STORMWATER MANAGEMENT PLAN
FOR

FOUR STAR FARM ROAD DIRT ROAD PAVING AND DRAINAGE

MESI # 170001-009
February 6, 2023

DALE ERIC LONG LICENSE No. 55393 STATE OF FLORIDA PROFESSIONAL ENGINEER

Digitally signed by Dale e Long
Date: 2023.02.07 15:25:09 -06'00'

This document has been digitally Signed and Sealed by Dale E. Long, P.E., LEED AP (FLPE #55393) at the date noted above. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

SUBMITTED BY:

MUNICIPAL ENGINEERING SERVICES INC

STORMWATER MANAGEMENT PLAN

PROJECT LOCATION:

Four Star Farm Road is an existing 0.39 mile dirt road located in Molino, Florida. See Appendix A Location Map.

PROJECT DESCRIPTION:

The project scope includes paving the existing 2-lane dirt road via the construction of a 2-lane 22-foot-wide asphalt roadway within the existing/new right-of-way of Four Star Farm Road. The new pavement will be complimented with drainage improvements to convey the runoff to the two new outfalls located along the roadway. Conveyances will include roadside swales as well as inlets and piping systems and cross-drains.

OFFSITE IMPACTS

The proposed project site receives a significant quantity of runoff from the properties adjacent to Four Star Farm Road. The offsite contribution has been accounted for in the design of the stormwater conveyances and outfalls. The contributing drainage basin delineation is provided as Appendix B.

STORMWATER MANAGEMENT PLAN REQUIREMENTS & CRITERIA:

This project is subject to the review of the following agencies:

Florida Department of Environmental Protection/Northwest Florida Water Management District - Environmental Resource Permitting:

- The site is eligible for a General Permit in accordance with FAC 62-330.051(4)(e).

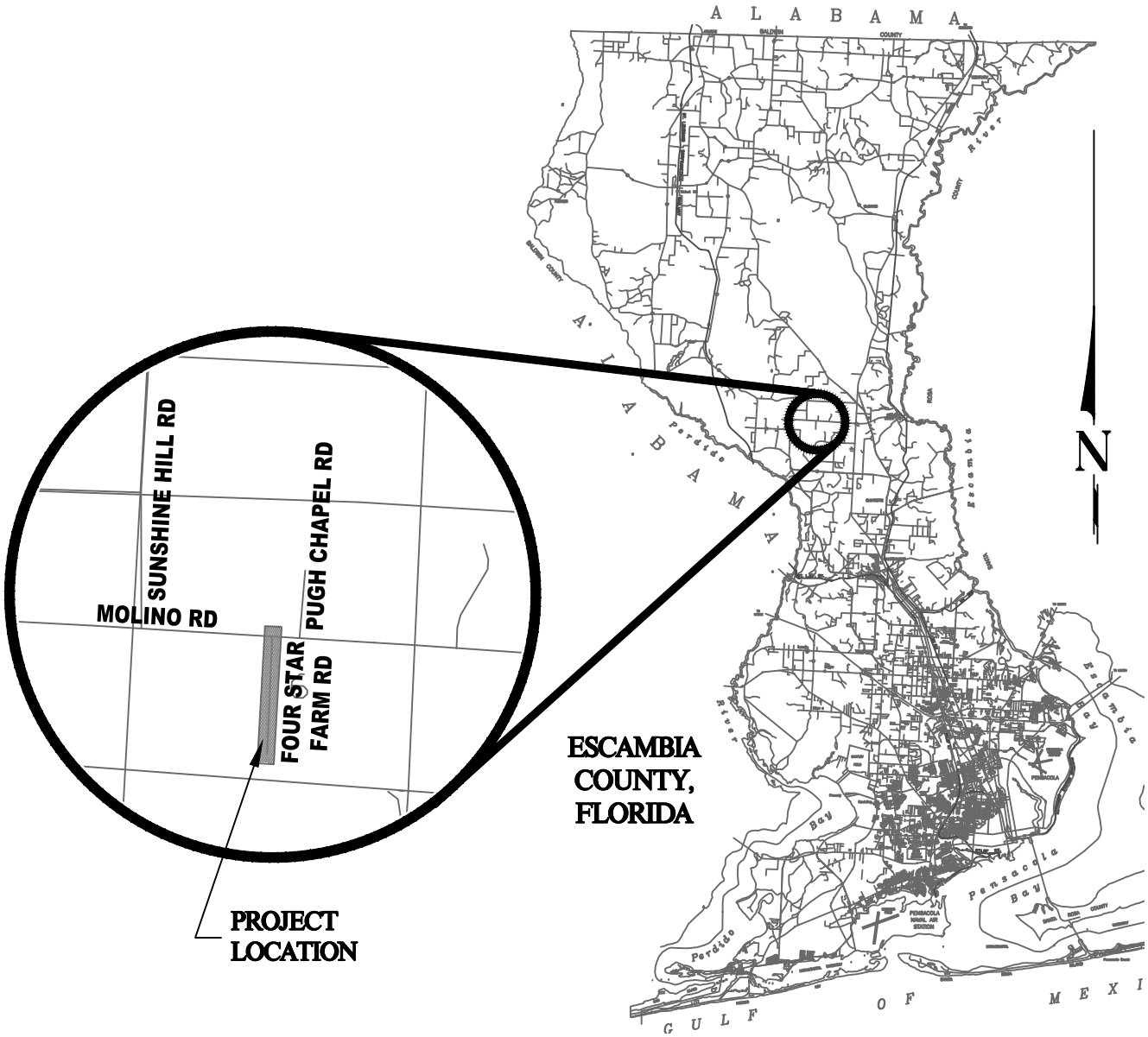
METHODOLOGY:

As noted above, stormwater runoff will be collected from the new asphalt roadway and directed into roadside swales and piping systems towards one of the two new drainage outfalls.

The system is designed to meet a 25-year design storm, and runoff calculations are based on the Rational Method. Detailed stormwater calculations can be found in Appendix C.

