0.00					
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	11.02	4.47	3.97
C & E Loss (ft)	0.00	Cum SA (acres)	4.17	0.65	0.79

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	149.37	156.29	159.47
Crit W.S. (ft)		Flow Area (sq ft)	533.96	294.94	140.31
E.G. Slope (ft/ft)	0.000040	Area (sq ft)	533.96	294.94	140.31
Q Total (cfs)	728.00	Flow (cfs)	271.77	402.73	53.50
Top Width (ft)	121.01	Top Width (ft)	70.51	22.51	27.99
Vel Total (ft/s)	0.75	Avg. Vel. (ft/s)	0.51	1.37	0.38
Max Chl Dpth (ft)	13.97	Hydr. Depth (ft)	7.57	13.10	5.01
Conv. Total (cfs)	114866.4	Conv. (cfs)	42880.9	63544.6	8440.8
Length Wtd. (ft)	154.46	Wetted Per. (ft)	72.56	25.80	29.41
Min Ch El (ft)	6.14	Shear (lb/sq ft)	0.02	0.03	0.01
Alpha	2.02	Stream Power (lb/ft s)	181.16	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	18.88	5.96	7.12
C & E Loss (ft)	0.00	Cum SA (acres)	4.98	0.65	0.99

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.00	Reach Len. (ft)	149.37	156.29	159.47
Crit W.S. (ft)		Flow Area (sq ft)	668.95	337.30	197.27
E.G. Slope (ft/ft)	0.000030	Area (sq ft)	668.95	337.30	197.27
Q Total (cfs)	846.00	Flow (cfs)	334.37	437.67	73.97
Top Width (ft)	128.03	Top Width (ft)	72.97	22.51	32.55
Vel Total (ft/s)	0.70	Avg. Vel. (ft/s)	0.50	1.30	0.37

Max Chl Dpth (ft)	15.86	Hydr. Depth (ft)	9.17	14.98	6.06
Conv. Total (cfs)	153615.2	Conv. (cfs)	60713.5	79470.9	13430.8
Length Wtd. (ft)	154.35	Wetted Per. (ft)	75.67	25.80	34.34
Min Ch El (ft)	6.14	Shear (lb/sq ft)	0.02	0.02	0.01
Alpha	1.99	Stream Power (lb/ft s)	181.16	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	23.61	7.54	8.81
C & E Loss (ft)	0.00	Cum SA (acres)	5.33	0.65	1.16

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 51095.56

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	8.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	8.00	Reach Len. (ft)	68.84	78.26	77.30
Crit W.S. (ft)		Flow Area (sq ft)		44.69	1.53
E.G. Slope (ft/ft)	0.003933	Area (sq ft)		44.69	1.53
Q Total (cfs)	182.00	Flow (cfs)		180.56	1.44
Top Width (ft)	25.05	Top Width (ft)		22.78	2.27
Vel Total (ft/s)	3.94	Avg. Vel. (ft/s)		4.04	0.94
Max Chl Dpth (ft)	2.33	Hydr. Depth (ft)		1.96	0.67
Conv. Total (cfs)	2902.0	Conv. (cfs)		2879.0	23.0
Length Wtd. (ft)	78.26	Wetted Per. (ft)		23.91	2.56
Min Ch El (ft)	5.67	Shear (lb/sq ft)		0.46	0.15
Alpha	1.04	Stream Power (lb/ft s)	213.66	0.00	0.00
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	0.68	1.08	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	1.23	0.52	0.02

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.68	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.32	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	9.36	Reach Len. (ft)	68.84	78.26
77.30				
Crit W.S. (ft)		Flow Area (sq ft)	0.76	76.71
5.91				
E.G. Slope (ft/ft)	0.002646	Area (sq ft)	0.76	76.71
5.91				
Q Total (cfs)	359.00	Flow (cfs)	0.40	351.62
6.97				
Top Width (ft)	30.51	Top Width (ft)	2.15	23.80
4.56				
Vel Total (ft/s)	4.31	Avg. Vel. (ft/s)	0.53	4.58
1.18				
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	0.35	3.22
1.29				
Conv. Total (cfs)	6979.7	Conv. (cfs)	7.8	6836.3
135.6				
Length Wtd. (ft)	78.07	Wetted Per. (ft)	2.24	25.22
5.26				
Min Ch El (ft)	5.67	Shear (lb/sq ft)	0.06	0.50
0.19				
Alpha	1.11	Stream Power (lb/ft s)	213.66	0.00
0.00				
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	2.30	1.80
0.51				
C & E Loss (ft)	0.02	Cum SA (acres)	2.27	0.55
0.32				

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.98	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	15.94	Reach Len. (ft)	68.84	78.26
77.30				
Crit W.S. (ft)		Flow Area (sq ft)	223.51	233.20
147.93				
E.G. Slope (ft/ft)	0.000094	Area (sq ft)	223.51	233.20
147.93				
Q Total (cfs)	613.00	Flow (cfs)	113.62	422.47
76.91				
Top Width (ft)	115.62	Top Width (ft)	56.63	23.80
35.19				
Vel Total (ft/s)	1.01	Avg. Vel. (ft/s)	0.51	1.81
0.52				
Max Chl Dpth (ft)	10.27	Hydr. Depth (ft)	3.95	9.80
4.20				
Conv. Total (cfs)	63283.0	Conv. (cfs)	11730.0	43613.5
7939.5				
Length Wtd. (ft)	75.73	Wetted Per. (ft)	57.49	25.22
36.79				
Min Ch El (ft)	5.67	Shear (lb/sq ft)	0.02	0.05
0.02				
Alpha	2.28	Stream Power (lb/ft s)	213.66	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	10.19	3.69

3.61					
C & E Loss (ft)	0.01	Cum SA (acres)	3.97	0.57	
0.69					

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.13	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	20.11	Reach Len. (ft)	68.84	78.26	
77.30					
Crit W.S. (ft)		Flow Area (sq ft)	478.26	332.49	
316.49					
E.G. Slope (ft/ft)	0.000027	Area (sq ft)	478.26	332.49	
316.49					
Q Total (cfs)	728.00	Flow (cfs)	195.25	409.87	
122.87					
Top Width (ft)	134.93	Top Width (ft)	65.51	23.80	
45.62					
Vel Total (ft/s)	0.65	Avg. Vel. (ft/s)	0.41	1.23	
0.39					
Max Chl Dpth (ft)	14.44	Hydr. Depth (ft)	7.30	13.97	
6.94					
Conv. Total (cfs)	139905.0	Conv. (cfs)	37523.1	78768.2	
23613.7					
Length Wtd. (ft)	75.01	Wetted Per. (ft)	67.31	25.22	
48.03					
Min Ch El (ft)	5.67	Shear (lb/sq ft)	0.01	0.02	
0.01					
Alpha	2.22	Stream Power (lb/ft s)	213.66	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	17.14	4.83	
6.28					
C & E Loss (ft)	0.00	Cum SA (acres)	4.75	0.57	
0.86					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.01	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	21.99	Reach Len. (ft)	68.84	78.26	
77.30					
Crit W.S. (ft)		Flow Area (sq ft)	605.34	377.29	
406.79					
E.G. Slope (ft/ft)	0.000021	Area (sq ft)	605.34	377.29	
406.79					
Q Total (cfs)	846.00	Flow (cfs)	244.81	446.94	
154.25					
Top Width (ft)	143.65	Top Width (ft)	69.52	23.80	
50.33					
Vel Total (ft/s)	0.61	Avg. Vel. (ft/s)	0.40	1.18	
0.38					
Max Chl Dpth (ft)	16.32	Hydr. Depth (ft)	8.71	15.85	
8.08					

Conv. Total (cfs)	184061.1	Conv. (cfs)	53261.8	97240.1	33559.2
Length Wtd. (ft)	74.85	Wetted Per. (ft)	71.73	25.22	53.10
Min Ch El (ft)	5.67	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	2.20	Stream Power (lb/ft s)	213.66	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	21.42	6.26	7.71
C & E Loss (ft)	0.00	Cum SA (acres)	5.09	0.57	1.01

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 51024.74

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	7.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.000	0.035	
W.S. Elev (ft)	7.72	Reach Len. (ft)	136.82	118.63	114.89
Crit W.S. (ft)	6.84	Flow Area (sq ft)	0.00	46.84	
E.G. Slope (ft/ft)	0.003566	Area (sq ft)	0.00	46.84	
Q Total (cfs)	182.00	Flow (cfs)	0.00	182.00	
Top Width (ft)	22.89	Top Width (ft)	0.31	22.58	
Vel Total (ft/s)	3.88	Avg. Vel. (ft/s)	0.06	3.89	
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	0.01	2.07	
Conv. Total (cfs)	3047.6	Conv. (cfs)	0.0	3047.6	
Length Wtd. (ft)	118.67	Wetted Per. (ft)	0.31	24.69	
Min Ch El (ft)	5.21	Shear (lb/sq ft)		0.42	
Alpha	1.00	Stream Power (lb/ft s)	249.68	0.00	0.00
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	0.68	1.00	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	1.23	0.48	0.01

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.22	Reach Len. (ft)	136.82	118.63	114.89
Crit W.S. (ft)	7.63	Flow Area (sq ft)	13.35	81.03	7.45
E.G. Slope (ft/ft)	0.002140	Area (sq ft)	13.35	81.03	7.45
Q Total (cfs)	359.00	Flow (cfs)	12.81	341.26	4.93
Top Width (ft)	50.05	Top Width (ft)	13.71	22.93	13.41
Vel Total (ft/s)	3.53	Avg. Vel. (ft/s)	0.96	4.21	0.66
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	0.97	3.53	0.56
Conv. Total (cfs)	7760.6	Conv. (cfs)	277.0	7377.1	106.5
Length Wtd. (ft)	119.09	Wetted Per. (ft)	13.83	25.80	13.48
Min Ch El (ft)	5.21	Shear (lb/sq ft)	0.13	0.42	0.07
Alpha	1.36	Stream Power (lb/ft s)	249.68	0.00	0.00
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	2.29	1.66	0.50
C & E Loss (ft)	0.03	Cum SA (acres)	2.26	0.51	0.31

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	136.82	118.63	114.89
Crit W.S. (ft)	8.58	Flow Area (sq ft)	429.55	235.33	217.26
E.G. Slope (ft/ft)	0.000053	Area (sq ft)	429.55	235.33	217.26
Q Total (cfs)	613.00	Flow (cfs)	198.20	317.47	97.33
Top Width (ft)	148.07	Top Width (ft)	82.18	22.93	42.96
Vel Total (ft/s)	0.69	Avg. Vel. (ft/s)	0.46	1.35	0.45
Max Chl Dpth (ft)	10.74	Hydr. Depth (ft)	5.23	10.26	5.06
Conv. Total (cfs)	84213.3	Conv. (cfs)	27227.8	43613.8	13371.7
Length Wtd. (ft)	123.66	Wetted Per. (ft)	83.24	25.80	44.00
Min Ch El (ft)	5.21	Shear (lb/sq ft)	0.02	0.03	

0.02				
Alpha	2.16	Stream Power (lb/ft s)	249.68	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	9.67	3.27
3.29				
C & E Loss (ft)	0.00	Cum SA (acres)	3.86	0.53
0.62				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	20.12	Reach Len. (ft)	136.82	118.63
114.89				
Crit W.S. (ft)	9.01	Flow Area (sq ft)	788.72	330.87
416.10				
E.G. Slope (ft/ft)	0.000016	Area (sq ft)	788.72	330.87
416.10				
Q Total (cfs)	728.00	Flow (cfs)	280.71	309.43
137.86				
Top Width (ft)	165.98	Top Width (ft)	90.56	22.93
52.49				
Vel Total (ft/s)	0.47	Avg. Vel. (ft/s)	0.36	0.94
0.33				
Max Chl Dpth (ft)	14.91	Hydr. Depth (ft)	8.71	14.43
7.93				
Conv. Total (cfs)	181057.9	Conv. (cfs)	69814.0	76956.4
34287.5				
Length Wtd. (ft)	124.70	Wetted Per. (ft)	92.63	25.80
54.40				
Min Ch El (ft)	5.21	Shear (lb/sq ft)	0.01	0.01
0.01				
Alpha	1.96	Stream Power (lb/ft s)	249.68	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	16.14	4.23
5.63				
C & E Loss (ft)	0.00	Cum SA (acres)	4.62	0.53
0.77				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.00	Reach Len. (ft)	136.82	118.63
114.89				
Crit W.S. (ft)	9.34	Flow Area (sq ft)	967.80	374.02
518.92				
E.G. Slope (ft/ft)	0.000013	Area (sq ft)	967.80	374.02
518.92				
Q Total (cfs)	846.00	Flow (cfs)	333.78	342.25

169.97					
Top Width (ft)	179.49	Top Width (ft)	99.77	22.93	56.79
Vel Total (ft/s)	0.45	Avg. Vel. (ft/s)	0.34	0.92	0.33
Max Chl Dpth (ft)	16.79	Hydr. Depth (ft)	9.70	16.31	9.14
Conv. Total (cfs)	233345.9	Conv. (cfs)	92063.4	94400.7	46881.9
Length Wtd. (ft)	124.83	Wetted Per. (ft)	102.02	25.80	59.10
Min Ch El (ft)	5.21	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	1.97	Stream Power (lb/ft s)	249.68	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	20.18	5.59	6.89
C & E Loss (ft)	0.00	Cum SA (acres)	4.95	0.53	0.91

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50878.95

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	7.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	7.18	Reach Len. (ft)	167.64	185.01	195.16
Crit W.S. (ft)	6.43	Flow Area (sq ft)	1.23	40.98	
E.G. Slope (ft/ft)	0.004420	Area (sq ft)	1.23	40.98	
Q Total (cfs)	182.00	Flow (cfs)	0.84	181.16	
Top Width (ft)	22.88	Top Width (ft)	3.59	19.29	
Vel Total (ft/s)	4.31	Avg. Vel. (ft/s)	0.68	4.42	
Max Chl Dpth (ft)	2.59	Hydr. Depth (ft)	0.34	2.12	
Conv. Total (cfs)	2737.6	Conv. (cfs)	12.7	2724.9	
Length Wtd. (ft)	183.95	Wetted Per. (ft)	3.66	20.91	
Min Ch El (ft)	4.59	Shear (lb/sq ft)	0.09	0.54	
Alpha	1.05	Stream Power (lb/ft s)	295.24	0.00	0.00
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.67	0.88	0.01
C & E Loss (ft)	0.02	Cum SA (acres)	1.22	0.43	0.01

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.08	Reach Len. (ft)	167.64	185.01	195.16
Crit W.S. (ft)	7.29	Flow Area (sq ft)	18.50	78.25	53.57
E.G. Slope (ft/ft)	0.001332	Area (sq ft)	18.50	78.25	53.57
Q Total (cfs)	359.00	Flow (cfs)	17.22	288.07	53.72
Top Width (ft)	69.45	Top Width (ft)	13.80	19.56	36.09
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	0.93	3.68	1.00
Max Chl Dpth (ft)	4.49	Hydr. Depth (ft)	1.34	4.00	1.48
Conv. Total (cfs)	9836.9	Conv. (cfs)	471.7	7893.3	1471.9
Length Wtd. (ft)	184.05	Wetted Per. (ft)	14.05	21.37	36.38
Min Ch El (ft)	4.59	Shear (lb/sq ft)	0.11	0.30	0.12
Alpha	1.94	Stream Power (lb/ft s)	295.24	0.00	0.00
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)	2.24	1.44	0.41
C & E Loss (ft)	0.02	Cum SA (acres)	2.21	0.45	0.24

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	167.64	185.01	195.16
Crit W.S. (ft)	8.41	Flow Area (sq ft)	471.46	212.48	343.21
E.G. Slope (ft/ft)	0.000038	Area (sq ft)	471.46	212.48	343.21
Q Total (cfs)	613.00	Flow (cfs)	194.28	256.79	161.94
Top Width (ft)	150.41	Top Width (ft)	82.98	19.56	

47.87					
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)	0.41	1.21	0.47
Max Chl Dpth (ft)	11.36	Hydr. Depth (ft)	5.68	10.86	7.17
Conv. Total (cfs)	99580.2	Conv. (cfs)	31560.0	41714.2	26306.0
Length Wtd. (ft)	180.90	Wetted Per. (ft)	84.19	21.37	50.02
Min Ch El (ft)	4.59	Shear (lb/sq ft)	0.01	0.02	0.02
Alpha	2.03	Stream Power (lb/ft s)	295.24	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	8.26	2.66	2.55
C & E Loss (ft)	0.00	Cum SA (acres)	3.60	0.47	0.50

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	167.64	185.01	195.16
Crit W.S. (ft)	8.69	Flow Area (sq ft)	844.18	293.99	558.30
E.G. Slope (ft/ft)	0.000013	Area (sq ft)	844.18	293.99	558.30
Q Total (cfs)	728.00	Flow (cfs)	273.39	261.32	193.29
Top Width (ft)	172.18	Top Width (ft)	96.80	19.56	55.82
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.32	0.89	0.35
Max Chl Dpth (ft)	15.52	Hydr. Depth (ft)	8.72	15.03	10.00
Conv. Total (cfs)	199656.6	Conv. (cfs)	74978.7	71668.3	53009.7
Length Wtd. (ft)	179.77	Wetted Per. (ft)	98.63	21.37	59.02
Min Ch El (ft)	4.59	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	1.93	Stream Power (lb/ft s)	295.24	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	13.58	3.38	4.35
C & E Loss (ft)	0.00	Cum SA (acres)	4.33	0.47	0.63

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.00	Reach Len. (ft)	167.64	185.01	195.16
Crit W.S. (ft)	8.93	Flow Area (sq ft)	1040.12	330.80	666.98
E.G. Slope (ft/ft)	0.000011	Area (sq ft)	1040.12	330.80	666.98
Q Total (cfs)	846.00	Flow (cfs)	324.77	292.84	228.40
Top Width (ft)	190.67	Top Width (ft)	111.43	19.56	59.68
Vel Total (ft/s)	0.42	Avg. Vel. (ft/s)	0.31	0.89	0.34
Max Chl Dpth (ft)	17.41	Hydr. Depth (ft)	9.33	16.91	11.18
Conv. Total (cfs)	252034.9	Conv. (cfs)	96752.3	87239.8	68042.9
Length Wtd. (ft)	178.50	Wetted Per. (ft)	113.39	21.37	63.31
Min Ch El (ft)	4.59	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	1.97	Stream Power (lb/ft s)	295.24	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	17.03	4.63	5.32
C & E Loss (ft)	0.00	Cum SA (acres)	4.62	0.47	0.76

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50668.61

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	6.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.95	Reach Len. (ft)	19.90	23.16	28.27
Crit W.S. (ft)		Flow Area (sq ft)	13.16	26.04	1.32
E.G. Slope (ft/ft)	0.007023	Area (sq ft)	13.16	26.04	1.32
Q Total (cfs)	182.00	Flow (cfs)	22.37	158.03	1.60
Top Width (ft)	26.78	Top Width (ft)	13.96	11.38	1.44
Vel Total (ft/s)	4.49	Avg. Vel. (ft/s)	1.70	6.07	

1.22					
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)	0.94	2.29	
0.91					
Conv. Total (cfs)	2171.7	Conv. (cfs)	266.9	1885.7	
19.1					
Length Wtd. (ft)	22.98	Wetted Per. (ft)	14.08	11.69	
2.33					
Min Ch El (ft)	3.50	Shear (lb/sq ft)	0.41	0.98	
0.25					
Alpha	1.60	Stream Power (lb/ft s)	385.20	0.00	
0.00					
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.65	0.73	
0.00					
C & E Loss (ft)	0.05	Cum SA (acres)	1.19	0.36	
0.01					

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.06	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.11	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	8.95	Reach Len. (ft)	19.90	23.16	
28.27					
Crit W.S. (ft)		Flow Area (sq ft)	84.61	60.27	
71.34					
E.G. Slope (ft/ft)	0.000719	Area (sq ft)	84.61	60.27	
71.34					
Q Total (cfs)	359.00	Flow (cfs)	90.87	204.74	
63.39					
Top Width (ft)	77.94	Top Width (ft)	32.19	11.38	
34.37					
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	1.07	3.40	
0.89					
Max Chl Dpth (ft)	5.45	Hydr. Depth (ft)	2.63	5.30	
2.08					
Conv. Total (cfs)	13388.7	Conv. (cfs)	3389.0	7635.8	
2363.9					
Length Wtd. (ft)	23.05	Wetted Per. (ft)	32.64	11.69	
36.58					
Min Ch El (ft)	3.50	Shear (lb/sq ft)	0.12	0.23	
0.09					
Alpha	2.54	Stream Power (lb/ft s)	385.20	0.00	
0.00					
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.04	1.15	
0.14					
C & E Loss (ft)	0.01	Cum SA (acres)	2.12	0.39	
0.08					

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	15.94	Reach Len. (ft)	19.90	23.16	
28.27					

Crit W.S. (ft)		Flow Area (sq ft)	802.05	139.81	333.82
E.G. Slope (ft/ft)	0.000030	Area (sq ft)	802.05	139.81	420.25
Q Total (cfs)	613.00	Flow (cfs)	283.53	170.43	159.05
Top Width (ft)	227.24	Top Width (ft)	151.04	11.38	64.82
Vel Total (ft/s)	0.48	Avg. Vel. (ft/s)	0.35	1.22	0.48
Max Chl Dpth (ft)	12.44	Hydr. Depth (ft)	5.31	12.29	8.80
Conv. Total (cfs)	111659.5	Conv. (cfs)	51645.7	31043.4	28970.5
Length Wtd. (ft)	22.25	Wetted Per. (ft)	151.81	11.69	40.38
Min Ch El (ft)	3.50	Shear (lb/sq ft)	0.01	0.02	0.02
Alpha	2.29	Stream Power (lb/ft s)	385.20	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	5.81	1.91	0.84
C & E Loss (ft)	0.00	Cum SA (acres)	3.15	0.40	0.25

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	19.90	23.16	28.27
Crit W.S. (ft)		Flow Area (sq ft)	1607.41	187.28	491.98
E.G. Slope (ft/ft)	0.000011	Area (sq ft)	1607.41	187.28	709.48
Q Total (cfs)	728.00	Flow (cfs)	384.04	164.23	179.72
Top Width (ft)	334.19	Top Width (ft)	248.58	11.38	74.22
Vel Total (ft/s)	0.32	Avg. Vel. (ft/s)	0.24	0.88	0.37
Max Chl Dpth (ft)	16.61	Hydr. Depth (ft)	6.47	16.46	12.97
Conv. Total (cfs)	223970.6	Conv. (cfs)	118151.6	50526.7	55292.4
Length Wtd. (ft)	21.95	Wetted Per. (ft)	249.46	11.69	40.38
Min Ch El (ft)	3.50	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	2.33	Stream Power (lb/ft s)	385.20	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.86	2.36	1.51
C & E Loss (ft)	0.00	Cum SA (acres)	3.67	0.40	0.33

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.00	Reach Len. (ft)	19.90	23.16	28.27
Crit W.S. (ft)		Flow Area (sq ft)	2084.73	208.70	602.09
E.G. Slope (ft/ft)	0.000009	Area (sq ft)	2084.73	208.70	853.49
Q Total (cfs)	846.00	Flow (cfs)	525.31	179.15	141.54
Top Width (ft)	348.70	Top Width (ft)	258.55	11.38	78.78
Vel Total (ft/s)	0.29	Avg. Vel. (ft/s)	0.25	0.86	0.24
Max Chl Dpth (ft)	18.50	Hydr. Depth (ft)	8.06	18.34	7.64
Conv. Total (cfs)	285801.5	Conv. (cfs)	177464.2	60522.2	47815.1
Length Wtd. (ft)	21.48	Wetted Per. (ft)	259.60	11.69	83.21
Min Ch El (ft)	3.50	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	2.40	Stream Power (lb/ft s)	385.20	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	11.01	3.48	1.92
C & E Loss (ft)	0.00	Cum SA (acres)	3.91	0.40	0.45

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50610.0

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	6.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.93	Reach Len. (ft)	22.50	21.17	23.63
Crit W.S. (ft)		Flow Area (sq ft)	0.89	38.30	0.33
E.G. Slope (ft/ft)	0.004165	Area (sq ft)	0.89	38.30	0.33
Q Total (cfs)	182.00	Flow (cfs)	0.70	181.11	0.19
Top Width (ft)	18.25	Top Width (ft)	1.85	15.69	0.71
Vel Total (ft/s)	4.61	Avg. Vel. (ft/s)	0.78	4.73	0.58
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)	0.48	2.44	

0.46					
Conv. Total (cfs)	2820.0	Conv. (cfs)	10.8	2806.2	3.0
Length Wtd. (ft)	21.17	Wetted Per. (ft)	2.08	16.89	1.17
Min Ch El (ft)	3.03	Shear (lb/sq ft)	0.11	0.59	0.07
Alpha	1.05	Stream Power (lb/ft s)	408.10	0.00	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	0.64	0.72	0.00
C & E Loss (ft)	0.05	Cum SA (acres)	1.18	0.35	0.01

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.86	Reach Len. (ft)	22.50	21.17	23.63
Crit W.S. (ft)		Flow Area (sq ft)	45.69	84.23	6.83
E.G. Slope (ft/ft)	0.000861	Area (sq ft)	45.69	84.23	78.64
Q Total (cfs)	359.00	Flow (cfs)	44.96	306.31	7.72
Top Width (ft)	75.42	Top Width (ft)	22.49	15.69	37.24
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)	0.98	3.64	1.13
Max Chl Dpth (ft)	5.83	Hydr. Depth (ft)	2.03	5.37	2.98
Conv. Total (cfs)	12231.4	Conv. (cfs)	1532.0	10436.4	263.1
Length Wtd. (ft)	21.47	Wetted Per. (ft)	23.02	16.89	2.79
Min Ch El (ft)	3.03	Shear (lb/sq ft)	0.11	0.27	0.13
Alpha	1.66	Stream Power (lb/ft s)	408.10	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.01	1.11	0.09
C & E Loss (ft)	0.01	Cum SA (acres)	2.11	0.38	0.06

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070

W.S. Elev (ft)	15.94	Reach Len. (ft)	22.50	21.17	23.63
Crit W.S. (ft)		Flow Area (sq ft)	837.16	195.25	23.03
E.G. Slope (ft/ft)	0.000041	Area (sq ft)	837.16	195.25	467.96
Q Total (cfs)	613.00	Flow (cfs)	327.83	272.34	12.83
Top Width (ft)	261.67	Top Width (ft)	171.08	15.69	74.90
Vel Total (ft/s)	0.58	Avg. Vel. (ft/s)	0.39	1.39	0.56
Max Chl Dpth (ft)	12.91	Hydr. Depth (ft)	4.89	12.44	10.06
Conv. Total (cfs)	95373.2	Conv. (cfs)	51004.5	42372.5	1996.3
Length Wtd. (ft)	21.99	Wetted Per. (ft)	172.17	16.89	2.79
Min Ch El (ft)	3.03	Shear (lb/sq ft)	0.01	0.03	0.02
Alpha	2.82	Stream Power (lb/ft s)	408.10	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	5.43	1.82	0.55
C & E Loss (ft)	0.00	Cum SA (acres)	3.08	0.39	0.20

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	22.50	21.17	23.63
Crit W.S. (ft)		Flow Area (sq ft)	1716.90	260.77	32.59
E.G. Slope (ft/ft)	0.000014	Area (sq ft)	1716.90	260.77	803.64
Q Total (cfs)	728.00	Flow (cfs)	460.95	253.87	13.17
Top Width (ft)	371.86	Top Width (ft)	270.35	15.69	85.83
Vel Total (ft/s)	0.36	Avg. Vel. (ft/s)	0.27	0.97	0.40
Max Chl Dpth (ft)	17.08	Hydr. Depth (ft)	6.35	16.62	14.23
Conv. Total (cfs)	196808.8	Conv. (cfs)	124614.9	68632.6	3561.3
Length Wtd. (ft)	22.10	Wetted Per. (ft)	271.55	16.89	2.79
Min Ch El (ft)	3.03	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	2.89	Stream Power (lb/ft s)	408.10	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.10	2.24	1.02
C & E Loss (ft)	0.00	Cum SA (acres)	3.55	0.40	0.28

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	21.99	Reach Len. (ft)	22.50	21.17	23.63
Crit W.S. (ft)		Flow Area (sq ft)	2235.35	290.33	121.84
E.G. Slope (ft/ft)	0.000010	Area (sq ft)	2235.35	290.33	969.90
Q Total (cfs)	846.00	Flow (cfs)	583.06	253.39	9.54
Top Width (ft)	386.31	Top Width (ft)	280.10	15.69	90.52
Vel Total (ft/s)	0.32	Avg. Vel. (ft/s)	0.26	0.87	0.08
Max Chl Dpth (ft)	18.96	Hydr. Depth (ft)	7.98	18.50	1.35
Conv. Total (cfs)	274044.3	Conv. (cfs)	188871.3	82081.3	3091.6
Length Wtd. (ft)	22.13	Wetted Per. (ft)	281.49	16.89	93.23
Min Ch El (ft)	3.03	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	2.69	Stream Power (lb/ft s)	408.10	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	10.03	3.35	1.33
C & E Loss (ft)	0.00	Cum SA (acres)	3.79	0.40	0.39

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50602.3

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	6.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	5.25	Reach Len. (ft)	34.80	34.36	34.29
Crit W.S. (ft)	5.25	Flow Area (sq ft)		25.06	0.09
E.G. Slope (ft/ft)	0.017222	Area (sq ft)		25.06	0.09
Q Total (cfs)	182.00	Flow (cfs)		181.94	0.06
Top Width (ft)	16.20	Top Width (ft)		15.52	0.68
Vel Total (ft/s)	7.24	Avg. Vel. (ft/s)		7.26	

0.67					
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)			1.61
0.13					
Conv. Total (cfs)	1386.8	Conv. (cfs)			1386.4
0.4					
Length Wtd. (ft)	34.36	Wetted Per. (ft)			16.85
0.72					
Min Ch El (ft)	3.00	Shear (lb/sq ft)			1.60
0.13					
Alpha	1.01	Stream Power (lb/ft s)	403.64		0.00
0.00					
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.64		0.70
0.00					
C & E Loss (ft)	0.22	Cum SA (acres)	1.18		0.35
0.01					

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.85	Reach Len. (ft)	34.80	34.36	34.29
Crit W.S. (ft)		Flow Area (sq ft)	40.14	81.10	26.41
E.G. Slope (ft/ft)	0.000857	Area (sq ft)	40.14	81.10	68.15
Q Total (cfs)	359.00	Flow (cfs)	38.71	286.41	33.88
Top Width (ft)	65.12	Top Width (ft)	20.09	15.57	29.46
Vel Total (ft/s)	2.43	Avg. Vel. (ft/s)	0.96	3.53	1.28
Max Chl Dpth (ft)	5.85	Hydr. Depth (ft)	2.00	5.21	3.01
Conv. Total (cfs)	12266.2	Conv. (cfs)	1322.8	9785.9	1157.5
Length Wtd. (ft)	34.39	Wetted Per. (ft)	20.75	16.93	8.90
Min Ch El (ft)	3.00	Shear (lb/sq ft)	0.10	0.26	0.16
Alpha	1.73	Stream Power (lb/ft s)	403.64	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.99	1.07	0.05

C & E Loss (ft)	0.03	Cum SA (acres)	2.10	0.37	0.04

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.94	Reach Len. (ft)	34.80	34.36	34.29
Crit W.S. (ft)		Flow Area (sq ft)	798.61	191.36	88.51
E.G. Slope (ft/ft)	0.000040	Area (sq ft)	798.61	191.36	400.79
Q Total (cfs)	613.00	Flow (cfs)	301.08	257.29	54.63
Top Width (ft)	252.01	Top Width (ft)	167.17	15.57	69.27
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.38	1.34	0.62
Max Chl Dpth (ft)	12.94	Hydr. Depth (ft)	4.78	12.29	10.09
Conv. Total (cfs)	97498.7	Conv. (cfs)	47887.5	40922.2	8689.0
Length Wtd. (ft)	34.55	Wetted Per. (ft)	168.21	16.93	8.90
Min Ch El (ft)	3.00	Shear (lb/sq ft)	0.01	0.03	0.02
Alpha	2.67	Stream Power (lb/ft s)	403.64	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	5.01	1.73	0.32
C & E Loss (ft)	0.00	Cum SA (acres)	2.99	0.39	0.17

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	34.80	34.36	34.29
Crit W.S. (ft)		Flow Area (sq ft)	1656.49	256.38	125.13
E.G. Slope (ft/ft)	0.000013	Area (sq ft)	1656.49	256.38	721.84
Q Total (cfs)	728.00	Flow (cfs)	430.66	241.30	56.04
Top Width (ft)	365.03	Top Width (ft)	265.19	15.57	84.28
Vel Total (ft/s)	0.36	Avg. Vel. (ft/s)	0.26	0.94	

0.45					
Max Chl Dpth (ft)	17.11	Hydr. Depth (ft)	6.25	16.47	14.27
Conv. Total (cfs)	201022.2	Conv. (cfs)	118917.6	66630.7	15473.9
Length Wtd. (ft)	34.59	Wetted Per. (ft)	266.35	16.93	8.90
Min Ch El (ft)	3.00	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	2.74	Stream Power (lb/ft s)	403.64	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	7.23	2.12	0.60
C & E Loss (ft)	0.00	Cum SA (acres)	3.41	0.39	0.24

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	21.99	Reach Len. (ft)	34.80	34.36	34.29
Crit W.S. (ft)		Flow Area (sq ft)	2165.16	285.71	221.70
E.G. Slope (ft/ft)	0.000010	Area (sq ft)	2165.16	285.71	889.00
Q Total (cfs)	846.00	Flow (cfs)	569.43	250.63	25.94
Top Width (ft)	383.73	Top Width (ft)	274.94	15.57	93.22
Vel Total (ft/s)	0.32	Avg. Vel. (ft/s)	0.26	0.88	0.12
Max Chl Dpth (ft)	18.99	Hydr. Depth (ft)	7.87	18.35	2.38
Conv. Total (cfs)	269404.7	Conv. (cfs)	181332.7	79811.7	8260.3
Length Wtd. (ft)	34.60	Wetted Per. (ft)	276.28	16.93	95.34
Min Ch El (ft)	3.00	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	2.74	Stream Power (lb/ft s)	403.64	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.89	3.21	0.82
C & E Loss (ft)	0.00	Cum SA (acres)	3.64	0.39	0.34

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50590.0

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.59	Reach Len. (ft)	69.95	31.62	12.37
Crit W.S. (ft)		Flow Area (sq ft)	2.49	70.52	2.16
E.G. Slope (ft/ft)	0.000900	Area (sq ft)	2.49	70.52	2.16
Q Total (cfs)	182.00	Flow (cfs)	1.21	179.82	0.97
Top Width (ft)	30.97	Top Width (ft)	3.42	24.28	3.27
Vel Total (ft/s)	2.42	Avg. Vel. (ft/s)	0.49	2.55	0.45
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)	0.73	2.90	0.66
Conv. Total (cfs)	6066.8	Conv. (cfs)	40.3	5994.2	32.3
Length Wtd. (ft)	37.04	Wetted Per. (ft)	3.74	24.90	3.67
Min Ch El (ft)	2.11	Shear (lb/sq ft)	0.04	0.16	0.03
Alpha	1.10	Stream Power (lb/ft s)	438.39	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.64	0.66	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	1.18	0.33	0.01

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	8.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.91	Reach Len. (ft)	69.95	31.62	12.37
Crit W.S. (ft)		Flow Area (sq ft)	47.57	151.11	18.02
E.G. Slope (ft/ft)	0.000226	Area (sq ft)	47.57	151.11	24.99
Q Total (cfs)	359.00	Flow (cfs)	25.35	321.06	12.59
Top Width (ft)	56.29	Top Width (ft)	21.37	24.28	10.64
Vel Total (ft/s)	1.66	Avg. Vel. (ft/s)	0.53	2.12	0.70
Max Chl Dpth (ft)	6.80	Hydr. Depth (ft)	2.23	6.22	3.61
Conv. Total (cfs)	23868.7	Conv. (cfs)	1685.5	21346.4	836.9
Length Wtd. (ft)	39.19	Wetted Per. (ft)	22.06	24.90	5.57
Min Ch El (ft)	2.11	Shear (lb/sq ft)	0.03	0.09	0.05
Alpha	1.48	Stream Power (lb/ft s)	438.39	0.00	0.00

Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.96	0.98	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	2.08	0.36	0.03

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.94	Reach Len. (ft)	69.95	31.62	12.37
Crit W.S. (ft)		Flow Area (sq ft)	705.50	321.77	53.09
E.G. Slope (ft/ft)	0.000023	Area (sq ft)	756.05	321.77	212.57
Q Total (cfs)	613.00	Flow (cfs)	231.64	357.29	24.07
Top Width (ft)	222.61	Top Width (ft)	156.84	24.28	41.49
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.33	1.11	0.45
Max Chl Dpth (ft)	13.83	Hydr. Depth (ft)	5.92	13.25	10.64
Conv. Total (cfs)	129074.3	Conv. (cfs)	48774.9	75231.7	5067.6
Length Wtd. (ft)	45.74	Wetted Per. (ft)	120.03	24.90	5.57
Min Ch El (ft)	2.11	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	2.38	Stream Power (lb/ft s)	438.39	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4.39	1.52	0.08
C & E Loss (ft)	0.00	Cum SA (acres)	2.86	0.37	0.12

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	69.95	31.62	12.37
Crit W.S. (ft)		Flow Area (sq ft)	1203.08	423.14	73.93
E.G. Slope (ft/ft)	0.000009	Area (sq ft)	1586.73	423.14	425.01
Q Total (cfs)	728.00	Flow (cfs)	350.95	351.04	26.01
Top Width (ft)	352.66	Top Width (ft)	262.77	24.28	

65.61					
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.29	0.83	0.35
Max Chl Dpth (ft)	18.00	Hydr. Depth (ft)	10.09	17.43	14.81
Conv. Total (cfs)	246268.5	Conv. (cfs)	118720.2	118749.8	8798.5
Length Wtd. (ft)	47.93	Wetted Per. (ft)	120.03	24.90	5.57
Min Ch El (ft)	2.11	Shear (lb/sq ft)	0.01	0.01	0.01
Alpha	2.06	Stream Power (lb/ft s)	438.39	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	5.93	1.85	0.15
C & E Loss (ft)	0.00	Cum SA (acres)	3.20	0.37	0.18

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	21.99	Reach Len. (ft)	69.95	31.62	12.37
Crit W.S. (ft)		Flow Area (sq ft)	1573.12	468.75	164.82
E.G. Slope (ft/ft)	0.000011	Area (sq ft)	2089.54	468.75	578.02
Q Total (cfs)	846.00	Flow (cfs)	358.43	471.20	16.37
Top Width (ft)	394.07	Top Width (ft)	272.50	24.28	97.28
Vel Total (ft/s)	0.38	Avg. Vel. (ft/s)	0.23	1.01	0.10
Max Chl Dpth (ft)	19.88	Hydr. Depth (ft)	5.77	19.31	1.69
Conv. Total (cfs)	252872.6	Conv. (cfs)	107137.2	140843.5	4892.0
Length Wtd. (ft)	43.13	Wetted Per. (ft)	273.74	24.90	99.68
Min Ch El (ft)	2.11	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	3.98	Stream Power (lb/ft s)	438.39	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	7.19	2.91	0.24
C & E Loss (ft)	0.01	Cum SA (acres)	3.43	0.37	0.27

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50541.89

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.65	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	5.58	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	3.31	Flow Area (sq ft)	50.37	53.15
E.G. Slope (ft/ft)	0.000547	Area (sq ft)	87.60	56.80
2.75				
Q Total (cfs)	182.00	Flow (cfs)	50.79	131.21
Top Width (ft)	49.72	Top Width (ft)	33.68	13.78
2.26				
Vel Total (ft/s)	1.76	Avg. Vel. (ft/s)	1.01	2.47
Max Chl Dpth (ft)	5.56	Hydr. Depth (ft)	2.91	4.19
Conv. Total (cfs)	7784.6	Conv. (cfs)	2172.6	5612.0
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.39	13.55
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.10	0.13
Alpha	1.51	Stream Power (lb/ft s)	433.21	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	0.57	0.62
0.00				
C & E Loss (ft)		Cum SA (acres)	1.15	0.32
0.01				

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	8.96	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	8.89	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	4.05	Flow Area (sq ft)	107.58	95.07
E.G. Slope (ft/ft)	0.000255	Area (sq ft)	320.56	102.40
17.36				
Q Total (cfs)	359.00	Flow (cfs)	122.85	236.15
Top Width (ft)	109.38	Top Width (ft)	87.06	13.78
8.55				
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.14	2.48

Max Chl Dpth (ft)	8.87	Hydr. Depth (ft)	6.22	7.50
Conv. Total (cfs)	22487.7	Conv. (cfs)	7695.3	14792.4
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.39	13.55
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.10	0.11
Alpha	1.44	Stream Power (lb/ft s)	433.21	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	1.66	0.88
0.00				
C & E Loss (ft)		Cum SA (acres)	2.00	0.34
0.02				

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.94	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.05	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	15.89	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	4.87	Flow Area (sq ft)	228.69	183.82
E.G. Slope (ft/ft)	0.000074	Area (sq ft)	997.29	198.92
174.21				
Q Total (cfs)	613.00	Flow (cfs)	232.08	380.92
Top Width (ft)	152.10	Top Width (ft)	106.17	13.78
32.16				
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	1.01	2.07
Max Chl Dpth (ft)	15.87	Hydr. Depth (ft)	13.23	14.51
Conv. Total (cfs)	71435.4	Conv. (cfs)	27045.7	44389.7
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.39	13.55
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.06	0.06
Alpha	1.38	Stream Power (lb/ft s)	433.21	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	2.98	1.34
0.02				
C & E Loss (ft)		Cum SA (acres)	2.65	0.36
0.11				

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.11	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	20.07	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	5.18	Flow Area (sq ft)	300.94	236.76

E.G. Slope (ft/ft)	0.000043	Area (sq ft)	1490.14	256.50 340.93
Q Total (cfs)	728.00	Flow (cfs)	281.77	446.23
Top Width (ft)	215.84	Top Width (ft)	143.91	13.78 58.15
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)	0.94	1.88
Max Chl Dpth (ft)	20.05	Hydr. Depth (ft)	17.41	18.69
Conv. Total (cfs)	110421.1	Conv. (cfs)	42737.9	67683.2
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.39	13.55
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.05	0.05
Alpha	1.37	Stream Power (lb/ft s)	433.21	0.00 0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	3.46	1.60 0.04
C & E Loss (ft)		Cum SA (acres)	2.87	0.36 0.16

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	21.99	Element	Left OB	Channel Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	21.91	Reach Len. (ft)	123.44	126.44 123.05
Crit W.S. (ft)	5.52	Flow Area (sq ft)	495.22	261.01 78.30
E.G. Slope (ft/ft)	0.000083	Area (sq ft)	1822.47	281.80 483.95
Q Total (cfs)	846.00	Flow (cfs)	164.33	669.00 12.67
Top Width (ft)	329.57	Top Width (ft)	218.13	13.78 97.65
Vel Total (ft/s)	1.01	Avg. Vel. (ft/s)	0.33	2.56 0.16
Max Chl Dpth (ft)	21.89	Hydr. Depth (ft)	2.27	18.94 0.80
Conv. Total (cfs)	92709.1	Conv. (cfs)	18008.3	73312.4 1388.5
Length Wtd. (ft)	126.44	Wetted Per. (ft)	220.87	15.34 102.53
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.01	0.09 0.00
Alpha	5.08	Stream Power (lb/ft s)	433.21	0.00 0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	4.05	2.64 0.09
C & E Loss (ft)		Cum SA (acres)	3.03	0.36 0.24

CULVERT

RIVER: 99
REACH: EXBLHEC RS: 50468.04

CULVERT OUTPUT Profile #2-YR Culv Group: Culvert #1

Q Culv Group (cfs)	182.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	4.63
Q Barrel (cfs)	91.00	Culv Vel DS (ft/s)	4.63
E.G. US. (ft)	5.65	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	5.58	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	5.14	Culv Frctn Ls (ft)	0.13
W.S. DS (ft)	5.12	Culv Exit Loss (ft)	0.31
Delta EG (ft)	0.52	Culv Entr Loss (ft)	0.07
Delta WS (ft)	0.46	Q Weir (cfs)	
E.G. IC (ft)	3.42	Weir Sta Lft (ft)	
E.G. OC (ft)	5.65	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.71	Min El Weir Flow (ft)	22.04

CULVERT OUTPUT Profile #10-YR Culv Group: Culvert #1

Q Culv Group (cfs)	359.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	9.14
Q Barrel (cfs)	179.50	Culv Vel DS (ft/s)	9.14
E.G. US. (ft)	8.96	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	8.89	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	6.93	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	6.88	Culv Exit Loss (ft)	1.25
Delta EG (ft)	2.03	Culv Entr Loss (ft)	0.26
Delta WS (ft)	2.01	Q Weir (cfs)	
E.G. IC (ft)	6.07	Weir Sta Lft (ft)	
E.G. OC (ft)	8.96	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.84	Min El Weir Flow (ft)	22.04

CULVERT OUTPUT Profile #25-YR Culv Group: Culvert #1

Q Culv Group (cfs)	613.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	15.61
Q Barrel (cfs)	306.50	Culv Vel DS (ft/s)	15.61
E.G. US. (ft)	15.94	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	15.89	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	9.95	Culv Frctn Ls (ft)	1.52
W.S. DS (ft)	9.88	Culv Exit Loss (ft)	3.71
Delta EG (ft)	5.99	Culv Entr Loss (ft)	0.76
Delta WS (ft)	6.01	Q Weir (cfs)	
E.G. IC (ft)	12.14	Weir Sta Lft (ft)	
E.G. OC (ft)	15.94	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	

Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CULVERT OUTPUT Profile #50-YR Culv Group: Culvert #1

Q Culv Group (cfs)	728.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	18.54
Q Barrel (cfs)	364.00	Culv Vel DS (ft/s)	18.54
E.G. US. (ft)	20.11	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	20.07	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	11.64	Culv Frctn Ls (ft)	2.15
W.S. DS (ft)	11.56	Culv Exit Loss (ft)	5.26
Delta EG (ft)	8.48	Culv Entr Loss (ft)	1.07
Delta WS (ft)	8.51	Q Weir (cfs)	
E.G. IC (ft)	15.93	Weir Sta Lft (ft)	
E.G. OC (ft)	20.11	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	632.69	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	16.11
Q Barrel (cfs)	316.34	Culv Vel DS (ft/s)	16.11
E.G. US. (ft)	21.99	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	21.91	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	15.59	Culv Frctn Ls (ft)	1.62
W.S. DS (ft)	15.53	Culv Exit Loss (ft)	3.97
Delta EG (ft)	6.40	Culv Entr Loss (ft)	0.81
Delta WS (ft)	6.38	Q Weir (cfs)	657.43
E.G. IC (ft)	20.46	Weir Sta Lft (ft)	0.40
E.G. OC (ft)	21.99	Weir Sta Rgt (ft)	335.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	0.97
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	0.82
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	274.52
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported outlet energy grade answer may not be valid.

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50418.36

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.035	
W.S. Elev (ft)	5.12	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	-0.38	Flow Area (sq ft)		163.53	
E.G. Slope (ft/ft)	0.000066	Area (sq ft)		178.82	
Q Total (cfs)	182.00	Flow (cfs)		182.00	
Top Width (ft)	38.33	Top Width (ft)		38.33	
Vel Total (ft/s)	1.11	Avg. Vel. (ft/s)		1.11	
Max Chl Dpth (ft)	8.13	Hydr. Depth (ft)		6.27	
Conv. Total (cfs)	22340.0	Conv. (cfs)		22340.0	
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33	
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.57	0.53	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	1.10	0.24	0.00

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	6.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.035	
W.S. Elev (ft)	6.88	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	0.50	Flow Area (sq ft)		209.43	
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	135.26	249.73	

Q Total (cfs)	359.00	Flow (cfs)		359.00
Top Width (ft)	166.03	Top Width (ft)	124.54	41.49
Vel Total (ft/s)	1.71	Avg. Vel. (ft/s)		1.71
Max Chl Dpth (ft)	9.89	Hydr. Depth (ft)		8.03
Conv. Total (cfs)	33740.4	Conv. (cfs)		33740.4
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.05
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1.66	0.72
0.00				
C & E Loss (ft)	0.00	Cum SA (acres)	1.70	0.26
0.01				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	9.95	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.		0.035
W.S. Elev (ft)	9.88	Reach Len. (ft)	26.22	27.31
28.13				
Crit W.S. (ft)	1.34	Flow Area (sq ft)		287.61
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	562.23	378.78
14.12				
Q Total (cfs)	613.00	Flow (cfs)		613.00
Top Width (ft)	222.02	Top Width (ft)	163.00	43.39
15.63				
Vel Total (ft/s)	2.13	Avg. Vel. (ft/s)		2.13
Max Chl Dpth (ft)	12.89	Hydr. Depth (ft)		11.03
Conv. Total (cfs)	57247.0	Conv. (cfs)		57247.0
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.07
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	2.98	0.95
0.02				
C & E Loss (ft)	0.00	Cum SA (acres)	2.27	0.27
0.04				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	11.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.035	
W.S. Elev (ft)	11.56	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	1.69	Flow Area (sq ft)		331.46	
E.G. Slope (ft/ft)	0.000101	Area (sq ft)	842.75	451.77	42.75
Q Total (cfs)	728.00	Flow (cfs)		728.00	
Top Width (ft)	231.07	Top Width (ft)	169.28	43.39	18.40
Vel Total (ft/s)	2.20	Avg. Vel. (ft/s)		2.20	
Max Chl Dpth (ft)	14.57	Hydr. Depth (ft)		12.71	
Conv. Total (cfs)	72521.5	Conv. (cfs)		72521.5	
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33	
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	3.46	1.04	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	2.43	0.27	0.05

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	15.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.035	
W.S. Elev (ft)	15.53	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	2.01	Flow Area (sq ft)		434.97	
E.G. Slope (ft/ft)	0.000055	Area (sq ft)	1537.88	624.04	128.83
Q Total (cfs)	846.00	Flow (cfs)		846.00	
Top Width (ft)	249.27	Top Width (ft)	180.88	43.39	25.01
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)		1.94	
Max Chl Dpth (ft)	18.54	Hydr. Depth (ft)		16.68	

Conv. Total (cfs)	114070.8	Conv. (cfs)			114070.8
Length Wtd. (ft)	27.31	Wetted Per. (ft)			28.33
Min Ch El (ft)	-3.01	Shear (lb/sq ft)			0.05
Alpha	1.00	Stream Power (lb/ft s)	287.93		0.00
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4.05		1.19
0.09					
C & E Loss (ft)	0.00	Cum SA (acres)	2.47		0.28
0.07					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50391.33

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.14	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.02	Wt. n-Val.			0.035
0.070					
W.S. Elev (ft)	5.12	Reach Len. (ft)	97.79		98.48
98.80					
Crit W.S. (ft)	0.34	Flow Area (sq ft)			156.58
1.32					
E.G. Slope (ft/ft)	0.000078	Area (sq ft)	0.07		178.13
3.45					
Q Total (cfs)	182.00	Flow (cfs)			181.66
0.34					
Top Width (ft)	36.87	Top Width (ft)	0.41		33.21
3.26					
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)			1.16
0.26					
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)			5.70
1.89					
Conv. Total (cfs)	20575.7	Conv. (cfs)			20537.5
38.1					
Length Wtd. (ft)	98.48	Wetted Per. (ft)			28.83
0.83					
Min Ch El (ft)	-1.30	Shear (lb/sq ft)			0.03
0.01					
Alpha	1.01	Stream Power (lb/ft s)	119.70		0.00
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)	0.57		0.42
C & E Loss (ft)		Cum SA (acres)	1.10		0.22
0.00					

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	6.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.88	Reach Len. (ft)	97.79	98.48	98.80
Crit W.S. (ft)	1.03	Flow Area (sq ft)		204.91	2.55
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	6.48	236.56	11.76
Q Total (cfs)	359.00	Flow (cfs)		357.73	1.27
Top Width (ft)	45.28	Top Width (ft)	5.97	33.21	6.10
Vel Total (ft/s)	1.73	Avg. Vel. (ft/s)		1.75	0.50
Max Chl Dpth (ft)	8.18	Hydr. Depth (ft)		7.46	3.65
Conv. Total (cfs)	32270.9	Conv. (cfs)		32156.7	114.2
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83	0.83
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.05	0.02
Alpha	1.01	Stream Power (lb/ft s)	119.70	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.62	0.57	0.00
C & E Loss (ft)		Cum SA (acres)	1.66	0.24	0.01

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	9.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	9.88	Reach Len. (ft)	97.79	98.48	98.80
Crit W.S. (ft)	1.83	Flow Area (sq ft)		287.36	4.65
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	32.17	336.24	36.19
Q Total (cfs)	613.00	Flow (cfs)		609.65	3.35
Top Width (ft)	54.54	Top Width (ft)	11.15	33.21	10.18
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)		2.12	0.72
Max Chl Dpth (ft)	11.18	Hydr. Depth (ft)		10.46	6.65
Conv. Total (cfs)	56808.7	Conv. (cfs)		56498.0	310.7
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83	0.83
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.07	0.04
Alpha	1.02	Stream Power (lb/ft s)	119.70	0.00	0.00

Frctn Loss (ft)		Cum Volume (acre-ft)	2.80	0.72
0.00				
C & E Loss (ft)		Cum SA (acres)	2.22	0.25
0.04				

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	11.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	11.56	Reach Len. (ft)	97.79	98.48
98.80				
Crit W.S. (ft)	2.15	Flow Area (sq ft)		333.59
5.83				
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	53.37	392.13
55.26				
Q Total (cfs)	728.00	Flow (cfs)		723.48
4.52				
Top Width (ft)	59.73	Top Width (ft)	14.05	33.21
12.48				
Vel Total (ft/s)	2.14	Avg. Vel. (ft/s)		2.17
0.77				
Max Chl Dpth (ft)	12.86	Hydr. Depth (ft)		12.14
8.33				
Conv. Total (cfs)	72899.7	Conv. (cfs)		72447.2
452.5				
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83
0.83				
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.07
0.04				
Alpha	1.02	Stream Power (lb/ft s)	119.70	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	3.19	0.77
0.01				
C & E Loss (ft)		Cum SA (acres)	2.37	0.25
0.04				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	15.59	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.06	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	15.53	Reach Len. (ft)	97.79	98.48
98.80				
Crit W.S. (ft)	2.46	Flow Area (sq ft)		442.71
8.61				
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	121.53	524.05
115.55				
Q Total (cfs)	846.00	Flow (cfs)		839.73
6.27				
Top Width (ft)	71.27	Top Width (ft)	20.18	33.21
17.88				
Vel Total (ft/s)	1.87	Avg. Vel. (ft/s)		1.90
0.73				
Max Chl Dpth (ft)	16.83	Hydr. Depth (ft)		16.12

12.30					
Conv. Total (cfs)	116971.8	Conv. (cfs)			116105.2
866.6					
Length Wtd. (ft)	98.48	Wetted Per. (ft)			28.83
0.83					
Min Ch El (ft)	-1.30	Shear (lb/sq ft)			0.05
0.03					
Alpha	1.02	Stream Power (lb/ft s)	119.70		0.00
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)	3.55		0.83
0.01					
C & E Loss (ft)		Cum SA (acres)	2.41		0.25
0.05					

CULVERT

RIVER: 99
REACH: EXBLHEC RS: 50341.6

CULVERT OUTPUT Profile #2-YR Culv Group: Culvert #1

Q Culv Group (cfs)	182.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	4.46
Q Barrel (cfs)	182.00	Culv Vel DS (ft/s)	4.07
E.G. US. (ft)	5.14	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	5.12	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	4.82	Culv Frctn Ls (ft)	0.04
W.S. DS (ft)	4.78	Culv Exit Loss (ft)	0.21
Delta EG (ft)	0.31	Culv Entr Loss (ft)	0.06
Delta WS (ft)	0.33	Q Weir (cfs)	
E.G. IC (ft)	3.68	Weir Sta Lft (ft)	
E.G. OC (ft)	5.14	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.77	Weir Max Depth (ft)	
Culv WS Outlet (ft)	4.78	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.09	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.52	Min El Weir Flow (ft)	21.68

CULVERT OUTPUT Profile #10-YR Culv Group: Culvert #1

Q Culv Group (cfs)	359.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	7.48
Q Barrel (cfs)	359.00	Culv Vel DS (ft/s)	7.48
E.G. US. (ft)	6.92	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	6.88	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	5.82	Culv Frctn Ls (ft)	0.17
W.S. DS (ft)	5.71	Culv Exit Loss (ft)	0.76
Delta EG (ft)	1.10	Culv Entr Loss (ft)	0.17
Delta WS (ft)	1.16	Q Weir (cfs)	
E.G. IC (ft)	6.08	Weir Sta Lft (ft)	
E.G. OC (ft)	6.92	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.97	Min El Weir Flow (ft)	21.68

CULVERT OUTPUT Profile #25-YR Culv Group: Culvert #1

Q Culv Group (cfs)	613.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	12.77
Q Barrel (cfs)	613.00	Culv Vel DS (ft/s)	12.77
E.G. US. (ft)	9.95	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	9.88	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	6.66	Culv Frctn Ls (ft)	0.49
W.S. DS (ft)	6.42	Culv Exit Loss (ft)	2.30
Delta EG (ft)	3.29	Culv Entr Loss (ft)	0.51
Delta WS (ft)	3.46	Q Weir (cfs)	
E.G. IC (ft)	10.47	Weir Sta Lft (ft)	
E.G. OC (ft)	9.95	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.07	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.67	Min El Weir Flow (ft)	21.68

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet
       equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #50-YR Culv Group: Culvert #1

Q Culv Group (cfs)	728.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	15.17
Q Barrel (cfs)	728.00	Culv Vel DS (ft/s)	15.17
E.G. US. (ft)	11.63	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	11.56	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	6.97	Culv Frctn Ls (ft)	0.69
W.S. DS (ft)	6.66	Culv Exit Loss (ft)	3.27
Delta EG (ft)	4.67	Culv Entr Loss (ft)	0.71
Delta WS (ft)	4.90	Q Weir (cfs)	
E.G. IC (ft)	12.79	Weir Sta Lft (ft)	
E.G. OC (ft)	11.63	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.80	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.00	Min El Weir Flow (ft)	21.68

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet
       equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	846.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	17.63
Q Barrel (cfs)	846.00	Culv Vel DS (ft/s)	24.98
E.G. US. (ft)	15.59	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	15.53	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	7.25	Culv Frctn Ls (ft)	1.51

W.S. DS (ft)	6.87	Culv Exit Loss (ft)	5.86
Delta EG (ft)	8.34	Culv Entr Loss (ft)	0.96
Delta WS (ft)	8.66	Q Weir (cfs)	
E.G. IC (ft)	15.59	Weir Sta Lft (ft)	
E.G. OC (ft)	13.58	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.00	Min El Weir Flow (ft)	21.68

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.
Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50292.86

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	4.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.		0.035	
W.S. Elev (ft)	4.78	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	1.78	Flow Area (sq ft)		108.59	
E.G. Slope (ft/ft)	0.000348	Area (sq ft)		108.59	
Q Total (cfs)	182.00	Flow (cfs)		182.00	
Top Width (ft)	29.17	Top Width (ft)		29.17	
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)		1.68	
Max Chl Dpth (ft)	5.70	Hydr. Depth (ft)		3.72	
Conv. Total (cfs)	9757.0	Conv. (cfs)		9757.0	
Length Wtd. (ft)	94.13	Wetted Per. (ft)		35.27	
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.07	
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.57	0.29	
C & E Loss (ft)	0.11	Cum SA (acres)	1.10	0.15	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	5.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	5.71	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	2.54	Flow Area (sq ft)		136.10	0.06
E.G. Slope (ft/ft)	0.000662	Area (sq ft)	4.63	136.21	0.15
Q Total (cfs)	359.00	Flow (cfs)		358.99	0.01
Top Width (ft)	43.56	Top Width (ft)	12.90	29.83	0.83
Vel Total (ft/s)	2.64	Avg. Vel. (ft/s)		2.64	0.24
Max Chl Dpth (ft)	6.63	Hydr. Depth (ft)		4.60	0.31
Conv. Total (cfs)	13948.8	Conv. (cfs)		13948.3	0.6
Length Wtd. (ft)	94.13	Wetted Per. (ft)		36.29	0.21
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.16	0.01
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00	0.00
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	1.62	0.42	0.00
C & E Loss (ft)	0.16	Cum SA (acres)	1.64	0.17	0.00

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	6.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.42	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	3.36	Flow Area (sq ft)		157.05	0.19
E.G. Slope (ft/ft)	0.001198	Area (sq ft)	15.48	157.31	1.32

Q Total (cfs)	613.00	Flow (cfs)		612.86
0.14				
Top Width (ft)	50.09	Top Width (ft)	17.77	29.83
2.49				
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)		3.90
0.70				
Max Chl Dpth (ft)	7.34	Hydr. Depth (ft)		5.30
1.02				
Conv. Total (cfs)	17710.3	Conv. (cfs)		17706.4
3.9				
Length Wtd. (ft)	94.14	Wetted Per. (ft)		36.29
0.21				
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.32
0.07				
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00
0.00				
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	2.80	0.54
0.00				
C & E Loss (ft)	0.16	Cum SA (acres)	2.19	0.18
0.02				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	6.97	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.31	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	6.66	Reach Len. (ft)	94.24	94.13
95.71				
Crit W.S. (ft)	3.68	Flow Area (sq ft)		164.13
0.24				
E.G. Slope (ft/ft)	0.001458	Area (sq ft)	19.93	164.44
1.98				
Q Total (cfs)	728.00	Flow (cfs)		727.79
0.21				
Top Width (ft)	52.30	Top Width (ft)	19.42	29.83
3.05				
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43
0.89				
Max Chl Dpth (ft)	7.58	Hydr. Depth (ft)		5.54
1.26				
Conv. Total (cfs)	19063.1	Conv. (cfs)		19057.5
5.6				
Length Wtd. (ft)	94.14	Wetted Per. (ft)		36.29
0.21				
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.41
0.11				
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00
0.00				
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	3.19	0.57
0.01				
C & E Loss (ft)	0.16	Cum SA (acres)	2.33	0.18

0.02

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	7.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.87	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	3.98	Flow Area (sq ft)		170.27	0.28
E.G. Slope (ft/ft)	0.001742	Area (sq ft)	24.10	170.63	2.67
Q Total (cfs)	846.00	Flow (cfs)		845.70	0.30
Top Width (ft)	54.22	Top Width (ft)	20.85	29.83	3.54
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)		4.97	1.08
Max Chl Dpth (ft)	7.79	Hydr. Depth (ft)		5.75	1.47
Conv. Total (cfs)	20267.4	Conv. (cfs)		20260.1	7.2
Length Wtd. (ft)	94.15	Wetted Per. (ft)		36.29	0.21
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.51	0.15
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	3.55	0.60	0.01
C & E Loss (ft)	0.15	Cum SA (acres)	2.36	0.18	0.03

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50198.72

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	4.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.41	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	4.22	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	3.85	Flow Area (sq ft)	0.77	35.50
E.G. Slope (ft/ft)	0.008097	Area (sq ft)	206.53	35.50
Q Total (cfs)	182.00	Flow (cfs)	0.44	181.56
Top Width (ft)	349.78	Top Width (ft)	327.82	21.97
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	0.57	5.11
Max Chl Dpth (ft)	2.18	Hydr. Depth (ft)	0.16	1.62
Conv. Total (cfs)	2022.6	Conv. (cfs)	4.9	2017.7
Length Wtd. (ft)	95.19	Wetted Per. (ft)	4.74	22.92
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.08	0.78
Alpha	1.04	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.35	0.14
C & E Loss (ft)	0.03	Cum SA (acres)	0.75	0.09

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	5.51	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.64	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	4.87	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	4.87	Flow Area (sq ft)	20.04	50.56
E.G. Slope (ft/ft)	0.009972	Area (sq ft)	436.58	50.56
Q Total (cfs)	359.00	Flow (cfs)	24.07	334.93
Top Width (ft)	400.54	Top Width (ft)	375.92	24.62
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)	1.20	6.62
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	0.43	2.05
Conv. Total (cfs)	3595.1	Conv. (cfs)	241.1	3354.0
Length Wtd. (ft)	94.99	Wetted Per. (ft)	46.96	25.88

Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.27	1.22
Alpha	1.59	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.67	Cum Volume (acre-ft)	1.14	0.22
C & E Loss (ft)	0.14	Cum SA (acres)	1.22	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	6.25	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.77	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	5.48	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	5.48	Flow Area (sq ft)	51.21	66.21
1.32				
E.G. Slope (ft/ft)	0.010053	Area (sq ft)	671.99	66.21
1.32				
Q Total (cfs)	613.00	Flow (cfs)	104.68	507.35
0.97				
Top Width (ft)	421.32	Top Width (ft)	388.97	25.93
6.42				
Vel Total (ft/s)	5.16	Avg. Vel. (ft/s)	2.04	7.66
0.74				
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)	0.94	2.55
0.20				
Conv. Total (cfs)	6113.7	Conv. (cfs)	1044.0	5060.0
9.7				
Length Wtd. (ft)	94.87	Wetted Per. (ft)	54.42	27.41
6.46				
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.59	1.52
0.13				
Alpha	1.85	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	2.06	0.30
0.00				
C & E Loss (ft)	0.16	Cum SA (acres)	1.75	0.12
0.01				

Warning: The energy equation could not be balanced within the specified number of

iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	6.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.70	Reach Len. (ft)	93.76	95.40	95.30
Crit W.S. (ft)	5.70	Flow Area (sq ft)	63.17	71.81	2.76
E.G. Slope (ft/ft)	0.010203	Area (sq ft)	756.04	71.81	2.76
Q Total (cfs)	728.00	Flow (cfs)	145.02	579.83	3.15
Top Width (ft)	426.81	Top Width (ft)	393.52	26.25	7.04
Vel Total (ft/s)	5.29	Avg. Vel. (ft/s)	2.30	8.07	1.14
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)	1.11	2.74	0.39
Conv. Total (cfs)	7207.2	Conv. (cfs)	1435.7	5740.3	31.2
Length Wtd. (ft)	94.85	Wetted Per. (ft)	57.02	27.80	7.11
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.71	1.65	0.25
Alpha	1.90	Stream Power (lb/ft s)	535.40	0.00	0.00
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	2.35	0.31	0.00
C & E Loss (ft)	0.15	Cum SA (acres)	1.89	0.12	0.01

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program

defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	6.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.90	Reach Len. (ft)	93.76	95.40	95.30
Crit W.S. (ft)	5.90	Flow Area (sq ft)	75.15	77.24	4.27
E.G. Slope (ft/ft)	0.010264	Area (sq ft)	837.48	77.24	4.27
Q Total (cfs)	846.00	Flow (cfs)	188.81	651.01	6.18
Top Width (ft)	432.07	Top Width (ft)	397.89	26.55	7.63
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	2.51	8.43	1.45
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)	1.26	2.91	0.56
Conv. Total (cfs)	8350.3	Conv. (cfs)	1863.6	6425.7	61.0
Length Wtd. (ft)	94.83	Wetted Per. (ft)	59.51	28.16	7.74
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.81	1.76	0.35
Alpha	1.92	Stream Power (lb/ft s)	535.40	0.00	0.00
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	2.62	0.33	0.01
C & E Loss (ft)	0.15	Cum SA (acres)	1.91	0.12	0.02

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50103.33

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	3.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	3.36	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	3.36	Flow Area (sq ft)	31.77	26.24	
E.G. Slope (ft/ft)	0.011596	Area (sq ft)	53.89	26.24	
Q Total (cfs)	182.00	Flow (cfs)	45.73	136.27	
Top Width (ft)	193.65	Top Width (ft)	172.51	21.14	
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	1.44	5.19	
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)	0.50	1.24	
Conv. Total (cfs)	1690.1	Conv. (cfs)	424.7	1265.4	
Length Wtd. (ft)	103.11	Wetted Per. (ft)	63.58	21.67	
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.36	0.88	
Alpha	2.10	Stream Power (lb/ft s)	552.21	0.00	0.00
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.07	0.07	
C & E Loss (ft)	0.02	Cum SA (acres)	0.21	0.05	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	4.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	4.21	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	3.76	Flow Area (sq ft)	87.89	46.40	
E.G. Slope (ft/ft)	0.005253	Area (sq ft)	290.88	46.40	

Q Total (cfs)	359.00	Flow (cfs)	157.22	201.78
Top Width (ft)	377.79	Top Width (ft)	350.93	26.85
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)	1.79	4.35
Max Chl Dpth (ft)	2.81	Hydr. Depth (ft)	1.26	1.73
Conv. Total (cfs)	4953.3	Conv. (cfs)	2169.2	2784.1
Length Wtd. (ft)	103.26	Wetted Per. (ft)	70.10	27.62
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.41	0.55
Alpha	1.68	Stream Power (lb/ft s)	552.21	0.00
0.00				
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.36	0.11
C & E Loss (ft)	0.06	Cum SA (acres)	0.43	0.05

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	5.06	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.24	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	4.81	Reach Len. (ft)	104.39	102.92
100.09				
Crit W.S. (ft)	4.16	Flow Area (sq ft)	137.99	63.78
0.20				
E.G. Slope (ft/ft)	0.005371	Area (sq ft)	512.97	63.78
0.20				
Q Total (cfs)	613.00	Flow (cfs)	288.59	324.32
0.09				
Top Width (ft)	425.63	Top Width (ft)	394.81	29.64
1.18				
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)	2.09	5.09
0.46				
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)	1.26	2.15
0.17				
Conv. Total (cfs)	8364.0	Conv. (cfs)	3937.6	4425.2
1.2				
Length Wtd. (ft)	103.43	Wetted Per. (ft)	109.67	30.53
1.23				
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.42	0.70
0.05				
Alpha	1.71	Stream Power (lb/ft s)	552.21	0.00
0.00				
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	0.78	0.15
0.00				
C & E Loss (ft)	0.04	Cum SA (acres)	0.90	0.06
0.00				

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	5.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.85	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	4.30	Flow Area (sq ft)	142.31	64.94	0.25
E.G. Slope (ft/ft)	0.007100	Area (sq ft)	528.44	64.94	0.25
Q Total (cfs)	728.00	Flow (cfs)	343.63	384.23	0.14
Top Width (ft)	427.69	Top Width (ft)	396.73	29.64	1.32
Vel Total (ft/s)	3.51	Avg. Vel. (ft/s)	2.41	5.92	0.57
Max Chl Dpth (ft)	3.45	Hydr. Depth (ft)	1.28	2.19	0.19
Conv. Total (cfs)	8639.7	Conv. (cfs)	4078.1	4559.9	1.7
Length Wtd. (ft)	103.52	Wetted Per. (ft)	111.31	30.53	1.37
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.57	0.94	0.08
Alpha	1.72	Stream Power (lb/ft s)	552.21	0.00	0.00
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	0.97	0.16	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	1.04	0.06	0.00

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	5.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.98	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	4.43	Flow Area (sq ft)	156.42	68.61	0.44
E.G. Slope (ft/ft)	0.007841	Area (sq ft)	578.03	68.61	0.44
Q Total (cfs)	846.00	Flow (cfs)	403.09	442.60	0.32
Top Width (ft)	434.22	Top Width (ft)	402.82	29.64	1.76

Vel Total (ft/s)	3.75	Avg. Vel. (ft/s)	2.58	6.45 0.72
Max Chl Dpth (ft)	3.58	Hydr. Depth (ft)	1.34	2.31 0.25
Conv. Total (cfs)	9554.0	Conv. (cfs)	4552.1	4998.3 3.6
Length Wtd. (ft)	103.55	Wetted Per. (ft)	116.52	30.53 1.83
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.66	1.10 0.12
Alpha	1.77	Stream Power (lb/ft s)	552.21	0.00 0.00
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	1.10	0.17 0.00
C & E Loss (ft)	0.01	Cum SA (acres)	1.04	0.06 0.01

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: EXBLHEC RS: 50000

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	2.43	Element	Left OB	Channel Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	1.89	Reach Len. (ft)		
Crit W.S. (ft)	1.60	Flow Area (sq ft)	0.79	30.97
E.G. Slope (ft/ft)	0.009407	Area (sq ft)	0.79	30.97
Q Total (cfs)	182.00	Flow (cfs)	0.60	181.40
Top Width (ft)	20.75	Top Width (ft)	3.39	17.36
Vel Total (ft/s)	5.73	Avg. Vel. (ft/s)	0.77	5.86
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.23	1.78
Conv. Total (cfs)	1876.5	Conv. (cfs)	6.2	1870.3
Length Wtd. (ft)		Wetted Per. (ft)	3.45	18.25
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.13	1.00
Alpha	1.04	Stream Power (lb/ft s)	573.03	0.00 0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	3.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	2.80	Reach Len. (ft)			
Crit W.S. (ft)	2.54	Flow Area (sq ft)	7.10	47.17	
E.G. Slope (ft/ft)	0.009413	Area (sq ft)	7.10	47.17	
Q Total (cfs)	359.00	Flow (cfs)	11.12	347.88	
Top Width (ft)	29.05	Top Width (ft)	10.58	18.47	
Vel Total (ft/s)	6.62	Avg. Vel. (ft/s)	1.57	7.38	
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)	0.67	2.55	
Conv. Total (cfs)	3700.2	Conv. (cfs)	114.7	3585.6	
Length Wtd. (ft)		Wetted Per. (ft)	10.69	19.69	
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.39	1.41	
Alpha	1.21	Stream Power (lb/ft s)	573.03	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	4.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	3.84	Reach Len. (ft)			
Crit W.S. (ft)	3.84	Flow Area (sq ft)	125.02	66.94	0.17
E.G. Slope (ft/ft)	0.005869	Area (sq ft)	139.39	66.94	0.17
Q Total (cfs)	613.00	Flow (cfs)	139.29	473.64	0.07
Top Width (ft)	379.62	Top Width (ft)	359.10	19.39	1.13
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	1.11	7.08	

0.44					
Max Chl Dpth (ft)	4.45	Hydr. Depth (ft)	0.51	3.45	
0.15					
Conv. Total (cfs)	8001.9	Conv. (cfs)	1818.2	6182.7	
1.0					
Length Wtd. (ft)		Wetted Per. (ft)	244.52	20.86	
1.17					
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.19	1.18	
0.05					
Alpha	3.83	Stream Power (lb/ft s)	573.03	0.00	
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	4.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.16	Reach Len. (ft)			
Crit W.S. (ft)	4.16	Flow Area (sq ft)	212.90	73.27	
0.74					
E.G. Slope (ft/ft)	0.004402	Area (sq ft)	283.14	73.27	
0.74					
Q Total (cfs)	728.00	Flow (cfs)	250.71	476.82	
0.47					
Top Width (ft)	490.54	Top Width (ft)	468.77	19.39	
2.38					
Vel Total (ft/s)	2.54	Avg. Vel. (ft/s)	1.18	6.51	
0.63					
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)	0.77	3.78	
0.31					
Conv. Total (cfs)	10972.8	Conv. (cfs)	3778.8	7186.9	
7.0					
Length Wtd. (ft)		Wetted Per. (ft)	278.46	20.86	
2.46					
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.21	0.97	
0.08					
Alpha	4.38	Stream Power (lb/ft s)	573.03	0.00	
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).

Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	4.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.27	Reach Len. (ft)			
Crit W.S. (ft)	4.27	Flow Area (sq ft)	244.21	75.45	1.03
E.G. Slope (ft/ft)	0.004725	Area (sq ft)	335.90	75.45	1.03
Q Total (cfs)	846.00	Flow (cfs)	326.48	518.77	0.75
Top Width (ft)	491.29	Top Width (ft)	469.10	19.39	2.80
Vel Total (ft/s)	2.64	Avg. Vel. (ft/s)	1.34	6.88	0.73
Max Chl Dpth (ft)	4.88	Hydr. Depth (ft)	0.88	3.89	0.37
Conv. Total (cfs)	12307.6	Conv. (cfs)	4749.6	7547.1	11.0
Length Wtd. (ft)		Wetted Per. (ft)	278.46	20.86	2.90
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.26	1.07	0.10
Alpha	4.26	Stream Power (lb/ft s)	573.03	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:99

Reach	River Sta.	n1	n2	n3
EXBLHEC	53100	.07	.035	.07
EXBLHEC	53000	.07	.035	.07
EXBLHEC	52900	Culvert		
EXBLHEC	52551.81	.07	.035	.07
EXBLHEC	52492.14	.07	.035	.07
EXBLHEC	52208.31	.07	.035	.07
EXBLHEC	52000.4	.07	.035	.07
EXBLHEC	51873.49	.07	.035	.07
EXBLHEC	51774.77	.07	.035	.07

EXBLHEC	51701.6	.07	.035	.07
EXBLHEC	51660.15	.07	.035	.07
EXBLHEC	51347.58	.07	.035	.07
EXBLHEC	51266.45	.07	.035	.07
EXBLHEC	51095.56	.07	.035	.07
EXBLHEC	51024.74	.07	.035	.07
EXBLHEC	50878.95	.07	.035	.07
EXBLHEC	50668.61	.07	.035	.07
EXBLHEC	50610.0	.07	.035	.07
EXBLHEC	50602.3	.07	.035	.07
EXBLHEC	50590.0	.07	.035	.07
EXBLHEC	50541.89	.07	.035	.07
EXBLHEC	50468.04	Culvert		
EXBLHEC	50418.36	.07	.035	.07
EXBLHEC	50391.33	.07	.035	.07
EXBLHEC	50341.6	Culvert		
EXBLHEC	50292.86	.07	.035	.07
EXBLHEC	50198.72	.07	.035	.07
EXBLHEC	50103.33	.07	.035	.07
EXBLHEC	50000	.07	.035	.07

SUMMARY OF REACH LENGTHS

River: 99

Reach	River Sta.	Left	Channel	Right
EXBLHEC	53100	77.24	70.3	64.94
EXBLHEC	53000	1742.97	1742.97	1742.97
EXBLHEC	52900	Culvert		
EXBLHEC	52551.81	53.53	59.29	67.97
EXBLHEC	52492.14	228.4	220.07	223.71
EXBLHEC	52208.31	193.13	180.95	159.72
EXBLHEC	52000.4	87.22	90.5	99.24
EXBLHEC	51873.49	95.78	101.26	104.73
EXBLHEC	51774.77	53.19	55.84	58.21
EXBLHEC	51701.6	47.61	47.25	47.08
EXBLHEC	51660.15	297.75	294.83	294.28
EXBLHEC	51347.58	72.54	74.15	73.79
EXBLHEC	51266.45	149.37	156.29	159.47
EXBLHEC	51095.56	68.84	78.26	77.3
EXBLHEC	51024.74	136.82	118.63	114.89
EXBLHEC	50878.95	167.64	185.01	195.16
EXBLHEC	50668.61	19.9	23.16	28.27
EXBLHEC	50610.0	22.5	21.17	23.63
EXBLHEC	50602.3	34.8	34.36	34.29
EXBLHEC	50590.0	69.95	31.62	12.37
EXBLHEC	50541.89	123.44	126.44	123.05
EXBLHEC	50468.04	Culvert		
EXBLHEC	50418.36	26.22	27.31	28.13
EXBLHEC	50391.33	97.79	98.48	98.8
EXBLHEC	50341.6	Culvert		
EXBLHEC	50292.86	94.24	94.13	95.71
EXBLHEC	50198.72	93.76	95.4	95.3
EXBLHEC	50103.33	104.39	102.92	100.09
EXBLHEC	50000	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: 99

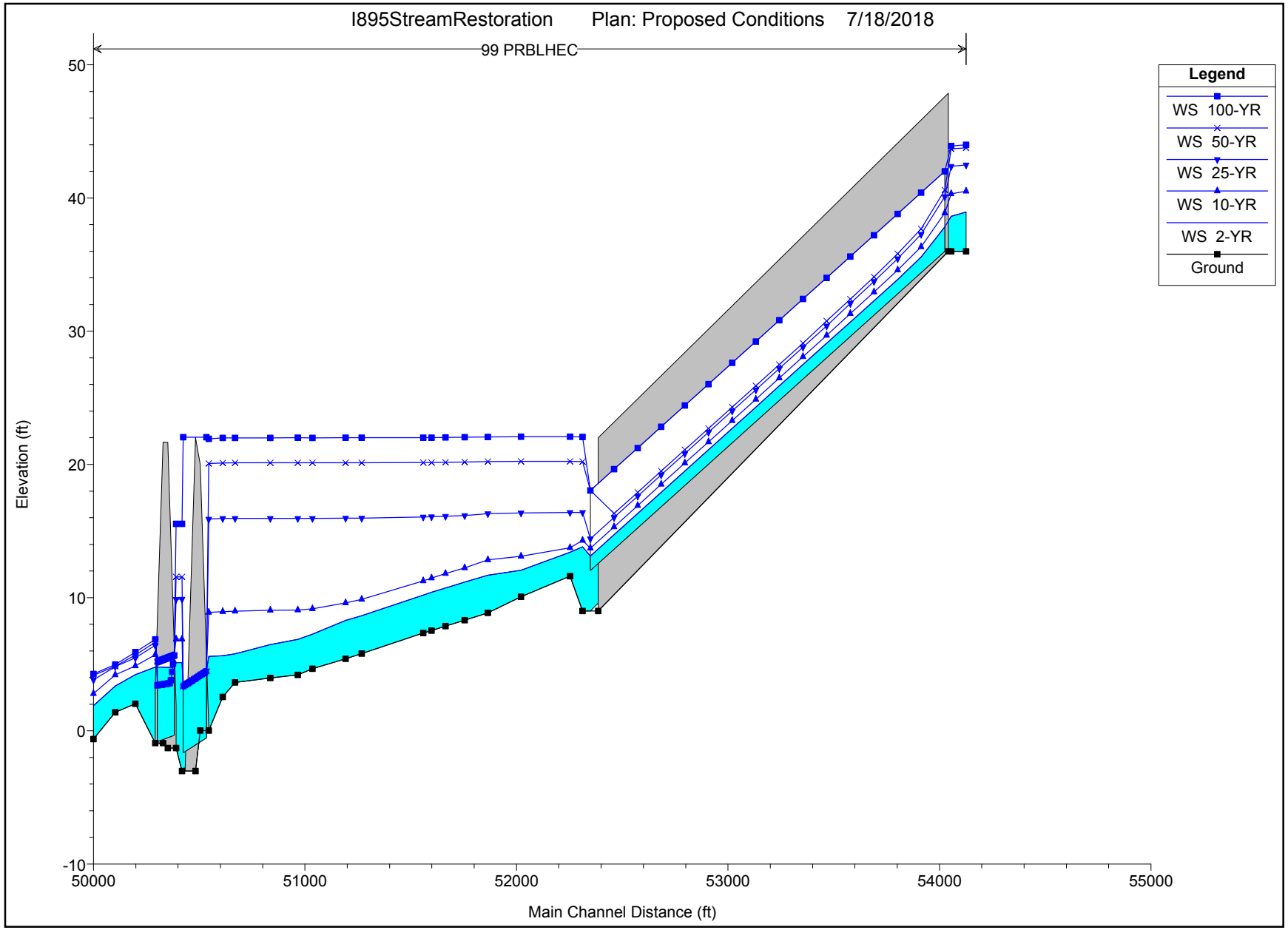
Reach	River Sta.	Contr.	Expan.
EXBLHEC	53100	.1	.3
EXBLHEC	53000	.1	.3
EXBLHEC	52900	Culvert	
EXBLHEC	52551.81	.3	.5
EXBLHEC	52492.14	.1	.3
EXBLHEC	52208.31	.1	.3
EXBLHEC	52000.4	.1	.3
EXBLHEC	51873.49	.1	.3
EXBLHEC	51774.77	.1	.3
EXBLHEC	51701.6	.1	.3
EXBLHEC	51660.15	.1	.3
EXBLHEC	51347.58	.1	.3
EXBLHEC	51266.45	.1	.3
EXBLHEC	51095.56	.1	.3
EXBLHEC	51024.74	.1	.3
EXBLHEC	50878.95	.1	.3
EXBLHEC	50668.61	.1	.3
EXBLHEC	50610.0	.1	.3
EXBLHEC	50602.3	.1	.3
EXBLHEC	50590.0	.1	.3
EXBLHEC	50541.89	.3	.5
EXBLHEC	50468.04	Culvert	
EXBLHEC	50418.36	.3	.5
EXBLHEC	50391.33	.3	.5
EXBLHEC	50341.6	Culvert	
EXBLHEC	50292.86	.3	.5
EXBLHEC	50198.72	.1	.3
EXBLHEC	50103.33	.1	.3
EXBLHEC	50000	.1	.3

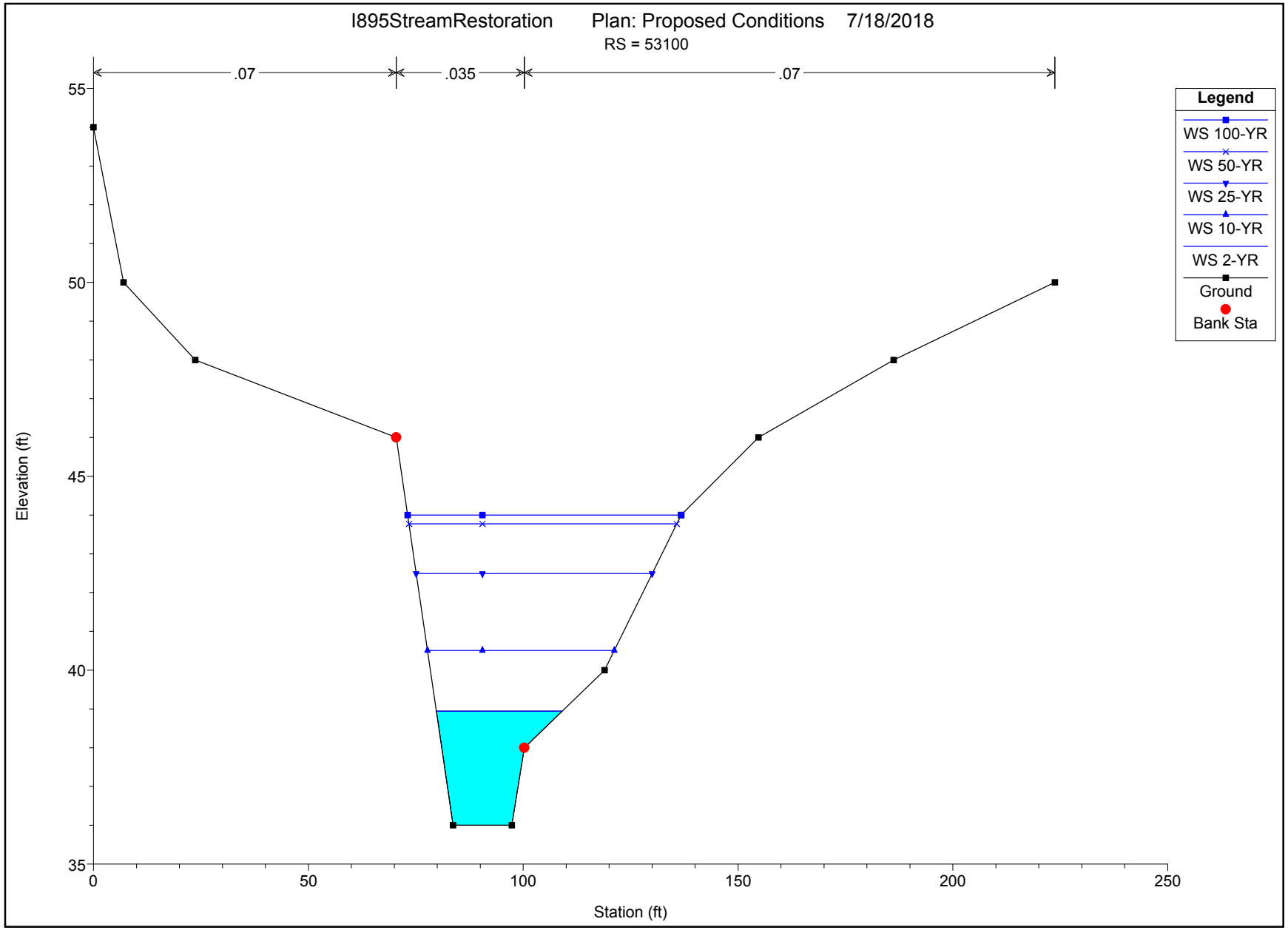
HEC-RAS Plan: PropCond River: 99 Reach: PRBLHEC

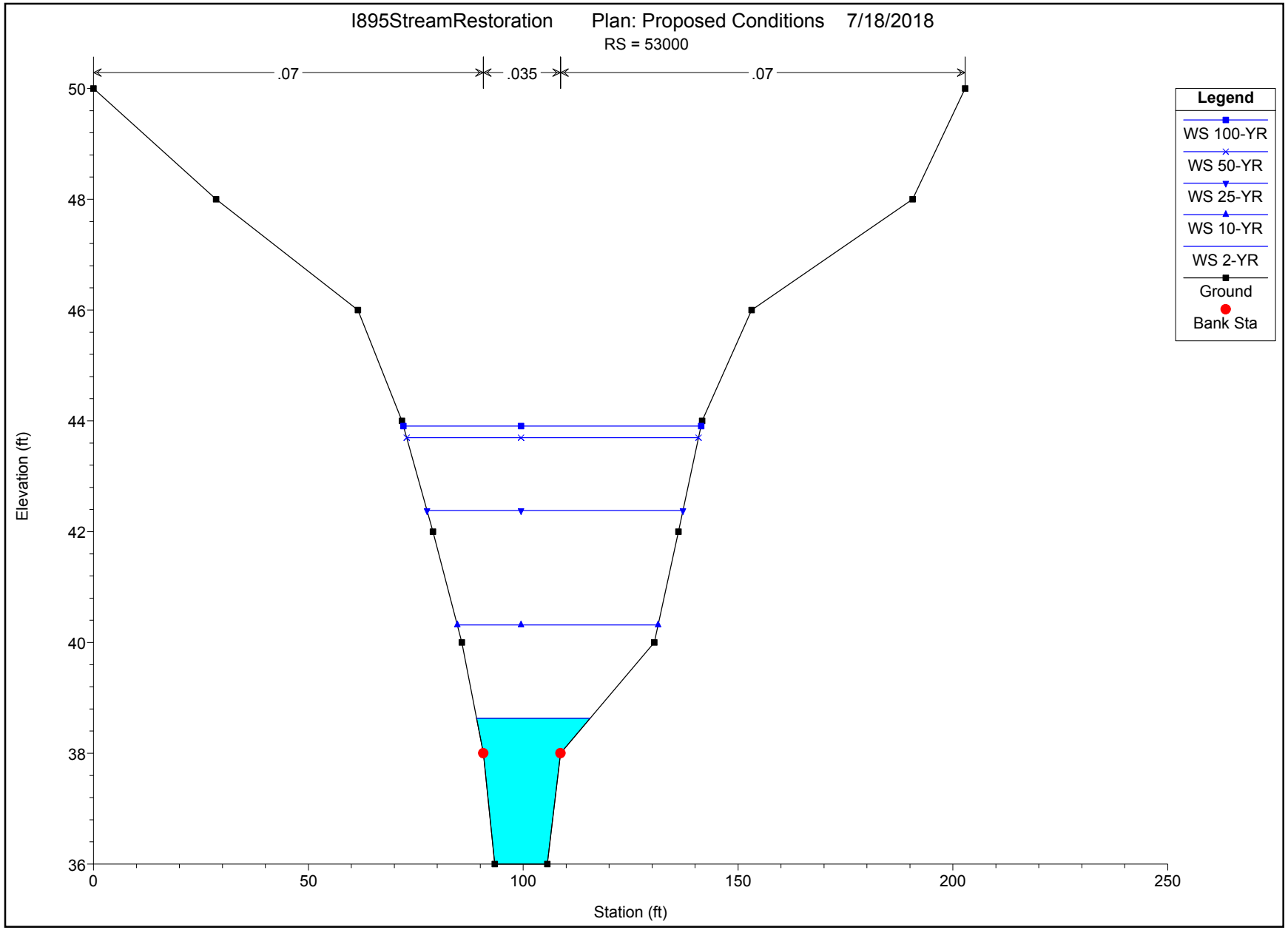
Reach	River Sta	Profile	Q Total	W.S. Elev	Vel Chnl	Vel Total	Flow Area	Top Width	Froude # Chl	Shear Total	Shear Chan	Shear LOB	Shear ROB
			(cfs)	(ft)	(ft/s)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
PRBLHEC	53100	2-YR	182.00	38.94	3.48	3.27	55.68	29.25	0.39	0.24	0.32		0.06
PRBLHEC	53100	10-YR	359.00	40.51	3.86	3.15	113.95	43.46	0.35	0.25	0.34		0.13
PRBLHEC	53100	25-YR	613.00	42.49	3.85	2.90	211.38	54.91	0.30	0.24	0.31		0.17
PRBLHEC	53100	50-YR	728.00	43.77	3.48	2.54	286.40	62.31	0.25	0.19	0.24		0.14
PRBLHEC	53100	100-YR	846.00	44.00	3.87	2.81	300.94	63.65	0.27	0.23	0.29		0.18
PRBLHEC	53000	2-YR	182.00	38.63	4.34	4.11	44.24	26.46	0.50	0.37	0.50	0.07	0.07
PRBLHEC	53000	10-YR	359.00	40.32	4.47	3.34	107.46	46.76	0.39	0.26	0.45	0.12	0.15
PRBLHEC	53000	25-YR	613.00	42.38	4.35	2.82	217.09	59.56	0.31	0.23	0.37	0.12	0.18
PRBLHEC	53000	50-YR	728.00	43.70	3.94	2.42	301.01	67.95	0.26	0.17	0.28	0.10	0.15
PRBLHEC	53000	100-YR	846.00	43.91	4.40	2.68	315.62	69.31	0.28	0.22	0.35	0.13	0.19
PRBLHEC	52900		Culvert										
PRBLHEC	52551.81	2-YR	182.00	13.81	2.93	2.85	63.80	40.15	0.39	0.24	0.25	0.10	
PRBLHEC	52551.81	10-YR	359.00	14.30	4.50	4.35	82.57	41.61	0.53	0.51	0.54	0.22	
PRBLHEC	52551.81	25-YR	613.00	16.40	3.92	3.66	167.34	47.84	0.33	0.29	0.33	0.14	
PRBLHEC	52551.81	50-YR	728.00	20.21	2.44	2.10	346.60	71.38	0.15	0.07	0.10	0.03	
PRBLHEC	52551.81	100-YR	846.00	22.06	2.09	1.39	610.18	128.61	0.12	0.03	0.07	0.02	0.02
PRBLHEC	52492.14	2-YR	182.00	13.40	6.11	2.67	68.19	89.93	0.86	0.70	1.15	0.65	0.68
PRBLHEC	52492.14	10-YR	359.00	13.75	8.27	3.76	95.40	92.24	1.05	1.36	1.97	1.27	1.34
PRBLHEC	52492.14	25-YR	613.00	16.40	3.90	1.97	311.59	162.14	0.32	0.29	0.33	0.27	0.30
PRBLHEC	52492.14	50-YR	728.00	20.23	2.33	1.03	703.77	227.28	0.14	0.06	0.10	0.05	0.10
PRBLHEC	52492.14	100-YR	846.00	22.08	1.27	0.51	1647.67	277.19	0.07	0.02	0.03	0.01	0.02
PRBLHEC	52208.31	2-YR	182.00	12.06	3.50	1.48	123.00	116.34	0.46	0.24	0.36	0.20	0.23
PRBLHEC	52208.31	10-YR	359.00	13.10	3.15	1.45	247.49	122.62	0.33	0.20	0.25	0.15	0.20
PRBLHEC	52208.31	25-YR	613.00	16.35	1.86	0.85	718.45	167.66	0.13	0.05	0.07	0.03	0.06
PRBLHEC	52208.31	50-YR	728.00	20.22	1.10	0.50	1441.95	199.40	0.06	0.02	0.02	0.01	0.02
PRBLHEC	52208.31	100-YR	846.00	22.08	1.01	0.47	1819.04	207.32	0.05	0.01	0.02	0.01	0.01
PRBLHEC	52000.40	2-YR	182.00	11.68	3.14	1.49	122.18	69.34	0.34	0.19	0.26	0.18	0.18
PRBLHEC	52000.40	10-YR	359.00	12.84	3.61	1.75	205.68	75.01	0.33	0.24	0.30	0.23	0.23
PRBLHEC	52000.40	25-YR	613.00	16.30	2.40	1.06	577.75	119.69	0.16	0.08	0.11	0.08	0.07
PRBLHEC	52000.40	50-YR	728.00	20.21	1.56	0.66	1102.30	155.54	0.08	0.03	0.04	0.02	0.03
PRBLHEC	52000.40	100-YR	846.00	22.07	1.42	0.60	1402.26	165.30	0.07	0.02	0.03	0.02	0.02
PRBLHEC	51873.49	2-YR	182.00	11.16	5.42	2.94	61.89	33.23	0.59	0.56	0.76	0.50	0.51
PRBLHEC	51873.49	10-YR	359.00	12.24	6.85	3.60	99.72	37.73	0.62	0.79	1.08	0.71	0.76
PRBLHEC	51873.49	25-YR	613.00	16.17	4.21	1.85	331.38	73.52	0.27	0.20	0.32	0.20	0.18
PRBLHEC	51873.49	50-YR	728.00	20.17	2.62	1.08	671.34	100.74	0.14	0.06	0.11	0.05	0.07
PRBLHEC	51873.49	100-YR	846.00	22.04	2.36	0.98	866.12	107.77	0.11	0.05	0.08	0.04	0.05
PRBLHEC	51774.77	2-YR	182.00	10.72	5.36	2.90	62.85	33.78	0.58	0.54	0.74	0.50	0.49
PRBLHEC	51774.77	10-YR	359.00	11.80	6.73	3.54	101.41	38.06	0.61	0.77	1.04	0.73	0.71
PRBLHEC	51774.77	25-YR	613.00	16.10	4.16	1.89	323.79	64.53	0.26	0.20	0.31	0.21	0.17
PRBLHEC	51774.77	50-YR	728.00	20.15	2.70	1.17	620.81	82.08	0.14	0.07	0.11	0.07	0.07
PRBLHEC	51774.77	100-YR	846.00	22.02	2.53	1.08	781.93	90.21	0.12	0.06	0.10	0.06	0.06
PRBLHEC	51701.60	2-YR	182.00	10.40	5.31	2.86	63.64	34.28	0.57	0.53	0.73	0.47	0.50
PRBLHEC	51701.60	10-YR	359.00	11.48	6.67	3.49	102.86	38.77	0.61	0.76	1.02	0.67	0.73
PRBLHEC	51701.60	25-YR	613.00	16.06	3.98	1.84	333.20	61.54	0.24	0.19	0.28	0.17	0.18
PRBLHEC	51701.60	50-YR	728.00	20.14	2.67	1.16	626.46	81.14	0.13	0.07	0.11	0.06	0.07
PRBLHEC	51701.60	100-YR	846.00	22.01	2.52	1.08	786.21	89.43	0.12	0.06	0.09	0.05	0.06
PRBLHEC	51660.15	2-YR	182.00	10.20	5.44	2.95	61.75	33.51	0.59	0.56	0.76	0.54	0.46
PRBLHEC	51660.15	10-YR	359.00	11.26	6.83	3.59	99.90	37.97	0.62	0.79	1.07	0.78	0.65
PRBLHEC	51660.15	25-YR	613.00	16.05	3.84	1.77	346.66	63.86	0.23	0.17	0.26	0.18	0.14
PRBLHEC	51660.15	50-YR	728.00	20.14	2.55	1.07	678.26	91.09	0.13	0.06	0.10	0.06	0.06
PRBLHEC	51660.15	100-YR	846.00	22.01	2.36	0.99	855.83	98.31	0.11	0.05	0.08	0.05	0.05
PRBLHEC	51347.58	2-YR	182.00	8.65	5.67	3.08	59.10	32.85	0.62	0.60	0.83	0.51	0.56
PRBLHEC	51347.58	10-YR	359.00	9.88	6.68	3.48	103.13	38.69	0.60	0.73	1.02	0.64	0.71
PRBLHEC	51347.58	25-YR	613.00	15.97	2.98	1.26	487.66	86.04	0.17	0.09	0.15	0.08	0.09
PRBLHEC	51347.58	50-YR	728.00	20.12	2.02	0.79	924.39	130.95	0.09	0.03	0.06	0.03	0.04
PRBLHEC	51347.58	100-YR	846.00	22.00	1.90	0.71	1199.35	152.97	0.08	0.03	0.05	0.02	0.03
PRBLHEC	51266.45	2-YR	182.00	8.29	5.30	2.86	63.63	34.21	0.57	0.53	0.72	0.43	0.52
PRBLHEC	51266.45	10-YR	359.00	9.61	6.12	3.19	112.60	39.81	0.54	0.62	0.84	0.51	0.63
PRBLHEC	51266.45	25-YR	613.00	15.96	2.77	1.13	541.66	96.11	0.15	0.07	0.13	0.06	0.07
PRBLHEC	51266.45	50-YR	728.00	20.12	1.81	0.72	1007.77	123.88	0.08	0.03	0.05	0.03	0.03
PRBLHEC	51266.45	100-YR	846.00	22.00	1.70	0.68	1249.34	132.93	0.07	0.02	0.04	0.02	0.02
PRBLHEC	51095.56	2-YR	182.00	7.26	6.19	3.32	54.83	34.23	0.70	0.72	1.02	0.63	0.68
PRBLHEC	51095.56	10-YR	359.00	9.16	5.49	2.78	129.33	44.10	0.47	0.47	0.66	0.42	0.46
PRBLHEC	51095.56	25-YR	613.00	15.95	2.27	0.90	681.59	116.65	0.12	0.05	0.08	0.04	0.05
PRBLHEC	51095.56	50-YR	728.00	20.12	1.50	0.60	1209.96	136.89	0.07	0.02	0.03	0.02	0.02
PRBLHEC	51095.56	100-YR	846.00	22.00	1.43	0.57	1476.18	146.02	0.06	0.02	0.03	0.02	0.02
PRBLHEC	51024.74	2-YR	182.00	6.87	5.71	3.04	59.84	35.71	0.64	0.62	0.86	0.54	0.59
PRBLHEC	51024.74	10-YR	359.00	9.07	4.76	2.29	156.47	52.34	0.39	0.33	0.49	0.31	0.30
PRBLHEC	51024.74	25-YR	613.00	15.95	1.68	0.66	928.61	145.68	0.09	0.03	0.04	0.02	0.03
PRBLHEC	51024.74	50-YR	728.00	20.12	1.14	0.46	1581.25	167.72	0.05	0.01	0.02	0.01	0.01
PRBLHEC	51024.74	100-YR	846.00	22.00	1.10	0.44	1906.28	177.71	0.05	0.01	0.02	0.01	0.01
PRBLHEC	50878.95	2-YR	182.00	6.47	3.63	1.73	105.31	67.31	0.42	0.26	0.36	0.23	0.26
PRBLHEC	50878.95	10-YR	359.00	9.05	2.48	1.11	322.40	98.98	0.20	0.09	0.13	0.08	0.09
PRBLHEC	50878.95	25-YR	613.00	15.95	1.12	0.50	1233.31	150.30	0.06	0.01	0.02	0.01	0.02
PRBLHEC	50878.95	50-YR	728.00	20.12	0.87	0.38	1903.24	172.51	0.04	0.01	0.01	0.01	0.01

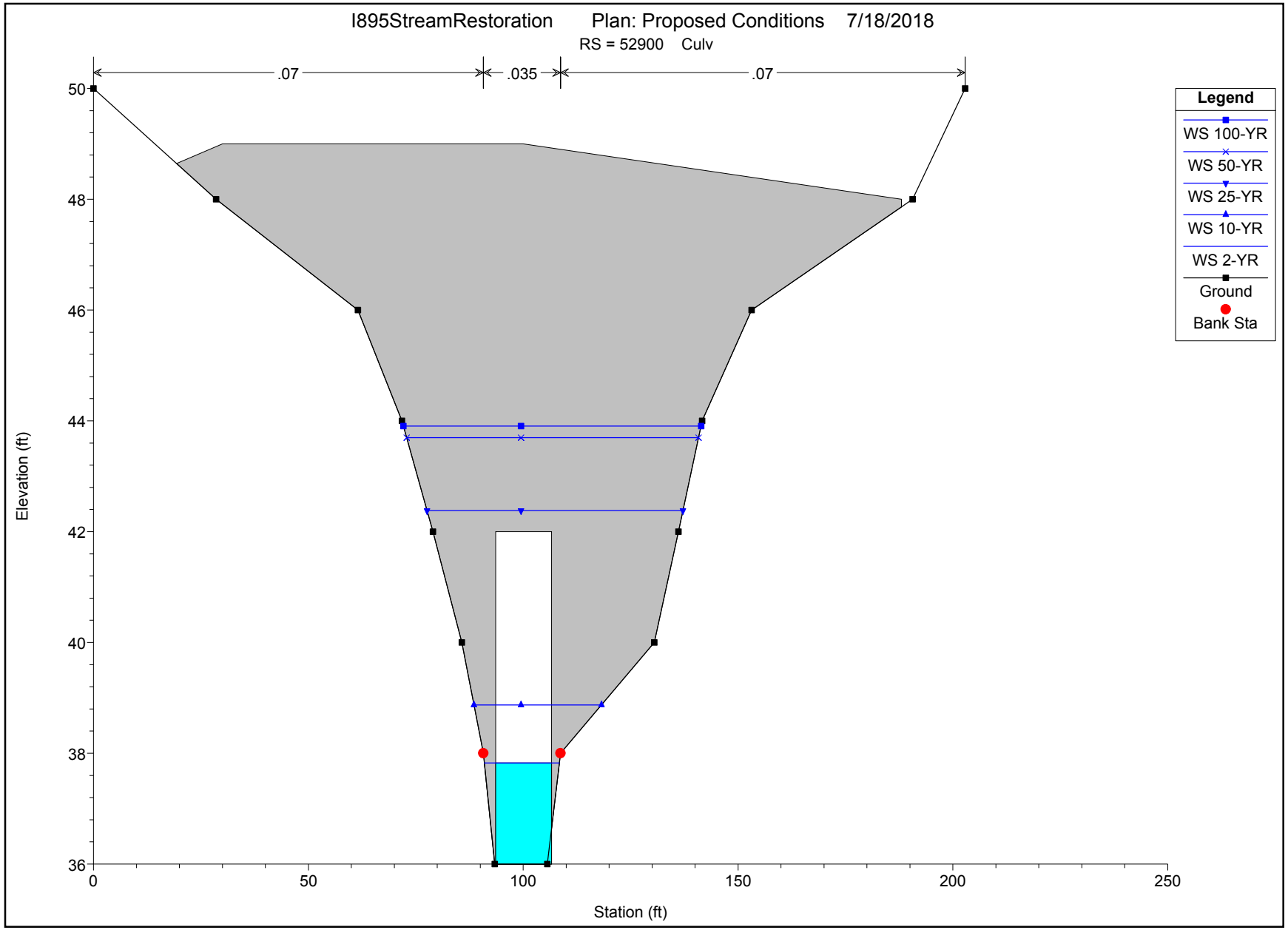
HEC-RAS Plan: PropCond River: 99 Reach: PRBLHEC (Continued)

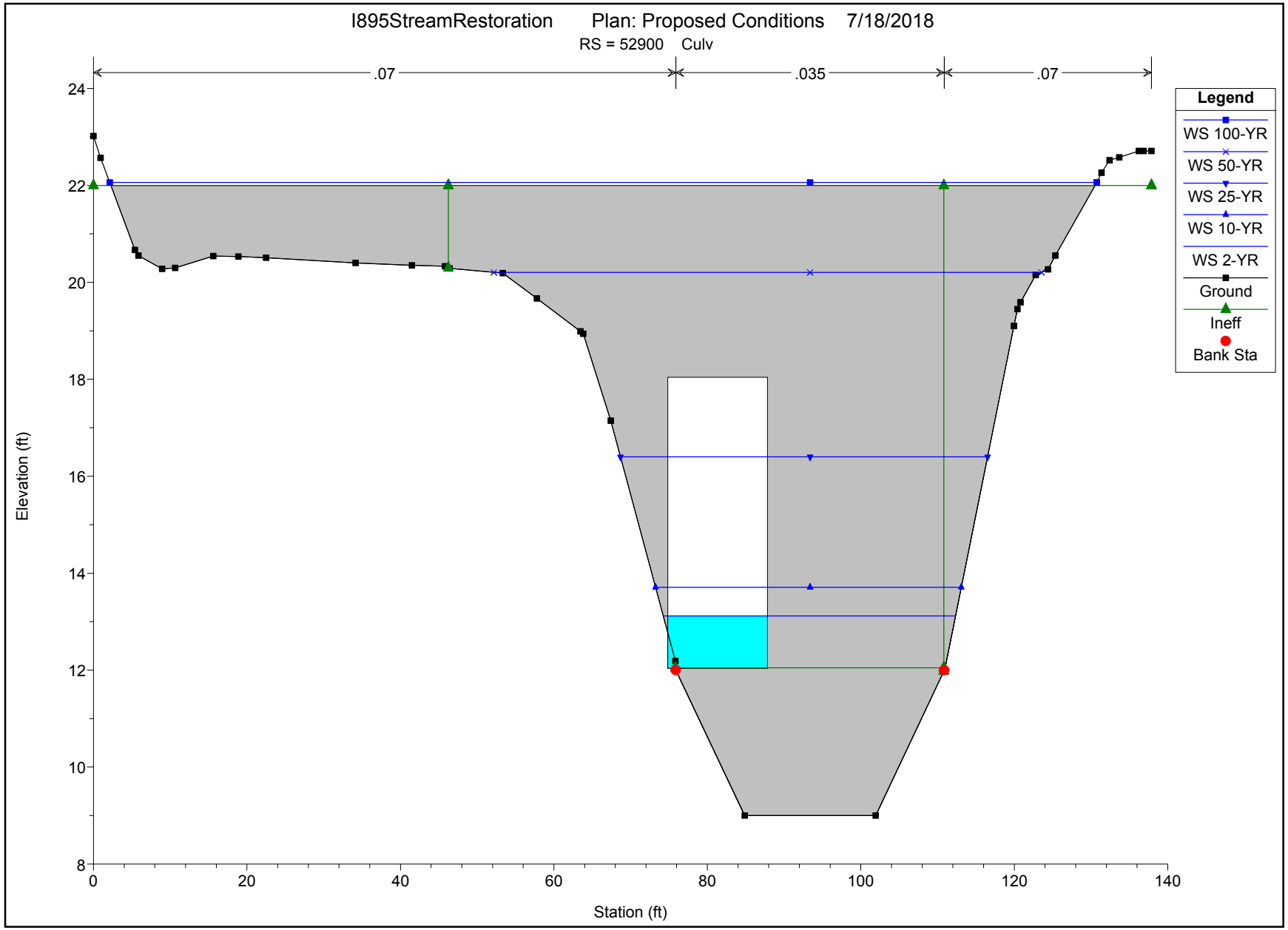
Reach	River Sta	Profile	Q Total	W.S. Elev	Vel Chnl	Vel Total	Flow Area	Top Width	Froude # Chl	Shear Total	Shear Chan	Shear LOB	Shear ROB
			(cfs)	(ft)	(ft/s)	(ft/s)	(sq ft)	(ft)		(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
PRBLHEC	50878.95	100-YR	846.00	22.00	0.88	0.38	2244.98	190.69	0.04	0.01	0.01	0.01	0.01
PRBLHEC	50668.61	2-YR	182.00	5.79	4.53	2.10	86.68	69.33	0.57	0.41	0.59	0.39	0.38
PRBLHEC	50668.61	10-YR	359.00	8.98	2.27	1.07	336.64	90.60	0.18	0.08	0.11	0.09	0.07
PRBLHEC	50668.61	25-YR	613.00	15.95	1.08	0.43	1442.26	225.71	0.05	0.01	0.02	0.01	0.01
PRBLHEC	50668.61	50-YR	728.00	20.12	0.79	0.29	2491.64	332.02	0.03	0.00	0.01	0.00	0.01
PRBLHEC	50668.61	100-YR	846.00	22.00	0.78	0.27	3106.83	346.51	0.03	0.00	0.01	0.00	0.00
PRBLHEC	50602.30	2-YR	182.00	5.64	3.52	1.76	103.44	51.64	0.37	0.23	0.31	0.23	0.21
PRBLHEC	50602.30	10-YR	359.00	8.95	2.38	1.15	312.60	73.75	0.17	0.09	0.11	0.08	0.08
PRBLHEC	50602.30	25-YR	613.00	15.94	1.26	0.49	1239.92	226.64	0.06	0.01	0.02	0.01	0.02
PRBLHEC	50602.30	50-YR	728.00	20.11	0.94	0.34	2171.67	345.54	0.04	0.01	0.01	0.00	0.01
PRBLHEC	50602.30	100-YR	846.00	22.00	0.97	0.30	2781.15	364.04	0.04	0.01	0.01	0.01	0.00
PRBLHEC	50541.89	2-YR	182.00	5.58	2.48	1.76	103.53	49.73	0.21	0.11	0.13	0.10	
PRBLHEC	50541.89	10-YR	359.00	8.89	2.49	1.77	202.66	109.39	0.16	0.10	0.11	0.10	
PRBLHEC	50541.89	25-YR	613.00	15.89	2.07	1.49	412.52	152.11	0.10	0.06	0.06	0.06	
PRBLHEC	50541.89	50-YR	728.00	20.07	1.89	1.35	537.71	215.86	0.08	0.05	0.05	0.05	
PRBLHEC	50541.89	100-YR	846.00	21.91	2.56	1.01	835.39	329.73	0.10	0.01	0.09	0.01	0.00
PRBLHEC	50468.04		Culvert										
PRBLHEC	50418.36	2-YR	182.00	5.12	1.11	1.11	163.54	38.33	0.08	0.02	0.02		
PRBLHEC	50418.36	10-YR	359.00	6.88	1.71	1.71	209.43	166.03	0.11	0.05	0.05		
PRBLHEC	50418.36	25-YR	613.00	9.88	2.13	2.13	287.61	222.02	0.11	0.07	0.07		
PRBLHEC	50418.36	50-YR	728.00	11.56	2.20	2.20	331.46	231.07	0.11	0.07	0.07		
PRBLHEC	50418.36	100-YR	846.00	15.53	1.94	1.94	434.97	249.27	0.08	0.05	0.05		
PRBLHEC	50391.33	2-YR	182.00	5.12	1.16	1.15	157.91	36.88	0.09	0.03	0.03		0.01
PRBLHEC	50391.33	10-YR	359.00	6.88	1.75	1.73	207.47	45.28	0.11	0.05	0.05		0.02
PRBLHEC	50391.33	25-YR	613.00	9.88	2.12	2.10	292.01	54.54	0.12	0.07	0.07		0.04
PRBLHEC	50391.33	50-YR	728.00	11.56	2.17	2.14	339.43	59.73	0.11	0.07	0.07		0.04
PRBLHEC	50391.33	100-YR	846.00	15.53	1.90	1.87	451.32	71.27	0.08	0.05	0.05		0.03
PRBLHEC	50341.60		Culvert										
PRBLHEC	50292.86	2-YR	182.00	4.78	1.68	1.68	108.61	29.17	0.15	0.07	0.07		
PRBLHEC	50292.86	10-YR	359.00	5.71	2.64	2.64	136.16	43.56	0.22	0.15	0.16		0.01
PRBLHEC	50292.86	25-YR	613.00	6.42	3.90	3.90	157.24	50.09	0.30	0.32	0.32		0.07
PRBLHEC	50292.86	50-YR	728.00	6.66	4.43	4.43	164.37	52.30	0.33	0.41	0.41		0.11
PRBLHEC	50292.86	100-YR	846.00	6.87	4.97	4.96	170.55	54.22	0.37	0.51	0.51		0.15
PRBLHEC	50198.72	2-YR	182.00	4.22	5.11	5.01	36.32	349.83	0.71	0.66	0.78	0.08	
PRBLHEC	50198.72	10-YR	359.00	4.87	6.62	5.09	70.60	400.54	0.81	0.60	1.22	0.27	
PRBLHEC	50198.72	25-YR	613.00	5.48	7.66	5.16	118.73	421.32	0.85	0.84	1.52	0.59	0.13
PRBLHEC	50198.72	50-YR	728.00	5.70	8.07	5.29	137.74	426.81	0.86	0.95	1.65	0.71	0.25
PRBLHEC	50198.72	100-YR	846.00	5.90	8.43	5.40	156.66	432.07	0.87	1.05	1.76	0.81	0.35
PRBLHEC	50103.33	2-YR	182.00	3.36	5.21	3.15	57.81	192.98	0.82	0.50	0.88	0.36	
PRBLHEC	50103.33	10-YR	359.00	4.21	4.35	2.67	134.29	377.79	0.58	0.45	0.55	0.41	
PRBLHEC	50103.33	25-YR	613.00	4.82	5.02	3.02	203.17	426.08	0.61	0.48	0.69	0.43	0.06
PRBLHEC	50103.33	50-YR	728.00	4.86	5.83	3.48	209.00	428.25	0.70	0.64	0.92	0.57	0.08
PRBLHEC	50103.33	100-YR	846.00	4.99	6.35	3.72	227.24	434.85	0.74	0.74	1.07	0.66	0.12
PRBLHEC	50000	2-YR	182.00	1.89	5.86	5.73	31.75	20.75	0.77	0.86	1.00	0.13	
PRBLHEC	50000	10-YR	359.00	2.80	7.38	6.62	54.27	29.05	0.81	1.05	1.41	0.39	
PRBLHEC	50000	25-YR	613.00	3.84	7.08	3.19	192.13	379.62	0.67	0.26	1.18	0.19	0.05
PRBLHEC	50000	50-YR	728.00	4.16	6.51	2.54	286.91	490.54	0.59	0.26	0.97	0.21	0.08
PRBLHEC	50000	100-YR	846.00	4.27	6.88	2.64	320.69	491.29	0.61	0.31	1.07	0.26	0.10

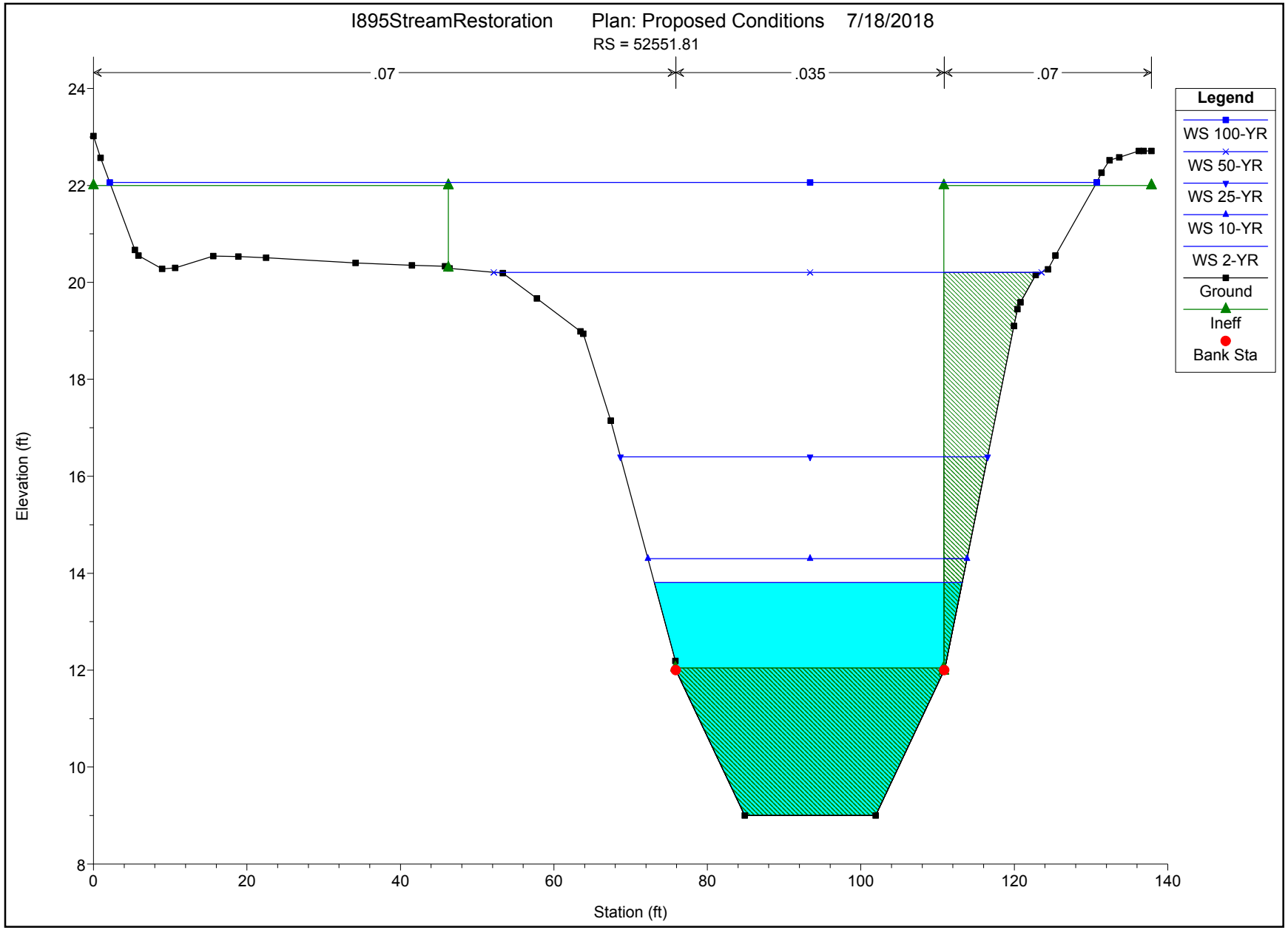

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
99 PRBLHEC
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Elevation (ft)
50
40
30
20
10
0
-10
50000
51000
52000
53000
54000
55000
Main Channel Distance (ft)

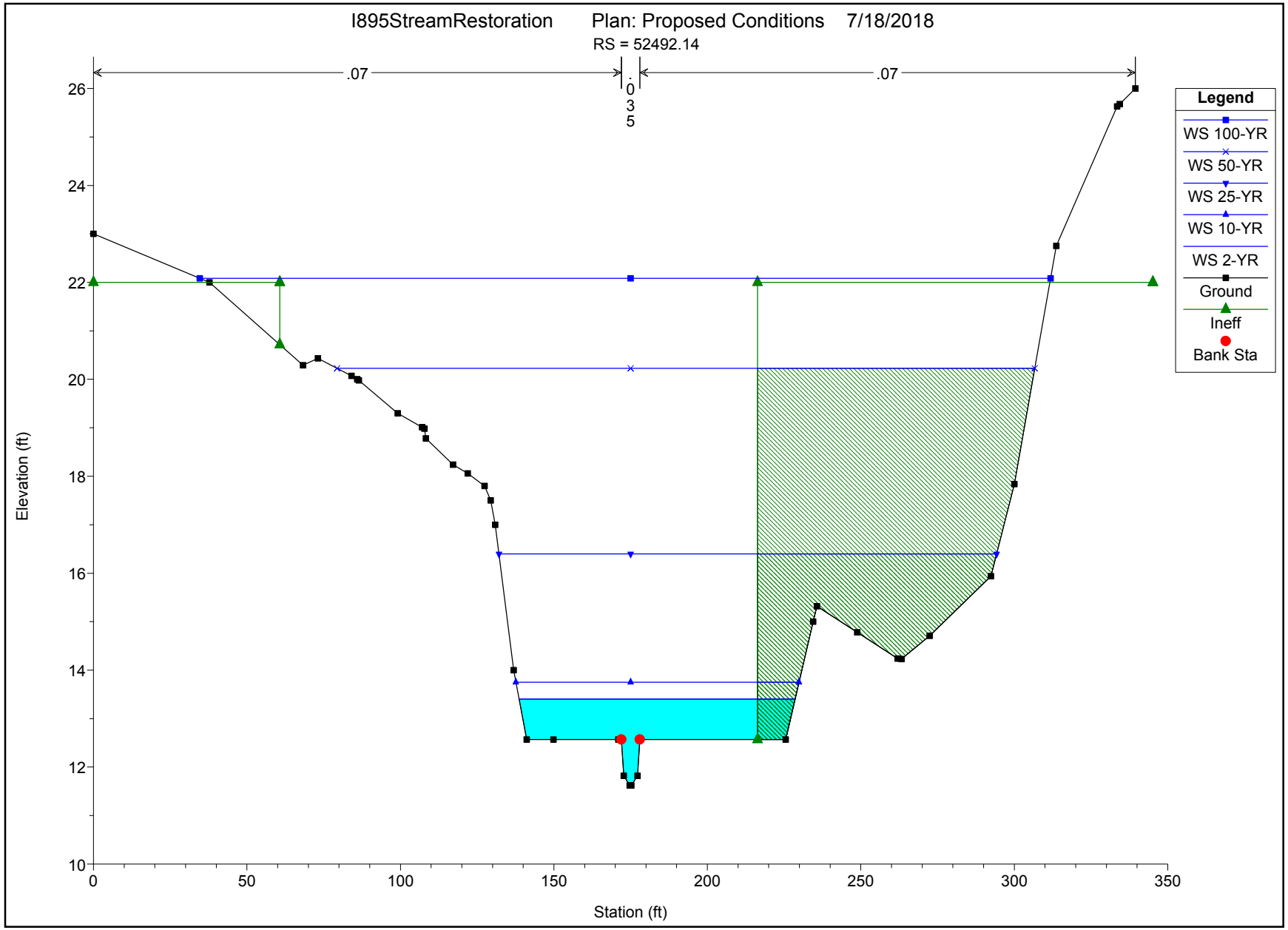

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 53100
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
55
50
45
40
35
0
50
100
150
200
250
Station (ft)

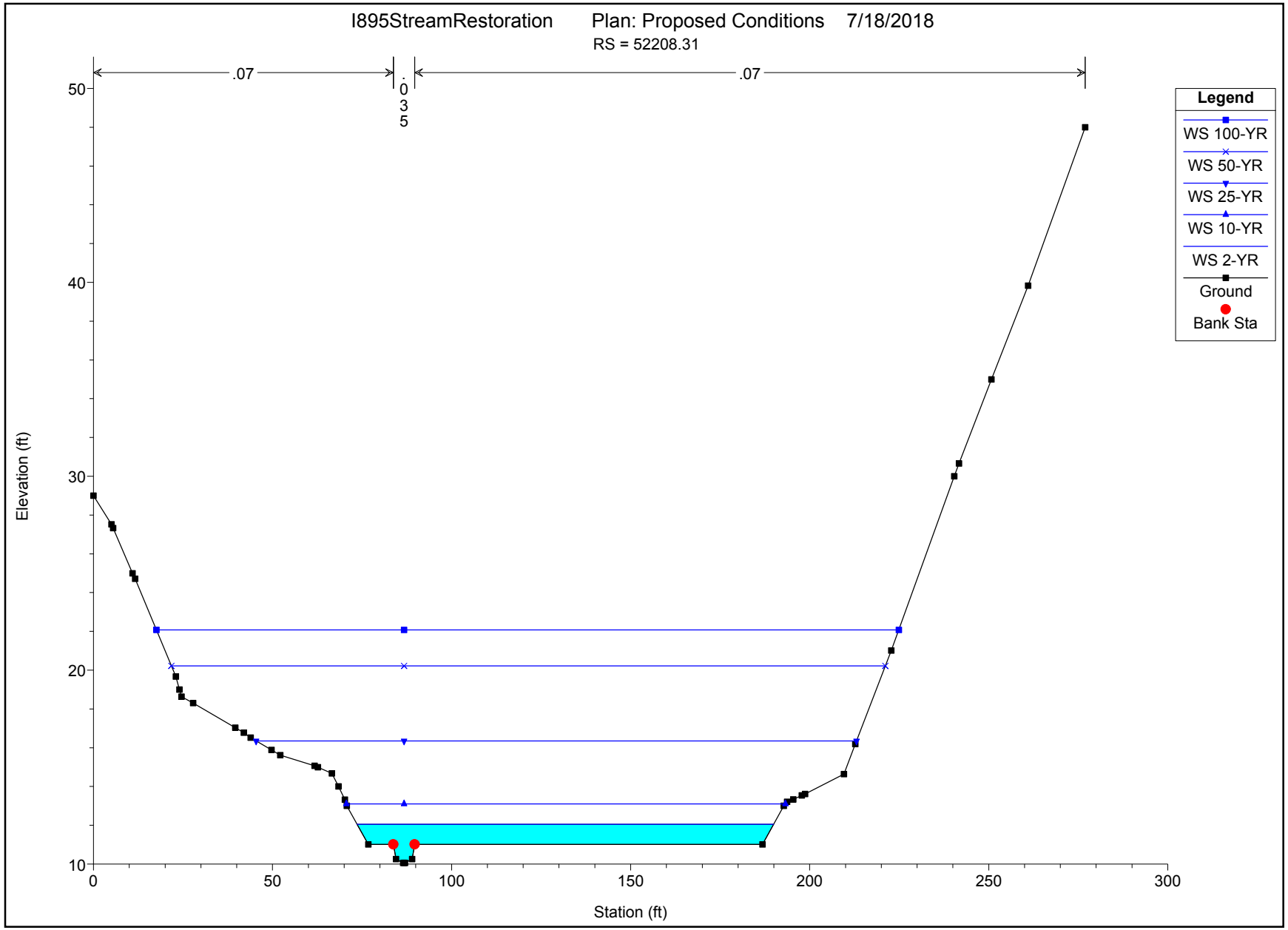

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 53000
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
50
48
46
44
42
40
38
36
0
50
100
150
200
250

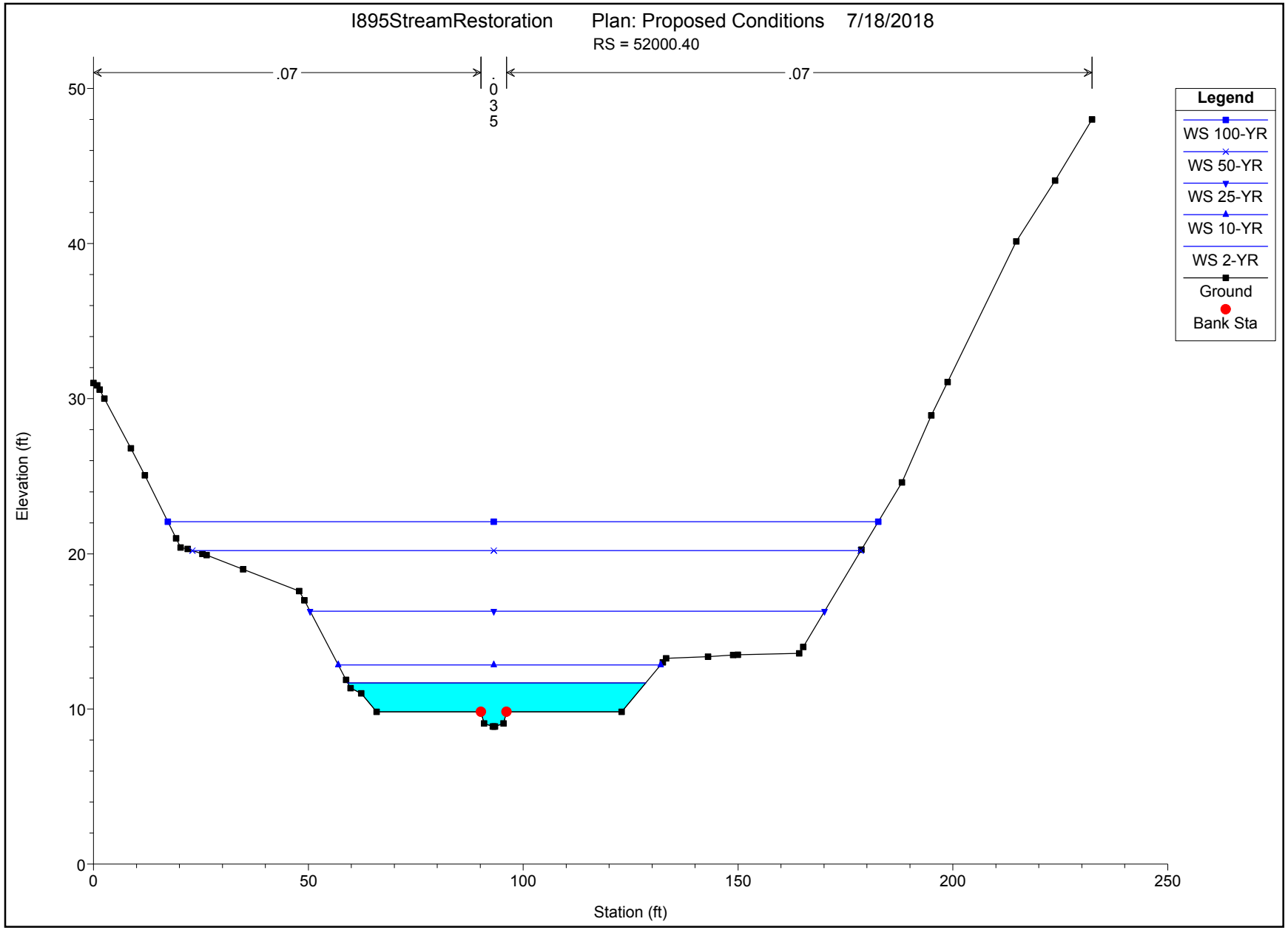

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52900 Culv
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
50
48
46
44
42
40
38
36
0
50
100
150
200
250

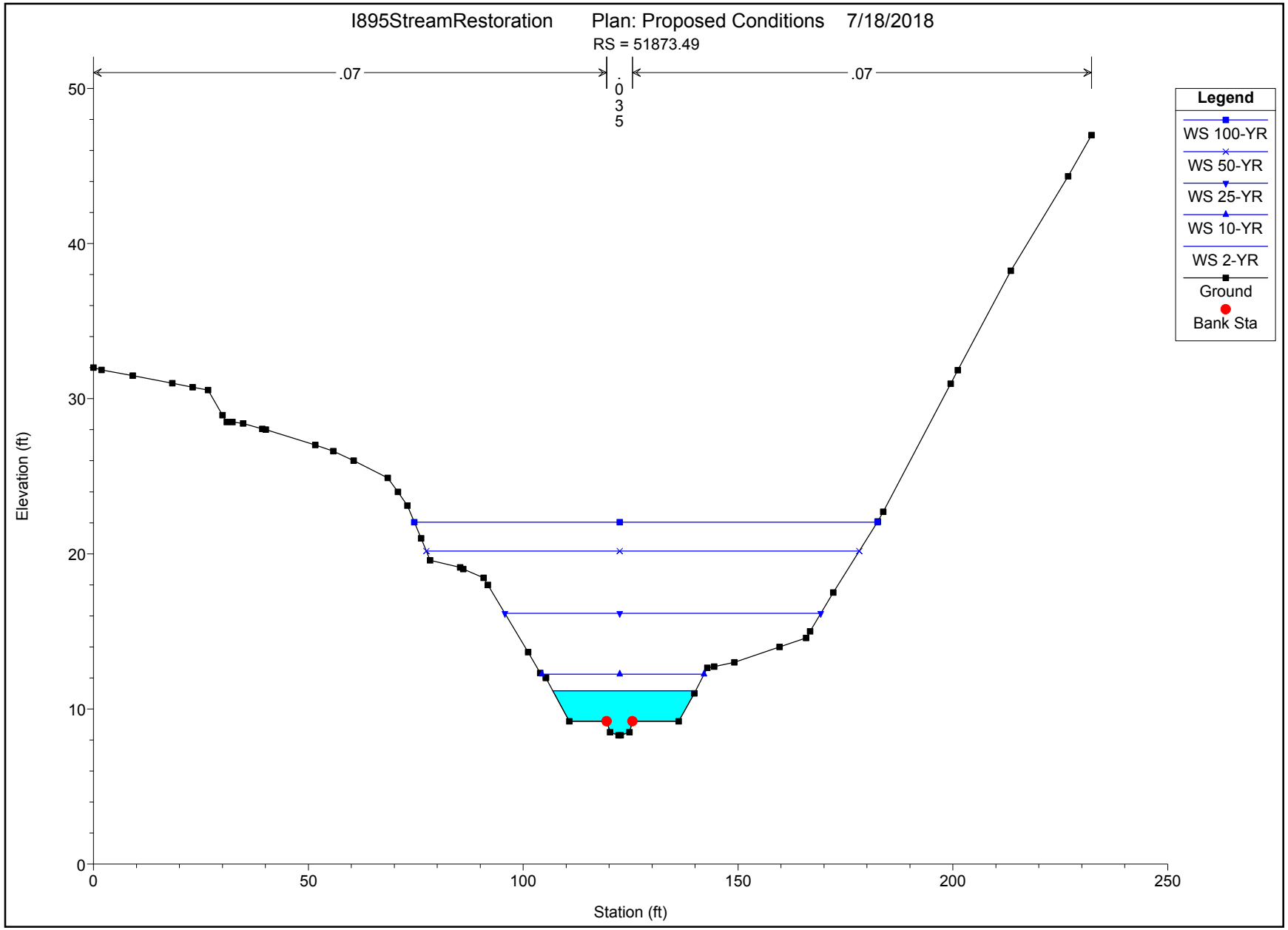

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52900 Culv
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
24
22
20
18
16
14
12
10
8
0
20
40
60
80
100
120
140

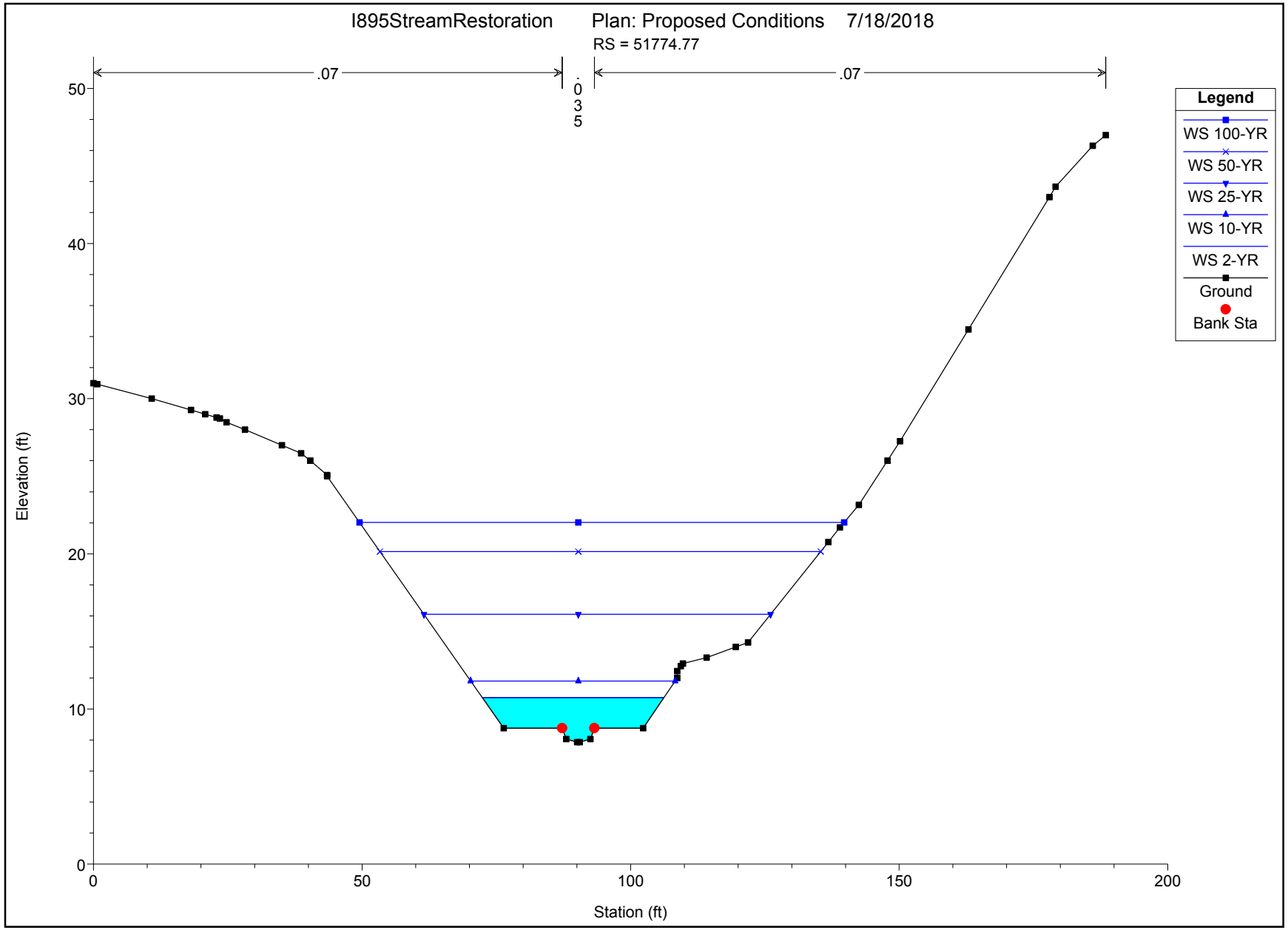

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52551.81
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
24
22
20
18
16
14
12
10
8
0
20
40
60
80
100
120
140

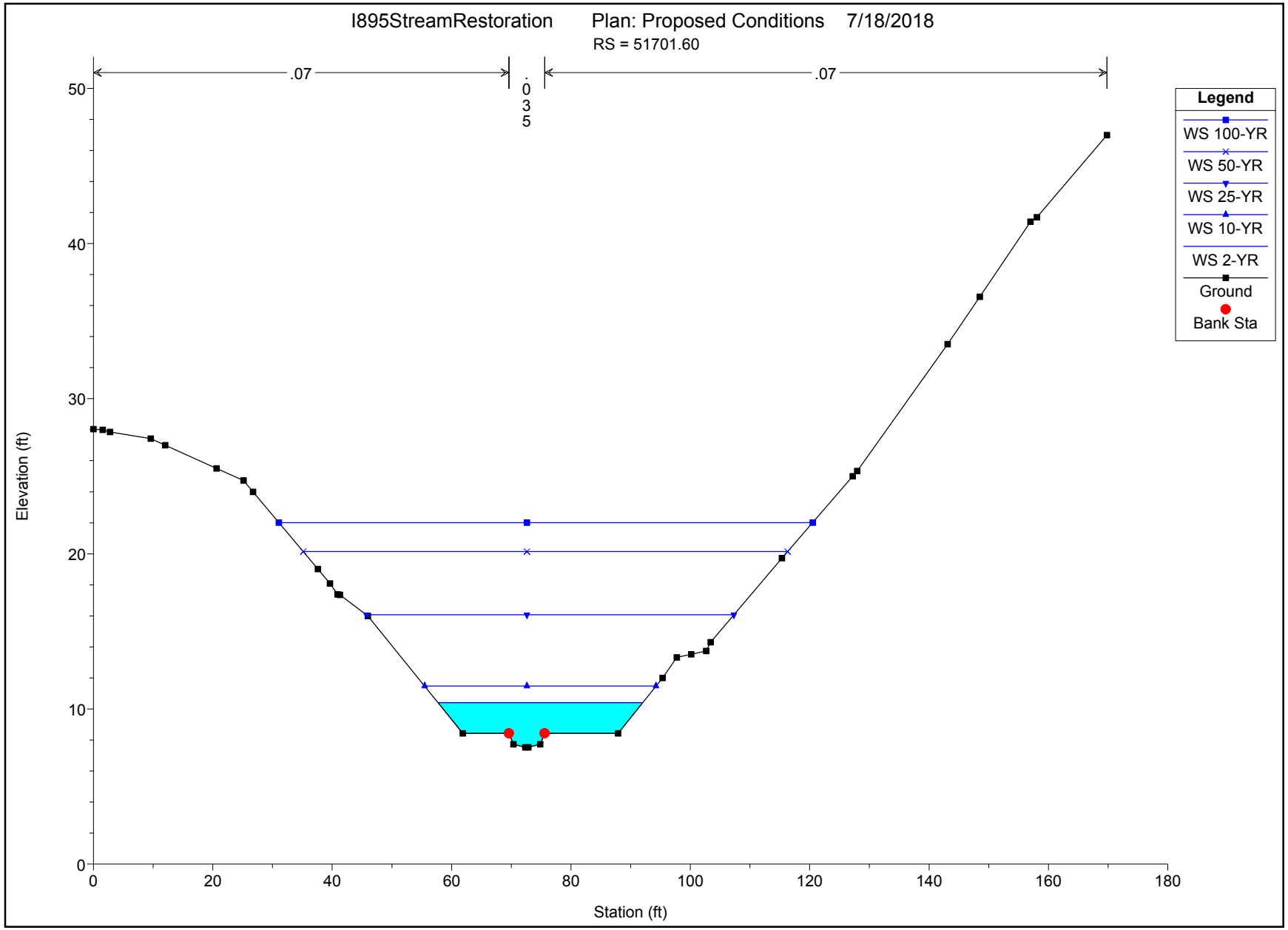

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52492.14
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
10
12
14
16
18
20
22
24
26
0
50
100
150
200
250
300
350

