

Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Onsite
- Normal Depth Calculations – Easements
- Normal Depth Calculations – Hammer Lane Analysis
- Normal Depth Calculations – Stockpile Analysis

Appendix C.1 – Normal Depth Calculations – Onsite

Worksheet for DON1-A1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.760 %
Discharge	1.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		0.48
	0+05.00		0.38
	0+06.50		0.00
	0+07.50		0.08
	0+07.50		0.13
	0+20.50		0.39
	0+33.50		0.13
	0+33.50		0.08
	0+34.50		0.00
	0+35.00		0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.23 ft
Roughness Coefficient	0.016
Elevation	0.23 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	1.0 ft ²
Wetted Perimeter	13.50 ft
Hydraulic Radius	0.08 ft
Top Width	13.28 ft
Normal Depth	0.23 ft
Critical Depth	0.23 ft
Critical Slope	0.902 %

Worksheet for DON1-A1

Results

Velocity	1.46 ft/s
Velocity Head	0.03 ft
Specific Energy	0.26 ft
Froude Number	0.924
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.23 ft
Critical Depth	0.23 ft
Channel Slope	0.760 %
Critical Slope	0.902 %

Worksheet for DON1-A1

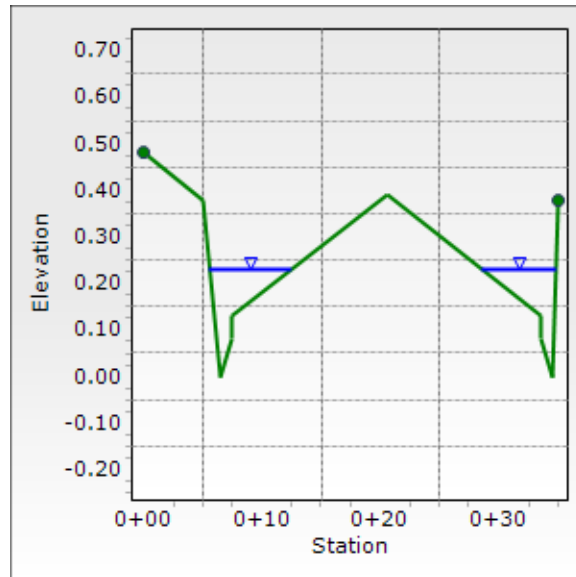
Messages:

Flow is divided.

Cross Section for DON1-A1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.760 %
Normal Depth	0.23 ft
Discharge	1.50 cfs



Worksheet for DON1-A2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.630 %
Discharge	1.50 cfs

Section Definitions

Station (ft)		Elevation (ft)
	0+00.00	0.48
	0+05.00	0.38
	0+06.50	0.00
	0+07.50	0.08
	0+07.50	0.13
	0+20.50	0.39
	0+33.50	0.13
	0+33.50	0.08
	0+34.50	0.00
	0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.24 ft
Roughness Coefficient	0.016
Elevation	0.24 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	1.1 ft ²
Wetted Perimeter	14.11 ft
Hydraulic Radius	0.08 ft
Top Width	13.89 ft
Normal Depth	0.24 ft
Critical Depth	0.23 ft
Critical Slope	0.903 %

Worksheet for DON1-A2

Results

Velocity	1.35 ft/s
Velocity Head	0.03 ft
Specific Energy	0.27 ft
Froude Number	0.846
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.24 ft
Critical Depth	0.23 ft
Channel Slope	0.630 %
Critical Slope	0.903 %

Worksheet for DON1-A2

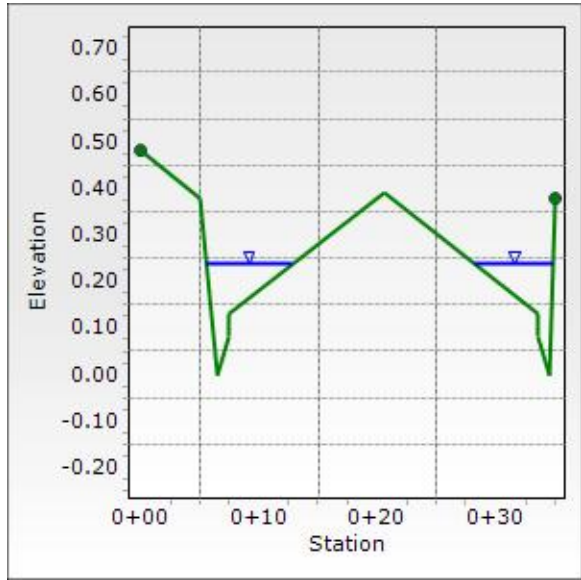
Messages:

Flow is divided.

XS for DON1-A2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 %
Normal Depth	0.24 ft
Discharge	1.50 cfs



Worksheet for DON1-C1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	4.340 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.22
0+06.00	0.22
0+17.00	0.00
0+36.00	0.38
0+55.00	0.00
0+66.00	0.22
0+72.00	2.22

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+72.00, 2.22)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.12 ft
Roughness Coefficient	0.016
Elevation	0.12 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	1.4 ft ²
Wetted Perimeter	23.43 ft
Hydraulic Radius	0.06 ft
Top Width	23.43 ft
Normal Depth	0.12 ft
Critical Depth	0.16 ft
Critical Slope	0.869 %
Velocity	2.92 ft/s
Velocity Head	0.13 ft
Specific Energy	0.25 ft

Worksheet for DON1-C1

Results

Froude Number	2.124
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

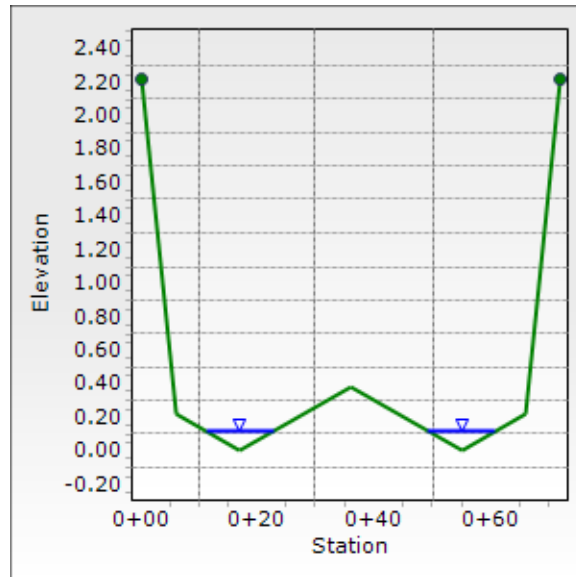
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.16 ft
Channel Slope	4.340 %
Critical Slope	0.869 %

