KA Enterprises C-Store and Car Wash
Drainage Study
3060 Carmel Valley Rd.
San Diego, CA 92130

Date Prepared:
August 25, 2023

Prepared for:
KA Enterprises
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Prepared By:

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Declaration of Responsible Charge:
I hereby declare that I am the engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current standards. I understand that the check of the project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as an engineer of work, of my responsibilities for project design.

Patric T. de Boer RCE 83583
Registration Expires 3-31-2025

REGISTERED PROFESSIONAL ENGINEER
PATRIC T DEBOER
No.83583
CIVIL
STATE OF CALIFORNIA

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Appendices

Site & Project Description

This drainage study has been prepared for the development located at 3060 Carmel Valley Rd., San Diego, CA 92130. The project site is currently occupied by a convenience store, gas station canopy, and asphalt parking lot. The project will involve the demo of the existing convenience store and construction of a proposed convenience store and a car wash along with its corresponding improvements. The existing gas station canopy, pumps and tanks will remain. The total area of analysis is 0.88 acres.

A gravel filled, detention facility with StormTech arches and a Modular Wetland System will be constructed for HMP and treatment purposes. The HMP and treatment properties of the facility are detailed in a separate Stormwater Quality Report (SWQMP).

The site is located adjacent to the on-ramp to Interstate 5 North. See figure No. 1 for a Vicinity Map. See Figure 2 for the existing drainage limits. See Figure 3 for the proposed drainage limits.

Methodology

This drainage report has been prepared in accordance with the current City of San Diego regulations and procedures. The Modified Rational Method was used to compute the anticipated runoff.

The proposed storm drain pipes and channels were sized using Manning's Equation in *The Handbook of Hydraulics*, by Brater & King.

The 100-yr, 6-hr storm depth (P_6) was determined using the isopluvial map included as Appendix 2 of this report.

The initial time of concentration (Ti) and maximum overland flow length (Lm) were determined using Appendix 6.

The total time of concentration was determined by adding the Ti value to the travel time (Tt). Tt was determined via the Kirpich Formula as described on Appendix 7 on this report. Tt for surface flow on an asphalt swale was determined by modeling the approximate existing grades of the existing parking lot using Hydraflow Express to determine a velocity. Tt for proposed ribbon gutter was also determined modeling the proposed gutter using Hydraflow Express to determine a velocity. See Appendix 8 for Hydraflow Exhibits. Then the length of flow was divided by the flow velocity to determine Tt.

$$\mathbf{Tc = Ti + Tt}$$

The Tc and the P_6 values were entered into the peak intensity formula from Appendix 4 to determine the intensity of the rainfall during the peak of the 100-year, 6-hr storm.

$$\mathbf{I = 7.44 \times P_6 \times Tc^{-0.645}}$$

The peak discharge rate was determined using the Rational Method Formula.

Rational Method

Q=CIA

Where:

Q=peak discharge, in cubic feet per second (cfs)

C=runoff coefficient, proportion of the rainfall that runs off the surface (no units)
Table A-1, City of San Diego Drainage Design Manual (Appendix 5)

I =average rainfall intensity for a duration equal to the Tc for the area, (in/hr)
= 7.44*P6*Tc^-0.645

A = drainage area contributing to the design location, in acres

Cp= Pervious Coefficient Runoff Value, minimum of 0.35

$$Tc = \frac{1.8\,(1.1-C)*(L)^{0.5}*}{S^{0.33}}$$

S= Slope of drainage course

See the attached calculations for particulars. The following references have been used in preparation of this report:

(1) Handbook of Hydraulics, E.F. Brater & H.W. King, 6th Ed., 1976.
(2) City of San Diego Drainage Design Manual, 2017
(3) County of San Diego Hydrology Manual, 2003
(4) Modern Sewer Design, American Iron & Steel Institute, 1st Ed., 1980

Existing Conditions

The existing site is graded and terraced into two tiers being the northerly portion of the lot at the highest elevation and sloping towards Carmel Valley Rd., south of the site. The site is a triangular shaped 0.88-acre lot that consists of an asphalt parking lot on the northerly portion of the site and convenience store with a gas station canopy on the southerly portion of the lot. The site currently does not have an on-site storm drain system.

The northerly portion of the lot drains towards the southerly development via an asphalt swale. The runoff then drains via surface flow to Carmel Valley Road and ultimately to the existing catch basin on the northeasterly corner of the intersection in Carmel Valley Road and the on-ramp to Interstate 5 North. This point is referred to as Discharge Point # 1 in this report.

Proposed Conditions

The proposed development involves the construction of a convenience store and a car wash along with its corresponding improvements. The project proposes to modify the onsite drainage system with the addition of catch basins, gutters and brow ditches to help convey runoff to the discharge point. The project will increase the impervious footprint of the site by 8%.

The site was analyzed as a single drainage basin. The runoff generated by the majority of the site will drain to a series of catch basins and drain towards the southwesterly corner of the site where it conveys to a subsurface detention facility. The subsurface detention facility will consist of a 900-sf gravel filled, subsurface detention with a row of 8 Stormtech SC-740 storage arches. The detention system is assumed to be full during the peak of the 100-year storm. No attenuation of peak flows is assumed in this analysis. Following detention and treatment, the flow will drain to an area drain located on the southeasterly landscape area. Finally, a 12" pipe will hard-connect to the existing curb inlet on the public sidewalk. This point is referred to as Discharge Point # 1 in this report.

The southeasterly corner of the site drains to the landscape area located on the southeasterly corner of the site. The runoff then drains to an area drain where it confluences with the runoff discharged from the subsurface detention basin.

Existing Rational Analysis

The existing area of site was modeled as a single basin. The existing basin is referred to as E-1 in this report. The average slope of the basin is approximately 4.1%. The weighted runoff coefficient is 0.85.

Below is a summary of the input data and the resulting flowrate for the 100-year, 6-hour storm.

Existing Rational Calculation Summary

Basin	Impervious %	C	I_{100} (in/hr)	Tc (mins)	Area (ac)	Q_{100} (cfs)
E-1	68%	0.85	3.80	11.7	0.88	2.86

The existing peak runoff flowrate DP-1 is 2.86 cfs. See the attached calculations for details.

Proposed Rational Analysis

The proposed site is modeled as a single basin. The proposed basin is referred to as P-1 in this report. The average slope of the basin is approximately 3.9%. The weighted runoff coefficient is 0.85.

Below is a summary of the input data and the resulting flowrate for the 100-year, 6-hour storm.

Proposed Rational Calculation Summary

Basin	Impervious %	C	I_{100} (in/hr)	Tc (mins)	Area (ac)	Q_{100} (cfs)
P-1	76%	0.85	3.59	12.8	0.88	2.70

The proposed peak runoff flowrate DP-1 is 2.70 cfs. See the attached calculations for details.

Results and Conclusions

The proposed improvements result in a decrease of generated runoff during the peak of the 100-year, 6-hr storm. The result is a peak storm water flowrate that is less than the existing conditions by 0.16 cfs.