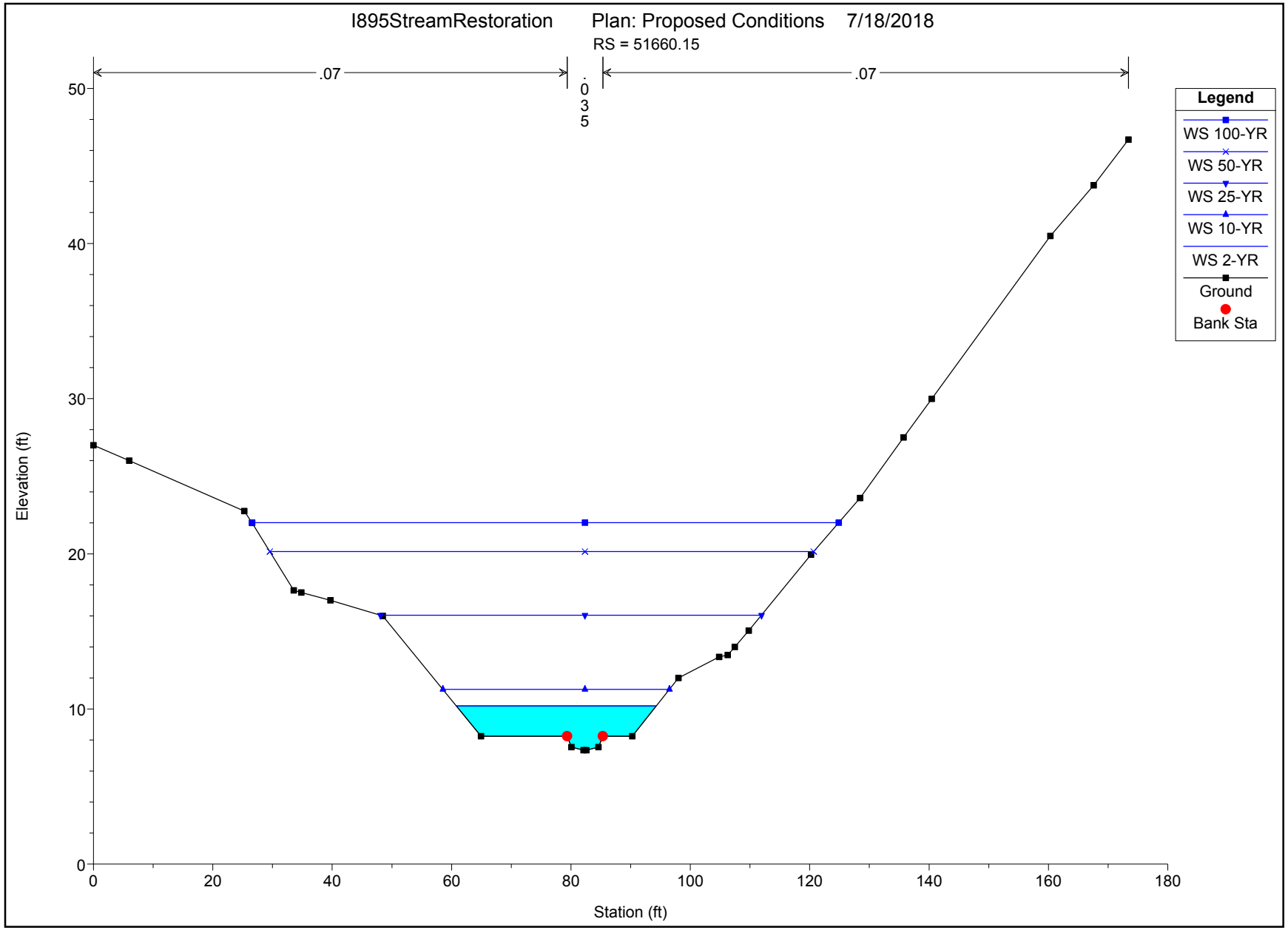

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52208.31
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
10
20
30
40
50
0
50
100
150
200
250
300

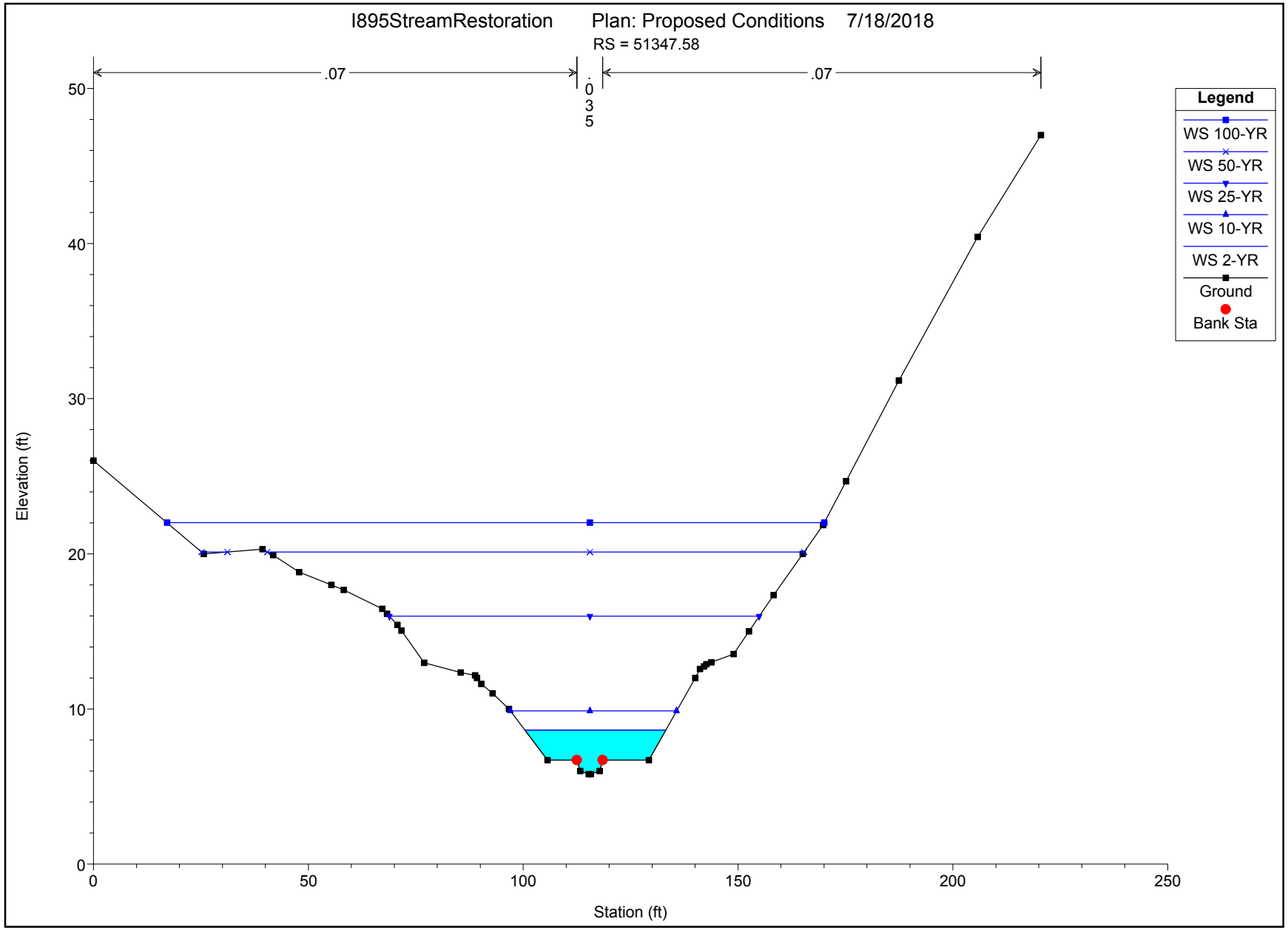

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 52000.40
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200
250

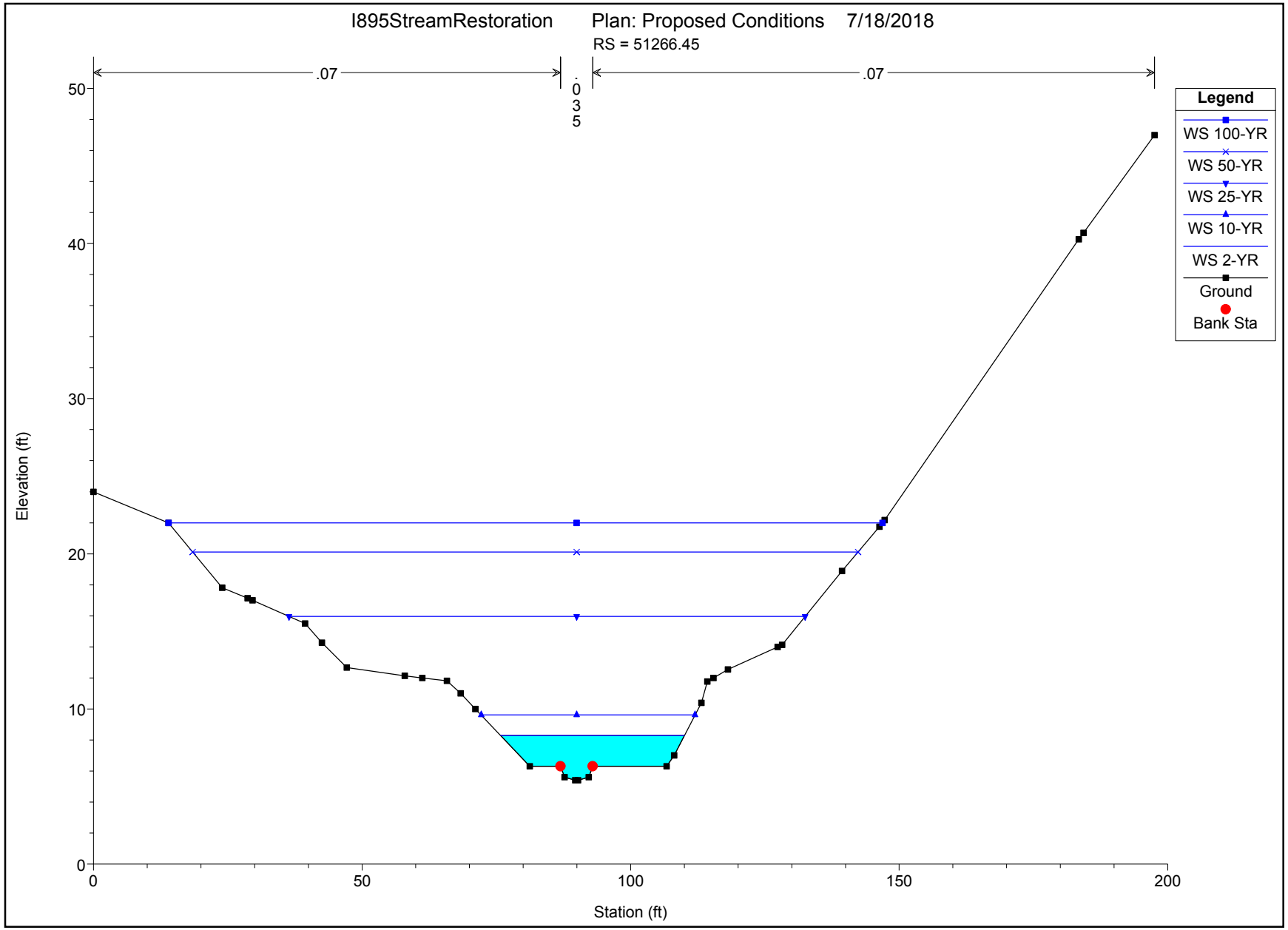

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51873.49
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200
250

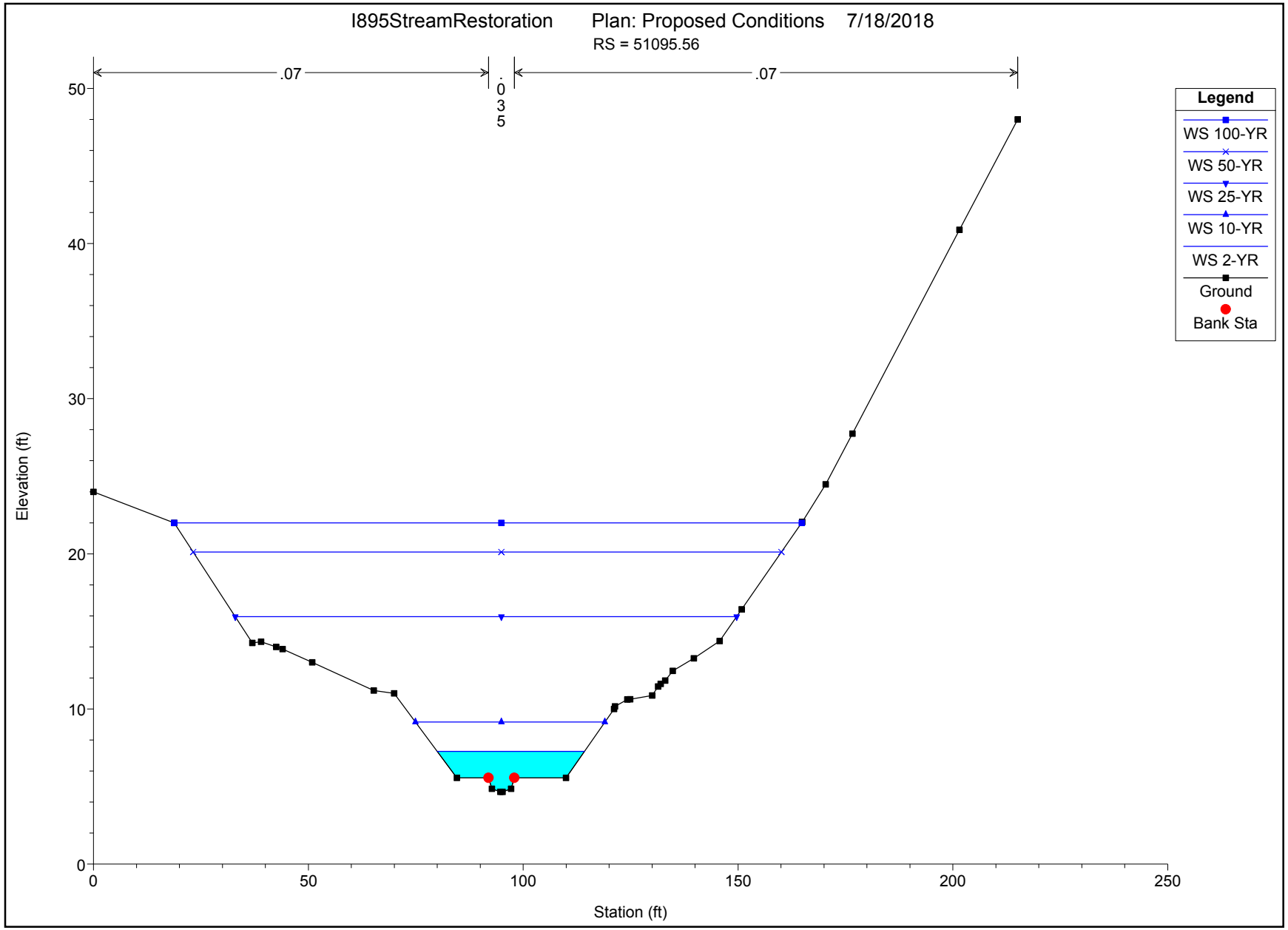

I895StreamRestoration
Plan: Proposed Conditions
7/18/2018
RS = 51774.77
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200

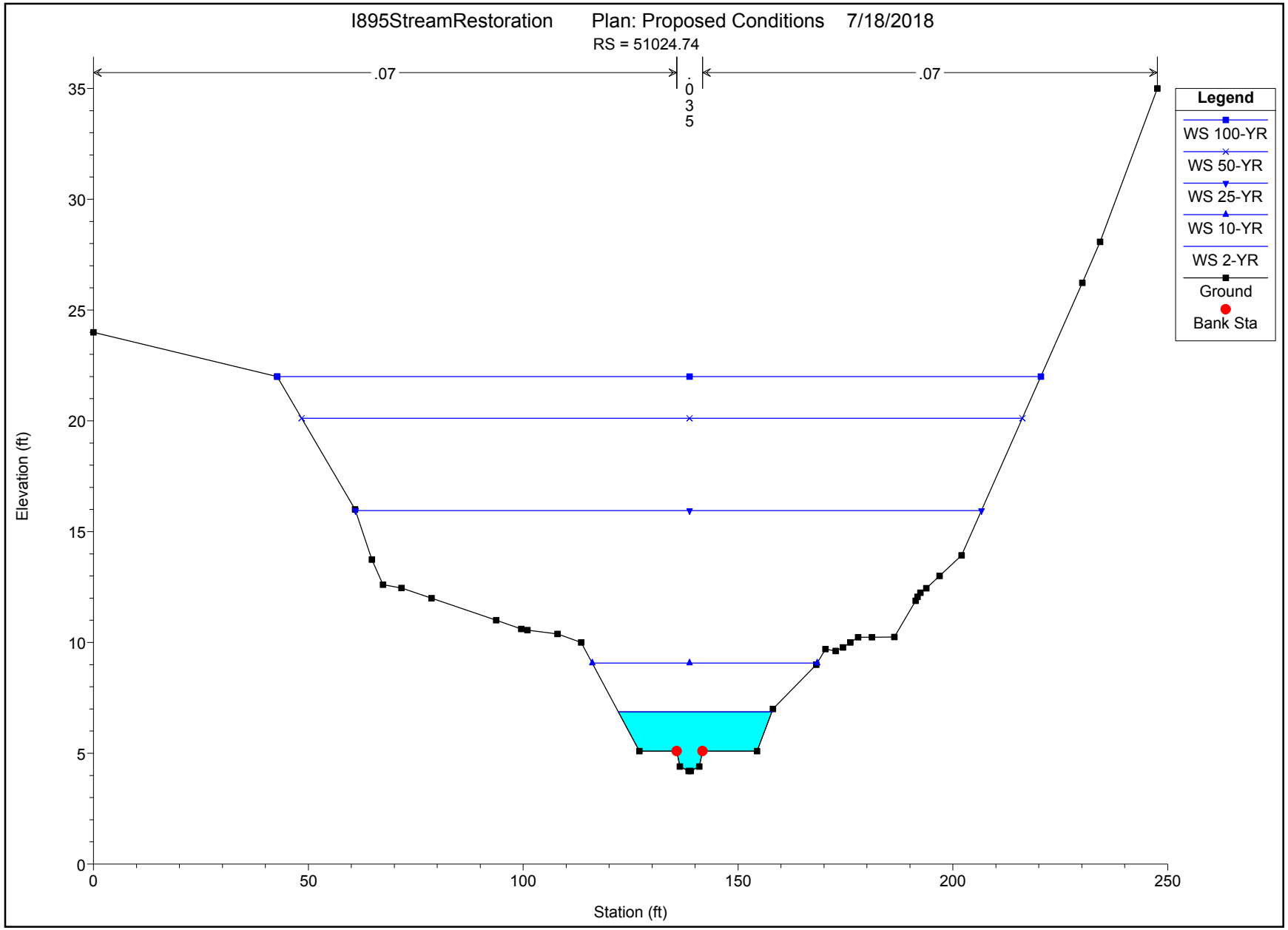

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51701.60
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160
180

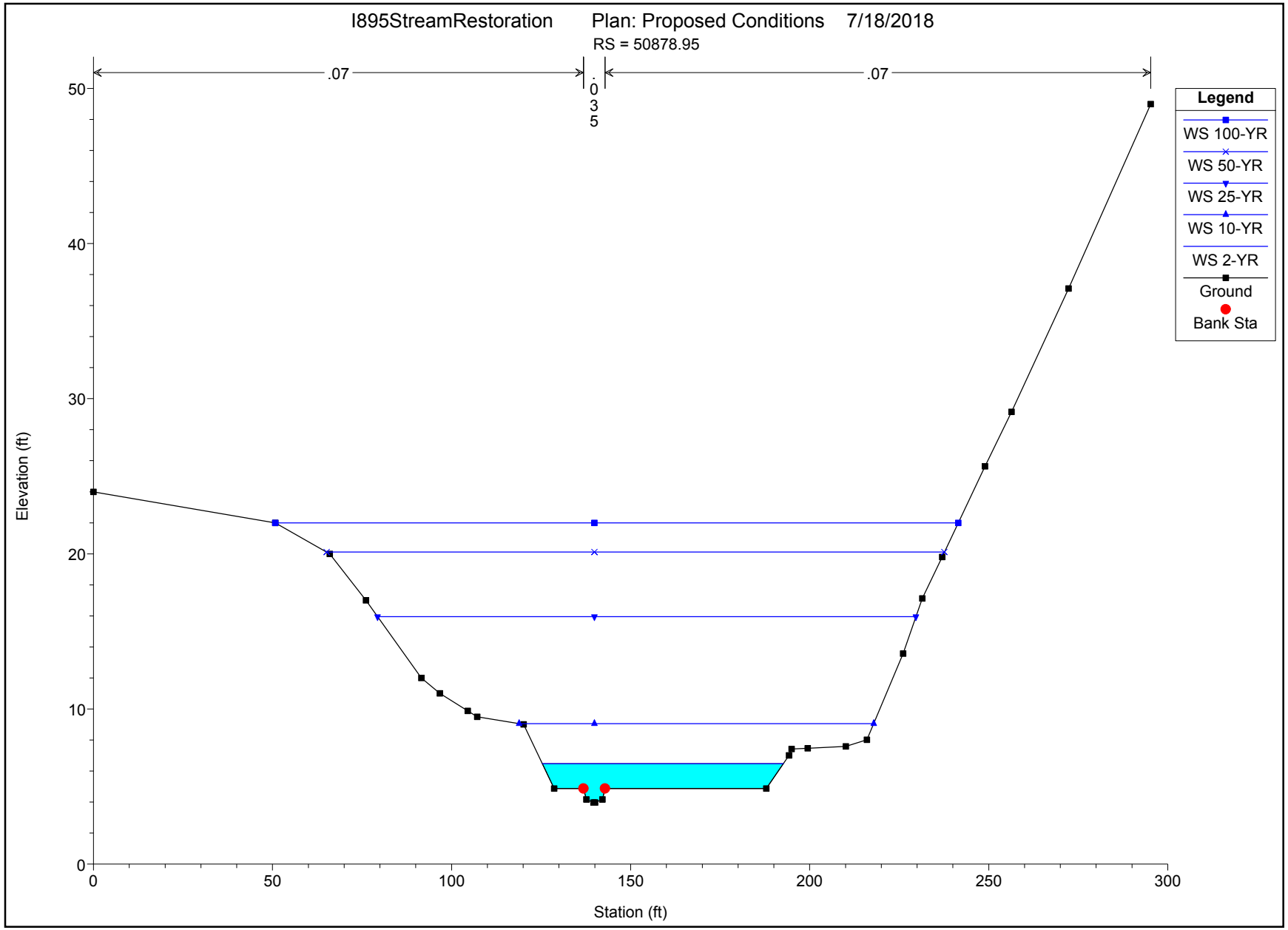

I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51660.15
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160
180


I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51347.58
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200
250


I895StreamRestoration
Plan: Proposed Conditions
7/18/2018
RS = 51266.45
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200


I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51095.56
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
10
20
30
40
50
0
50
100
150
200
250


I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 51024.74
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
5
10
15
20
25
30
35
0
50
100
150
200
250


I895StreamRestoration Plan: Proposed Conditions 7/18/2018
RS = 50878.95
.07
.035
.07
Legend
WS 100-YR
WS 50-YR
WS 25-YR
WS 10-YR
WS 2-YR
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Station (ft)
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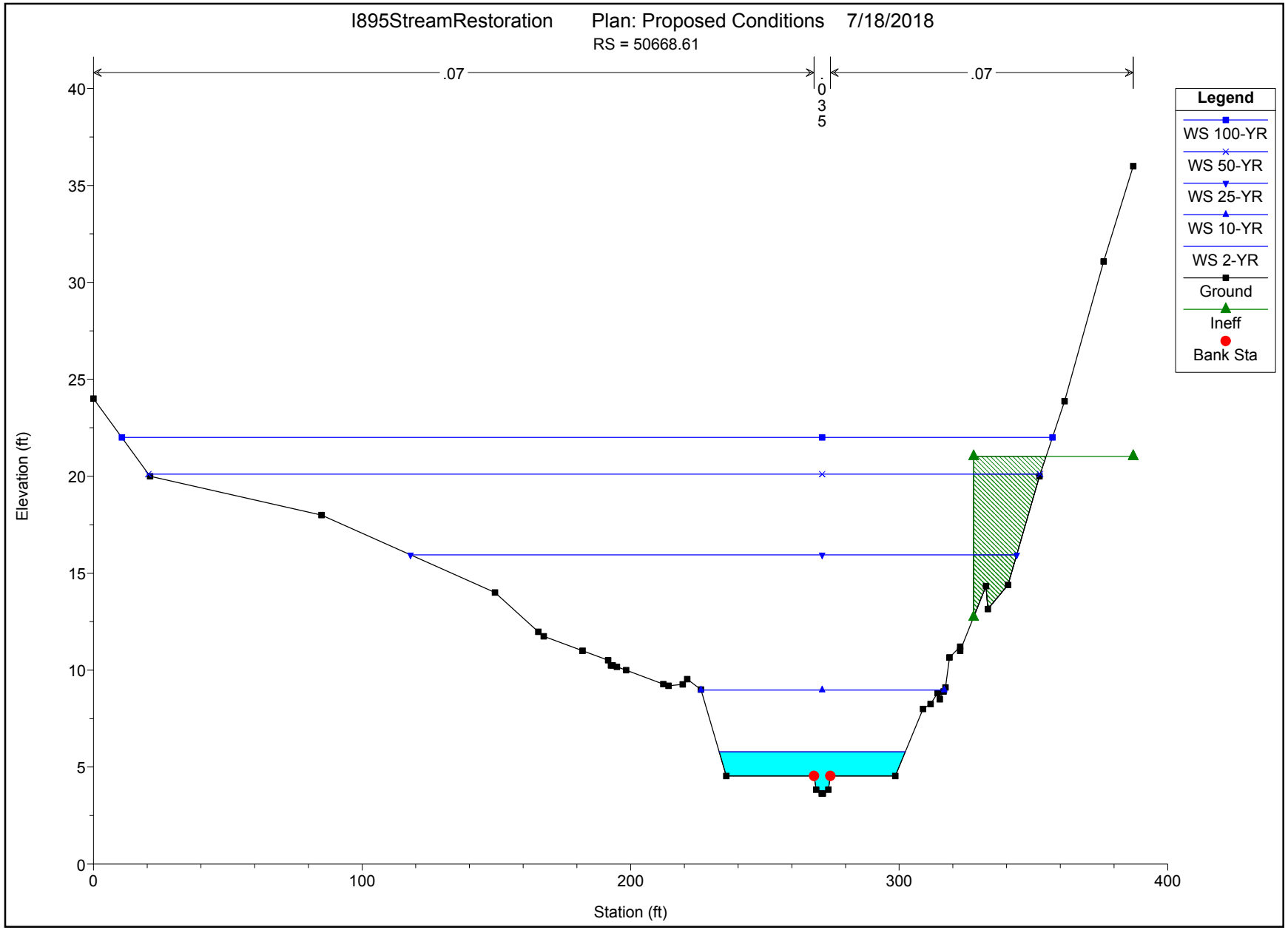
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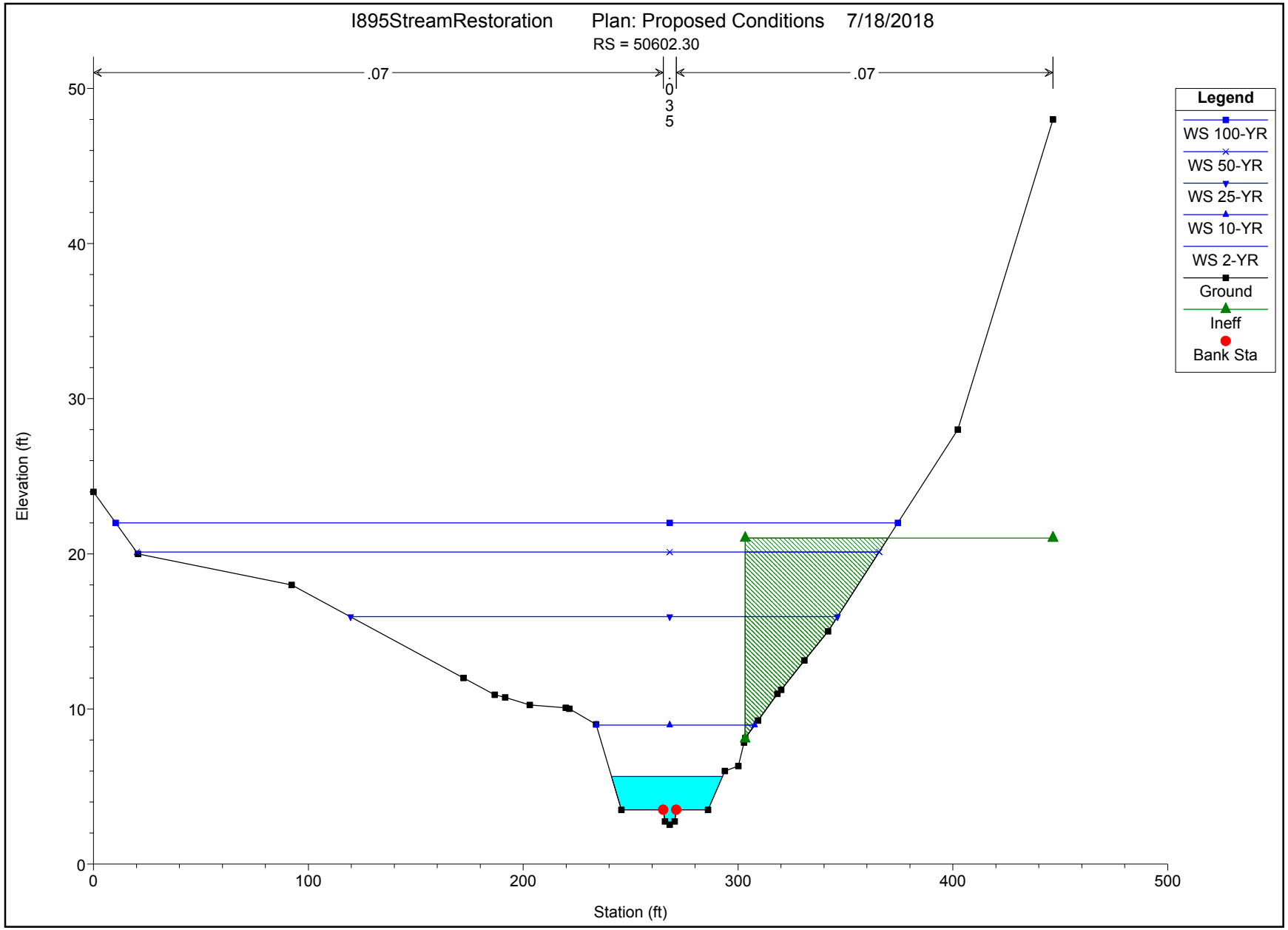
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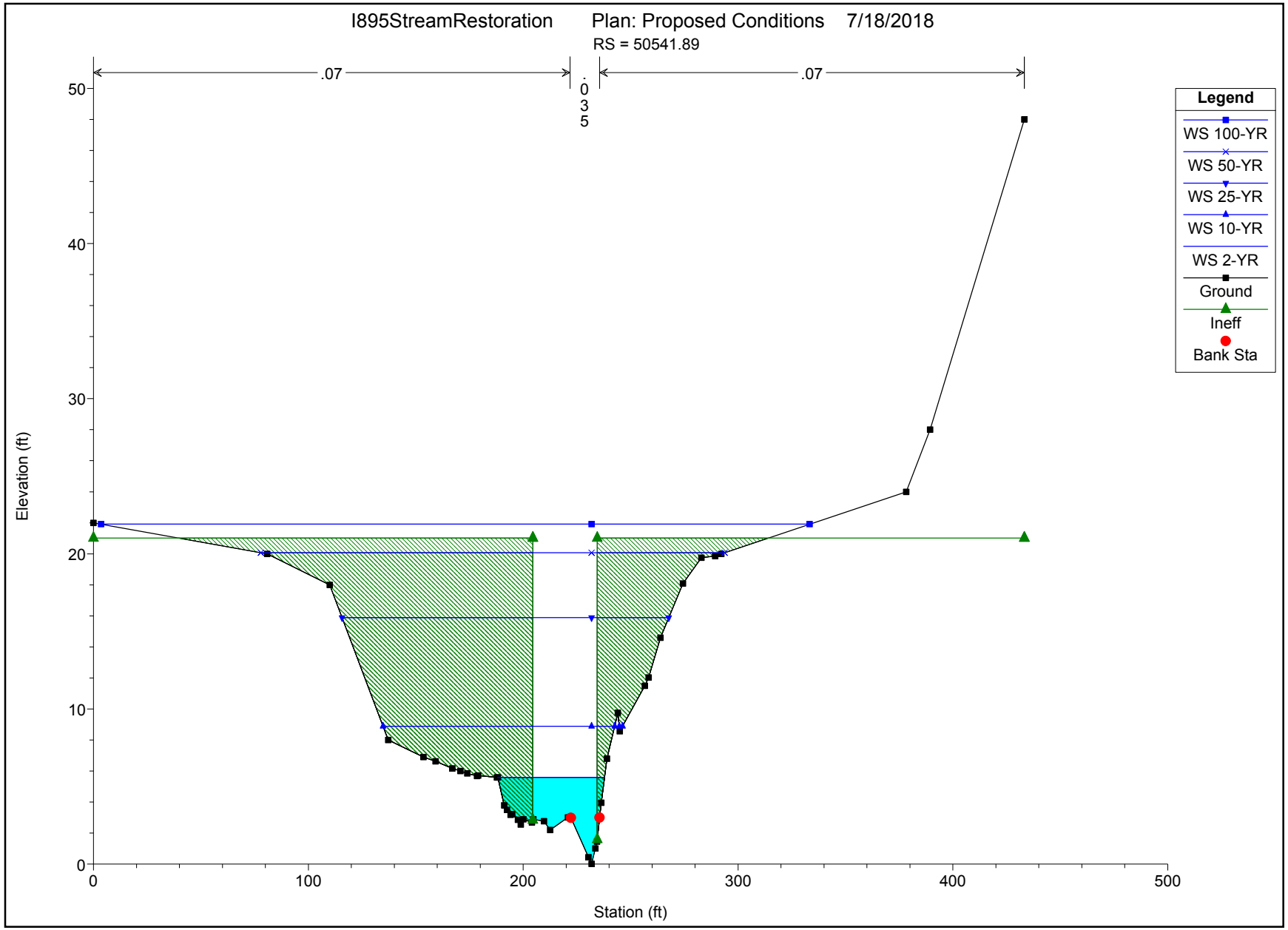
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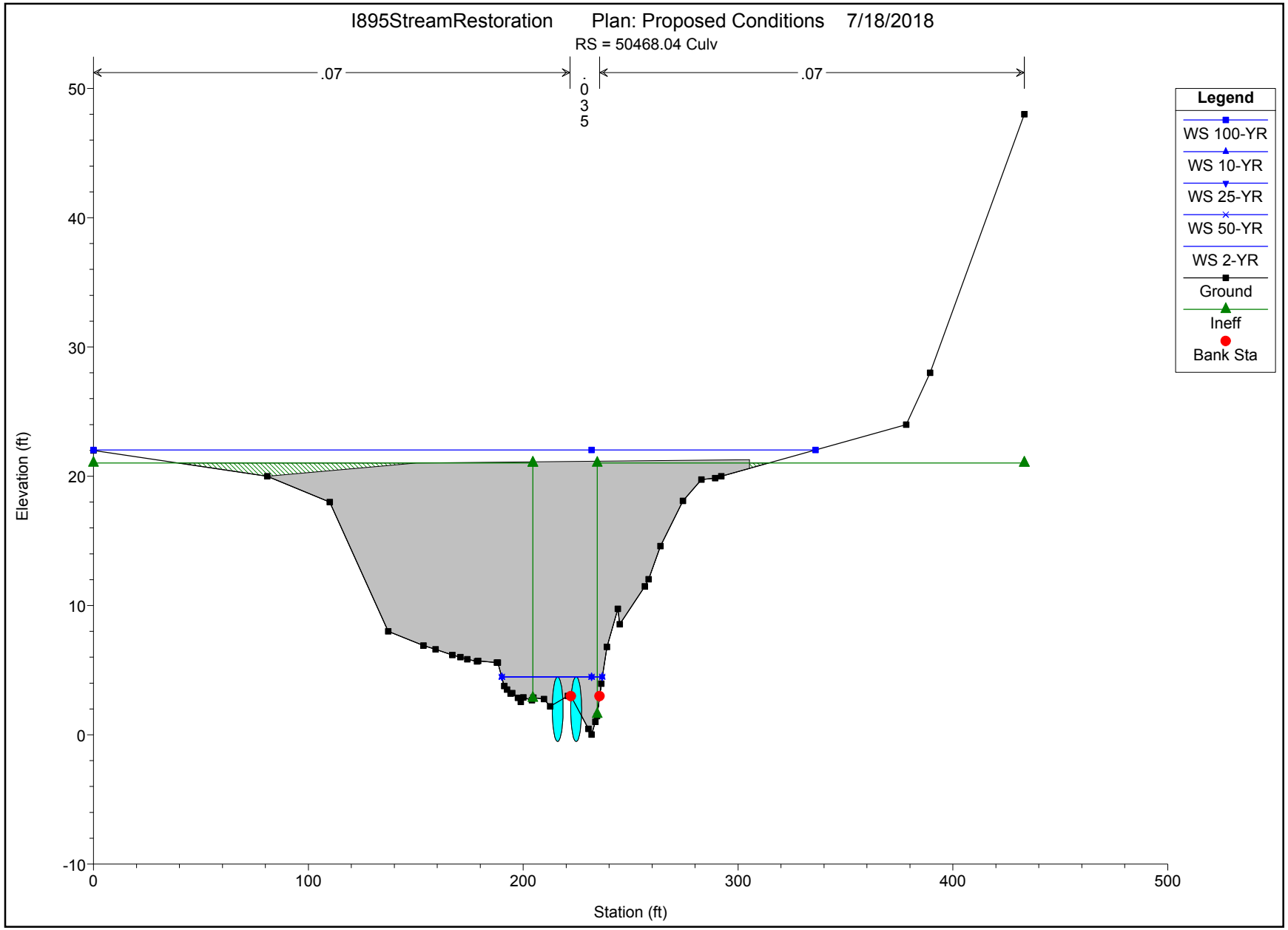
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WS 50-YR
WS 2-YR
Ground
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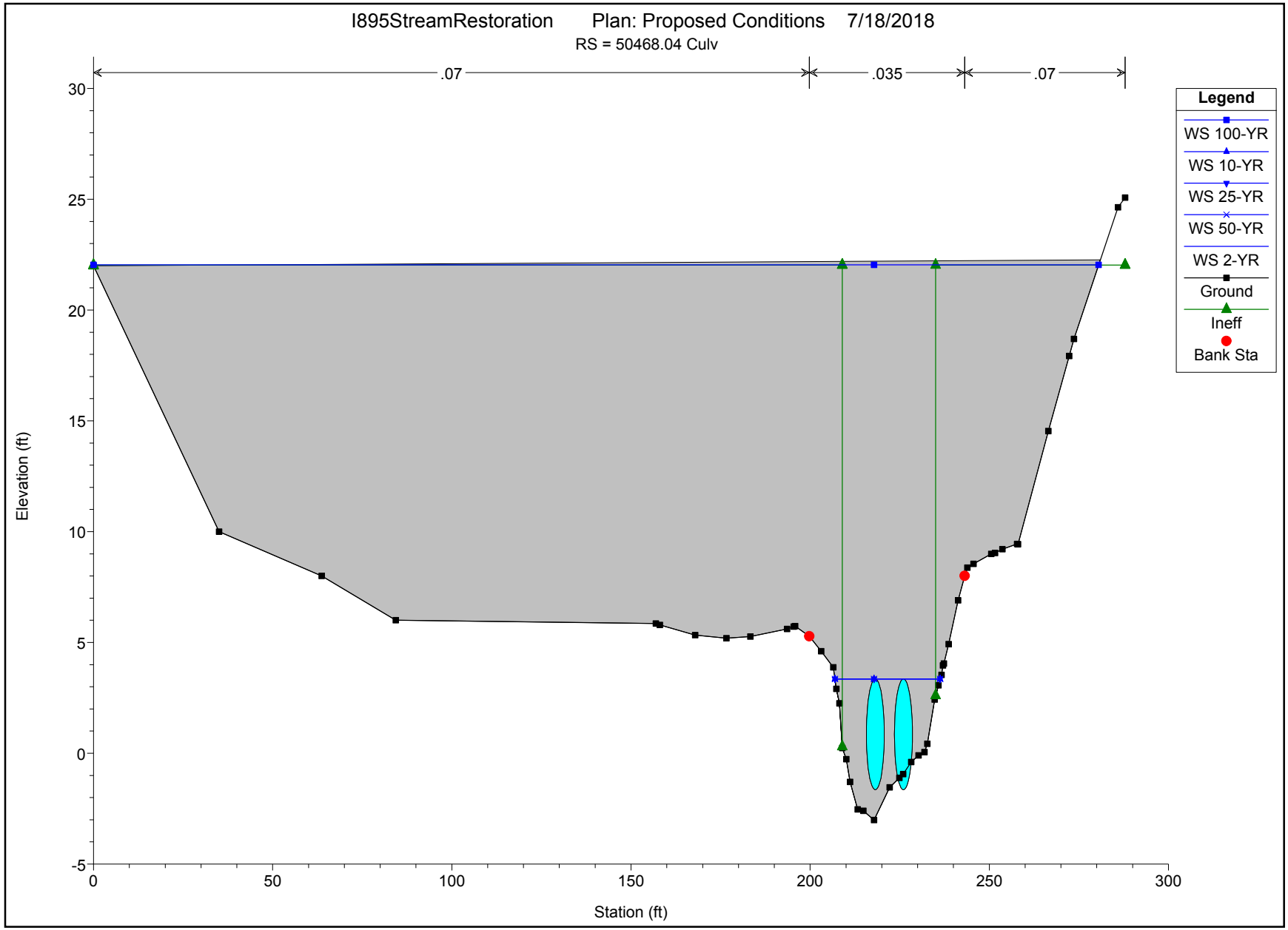
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Ineff
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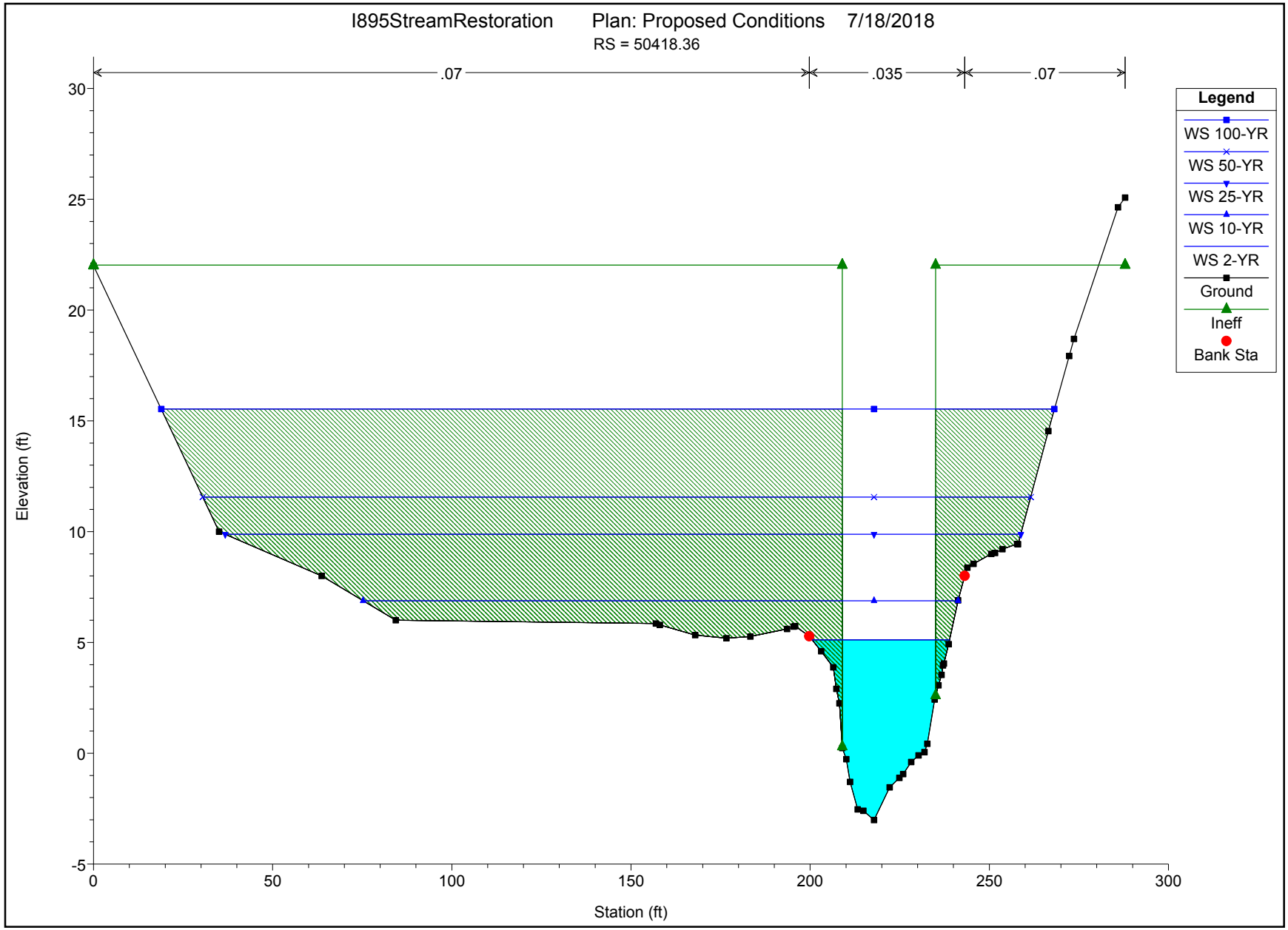
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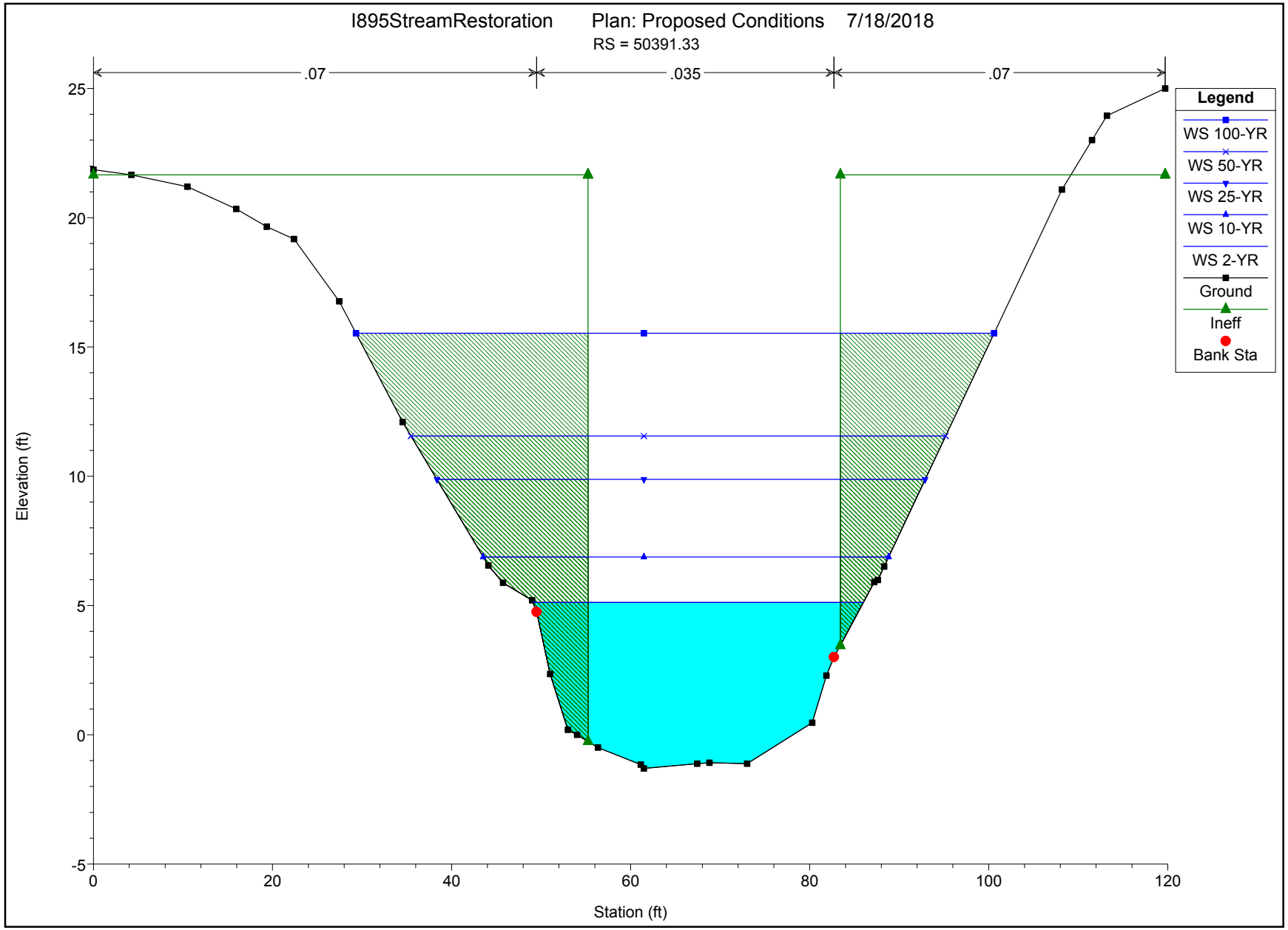
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WS 10-YR
WS 2-YR
Ground
Ineff
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Station (ft)
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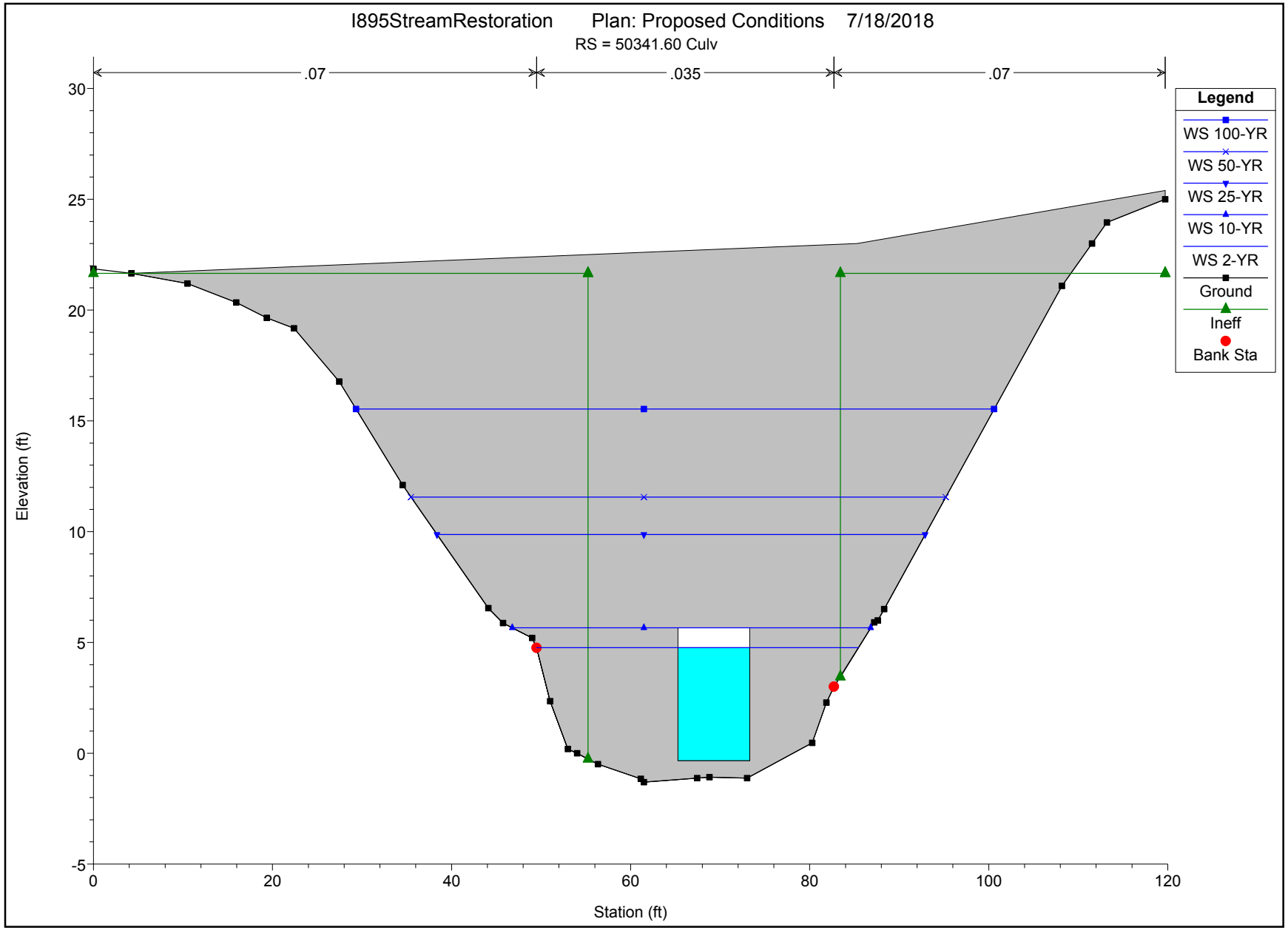
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WS 2-YR
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Ineff
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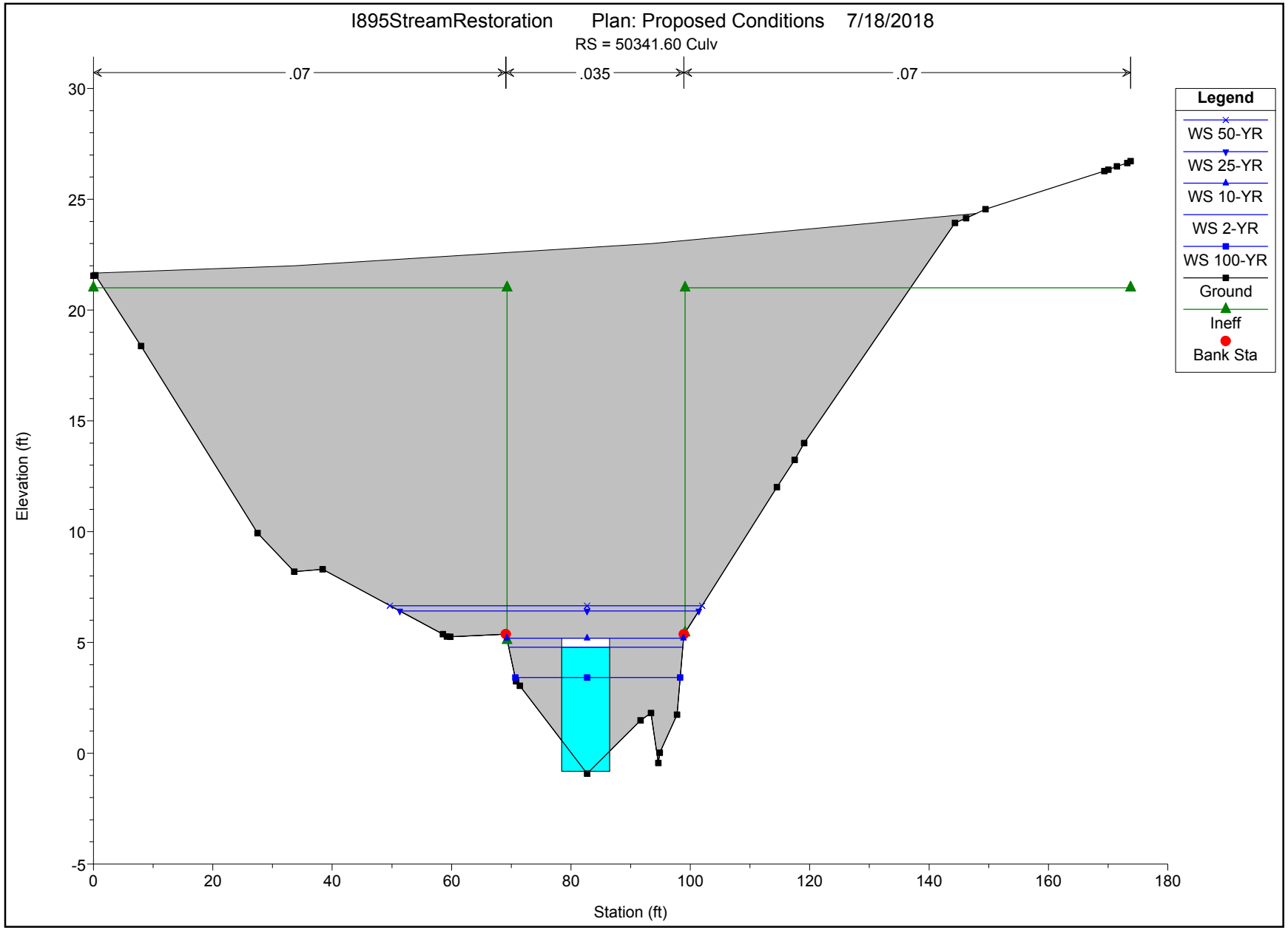
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Legend
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WS 2-YR
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Ground
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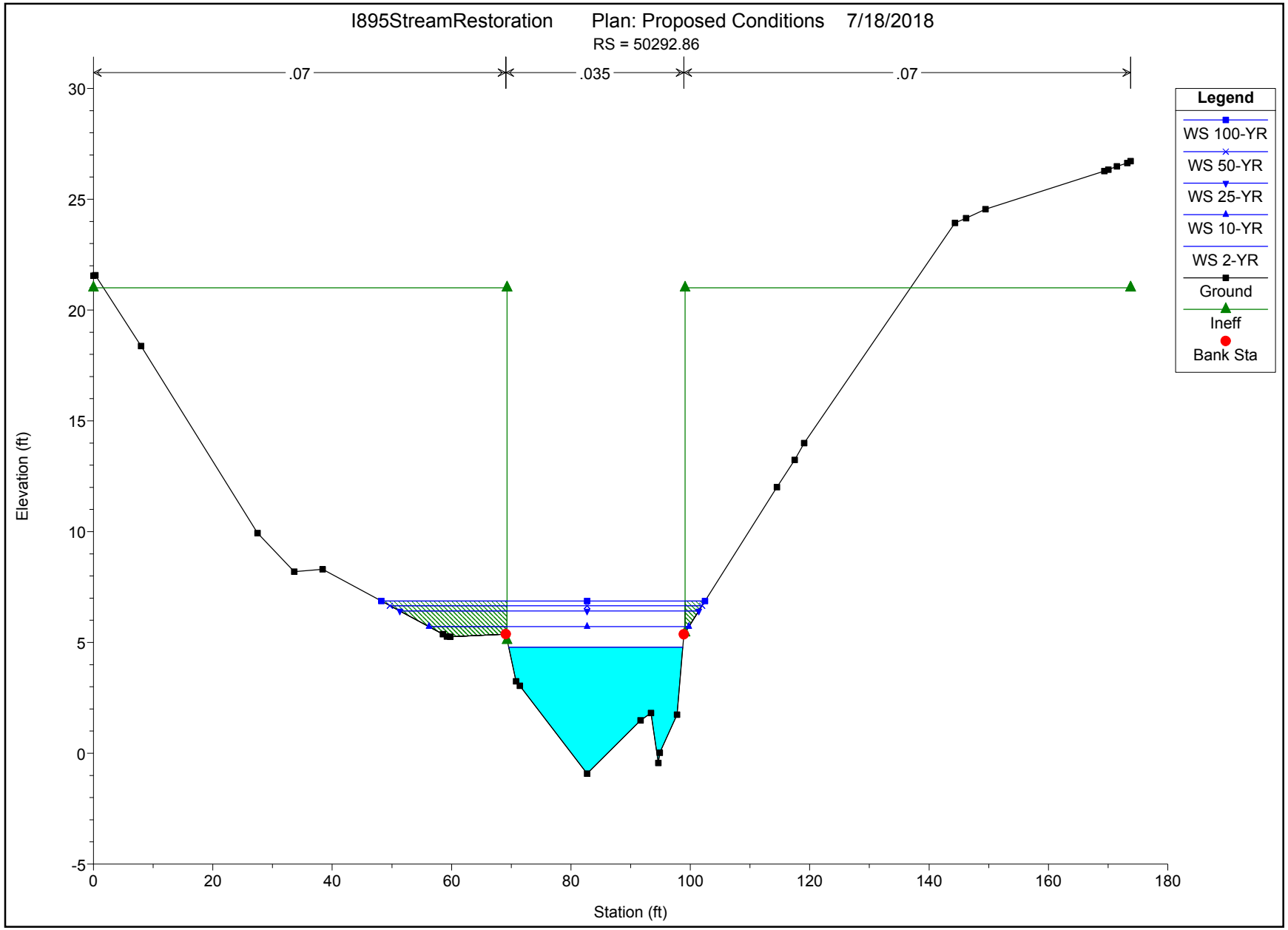
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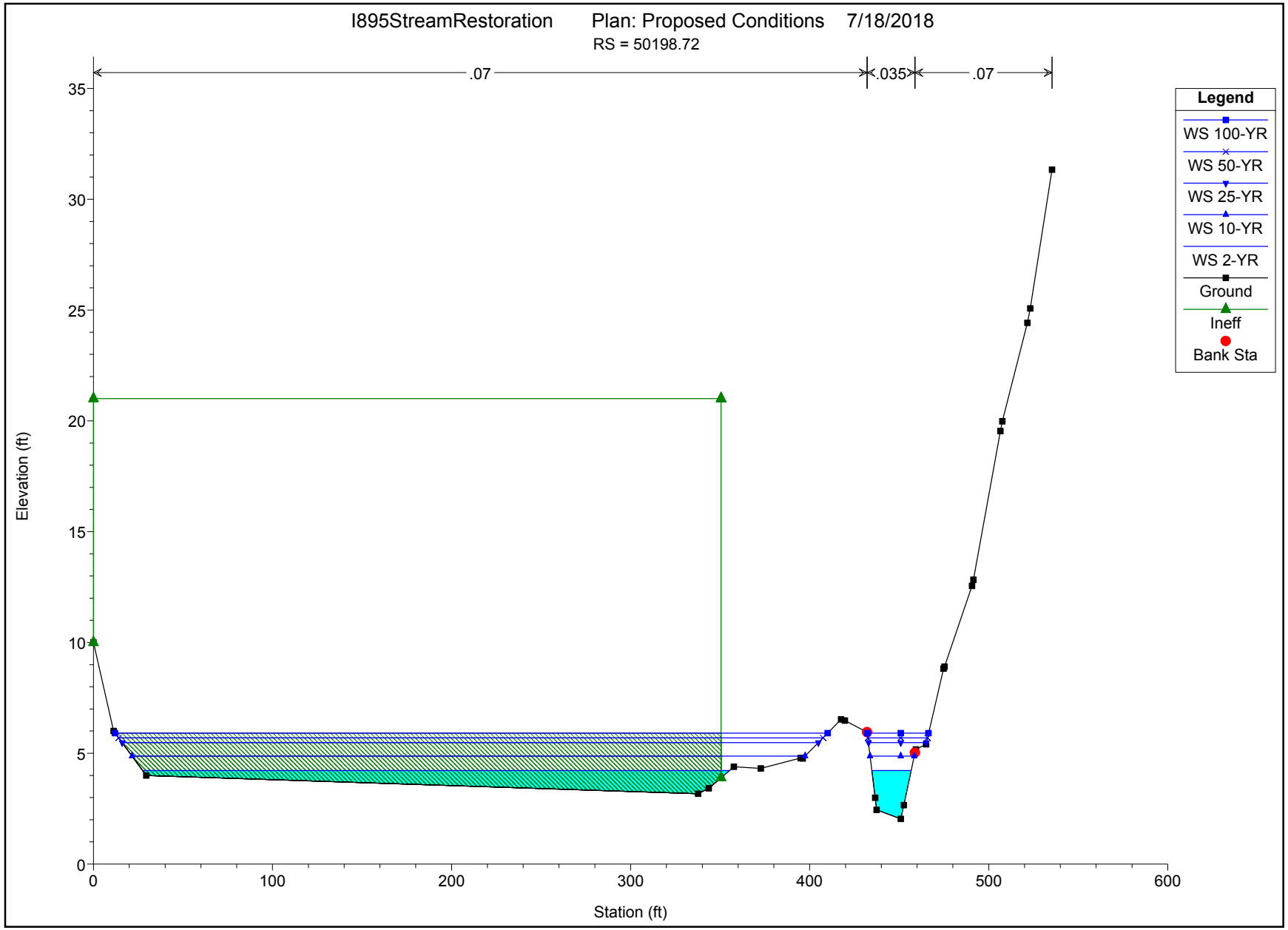
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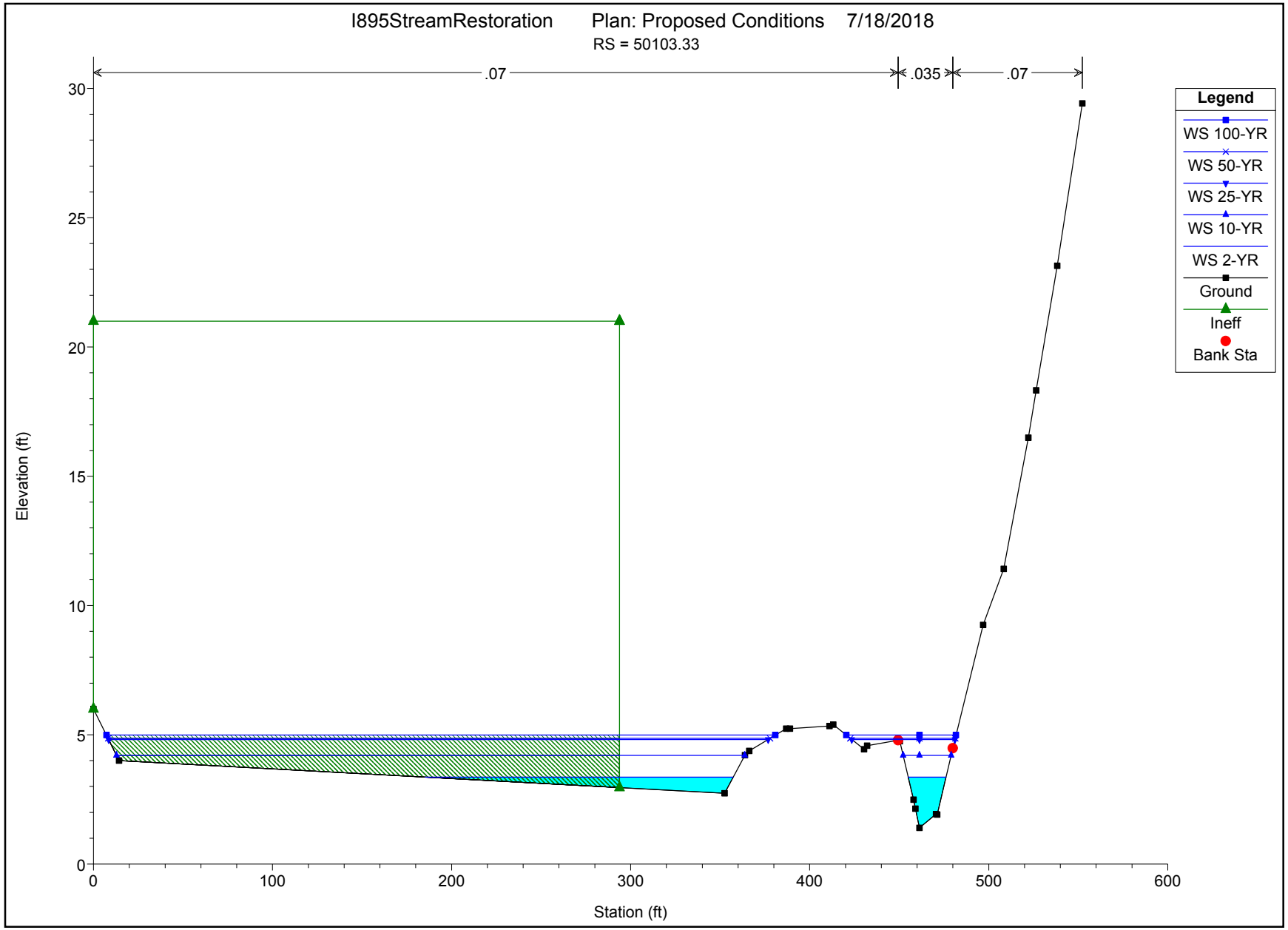
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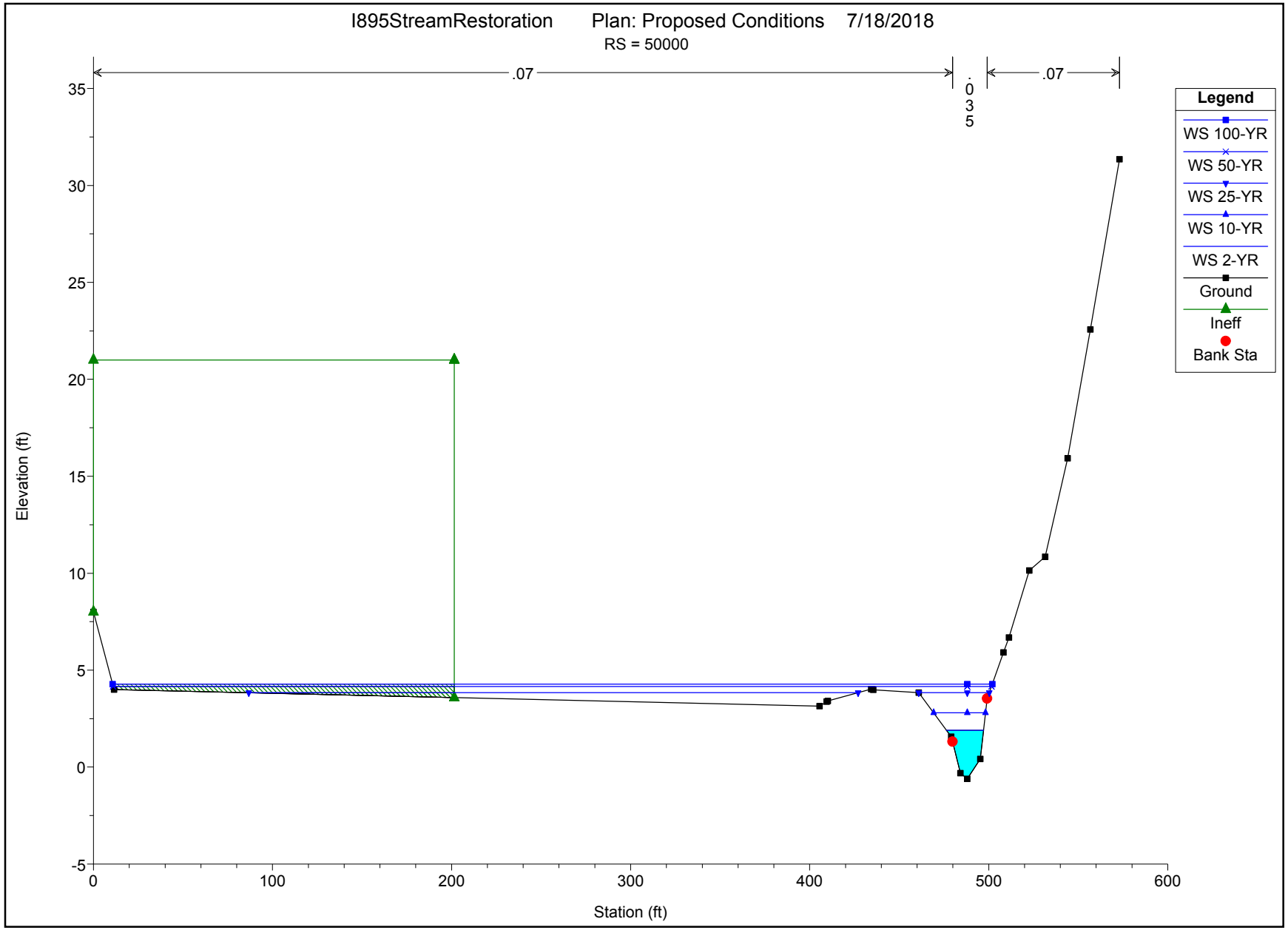
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WS 10-YR
WS 2-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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I895StreamRestorati.rep