Cross Section for DON1-C1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.340 %
Normal Depth	0.12 ft
Discharge	4.00 cfs



Worksheet for DON1-C3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.950 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.48
0+05.00	0.38
0+06.50	0.00
0+07.50	0.08
0+07.50	0.13
0+20.50	0.39
0+33.50	0.13
0+33.50	0.08
0+34.50	0.00
0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.25 ft
Roughness Coefficient	0.016
Elevation	0.25 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	1.3 ft ²
Wetted Perimeter	15.56 ft
Hydraulic Radius	0.08 ft
Top Width	15.34 ft
Normal Depth	0.25 ft
Critical Depth	0.30 ft
Critical Slope	0.801 %

Worksheet for DON1-C3

Results

Velocity	3.06 ft/s
Velocity Head	0.15 ft
Specific Energy	0.40 ft
Froude Number	1.847
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

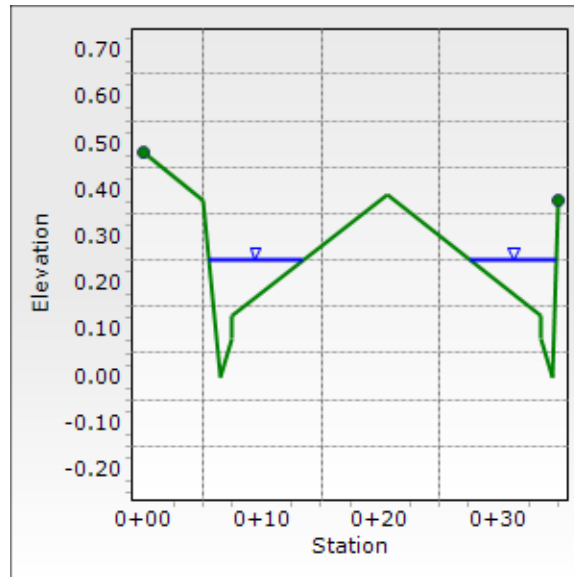
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.25 ft
Critical Depth	0.30 ft
Channel Slope	2.950 %
Critical Slope	0.801 %

Cross Section for DON1-C3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.950 %
Normal Depth	0.25 ft
Discharge	4.00 cfs



Worksheet for DON1-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	6.670 %
Discharge	1.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)
	0+00.00	0.48
	0+05.00	0.38
	0+06.50	0.00
	0+07.50	0.08
	0+07.50	0.13
	0+20.50	0.39
	0+33.50	0.13
	0+33.50	0.08
	0+34.50	0.00
	0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.14 ft
Roughness Coefficient	0.016
Elevation	0.14 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.3 ft ²
Wetted Perimeter	3.86 ft
Hydraulic Radius	0.07 ft
Top Width	3.69 ft
Normal Depth	0.14 ft
Critical Depth	0.20 ft
Critical Slope	0.943 %

Worksheet for DON1-D

Results

Velocity	3.92 ft/s
Velocity Head	0.24 ft
Specific Energy	0.38 ft
Froude Number	2.631
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

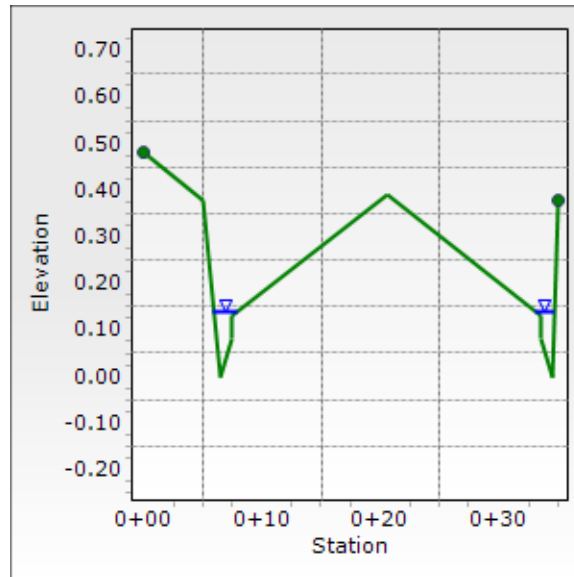
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.14 ft
Critical Depth	0.20 ft
Channel Slope	6.670 %
Critical Slope	0.943 %

Cross Section for DON1-D

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	6.670 %
Normal Depth	0.14 ft
Discharge	1.00 cfs



Worksheet for DON1-E1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.500 %
Discharge	6.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		0.48
	0+05.00		0.38
	0+06.50		0.00
	0+07.50		0.08
	0+07.50		0.13
	0+20.50		0.39
	0+33.50		0.13
	0+33.50		0.08
	0+34.50		0.00
	0+35.00		0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.31 ft
Roughness Coefficient	0.016
Elevation	0.31 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	2.5 ft ²
Wetted Perimeter	22.18 ft
Hydraulic Radius	0.11 ft
Top Width	21.92 ft
Normal Depth	0.31 ft
Critical Depth	0.34 ft
Critical Slope	0.752 %

Worksheet for DON1-E1

Results

Velocity	2.63 ft/s
Velocity Head	0.11 ft
Specific Energy	0.42 ft
Froude Number	1.379
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