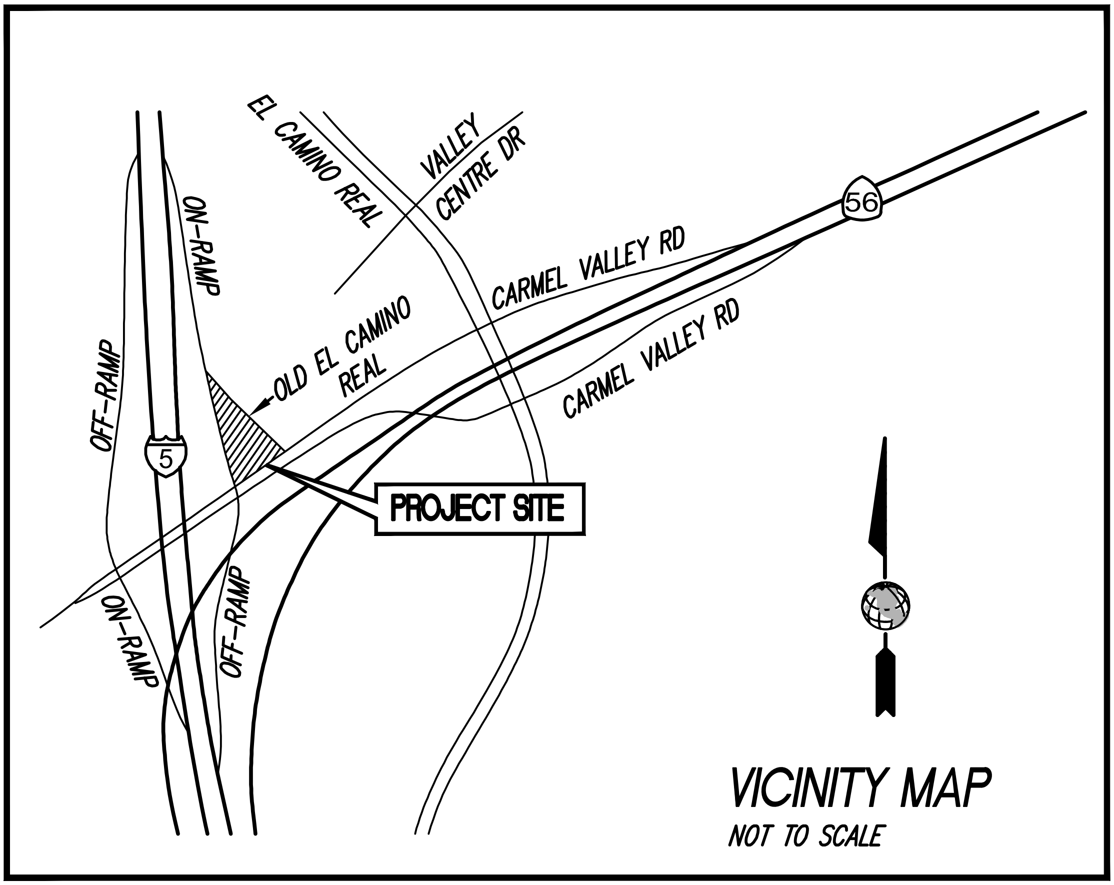
The project is not anticipated to exceed the capacity of the proposed onsite conveyances, as well as the existing offsite storm drain system conveyances.

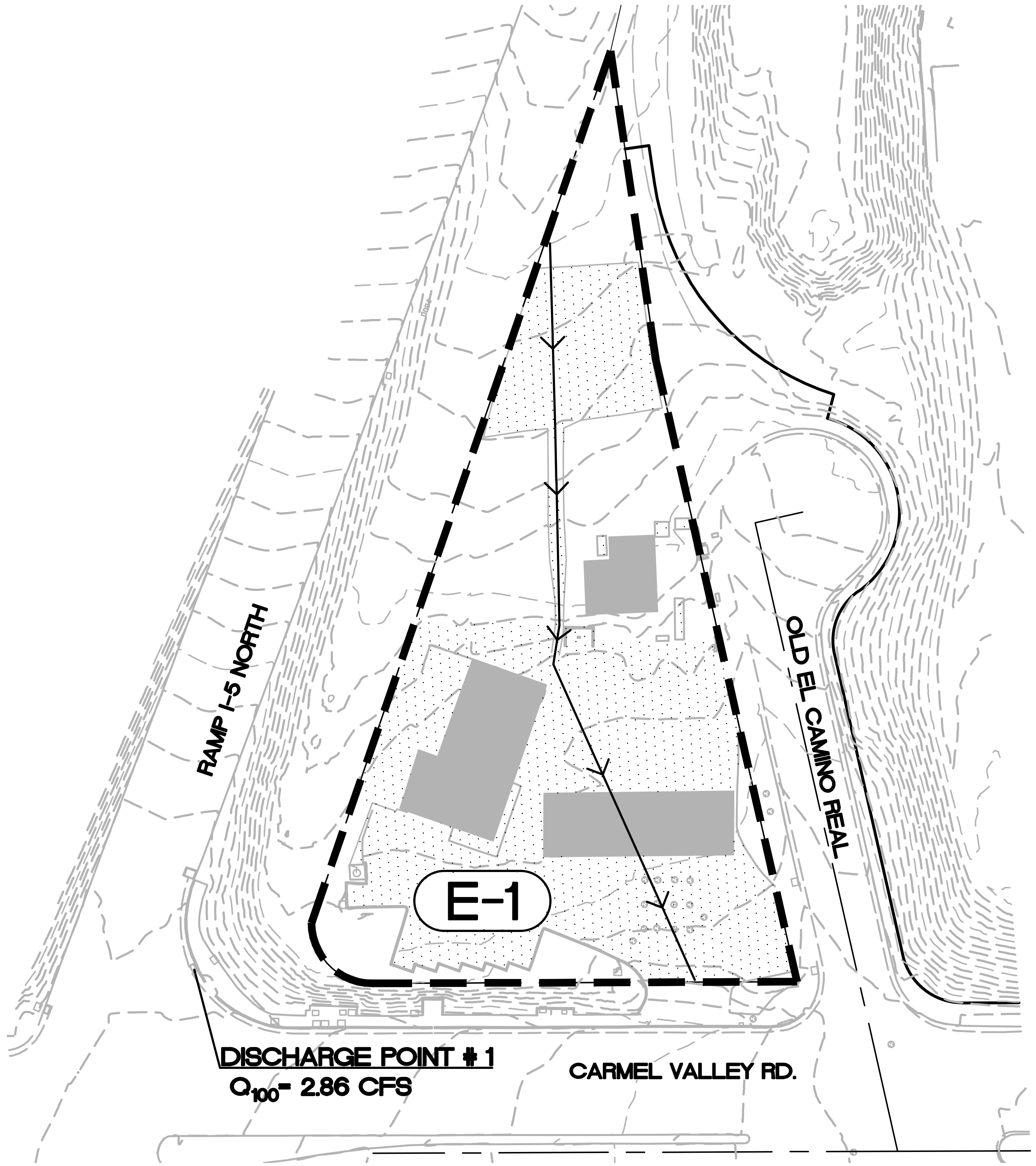
It is the opinion of Omega Engineering Consultants that the project will not place any structures in the 100-year flood hazard areas or flood plain and is not located in an area that is exposed to the risk of flooding as a result of a dam levee failure, thus the project will not expose people or structured to significant risk of loss, injury or death involving flooding as a result of a failure of a levee or dam.