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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PROJECT DATA
Project Title: I895StreamRestoration
Project File : I895StreamRestorati.prj
Run Date and Time: 7/18/2018 2:46:17 PM

Project in English units

PLAN DATA

Plan Title: Proposed Conditions
Plan File : q:\2015\151777_003_I-895_TMDL_Stream_Re\Working Data\Design Computations\H&H\I895StreamRestorati.p04

Geometry Title: ProposedConditionsGeo
Geometry File : q:\2015\151777_003_I-895_TMDL_Stream_Re\Working Data\Design Computations\H&H\I895StreamRestorati.g06

Flow Title : ProposedFlowData
Flow File : q:\2015\151777_003_I-895_TMDL_Stream_Re\Working Data\Design Computations\H&H\I895StreamRestorati.f03

Plan Summary Information:

Number of:	Cross Sections	= 24	Multiple Openings	=	0
	Culverts	= 3	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: ProposedFlowData
Flow File : q:\2015\151777_003_I-895_TMDL_Stream_Re\Working Data\Design Computations\H&H\I895StreamRestorati.f03

Flow Data (cfs)

River	Reach	RS	2-YR	10-YR	25-YR	50-YR	100-YR
99	PRBLHEC	53100	182	359	613	728	846

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
99	PRBLHEC	2-YR		Normal S = 0.0094
99	PRBLHEC	10-YR		Normal S = 0.0094
99	PRBLHEC	25-YR		Normal S = 0.0094
99	PRBLHEC	50-YR		Normal S = 0.0094
99	PRBLHEC	100-YR		Normal S = 0.0094

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 53100

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	39.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	38.94	Reach Len. (ft)	77.24	70.30	64.94
Crit W.S. (ft)		Flow Area (sq ft)		51.54	4.14
E.G. Slope (ft/ft)	0.002172	Area (sq ft)		51.54	4.14
Q Total (cfs)	182.00	Flow (cfs)		179.53	2.47
Top Width (ft)	29.25	Top Width (ft)		20.46	8.79
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)		3.48	0.60
Max Chl Dpth (ft)	2.94	Hydr. Depth (ft)		2.52	

0.47				
Conv. Total (cfs)	3904.9	Conv. (cfs)		3851.9
53.0				
Length Wtd. (ft)	70.25	Wetted Per. (ft)		22.07
8.84				
Min Ch El (ft)	36.00	Shear (lb/sq ft)		0.32
0.06				
Alpha	1.12	Stream Power (lb/ft s)	223.70	0.00
0.00				
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	1.65	1.99
1.70				
C & E Loss (ft)	0.01	Cum SA (acres)	1.99	1.68
1.52				

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	40.72	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.21	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	40.51	Reach Len. (ft)	77.24	70.30
64.94				
Crit W.S. (ft)		Flow Area (sq ft)		85.23
28.72				
E.G. Slope (ft/ft)	0.001584	Area (sq ft)		85.23
28.72				
Q Total (cfs)	359.00	Flow (cfs)		329.18
29.82				
Top Width (ft)	43.46	Top Width (ft)		22.54
20.92				
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)		3.86
1.04				
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		3.78
1.37				
Conv. Total (cfs)	9019.3	Conv. (cfs)		8270.0
749.3				
Length Wtd. (ft)	69.91	Wetted Per. (ft)		24.66
21.08				
Min Ch El (ft)	36.00	Shear (lb/sq ft)		0.34
0.13				
Alpha	1.39	Stream Power (lb/ft s)	223.70	0.00
0.00				
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	4.26	3.08
3.92				
C & E Loss (ft)	0.01	Cum SA (acres)	3.15	1.70
2.15				

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	42.69	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.20	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	42.49	Reach Len. (ft)	77.24	70.30
64.94				
Crit W.S. (ft)		Flow Area (sq ft)		132.46
78.92				

E.G. Slope (ft/ft)	0.001035	Area (sq ft)			132.46
78.92					
Q Total (cfs)	613.00	Flow (cfs)			510.59
102.41					
Top Width (ft)	54.91	Top Width (ft)			25.16
29.76					
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)			3.85
1.30					
Max Chl Dpth (ft)	6.49	Hydr. Depth (ft)			5.27
2.65					
Conv. Total (cfs)	19049.7	Conv. (cfs)			15867.3
3182.4					
Length Wtd. (ft)	69.52	Wetted Per. (ft)			27.95
30.14					
Min Ch El (ft)	36.00	Shear (lb/sq ft)			0.31
0.17					
Alpha	1.51	Stream Power (lb/ft s)	223.70		0.00
0.00					
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	15.20		5.40
14.52					
C & E Loss (ft)	0.00	Cum SA (acres)	5.33		1.72
3.49					

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	43.92	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.15	Wt. n-Val.			0.035
0.070					
W.S. Elev (ft)	43.77	Reach Len. (ft)	77.24		70.30
64.94					
Crit W.S. (ft)		Flow Area (sq ft)			165.75
120.66					
E.G. Slope (ft/ft)	0.000691	Area (sq ft)			165.75
120.66					
Q Total (cfs)	728.00	Flow (cfs)			577.18
150.82					
Top Width (ft)	62.31	Top Width (ft)			26.85
35.46					
Vel Total (ft/s)	2.54	Avg. Vel. (ft/s)			3.48
1.25					
Max Chl Dpth (ft)	7.77	Hydr. Depth (ft)			6.17
3.40					
Conv. Total (cfs)	27693.8	Conv. (cfs)			21956.5
5737.3					
Length Wtd. (ft)	69.39	Wetted Per. (ft)			30.07
35.99					
Min Ch El (ft)	36.00	Shear (lb/sq ft)			0.24
0.14					
Alpha	1.54	Stream Power (lb/ft s)	223.70		0.00
0.00					
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	27.27		7.08
26.07					
C & E Loss (ft)	0.00	Cum SA (acres)	7.24		1.72
4.17					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	44.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	44.00	Reach Len. (ft)	77.24	70.30	64.94
Crit W.S. (ft)		Flow Area (sq ft)		171.98	128.96
E.G. Slope (ft/ft)	0.000826	Area (sq ft)		171.98	128.96
Q Total (cfs)	846.00	Flow (cfs)		665.32	180.68
Top Width (ft)	63.65	Top Width (ft)		27.16	36.50
Vel Total (ft/s)	2.81	Avg. Vel. (ft/s)		3.87	1.40
Max Chl Dpth (ft)	8.00	Hydr. Depth (ft)		6.33	3.53
Conv. Total (cfs)	29440.8	Conv. (cfs)		23153.3	6287.5
Length Wtd. (ft)	69.37	Wetted Per. (ft)		30.45	37.05
Min Ch El (ft)	36.00	Shear (lb/sq ft)		0.29	0.18
Alpha	1.54	Stream Power (lb/ft s)	223.70	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	35.05	10.18	32.04
C & E Loss (ft)	0.00	Cum SA (acres)	8.96	1.73	4.60

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 53000

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	38.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	38.63	Reach Len. (ft)	1742.97	1742.97	1742.97
Crit W.S. (ft)	37.76	Flow Area (sq ft)	0.50	41.57	2.17
E.G. Slope (ft/ft)	0.003742	Area (sq ft)	0.50	41.57	2.17
Q Total (cfs)	182.00	Flow (cfs)	0.29	180.41	1.30
Top Width (ft)	26.46	Top Width (ft)	1.58	17.99	6.89
Vel Total (ft/s)	4.11	Avg. Vel. (ft/s)	0.57	4.34	0.60
Max Chl Dpth (ft)	2.63	Hydr. Depth (ft)	0.32	2.31	0.32
Conv. Total (cfs)	2975.2	Conv. (cfs)	4.7	2949.2	

21.3				
Length Wtd. (ft)	1742.97	Wetted Per. (ft)	1.70	19.25
6.92				
Min Ch El (ft)	36.00	Shear (lb/sq ft)	0.07	0.50
0.07				
Alpha	1.10	Stream Power (lb/ft s)	202.83	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	1.65	1.92
1.69				
C & E Loss (ft)		Cum SA (acres)	1.98	1.64
1.51				

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	40.59	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.28	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	40.32	Reach Len. (ft)	1742.97	1742.97
1742.97				
Crit W.S. (ft)	38.69	Flow Area (sq ft)	6.74	71.87
28.85				
E.G. Slope (ft/ft)	0.001914	Area (sq ft)	6.74	71.87
28.85				
Q Total (cfs)	359.00	Flow (cfs)	6.42	321.29
31.29				
Top Width (ft)	46.76	Top Width (ft)	6.06	17.99
22.71				
Vel Total (ft/s)	3.34	Avg. Vel. (ft/s)	0.95	4.47
1.08				
Max Chl Dpth (ft)	4.32	Hydr. Depth (ft)	1.11	3.99
1.27				
Conv. Total (cfs)	8205.8	Conv. (cfs)	146.8	7343.9
715.1				
Length Wtd. (ft)	1742.97	Wetted Per. (ft)	6.49	19.25
22.86				
Min Ch El (ft)	36.00	Shear (lb/sq ft)	0.12	0.45
0.15				
Alpha	1.61	Stream Power (lb/ft s)	202.83	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	4.25	2.95
3.88				
C & E Loss (ft)		Cum SA (acres)	3.15	1.67
2.11				

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	42.61	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.23	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	42.38	Reach Len. (ft)	1742.97	1742.97
1742.97				
Crit W.S. (ft)	39.72	Flow Area (sq ft)	26.43	109.00
81.67				
E.G. Slope (ft/ft)	0.001038	Area (sq ft)	26.43	109.00
81.67				

Q Total (cfs)	613.00	Flow (cfs)	27.85	473.70	111.45
Top Width (ft)	59.56	Top Width (ft)	13.10	17.99	28.47
Vel Total (ft/s)	2.82	Avg. Vel. (ft/s)	1.05	4.35	1.36
Max Chl Dpth (ft)	6.38	Hydr. Depth (ft)	2.02	6.06	2.87
Conv. Total (cfs)	19025.3	Conv. (cfs)	864.3	14701.9	3459.1
Length Wtd. (ft)	1742.97	Wetted Per. (ft)	13.83	19.25	28.97
Min Ch El (ft)	36.00	Shear (lb/sq ft)	0.12	0.37	0.18
Alpha	1.88	Stream Power (lb/ft s)	202.83	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	15.18	5.21	14.40
C & E Loss (ft)		Cum SA (acres)	5.32	1.69	3.45

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	43.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	43.70	Reach Len. (ft)	1742.97	1742.97	1742.97
Crit W.S. (ft)	40.15	Flow Area (sq ft)	46.80	132.67	121.54
E.G. Slope (ft/ft)	0.000657	Area (sq ft)	46.80	132.67	121.54
Q Total (cfs)	728.00	Flow (cfs)	46.85	522.96	158.19
Top Width (ft)	67.95	Top Width (ft)	17.85	17.99	32.12
Vel Total (ft/s)	2.42	Avg. Vel. (ft/s)	1.00	3.94	1.30
Max Chl Dpth (ft)	7.70	Hydr. Depth (ft)	2.62	7.37	3.78
Conv. Total (cfs)	28400.6	Conv. (cfs)	1827.5	20401.7	6171.4
Length Wtd. (ft)	1742.97	Wetted Per. (ft)	18.76	19.25	32.85
Min Ch El (ft)	36.00	Shear (lb/sq ft)	0.10	0.28	0.15
Alpha	1.98	Stream Power (lb/ft s)	202.83	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	27.23	6.84	25.89
C & E Loss (ft)		Cum SA (acres)	7.23	1.69	4.11

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	44.13	Element	Left OB	Channel

Right OB					
Vel Head (ft)	0.22	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	43.91	Reach Len. (ft)	1742.97	1742.97	1742.97
Crit W.S. (ft)	40.46	Flow Area (sq ft)	50.68	136.50	128.44
E.G. Slope (ft/ft)	0.000790	Area (sq ft)	50.68	136.50	128.44
Q Total (cfs)	846.00	Flow (cfs)	57.05	601.18	187.77
Top Width (ft)	69.31	Top Width (ft)	18.62	17.99	32.71
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)	1.13	4.40	1.46
Max Chl Dpth (ft)	7.91	Hydr. Depth (ft)	2.72	7.59	3.93
Conv. Total (cfs)	30104.8	Conv. (cfs)	2030.0	21393.1	6681.7
Length Wtd. (ft)	1742.97	Wetted Per. (ft)	19.55	19.25	33.48
Min Ch El (ft)	36.00	Shear (lb/sq ft)	0.13	0.35	0.19
Alpha	2.00	Stream Power (lb/ft s)	202.83	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	35.00	9.94	31.85
C & E Loss (ft)		Cum SA (acres)	8.94	1.69	4.55

CULVERT

RIVER: 99
REACH: PRBLHEC RS: 52900

CULVERT OUTPUT Profile #2-YR Culv Group: Culvert #1

Q Culv Group (cfs)	182.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	7.67
Q Barrel (cfs)	182.00	Culv Vel DS (ft/s)	12.97
E.G. US. (ft)	38.92	Culv Inv El Up (ft)	36.00
W.S. US. (ft)	38.63	Culv Inv El Dn (ft)	12.04
E.G. DS (ft)	13.94	Culv Frctn Ls (ft)	23.01
W.S. DS (ft)	13.81	Culv Exit Loss (ft)	1.79
Delta EG (ft)	24.98	Culv Entr Loss (ft)	0.18
Delta WS (ft)	24.82	Q Weir (cfs)	
E.G. IC (ft)	38.84	Weir Sta Lft (ft)	
E.G. OC (ft)	38.92	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	37.83	Weir Max Depth (ft)	
Culv WS Outlet (ft)	13.12	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.08	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.83	Min El Weir Flow (ft)	47.87

Warning: Since the culvert has supercritical flow, the program should be run in mixed flow in order to check if the cross section
downstream of the culvert has supercritical flow.
Note: During supercritical analysis, the culvert direct step method went to

normal depth. The program then assumed normal
depth at the outlet.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10-YR Culv Group: Culvert #1

Q Culv Group (cfs)	359.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	9.62
Q Barrel (cfs)	359.00	Culv Vel DS (ft/s)	16.54
E.G. US. (ft)	40.59	Culv Inv El Up (ft)	36.00
W.S. US. (ft)	40.32	Culv Inv El Dn (ft)	12.04
E.G. DS (ft)	14.61	Culv Frctn Ls (ft)	22.35
W.S. DS (ft)	14.30	Culv Exit Loss (ft)	3.34
Delta EG (ft)	25.98	Culv Entr Loss (ft)	0.29
Delta WS (ft)	26.01	Q Weir (cfs)	
E.G. IC (ft)	40.56	Weir Sta Lft (ft)	
E.G. OC (ft)	40.59	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	38.87	Weir Max Depth (ft)	
Culv WS Outlet (ft)	13.71	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.67	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.87	Min El Weir Flow (ft)	47.87

Warning: Since the culvert has supercritical flow, the program should be run in mixed flow in order to check if the cross section
downstream of the culvert has supercritical flow.
Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal
depth at the outlet.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25-YR Culv Group: Culvert #1

Q Culv Group (cfs)	613.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	11.49
Q Barrel (cfs)	613.00	Culv Vel DS (ft/s)	19.78
E.G. US. (ft)	42.61	Culv Inv El Up (ft)	36.00
W.S. US. (ft)	42.38	Culv Inv El Dn (ft)	12.04
E.G. DS (ft)	16.63	Culv Frctn Ls (ft)	21.65
W.S. DS (ft)	16.40	Culv Exit Loss (ft)	3.87
Delta EG (ft)	25.98	Culv Entr Loss (ft)	0.46
Delta WS (ft)	25.98	Q Weir (cfs)	
E.G. IC (ft)	42.61	Weir Sta Lft (ft)	
E.G. OC (ft)	42.56	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	40.10	Weir Max Depth (ft)	
Culv WS Outlet (ft)	14.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.38	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.10	Min El Weir Flow (ft)	47.87

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal
depth at the outlet.
Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #50-YR Culv Group: Culvert #1

Q Culv Group (cfs)	728.00	Culv Full Len (ft)	184.58
# Barrels	1	Culv Vel US (ft/s)	12.17
Q Barrel (cfs)	728.00	Culv Vel DS (ft/s)	9.33
E.G. US. (ft)	43.88	Culv Inv El Up (ft)	36.00

W.S. US. (ft)	43.70	Culv Inv El Dn (ft)	12.04
E.G. DS (ft)	20.30	Culv Frctn Ls (ft)	21.34
W.S. DS (ft)	20.21	Culv Exit Loss (ft)	1.26
Delta EG (ft)	23.58	Culv Entr Loss (ft)	0.98
Delta WS (ft)	23.49	Q Weir (cfs)	
E.G. IC (ft)	43.88	Weir Sta Lft (ft)	
E.G. OC (ft)	43.36	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	40.60	Weir Max Depth (ft)	
Culv WS Outlet (ft)	18.04	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.68	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.60	Min El Weir Flow (ft)	47.87

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	846.00	Culv Full Len (ft)	370.89
# Barrels	1	Culv Vel US (ft/s)	10.85
Q Barrel (cfs)	846.00	Culv Vel DS (ft/s)	10.85
E.G. US. (ft)	44.14	Culv Inv El Up (ft)	36.00
W.S. US. (ft)	43.91	Culv Inv El Dn (ft)	12.04
E.G. DS (ft)	22.12	Culv Frctn Ls (ft)	19.94
W.S. DS (ft)	22.06	Culv Exit Loss (ft)	1.77
Delta EG (ft)	22.02	Culv Entr Loss (ft)	0.37
Delta WS (ft)	21.85	Q Weir (cfs)	
E.G. IC (ft)	45.20	Weir Sta Lft (ft)	
E.G. OC (ft)	44.14	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	42.00	Weir Max Depth (ft)	
Culv WS Outlet (ft)	18.04	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.96	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.09	Min El Weir Flow (ft)	47.87

Note: During supercritical analysis, the culvert direct step method went to normal depth. The program then assumed normal depth at the outlet.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 52551.81

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	13.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.070	0.035	

W.S. Elev (ft)	13.81	Reach Len. (ft)	53.53	59.74	64.78
Crit W.S. (ft)	12.99	Flow Area (sq ft)	2.33	61.47	
E.G. Slope (ft/ft)	0.002328	Area (sq ft)	2.33	141.34	2.17
Q Total (cfs)	182.00	Flow (cfs)	1.85	180.15	
Top Width (ft)	40.15	Top Width (ft)	2.81	34.99	2.35
Vel Total (ft/s)	2.85	Avg. Vel. (ft/s)	0.80	2.93	
Max Chl Dpth (ft)	4.81	Hydr. Depth (ft)	0.83	1.76	
Conv. Total (cfs)	3772.2	Conv. (cfs)	38.4	3733.8	
Length Wtd. (ft)	59.71	Wetted Per. (ft)	3.39	35.92	
Min Ch El (ft)	9.00	Shear (lb/sq ft)	0.10	0.25	
Alpha	1.05	Stream Power (lb/ft s)	137.88	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1.65	1.31	1.69
C & E Loss (ft)	0.03	Cum SA (acres)	1.90	0.58	1.33

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	14.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	14.30	Reach Len. (ft)	53.53	59.74	64.78
Crit W.S. (ft)	13.53	Flow Area (sq ft)	3.91	78.66	
E.G. Slope (ft/ft)	0.003955	Area (sq ft)	3.91	158.55	3.48
Q Total (cfs)	359.00	Flow (cfs)	4.86	354.14	
Top Width (ft)	41.61	Top Width (ft)	3.64	34.99	2.97
Vel Total (ft/s)	4.35	Avg. Vel. (ft/s)	1.24	4.50	
Max Chl Dpth (ft)	5.30	Hydr. Depth (ft)	1.07	2.25	
Conv. Total (cfs)	5708.5	Conv. (cfs)	77.3	5631.2	
Length Wtd. (ft)	59.69	Wetted Per. (ft)	4.36	35.92	
Min Ch El (ft)	9.00	Shear (lb/sq ft)	0.22	0.54	

Alpha	1.06	Stream Power (lb/ft s)	137.88	0.00
0.00				
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	4.25	1.98
3.88				
C & E Loss (ft)	0.03	Cum SA (acres)	2.95	0.61
1.60				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.23	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	16.40	Reach Len. (ft)	53.53	59.74
64.78				
Crit W.S. (ft)	14.16	Flow Area (sq ft)	15.30	152.04
E.G. Slope (ft/ft)	0.001245	Area (sq ft)	15.30	232.01
12.53				
Q Total (cfs)	613.00	Flow (cfs)	16.97	596.03
Top Width (ft)	47.84	Top Width (ft)	7.21	34.99
5.65				
Vel Total (ft/s)	3.66	Avg. Vel. (ft/s)	1.11	3.92
Max Chl Dpth (ft)	7.40	Hydr. Depth (ft)	2.12	4.35
Conv. Total (cfs)	17369.6	Conv. (cfs)	481.0	16888.6
Length Wtd. (ft)	59.59	Wetted Per. (ft)	8.49	35.92
Min Ch El (ft)	9.00	Shear (lb/sq ft)	0.14	0.33
Alpha	1.12	Stream Power (lb/ft s)	137.88	0.00
0.00				
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	15.18	3.77
14.40				
C & E Loss (ft)	0.08	Cum SA (acres)	4.92	0.63
2.77				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.30	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.09	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	20.21	Reach Len. (ft)	53.53	59.74
64.78				

Crit W.S. (ft)	14.41	Flow Area (sq ft)	61.51	285.09
E.G. Slope (ft/ft)	0.000208	Area (sq ft)	61.51	365.21
43.84				
Q Total (cfs)	728.00	Flow (cfs)	33.68	694.32
Top Width (ft)	71.38	Top Width (ft)	23.71	34.99
12.67				
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)	0.55	2.44
Max Chl Dpth (ft)	11.21	Hydr. Depth (ft)	2.59	8.16
Conv. Total (cfs)	50490.2	Conv. (cfs)	2336.1	48154.1
Length Wtd. (ft)	59.66	Wetted Per. (ft)	25.70	35.92
Min Ch El (ft)	9.00	Shear (lb/sq ft)	0.03	0.10
Alpha	1.29	Stream Power (lb/ft s)	137.88	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	27.23	5.12
25.89				
C & E Loss (ft)	0.03	Cum SA (acres)	6.40	0.63
3.22				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.06	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.06	Reach Len. (ft)	53.53	59.74
64.78				
Crit W.S. (ft)	14.66	Flow Area (sq ft)	185.30	350.32
74.55				
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	185.30	430.12
74.55				
Q Total (cfs)	846.00	Flow (cfs)	76.81	731.62
37.57				
Top Width (ft)	128.61	Top Width (ft)	73.75	34.99
19.87				
Vel Total (ft/s)	1.39	Avg. Vel. (ft/s)	0.41	2.09
0.50				
Max Chl Dpth (ft)	13.06	Hydr. Depth (ft)	2.51	10.01
3.75				
Conv. Total (cfs)	78438.8	Conv. (cfs)	7121.6	67833.7
3483.6				
Length Wtd. (ft)	60.42	Wetted Per. (ft)	76.06	35.97
22.83				
Min Ch El (ft)	9.00	Shear (lb/sq ft)	0.02	0.07
0.02				
Alpha	1.98	Stream Power (lb/ft s)	137.88	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	35.00	6.66
31.85				
C & E Loss (ft)	0.03	Cum SA (acres)	7.09	0.63
3.50				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 52492.14

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	13.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	13.40	Reach Len. (ft)	237.65	231.59	240.92
Crit W.S. (ft)	13.31	Flow Area (sq ft)	26.74	9.44	32.01
E.G. Slope (ft/ft)	0.012978	Area (sq ft)	26.74	9.44	40.94
Q Total (cfs)	182.00	Flow (cfs)	55.69	57.73	68.59
Top Width (ft)	89.93	Top Width (ft)	33.31	6.00	50.62
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)	2.08	6.11	2.14
Max Chl Dpth (ft)	1.78	Hydr. Depth (ft)	0.80	1.57	0.83
Conv. Total (cfs)	1597.6	Conv. (cfs)	488.8	506.7	602.1
Length Wtd. (ft)	237.88	Wetted Per. (ft)	33.45	6.64	38.39
Min Ch El (ft)	11.62	Shear (lb/sq ft)	0.65	1.15	0.68
Alpha	2.09	Stream Power (lb/ft s)	339.46	0.00	0.00
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	1.64	1.21	1.66
C & E Loss (ft)	0.05	Cum SA (acres)	1.87	0.56	1.29

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	14.15	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.39	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	13.75	Reach Len. (ft)	237.65	231.59
240.92				
Crit W.S. (ft)	13.67	Flow Area (sq ft)	38.50	11.53
45.37				
E.G. Slope (ft/ft)	0.018190	Area (sq ft)	38.50	11.53
58.77				
Q Total (cfs)	359.00	Flow (cfs)	118.49	95.33
145.17				
Top Width (ft)	92.24	Top Width (ft)	34.36	6.00
51.89				
Vel Total (ft/s)	3.76	Avg. Vel. (ft/s)	3.08	8.27
3.20				
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)	1.12	1.92
1.18				
Conv. Total (cfs)	2661.8	Conv. (cfs)	878.6	706.9
1076.4				
Length Wtd. (ft)	238.34	Wetted Per. (ft)	34.55	6.64
38.39				
Min Ch El (ft)	11.62	Shear (lb/sq ft)	1.27	1.97
1.34				
Alpha	1.80	Stream Power (lb/ft s)	339.46	0.00
0.00				
Frctn Loss (ft)	0.90	Cum Volume (acre-ft)	4.23	1.87
3.83				
C & E Loss (ft)	0.10	Cum SA (acres)	2.93	0.58
1.56				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.48	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.08	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	16.40	Reach Len. (ft)	237.65	231.59
240.92				
Crit W.S. (ft)	14.08	Flow Area (sq ft)	137.13	27.42
147.04				
E.G. Slope (ft/ft)	0.001273	Area (sq ft)	137.13	27.42
291.88				
Q Total (cfs)	613.00	Flow (cfs)	233.45	106.90
272.65				
Top Width (ft)	162.14	Top Width (ft)	39.90	6.00
116.24				
Vel Total (ft/s)	1.97	Avg. Vel. (ft/s)	1.70	3.90
1.85				
Max Chl Dpth (ft)	4.78	Hydr. Depth (ft)	3.44	4.57

3.83					
Conv. Total (cfs)	17179.3	Conv. (cfs)	6542.5	2995.7	7641.0
Length Wtd. (ft)	238.84	Wetted Per. (ft)	40.70	6.64	38.39
Min Ch El (ft)	11.62	Shear (lb/sq ft)	0.27	0.33	0.30
Alpha	1.37	Stream Power (lb/ft s)	339.46	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	15.09	3.59	14.17
C & E Loss (ft)	0.02	Cum SA (acres)	4.89	0.60	2.68

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.23	Reach Len. (ft)	237.65	231.59	240.92
Crit W.S. (ft)	14.23	Flow Area (sq ft)	359.51	50.37	293.89
E.G. Slope (ft/ft)	0.000202	Area (sq ft)	359.51	50.37	762.38
Q Total (cfs)	728.00	Flow (cfs)	265.91	117.41	344.67
Top Width (ft)	227.28	Top Width (ft)	92.62	6.00	128.66
Vel Total (ft/s)	1.03	Avg. Vel. (ft/s)	0.74	2.33	1.17
Max Chl Dpth (ft)	8.61	Hydr. Depth (ft)	3.88	8.39	7.66
Conv. Total (cfs)	51182.3	Conv. (cfs)	18695.2	8254.9	24232.2
Length Wtd. (ft)	238.91	Wetted Per. (ft)	93.76	6.64	38.39
Min Ch El (ft)	11.62	Shear (lb/sq ft)	0.05	0.10	0.10
Alpha	1.61	Stream Power (lb/ft s)	339.46	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	26.97	4.83	25.29
C & E Loss (ft)	0.01	Cum SA (acres)	6.32	0.60	3.11

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.08	Reach Len. (ft)	237.65	231.59	240.92
Crit W.S. (ft)	14.40	Flow Area (sq ft)	579.80	61.52	1006.35
E.G. Slope (ft/ft)	0.000046	Area (sq ft)	579.80	61.52	1006.35
Q Total (cfs)	846.00	Flow (cfs)	216.47	78.04	551.49
Top Width (ft)	277.19	Top Width (ft)	137.36	6.00	133.83
Vel Total (ft/s)	0.51	Avg. Vel. (ft/s)	0.37	1.27	0.55
Max Chl Dpth (ft)	10.46	Hydr. Depth (ft)	4.22	10.25	7.52
Conv. Total (cfs)	124903.2	Conv. (cfs)	31960.2	11521.1	81421.9
Length Wtd. (ft)	239.40	Wetted Per. (ft)	138.55	6.64	135.24
Min Ch El (ft)	11.62	Shear (lb/sq ft)	0.01	0.03	0.02
Alpha	1.44	Stream Power (lb/ft s)	339.46	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	34.53	6.32	31.05
C & E Loss (ft)	0.00	Cum SA (acres)	6.96	0.60	3.38

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 52208.31

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	12.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	12.06	Reach Len. (ft)	158.89	156.68	155.97
Crit W.S. (ft)		Flow Area (sq ft)	8.98	10.72	103.30
E.G. Slope (ft/ft)	0.003595	Area (sq ft)	8.98	10.72	103.30
Q Total (cfs)	182.00	Flow (cfs)	10.42	37.56	134.02
Top Width (ft)	116.34	Top Width (ft)	10.14	6.00	

100.20					
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)	1.16	3.50	1.30
Max Chl Dpth (ft)	2.00	Hydr. Depth (ft)	0.89	1.79	1.03
Conv. Total (cfs)	3035.3	Conv. (cfs)	173.7	626.4	2235.2
Length Wtd. (ft)	156.73	Wetted Per. (ft)	10.31	6.64	100.37
Min Ch El (ft)	10.06	Shear (lb/sq ft)	0.20	0.36	0.23
Alpha	1.76	Stream Power (lb/ft s)	276.96	0.00	0.00
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	1.54	1.16	1.26
C & E Loss (ft)	0.00	Cum SA (acres)	1.76	0.52	0.87

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	13.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	13.10	Reach Len. (ft)	158.89	156.68	155.97
Crit W.S. (ft)		Flow Area (sq ft)	21.17	16.97	209.35
E.G. Slope (ft/ft)	0.001575	Area (sq ft)	21.17	16.97	209.35
Q Total (cfs)	359.00	Flow (cfs)	24.08	53.45	281.47
Top Width (ft)	122.62	Top Width (ft)	13.14	6.00	103.48
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	1.14	3.15	1.34
Max Chl Dpth (ft)	3.04	Hydr. Depth (ft)	1.61	2.83	2.02
Conv. Total (cfs)	9047.0	Conv. (cfs)	606.7	1347.1	7093.3
Length Wtd. (ft)	156.75	Wetted Per. (ft)	13.49	6.64	103.81
Min Ch El (ft)	10.06	Shear (lb/sq ft)	0.15	0.25	0.20
Alpha	1.42	Stream Power (lb/ft s)	276.96	0.00	0.00
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	4.06	1.79	3.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.80	0.55	1.13

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	16.35	Reach Len. (ft)	158.89	156.68	155.97
Crit W.S. (ft)		Flow Area (sq ft)	92.84	36.48	589.13
E.G. Slope (ft/ft)	0.000197	Area (sq ft)	92.84	36.48	589.13
Q Total (cfs)	613.00	Flow (cfs)	49.33	67.71	495.96
Top Width (ft)	167.66	Top Width (ft)	38.29	6.00	123.36
Vel Total (ft/s)	0.85	Avg. Vel. (ft/s)	0.53	1.86	0.84
Max Chl Dpth (ft)	6.29	Hydr. Depth (ft)	2.42	6.08	4.78
Conv. Total (cfs)	43645.2	Conv. (cfs)	3512.3	4820.9	35312.0
Length Wtd. (ft)	156.71	Wetted Per. (ft)	39.02	6.64	124.16
Min Ch El (ft)	10.06	Shear (lb/sq ft)	0.03	0.07	0.06
Alpha	1.34	Stream Power (lb/ft s)	276.96	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	14.46	3.42	11.74
C & E Loss (ft)	0.00	Cum SA (acres)	4.67	0.57	2.01

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.22	Reach Len. (ft)	158.89	156.68	155.97
Crit W.S. (ft)		Flow Area (sq ft)	299.59	59.72	1082.64
E.G. Slope (ft/ft)	0.000036	Area (sq ft)	299.59	59.72	1082.64
Q Total (cfs)	728.00	Flow (cfs)	107.17	65.51	555.32
Top Width (ft)	199.40	Top Width (ft)	61.96	6.00	131.43
Vel Total (ft/s)	0.50	Avg. Vel. (ft/s)	0.36	1.10	0.51
Max Chl Dpth (ft)	10.16	Hydr. Depth (ft)	4.83	9.95	8.24
Conv. Total (cfs)	121844.2	Conv. (cfs)	17937.2	10963.6	92943.4
Length Wtd. (ft)	156.72	Wetted Per. (ft)	63.25	6.64	133.11
Min Ch El (ft)	10.06	Shear (lb/sq ft)	0.01	0.02	0.02
Alpha	1.29	Stream Power (lb/ft s)	276.96	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	25.17	4.54	

20.19					
C & E Loss (ft)	0.00	Cum SA (acres)	5.90	0.57	
2.39					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.08	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.08	Reach Len. (ft)	158.89	156.68	
155.97					
Crit W.S. (ft)		Flow Area (sq ft)	418.37	70.84	
1329.83					
E.G. Slope (ft/ft)	0.000024	Area (sq ft)	418.37	70.84	
1329.83					
Q Total (cfs)	846.00	Flow (cfs)	146.29	71.39	
628.32					
Top Width (ft)	207.32	Top Width (ft)	66.16	6.00	
135.16					
Vel Total (ft/s)	0.47	Avg. Vel. (ft/s)	0.35	1.01	
0.47					
Max Chl Dpth (ft)	12.02	Hydr. Depth (ft)	6.32	11.81	
9.84					
Conv. Total (cfs)	172721.8	Conv. (cfs)	29866.9	14574.7	
128280.2					
Length Wtd. (ft)	156.78	Wetted Per. (ft)	67.83	6.64	
137.28					
Min Ch El (ft)	10.06	Shear (lb/sq ft)	0.01	0.02	
0.01					
Alpha	1.26	Stream Power (lb/ft s)	276.96	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	31.81	5.97	
24.59					
C & E Loss (ft)	0.00	Cum SA (acres)	6.41	0.57	
2.64					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 52000.40

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	11.74	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.06	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	11.68	Reach Len. (ft)	112.24	109.86	
107.70					
Crit W.S. (ft)		Flow Area (sq ft)	51.31	15.65	
55.23					
E.G. Slope (ft/ft)	0.001746	Area (sq ft)	51.31	15.65	
55.23					
Q Total (cfs)	182.00	Flow (cfs)	63.29	49.17	

69.54				
Top Width (ft)	69.34	Top Width (ft)	30.99	6.00
32.36				
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	1.23	3.14
1.26				
Max Chl Dpth (ft)	2.82	Hydr. Depth (ft)	1.66	2.61
1.71				
Conv. Total (cfs)	4355.1	Conv. (cfs)	1514.6	1176.6
1664.0				
Length Wtd. (ft)	109.83	Wetted Per. (ft)	31.29	6.64
32.66				
Min Ch El (ft)	8.86	Shear (lb/sq ft)	0.18	0.26
0.18				
Alpha	1.71	Stream Power (lb/ft s)	232.36	0.00
0.00				
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	1.43	1.11
0.98				
C & E Loss (ft)	0.02	Cum SA (acres)	1.68	0.50
0.63				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	12.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	12.84	Reach Len. (ft)	112.24	109.86
107.70				
Crit W.S. (ft)		Flow Area (sq ft)	88.43	22.59
94.66				
E.G. Slope (ft/ft)	0.001416	Area (sq ft)	88.43	22.59
94.66				
Q Total (cfs)	359.00	Flow (cfs)	134.18	81.62
143.20				
Top Width (ft)	75.01	Top Width (ft)	33.19	6.00
35.83				
Vel Total (ft/s)	1.75	Avg. Vel. (ft/s)	1.52	3.61
1.51				
Max Chl Dpth (ft)	3.98	Hydr. Depth (ft)	2.66	3.77
2.64				
Conv. Total (cfs)	9540.8	Conv. (cfs)	3566.0	2169.1
3805.7				
Length Wtd. (ft)	109.84	Wetted Per. (ft)	33.77	6.64
36.32				
Min Ch El (ft)	8.86	Shear (lb/sq ft)	0.23	0.30
0.23				
Alpha	1.56	Stream Power (lb/ft s)	232.36	0.00
0.00				
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	3.86	1.72
2.54				
C & E Loss (ft)	0.03	Cum SA (acres)	2.72	0.53
0.88				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)

is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	16.30	Reach Len. (ft)	112.24	109.86	107.70
Crit W.S. (ft)		Flow Area (sq ft)	214.81	43.39	319.55
E.G. Slope (ft/ft)	0.000261	Area (sq ft)	214.81	43.39	319.55
Q Total (cfs)	613.00	Flow (cfs)	221.46	103.95	287.59
Top Width (ft)	119.69	Top Width (ft)	39.74	6.00	73.95
Vel Total (ft/s)	1.06	Avg. Vel. (ft/s)	1.03	2.40	0.90
Max Chl Dpth (ft)	7.44	Hydr. Depth (ft)	5.41	7.23	4.32
Conv. Total (cfs)	37961.1	Conv. (cfs)	13714.5	6437.1	17809.5
Length Wtd. (ft)	109.69	Wetted Per. (ft)	41.18	6.64	75.12
Min Ch El (ft)	8.86	Shear (lb/sq ft)	0.08	0.11	0.07
Alpha	1.54	Stream Power (lb/ft s)	232.36	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	13.90	3.27	10.11
C & E Loss (ft)	0.01	Cum SA (acres)	4.53	0.55	1.66

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.21	Reach Len. (ft)	112.24	109.86	107.70
Crit W.S. (ft)		Flow Area (sq ft)	410.30	66.84	625.16
E.G. Slope (ft/ft)	0.000062	Area (sq ft)	410.30	66.84	625.16
Q Total (cfs)	728.00	Flow (cfs)	225.60	104.42	397.98
Top Width (ft)	155.54	Top Width (ft)	67.14	6.00	82.40
Vel Total (ft/s)	0.66	Avg. Vel. (ft/s)	0.55	1.56	0.64
Max Chl Dpth (ft)	11.35	Hydr. Depth (ft)	6.11	11.14	

7.59					
Conv. Total (cfs)	92222.9	Conv. (cfs)	28578.4	13228.3	50416.2
Length Wtd. (ft)	109.43	Wetted Per. (ft)	69.03	6.64	84.42
Min Ch El (ft)	8.86	Shear (lb/sq ft)	0.02	0.04	0.03
Alpha	1.53	Stream Power (lb/ft s)	232.36	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	23.88	4.31	17.13
C & E Loss (ft)	0.00	Cum SA (acres)	5.67	0.55	2.01

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.07	Reach Len. (ft)	112.24	109.86	107.70
Crit W.S. (ft)		Flow Area (sq ft)	542.28	77.99	782.00
E.G. Slope (ft/ft)	0.000042	Area (sq ft)	542.28	77.99	782.00
Q Total (cfs)	846.00	Flow (cfs)	277.88	110.62	457.50
Top Width (ft)	165.30	Top Width (ft)	72.85	6.00	86.45
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)	0.51	1.42	0.59
Max Chl Dpth (ft)	13.21	Hydr. Depth (ft)	7.44	13.00	9.05
Conv. Total (cfs)	130826.2	Conv. (cfs)	42971.7	17105.6	70748.9
Length Wtd. (ft)	109.49	Wetted Per. (ft)	75.19	6.64	88.87
Min Ch El (ft)	8.86	Shear (lb/sq ft)	0.02	0.03	0.02
Alpha	1.47	Stream Power (lb/ft s)	232.36	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	30.06	5.70	20.81
C & E Loss (ft)	0.00	Cum SA (acres)	6.15	0.55	2.24

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51873.49

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	11.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	11.16	Reach Len. (ft)	93.61	90.16	87.15
Crit W.S. (ft)		Flow Area (sq ft)	20.92	15.96	25.00
E.G. Slope (ft/ft)	0.004995	Area (sq ft)	20.92	15.96	25.00
Q Total (cfs)	182.00	Flow (cfs)	43.03	86.56	52.41
Top Width (ft)	33.23	Top Width (ft)	12.55	6.00	14.68
Vel Total (ft/s)	2.94	Avg. Vel. (ft/s)	2.06	5.42	2.10
Max Chl Dpth (ft)	2.86	Hydr. Depth (ft)	1.67	2.66	1.70
Conv. Total (cfs)	2575.2	Conv. (cfs)	608.8	1224.8	741.5
Length Wtd. (ft)	90.27	Wetted Per. (ft)	13.03	6.57	15.14
Min Ch El (ft)	8.30	Shear (lb/sq ft)	0.50	0.76	0.51
Alpha	1.88	Stream Power (lb/ft s)	232.25	0.00	0.00
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	1.34	1.07	0.88
C & E Loss (ft)	0.00	Cum SA (acres)	1.62	0.49	0.58

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	12.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	12.24	Reach Len. (ft)	93.61	90.16	87.15
Crit W.S. (ft)		Flow Area (sq ft)	35.53	22.40	41.79
E.G. Slope (ft/ft)	0.005074	Area (sq ft)	35.53	22.40	41.79
Q Total (cfs)	359.00	Flow (cfs)	92.12	153.41	113.47
Top Width (ft)	37.73	Top Width (ft)	15.10	6.00	16.63
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)	2.59	6.85	2.72
Max Chl Dpth (ft)	3.94	Hydr. Depth (ft)	2.35	3.73	2.51
Conv. Total (cfs)	5039.9	Conv. (cfs)	1293.3	2153.7	1593.0

Length Wtd. (ft)	90.27	Wetted Per. (ft)	15.82	6.57 17.37
Min Ch El (ft)	8.30	Shear (lb/sq ft)	0.71	1.08 0.76
Alpha	1.86	Stream Power (lb/ft s)	232.25	0.00 0.00
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	3.70	1.66 2.37
C & E Loss (ft)	0.00	Cum SA (acres)	2.65	0.52 0.81

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.28	Element	Left OB	Channel Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	16.17	Reach Len. (ft)	93.61	90.16 87.15
Crit W.S. (ft)		Flow Area (sq ft)	112.10	45.97 173.31
E.G. Slope (ft/ft)	0.000737	Area (sq ft)	112.10	45.97 173.31
Q Total (cfs)	613.00	Flow (cfs)	174.25	193.71 245.04
Top Width (ft)	73.52	Top Width (ft)	23.71	6.00 43.81
Vel Total (ft/s)	1.85	Avg. Vel. (ft/s)	1.55	4.21 1.41
Max Chl Dpth (ft)	7.87	Hydr. Depth (ft)	4.73	7.66 3.96
Conv. Total (cfs)	22585.2	Conv. (cfs)	6420.0	7137.1 9028.1
Length Wtd. (ft)	90.16	Wetted Per. (ft)	25.30	6.57 45.08
Min Ch El (ft)	8.30	Shear (lb/sq ft)	0.20	0.32 0.18
Alpha	2.07	Stream Power (lb/ft s)	232.25	0.00 0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	13.48	3.16 9.50
C & E Loss (ft)	0.00	Cum SA (acres)	4.45	0.53 1.52

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.21	Element	Left OB	Channel Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	20.17	Reach Len. (ft)	93.61	90.16 87.15
Crit W.S. (ft)		Flow Area (sq ft)	234.80	70.00 366.53
E.G. Slope (ft/ft)	0.000162	Area (sq ft)	234.80	70.00 366.53
Q Total (cfs)	728.00	Flow (cfs)	193.02	183.35

351.62					
Top Width (ft)	100.74	Top Width (ft)	41.99	6.00	
52.75					
Vel Total (ft/s)	1.08	Avg. Vel. (ft/s)	0.82	2.62	
0.96					
Max Chl Dpth (ft)	11.87	Hydr. Depth (ft)	5.59	11.67	
6.95					
Conv. Total (cfs)	57128.2	Conv. (cfs)	15147.2	14388.2	
27592.8					
Length Wtd. (ft)	89.92	Wetted Per. (ft)	44.32	6.57	
54.88					
Min Ch El (ft)	8.30	Shear (lb/sq ft)	0.05	0.11	
0.07					
Alpha	2.00	Stream Power (lb/ft s)	232.25	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	23.05	4.14	
15.91					
C & E Loss (ft)	0.00	Cum SA (acres)	5.53	0.53	
1.84					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.07	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.04	Reach Len. (ft)	93.61	90.16	
87.15					
Crit W.S. (ft)		Flow Area (sq ft)	315.86	81.21	
469.05					
E.G. Slope (ft/ft)	0.000108	Area (sq ft)	315.86	81.21	
469.05					
Q Total (cfs)	846.00	Flow (cfs)	245.45	191.29	
409.26					
Top Width (ft)	107.77	Top Width (ft)	44.78	6.00	
56.99					
Vel Total (ft/s)	0.98	Avg. Vel. (ft/s)	0.78	2.36	
0.87					
Max Chl Dpth (ft)	13.74	Hydr. Depth (ft)	7.05	13.54	
8.23					
Conv. Total (cfs)	81510.3	Conv. (cfs)	23648.9	18430.0	
39431.4					
Length Wtd. (ft)	89.94	Wetted Per. (ft)	47.68	6.57	
59.52					
Min Ch El (ft)	8.30	Shear (lb/sq ft)	0.04	0.08	
0.05					
Alpha	1.88	Stream Power (lb/ft s)	232.25	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	28.95	5.50	
19.26					
C & E Loss (ft)	0.00	Cum SA (acres)	6.00	0.53	
2.07					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51774.77

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	10.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	10.72	Reach Len. (ft)	66.65	66.63	70.43
Crit W.S. (ft)		Flow Area (sq ft)	25.32	15.96	21.57
E.G. Slope (ft/ft)	0.004881	Area (sq ft)	25.32	15.96	21.57
Q Total (cfs)	182.00	Flow (cfs)	52.46	85.56	43.98
Top Width (ft)	33.78	Top Width (ft)	14.88	6.00	12.91
Vel Total (ft/s)	2.90	Avg. Vel. (ft/s)	2.07	5.36	2.04
Max Chl Dpth (ft)	2.86	Hydr. Depth (ft)	1.70	2.66	1.67
Conv. Total (cfs)	2605.0	Conv. (cfs)	750.9	1224.6	629.5
Length Wtd. (ft)	67.71	Wetted Per. (ft)	15.34	6.57	13.38
Min Ch El (ft)	7.86	Shear (lb/sq ft)	0.50	0.74	0.49
Alpha	1.88	Stream Power (lb/ft s)	188.45	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	1.29	1.04	0.83
C & E Loss (ft)	0.00	Cum SA (acres)	1.60	0.48	0.55

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	12.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	11.80	Reach Len. (ft)	66.65	66.63	70.43
Crit W.S. (ft)		Flow Area (sq ft)	42.46	22.40	36.55
E.G. Slope (ft/ft)	0.004904	Area (sq ft)	42.46	22.40	36.55
Q Total (cfs)	359.00	Flow (cfs)	112.84	150.87	95.28
Top Width (ft)	38.06	Top Width (ft)	17.05	6.00	15.01
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	2.66	6.73	2.61
Max Chl Dpth (ft)	3.94	Hydr. Depth (ft)	2.49	3.73	2.43
Conv. Total (cfs)	5126.5	Conv. (cfs)	1611.4	2154.5	1360.6
Length Wtd. (ft)	67.80	Wetted Per. (ft)	17.76	6.57	15.74

Min Ch El (ft)	7.86	Shear (lb/sq ft)	0.73	1.04	0.71
Alpha	1.84	Stream Power (lb/ft s)	188.45	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	3.62	1.62	2.30
C & E Loss (ft)	0.00	Cum SA (acres)	2.62	0.50	0.78

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	16.10	Reach Len. (ft)	66.65	66.63	70.43
Crit W.S. (ft)		Flow Area (sq ft)	134.53	48.21	141.05
E.G. Slope (ft/ft)	0.000674	Area (sq ft)	134.53	48.21	141.05
Q Total (cfs)	613.00	Flow (cfs)	213.78	200.63	198.58
Top Width (ft)	64.53	Top Width (ft)	25.76	6.00	32.77
Vel Total (ft/s)	1.89	Avg. Vel. (ft/s)	1.59	4.16	1.41
Max Chl Dpth (ft)	8.24	Hydr. Depth (ft)	5.22	8.04	4.30
Conv. Total (cfs)	23613.4	Conv. (cfs)	8235.1	7728.6	7649.7
Length Wtd. (ft)	68.00	Wetted Per. (ft)	27.47	6.57	34.54
Min Ch El (ft)	7.86	Shear (lb/sq ft)	0.21	0.31	0.17
Alpha	2.01	Stream Power (lb/ft s)	188.45	0.00	0.00
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	13.21	3.06	9.19
C & E Loss (ft)	0.00	Cum SA (acres)	4.40	0.52	1.44

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.15	Reach Len. (ft)	66.65	66.63	70.43
Crit W.S. (ft)		Flow Area (sq ft)	255.50	72.53	292.78
E.G. Slope (ft/ft)	0.000164	Area (sq ft)	255.50	72.53	292.78
Q Total (cfs)	728.00	Flow (cfs)	253.77	195.58	278.65
Top Width (ft)	82.08	Top Width (ft)	33.96	6.00	

42.13					
Vel Total (ft/s)	1.17	Avg. Vel. (ft/s)	0.99	2.70	
0.95					
Max Chl Dpth (ft)	12.29	Hydr. Depth (ft)	7.52	12.09	
6.95					
Conv. Total (cfs)	56812.0	Conv. (cfs)	19804.2	15262.5	
21745.3					
Length Wtd. (ft)	68.16	Wetted Per. (ft)	36.62	6.57	
44.74					
Min Ch El (ft)	7.86	Shear (lb/sq ft)	0.07	0.11	
0.07					
Alpha	1.92	Stream Power (lb/ft s)	188.45	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	22.52	3.99	
15.25					
C & E Loss (ft)	0.00	Cum SA (acres)	5.45	0.52	
1.75					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.06	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.02	Reach Len. (ft)	66.65	66.63	
70.43					
Crit W.S. (ft)		Flow Area (sq ft)	322.56	83.75	
375.62					
E.G. Slope (ft/ft)	0.000120	Area (sq ft)	322.56	83.75	
375.62					
Q Total (cfs)	846.00	Flow (cfs)	296.98	212.15	
336.87					
Top Width (ft)	90.21	Top Width (ft)	37.74	6.00	
46.47					
Vel Total (ft/s)	1.08	Avg. Vel. (ft/s)	0.92	2.53	
0.90					
Max Chl Dpth (ft)	14.16	Hydr. Depth (ft)	8.55	13.96	
8.08					
Conv. Total (cfs)	77357.0	Conv. (cfs)	27155.3	19398.7	
30803.0					
Length Wtd. (ft)	68.20	Wetted Per. (ft)	40.84	6.57	
49.47					
Min Ch El (ft)	7.86	Shear (lb/sq ft)	0.06	0.10	
0.06					
Alpha	1.90	Stream Power (lb/ft s)	188.45	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	28.27	5.33	
18.41					
C & E Loss (ft)	0.00	Cum SA (acres)	5.91	0.52	
1.96					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51701.60

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	10.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	10.40	Reach Len. (ft)	35.53	38.71	41.69
Crit W.S. (ft)		Flow Area (sq ft)	19.33	16.01	28.30
E.G. Slope (ft/ft)	0.004778	Area (sq ft)	19.33	16.01	28.30
Q Total (cfs)	182.00	Flow (cfs)	38.30	85.04	58.67
Top Width (ft)	34.28	Top Width (ft)	11.87	6.00	16.40
Vel Total (ft/s)	2.86	Avg. Vel. (ft/s)	1.98	5.31	2.07
Max Chl Dpth (ft)	2.87	Hydr. Depth (ft)	1.63	2.67	1.73
Conv. Total (cfs)	2632.9	Conv. (cfs)	554.0	1230.2	848.7
Length Wtd. (ft)	38.47	Wetted Per. (ft)	12.32	6.57	16.85
Min Ch El (ft)	7.53	Shear (lb/sq ft)	0.47	0.73	0.50
Alpha	1.88	Stream Power (lb/ft s)	169.80	0.00	0.00
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	1.25	1.01	0.79
C & E Loss (ft)	0.00	Cum SA (acres)	1.57	0.47	0.52

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	11.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	11.48	Reach Len. (ft)	35.53	38.71	41.69
Crit W.S. (ft)		Flow Area (sq ft)	33.29	22.45	47.11
E.G. Slope (ft/ft)	0.004794	Area (sq ft)	33.29	22.45	47.11
Q Total (cfs)	359.00	Flow (cfs)	83.93	149.67	125.40
Top Width (ft)	38.77	Top Width (ft)	14.13	6.00	18.64
Vel Total (ft/s)	3.49	Avg. Vel. (ft/s)	2.52	6.67	2.66
Max Chl Dpth (ft)	3.95	Hydr. Depth (ft)	2.36	3.74	2.53
Conv. Total (cfs)	5185.1	Conv. (cfs)	1212.2	2161.7	1811.2
Length Wtd. (ft)	38.45	Wetted Per. (ft)	14.82	6.57	19.33
Min Ch El (ft)	7.53	Shear (lb/sq ft)	0.67	1.02	0.73

Alpha	1.85	Stream Power (lb/ft s)	169.80	0.00
0.00				
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	3.56	1.58
2.23				
C & E Loss (ft)	0.00	Cum SA (acres)	2.60	0.49
0.76				

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.17	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.10	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	16.06	Reach Len. (ft)	35.53	38.71
41.69				
Crit W.S. (ft)		Flow Area (sq ft)	120.26	49.98
162.96				
E.G. Slope (ft/ft)	0.000586	Area (sq ft)	120.26	49.98
162.96				
Q Total (cfs)	613.00	Flow (cfs)	173.46	198.69
240.85				
Top Width (ft)	61.54	Top Width (ft)	23.86	6.00
31.68				
Vel Total (ft/s)	1.84	Avg. Vel. (ft/s)	1.44	3.98
1.48				
Max Chl Dpth (ft)	8.53	Hydr. Depth (ft)	5.04	8.33
5.14				
Conv. Total (cfs)	25316.4	Conv. (cfs)	7163.6	8205.7
9947.0				
Length Wtd. (ft)	38.52	Wetted Per. (ft)	25.58	6.57
33.42				
Min Ch El (ft)	7.53	Shear (lb/sq ft)	0.17	0.28
0.18				
Alpha	1.94	Stream Power (lb/ft s)	169.80	0.00
0.00				
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	13.02	2.99
8.94				
C & E Loss (ft)	0.00	Cum SA (acres)	4.36	0.51
1.39				

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.18	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	20.14	Reach Len. (ft)	35.53	38.71
41.69				
Crit W.S. (ft)		Flow Area (sq ft)	241.59	74.44
310.42				
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	241.59	74.44
310.42				
Q Total (cfs)	728.00	Flow (cfs)	223.53	198.85
305.62				
Top Width (ft)	81.14	Top Width (ft)	34.46	6.00
40.68				
Vel Total (ft/s)	1.16	Avg. Vel. (ft/s)	0.93	2.67

0.98					
Max Chl Dpth (ft)	12.61	Hydr. Depth (ft)	7.01	12.41	
7.63					
Conv. Total (cfs)	58359.4	Conv. (cfs)	17919.4	15940.5	
24499.5					
Length Wtd. (ft)	38.58	Wetted Per. (ft)	36.99	6.57	
43.30					
Min Ch El (ft)	7.53	Shear (lb/sq ft)	0.06	0.11	
0.07					
Alpha	1.94	Stream Power (lb/ft s)	169.80	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	22.14	3.88	
14.76					
C & E Loss (ft)	0.00	Cum SA (acres)	5.39	0.51	
1.68					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.05	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.01	Reach Len. (ft)	35.53	38.71	
41.69					
Crit W.S. (ft)		Flow Area (sq ft)	309.97	85.68	
390.55					
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	309.97	85.68	
390.55					
Q Total (cfs)	846.00	Flow (cfs)	269.71	216.11	
360.18					
Top Width (ft)	89.43	Top Width (ft)	38.55	6.00	
44.88					
Vel Total (ft/s)	1.08	Avg. Vel. (ft/s)	0.87	2.52	
0.92					
Max Chl Dpth (ft)	14.48	Hydr. Depth (ft)	8.04	14.28	
8.70					
Conv. Total (cfs)	78880.2	Conv. (cfs)	25147.1	20150.2	
33582.9					
Length Wtd. (ft)	38.56	Wetted Per. (ft)	41.49	6.57	
47.90					
Min Ch El (ft)	7.53	Shear (lb/sq ft)	0.05	0.09	
0.06					
Alpha	1.92	Stream Power (lb/ft s)	169.80	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	27.78	5.20	
17.80					
C & E Loss (ft)	0.00	Cum SA (acres)	5.86	0.51	
1.89					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51660.15

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	10.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	10.20	Reach Len. (ft)	287.72	291.38	287.64
Crit W.S. (ft)		Flow Area (sq ft)	32.25	15.91	13.58
E.G. Slope (ft/ft)	0.005050	Area (sq ft)	32.25	15.91	13.58
Q Total (cfs)	182.00	Flow (cfs)	69.24	86.58	26.18
Top Width (ft)	33.51	Top Width (ft)	18.56	6.00	8.95
Vel Total (ft/s)	2.95	Avg. Vel. (ft/s)	2.15	5.44	1.93
Max Chl Dpth (ft)	2.86	Hydr. Depth (ft)	1.74	2.65	1.52
Conv. Total (cfs)	2561.1	Conv. (cfs)	974.4	1218.4	368.3
Length Wtd. (ft)	289.48	Wetted Per. (ft)	19.00	6.57	9.40
Min Ch El (ft)	7.34	Shear (lb/sq ft)	0.54	0.76	0.46
Alpha	1.88	Stream Power (lb/ft s)	173.42	0.00	0.00
Frctn Loss (ft)	1.53	Cum Volume (acre-ft)	1.23	1.00	0.77
C & E Loss (ft)	0.00	Cum SA (acres)	1.56	0.46	0.51

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	11.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	11.26	Reach Len. (ft)	287.72	291.38	287.64
Crit W.S. (ft)		Flow Area (sq ft)	53.27	22.32	24.31
E.G. Slope (ft/ft)	0.005065	Area (sq ft)	53.27	22.32	24.31
Q Total (cfs)	359.00	Flow (cfs)	147.35	152.35	59.30
Top Width (ft)	37.97	Top Width (ft)	20.82	6.00	11.15
Vel Total (ft/s)	3.59	Avg. Vel. (ft/s)	2.77	6.83	2.44
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)	2.56	3.72	2.18
Conv. Total (cfs)	5044.6	Conv. (cfs)	2070.5	2140.8	833.3
Length Wtd. (ft)	289.27	Wetted Per. (ft)	21.50	6.57	11.84

Min Ch El (ft)	7.34	Shear (lb/sq ft)	0.78	1.07 0.65
Alpha	1.85	Stream Power (lb/ft s)	173.42	0.00 0.00
Frctn Loss (ft)	1.40	Cum Volume (acre-ft)	3.53	1.56 2.19
C & E Loss (ft)	0.00	Cum SA (acres)	2.58	0.49 0.74

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.14	Element	Left OB	Channel Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	16.05	Reach Len. (ft)	287.72	291.38 287.64
Crit W.S. (ft)		Flow Area (sq ft)	177.17	51.02 118.47
E.G. Slope (ft/ft)	0.000532	Area (sq ft)	177.17	51.02 118.47
Q Total (cfs)	613.00	Flow (cfs)	265.83	195.91 151.26
Top Width (ft)	63.86	Top Width (ft)	31.29	6.00 26.57
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.50	3.84 1.28
Max Chl Dpth (ft)	8.71	Hydr. Depth (ft)	5.66	8.50 4.46
Conv. Total (cfs)	26574.6	Conv. (cfs)	11524.1	8492.9 6557.5
Length Wtd. (ft)	288.81	Wetted Per. (ft)	33.03	6.57 28.14
Min Ch El (ft)	7.34	Shear (lb/sq ft)	0.18	0.26 0.14
Alpha	1.95	Stream Power (lb/ft s)	173.42	0.00 0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	12.90	2.94 8.81
C & E Loss (ft)	0.01	Cum SA (acres)	4.34	0.50 1.36

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.17	Element	Left OB	Channel Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	20.14	Reach Len. (ft)	287.72	291.38

287.64				
Crit W.S. (ft)		Flow Area (sq ft)	357.68	75.57
245.01				
E.G. Slope (ft/ft)	0.000139	Area (sq ft)	357.68	75.57
245.01				
Q Total (cfs)	728.00	Flow (cfs)	322.27	192.60
213.13				
Top Width (ft)	91.09	Top Width (ft)	49.78	6.00
35.31				
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	0.90	2.55
0.87				
Max Chl Dpth (ft)	12.80	Hydr. Depth (ft)	7.19	12.59
6.94				
Conv. Total (cfs)	61779.4	Conv. (cfs)	27348.1	16344.7
18086.6				
Length Wtd. (ft)	288.61	Wetted Per. (ft)	52.32	6.57
37.78				
Min Ch El (ft)	7.34	Shear (lb/sq ft)	0.06	0.10
0.06				
Alpha	2.00	Stream Power (lb/ft s)	173.42	0.00
0.00				
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	21.90	3.81
14.50				
C & E Loss (ft)	0.00	Cum SA (acres)	5.36	0.50
1.65				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.04	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.01	Reach Len. (ft)	287.72	291.38
287.64				
Crit W.S. (ft)		Flow Area (sq ft)	453.84	86.82
315.17				
E.G. Slope (ft/ft)	0.000099	Area (sq ft)	453.84	86.82
315.17				
Q Total (cfs)	846.00	Flow (cfs)	387.44	204.99
253.58				
Top Width (ft)	98.31	Top Width (ft)	52.78	6.00
39.53				
Vel Total (ft/s)	0.99	Avg. Vel. (ft/s)	0.85	2.36
0.80				
Max Chl Dpth (ft)	14.67	Hydr. Depth (ft)	8.60	14.47
7.97				
Conv. Total (cfs)	85011.3	Conv. (cfs)	38931.9	20598.3
25481.2				
Length Wtd. (ft)	288.53	Wetted Per. (ft)	55.87	6.57
42.40				
Min Ch El (ft)	7.34	Shear (lb/sq ft)	0.05	0.08
0.05				
Alpha	1.92	Stream Power (lb/ft s)	173.42	0.00
0.00				
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	27.47	5.13
17.46				
C & E Loss (ft)	0.00	Cum SA (acres)	5.82	0.51
1.85				

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51347.58

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	8.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.65	Reach Len. (ft)	75.64	76.38	77.20
Crit W.S. (ft)		Flow Area (sq ft)	18.50	15.85	24.76
E.G. Slope (ft/ft)	0.005523	Area (sq ft)	18.50	15.85	24.76
Q Total (cfs)	182.00	Flow (cfs)	37.91	89.92	54.18
Top Width (ft)	32.85	Top Width (ft)	12.15	6.00	14.70
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)	2.05	5.67	2.19
Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)	1.52	2.64	1.68
Conv. Total (cfs)	2448.9	Conv. (cfs)	510.1	1209.9	729.0
Length Wtd. (ft)	76.51	Wetted Per. (ft)	12.49	6.57	15.16
Min Ch El (ft)	5.80	Shear (lb/sq ft)	0.51	0.83	0.56
Alpha	1.92	Stream Power (lb/ft s)	220.46	0.00	0.00
Frctn Loss (ft)	0.39	Cum Volume (acre-ft)	1.06	0.89	0.64
C & E Loss (ft)	0.01	Cum SA (acres)	1.46	0.42	0.43

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	10.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.88	Reach Len. (ft)	75.64	76.38	77.20
Crit W.S. (ft)		Flow Area (sq ft)	35.50	23.23	44.40
E.G. Slope (ft/ft)	0.004601	Area (sq ft)	35.50	23.23	44.40
Q Total (cfs)	359.00	Flow (cfs)	86.78	155.27	116.94
Top Width (ft)	38.69	Top Width (ft)	15.48	6.00	17.20
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	2.44	6.68	2.63

Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)	2.29	3.87 2.58
Conv. Total (cfs)	5292.4	Conv. (cfs)	1279.4	2289.0 1724.0
Length Wtd. (ft)	76.51	Wetted Per. (ft)	16.05	6.57 17.94
Min Ch El (ft)	5.80	Shear (lb/sq ft)	0.64	1.02 0.71
Alpha	1.90	Stream Power (lb/ft s)	220.46	0.00 0.00
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	3.23	1.41 1.97
C & E Loss (ft)	0.02	Cum SA (acres)	2.46	0.45 0.65

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.03	Element	Left OB	Channel Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	15.97	Reach Len. (ft)	75.64	76.38 77.20
Crit W.S. (ft)		Flow Area (sq ft)	223.16	59.82 204.68
E.G. Slope (ft/ft)	0.000259	Area (sq ft)	223.16	59.82 204.68
Q Total (cfs)	613.00	Flow (cfs)	221.31	178.13 213.57
Top Width (ft)	86.04	Top Width (ft)	43.64	6.00 36.41
Vel Total (ft/s)	1.26	Avg. Vel. (ft/s)	0.99	2.98 1.04
Max Chl Dpth (ft)	10.17	Hydr. Depth (ft)	5.11	9.97 5.62
Conv. Total (cfs)	38101.8	Conv. (cfs)	13755.7	11071.7 13274.5
Length Wtd. (ft)	76.41	Wetted Per. (ft)	45.10	6.57 38.33
Min Ch El (ft)	5.80	Shear (lb/sq ft)	0.08	0.15 0.09
Alpha	2.10	Stream Power (lb/ft s)	220.46	0.00 0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	11.57	2.57 7.74
C & E Loss (ft)	0.00	Cum SA (acres)	4.09	0.46 1.15

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.14	Element	Left OB	Channel Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	20.12	Reach Len. (ft)	75.64	76.38 77.20
Crit W.S. (ft)		Flow Area (sq ft)	462.52	84.70

377.18					
E.G. Slope (ft/ft)	0.000075	Area (sq ft)	462.52	84.70	
377.18					
Q Total (cfs)	728.00	Flow (cfs)	288.57	171.21	
268.23					
Top Width (ft)	130.95	Top Width (ft)	78.08	6.00	
46.87					
Vel Total (ft/s)	0.79	Avg. Vel. (ft/s)	0.62	2.02	
0.71					
Max Chl Dpth (ft)	14.32	Hydr. Depth (ft)	5.92	14.12	
8.05					
Conv. Total (cfs)	84055.0	Conv. (cfs)	33317.8	19767.6	
30969.6					
Length Wtd. (ft)	76.38	Wetted Per. (ft)	79.88	6.57	
49.58					
Min Ch El (ft)	5.80	Shear (lb/sq ft)	0.03	0.06	
0.04					
Alpha	2.10	Stream Power (lb/ft s)	220.46	0.00	
0.00					
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	19.19	3.28	
12.44					
C & E Loss (ft)	0.00	Cum SA (acres)	4.94	0.46	
1.37					

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.02	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.00	Reach Len. (ft)	75.64	76.38	
77.20					
Crit W.S. (ft)		Flow Area (sq ft)	633.53	95.99	
469.83					
E.G. Slope (ft/ft)	0.000056	Area (sq ft)	633.53	95.99	
469.83					
Q Total (cfs)	846.00	Flow (cfs)	350.57	182.21	
313.22					
Top Width (ft)	152.97	Top Width (ft)	95.40	6.00	
51.57					
Vel Total (ft/s)	0.71	Avg. Vel. (ft/s)	0.55	1.90	
0.67					
Max Chl Dpth (ft)	16.20	Hydr. Depth (ft)	6.64	16.00	
9.11					
Conv. Total (cfs)	113054.9	Conv. (cfs)	46848.2	24349.1	
41857.7					
Length Wtd. (ft)	76.37	Wetted Per. (ft)	97.44	6.57	
54.64					
Min Ch El (ft)	5.80	Shear (lb/sq ft)	0.02	0.05	
0.03					
Alpha	2.15	Stream Power (lb/ft s)	220.46	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	23.88	4.51	
14.87					
C & E Loss (ft)	0.00	Cum SA (acres)	5.33	0.47	
1.55					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51266.45

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	8.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.29	Reach Len. (ft)	157.31	156.29	158.74
Crit W.S. (ft)		Flow Area (sq ft)	16.75	16.09	30.80
E.G. Slope (ft/ft)	0.004731	Area (sq ft)	16.75	16.09	30.80
Q Total (cfs)	182.00	Flow (cfs)	31.41	85.33	65.26
Top Width (ft)	34.21	Top Width (ft)	11.15	6.00	17.06
Vel Total (ft/s)	2.86	Avg. Vel. (ft/s)	1.88	5.30	2.12
Max Chl Dpth (ft)	2.89	Hydr. Depth (ft)	1.50	2.68	1.81
Conv. Total (cfs)	2646.0	Conv. (cfs)	456.7	1240.5	948.9
Length Wtd. (ft)	157.30	Wetted Per. (ft)	11.50	6.57	17.62
Min Ch El (ft)	5.40	Shear (lb/sq ft)	0.43	0.72	0.52
Alpha	1.88	Stream Power (lb/ft s)	197.55	0.00	0.00
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	1.03	0.86	0.59
C & E Loss (ft)	0.01	Cum SA (acres)	1.44	0.41	0.41

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.61	Reach Len. (ft)	157.31	156.29	158.74
Crit W.S. (ft)		Flow Area (sq ft)	33.89	24.02	54.68
E.G. Slope (ft/ft)	0.003690	Area (sq ft)	33.89	24.02	54.68
Q Total (cfs)	359.00	Flow (cfs)	74.09	147.03	137.88
Top Width (ft)	39.81	Top Width (ft)	14.77	6.00	19.04
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	2.19	6.12	2.52