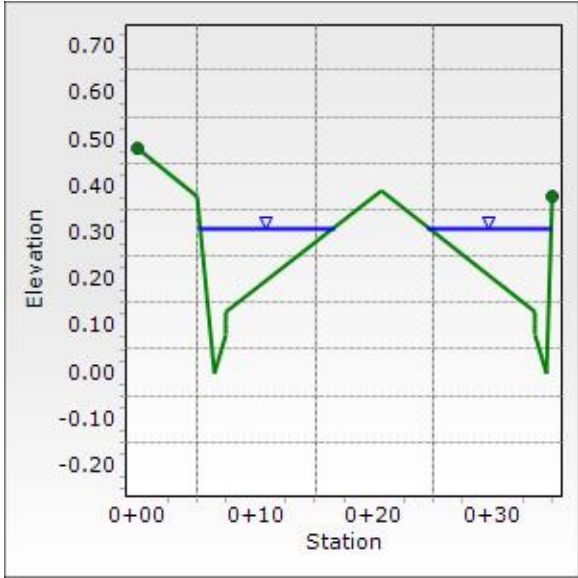
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.31 ft
Critical Depth	0.34 ft
Channel Slope	1.500 %
Critical Slope	0.752 %

XS for DON1-E1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.500 %
Normal Depth	0.31 ft
Discharge	6.50 cfs



Worksheet for DON1-F1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	4.120 %
Discharge	7.50 cfs

Section Definitions

Station (ft)		Elevation (ft)
	0+00.00	0.48
	0+05.00	0.38
	0+06.50	0.00
	0+07.50	0.08
	0+07.50	0.13
	0+20.50	0.39
	0+33.50	0.13
	0+33.50	0.08
	0+34.50	0.00
	0+35.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.28 ft
Roughness Coefficient	0.016
Elevation	0.28 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	1.9 ft ²
Wetted Perimeter	19.06 ft
Hydraulic Radius	0.10 ft
Top Width	18.82 ft
Normal Depth	0.28 ft
Critical Depth	0.36 ft
Critical Slope	0.738 %

Worksheet for DON1-F1

Results

Velocity	4.00 ft/s
Velocity Head	0.25 ft
Specific Energy	0.53 ft
Froude Number	2.237
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

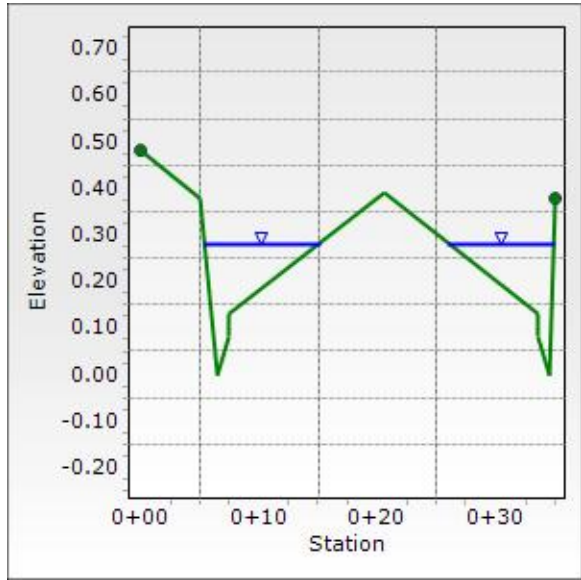
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.28 ft
Critical Depth	0.36 ft
Channel Slope	4.120 %
Critical Slope	0.738 %

XS for DON1-F1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.120 %
Normal Depth	0.28 ft
Discharge	7.50 cfs



Worksheet for DON1-F2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.600 %
Discharge	7.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)
	0+00.00	2.22
	0+06.00	0.22
	0+17.00	0.00
	0+36.00	0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+36.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.28 ft
Roughness Coefficient	0.016
Elevation	0.28 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	3.7 ft ²
Wetted Perimeter	24.94 ft
Hydraulic Radius	0.15 ft
Top Width	24.93 ft
Normal Depth	0.28 ft
Critical Depth	0.27 ft
Critical Slope	0.714 %
Velocity	2.02 ft/s
Velocity Head	0.06 ft
Specific Energy	0.34 ft
Froude Number	0.922
Flow Type	Subcritical

Worksheet for DON1-F2

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

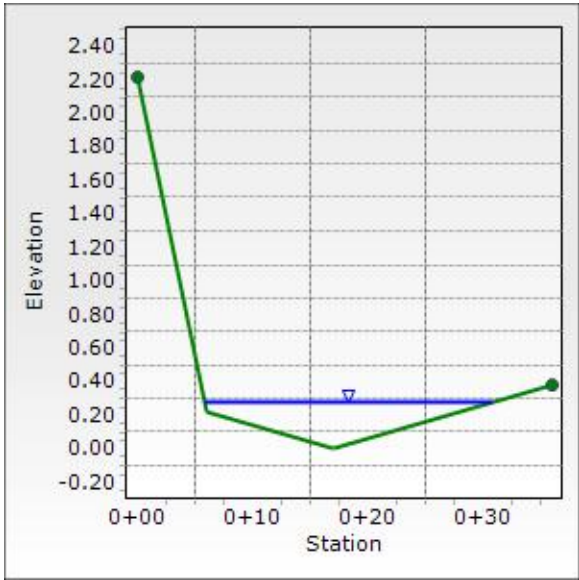
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.28 ft
Critical Depth	0.27 ft
Channel Slope	0.600 %
Critical Slope	0.714 %

XS for DON1-F2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.600 %
Normal Depth	0.28 ft
Discharge	7.50 cfs



Worksheet for DON1-G

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.640 %
Discharge	1.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		0.48
	0+05.00		0.38
	0+06.50		0.00
	0+07.50		0.08
	0+07.50		0.13
	0+20.50		0.39
	0+33.50		0.13
	0+33.50		0.08
	0+34.50		0.00
	0+35.00		0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.48)	(0+35.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.21 ft
Roughness Coefficient	0.016
Elevation	0.21 ft
Elevation Range	0.00 to 0.48 ft
Flow Area	0.8 ft ²
Wetted Perimeter	11.10 ft
Hydraulic Radius	0.07 ft
Top Width	10.90 ft
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Critical Slope	0.902 %

Worksheet for DON1-G

Results

Velocity	1.99 ft/s
Velocity Head	0.06 ft
Specific Energy	0.27 ft
Froude Number	1.333
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