APPENDIX A

LOCATION MAP

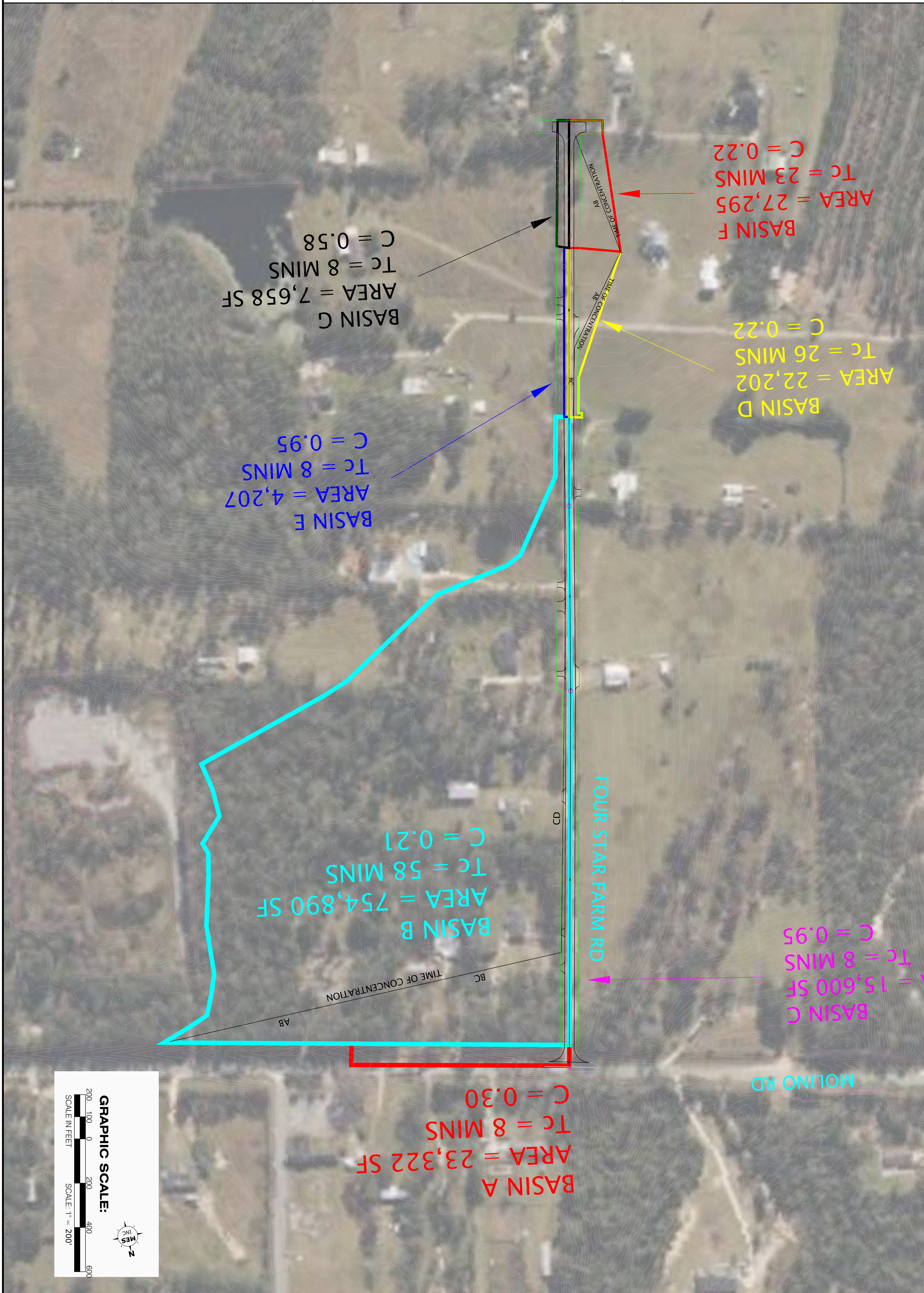


VICINITY MAP

APPENDIX B

DRAINAGE BASIN MAP

PHASE REVIEW	ORIGINATOR (RP) DATE	ORIGINATOR (QR) Correct (Green Highlighter) Change (Red Pen) DATE	VERIFICATION, CHECKER (QR) (Blue Highlighter) DATE
SIGNATURE:	PRODUCTION CHECKING COMPLETE, READY FOR SUBMITTAL REVIEW (RP)	CHECKER (RP) (Red Pen X-Out to Disagrree or Remark) DATE	REMARK INCORPORATION (Blue Highlighter) DATE
		CHANGE INCORPORATION (Yellow HighLighter) DATE	ORIGINATOR VERIFICATION Correct (Pink Highlighter) DATE



NUMBER	REVISIONS	DATE	APPROVED BY

MUNICIPAL ENGINEERING SERVICES INC
EXCELLENCE IN ENGINEERING SERVICE
8574 Turkey Bluff Road
Navarre, Florida 32566
p: (850) 939-5732
CERTIFICATE OF AUTHORIZATION: CA-30886

DRAWN BY:	DESIGNED BY:	CHECKED BY:	REG. FLA. ENG. NO.	DATE:
EMD	DEL	WVP,II	55393	
DATE: FEBRUARY 2023	PROJECT MANAGER: JOHN ROSENAU	DISTRICT: 5	SIGNATURE:	
FIELD BOOK / PAGES: FB 506/PP 21-33	SECTION / TOWNSHIP / RANGE: 06-2N-31W		DALE E. LONG, P.E.	

ESCAMBIA COUNTY FLORIDA

FOUR STAR FARM ROAD
DIRT ROAD PAVING & DRAINAGE

DRAWING NUMBER
PROJECT NUMBER 170001-009
SURVEY NUMBER L-6217
SHEET OF 60

APPENDIX C

SUPPORTING CALCULATIONS

Four Star Farm Road Dirt Road Paving and Drainage
MESI Project No. 170001-009
October 26, 2022

TIME OF CONCENTRATION CALCULATION

Basin B -East Side of Four Star from Molino to Low Point

CONTRIBUTING BASIN

SHEET FLOW

		Segment ID		AB
1	COVER TYPE		UNIT	**WOODED**
2	MANNING'S ROUGHNESS COEFF. (n)		NONE	0.6
3	FLOW LENGTH (L) (TOTAL L < 300 FT)		FT	300
4	TWO-YR 24HOUR RAINFALL (P2)		IN	5.75
5	SLOPE OF LAND (S)		FT/FT	0.0243
6	Tt = [(0.007 (nL)**.8)/[(P2**.5)(s**.4)]]		HOUR	0.82

SHALLOW CONCENTRATED FLOW

		Segment ID		BC
7	PAVED OR UNPAVED		NONE	**UNPAVED**
8	FLOW LENGTH (L)		FT	607
9	WATERCOURSE SLOPE (s)		FT/FT	0.0243
10	AVERAGE VELOCITY (v)		FT/S	2.30
11	Tt = L / 3600/V		HOUR	0.07

CHANNEL FLOW

		Segment ID		CD
12	PAVED OR UNPAVED		NONE	**UNPAVED**
13	FLOW LENGTH (L)		FT	1210
14	ASSUMED VELOCITY (v)		FT/S	5.00
15	Tt = L / 3600/V		HOUR	0.07
16	WATERSHED TOTAL Tc (SUM OF ALL SEGMENTS)		HOURS	0.96
			MINS	**58**

TIME OF CONCENTRATION CALCULATION

Basin F - West side of Four Star at South End

CONTRIBUTING BASIN

SHEET FLOW

		Segment ID		AB
1	COVER TYPE		UNIT	**GRASS**
2	MANNING'S ROUGHNESS COEFF. (n)		NONE	0.24
3	FLOW LENGTH (L) (TOTAL L < 300 FT)		FT	281
4	TWO-YR 24HOUR RAINFALL (P2)		IN	5.75
5	SLOPE OF LAND (S)		FT/FT	0.0231
6	Tt = [(0.007 (nL)**.8)/[(P2**.5)(s**.4)]]		HOUR	0.38
7	WATERSHED TOTAL Tc (SUM OF ALL SEGMENTS)		HOURS	0.38
			MINS	**23**

Four Star Farm Road Dirt Road Paving and Drainage
MESI Project No. 170001-009
October 26, 2022

TIME OF CONCENTRATION CALCULATION

Basin D - West side of Four Star at South End

CONTRIBUTING BASIN

SHEET FLOW

		Segment ID		AB
1	COVER TYPE		UNIT	**GRASS**
2	MANNING'S ROUGHNESS COEFF. (n)		NONE	0.24
3	FLOW LENGTH (L) (TOTAL L < 300 FT)		FT	240
4	TWO-YR 24HOUR RAINFALL (P2)		IN	5.75
5	SLOPE OF LAND (S)		FT/FT	0.0125
6	Tt = [(0.007 (nL)**.8)/[(P2**.5)(s**.4)]]		HOUR	0.43

CHANNEL FLOW

		Segment ID		BC
7	PAVED OR UNPAVED		NONE	**UNPAVED**
8	FLOW LENGTH (L)		FT	156
9	ASSUMED VELOCITY (v)		FT/S	5.00
10	Tt = L / 3600/V		HOUR	0.01
11	WATERSHED TOTAL Tc (SUM OF ALL SEGMENTS)		HOURS	0.44
			MINS	**26**

TIME OF CONCENTRATION CALCULATION

Basin A, C, E, G -Small Basin areas, road and right-of-way areas only.

