
APPENDIX P

HYDROLOGY STUDY AND STORMWATER QUALITY MANAGEMENT PLAN

APPENDIX

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HYDROLOGY STUDY AND STORMWATER QUALITY MANAGEMENT PLAN

**Marici Project, LLC
15207, 16233 and 16285 Gale Avenue
City of Industry, CA 91745**

Prepared For:

Marici Project, LLC

Prepared By:



6 Executive Circle, Suite 200
Irvine, California 92614

Under Supervision of:

Stephen V. Huvane, P.E.

February 2025

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1.0 Project Description

Five (5) Parcels will be merged into one and contain a Battery Energy Storage System (BESS) after redevelopment. These parcels (APNs 8242-016-061, 8242-016-033, 8242-016-034, 8242-016-036 and 8242-016-044) total approximately 9.21 acres. The merged lot will have batteries, control equipment, and ancillary facilities. Batteries will be contained in purpose-built free-standing enclosures. Ancillary facilities include access roads designed to fire department standards, fire water system, exterior lighting, inverters, transformers, an onsite electric substation, stormwater conveyance systems (discussed later in this report), a building with work stations, break area, sanitary facilities and a perimeter reinforced concrete wall around the entire facility designed for safety and aesthetics of the surrounding area. The onsite substation will be connected to the adjacent Southern California Edison walnut substation by an overhead 220 kv electric line.

The Site is located at 16207, 16233 and 16285 Gale Avenue, Industry, California, within the San Gabriel Watershed in Los Angeles (LA) County.

The purpose of this report is to provide a preliminary stormwater analysis of this redevelopment and to ensure it complies with stormwater requirements set forth by the City of Industry and LA county.

1.1 Proposed Stormwater Conditions

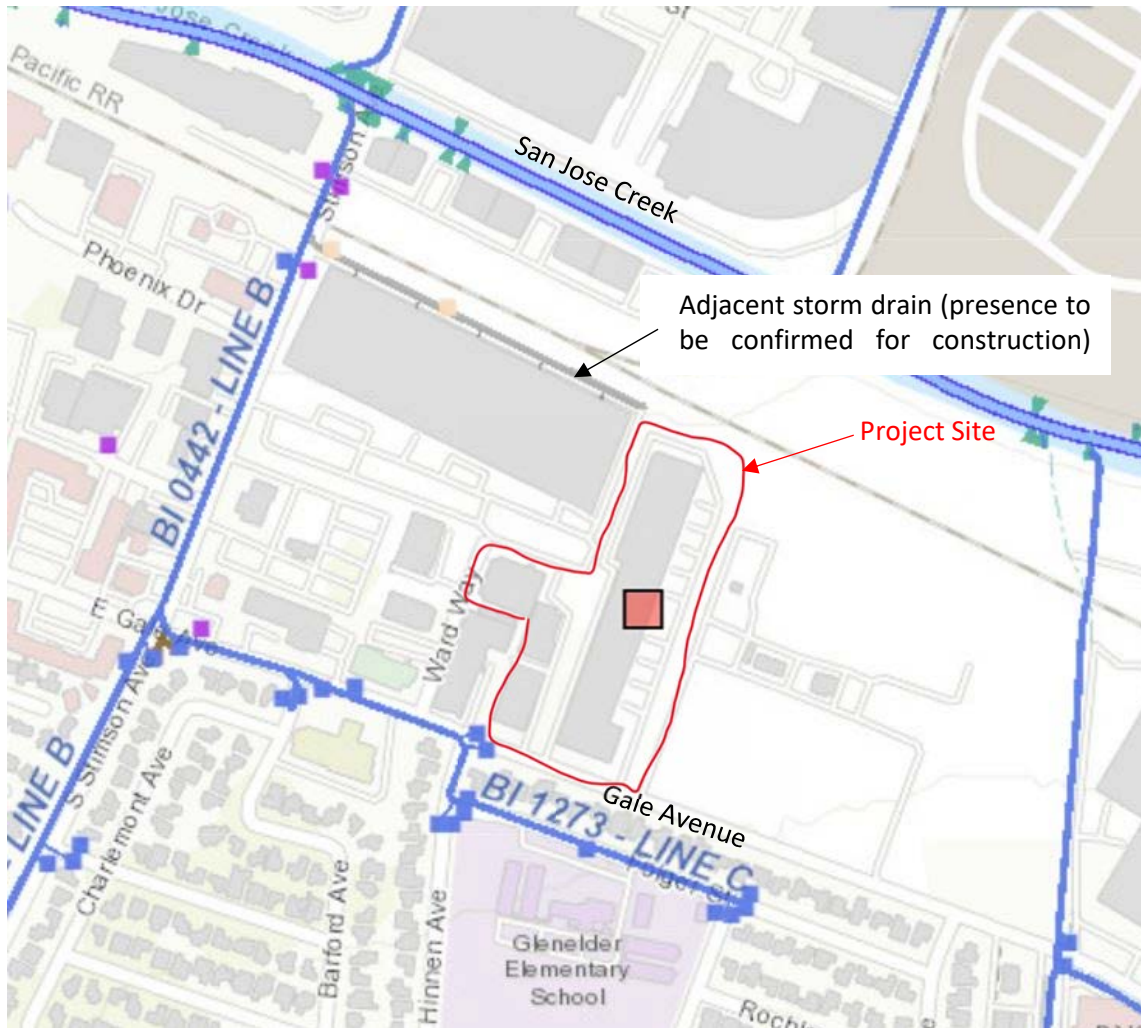
The proposed stormwater design consists of an underground storm drain system, curb and gutters and open vegetated ditches. The proposed storm drain will connect to an existing curb inlet that is to remain on the property. Calculations shown herein will prove there is no increase of stormwater runoff to this existing inlet and anywhere else on site after development.

2.0 Existing Site Conditions

The five existing parcels contain a few different commercial stores, services and storage buildings. The parcels are almost entirely covered by impervious cover (pavement, buildings and loading docks). Total existing impervious cover is approximately 8.43 acres, which makes up approximately 92% of the total merged lot (Site). FEMA flood zone mapping shows the Site lies in a minimal flood hazard area (Zone X) as shown in **Appendix A**.

Stormwater on these parcels make their way to an existing underground system by means of sheet flow, roof drains, gutters and into grate and curb inlets. A small area discharges to the underground system along Gale Ave, while most of the area is conveyed through an independent stormwater system. It is assumed for this report, the independent system connects to an adjacent storm drain. It is clear both systems eventually make their way to San Jose Creek, a concrete lined channel approximately 1300 ft northwest of the Sites northwest lot corner. **Figure 1** below depicts the existing storm drain system along Gale Ave that leads into San Jose Creek. The Image was captured from the LA county public works website. This report analyzes four (4) discharge points; Discharge (DP) A, DP B, DP C and DP G. The discharge points, existing surface flow and drainage areas are depicted in the Existing Drainage Area Map found in **Appendix B**.

Figure 1 – Public Works LA County Storm Drain System



3.0 Stormwater Calculations

The project will develop a total of 3.89 acres (42%) of impervious surface on approximately 9.21 acre site. This 3.89 acres make up the asphalt access roads, concrete curb and gutters, substation area, buildings, storage units as well as concrete pads and foundations for equipment.

3.1 Methodology

The modified rational method (MODRAT) was used to calculate existing and proposed development runoff. Proposed equations for this method can be found in Chapter 6.3 and 7.3 of the *Hydrology Manual*.

February 2025

Marici Project, LLC Hydrology Study and Stormwater Quality Management Plan

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3.2 Soil Characteristics and Design Rainfall

The soil types in the proposed site are 017 and 003 based on USGS Quadrangle as shown in the index Isohyetal Map in **Appendix D**. From this map, 6.36 inches was used for the 50-year 24-hour storm analysis. For the 100-year 24-hour storm, 6.86 inches was used, and was taken from NOAA Atlas 14, Volume 6 Version 2.

3.3 Runoff Coefficient and Time of Concentration

Although only 42% of the BESS site is impervious, 91% impervious was used to find the Developed Runoff Coefficient (C_D) in equation 6.3.2 of the *Hydrology Manual*. This 91% is based on a mixed commercial and industrial land use type per the table in Appendix D in the *Hydrology Manual*. This is a conservative approach to the stormwater design and is appropriate for this design stage. The steps outlined in section 7.3 of the *Hydrology Manual* were followed to find the Time of Concentration for each drainage area. **Appendix E** shows these results, along with the runoff coefficient curves for each soil type. Where times of concentration were below 5 minutes, 5 minutes was used per section 11.1 of the *Hydrology Manual*.

3.4 Results

Both existing and proposed development for the 50-year, 24-hour storm event is calculated to compare the discharge rates before and after. The results are summarized below in **Table 1**. The drainage areas that correspond to these flow rates are shown in **Appendix B and C**.

Table 1 – 50-year Peak Flow Summary

Discharge Point	Existing Flow (cfs)	Proposed Flow (cfs)	Difference (cfs)
A	21.15	21.11	-0.04
B	0.24	0.24	0.00
C1	5.43	0.00	-5.43
C2	13.32	11.59	-1.73
G	0.69	0.69	0.00

3.4.1 Underground Stormwater System

The rational method, along with Manning's equation was used to calculate the flows, velocities, and other hydraulic information for the underground storm drain system. In order to size the inlets and underground storm drain, the 100-year, 24-hour storm was used. The results for the 100-year peak flow rates are summarized below in **Table 2**. Note the proposed flow rate for discharge point A comes from **Appendix G**, column 15, at the end of Storm line A1.

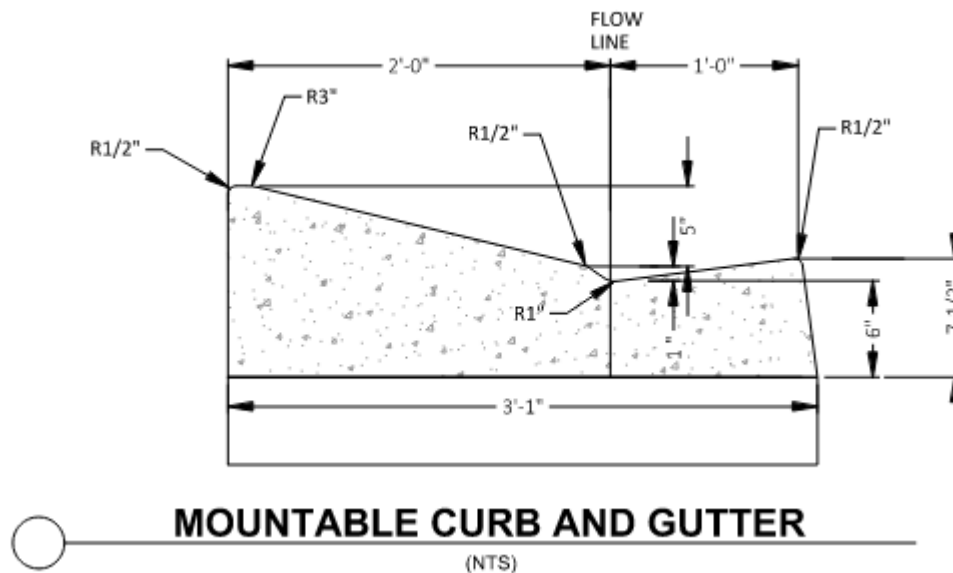
Table 2 –100-year Peak Flow Summary

Discharge Point	Existing Flow (cfs)	Proposed Flow (cfs)	Difference (cfs)
A	27.72	21.55	-6.17
B	0.26	0.26	0.00
C1	1.07	0.00	-1.07
C2	14.41	12.58	-1.83
G	0.75	0.75	0.00

3.4.2 Inlet sizing

Inlet sizing is based on multiple parameters, including gutter type, curb type, road slope and spread of water (T) in the road. FlowMaster version 10.03.00.03 was used to find the depth of water and spread within the road at each inlet location. This Site utilizes mountable curb and gutter. **Figure 2** shows a detail of the curb type. **Appendix F** shows the flow to the inlets, size and type of inlet at each location as well as the worksheets printed from FlowMaster.