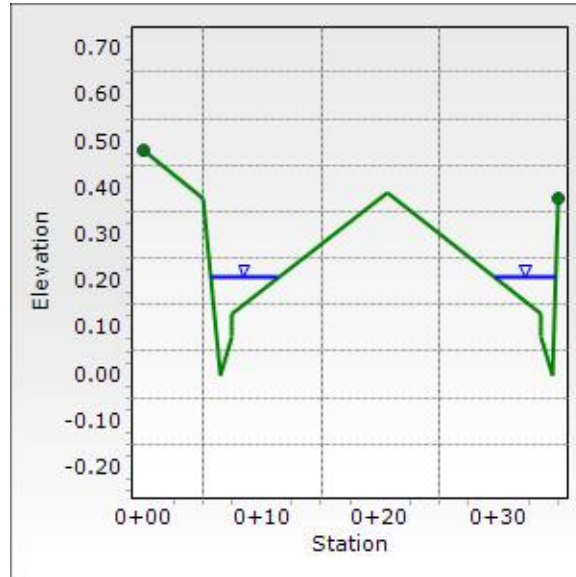
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.23 ft
Channel Slope	1.640 %
Critical Slope	0.902 %

XS for DON1-G

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.640 %
Normal Depth	0.21 ft
Discharge	1.50 cfs



Worksheet for DON1-H2A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.870 %
Discharge	75.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		3.48
	0+00.00		0.48
	0+05.00		0.38
	0+06.50		0.00
	0+07.50		0.08
	0+07.50		0.13
	0+20.50		0.39
	0+33.50		0.13
	0+33.50		0.08
	0+34.50		0.00
	0+35.00		0.38
	0+35.00		3.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient	
(0+00.00, 3.48)	(0+35.00, 3.38)		0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.55 ft
Roughness Coefficient	0.016
Elevation	0.55 ft
Elevation Range	0.00 to 3.48 ft
Flow Area	9.7 ft ²
Wetted Perimeter	35.52 ft
Hydraulic Radius	0.27 ft
Top Width	35.00 ft
Normal Depth	0.55 ft

Worksheet for DON1-H2A

Results

Critical Depth	0.79 ft
Critical Slope	0.481 %
Velocity	7.71 ft/s
Velocity Head	0.92 ft
Specific Energy	1.47 ft
Froude Number	2.577
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

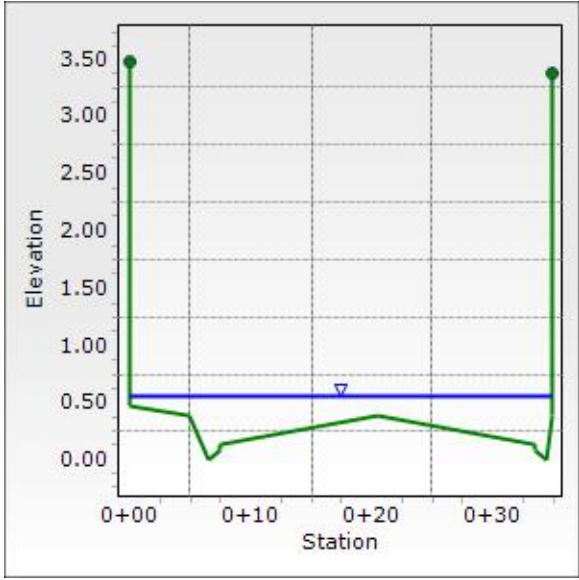
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.55 ft
Critical Depth	0.79 ft
Channel Slope	3.870 %
Critical Slope	0.481 %

XS for DON1-H2A

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.870 %
Normal Depth	0.55 ft
Discharge	75.00 cfs



Worksheet for DON1-H2B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	3.500 %
Discharge	78.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		3.48
	0+00.00		0.48
	0+05.00		0.38
	0+06.50		0.00
	0+07.50		0.08
	0+07.50		0.13
	0+20.50		0.39
	0+33.50		0.13
	0+33.50		0.08
	0+34.50		0.00
	0+35.00		0.38
	0+35.00		3.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.48)	(0+35.00, 3.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.56 ft
Roughness Coefficient	0.016
Elevation	0.56 ft
Elevation Range	0.00 to 3.48 ft
Flow Area	10.3 ft ²
Wetted Perimeter	35.55 ft
Hydraulic Radius	0.29 ft
Top Width	35.00 ft
Normal Depth	0.56 ft

Worksheet for DON1-H2B

Results

Critical Depth	0.81 ft
Critical Slope	0.477 %
Velocity	7.61 ft/s
Velocity Head	0.90 ft
Specific Energy	1.46 ft
Froude Number	2.473
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

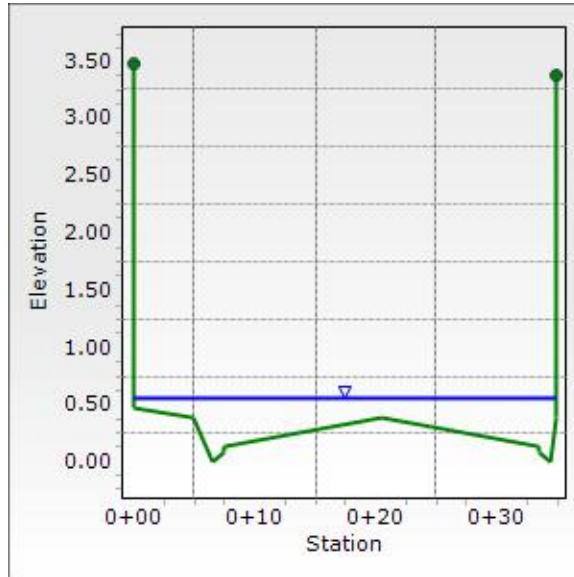
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.56 ft
Critical Depth	0.81 ft
Channel Slope	3.500 %
Critical Slope	0.477 %

XS for DON1-H2B

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.500 %
Normal Depth	0.56 ft
Discharge	78.50 cfs



Worksheet for DON1-H4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.500 %
Discharge	84.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		2.22
	0+06.00		0.22
	0+17.00		0.00
	0+36.00		0.38

