DRAINAGE STUDY

FOR

Junipero Serra Museum ADA Improvements

DWG: 40809-D

Developed for:

City of San Diego, Parks and Recreation Department
600 B Street
San Diego, CA 92111

Prepared by:

Nasland Engineering
4740 Ruffner Street
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(858) 292-7770
NE Job No. 117-229.1

November 21, 2025

Table of Contents

Appendices

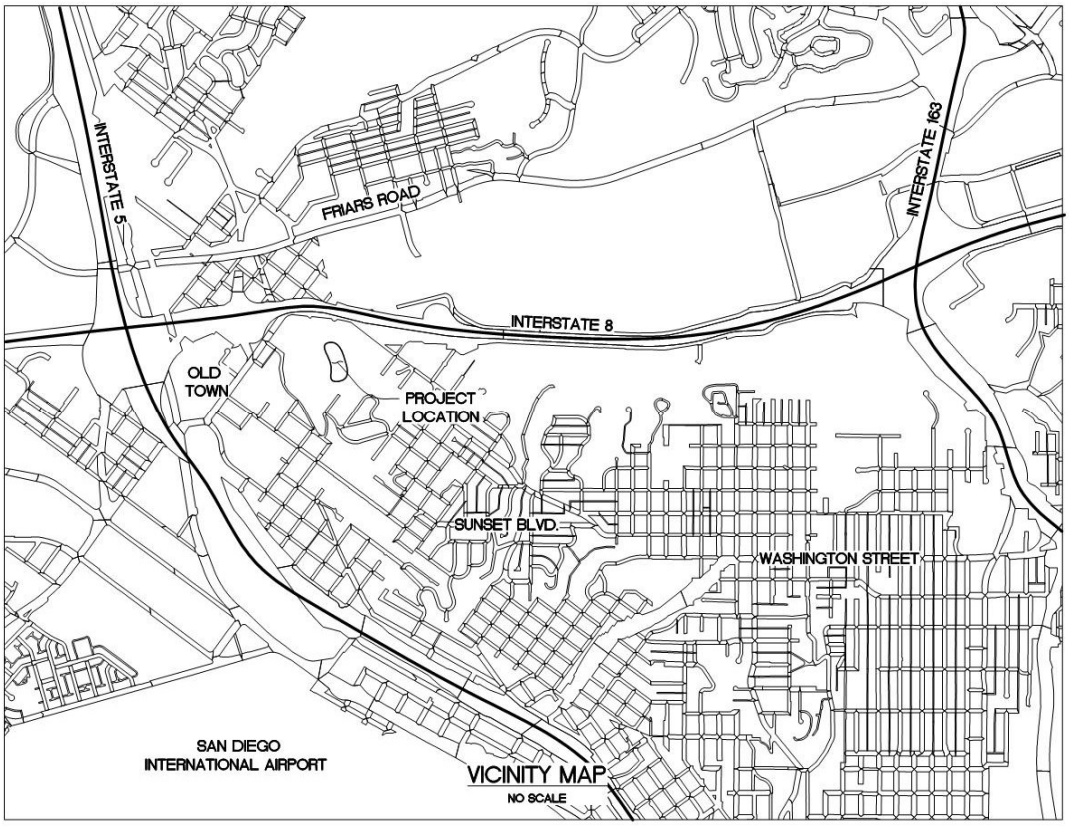
Purpose:

The purpose of this hydrology study is to examine the existing conditions and the effects of the proposed construction of a parking lot, driveway, and walkway for the Junipero Serra Museum.

Description:

The project is located on City of San Diego property at 2727 Presidio Drive. The project site is located east of Presidio Park and south of the Junipero Serra Museum and Taylor Street. This study assesses the hydrology associated with the onsite area.

Vicinity Map:



Existing Conditions:

The site is located within the Mission San Diego hydrologic sub area (907.11) of the Lower San Diego River Watershed. The existing site is close to the top of an undeveloped hillside with native dirt cover and trees. The total proposed project footprint covers approximately 1.42 acres. The underlying hydrologic soils type consists of type D soils and ground water is estimated to be greater than 20 feet deep.

The existing onsite drainage mostly sheet flows down the hillside in two separate directions. Surface flow down the western hillside is collected in an existing cobble gutter that runs down Presidio Drive. A portion of the Presidio Drive asphalt street also drains into the existing cobble gutter. Surface flow down the eastern hillside is collected in an existing cobble drainage channel that connects to an existing storm drain system underneath Taylor Street. There is no source of storm water run-on to the project.

Existing impervious area on the project site includes 110 square feet of an existing concrete driveway that will be removed. Other existing impervious area on the project site are a part of the museum's pedestrian facilities, which will not be disturbed but are included as part of the drainage areas.

Proposed Conditions:

The proposed project consists of an asphalt driveway with cobble cross gutter, asphalt parking lot with a total of 9 parking stalls, and an ADA accessible concrete walkway that connects to the pedestrian facilities at Junipero Serra Museum. Minimal demolition of existing surfaces is required.

The project proposes a total of 24,630 square feet of impervious surface. A biofiltration basin is proposed to collect runoff from the driveway and parking lot (PR-1A) and discharge to the existing cobble gutter along Presidio Drive. Runoff from PR-1B will flow across the existing hillside before discharging into the existing cobble swale. Drainage from PR-1C will sheet flow over the proposed ADA walkway before flowing into the proposed catch basin and then into proposed storm drain pipes before flowing out a proposed headwall and into the existing cobble swale. Drainage from PR-1D and PR-1F will sheet flow across the hillside and into the existing cobble swale. Drainage from PR-1E will flow across the ADA walkway and into the proposed Type F catch basin before flowing into storm drains that outlet through a headwall and into the existing cobble swale. A good portion of the Presidio Drive asphalt street will remain largely unchanged and continue to drain into the existing cobble gutter delineated as O-1. Drainage from EX-2A remains largely unchanged and will continue to drain to the existing cobble channel that connects to an existing storm drain system underneath Taylor Street.

Assumptions and Methodology:

This report was prepared in accordance with the City of San Diego Storm Water Standards Manual dated May 2021. Surface data and runoff equations were acquired from the City of San Diego Drainage Design Manual dated January 2017. All maps and tables utilized from these Manuals are located in the maps and tables attachment at the end of this report.

Runoff was calculated Following Appendix I: Rational Method which is given by the following equation:

Q = C x I x A

- Q = flow rate in cubic feet per second (cfs)
- C = Runoff Coefficient
- I = Rainfall intensity in inches per hour (in/hr)
- A = Drainage basin area in acres (acres)

Runoff Coefficient: The runoff coefficient C is determined using Table A-1: Runoff Coefficients (Rational Method) on page 191 of the City of San Diego Drainage Design Manual.

Rainfall Intensity: Intensity was calculated as a function of time of concentration, as defined by the Intensity Duration Design Chart on page 192 of the City of San Diego Drainage Design Manual.

Time of Concentration: Determined from using Figure 3-3 or Figure 3-4 of the SDC Drainage Design Manual:

For sheet flow: Urban Areas Overland Time of Flow Curves (Appendix I-E):

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

C = Runoff Coefficient

D = Watercourse Distance (ft)

s = Slope of basin

Grated Inlet Sizing: Inlet capacity sizing for grated inlets was determined by following the calculations provided by the County of San Diego Hydraulic Design Manual. Runoff will flow towards each grated inlet either by being a localized low point or a low point within a biofiltration basin, therefore the inlet capacity can be assumed to be modeled in a sag condition with the equation:

$$Q = C_W * P_e * d^{3/2}$$

Where:

Q = Inlet capacity

C_w = Weir coeifficent (3.0)

P_e = Effective grate permeter (ft)

d = Flow depth (ft)

Detention Analysis:

Storm water detention follows the design procedure described in the San Diego County Hydrology Manual. The project will utilize the proposed biofiltration basins as detention basins to mitigate the increase in storm water runoff rates. For a 6-hour storm event, a hydrograph was generated to determine the total volume of the design storm. Orifice structures are utilized to detain the flow within the basin and control the release of the runoff.

Detention analysis utilizes two programs to develop and model the hydrographs. RATHYDRO develops the rainfall distribution for a 6-hour design storm utilizing the 2/3, 1/3 method defined in the hydrology manual. The data produced by RATHYDRO can be manually entered into a hydrograph modeling program, Hydraflow Hydrographs extension. Hydraflow Hydrographs generates the hydrograph and models the outflow of the detention pond to determine the overall volume needed for the system. Detention volume calculations and hydrographs have been provided in **Appendix B.**

Results:

EXISTING BASIN SUMMARY

100 YEAR - 6 HOUR Storm

Basin	C Value	T_c (mins)	Intensity ($^{in}/_{hr}$)	Area (acres)	Runoff (Q, cfs)
O-1	0.90	5.00	4.40	0.14	0.57
EX-1A	0.50	5.00	4.40	1.79	3.94
EX-2A	0.50	6.00	4.20	5.49	11.54
				Q100 =	**16.05**

PROPOSED BASIN SUMMARY

100 YEAR - 6 HOUR Storm

Basin	C Value	T_c (mins)	Intensity ($^{in}/_{hr}$)	Area (acres)	Runoff (Q, cfs)	Mitigated Runoff (Q, cfs)
O-1	0.90	5.00	4.40	0.16	0.62	
PR-1A	0.68	5.00	4.40	0.70	2.10	1.49
PR-1B	0.50	5.00	4.40	0.39	0.86	
PR-1C	0.50	5.00	4.40	0.19	0.42	
PR-1D	0.50	5.00	4.40	0.35	0.76	
PR-1E	0.50	5.30	4.25	0.32	0.69	
PR-1F	0.50	5.00	4.40	0.14	0.30	
EX-2A	0.50	6.04	4.20	5.18	10.89	
					16.02	

Q100 POC COMPARISON

POC	PRE (Q, CFS)	POST (Q, CFS)	NET CHANGE (Q, CFS)	% CHANGE
A	4.51	5.14	0.63	13.9%
B	11.54	10.89	-0.65	-5.6%
TOTAL	**16.05**	**16.02**	**-0.02**	**-0.1%**

Grated Inlet Capacity

Structure Type: 24"x24" Catch Basin L = 2 ft

Grate Type: Metal Grate W = 2 ft

GRATE CHARACTERISTICS

Effective length	L_e =	1.5 ft	(50% clogging Factor), Length of grate - Width of bars
Effective Width	W_e =	0.8 ft	(50% clogging Factor), Width of grate - Width of bars
Effective perimeter	P_e =	4.6 ft	(4 sides = $2W_e + 2L_e$)
Effective Area	A_e =	2.35 ft^2	(50% clogging Factor)
Splash Over Velocity	V_o =	2 ft/s	

Weir

$$Q=C_W P_e d^{3/2}$$

Where: C_W = 3

Pe = 4.6 ft

d = 0.25 ft

Q = 1.72 cfs

With a depth of flow of 0.25 inches, a 24”x24” Catch Basin with a grated inlet has a capacity of 1.72 cfs. Therefore, the proposed sized grated inlets should be able to handle the peak flow rate produced by drainage areas PR-1C.

Notes:

- A minimum time of concentration of 5 minutes was utilized.
- The project assumes Hydrologic Soil Type D.
- The Land Use for this site is a public park with a paved parking lot and boat ramp. This project does not fit into any of the pre-defined Land Use categories in Table A-1. A ratio of the actual pervious and impervious areas shall be used in order to calculate the C-Value for the basins for project. C-Values of 0.35 and 0.90 shall be used for pervious and impervious areas, respectively. **The final coefficient may not be less than 0.50 per City of San Diego Drainage Manual Section A.1.2.**

Applicability of Section 401 or 404:

According to the State Water Board Website, a 401-water quality permit is required if you have waters of the US on the subject property. A 404 permit is required if waters of the US are to be dredged or filled. The project site contains no natural drainage features. Therefore, no waters of the US are present onsite. A 401 or 404 permit is not applicable to this project.

Conclusions:

The Serra Museum ADA Improvements will increase the impervious area and subsequently increase the total runoff generated from the site at an unmitigated condition by 0.58CFS (3.6%). More specifically, the total runoffs to POC A will increase by 1.23 CFS (27.3%) and POC B will decrease by 0.65 CFS (5.6%) in the unmitigated condition. However, the runoff entering the biofiltration basins will be detained which will mitigate the projects overall runoff rate and specifically to POC A. The mitigated total runoff generated by the project will be 16.02 CFS, which is a net change in .02 CFS (1.2%) from the existing conditions. With the above improvements in place, we do not anticipate any adverse effects to the areas surrounding the Serra Museum ADA Improvements.

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 the current standards.

I understand that the check of the project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

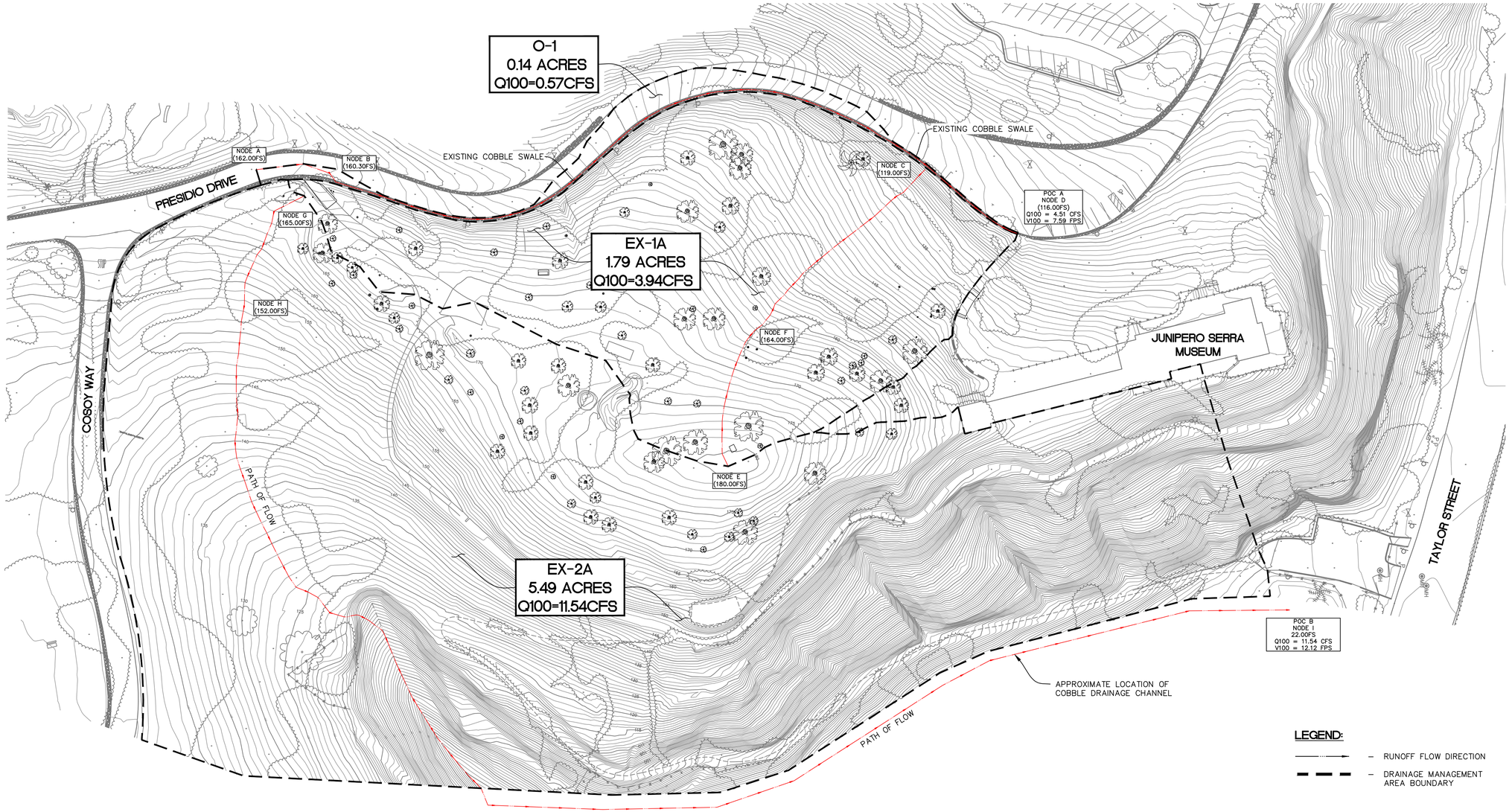
James J linn Date

R.C.E. 84231

Exp. 9-30-2027

Appendix A – Pre-Developed Conditions

Pre-Developed Conditions, Calculations, Intensity Duration Curves.