Max Chl Dpth (ft)	4.21	Hydr. Depth (ft)	2.29	4.00	2.87
Conv. Total (cfs)	5910.0	Conv. (cfs)	1219.6	2420.5	2269.8
Length Wtd. (ft)	157.43	Wetted Per. (ft)	15.35	6.57	20.00
Min Ch El (ft)	5.40	Shear (lb/sq ft)	0.51	0.84	0.63
Alpha	1.85	Stream Power (lb/ft s)	197.55	0.00	0.00
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	3.17	1.37	1.88
C & E Loss (ft)	0.02	Cum SA (acres)	2.44	0.44	0.62

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	16.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.96	Reach Len. (ft)	157.31	156.29	158.74
Crit W.S. (ft)		Flow Area (sq ft)	246.44	62.15	233.08
E.G. Slope (ft/ft)	0.000212	Area (sq ft)	246.44	62.15	233.08
Q Total (cfs)	613.00	Flow (cfs)	214.88	171.97	226.15
Top Width (ft)	96.11	Top Width (ft)	50.57	6.00	39.54
Vel Total (ft/s)	1.13	Avg. Vel. (ft/s)	0.87	2.77	0.97
Max Chl Dpth (ft)	10.56	Hydr. Depth (ft)	4.87	10.36	5.89
Conv. Total (cfs)	42060.5	Conv. (cfs)	14743.9	11799.3	15517.3
Length Wtd. (ft)	157.60	Wetted Per. (ft)	52.08	6.57	41.97
Min Ch El (ft)	5.40	Shear (lb/sq ft)	0.06	0.13	0.07
Alpha	2.16	Stream Power (lb/ft s)	197.55	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	11.17	2.47	7.35
C & E Loss (ft)	0.00	Cum SA (acres)	4.01	0.45	1.08

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.12	Reach Len. (ft)	157.31	156.29	158.74
Crit W.S. (ft)		Flow Area (sq ft)	502.92	87.09	

417.76				
E.G. Slope (ft/ft)	0.000058	Area (sq ft)	502.92	87.09
417.76				
Q Total (cfs)	728.00	Flow (cfs)	301.26	157.83
268.91				
Top Width (ft)	123.88	Top Width (ft)	68.49	6.00
49.39				
Vel Total (ft/s)	0.72	Avg. Vel. (ft/s)	0.60	1.81
0.64				
Max Chl Dpth (ft)	14.72	Hydr. Depth (ft)	7.34	14.51
8.46				
Conv. Total (cfs)	95504.3	Conv. (cfs)	39521.6	20705.4
35277.3				
Length Wtd. (ft)	157.66	Wetted Per. (ft)	70.61	6.57
52.65				
Min Ch El (ft)	5.40	Shear (lb/sq ft)	0.03	0.05
0.03				
Alpha	1.94	Stream Power (lb/ft s)	197.55	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	18.35	3.13
11.74				
C & E Loss (ft)	0.00	Cum SA (acres)	4.81	0.45
1.29				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.01	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.00	Reach Len. (ft)	157.31	156.29
158.74				
Crit W.S. (ft)		Flow Area (sq ft)	635.99	98.38
514.97				
E.G. Slope (ft/ft)	0.000043	Area (sq ft)	635.99	98.38
514.97				
Q Total (cfs)	846.00	Flow (cfs)	368.44	167.19
310.37				
Top Width (ft)	132.93	Top Width (ft)	72.98	6.00
53.95				
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)	0.58	1.70
0.60				
Max Chl Dpth (ft)	16.60	Hydr. Depth (ft)	8.71	16.40
9.54				
Conv. Total (cfs)	128366.6	Conv. (cfs)	55904.1	25368.6
47093.9				
Length Wtd. (ft)	157.68	Wetted Per. (ft)	75.48	6.57
57.59				
Min Ch El (ft)	5.40	Shear (lb/sq ft)	0.02	0.04
0.02				
Alpha	1.85	Stream Power (lb/ft s)	197.55	0.00
0.00				
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	22.78	4.34
13.99				
C & E Loss (ft)	0.00	Cum SA (acres)	5.18	0.45
1.45				

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51095.56

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	7.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	7.26	Reach Len. (ft)	65.21	69.49	54.74
Crit W.S. (ft)		Flow Area (sq ft)	16.41	14.36	24.05
E.G. Slope (ft/ft)	0.007484	Area (sq ft)	16.41	14.36	24.05
Q Total (cfs)	182.00	Flow (cfs)	36.64	88.86	56.51
Top Width (ft)	34.23	Top Width (ft)	11.94	6.00	16.29
Vel Total (ft/s)	3.32	Avg. Vel. (ft/s)	2.23	6.19	2.35
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)	1.37	2.39	1.48
Conv. Total (cfs)	2103.8	Conv. (cfs)	423.5	1027.1	653.2
Length Wtd. (ft)	64.00	Wetted Per. (ft)	12.24	6.57	16.62
Min Ch El (ft)	4.66	Shear (lb/sq ft)	0.63	1.02	0.68
Alpha	1.94	Stream Power (lb/ft s)	215.07	0.00	0.00
Frctn Loss (ft)	0.43	Cum Volume (acre-ft)	0.97	0.81	0.49
C & E Loss (ft)	0.02	Cum SA (acres)	1.40	0.39	0.35

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.16	Reach Len. (ft)	65.21	69.49	54.74
Crit W.S. (ft)		Flow Area (sq ft)	43.96	25.78	59.59
E.G. Slope (ft/ft)	0.002699	Area (sq ft)	43.96	25.78	59.59
Q Total (cfs)	359.00	Flow (cfs)	88.97	141.41	128.62
Top Width (ft)	44.10	Top Width (ft)	17.03	6.00	21.07
Vel Total (ft/s)	2.78	Avg. Vel. (ft/s)	2.02	5.49	2.16
Max Chl Dpth (ft)	4.50	Hydr. Depth (ft)	2.58	4.30	2.83

Conv. Total (cfs)	6910.7	Conv. (cfs)	1712.6	2722.1	2476.0
Length Wtd. (ft)	63.14	Wetted Per. (ft)	17.68	6.57	21.76
Min Ch El (ft)	4.66	Shear (lb/sq ft)	0.42	0.66	0.46
Alpha	1.89	Stream Power (lb/ft s)	215.07	0.00	0.00
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	3.03	1.28	1.67
C & E Loss (ft)	0.02	Cum SA (acres)	2.38	0.42	0.54

CROSS SECTION OUTPUT Profile #25-YR

					Right OB
E.G. Elev (ft)	15.97	Element	Left OB	Channel	
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	65.21	69.49	54.74
Crit W.S. (ft)		Flow Area (sq ft)	300.05	66.50	315.04
E.G. Slope (ft/ft)	0.000131	Area (sq ft)	300.05	66.50	315.04
Q Total (cfs)	613.00	Flow (cfs)	212.05	151.13	249.82
Top Width (ft)	116.65	Top Width (ft)	58.93	6.00	51.72
Vel Total (ft/s)	0.90	Avg. Vel. (ft/s)	0.71	2.27	0.79
Max Chl Dpth (ft)	11.29	Hydr. Depth (ft)	5.09	11.08	6.09
Conv. Total (cfs)	53577.4	Conv. (cfs)	18533.7	13208.8	21834.9
Length Wtd. (ft)	61.84	Wetted Per. (ft)	60.45	6.57	53.40
Min Ch El (ft)	4.66	Shear (lb/sq ft)	0.04	0.08	0.05
Alpha	2.10	Stream Power (lb/ft s)	215.07	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	10.18	2.24	6.35
C & E Loss (ft)	0.00	Cum SA (acres)	3.81	0.43	0.92

CROSS SECTION OUTPUT Profile #50-YR

					Right OB
E.G. Elev (ft)	20.13	Element	Left OB	Channel	
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.12	Reach Len. (ft)	65.21	69.49	54.74
Crit W.S. (ft)		Flow Area (sq ft)	566.09	91.51	552.35
E.G. Slope (ft/ft)	0.000037	Area (sq ft)	566.09	91.51	

552.35					
Q Total (cfs)	728.00	Flow (cfs)	292.12	137.09	
298.79					
Top Width (ft)	136.89	Top Width (ft)	68.73	6.00	
62.16					
Vel Total (ft/s)	0.60	Avg. Vel. (ft/s)	0.52	1.50	
0.54					
Max Chl Dpth (ft)	15.46	Hydr. Depth (ft)	8.24	15.25	
8.89					
Conv. Total (cfs)	119408.7	Conv. (cfs)	47914.0	22486.5	
49008.2					
Length Wtd. (ft)	61.58	Wetted Per. (ft)	71.10	6.57	
64.64					
Min Ch El (ft)	4.66	Shear (lb/sq ft)	0.02	0.03	
0.02					
Alpha	1.79	Stream Power (lb/ft s)	215.07	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	16.42	2.81	
9.97					
C & E Loss (ft)	0.00	Cum SA (acres)	4.56	0.43	
1.09					

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.01	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	22.00	Reach Len. (ft)	65.21	69.49	
54.74					
Crit W.S. (ft)		Flow Area (sq ft)	699.61	102.80	
673.77					
E.G. Slope (ft/ft)	0.000029	Area (sq ft)	699.61	102.80	
673.77					
Q Total (cfs)	846.00	Flow (cfs)	350.71	146.66	
348.63					
Top Width (ft)	146.02	Top Width (ft)	73.16	6.00	
66.87					
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.50	1.43	
0.52					
Max Chl Dpth (ft)	17.34	Hydr. Depth (ft)	9.56	17.13	
10.08					
Conv. Total (cfs)	157475.7	Conv. (cfs)	65282.2	27298.9	
64894.6					
Length Wtd. (ft)	61.51	Wetted Per. (ft)	75.91	6.57	
69.71					
Min Ch El (ft)	4.66	Shear (lb/sq ft)	0.02	0.03	
0.02					
Alpha	1.73	Stream Power (lb/ft s)	215.07	0.00	
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	20.36	3.98	
11.83					
C & E Loss (ft)	0.00	Cum SA (acres)	4.92	0.43	
1.23					

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 51024.74

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	7.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	6.87	Reach Len. (ft)	138.44	130.21	138.38
Crit W.S. (ft)		Flow Area (sq ft)	19.63	14.77	25.45
E.G. Slope (ft/ft)	0.006155	Area (sq ft)	19.63	14.77	25.45
Q Total (cfs)	182.00	Flow (cfs)	41.20	84.39	56.41
Top Width (ft)	35.71	Top Width (ft)	13.56	6.00	16.15
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)	2.10	5.71	2.22
Max Chl Dpth (ft)	2.67	Hydr. Depth (ft)	1.45	2.46	1.58
Conv. Total (cfs)	2319.9	Conv. (cfs)	525.1	1075.7	719.0
Length Wtd. (ft)	135.37	Wetted Per. (ft)	13.87	6.57	16.57
Min Ch El (ft)	4.20	Shear (lb/sq ft)	0.54	0.86	0.59
Alpha	1.91	Stream Power (lb/ft s)	247.56	0.00	0.00
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	0.95	0.78	0.46
C & E Loss (ft)	0.06	Cum SA (acres)	1.38	0.38	0.32

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	9.07	Reach Len. (ft)	138.44	130.21	138.38
Crit W.S. (ft)		Flow Area (sq ft)	56.20	27.98	72.29
E.G. Slope (ft/ft)	0.001826	Area (sq ft)	56.20	27.98	72.29
Q Total (cfs)	359.00	Flow (cfs)	100.31	133.30	125.38
Top Width (ft)	52.34	Top Width (ft)	19.66	6.00	26.68
Vel Total (ft/s)	2.29	Avg. Vel. (ft/s)	1.78	4.76	1.73

Max Chl Dpth (ft)	4.87	Hydr. Depth (ft)	2.86	4.66	2.71
Conv. Total (cfs)	8402.0	Conv. (cfs)	2347.7	3119.8	2934.5
Length Wtd. (ft)	136.05	Wetted Per. (ft)	20.36	6.57	27.34
Min Ch El (ft)	4.20	Shear (lb/sq ft)	0.31	0.49	0.30
Alpha	1.97	Stream Power (lb/ft s)	247.56	0.00	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	2.96	1.23	1.59
C & E Loss (ft)	0.04	Cum SA (acres)	2.35	0.41	0.51

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	138.44	130.21	138.38
Crit W.S. (ft)		Flow Area (sq ft)	434.99	69.29	424.33
E.G. Slope (ft/ft)	0.000068	Area (sq ft)	434.99	69.29	424.33
Q Total (cfs)	613.00	Flow (cfs)	241.98	116.37	254.65
Top Width (ft)	145.68	Top Width (ft)	74.76	6.00	64.93
Vel Total (ft/s)	0.66	Avg. Vel. (ft/s)	0.56	1.68	0.60
Max Chl Dpth (ft)	11.75	Hydr. Depth (ft)	5.82	11.55	6.54
Conv. Total (cfs)	74503.8	Conv. (cfs)	29410.7	14143.4	30949.8
Length Wtd. (ft)	137.10	Wetted Per. (ft)	76.52	6.57	66.62
Min Ch El (ft)	4.20	Shear (lb/sq ft)	0.02	0.04	0.03
Alpha	1.85	Stream Power (lb/ft s)	247.56	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	9.63	2.13	5.89
C & E Loss (ft)	0.00	Cum SA (acres)	3.71	0.42	0.84

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.12	Reach Len. (ft)	138.44	130.21	138.38
Crit W.S. (ft)		Flow Area (sq ft)	772.36	94.28	714.60
E.G. Slope (ft/ft)	0.000021	Area (sq ft)	772.36	94.28	714.60
Q Total (cfs)	728.00	Flow (cfs)	314.34	107.88	305.78
Top Width (ft)	167.72	Top Width (ft)	87.28	6.00	74.44
Vel Total (ft/s)	0.46	Avg. Vel. (ft/s)	0.41	1.14	0.43
Max Chl Dpth (ft)	15.92	Hydr. Depth (ft)	8.85	15.71	9.60
Conv. Total (cfs)	159482.2	Conv. (cfs)	68863.1	23632.3	66986.8
Length Wtd. (ft)	137.33	Wetted Per. (ft)	89.73	6.57	77.01
Min Ch El (ft)	4.20	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.62	Stream Power (lb/ft s)	247.56	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	15.42	2.66	9.17
C & E Loss (ft)	0.00	Cum SA (acres)	4.44	0.42	1.00

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.00	Reach Len. (ft)	138.44	130.21	138.38
Crit W.S. (ft)		Flow Area (sq ft)	941.97	105.57	858.74
E.G. Slope (ft/ft)	0.000017	Area (sq ft)	941.97	105.57	858.74
Q Total (cfs)	846.00	Flow (cfs)	373.79	116.16	356.05
Top Width (ft)	177.71	Top Width (ft)	92.97	6.00	78.74
Vel Total (ft/s)	0.44	Avg. Vel. (ft/s)	0.40	1.10	0.41
Max Chl Dpth (ft)	17.80	Hydr. Depth (ft)	10.13	17.60	10.91
Conv. Total (cfs)	207831.8	Conv. (cfs)	91826.7	28535.4	87469.7
Length Wtd. (ft)	137.38	Wetted Per. (ft)	95.72	6.57	81.70
Min Ch El (ft)	4.20	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.56	Stream Power (lb/ft s)	247.56	0.00	0.00

Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	19.14	3.82 10.86
C & E Loss (ft)	0.00	Cum SA (acres)	4.80	0.42 1.14

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50878.95

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	6.55	Element	Left OB	Channel Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	6.47	Reach Len. (ft)	164.59	166.50 177.04
Crit W.S. (ft)		Flow Area (sq ft)	15.76	13.77 75.78
E.G. Slope (ft/ft)	0.002732	Area (sq ft)	15.76	13.77 75.78
Q Total (cfs)	182.00	Flow (cfs)	21.11	50.02 110.86
Top Width (ft)	67.31	Top Width (ft)	11.51	6.00 49.80
Vel Total (ft/s)	1.73	Avg. Vel. (ft/s)	1.34	3.63 1.46
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	1.37	2.29 1.52
Conv. Total (cfs)	3482.0	Conv. (cfs)	403.9	957.0 2121.0
Length Wtd. (ft)	170.81	Wetted Per. (ft)	11.88	6.57 50.06
Min Ch El (ft)	3.97	Shear (lb/sq ft)	0.23	0.36 0.26
Alpha	1.72	Stream Power (lb/ft s)	295.23	0.00 0.00
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	0.89	0.74 0.30
C & E Loss (ft)	0.00	Cum SA (acres)	1.34	0.36 0.22

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.08	Element	Left OB	Channel Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	9.05	Reach Len. (ft)	164.59	166.50 177.04
Crit W.S. (ft)		Flow Area (sq ft)	52.33	29.23 240.84
E.G. Slope (ft/ft)	0.000468	Area (sq ft)	52.33	29.23 240.84

Q Total (cfs)	359.00	Flow (cfs)	47.36	72.58	239.06
Top Width (ft)	98.98	Top Width (ft)	17.97	6.00	75.02
Vel Total (ft/s)	1.11	Avg. Vel. (ft/s)	0.90	2.48	0.99
Max Chl Dpth (ft)	5.08	Hydr. Depth (ft)	2.91	4.87	3.21
Conv. Total (cfs)	16598.9	Conv. (cfs)	2189.7	3356.0	11053.3
Length Wtd. (ft)	171.26	Wetted Per. (ft)	18.91	6.57	75.76
Min Ch El (ft)	3.97	Shear (lb/sq ft)	0.08	0.13	0.09
Alpha	1.62	Stream Power (lb/ft s)	295.23	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	2.79	1.15	1.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.29	0.39	0.35

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	164.59	166.50	177.04
Crit W.S. (ft)		Flow Area (sq ft)	361.44	70.66	801.21
E.G. Slope (ft/ft)	0.000029	Area (sq ft)	361.44	70.66	801.21
Q Total (cfs)	613.00	Flow (cfs)	138.17	78.87	395.96
Top Width (ft)	150.30	Top Width (ft)	57.51	6.00	86.79
Vel Total (ft/s)	0.50	Avg. Vel. (ft/s)	0.38	1.12	0.49
Max Chl Dpth (ft)	11.98	Hydr. Depth (ft)	6.28	11.78	9.23
Conv. Total (cfs)	113588.5	Conv. (cfs)	25603.1	14614.2	73371.2
Length Wtd. (ft)	171.15	Wetted Per. (ft)	59.29	6.57	89.42
Min Ch El (ft)	3.97	Shear (lb/sq ft)	0.01	0.02	0.02
Alpha	1.42	Stream Power (lb/ft s)	295.23	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.36	1.92	3.94
C & E Loss (ft)	0.00	Cum SA (acres)	3.50	0.40	0.60

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel

Right OB				
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	20.12	Reach Len. (ft)	164.59	166.50
177.04				
Crit W.S. (ft)		Flow Area (sq ft)	629.22	95.66
1178.36				
E.G. Slope (ft/ft)	0.000012	Area (sq ft)	629.22	95.66
1178.36				
Q Total (cfs)	728.00	Flow (cfs)	192.02	83.65
452.33				
Top Width (ft)	172.51	Top Width (ft)	71.75	6.00
94.76				
Vel Total (ft/s)	0.38	Avg. Vel. (ft/s)	0.31	0.87
0.38				
Max Chl Dpth (ft)	16.15	Hydr. Depth (ft)	8.77	15.94
12.44				
Conv. Total (cfs)	210689.8	Conv. (cfs)	55572.6	24210.0
130907.1				
Length Wtd. (ft)	170.85	Wetted Per. (ft)	74.14	6.57
98.42				
Min Ch El (ft)	3.97	Shear (lb/sq ft)	0.01	0.01
0.01				
Alpha	1.39	Stream Power (lb/ft s)	295.23	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	13.19	2.38
6.17				
C & E Loss (ft)	0.00	Cum SA (acres)	4.19	0.41
0.73				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.00	Reach Len. (ft)	164.59	166.50
177.04				
Crit W.S. (ft)		Flow Area (sq ft)	777.72	106.95
1360.32				
E.G. Slope (ft/ft)	0.000011	Area (sq ft)	777.72	106.95
1360.32				
Q Total (cfs)	846.00	Flow (cfs)	227.69	94.49
523.82				
Top Width (ft)	190.69	Top Width (ft)	86.07	6.00
98.62				
Vel Total (ft/s)	0.38	Avg. Vel. (ft/s)	0.29	0.88
0.39				
Max Chl Dpth (ft)	18.03	Hydr. Depth (ft)	9.04	17.82
13.79				
Conv. Total (cfs)	261053.0	Conv. (cfs)	70257.7	29158.0
161637.4				
Length Wtd. (ft)	170.32	Wetted Per. (ft)	88.58	6.57
102.72				
Min Ch El (ft)	3.97	Shear (lb/sq ft)	0.01	0.01
0.01				
Alpha	1.42	Stream Power (lb/ft s)	295.23	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	16.40	3.50
7.34				

C & E Loss (ft)	0.00	Cum SA (acres)	4.51	0.41	0.86

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50668.61

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	5.79	Reach Len. (ft)	42.56	58.43	76.59
Crit W.S. (ft)		Flow Area (sq ft)	42.52	11.66	32.50
E.G. Slope (ft/ft)	0.005302	Area (sq ft)	42.52	11.66	32.50
Q Total (cfs)	182.00	Flow (cfs)	73.86	52.82	55.32
Top Width (ft)	69.33	Top Width (ft)	35.40	6.00	27.92
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)	1.74	4.53	1.70
Max Chl Dpth (ft)	2.15	Hydr. Depth (ft)	1.20	1.94	1.16
Conv. Total (cfs)	2499.6	Conv. (cfs)	1014.4	725.4	759.7
Length Wtd. (ft)	57.71	Wetted Per. (ft)	35.68	6.57	28.12
Min Ch El (ft)	3.64	Shear (lb/sq ft)	0.39	0.59	0.38
Alpha	1.83	Stream Power (lb/ft s)	387.12	0.00	0.00
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	0.78	0.69	0.08
C & E Loss (ft)	0.01	Cum SA (acres)	1.25	0.34	0.06

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	9.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	8.98	Reach Len. (ft)	42.56	58.43	76.59
Crit W.S. (ft)		Flow Area (sq ft)	166.24	30.80	139.59

E.G. Slope (ft/ft)	0.000364	Area (sq ft)	166.24	30.80	139.59
Q Total (cfs)	359.00	Flow (cfs)	165.54	69.91	123.55
Top Width (ft)	90.60	Top Width (ft)	42.14	6.00	42.46
Vel Total (ft/s)	1.07	Avg. Vel. (ft/s)	1.00	2.27	0.89
Max Chl Dpth (ft)	5.34	Hydr. Depth (ft)	3.94	5.13	3.29
Conv. Total (cfs)	18809.8	Conv. (cfs)	8673.7	3662.9	6473.1
Length Wtd. (ft)	58.22	Wetted Per. (ft)	43.14	6.57	43.23
Min Ch El (ft)	3.64	Shear (lb/sq ft)	0.09	0.11	0.07
Alpha	1.52	Stream Power (lb/ft s)	387.12	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.37	1.03	0.32
C & E Loss (ft)	0.00	Cum SA (acres)	2.18	0.37	0.11

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.95	Reach Len. (ft)	42.56	58.43	76.59
Crit W.S. (ft)		Flow Area (sq ft)	881.94	72.62	487.70
E.G. Slope (ft/ft)	0.000026	Area (sq ft)	881.94	72.62	519.28
Q Total (cfs)	613.00	Flow (cfs)	309.22	78.12	225.66
Top Width (ft)	225.71	Top Width (ft)	150.31	6.00	69.40
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)	0.35	1.08	0.46
Max Chl Dpth (ft)	12.31	Hydr. Depth (ft)	5.87	12.10	9.15
Conv. Total (cfs)	120022.0	Conv. (cfs)	60543.5	15294.5	44184.0
Length Wtd. (ft)	57.09	Wetted Per. (ft)	151.65	6.57	55.31
Min Ch El (ft)	3.64	Shear (lb/sq ft)	0.01	0.02	0.01
Alpha	1.60	Stream Power (lb/ft s)	387.12	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	6.01	1.64	1.26
C & E Loss (ft)	0.00	Cum SA (acres)	3.11	0.38	0.29

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	20.12	Reach Len. (ft)	42.56	58.43
76.59				
Crit W.S. (ft)		Flow Area (sq ft)	1683.99	97.63
710.02				
E.G. Slope (ft/ft)	0.000010	Area (sq ft)	1683.99	97.63
826.76				
Q Total (cfs)	728.00	Flow (cfs)	395.01	77.46
255.53				
Top Width (ft)	332.02	Top Width (ft)	247.87	6.00
78.15				
Vel Total (ft/s)	0.29	Avg. Vel. (ft/s)	0.23	0.79
0.36				
Max Chl Dpth (ft)	16.48	Hydr. Depth (ft)	6.79	16.27
13.31				
Conv. Total (cfs)	235406.0	Conv. (cfs)	127730.5	25048.0
82627.5				
Length Wtd. (ft)	55.71	Wetted Per. (ft)	249.32	6.57
55.31				
Min Ch El (ft)	3.64	Shear (lb/sq ft)	0.00	0.01
0.01				
Alpha	1.67	Stream Power (lb/ft s)	387.12	0.00
0.00				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.82	2.01
2.09				
C & E Loss (ft)	0.00	Cum SA (acres)	3.59	0.38
0.38				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	22.00	Reach Len. (ft)	42.56	58.43
76.59				
Crit W.S. (ft)		Flow Area (sq ft)	2159.92	108.92
837.99				
E.G. Slope (ft/ft)	0.000008	Area (sq ft)	2159.92	108.92
978.16				
Q Total (cfs)	846.00	Flow (cfs)	533.48	85.15
227.38				
Top Width (ft)	346.51	Top Width (ft)	257.80	6.00
82.71				
Vel Total (ft/s)	0.27	Avg. Vel. (ft/s)	0.25	0.78
0.27				
Max Chl Dpth (ft)	18.36	Hydr. Depth (ft)	8.38	18.15
10.13				
Conv. Total (cfs)	298683.8	Conv. (cfs)	188346.1	30061.4
80276.2				
Length Wtd. (ft)	51.93	Wetted Per. (ft)	259.42	6.57
87.41				
Min Ch El (ft)	3.64	Shear (lb/sq ft)	0.00	0.01
0.00				
Alpha	1.62	Stream Power (lb/ft s)	387.12	0.00
0.00				

Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	10.85	3.09
2.59				
C & E Loss (ft)	0.00	Cum SA (acres)	3.86	0.38
0.49				

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50602.30

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.73	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.09	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	5.64	Reach Len. (ft)	106.59	65.99
38.98				
Crit W.S. (ft)		Flow Area (sq ft)	47.05	17.30
39.09				
E.G. Slope (ft/ft)	0.001921	Area (sq ft)	47.05	17.30
39.09				
Q Total (cfs)	182.00	Flow (cfs)	67.37	60.98
53.65				
Top Width (ft)	51.64	Top Width (ft)	24.16	6.00
21.48				
Vel Total (ft/s)	1.76	Avg. Vel. (ft/s)	1.43	3.52
1.37				
Max Chl Dpth (ft)	3.10	Hydr. Depth (ft)	1.95	2.88
1.82				
Conv. Total (cfs)	4152.3	Conv. (cfs)	1537.1	1391.2
1224.0				
Length Wtd. (ft)	75.38	Wetted Per. (ft)	24.64	6.64
21.82				
Min Ch El (ft)	2.54	Shear (lb/sq ft)	0.23	0.31
0.21				
Alpha	1.77	Stream Power (lb/ft s)	446.53	0.00
0.00				
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.74	0.67
0.02				
C & E Loss (ft)	0.00	Cum SA (acres)	1.22	0.33
0.02				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	8.98	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	8.95	Reach Len. (ft)	106.59	65.99
38.98				

Crit W.S. (ft)		Flow Area (sq ft)	138.73	37.16	136.72
E.G. Slope (ft/ft)	0.000315	Area (sq ft)	138.73	37.16	138.61
Q Total (cfs)	359.00	Flow (cfs)	137.64	88.26	133.10
Top Width (ft)	73.75	Top Width (ft)	31.25	6.00	36.50
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)	0.99	2.38	0.97
Max Chl Dpth (ft)	6.41	Hydr. Depth (ft)	4.44	6.19	4.26
Conv. Total (cfs)	20227.7	Conv. (cfs)	7755.2	4973.1	7499.3
Length Wtd. (ft)	75.98	Wetted Per. (ft)	32.46	6.64	32.91
Min Ch El (ft)	2.54	Shear (lb/sq ft)	0.08	0.11	0.08
Alpha	1.60	Stream Power (lb/ft s)	446.53	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.22	0.99	0.07
C & E Loss (ft)	0.00	Cum SA (acres)	2.14	0.36	0.04

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	15.94	Reach Len. (ft)	106.59	65.99	38.98
Crit W.S. (ft)		Flow Area (sq ft)	799.98	79.10	360.84
E.G. Slope (ft/ft)	0.000032	Area (sq ft)	799.98	79.10	529.04
Q Total (cfs)	613.00	Flow (cfs)	298.59	99.57	214.84
Top Width (ft)	226.64	Top Width (ft)	145.55	6.00	75.09
Vel Total (ft/s)	0.49	Avg. Vel. (ft/s)	0.37	1.26	0.60
Max Chl Dpth (ft)	13.40	Hydr. Depth (ft)	5.50	13.18	11.26
Conv. Total (cfs)	107855.0	Conv. (cfs)	52535.1	17519.1	37800.8
Length Wtd. (ft)	79.15	Wetted Per. (ft)	147.02	6.64	32.91
Min Ch El (ft)	2.54	Shear (lb/sq ft)	0.01	0.02	0.02
Alpha	1.84	Stream Power (lb/ft s)	446.53	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	5.19	1.54	0.34
C & E Loss (ft)	0.00	Cum SA (acres)	2.96	0.37	0.16

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	20.11	Reach Len. (ft)	106.59	65.99	38.98
Crit W.S. (ft)		Flow Area (sq ft)	1572.97	104.13	494.57
E.G. Slope (ft/ft)	0.000012	Area (sq ft)	1572.97	104.13	882.63
Q Total (cfs)	728.00	Flow (cfs)	404.89	97.68	225.43
Top Width (ft)	345.54	Top Width (ft)	245.09	6.00	94.45
Vel Total (ft/s)	0.34	Avg. Vel. (ft/s)	0.26	0.94	0.46
Max Chl Dpth (ft)	17.57	Hydr. Depth (ft)	6.42	17.36	15.43
Conv. Total (cfs)	206448.0	Conv. (cfs)	114819.9	27700.4	63927.7
Length Wtd. (ft)	81.28	Wetted Per. (ft)	246.67	6.64	32.91
Min Ch El (ft)	2.54	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	1.95	Stream Power (lb/ft s)	446.53	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	7.23	1.87	0.59
C & E Loss (ft)	0.00	Cum SA (acres)	3.35	0.37	0.23

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	22.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	22.00	Reach Len. (ft)	106.59	65.99	38.98
Crit W.S. (ft)		Flow Area (sq ft)	2043.55	115.43	622.17
E.G. Slope (ft/ft)	0.000012	Area (sq ft)	2043.55	115.43	1068.68
Q Total (cfs)	846.00	Flow (cfs)	587.73	111.73	146.54
Top Width (ft)	364.04	Top Width (ft)	254.84	6.00	103.19
Vel Total (ft/s)	0.30	Avg. Vel. (ft/s)	0.29	0.97	0.24

Max Chl Dpth (ft)	19.46	Hydr. Depth (ft)	8.02	19.24	6.03
Conv. Total (cfs)	249013.5	Conv. (cfs)	172993.5	32887.3	43132.6
Length Wtd. (ft)	81.96	Wetted Per. (ft)	256.61	6.64	105.42
Min Ch El (ft)	2.54	Shear (lb/sq ft)	0.01	0.01	0.00
Alpha	2.06	Stream Power (lb/ft s)	446.53	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	8.80	2.94	0.79
C & E Loss (ft)	0.01	Cum SA (acres)	3.61	0.37	0.33

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50541.89

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.069	0.035	
W.S. Elev (ft)	5.58	Reach Len. (ft)	123.44	126.44	123.05
Crit W.S. (ft)	3.30	Flow Area (sq ft)	51.34	52.19	
E.G. Slope (ft/ft)	0.000545	Area (sq ft)	88.57	55.85	2.75
Q Total (cfs)	182.00	Flow (cfs)	52.53	129.47	
Top Width (ft)	49.73	Top Width (ft)	34.06	13.41	2.26
Vel Total (ft/s)	1.76	Avg. Vel. (ft/s)	1.02	2.48	
Max Chl Dpth (ft)	5.56	Hydr. Depth (ft)	2.91	4.24	
Conv. Total (cfs)	7796.2	Conv. (cfs)	2250.0	5546.2	
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.76	13.18	
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.10	0.13	
Alpha	1.51	Stream Power (lb/ft s)	433.21	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.57	0.62	0.00
C & E Loss (ft)		Cum SA (acres)	1.15	0.32	0.01

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	8.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.069	0.035	
W.S. Elev (ft)	8.89	Reach Len. (ft)	123.44	126.44	123.05
Crit W.S. (ft)	4.04	Flow Area (sq ft)	109.77	92.89	
E.G. Slope (ft/ft)	0.000255	Area (sq ft)	322.78	100.22	17.36
Q Total (cfs)	359.00	Flow (cfs)	127.65	231.35	
Top Width (ft)	109.39	Top Width (ft)	87.43	13.41	8.55
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.16	2.49	
Max Chl Dpth (ft)	8.87	Hydr. Depth (ft)	6.22	7.55	
Conv. Total (cfs)	22495.9	Conv. (cfs)	7999.2	14496.7	
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.76	13.18	
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.10	0.11	
Alpha	1.43	Stream Power (lb/ft s)	433.21	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	1.66	0.88	0.00
C & E Loss (ft)		Cum SA (acres)	2.00	0.34	0.02

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	15.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.069	0.035	
W.S. Elev (ft)	15.89	Reach Len. (ft)	123.44	126.44	123.05
Crit W.S. (ft)	4.87	Flow Area (sq ft)	233.47	179.05	
E.G. Slope (ft/ft)	0.000074	Area (sq ft)	1002.12	194.15	174.22
Q Total (cfs)	613.00	Flow (cfs)	241.65	371.35	
Top Width (ft)	152.11	Top Width (ft)	106.54	13.41	32.16
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	1.04	2.07	
Max Chl Dpth (ft)	15.87	Hydr. Depth (ft)	13.22	14.56	
Conv. Total (cfs)	71441.1	Conv. (cfs)	28163.1	43278.0	
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.76	13.18	
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.06	0.06	

Alpha	1.37	Stream Power (lb/ft s)	433.21	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	2.99	1.34
0.02				
C & E Loss (ft)		Cum SA (acres)	2.65	0.36
0.11				

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	20.11	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.04	Wt. n-Val.	0.069	0.035
W.S. Elev (ft)	20.07	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	5.21	Flow Area (sq ft)	307.27	230.44
E.G. Slope (ft/ft)	0.000043	Area (sq ft)	1496.52	250.18
340.96				
Q Total (cfs)	728.00	Flow (cfs)	293.51	434.49
Top Width (ft)	215.86	Top Width (ft)	144.30	13.41
58.16				
Vel Total (ft/s)	1.35	Avg. Vel. (ft/s)	0.96	1.89
Max Chl Dpth (ft)	20.05	Hydr. Depth (ft)	17.40	18.74
Conv. Total (cfs)	110425.9	Conv. (cfs)	44520.0	65905.9
Length Wtd. (ft)	126.44	Wetted Per. (ft)	17.76	13.18
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.05	0.05
Alpha	1.36	Stream Power (lb/ft s)	433.21	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	3.47	1.60
0.04				
C & E Loss (ft)		Cum SA (acres)	2.87	0.36
0.16				

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	21.99	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.08	Wt. n-Val.	0.066	0.035
0.070				
W.S. Elev (ft)	21.91	Reach Len. (ft)	123.44	126.44
123.05				
Crit W.S. (ft)	5.53	Flow Area (sq ft)	502.79	254.04
78.55				
E.G. Slope (ft/ft)	0.000083	Area (sq ft)	1830.05	274.83
484.21				
Q Total (cfs)	846.00	Flow (cfs)	183.73	649.55
12.73				
Top Width (ft)	329.73	Top Width (ft)	218.61	13.41
97.71				

Vel Total (ft/s)	1.01	Avg. Vel. (ft/s)	0.37	2.56	0.16
Max Chl Dpth (ft)	21.89	Hydr. Depth (ft)	2.30	18.94	0.80
Conv. Total (cfs)	92774.4	Conv. (cfs)	20148.1	71230.8	1395.6
Length Wtd. (ft)	126.44	Wetted Per. (ft)	221.34	14.97	102.59
Min Ch El (ft)	0.02	Shear (lb/sq ft)	0.01	0.09	0.00
Alpha	4.92	Stream Power (lb/ft s)	433.21	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	4.06	2.64	0.09
C & E Loss (ft)		Cum SA (acres)	3.03	0.36	0.24

CULVERT

RIVER: 99
REACH: PRBLHEC RS: 50468.04

CULVERT OUTPUT Profile #2-YR Culv Group: Culvert #1

Q Culv Group (cfs)	182.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	4.63
Q Barrel (cfs)	91.00	Culv Vel DS (ft/s)	4.63
E.G. US. (ft)	5.65	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	5.58	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	5.14	Culv Frctn Ls (ft)	0.13
W.S. DS (ft)	5.12	Culv Exit Loss (ft)	0.31
Delta EG (ft)	0.52	Culv Entr Loss (ft)	0.07
Delta WS (ft)	0.46	Q Weir (cfs)	
E.G. IC (ft)	3.42	Weir Sta Lft (ft)	
E.G. OC (ft)	5.65	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.71	Min El Weir Flow (ft)	22.04

CULVERT OUTPUT Profile #10-YR Culv Group: Culvert #1

Q Culv Group (cfs)	359.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	9.14
Q Barrel (cfs)	179.50	Culv Vel DS (ft/s)	9.14
E.G. US. (ft)	8.96	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	8.89	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	6.93	Culv Frctn Ls (ft)	0.52
W.S. DS (ft)	6.88	Culv Exit Loss (ft)	1.25
Delta EG (ft)	2.03	Culv Entr Loss (ft)	0.26
Delta WS (ft)	2.01	Q Weir (cfs)	
E.G. IC (ft)	6.07	Weir Sta Lft (ft)	
E.G. OC (ft)	8.96	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	

Culv Crt Depth (ft)	3.84	Min El Weir Flow (ft)	22.04

CULVERT OUTPUT Profile #25-YR Culv Group: Culvert #1

Q Culv Group (cfs)	613.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	15.61
Q Barrel (cfs)	306.50	Culv Vel DS (ft/s)	15.61
E.G. US. (ft)	15.94	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	15.89	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	9.95	Culv Frctn Ls (ft)	1.52
W.S. DS (ft)	9.88	Culv Exit Loss (ft)	3.71
Delta EG (ft)	5.99	Culv Entr Loss (ft)	0.76
Delta WS (ft)	6.02	Q Weir (cfs)	
E.G. IC (ft)	12.14	Weir Sta Lft (ft)	
E.G. OC (ft)	15.94	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CULVERT OUTPUT Profile #50-YR Culv Group: Culvert #1

Q Culv Group (cfs)	728.00	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	18.54
Q Barrel (cfs)	364.00	Culv Vel DS (ft/s)	18.54
E.G. US. (ft)	20.11	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	20.07	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	11.64	Culv Frctn Ls (ft)	2.15
W.S. DS (ft)	11.56	Culv Exit Loss (ft)	5.26
Delta EG (ft)	8.48	Culv Entr Loss (ft)	1.07
Delta WS (ft)	8.51	Q Weir (cfs)	
E.G. IC (ft)	15.93	Weir Sta Lft (ft)	
E.G. OC (ft)	20.11	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	632.69	Culv Full Len (ft)	109.89
# Barrels	2	Culv Vel US (ft/s)	16.11
Q Barrel (cfs)	316.34	Culv Vel DS (ft/s)	16.11
E.G. US. (ft)	21.99	Culv Inv El Up (ft)	-0.52
W.S. US. (ft)	21.91	Culv Inv El Dn (ft)	-1.65
E.G. DS (ft)	15.59	Culv Frctn Ls (ft)	1.62
W.S. DS (ft)	15.53	Culv Exit Loss (ft)	3.97
Delta EG (ft)	6.40	Culv Entr Loss (ft)	0.81

Delta WS (ft)	6.38	Q Weir (cfs)	658.01
E.G. IC (ft)	20.46	Weir Sta Lft (ft)	0.40
E.G. OC (ft)	21.99	Weir Sta Rgt (ft)	335.00
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	4.48	Weir Max Depth (ft)	0.97
Culv WS Outlet (ft)	3.35	Weir Avg Depth (ft)	0.82
Culv Nml Depth (ft)	5.00	Weir Flow Area (sq ft)	274.52
Culv Crt Depth (ft)	5.00	Min El Weir Flow (ft)	22.04

Warning: During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of
energy within the specified tolerance and number of trials. The program used the solution with the minimum error.
Warning: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet
energy grade answer may not be valid.
Warning: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported
outlet energy grade answer may not be valid.
Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50418.36

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.035	
W.S. Elev (ft)	5.12	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	-0.38	Flow Area (sq ft)		163.54	
E.G. Slope (ft/ft)	0.000066	Area (sq ft)		178.84	
Q Total (cfs)	182.00	Flow (cfs)		182.00	
Top Width (ft)	38.33	Top Width (ft)		38.33	
Vel Total (ft/s)	1.11	Avg. Vel. (ft/s)		1.11	
Max Chl Dpth (ft)	8.13	Hydr. Depth (ft)		6.27	
Conv. Total (cfs)	22342.5	Conv. (cfs)		22342.5	
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33	
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.57	0.53	0.00

C & E Loss (ft)	0.00	Cum SA (acres)	1.10	0.24	0.00

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	6.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.035	
W.S. Elev (ft)	6.88	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	0.50	Flow Area (sq ft)		209.43	
E.G. Slope (ft/ft)	0.000113	Area (sq ft)	135.26	249.73	
Q Total (cfs)	359.00	Flow (cfs)		359.00	
Top Width (ft)	166.03	Top Width (ft)	124.54	41.49	
Vel Total (ft/s)	1.71	Avg. Vel. (ft/s)		1.71	
Max Chl Dpth (ft)	9.89	Hydr. Depth (ft)		8.03	
Conv. Total (cfs)	33740.4	Conv. (cfs)		33740.4	
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33	
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1.66	0.72	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	1.70	0.26	0.01

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	9.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.035	
W.S. Elev (ft)	9.88	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	1.34	Flow Area (sq ft)		287.61	
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	562.23	378.78	14.12
Q Total (cfs)	613.00	Flow (cfs)		613.00	
Top Width (ft)	222.02	Top Width (ft)	163.00	43.39	

15.63					
Vel Total (ft/s)	2.13	Avg. Vel. (ft/s)			2.13
Max Chl Dpth (ft)	12.89	Hydr. Depth (ft)			11.03
Conv. Total (cfs)	57247.0	Conv. (cfs)			57247.0
Length Wtd. (ft)	27.31	Wetted Per. (ft)			28.33
Min Ch El (ft)	-3.01	Shear (lb/sq ft)			0.07
Alpha	1.00	Stream Power (lb/ft s)	287.93		0.00
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	2.99		0.95
0.02					
C & E Loss (ft)	0.00	Cum SA (acres)	2.27		0.28
0.04					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	11.64	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.07	Wt. n-Val.			0.035
W.S. Elev (ft)	11.56	Reach Len. (ft)	26.22		27.31
28.13					
Crit W.S. (ft)	1.69	Flow Area (sq ft)			331.46
E.G. Slope (ft/ft)	0.000101	Area (sq ft)	842.75		451.77
42.75					
Q Total (cfs)	728.00	Flow (cfs)			728.00
Top Width (ft)	231.07	Top Width (ft)	169.28		43.39
18.40					
Vel Total (ft/s)	2.20	Avg. Vel. (ft/s)			2.20
Max Chl Dpth (ft)	14.57	Hydr. Depth (ft)			12.71
Conv. Total (cfs)	72521.5	Conv. (cfs)			72521.5
Length Wtd. (ft)	27.31	Wetted Per. (ft)			28.33
Min Ch El (ft)	-3.01	Shear (lb/sq ft)			0.07
Alpha	1.00	Stream Power (lb/ft s)	287.93		0.00
0.00					
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	3.47		1.04
0.04					
C & E Loss (ft)	0.00	Cum SA (acres)	2.43		0.28
0.05					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	15.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.035	
W.S. Elev (ft)	15.53	Reach Len. (ft)	26.22	27.31	28.13
Crit W.S. (ft)	2.01	Flow Area (sq ft)		434.97	
E.G. Slope (ft/ft)	0.000055	Area (sq ft)	1537.88	624.04	128.83
Q Total (cfs)	846.00	Flow (cfs)		846.00	
Top Width (ft)	249.27	Top Width (ft)	180.88	43.39	25.01
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)		1.94	
Max Chl Dpth (ft)	18.54	Hydr. Depth (ft)		16.68	
Conv. Total (cfs)	114070.8	Conv. (cfs)		114070.8	
Length Wtd. (ft)	27.31	Wetted Per. (ft)		28.33	
Min Ch El (ft)	-3.01	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)	287.93	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	4.06	1.19	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	2.47	0.28	0.07

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50391.33

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	5.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	5.12	Reach Len. (ft)	97.79	98.48	98.80
Crit W.S. (ft)	0.35	Flow Area (sq ft)		156.59	1.32
E.G. Slope (ft/ft)	0.000078	Area (sq ft)	0.07	178.14	3.45
Q Total (cfs)	182.00	Flow (cfs)		181.66	0.34
Top Width (ft)	36.88	Top Width (ft)	0.41	33.21	3.26
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)		1.16	

0.26					
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)			5.70
1.89					
Conv. Total (cfs)	20578.2	Conv. (cfs)			20540.0
38.1					
Length Wtd. (ft)	98.48	Wetted Per. (ft)			28.83
0.83					
Min Ch El (ft)	-1.30	Shear (lb/sq ft)			0.03
0.01					
Alpha	1.01	Stream Power (lb/ft s)	119.70		0.00
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)	0.57		0.42
C & E Loss (ft)		Cum SA (acres)	1.10		0.22
0.00					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	6.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.88	Reach Len. (ft)	97.79	98.48	98.80
Crit W.S. (ft)	1.04	Flow Area (sq ft)		204.91	
2.55					
E.G. Slope (ft/ft)	0.000124	Area (sq ft)	6.48	236.56	
11.76					
Q Total (cfs)	359.00	Flow (cfs)		357.73	
1.27					
Top Width (ft)	45.28	Top Width (ft)	5.97	33.21	
6.10					
Vel Total (ft/s)	1.73	Avg. Vel. (ft/s)		1.75	
0.50					
Max Chl Dpth (ft)	8.18	Hydr. Depth (ft)		7.46	
3.65					
Conv. Total (cfs)	32270.9	Conv. (cfs)		32156.7	
114.2					
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83	
0.83					
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.05	
0.02					
Alpha	1.01	Stream Power (lb/ft s)	119.70	0.00	
0.00					
Frctn Loss (ft)		Cum Volume (acre-ft)	1.62	0.57	
0.00					
C & E Loss (ft)		Cum SA (acres)	1.66	0.24	
0.01					

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	9.95	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	9.88	Reach Len. (ft)	97.79	98.48
98.80				
Crit W.S. (ft)	1.84	Flow Area (sq ft)		287.36
4.65				
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	32.17	336.24
36.19				
Q Total (cfs)	613.00	Flow (cfs)		609.65
3.35				
Top Width (ft)	54.54	Top Width (ft)	11.15	33.21
10.18				
Vel Total (ft/s)	2.10	Avg. Vel. (ft/s)		2.12
0.72				
Max Chl Dpth (ft)	11.18	Hydr. Depth (ft)		10.46
6.65				
Conv. Total (cfs)	56808.7	Conv. (cfs)		56498.0
310.7				
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83
0.83				
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.07
0.04				
Alpha	1.02	Stream Power (lb/ft s)	119.70	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	2.81	0.72
0.00				
C & E Loss (ft)		Cum SA (acres)	2.22	0.25
0.04				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	11.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	11.56	Reach Len. (ft)	97.79	98.48
98.80				
Crit W.S. (ft)	2.16	Flow Area (sq ft)		333.59
5.83				
E.G. Slope (ft/ft)	0.000100	Area (sq ft)	53.37	392.13
55.26				
Q Total (cfs)	728.00	Flow (cfs)		723.48
4.52				
Top Width (ft)	59.73	Top Width (ft)	14.05	33.21
12.48				
Vel Total (ft/s)	2.14	Avg. Vel. (ft/s)		2.17
0.77				
Max Chl Dpth (ft)	12.86	Hydr. Depth (ft)		12.14
8.33				
Conv. Total (cfs)	72899.7	Conv. (cfs)		72447.2
452.5				
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83
0.83				
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.07
0.04				

Alpha	1.02	Stream Power (lb/ft s)	119.70	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	3.20	0.77
0.01				
C & E Loss (ft)		Cum SA (acres)	2.37	0.25
0.04				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	15.59	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.06	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	15.53	Reach Len. (ft)	97.79	98.48
98.80				
Crit W.S. (ft)	2.48	Flow Area (sq ft)		442.71
8.61				
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	121.53	524.05
115.55				
Q Total (cfs)	846.00	Flow (cfs)		839.73
6.27				
Top Width (ft)	71.27	Top Width (ft)	20.18	33.21
17.88				
Vel Total (ft/s)	1.87	Avg. Vel. (ft/s)		1.90
0.73				
Max Chl Dpth (ft)	16.83	Hydr. Depth (ft)		16.12
12.30				
Conv. Total (cfs)	116971.8	Conv. (cfs)		116105.2
866.6				
Length Wtd. (ft)	98.48	Wetted Per. (ft)		28.83
0.83				
Min Ch El (ft)	-1.30	Shear (lb/sq ft)		0.05
0.03				
Alpha	1.02	Stream Power (lb/ft s)	119.70	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)	3.56	0.83
0.01				
C & E Loss (ft)		Cum SA (acres)	2.40	0.25
0.05				

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: 99
REACH: PRBLHEC RS: 50341.60

CULVERT OUTPUT Profile #2-YR Culv Group: Culvert #1

Q Culv Group (cfs)	182.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	4.46
Q Barrel (cfs)	182.00	Culv Vel DS (ft/s)	4.07

E.G. US. (ft)	5.14	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	5.12	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	4.83	Culv Frctn Ls (ft)	0.04
W.S. DS (ft)	4.78	Culv Exit Loss (ft)	0.21
Delta EG (ft)	0.31	Culv Entr Loss (ft)	0.06
Delta WS (ft)	0.33	Q Weir (cfs)	
E.G. IC (ft)	3.68	Weir Sta Lft (ft)	
E.G. OC (ft)	5.14	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	4.77	Weir Max Depth (ft)	
Culv WS Outlet (ft)	4.78	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.09	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.52	Min El Weir Flow (ft)	21.68

CULVERT OUTPUT Profile #10-YR Culv Group: Culvert #1

Q Culv Group (cfs)	359.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	7.48
Q Barrel (cfs)	359.00	Culv Vel DS (ft/s)	7.48
E.G. US. (ft)	6.92	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	6.88	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	5.82	Culv Frctn Ls (ft)	0.17
W.S. DS (ft)	5.71	Culv Exit Loss (ft)	0.76
Delta EG (ft)	1.10	Culv Entr Loss (ft)	0.17
Delta WS (ft)	1.16	Q Weir (cfs)	
E.G. IC (ft)	6.08	Weir Sta Lft (ft)	
E.G. OC (ft)	6.92	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)		Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	3.97	Min El Weir Flow (ft)	21.68

CULVERT OUTPUT Profile #25-YR Culv Group: Culvert #1

Q Culv Group (cfs)	613.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	12.77
Q Barrel (cfs)	613.00	Culv Vel DS (ft/s)	12.77
E.G. US. (ft)	9.95	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	9.88	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	6.66	Culv Frctn Ls (ft)	0.49
W.S. DS (ft)	6.42	Culv Exit Loss (ft)	2.30
Delta EG (ft)	3.29	Culv Entr Loss (ft)	0.51
Delta WS (ft)	3.46	Q Weir (cfs)	
E.G. IC (ft)	10.47	Weir Sta Lft (ft)	
E.G. OC (ft)	9.95	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.07	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	5.67	Min El Weir Flow (ft)	21.68

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet
equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #50-YR Culv Group: Culvert #1

Q Culv Group (cfs)	728.00	Culv Full Len (ft)	79.98
# Barrels	1	Culv Vel US (ft/s)	15.17
Q Barrel (cfs)	728.00	Culv Vel DS (ft/s)	15.17
E.G. US. (ft)	11.63	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	11.56	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	6.97	Culv Frctn Ls (ft)	0.69
W.S. DS (ft)	6.66	Culv Exit Loss (ft)	3.27
Delta EG (ft)	4.67	Culv Entr Loss (ft)	0.71
Delta WS (ft)	4.90	Q Weir (cfs)	
E.G. IC (ft)	12.79	Weir Sta Lft (ft)	
E.G. OC (ft)	11.63	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	5.19	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	5.80	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.00	Min El Weir Flow (ft)	21.68

Note: Culvert critical depth exceeds the height of the culvert.
Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet
equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #100-YR Culv Group: Culvert #1

Q Culv Group (cfs)	846.00	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	17.63
Q Barrel (cfs)	846.00	Culv Vel DS (ft/s)	24.98
E.G. US. (ft)	15.59	Culv Inv El Up (ft)	-0.33
W.S. US. (ft)	15.53	Culv Inv El Dn (ft)	-0.81
E.G. DS (ft)	7.25	Culv Frctn Ls (ft)	1.51
W.S. DS (ft)	6.87	Culv Exit Loss (ft)	5.86
Delta EG (ft)	8.34	Culv Entr Loss (ft)	0.96
Delta WS (ft)	8.66	Q Weir (cfs)	
E.G. IC (ft)	15.59	Weir Sta Lft (ft)	
E.G. OC (ft)	13.58	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	5.67	Weir Max Depth (ft)	
Culv WS Outlet (ft)	3.42	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	6.00	Min El Weir Flow (ft)	21.68

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
of the culvert.
Note: Culvert critical depth exceeds the height of the culvert.
Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50292.86

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	4.83	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.04	Wt. n-Val.		0.035
W.S. Elev (ft)	4.78	Reach Len. (ft)	94.24	94.13
95.71				
Crit W.S. (ft)	1.78	Flow Area (sq ft)		108.61
E.G. Slope (ft/ft)	0.000348	Area (sq ft)		108.61
Q Total (cfs)	182.00	Flow (cfs)		182.00
Top Width (ft)	29.17	Top Width (ft)		29.17
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)		1.68
Max Chl Dpth (ft)	5.70	Hydr. Depth (ft)		3.72
Conv. Total (cfs)	9758.9	Conv. (cfs)		9758.9
Length Wtd. (ft)	94.13	Wetted Per. (ft)		35.27
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.07
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00
0.00				
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.57	0.29
C & E Loss (ft)	0.11	Cum SA (acres)	1.10	0.15

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	5.82	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.11	Wt. n-Val.		0.035
0.070				
W.S. Elev (ft)	5.71	Reach Len. (ft)	94.24	94.13
95.71				
Crit W.S. (ft)	2.54	Flow Area (sq ft)		136.10
0.06				
E.G. Slope (ft/ft)	0.000662	Area (sq ft)	4.63	136.21
0.15				
Q Total (cfs)	359.00	Flow (cfs)		358.99
0.01				
Top Width (ft)	43.56	Top Width (ft)	12.90	29.83
0.83				
Vel Total (ft/s)	2.64	Avg. Vel. (ft/s)		2.64
0.24				
Max Chl Dpth (ft)	6.63	Hydr. Depth (ft)		4.60
0.31				
Conv. Total (cfs)	13948.8	Conv. (cfs)		13948.3

0.6					
Length Wtd. (ft)	94.13	Wetted Per. (ft)			36.29
0.21					
Min Ch El (ft)	-0.92	Shear (lb/sq ft)			0.16
0.01					
Alpha	1.00	Stream Power (lb/ft s)	173.79		0.00
0.00					
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	1.62		0.42
0.00					
C & E Loss (ft)	0.16	Cum SA (acres)	1.64		0.17
0.00					

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	6.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.42	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	3.36	Flow Area (sq ft)		157.05	0.19
E.G. Slope (ft/ft)	0.001198	Area (sq ft)	15.48	157.31	1.32
Q Total (cfs)	613.00	Flow (cfs)		612.86	0.14
Top Width (ft)	50.09	Top Width (ft)	17.77	29.83	2.49
Vel Total (ft/s)	3.90	Avg. Vel. (ft/s)		3.90	0.70
Max Chl Dpth (ft)	7.34	Hydr. Depth (ft)		5.30	1.02
Conv. Total (cfs)	17710.3	Conv. (cfs)		17706.4	3.9
Length Wtd. (ft)	94.14	Wetted Per. (ft)		36.29	0.21
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.32	0.07
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00	0.00
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	2.81	0.54	0.00
C & E Loss (ft)	0.16	Cum SA (acres)	2.19	0.18	0.02

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	6.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.66	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	3.68	Flow Area (sq ft)		164.13	0.24
E.G. Slope (ft/ft)	0.001458	Area (sq ft)	19.93	164.44	1.98
Q Total (cfs)	728.00	Flow (cfs)		727.79	0.21
Top Width (ft)	52.30	Top Width (ft)	19.42	29.83	3.05
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)		4.43	0.89
Max Chl Dpth (ft)	7.58	Hydr. Depth (ft)		5.54	1.26
Conv. Total (cfs)	19063.1	Conv. (cfs)		19057.5	5.6
Length Wtd. (ft)	94.14	Wetted Per. (ft)		36.29	0.21
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.41	0.11
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00	0.00
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	3.20	0.57	0.01
C & E Loss (ft)	0.16	Cum SA (acres)	2.33	0.18	0.02

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	7.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.		0.035	0.070
W.S. Elev (ft)	6.87	Reach Len. (ft)	94.24	94.13	95.71
Crit W.S. (ft)	3.98	Flow Area (sq ft)		170.27	0.28
E.G. Slope (ft/ft)	0.001742	Area (sq ft)	24.10	170.63	2.67
Q Total (cfs)	846.00	Flow (cfs)		845.70	0.30
Top Width (ft)	54.22	Top Width (ft)	20.85	29.83	

3.54				
Vel Total (ft/s)	4.96	Avg. Vel. (ft/s)		4.97
1.08				
Max Chl Dpth (ft)	7.79	Hydr. Depth (ft)		5.75
1.47				
Conv. Total (cfs)	20267.4	Conv. (cfs)		20260.1
7.2				
Length Wtd. (ft)	94.15	Wetted Per. (ft)		36.29
0.21				
Min Ch El (ft)	-0.92	Shear (lb/sq ft)		0.51
0.15				
Alpha	1.00	Stream Power (lb/ft s)	173.79	0.00
0.00				
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	3.56	0.60
0.01				
C & E Loss (ft)	0.15	Cum SA (acres)	2.36	0.18
0.03				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50198.72

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	4.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.40	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	4.22	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	3.85	Flow Area (sq ft)	0.78	35.54
E.G. Slope (ft/ft)	0.008072	Area (sq ft)	207.07	35.54
Q Total (cfs)	182.00	Flow (cfs)	0.44	181.56
Top Width (ft)	349.83	Top Width (ft)	327.85	21.97
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	0.57	5.11
Max Chl Dpth (ft)	2.18	Hydr. Depth (ft)	0.16	1.62
Conv. Total (cfs)	2025.7	Conv. (cfs)	4.9	2020.7
Length Wtd. (ft)	95.19	Wetted Per. (ft)	4.76	22.93
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.08	0.78
Alpha	1.04	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.35	0.14

C & E Loss (ft)	0.02	Cum SA (acres)	0.75	0.09

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	5.51	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.64	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	4.87	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	4.87	Flow Area (sq ft)	20.04	50.56
E.G. Slope (ft/ft)	0.009972	Area (sq ft)	436.58	50.56
Q Total (cfs)	359.00	Flow (cfs)	24.07	334.93
Top Width (ft)	400.54	Top Width (ft)	375.92	24.62
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)	1.20	6.62
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	0.43	2.05
Conv. Total (cfs)	3595.1	Conv. (cfs)	241.1	3354.0
Length Wtd. (ft)	94.99	Wetted Per. (ft)	46.96	25.88
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.27	1.22
Alpha	1.59	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.67	Cum Volume (acre-ft)	1.14	0.22
C & E Loss (ft)	0.14	Cum SA (acres)	1.22	0.11

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	6.25	Element	Left OB	Channel Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	5.48	Reach Len. (ft)	93.76	95.40 95.30
Crit W.S. (ft)	5.48	Flow Area (sq ft)	51.21	66.21 1.32
E.G. Slope (ft/ft)	0.010053	Area (sq ft)	671.99	66.21 1.32
Q Total (cfs)	613.00	Flow (cfs)	104.68	507.35 0.97
Top Width (ft)	421.32	Top Width (ft)	388.97	25.93 6.42
Vel Total (ft/s)	5.16	Avg. Vel. (ft/s)	2.04	7.66 0.74
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)	0.94	2.55 0.20
Conv. Total (cfs)	6113.7	Conv. (cfs)	1044.0	5060.0 9.7
Length Wtd. (ft)	94.87	Wetted Per. (ft)	54.42	27.41 6.46
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.59	1.52 0.13
Alpha	1.85	Stream Power (lb/ft s)	535.40	0.00 0.00
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	2.06	0.30 0.00
C & E Loss (ft)	0.16	Cum SA (acres)	1.75	0.12 0.01

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	6.52	Element	Left OB	Channel Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.070	0.035 0.070
W.S. Elev (ft)	5.70	Reach Len. (ft)	93.76	95.40 95.30
Crit W.S. (ft)	5.70	Flow Area (sq ft)	63.17	71.81 2.76
E.G. Slope (ft/ft)	0.010203	Area (sq ft)	756.04	71.81

2.76				
Q Total (cfs)	728.00	Flow (cfs)	145.02	579.83
3.15				
Top Width (ft)	426.81	Top Width (ft)	393.52	26.25
7.04				
Vel Total (ft/s)	5.29	Avg. Vel. (ft/s)	2.30	8.07
1.14				
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)	1.11	2.74
0.39				
Conv. Total (cfs)	7207.2	Conv. (cfs)	1435.7	5740.3
31.2				
Length Wtd. (ft)	94.85	Wetted Per. (ft)	57.02	27.80
7.11				
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.71	1.65
0.25				
Alpha	1.90	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	2.36	0.31
0.00				
C & E Loss (ft)	0.15	Cum SA (acres)	1.89	0.12
0.01				

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	6.77	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.87	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	5.90	Reach Len. (ft)	93.76	95.40
95.30				
Crit W.S. (ft)	5.90	Flow Area (sq ft)	75.15	77.24
4.27				
E.G. Slope (ft/ft)	0.010264	Area (sq ft)	837.48	77.24
4.27				
Q Total (cfs)	846.00	Flow (cfs)	188.81	651.01
6.18				
Top Width (ft)	432.07	Top Width (ft)	397.89	26.55
7.63				
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	2.51	8.43
1.45				
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)	1.26	2.91
0.56				
Conv. Total (cfs)	8350.3	Conv. (cfs)	1863.6	6425.7

61.0				
Length Wtd. (ft)	94.82	Wetted Per. (ft)	59.51	28.16
7.74				
Min Ch El (ft)	2.04	Shear (lb/sq ft)	0.81	1.76
0.35				
Alpha	1.92	Stream Power (lb/ft s)	535.40	0.00
0.00				
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	2.63	0.33
0.01				
C & E Loss (ft)	0.15	Cum SA (acres)	1.91	0.12
0.02				

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50103.33

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	3.69	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.32	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	3.36	Reach Len. (ft)	104.39	102.92
100.09				
Crit W.S. (ft)	3.36	Flow Area (sq ft)	31.62	26.19
E.G. Slope (ft/ft)	0.011688	Area (sq ft)	53.48	26.19
Q Total (cfs)	182.00	Flow (cfs)	45.56	136.44
Top Width (ft)	192.98	Top Width (ft)	171.85	21.12
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	1.44	5.21
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)	0.50	1.24
Conv. Total (cfs)	1683.5	Conv. (cfs)	421.4	1262.0
Length Wtd. (ft)	103.11	Wetted Per. (ft)	63.56	21.65
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.36	0.88

Alpha	2.11	Stream Power (lb/ft s)	552.21	0.00
0.00				
Frctn Loss (ft)	1.08	Cum Volume (acre-ft)	0.07	0.07
C & E Loss (ft)	0.02	Cum SA (acres)	0.21	0.05

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	4.39	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.19	Wt. n-Val.	0.070	0.035
W.S. Elev (ft)	4.21	Reach Len. (ft)	104.39	102.92
100.09				
Crit W.S. (ft)	3.75	Flow Area (sq ft)	87.89	46.40
E.G. Slope (ft/ft)	0.005253	Area (sq ft)	290.88	46.40
Q Total (cfs)	359.00	Flow (cfs)	157.22	201.78
Top Width (ft)	377.79	Top Width (ft)	350.93	26.85
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)	1.79	4.35
Max Chl Dpth (ft)	2.81	Hydr. Depth (ft)	1.26	1.73
Conv. Total (cfs)	4953.3	Conv. (cfs)	2169.2	2784.1
Length Wtd. (ft)	103.26	Wetted Per. (ft)	70.10	27.62
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.41	0.55
Alpha	1.68	Stream Power (lb/ft s)	552.21	0.00
0.00				
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.36	0.11
C & E Loss (ft)	0.06	Cum SA (acres)	0.43	0.05

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	5.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.82	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	4.16	Flow Area (sq ft)	138.89	64.07	0.21
E.G. Slope (ft/ft)	0.005391	Area (sq ft)	516.31	64.07	0.21
Q Total (cfs)	613.00	Flow (cfs)	291.34	321.56	0.10
Top Width (ft)	426.08	Top Width (ft)	394.39	30.48	1.21
Vel Total (ft/s)	3.02	Avg. Vel. (ft/s)	2.10	5.02	0.47
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)	1.27	2.10	0.17
Conv. Total (cfs)	8348.6	Conv. (cfs)	3967.8	4379.5	1.3
Length Wtd. (ft)	103.44	Wetted Per. (ft)	109.19	31.37	1.26
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.43	0.69	0.06
Alpha	1.68	Stream Power (lb/ft s)	552.21	0.00	0.00
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	0.79	0.15	0.00
C & E Loss (ft)	0.04	Cum SA (acres)	0.90	0.06	0.00

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	5.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.86	Reach Len. (ft)	104.39	102.92	100.09
Crit W.S. (ft)	4.30	Flow Area (sq ft)	143.41	65.33	0.26
E.G. Slope (ft/ft)	0.007097	Area (sq ft)	532.58	65.33	0.26
Q Total (cfs)	728.00	Flow (cfs)	346.79	381.06	0.15
Top Width (ft)	428.25	Top Width (ft)	396.41	30.48	1.36
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	2.42	5.83	0.58
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	1.29	2.14	

0.19					
Conv. Total (cfs)	8641.5	Conv. (cfs)	4116.4	4523.3	
1.8					
Length Wtd. (ft)	103.52	Wetted Per. (ft)	110.92	31.37	
1.41					
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.57	0.92	
0.08					
Alpha	1.70	Stream Power (lb/ft s)	552.21	0.00	
0.00					
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	0.98	0.16	
0.00					
C & E Loss (ft)	0.01	Cum SA (acres)	1.04	0.06	
0.00					

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	5.36	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.38	Wt. n-Val.	0.070	0.035	
0.070					
W.S. Elev (ft)	4.99	Reach Len. (ft)	104.39	102.92	
100.09					
Crit W.S. (ft)	4.43	Flow Area (sq ft)	157.64	69.15	
0.46					
E.G. Slope (ft/ft)	0.007808	Area (sq ft)	582.68	69.15	
0.46					
Q Total (cfs)	846.00	Flow (cfs)	406.24	439.43	
0.34					
Top Width (ft)	434.85	Top Width (ft)	402.57	30.48	
1.80					
Vel Total (ft/s)	3.72	Avg. Vel. (ft/s)	2.58	6.35	
0.73					
Max Chl Dpth (ft)	3.59	Hydr. Depth (ft)	1.36	2.27	
0.25					
Conv. Total (cfs)	9574.1	Conv. (cfs)	4597.3	4972.9	
3.8					
Length Wtd. (ft)	103.55	Wetted Per. (ft)	116.18	31.37	
1.87					
Min Ch El (ft)	1.40	Shear (lb/sq ft)	0.66	1.07	
0.12					
Alpha	1.74	Stream Power (lb/ft s)	552.21	0.00	
0.00					
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	1.10	0.17	
0.00					
C & E Loss (ft)	0.01	Cum SA (acres)	1.04	0.06	
0.01					

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: 99
REACH: PRBLHEC RS: 50000

CROSS SECTION OUTPUT Profile #2-YR

E.G. Elev (ft)	2.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	1.89	Reach Len. (ft)			
Crit W.S. (ft)	1.60	Flow Area (sq ft)	0.79	30.97	
E.G. Slope (ft/ft)	0.009407	Area (sq ft)	0.79	30.97	
Q Total (cfs)	182.00	Flow (cfs)	0.60	181.40	
Top Width (ft)	20.75	Top Width (ft)	3.39	17.36	
Vel Total (ft/s)	5.73	Avg. Vel. (ft/s)	0.77	5.86	
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.23	1.78	
Conv. Total (cfs)	1876.5	Conv. (cfs)	6.2	1870.3	
Length Wtd. (ft)		Wetted Per. (ft)	3.45	18.25	
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.13	1.00	
Alpha	1.04	Stream Power (lb/ft s)	573.03	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YR

E.G. Elev (ft)	3.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.070	0.035	
W.S. Elev (ft)	2.80	Reach Len. (ft)			
Crit W.S. (ft)	2.54	Flow Area (sq ft)	7.10	47.17	
E.G. Slope (ft/ft)	0.009413	Area (sq ft)	7.10	47.17	
Q Total (cfs)	359.00	Flow (cfs)	11.12	347.88	
Top Width (ft)	29.05	Top Width (ft)	10.58	18.47	
Vel Total (ft/s)	6.62	Avg. Vel. (ft/s)	1.57	7.38	
Max Chl Dpth (ft)	3.41	Hydr. Depth (ft)	0.67	2.55	

Conv. Total (cfs)	3700.2	Conv. (cfs)	114.7	3585.6
Length Wtd. (ft)		Wetted Per. (ft)	10.69	19.69
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.39	1.41
Alpha	1.21	Stream Power (lb/ft s)	573.03	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-YR

E.G. Elev (ft)	4.44	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.60	Wt. n-Val.	0.070	0.035
0.070				
W.S. Elev (ft)	3.84	Reach Len. (ft)		
Crit W.S. (ft)	3.84	Flow Area (sq ft)	125.02	66.94
0.17				
E.G. Slope (ft/ft)	0.005869	Area (sq ft)	139.39	66.94
0.17				
Q Total (cfs)	613.00	Flow (cfs)	139.29	473.64
0.07				
Top Width (ft)	379.62	Top Width (ft)	359.10	19.39
1.13				
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	1.11	7.08
0.44				
Max Chl Dpth (ft)	4.45	Hydr. Depth (ft)	0.51	3.45
0.15				
Conv. Total (cfs)	8001.9	Conv. (cfs)	1818.2	6182.7
1.0				
Length Wtd. (ft)		Wetted Per. (ft)	244.52	20.86
1.17				
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.19	1.18
0.05				
Alpha	3.83	Stream Power (lb/ft s)	573.03	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YR