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.22)	(0+36.00, 0.38)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.76 ft
Roughness Coefficient	0.016
Elevation	0.76 ft
Elevation Range	0.00 to 2.22 ft
Flow Area	18.5 ft ²
Wetted Perimeter	32.10 ft
Hydraulic Radius	0.58 ft
Top Width	31.63 ft
Normal Depth	0.76 ft
Critical Depth	0.78 ft
Critical Slope	0.451 %
Velocity	4.54 ft/s
Velocity Head	0.32 ft
Specific Energy	1.08 ft
Froude Number	1.048
Flow Type	Supercritical

Worksheet for DON1-H4

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

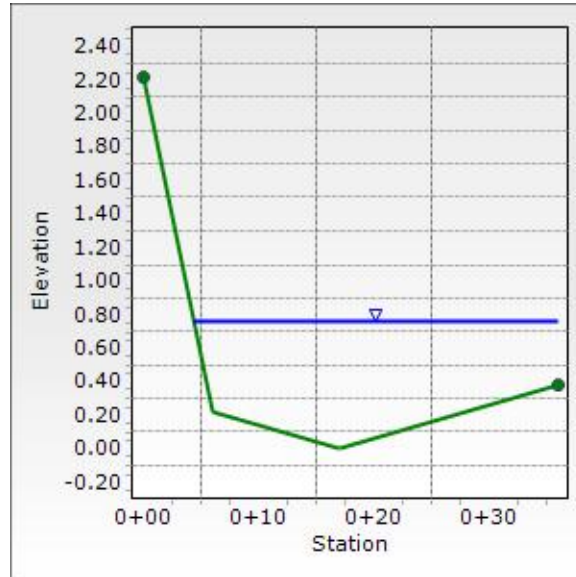
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.76 ft
Critical Depth	0.78 ft
Channel Slope	0.500 %
Critical Slope	0.451 %

XS for DON1-H4

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.500 %
Normal Depth	0.76 ft
Discharge	84.00 cfs



Appendix C.2 – Normal Depth Calculations – Easements

Worksheet for ON1-B2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	3.510 %
Discharge	2.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.13 ft
Roughness Coefficient	0.016
Elevation	0.13 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	0.9 ft ²
Wetted Perimeter	13.27 ft
Hydraulic Radius	0.07 ft
Top Width	13.27 ft
Normal Depth	0.13 ft
Critical Depth	0.17 ft
Critical Slope	0.844 %
Velocity	2.84 ft/s
Velocity Head	0.13 ft
Specific Energy	0.26 ft
Froude Number	1.943
Flow Type	Supercritical

Worksheet for ON1-B2

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

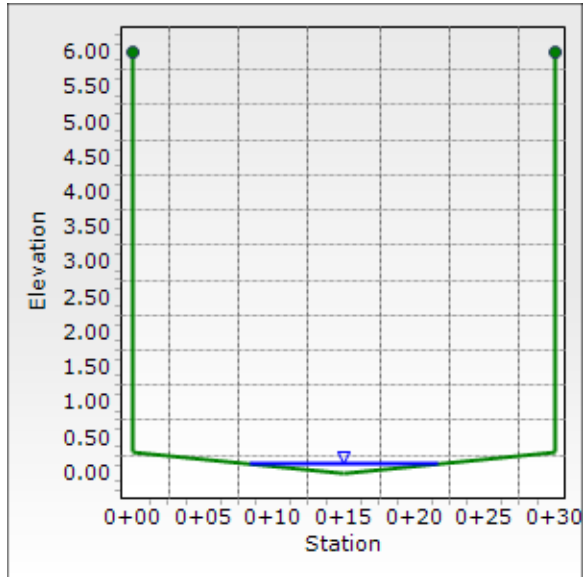
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.13 ft
Critical Depth	0.17 ft
Channel Slope	3.510 %
Critical Slope	0.844 %

Cross Section for ON1-B2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	3.510 %
Normal Depth	0.13 ft
Discharge	2.50 cfs



Worksheet for ON1-C2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.890 %
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.18 ft
Roughness Coefficient	0.016
Elevation	0.18 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	1.6 ft ²
Wetted Perimeter	17.75 ft
Hydraulic Radius	0.09 ft
Top Width	17.74 ft
Normal Depth	0.18 ft
Critical Depth	0.21 ft
Critical Slope	0.792 %
Velocity	2.54 ft/s
Velocity Head	0.10 ft
Specific Energy	0.28 ft
Froude Number	1.504
Flow Type	Supercritical

Worksheet for ON1-C2

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

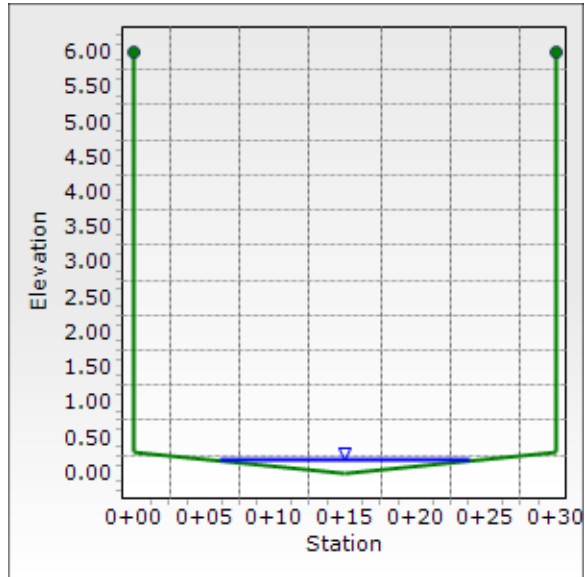
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.18 ft
Critical Depth	0.21 ft
Channel Slope	1.890 %
Critical Slope	0.792 %

Cross Section for ON1-C2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.890 %
Normal Depth	0.18 ft
Discharge	4.00 cfs