EXISTING BASIN SUMMARY

100 YEAR - 6 HOUR Storm

Basin	C Value	T_c (mins)	Intensity ($^{in}/_{hr}$)	Area (acres)	Runoff (Q, cfs)
O-1	0.90	5.00	4.40	0.14	0.57
EX-1A	0.50	5.00	4.40	1.79	3.94
EX-2A	0.50	6.00	4.20	5.49	11.54

BASIN SUMMARY

Runoff to Presidio Drive (POC A) =	4.51 cfs
Runoff to Palm Canyon (POC B) =	11.54 cfs

LEGEND:

- RUNOFF FLOW DIRECTION
- DRAINAGE MANAGEMENT AREA BOUNDARY

SOIL CONDITIONS:

UNDERLYING SOIL TYPE: NRCS TYPE D

DEPTH TO GROUNDWATER: DEPTH > 20 FEET

NO EXISTING NATURAL HYDROLOGIC FEATURE ON PROJECT SITE

NO CRITICAL COARSE SEDIMENT YIELD AREAS ON PROJECT SITE

40 0 40 80 120 160

SCALE 1" = 40'

EXISTING CONDITIONS

JUNIPERO SERRA MUSEUM
ADA IMPROVEMENTS

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NE JOB # 117-229.1
DATE: 11-24-2025

EX-01

BASIN DATA: EXISTING CONDITIONS

Runoff Coefficient

Sub Area	Area (acres)	% Impervious	% Pervious	Description	C Value
Offsite					
O-1	0.14	100.0%	0.0%	Gutter	**0.90**
Basin 1					
EX-1A	1.79	0.0%	100.0%	Natural Sloped Terrain	**0.50**
Basin 2					
EX-2A	5.49	0.2%	99.8%	Natural Sloped Terrain	**0.50**
	7.43				

Hydrologic Soil Type D

Time of concentration

Sheet Flow $T_i = \frac{1.8(1.1 - C)\sqrt{L}}{\sqrt[3]{S}}$

Basin	Node	C Value	L (ft)	Δ Height (ft)	Slope (%)	T_i (min)
O-1	A-B	0.90	64.00	1.70	2.66	2.08
EX-1A	E-F	0.50	100.00	16.00	16.00	4.29
EX-2A	G-H	0.50	100.00	13.00	13.00	4.59

Channelized Flow $T_t = \frac{L}{60V}$

Basin	Channel Description	Node	Channel Length (ft)	Channel Slope (%)	Average Q (cfs)	Velocity (fps)	T_t (min)
O-1	Gutter	B-D	576.40	7.70	2.25	7.59	1.27
EX-1A	Concentrated Flow	F-C	184.00	24.50	1.97	4.93	0.62
EX-2A	Channel Flow	H-I	1084.00	12.00	5.77	12.85	1.41

Total Time of Concentration

Basin	T_i (min)	T_t (min)	Tc (min)
O-1	2.08	1.27	5.00
EX-1A	4.29	0.62	5.00
EX-2A	4.59	1.41	6.00

100 YEAR - 6 HOUR Storm

Use Figure A-1: Intensity Duration-Frequency Chart

Basin	C Value	T_c (mins)	Intensity ($^{in}/_{hr}$)	Area (acres)	Runoff (Q, cfs)
O-1	0.90	5.00	4.40	0.14	0.57
EX-1A	0.50	5.00	4.40	1.79	3.94
EX-2A	0.50	6.00	4.20	5.49	11.54

BASIN SUMMARY

Runoff to Presidio Drive (POC A) = 4.51 cfs
Runoff to Palm Canyon (POC B) = 11.54 cfs

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 20 2025

EXISTING COBBLE SWALE (O-1)

Gutter

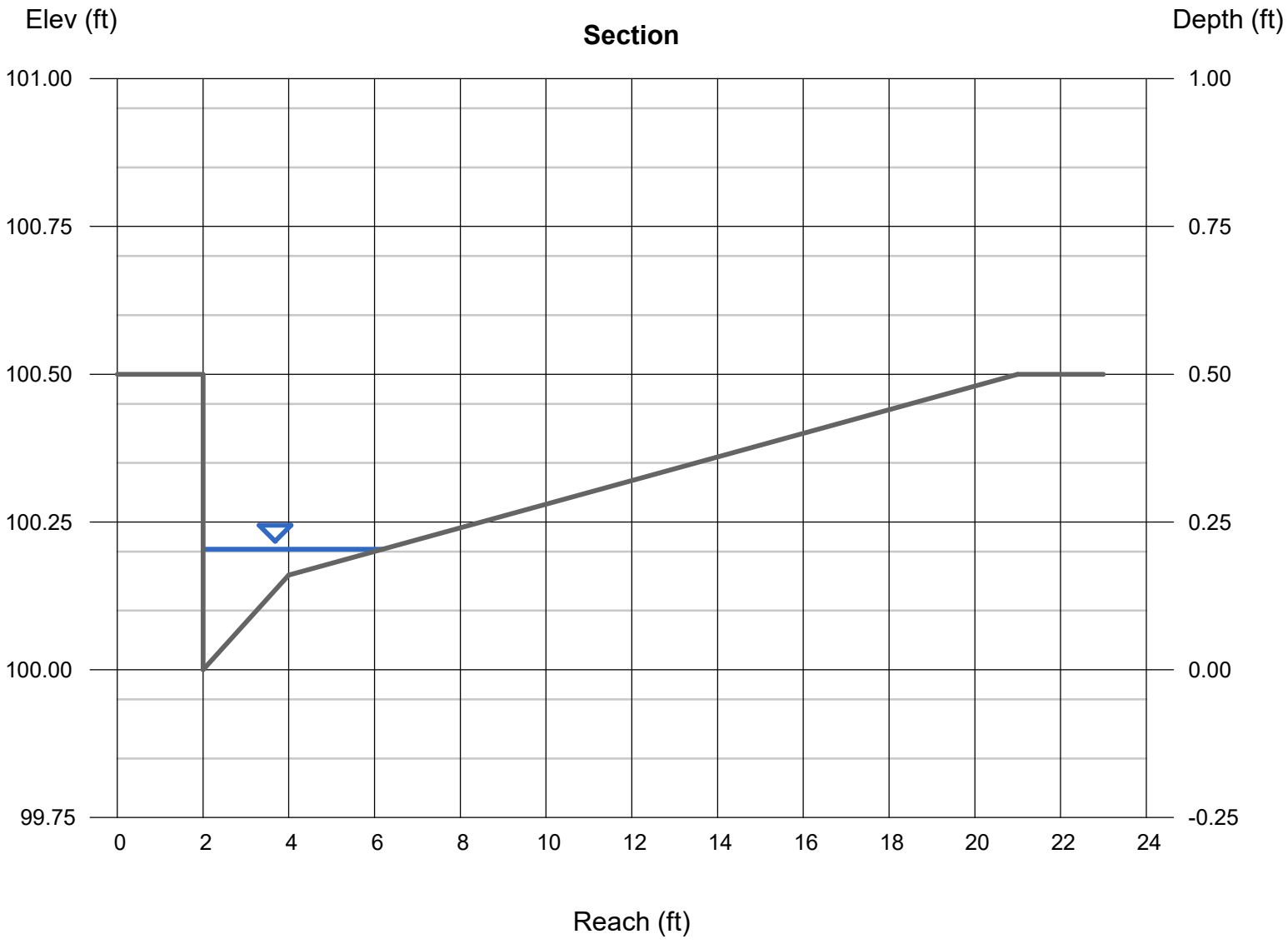
Cross Sl, Sx (ft/ft)	= 0.020
Cross Sl, Sw (ft/ft)	= 0.080
Gutter Width (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 7.70
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.25

Highlighted

Depth (ft)	= 0.20
Q (cfs)	= 2.250
Area (sqft)	= 0.30
Velocity (ft/s)	= 7.59
Wetted Perim (ft)	= 4.41
Crit Depth, Yc (ft)	= 0.33
Spread Width (ft)	= 4.20
EGL (ft)	= 1.10



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 20 2025

EXISTING COBBLE CHANNEL(EX-2A)

Triangular

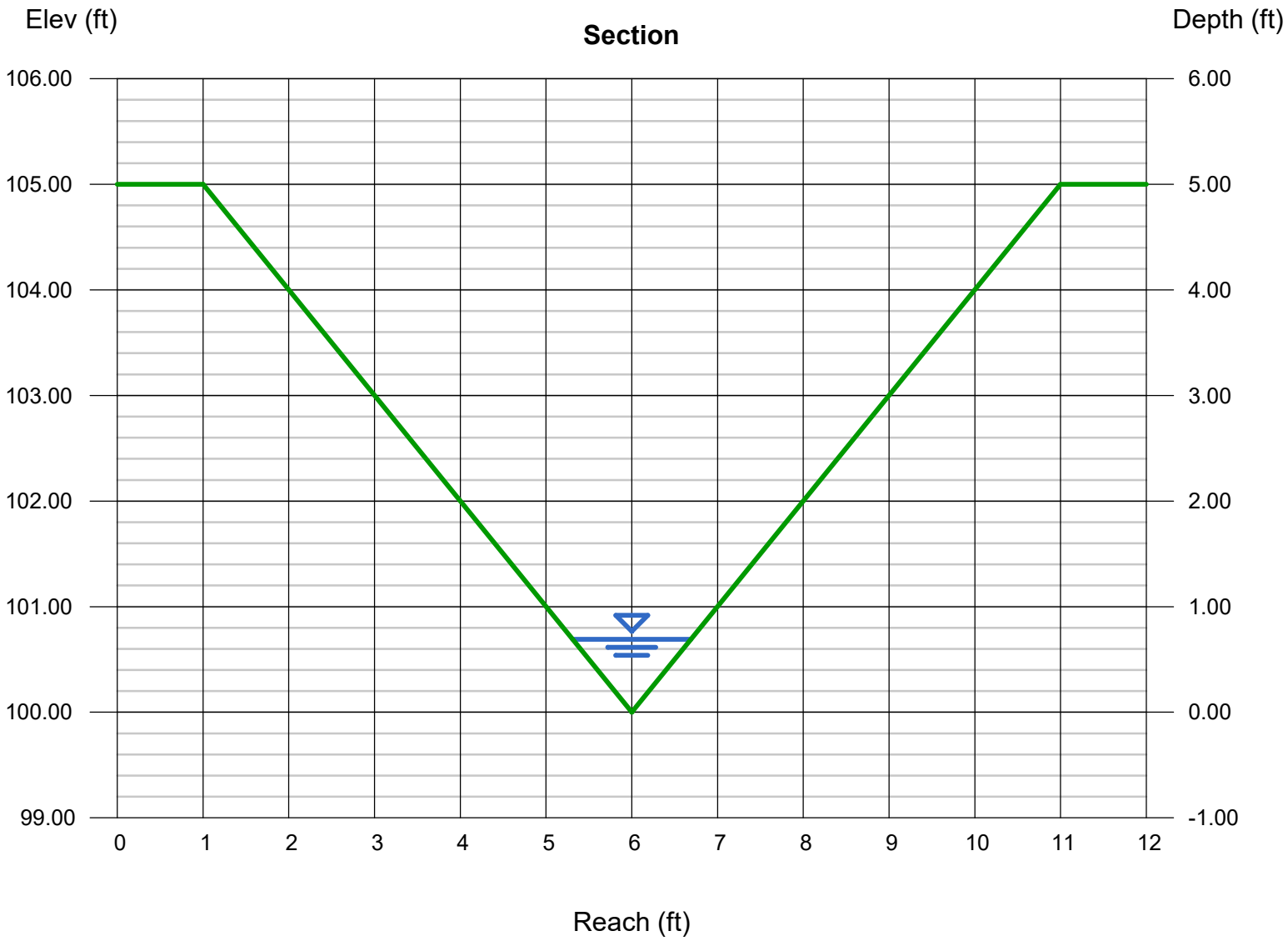
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 10.00
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.77

Highlighted

Depth (ft)	= 0.69
Q (cfs)	= 5.770
Area (sqft)	= 0.48
Velocity (ft/s)	= 12.12
Wetted Perim (ft)	= 1.95
Crit Depth, Yc (ft)	= 1.16
Top Width (ft)	= 1.38
EGL (ft)	= 2.97



