES) = 3.53 AREA-AVERAGED Fm(INCH/HR) = 0.03
202 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
203 TOTAL AREA(ACRES) = 3.5 PEAK FLOW RATE(CFS) = 11.99
204
205 *****
206 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 11
207 -----
208 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
209 =====
210
211 ** MAIN STREAM CONFLUENCE DATA **
212 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
213 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
214 1 11.99 11.69 3.803 0.30( 0.03) 0.10 3.5 60.00
215 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
216
217 ** MEMORY BANK # 1 CONFLUENCE DATA **
218 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
219 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
220 1 1.39 6.61 5.274 0.30( 0.03) 0.10 0.3 20.00
221 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 330.00 FEET.
222
223 ** PEAK FLOW RATE TABLE **
224 STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
225 NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
226 1 10.80 6.61 5.274 0.30( 0.03) 0.10 2.3 20.00
227 2 12.99 11.69 3.803 0.30( 0.03) 0.10 3.8 60.00
228 TOTAL AREA(ACRES) = 3.8
229
230 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
231 PEAK FLOW RATE(CFS) = 12.99 Tc(MIN.) = 11.689
232 EFFECTIVE AREA(ACRES) = 3.81 AREA-AVERAGED Fm(INCH/HR) = 0.03
233 AREA-AVERAGED Fp(INCH/HR) = 0.30 AREA-AVERAGED Ap = 0.10
234 TOTAL AREA(ACRES) = 3.8
235 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 22.00 = 635.00 FEET.
236
237 *****
238 FLOW PROCESS FROM NODE 22.00 TO NODE 43.00 IS CODE = 41
239 -----
240 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
241 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
242 =====
243 REPRESENTATIVE SLOPE = 0.0350
244 FLOW LENGTH(FEET) = 116.00 MANNING'S N = 0.013
245 ASSUME FULL-FLOWING PIPELINE
246 PIPE-FLOW VELOCITY(FEET/SEC.) = 10.58
247 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
248 GIVEN PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
249 PIPE-FLOW(CFS) = 12.99
250 PIPE TRAVEL TIME(MIN.) = 0.18 Tc(MIN.) = 11.87
251 LONGEST FLOWPATH FROM NODE 60.00 TO NODE 43.00 = 751.00 FEET.
252
253 *****
254 FLOW PROCESS FROM NODE 43.00 TO NODE 43.00 IS CODE = 10
255 -----
256 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<<
257 =====
258
259 *****
260 FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 21
261 -----
262 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
263 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
264 =====

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265 INITIAL SUBAREA FLOW-LENGTH(FEET) = 419.00
266 ELEVATION DATA: UPSTREAM(FEET) = 149.05 DOWNSTREAM(FEET) = 146.61
267
268  $T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$ 
269 SUBAREA ANALYSIS USED MINIMUM  $T_c$ (MIN.) = 9.522
270 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.278
271 SUBAREA  $T_c$  AND LOSS RATE DATA(AMC II):
272 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS  $T_c$ 
273 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
274 COMMERCIAL B 2.54 0.30 0.100 56 9.52
275 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
276 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
277 SUBAREA RUNOFF(CFS) = 9.71
278 TOTAL AREA(ACRES) = 2.54 PEAK FLOW RATE(CFS) = 9.71
279
280 *****
281 FLOW PROCESS FROM NODE 41.00 TO NODE 42.00 IS CODE = 41
282 -----
283 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
284 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
285 =====
286 REPRESENTATIVE SLOPE = 0.0150
287 FLOW LENGTH(FEET) = 288.00 MANNING'S N = 0.013
288 ASSUME FULL-FLOWING PIPELINE
289 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.91
290 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
291 GIVEN PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
292 PIPE-FLOW(CFS) = 9.71
293 PIPE TRAVEL TIME(MIN.) = 0.61  $T_c$ (MIN.) = 10.13
294 LONGEST FLOWPATH FROM NODE 40.00 TO NODE 42.00 = 707.00 FEET.
295
296 *****
297 FLOW PROCESS FROM NODE 42.00 TO NODE 42.00 IS CODE = 81
298 -----
299 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
300 =====
301 MAINLINE  $T_c$ (MIN.) = 10.13
302 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.129
303 SUBAREA LOSS RATE DATA(AMC II):
304 DEVELOPMENT TYPE/ SCS SOIL AREA  $F_p$   $A_p$  SCS
305 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
306 COMMERCIAL B 1.08 0.30 0.100 56
307 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.30
308 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.100
309 SUBAREA AREA(ACRES) = 1.08 SUBAREA RUNOFF(CFS) = 3.98
310 EFFECTIVE AREA(ACRES) = 3.62 AREA-AVERAGED  $F_m$ (INCH/HR) = 0.03
311 AREA-AVERAGED  $F_p$ (INCH/HR) = 0.30 AREA-AVERAGED  $A_p$  = 0.10
312 TOTAL AREA(ACRES) = 3.6 PEAK FLOW RATE(CFS) = 13.35
313
314 *****
315 FLOW PROCESS FROM NODE 42.00 TO NODE 43.00 IS CODE = 41
316 -----
317 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
318 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
319 =====
320 REPRESENTATIVE SLOPE = 0.0070
321 FLOW LENGTH(FEET) = 138.00 MANNING'S N = 0.013
322 DEPTH OF FLOW IN 24.0 INCH PIPE IS 15.1 INCHES
323 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.40
324 GIVEN PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
325 PIPE-FLOW(CFS) = 13.35
326 PIPE TRAVEL TIME(MIN.) = 0.36  $T_c$ (MIN.) = 10.49
327 LONGEST FLOWPATH FROM NODE 40.00 TO NODE 43.00 = 845.00 FEET.
328
329 *****
330 FLOW PROCESS FROM NODE 43.00 TO NODE 43.00 IS CODE = 11