MINS	**8**

Four Star Farm Road Dirt Road Paving and Drainage
MESI Project No. 170001-009
October 26, 2022

RATIONAL COEFFICIENT
BASIN A

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	23,322	100%
Pervious C =	16,325	70%
Impervious C =	6,997	30%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	23,322	
Composite C =	**0.43**	

RATIONAL COEFFICIENT
BASIN D

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	22,202	100%
Pervious C =	21,758	98%
Impervious C =	444	2%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	22,202	
Composite C =	**0.22**	

RATIONAL COEFFICIENT
BASIN F

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	27,295	100%
Pervious C =	26,749	98%
Impervious C =	546	2%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	27,295	
Composite C =	**0.22**	

RATIONAL COEFFICIENT
BASIN B

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	754,890	100%
Pervious C =	0	0%
Impervious C =	0	0%
Wooded C =	566,168	75%
Farmland/Pasture C =	0	0%
Residential C =	188,723	25%
	754,890	
Composite C =	**0.21**	

RATIONAL COEFFICIENT
BASIN E

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	11,057	100%
Pervious C =	0	0%
Impervious C =	11,057	100%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	11,057	
Composite C =	**0.95**	

RATIONAL COEFFICIENT
BASIN G

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	7,658	100%
Pervious C =	3,829	50%
Impervious C =	3,829	50%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	7,658	
Composite C =	**0.58**	

RATIONAL COEFFICIENT
BASIN C

Pervious C =	0.20
Impervious C =	0.95
Wooded C =	0.15
Farmland/Pasture C =	0.25
Residential C =	0.40

	SF	%
Total Area =	15,600	100%
Pervious C =	0	0%
Impervious C =	15,600	100%
Wooded C =	0	0%
Farmland/Pasture C =	0	0%
Residential C =	0	0%
	15,600	
Composite C =	**0.95**	

Four Star Farm Road Dirt Road Paving and Drainage
MESI Project No. 170001-009
October 26, 2022
BASIN RUNOFF CALCULATIONS

Assumptions:

1 All Areas are taken from the Computer.
2 All Inlet calculations are based on a 25 year design storm.
3 Existing Piping Calculations from the west were tabultaed via the SCS Method due to contributing area.
4 Runoff calculations for inlets and new piping are based on the Rational Method where Q= C*i*A.
5 Travel time through pipe sections is ignored.

Basin	Time of Concentration (min)	Corresponding i (in/hr)	Runoff C	Area (SF)	Area (AC)	Runoff (cfs)	
Basin A	8	8.50	0.43	23,322	0.54	1.93	Culvert under Four Star at Molino Road Intersection
Basin B	58	3.75	0.21	754,890	17.33	13.81	Overall Basin at North end of Four Star East Side
Basin C	8	8.50	0.95	15,600	0.36	2.89	Inlet Design
Basin D	26	5.70	0.22	22,202	0.51	0.62	Inlet Design
Basin E	8	8.50	0.95	11,057	0.25	2.05	Inlet Design
Basin F	23	6.00	0.22	27,295	0.63	0.81	Inlet Design
Basin G	8	8.50	0.58	7,658	0.18	0.86	Inlet Design

Four Star Farm Road Dirt Road Paving and Drainage
MESI Project No. 170001-009
February 6, 2023
RUNOFF CALCULATIONS AT VARIOUS POINTS OF INTEREST

Drainage Ditch - Sta 0+50 to Sta 14+85 Left
Cross-Drain at Low Point (Station 14+85)

Basins	Rational C	Area (Ac)	C x A	Concentration (mins)	Intensity (in/hr)
Basin B	0.21	17.33	3.68	58.00	3.75
Basin C	0.95	0.36	0.340	8	8.50
		17.69	4.02	58	3.75

Composite C =	0.23	
Max Tc =	58	mins
Controlling i =	3.75	in/hr
25 year Q =	**15.09**	cfs

Note that the conveyance in the pipe is distriubuted evenly along the pipe route. The ditches over top of pipes are considered to include minimal localized flows only from Station 0+50 to station 11+05.

Drainage Ditch - Sta 14+85 to Sta 18+50 Right

Basins	Rational C	Area (Ac)	C x A	Concentration (mins)	Intensity (in/hr)
Basin B	0.21	17.33	3.68	58.00	3.75
Basin C	0.95	0.36	0.34	8	8.50
Basin D	0.22	0.51	0.11	26.00	5.70
Basin E	0.95	0.25	0.24	8.00	8.50
		18.45	4.37	58	3.75

Composite C =	0.24	
Max Tc =	58	mins
Controlling i =	3.75	in/hr
25 year Q =	**16.39**	cfs

Drainage Ditch - Sta 14+85 to Sta 18+50 Right

Basins	Rational C	Area (Ac)	C x A	Concentration (mins)	Intensity (in/hr)
Basin D	0.22	0.51	0.11	26.00	5.70
Basin E	0.95	0.25	0.241	8	8.50
		0.76	0.35	26	5.7

Composite C =	0.46	
Max Tc =	26	mins
Controlling i =	5.7	in/hr
25 year Q =	**2.00**	cfs

Outfall Pipe from Junction Box C-2 to Bubble-Up Structure C-1

Basins	Rational C	Area (Ac)	C x A	Concentration (mins)	Intensity (in/hr)
Basin F	0.22	0.63	0.13	23.00	6.00
Basin G	0.58	0.18	0.101	8	8.50
		0.80	0.24	23	6

Composite C =	0.29	
Max Tc =	23	mins
Controlling i =	6	in/hr
25 year Q =	**1.41**	cfs

Four Star Farm Road Dirt Road Paving and Drainage

MESI Project No. 170001-009

February 6, 2023

LEFT SIDE (DITCH)

Begin Station	Begin Station Converted	End Station	End Station Converted	Length (Ft)	Upstream Invert	Downstream Invert		Elevation Difference	Slope (ft/ft)	Slope (%)
Drain to A-9										
0+50	50.00	2+00	200.00	150.00	151.5	151.5	150.93	-0.57	-0.003800	-0.3800%
1+00	100.00			50.00	151.5	151.31		-0.19	-0.003800	-0.3800%
1+50	150.00			50.00	151.31	151.12		-0.19	-0.003800	-0.3800%
2+00	200.00			50.00	151.12	150.93	0.00	-0.19	-0.003800	-0.3800%
Drain to A-8										
2+40	240.00	2+90	290.00	50.00	151.25	151.25	151.00	-0.25	-0.005000	-0.5000%
2+50	250.00			10.00	151.25	151.20		-0.05	-0.005000	-0.5000%
2+90	290.00			40.00	151.20	151.00	0.00	-0.20	-0.005000	-0.5000%
Drain to A-7										
3+20	320.00	4+50	450.00	130.00	151.30	151.30	150.57	-0.73	-0.005615	-0.5615%
3+50	350.00			30.00	151.30	151.13		-0.17	-0.005615	-0.5615%
4+00	400.00			50.00	151.13	150.85		-0.28	-0.005615	-0.5615%
4+50	450.00			50.00	150.85	150.57	0.00	-0.28	-0.005615	-0.5615%
Drain to A-6										
4+75	475.00	5+85	585.00	110.00	151.00	151.00	150.65	-0.35	-0.003182	-0.3182%
5+00	500.00			25.00	151.00	150.92		-0.08	-0.003182	-0.3182%
5+50	550.00			50.00	150.92	150.76		-0.16	-0.003182	-0.3182%
5+85	585.00			35.00	150.76	150.65	0.00	-0.11	-0.003182	-0.3182%
Drain to A-5										
6+35	635.00	7+20	720.00	85.00	151.10	151.10	150.53	-0.57	-0.006706	-0.6706%
6+50	650.00			15.00	151.10	151.00		-0.10	-0.006706	-0.6706%
7+00	700.00			50.00	151.00	150.66		-0.34	-0.006706	-0.6706%
7+20	720.00			20.00	150.66	150.53	0.00	-0.13	-0.006706	-0.6706%