O-1

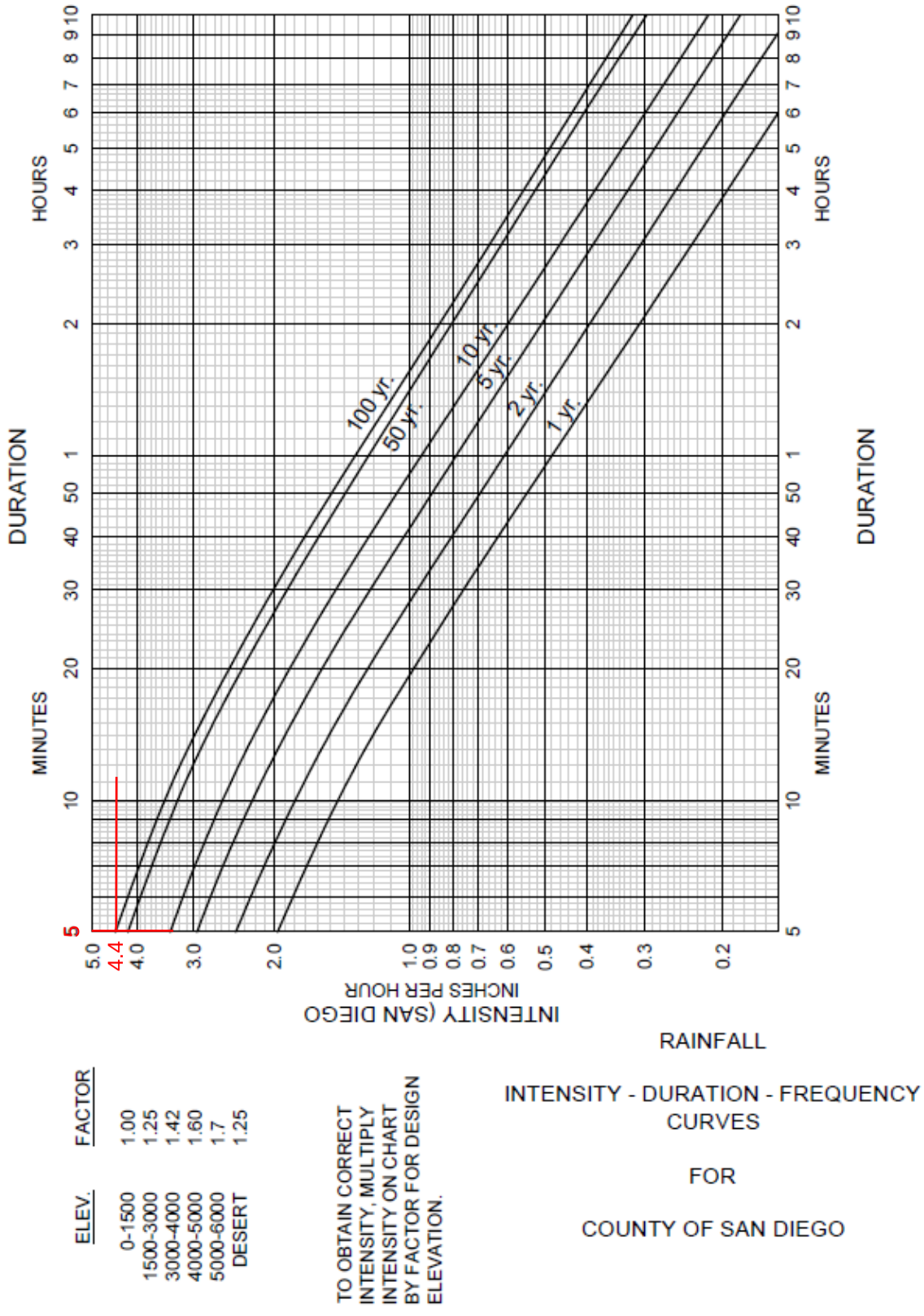


Figure A-1. Intensity-Duration-Frequency Design Chart

EX-1A

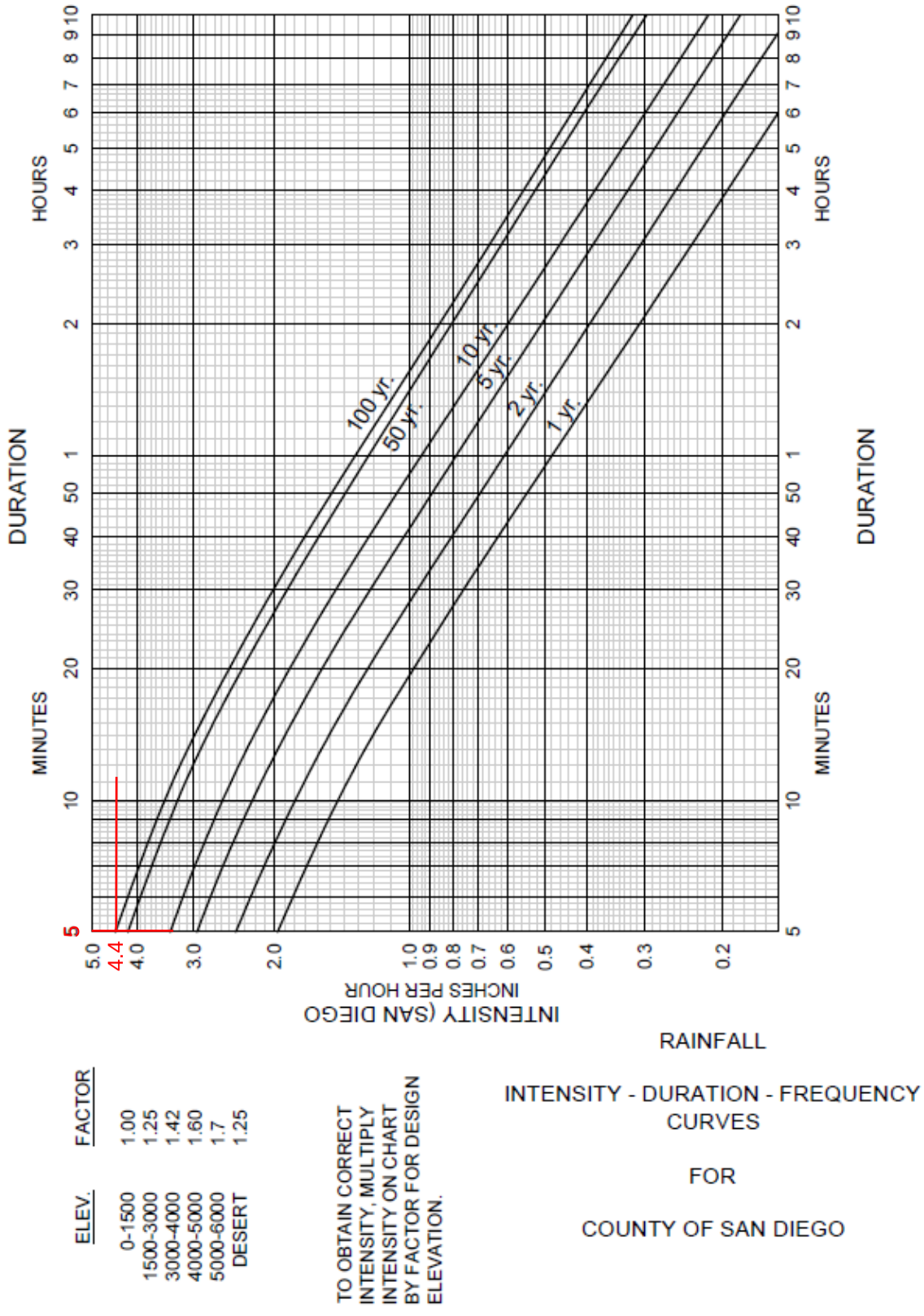


Figure A-1. Intensity-Duration-Frequency Design Chart

EX-2A

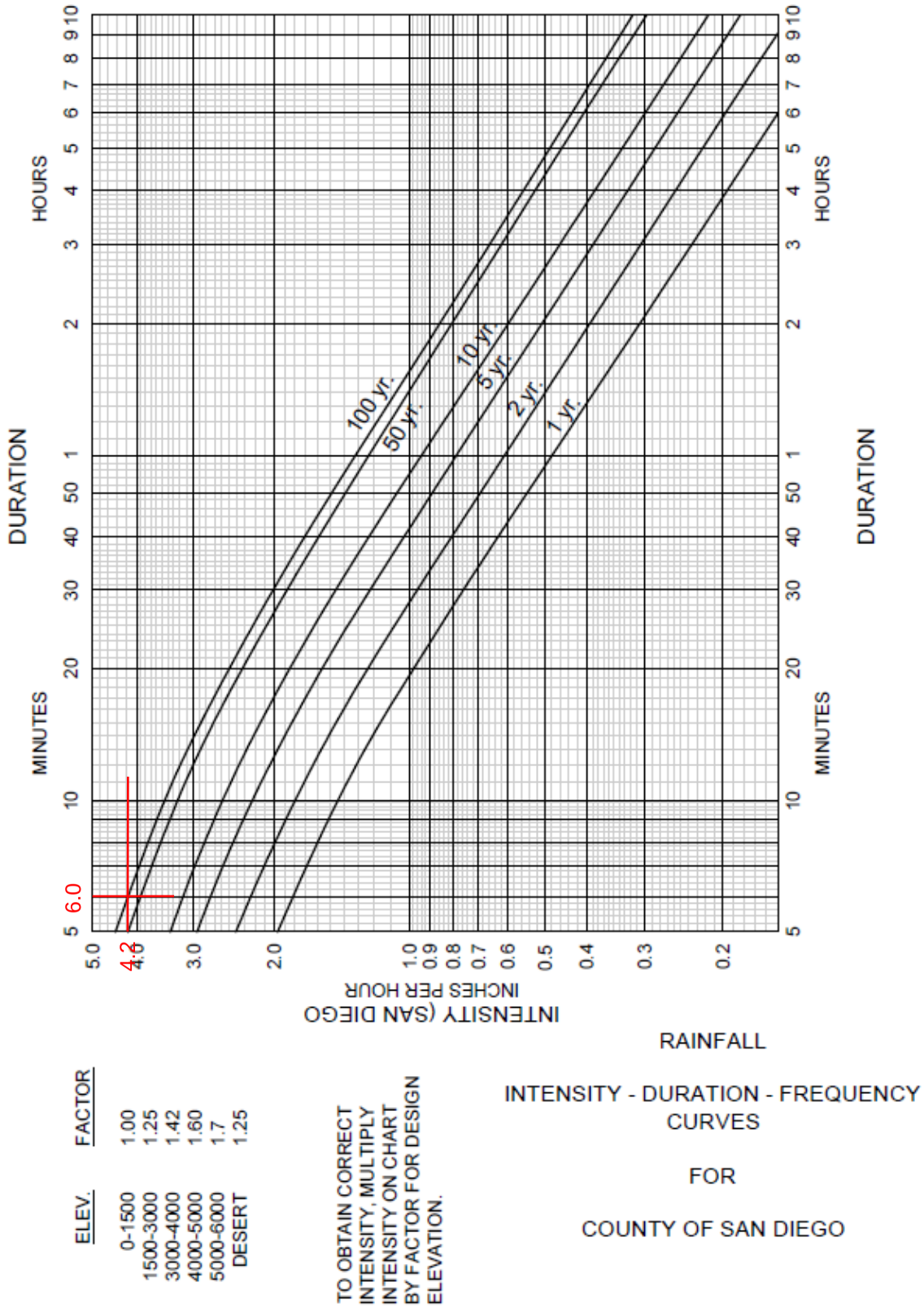
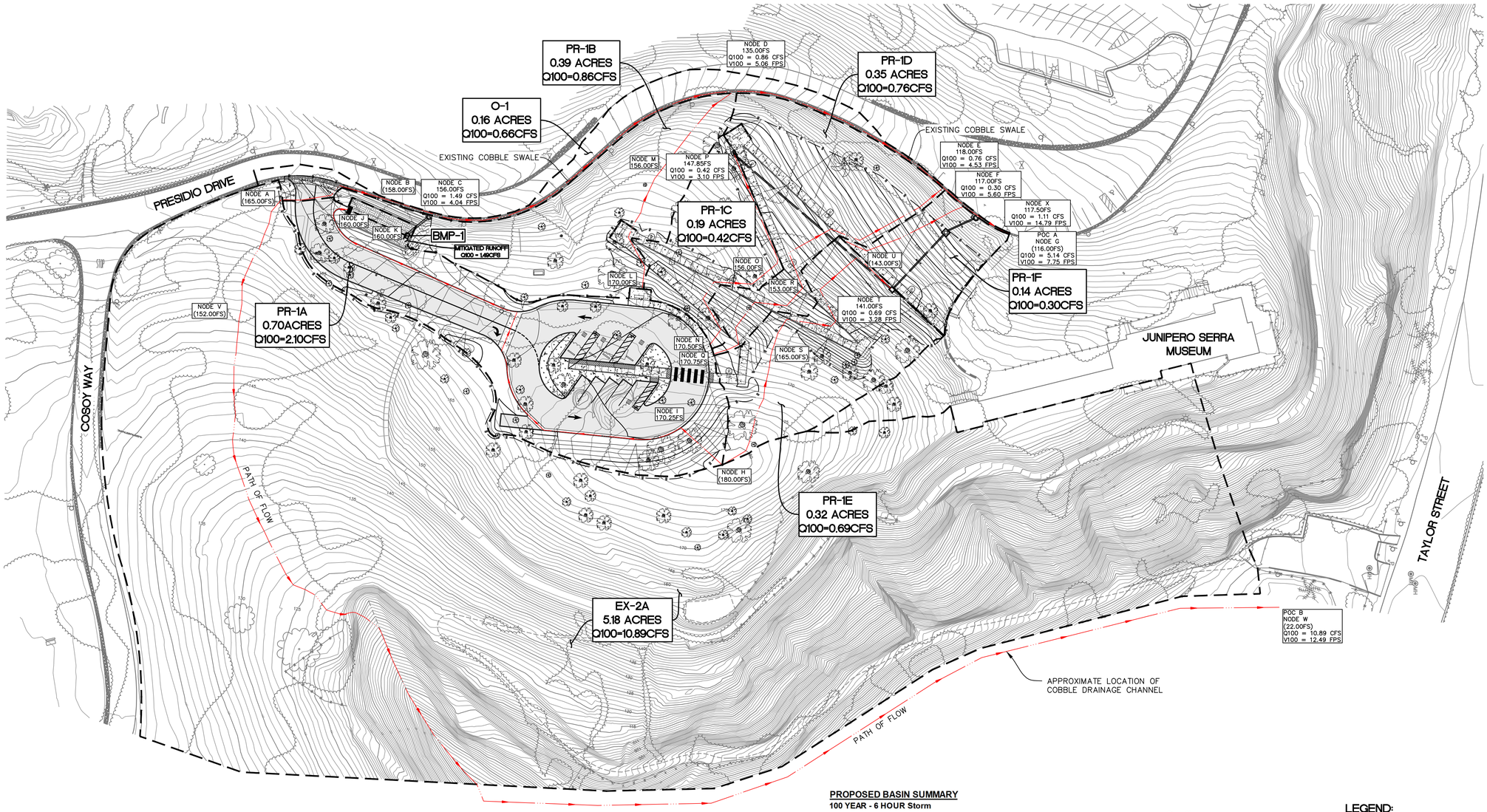


Figure A-1. Intensity-Duration-Frequency Design Chart

Appendix B – Post-Developed Conditions

Post-Developed Conditions, Calculations, Intensity Duration Curves.



PROPOSED BASIN SUMMARY

100 YEAR - 6 HOUR Storm

Basin	C Value	T_c (mins)	Intensity ($^{IN}/_{HT}$)	Area (acres)	Runoff (Q, cfs)	Mitigated Runoff (Q, cfs)
O-1	0.90	5.00	4.40	0.16	0.62	
PR-1A	0.68	5.00	4.40	0.70	2.10	1.49
PR-1B	0.50	5.00	4.40	0.39	0.86	
PR-1C	0.50	5.00	4.40	0.19	0.42	
PR-1D	0.50	5.00	4.40	0.35	0.76	
PR-1E	0.50	5.30	4.25	0.32	0.69	
PR-1F	0.50	5.00	4.40	0.14	0.30	
EX-2A	0.50	6.04	4.20	5.18	10.89	

BASIN SUMMARY

Runoff to Presidio Drive (POC A) = 5.14 cfs
Runoff to Palm Canyon (POC B) = 10.89 cfs

LEGEND:

– RUNOFF FLOW DIRECTION
– DRAINAGE MANAGEMENT AREA BOUNDARY
– BIORETENTION BASIN

SOIL CONDITIONS:

UNDERLYING SOIL TYPE: NRCS TYPE D
DEPTH TO GROUNDWATER: DEPTH > 20 FEET
NO EXISTING NATURAL HYDROLOGIC FEATURE ON PROJECT SITE
NO CRITICAL COARSE SEDIMENT YIELD AREAS ON PROJECT SITE

40 0 40 80 120 160
SCALE 1" = 40'

PROPOSED CONDITIONS

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NE JOB # 117-229.1
DATE: 11-24-2025

PR-01

BASIN DATA: PROPOSED CONDITIONS

Runoff Coefficient

Sub Area	Area (acres)	% Impervious	% Pervious	Description	C Value
Offsite					
O-1	0.16	99.5%	0.5%	Asphalt road and gutter	0.90
Basin 1					
PR-1A	0.70	60.1%	39.9%	Access Driveway and Lot	0.68
PR-1B		2.4%	97.6%	Natural Sloped Terrain, ADA	
	0.39			Pathway	0.36
PR-1C		12.2%	87.8%	Natural Sloped Terrain, ADA	
	0.19			Pathway	0.42
		14.7%		Natural Sloped Terrain, ADA	
PR-1D	0.35			Pathway	0.43
		9.2%		Natural Sloped Terrain, ADA	
PR-1E	0.32			Pathway	0.40
		11.8%		Natural Sloped Terrain, ADA	
PR-1F	0.14			Pathway	0.41
Basin 2					
EX-2A	5.18	0.24%	99.8%	Natural Sloped Terrain	0.35
	7.43				

Assumes Hydrologic Soil Type D

Time of concentration

Sheet Flow $T_i = \frac{1.8(1.1 - C)\sqrt{L}}{\sqrt[3]{S}}$

Basin	Node	C Value	L (ft)	Delta (ft)	Slope (%)	T_i (min)
O-1	A-B	0.90	85.00	7.00	8.24	1.67
PR-1A	H-I	0.68	42.00	9.75	23.21	1.72
PR-1B	L-M	0.50	100.00	14.00	14.00	4.48
PR-1C	N-O	0.50	100.00	14.50	14.50	4.43
PR-1D	Q-R	0.50	100.00	17.75	17.75	4.14
PR-1E	H-S	0.50	100.00	15.00	15.00	4.38
PR-1F	U-F	0.50	100.00	21.00	21.00	3.91
EX-2A	A-V	0.50	100.00	13.00	13.00	4.59

On-Site Channelized Flow $T_t = \frac{L}{60V}$

Basin	Node	Channel Description	Channel Length (ft)	Channel Slope (%)	Average Q (cfs)	Velocity (fps)	T_t (min)
O-1	B-G	Gutter Flow	532.00	7.90%	2.57	7.75	1.14
PR-1A	I-J	Gutter Flow	383.00	2.68%	1.05	3.82	1.67
	K-C	Pipe Flow	19.44	1.30%	0.75	4.04	0.08
PR-1B	M-D	Concentrated Flow	77.00	27.30%	0.43	5.06	0.25
PR-1C	O-P	Concentrated Flow	98.00	8.30%	0.21	3.10	0.53
	P-U	Pipe Flow	156.00	6.80%	0.38	5.48	0.47
PR-1D	R-E	Concentrated Flow	162.00	21.60%	0.34	4.53	0.60
PR-1E	S-T	Concentrated Flow	163.00	14.70%	0.15	3.28	0.83
	T-X	Pipe Flow	82.40	41.80%	1.11	14.79	0.09
EX-2A	V-W	Channel Flow	1084.00	11.99%	5.44	12.49	1.45

Total Time of Concentration

Basin	T_i (min)	T_t (min)	Tc (min)
O-1	1.67	1.14	5.00
PR-1A	1.72	1.75	5.00
PR-1B	4.48	0.25	5.00
PR-1C	4.43	0.53	5.00
PR-1D	4.14	0.60	5.00
PR-1E	4.38	0.92	5.30
PR-1F	3.91	0.00	5.00
EX-2A	4.59	1.45	6.04

100 YEAR - 6 HOUR Storm

Use Figure A-1: Intensity Duration-Frequency Chart

Basin	C Value	T_c (mins)	Intensity ($^{in}/_{hr}$)	Area (acres)	Runoff (Q, cfs)	Mitigated Runoff (Q, cfs)	
O-1	0.90	5.00	4.40	0.16	0.62		
PR-1A	0.68	5.00	4.40	0.70	2.10	1.49	Flow to be captured and treated
PR-1B	0.50	5.00	4.40	0.39	0.86		Runoff to existing gutter
PR-1C	0.50	5.00	4.40	0.19	0.42		Runoff to existing gutter
PR-1D	0.50	5.00	4.40	0.35	0.76		
PR-1E	0.50	5.30	4.25	0.32	0.69		
PR-1F	0.50	5.00	4.40	0.14	0.30		
EX-2A	0.50	6.04	4.20	5.18	10.89		Runoff to existing channel

BASIN SUMMARY

Runoff to Presidio Drive (POC A) = 5.14 cfs
Runoff to Palm Canyon (POC B) = 10.89 cfs

Pond Report

Pond No. 1 - Biofiltration Basin

First pond report produced to find at what stage (elevation) the Water Quality Control DCV requirement has been achieved

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	156.75	n/a	0	0
1.25	158.00	n/a	481	481
3.25	160.00	n/a	385	866
4.75	162.00	n/a	1,443	2,309

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	8.00	0.00	0.00
Span (in)	= 18.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 156.75	157.00	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 1.00	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 161.15	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	156.75	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.13	48	156.88	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.25	96	157.00	0.00	0.00	---	---	0.00	---	---	---	---	---	0.000
0.38	144	157.13	0.06 ic	0.06 ic	---	---	0.00	---	---	---	---	---	0.057
0.50	192	157.25	0.22 ic	0.20 ic	---	---	0.00	---	---	---	---	---	0.204
0.63	241	157.38	0.42 ic	0.42 ic	---	---	0.00	---	---	---	---	---	0.422
0.75	289	157.50	0.68 ic	0.68 ic	---	---	0.00	---	---	---	---	---	0.680
0.88	337	157.63	0.92 ic	0.92 ic	---	---	0.00	---	---	---	---	---	0.915
1.00	385	157.75	1.08 ic					---	---	---	---	---	1.085
1.13	433	157.88	1.27 ic					---	---	---	---	---	1.237
1.25	481	158.00	1.40 ic					---	---	---	---	---	1.372
1.45	520	158.20	1.62 ic					---	---	---	---	---	1.564
1.65	558	158.40	1.77 ic	1.74 ic	---	---	0.00	---	---	---	---	---	1.736
1.85	597	158.60	1.93 ic	1.89 ic	---	---	0.00	---	---	---	---	---	1.891
2.05	635	158.80	2.04 ic	2.04 ic	---	---	0.00	---	---	---	---	---	2.035
2.25	674	159.00	2.19 ic	2.17 ic	---	---	0.00	---	---	---	---	---	2.170
2.45	712	159.20	2.30 ic	2.30 ic	---	---	0.00	---	---	---	---	---	2.296
2.65	751	159.40	2.46 ic	2.42 ic	---	---	0.00	---	---	---	---	---	2.416
2.85	789	159.60	2.56 ic	2.53 ic	---	---	0.00	---	---	---	---	---	2.530
3.05	828	159.80	2.66 ic	2.64 ic	---	---	0.00	---	---	---	---	---	2.639
3.25	866	160.00	2.75 ic	2.74 ic	---	---	0.00	---	---	---	---	---	2.744
3.40	1,010	160.15	2.86 ic	2.82 ic	---	---	0.00	---	---	---	---	---	2.819
3.55	1,155	160.30	2.96 ic	2.89 ic	---	---	0.00	---	---	---	---	---	2.887
3.70	1,299	160.45	2.96 ic	2.96 ic	---	---	0.00	---	---	---	---	---	2.959
3.85	1,443	160.60	3.63 ic	2.99 ic	---	---	0.63	---	---	---	---	---	3.626
4.00	1,588	160.75	5.56 ic	2.98 ic	---	---	2.50	---	---	---	---	---	5.477
4.15	1,732	160.90	8.00 ic	2.95 ic	---	---	5.05	---	---	---	---	---	8.002
4.30	1,876	161.05	11.04 ic	2.89 ic	---	---	8.15	---	---	---	---	---	11.04
4.45	2,020	161.20	12.19 oc	1.19 ic	---	---	11.00 s	---	---	---	---	---	12.19
4.60	2,165	161.35	13.00 oc	0.95 ic	---	---	12.05 s	---	---	---	---	---	13.00
4.75	2,309	162.00	14.92 oc	0.50 ic	---	---	14.41 s	---	---	---	---	---	14.91

