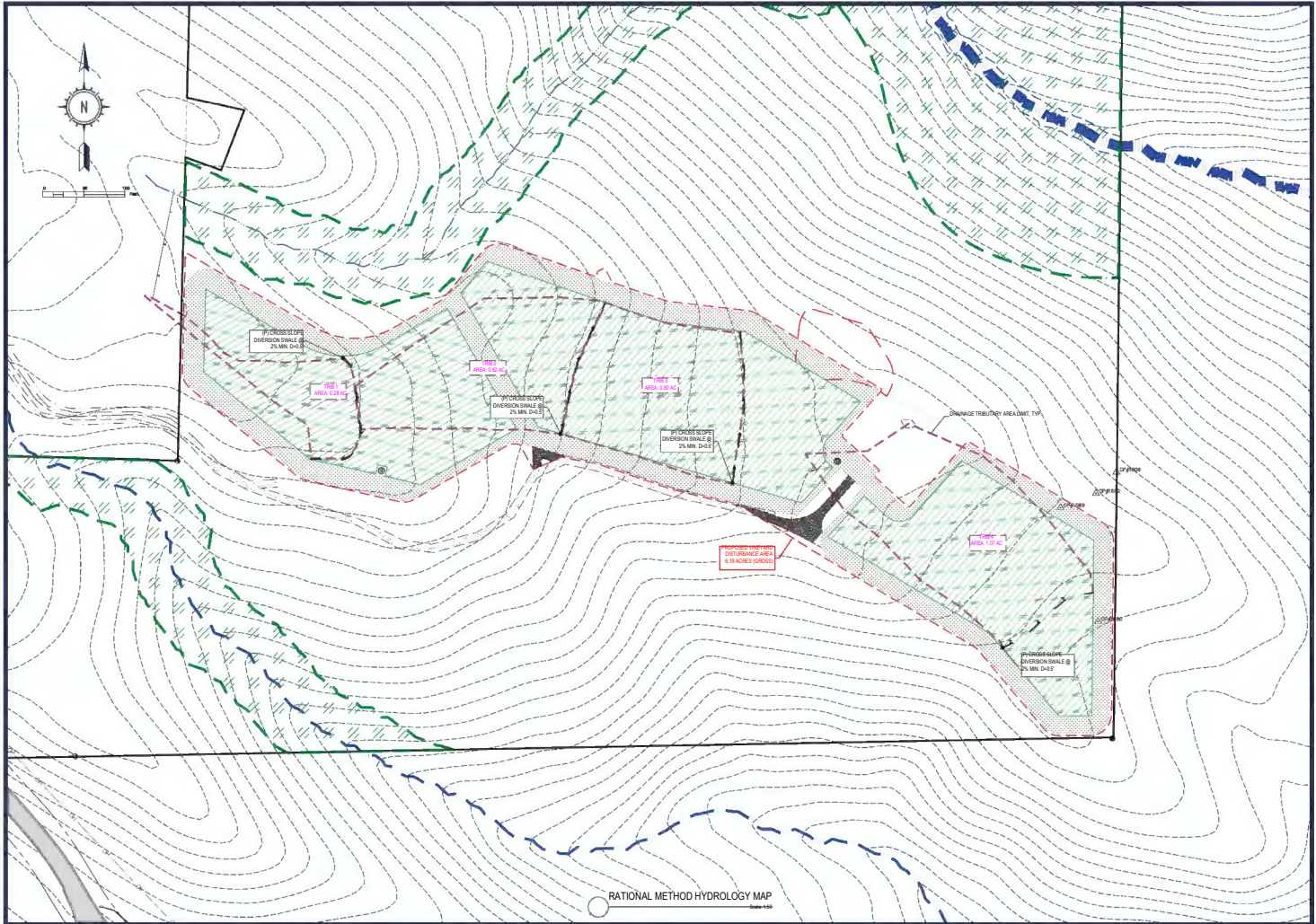




T R U N O R T H

I. Incremental Rational Method Swale Calculations



VINEYARD ECP

OWNER INFORMATION

LANDS OF MISTY
MOUNTAIN
PROPERTIES LLC

SITE INFORMATION

SPRING MOUNTAIN RD.
ST. HELENA, CA
APN: 022-140-054-000



PUBLISHED 8/22/2025

SHEET TITLE

DRAINAGE
ANALYSIS

SHEET NUMBER



H3



$$Q_p = C * I * A \quad (\text{Equation 3.1})$$

Where,

- Q_p is the peak flow rate for the design rainfall event (cfs);
- C is the runoff coefficient (dimensionless);
- I is the rainfall intensity (inches/hr) for the design rainfall event; and
- A is the watershed or subwatershed area (ac).



NOAA Atlas 14, Volume 6, Version 2
 Location name: Saint Helena, California, USA*
 Latitude: 38.5218°, Longitude: -122.5257°