E.G. Elev (ft)	4.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.16	Reach Len. (ft)			
Crit W.S. (ft)	4.16	Flow Area (sq ft)	212.90	73.27	0.74
E.G. Slope (ft/ft)	0.004402	Area (sq ft)	283.14	73.27	0.74
Q Total (cfs)	728.00	Flow (cfs)	250.71	476.82	0.47
Top Width (ft)	490.54	Top Width (ft)	468.77	19.39	2.38
Vel Total (ft/s)	2.54	Avg. Vel. (ft/s)	1.18	6.51	0.63
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)	0.77	3.78	0.31
Conv. Total (cfs)	10972.8	Conv. (cfs)	3778.8	7186.9	7.0
Length Wtd. (ft)		Wetted Per. (ft)	278.46	20.86	2.46
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.21	0.97	0.08
Alpha	4.38	Stream Power (lb/ft s)	573.03	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #100-YR

E.G. Elev (ft)	4.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.070	0.035	0.070
W.S. Elev (ft)	4.27	Reach Len. (ft)			
Crit W.S. (ft)	4.27	Flow Area (sq ft)	244.21	75.45	1.03
E.G. Slope (ft/ft)	0.004725	Area (sq ft)	335.90	75.45	1.03
Q Total (cfs)	846.00	Flow (cfs)	326.48	518.77	0.75
Top Width (ft)	491.29	Top Width (ft)	469.10	19.39	2.80
Vel Total (ft/s)	2.64	Avg. Vel. (ft/s)	1.34	6.88	0.73
Max Chl Dpth (ft)	4.88	Hydr. Depth (ft)	0.88	3.89	0.37
Conv. Total (cfs)	12307.6	Conv. (cfs)	4749.6	7547.1	

11.0				
Length Wtd. (ft)		Wetted Per. (ft)	278.46	20.86
2.90				
Min Ch El (ft)	-0.61	Shear (lb/sq ft)	0.26	1.07
0.10				
Alpha	4.26	Stream Power (lb/ft s)	573.03	0.00
0.00				
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:99

Reach	River Sta.	n1	n2	n3
PRBLHEC	53100	.07	.035	.07
PRBLHEC	53000	.07	.035	.07
PRBLHEC	52900	Culvert		
PRBLHEC	52551.81	.07	.035	.07
PRBLHEC	52492.14	.07	.035	.07
PRBLHEC	52208.31	.07	.035	.07
PRBLHEC	52000.40	.07	.035	.07
PRBLHEC	51873.49	.07	.035	.07
PRBLHEC	51774.77	.07	.035	.07
PRBLHEC	51701.60	.07	.035	.07
PRBLHEC	51660.15	.07	.035	.07
PRBLHEC	51347.58	.07	.035	.07
PRBLHEC	51266.45	.07	.035	.07
PRBLHEC	51095.56	.07	.035	.07
PRBLHEC	51024.74	.07	.035	.07
PRBLHEC	50878.95	.07	.035	.07
PRBLHEC	50668.61	.07	.035	.07
PRBLHEC	50602.30	.07	.035	.07
PRBLHEC	50541.89	.07	.035	.07
PRBLHEC	50468.04	Culvert		
PRBLHEC	50418.36	.07	.035	.07
PRBLHEC	50391.33	.07	.035	.07
PRBLHEC	50341.60	Culvert		
PRBLHEC	50292.86	.07	.035	.07
PRBLHEC	50198.72	.07	.035	.07
PRBLHEC	50103.33	.07	.035	.07
PRBLHEC	50000	.07	.035	.07

SUMMARY OF REACH LENGTHS

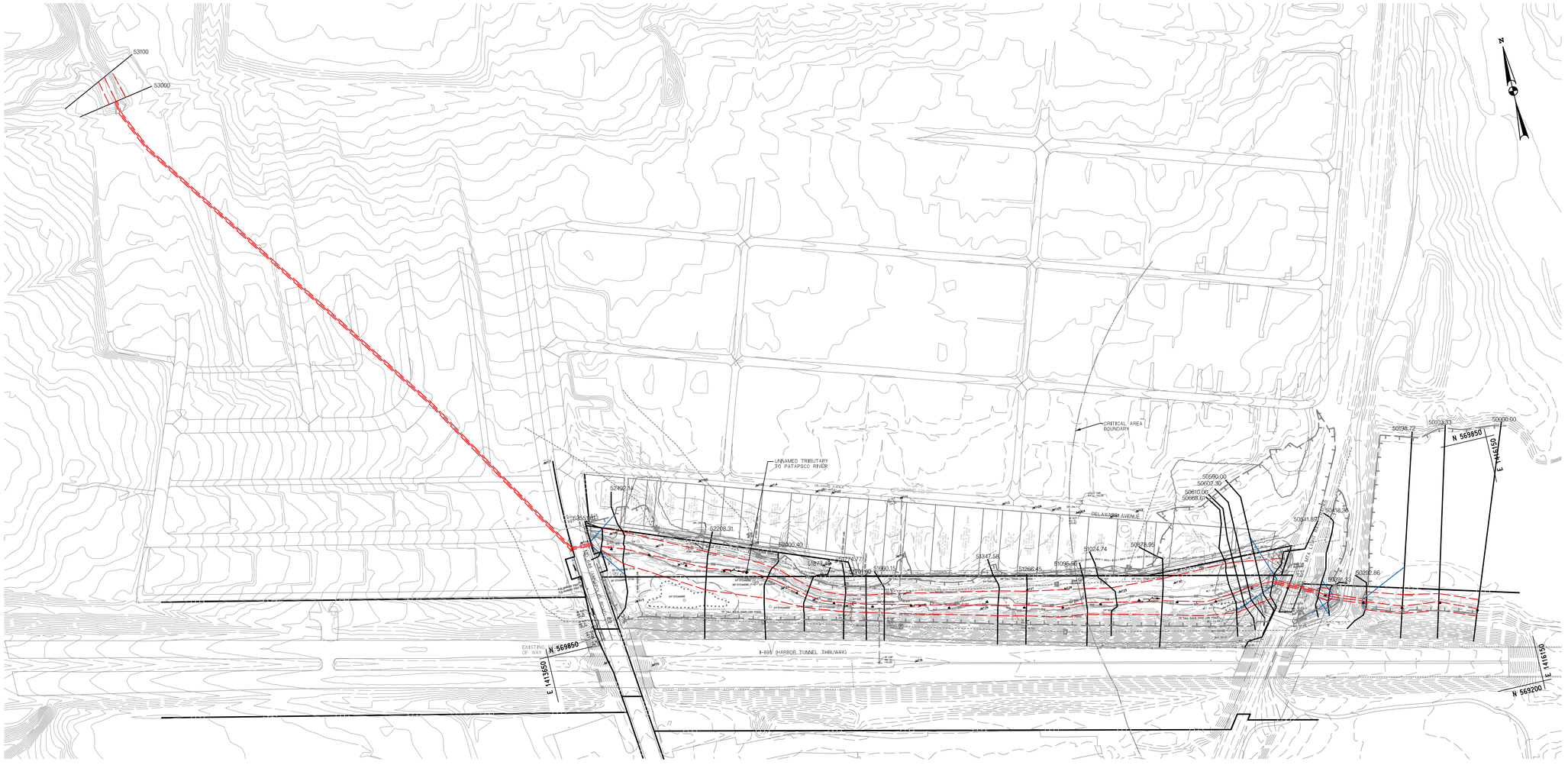
River: 99

Reach	River Sta.	Left	Channel	Right
PRBLHEC	53100	77.24	70.3	64.94
PRBLHEC	53000	1742.97	1742.97	1742.97
PRBLHEC	52900	Culvert		
PRBLHEC	52551.81	53.53	59.74	64.78
PRBLHEC	52492.14	237.65	231.59	240.92
PRBLHEC	52208.31	158.89	156.68	155.97
PRBLHEC	52000.40	112.24	109.86	107.7
PRBLHEC	51873.49	93.61	90.16	87.15
PRBLHEC	51774.77	66.65	66.63	70.43
PRBLHEC	51701.60	35.53	38.71	41.69
PRBLHEC	51660.15	287.72	291.38	287.64
PRBLHEC	51347.58	75.64	76.38	77.2
PRBLHEC	51266.45	157.31	156.29	158.74
PRBLHEC	51095.56	65.21	69.49	54.74
PRBLHEC	51024.74	138.44	130.21	138.38
PRBLHEC	50878.95	164.59	166.5	177.04
PRBLHEC	50668.61	42.56	58.43	76.59
PRBLHEC	50602.30	106.59	65.99	38.98
PRBLHEC	50541.89	123.44	126.44	123.05
PRBLHEC	50468.04	Culvert		
PRBLHEC	50418.36	26.22	27.31	28.13
PRBLHEC	50391.33	97.79	98.48	98.8
PRBLHEC	50341.60	Culvert		
PRBLHEC	50292.86	94.24	94.13	95.71
PRBLHEC	50198.72	93.76	95.4	95.3
PRBLHEC	50103.33	104.39	102.92	100.09
PRBLHEC	50000			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: 99

Reach	River Sta.	Contr.	Expan.
PRBLHEC	53100	.1	.3
PRBLHEC	53000	.1	.3
PRBLHEC	52900	Culvert	
PRBLHEC	52551.81	.3	.5
PRBLHEC	52492.14	.1	.3
PRBLHEC	52208.31	.1	.3
PRBLHEC	52000.40	.1	.3
PRBLHEC	51873.49	.1	.3
PRBLHEC	51774.77	.1	.3
PRBLHEC	51701.60	.1	.3
PRBLHEC	51660.15	.1	.3
PRBLHEC	51347.58	.1	.3
PRBLHEC	51266.45	.1	.3
PRBLHEC	51095.56	.1	.3
PRBLHEC	51024.74	.1	.3
PRBLHEC	50878.95	.1	.3
PRBLHEC	50668.61	.1	.3
PRBLHEC	50602.30	.1	.3
PRBLHEC	50541.89	.3	.5
PRBLHEC	50468.04	Culvert	
PRBLHEC	50418.36	.3	.5
PRBLHEC	50391.33	.3	.5
PRBLHEC	50341.60	Culvert	
PRBLHEC	50292.86	.3	.5

```
PRBLHEC              50198.72         .1         .3
PRBLHEC              50103.33         .1         .3
PRBLHEC              50000            .1         .3
```



PLAN

LEGEND

REACH LENGTHS

EXISTING HEC-RAS CROSS SECTIONS

EXISTING FLOODPLAIN

INNEFECTIVE FLOW LIMTIS

150 0 150 300
SCALE: 1" = 150'

FILE: Q:\2015\151777.003_I-895_TMDL_Stream_Re\CADD\xpHC-E001_I895 STREAM RESTORATION.dgn
DATE: Tuesday, November 20, 2018 AT 12:43 PM 12:43 PM

jmt.com

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. _____

EXPIRATION DATE: _____

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

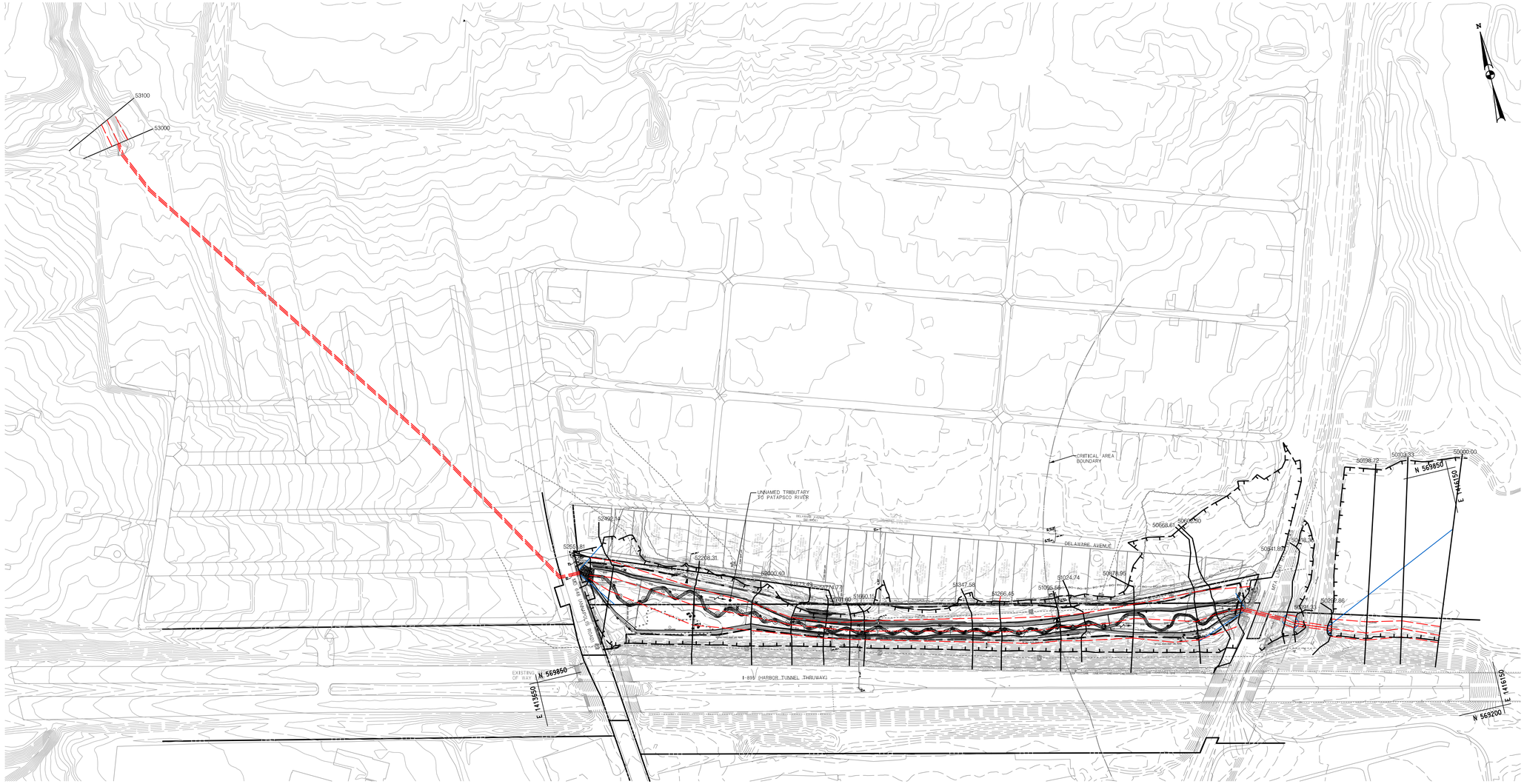
MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EXISTING 100-YR FLOODPLAIN MAP

CONTRACT NO. HT-3012-0000

DRAWING NO.

DESIGNED BY	MRG	DRAWN BY	JMB	CHECKED BY	JSK
CONST. REVIEW BY		DATE	AUGUST, 2018	SCALE	1" = 150'

SHEET NO. OF 26



PLAN

LEGEND

REACH LENGTHS
PROPOSED HEC-RAS CROSS SECTIONS
PROPOSED FLOODPLAIN
INNEFECTIVE FLOW LIMTIS

150' 0 150' 300'
SCALE: 1" =150'

FILE: Q:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pHC-P001_I895 STREAM RESTORATION.dgn
DATE: Wednesday, July 18, 2018 AT 03:48 PM 03:48 PM

jmt.com

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. ____________

EXPIRATION DATE: ____________

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
PROPOSED 100-YR FLOODPLAIN MAP

DESIGNED BY MRG	DRAWN BY JMB	CHECKED BY^3 JSK
CONST. REVIEW BY ____	DATE APRIL, 2018	SCALE 1" = 150'

CONTRACT NO.
HT-3012-0000

DRAWING NO.

SHEET NO.
OF 27

Appendix H

Final Design Cost Estimate

JOHNSON, MIRMIRAN & THOMPSON

ENGINEER'S ESTIMATE

December 31, 2018

Item No.	Category	Item Description	Unit	Quantity	Unit Cost	Total Cost
1001	**100000**	AS-BUILT CERTIFICATION	**LS**	**1**	**$20,000.00**	**$20,000.00**
1002	**100000**	CRITICAL PATH METHOD PROJECT SCHEDULE	**LS**	**1**	**$5,000.00**	**$5,000.00**
1003	**110100**	CLEARING AND GRUBBING	**LS**	**1**	**$40,000.00**	**$40,000.00**
1004	**110350**	TYPE B ENGINEER'S OFFICE	**LS**	**1**	**$35,000.00**	**$35,000.00**
1005	**120500**	MAINTENANCE OF TRAFFIC	**LS**	**1**	**$9,588.59**	**$9,588.59**
1006	**120784**	TEMPORARY ORANGE CONSTRUCTION FENCE	**LF**	**1531**	**$5.00**	**$7,655.00**
1007	**120890**	ADDITIONAL PROTECTION VEHICLE	**UD**	**30**	**$300.00**	**$9,000.00**
1008	**130840**	CONSTRUCTION STAKEOUT	**LS**	**1**	**$26,870.45**	**$26,870.45**
1009	**130850**	MOBILIZATION	**LS**	**1**	**$107,481.81**	**$107,481.81**
2001	**200000**	MICROTOPOGRAPHY	**SY**	**598**	**$25.00**	**$14,947.22**
2002	**201030**	CLASS I EXCAVATION	**CY**	**9200**	**$39.00**	**$358,800.00**
2003	**210010**	REINFORCED CURB AND GUTTER; ANY TYPE	**LF**	**30**	**$40.00**	**$1,200.00**
2004	**202065**	COMMON BORROW	**CY**	**1950**	**$20.00**	**$39,000.00**
3001	**300000**	IN-CHANNEL/FLOODPLAIN LOG SILLS	**LF**	**1184**	**$15.00**	**$17,760.00**
3002	**300000**	TYPE 'I' STREAMBED UNDERLAYMENT	**SY**	**2060**	**$70.00**	**$144,200.00**
3003	**300000**	ROCK FOR ROCK CROSS VANE STRUCTURE	**LF**	**666**	**$200.00**	**$133,200.00**
3004	**300000**	FURNISHED STREAMBED GRAVEL	**TON**	**1409**	**$90.00**	**$126,810.00**
3005	**300000**	LOG VANE STRUCTURES	**EA**	**16**	**$6,000.00**	**$96,000.00**
3006	**300000**	TEMPORARY ACCESS ROAD	**SY**	**963**	**$8.00**	**$7,704.00**
3007	**300000**	TEMPORARY ACCESS BRIDGE	**EA**	**1**	**$10,000.00**	**$10,000.00**
3008	**300000**	ROCK OUTLET PROTECTION	**SY**	**6**	**$80.00**	**$480.00**
3009	**301008**	STABILIZED CONSTRUCTION ENTRANCE	**EA**	**1**	**$3,000.00**	**$3,000.00**
3010	**340012**	TEMPORARY ACCESS CULVERT	**LF**	**23**	**$100.00**	**$2,300.00**
3011	**354427**	STANDARD TYPE C ENDWALL FOR 27" PIPE	**EA**	**1**	**$4,000.00**	**$4,000.00**
3012	**388160**	FILTER BAG	**EA**	**5**	**$1,000.00**	**$5,000.00**
3013	**390221**	CLASS I RIPRAP SLOPE AND CHANNEL PROTECTION	**SY**	**12**	**$80.00**	**$960.00**
3014	**390221**	CLASS II RIPRAP SLOPE AND CHANNEL PROTECTION	**SY**	**313**	**$90.00**	**$28,170.00**
3015	**390223**	CLASS III RIPRAP FOR SCOUR PROTECTION	**SY**	**143**	**$95.00**	**$13,585.00**
3016	**390535**	SUPER SILT FENCE	**LF**	**2589**	**$11.00**	**$28,479.00**
3017	**390535**	FILTER LOG	**LF**	**609**	**$11.00**	**$6,699.00**
3018	**391003**	BOTTOM CUTTOFF WALL FOR CLASS III RIPRAP	**LF**	**37**	**$50.00**	**$1,850.00**
4001	**410005**	MAINTENANCE OF STREAM FLOW	**LS**	**1**	**$50,000.00**	**$50,000.00**
7001	**700000**	HARDWOOD CONSTRUCTION MATS	**SY**	**1880**	**$30.00**	**$56,400.00**
7002	**7010404**	PLACING FURNISHED TOPSOIL, 2 INCH DEPTH	**SY**	**4041**	**$5.00**	**$20,205.00**
7003	**7010404**	PLACING FURNISHED TOPSOIL, 4 INCH DEPTH	**SY**	**7986**	**$8.00**	**$63,888.00**
7004	**705405**	TEMPORARY SEED	**SY**	**20135**	**$3.00**	**$60,405.00**
7005	**705412**	TEMPORARY MULCH	**SY**	**20135**	**$1.00**	**$20,135.00**
7006	**709130**	TYPE D SOIL STABILIZATION MATTING	**SY**	**20135**	**$7.50**	**$151,012.50**
7007	**707400**	UPLAND MEADOW ESTABLISHMENT	**SY**	**8765**	**$2.00**	**$17,530.00**
7008	**707410**	LOWLAND MEADOW ESTABLISHMENT	**SY**	**11370**	**$2.00**	**$22,740.00**
7009	**710150**	TREE, SHRUB AND PERENNIAL INSALLATION AND ESTABLISHMENT	**LS**	**1**	**$167,248.75**	**$167,248.75**
7010	**700000**	NON-NATIVE INVASIVE SPECIES CONTROL	**LS**	**1**	**$10,000.00**	**$10,000.00**
					SUBTOTAL	**$1,919,304**
					Miscellaneous	**$50,000**
					TOTAL	**1,969,304**
					SAY:	$1,970,000.00

Appendix I

Erosion and Sediment Control Computations

TO CWD 3-1

PROJECT INFORMATION

Project : **I895 Stream Restoration** By **PVC** Date **12/14/2018**

Location : **18" CMP** Checked _____ Date **12/14/2018**

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

Comments :

Worksheet 2: Runoff curve number and runoff

Project **I895 Stream Restoration** By _____ Date _____

Location **18" CMP** Checked _____ Date _____

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Fig. 2-3	CN* Fig. 2-4	Area acres	Product of CN x area
D	Urban areas; Impervious areas; Streets and roads; Paved; open ditches (including right-of-way)	***93***			***1.64***	***152.5***
D	Other agricultural lands; Woods; Good conditon	***77***			***0.47***	***36.2***
* Use only one CN source per line				Totals =	***2.11***	***188.7***
				SQ. MILES =	***0.003297***	

CN (weighted) = total product / total area = ***89.44*** Use CN = ***89.4***

Worksheet 3: Time of concentration (Tc) or travel time (Tt)

Project : **I895 Stream Restoration** By _____ Date _____

Location : **18" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

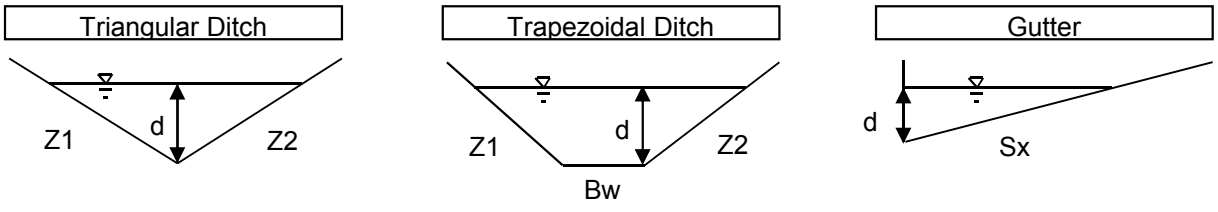
NOTE : Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to Tc only)	Segment ID	AB			
1. Surface Description (table 3-1)					
2. Manning's roughness coeff., n (table 3-1)					
3. Flow length, L (total L ≤ 100 ft)	ft				
4. Two-yr 24-hr rainfall, P_2	in				
5. Upstream elevation					
6. Downstream elevation					
7. Land slope, s	ft/ft				
8. $T_t = 0.007\ (nL)^{0.8} / [(P_2^{0.5})(s^{0.4})]$	hr				= 0.000

Shallow concentrated flow	Segment ID	BC			
9. Surface description (Cerrelli Chart)					
10. Flow length, L	ft				
11. Upstream elevation					
12. Downstream elevation					
13. Watercourse slope, s	ft/ft				
14. Average velocity, V	ft/s				
15. T_t = L / 3600*V	hr				= 0.000

Channel Flow	Segment ID				
16. Channel Geometry					
17. Cross-sectional flow area, A	ft²				
18. Wetted perimeter, P_W	ft²				
19. Hydraulic radius, R	ft				
20. Upstream elevation					
21. Downstream elevation					
22. Channel slope, S	ft/ft				
23. Manning's roughness coeff., n					
24. Velocity	ft/s				
25. Flow length, L	ft				
26. T_t = L / 3600*V	hr				= 0.000

27. Watershed or subarea Tc or Tt ..... hr 0.100



JOHNSON, MIRMIRAN & THOMPSON
Engineering A Brighter Future®

Worksheet 4: Graphical Peak Discharge Method

Project : **I895 Stream Restoration** By _____ Date _____

Location : **18" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Data

Drainage Area	A_m =	0.0032969	mi² (acres/640)
Runoff Curve Number	CN =	89.4	(From worksheet 2)
Time of Concentration	T_C =	0.100	hr (From worksheet 3)
Rainfall Distribution	=	II	(I, IA, II, III)
Pond and swamp areas spread throughout watershed	=	0	mi² (acres/640)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	1 yr - 24 hr	2 yr - 24 hr	100 yr - 24 hr
3. Rainfall, P (24-hour)	in	2.6	3.2	7.1
4. Initial abstraction, I_a		0.24	0.24	0.24
(Use CN with table 4-1)				
5. Compute I_a/P		0.09	0.10	0.03
6. Unit peak discharge q_u	csm/in	1002	1000	1017
(Use TC and Ia/P with exhibit 4-II)				
7. Runoff, Q	in	1.58	2.12	5.86
(From worksheet 2) Figure 2-6				
8. Pond and swamp adjustment factor, F_p		1.00	1.00	1.00
(Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero pond and swamp area.)				
9. Peak discharge, q_p		5.21	6.99	19.63
(Where $q_p = q_u A_m Q F_p$)				

CWD 3-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00600	ft/ft
Diameter	1.50	ft
Discharge	6.99	ft³/s

Results

Normal Depth	0.89	ft
Flow Area	1.09	ft²
Wetted Perimeter	2.64	ft
Hydraulic Radius	0.41	ft
Top Width	1.47	ft
Critical Depth	1.02	ft
Percent Full	59.4	%
Critical Slope	0.00400	ft/ft
Velocity	6.39	ft/s
Velocity Head	0.64	ft
Specific Energy	1.53	ft
Froude Number	1.31	
Maximum Discharge	11.38	ft³/s
Discharge Full	10.58	ft³/s
Slope Full	0.00262	ft/ft
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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	59.37	%
Downstream Velocity	Infinity	ft/s

CWD 3-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.89	ft
Critical Depth	1.02	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00400	ft/ft

TO CWD 4-2

PROJECT INFORMATION

Project : **I895 Stream Restoration** By **PVC** Date **12/14/2018**

Location : **30" CMP** Checked _____ Date **12/14/2018**

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

Comments :

Worksheet 2: Runoff curve number and runoff

Project **I895 Stream Restoration** By _____ Date _____

Location **30" CMP** Checked _____ Date _____

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Fig. 2-3	CN* Fig. 2-4	Area acres	Product of CN x area
D	Urban areas; Impervious areas; Streets and roads; Paved; open ditches (including right-of-way)	***93***			***7.19***	***668.7***
D	Other agricultural lands; Woods; Good conditon	***77***			***1.99***	***153.2***
* Use only one CN source per line				Totals =	***9.18***	***821.9***
				SQ. MILES =	***0.014344***	

CN (weighted) = total product / total area = ***89.53*** Use CN = ***89.5***

Worksheet 3: Time of concentration (Tc) or travel time (Tt)

Project : **I895 Stream Restoration** By _____ Date _____

Location : **30" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

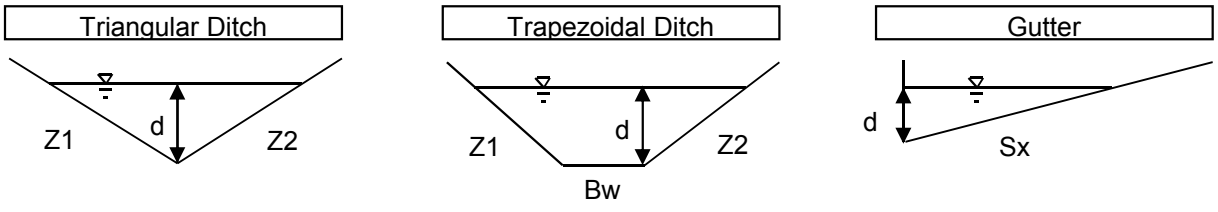
NOTE : Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to Tc only)	Segment ID	AB			
1. Surface Description (table 3-1)					
2. Manning's roughness coeff., n (table 3-1)					
3. Flow length, L (total L ≤ 100 ft)	ft				
4. Two-yr 24-hr rainfall, P_2	in				
5. Upstream elevation					
6. Downstream elevation					
7. Land slope, s	ft/ft				
8. $T_t = 0.007\ (nL)^{0.8} / [(P_2^{0.5})(s^{0.4})]$	hr				= 0.000

Shallow concentrated flow	Segment ID	BC			
9. Surface description (Cerrelli Chart)					
10. Flow length, L	ft				
11. Upstream elevation					
12. Downstream elevation					
13. Watercourse slope, s	ft/ft				
14. Average velocity, V	ft/s				
15. T_t = L / 3600*V	hr				= 0.000

Channel Flow	Segment ID				
16. Channel Geometry					
17. Cross-sectional flow area, A	ft²				
18. Wetted perimeter, P_W	ft²				
19. Hydraulic radius, R	ft				
20. Upstream elevation					
21. Downstream elevation					
22. Channel slope, S	ft/ft				
23. Manning's roughness coeff., n					
24. Velocity	ft/s				
25. Flow length, L	ft				
26. T_t = L / 3600*V	hr				= 0.000

27. Watershed or subarea Tc or Tt ..... hr 0.100



Worksheet 4: Graphical Peak Discharge Method

Project : **I895 Stream Restoration** By _____ Date _____

Location : **30" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Data

Drainage Area	A_m	=	0.0143438	mi² (acres/640)
Runoff Curve Number	CN	=	89.5	(From worksheet 2)
Time of Concentration	T_C	=	0.100	hr (From worksheet 3)
Rainfall Distribution		=	II	(I, IA, II, III)
Pond and swamp areas spread throughout watershed		=	0	mi² (acres/640)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	1 yr - 24 hr	2 yr - 24 hr	100 yr - 24 hr
3. Rainfall, P (24-hour)	in	2.6	3.2	7.1
4. Initial abstraction, I_a		0.23	0.23	0.23
(Use CN with table 4-1)				
5. Compute I_a/P		0.09	0.10	0.03
6. Unit peak discharge q_u	csm/in	1003	1000	1017
(Use TC and Ia/P with exhibit 4-II)				
7. Runoff, Q	in	1.58	2.13	5.87
(From worksheet 2) Figure 2-6				
8. Pond and swamp adjustment factor, F_p		1.00	1.00	1.00
(Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero pond and swamp area.)				
9. Peak discharge, q_p		22.77	30.52	85.57
(Where $q_p = q_u A_m Q F_p$)				

CWD 4-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00660	ft/ft
Diameter	2.50	ft
Discharge	30.52	ft³/s

Results

Normal Depth	1.55	ft
Flow Area	3.19	ft²
Wetted Perimeter	4.53	ft
Hydraulic Radius	0.70	ft
Top Width	2.43	ft
Critical Depth	1.88	ft
Percent Full	61.9	%
Critical Slope	0.00390	ft/ft
Velocity	9.56	ft/s
Velocity Head	1.42	ft
Specific Energy	2.97	ft
Froude Number	1.47	
Maximum Discharge	46.60	ft³/s
Discharge Full	43.32	ft³/s
Slope Full	0.00328	ft/ft
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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	61.91	%
Downstream Velocity	Infinity	ft/s

CWD 4-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.55	ft
Critical Depth	1.88	ft
Channel Slope	0.00660	ft/ft
Critical Slope	0.00390	ft/ft

TO CWD 3-3

PROJECT INFORMATION

Project : **I895 Stream Restoration** By **PVC** Date **12/14/2018**

Location : **36" CMP** Checked _____ Date **12/14/2018**

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

Comments :

JOHNSON, MIRMIRAN & THOMPSON
Engineering A Brighter Future®

Worksheet 2: Runoff curve number and runoff

Project **I895 Stream Restoration** By _____ Date _____

Location **36" CMP** Checked _____ Date _____

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Fig. 2-3	CN* Fig. 2-4	Area acres	Product of CN x area
D	Urban areas; Impervious areas; Streets and roads; Paved; open ditches (including right-of-way)	***93***			***3.33***	***309.7***
D	Other agricultural lands; Woods; Good conditon	***77***			***2.37***	***182.5***
* Use only one CN source per line				Totals =	***5.70***	***492.2***
				SQ. MILES =	***0.008906***	

CN (weighted) = total product / total area = ***86.35*** Use CN = ***86.3***

Worksheet 3: Time of concentration (Tc) or travel time (Tt)

Project : **I895 Stream Restoration** By _____ Date _____

Location : **36" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

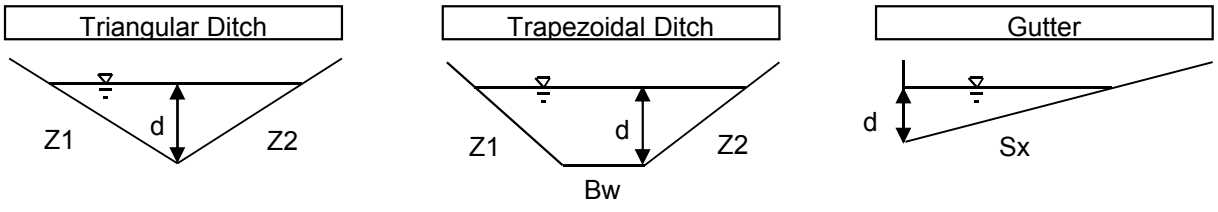
NOTE : Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to Tc only)	Segment ID	AB			
1. Surface Description (table 3-1)					
2. Manning's roughness coeff., n (table 3-1)					
3. Flow length, L (total L ≤ 100 ft)	ft				
4. Two-yr 24-hr rainfall, P_2	in				
5. Upstream elevation					
6. Downstream elevation					
7. Land slope, s	ft/ft				
8. $T_t = 0.007\ (nL)^{0.8} / [(P_2^{0.5})(s^{0.4})]$	hr				= 0.000

Shallow concentrated flow	Segment ID	BC			
9. Surface description (Cerrelli Chart)					
10. Flow length, L	ft				
11. Upstream elevation					
12. Downstream elevation					
13. Watercourse slope, s	ft/ft				
14. Average velocity, V	ft/s				
15. T_t = L / 3600*V	hr				= 0.000

Channel Flow	Segment ID				
16. Channel Geometry					
17. Cross-sectional flow area, A	ft²				
18. Wetted perimeter, P_W	ft²				
19. Hydraulic radius, R	ft				
20. Upstream elevation					
21. Downstream elevation					
22. Channel slope, S	ft/ft				
23. Manning's roughness coeff., n					
24. Velocity	ft/s				
25. Flow length, L	ft				
26. T_t = L / 3600*V	hr				= 0.000

27. Watershed or subarea Tc or Tt ..... hr 0.100



Worksheet 4: Graphical Peak Discharge Method

Project : **I895 Stream Restoration** By _____ Date _____

Location : **36" CMP** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Data

Drainage Area	A_m =	0.0089063	mi² (acres/640)
Runoff Curve Number	CN =	86.3	(From worksheet 2)
Time of Concentration	T_C =	0.100	hr (From worksheet 3)
Rainfall Distribution	=	II	(I, IA, II, III)
Pond and swamp areas spread throughout watershed	=	0	mi² (acres/640)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	1 yr - 24 hr	2 yr - 24 hr	100 yr - 24 hr
3. Rainfall, P (24-hour)	in	2.6	3.2	7.1
4. Initial abstraction, I_a		0.32	0.32	0.32
(Use CN with table 4-1)				
5. Compute I_a/P		0.12	0.10	0.04
6. Unit peak discharge q_u	csm/in	995	1000	1014
(Use TC and Ia/P with exhibit 4-II)				
7. Runoff, Q	in	1.35	1.86	5.50
(From worksheet 2) Figure 2-6				
8. Pond and swamp adjustment factor, F_p		1.00	1.00	1.00
(Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero pond and swamp area.)				
9. Peak discharge, q_p		11.95	16.59	49.68
(Where $q_p = q_u A_m Q F_p$)				

CWD 3-3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00815	ft/ft
Diameter	2.00	ft
Discharge	16.59	ft³/s

Results

Normal Depth	1.15	ft
Flow Area	1.86	ft²
Wetted Perimeter	3.43	ft
Hydraulic Radius	0.54	ft
Top Width	1.98	ft
Critical Depth	1.47	ft
Percent Full	57.3	%
Critical Slope	0.00402	ft/ft
Velocity	8.92	ft/s
Velocity Head	1.24	ft
Specific Energy	2.38	ft
Froude Number	1.62	
Maximum Discharge	28.56	ft³/s
Discharge Full	26.55	ft³/s
Slope Full	0.00318	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

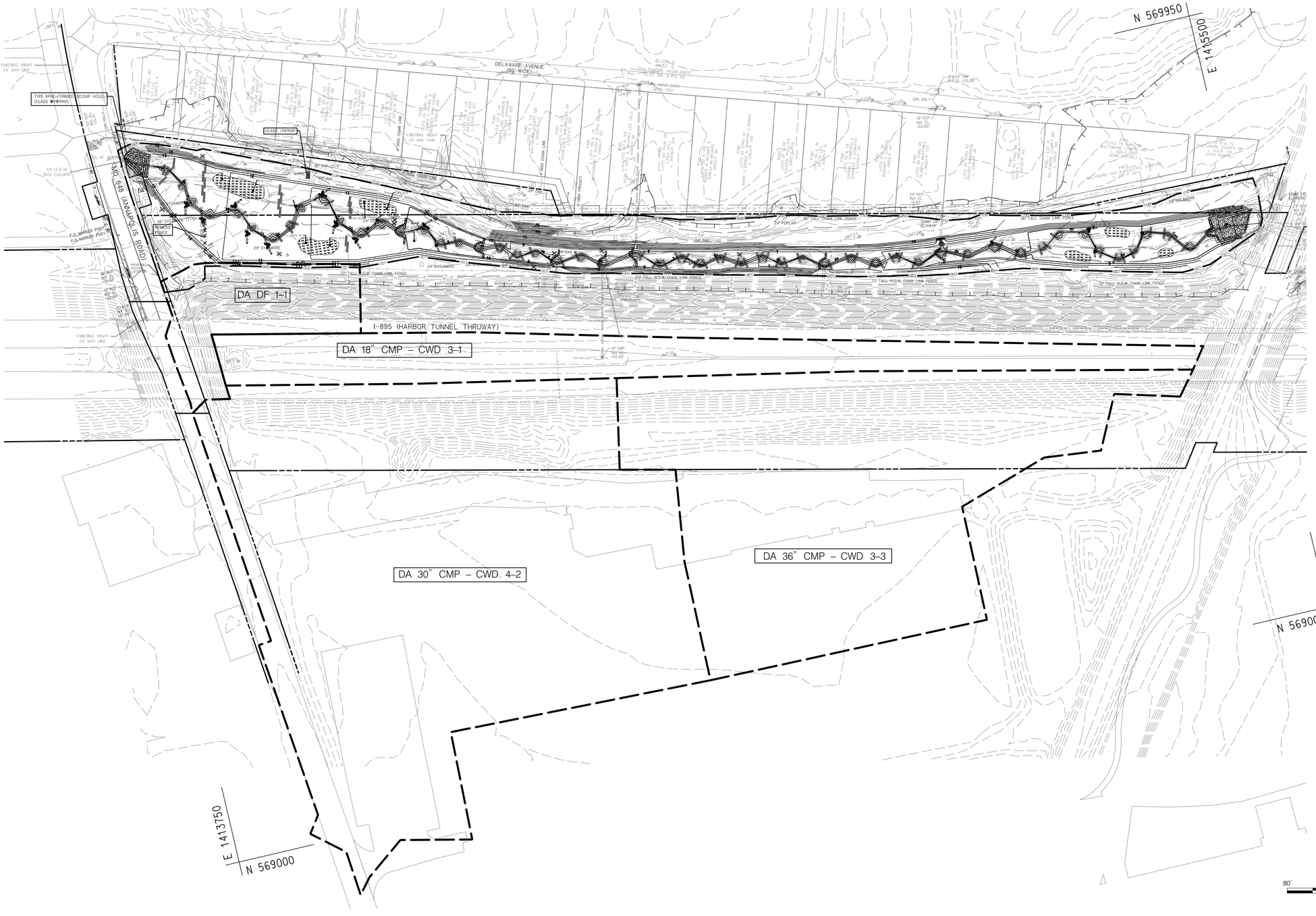
GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	57.27	%
Downstream Velocity	Infinity	ft/s

CWD 3-3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.15	ft
Critical Depth	1.47	ft
Channel Slope	0.00815	ft/ft
Critical Slope	0.00402	ft/ft



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DATE: Friday, December 21, 2018 AT 02:36 PM 02:36 PM

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. _____

EXPIRATION DATE: _____

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY

STREAM RESTORATION PROJECT

ESC DRAINAGE AREA MAP

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE DECEMBER, 2018	SCALE 1"=80'

CONTRACT NO. HT-3012-0000

DRAWING NO.

SHEET NO.

CWD 2-1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00200	ft/ft
Diameter	2.00	ft
Discharge	11.33	ft³/s

Results

Normal Depth	1.43	ft
Flow Area	2.41	ft²
Wetted Perimeter	4.03	ft
Hydraulic Radius	0.60	ft
Top Width	1.80	ft
Critical Depth	1.21	ft
Percent Full	71.6	%
Critical Slope	0.00322	ft/ft
Velocity	4.71	ft/s
Velocity Head	0.34	ft
Specific Energy	1.78	ft
Froude Number	0.72	
Maximum Discharge	14.15	ft³/s
Discharge Full	13.15	ft³/s
Slope Full	0.00148	ft/ft
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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	71.57	%
Downstream Velocity	Infinity	ft/s

CWD 2-1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.43	ft
Critical Depth	1.21	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.00322	ft/ft

CWD 3-2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.00200	ft/ft
Diameter	2.00	ft
Discharge	10.46	ft³/s

Results

Normal Depth	1.35	ft
Flow Area	2.25	ft²
Wetted Perimeter	3.85	ft
Hydraulic Radius	0.58	ft
Top Width	1.88	ft
Critical Depth	1.16	ft
Percent Full	67.4	%
Critical Slope	0.00313	ft/ft
Velocity	4.65	ft/s
Velocity Head	0.34	ft
Specific Energy	1.68	ft
Froude Number	0.75	
Maximum Discharge	14.15	ft³/s
Discharge Full	13.15	ft³/s
Slope Full	0.00127	ft/ft
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		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	67.37	%
Downstream Velocity	Infinity	ft/s

CWD 3-2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.35	ft
Critical Depth	1.16	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.00313	ft/ft

PROJECT INFORMATION

Project : **I895 Stream Restoration** By **PVC** Date **12/21/2018**

Location : **DF 1-1** Checked _____ Date **12/21/2018**

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

Comments :

Worksheet 2: Runoff curve number and runoff

Project **I895 Stream Restoration** By _____ Date _____

Location **DF 1-1** Checked _____ Date _____

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Runoff curve number (CN)

Soil name and hydrologic group	Cover description (cover type, treatment and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN* Table 2-2	CN* Fig. 2-3	CN* Fig. 2-4	Area acres	Product of CN x area
D	Urban areas; Impervious areas; Streets and roads; Paved; open ditches (including right-of-way)	***93***			***0.32***	***29.8***
D	Other agricultural lands; Woods; Good conditon	***77***			***0.60***	***46.2***
* Use only one CN source per line				Totals =	***0.92***	***76.0***
				SQ. MILES =	***0.001438***	

CN (weighted) = total product / total area = ***82.57*** Use CN = ***82.6***

Worksheet 3: Time of concentration (Tc) or travel time (Tt)

Project : **I895 Stream Restoration** By _____ Date _____

Location : **DF 1-1** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

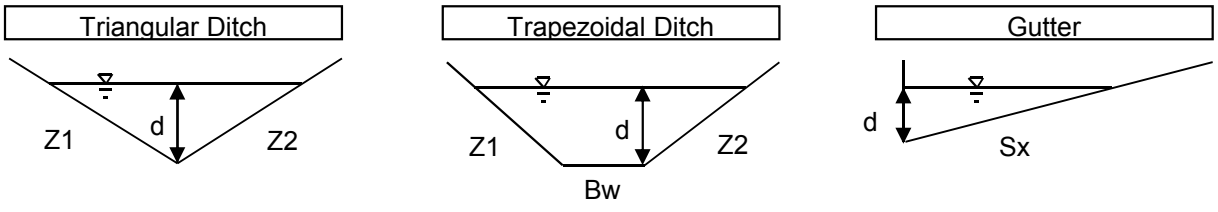
NOTE : Space for as many as three segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments

Sheet flow (Applicable to Tc only)	Segment ID	AB			
1. Surface Description (table 3-1)					
2. Manning's roughness coeff., n (table 3-1)					
3. Flow length, L (total L ≤ 100 ft)	ft				
4. Two-yr 24-hr rainfall, P_2	in				
5. Upstream elevation					
6. Downstream elevation					
7. Land slope, s	ft/ft				
8. $T_t = 0.007\ (nL)^{0.8} / [(P_2^{0.5})(s^{0.4})]$	hr				= 0.000

Shallow concentrated flow	Segment ID	BC			
9. Surface description (Cerrelli Chart)					
10. Flow length, L	ft				
11. Upstream elevation					
12. Downstream elevation					
13. Watercourse slope, s	ft/ft				
14. Average velocity, V	ft/s				
15. T_t = L / 3600*V	hr				= 0.000

Channel Flow	Segment ID				
16. Channel Geometry					
17. Cross-sectional flow area, A	ft²				
18. Wetted perimeter, P_W	ft²				
19. Hydraulic radius, R	ft				
20. Upstream elevation					
21. Downstream elevation					
22. Channel slope, S	ft/ft				
23. Manning's roughness coeff., n					
24. Velocity	ft/s				
25. Flow length, L	ft				
26. T_t = L / 3600*V	hr				= 0.000

27. Watershed or subarea Tc or Tt ..... hr 0.100



Worksheet 4: Graphical Peak Discharge Method

Project : **I895 Stream Restoration** By _____ Date _____

Location : **DF 1-1** Checked _____ Date _____

County : **Baltimore County, MD**

Circle one: Present [Developed] **PROPOSED CONDITIONS**

1. Data

Drainage Area	A_m =	0.0014375	mi² (acres/640)
Runoff Curve Number	CN =	82.6	(From worksheet 2)
Time of Concentration	T_C =	0.100	hr (From worksheet 3)
Rainfall Distribution	=	II	(I, IA, II, III)
Pond and swamp areas spread throughout watershed	=	0	mi² (acres/640)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	1 yr - 24 hr	2 yr - 24 hr	100 yr - 24 hr
3. Rainfall, P (24-hour)	in	2.6	3.2	7.1
4. Initial abstraction, I_a		0.42	0.42	0.42
(Use CN with table 4-1)				
5. Compute I_a/P		0.16	0.13	0.06
6. Unit peak discharge q_u	csm/in	984	992	1010
(Use TC and Ia/P with exhibit 4-II)				
7. Runoff, Q	in	1.11	1.58	5.07
(From worksheet 2) Figure 2-6				
8. Pond and swamp adjustment factor, F_p		1.00	1.00	1.00
(Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero pond and swamp area.)				
9. Peak discharge, q_p		1.56	2.25	7.37
(Where $q_p = q_u A_m Q F_p$)				

DF 1-1 Velocity Computation

Project Description

Solve For	Spread

Input Data

Channel Slope	0.00470	ft/ft
Discharge	2.25	ft³/s
Gutter Width	4.00	ft
Gutter Cross Slope	0.12	ft/ft
Road Cross Slope	0.12	ft/ft
Roughness Coefficient	0.035	

Results

Spread	4.98	ft
Flow Area	1.46	ft²
Depth	0.59	ft
Gutter Depression	0.00	ft
Velocity	1.54	ft/s

Appendix J

Final Design Plans (under separate cover)

HT-3012-0000

AASHTO DESIGN CRITERIA

THIS PROJECT WAS DESIGNED IN ACCORDANCE WITH THE 2011 EDITION OF AASHTO'S "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS."

NOTE TO CONTRACTOR: EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED.

INDEX OF SHEETS

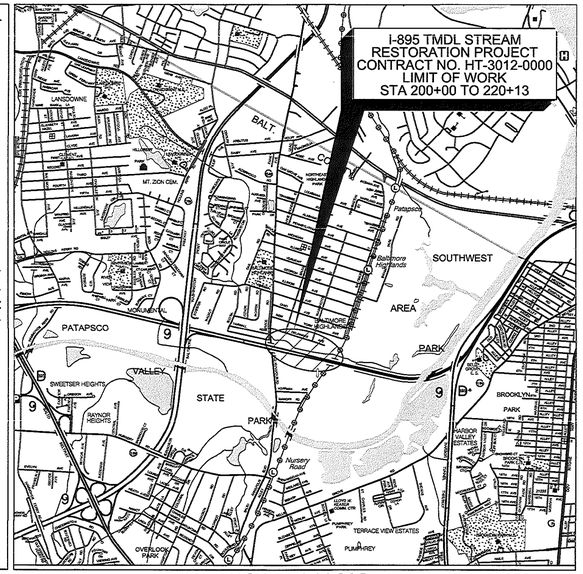
Maryland Transportation Authority

I-895 TMDL STREAM RESTORATION PROJECT

BALTIMORE COUNTY, MD

CONTRACT NO.: HT-3012-0000

LOCATION MAP
SCALE : 1"=500'



VICINITY MAP
SCALE : 1"=2000'

PROJECT LENGTH
1,750 FEET

HORIZONTAL DATUM	NAD 83 / 91
VERTICAL DATUM	NAVD 88

STANDARDS AND SPECIFICATIONS

THIS PROJECT SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE MARYLAND STATE HIGHWAY ADMINISTRATION'S "STANDARDS FOR HIGHWAY AND INCIDENTAL CONSTRUCTION", THE MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION'S "STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS, JULY 2018" AND ALL REVISIONS THEREOF, THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND AS SPECIFIED IN THE CONTRACT DOCUMENTS.

COMPLETENESS OF DOCUMENTS

THE MARYLAND TRANSPORTATION AUTHORITY SHALL ONLY BE RESPONSIBLE FOR THE COMPLETENESS OF DOCUMENTS OBTAINED DIRECTLY FROM EMARYLAND MARKETPLACE. ALL RELEVANT DOCUMENTS REQUIRED FOR BIDDING PROJECTS ARE POSTED ON AND ARE DOWNLOADABLE FROM EMARYLAND MARKETPLACE.

RIGHT OF WAY

RIGHT OF WAY AND EASEMENT LINES SHOWN ON THESE PLANS ARE FOR ASSISTANCE IN INTERPRETING THE PLANS. THEY ARE NOT OFFICIAL. FOR OFFICIAL FEE RIGHT OF WAY AND EASEMENT INFORMATION, SEE APPROPRIATE RIGHT OF WAY PLATS.

UTILITIES

THE LOCATION OF UTILITIES SHOWN ON THE PLANS ARE FOR INFORMATION AND GUIDANCE ONLY. NO GUARANTEE IS MADE OF THE ACCURACY OF SAID LOCATIONS. NOTIFICATION TO "MISS UTILITY", 1.800.257.7777, SHALL BE GIVEN 72 HOURS (THREE FULL WORKING DAYS) IN ADVANCE OF WORKING IN THE AREA OF THE SPECIFIC AFFECTED UTILITY. THE NOTIFICATION TO "MISS UTILITY" IS REQUIRED WHENEVER ANY EXCAVATING OR SIMILAR WORK IS TO BE PERFORMED.

NOTIFICATION TO BILL PROSS, THE MDTA UTILITIES COORDINATOR (410.537.7829), SHALL BE GIVEN 72 HOURS (THREE FULL WORKING DAYS) IN ADVANCE OF WORKING IN THE AREA OF MDTA UTILITIES.

ENVIRONMENTAL INFORMATION

FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.

THE GRADING LIMITS SHOWN ON THE PLANS SHALL NOT BE EXCEEDED. ANY CHANGES IN THE SEDIMENT CONTROL PLAN, THE STORMWATER MANAGEMENT BEST MANAGEMENT PRACTICES (BMP'S) OR OTHER SEGMENT OF WORK MUST BE REVIEWED AND APPROVED BY MDTA ENVIRONMENTAL DIVISION AND MARYLAND DEPARTMENT OF ENVIRONMENT, SEDIMENT AND STORMWATER PLAN REVIEW DIVISION.

ALL STORMWATER MANAGEMENT FACILITIES CONSTRUCTED FOR THIS CONTRACT SHALL BE INSPECTED AND MAINTAINED IN ACCORDANCE WITH THE MDOT MDTA BEST MANAGEMENT PRACTICES (BMP) INSPECTION AND REMEDIATION PROGRAM.

ADA COMPLIANCE

THE DESIGN OF THIS PROJECT HAS INCORPORATED FACILITIES IN COMPLIANCE WITH THE STATE AND FEDERAL LEGISLATION

OWNERS / DEVELOPERS CERTIFICATION :

I/WE HEREBY CERTIFY THAT ALL CLEARING, GRADING, CONSTRUCTION, AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN AND THAT ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OF ATTENDANCE AT A MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION AND SEDIMENT BEFORE BEGINNING THE PROJECT. I/WE HEREBY AUTHORIZE THE RIGHT OF ENTRY FOR PERIODIC ON- SITE EVALUATION BY APPROPRIATE INSPECTION AND ENFORCEMENT AUTHORITY OR THE STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT. I/WE HEREBY CERTIFY THAT STORMWATER MANAGEMENT FACILITIES WILL BE MAINTAINED IN ACCORDANCE WITH APPROVED PLANS.

4/17/2019
DATE

Peter Mattejat
OWNER /DEVELOPER SIGNATURE

RPE 013058
RESPONSIBLE PERSONNEL CERTIFICATION NO.

Peter Mattejat, PE
Environmental Manager
PRINTED NAME AND TITLE

ADVERTISEMENT

JUNE 3, 2019
DATE

MDE No. 18-SF-0102

ADDENDA	MARYLAND TRANSPORTATION AUTHORITY	
	RECOMMENDED FOR APPROVAL DIRECTOR OF ENGINEERING, OFFICE OF ENGINEERING AND CONSTRUCTION	04/17/2019 DATE
	APPROVED CHIEF ENGINEER, OFFICE OF ENGINEERING AND CONSTRUCTION	4/22/19 DATE

jmt.com

STATE OF MARYLAND · JEREMY SCOTT YODER · No. 31183 · PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31183, EXPIRATION DATE: 1/13/2021.

BY: PCRAWFORD -

ABBREVIATIONS

A.A.S.H.T.O.	AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS
ADT	AVERAGE DAILY TRAFFIC
AHD	AHEAD
APPROX.	APPROXIMATE
B. or B/L	BASELINE
BK	BACK /BOOK
BIT.	BITUMINOUS
B.C.	BITUMINOUS CONCRETE
B.M.	BENCH MARK
BOT.	BOTTOM
C.C.	CENTER OF CURVE
CATV	CABLE TELEVISION
C.B.R.	CALIFORNIA BEARING RATIO
℄ or C/L	CENTERLINE
CL.	CLASS
C.L.F.	CHAINLINK FENCE
CMP	CORRUGATED METAL PIPE
C.O.	CLEANOUT
COMB.	COMBINATION
CONC.	CONCRETE
CONSTR.	CONSTRUCTION
COR.	CORNER
CORR.	CORRECTION
DC	DEGREE OF CURVE
D.H.V.	DESIGN HOURLY VOLUME
D.I.	DROP INLET
DIA.	DIAMETER
D.O.	DOUBLE OPENING
E	EAST
E	ELECTRIC
E	EXTERNAL DISTANCE
EA.	EACH
E.B.	EASTBOUND
ELEV.	ELEVATION
E.R.C.C.P.	ELLIPTICAL REINFORCED CEMENT CONCRETE PIPE
ES	END SECTION
EX. or EXIST.	EXISTING
FT.	FEET
FF	FINSHED FLOOR
F. or FL.	FLOWLINE
F.B.D.	FLAT BOTTOM DITCH
F.H.	FIRE HYDRANT
FWD.	FORWARD
G	GAS
G.V.	GAS VALVE
H.B.	HANDBOX
H.D.P.	HIGH DENSITY POLYETHEYLENE
HDWL.	HEADWALL
H.E.R.C.P.	HORIZONTAL ELLIPTICAL REINFORCED CONCRETE PIPE
HMA	HOT MIX ASPHALT
HP	HIGH POINT
IN	INCH
I.S.T.	INLET SEDIMENT TRAP
INV.	INVERT
J.B.	JUNCTION BOX
K	K INLET
L	LENGTH
L.F.	LINEAR FEET
L.L.	LIQUID LIMIT
LOD	LIMIT OF DISTURBANCE
LP	LOW POINT
L.P.	LIGHT POLE
LT.	LEFT
MAC.	MACADAM
M.C.	MOISTURE CONTENT
MAX.	MAXIMUM
M.D.D.	MAXIMUM DRY CONTENT
MOD.	MODIFIED
MIN.	MINIMUM
MUTCD	MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES
N	NORTH
N.B.	NORTHBOUND
N.E.	NORTHEAST
N.P.	NON-PLASTIC
O.C.	ON CENTER
OHE	OVERHEAD ELECTRIC
O.M.	OPTIMUM MOISTURE
PAV'T.	PAVEMENT
P.C.	POINT OF CURVATURE
P.C.C.	POINT OF COMPOUND CURVATURE
PC	POINT OF CROWN
PGE	PROFILE GRADE ELEVATION
P.G.E.	PROFILE GROUND ELEVATION
P.G.L.	PROFILE GRADE LINE
PGL	PROFILE GROUND LINE
PR	POINT OF ROTATION
P.I.	PLASTICITY INDEX
P.I.	POINT OF INTERSECTION
P.O.C.	POINT ON CURVE
P.O.T.	POINT ON TANGENT
PR. OR PROP.	PROPOSED
P.R.C.	POINT OF REVERSE CURVE
PT.	POINT
P.T.	POINT OF TANGENCY
P.V.C.	POINT OF VERTICAL CURVE
PVC	POLYVINYL CHLORIDE
P.VI.	POINT OF VERTICAL INTERSECTION
P.VRC.	POINT OF VERTICAL REVERSE CURVE
P.VT.	POINT OF VERTICAL TANGENCY
R	RADIUS
R.F.	ROCK FRAGMENTS
RT.	RIGHT
RW. or R/W.	RIGHT OF WAY
R.C.P.	REINFORCED CEMENT PIPE
R.C.C.P.	REINFORCED CEMENT CONCRETE PIPE
R.Q.D.	ROCK QUALITY DESIGNATION
R.M.	ROOTMAT
RMP	RAISED PAVEMENT MARKING
S	SOUTH
SAN.	SANITARY SEWER
SB. or S/B	SOUTHBOUND
S.D.	STORM DRAIN
S.D.D.	SURFACE DRAIN DITCH
S.E.	SUPER ELEVATION
SF	SILT FENCE
S.F.	SQUARE FEET
SHT.	SHEET
S.P.P.	STRUCTURAL PLATE PIPE
S.P.T.	STANDARD PENETRATION TESTING
SSD	STOPPING SIGHT DISTANCE
SSF	SUPER SILT FENCE
STD.	STANDARD
STA.	STATION
SO.	SINGLE OPENING
S.Y.	SQUARE YARDS
SWM	STORMWATER MANAGEMENT
T	TANGENT
T	TELEPHONE
T.C.	TOP OF COVER
T.G.	TOP OF GRATE
T. or TL	TRAVERSE LINE
T.M.	TOP OF MANHOLE
TRAV.	TRAVERSE
TS	TEMPORARY SWALE
T.S.	TOP OF SLAB
T.S.	TOPSOIL
TYP.	TYPICAL
U.D.	UNDER DRAIN
U.G.	UNDERGROUND
U.P.	UTILITY POLE
U.S.D.A.	UNITED STATES DEPARTMENT OF AGRICULTURE
VCL	VERTICAL CLEARANCE
V.C.L.	VERTICAL CURVE LENGTH
W	WATER
W	WEST
W.B.	WESTBOUND
WB	WETLAND BUFFER
W.M.	WATER METER
W.S.	WRAPPED STEEL
WUS	WATERS OF THE UNITED STATES
W.V.	WATER VALVE

CONVENTIONAL SIGNS

INLET PROTECTION — I.P. CIP SIP
SILT FENCE — SF
SUPER SILT FENCE — SSF
SANDBAGS
STABILIZED CONSTRUCTION ENTRANCE — SCE
REMOVABLE PUMPING STATION/SUMP PIT — RPS/SP
PORTABLE SEDIMENTATION TANK — PST
LIMIT OF DISTURBANCE — LOD
ELECTRICAL HAND BOX – SIGNALS — H.B.
EXISTING TRAFFIC LIGHT POLE
EXISTING ELECTRICITY POLE
EXISTING SIGN
EXISTING WATER METER/MANHOLE — M.M. W
EXISTING FIRE HYDRANT — F.H.
EXISTING ELECTRICITY MANHOLE — E
EXISTING TELECOMMUNICATION MANHOLE — T
EXISTING STORM DRAIN INLET
EXISTING STORM DRAIN MANHOLE — SD
EXISTING CULVERT/PIPE
BURIED ELECTRICITY LINES — E
BURIED TELECOMMUNICATION/CABLE TV CABLES — T — CATV
BURIED FIBER OPTIC CABLES — FO

BURIED GAS LINES — G
BURIED WATER LINES — W
OHE WIRES — E
EXISTING CHAIN LINK FENCE
PROPOSED CHAIN LINK FENCE
EXISTING CURB OR CURB & GUTTER
TEMPORARY BRIDGE — TB
RIGHT OF WAY LINE
PROPERTY LINE
EXISTING ROADWAY EDGE
EXISTING TRAFFIC BARRIER
PROPOSED TRAFFIC BARRIER
EXISTING CONTOURS — 10
PROPOSED CONTOURS — 10
TEST HOLE, SOIL BORING — TH-4 SB-5
BASE OR SURVEY LINE
RIP-RAP
SANITARY SEWER MANHOLE — SS
TEMPORARY MULCH ACCESS ROAD
WATERS OF THE US — WUS
WETLANDS, WITH BUFFER — B

TREES/CRITICAL ROOT ZONE/ NUMBER/DBH/TYPE — T-01 2.5 LITU
FOREST BUFFER — FS 4
EXISTING TREE LINE
DITCH/FLOW LINE
DRAINAGE AREA BOUNDARY
1,000-FT. CRITICAL AREA BOUNDARY — CBCA
EXPANDED 100-FT CRITICAL AREA BOUNDARY — CAB
TEMPORARY ORANGE CONSTRUCTION FENCE FOR TREE PROTECTION — OCF
EXISTING FLOODPLAIN BOUNDARY
SANITARY SEWER LINE — SAN
LOG SILLS
ROCK CROSS VANE
LOG VANE
FLOODPLAIN MICROTOPOGRAPHY
ACCESS ROAD WITH HARDWOOD CONSTRUCTION MATS

STREAM WIDTH
TEMPORARY STAGING AREA

GENERAL NOTES

1. ALL WORK ON THE PROJECT SHALL BE DONE IN ACCORDANCE WITH BOTH MDSHA AND THE PROJECT SPECIFICATIONS AND WHERE REFERENCED IS MADE, THE REQUIREMENTS OF THE MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION'S SPECIFICATIONS ENTITLED: "2018 MDOT SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS", DATED JULY 2018 AND REVISIONS THEREOF OR ADDITIONS THERETO, AND THE TECHNICAL SPECIFICATIONS.

2. STANDARDS FOR THIS CONTRACT SHALL BE THOSE OF THE MARYLAND STATE HIGHWAY ADMINISTRATION. IT SHALL ALSO BE THE CONTRACTOR'S RESPONSIBILITY TO HAVE IN HIS POSSESSION THE MARYLAND SHA " BOOK OF STANDARDS, HIGHWAY AND INCIDENTAL STRUCTURES" WITH THE LATEST UP-TO-DATE MSHA STANDARDS AS OF THE DATE OF ADVERTISEMENT OF THIS PROJECT.

3. THE PROJECT IS ORIENTED TO CONFORM TO THE MARYLAND STATE PLANE COORDINATE SYSTEM, NAD 8391. THE LOCATION AND ELEVATION OF BENCHMARKS ARE SHOWN ON THE PLANS. ALL ELEVATIONS ARE IN FEET AND ARE BASED ON THE U.S. COAST AND GEODETIC SURVEY MEAN SEA LEVEL DATUM OF 1988 (NAVD 88). THE CONTRACTOR, IN THE CONSTRUCTION-ALIGNMENT PROCESS AND FOR ALL SURVEY OPERATIONS, SHALL USE ONLY BENCHMARKS NOTED AS "NAD 83-91" (HORIZONTAL DATUM) AND "NAVD 88" (VERTICAL DATUM) ON THE CONSTRUCTION PLANS AND IN THE CONSTRUCTION STAKEOUT INFORMATION FOR HORIZONTAL AND VERTICAL LAYOUT. CONTROL POINTS NOT LISTED AS SUCH SHALL BE USED ONLY UPON PRIOR APPROVAL FROM THE MARYLAND TRANSPORTATION AUTHORITY.

5. THE CONTRACTOR SHALL CONTACT "MISS UTILITY" AT 1-800-257-7777 AND JEFF ALTER, CHIEF FACILITY MAINTENANCE OFFICER AT THE MARYLAND TRANSPORTATION AUTHORITY AT 410-537-1315, 72 HOURS PRIOR TO EXCAVATION FOR MARKING AND LOCATION OF UTILITIES.

6. ALL EXISTING STORM DRAIN STRUCTURES, SEWER MANHOLES, VALVE BOXES VAULTS, ETC. SHALL BE ADJUSTED BY THE CONTRACTOR TO MEET THE FINISHED GRADE ELEVATION, UNLESS THESE APPURTENANCES ARE ABANDONED OR REMOVED UNDER THIS CONTRACT.

7. THE EXISTING UTILITIES AND OBSTRUCTIONS SHOWN ON THESE PLANS ARE FROM THE BEST AVAILABLE RECORDS AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. ALL UTILITY ONWERS SHALL BE NOTIFIED A MINIMUM OF 60 DAYS IN ADVANCE OF CONSTRUCTION. THE CONTRACTOR SHALL SEE IFB FOR FURTHER UTILITY STATEMENT.

8. THE LOCATION AND LENGTH OF PROPOSED PIPE AND DRAINAGE STRUCTURES SHALL BE VERIFIED BY THE CONTRACTOR BEFORE ORDERING.

9. ALL INVERT ELEVATIONS ARE APPROXIMATE. INVERT ELEVATIONS OF INLETS AND PIPES MAY BE MODIFIED AS DIRECTED BY THE ENGINEER TO MEET CONDITIONS ENCOUNTERED DURING INSTALLATION OF DRAINAGE STRUCTURES. ALL PIPES AND DITCHES SHALL BE CONSTRUCTED ON A UNIFORM GRADE BETWEEN INVERT ELEVATIONS NOTED ON THE PLANS, UNLESS INDICATED OTHERWISE ON THE PLANS OR DETAILS OR AS DIRECTED BY THE ENGINEER.

10. LANDSCAPING: UNLESS OTHERWISE NOTED, THE CONTRACTOR IS TO USE 2" TOPSOIL ALL GRADED AREAS THAT HAS A SLOPE OF 3:1 OR STEEPER. FOR ALL OTHER GRADED AREAS, 4" TOPSOIL SHOULD BE USED UNLESS OTHERWISE NOTED.

11. THE CONTRACTOR SHALL PROTECT AND NOT INTERRUPT EXISTING UTILITY SERVICES UNLESS OTHERWISE NOTED ON THE PLANS OR AUTHORIZED BY THE ENGINEER. SEE UTILITY STATEMENT.

12. THE CONTRACTOR SHALL SUBMIT MISS UTILITY TICKETS AND SCOUT WORK SITES AS A FIRST ORDER OF BUSINESS. THE SITES SHALL BE PRIORITIZED IN ACCORDANCE WITH THE CONTRACTOR'S INTENDED SCHEDULE OF CONSTRUCTION. THE CONTRACTOR IS TO BE AWARE THAT COMPANIES SUCH AS BGE REQUIRE A MINIMUM OF NINETY (60-90) DAYS TO RESOLVE UTILITY CONFLICTS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY UPON DETERMINATION OF ANY UTILITY IMPACTS. REPAIRS TO UTILITIES, FACILITIES, AND/OR PROPERTY AS A RESULT OF THE CONTRACTOR'S NEGLIGENCE OR MEANS AND METHODS SHALL BE AT THE CONTRACTOR'S EXPENSE.

13. MATERIAL REMOVED DURING CONSTRUCTION SHALL BECOME THE CONTRACTOR'S PROPERTY UNLESS OTHERWISE NOTED ON THE PLANS OR IN THE SPECIAL PROVISIONS. ALL EXCAVATED ROADWAY MATERIALS, INCLUDING EXISTING PAVEMENT, SIDEWALKS, OR COMBINATION CURB AND GUTTER, DETERMINED BY THE ENGINEER TO BE UNSUITABLE FOR USE IN EMBANKMENTS SHALL BE REMOVED FROM THE PROJECT SITE AND DISPOSED OF IN AN APPROVED LOCATION.

14. SAW CUTS WILL NOT BE MEASURED BUT WILL BE INCIDENTAL TO OTHER RELATED ITEMS.

15. THE CONTRACTOR IS RESPONSIBLE TO ENSURE THAT THE SAFETY OF THE PUBLIC AND ALL WORKERS IS MAINTAINED AT ALL TIMES THROUGHOUT THE TERM OF THE CONTRACT. MOTORISTS SHALL BE GUIDED IN A CLEAR AND POSITIVE MANNER WHILE APPROACHING AND PASSING THROUGH CONSTRUCTION WORK /EQUIPMENT AREAS.

16. ALL CHAIN LINK FENCE AND GATES SHALL BE BONDED ALUMINUM COATED FABRIC UTILIZING GALVANIZED STEEL OR GALVANIZED BONDED ALUMINUM COATED STEEL LINE POSTS AND FITTINGS. FENCE POSTS AND FENCING SHALL NOT BE INSTALLED WITHIN STREAM CHANNELS OR ACROSS ANY STREAM CHANNELS THAT MAY BLOCK OR OBSTRUCT THE FLOW OF THE STREAM.

17. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY DIMENSIONS AND ELEVATIONS AFFECTING ALL WORK IN THE FIELD. NO SEPARATE OR ADDITIONAL COMPENSATION WILL BE ALLOWED FOR THIS WORK.

18. ALL ROADS, STRUCTURES, PIPES, CURBS, INLETS, ETC. THAT ARE TO REMAIN IN PLACE SHALL BE PROTECTED FROM DAMAGE THROUGHOUT THE DURATION OF THE CONTRACT. ANY DAMAGE TO EXISTING STRUCTURES AND/OR FEATURES SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSES IN A MANNER APPROVED BY THE ENGINEER.

19. THE MARYLAND TRANSPORTATION AUTHORITY DOES NOT WARRANT THE CORRECTNESS OF THE TOPOGRAPHIC OR UTILITY DATA PRESENTED HEREIN AND IS NOT RESPONSIBLE FOR ANY CONCLUSIONS DRAWN FROM THEM.

20. DURING EXCAVATION, ANY PETROLEUM IMPACTED SOILS OR OTHER HAZARDOUS MATERIALS ENCOUNTERED WILL REQUIRE THAT THE ENGINEER AND THE OFFICE OF ENVIRONMENT SAFETY AND RISK MANAGEMENT BE NOTIFIED. WHILE THE CONTRACTOR WILL BE RESPONSIBLE FOR PROCURING DISPOSAL, ONLY OESRM PERSONEL WILL BE RESPONSIBLE FOR THE SIGNING OF MANIFESTS AND THE RELEASING OF WASTE TO THE WASTED HAULER.