Water Quality Control DCV: 1124 CF
Achieved at stage 3.52
Water Quality Control Elevation: 160.27

Note that the Water Quality Control DCV has been obtained from Worksheet B5.1 of the SWQMP report

1 Watershed Model Schematic

Legend

Hyd.	Origin	Description
1	Manual	PR-1A
2	Reservoir	PR-1A Mitigated

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	Manual	------	-------	0.000	-------	-------	0.000	-------	-------	2.100	PR-1A
2	Reservoir	1	-------	0.000	-------	-------	0.000	-------	-------	1.492	PR-1A Mitigated

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2025

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	2.100	5	240	4,500	------	------	------	PR-1A
2	Reservoir	1.492	5	245	4,498	1	161.16	857	PR-1A Mitigated

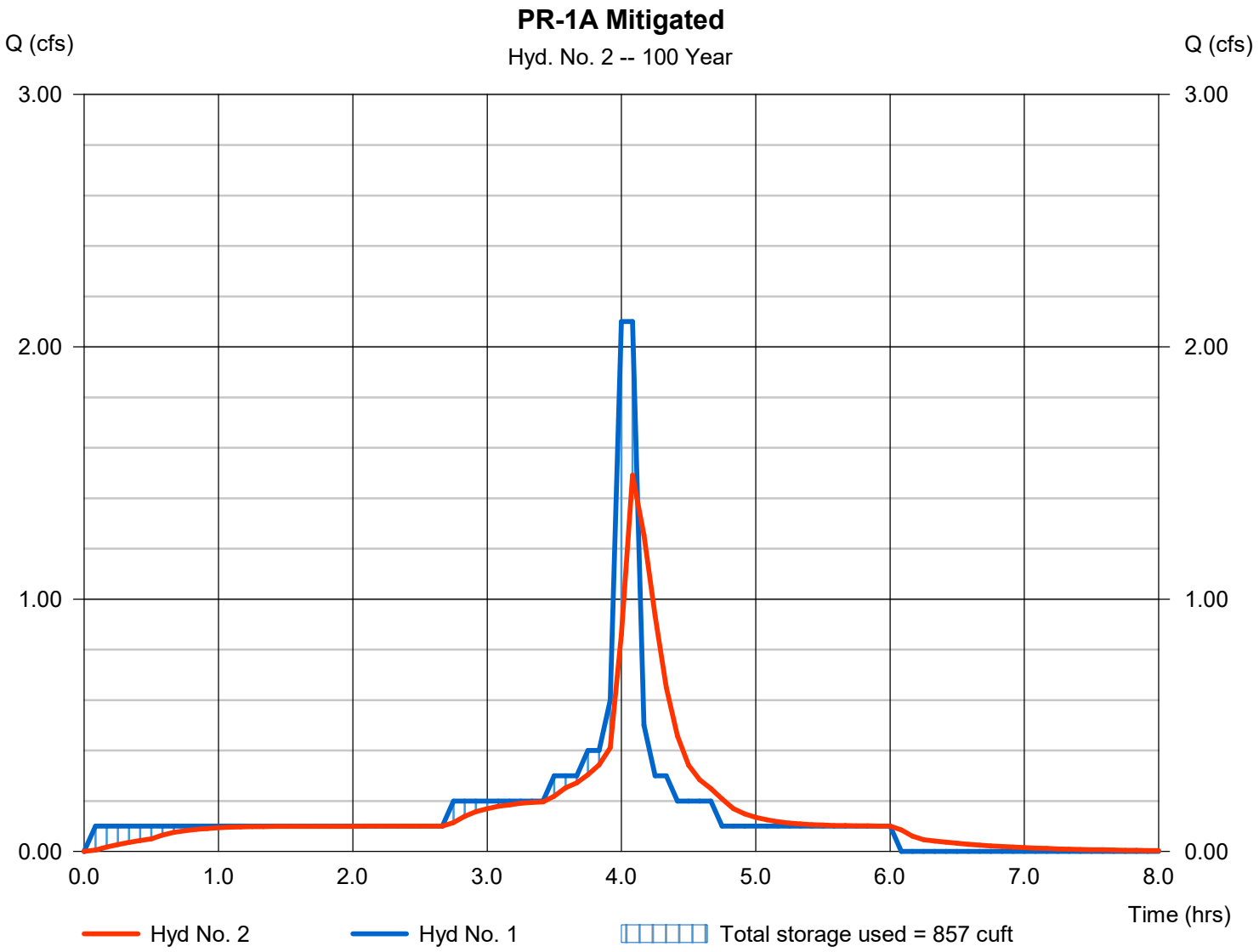
Hydrograph Report

Hyd. No. 2

PR-1A Mitigated

Hydrograph type	=	Reservoir	Peak discharge	=	1.492 cfs
Storm frequency	=	100 yrs	Time to peak	=	4.08 hrs
Time interval	=	5 min	Hyd. volume	=	4,498 cuft
Inflow hyd. No.	=	1 - PR-1A	Max. Elevation	=	161.16 ft
Reservoir name	=	Biofiltration Basin	Max. Storage	=	857 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - Biofiltration Basin

To model only flood control, the stage where water quality control is achieved (stage 3.52), will be set to stage 0

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	160.27	n/a	0	0
1.23	161.50	n/a	1,183	1,183

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	8.00	0.00	0.00
Span (in)	= 18.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 160.27	160.27	0.00	0.00
Length (ft)	= 100.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 1.00	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

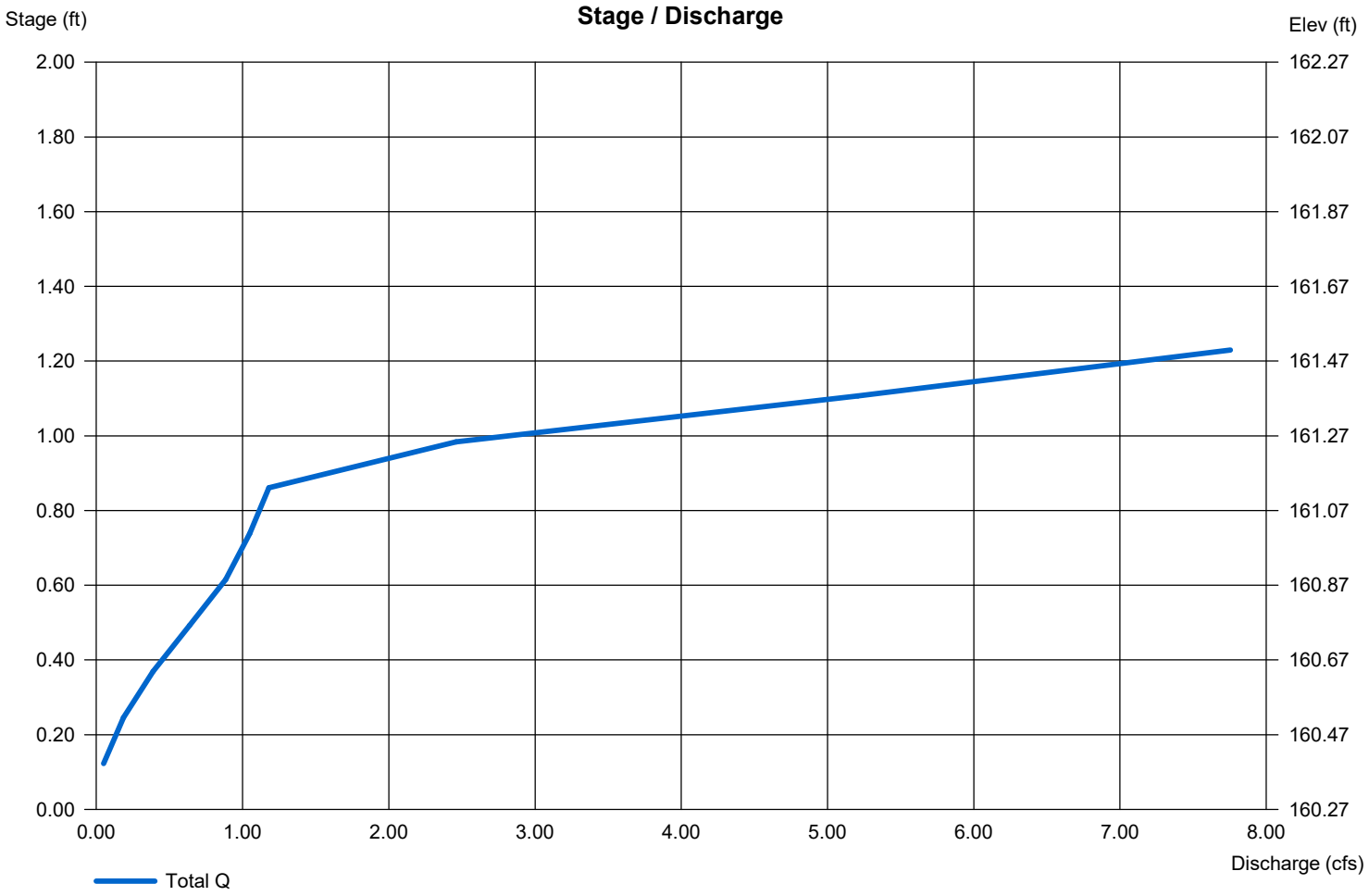
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 161.15	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 20 2025

PROPOSED GUTTER(PR-1A)

Gutter

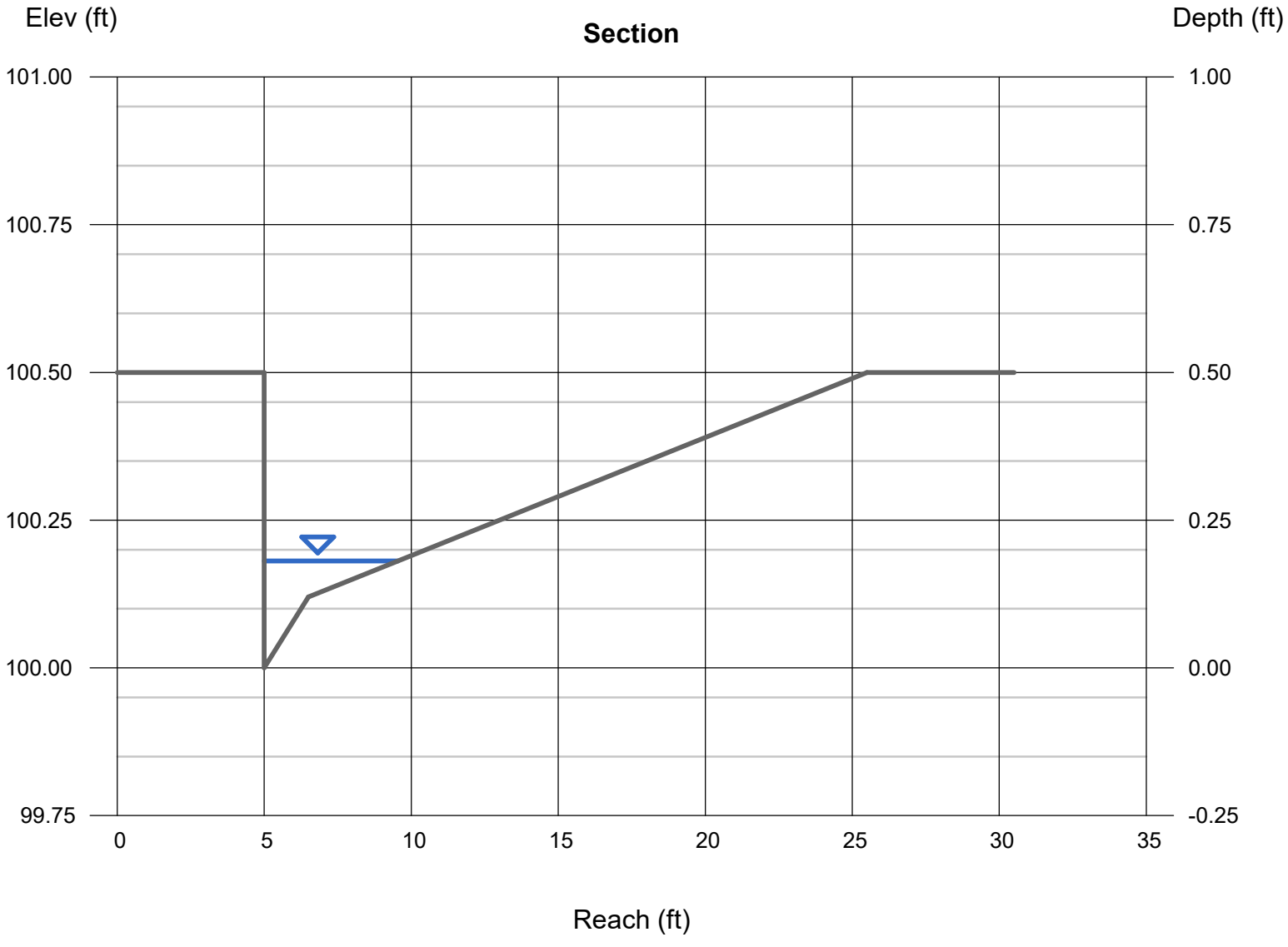
Cross Sl, Sx (ft/ft)	= 0.020
Cross Sl, Sw (ft/ft)	= 0.080
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 2.68
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.05

Highlighted

Depth (ft)	= 0.18
Q (cfs)	= 1.050
Area (sqft)	= 0.27
Velocity (ft/s)	= 3.82
Wetted Perim (ft)	= 4.74
Crit Depth, Yc (ft)	= 0.25
Spread Width (ft)	= 4.55
EGL (ft)	= 0.41



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 20 2025

EXISTING COBBLE CHANNEL(EX-2A)

Triangular

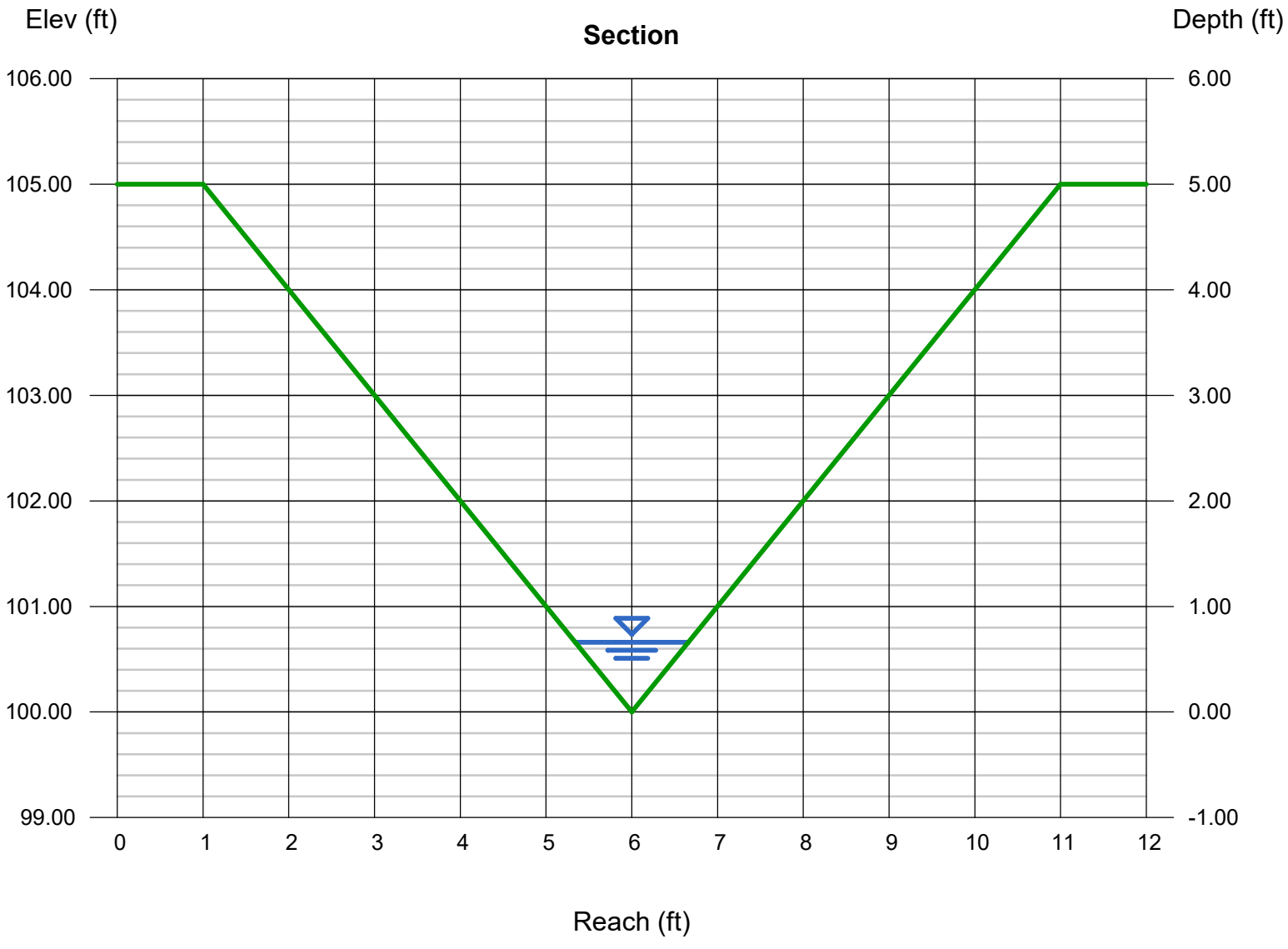
Side Slopes (z:1)	= 1.00, 1.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 100.00
Slope (%)	= 11.99
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.44