Figure 2 – Mountable Curb and Gutter



3.5 Stormwater Quality

Stormwater Quality will be met for drainage area A by installing a proprietary stormwater quality device. This device shall be selected and sized prior to construction plans. The device will be located on the northwest corner of the Site along the storm drain line that discharges to the existing storm drain system. Once the device is selected and sized, per LID Manual it must be approved by LA County Department of Public Works. Drainage areas C, G and B that do not flow through this device will flow through vegetated swales and/or strips prior to discharging to the adjacent property or the Gale Avenue existing storm drain system. The stormwater quality design volume is based on the 85th percentile, 24-hour rainfall depth of 1.10 inches. **See Appendix H** for the Isohyetal Map and peak flow rates for the 85th percentile storm.

4.0 Conclusions

The Marici Project does not increase the stormwater runoff from its Site. Proposed flow rates are either at or below existing conditions. The impervious cover has decreased from 8.43 acres in its current existing conditions to 3.89 acres in the proposed condition. The increase in times of concentration as well as the cover type, allow the Site to have at or below existing peak flow rates.

5.0 References

Los Angeles County Department of Public Works Hydrology Manual. January 2006. – *Hydrology Manual*.

Los Angeles County Flood Control District Hydraulic Manual. March 1982. – *Hydraulic Manual*

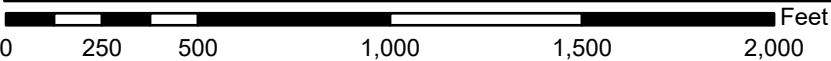
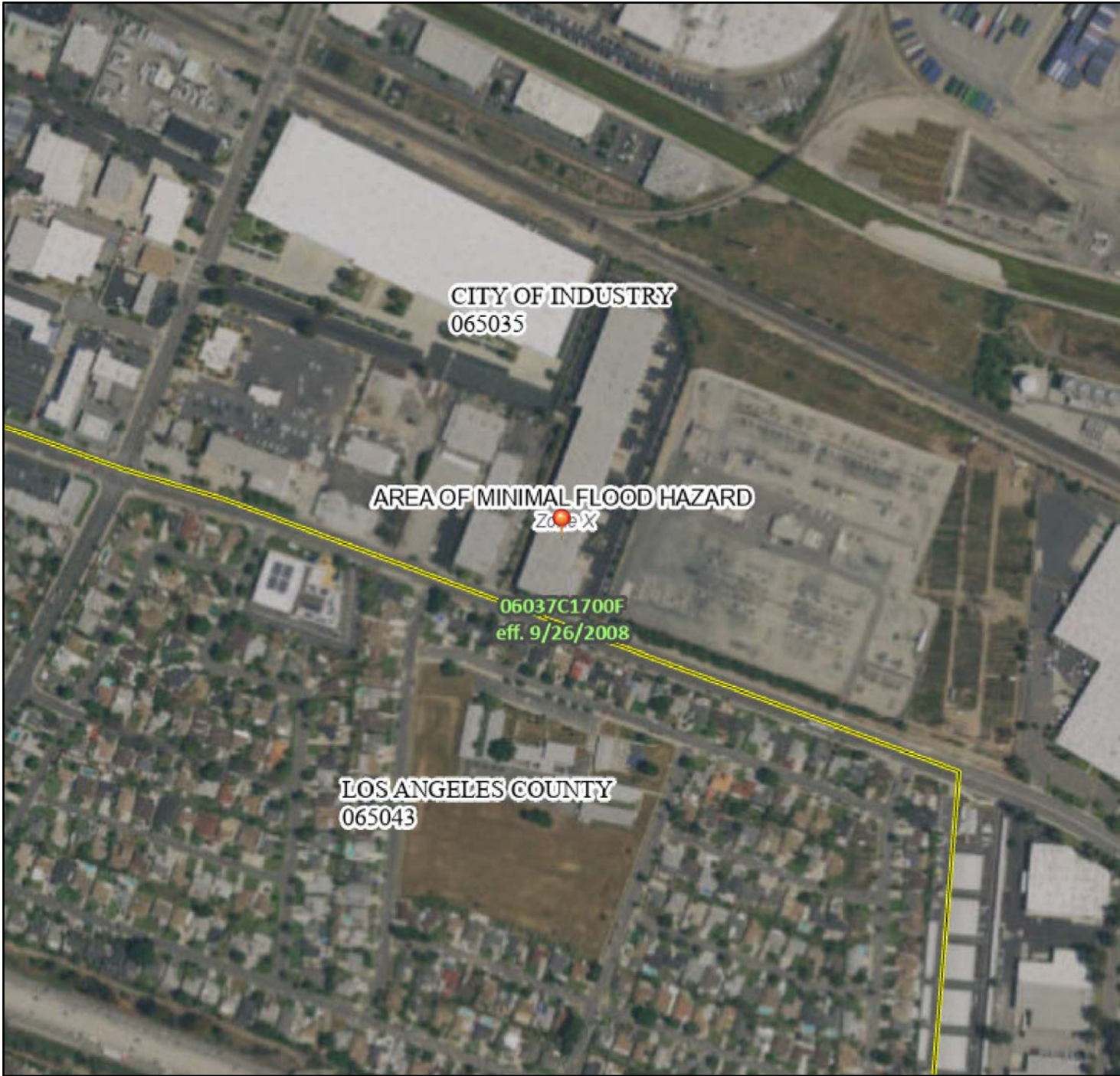
Los Angeles County Low Impact Development Manual. February 2014 – *LID Manual*

Appendix A: FEMA Flood Map

National Flood Hazard Layer FIRMMette



117°57'26"W 34°0'44"N



1:6,000 P-10

117°56'48"W 34°0'15"N

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainage area of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee Elevation Zone X
		Area with Flood Risk due to Levee Breach Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert or Storm Sewer
		Levee Dike or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Base Line
		Profile Base Line
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

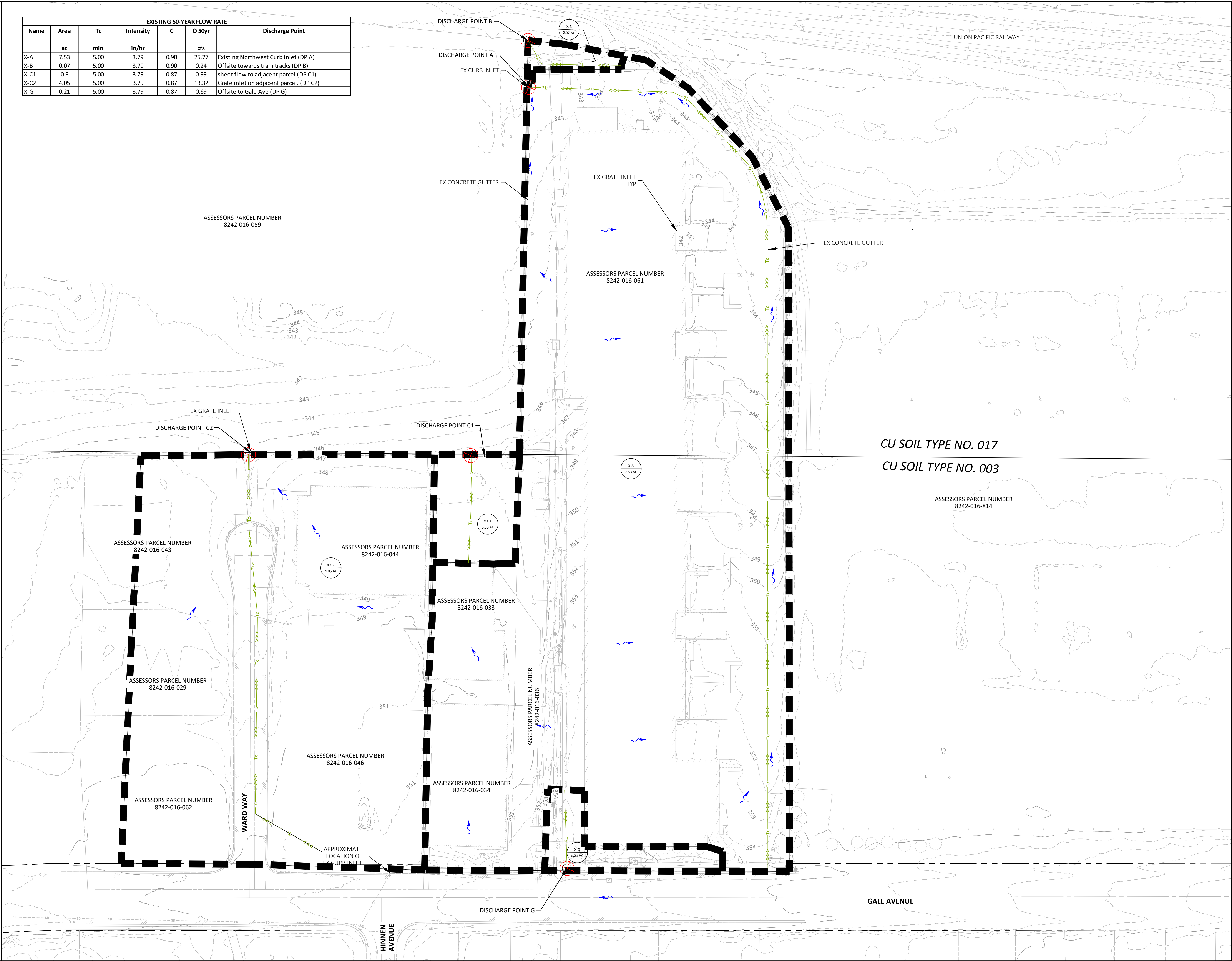
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL we use and is provided by FEMA. This map was exported on 5/30/2024 at 3:15 PM and does not reflect change or amendments subsequent to this date and time. The NFHL and effective information may change or be superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear on a base map image, flood zone labels, legend, scale bar, map creation date, community identifier, FIRM panel number, and FIRM effective date. Map image for unmapped and unmapped areas cannot be used for regulatory purposes.

Appendix B: Existing Drainage Area Map

EXISTING 50-YEAR FLOW RATE						
Name	Area	Tc	Intensity	C	Q 50yr	Discharge Point
	ac	min	in/hr		cfs	
X-A	7.53	5.00	3.79	0.90	25.77	Existing Northwest Curb Inlet (DP A)
X-B	0.07	5.00	3.79	0.90	0.24	Offsite towards train tracks (DP B)
X-C1	0.3	5.00	3.79	0.87	0.99	sheet flow to adjacent parcel (DP C1)
X-C2	4.05	5.00	3.79	0.87	13.32	Grate inlet on adjacent parcel. (DP C2)
X-G	0.21	5.00	3.79	0.87	0.69	Offsite to Gale Ave (DP G)



VICINITY MAP
SCALE: 1" = 500'

LEGEND

EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
PROJECT BOUNDARY
SURFACE WATER FLOW

DRAINAGE AREA ID AND ACREAGE

FLOW PATH

GENERAL NOTES

1. EXISTING CONTOURS OBTAINED FROM USGS, AND MAY NOT REFLECT ON-THE GROUND TOPOGRAPHIC SURVEY.

2. SITE VISITS, AERIAL IMAGERY, SURVEY DATA ON APN 8242-016-061, AND PUBLIC INFORMATION WAS USED TO IDENTIFY DISCHARGE POINTS FOR THE SITE.

3. STORMWATER ANALYSIS SHALL BE RE-EVALUATED UPON RECEIVING DETAILED TOPOGRAPHIC SURVEY PRIOR TO CONSTRUCTION PLANS.

GRAPHIC SCALE
1" = 50'

NORTH

SEAL:

**PERMIT PLAN SET
NOT FOR
CONSTRUCTION**

PROFESSIONAL ENGINEER:
DATE:

NO.	BY	DATE	REVISION	APP'D.