21. THE MAJORITY OF THE LIMITS OF DISTURBANCE FOR THIS PROJECT ARE WITHIN THE 100-YEAR FLOODPLAIN. CONTRACTOR TO REVIEW AND ADHERE TO THE FLOODPLAIN ACTION AND PROTECTION PLAN PROVIDED IN THE SPECIFICATIONS FOR THIS PROJECT.

jmt.com

STATE OF MARYLAND — JEREMY SCOTT KOSER — No. 31183 — PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
GENERAL NOTES AND ABBREVIATIONS

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE N.T.S.

CONTRACT NO. HT-3012-0000
DRAWING NO. **GN-01**
SHEET NO. 2 OF 26

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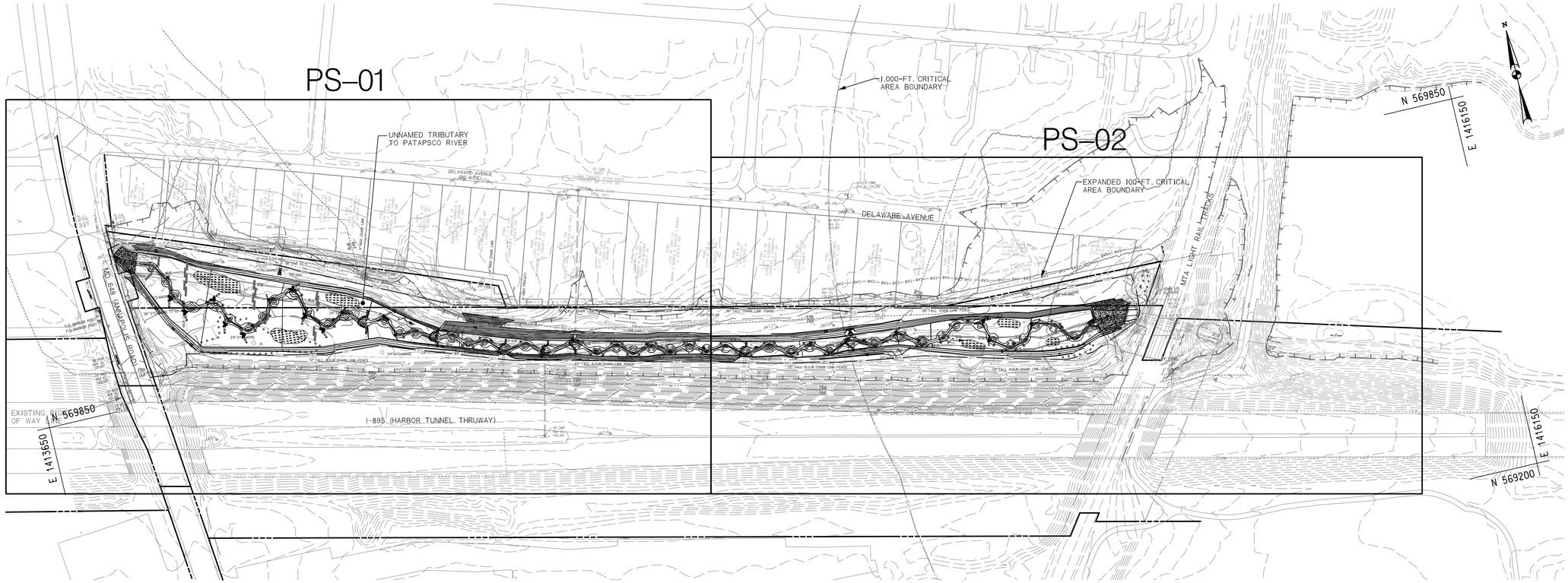


PLAN

100' 0 100' 200'
SCALE: 1" = 100'

FILE: G:\2015\151777_003_I-895_TMDL_Stream_Res\CADD\pKM-001_I895 STREAM RESTORATION.dgn
DATE: Tuesday, February 05, 2019 AT 12:35 PM 12:35 PM

jmt.com

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

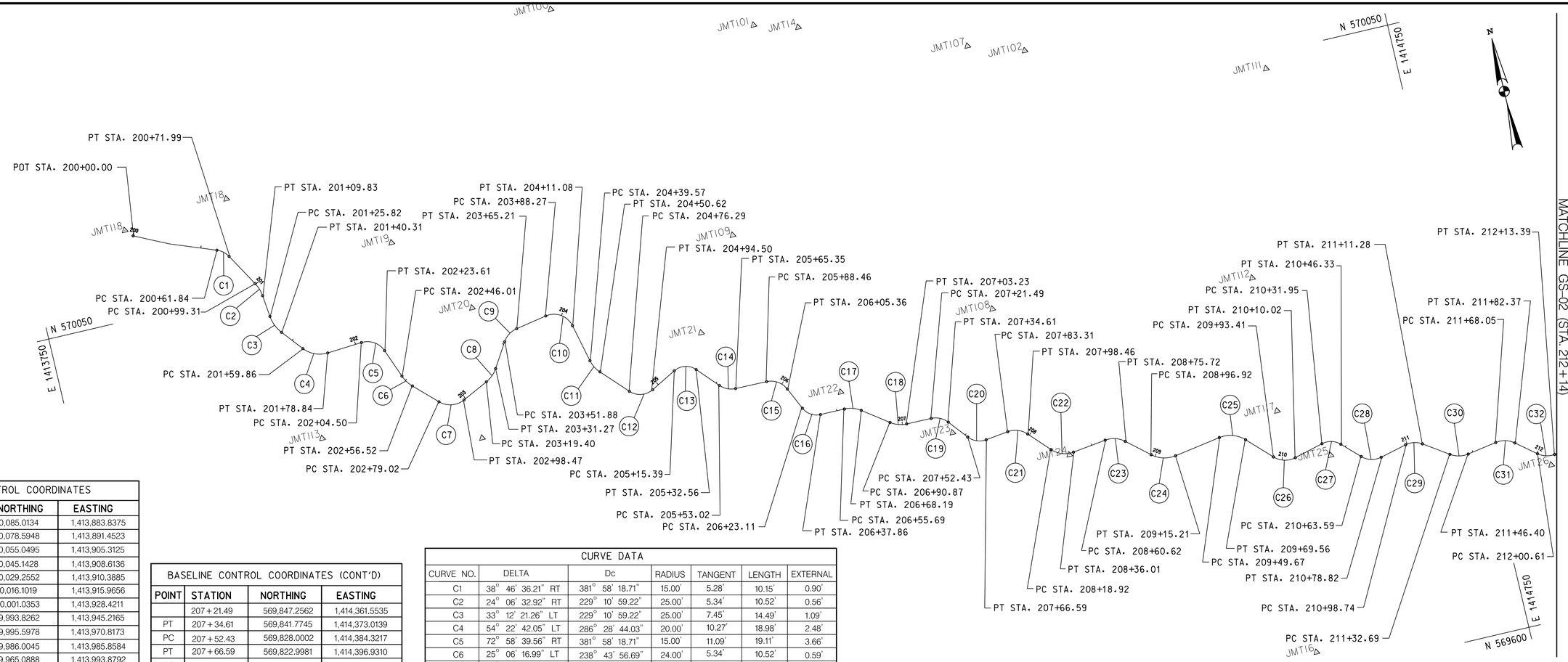
ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT
KEY MAP

CONTRACT NO. HT-3012-0000

DRAWING NO. **KM-01**

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	SHEET NO. 3 OF 26
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1" = 100'	



BASELINE CONTROL COORDINATES			
POINT	STATION	NORTHING	EASTING
PC	200+61.84	570,085.0134	1,413,883.8375
PT	200+71.99	570,078.5948	1,413,891.4523
PC	200+99.31	570,055.0495	1,413,905.3125
PT	201+09.83	570,045.1428	1,413,908.6136
PC	201+25.82	570,029.2552	1,413,910.3885
PT	201+40.31	570,016.1019	1,413,915.9656
PC	201+59.86	570,001.0353	1,413,928.4211
PT	201+78.84	569,993.8262	1,413,945.2165
PC	202+04.50	569,995.5978	1,413,970.8173
PT	202+23.61	569,986.0045	1,413,985.8584
PC	202+46.01	569,965.0888	1,413,993.8792
PC	202+56.52	569,956.3931	1,413,999.6421
PC	202+79.02	569,940.7912	1,414,015.8468
PT	202+98.47	569,937.9072	1,414,033.8976
PC	203+19.40	569,946.9999	1,414,052.7409
PT	203+31.27	569,954.8368	1,414,061.4558
PC	203+51.88	569,972.3417	1,414,072.3233
PT	203+65.21	569,979.6377	1,414,083.0171
PC	203+88.27	569,983.8166	1,414,105.6942
PT	204+11.08	569,972.5173	1,414,123.0099
PC	204+39.57	569,944.7865	1,414,129.5684
PT	204+50.62	569,935.1772	1,414,134.7597
PC	204+76.29	569,916.5441	1,414,152.4122
PT	204+94.50	569,913.8101	1,414,169.1458
PC	205+15.39	569,923.6149	1,414,187.5941
PT	205+32.56	569,920.8922	1,414,203.3034
PC	205+53.02	569,905.7706	1,414,217.0849
PT	205+65.35	569,900.8752	1,414,228.0298
PC	205+88.46	569,900.6570	1,414,251.1389
PT	206+05.36	569,891.9722	1,414,264.6035
PC	206+23.11	569,875.8775	1,414,272.0728
PT	206+37.86	569,868.3501	1,414,283.8435
PC	206+55.69	569,868.3208	1,414,301.6769
PT	206+68.19	569,864.5192	1,414,313.3749
PC	206+90.87	569,851.2193	1,414,331.7398
PT	207+03.23	569,847.4184	1,414,343.2930

BASELINE CONTROL COORDINATES (CONT'D)			
POINT	STATION	NORTHING	EASTING
	207+21.49	569,847.2562	1,414,361.5535
PT	207+34.61	569,841.7745	1,414,373.0139
PC	207+52.43	569,828.0002	1,414,384.3217
PT	207+66.59	569,822.9981	1,414,396.9310
PC	207+83.31	569,825.1348	1,414,413.5201
PT	207+98.46	569,820.1975	1,414,427.2474
PC	208+18.92	569,805.2601	1,414,441.2238
PT	208+36.01	569,799.7128	1,414,456.7211
PC	208+60.62	569,802.9299	1,414,481.1139
PT	208+75.72	569,798.7615	1,414,495.1695
PC	208+96.92	569,784.9753	1,414,511.2825
PT	209+15.21	569,780.2104	1,414,528.3432
PC	209+49.67	569,785.8032	1,414,562.3456
PT	209+69.56	569,779.9464	1,414,580.5877
PC	209+93.41	569,763.1011	1,414,597.4681
PT	210+10.02	569,758.9379	1,414,612.7823
PC	210+31.95	569,764.4388	1,414,634.0178
PT	210+46.33	569,760.9019	1,414,647.3105
PC	210+63.59	569,748.8438	1,414,659.6568
PT	210+78.82	569,745.0102	1,414,673.7248
PC	210+98.74	569,749.7759	1,414,693.0734
PT	211+11.28	569,747.6411	1,414,705.0570
PC	211+32.69	569,735.6543	1,414,722.8026
PT	211+46.40	569,732.8222	1,414,735.8797
PC	211+68.05	569,736.4331	1,414,757.2297
PT	211+82.37	569,732.9452	1,414,770.6853
PC	212+00.61	569,721.5535	1,414,784.9229
PT	212+13.39	569,718.1701	1,414,796.9013

CURVE DATA						
CURVE NO.	DELTA	Dc	RADIUS	TANGENT	LENGTH	EXTERNAL
C1	38° 46' 36.21" RT	381° 58' 18.71"	15.00'	5.28'	10.15'	0.90'
C2	24° 06' 32.92" RT	229° 10' 59.22"	25.00'	5.34'	10.52'	0.56'
C3	33° 12' 21.26" LT	229° 10' 59.22"	25.00'	7.45'	14.49'	1.09'
C4	54° 22' 42.05" LT	286° 28' 44.03"	20.00'	10.27'	18.98'	2.48'
C5	72° 58' 39.56" RT	381° 58' 18.71"	15.00'	11.09'	19.11'	3.66'
C6	25° 06' 16.99" LT	238° 43' 56.69"	24.00'	5.34'	10.52'	0.59'
C7	69° 40' 24.77" LT	358° 05' 55.04"	16.00'	11.14'	19.46'	3.49'
C8	32° 24' 28.18" LT	272° 50' 13.36"	21.00'	6.10'	11.88'	0.87'
C9	47° 43' 33.73" RT	358° 05' 55.04"	16.00'	7.08'	13.33'	1.50'
C10	87° 08' 04.87" RT	381° 58' 18.71"	15.00'	14.27'	22.81'	5.70'
C11	30° 08' 44.10" LT	272° 50' 13.36"	21.00'	5.66'	11.05'	0.75'
C12	74° 32' 14.84" LT	409° 15' 20.04"	14.00'	10.65'	18.21'	3.59'
C13	75° 38' 38.99" RT	440° 44' 12.36"	13.00'	10.09'	17.16'	3.46'
C14	47° 06' 49.48" LT	381° 58' 18.71"	15.00'	6.54'	12.33'	1.36'
C15	64° 33' 49.13" RT	381° 58' 18.71"	15.00'	9.48'	16.90'	2.74'
C16	65° 00' 37.80" LT	440° 44' 12.36"	13.00'	8.28'	14.75'	2.41'
C17	35° 49' 04.51" RT	286° 28' 44.03"	20.00'	6.46'	12.50'	1.02'
C18	35° 24' 10.54" LT	286° 28' 44.03"	20.00'	6.38'	12.36'	0.99'
C19	50° 06' 25.77" RT	381° 58' 18.71"	15.00'	7.01'	13.12'	1.56'
C20	57° 57' 20.60" LT	409° 15' 20.04"	14.00'	7.75'	14.16'	2.00'
C21	54° 14' 35.15" RT	358° 05' 55.04"	16.00'	8.20'	15.15'	1.98'
C22	54° 25' 00.74" LT	318° 18' 35.59"	18.00'	9.25'	17.10'	2.24'
C23	48° 03' 47.82" RT	318° 18' 35.59"	18.00'	8.03'	15.10'	1.71'
C24	49° 53' 26.15" LT	272° 50' 13.36"	21.00'	9.77'	18.29'	2.16'
C25	54° 16' 50.97" RT	272° 50' 13.36"	21.00'	10.76'	19.89'	2.60'
C26	59° 27' 47.39" LT	358° 05' 55.04"	16.00'	9.14'	16.61'	2.43'
C27	58° 50' 46.52" RT	409° 15' 20.04"	14.00'	7.90'	14.38'	2.07'
C28	58° 09' 37.07" LT	381° 58' 18.71"	15.00'	8.34'	15.23'	2.16'
C29	47° 52' 31.03" RT	381° 58' 18.71"	15.00'	6.66'	12.53'	1.41'
C30	43° 38' 15.52" LT	318° 18' 35.59"	18.00'	7.21'	13.71'	1.39'
C31	48° 15' 46.25" RT	337° 02' 02.39"	17.00'	7.62'	14.32'	1.63'
C32	45° 46' 51.44" LT	358° 05' 55.04"	16.00'	6.76'	12.78'	1.37'

JMT SURVEY TRAVERSE COORDINATE TABLE				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
JMT100	570200.0932	1414160.2475	39.284	TRAV,MAG. NAIL
JMT101	570155.2524	1414301.2283	39.366	TRAV,MAG. NAIL
JMT102	570092.0453	1414488.9586	34.321	TRAV,MAG. NAIL
JMT107	570104.8684	1414449.1238	35.787	TRAV,MAG. NAIL
JMT108	569914.4934	1414423.0776	31.892	TRAV,R&C
JMT109	570009.9230	1414251.4692	32.182	TRAV,8" SPIKE
JMT111	570039.2643	1414656.7841	29.586	TRAV,MAG. NAIL
JMT112	569893.3106	1414612.1613	23.122	TRAV,MAG. NAIL
JMT113	569934.1044	1413927.1769	15.659	TRAV,R&C FLY
JMT117	569794.9884	1414607.7450	14.730	TRAV,H&T FLY
JMT118	570114.2537	1413821.9440	22.530	TRAV,R&C FLY
JMT14	570146.2853	1414332.4122	39.092	TRAV,
JMT16	569617.5276	1414595.5473	47.964	TRAV,
JMT18	570119.7179	1413899.0867	18.744	TRAV,
JMT19	570061.2073	1414008.7274	17.234	TRAV,R&C
JMT20	570001.6848	1414054.9315	11.299	TRAV,R&C
JMT21	569945.9719	1414212.9558	10.816	TRAV,R&C
JMT22	569880.8204	1414301.9108	9.942	TRAV,R&C
JMT23	569833.4716	1414374.3789	9.288	TRAV,HR:2.4 (2.4 + 0.0 Offset)
JMT24	569798.4177	1414453.4328	8.847	TRAV,R&C
JMT25	569754.6728	1414638.2687	8.185	TRAV,R&C
JMT26	569711.2188	1414792.8964	9.837	TRAV,R&C

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

STREAM RESTORATION GEOMETRY PLAN

CONTRACT NO. HT-3012-0000

DRAWING NO. **GS-01**

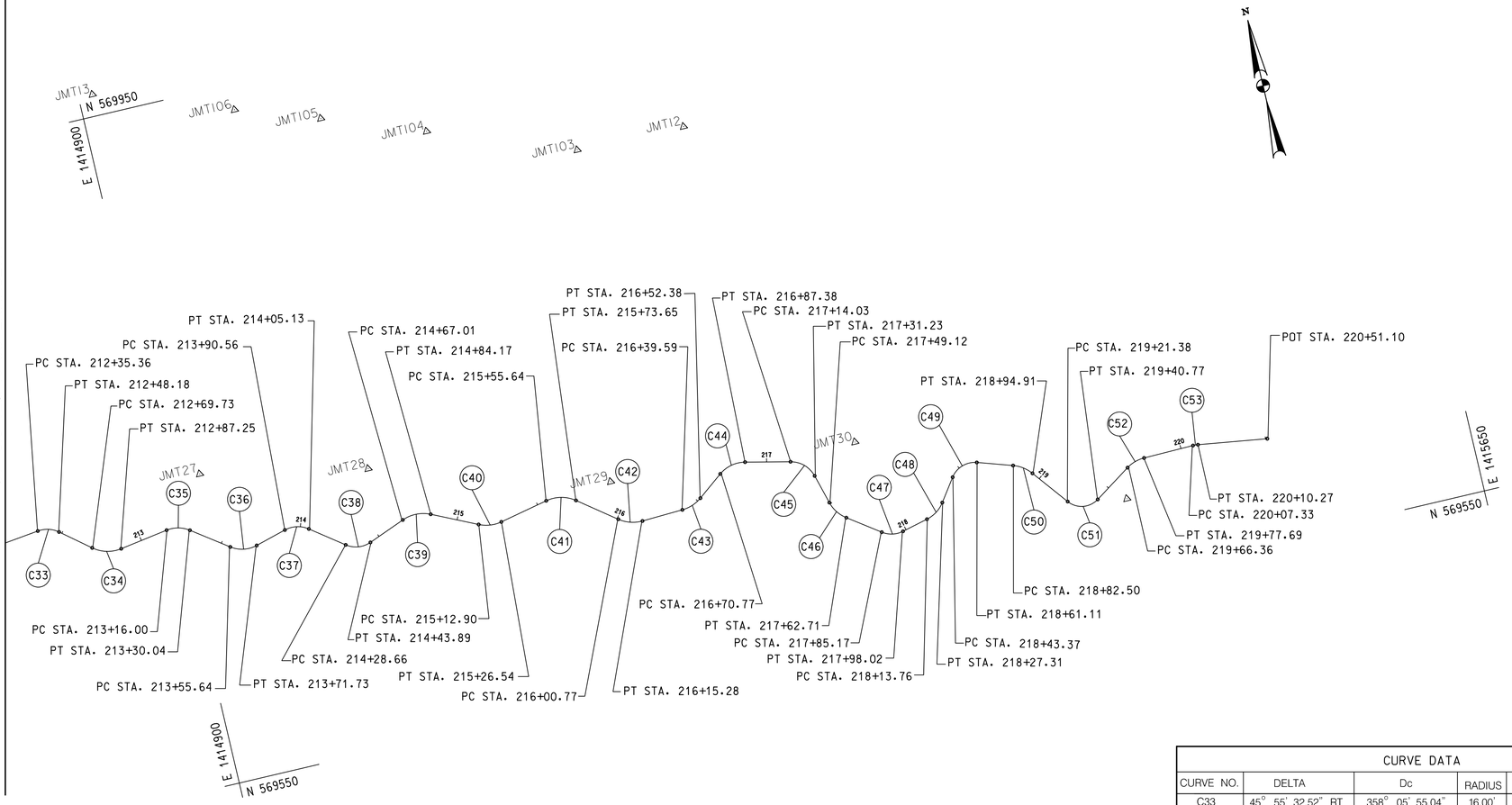
DESIGNED BY MRG/PVC | DRAWN BY JMB | CHECKED BY MRG/JSK

CONST. REVIEW BY JSK | DATE MAY, 2019 | SCALE 1"=40'

SHEET NO. 4 OF 26

FILE: Q:\2015\15177_003_I-895_TMDL_Stream_Re\CADD\pCS-P001_895 STREAM RESTORATION.dgn
DATE: Monday, December 17, 2018 AT 11:45 AM 11:45 AM

MATCHLINE GS-01 (STA. 212+14)



JMT SURVEY TRAVERSE COORDINATE TABLE

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
JMT103	569866.0928	1415177.8018	25.775	TRAV,MAG. NAIL
JMT104	569896.8666	1415094.2724	23.883	TRAV,MAG. NAIL
JMT105	569918.4156	1415035.5815	24.771	TRAV,MAG. NAIL
JMT106	569934.9324	1414987.5090	26.352	TRAV,MAG. NAIL
JMT12	569865.1773	1415241.5996	24.838	TRAV,
JMT13	569962.6964	1414908.4122	28.527	TRAV,
JMT27	569731.6335	1414918.8283	12.243	TRAV,R&C
JMT28	569712.0951	1415015.7202	11.274	TRAV,R&C
JMT29	569672.2063	1415152.4300	9.176	TRAV,R&C
JMT30	569662.1132	1415297.2357	10.157	TRAV,R&C

BASELINE CONTROL COORDINATES

POINT	STATION	NORTHING	EASTING
PC	212+35.36	569,720.8916	1,414,818.6968
PT	212+48.18	569,717.4828	1,414,830.7067
PC	212+69.73	569,703.9801	1,414,847.4957
PT	212+87.25	569,699.6033	1,414,863.9443
PC	213+16.00	569,704.1042	1,414,892.3399
PT	213+30.04	569,700.9479	1,414,905.6557
PC	213+55.64	569,686.0199	1,414,926.4480
PT	213+71.73	569,683.2998	1,414,941.7686
PC	213+90.56	569,688.3459	1,414,959.9136
PT	214+05.13	569,685.7737	1,414,973.7432
PC	214+28.66	569,671.7384	1,414,992.6322
PT	214+43.89	569,669.8290	1,415,007.0930
PC	214+67.01	569,678.3297	1,415,028.5968
PT	214+84.17	569,677.7968	1,415,045.2687
PC	215+12.90	569,665.5489	1,415,071.2601
PT	215+26.54	569,664.0030	1,415,084.5720
PC	215+55.64	569,670.0447	1,415,113.0357
PT	215+73.65	569,666.2381	1,415,130.0811
PC	216+00.77	569,649.8543	1,415,151.6967
PT	216+15.28	569,645.6087	1,415,165.2647
PC	216+39.59	569,646.6307	1,415,189.5534
PT	216+52.38	569,650.9106	1,415,201.4009
PC	216+70.77	569,662.0614	1,415,216.0301
PT	216+87.38	569,665.4817	1,415,231.7430
PC	217+14.03	569,659.5972	1,415,257.7374
PT	217+31.23	569,648.3062	1,415,269.6122
PC	217+49.12	569,631.0854	1,415,274.4341
PT	217+62.71	569,620.1792	1,415,282.1027
PC	217+85.17	569,607.1643	1,415,300.4044
PT	217+98.02	569,604.8142	1,415,312.6454
PC	218+13.76	569,608.5376	1,415,327.9399
PT	218+27.31	569,615.9786	1,415,338.9236
PC	218+43.37	569,629.0585	1,415,348.2361
PT	218+61.11	569,634.2487	1,415,363.9818
PC	218+82.50	569,627.6175	1,415,384.3143
PT	218+94.91	569,620.6001	1,415,394.3365
PC	219+21.38	569,599.7661	1,415,410.6518
PT	219+40.77	569,596.9440	1,415,428.0670
PC	219+66.36	569,611.0815	1,415,449.4051
PT	219+77.69	569,614.4053	1,415,460.0759
PC	220+07.33	569,614.9621	1,415,489.7112
PT	220+10.27	569,614.7775	1,415,492.6426

CURVE DATA

CURVE NO.	DELTA	Dc	RADIUS	TANGENT	LENGTH	EXTERNAL
C33	45° 55' 32.52" RT	358° 05' 55.04"	16.00'	6.78'	12.82'	1.38'
C34	47° 48' 54.76" LT	272° 50' 13.36"	21.00'	9.31'	17.53'	1.97'
C35	44° 41' 01.46" RT	318° 18' 35.59"	18.00'	7.40'	14.04'	1.46'
C36	51° 13' 05.34" LT	318° 18' 35.59"	18.00'	8.63'	16.09'	1.96'
C37	52° 09' 18.39" RT	358° 05' 55.04"	16.00'	7.83'	14.56'	1.81'
C38	58° 10' 59.93" LT	381° 58' 18.71"	15.00'	8.35'	15.23'	2.17'
C39	46° 48' 02.76" RT	272° 50' 13.36"	21.00'	9.09'	17.15'	1.88'
C40	37° 12' 53.38" LT	272° 50' 13.36"	21.00'	7.07'	13.64'	1.16'
C41	49° 08' 39.86" RT	272° 50' 13.36"	21.00'	9.60'	18.01'	2.09'
C42	39° 34' 12.71" LT	272° 50' 13.36"	21.00'	7.55'	14.50'	1.32'
C43	34° 54' 22.72" LT	272° 50' 13.36"	21.00'	6.60'	12.79'	1.01'
C44	50° 04' 16.03" RT	301° 33' 24.24"	19.00'	8.87'	16.60'	1.97'
C45	61° 36' 06.96" RT	358° 05' 55.04"	16.00'	9.54'	17.20'	2.63'
C46	38° 56' 22.40" LT	286° 28' 44.03"	20.00'	7.07'	13.59'	1.21'
C47	49° 06' 00.09" LT	381° 58' 18.71"	15.00'	6.85'	12.85'	1.49'
C48	40° 52' 04.27" LT	301° 33' 24.24"	19.00'	7.08'	13.55'	1.28'
C49	72° 36' 47.43" RT	409° 15' 20.04"	14.00'	10.29'	17.74'	3.37'
C50	33° 52' 19.30" RT	272° 50' 13.36"	21.00'	6.39'	12.41'	0.95'
C51	85° 27' 41.07" LT	440° 44' 12.36"	13.00'	12.01'	19.39'	4.70'
C52	32° 27' 00.13" RT	286° 28' 44.03"	20.00'	5.82'	11.33'	0.83'
C53	9° 21' 34.53" RT	318° 18' 35.59"	18.00'	1.47'	2.94'	0.06'

40' 0 40' 80'
SCALE: 1" = 40'

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

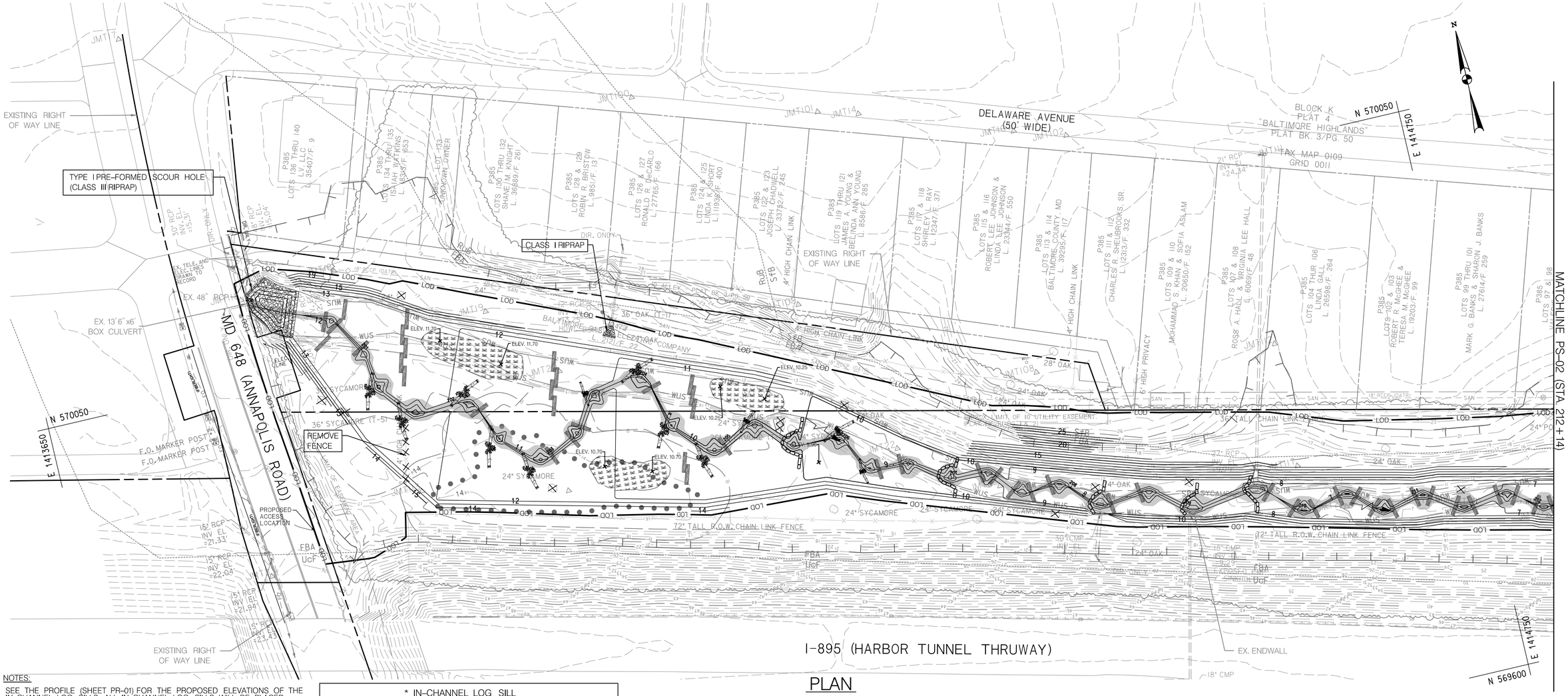
MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
STREAM RESTORATION GEOMETRY PLAN

CONTRACT NO. HT-3012-0000

DRAWING NO. **GS-02**

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	SHEET NO. 5 OF 26
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"=40'	

FILE: Q:\2015\15177_003_I-895_TMDL_Stream_Re\CADD\pGS-P002_I895 STREAM RESTORATION.dgn
DATE: Monday, December 17, 2018 AT 11:48 AM 11:48 AM



PLAN

NOTES:

1. SEE THE PROFILE (SHEET PR-01) FOR THE PROPOSED ELEVATIONS OF THE IN-CHANNEL LOG SILLS. ALL IN-CHANNEL LOG SILLS WILL BE PLACED PERPENDICULAR TO STREAM CHANNEL.
2. STATIONS AND OFFSETS FOR FLOODPLAIN LOG SILLS ARE TO THE CENTER OF SILL STRUCTURE. TOP OF FLOODPLAIN LOG SILLS WILL BE SET AT THE PROPOSED FLOODPLAIN ELEVATION.
3. SEE THE TYPICAL SECTIONS (SHEET TS-01) FOR DIMENSION OF THE PROPOSED CHANNEL.
4. SEE SHEET DE-03 FOR THE IN-CHANNEL AND FLOODPLAIN LOG SILL DETAILS.
5. CENTER OF IN-CHANNEL LOG SILLS IS THE BASELINE. TOP OF IN-CHANNEL LOG SILLS SHALL BE PLACED FLUSH WITH THE PROPOSED STREAMBED ELEVATION.
6. CENTER OF ROCK CROSS VANES IS THE BASELINE. TOP OF ROCK CROSS VANES SHALL BE PLACED FLUSH WITH THE PROPOSED STREAMBED ELEVATION.
7. AN ADJACENT PROJECT INVOLVING THE SLIPLINING OF CULVERTS THAT OUTFALL INTO THE SOUTHERN EDGE OF THE PROJECT AREA FROM I-895 MAY OCCUR CONCURRENTLY TO THIS PROJECT. THE CONTRACTOR SHALL COORDINATE, AS NEEDED, WITH MDTA AND MDTA'S CONTRACTOR PERFORMING THE SLIPLINING WORK ON AN ADJACENT PROJECT.
8. A MAXIMUM OF TWO (2) LOGS ARE TO BE USED FOR EACH LOG VANE.
9. PER STANDARD SPECIFICATIONS, THE COST OF FENCE REMOVAL IS INCIDENTAL TO CLEARING AND GRUBBING.

* IN-CHANNEL LOG SILL

STATION	LENGTH (FT)	STATION	LENGTH (FT)	STATION	LENGTH (FT)
200+61.82	16	207+21.48	16	210+46.33	16
200+72.00	16	207+34.61	16	210+63.59	16
200+99.31	16	207+52.43	16	210+80.07	16
202+23.61	16	207+66.79	16	210+98.74	16
202+98.47	16	207+83.31	16	211+11.28	16
203+19.40	16	208+36.01	16	211+32.70	16
203+31.27	16	208+60.62	16	211+46.40	16
204+11.08	16	209+69.56	16	211+68.05	16
204+94.50	16	209+93.41	16	211+82.37	16
206+37.86	16	210+10.01	16	212+00.61	16
206+55.69	16	210+31.95	16	212+13.38	16

* SEE NOTE 5 THIS SHEET.

FURNISHED STREAMBED GRAVEL

TYPE	AVERAGE WIDTH (FT)	QUANTITY (SY)
I	16	1249

LOG VANE

STATION	DIMENSIONS AND CRITICAL ELEVATIONS, SEE DETAILS (FEET)			
	L	NOTES	A	B
201+26.00	30	RIGHT	11.41	12.36
201+60.00	30	RIGHT	11.23	12.18
202+05.00	30	LEFT	10.98	11.93
202+46.00	30	RIGHT	10.77	11.72
202+79.00	30	RIGHT	10.56	11.51
203+52.00	20	LEFT	10.17	11.12
203+88.00	30	LEFT	9.95	10.90
204+40.00	30	RIGHT	9.68	10.63
204+76.00	30	RIGHT	9.43	10.38
205+15.00	20	LEFT	9.24	10.19
205+88.00	30	LEFT	8.83	9.78
206+23.00	20	RIGHT	8.66	9.61

* FLOODPLAIN LOG SILL

STATION	OFFSET	LENGTH (FT)	STATION	OFFSET	LENGTH (FT)
200+69.84	12.74, LT	16	203+51.75	31.56, LT	16
200+75.22	9.14, RT	16	203+55.32	32.09, LT	16
201+02.38	43.50, LT	16	203+58.08	41.31, LT	16
201+05.72	33.77, LT	16	204+23.26	28.92, LT	16
201+10.97	31.77, LT	16	204+31.32	26.30, LT	16
201+20.81	24.65, LT	16	204+52.59	21.53, LT	16
201+44.27	20.55, LT	16	204+70.03	18.02, RT	16
203+40.33	25.49, LT	16	204+76.56	24.86, RT	16

* SEE NOTE 2 THIS SHEET.

BOTTOM CUTTOFF WALL

STATION	CLASS	L	W	D	QUANTITY (LF)
203+89	I	10'	1'	36"	10
200+38	III	37'	2'	48"	37

* ROCK CROSS VANE STRUCTURE

STATION	OFFSET	QUANTITY (LF)	ELEV 'A'	ELEV 'B'	ELEV 'C'	L1	L2	L3	L4	L5
205+52.00	0+00'	59	10.00	9.05	10.00	14'	7'	14'	8'	8'
206+91.00	0+00'	48	9.23	8.28	9.23	17'	9'	14'	4'	4'
208+18.00	0+00'	37	8.65	7.70	8.65	8'	10'	9'	N/A	10'
208+96.00	0+00'	34	8.28	7.33	8.28	5'	10'	11'	N/A	8'
209+49.00	0+00'	39	8.01	7.06	8.01	12'	5'	5'	10'	7'

* SEE NOTE 6 THIS SHEET.

RIPRAP SLOPE AND CHANNEL PROTECTION SCHEDULE

STATION	CLASS	L	W	D	FABRIC	QUANTITY (SY)
203+89	I	8'	10'	19"	CLASS 'SE'	6
200+00	III	38'	10.5	36"	CLASS 'SE'	143

40' 0 40' 80'
SCALE: 1" = 40'

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

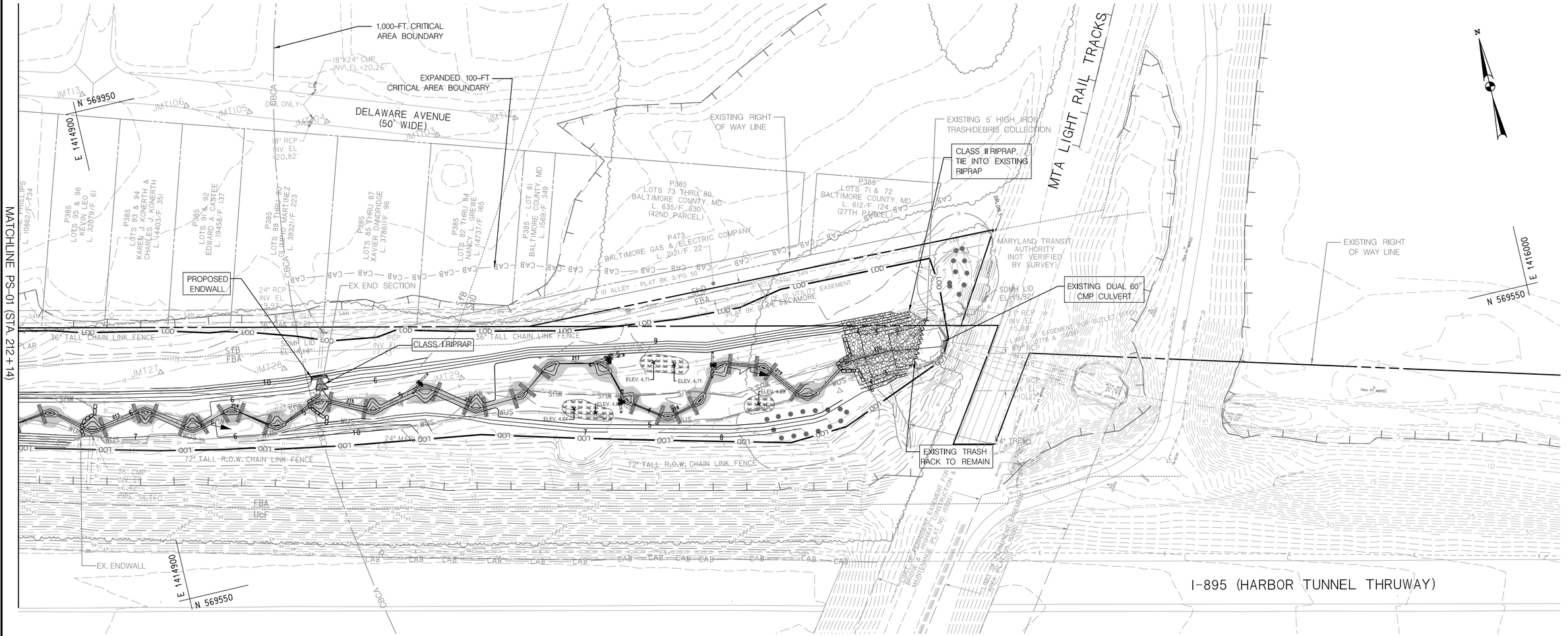
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
STREAM RESTORATION PLAN

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"=40'

CONTRACT NO. HT-3012-0000
DRAWING NO. **PS-01**
SHEET NO. 6 OF 26

FILE: G:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pSR-001_I895 STREAM RESTORATION.dgn
DATE: Thursday, March 14, 2019 AT 11:55 AM



MATCHLINE PS-01 (STA. 212+14)

PLAN

NOTES:

1. SEE THE PROFILE FOR THE PROPOSED ELEVATIONS OF THE IN-CHANNEL LOG SILLS. ALL IN-CHANNEL LOG SILLS WILL BE PLACED PERPENDICULAR TO STREAM CHANNEL.
2. SEE THE TYPICAL SECTIONS FOR DIMENSIONS OF ALL PROPOSED CHANNELS.
3. SEE SHEET DE-03 FOR THE IN-CHANNEL AND FLOODPLAIN LOG SILL DETAILS.
4. CENTER OF IN-CHANNEL LOG SILLS IS THE BASELINE. TOP OF IN-CHANNEL LOG SILLS SHALL BE PLACED FLUSH WITH THE PROPOSED STREAMBED ELEVATION.
5. CENTER OF ROCK CROSS VANES IS THE BASELINE. TOP OF ROCK CROSS VANES SHALL BE PLACED FLUSH WITH THE PROPOSED STREAMBED ELEVATION.
6. AN ADJACENT PROJECT INVOLVING THE SLIPLINING OF CULVERTS THAT OUTFALL INTO THE SOUTHERN EDGE OF THE PROJECT AREA FROM I-895 MAY OCCUR CONCURRENTLY TO THIS PROJECT. THE CONTRACTOR SHALL COORDINATE, AS NEEDED, WITH MDTA AND MDTA'S CONTRACTOR PERFORMING THE SLIPLINING WORK ON AN ADJACENT PROJECT.
7. A MAXIMUM OF TWO (2) LOGS ARE TO BE USED FOR EACH LOG VANE.
8. CONTRACTOR IS TO CONFIRM THE TIE-IN ELEVATION IN THE FIELD WITH THE DESIGNATED SPECIALIST.

* IN-CHANNEL LOG SILL

STATION	LENGTH (FT)	STATION	LENGTH (FT)
212+35.34	16	216+15.28	16
212+87.25	16	216+39.59	16
213+16.00	16	216+52.38	16
213+30.04	16	216+70.77	16
213+55.64	16	217+62.71	16
213+71.82	16	217+85.17	16
213+90.65	16	217+98.02	16
214+05.12	16	218+13.76	16
214+28.67	16	218+61.12	16
214+84.17	16	218+82.51	16
215+12.90	16	218+94.91	16
215+73.65	16	219+21.40	16
216+00.77	16		

* SEE NOTE 4 THIS SHEET.

LOG VANE

STATION	DIMENSIONS AND CRITICAL ELEVATIONS, SEE DETAILS (FEET)			
	L	NOTES	A	B
215+55.60	20	LEFT	4.15	4.80
217+13.00	30	LEFT	3.89	4.84
217+48.00	20	RIGHT	3.84	4.79
218+42.00	20	LEFT	3.69	4.64

IMPORTED STREAMBED UNDERLAYMENT

TYPE	AVERAGE WIDTH (FT)	QUANTITY (SY)
I	16	906

* ROCK CROSS VANE STRUCTURE

STATION	OFFSET	QUANTITY (LF)	ELEV 'A'	ELEV 'B'	ELEV 'C'	L1	L2	L3	L4	L5
212+69.00	0+00'	28	6.51	5.56	6.51	6'	6'	16'	N/A	N/A
214+66.00	0+00'	29	5.56	4.61	5.56	14'	5'	10'	N/A	N/A
219+65.00	0+00'	56	4.44	3.49	4.44	11'	8'	15'	11'	11'

* SEE NOTE 5 THIS SHEET.

DRAINAGE STRUCTURE SCHEDULE (PROPOSED ENDWALL)

STA.	OFFSET	TYPE	QUANTITY (EA)
214+77.54	19.52' LT.	STANDARD TYPE 'C' ENDWALL FOR 27" PIPE	1

RIPRAP SLOPE AND CHANNEL PROTECTION SCHEDULE

STATION	CLASS	L	W	D	FABRIC	QUANTITY (SY)
214+78	I	8.5'	10'	19"	CLASS 'SE'	6
219+92	II	54'	57'	32"	CLASS 'SE'	313

BOTTOM CUTTOFF WALL

STATION	CLASS	L	W	D	QUANTITY (LF)
214+78	I	10'	1'	36"	10

40' 0 40' 80'
SCALE: 1" = 40'

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STATE OF MARYLAND JEREMY SCOTT KOSER No. 31183 PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION

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LICENSE NO. 31183

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MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

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MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
STREAM RESTORATION PLAN

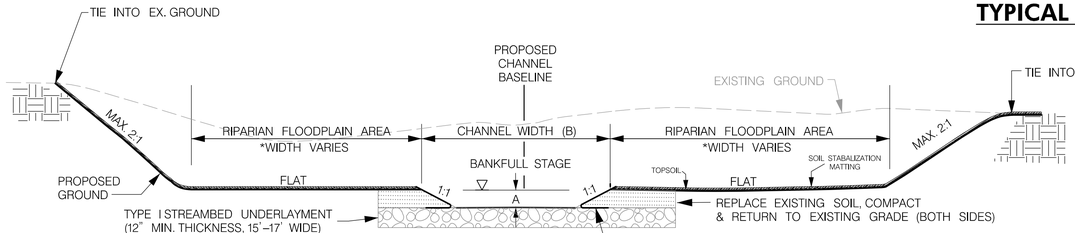
DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"=40'

CONTRACT NO. HT-3012-0000
DRAWING NO. **PS-02**
SHEET NO. 7 OF 26

FILE: Q:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pSR-002_I895 STREAM RESTORATION.dgn
DATE: Thursday, March 14, 2019 AT 11:59 AM

TYPICAL CROSS SECTIONS

N.T.S.



RIFFLE SECTION

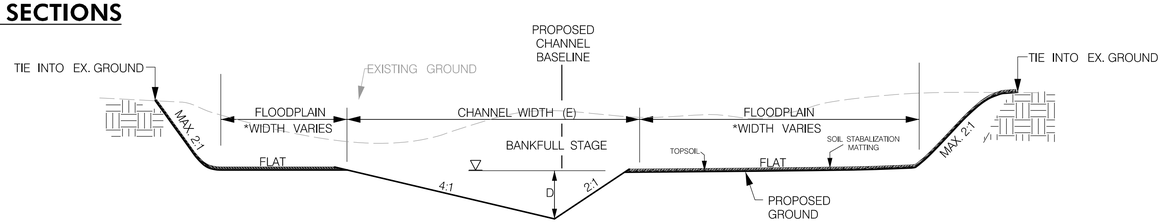
N.T.S.

STA. 200+50 TO STA. 207+00 (REACH 1)
STA. 207+00 TO STA. 215+73 (REACH 2)
STA. 215+73 TO STA. 219+77 (REACH 3)

RIFFLE DIMENSION TABLE		
BANKFULL DEPTH (A)	CHANNEL WIDTH (B)	REACH
0.95'	5' – 7'	1
0.95'	5' – 7'	2
0.95'	5' – 7'	3

NOTES:

1. POOL CROSS–SECTION REPRESENTS THE MAXIMUM POOL CONDITION. POOL CROSS–SECTION WILL NEED TO TRANSITION INTO RIFFLE CROSS–SECTION, AS SHOWN ON PROFILE.
2. THE FLOODPLAIN AREAS SHOWN AS FLAT ON THE TYPICAL SECTIONS, WILL ACTUALLY CONTAINED VARIED MICROTOPOGRAPHY TO BE CREATED DURING CONSTRUCTION UNDER THE GUIDANCE OF THE DESIGNATED SPECIALIST.
3. THE IMPORTED GRAVEL UNDERLAYMENT SHALL BE OF APPROPRIATE NATURAL COLOR (EG. BROWN/GRAY, DARK GRAY, DARK BROWN). WHITE STONE WILL NOT BE ACCEPTABLE.
4. EXCAVATION REQUIRED FOR THE INSTALLATION OF UNDERLAYMENT MATERIALS IS INCIDENTAL TO THE COST OF THE UNDERLAYMENT.
5. SEE LANDSCAPE PLANS FOR PLACEMENT OF TOPSOIL.



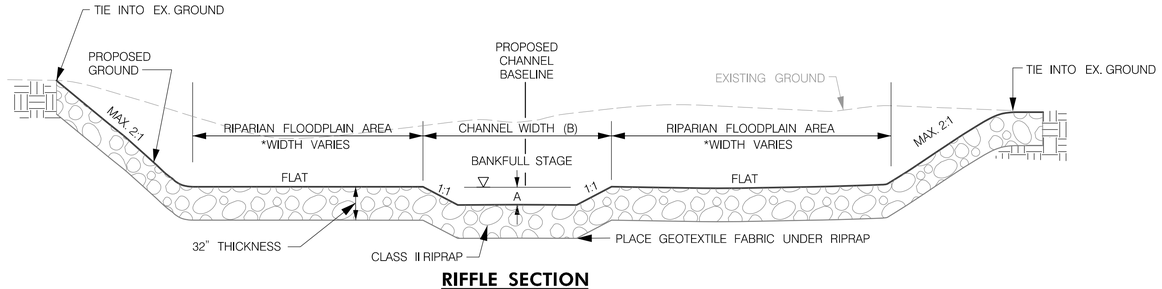
POOL SECTION

N.T.S.

STA. 200+50 TO STA. 207+00 (REACH 1)
STA. 207+00 TO STA. 215+73 (REACH 2)
STA. 215+73 TO STA. 219+77 (REACH 3)

*NOTE: LEFT POOL SECTION IS MIRROR IMAGE OF RIGHT POOL SHOWN.

POOL DIMENSION TABLE		
BANKFULL DEPTH (D)	CHANNEL WIDTH (E)	REACH
2.55'–2.95'	15.3' – 17.7'	1
2.95'–3.0'	17.7' – 18'	2
2.95'	16' – 17.7'	3



RIFFLE SECTION

STA. 219+77 TO STA. 220+30 (REACH 4)

RIFFLE DIMENSION TABLE		
BANKFULL DEPTH (A)	CHANNEL WIDTH (B)	REACH
0.95'	5' – 7'	4

EARTHWORK SUMMARY TABLE	
TOTAL CUT	9,200 CY
COMMON BORROW FOR EROSION SEDIMENT CONTROL	1950 CY
EXCAVATION FOR UNDERLAYMENT*	718 CY
EXCAVATION FOR SCOUR HOLE CLASS III RIPRAP*	183 CY
EXCAVATION FOR CLASS I RIPRAP OUTLET PROTECTION*	7 CY
EXCAVATION FOR CLASS II RIPRAP SLOPE PROTECTION*	278 CY
EXCAVATION FOR 2" THICK TOPSOIL*	232 CY
EXCAVATION FOR 4" THICK TOPSOIL*	834 CY

*EXCAVATION COSTS ARE INCIDENTAL FOR EACH ITEM LISTED

FILE: Q:\2015\15I777_003_I-895_TMDL_Stream_Re\CADD\pTS_I895 STREAM RESTORATION.dgn
DATE: Thursday, March 28, 2019 AT 02:43 PM 02:43 PM

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STATE OF MARYLAND JEREMY SCOTT KOSER No. 31183 PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

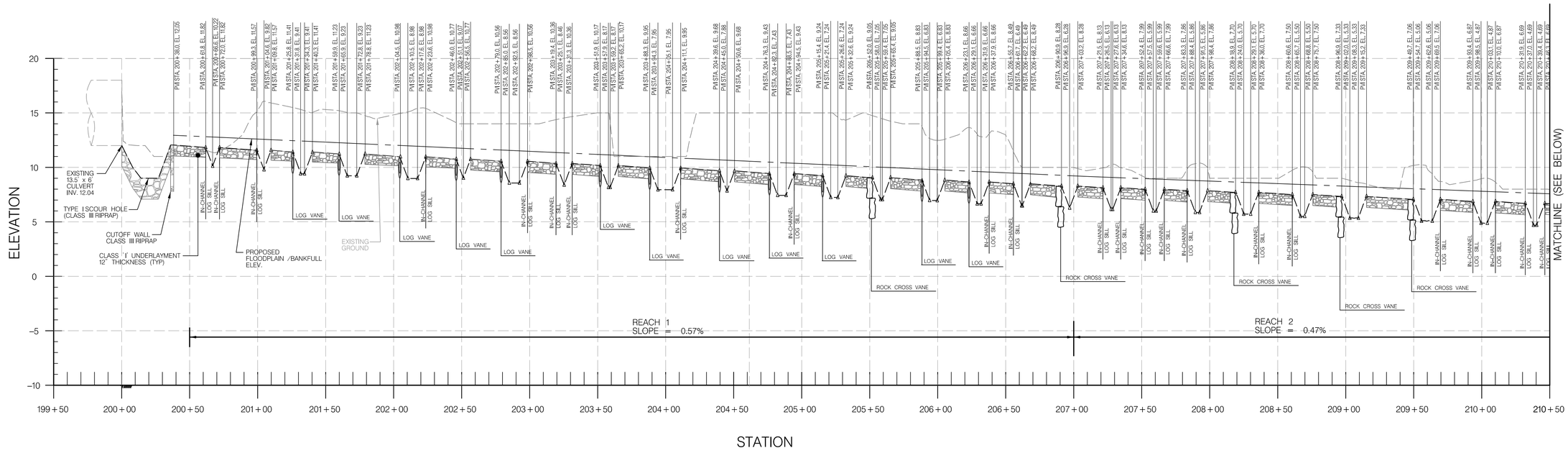
Engineering Division

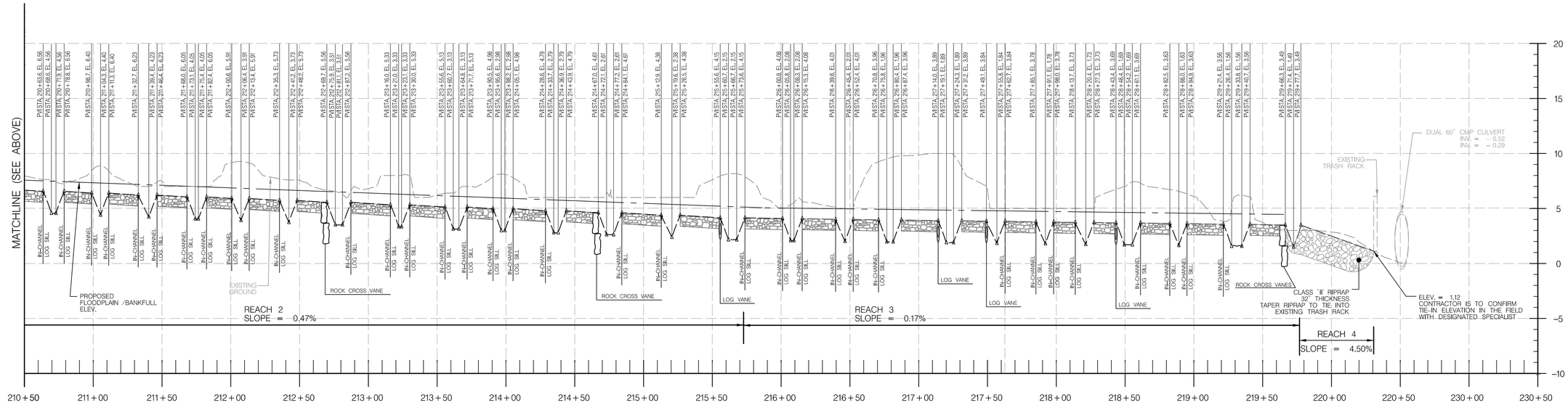
ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
TYPICAL SECTIONS

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE N.T.S.	

CONTRACT NO. HT-3012-0000
DRAWING NO. **TS–01**
SHEET NO. 8 OF 26





SCALE: HOR. 1" = 40'
VERT. 1" = 5'

LEGEND

EXISTING GROUND

FLOODPLAIN/BANKFULL ELEV.

PROPOSED GROUND

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND — JEREMY SCOTT KOSER — No. 31183 — PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

STREAM RESTORATION PROFILE

CONTRACT NO. HT-3012-0000

DRAWING NO. **PR-01**

DESIGNED BY	MRG/PVC	DRAWN BY	JMB	CHECKED BY	MRG/JSK
CONST. REVIEW BY	JSK	DATE	MAY, 2019	SCALE	

SHEET NO. 9 OF 26

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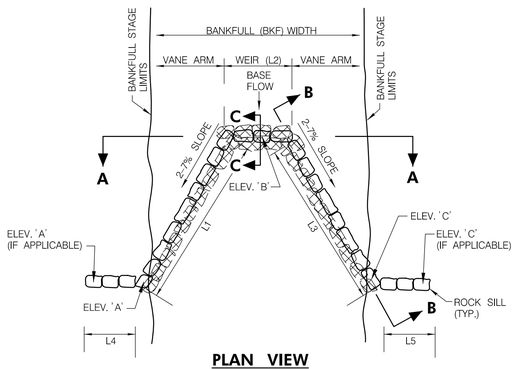
DATE: Friday, February 08, 2019 AT 02:07 PM 02:07 PM

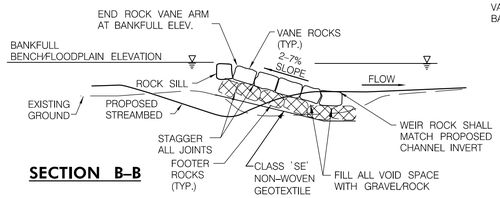
ROCK CROSS VANE STRUCTURE CONSTRUCTION DETAILS

N.T.S.

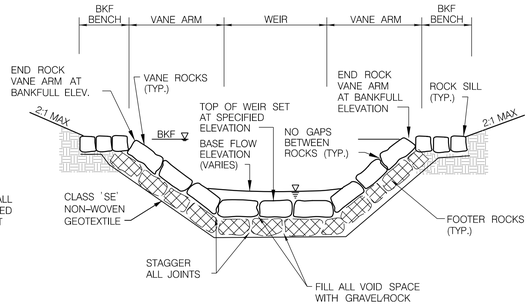
ROCK CROSS VANE STRUCTURE DETAILS



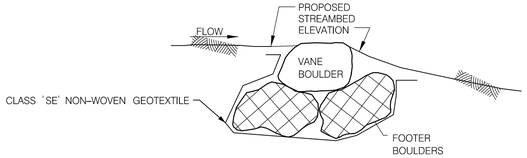
PLAN VIEW



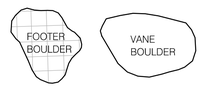
SECTION B–B



SECTION A–A



SECTION C–C



VANE AND FOOTER BOULDERS SHALL HAVE A MINIMUM INTERMEDIATE AXIS DIMENSION OF 2.0' (24"). MINIMUM SIZE OF THE BOULDERS WIL BE 2.5'x2.0'x3.0'.

SILL STONES SHALL HAVE A MINIMUM INTERMEDIATE AXIS DIMENSION OF 1.5' (18"). MINIMUM SIZE OF THE SILL ROCKS WILL BE 2.0'x1.5'x2.0'

ALL BOULDERS USED SHALL HAVE A MINIMUM DENSITY OF 160 POUNDS PER CUBIC FOOT.

BOULDER DETAIL

CONSTRUCTION PROCEDURES FOR ROCK CROSS VANE STRUCTURES

1. CUT A TRENCH, FOR THE GRADE CONTROL VANE ARM, FROM THE OUTWARD LIMIT OF THE STRUCTURE, EXTENDING INTO THE STREAM AT THE SPECIFIED ANGLE UPSTREAM (AT LEAST TWO PERCENT (2%). FIRST PLACE THE BOTTOM MOST FOOTER BOULDERS ON EXISTING GROUND & WORKING HIGHER, PLACE SECOND ROW OF FOOTER BOULDERS AND THEN PLACE VANE ROCKS TO ACHIEVE THE CORRECT PROPOSED ELEVATION OF EACH STRUCTURE. EXCAVATION OF THE TRENCH SHALL BE CONDUCTED IN CONJUCTION WITH THE PLACEMENT OF THE FOOTER AND THE VANE ROCKS TO ACHIEVE PROPER ELEVATIONS AT THE TOP OF THE VANE ROCKS.
2. FOOTER ROCKS SHALL BE PLACED IN THE EXCAVATED TRENCH SUCH THAT THEY BUTT AGAINST ONE ANOTHER, WHICH WILL ALLOW THE VANE ROCKS TO INTERLOCK WITH THE FOOTER ROCKS. ADDITIONAL FOOTER ROCKS MAY BE REQUIRED FOR PLACEMENT OF THE VANE ROCKS TO ACHIEVE THE PROPOSED ELEVATION.
3. THE DEPTH OF EXCAVATION SHALL BE TO THE DEPTH OF THE DEEPEST FOOTER ROCK. THE WIDTH OF EXCAVATION IN THE DIRECTION OF FLOW SHALL ONLY BE THE WIDTH OF THE ROCKS.
4. THE VANE ROCKS SHALL BE PLACED ON TOP OF THE FOOTER ROCKS SUCH THAT THEY ARE CONTINUOUS, STAGGERED OVER THE TWO (2) ADJACENT FOOTER ROCKS, AND PLACED SKEWED UPSTREAM OF THE FOOTER ROCKS.
5. THE ENGINEER RESERVES THE RIGHT TO ADJUST THE ANGLE OR ELEVATION OF THE PROPOSED STRUCTURE IN THE FIELD TO MEET THE SITE CONDITIONS.

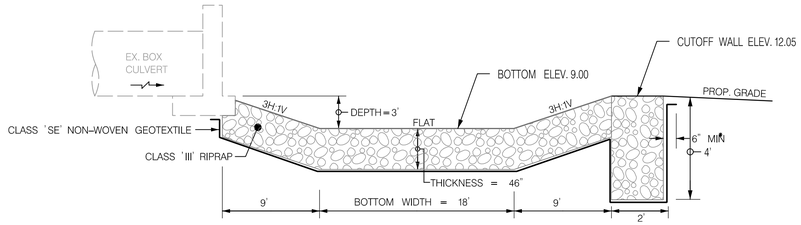
ROCK SIZING SCHEDULE

(SEE SPECIFICATIONS FOR DETAILED DESCRIPTIONS AND TOLERANCES OF FURNISHED AND SALVAGED STONE/ROCK MATERIALS)

TYPE	MINIMUM LENGTH	MINIMUM WIDTH	MINIMUM HEIGHT	TYPICAL SHAPE	TYPICAL USAGES
STRUCTURE CREST STONES / FOOTER STONES / FOUNDATION STONES / IMBRICATED RIPRAP	30"	24"	18"	TABULAR	VANE STRUCTURES, ROCK TOW, IMBRICATED RIPRAP
SILL STONES	24"	18"	12"	TABULAR	VANE STRUCTURES
SALVAGED CHANNEL BED MATERIAL	VARIES			VARIES	CHOKING IN MATERIAL FOR CHANNEL BED, BACKFILL
FURNISHED CHANNEL BED MATERIAL	SEE SPECIFICATIONS FOR PARTICLE SIZE DISTRIBUTION			MIXED	CHOKING IN MATERIAL FOR CHANNEL BED, BACKFILL
CLASS I RIPRAP UNDERLAYMENT	SEE MDE 2011 E&S SPECIFICATIONS, TABLE H.2			ANGULAR	ALL CHANNEL BED LOCATION, 1' THICKNESS AT NOTED WIDTHS, AND UNDER 6" FURNISHED TOPSOIL ON PROPOSED STREAM BANKS
CLASS I, II, III RIPRAP	SEE MDE 2011 E&S SPECIFICATIONS, TABLE H.2			ANGULAR	OUTFALL PROTECTION, SLOPE AND CHANNEL PROTECTION, MISC. USES AS NOTED

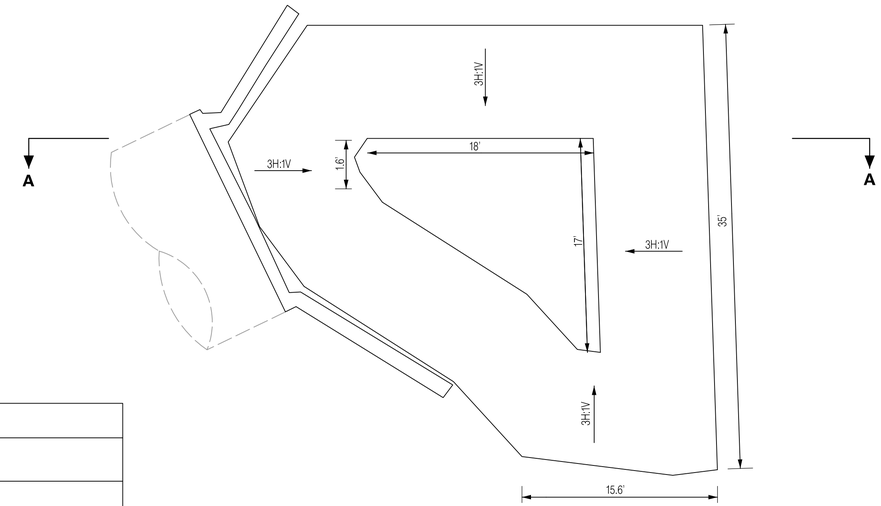
TYPE I PRE–FORMED SCOUR HOLE

N.T.S.



SECTION A–A

* GEOTEXTILE SHALL BE EMBEDDED A MINIMUM OF 4" AND SHALL EXTEND AT LEAST 6" BEYOND THE END OF THE RIPRAP



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DATE: Thursday, March 14, 2019 AT 12:20 PM 12:20 PM

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Engineering Division

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MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

STREAM RESTORATION DETAILS

DESIGNED BY MRG/PVC | DRAWN BY JMB | CHECKED BY MRG/JSK

CONST. REVIEW BY JSK | DATE MAY, 2019 | SCALE N.T.S.

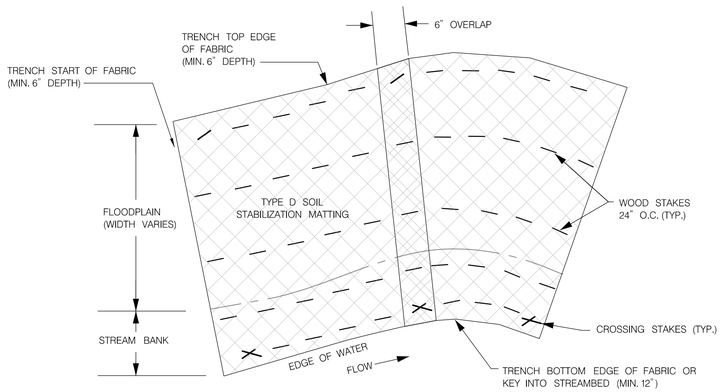
CONTRACT NO. HT-3012-0000

DRAWING NO. **DE–01**

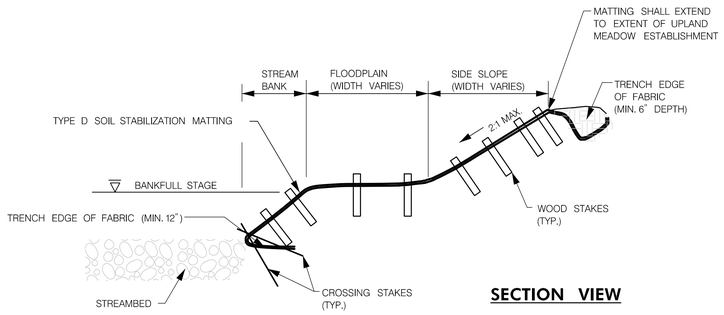
SHEET NO. 10 OF 26

STREAMBANK/FLOODPLAIN STABILIZATION DETAILS

N.T.S.



PLAN VIEW



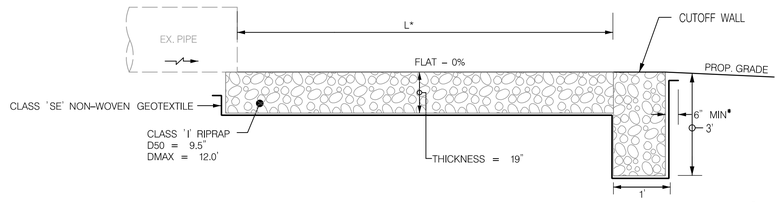
SECTION VIEW

NOTES:

1. TYPE D SOIL STABILIZATION MATTING (SSM) SHALL BE OVERLAPPED 'SHINGLE' STYLE OR PERPENDICULAR TO THE CHANNEL, WITH THE UPSTREAM SECTION OF MATTING OVERLAPPING THE NEXT DOWNSTREAM SECTION OF MATTING.
2. SPECIFIED SEED MIX SHALL BE APPLIED FIRST AND IMMEDIATELY COVERED WITH THE SSM.
3. THE SSM SHALL BE 100 PERCENT BIODEGRADABLE COIR FIBER MATTING.
4. THE SSM SHALL CONFORM TO THE SPECIFICATIONS.
5. WOOD CROSSING STAKES SHALL BE UTILIZED TO SECURE ENDS OF THE SSM WHERE IT IS NOT FEASIBLE TO TRENCH OR KEY-IN THE END OF THE FABRIC.
6. WOOD STAKES SHALL BE UNTREATED HARDWOOD OR SOUTHERN YELLOW PINE WITH A SAW-FORMED POINT ON ONE END, 1 INCH BY 2 INCHES IN SIZE AND A MINIMUM OF 18 INCHES IN LENGTH.
7. STAPLES ARE NOT AN ACCEPTABLE SUBSTITUTE FOR STAKES.
8. IN THE EVENT OF LOSS OF FABRIC PRIOR TO GROWTH OF VEGETATION, THE CONTRACTOR SHALL INSTALL NEW SEED AND TOPSOIL TO PROPOSED FINISHED GRADE AND RE-MAT AREAS AT NO ADDITIONAL COST TO THE AUTHORITY.

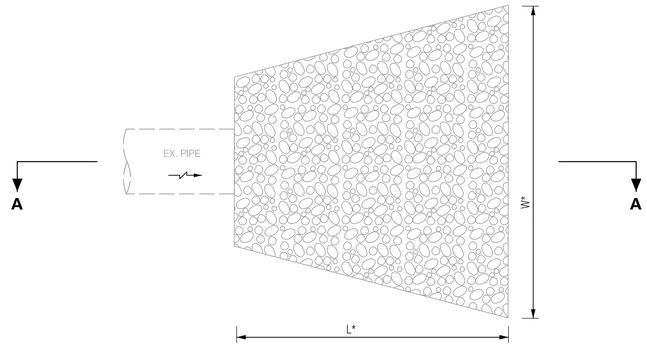
CLASS I RIPRAP SLOPE AND CHANNEL PROTECTION

N.T.S.



* GEOTEXTILE SHALL BE EMBEDDED A MINIMUM OF 4" AND SHALL EXTEND AT LEAST 6" BEYOND THE END OF THE RIPRAP

SECTION A–A



PLAN

FILE: Q:\2015\15I777_003_I-895_TMDL_Stream_Re\CADD\pDE_P002_I895 STREAM RESTORATION.dgn
DATE: Thursday, March 14, 2019 AT 01:43 PM 01:43 PM

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
STREAM RESTORATION DETAILS

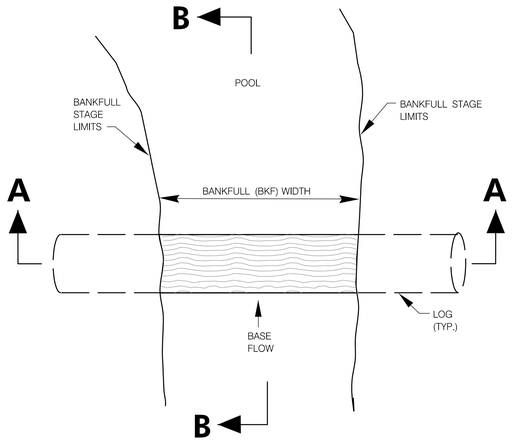
CONTRACT NO. HT-3012-0000

DRAWING NO. **DE-02**

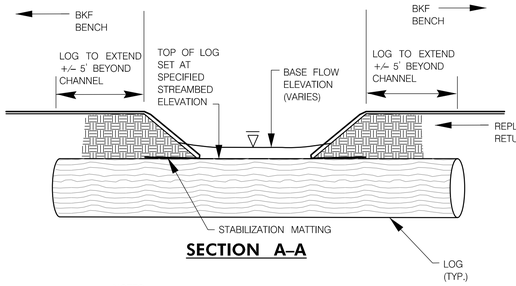
DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	SHEET NO.
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE N.T.S.	11 OF 26

IN–CHANNEL LOG SILL PLACEMENT DETAILS

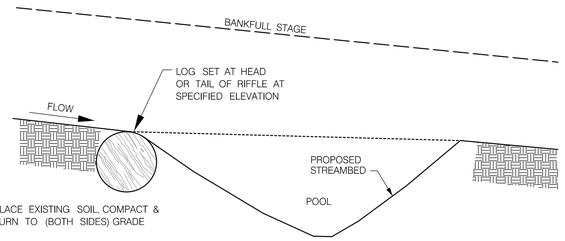
N.T.S.