Drain to A-3										
7+55	755.00	8+70	870.00	115.00	150.70	150.70	148.00	-2.70	-0.023478	-2.3478%
8+00	800.00			45.00	150.70	149.64		-1.06	-0.023478	-2.3478%
8+50	850.00			50.00	149.64	148.47		-1.17	-0.023478	-2.3478%
8+70	870.00			20.00	148.47	148.00	0.00	-0.47	-0.023478	-2.3478%
Drain to A-2										
9+05	905.00	10+20	1020.00	115.00	148.00	148.00	144.25	-3.75	-0.032609	-3.2609%
9+50	950.00			45.00	148.00	146.53		-1.47	-0.032609	-3.2609%
10+00	1000.00			50.00	146.53	144.90		-1.63	-0.032609	-3.2609%
10+20	1020.00			20.00	144.90	144.25	0.00	-0.65	-0.032609	-3.2609%
Outfall to Breakpoint										
11+05	1105.00	13+45	1345.00	240.00	141.01	141.01	134.29	-6.72	-0.028000	-2.8000%
11+50	1150.00			45.00	141.01	139.75		-1.26	-0.028000	-2.8000%
12+00	1200.00			50.00	139.75	138.35		-1.40	-0.028000	-2.8000%
12+50	1250.00			50.00	138.35	136.95		-1.40	-0.028000	-2.8000%
12+94	1294.00			44.00	136.95	135.72		-1.23	-0.028000	-2.8000%
13+45	1345.00			51.00	135.72	134.29	0.00	-1.43	-0.028000	-2.8000%
Breakpoint to Cross Drain										
13+45	1345.00	14+85	1485.00	140.00	134.29	134.29	132.02	-2.27	-0.016214	-1.6214%
13+50	1350.00			5.00	134.29	134.21		-0.08	-0.016214	-1.6214%
14+00	1400.00			50.00	134.21	133.40		-0.81	-0.016214	-1.6214%
14+50	1450.00			50.00	133.40	132.59		-0.81	-0.016214	-1.6214%
14+85	1485.00			35.00	132.59	132.02	0.00	-0.57	-0.016214	-1.6214%
Drain to C-3										
18+75	1875.00	20+90	2090.00	215.00	134.50	134.50	129.00	-5.50	-0.025581	-2.5581%
19+00	1900.00			25.00	134.50	133.86		-0.64	-0.025581	-2.5581%
19+50	1950.00			50.00	133.86	132.58		-1.28	-0.025581	-2.5581%
20+00	2000.00			50.00	132.58	131.30		-1.28	-0.025581	-2.5581%
20+50	2050.00			50.00	131.30	130.02		-1.28	-0.025581	-2.5581%
20+90	2090.00			40.00	130.02	129.00	0.00	-1.02	-0.025581	-2.5581%

Four Star Farm Road Dirt Road Paving and Drainage

MESI Project No. 170001-009

February 6, 2023

LEFT SIDE (PIPE)

Begin Station	Begin Station Converted	End Station	End Station Converted	Length (Ft)	Upstream Invert	Downstream Invert		Elevation Difference	Slope (ft/ft)	Slope (%)	
A-9 to A-8											
2+00	200	2+90	290.00	90.00	148.50	148.50	148.00	-0.50	-0.005556	-0.5556%	18" ADS HP
2+22	222			22.00	148.50	148.38		-0.12	-0.005556	-0.5556%	18" ADS HP
2+50	250			28.00	148.38	148.22		-0.16	-0.005556	-0.5556%	18" ADS HP
2+90	290			40.00	148.22	148.00	0.00	-0.22	-0.005556	-0.5556%	18" ADS HP
A-8 to A-7											
2+90	290	4+50	450.00	160.00	148.00	148.00	147.19	-0.81	-0.005063	-0.5063%	18" ADS HP
3+00	300			10.00	148.00	147.95		-0.05	-0.005063	-0.5063%	18" ADS HP
3+03	303			3.00	147.95	147.93		-0.02	-0.005063	-0.5063%	18" ADS HP
3+50	350			47.00	147.93	147.69		-0.24	-0.005063	-0.5063%	18" ADS HP
4+00	400			50.00	147.69	147.44		-0.25	-0.005063	-0.5063%	18" ADS HP
4+50	450			50.00	147.44	147.19	0.00	-0.25	-0.005063	-0.5063%	18" ADS HP
A-7 to A-6											
4+50	450	5+85	585.00	135.00	146.69	146.69	145.99	-0.70	-0.005185	-0.5185%	24" ADS HP
5+00	500			50.00	146.69	146.43		-0.26	-0.005185	-0.5185%	24" ADS HP
5+50	550			50.00	146.43	146.17		-0.26	-0.005185	-0.5185%	24" ADS HP
5+85	585			35.00	146.17	145.99	0.00	-0.18	-0.005185	-0.5185%	24" ADS HP
A-6 to A-5											
5+85	585	7+20	720.00	135.00	145.99	145.99	145.39	-0.60	-0.004444	-0.4444%	24" ADS HP
6+00	600			15.00	145.99	145.92		-0.07	-0.004444	-0.4444%	24" ADS HP
6+10	610			10.00	145.92	145.88		-0.04	-0.004444	-0.4444%	24" ADS HP
6+50	650			40.00	145.88	145.70		-0.18	-0.004444	-0.4444%	24" ADS HP
7+00	700			50.00	145.70	145.48		-0.22	-0.004444	-0.4444%	24" ADS HP
7+20	720			20.00	145.48	145.39	0.00	-0.09	-0.004444	-0.4444%	24" ADS HP

A-5 to A-3											
7+20	720	8+70	870.00	150.00	145.39	145.39	144.64	-0.75	-0.005000	-0.5000%	24" ADS HP
7+38	738			18.00	145.39	145.30		-0.09	-0.005000	-0.5000%	24" ADS HP
7+50	750			12.00	145.30	145.24		-0.06	-0.005000	-0.5000%	24" ADS HP
8+00	800			50.00	145.24	144.99		-0.25	-0.005000	-0.5000%	24" ADS HP
8+50	850			50.00	144.99	144.74		-0.25	-0.005000	-0.5000%	24" ADS HP
8+70	870			20.00	144.74	144.64	0.00	-0.10	-0.005000	-0.5000%	24" ADS HP
A-3 to A-2											
8+70	870	10+20	1020.00	150.00	144.64	144.64	141.49	-3.15	-0.021000	-2.1000%	19" x 30" RCEP
8+87	887			17.00	144.64	144.28		-0.36	-0.021000	-2.1000%	19" x 30" RCEP
9+00	900			13.00	144.28	144.01		-0.27	-0.021000	-2.1000%	19" x 30" RCEP
9+50	950			50.00	144.01	142.96		-1.05	-0.021000	-2.1000%	19" x 30" RCEP
10+00	1000			50.00	142.96	141.91		-1.05	-0.021000	-2.1000%	19" x 30" RCEP
10+20	1020			20.00	141.91	141.49	0.00	-0.42	-0.021000	-2.1000%	19" x 30" RCEP
A-2 to A-1											
10+20	1020	10+65	1065.00	45.00	141.49	141.49	141.25	-0.24	-0.005333	-0.5333%	19" x 30" RCEP
10+40	1040			20.00	141.49	141.38		-0.11	-0.005333	-0.5333%	19" x 30" RCEP
10+50	1050			10.00	141.38	141.33		-0.05	-0.005333	-0.5333%	19" x 30" RCEP
10+65	1065			15.00	141.33	141.25	0.00	-0.08	-0.005333	-0.5333%	19" x 30" RCEP
A-1 to Outfall											
10+65	1065	11+05	1105.00	40.00	141.25	141.25	141.01	-0.24	-0.006000	-0.6000%	19" x 30" RCEP
10+88	1088			23.00	141.25	141.11		-0.14	-0.006000	-0.6000%	19" x 30" RCEP
11+00	1100			12.00	141.11	141.04		-0.07	-0.006000	-0.6000%	19" x 30" RCEP
11+05	1105			5.00	141.04	141.01	0.00	-0.03	-0.006000	-0.6000%	19" x 30" RCEP

RIGHT SIDE (DITCH)