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331 -----
332 >>>>>CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY<<<<<
333 =====
334
335 ** MAIN STREAM CONFLUENCE DATA **
336 STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
337 NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
338 1          13.35   10.49   4.047  0.30( 0.03)  0.10      3.6      40.00
339 LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 =      845.00 FEET.
340
341 ** MEMORY BANK # 2 CONFLUENCE DATA **
342 STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
343 NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
344 1          10.80    6.79   5.194  0.30( 0.03)  0.10      2.3      20.00
345 2          12.99   11.87   3.770  0.30( 0.03)  0.10      3.8      60.00
346 LONGEST FLOWPATH FROM NODE      60.00 TO NODE      43.00 =      751.00 FEET.
347
348 ** PEAK FLOW RATE TABLE **
349 STREAM      Q      Tc  Intensity  Fp(Fm)      Ap      Ae      HEADWATER
350 NUMBER      (CFS)  (MIN.) (INCH/HR) (INCH/HR)      (ACRES)  NODE
351 1          21.91    6.79   5.194  0.30( 0.03)  0.10      4.6      20.00
352 2          25.75   10.49   4.047  0.30( 0.03)  0.10      7.0      40.00
353 3          25.42   11.87   3.770  0.30( 0.03)  0.10      7.4      60.00
354 TOTAL AREA(ACRES) =      7.4
355
356 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
357 PEAK FLOW RATE(CFS) =      25.75  Tc(MIN.) = 10.488
358 EFFECTIVE AREA(ACRES) =      7.01  AREA-AVERAGED Fm(INCH/HR) = 0.03
359 AREA-AVERAGED Fp(INCH/HR) = 0.30  AREA-AVERAGED Ap = 0.10
360 TOTAL AREA(ACRES) =      7.4
361 LONGEST FLOWPATH FROM NODE      40.00 TO NODE      43.00 =      845.00 FEET.
362
363 +-----+
364 | Outfall to Site Storm Drain |
365 +-----+
366
367 *****
368 FLOW PROCESS FROM NODE      30.00 TO NODE      31.00 IS CODE = 21
369 -----
370 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
371 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
372 =====
373 INITIAL SUBAREA FLOW-LENGTH(FEET) = 211.00
374 ELEVATION DATA: UPSTREAM(FEET) = 149.27  DOWNSTREAM(FEET) = 148.10
375
376 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
377 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.308
378 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.978
379 SUBAREA Tc AND LOSS RATE DATA(AMC II):
380 DEVELOPMENT TYPE/      SCS SOIL  AREA      Fp      Ap      SCS  Tc
381 LAND USE      GROUP  (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
382 COMMERCIAL      B      0.70      0.30      0.100      56  7.31
383 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
384 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
385 SUBAREA RUNOFF(CFS) = 3.12
386 TOTAL AREA(ACRES) = 0.70  PEAK FLOW RATE(CFS) = 3.12
387
388 *****
389 FLOW PROCESS FROM NODE      31.00 TO NODE      32.00 IS CODE = 41
390 -----
391 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
392 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
393 =====
394 REPRESENTATIVE SLOPE = 0.0050
395 FLOW LENGTH(FEET) = 180.00  MANNING'S N = 0.013
396 ASSUME FULL-FLOWING PIPELINE