The redevelopment of the site is not anticipated to create the risk of substantial erosion on or offsite due to the decrease in calculated peak flows and the implementation of hydromodification controls.

Project does not propose to discharge fill or dredged materials to the Waters of the State, therefore no CWA 401 or 404 permit is required. It is the opinion of Omega Engineering Consultants that the project will not create new adverse effects to the downstream facilities or receiving waters as a result of stormwater flowrates produced by the site.

It is the opinion of Omega Engineering Consultants that the project will not cause adverse effects to the downstream facilities or receiving waters. A separate Storm Water Quality Management Plan has been prepared to discuss the water quality impacts for the proposed development.


EL CAMINO REAL
VALLEY CENTRE DR
56
ON-RAMP
CARMEL VALLEY RD
OLD EL CAMINO REAL
CARMEL VALLEY RD
OFF-RAMP
5
PROJECT SITE
ON-RAMP
OFF-RAMP
VICINITY MAP
NOT TO SCALE



LEGEND

- BASIN NUMBER .... E-#
- AREA LIMITS
- DRAINAGE FLOW PATH
- BUILDING AREA
- PAVEMENT AREA
- PERVIOUS AREA

DRAINAGE BASIN DATA					
BASIN #	AREA (AC)	C-VALUE	T_c (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)
E-1	0.88	0.85	11.7	3.80	2.86
–	–	–	–	–	–

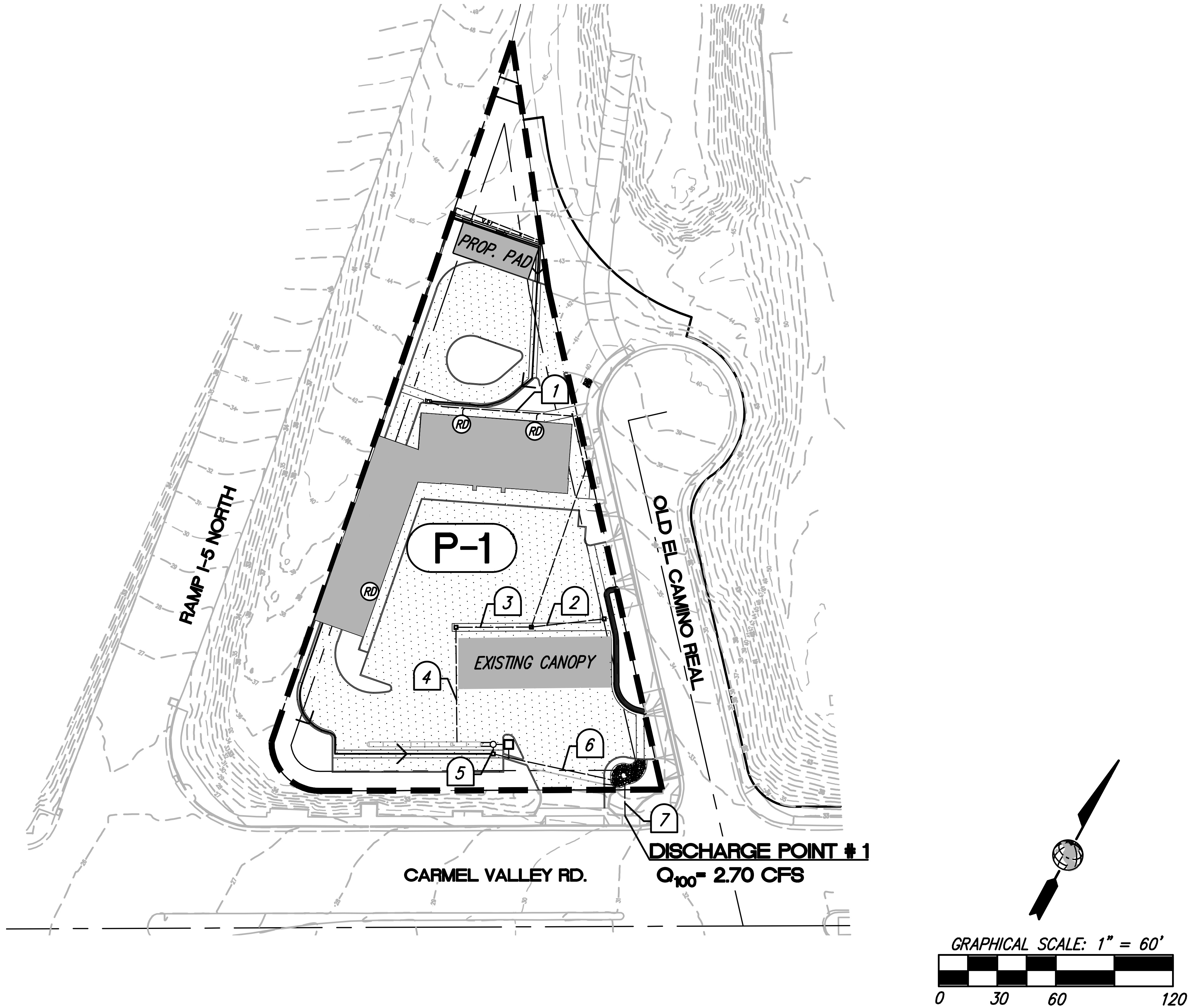
GRAPHICAL SCALE: 1" = 60'

0 30 60 120

KA ENTERPRISES C-STORE AND CAR WASH EXISTING HYDROLOGY EXHIBIT

OMEGA

EX. HYDROLOGY EXHIBIT



LEGEND

- BASIN NUMBER .... P-#
- AREA LIMITS
- DRAINAGE FLOW PATH
- BUILDING AREA
- PAVEMENT AREA
- PERVIOUS AREA

DRAINAGE BASIN DATA

BASIN #	AREA (AC)	C-VALUE	T_C (MINS)	I_{100} (IN/HR)	Q_{100} (CFS)
P-1	0.88	0.85	12.8	3.59	2.70

(X) PIPE DATA

PIPE #	DIAMETER (INCHES)	SLOPE (%)	DEPTH /DIA	V_{100} (FPS)	Q_{100} (CFS)
1	8	1.0	0.69	3.79	1.00
2	6	0.5	0.18	1.25	0.03
3	8	1.95	0.56	5.12	1.03
4	10	3.9	0.48	7.96	2.06
5	8	10.0	0.42	10.21	1.42
6	10	6.4	0.49	10.16	2.70
7	12	1.0	0.65	5.00	2.70

KA ENTERPRISES C-STORE AND CAR WASH PROPOSED HYDROLOGY EXHIBIT

OMEGA

PROP. HYDROLOGY EXHIBIT

KA ENTERPRISES C-STORE AND CAR WASH
HYDROLOGY AND HYDRAULICS CALCS

BASIN	AREA (SF)	AREA (AC)	% Imp	"C" Value
E-1	38,483	0.88	68.4%	0.85
EX. TOTAL	**38,483**	**0.88**		
P-1	38,483	0.88	75.8%	0.85
PROP TOTAL	**38,483**	**0.88**		