 Elevation: 1559 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Helm, Lillian Hiner, Kazungu Maltaria, 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 & aeries](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.87 (1.67-2.12)	2.24 (1.99-2.56)	2.75 (2.42-3.13)	3.14 (2.76-3.62)	3.71 (3.12-4.43)	4.13 (3.41-5.06)	4.57 (3.66-5.77)	5.04 (3.91-6.55)	5.68 (4.20-7.74)	6.17 (4.39-8.76)
10-min	1.34 (1.19-1.52)	1.61 (1.43-1.84)	1.97 (1.74-2.24)	2.26 (1.98-2.60)	2.65 (2.24-3.17)	2.96 (2.44-3.63)	3.28 (2.63-4.13)	3.61 (2.80-4.70)	4.06 (3.01-5.54)	4.42 (3.15-6.28)

	TRIBUTARY	RUNOFF COEFFICIENT (C)	AREA (A) ACRES	INTENSITY (I) IN/HR	Peak Flow Rate (Q) in cfs
100 year	1	0.45	0.28	3.28	0.41
	2	0.45	0.82	3.28	1.21
	3	0.45	0.80	3.28	1.18
	4	0.45	1.07	3.28	1.58



RUNOFF COEFFICIENTS FOR RATIONAL FORMULA

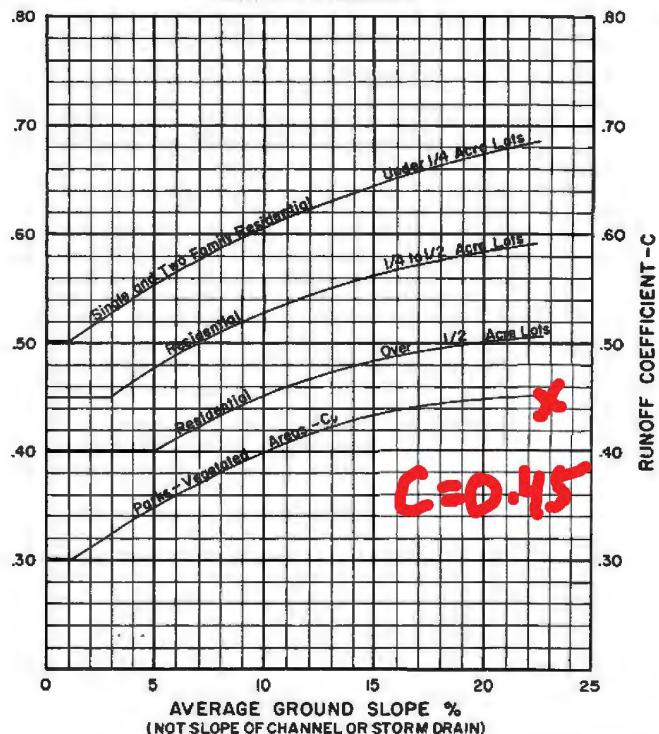


Table 4. Apron length and rock size base on pipe size and discharge rate (source: USDA – SCS).