Highlighted

Depth (ft)	= 0.66
Q (cfs)	= 5.440
Area (sqft)	= 0.44
Velocity (ft/s)	= 12.49
Wetted Perim (ft)	= 1.87
Crit Depth, Yc (ft)	= 1.13
Top Width (ft)	= 1.32
EGL (ft)	= 3.08



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Nov 21 2025

EXISTING COBBLE SWALE(O-1)

Gutter

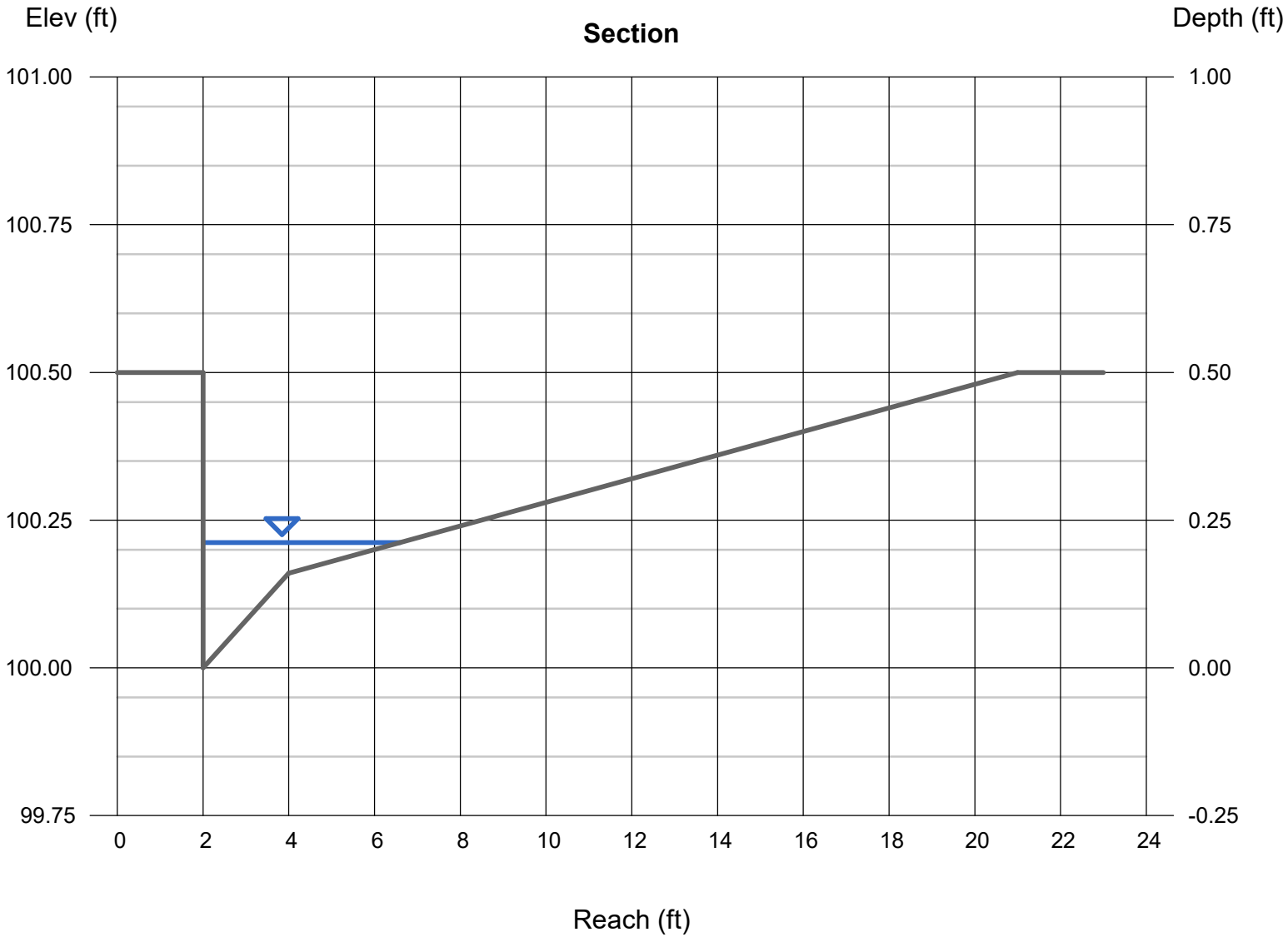
Cross Sl, Sx (ft/ft)	= 0.020
Cross Sl, Sw (ft/ft)	= 0.080
Gutter Width (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 7.90
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.57

Highlighted

Depth (ft)	= 0.21
Q (cfs)	= 2.570
Area (sqft)	= 0.33
Velocity (ft/s)	= 7.75
Wetted Perim (ft)	= 4.82
Crit Depth, Yc (ft)	= 0.34
Spread Width (ft)	= 4.60
EGL (ft)	= 1.15



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Nov 20 2025

PROPOSED 12 INCH STORM DRAIN (PR-1E)

Circular

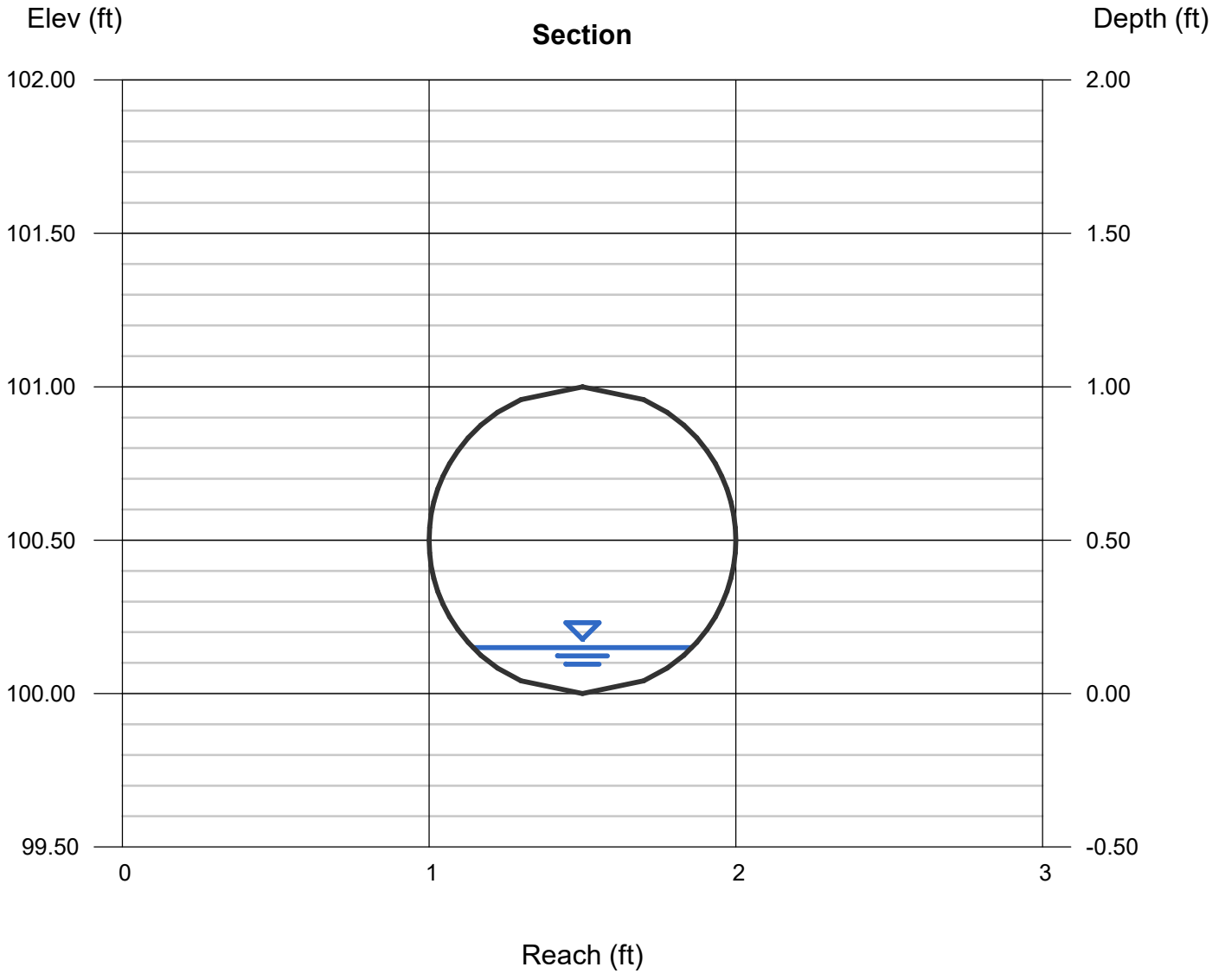
Diameter (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 41.80
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.11

Highlighted

Depth (ft)	= 0.15
Q (cfs)	= 1.110
Area (sqft)	= 0.08
Velocity (ft/s)	= 14.79
Wetted Perim (ft)	= 0.80
Crit Depth, Yc (ft)	= 0.45
Top Width (ft)	= 0.72
EGL (ft)	= 3.55



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Nov 21 2025

18 INCH STORM DRAIN(PR-1A)

Circular

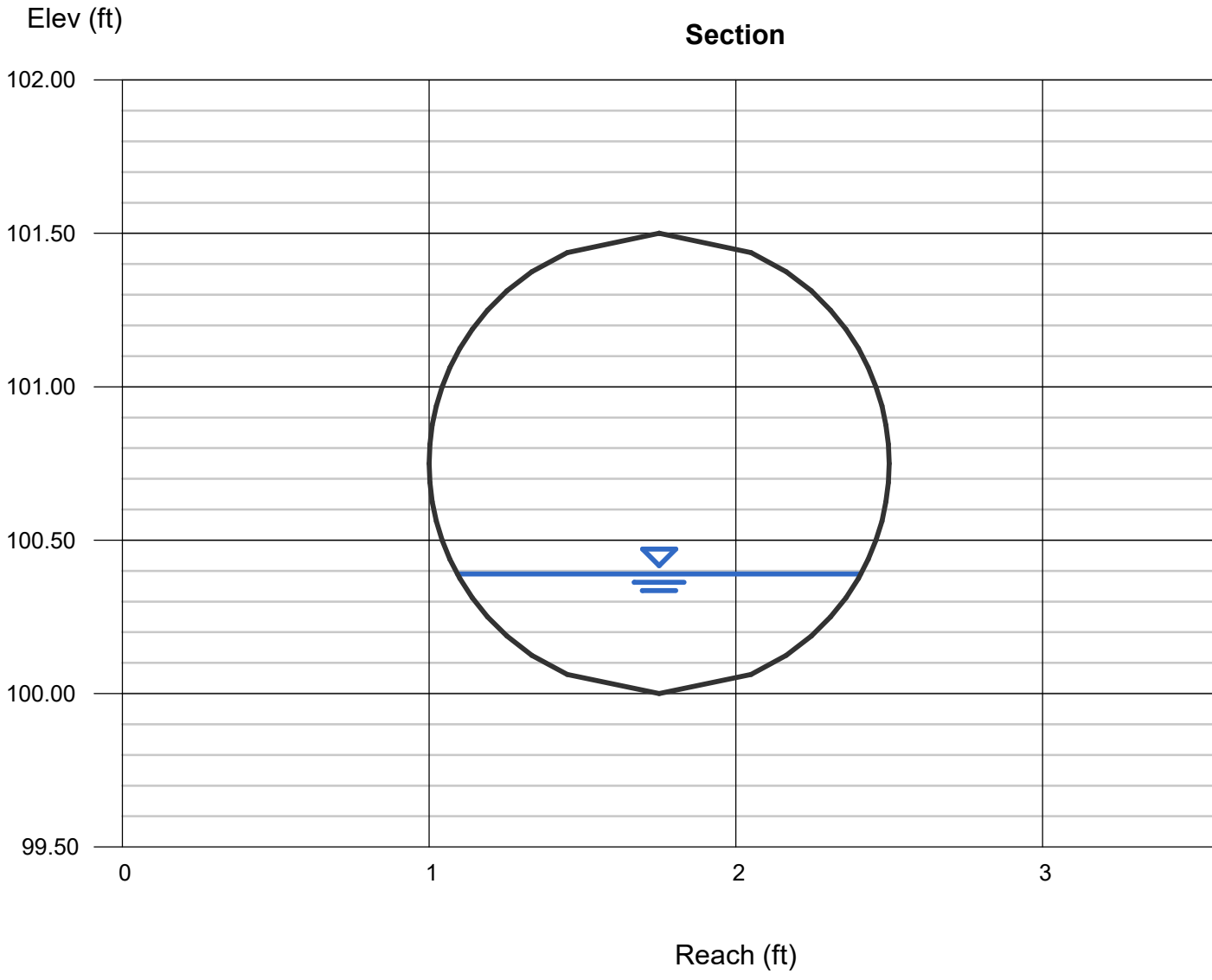
Diameter (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.49

Highlighted

Depth (ft)	= 0.39
Q (cfs)	= 1.490
Area (sqft)	= 0.37
Velocity (ft/s)	= 4.03
Wetted Perim (ft)	= 1.61
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 1.32
EGL (ft)	= 0.64