Worksheet for ON1-E2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.850 %
Discharge	6.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		6.00
	0+00.00		0.10
	0+05.00		0.00
	0+10.00		0.10
	0+10.00		6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+10.00, 6.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.18 ft
Roughness Coefficient	0.016
Elevation	0.18 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	1.3 ft ²
Wetted Perimeter	10.16 ft
Hydraulic Radius	0.13 ft
Top Width	10.00 ft
Normal Depth	0.18 ft
Critical Depth	0.29 ft
Critical Slope	0.634 %
Velocity	5.11 ft/s
Velocity Head	0.41 ft
Specific Energy	0.58 ft
Froude Number	2.523
Flow Type	Supercritical

Worksheet for ON1-E2

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

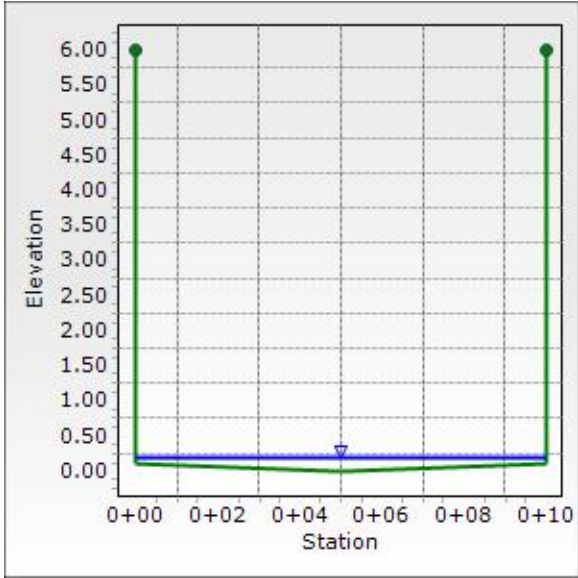
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.18 ft
Critical Depth	0.29 ft
Channel Slope	4.850 %
Critical Slope	0.634 %

XS for ON1-E2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.850 %
Normal Depth	0.18 ft
Discharge	6.50 cfs



Worksheet for ON1-H1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	4.220 %
Discharge	75.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	6.00
0+00.00	0.30
0+15.00	0.00
0+30.00	0.30
0+30.00	6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.45 ft
Roughness Coefficient	0.016
Elevation	0.45 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	8.9 ft ²
Wetted Perimeter	30.30 ft
Hydraulic Radius	0.29 ft
Top Width	30.00 ft
Normal Depth	0.45 ft
Critical Depth	0.73 ft
Critical Slope	0.465 %
Velocity	8.43 ft/s
Velocity Head	1.10 ft
Specific Energy	1.55 ft
Froude Number	2.729
Flow Type	Supercritical

Worksheet for ON1-H1

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

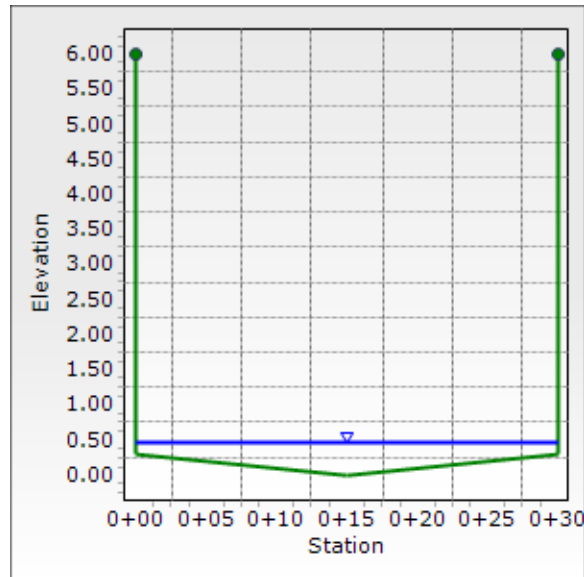
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	0.73 ft
Channel Slope	4.220 %
Critical Slope	0.465 %

Cross Section for ON1-H1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.220 %
Normal Depth	0.45 ft
Discharge	75.00 cfs



Worksheet for ON1-H3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	1.870 %
Discharge	78.50 cfs

Section Definitions

	Station (ft)	Elevation (ft)	
	0+00.00		6.00
	0+00.00		0.30
	0+15.00		0.00
	0+30.00		0.30
	0+30.00		6.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 6.00)	(0+30.00, 6.00)	0.016

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.54 ft
Roughness Coefficient	0.016
Elevation	0.54 ft
Elevation Range	0.00 to 6.00 ft
Flow Area	11.7 ft ²
Wetted Perimeter	30.49 ft
Hydraulic Radius	0.38 ft
Top Width	30.00 ft
Normal Depth	0.54 ft
Critical Depth	0.75 ft
Critical Slope	0.461 %
Velocity	6.71 ft/s
Velocity Head	0.70 ft
Specific Energy	1.24 ft
Froude Number	1.895
Flow Type	Supercritical

Worksheet for ON1-H3

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

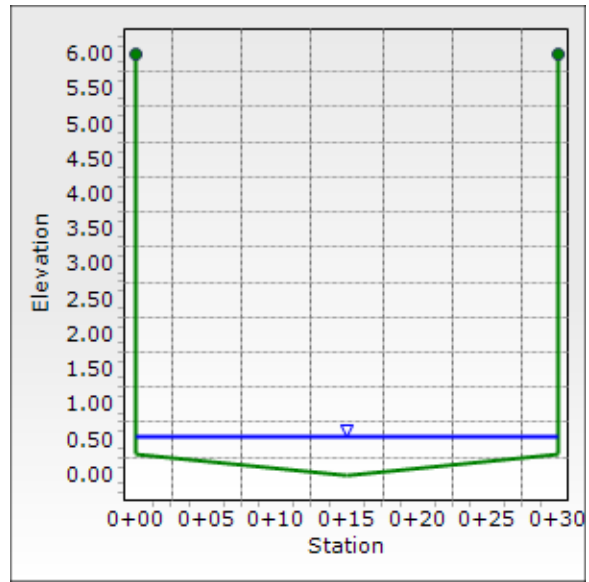
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.54 ft
Critical Depth	0.75 ft
Channel Slope	1.870 %
Critical Slope	0.461 %