PROJECT: MARICI PROJECT, LLC
16207, 16233, AND 16285 GALE AVENUE
CITY OF INDUSTRY, CA 91745-1719

TITLE: EXISTING DRAINAGE AREA MAP

DRAWN BY:	PROJ. NO:	604109
CHECKED BY: DG	D-001	
APPROVED BY: SH		
DATE: 2/6/2025		

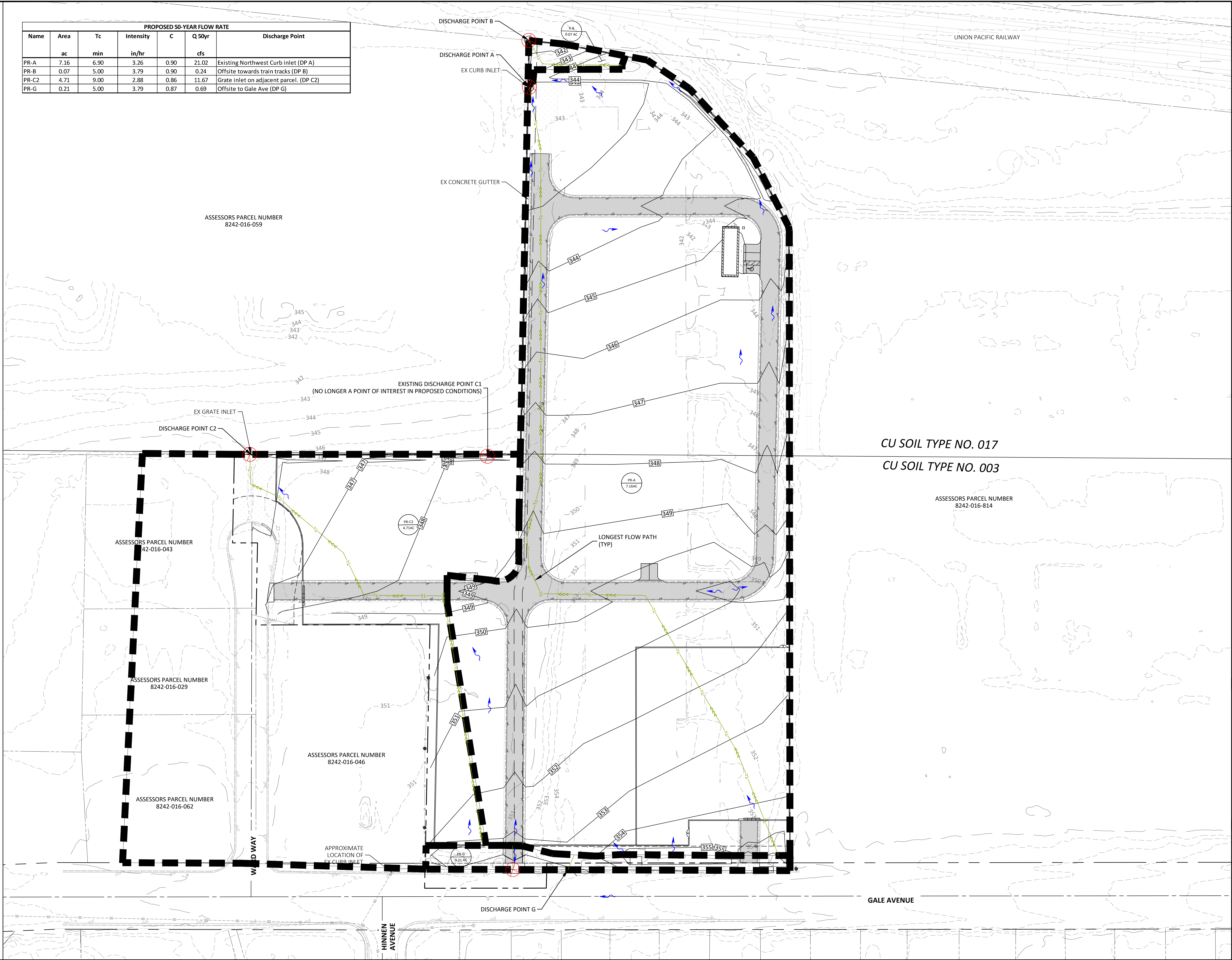
TRC

6 Executive Circle
Suite 200
Irvine, CA 92614
Phone: 949.727.9336

H:\WORK IN PROGRESS\SOLAR_SITES\MARICI\CAO\SITE PLANS\EXHIBITS FOR DRAINAGE REPORT\EX DRAINAGE MAP.DWG

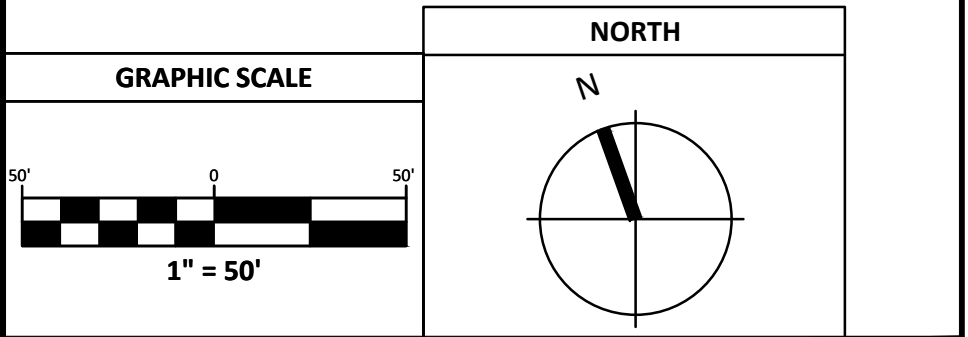
Appendix C: Proposed Drainage Area Maps

PROPOSED 50-YEAR FLOW RATE						Discharge Point
Name	Area	Tc	Intensity	C	Q 50yr	
	ac	min	in/hr		cfs	
PR-A	7.16	6.90	3.26	0.90	21.02	Existing Northwest Curb inlet (DP A)
PR-B	0.07	5.00	3.79	0.90	0.24	Offsite towards train tracks (DP B)
PR-C2	4.71	9.00	2.88	0.86	11.67	Grate inlet on adjacent parcel. (DP C2)
PR-G	0.21	5.00	3.79	0.87	0.69	Offsite to Gale Ave (DP G)



VICINITY MAP	
SCALE: 1" = 500'	
LEGEND	
EXISTING MAJOR CONTOUR	— 340 —
EXISTING MINOR CONTOUR	- - - 340 - - -
PROPOSED MAJOR CONTOUR	— 340 —
PROPOSED MINOR CONTOUR	- - - 340 - - -
PROJECT BOUNDARY	— 340 —
SURFACE WATER FLOW	— 340 —
DRAINAGE AREA ID AND ACREAGE	340
FLOW PATH	— 340 —

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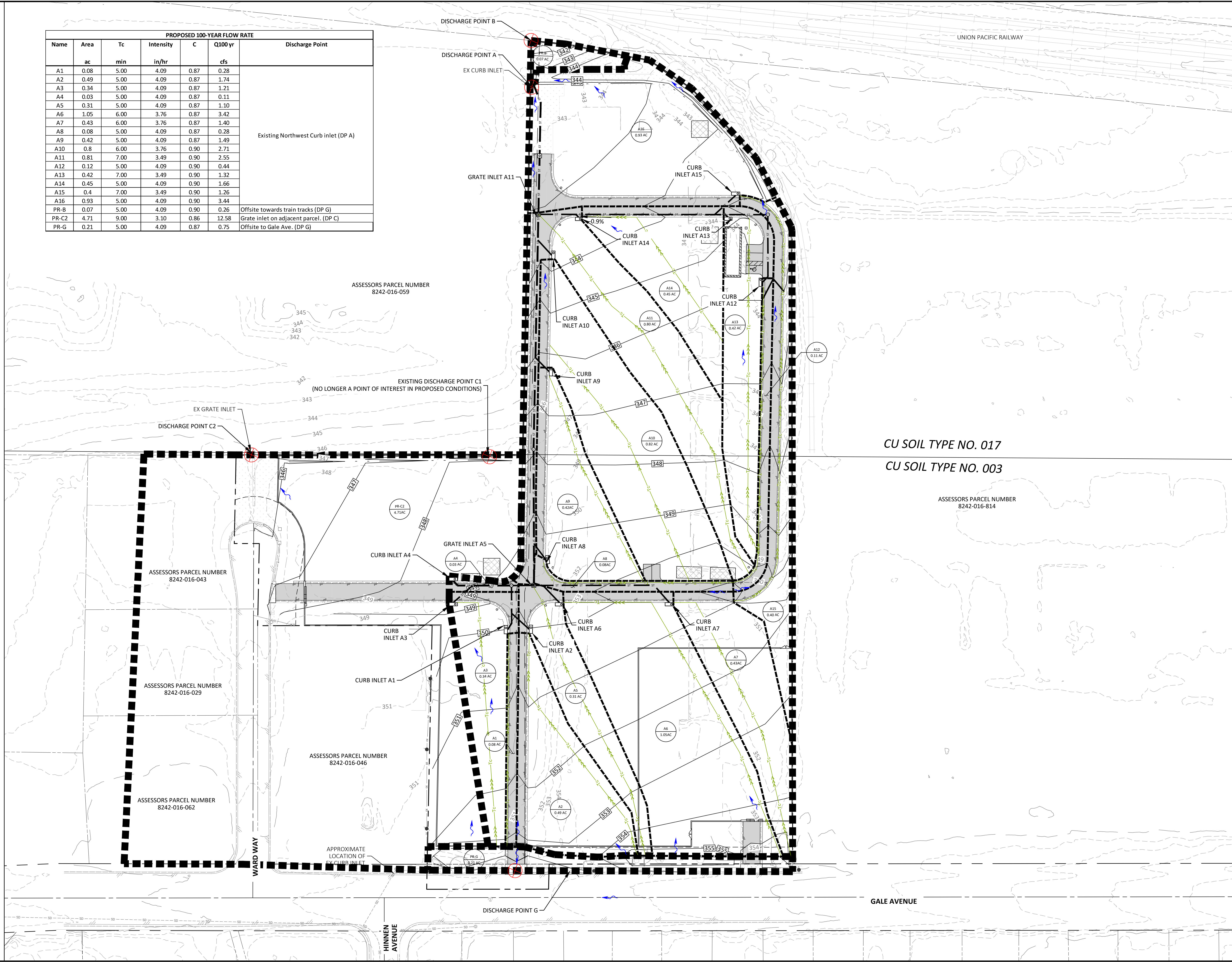


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PERMIT PLAN SET NOT FOR CONSTRUCTION		DATE:	
NO.		BY	
DATE		REVISION	
PROJECT:		MARICI PROJECT, LLC	
TITLE:		16207, 16233, AND 16285 GALE AVENUE	
DRAWN BY:		PROJ. NO. 604109	
CHECKED BY: DG		D-002	
APPROVED BY: SH		DATE: 2/6/2025	

TRC

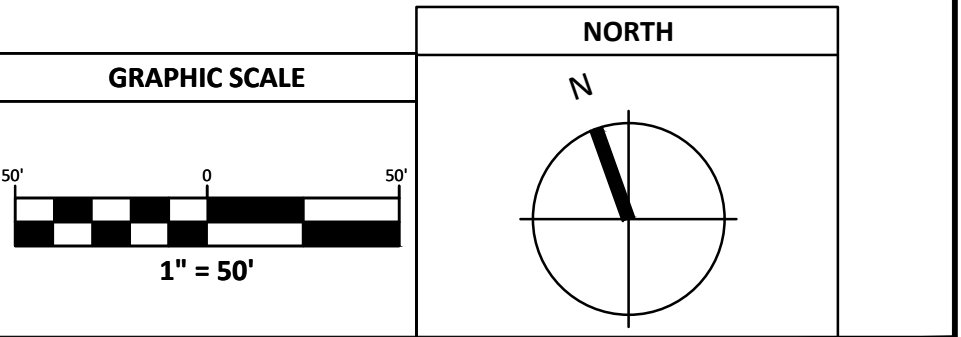
6 Executive Circle
Suite 200
Irvine, CA 92614
Phone: 949.727.9336