Pipe Diameter (in)	Discharge (ft ³ /s)	Apron Length, La (ft)	Riprap d ₅₀ Diameter (in)
12	5	10	4
	10	13	6
18	10	10	6
	20	16	8
	30	23	12
	40	26	16
24	30	16	8
	40	26	8
	50	26	12
	60	30	16

Table D.2-1. Manning's Roughness Coefficients for Channels

Channel Material	Manning's Roughness (n)
Concrete, steel troweled, or smooth-form finish	0.014
Concrete, wood float or broomed finish, including pneumatically applied mortar	0.015
Asphaltic concrete	0.017
Sack concrete riprap	0.030
Grouted rock riprap	0.030
Loose rock riprap	0.035
Grass channels	0.035
Constructed natural waterways	0.050 minimum, under typical conditions*
Other natural channels	See references: Arcement, G. J., and V. R. Schneider. 1989. Guide for selecting Manning's roughness coefficients for natural channels and flood plains. U.S. Department of the Interior, US Geological Survey, 67 pp. Available at: pubs.er.usgs.gov/publication/wsp2339. Barnes, H. H. 1967. Roughness characteristics of natural channels. U.S. Government Printing Office, 213 pp. Available at: pubs.usgs.gov/wsp/wsp_1849/pdf/wsp_1849_h.pdf.

Channel Report

Trib. 1 - Cross Slope Diversion Swale

Triangular

Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 0.50

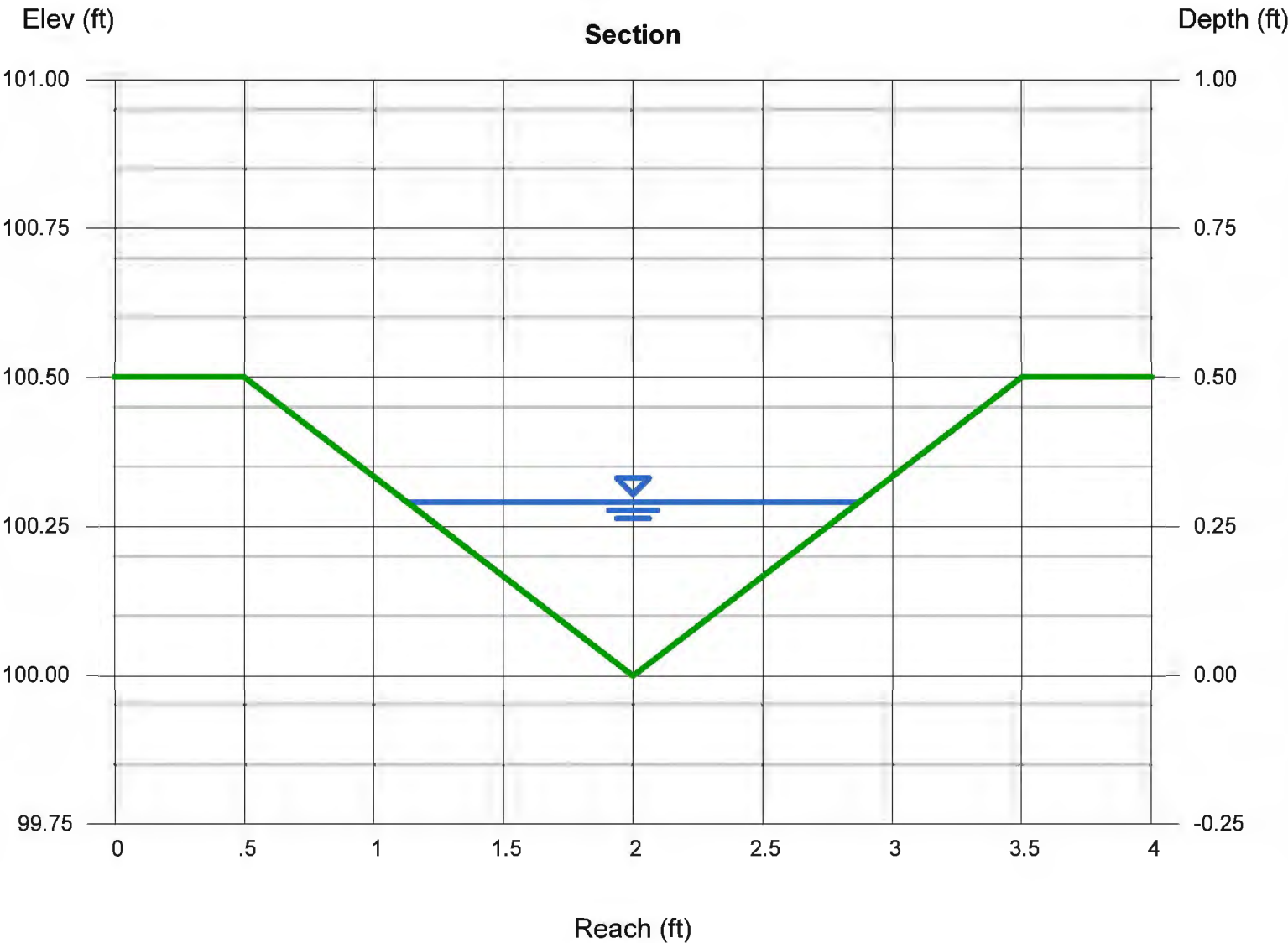
Invert Elev (ft) = 100.00
Slope (%) = 2.00
N-Value = 0.035