Begin Station	Begin Station Converted	End Station	End Station Converted	Length (Ft)	Upstream Invert	Downstream Invert		Elevation Difference	Slope (ft/ft)	Slope (%)
Drain to B-1										
14+85	1485.00	16+60	1660.00	175.00	133.90	133.90	134.74	0.84	0.004800	0.4800%
15+00	1500.00			15.00	133.90	133.97		0.07	0.004800	0.4800%
15+50	1550.00			50.00	133.97	134.21		0.24	0.004800	0.4800%
16+00	1600.00			50.00	134.21	134.45		0.24	0.004800	0.4800%
16+50	1650.00			50.00	134.45	134.69		0.24	0.004800	0.4800%
16+60	1660.00			10.00	134.69	134.74	0.00	0.05	0.004800	0.4800%
Drain to B-2										
17+05	1705.00	18+50	1850.00	145.00	134.90	134.90	135.63	0.73	0.005034	0.5034%
17+28	1728.00			23.00	134.90	135.02		0.12	0.005034	0.5034%
17+50	1750.00			22.00	135.02	135.13		0.11	0.005034	0.5034%
18+00	1800.00			50.00	135.13	135.38		0.25	0.005034	0.5034%
18+50	1850.00			50.00	135.38	135.63	0.00	0.25	0.005034	0.5034%
Drain to C-4										
18+75	1875.00	20+90	2090.00	215.00	134.80	134.80	129.00	-5.80	-0.026977	-2.6977%
19+00	1900.00			25.00	134.80	134.13		-0.67	-0.026977	-2.6977%
19+50	1950.00			50.00	134.13	132.78		-1.35	-0.026977	-2.6977%
20+00	2000.00			50.00	132.78	131.43		-1.35	-0.026977	-2.6977%
20+50	2050.00			50.00	131.43	130.08		-1.35	-0.026977	-2.6977%
20+90	2090.00			40.00	130.08	129.00	0.00	-1.08	-0.026977	-2.6977%

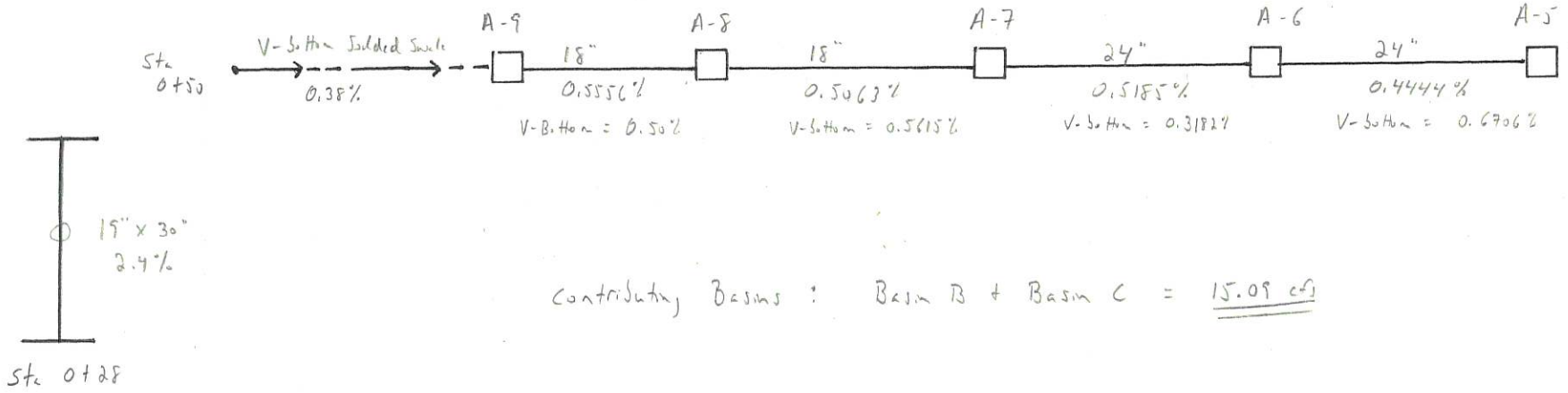
Four Star Farm Road Dirt Road Paving and Drainage

MESI Project No. 170001-009

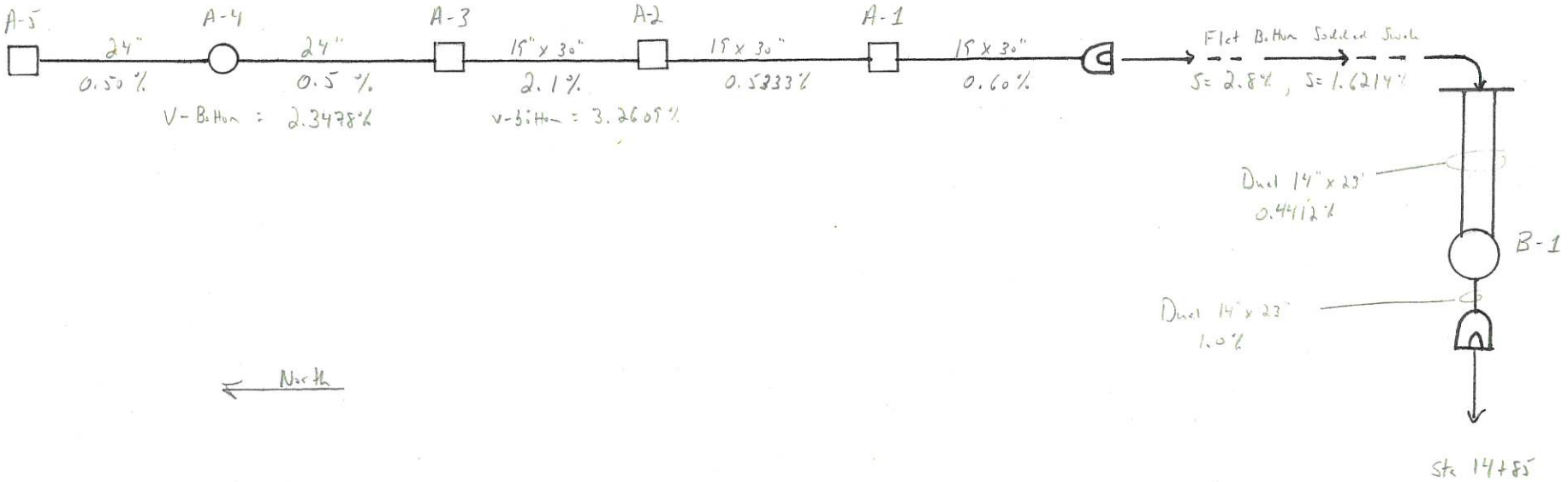
February 6, 2023

RIGHT SIDE (PIPE)

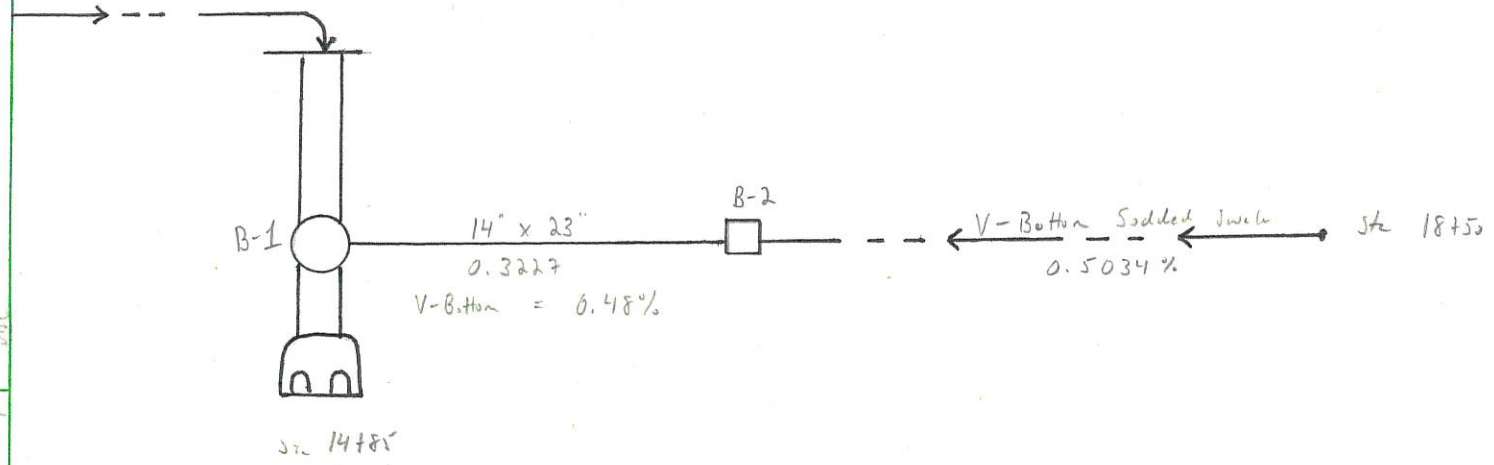
Begin Station	Begin Station Converted	End Station	End Station Converted	Length (Ft)	Upstream Invert	Downstream Invert		Elevation Difference	Slope (ft/ft)	Slope (%)	
B-2 to B-1											
14+85	1485	17+05	1705.00	220.00	131.85	131.85	132.56	0.71	0.003227	0.3227%	14" x 23" RCEP
15+00	1500			15.00	131.85	131.90		0.05	0.003227	0.3227%	14" x 23" RCEP
15+50	1550			50.00	131.90	132.06		0.16	0.003227	0.3227%	14" x 23" RCEP
16+00	1600			50.00	132.06	132.22		0.16	0.003227	0.3227%	14" x 23" RCEP
16+50	1650			50.00	132.22	132.38		0.16	0.003227	0.3227%	14" x 23" RCEP
16+89	1689			39.00	132.38	132.51		0.13	0.003227	0.3227%	14" x 23" RCEP
16+93	1693			4.00	132.51	132.52		0.01	0.003227	0.3227%	14" x 23" RCEP
17+00	1700			7.00	132.52	132.54		0.02	0.003227	0.3227%	14" x 23" RCEP
17+05	1705			5.00	132.54	132.56	0.00	0.02	0.003227	0.3227%	14" x 23" RCEP