PROPOSED 100-YEAR FLOW RATE						Discharge Point
Name	Area	Tc	Intensity	C	Q100 yr	
	ac	min	in/hr		cfs	
A1	0.08	5.00	4.09	0.87	0.28	Existing Northwest Curb inlet (DP A)
A2	0.49	5.00	4.09	0.87	1.74	
A3	0.34	5.00	4.09	0.87	1.21	
A4	0.03	5.00	4.09	0.87	0.11	
A5	0.31	5.00	4.09	0.87	1.10	
A6	1.05	6.00	3.76	0.87	3.42	
A7	0.43	6.00	3.76	0.87	1.40	
A8	0.08	5.00	4.09	0.87	0.28	
A9	0.42	5.00	4.09	0.87	1.49	
A10	0.8	6.00	3.76	0.90	2.71	
A11	0.81	7.00	3.49	0.90	2.55	
A12	0.12	5.00	4.09	0.90	0.44	
A13	0.42	7.00	3.49	0.90	1.32	
A14	0.45	5.00	4.09	0.90	1.66	
A15	0.4	7.00	3.49	0.90	1.26	
A16	0.93	5.00	4.09	0.90	3.44	
PR-B	0.07	5.00	4.09	0.90	0.26	Offsite towards train tracks (DP G)
PR-C2	4.71	9.00	3.10	0.86	12.58	Gate inlet on adjacent parcel. (DP C)
PR-G	0.21	5.00	4.09	0.87	0.75	Offsite to Gale Ave. (DP G)



LEGEND	
EXISTING FEATURES	
EXISTING MAJOR CONTOUR	— 340 —
EXISTING MINOR CONTOUR	- - - 340 - - -
PROPOSED MAJOR CONTOUR	— 340 —
PROPOSED MINOR CONTOUR	- - - 340 - - -
PROJECT BOUNDARY	— 340 —
SURFACE WATER FLOW	—>—>—>
DRAINAGE AREA ID AND ACREAGE	○ A-A w AC
FLOW PATH	—>—>—> Tc

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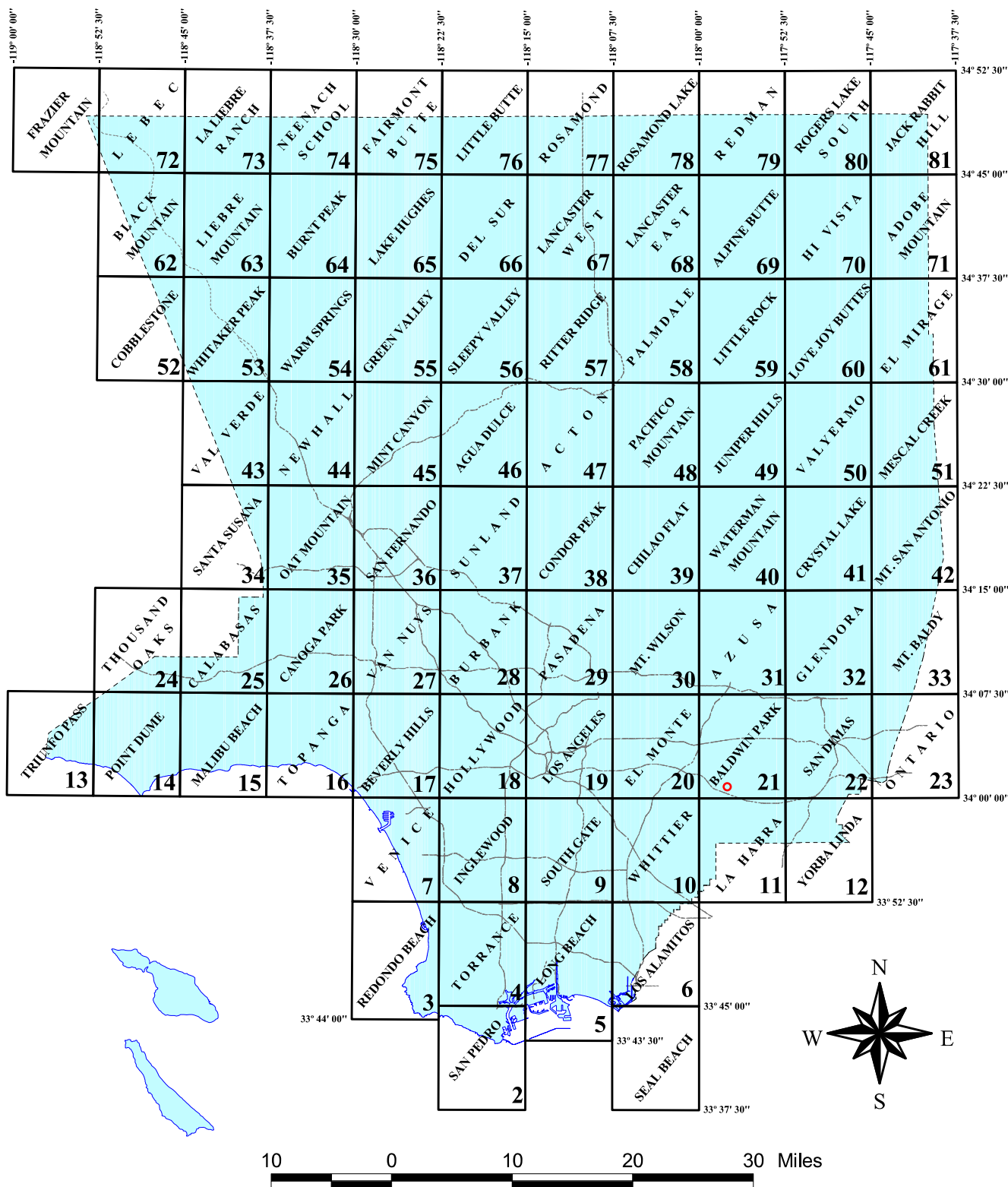
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NO.	BY	DATE	REVISION	APP'D.
PROJECT: MARICI PROJECT, LLC 16207, 16233, AND 16285 GALE AVENUE CITY OF INDUSTRY, CA 91745-1719				
TITLE: PROPOSED INLET DRAINAGE AREA MAP				
DRAWN BY: DG		PROJ. NO: 604109		
CHECKED BY: SH		D-003		
APPROVED BY: SH		DATE: 2/6/2025		

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H:\WORK IN PROGRESS\SOLAR_SITES\MARICI\CAO\SITE PLANS\EXHIBITS FOR DRAINAGE REPORT\PR DRAINAGE MAP_INLET AREAS.DWG

Appendix D: Rainfall and Runoff Data

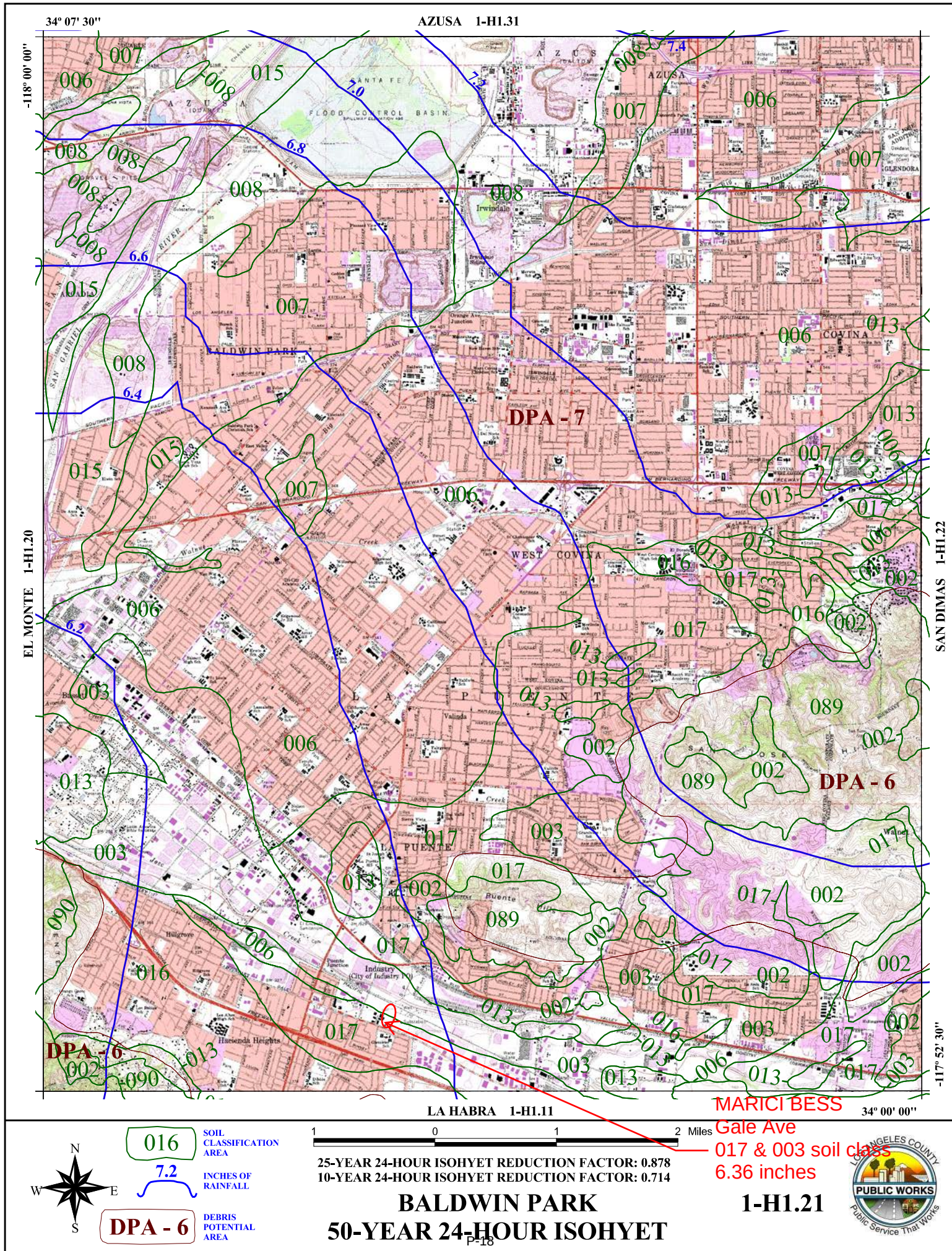


INDEX ISOHYETAL MAP

50-YEAR 24-HOUR ISOHYET

BASED ON USGS QUADRANGLE







NOAA Atlas 14, Volume 6, Version 2
Location name: Hacienda Heights, California,
USA*

Latitude: 34.0097°, Longitude: -117.9525°

Elevation: 343 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 & aerals](#)