Basin Confluence	Symbol

(A) DP # - Existing/Proposed Discharge Point
CP # - Existing/Proposed Confluence Point

(B) C value for Commercial, 80% Impervious, is 0.85 (Table A-1 City of San Diego Drainage Design Manual)
(Type 'D' soil)

KA ENTERPRISES C-STORE AND CAR WASH
HYDROLOGY AND HYDRAULICS CALCS

Sub-Basin	AREA Ac.	"C"	Overland flow length	Concentrated Flow Length, (ft)	S(%) (avg.)	Ti mins	Tt mins	T_c mins	I in/hr	Q cfs	NOTES 100-year, 6 hr storm
											P(6) 2.5
E-1	0.88	0.85	100.0	238.0	4.1%	10.3	1.42	11.7	3.80	2.86	
								11.7	**3.80**	**2.86**	**Discharge Point-1**
P-1	0.88	0.85	100.0	257.0	3.9%	10.9	1.91	12.8	3.59	2.70	
								12.8	**3.59**	**2.70**	**Discharge Point-1**

CONDUIT SIZING CALCULATIONS

The following chart details the sizing parameters and for conduits that convey runoff on the site.

K'= Discharge factor	=	$(Q*n)/(d^{8/3}*s^{1/2})$
n= Mannings coefficient	=	0.013 for PVC & HDPE
d=diameter of conduit (ft)	=	per chart
Q= Discharge	=	based off portions of basins tributary to outlet
s=Minimum Pipe Slope (ft/ft)	=	per chart
D=depth of flow	=	From table 7-4 See right
C_a= Flow factor	=	From table 7-14 See right
A=Cross sectional area of flow	=	C_a*d^2
V=Velocity	=	Q/A

Pipe Flow

Pipe	Tributary Areas	Q (cfs)	S (%)	d (in)	K'	D/d	C_a	A (sf)	V (fps)
1	**Northwesterly portion of basin P-1 and northerly portion of proposed building**	1.00	1	8	0.3833	0.69	0.578	0.257	3.89
2	**Portion of 4' ribbon gutter on easterly driveway**	0.03	0.5	6	0.035	0.18	0.096	0.024	1.25
3	**Confluence Flow Pipes # 1 & 2**	1.03	1.95	8	0.2827	0.56	0.453	0.201	5.12
4	**Confluence Flow Pipes # 1, 2 & 3**	2.06	3.9	10	0.2205	0.48	0.373	0.259	7.96
5	**Southwesterly portion of basin P-1**	1.42	10	8	0.1721	0.42	0.313	0.139	10.21
6	**Confluence Flow Pipes # 1, 2, 3, 4, 5 & 6**	2.70	6.4	10	0.2256	0.49	0.383	0.266	10.16
7	**Entire Site**	2.70	1	12	0.351	0.65	0.54	0.540	5.00

Table 7-4. For Determining the Area a of the Cross Section of a Circular Conduit Flowing Part Full

Let $\frac{\text{depth of water}}{\text{diameter of channel}} = \frac{D}{d}$ and C_a = the tabulated value. Then $a = C_a d^2$.

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0013	.0037	.0069	.0105	.0147	.0192	.0242	.0294	.0350
.1	.0409	.0470	.0534	.0600	.0668	.0739	.0811	.0885	.0961	.1039
.2	.1118	.1199	.1281	.1365	.1449	.1535	.1623	.1711	.1800	.1890
.3	.1982	.2074	.2167	.2260	.2355	.2450	.2546	.2642	.2739	.2836
.4	.2934	.3032	.3130	.3229	.3328	.3428	.3527	.3627	.3727	.3827
.5	.393	.403	.413	.423	.433	.443	.453	.462	.472	.482
.6	.492	.502	.512	.521	.531	.540	.550	.559	.569	.578
.7	.587	.596	.605	.614	.623	.632	.640	.649	.657	.666
.8	.674	.681	.689	.697	.704	.712	.719	.725	.732	.738
.9	.745	.750	.756	.761	.766	.771	.775	.779	.782	.784

Table 7-14. Values of K' for Circular Channels in the Formula

$$Q = \frac{K'}{n} d^{8/3} s^{1/2}$$

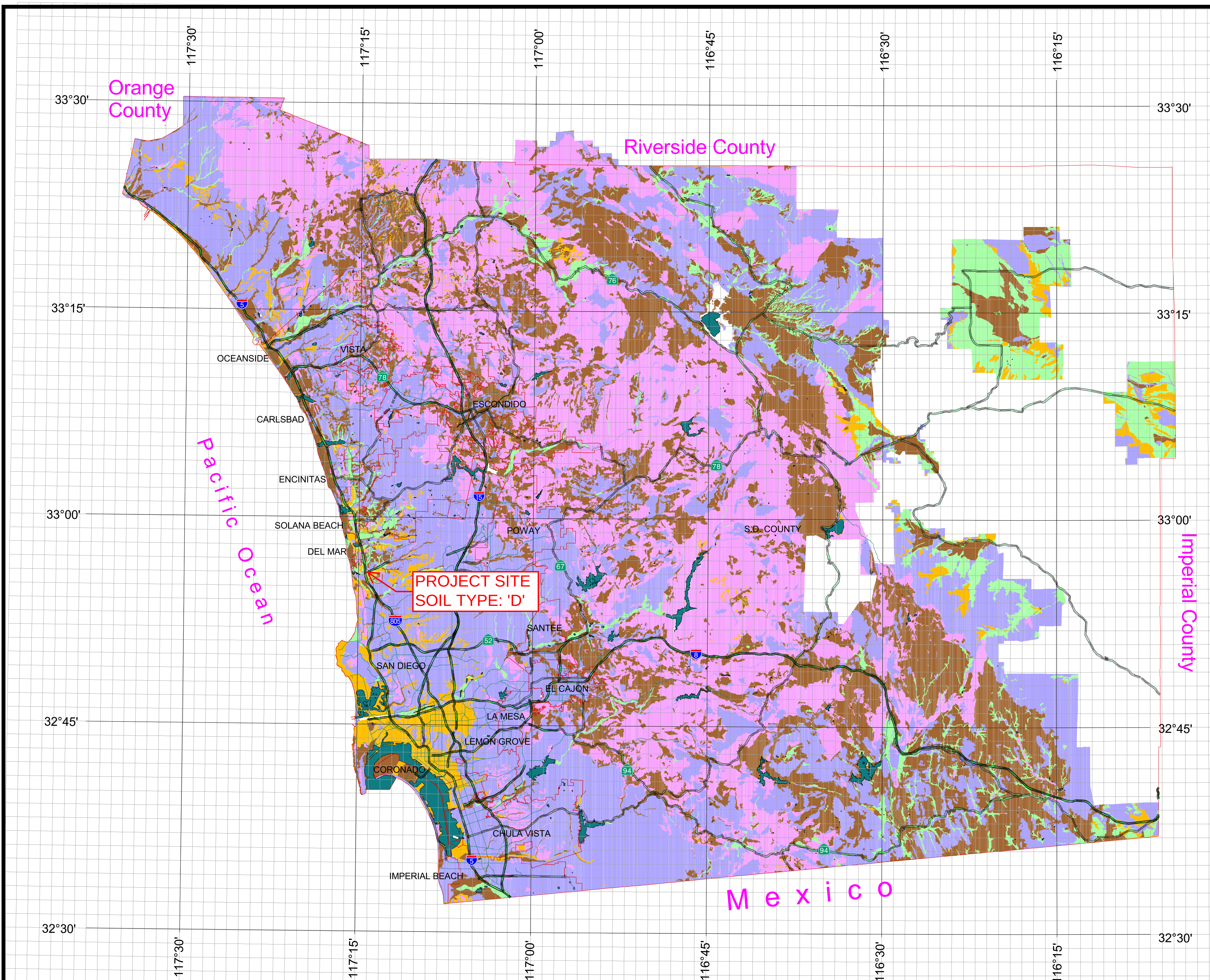
D = depth of water d = diameter of channel