Contributing Basins : Basin B + Basin C = 15.09 cfs



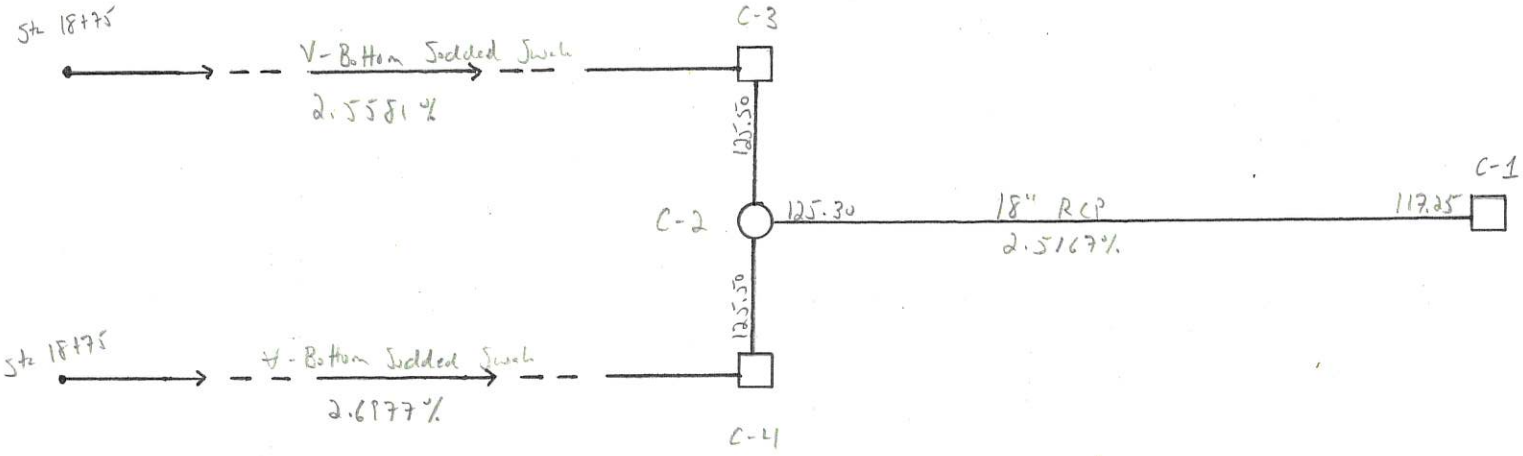
North



Contr. Safety Basin : Basin D + Basin E ⇒ Q = 2.00 cfs

← North

4 Star Farm Road 170001-005 Dist 2/6/2023



Contributing Basins: Basin F = 0.81 cfs right side

Basin G = 0.81 cfs left side

Basin F + G = 1.41 cfs Outfall

North

Hydraulic Analysis - Open Channel Pipe Flow *ver 0.0*

https://pipeeng.com/gravity_flow.html

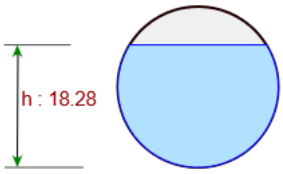
Project	*Four Star Farm Road*		Developer	*DEL*
Date	*2023-02-06*		Approver	
Revision	*A-7 to Outfall (Min Slope)*		Reviewer	

This tool was developed using the Camp or Manning Equation to help users to size partially full pipe based on the slope available. The Camp method is recommended as a flow depth dependent variation in Manning roughness coefficient has been used to improve the accuracy.

Input Data

Equation		Manning Method
Manning Roughness Coefficient, n	-	0.0130
Hydraulic Slope, Sh	ft/ft	0.0044
Pipe Inner Diameter, ID	inch	24.00

Filled Pipe



Output

Fluid Depth, h	inch	18.28
Wetted Angle by flow, θ	rads	4.24
Cross-Sectional Area of Flow Bore, Ac	ft²	2.57
Wetted Perimeter, Pw	ft	4.24
Hydraulic Radius, rH	ft	0.61
Flow Velocity, V	ft/s	5.45
Actual Flow Rate, Qa	ft³/s	14.00
Full Pipe Flow Rate, Qf	ft³/s	15.08

Notes :

- *Nearly full circular pipes will carry more liquid than a completely full pipe. Maximum flow is achieved at about 93% of full pipe flow, and maximum velocity at about 78% of full pipe flow.*

Hydraulic Analysis - Open Channel Pipe Flow *ver 0.0*

https://pipeeng.com/gravity_flow.html

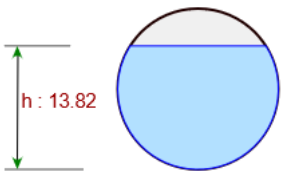
Project	*Four Star Farm Road*		Developer	*DEL*
Date	*2023-02-06*		Approver	
Revision	*A-9 through A-7 (Min Slope)*		Reviewer	

This tool was developed using the Camp or Manning Equation to help users to size partially full pipe based on the slope available. The Camp method is recommended as a flow depth dependent variation in Manning roughness coefficient has been used to improve the accuracy.

Input Data

Equation		Manning Method
Manning Roughness Coefficient, n	-	0.0130
Hydraulic Slope, Sh	ft/ft	0.0051
Pipe Inner Diameter, ID	inch	18.00

Filled Pipe



Output

Fluid Depth, h	inch	13.82
Wetted Angle by flow, θ	rads	4.27
Cross-Sectional Area of Flow Bore, Ac	ft²	1.46
Wetted Perimeter, Pw	ft	3.20
Hydraulic Radius, rH	ft	0.45
Flow Velocity, V	ft/s	4.81
Actual Flow Rate, Qa	ft³/s	7.00
Full Pipe Flow Rate, Qf	ft³/s	7.47

Notes :

- *Nearly full circular pipes will carry more liquid than a completely full pipe. Maximum flow is achieved at about 93% of full pipe flow, and maximum velocity at about 78% of full pipe flow.*

Hydraulic Analysis - Open Channel Pipe Flow *ver 0.0*

https://pipeeng.com/gravity_flow.html

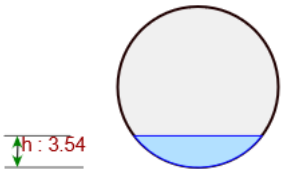
Project	*Four Star Farm Road*		Developer	*DEL*
Date	*2023-02-06*		Approver	
Revision	*Inlet C-2 to Bubble-Up C-1*		Reviewer	

This tool was developed using the Camp or Manning Equation to help users to size partially full pipe based on the slope available. The Camp method is recommended as a flow depth dependent variation in Manning roughness coefficient has been used to improve the accuracy.