O-1

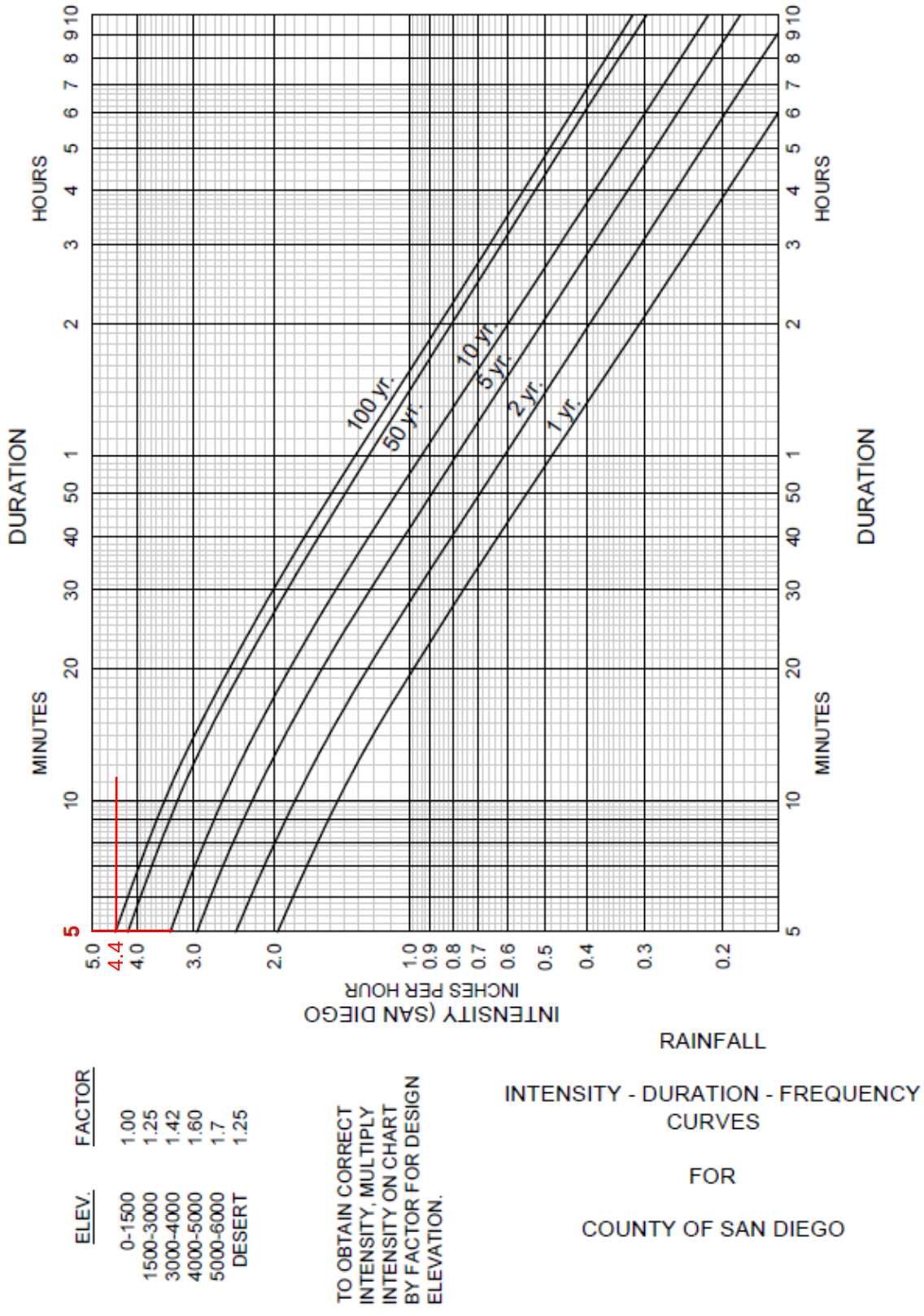


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1A

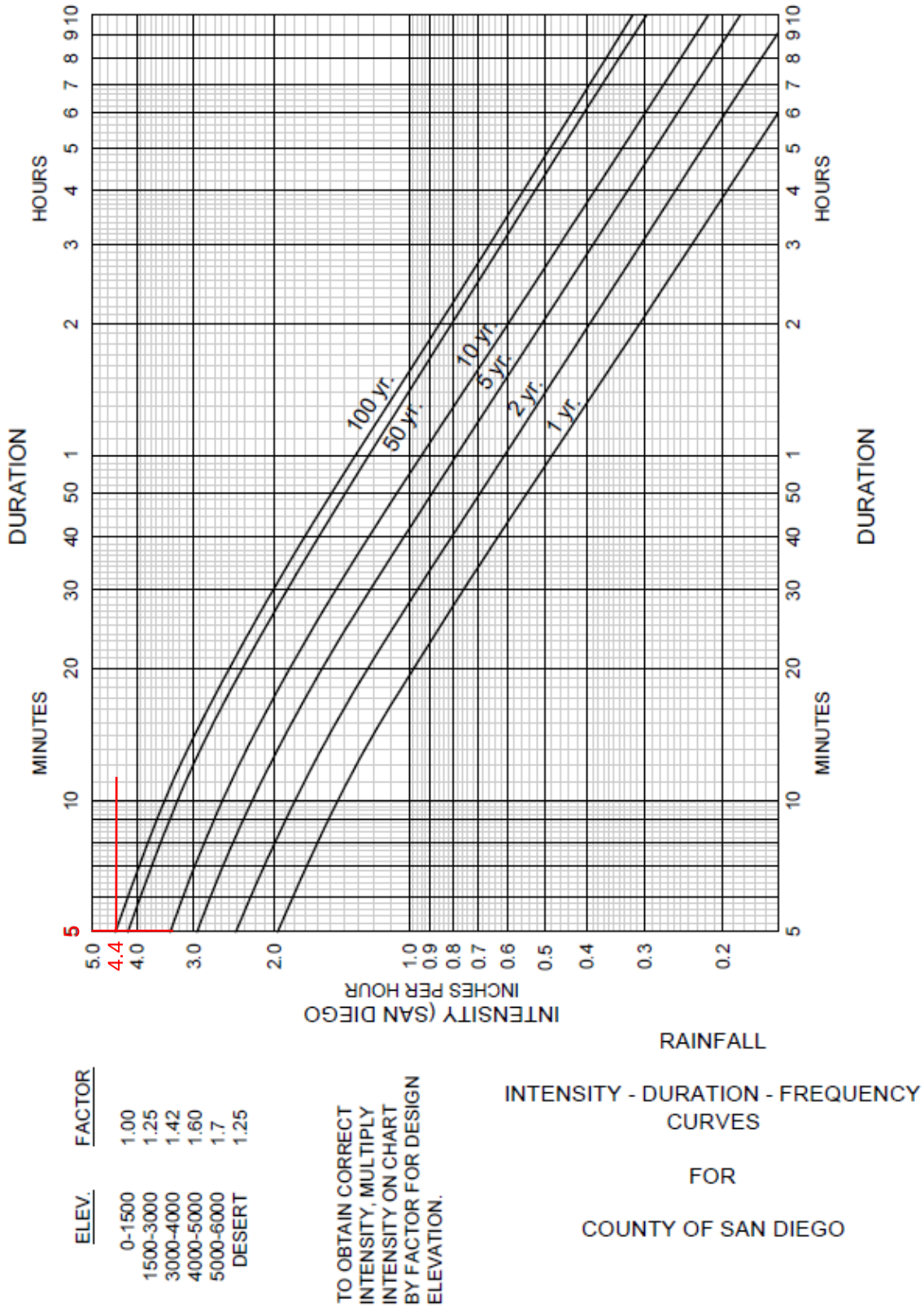


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1B

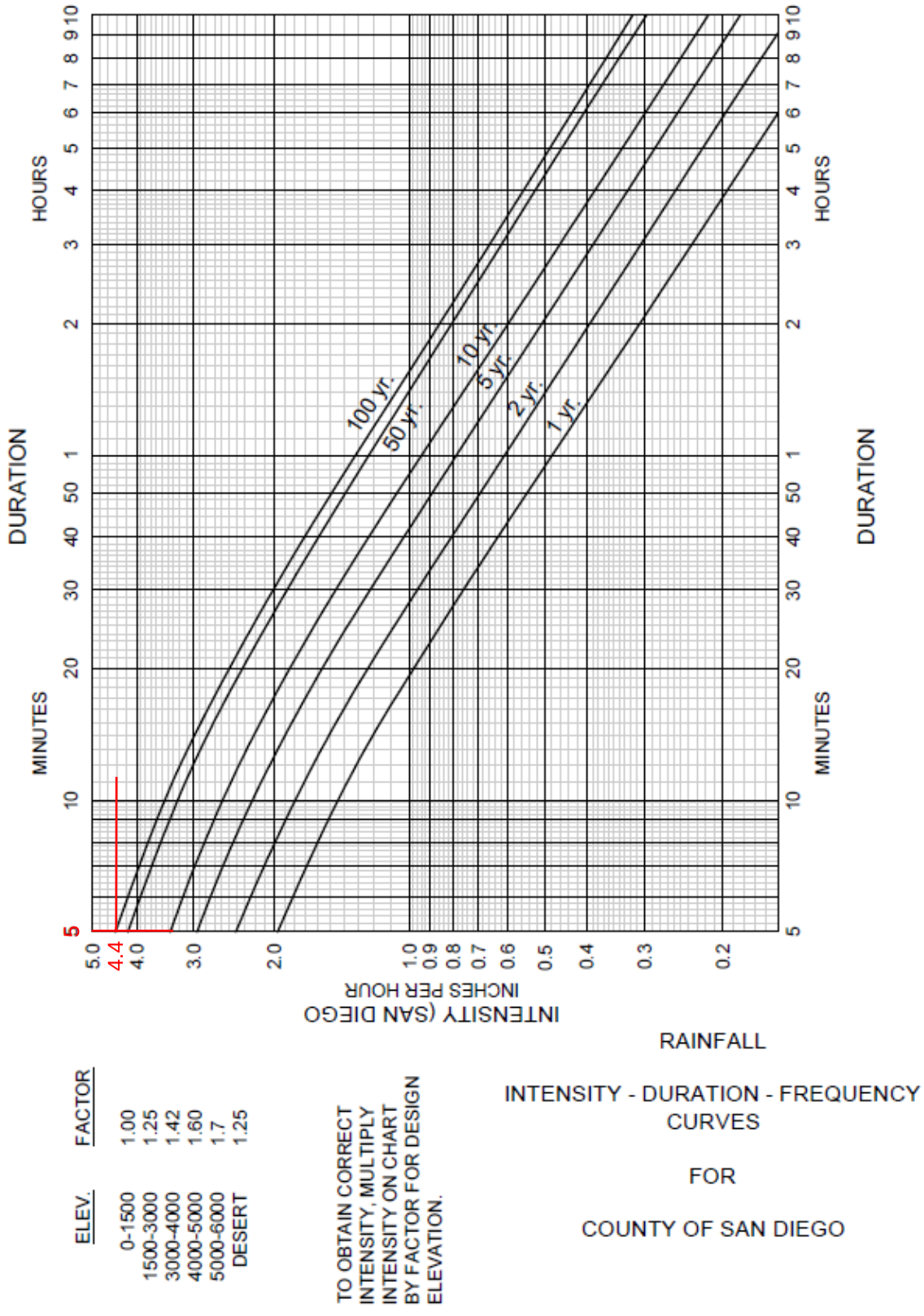


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1C

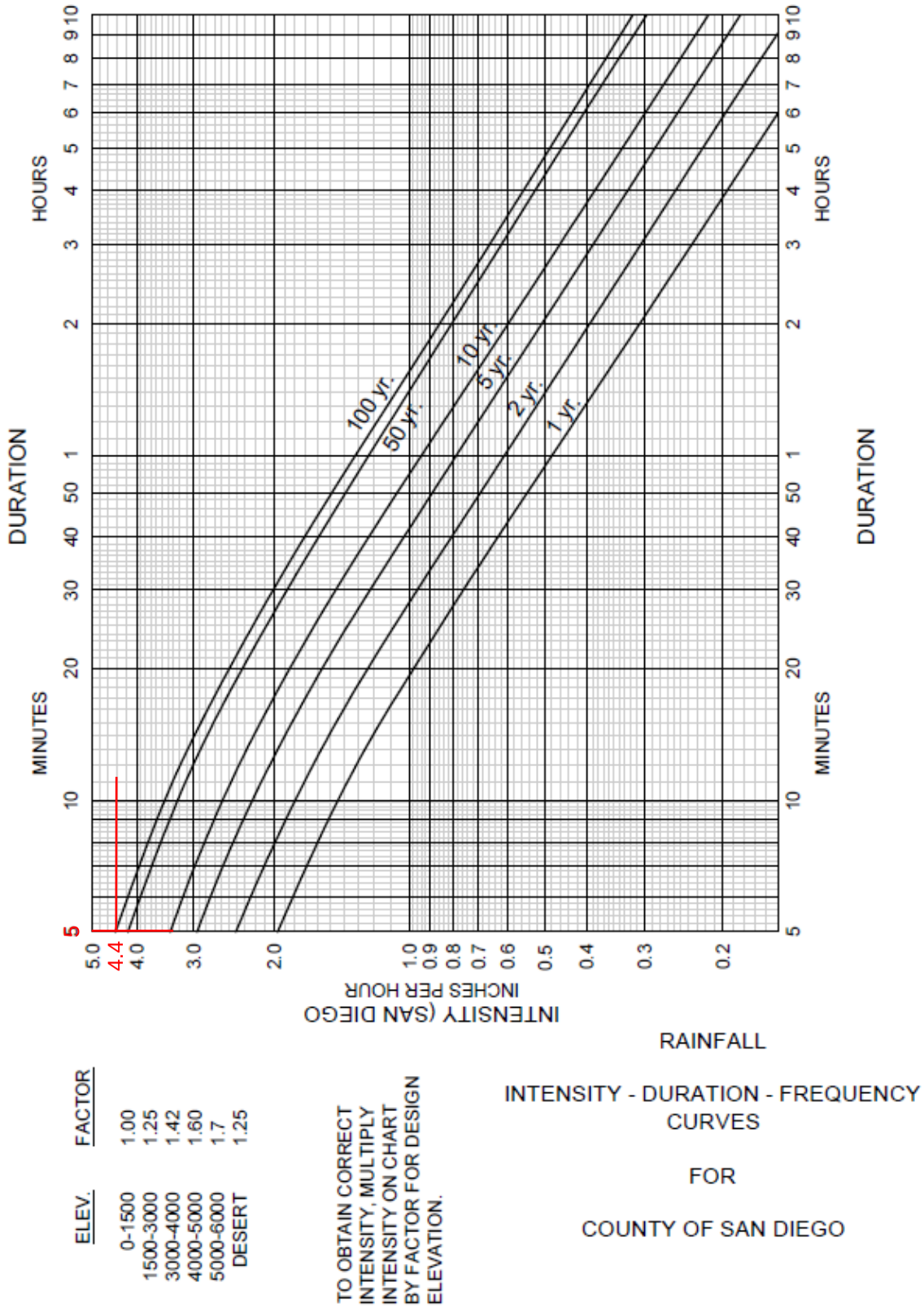


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1D

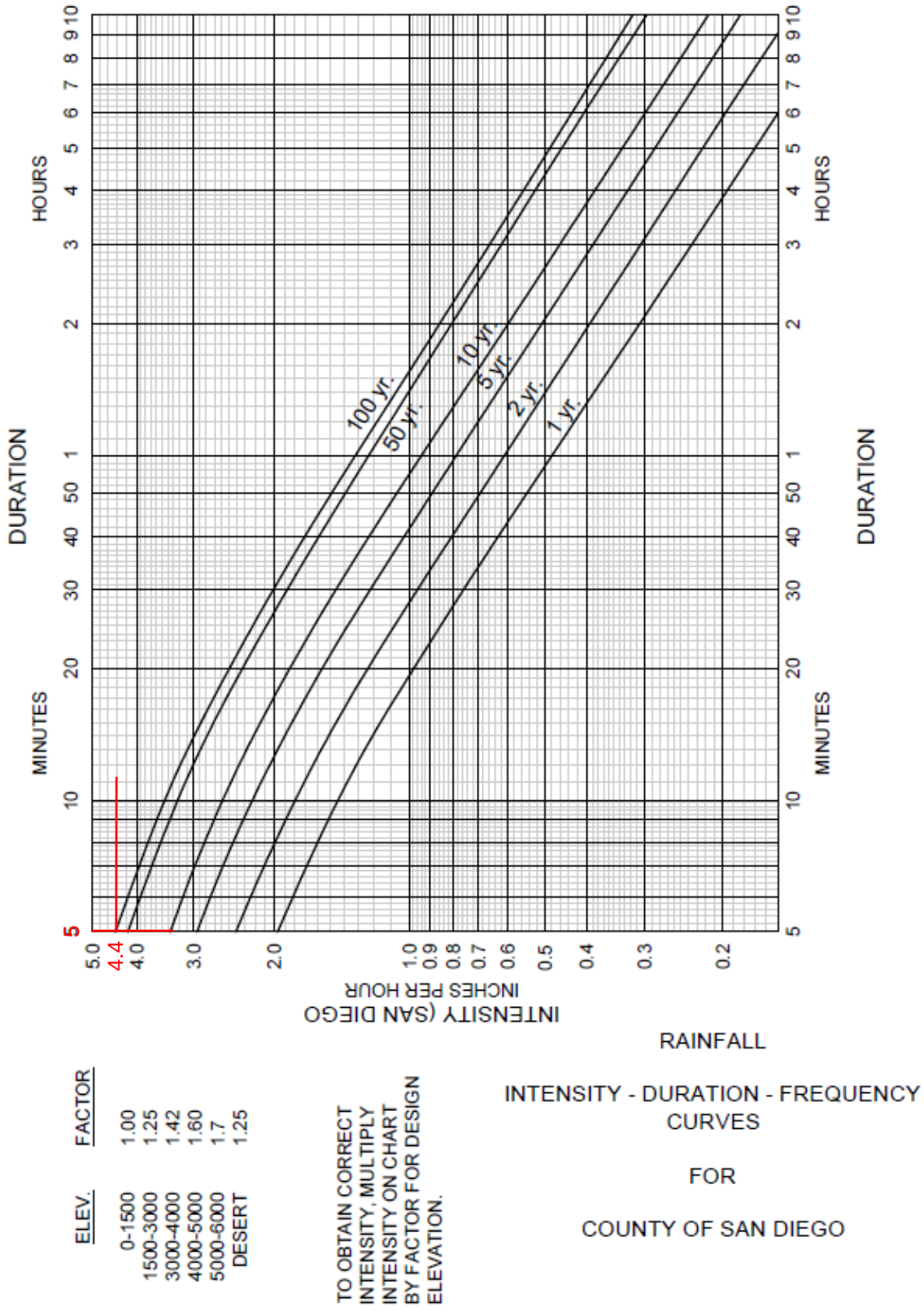


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1E

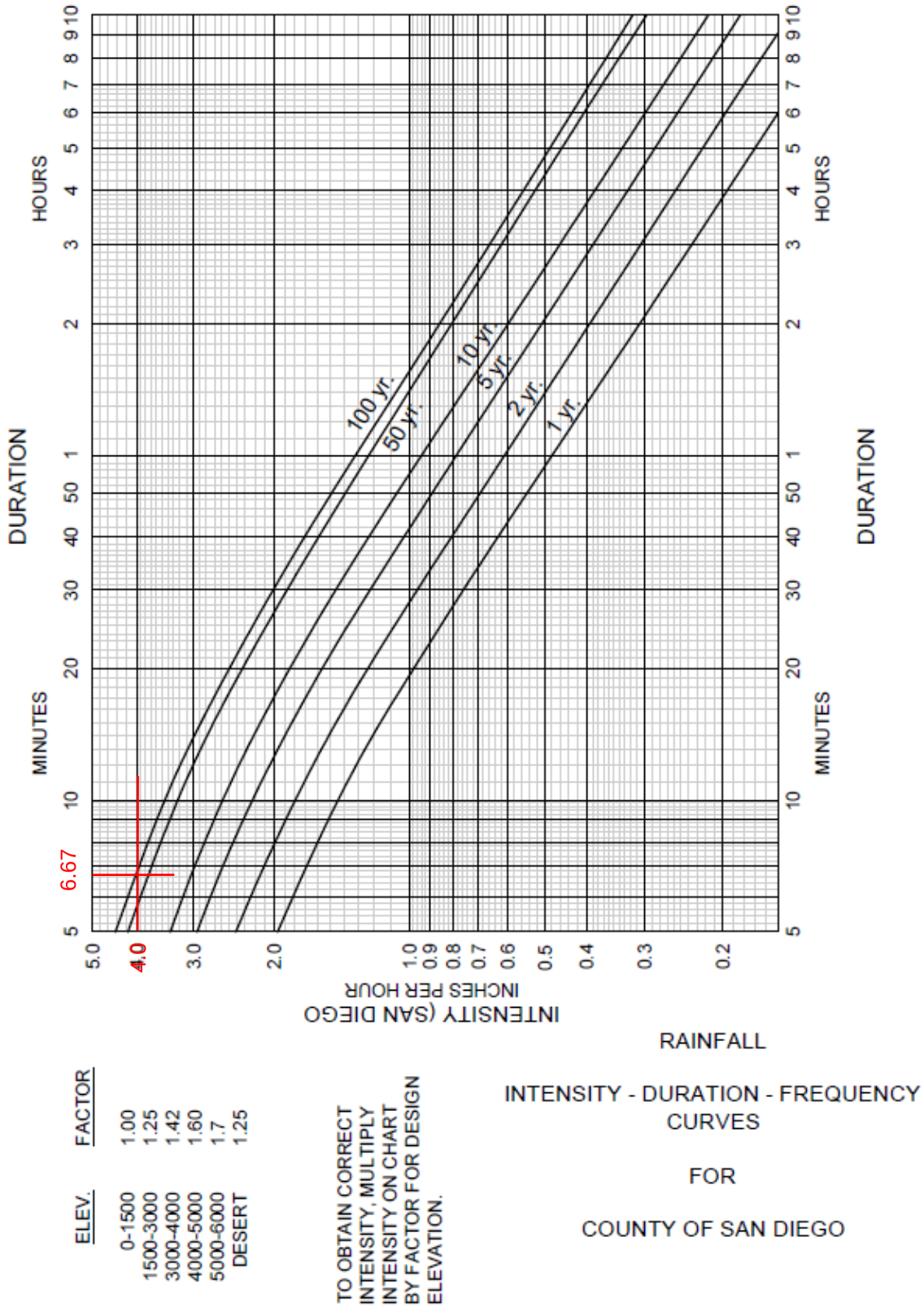


Figure A-1. Intensity-Duration-Frequency Design Chart

PR-1F

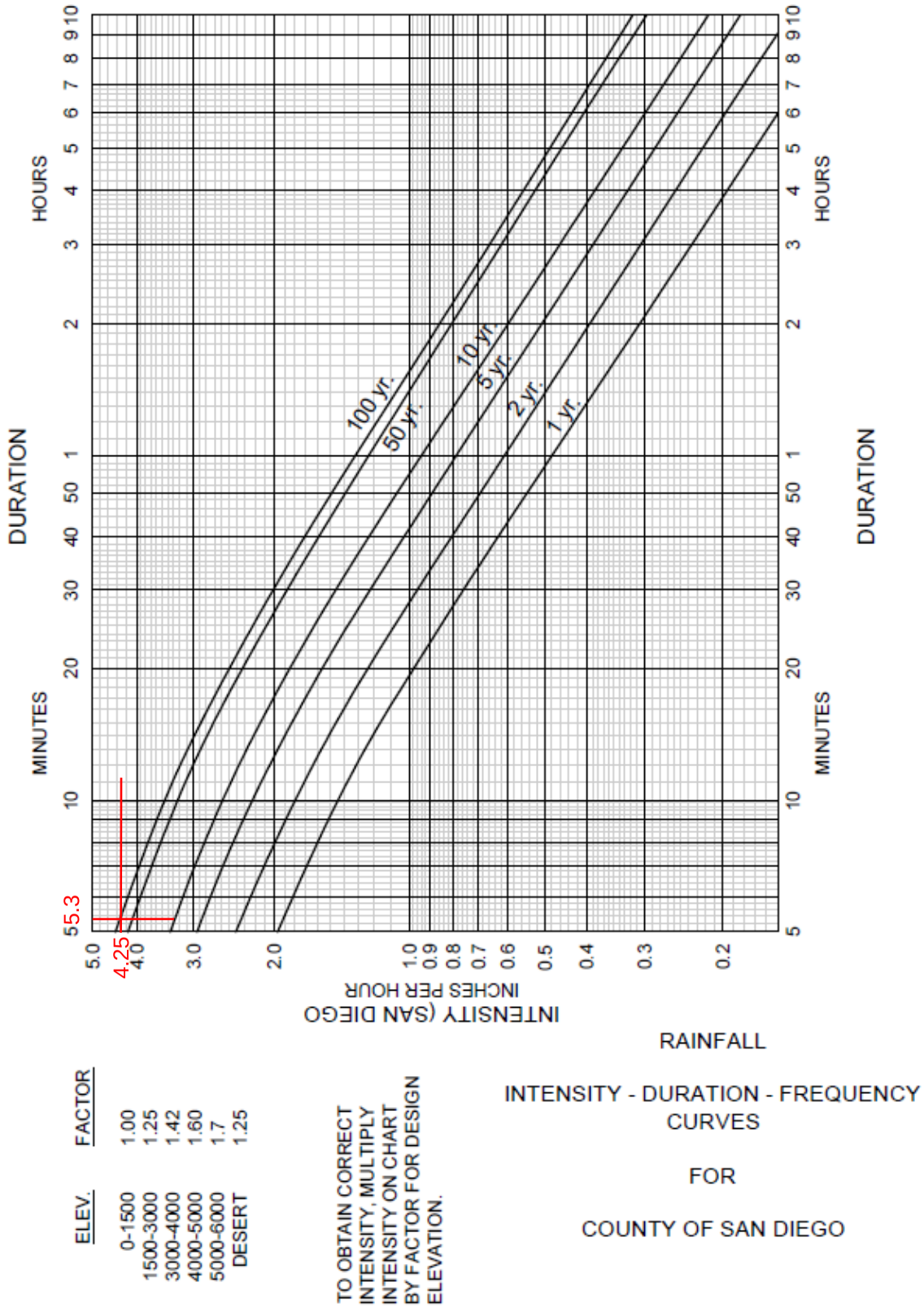