$\frac{D}{d}$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0		.00007	.00031	.00074	.00138	.00222	.00328	.00455	.00604	.00775
.1	.00967	.0118	.0142	.0167	.0195	.0225	.0257	.0291	.0327	.0366
.2	.0406	.0448	.0492	.0537	.0585	.0634	.0686	.0738	.0793	.0849
.3	.0907	.0966	.1027	.1089	.1153	.1218	.1284	.1352	.1420	.1490
.4	.1561	.1633	.1705	.1779	.1854	.1929	.2005	.2082	.2160	.2238
.5	.232	.239	.247	.255	.263	.271	.279	.287	.295	.303
.6	.311	.319	.327	.335	.343	.350	.358	.366	.373	.380
.7	.388	.395	.402	.409	.416	.422	.429	.435	.441	.447
.8	.453	.458	.463	.468	.473	.477	.481	.485	.488	.491
.9	.494	.496	.497	.498	.498	.498	.496	.494	.489	.483
1.0	.463									

Appendix 1

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

DPW GIS Department of Public Works Geographic Information Services

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N E S W

3 0 3 Miles

APPENDIX 1.0

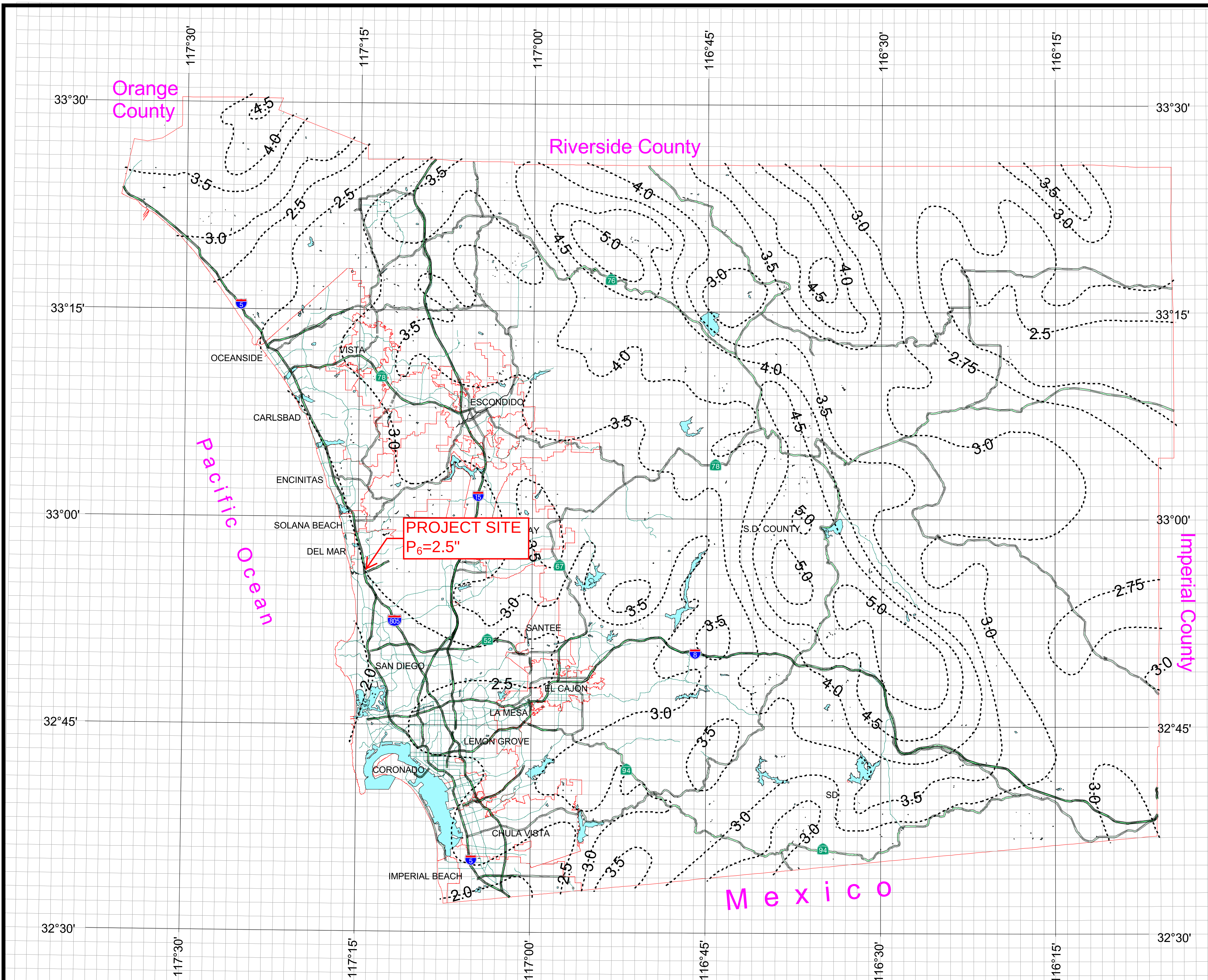
Appendix 2

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)