Input Data

Equation		Manning Method
Manning Roughness Coefficient, n	-	0.0130
Hydraulic Slope, Sh	ft/ft	0.0252
Pipe Inner Diameter, ID	inch	18.00

Filled Pipe



Output

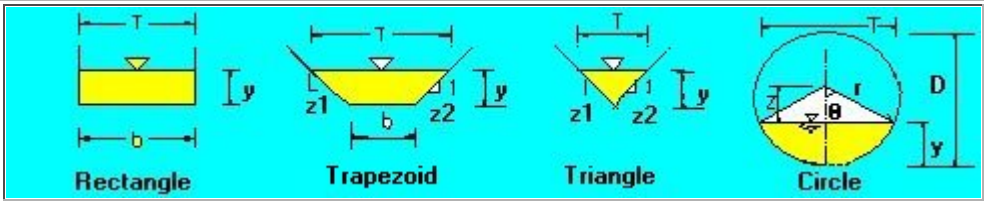
Fluid Depth, h	inch	3.54
Wetted Angle by flow, θ	rads	1.84
Cross-Sectional Area of Flow Bore, Ac	ft²	0.25
Wetted Perimeter, Pw	ft	1.38
Hydraulic Radius, rH	ft	0.18
Flow Velocity, V	ft/s	5.74
Actual Flow Rate, Qa	ft³/s	1.41
Full Pipe Flow Rate, Qf	ft³/s	16.66

Notes :

- *Nearly full circular pipes will carry more liquid than a completely full pipe. Maximum flow is achieved at about 93% of full pipe flow, and maximum velocity at about 78% of full pipe flow.*

The open channel flow calculator

Select Channel Type: Triangle

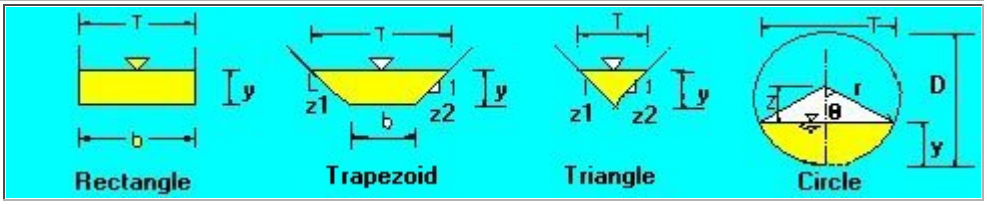


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.032609 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 2.0489 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:\
Flow discharge 1.5366 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.57 ft	Froude number 0.72	Flow status Subcritical flow
Critical depth 0.44 ft	Critical slope 0.0637 ft/ft	Velocity head 0.07 ft

The open channel flow calculator

Select Channel Type: Triangle

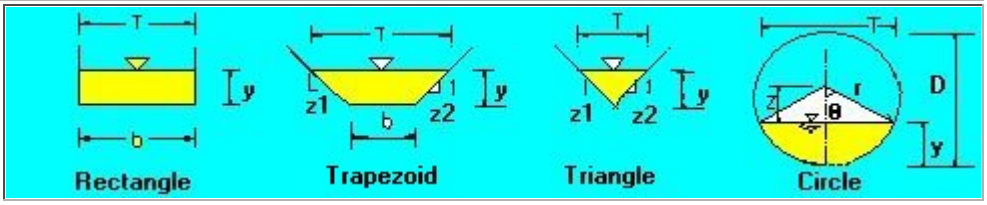


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.023478 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 1.7385 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:\
Flow discharge 1.3039 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.55 ft	Froude number 0.61	Flow status Subcritical flow
Critical depth 0.41 ft	Critical slope 0.0651 ft/ft	Velocity head 0.05 ft

The open channel flow calculator

Select Channel Type: Triangle

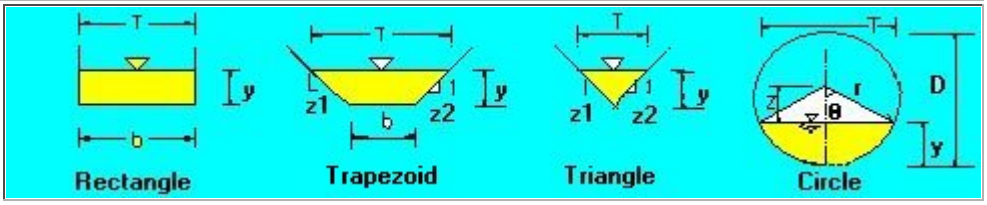


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.006706 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 0.9291 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:V
Flow discharge 0.6968 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.51 ft	Froude number 0.33	Flow status Subcritical flow
Critical depth 0.32 ft	Critical slope 0.0701 ft/ft	Velocity head 0.01 ft

The open channel flow calculator

Select Channel Type: Triangle

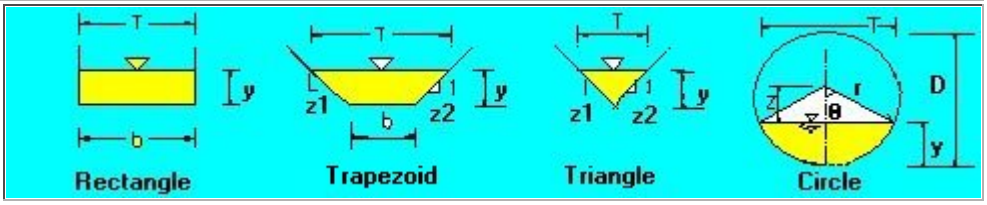


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.003182 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 0.64 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:V
Flow discharge 0.48 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.51 ft	Froude number 0.23	Flow status Subcritical flow
Critical depth 0.28 ft	Critical slope 0.075 ft/ft	Velocity head 0.01 ft

The open channel flow calculator

Select Channel Type: Triangle

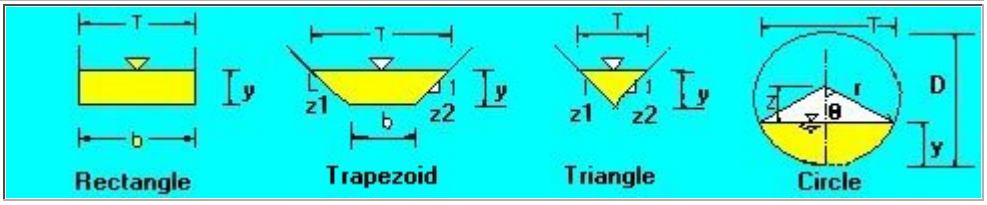


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.005615 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 0.8502 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:\
Flow discharge 0.6376 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.51 ft	Froude number 0.3	Flow status Subcritical flow
Critical depth 0.31 ft	Critical slope 0.0701 ft/ft	Velocity head 0.01 ft

The open channel flow calculator

Select Channel Type: Triangle

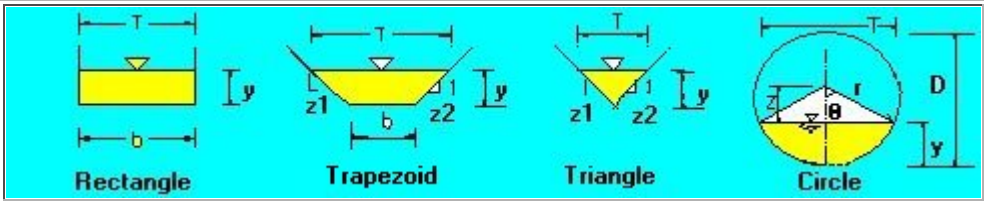


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.005 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 0.8023 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:\
Flow discharge 0.6017 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.51 ft	Froude number 0.28	Flow status Subcritical flow
Critical depth 0.3 ft	Critical slope 0.0704 ft/ft	Velocity head 0.01 ft