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397     PIPE-FLOW VELOCITY(FEET/SEC.) =    3.97
398     PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
399     GIVEN PIPE DIAMETER(INCH) =    12.00     NUMBER OF PIPES =    1
400     PIPE-FLOW(CFS) =    3.12
401     PIPE TRAVEL TIME(MIN.) =    0.76     Tc(MIN.) =    8.06
402     LONGEST FLOWPATH FROM NODE    30.00 TO NODE    32.00 =    391.00 FEET.
403
404     *****
405     FLOW PROCESS FROM NODE    33.00 TO NODE    34.00 IS CODE =    41
406     -----
407     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
408     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
409     =====
410     REPRESENTATIVE SLOPE =    0.0050
411     FLOW LENGTH(FEET) =    206.00     MANNING'S N =    0.013
412     ASSUME FULL-FLOWING PIPELINE
413     PIPE-FLOW VELOCITY(FEET/SEC.) =    3.97
414     PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
415     GIVEN PIPE DIAMETER(INCH) =    12.00     NUMBER OF PIPES =    1
416     PIPE-FLOW(CFS) =    3.12
417     PIPE TRAVEL TIME(MIN.) =    0.87     Tc(MIN.) =    8.93
418     LONGEST FLOWPATH FROM NODE    30.00 TO NODE    34.00 =    597.00 FEET.
419
420     *****
421     FLOW PROCESS FROM NODE    34.00 TO NODE    35.00 IS CODE =    41
422     -----
423     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
424     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
425     =====
426     REPRESENTATIVE SLOPE =    0.0030
427     FLOW LENGTH(FEET) =    192.00     MANNING'S N =    0.013
428     DEPTH OF FLOW IN    24.0 INCH PIPE IS    8.3 INCHES
429     PIPE-FLOW VELOCITY(FEET/SEC.) =    3.22
430     GIVEN PIPE DIAMETER(INCH) =    24.00     NUMBER OF PIPES =    1
431     PIPE-FLOW(CFS) =    3.12
432     PIPE TRAVEL TIME(MIN.) =    0.99     Tc(MIN.) =    9.92
433     LONGEST FLOWPATH FROM NODE    30.00 TO NODE    35.00 =    789.00 FEET.
434
435     *****
436     FLOW PROCESS FROM NODE    35.00 TO NODE    35.00 IS CODE =    81
437     -----
438     >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
439     =====
440     MAINLINE Tc(MIN.) =    9.92
441     * 100 YEAR RAINFALL INTENSITY(INCH/HR) =    4.178
442     SUBAREA LOSS RATE DATA(AMC II):
443     DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS
444     LAND USE              GROUP      (ACRES)  (INCH/HR)  (DECIMAL)  CN
445     COMMERCIAL            B          0.60      0.30      0.100      56
446     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =    0.30
447     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =    0.100
448     SUBAREA AREA(ACRES) =    0.60      SUBAREA RUNOFF(CFS) =    2.24
449     EFFECTIVE AREA(ACRES) =    1.30      AREA-AVERAGED Fm(INCH/HR) =    0.03
450     AREA-AVERAGED Fp(INCH/HR) =    0.30      AREA-AVERAGED Ap =    0.10
451     TOTAL AREA(ACRES) =    1.3      PEAK FLOW RATE(CFS) =    4.85
452
453     *****
454     FLOW PROCESS FROM NODE    35.00 TO NODE    36.00 IS CODE =    41
455     -----
456     >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
457     >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
458     =====
459     REPRESENTATIVE SLOPE =    0.0200
460     FLOW LENGTH(FEET) =    43.80     MANNING'S N =    0.013
461     DEPTH OF FLOW IN    28.0 INCH PIPE IS    6.1 INCHES
462     PIPE-FLOW VELOCITY(FEET/SEC.) =    7.10

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463     GIVEN PIPE DIAMETER(INCH) = 28.00     NUMBER OF PIPES = 1
464     PIPE-FLOW(CFS) = 4.85
465     PIPE TRAVEL TIME(MIN.) = 0.10     Tc(MIN.) = 10.03
466     LONGEST FLOWPATH FROM NODE 30.00 TO NODE 36.00 = 832.80 FEET.
467
468 +-----+
469 | Outfall to Lemon Stret Strom Drain |
470 +-----+
471
472 *****
473     FLOW PROCESS FROM NODE 50.00 TO NODE 51.00 IS CODE = 21
474 -----
475     >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
476     >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
477 =====
478     INITIAL SUBAREA FLOW-LENGTH(FEET) = 35.00
479     ELEVATION DATA: UPSTREAM(FEET) = 150.00 DOWNSTREAM(FEET) = 148.90
480
481     Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
482     SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
483     * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
484     SUBAREA Tc AND LOSS RATE DATA(AMC II):
485     DEVELOPMENT TYPE/      SCS SOIL      AREA      Fp      Ap      SCS      Tc
486     LAND USE              GROUP      (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
487     COMMERCIAL            B          0.24      0.30      0.100      56   5.00
488     SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.30
489     SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
490     SUBAREA RUNOFF(CFS) = 1.33
491     TOTAL AREA(ACRES) = 0.24     PEAK FLOW RATE(CFS) = 1.33
492
493 +-----+
494 | Outfall to Lemon Street Curb and Gutter |
495 +-----+
496 =====
497     END OF STUDY SUMMARY:
498     TOTAL AREA(ACRES) = 0.2     TC(MIN.) = 5.00
499     EFFECTIVE AREA(ACRES) = 0.24     AREA-AVERAGED Fm(INCH/HR) = 0.03
500     AREA-AVERAGED Fp(INCH/HR) = 0.30     AREA-AVERAGED Ap = 0.100
501     PEAK FLOW RATE(CFS) = 1.33
502 =====
503 =====
504     END OF RATIONAL METHOD ANALYSIS
505
506 END
507
508

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APPENDIX E – REFERENCE PLANS