Calculations

Compute by: Known Q
Known Q (cfs) = 0.40

Highlighted

Depth (ft) = 0.29
Q (cfs) = 0.400
Area (sqft) = 0.25
Velocity (ft/s) = 1.59
Wetted Perim (ft) = 1.83
Crit Depth, Yc (ft) = 0.26
Top Width (ft) = 1.74
EGL (ft) = 0.33



Channel Report

Trib. 2 - Cross Slope Diversion Swale

Triangular

Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 0.50

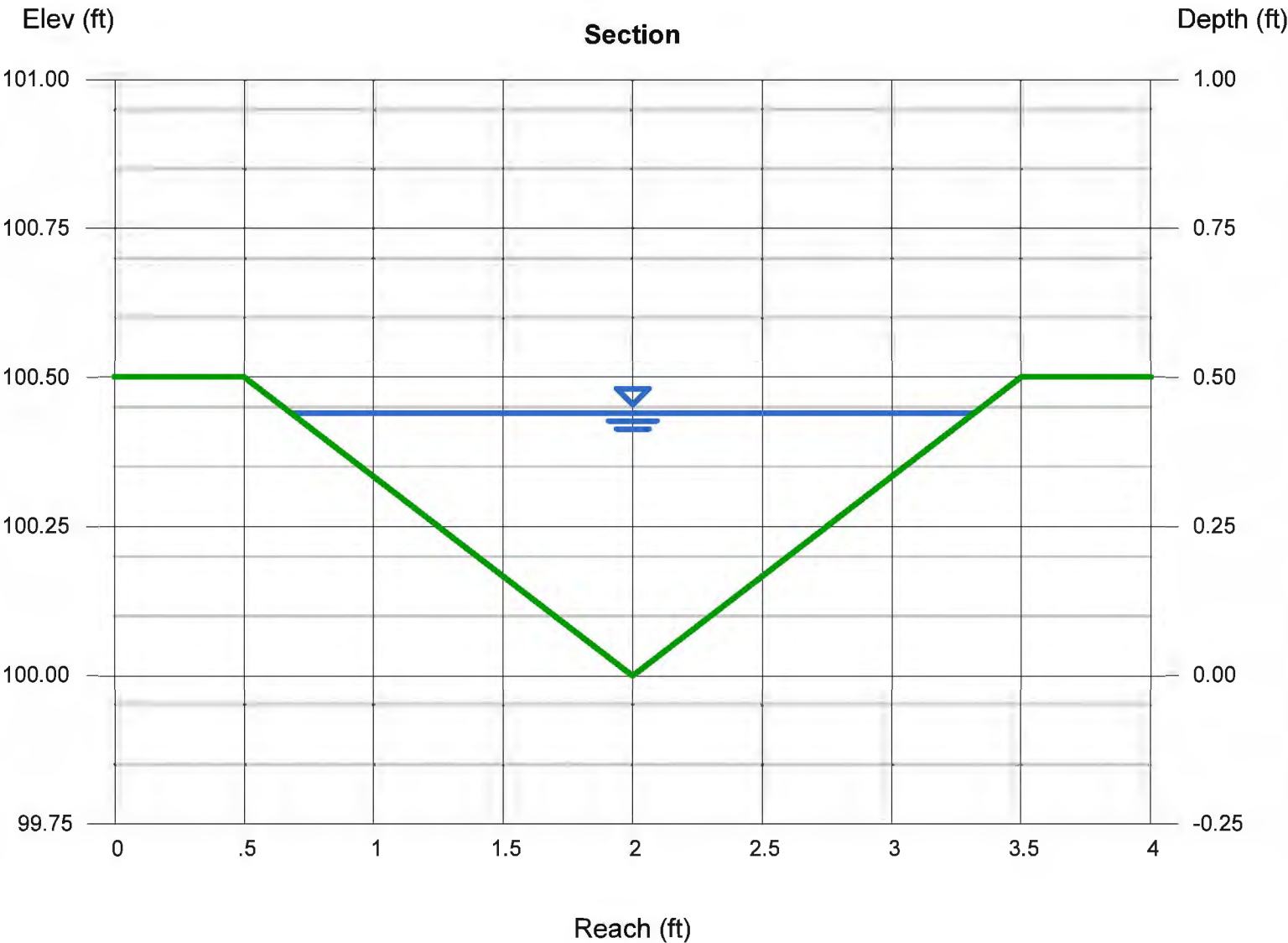
Invert Elev (ft) = 100.00
Slope (%) = 2.00
N-Value = 0.035

Calculations

Compute by: Known Q
Known Q (cfs) = 1.20

Highlighted

Depth (ft) = 0.44
Q (cfs) = 1.200
Area (sqft) = 0.58
Velocity (ft/s) = 2.07
Wetted Perim (ft) = 2.78
Crit Depth, Yc (ft) = 0.40
Top Width (ft) = 2.64
EGL (ft) = 0.51