Figure A-1. Intensity-Duration-Frequency Design Chart

EX-2A

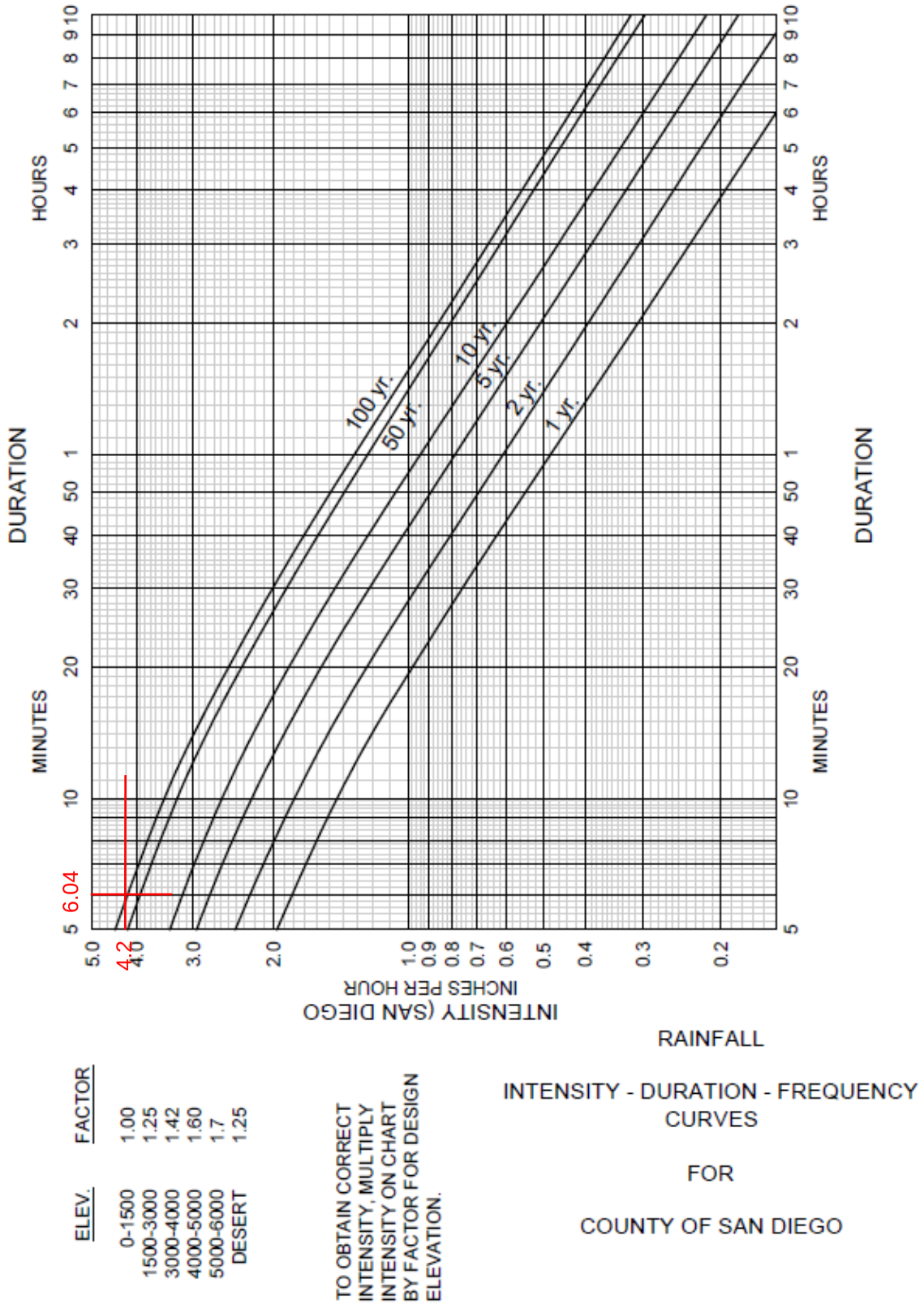


Figure A-1. Intensity-Duration-Frequency Design Chart

Appendix C – Reference Documents

Intensity Duration Frequency Design Chart, Time of Concentration, Runoff Coefficient

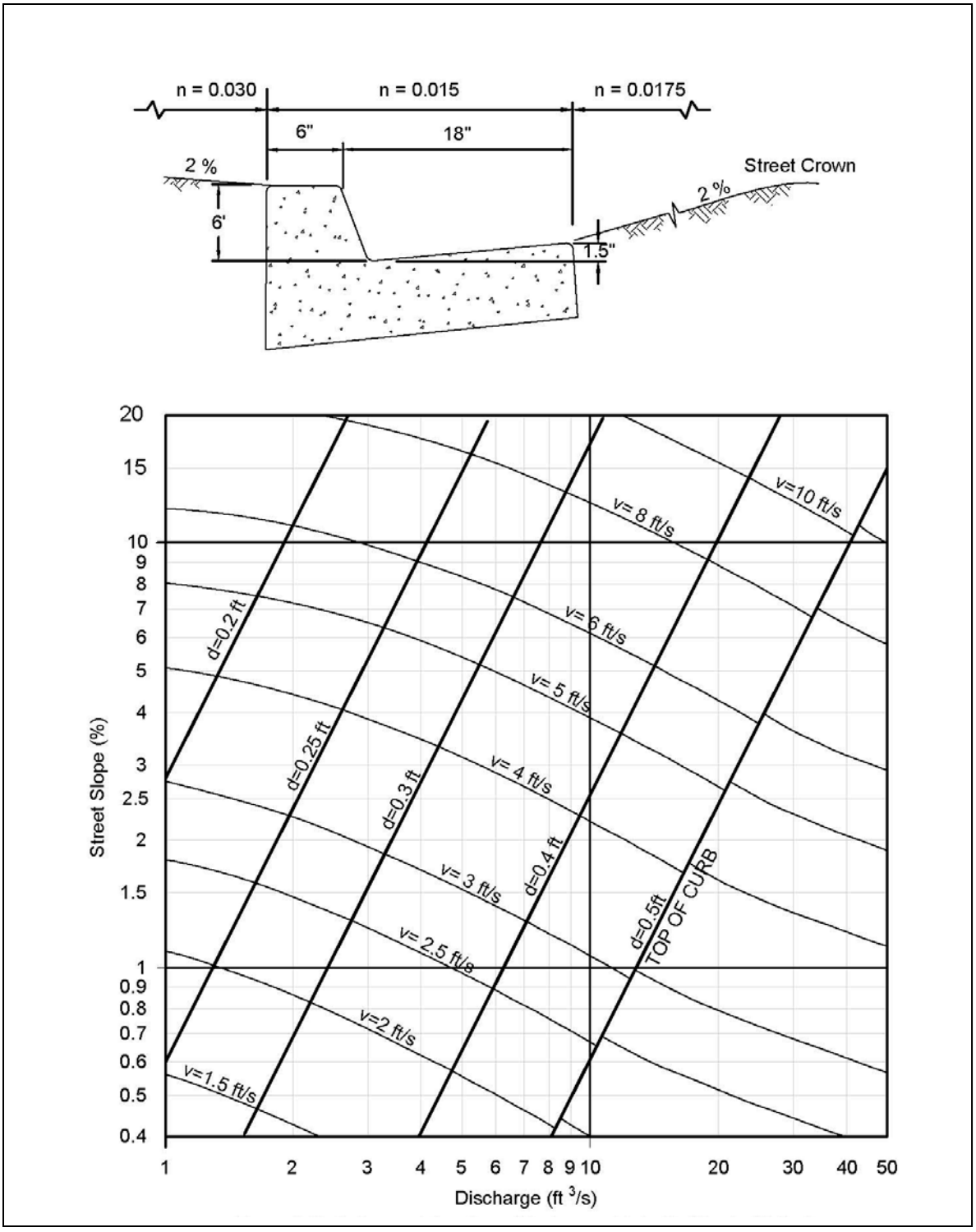


Figure 3-2: Gutter and Roadway Discharge-Velocity Chart (6" Curb)

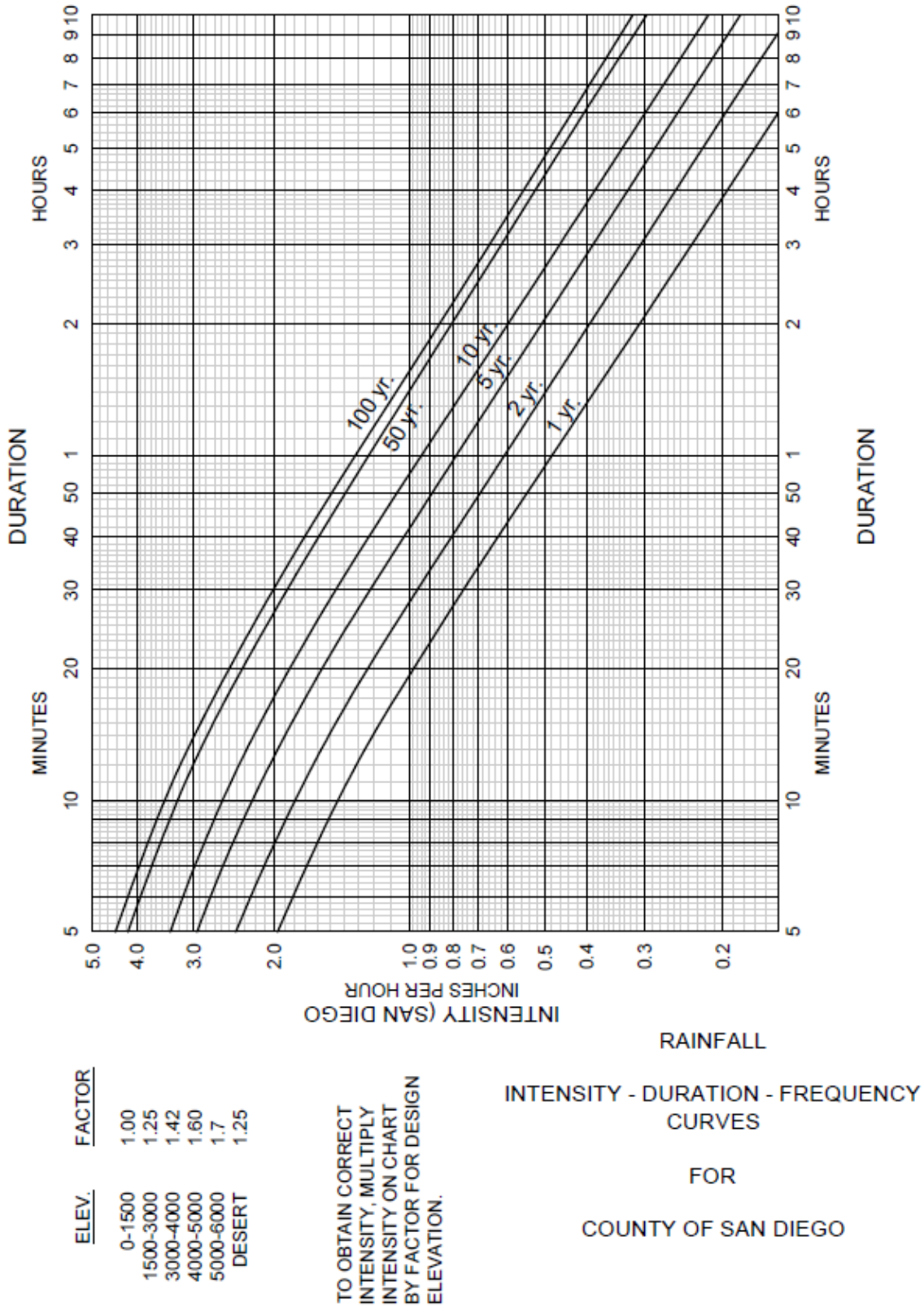


Figure A-1. Intensity-Duration-Frequency Design Chart

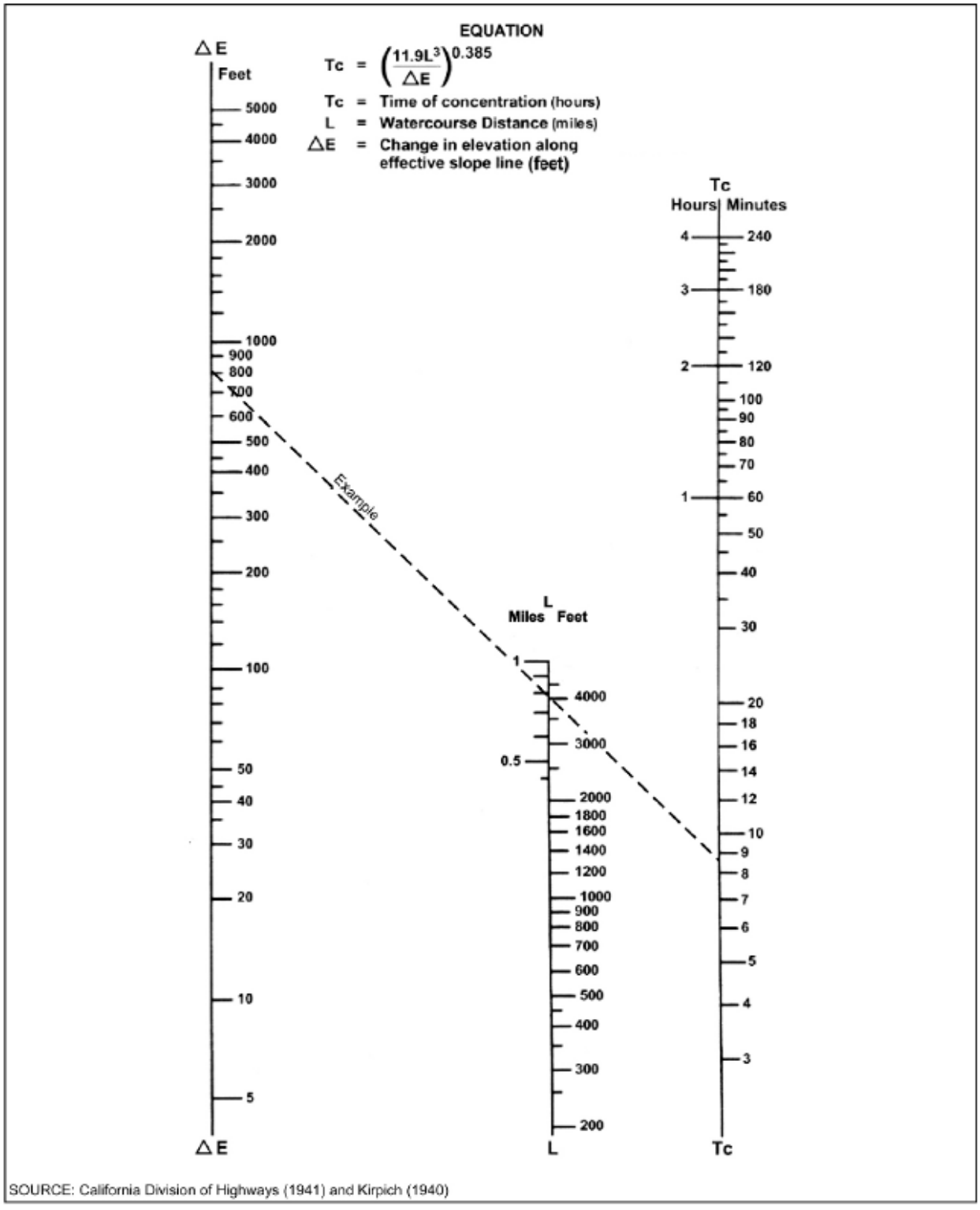


Figure A-2. Nomograph for Determination of T_c for Natural Watersheds

Note: Add ten minutes to the computed time of concentration from Figure A-2.