Cross Section for ON1-H3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.870 %
Normal Depth	0.54 ft
Discharge	78.50 cfs



Appendix C.3 – Normal Depth Calculations – Hammer Lane Analysis

Worksheet for ES-1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.100 %
Discharge	84.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)
	0+00.00	89.90
	0+27.05	89.70
	0+80.55	89.43
	1+05.55	89.19
	1+39.55	88.60
	1+98.25	88.22
	2+21.55	88.31
	2+42.24	88.98

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 89.90)	(2+42.24, 88.98)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.42 ft
Roughness Coefficient	0.025
Elevation	88.64 ft
Elevation Range	88.22 to 89.90 ft
Flow Area	24.2 ft ²
Wetted Perimeter	94.73 ft
Hydraulic Radius	0.26 ft
Top Width	94.73 ft
Normal Depth	0.42 ft
Critical Depth	0.46 ft
Critical Slope	1.386 %
Velocity	3.47 ft/s
Velocity Head	0.19 ft

Worksheet for ES-1

Results

Specific Energy	0.61 ft
Froude Number	1.210
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

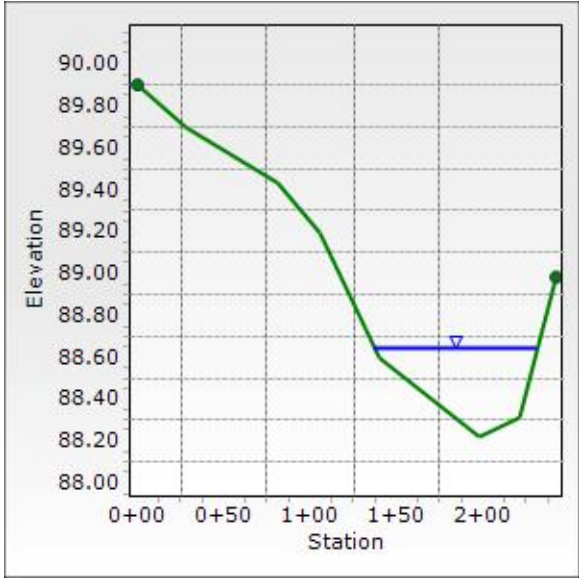
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.46 ft
Channel Slope	2.100 %
Critical Slope	1.386 %

XS for ES-1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.100 %
Normal Depth	0.42 ft
Discharge	84.00 cfs



Worksheet for Proposed HL-1 - 100-YEAR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.110 %
Discharge	84.00 cfs

Section Definitions

	Station (ft)	Elevation (ft)
	0+00.00	85.93
	0+09.96	85.98
	0+14.70	85.67
	0+21.20	84.05
	0+30.20	85.55
	0+34.20	85.63
	0+49.00	85.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 85.93)	(0+49.00, 85.87)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.35 ft
Roughness Coefficient	0.025
Elevation	85.40 ft
Elevation Range	84.05 to 85.98 ft
Flow Area	9.2 ft ²
Wetted Perimeter	13.83 ft
Hydraulic Radius	0.66 ft
Top Width	13.55 ft
Normal Depth	1.35 ft
Critical Depth	1.84 ft
Critical Slope	1.135 %
Velocity	9.16 ft/s
Velocity Head	1.30 ft
Specific Energy	2.66 ft

Worksheet for Proposed HL-1 - 100-YEAR

Results

Froude Number	1.964
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

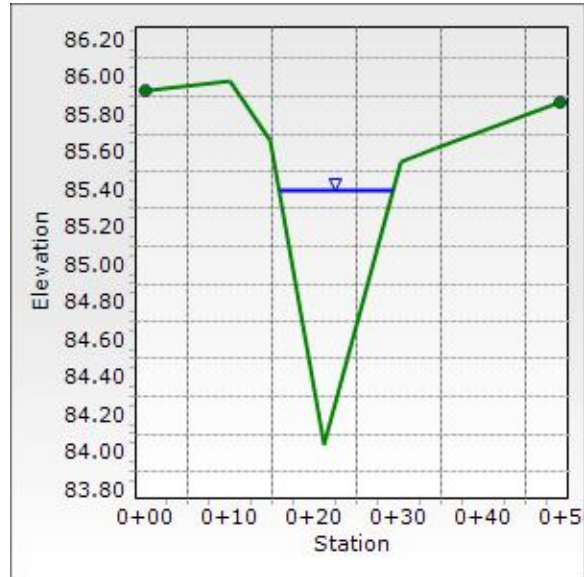
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.35 ft
Critical Depth	1.84 ft
Channel Slope	4.110 %
Critical Slope	1.135 %

XS for Proposed HL-1 - 100-YEAR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	4.110 %
Normal Depth	1.35 ft
Discharge	84.00 cfs



Worksheet for Proposed HL-2 - 100-YEAR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.010 %
Discharge	84.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	82.00
0+10.26	81.97
0+14.70	81.44
0+24.70	78.94
0+33.70	80.44
0+48.90	80.65

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 82.00)	(0+48.90, 80.65)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.30 ft
Roughness Coefficient	0.025
Elevation	80.24 ft
Elevation Range	78.94 to 82.00 ft
Flow Area	8.5 ft ²
Wetted Perimeter	13.31 ft
Hydraulic Radius	0.64 ft
Top Width	13.05 ft
Normal Depth	1.30 ft
Critical Depth	1.80 ft
Critical Slope	1.097 %
Velocity	9.87 ft/s
Velocity Head	1.51 ft
Specific Energy	2.82 ft
Froude Number	2.155