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	0.143 (0.119-0.172)	0.182 (0.152-0.220)	0.234 (0.195-0.283)	0.277 (0.228-0.339)	0.336 (0.268-0.426)	0.383 (0.298-0.496)	0.431 (0.327-0.573)	0.481 (0.355-0.659)	0.550 (0.388-0.788)	0.605 (0.412-0.898)
10-min	0.204 (0.171-0.247)	0.260 (0.217-0.315)	0.335 (0.279-0.406)	0.397 (0.327-0.485)	0.482 (0.384-0.611)	0.549 (0.427-0.711)	0.617 (0.469-0.821)	0.689 (0.508-0.944)	0.789 (0.557-1.13)	0.867 (0.590-1.29)
15-min	0.247 (0.207-0.299)	0.315 (0.263-0.381)	0.405 (0.337-0.491)	0.480 (0.396-0.587)	0.583 (0.464-0.739)	0.663 (0.517-0.860)	0.747 (0.567-0.993)	0.834 (0.615-1.14)	0.954 (0.673-1.36)	1.05 (0.714-1.56)
30-min	0.338 (0.283-0.409)	0.431 (0.360-0.521)	0.554 (0.461-0.672)	0.656 (0.542-0.803)	0.797 (0.635-1.01)	0.908 (0.707-1.18)	1.02 (0.776-1.36)	1.14 (0.841-1.56)	1.30 (0.921-1.87)	1.44 (0.977-2.13)
60-min	0.481 (0.402-0.581)	0.613 (0.512-0.741)	0.788 (0.656-0.956)	0.933 (0.771-1.14)	1.13 (0.904-1.44)	1.29 (1.01-1.67)	1.45 (1.10-1.93)	1.62 (1.20-2.22)	1.86 (1.31-2.66)	2.04 (1.39-3.03)
2-hr	0.699 (0.584-0.844)	0.888 (0.742-1.07)	1.14 (0.949-1.38)	1.35 (1.11-1.65)	1.63 (1.30-2.07)	1.85 (1.44-2.40)	2.08 (1.58-2.76)	2.31 (1.70-3.17)	2.64 (1.86-3.77)	2.89 (1.97-4.29)
3-hr	0.874 (0.731-1.06)	1.11 (0.928-1.34)	1.42 (1.18-1.73)	1.68 (1.39-2.05)	2.03 (1.62-2.57)	2.30 (1.79-2.98)	2.58 (1.96-3.43)	2.87 (2.11-3.93)	3.26 (2.30-4.67)	3.57 (2.43-5.30)
6-hr	1.24 (1.04-1.50)	1.58 (1.32-1.91)	2.02 (1.68-2.45)	2.38 (1.97-2.91)	2.87 (2.29-3.64)	3.25 (2.54-4.22)	3.64 (2.76-4.84)	4.04 (2.98-5.54)	4.58 (3.24-6.56)	5.01 (3.41-7.44)
12-hr	1.64 (1.37-1.98)	2.10 (1.75-2.54)	2.70 (2.25-3.27)	3.19 (2.63-3.90)	3.85 (3.07-4.88)	4.36 (3.40-5.66)	4.88 (3.71-6.49)	5.41 (3.99-7.42)	6.14 (4.33-8.78)	6.70 (4.56-9.94)
24-hr	2.22 (1.97-2.56)	2.88 (2.55-3.33)	3.74 (3.30-4.33)	4.44 (3.88-5.18)	5.39 (4.56-6.50)	6.12 (5.07-7.53)	6.86 (5.55-8.65)	7.62 (6.00-9.88)	8.66 (6.55-11.7)	9.46 (6.92-13.2)
2-day	2.71 (2.40-3.13)	3.57 (3.15-4.12)	4.69 (4.14-5.43)	5.62 (4.91-6.55)	6.88 (5.82-8.29)	7.85 (6.51-9.66)	8.85 (7.16-11.2)	9.88 (7.78-12.8)	11.3 (8.53-15.2)	12.4 (9.05-17.3)
3-day	3.02 (2.67-3.48)	4.03 (3.56-4.65)	5.36 (4.73-6.21)	6.46 (5.65-7.54)	7.97 (6.74-9.61)	9.14 (7.58-11.2)	10.3 (8.37-13.0)	11.6 (9.12-15.0)	13.3 (10.0-17.9)	14.6 (10.7-20.4)
4-day	3.25 (2.88-3.75)	4.37 (3.86-5.05)	5.87 (5.17-6.79)	7.10 (6.20-8.28)	8.79 (7.44-10.6)	10.1 (8.38-12.4)	11.5 (9.29-14.5)	12.9 (10.2-16.7)	14.8 (11.2-20.0)	16.4 (12.0-22.8)
7-day	3.71 (3.28-4.28)	5.01 (4.42-5.78)	6.75 (5.95-7.82)	8.21 (7.18-9.58)	10.3 (8.68-12.4)	11.9 (9.84-14.6)	13.6 (11.0-17.1)	15.3 (12.1-19.9)	17.8 (13.5-24.0)	19.8 (14.5-27.6)
10-day	4.00 (3.54-4.62)	5.41 (4.78-6.25)	7.33 (6.46-8.48)	8.94 (7.82-10.4)	11.2 (9.50-13.5)	13.0 (10.8-16.1)	15.0 (12.1-18.9)	17.0 (13.4-22.0)	19.9 (15.0-26.8)	22.2 (16.2-30.9)
20-day	4.69 (4.15-5.41)	6.37 (5.63-7.36)	8.70 (7.66-10.1)	10.7 (9.34-12.5)	13.5 (11.4-16.3)	15.8 (13.1-19.5)	18.3 (14.8-23.0)	20.9 (16.5-27.1)	24.7 (18.7-33.3)	27.8 (20.3-38.7)
30-day	5.52 (4.88-6.36)	7.51 (6.63-8.67)	10.3 (9.05-11.9)	12.6 (11.0-14.7)	16.0 (13.6-19.4)	18.8 (15.6-23.2)	21.8 (17.6-27.5)	25.0 (19.7-32.4)	29.6 (22.4-40.0)	33.4 (24.4-46.6)
45-day	6.49 (5.74-7.49)	8.82 (7.79-10.2)	12.0 (10.6-13.9)	14.8 (13.0-17.3)	18.8 (15.9-22.7)	22.1 (18.3-27.2)	25.6 (20.7-32.2)	29.4 (23.1-38.0)	34.8 (26.3-47.0)	39.3 (28.7-54.8)
60-day	7.48 (6.62-8.62)	10.1 (8.93-11.7)	13.8 (12.1-15.9)	16.9 (14.8-19.7)	21.4 (18.1-25.8)	25.1 (20.8-30.8)	29.0 (23.4-36.5)	33.2 (26.1-43.0)	39.2 (29.7-52.9)	44.2 (32.3-61.7)

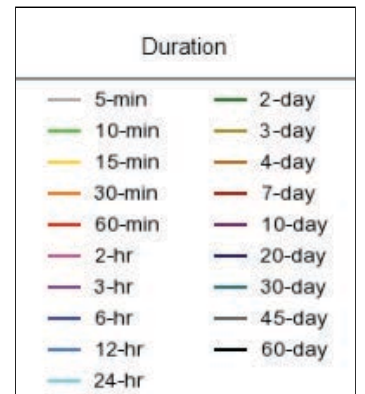
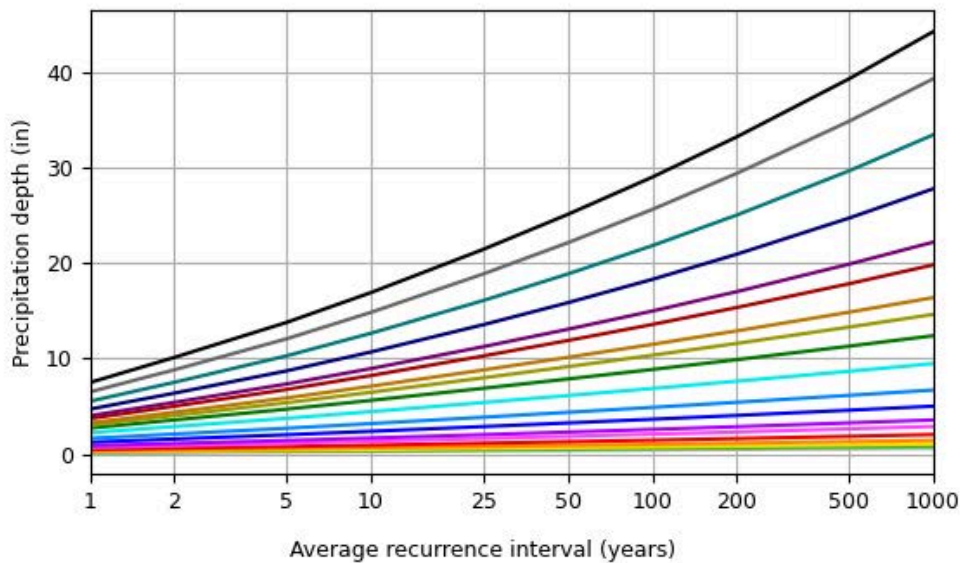
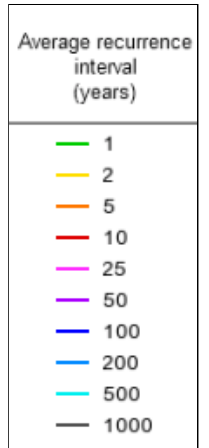
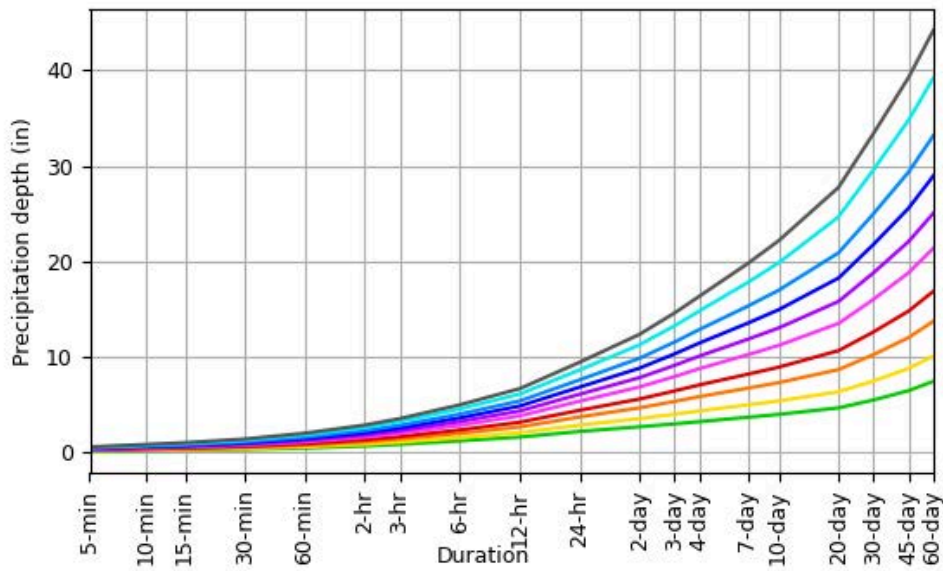
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

PDS-based depth-duration-frequency (DDF) curves

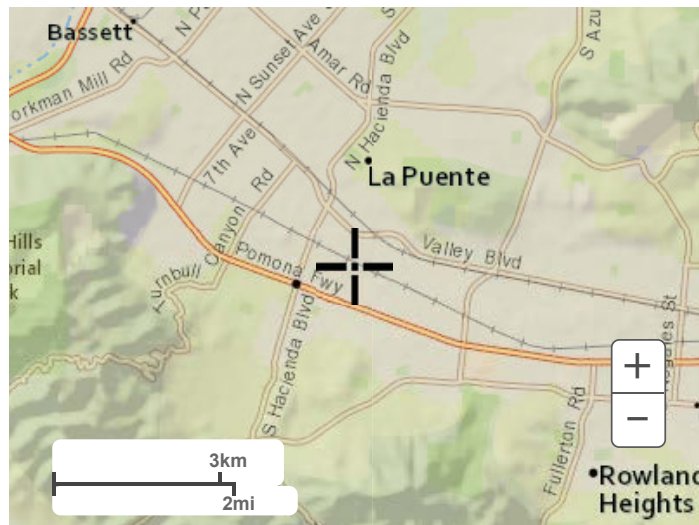
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Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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Appendix E: Time of Concentration and Runoff Coefficients

TIME OF CONCENTRATION (EXISTING CONDITIONS) 50-YEAR																			
Name	Area ac	Overall Flow Length ft	Overland Length ft	Overland Slope %	Gutter Length ft	Gutter Slope %	Percent Impervious (IMP)	Estimated Tc min	Intensity in/hr	Soil Group	Undev Coeff Cu	Dev Coeff Cd	Ix = Cd*I	Overland Flow Time (to) min	Qavg in gutter cfs	Cross sectional area of gutter (a) sf	Velocity for avg gutter flow v=Qavg/a ft/s	Gutter Flow Time tc min	Time of concentration Tc = to+tc min
X-A	7.53	1147	0	0.00%	1147	1.13%	91.00%	5	3.79	017	0.92	0.90	3.42	0.00	12.88	0.26	49.55	0.39	0.39
X-B	0.07	124	124	3.81%	0	0.00%	91.00%	5	3.79	017	0.92	0.90	3.42	2.13	0.12	0.26	0.46	0.00	2.13
X-C1	0.30	129	129	1.61%	0	0.00%	91.00%	5	3.79	003	0.53	0.87	3.29	0.00	0.49	0.26	1.90	0.00	0.00
X-C2	4.05	522	91	2.10%	431	0.96%	91.00%	5	3.79	003	0.53	0.87	3.29	1.00	6.66	0.5	13.32	0.54	1.54
X-G	0.21	94	94	1.15%	0	0.00%	91.00%	5	3.79	003	0.53	0.87	3.29	2.63	0.35	0.26	1.33	0.00	2.63