DPW GIS Department of Public Works Geographic Information Services

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3 0 3 Miles

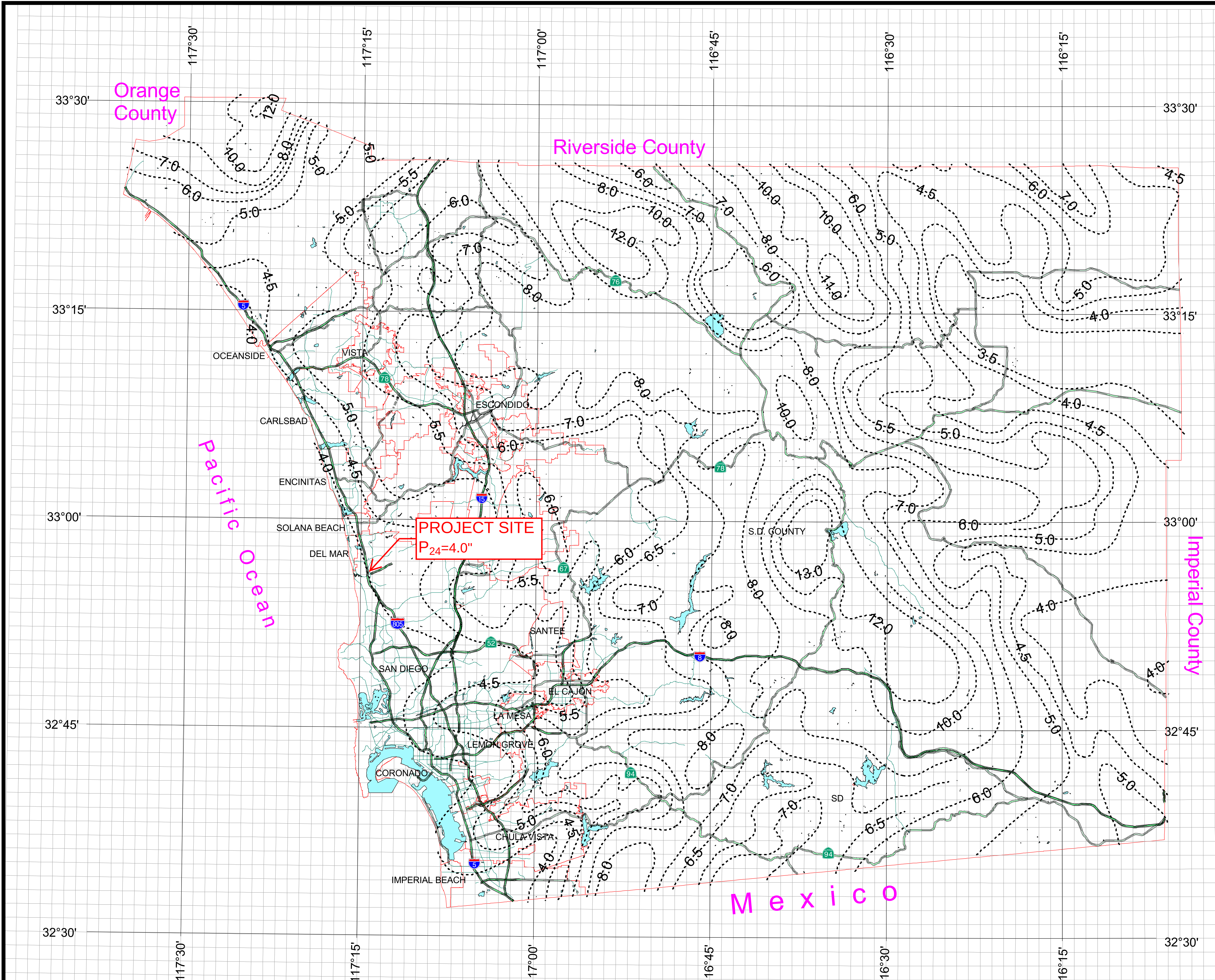
APPENDIX 2.0

Appendix 3

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours



DPW GIS Department of Public Works Geographic Information Services

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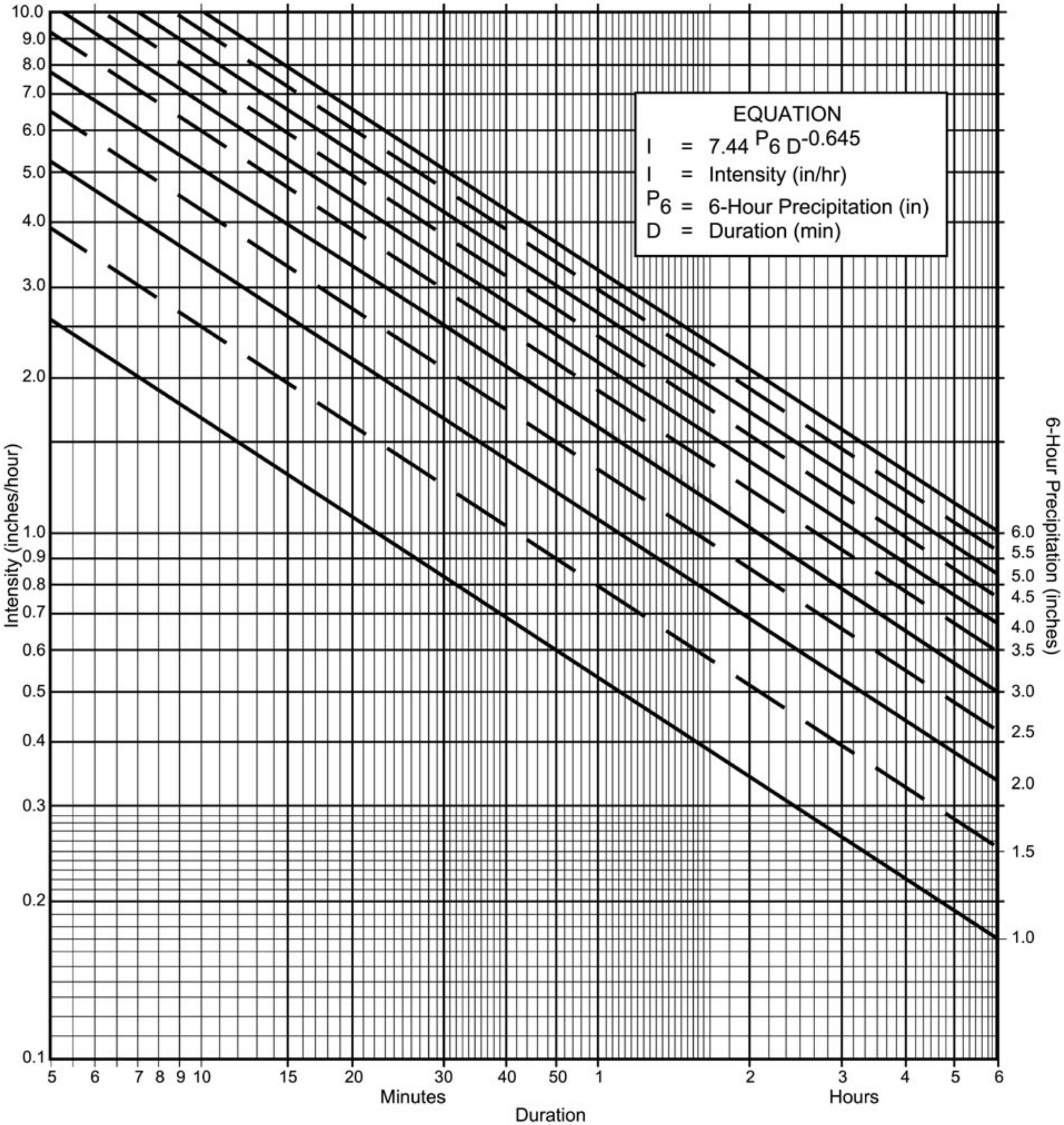
APPENDIX 3.0

Appendix 4



Directions for Application:

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

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

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

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

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

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.5" in., P_{24} = 4.0", $\frac{P_6}{P_{24}}$ = 62.5 %$^{(2)}$

(c) Adjusted $P_6^{(2)}$ = ______ in.