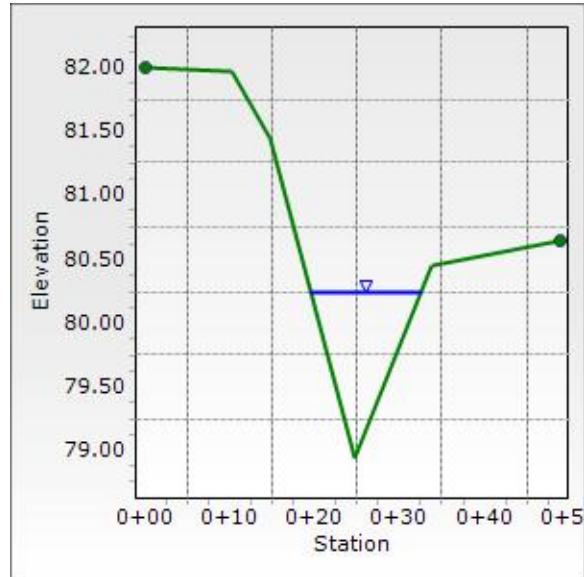
Worksheet for Proposed HL-2 - 100-YEAR

Results	
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.30 ft
Critical Depth	1.80 ft
Channel Slope	5.010 %
Critical Slope	1.097 %

XS for Proposed HL-2 - 100-YEAR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	5.010 %
Normal Depth	1.30 ft
Discharge	84.00 cfs



Appendix C.4 – Normal Depth Calculations – Stockpile Analysis

Worksheet for DON1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.016 ft/ft
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.90
0+12	0.00
0+16	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.90)	(0+16, 2.00)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.5 ft
Roughness Coefficient	0.025
Elevation	0.48 ft
Elevation Range	0.0 to 2.0 ft
Flow Area	1.8 ft ²
Wetted Perimeter	7.5 ft
Hydraulic Radius	0.2 ft
Top Width	7.39 ft
Normal Depth	0.5 ft
Critical Depth	0.5 ft
Critical Slope	0.015 ft/ft
Velocity	2.84 ft/s
Velocity Head	0.13 ft
Specific Energy	0.60 ft
Froude Number	1.027
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
------------------	--------

Worksheet for DON1

GVF Input Data

Length	0.0 ft
Number Of Steps	0

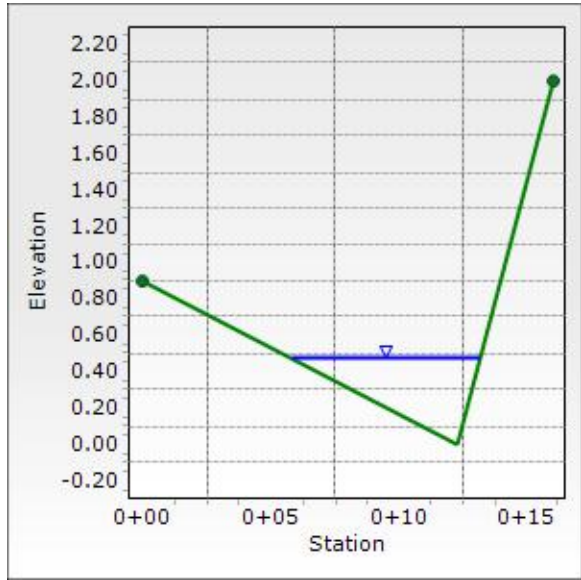
GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.5 ft
Critical Depth	0.5 ft
Channel Slope	0.016 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for DON1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.016 ft/ft
Normal Depth	0.5 ft
Discharge	5.00 cfs



Worksheet for DON3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.033 ft/ft
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	1.10
0+12	0.00
0+16	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1.10)	(0+16, 2.00)	0.025

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.2 ft
Roughness Coefficient	0.025
Elevation	0.24 ft
Elevation Range	0.0 to 2.0 ft
Flow Area	0.4 ft ²
Wetted Perimeter	3.2 ft
Hydraulic Radius	0.1 ft
Top Width	3.14 ft
Normal Depth	0.2 ft
Critical Depth	0.3 ft
Critical Slope	0.018 ft/ft
Velocity	2.62 ft/s
Velocity Head	0.11 ft
Specific Energy	0.35 ft
Froude Number	1.321
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 ft

Worksheet for DON3

GVF Input Data

Length	0.0 ft
Number Of Steps	0

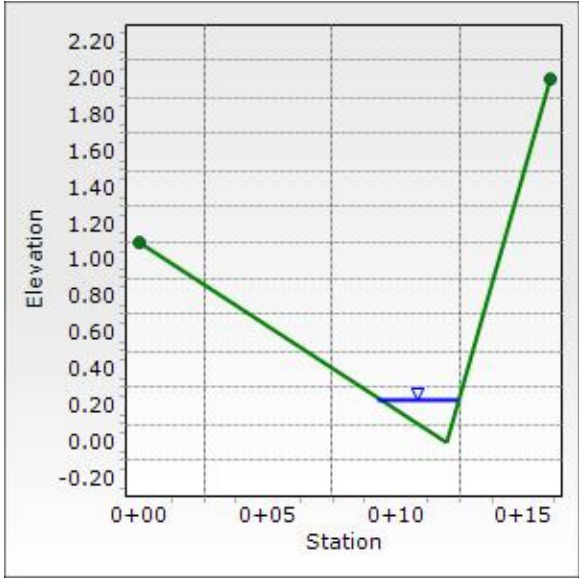
GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.2 ft
Critical Depth	0.3 ft
Channel Slope	0.033 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for DON3

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.033 ft/ft
Normal Depth	0.2 ft
Discharge	1.00 cfs



Worksheet for HW1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.012 ft/ft
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	1.10
0+15	0.78
0+21	0.70
0+23	0.00
0+29	1.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1.10)	(0+29, 1.50)	0.025

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.6 ft
Roughness Coefficient	0.025
Elevation	0.63 ft
Elevation Range	0.0 to 1.5 ft
Flow Area	1.4 ft ²
Wetted Perimeter	4.5 ft
Hydraulic Radius	0.3 ft
Top Width	4.31 ft
Normal Depth	0.6 ft
Critical Depth	0.6 ft
Critical Slope	0.014 ft/ft
Velocity	2.96 ft/s
Velocity Head	0.14 ft
Specific Energy	0.76 ft
Froude Number	0.931
Flow Type	Subcritical

Worksheet for HW1

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.6 ft
Critical Depth	0.6 ft
Channel Slope	0.012 ft/ft
Critical Slope	0.014 ft/ft

Cross Section for HW1

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.012 ft/ft
Normal Depth	0.6 ft
Discharge	4.00 cfs