TIME OF CONCENTRATION (PROPOSED CONDITIONS) 50-YEAR																			
Name	Area ac	Overall Flow Length ft	Overland Length ft	Overland Slope %	Gutter Length ft	Gutter Slope %	Percent Impervious (IMP)	Estimated Tc min	Intensity in/hr		Undev Coeff Cu	Dev Coeff Cd	Ix = Cd*I	Overland Flow Time (to) min	Qavg in gutter cfs	Cross sectional area of gutter (a) sf	Velocity for avg gutter flow v=Qavg/a ft/s	Gutter Flow Time tc min	Time of concentration Tc = to+tc min
PR-A	7.16	1090	351	1.32%	739	1.13%	91.00%	6.9	3.26	017	0.90	0.90	2.94	5.81	10.51	0.5	21.02	0.59	6.40
PR-B	0.07	128	128	3.59%	0	0.00%	91.00%	5	3.79	017	0.92	0.90	3.42	2.21	0.12	0.5	0.24	0.00	2.21
PR-C2	4.71	630	630	1.27%	0	0.00%	91.00%	9	2.88	003	0.46	0.86	2.48	8.94	5.83	0.5	11.67	0.00	8.94
PR-G	0.21	28	28	1.82%	0	0	91.00%	5	3.79	003	0.53	0.87	3.29	1.11	0.35	0.5	0.69	0.00	1.11

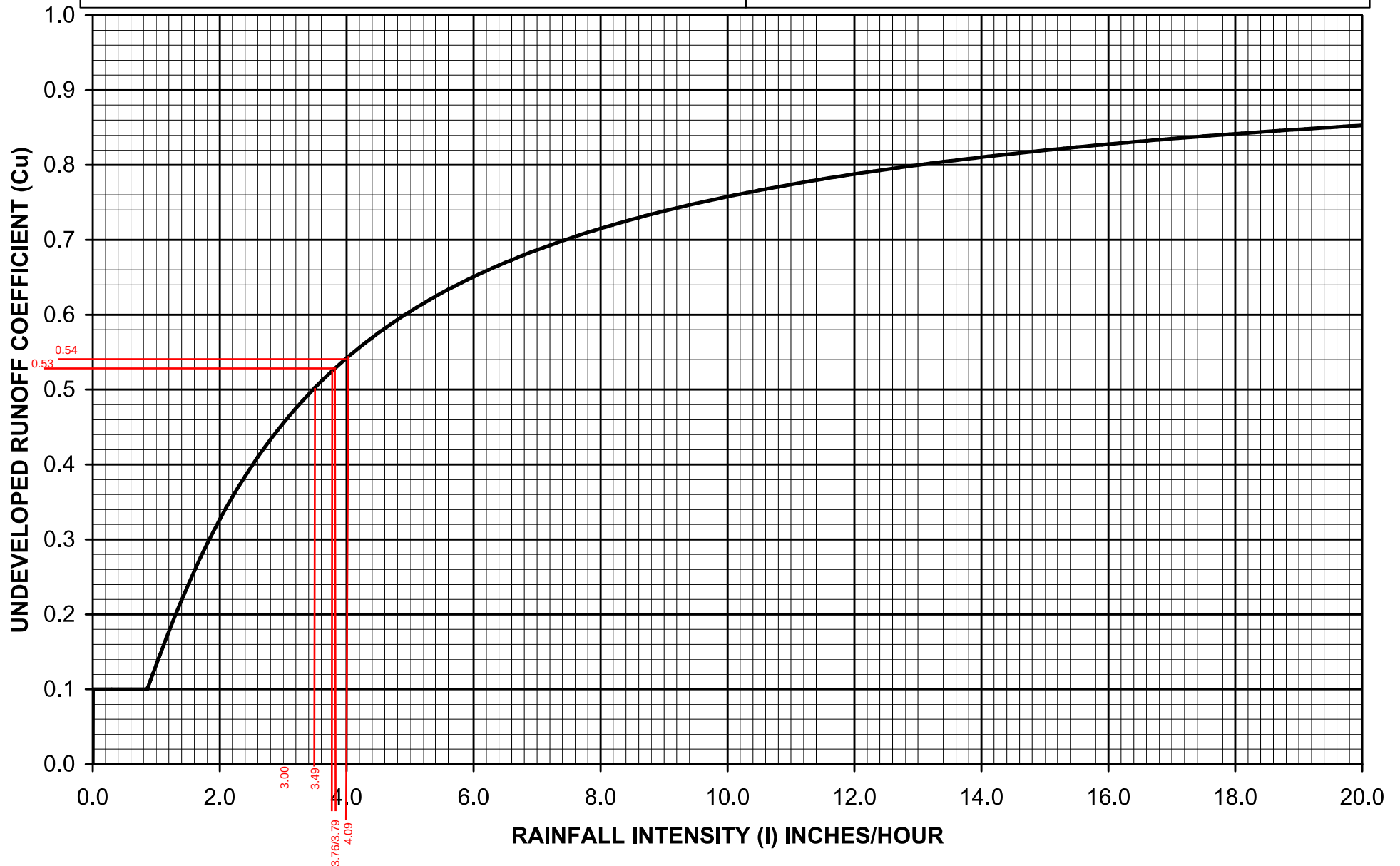
TIME OF CONCENTRATION (PROPOSED CONDITIONS) 100-YEAR																		
Name	Area ac	Overland Length ft	Overland Slope %	Gutter Length ft	Gutter Slope %	Percent Impervious (IMP)	Estimated Tc min	Intensity in/hr	Soils Type	Undev Coeff Cu	Dev Coeff Cd	Ix = Cd*I	Overland Flow Time (to) min	Qavg in gutter cfs	Cross sectional area of gutter (a) sf	Velocity for avg gutter flow v=Qavg/a ft/s	Gutter Flow Time tc min	Time of concentration Tc = to+tc min
A1	0.08	0	0.00%	255	1.05%	91.00%	5	4.09	003	0.54	0.87	3.55	0.00	0.14	0.5	0.28	14.96	14.96
A2	0.49	235	1.76%	73	3.99%	91.00%	5	4.09	003	0.54	0.87	3.55	3.89	0.87	0.5	1.74	0.70	4.59
A3	0.34	293	1.43%	25	0.64%	91.00%	5	4.09	003	0.54	0.87	3.55	4.72	0.60	0.5	1.21	0.35	5.07
A4	0.03	0	0.00%	61	0.75%	91.00%	5	4.09	003	0.54	0.87	3.55	0.00	0.05	0.5	0.11	9.54	9.54
A5	0.31	373	1.56%	0	0.00%	91.00%	5	4.09	003	0.54	0.87	3.55	5.32	0.00	0.5	0.00	0.00	5.32
A6	1.05	342	1.37%	105	0.46%	91.00%	6	3.76	003	0.53	0.87	3.26	5.44	1.71	0.5	3.42	0.51	5.95
A7	0.43	327	1.33%	27	0.63%	91.00%	6	3.76	003	0.53	0.87	3.26	5.33	0.70	0.5	1.40	0.32	5.65
A8	0.08	0	0.00%	269	0.72%	91.00%	5	4.09	003	0.54	0.87	3.55	0.00	0.14	0.5	0.28	15.78	15.78
A9	0.42	271	1.52%	0	0.00%	91.00%	5	4.09	003	0.54	0.87	3.55	4.42	0.00	0.5	0.00	0.00	4.42
A10	0.80	331	1.53%	103	1.85%	91.00%	6	3.76	017	0.92	0.90	3.39	5.07	1.36	0.5	2.71	0.63	5.70
A11	0.81	510	1.50%	0	0.00%	91.00%	7	3.49	017	0.91	0.90	3.15	6.82	0.00	0.5	0.00	0.00	6.82
A12	0.12	0	0.00%	371	1.06%	91.00%	5	4.09	017	0.93	0.90	3.69	0.00	0.22	0.5	0.44	13.95	13.95
A13	0.42	400	1.07%	21	1.29%	91.00%	7	3.49	017	0.91	0.90	3.15	6.51	0.66	0.5	1.32	0.26	6.78
A14	0.45	181	1.85%	65	0.97%	91.00%	5	4.09	017	0.93	0.90	3.69	3.22	0.83	0.5	1.66	0.65	3.87
A15	0.40	0	0.00%	545	0.94%	91.00%	7	3.49	017	0.91	0.90	3.15	0.00	0.63	0.5	1.26	7.21	7.21
A16	0.93	285	1.24%	0	0.00%	91.00%	5	4.09	017	0.93	0.90	3.69	4.78	0.00	0.5	0.00	0.00	4.78
PR-B	0.07	128	3.59%	0	0.00%	91.00%	5	4.09	017	0.93	0.90	3.69	2.15	0.00	0.5	0.00	0.00	2.15
PR-C2	4.71	630	1.27%	0	0.00%	91.00%	9	3.10	003	0.46	0.86	2.67	8.67	6.29	0.5	12.58	0.00	8.67
PR-G	0.21	28	1.82%	0	0	91.00%	5	4.09	003	0.54	0.87	3.55	1.07	0.00	0.5	0.00	0.00	1.07

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$
 Where: C_D = Developed Runoff Coefficient
 IMP = Proportion Impervious
 C_U = Undeveloped runoff coefficient



Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE SOIL TYPE NO. 003

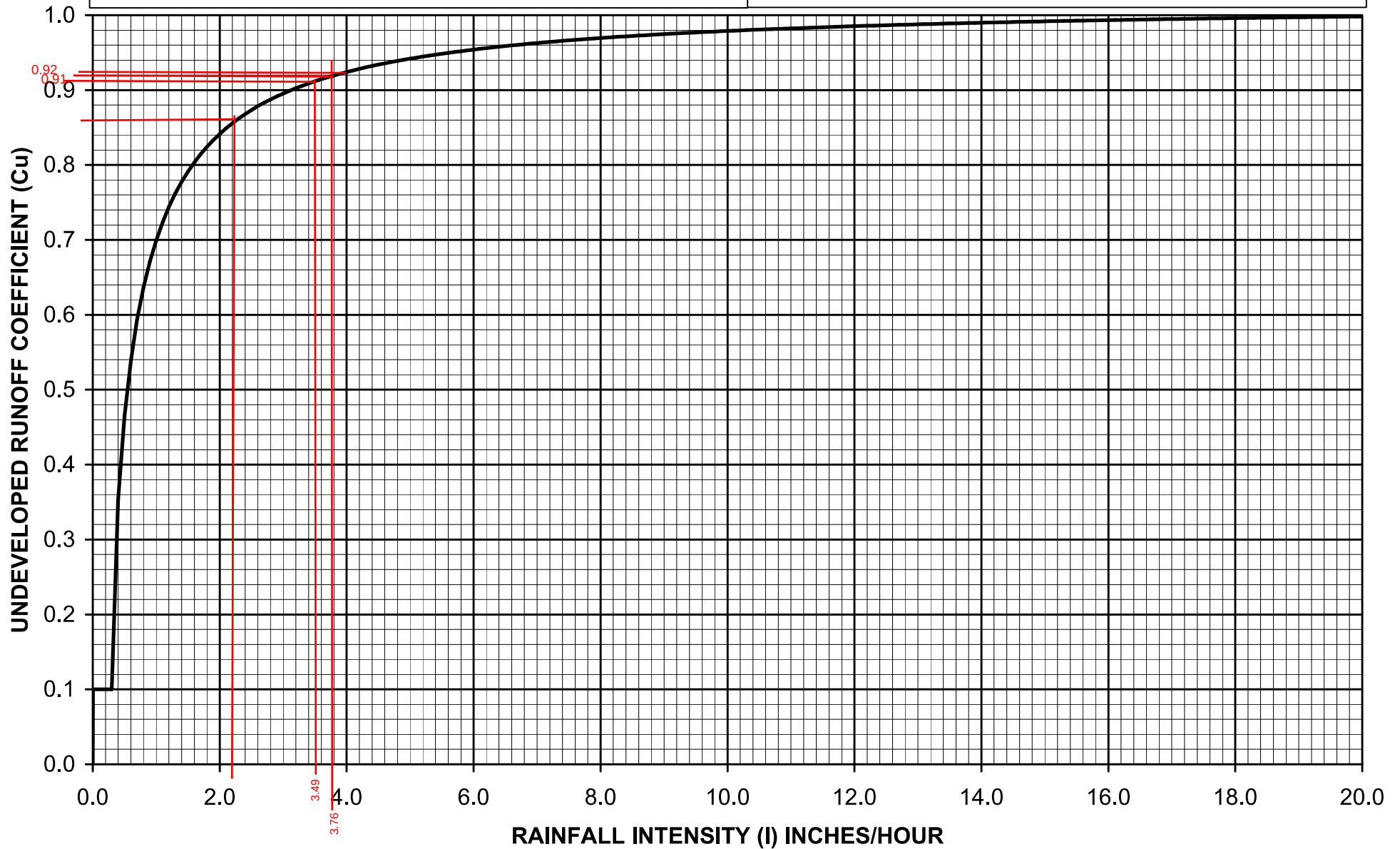


$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$
 Where: C_D = Developed Runoff Coefficient
 IMP = Proportion Impervious
 C_U = Undeveloped runoff coefficient



Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE SOIL TYPE NO. 017



Appendix F: Inlet Sizing

INLET SIZING (100-YR)													
Name	Area	Tc	Intensity	C	Q 100yr	Inlet	Q100yr	Inlet Type	Inlet Length or Size	Spread (T)	Depth	Inlet Capacity	Bypass Flow
	ac	min	in/hr		cfs	Carry Over	Total		ft	ft	in	cfs	
						cfs	cfs						
A1	0.08	5.00	4.09	0.87	0.28	0.00	0.28	Curb on Grade	6	1.70	1.7	1.39	0.00
A2	0.49	5.00	4.09	0.87	1.74	0.00	1.74	Curb on Grade	8	6.70	3.1	2.20	0.00
A3	0.34	5.00	4.09	0.87	1.21	0.00	1.21	Curb on Grade	6	6.30	3.0	1.69	0.00
A4	0.03	5.00	4.09	0.87	0.11	0.00	0.11	Curb on Grade	6	1.30	1.3	1.69	0.00
A5	0.31	5.00	4.09	0.87	1.10	0.77	1.87	Grate inlet in sag	3'x3'	3.60	0.3	1.87	0.00
A6	1.05	6.00	3.76	0.87	3.42	0.00	3.42	Curb on Grade	8	10.70	4.1	2.65	0.77
A7	0.43	6.00	3.76	0.87	1.40	0.00	1.40	Curb on Grade	6	6.90	3.2	1.69	0.00
A8	0.08	5.00	4.09	0.87	0.28	0.00	0.28	Curb on Grade	6	2.00	2.0	1.69	0.00
A9	0.42	5.00	4.09	0.87	1.49	0.00	1.49	Curb on Grade	8	5.50	2.8	1.90	0.00
A10	0.8	6.00	3.76	0.90	2.71	0.00	2.71	Curb on Grade	10	7.60	3.3	2.80	0.00
A11	0.81	7.00	3.49	0.90	2.55	0.27	2.82	Grate inlet in sag	4'x4'	7.00	0.5	2.82	0.00
A12	0.12	5.00	4.09	0.90	0.44	0.00	0.44	Curb on Grade	6	2.00	2.0	1.39	0.00
A13	0.42	7.00	3.49	0.90	1.32	0.00	1.32	Curb on Grade	6	5.70	2.9	1.39	0.00
A14	0.45	5.00	4.09	0.90	1.66	0.00	1.66	Curb on Grade	6	6.50	3.1	1.39	0.27
A15	0.4	7.00	3.49	0.90	1.26	0.00	1.26	Curb on Grade	6	5.50	2.8	1.39	0.00

Curb Inlet On Grade - 6ft on 1.1%_Capacity

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	1.39 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	6.0 ft
Intercepted Flow	1.39 cfs
Bypass Flow	0.00 cfs
Spread	5.8 ft
Depth	2.9 in
Flow Area	0.5 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.98 ft/s
Equivalent Cross Slope	0.211 ft/ft
Length Factor	1.000
Total Interception Length	6.0 ft

Curb Inlet On Grade - 8ft on 0.6%_Capacity

Project Description	
Solve For	Efficiency
Input Data	
Discharge	3.42 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	8.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	96.84 %
Intercepted Flow	3.31 cfs
Bypass Flow	0.11 cfs
Spread	10.7 ft
Depth	4.1 in
Flow Area	1.3 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.71 ft/s
Equivalent Cross Slope	0.145 ft/ft
Length Factor	0.853
Total Interception Length	9.3 ft

Curb Inlet On Grade - 8ft on 1.1%_Capacity

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	2.20 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	8.0 ft
Intercepted Flow	2.20 cfs
Bypass Flow	0.00 cfs
Spread	7.6 ft
Depth	3.3 in
Flow Area	0.7 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.16 ft/s
Equivalent Cross Slope	0.184 ft/ft
Length Factor	1.000
Total Interception Length	8.0 ft

Curb Inlet On Grade - 10ft @ 1.6% Capacity

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	2.80 cfs
Slope	0.016 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	10.0 ft
Intercepted Flow	2.80 cfs
Bypass Flow	0.00 cfs
Spread	7.7 ft
Depth	3.4 in
Flow Area	0.7 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.92 ft/s
Equivalent Cross Slope	0.183 ft/ft
Length Factor	1.000
Total Interception Length	10.0 ft

Curb Inlet On Grade - 10ft on 1.6%_Capacity

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	2.80 cfs
Slope	0.016 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	10.0 ft
Intercepted Flow	2.80 cfs
Bypass Flow	0.00 cfs
Spread	7.7 ft
Depth	3.4 in
Flow Area	0.7 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.92 ft/s
Equivalent Cross Slope	0.183 ft/ft
Length Factor	1.000
Total Interception Length	10.0 ft

Curb Inlet On Grade - A1

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.28 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	6.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	0.28 cfs
Bypass Flow	0.00 cfs
Spread	1.7 ft
Depth	1.7 in
Flow Area	0.1 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.41 ft/s
Equivalent Cross Slope	0.250 ft/ft
Length Factor	2.134
Total Interception Length	2.8 ft

Curb Inlet On Grade - A2

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.74 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	8.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	1.74 cfs
Bypass Flow	0.00 cfs
Spread	6.7 ft
Depth	3.1 in
Flow Area	0.6 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.06 ft/s
Equivalent Cross Slope	0.198 ft/ft
Length Factor	1.159
Total Interception Length	6.9 ft

Curb Inlet On Grade - A3

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.21 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	6.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	1.21 cfs
Bypass Flow	0.00 cfs
Spread	6.3 ft
Depth	3.0 in
Flow Area	0.5 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.29 ft/s
Equivalent Cross Slope	0.203 ft/ft
Length Factor	1.222
Total Interception Length	4.9 ft

Curb Inlet On Grade - A4

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.10 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	6.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	0.10 cfs
Bypass Flow	0.00 cfs
Spread	1.3 ft
Depth	1.3 in
Flow Area	0.1 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	1.48 ft/s
Equivalent Cross Slope	0.250 ft/ft
Length Factor	3.944
Total Interception Length	1.5 ft

Grate Inlet In Sag - A5

Project Description		
Solve For		Spread
Input Data		
Discharge		1.87 cfs
Gutter Width		0.00 ft
Gutter Cross Slope		0.006 ft/ft
Road Cross Slope		0.006 ft/ft
Grate Width		3.00 ft
Grate Length		3.0 ft
Local Depression		5.0 in
Local Depression Width		5.0 in
Grate Type	P-50 mm (P-1 -7/8")	
Clogging		0.0 %
Results		
Spread		3.6 ft
Depth		0.3 in
Gutter Depression		0.0 in
Total Depression		5.0 in
Open Grate Area		8.1 ft²
Active Grate Weir Length		9.0 ft

Curb Inlet On Grade - A6

Project Description	
Solve For	Efficiency
Input Data	
Discharge	3.42 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	8.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	96.84 %
Intercepted Flow	3.31 cfs
Bypass Flow	0.11 cfs
Spread	10.7 ft
Depth	4.1 in
Flow Area	1.3 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.71 ft/s
Equivalent Cross Slope	0.145 ft/ft
Length Factor	0.853
Total Interception Length	9.3 ft

Curb Inlet On Grade - A7

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.40 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	6.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	1.40 cfs
Bypass Flow	0.00 cfs
Spread	6.9 ft
Depth	3.2 in
Flow Area	0.6 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.33 ft/s
Equivalent Cross Slope	0.194 ft/ft
Length Factor	1.114
Total Interception Length	5.4 ft

Curb Inlet On Grade - A8

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.32 cfs
Slope	0.006 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	6.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	0.32 cfs
Bypass Flow	0.00 cfs
Spread	2.0 ft
Depth	2.0 in
Flow Area	0.2 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	1.98 ft/s
Equivalent Cross Slope	0.250 ft/ft
Length Factor	2.405
Total Interception Length	2.5 ft

Curb Inlet On Grade - A9

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.56 cfs
Slope	0.016 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	8.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	1.56 cfs
Bypass Flow	0.00 cfs
Spread	5.5 ft
Depth	2.8 in
Flow Area	0.4 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.64 ft/s
Equivalent Cross Slope	0.216 ft/ft
Length Factor	1.128
Total Interception Length	7.1 ft

Curb Inlet On Grade - A10

Project Description	
Solve For	Efficiency
Input Data	
Discharge	2.78 cfs
Slope	0.016 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	2.78 cfs
Bypass Flow	0.00 cfs
Spread	7.6 ft
Depth	3.3 in
Flow Area	0.7 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.92 ft/s
Equivalent Cross Slope	0.183 ft/ft
Length Factor	1.000
Total Interception Length	10.0 ft

Grate Inlet In Sag - A11

Project Description	
Solve For	Spread
Input Data	
Discharge	2.82 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.006 ft/ft
Road Cross Slope	0.006 ft/ft
Grate Width	4.00 ft
Grate Length	4.0 ft
Local Depression	5.0 in
Local Depression Width	5.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Results	
Spread	7.0 ft
Depth	0.5 in
Gutter Depression	0.0 in
Total Depression	5.0 in
Open Grate Area	14.4 ft ²
Active Grate Weir Length	12.0 ft

Curb Inlet On Grade - A12

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	0.44 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	3.4 ft
Intercepted Flow	0.44 cfs
Bypass Flow	0.00 cfs
Spread	2.0 ft
Depth	2.0 in
Flow Area	0.2 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.65 ft/s
Equivalent Cross Slope	0.250 ft/ft
Length Factor	1.000
Total Interception Length	3.4 ft

Curb Inlet On Grade - A13

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	1.32 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	5.9 ft
Intercepted Flow	1.32 cfs
Bypass Flow	0.00 cfs
Spread	5.7 ft
Depth	2.9 in
Flow Area	0.4 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.96 ft/s
Equivalent Cross Slope	0.214 ft/ft
Length Factor	1.000
Total Interception Length	5.9 ft

Curb Inlet On Grade - A14

Project Description	
Solve For	Curb Opening Length
Input Data	
Discharge	1.66 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Efficiency	100.00 %
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Curb Opening Length	6.7 ft
Intercepted Flow	1.66 cfs
Bypass Flow	0.00 cfs
Spread	6.5 ft
Depth	3.1 in
Flow Area	0.5 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	3.04 ft/s
Equivalent Cross Slope	0.201 ft/ft
Length Factor	1.000
Total Interception Length	6.7 ft

Curb Inlet On Grade - A15

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.26 cfs
Slope	0.011 ft/ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	5.7 ft
Local Depression	4.0 in
Local Depression Width	6.0 in
Results	
Efficiency	100.00 %
Intercepted Flow	1.26 cfs
Bypass Flow	0.00 cfs
Spread	5.5 ft
Depth	2.8 in
Flow Area	0.4 ft ²
Gutter Depression	1.5 in
Total Depression	5.5 in
Velocity	2.95 ft/s
Equivalent Cross Slope	0.217 ft/ft
Length Factor	1.000
Total Interception Length	5.7 ft