(d) t_x = ______ min. see calculations for values of each basin

(e) I = ______ in./hr. See methodology to see the equations used for Intensity and time of concentration

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

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

Intensity-Duration Design Chart - Template

FIGURE **3-1**

Appendix 5

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C) Soil Type [1]
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_C for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_C calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

Appendix 6

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

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

Table 3-2

Basin P-1

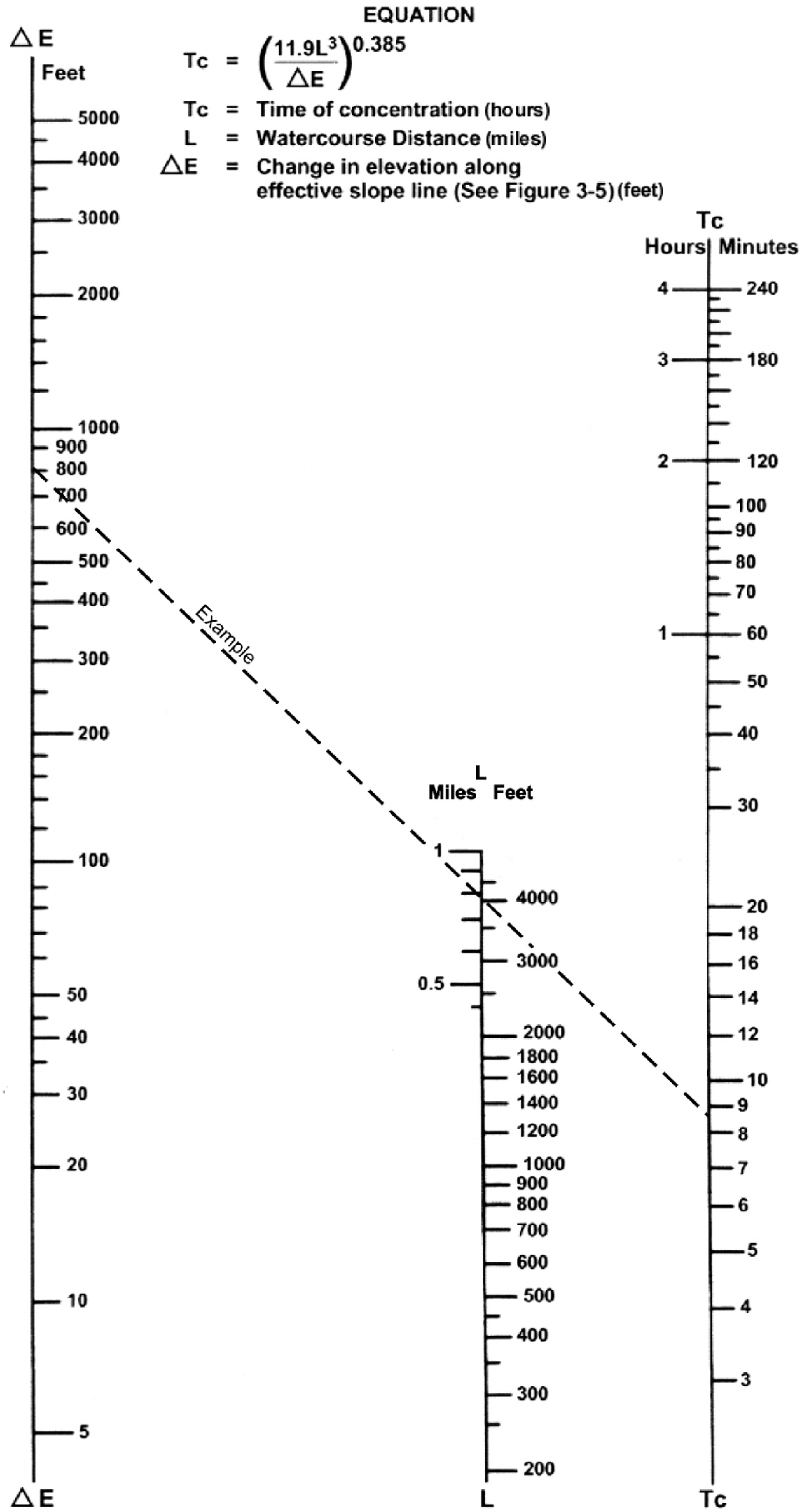
Basin E-1

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

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

*See Table 3-1 for more detailed description

Appendix 7



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

FIGURE **3-4**

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

Appendix 8

Channel Report

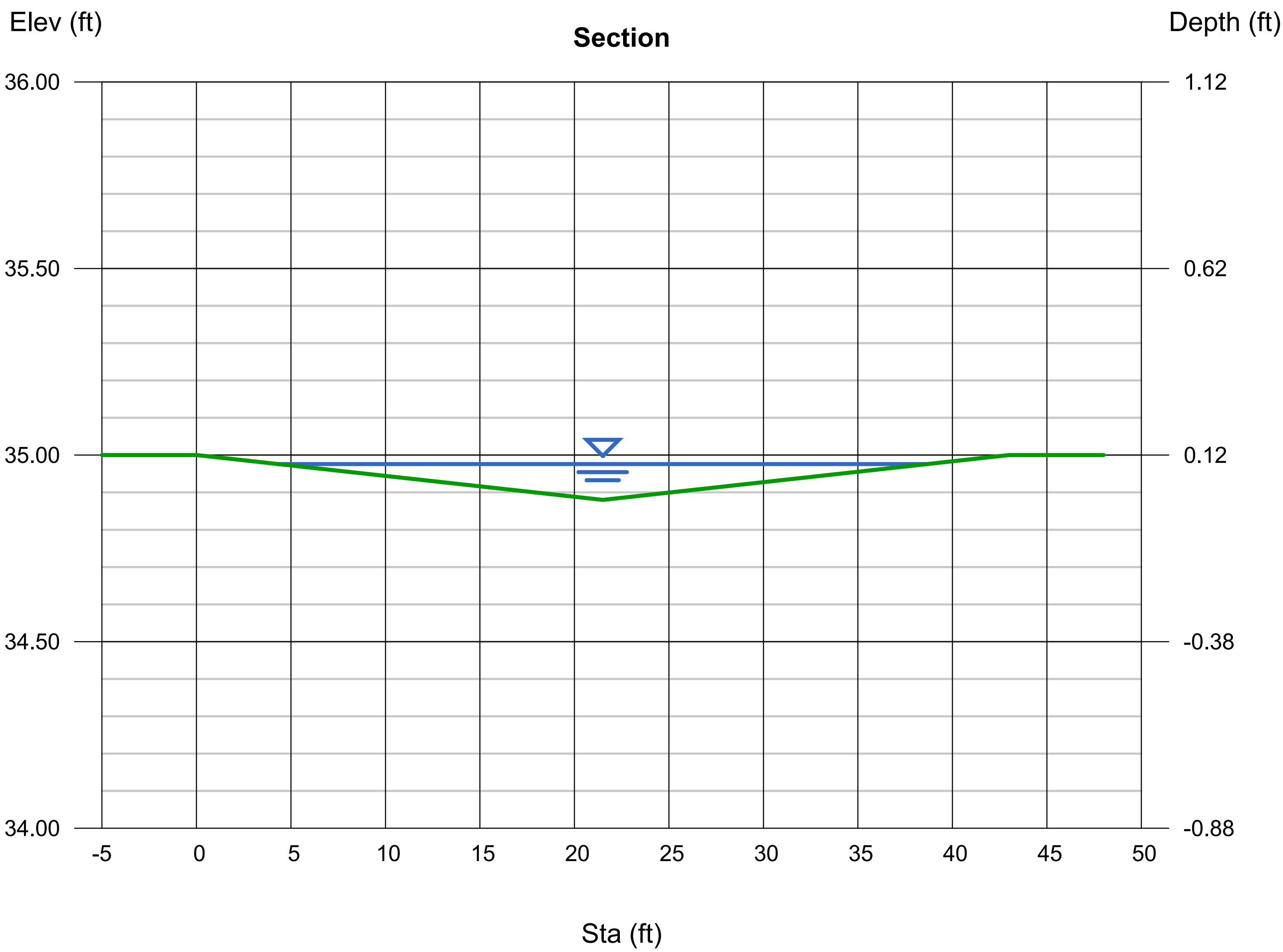
Basin E-1 - Asphalt Swale

User-defined
Invert Elev (ft) = 34.88
Slope (%) = 3.40
N-Value = Composite

Calculations
Compute by: Q vs Depth
No. Increments = 10

(Sta, El, n)-(Sta, El, n)...