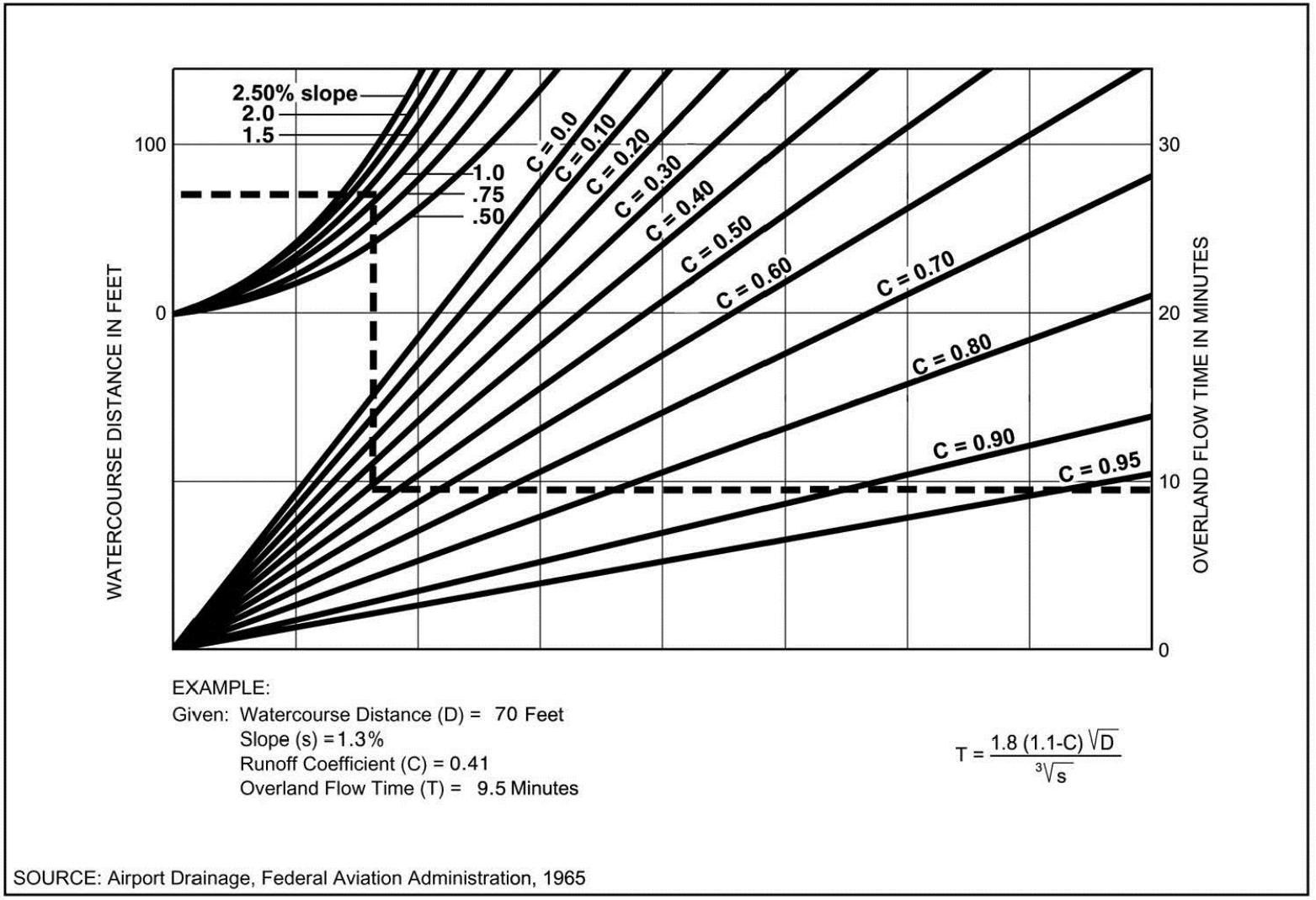
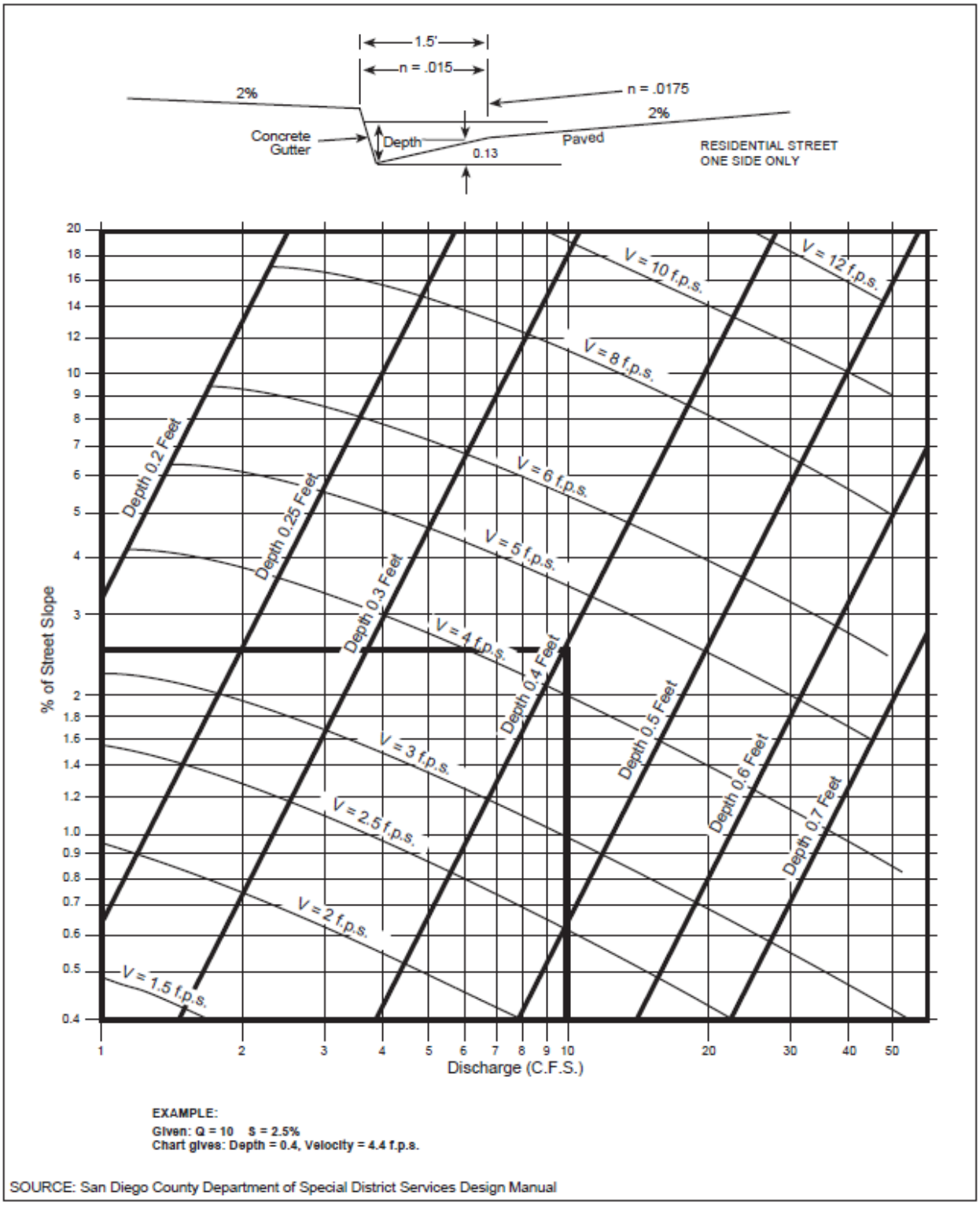


Figure A-4. Rational Formula – Overland Time of Flow Nomograph

Note: Use formula for watercourse distances in excess of 100 feet.



SOURCE: San Diego County Department of Special District Services Design Manual

Figure A-5. Gutter and Roadway Discharge – Velocity Chart

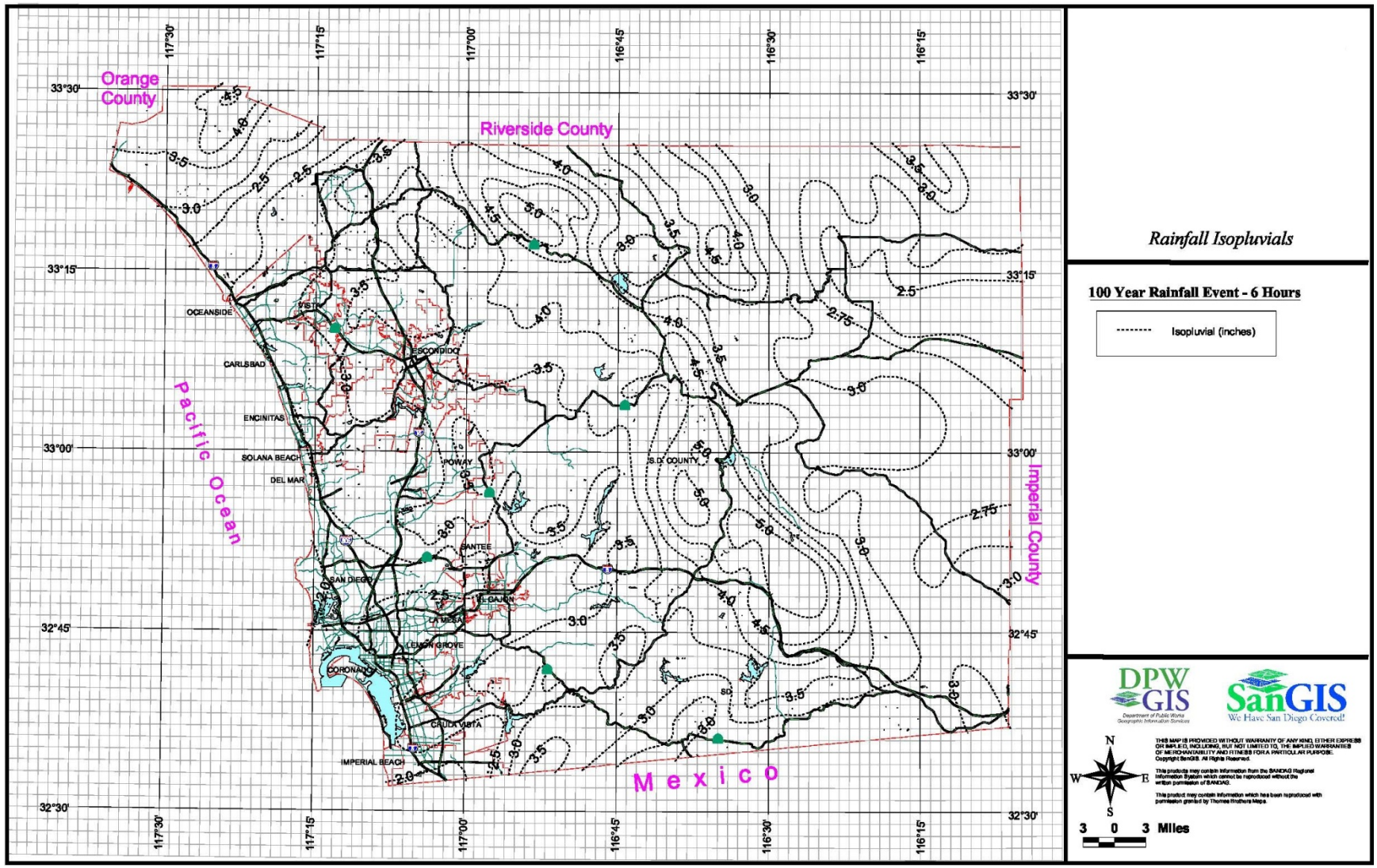


Figure B-2. 100-Year 6-Hour Isopluvials.

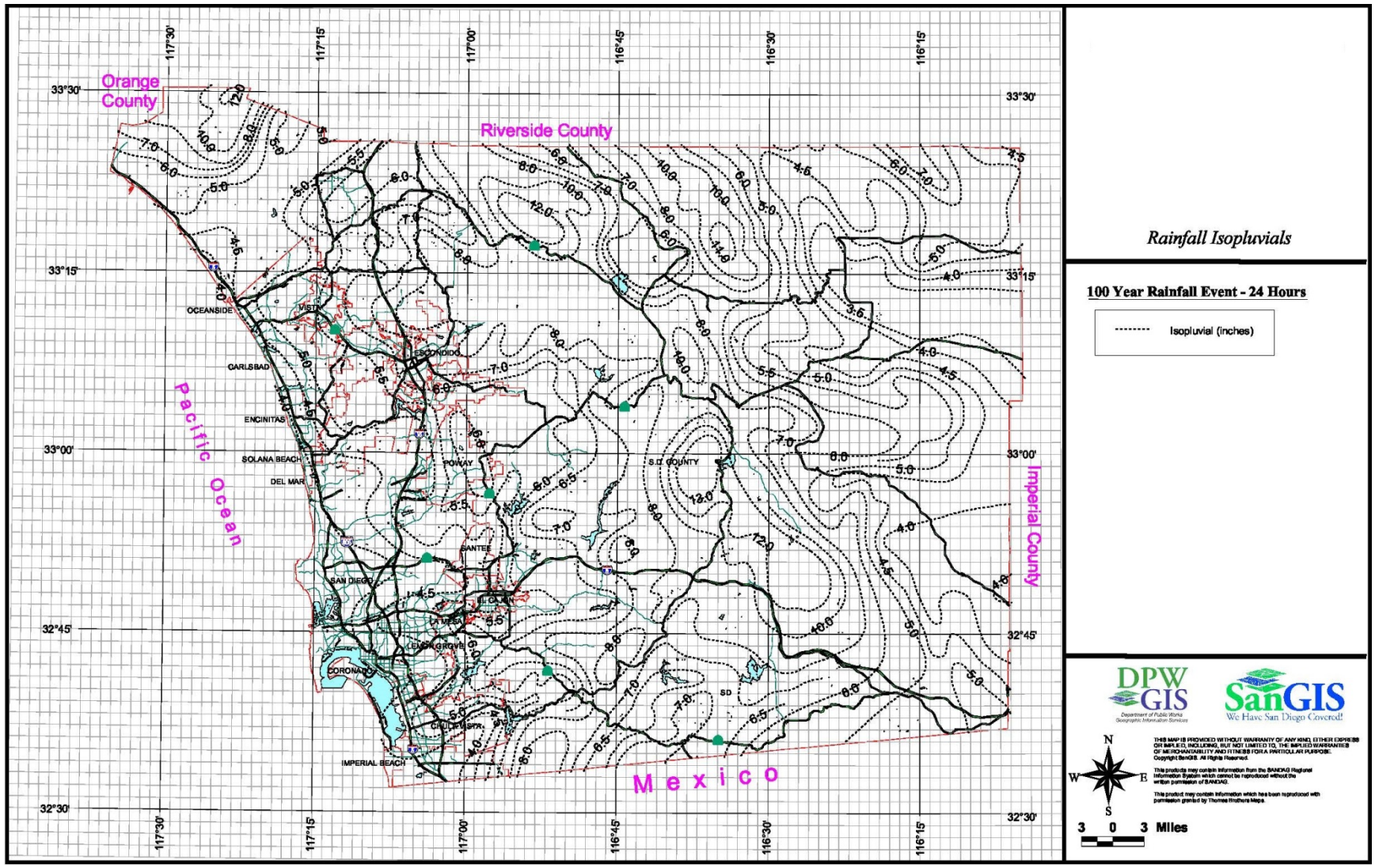


Figure B-3. 100-Year 24-Hour Isopluvials