Channel Report

Trib. 3 - Cross Slope Diversion Swale

Triangular

Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 0.50

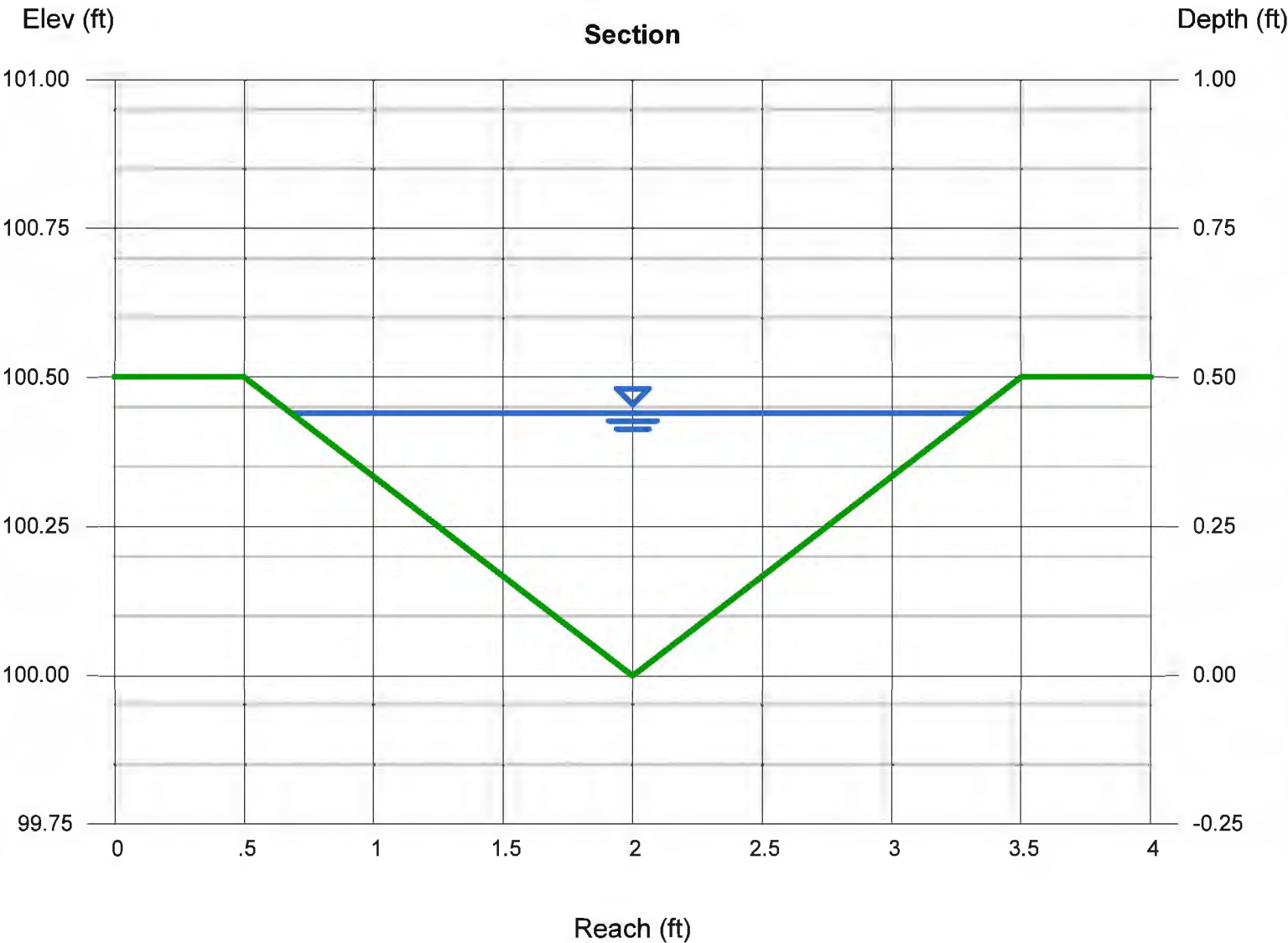
Invert Elev (ft) = 100.00
Slope (%) = 2.00
N-Value = 0.035

Calculations

Compute by: Known Q
Known Q (cfs) = 1.18

Highlighted

Depth (ft) = 0.44
Q (cfs) = 1.180
Area (sqft) = 0.58
Velocity (ft/s) = 2.03
Wetted Perim (ft) = 2.78
Crit Depth, Yc (ft) = 0.40
Top Width (ft) = 2.64
EGL (ft) = 0.50



Channel Report

Trib. 4 - Cross Slope Diversion Swale

Triangular

Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 2.00
N-Value = 0.035

Calculations

Compute by: Known Q
Known Q (cfs) = 1.58

Highlighted

Depth (ft) = 0.49
Q (cfs) = 1.580
Area (sqft) = 0.72
Velocity (ft/s) = 2.19
Wetted Perim (ft) = 3.10
Crit Depth, Yc (ft) = 0.45
Top Width (ft) = 2.94
EGL (ft) = 0.56