The open channel flow calculator

Select Channel Type: Triangle

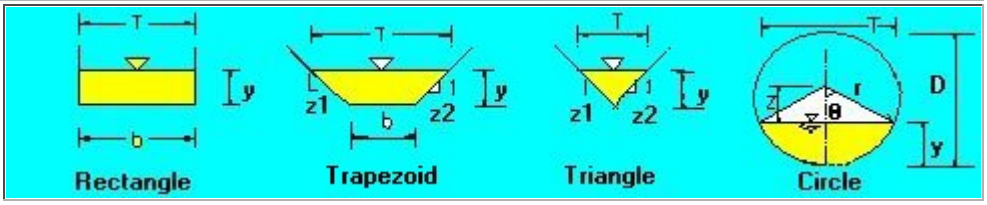


Velocity(V)&Discharge(Q) | Select unit system: Feet(ft)

Channel slope: 0.0038 ft/ft	Water depth(y): 0.5 ft	Bottom W(b) 0 ft
Flow velocity 0.6994 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:V
Flow discharge 0.5246 ft^3/s	Input n value 0.05 or select n clean,uncoated castiron:0.014	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 3.18 ft	Flow area 0.75 ft^2	Top width(T) 3 ft
Specific energy 0.51 ft	Froude number 0.25	Flow status Subcritical flow
Critical depth 0.29 ft	Critical slope 0.0734 ft/ft	Velocity head 0.01 ft

The open channel flow calculator

Select Channel Type: Triangle

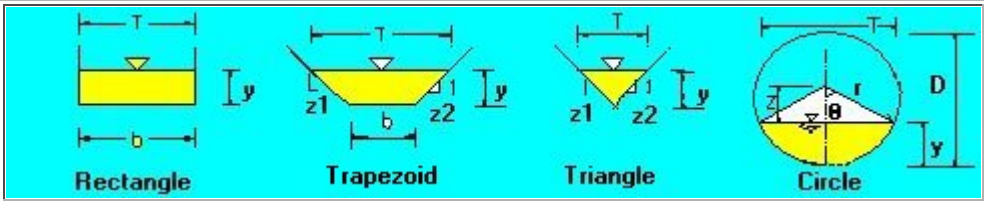


Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.3227 ft/ft	Water depth(y): 0.36 ft	Bottom W(b) 0 ft
Flow velocity 5.070527 ft/s	LeftSlope (Z1): 4 to 1 (H:	RightSlope (Z2): 2 to 1 (H:\
Flow discharge 2 ft^3/s	Input n value 0.05 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 2.31 ft	Flow area 0.39 ft^2	Top width(T) 2.18 ft
Specific energy 0.76 ft	Froude number 2.1	Flow status Supercritical flow
Critical depth 0.49 ft	Critical slope 0.0615 ft/ft	Velocity head 0.4 ft

The open channel flow calculator

Select Channel Type: Triangle



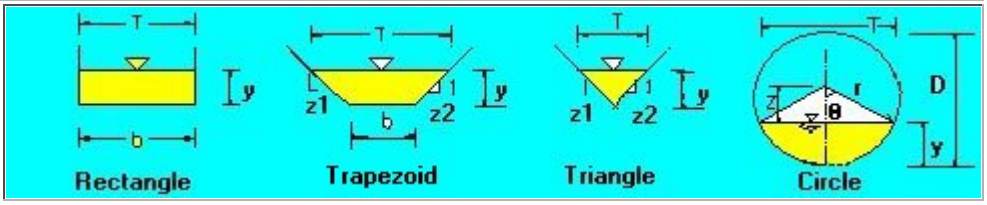
Depth from Q

Select unit system: Feet(ft)

Channel slope: 2.5581 ft/ft	Water depth(y): 0.18 ft	Bottom W(b) 0 ft
Flow velocity 8.721307 ft/s	LeftSlope (Z1): 4 to 1 (H:	RightSlope (Z2): 2 to 1 (H:\
Flow discharge 0.86 ft^3/s	Input n value 0.05 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.15 ft	Flow area 0.1 ft^2	Top width(T) 1.09 ft
Specific energy 1.36 ft	Froude number 5.1	Flow status Supercritical flow
Critical depth 0.35 ft	Critical slope 0.0656 ft/ft	Velocity head 1.18 ft

The open channel flow calculator

Select Channel Type: Triangle



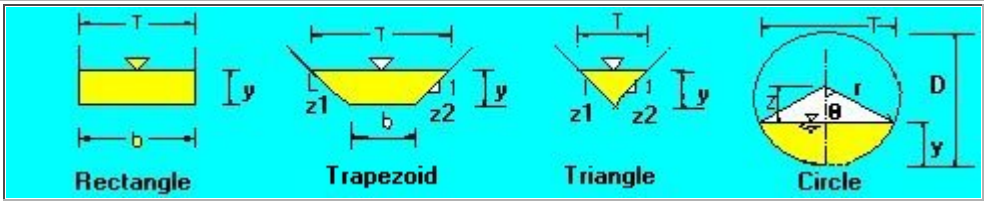
Depth from Q

Select unit system: Feet(ft)

Channel slope: 2.6977 ft/ft	Water depth(y): 0.18 ft	Bottom W(b) 0 ft
Flow velocity 8.67694 ft/s	LeftSlope (Z1): 4 to 1 (H:	RightSlope (Z2): 2 to 1 (H:\
Flow discharge 0.81 ft^3/s	Input n value 0.05 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 1.12 ft	Flow area 0.09 ft^2	Top width(T) 1.06 ft
Specific energy 1.35 ft	Froude number 5.15	Flow status Supercritical flow
Critical depth 0.34 ft	Critical slope 0.0676 ft/ft	Velocity head 1.17 ft

The open channel flow calculator

Select Channel Type: Trapezoid



Depth from Q | Select unit system: Feet(ft)

Channel slope: 0.016214 ft/ft	Water depth(y): 0.95 ft	Bottom width(b) 3 ft
Flow velocity 2.713 ft/s	LeftSlope (Z1): 2 to 1 (H:	RightSlope (Z2): 4 to 1 (H:V
Flow discharge 15.09 ft^3/s	Input n value 0.05 or select n	
Calculate!	Status: Calculation finished	Reset
Wetted perimeter 9.05 ft	Flow area 5.56 ft^2	Top width(T) 8.7 ft
Specific energy 1.06 ft	Froude number 0.6	Flow status Subcritical flow
Critical depth 0.73 ft	Critical slope 0.047 ft/ft	Velocity head 0.11 ft

Hydraulic Analysis - Open Channel Pipe Flow *ver 0.0*

https://pipeeng.com/gravity_flow.html

Project	*Four Star Farm Road*		Developer	*DEL*
Date	*2023-02-06*		Approver	
Revision	*Outfall to Easement at Sta 14+85*		Reviewer	

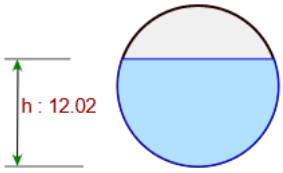
This tool was developed using the Camp or Manning Equation to help users to size partially full pipe based on the slope available. The Camp method is recommended as a flow depth dependent variation in Manning roughness coefficient has been used to improve the accuracy.

Input Data

Equation		Manning Method
Manning Roughness Coefficient, n	-	0.0130
Hydraulic Slope, Sh	ft/ft	0.0100
Pipe Inner Diameter, ID	inch	18.00

Filled Pipe

NOTE: Dual 14" x 23" RCEP



Output

Fluid Depth, h	inch	12.02
Wetted Angle by flow, θ	rads	3.83
Cross-Sectional Area of Flow Bore, Ac	ft²	1.25
Wetted Perimeter, Pw	ft	2.87
Hydraulic Radius, rH	ft	0.44
Flow Velocity, V	ft/s	6.58
Actual Flow Rate, Qa	ft³/s	8.25
Full Pipe Flow Rate, Qf	ft³/s	10.50

Notes :

- *Nearly full circular pipes will carry more liquid than a completely full pipe. Maximum flow is achieved at about 93% of full pipe flow, and maximum velocity at about 78% of full pipe flow.*