(0.00, 35.00)-(21.50, 34.88, 0.013)-(43.00, 35.00, 0.013)

Highlighted
Depth (ft) = 0.10
Q (cfs) = 4.602
Area (sqft) = 1.65
Velocity (ft/s) = 2.79
Wetted Perim (ft) = 34.40
Crit Depth, Yc (ft) = 0.12
Top Width (ft) = 34.40
EGL (ft) = 0.22



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. | Wednesday, Jan 26 2022

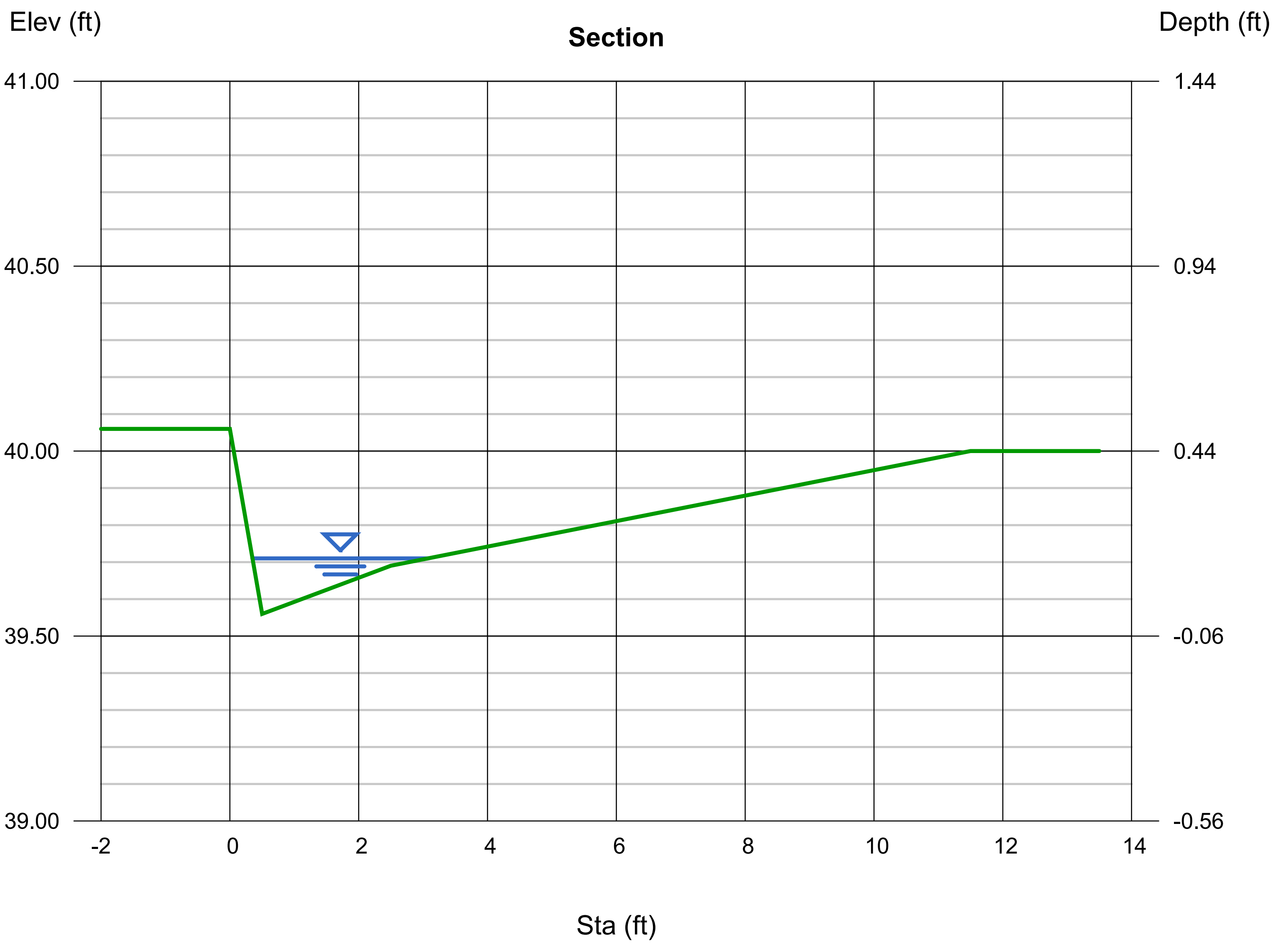
Basin P-1 - 2.5' Curb & Gutter Analysis

User-defined
Invert Elev (ft) = 39.56
Slope (%) = 3.00
N-Value = Composite

Calculations
Compute by: Q vs Depth
No. Increments = 10

(Sta, El, n)-(Sta, El, n)...
(0.00, 40.06)-(0.50, 39.56, 0.013)-(2.50, 39.69, 0.013)-(11.50, 40.00, 0.013)

Highlighted
Depth (ft) = 0.15
Q (cfs) = 0.611
Area (sqft) = 0.19
Velocity (ft/s) = 3.27
Wetted Perim (ft) = 2.80
Crit Depth, Yc (ft) = 0.21
Top Width (ft) = 2.73
EGL (ft) = 0.32



Channel Report

Basin P-2 - 4' Gutter Analysis

User-defined
Invert Elev (ft) = 35.43
Slope (%) = 1.20
N-Value = Composite

Calculations
Compute by: Q vs Depth
No. Increments = 10

Highlighted
Depth (ft) = 0.13
Q (cfs) = 0.520
Area (sqft) = 0.28
Velocity (ft/s) = 1.87
Wetted Perim (ft) = 4.81
Crit Depth, Yc (ft) = 0.16
Top Width (ft) = 4.80
EGL (ft) = 0.19

(Sta, El, n)-(Sta, El, n)...
(0.00, 36.10)-(0.50, 35.60, 0.013)-(7.50, 35.56, 0.013)-(9.50, 35.43, 0.013)-(11.50, 35.56, 0.013)-(18.50, 35.83, 0.013)