Appendix G: Storm Drain Calculations

STORM DRAIN CALCULATIONS (100-YEAR)																														
RUNOFF COLLECTION POINT (Inlet or Manhole)		Drainage Structure	Distance Between Collection Points	INCREMENTAL DRAINAGE AREA				Incremental "CA"	Accum- ulated "CA"	TIME OF CONCENTRATION			Intensity "I"	Storm Water Runoff "Q100"	Inlet Carryover To Inlet	Inlet Carryover From Inlet	Slope of Pipe	Design Discharge (Capacity) "Qpipe"	Top of Pipe Downstream	Partial Flow	Number of Boxes or Pipes	Width of Box (ft.) or Pipe Diameter (inches)	Manning's Roughness Coefficient "n"	Slope of Hydraulic Gradient "Sf"	HGL		Incoming Velocity "V _{in} "	Outgoing Velocity "V _{out} "	Velocity Head at Upstream Station V _{in} ² /2g (ft)	Velocity Head at Downstream Station V _{out} ² /2g (ft)
										Inlet Time	Flow Time in Sewer	Total													Upstream	Downstream				
DOWNSTREAM STATION	UPSTREAM STATION			Area No.	Drainage Area "A" (Acres)	Total Areas (Acres)	Runoff Coeff. "C"			(minutes)	(minutes)	(minutes)	(in./hr.)	(c.f.s.)	(c.f.s.)	(c.f.s.)	(ft./ft.)	(c.f.s.)	(Elev)	(Full/Partial)					(ft)	(ft)	(f.p.s.)	(f.p.s.)		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22a	22b	23	24	25	26	27	28	29	30
STORM LINE A1																														
6+52.81	6+77.73	INLET	24.92	A2	0.49	0.49	0.90	0.44	0.44	5.00	0.72	5.72	4.09	1.80	0.00	0.00	0.71%	20.65	344.43	PARTIAL	1	24	0.012	0.00005	342.81	342.81	0.57	0.57	0.01	0.01
6+06.12	6+52.81	INLET	46.69	A3	0.34	0.34	0.90	0.31	0.75	5.72	0.85	6.57	3.84	2.87	0.00	0.00	0.71%	20.65	344.10	PARTIAL	1	24	0.012	0.00014	342.80	342.79	0.91	0.91	0.01	0.01
5+33.68	6+06.12	GRATE INLET	72.44	A5, STRM LINE A2, A3	2.36	2.36	0.90	2.12	2.87	6.57	0.37	6.94	3.60	10.33	0.00	0.00	0.71%	20.65	343.58	PARTIAL	1	24	0.012	0.00178	342.64	342.51	3.29	3.29	0.17	0.17
3+30.00	5+33.68	INLET	203.68	A8	0.08	0.08	0.90	0.07	2.94	6.94	1.03	7.98	3.51	10.32	0.00	0.00	0.71%	20.65	342.13	FULL	1	24	0.012	0.00177	342.51	342.15	3.29	3.29	0.17	0.17
1+89.21	3+30.00	INLET	140.79	A9	0.42	0.50	0.90	0.38	3.32	7.98	0.68	8.65	3.29	10.91	0.00	0.00	0.71%	20.65	341.14	FULL	1	24	0.012	0.00198	342.13	341.85	3.29	3.47	0.17	0.19
1+58.31	1+89.21	INLET	30.90	A10	0.80	1.30	0.90	0.72	4.04	8.65	0.13	8.78	3.16	12.78	0.00	0.00	0.60%	18.98	340.95	FULL	1	24	0.012	0.00272	341.78	341.70	3.47	4.07	0.19	0.26
0+00.00	1+58.31	GRATE INLET	158.31	A11, STM LINE A4, A16	3.13	4.43	0.90	2.82	6.86	8.78	0.38	9.16	3.14	21.55	0.00	0.00	0.60%	18.98	340.00	FULL	1	24	0.012	0.00773	341.22	340.00	4.07	6.86	0.26	0.73
STORM LINE A2																														
0+32.53	0+60.97	INLET	28.44	A1	0.08	0.08	0.90	0.07	0.07	5.00	2.84	7.84	4.09	0.29	0.00	0.00	4.75%	24.80	345.44	PARTIAL	1	18	0.012	0.00001	344.11	344.11	0.17	0.17	0.00	0.00
0+00.00	0+32.53	INLET	32.53	A2	0.49	0.57	0.90	0.44	0.51	7.84	0.56	8.41	3.31	1.70	0.00	0.00	4.75%	24.80	344.09	FULL	1	18	0.012	0.00022	344.10	344.09	0.17	0.96	0.00	0.01
STORM LINE A3																														
0+37.69	1+98.41	INLET	160.72	A7	0.43	0.43	0.90	0.39	0.39	6.00	3.26	9.26	3.76	1.45	0.00	0.00	1.73%	14.97	346.87	PARTIAL	1	18	0.012	0.00016	344.24	344.21	0.82	0.82	0.01	0.01
0+00.00	0+37.69	INLET	37.69	A6	1.05	1.48	0.90	0.95	1.33	9.26	0.27	9.53	3.06	4.08	0.00	0.00	1.73%	14.97	344.09	FULL	1	18	0.012	0.00129	344.14	344.09	0.82	2.31	0.01	0.08
STORM LINE A4																														
2+23.67	3+58.41	INLET	134.74	A12	0.12	0.12	0.90	0.11	0.11	5.00	8.98	13.98	4.09	0.44	0.00	0.00	0.50%	8.05	342.51	PARTIAL	1	18	0.012	0.00002	341.36	341.35	0.25	0.25	0.00	0.00
2+11.07	2+23.67	INLET	12.60	A13	0.42	0.54	0.90	0.38	0.49	13.98	0.30	14.28	2.52	1.23	0.00	0.00	0.50%	8.05	341.83	PARTIAL	1	18	0.012	0.00012	341.35	341.35	0.69	0.69	0.01	0.01
0+44.82	2+11.07	INLET	166.25	A15	0.40	0.94	0.90	0.36	0.85	14.28	2.32	16.60	2.50	2.11	0.00	0.00	0.50%	8.05	341.77	PARTIAL	1	18	0.012	0.00035	341.33	341.27	1.20	1.20	0.02	0.02
0+00.00	0+44.82	INLET	44.82	A14	0.45	1.39	0.90	0.41	1.25	16.60	0.45	17.05	2.33	2.91	0.00	0.00	0.50%	8.05	340.94	FULL	1	18	0.012	0.00066	341.25	341.22	1.65	1.65	0.04	0.04

Appendix H: 85th Percentile, 24 hour Rainfall Isohyetal Map

SWQ (85th PERCENTILE) PEAK FLOW RATE						
Name	Area	Tc	Intensity	C	Q 50yr	Comments
	ac	min	in/hr.		cfs	
PR-A	7.16	21.00	0.33	0.83	1.98	Flow to be treated with stormwater device
PR-B	0.07	5.00	0.66	0.87	0.04	Flow to be treated with vegetation
PR-C2	4.71	22.00	0.33	0.83	1.28	Flow to be treated with vegetation
PR-G	0.21	5.00	0.66	0.83	0.11	Flow to be treated with vegetation

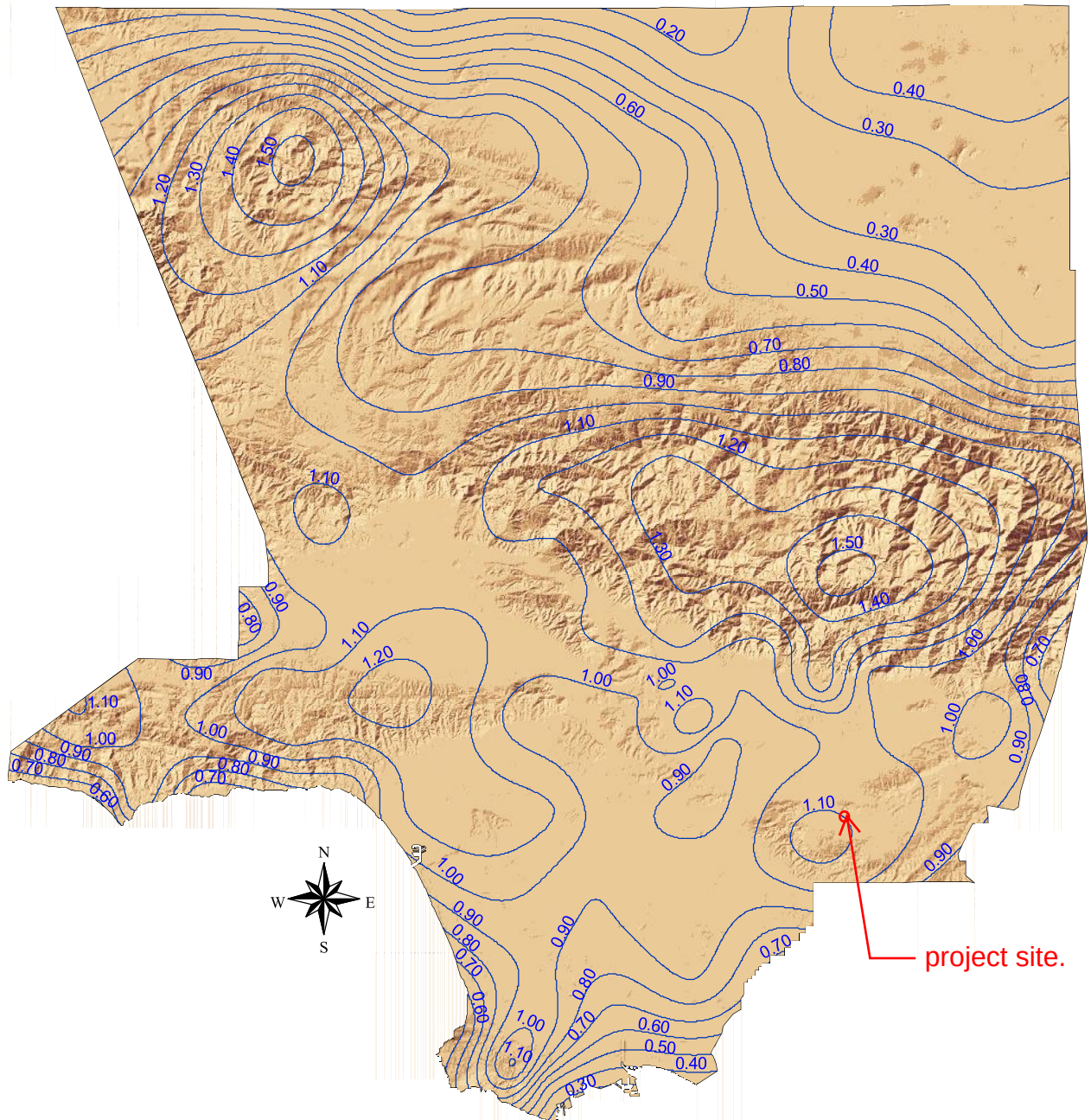
Ditch 1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.035
Channel Slope	0.006 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Discharge	3.44 cfs
Results	
Normal Depth	9.7 in
Flow Area	2.0 ft ²
Wetted Perimeter	5.1 ft
Hydraulic Radius	4.6 in
Top Width	4.87 ft
Critical Depth	7.3 in
Critical Slope	0.029 ft/ft
Velocity	1.74 ft/s
Velocity Head	0.05 ft
Specific Energy	0.86 ft
Froude Number	0.482
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	9.7 in
Critical Depth	7.3 in
Channel Slope	0.006 ft/ft
Critical Slope	0.029 ft/ft

Ditch 2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.035
Channel Slope	0.010 ft/ft
Left Side Slope	3.000 H:V
Right Side Slope	3.000 H:V
Discharge	1.26 cfs
Results	
Normal Depth	6.1 in
Flow Area	0.8 ft ²
Wetted Perimeter	3.2 ft
Hydraulic Radius	2.9 in
Top Width	3.04 ft
Critical Depth	4.9 in
Critical Slope	0.033 ft/ft
Velocity	1.64 ft/s
Velocity Head	0.04 ft
Specific Energy	0.55 ft
Froude Number	0.574
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	6.1 in
Critical Depth	4.9 in
Channel Slope	0.010 ft/ft
Critical Slope	0.033 ft/ft

85th Percentile 24-hr Rainfall Isohyetal Map



10 0 10 20 30 40 Miles

 85th Percentile 24-hr Rainfall Depth