PLAN VIEW



SECTION A–A



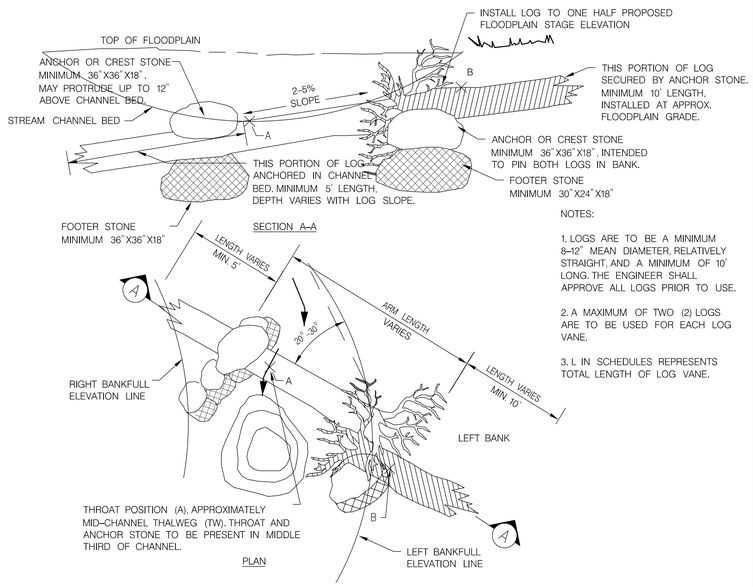
SECTION B–B

NOTES:

1. BURIED LOGS SHALL HAVE A MINIMUM DIAMETER OF 12".
2. TOP OF THE LOG SHALL BE FLUSH WITH THE PROPOSED STREAMBED ELEVATION.
3. SEE PLAN FOR LOCATIONS AND PROFILE FOR SPECIFIED TOP ELEVATIONS.

LOG VANE

N.T.S.

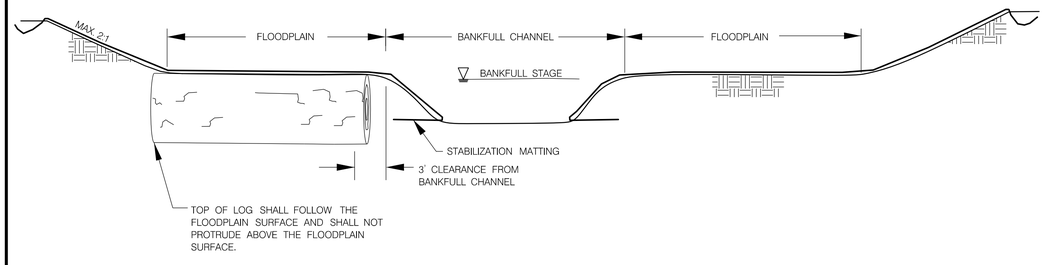


NOTES:

1. LOGS ARE TO BE A MINIMUM 8–12" MEAN DIAMETER, RELATIVELY STRAIGHT, AND A MINIMUM OF 10' LONG. THE ENGINEER SHALL APPROVE ALL LOGS PRIOR TO USE.
2. A MAXIMUM OF TWO (2) LOGS ARE TO BE USED FOR EACH LOG VANE.
3. L IN SCHEDULES REPRESENTS TOTAL LENGTH OF LOG VANE.

FLOODPLAIN LOG SILL PLACEMENT DETAIL

N.T.S.



SECTION VIEW

NOTES:

1. BURIED FLOODPLAIN LOGS SHALL HAVE A MINIMUM DIAMETER OF 12".
2. TOP OF FLOODPLAIN LOGS WILL BE SET AT THE ELEVATION OF THE PROPOSED FLOODPLAIN.
3. BRANCHES AND OTHER IREEGULARITIES MAY PROTRUDE ABOVE THE FLOODPLAIN SURFACE.
4. LOCATIONS OF BURIED LOGS SPECIFIED ON THE PLAN SHEETS IS TO BE APPROXIMATE CENTER POINT OF THE LOG.
5. THE ANGLES OF THE LOGS SHOWN ON THE PLANS MAY VARY FROM WHAT IS ACTUALLY DEPICTED BASED ON LOCAL SITE CONDITIONS AND DIAMETER AND LENGTH OF LOGS AVAILABLE.
6. IF ONE SINGLE LOG OF THE REQUIRED LENGTH IS NOT AVAILABLE, MULTIPLE LOGS MAY BE SUBSTITUTED AND PLACED IN STAGGERED FASHION WITH A MINIMUM OVERLAP OF 12".

jmt.com

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

STREAM RESTORATION DETAILS

CONTRACT NO. HT-3012-0000

DRAWING NO. **DE–03**

DESIGNED BY	MRG/PVC	DRAWN BY	JMB	CHECKED BY	MRG/JSK	SHEET NO.
CONST. REVIEW BY	JSK	DATE	MAY, 2019	SCALE	N.T.S.	12 OF 26

FILE: Q:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pDE-P003_I895 STREAM RESTORATION.dgn
DATE: Monday, December 17, 2018 AT 02:33 PM 02:33 PM

ORANGE CONSTRUCTION FENCE							
OCF #	BEGIN STA.	OFFSET	END STA.	OFFSET	STA. OF CENTER	OFFSET	LENGTH (LF)
1–1	202+86	120' LT	212+2	73' LT	N/A	N/A	792

SUPER SILT FENCE					
SSF #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1–1	201+58	84' RT	201+75	32' RT	79
1–2	202+11	21' RT	202+67	20' RT	48
1–3	202+8	21' RT	204+69	30' RT	221
1–4	201+46	24' LT	202+40	1' LT	86
1–5	202+84	4' LT	205+10	45' LT	166
1–6	204+79	60' LT	205+89	29' LT	124
1–7	205+86	41' LT	207+74	27' LT	152
1–8	207+47	45' LT	208+59	42' LT	111
1–9	208+50	24' LT	209+56	32' LT	124
1–10	209+54	20' LT	212+2	35' LT	221

TEMPORARY ACCESS CULVERT						
TP #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)	TYPE
1–1	203+65	37' LT	203+62	15' LT	23	12 INCH CORRUGATED POLYETHYLENE PIPE CONNECTION, TYPE S

TEMPORARY ACCESS ROAD						
TYPE	BEGIN STA.	OFFSET	END STA.	OFFSET	QUANTITY (SY)	NOTE
MULCH	201+66.79	80' RT	202+19.57	12' LT	397	SEE DETAILS ON ES–03
HARDWOOD CONSTUCTION MATS	203+61.46	55' LT	212+34.72	60' LT	981	

DIVERSION FENCE					
DF #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1–1	201+71	74' RT	204+84	46' RT	241

RIPRAP SLOPE AND CHANNEL PROTECTION								
RO #	STA. OF CENTER	OFFSET OF CENTER	CLASS	L	W	D	QUANTITY (SY)
1–1	201+72	76' RT	I	5'	5'	19"	3
1–2	203+31	24.3' RT	I	5'	5'	19"	3

STABILIZED CONSTRUCTION ENTRANCE					
SCE	BEGIN STA.	OFFSET	END STA.	OFFSET	EA
1–1	201+60	127' RT	201+67	80' RT	1

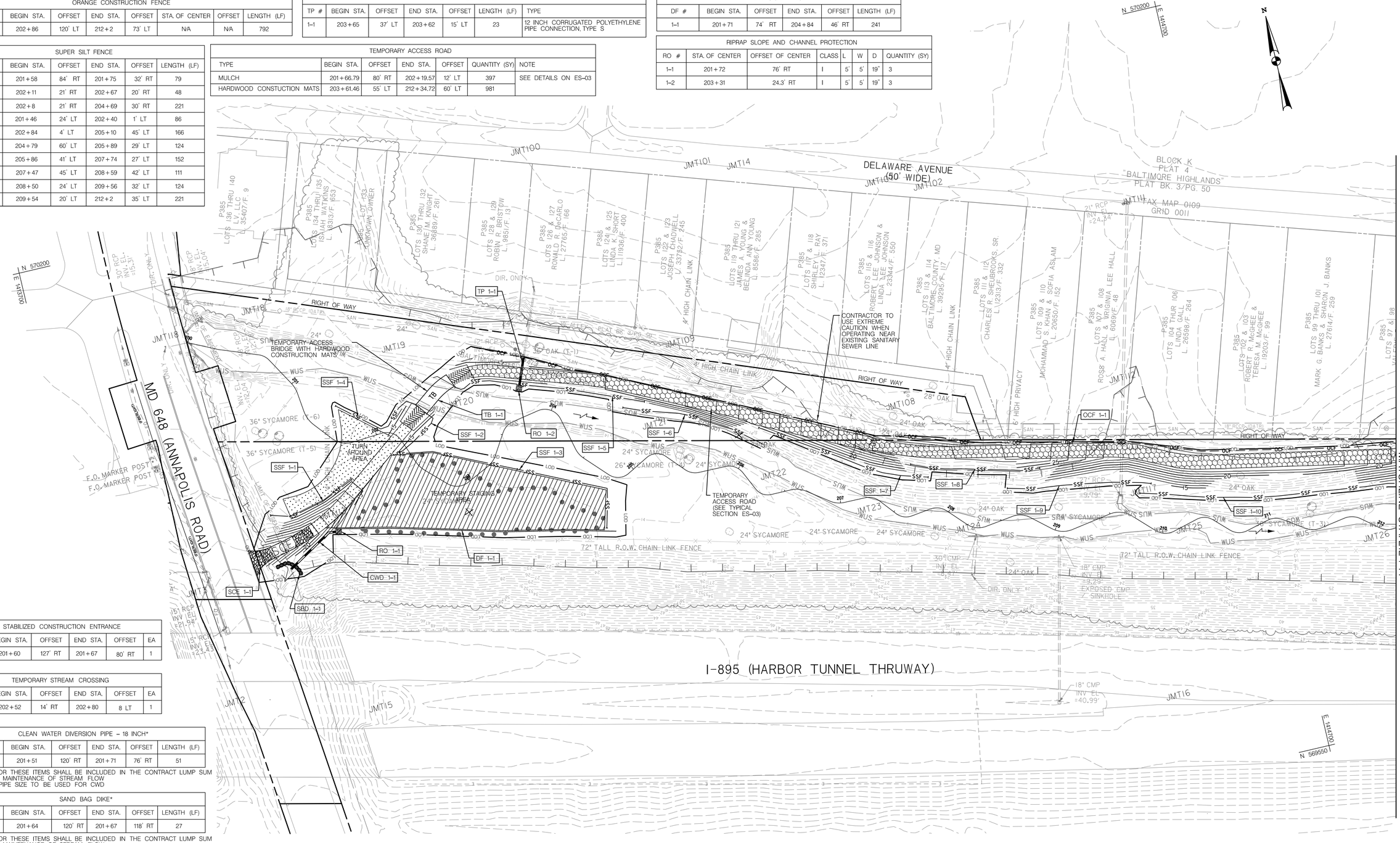
TEMPORARY STREAM CROSSING					
TB #	BEGIN STA.	OFFSET	END STA.	OFFSET	EA
1–1	202+52	14' RT	202+80	8 LT	1

CLEAN WATER DIVERSION PIPE – 18 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1–1**	201+51	120' RT	201+71	76' RT	51

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW
**MINIMUM PIPE SIZE TO BE USED FOR CWD

SAND BAG DIKE*					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1–1	201+64	120' RT	201+67	118' RT	27

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW



FILE: G:\2015\15I777_003_I-895_TMDL_Stream_Re\CADD\ePEP-0001_I895 STREAM RESTORATION - PHASE I.dgn
DATE: Thursday, March 28, 2019 AT 02:28 PM

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL PLAN PHASE I

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1" = 40'

CONTRACT NO. HT-3012-0000
DRAWING NO. **EP–01**
SHEET NO. 13 OF 26

SUPER SILT FENCE					
SSF #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1-11	212+2	35' LT	212+65	38' LT	61
1-12	212+62	26' LT	213+83	12' LT	111

ORANGE CONSTRUCTION FENCE					
OCF #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1-1	212+02	73' LT	220+45	71' LT	739

FILTER LOG - 12 INCH					
FL #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
1-1	213+80	30' LT	220+37	48' LT	609

TEMPORARY ACCESS ROAD						
TYPE	BEGIN STA.	OFFSET	END STA.	OFFSET	QUANTITY (SY)	NOTE
HARDWOOD CONSTUCTION MATS	212+34.72	60' LT	220+46.8	71' LT	1339	SEE DETAIL ON ES-03

FILE: Q:\2015\15177_003_I-895_TMDL_Stream_Re\CADD\pEP-0002_I895 STREAM RESTORATION - PHASE I.dgn
DATE: Thursday, March 28, 2019 AT 02:27 PM 02:27 PM

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

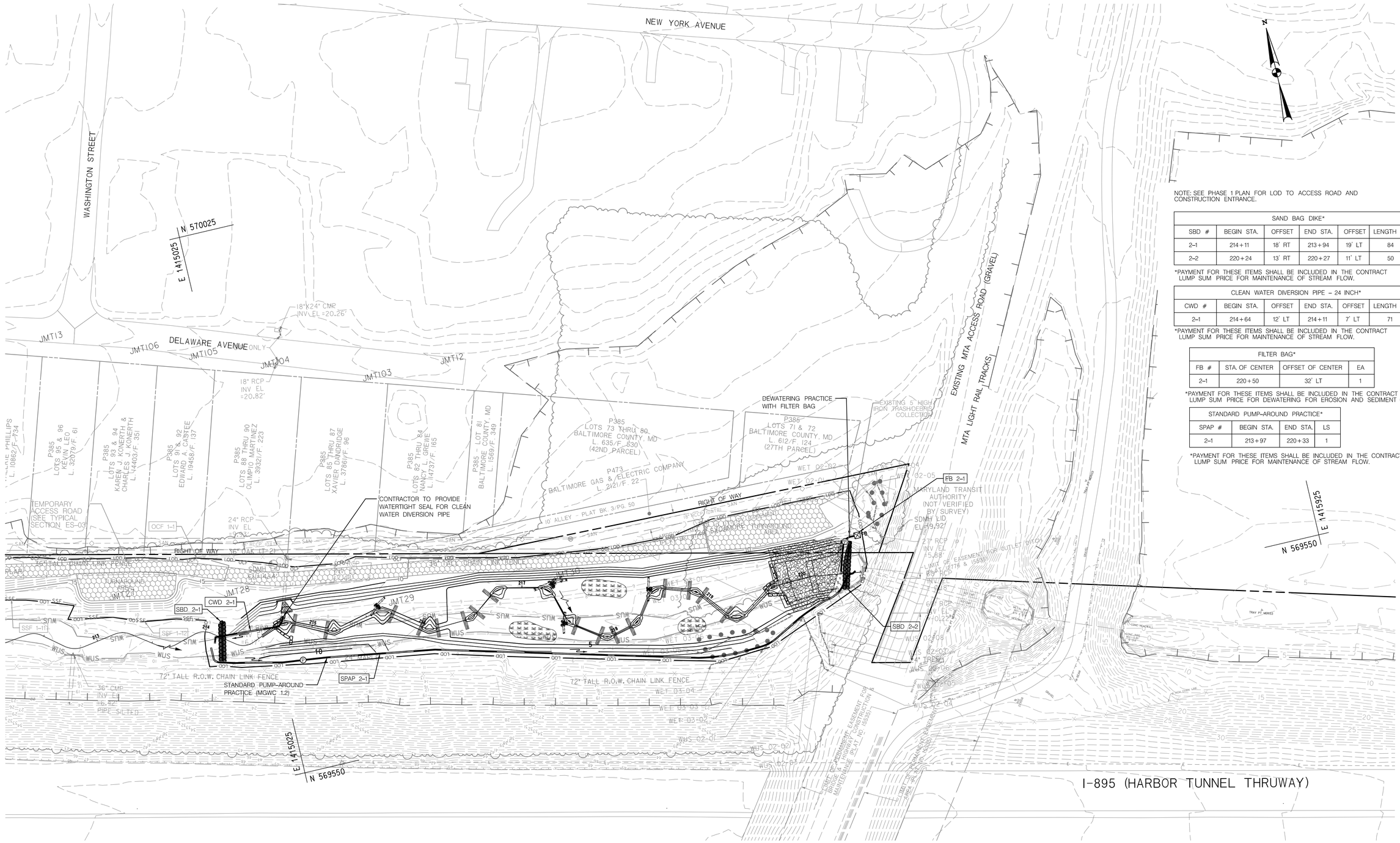
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL PLAN PHASE I

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1" = 40'

CONTRACT NO. HT-3012-0000

DRAWING NO. **EP-02**

SHEET NO. 14 OF 26



NOTE: SEE PHASE 1 PLAN FOR LOD TO ACCESS ROAD AND CONSTRUCTION ENTRANCE.

SAND BAG DIKE*					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
2–1	214+11	18' RT	213+94	19' LT	84
2–2	220+24	13' RT	220+27	11' LT	50

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

CLEAN WATER DIVERSION PIPE – 24 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
2–1	214+64	12' LT	214+11	7' LT	71

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

FILTER BAG*			
FB #	STA. OF CENTER	OFFSET OF CENTER	EA
2–1	220+50	32' LT	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR DEWATERING FOR EROSION AND SEDIMENT CONTROL.

STANDARD PUMP–AROUND PRACTICE*			
SPAP #	BEGIN STA.	END STA.	LS
2–1	213+97	220+33	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

FILE: Q:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pEP-0003_I895 STREAM RESTORATION - PHASE 2.dgn
DATE: Thursday, March 28, 2019 AT 02:24 PM 02:24 PM

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JEREMY SCOTT KOSER
No. 31183

Jeremy Koser

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL PLAN PHASE 2

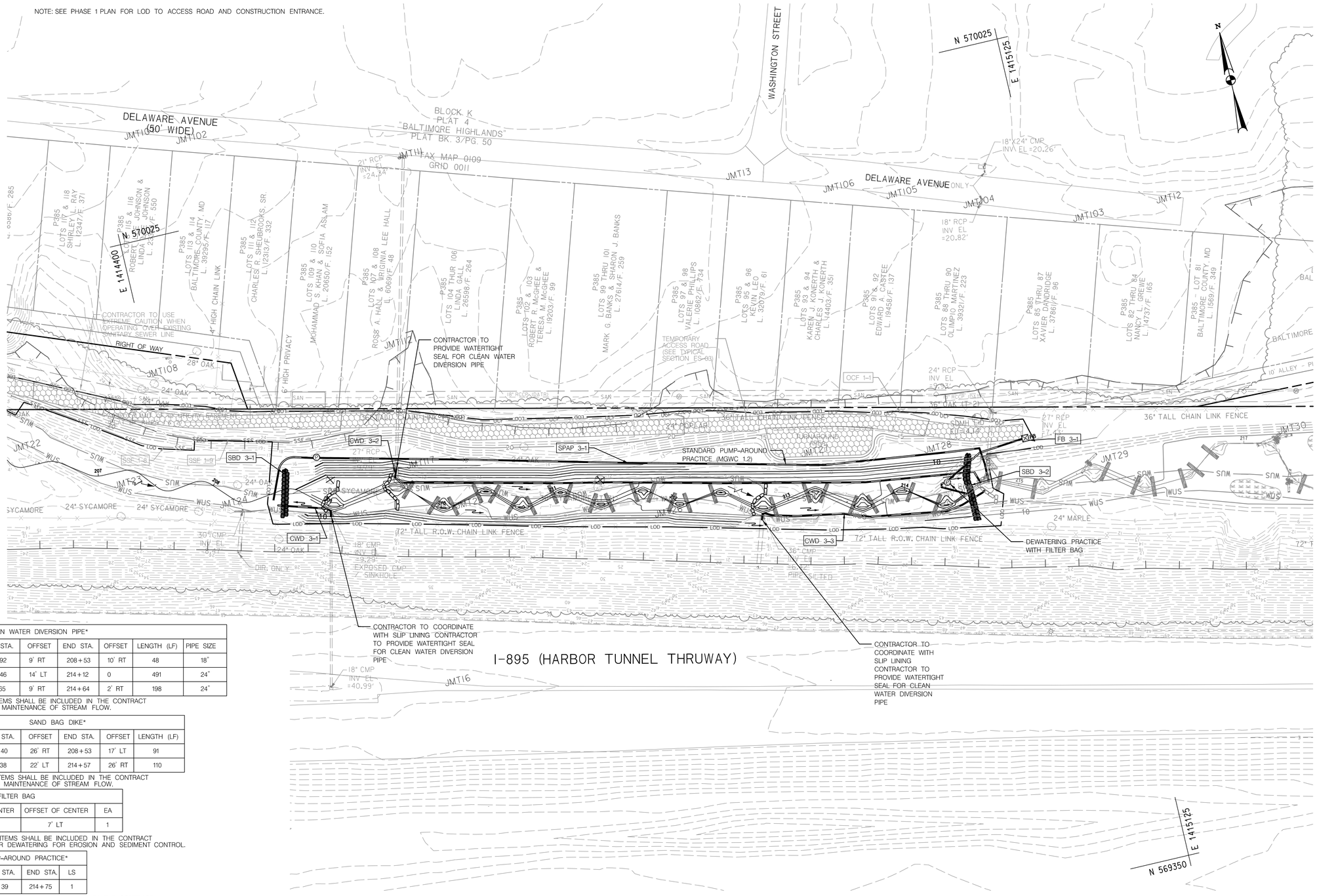
CONTRACT NO. HT-3012-0000

DRAWING NO. **EP–03**

DESIGNED BY MRG/PVC
DRAWN BY JMB
CHECKED BY MRG/JSK
CONST. REVIEW BY JSK
DATE MAY, 2019
SCALE 1" = 40'

SHEET NO. 15 OF 26

NOTE: SEE PHASE 1 PLAN FOR LOD TO ACCESS ROAD AND CONSTRUCTION ENTRANCE.



CLEAN WATER DIVERSION PIPE*						
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)	PIPE SIZE
3-1	208+92	9' RT	208+53	10' RT	48	18"
3-2	209+46	14' LT	214+12	0	491	24"
3-3	212+65	9' RT	214+64	2' RT	198	24"

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

SAND BAG DIKE*					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
3-1	208+40	26' RT	208+53	17' LT	91
3-2	214+38	22' LT	214+57	26' RT	110

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

FILTER BAG			
FB #	STA. OF CENTER	OFFSET OF CENTER	EA
3-1	214+39	7' LT	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR DEWATERING FOR EROSION AND SEDIMENT CONTROL.

STANDARD PUMP-AROUND PRACTICE*			
SPAP #	BEGIN STA.	END STA.	LS
3-1	208+39	214+75	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

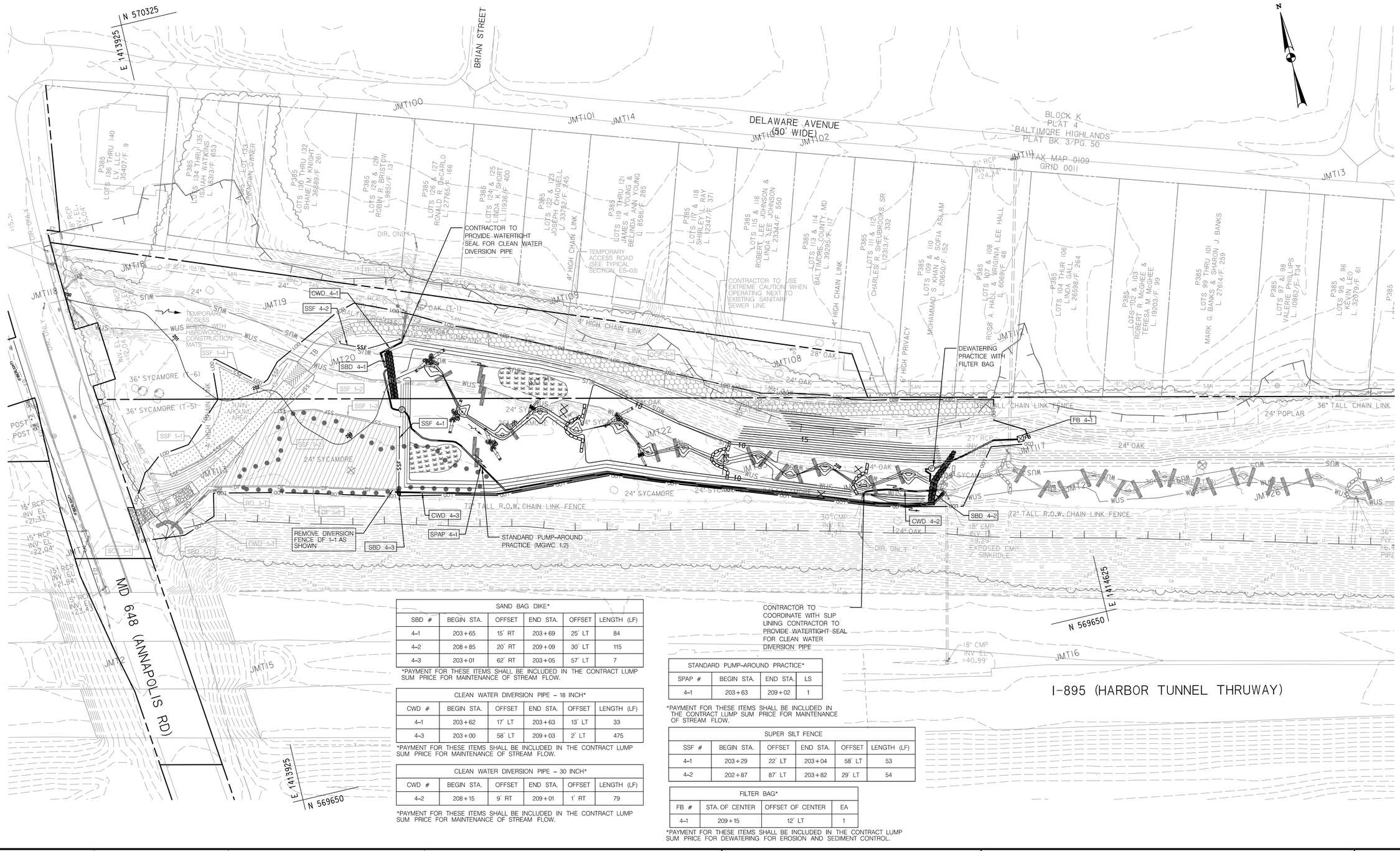
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL PLAN PHASE 3

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"= 40'

CONTRACT NO. HT-3012-0000
DRAWING NO. **EP-04**
SHEET NO. 16 OF 26

FILE: Q:\2015\15177_003_I-895_TMDL_Stream_Re\CADD\ePE-0004_I895 STREAM RESTORATION - PHASE 3.dgn
DATE: Thursday, March 28, 2019 AT 02:15 PM



SAND BAG DIKE*					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
4-1	203+65	15' RT	203+69	25' LT	84
4-2	208+85	20' RT	209+09	30' LT	115
4-3	203+01	62' RT	203+05	57' LT	7

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

CLEAN WATER DIVERSION PIPE – 18 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
4-1	203+62	17' LT	203+63	13' LT	33
4-3	203+00	58' LT	209+03	2' LT	475

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

CLEAN WATER DIVERSION PIPE – 30 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
4-2	208+15	9' RT	209+01	1' RT	79

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

STANDARD PUMP-AROUND PRACTICE*			
SPAP #	BEGIN STA.	END STA.	LS
4-1	203+63	209+02	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

SUPER SILT FENCE					
SSF #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
4-1	203+29	22' LT	203+04	58' LT	53
4-2	202+87	87' LT	203+82	29' LT	54

FILTER BAG*			
FB #	STA. OF CENTER	OFFSET OF CENTER	EA
4-1	209+15	12' LT	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR DEWATERING FOR EROSION AND SEDIMENT CONTROL.

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

EROSION AND SEDIMENT CONTROL PLAN PHASE 4

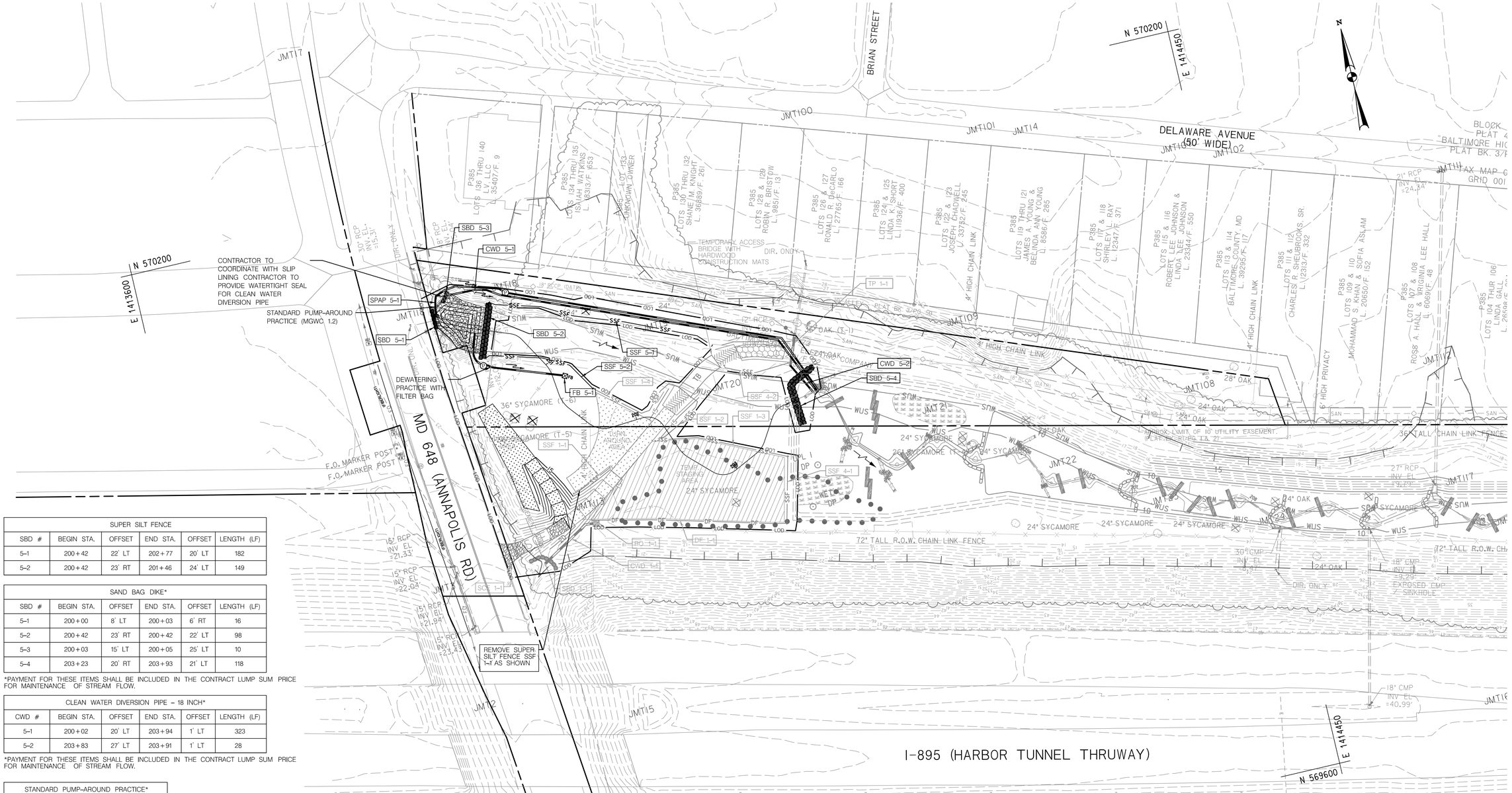
CONTRACT NO. HT-3012-0000

DRAWING NO. **EP-05**

DESIGNED BY	MRG/PVC	DRAWN BY	JMB	CHECKED BY	MRG/JSK
CONST. REVIEW BY	JSK	DATE	MAY, 2019	SCALE	1" = 40'

SHEET NO. 17 OF 26

FILE: G:\2015\151777-003_I-895_TMDL_Stream_Re\CADD\xEP-0005_I895 STREAM RESTORATION - PHASE 4.dgn
DATE: Thursday, March 28, 2019 AT 02:17 PM



SUPER SILT FENCE					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
5-1	200+42	22' LT	202+77	20' LT	182
5-2	200+42	23' RT	201+46	24' LT	149

SAND BAG DIKE*					
SBD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
5-1	200+00	8' LT	200+03	6' RT	16
5-2	200+42	23' RT	200+42	22' LT	98
5-3	200+03	15' LT	200+05	25' LT	10
5-4	203+23	20' RT	203+93	21' LT	118

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

CLEAN WATER DIVERSION PIPE - 18 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
5-1	200+02	20' LT	203+94	1' LT	323
5-2	203+83	27' LT	203+91	1' LT	28

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

STANDARD PUMP-AROUND PRACTICE*			
SPAP #	BEGIN STA.	END STA.	LS
5-1	200+00	203+95	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

TEMPORARY ACCESS ROAD						
TYPE	BEGIN STA.	OFFSET	END STA.	OFFSET	QUANTITY (SY)	NOTE
MULCH	201+66.79	80' RT	200+50	62' RT	218	SEE DETAIL ON ES-03

FILTER BAG*			
FB #	STA. OF CENTER	OFFSET OF CENTER	EA
5-1	201+14	9' RT	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR DEWATERING FOR EROSION AND SEDIMENT CONTROL.

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY STREAM RESTORATION PROJECT

EROSION AND SEDIMENT CONTROL PLAN PHASE 5

DESIGNED BY MRG/PVC | DRAWN BY JMB | CHECKED BY MRG/JSK

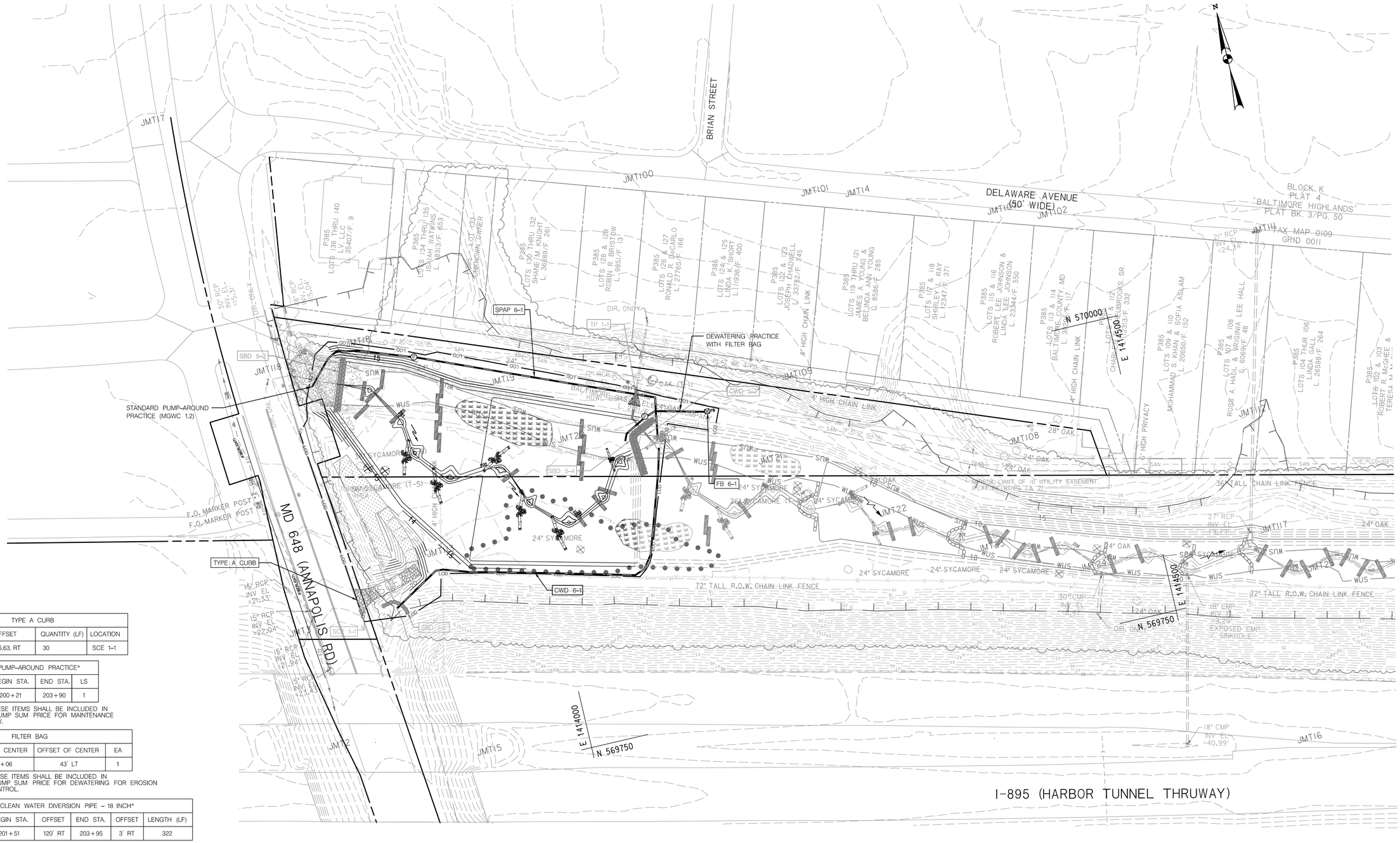
CONST. REVIEW BY JSK | DATE MAY, 2019 | SCALE 1" = 40'

CONTRACT NO. HT-3012-0000

DRAWING NO. **EP-06**

SHEET NO. 18 OF 26

FILE: Q:\2015\5177_003_I-895_TMDL_Stream_Re\CADD\pEP-0006_I895 STREAM RESTORATION - PHASE 5.dgn
DATE: Thursday, March 28, 2019 AT 02:19 PM



TYPE A CURB			
STATION	OFFSET	QUANTITY (LF)	LOCATION
201+61.33	126.63, RT	30	SCE 1-1

STANDARD PUMP-AROUND PRACTICE*			
SPAP #	BEGIN STA.	END STA.	LS
6-1	200+21	203+90	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

FILTER BAG			
FB #	STA. OF CENTER	OFFSET OF CENTER	EA
6-1	204+06	43' LT	1

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR DEWATERING FOR EROSION AND SEDIMENT CONTROL.

CLEAN WATER DIVERSION PIPE – 18 INCH*					
CWD #	BEGIN STA.	OFFSET	END STA.	OFFSET	LENGTH (LF)
6-1	201+51	120' RT	203+95	3' RT	322

*PAYMENT FOR THESE ITEMS SHALL BE INCLUDED IN THE CONTRACT LUMP SUM PRICE FOR MAINTENANCE OF STREAM FLOW.

jmt.com

STATE OF MARYLAND
JEREMY SCOTT KOSER
No. 31183
PROFESSIONAL ENGINEER

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY

Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY

ENGINEERING DIVISION

I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY

STREAM RESTORATION PROJECT

EROSION AND SEDIMENT CONTROL PLAN PHASE 6

CONTRACT NO. HT-3012-0000

DRAWING NO. **EP-07**

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	SHEET NO. 19 OF 26
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1" = 40'	

FILE: G:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pEP-0007_I895 STREAM RESTORATION - PHASE 6.dgn
DATE: Thursday, March 28, 2019 AT 02:22 PM

Maryland Department of the Environment
STANDARD EROSION AND SEDIMENT CONTROL NOTES

MDE REQUIRES THAT THESE NOTES, IN THEIR ENTIRETY, BE INCLUDED ON THE EROSION AND SEDIMENT CONTROL PLAN. IT IS RECOGNIZED THAT NOT EVERY NOTE MAY APPLY TO ALL PROJECTS. THE REQUIREMENTS OF ANY INDIVIDUAL NOTE NOT APPLICABLE TO THE SUBJECT PROJECT IS NOT BINDING UPON THE APPLICANT OR THE APPLICANT'S CONTRACTOR.

A. EROSION AND SEDIMENT CONTROL GENERAL NOTES

1. THE CONTRACTOR SHALL NOTIFY MDE AT (410) 537-3510 SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY MDE, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF MDE.

2. THE CONTRACTOR SHALL NOTIFY MDE IN WRITING AND BY TELEPHONE AT THE FOLLOWING POINTS:
   A. THE REQUIRED PRE-CONSTRUCTION MEETING.
   B. FOLLOWING INSTALLATION OF SEDIMENT CONTROL MEASURES.
   C. DURING THE INSTALLATION OF SEDIMENT BASINS (TO BE CONVERTED TO PERMANENT STORMWATER MANAGEMENT STRUCTURES) AT THE REQUIRED INSPECTION POINTS (SEE INSPECTION CHECKLIST ON PLAN). NOTIFICATION PRIOR TO COMMENCING CONSTRUCTION OF EACH STEP IS MANDATORY.
   D. PRIOR TO REMOVAL OR MODIFICATION OF ANY SEDIMENT CONTROL STRUCTURE(S).
   E. PRIOR TO REMOVAL OF ALL SEDIMENT CONTROL DEVICES.
   F. PRIOR TO FINAL ACCEPTANCE.

3. THE PLAN APPROVAL LETTER, APPROVED EROSION AND SEDIMENT CONTROL PLANS, DAILY LOG BOOKS, AND TEST REPORTS SHALL BE AVAILABLE AT THE SITE FOR INSPECTION BY DULY AUTHORIZED OFFICIALS OF MDE AND THE AGENCY RESPONSIBLE FOR THE PROJECT.

4. THE CONTRACTOR SHALL CONSTRUCT ALL EROSION AND SEDIMENT CONTROL MEASURES PER THE APPROVED PLAN AND CONSTRUCTION SEQUENCE AND SHALL HAVE THEM INSPECTED AND APPROVED BY THE MDE INSPECTOR PRIOR TO BEGINNING ANY OTHER LAND DISTURBANCES. MINOR SEDIMENT CONTROL DEVICE LOCATION ADJUSTMENTS MAY BE MADE IN THE FIELD WITH THE APPROVAL OF THE MDE INSPECTOR. THE CONTRACTOR SHALL ENSURE THAT ALL RUNOFF FROM DISTURBED AREAS IS DIRECTED TO THE SEDIMENT CONTROL DEVICES AND SHALL NOT REMOVE ANY EROSION OR SEDIMENT CONTROL MEASURE WITHOUT PRIOR PERMISSION FROM THE MDE INSPECTOR. THE CONTRACTOR SHALL OBTAIN PRIOR AGENCY AND MDE APPROVAL FOR MODIFICATIONS TO THE EROSION AND SEDIMENT CONTROL PLAN AND/OR SEQUENCE OF CONSTRUCTION.

5. THE MDE INSPECTOR HAS THE OPTION OF REQUIRING ADDITIONAL SAFETY OR SEDIMENT CONTROL MEASURES, IF DEEMED NECESSARY.

6. THE CONTRACTOR SHALL PROTECT ALL POINTS OF CONSTRUCTION INGRESS AND EGRESS TO PREVENT THE DEPOSITION OF MATERIALS ONTO PUBLIC ROADS. ALL MATERIALS DEPOSITED ONTO PUBLIC ROADS SHALL BE REMOVED IMMEDIATELY.

7. THE CONTRACTOR SHALL INSPECT DAILY AND MAINTAIN CONTINUOUSLY IN AN EFFECTIVE OPERATING CONDITION ALL EROSION AND SEDIMENT CONTROL MEASURES UNTIL SUCH TIME AS THEY ARE REMOVED WITH PRIOR PERMISSION FROM THE MDE INSPECTOR.

8. EROSION AND SEDIMENT CONTROL FOR UTILITY CONSTRUCTION SHALL BE PROVIDED IN ACCORDANCE WITH APPROVED PLANS. UTILITY CONSTRUCTION SHALL ONLY BE FOR AREAS WITHIN THE DELINEATED LIMIT OF DISTURBANCE. CALL "MISS UTILITY" AT 1-800-257-7777 48 HOURS PRIOR TO THE START OF ANY WORK. WHEN SAME DAY STABILIZATION IS APPROVED:
   A. EXCAVATED TRENCH MATERIAL SHALL BE PLACED ON THE HIGH SIDE OF THE TRENCH.
   B. TRENCHES FOR UTILITY INSTALLATION SHALL BE BACKFILLED, COMPACTED, AND STABILIZED AT THE END OF EACH WORKING DAY. NO MORE TRENCH SHALL BE OPENED THAN CAN BE COMPLETED THE SAME DAY.

9. ALL WATER REMOVED FROM EXCAVATED AREAS SHALL BE PASSED THROUGH AN MDE APPROVED DEWATERING PRACTICE OR PUMPED TO A SEDIMENT TRAP OR BASIN PRIOR TO DISCHARGE TO A FUNCTIONAL STORM DRAIN SYSTEM OR TO STABLE GROUND SURFACE.

10. CONCRETE WASHOUT STRUCTURES SHALL BE USED WHEN CONCRETE TRUCKS, DRUMS, PUMPS, CHUTES, OR OTHER EQUIPMENT IS RINSED OR CLEANED ON-SITE.

11. CONSTRUCTION ACTIVITIES PRODUCING DUST SHALL IMPLEMENT CONTROL MEASURES TO AVOID THE SUSPENSION OF DUST PARTICLES AND/OR PREVENT DUST FROM BLOWING OFF-SITE OR TO AREAS WITHOUT TREATMENT.

12. FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN:
   A. THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND
   B. SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.

13. VEGETATIVE STABILIZATION SHALL BE PERFORMED IN ACCORDANCE WITH THE 2011 MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL. REFER TO APPROPRIATE SPECIFICATIONS FOR TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, SODDING, AND GROUND COVERS.

14. WHEN SEEDING, ALL DISTURBED AREAS WITH SLOPES FLATTER THAN 2:1 SHALL BE STABILIZED WITH 4 INCHES OF TOPSOIL, SEED, AND MULCH. ALL DISTURBED AREAS WITH SLOPES 2:1 OR STEEPER SHALL BE STABILIZED WITH MATTING OVER 2 INCHES OF TOPSOIL AND SEED.

15. ALL SEDIMENT BASINS, TRAP EMBANKMENTS AND SLOPES, PERIMETER DIKES, SWALES AND ALL DISTURBED SLOPES STEEPER THAN OR EQUAL TO 3:1 SHALL BE STABILIZED WITH SEED AND ANCHORED STRAW MULCH, SOD, OR OTHER APPROVED STABILIZATION MEASURES, AS SOON AS POSSIBLE BUT NO LATER THAN THREE (3) CALENDAR DAYS AFTER ESTABLISHMENT. ALL AREAS DISTURBED OUTSIDE OF THE PERIMETER SEDIMENT CONTROL SYSTEM SHALL BE MINIMIZED. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.

16. PERMANENT SWALES OR OTHER POINTS OF CONCENTRATED WATER FLOW SHALL BE STABILIZED WITH SEED AND AN APPROVED EROSION CONTROL MATTING, SOD, RIPRAP, OR OTHER APPROVED STABILIZATION MEASURES.

17. FOR STOCKPILE SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1), THE CONTRACTOR SHALL APPLY SEED AND ANCHORED STRAW MULCH, SOD, OR OTHER APPROVED STABILIZATION MEASURES TO THE FACE OF THE STOCKPILE WITHIN THREE (3) CALENDAR DAYS OF ACTIVITY HAVING CEASED ON THE RESPECTIVE FACE. FOR SLOPES 3:1 OR FLATTER, THE CONTRACTOR SHALL APPLY STABILIZATION MEASURES TO THE FACE OF THE STOCKPILE WITHIN SEVEN (7) CALENDAR DAYS OF ACTIVITY HAVING CEASED ON THE RESPECTIVE FACE. MAINTENANCE SHALL BE PERFORMED AS NECESSARY TO ENSURE CONTINUED STABILIZATION.

18. FOR FINISHED GRADING, THE CONTRACTOR SHALL PROVIDE ADEQUATE GRADIENTS TO PREVENT WATER FROM PONDING FOR MORE THAN TWENTY-FOUR (24) HOURS AFTER THE END OF A RAINFALL EVENT. DRAINAGE COURSES AND SWALE FLOW AREAS MAY TAKE AS LONG AS FORTY-EIGHT (48) HOURS AFTER THE END OF A RAINFALL EVENT TO DRAIN. AREAS DESIGNED TO HAVE STANDING WATER SHALL NOT BE REQUIRED TO MEET THIS REQUIREMENT.

19. WHERE DEEMED APPROPRIATE BY THE ENGINEER OR INSPECTOR, SEDIMENT BASINS AND TRAPS MAY NEED TO BE SURROUNDED WITH AN APPROVED SAFETY FENCE. THE FENCE MUST CONFORM TO LOCAL ORDINANCES AND REGULATIONS. THE DEVELOPER OR OWNER SHALL CHECK WITH LOCAL BUILDING OFFICIALS ON APPLICABLE SAFETY REQUIREMENTS. WHERE SAFETY FENCE IS DEEMED APPROPRIATE AND LOCAL ORDINANCES DO NOT SPECIFY FENCING SIZES AND TYPES, THE FOLLOWING SHALL BE USED AS A MINIMUM STANDARD: THE SAFETY FENCE SHALL BE MADE OF WELDED WIRE AND AT LEAST 42 INCHES HIGH, HAVE POSTS SPACED NO FARTHER APART THAN 8 FEET, HAVE MESH OPENINGS NO GREATER THAN 2 INCHES IN WIDTH AND 4 INCHES IN HEIGHT WITH A MINIMUM OF 14 GAUGE WIRE. SAFETY FENCE SHALL BE MAINTAINED AND IN GOOD CONDITION AT ALL TIMES.

20. ALL SEDIMENT TRAP DEPTH DIMENSIONS ARE RELATIVE TO THE OUTLET ELEVATION. ALL TRAPS HAVE A STABLE OUTFALL. ALL TRAPS AND BASINS SHALL HAVE STABLE INFLOW POINTS.

21. SEDIMENT SHALL BE REMOVED AND THE TRAP OR BASIN RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO ONE QUARTER OF THE TOTAL DEPTH OF THE TRAP OR BASIN. TOTAL DEPTH SHALL BE MEASURED FROM THE TRAP OR BASIN BOTTOM TO THE CREST OF THE OUTLET.

22. SEDIMENT REMOVED FROM TRAPS (AND BASINS) SHALL BE PLACED AND STABILIZED IN APPROVED AREAS, BUT NOT WITHIN A FLOODPLAIN, WETLAND, OR TREE-SAVE AREA. WHEN PUMPING SEDIMENT LADEN WATER, THE DISCHARGE SHALL BE DIRECTED TO AN MDE APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO RELEASE FROM THE SITE. A SUMP PIT MAY BE USED IF SEDIMENT TRAPS THEMSELVES ARE BEING PUMPED OUT.

23. PRIOR TO REMOVAL OF SEDIMENT CONTROL MEASURES, THE CONTRACTOR SHALL STABILIZE AND HAVE ESTABLISHED PERMANENT STABILIZATION FOR ALL CONTRIBUTORY DISTURBED AREAS USING SOD OR AN APPROVED PERMANENT SEED MIXTURE WITH REQUIRED SOIL AMENDMENTS AND AN APPROVED ANCHORED MULCH. WOOD FIBER MULCH MAY ONLY BE USED IN SEEDING SEASON WHERE SLOPE DOES NOT EXCEED 10% AND GRADING HAD BEEN DONE TO PROMOTE SHEET FLOW DRAINAGE. AREAS BROUGHT TO FINISHED GRADE DURING THE SEEDING SEASON SHALL BE PERMANENTLY STABILIZED AS SOON AS POSSIBLE, BUT NOT LATER THAN THREE (3) CALENDAR DAYS AFTER ESTABLISHMENT FOR SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1) AND SEVEN (7) CALENDAR DAYS FOR FLATTER SLOPES. WHEN PROPERTY IS BROUGHT TO FINISHED GRADE DURING THE MONTHS OF NOVEMBER THROUGH FEBRUARY, AND PERMANENT STABILIZATION IS FOUND TO BE IMPRACTICAL, TEMPORARY SEED AND ANCHORED STRAW MULCH SHALL BE APPLIED TO DISTURBED AREAS. THE FINAL PERMANENT STABILIZATION OF SUCH PROPERTY SHALL BE APPLIED BY MARCH 15 OR EARLIER IF GROUND AND WEATHER CONDITIONS ALLOW.

24. TEMPORARY SEDIMENT CONTROL DEVICES SHALL BE REMOVED WITH PERMISSION OF THE MDE INSPECTOR WITHIN THIRTY (30) CALENDAR DAYS FOLLOWING ESTABLISHMENT OF PERMANENT STABILIZATION IN ALL CONTRIBUTORY DRAINAGE AREAS. UPON REMOVAL OF SEDIMENT CONTROL DEVICES, THE AREA DISTURBED BY REMOVAL SHALL BE STABILIZED WITH TOPSOIL, SEED, AND MULCH, OR AS SPECIFIED, WITHIN 24 HOURS OF SAID REMOVAL. STORMWATER MANAGEMENT STRUCTURES USED TEMPORARILY FOR SEDIMENT CONTROL SHALL BE CONVERTED TO THE PERMANENT CONFIGURATION WITHIN THIS TIME PERIOD AS WELL.

25. OFF-SITE SPOIL OR BORROW AREAS ON STATE OR FEDERAL PROPERTY SHALL HAVE PRIOR APPROVAL BY MDE AND OTHER APPLICABLE STATE, FEDERAL, AND LOCAL AGENCIES; OTHERWISE APPROVAL SHALL BE GRANTED BY THE LOCAL AUTHORITIES. ALL WASTE AND BORROW AREAS OFF-SITE SHALL BE PROTECTED BY SEDIMENT CONTROL MEASURES AND STABILIZED.

26. SITE INFORMATION:
   A.AREA DISTURBED ____ 4.48 ACRES
   B.TOTAL CUT ____ 9,200 CUBIC YARDS
   C.TOTAL FILL ____ 1,850 CUBIC YARDS
   D.OFF-SITE WASTE / BORROW AREA LOCATION ____ N/A

B. STANDARD STABILIZATION NOTE

FOLLOWING INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES STEEPER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.

C. OWNER'S/DEVELOPER'S CERTIFICATION

I / WE HEREBY CERTIFY THAT ALL CLEARING, GRADING, CONSTRUCTION, AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN AND THAT ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OF ATTENDANCE AT A MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION AND SEDIMENT BEFORE BEGINNING THE PROJECT. I/WE HEREBY AUTHORIZE THE RIGHT OF ENTRY FOR PERIODIC ON-SITE EVALUATION BY APPROPRIATE INSPECTION AND ENFORCEMENT AUTHORITY OR THE STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT. I/WE HEREBY CERTIFY THAT STORMWATER MANAGEMENT FACILITIES WILL BE MAINTAINED IN ACCORDANCE WITH APPROVED PLANS.

5/1/19
DATE

Peter Mattegat
OWNER / DEVELOPER SIGNATURE

RPE 013058
RESPONSIBLE PERSONNEL CERTIFICATION NO.

Peter Mattegat, PE
Environmental Manager
PRINTED NAME AND TITLE

SEQUENCE OF CONSTRUCTION
(ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THESE NOTES)

1. THE CONTRACTOR SHALL NOTIFY MDE AT (410) 537-3510 SEVEN (7) DAYS BEFORE COMMENCING ANY LAND DISTURBING ACTIVITY AND, UNLESS WAIVED BY MDE, SHALL BE REQUIRED TO HOLD A PRE-CONSTRUCTION MEETING BETWEEN PROJECT REPRESENTATIVES AND A REPRESENTATIVE OF MDE.

2. PERFORM CONSTRUCTION STAKEOUT. IF APPLICABLE, ORANGE HIGH VISIBILITY FENCE SHALL BE MANUALLY INSTALLED ALONG THE LIMIT OF DISTURBANCE, WHERE THE LIMIT IS WITHIN 50 FEET OF THE FOREST BUFFER/CONSERVATION EASEMENT. THIS SHALL BE COMPLETED BY AND INSPECTED AT THE PRE-CONSTRUCTION MEETING.

3. THE STREAM WORK IS DIVIDED INTO 6 PHASES AS SHOWN ON THE EROSION AND SEDIMENT CONTROL PLANS. WORK IN THE STREAM AREAS MUST OCCUR IN ORDER FROM DOWNSTREAM TO UPSTREAM UNLESS OTHERWISESPECIFIED.

4. WORK WILL NEED TO BE COMPLETED IN THE PHASE THAT CORRESPONDS TO THE STATION RANGE OF WHERE THE WORK AREA IS LOCATED. PUMPS FOR PUMP AROUND SYSTEMS CAN BE TURNED OFF AT THE END OF THE DAY FOLLOWING SITE STABILIZATION.

5. CONTRACTOR IS NOT TO IMPACT WORK THAT HAS BEEN COMPLETED IN PREVIOUS PHASES.

PHASE 1

1. INSTALL STABILIZED CONSTRUCTION ENTRANCE SCE 1-1 AS INDICATED ON PLANS.

2. CLEAR AND GRUB WORK AREA IN PREPARATION OF INSTALLING PHASE 1 EROSION AND SEDIMENT CONTROL DEVICES. INSTALL ORANGE CONSTRUCTION FENCING OCF 1-1, SUPER SILT FENCE SSF 1-1 THROUGH 1-12, AND FILTER LOG FL 1-1.

3. INSTALL CLEAN WATER DIVERSION CWD 1-1 WITH SAND BAG DIKE SBD 1-1, ROCK OUTLET PROTECTION R0 1-1, AND DIVERSION FENCE DF 1-1 AS INDICATED ON THE PLANS OR AS DIRECTED BY THE SEDIMENT CONTROL INSPECTOR.

4. INSTALL TEMPORARY PIPE TP 1-1 AND ROCK OUTLET PROTECTION RO 1-2 AS SHOWN ON PLANS.

5. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, GRADE AND INSTALL THE TEMPORARY ACCESS ROAD AND TIMBER MAT SURFACE, INCLUDING THE TEMPORARY STAGING AREAS AND TURN AROUND AREAS. CONSTRUCT TEMPORARY BRIDGE 1-1 INCLUDING TEMPORARY TIMBER MATTING. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTURBANCE AREAS ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH.

6. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR, REMOVE FILTER LOG FL 1-1 AND PROCEED TO PHASE 2 OF CONSTRUCTION.

PHASE 2

1. CLEAR AND GRUB WORK AREA IN PREPARATION FOR THE INSTALLATION OF THE EROSION AND SEDIMENT CONTROLS AND PHASE 2 CONSTRUCTION.

2. INSTALL PUMP-AROUND SYSTEM SPAP 2-1 PER PUMP AROUND PRACTICE STANDARD MGWC 1.2 OR AS DIRECTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR. CONSTRUCT UPSTREAM SAND BAG DIKE SBD 2-1 AND INSTALL PUMP AROUND HOSES. INSTALL DOWNSTREAM SAND BAG DIKE SBD 2-2 AS SHOWN ON PLANS. INSTALL CLEAN WATER DIVERSION PIPE CWD 2-1 AND PUMP CLEAN WATER AROUND WORK AREA. INSTALL PUMP AND FILTER BAG FB 2-1 AND BEGIN TO PUMP ENTRAPPED WATER OUT OF THE WORK AREA. ALL SEDIMENT LADEN WATER WILL BE PUMPED TO THE FILTER BAG OR APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO WATER ENTERING STREAM.

3. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, PERFORM STREAM GRADING AND RESTORATION WORK FROM STA. 214+41 TO STA. 220+30 (TO THE EXISTING TRASH RACK) PER THE DESIGN PLANS. INSTALL PROPOSED CLASS II RIPRAP, PROPOSED TYPE C ENDWALL, AND RIPRAP OUTFALL PROTECTION. RESET CWD 2-1 TO THE PROPOSED TYPE C ENDWALL. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTURBANCE ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH OR BY VEGETATIVE STABILIZATION PER THE LANDSCAPING PLANS.

4. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE THE PUMP AROUND SYSTEM SPAP 2-1 (SBD 2-1, SBD 2-2, PUMP AND FB 2-1), CLEAN WATER DIVERSION PIPE CWD 2-1 AND SUPER SILT FENCE SSF 1-10 THROUGH SSF 1-12. PROCEED TO PHASE 3 OF CONSTRUCTION.

PHASE 3

1. CLEAR AND GRUB WORK AREA IN PREPARATION FOR THE INSTALLATION OF THE EROSION AND SEDIMENT CONTROLS AND PHASE 3 CONSTRUCTION.

2. INSTALL PUMP-AROUND SYSTEM SPAP 3-1 PER PUMP AROUND PRACTICE STANDARD MGWC 1.2 OR AS DIRECTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR. CONSTRUCT UPSTREAM SAND BAG DIKE SBD 3-1 AND INSTALL PUMP AROUND HOSES. INSTALL DOWNSTREAM SAND BAG DIKE SBD 3-2 AS SHOWN ON PLANS. INSTALL CLEAN WATER DIVERSION PIPES CWD 3-1, 3-2 AND 3-3 AND PUMP CLEAN WATER AROUND WORK AREA. INSTALL PUMP AND FILTER BAG FB 3-1 AND BEGIN TO PUMP ENTRAPPED WATER OUT OF THE WORK AREA. ALL SEDIMENT LADEN WATER WILL BE PUMPED TO THE FILTER BAG OR APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO WATER ENTERING STREAM.

3. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, PERFORM STREAM GRADING AND RESTORATION WORK FROM STA. 208+73 TO STA. 214+41 PER THE DESIGN PLANS. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTRUBANCE ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH OR BY VEGETATIVE STABILIZATION PER THE LANDSCAPING PLANS.

4. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE THE PUMP AROUND SYSTEM SPAP 3-1 (SBD 3-1, SBD 3-2, PUMP AND FB 3-1), CLEAN WATER DIVERSION PIPES CWD 3-1, 3-2 AND 3-3, AND SUPER SILT FENCE SSF 1-5 THROUGH SSF 1-9. DECONSTRUCT TEMPORARY ACCESS ROAD, TEMPORARY STAGING AND TURN AROUND AREAS AS NEEDED AND RE-GRADE TO EXISTING CONDITIONS. PROCEED TO PHASE 4 OF CONSTRUCTION.

PHASE 4

1. CLEAR AND GRUB WORK AREA IN PREPARATION FOR THE INSTALLATION OF THE EROSION AND SEDIMENT CONTROLS AND PHASE 4 CONSTRUCTION.

2. DECONSTRUCT PORTION OF TEMPORARY STAGING AREA, SSF 1-3, AND DF 1-1 TO THE LIMITS SHOWN ON THE PLAN. INSTALL SUPER SILT FENCE SSF 4-1 AND SSF 4-2. INSTALL PUMP-AROUND SYSTEM SPAP 4-1 PER PUMP AROUND PRACTICE STANDARD MGWC 1.2 OR AS DIRECTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR. CONSTRUCT UPSTREAM SAND BAG DIKE SBD 4-1 AND INSTALL PUMP AROUND HOSES. INSTALL DOWNSTREAM SAND BAG DIKE SBD 4-2 AS SHOWN ON PLANS. INSTALL SAND BAG DIKE SBD 4-3 AND CLEAN WATER DIVERSION PIPES CWD 4-1, CWD 4-2, CWD 4-3 AND PUMP CLEAN WATER AROUND WORK AREA. INSTALL PUMP AND FILTER BAG FB 4-1 AND BEGIN TO PUMP ENTRAPPED WATER OUT OF THE WORK AREA. ALL SEDIMENT LADEN WATER WILL BE PUMPED TO THE FILTER BAG OR APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO WATER ENTERING STREAM.

3. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, PERFORM STREAM GRADING AND RESTORATION WORK FROM STA. 203+70 TO STA. 208+73 PER THE DESIGN PLANS. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTRUBANCE ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH OR BY VEGETATIVE STABILIZATION PER THE LANDSCAPING PLANS.

4. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE THE PUMP AROUND SYSTEM SPAP 4-1 (SBD 4-1, SBD 4-2, PUMP AND FB 4-1), CLEAN WATER DIVERSION PIPES CWD 4-1, CWD 4-2, CWD 4-3, SAND BAG DIKE 4-3, AND ORANGE CONSTRUCTION FENCE OCF 1-1. PROCEED TO PHASE 5 OF CONSTRUCTION.

JEREMY SCOTT KOSER
No. 31183

PHASE 5

1. CLEAR AND GRUB WORK AREA IN PREPARATION FOR THE INSTALLATION OF THE EROSION AND SEDIMENT CONTROLS AND PHASE 5 CONSTRUCTION.

2. REMOVE PORTION OF SSF 1-1 TO THE LIMITS SHOWN ON THE PLAN. INSTALL SUPER SILT FENCE SSF 5-1 AND SSF 5-2. INSTALL PUMP-AROUND SYSTEM SPAP 5-1 PER PUMP AROUND PRACTICE STANDARD MGWC 1.2 OR AS DIRECTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR. CONSTRUCT UPSTREAM SAND BAG DIKE SBD 5-1 WITHIN THE EXISTING BOX CULVERT AND INSTALL PUMP AROUND HOSES THROUGH THE SANDBAGS USING A WATERTIGHT SEAL. INSTALL DOWNSTREAM SAND BAG DIKES SBD 5-2 AND SBD 5-4 AS SHOWN ON PLANS. INSTALL SAND BAG DIKE SBD 5-3 AND CLEAN WATER DIVERSION PIPE CWD 5-1 AND PUMP CLEAN WATER AROUND WORK AREA. INSTALL CLEAN WATER DIVERSION CWD 5-2. INSTALL PUMP AND FILTER BAG FB 5-1 AND BEGIN TO PUMP ENTRAPPED WATER OUT OF THE WORK AREA. ALL SEDIMENT LADEN WATER WILL BE PUMPED TO THE FILTER BAG OR APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO WATER ENTERING STREAM.

3. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, GRADE AND INSTALL THE TEMPORARY ACCESS ROAD AND TIMBER MAT SURFACE, INCLUDING THE TURN AROUND AREA AND PERFORM GRADING OF SCOUR HOLE AND RESTORATION WORK PER THE DESIGN PLANS. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTRUBANCE ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH OR BY VEGETATIVE STABILIZATION PER THE LANDSCAPING PLANS.

4. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE THE PUMP AROUND SYSTEM SPAP 5-1 (SBD 5-1, PUMP AND FB 5-1), CLEAN WATER DIVERSION PIPES CWD 5-1 AND CWD 1-1, ROCK OUTLET PROTECTION RO 1-1, SAND BAG DIKE SBD 5-3, DIVERSION FENCE DF 1-1, AND SUPER SILT FENCE SSF 5-1, SSF 5-2, SSF 1-1, SSF 1-2, SSF 1-3, SSF 1-4. SSF 4-1, AND SSF 4-2. DECONSTRUCT TEMPORARY ACCESS ROAD, TEMPORARY STAGING AND TURN AROUND AREAS TO LIMITS SHOWN ON PHASE 6 EP-07 AND RE-GRADE TO EXISTING CONDITIONS. PLEASE NOTE THAT STABILIZED CONSTRUCTION ENTRACE SCE-1 IS TO REMAIN IN PLACE. PROCEED TO PHASE 6 OF CONSTRUCTION.

PHASE 6

1. CLEAR AND GRUB WORK AREA IN PREPARATION FOR THE INSTALLATION OF THE EROSION AND SEDIMENT CONTROLS AND PHASE 5 CONSTRUCTION.

2. INSTALL PUMP-AROUND SYSTEM SPAP 6-1 PER PUMP AROUND PRACTICE STANDARD MGWC 1.2 OR AS DIRECTED BY THE EROSION AND SEDIMENT CONTROL INSPECTOR. UTILIZE UPSTREAM SAND BAG DIKE SBD 5-2 AND DOWNSTREAM SANDBAG DIKE SBD 5-4 AND INSTALL PUMP AROUND HOSES. INSTALL CLEAN WATER DIVERSION CWD 6-1. INSTALL PUMP AND FILTER BAG FB 6-1 AND BEGIN TO PUMP ENTRAPPED WATER OUT OF THE WORK AREA. ALL SEDIMENT LADEN WATER WILL BE PUMPED TO THE FILTER BAG OR APPROVED SEDIMENT TRAPPING DEVICE PRIOR TO WATER ENTERING STREAM.

3. WITH THE EROSION AND SEDIMENT CONTROL INSPECTOR'S PERMISSION, PERFORM STREAM GRADING AND RESTORATION WORK FROM STA. 200+38 TO STA. 203+70 PER THE DESIGN PLANS. CONTRACTOR IS TO INSALL THE CLASS I RIPRAP OUTFALL PROTECTION WITHIN A 3 DAY DRY PERIOUD. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. ALL DISTRUBANCE ADJACENT TO THE STREAM CHANNEL SHALL BE STABILIZED USING TEMPORARY SEED AND MULCH OR BY VEGETATIVE STABILIZATION PER THE LANDSCAPING PLANS.

4. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE ALL REMAINING EROSION AND SEDIMENT CONTROLS EXCEPT SCE 1-1 WHICH WILL BE UTILIZED FOR LANDSCAPING ACTIVITIES.

5. STABILIZE ALL DISTURBED AREAS WITH SEED AND MULCH OR PER THE LANDSCAPE PLANS AS PERMANENT STABILIZATION.

6. INSTALL PROPOSED PLANTINGS AND SEEDINGS PER THE LANSCAPING PLANS AT THE END OF PHASE 6 ONCE ALL AREAS ARE STABILIZED.

7. ONCE ALL DISTURBED AREAS HAVE BEEN STABILIZED AND WITH THE PERMISSION OF THE EROSION AND SEDIMENT CONTROL INSPECTOR REMOVE SCE 1-1 AND INSTALL TYPE A CURB.

BEST MANAGEMENT PRACTICES FOR WORKING IN NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, AND 100-YEAR FLOODPLAINS

1. NO EXCESS FILL, CONSTRUCTION MATERIAL, OR DEBRIS SHALL BE STOCKPILED OR STORED IN NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.

2. PLACE MATERIALS IN A LOCATION AND MANNER WHICH DOES NOT ADVERSELY IMPACT SURFACE OR SUBSURFACE WATER FLOW INTO OR OUT OF THE NONTIDAL WETLAND, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.

3. DO NOT USE THE EXCAVATED MATERIAL AS BACKFILL IF IT CONTAINS WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE. IF ADDITIONAL BACKFILL IS REQUIRED, USE CLEAN MATERIAL FREE OF WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE.

4. PLACE HEAVY EQUIPMENT ON MATS OR SUITABLY OPERATE THE EQUIPMENT TO PREVENT DAMAGE TO THE NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.

5. REPAIR AND MAINTAIN ANY SERVICEABLE STRUCTURE OR FILL SO THERE IS NO PERMANENT LOSS OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, OR WATERWAYS, OR PERMANENT MODIFICATION OF THE 100-YEAR FLOODPLAIN IN EXCESS OF THAT LOST UNDER THE ORIGINALLY AUTHORIZED STRUCTURE OR FILL.

6. RECTIFY ANY NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, OR 100-YEAR FLOODPLAIN TEMPORARILY IMPACTED BY ANY CONSTRUCTION.

7. ALL STABILIZATION IN THE NONTIDAL WETLAND AND NONTIDAL WETLAND BUFFER SHALL CONSIST OF THE FOLLOWING SPECIES: ANNUAL RYEGRASS (LOLIUM MULTIFLORUM), MILLET (SETARIA ITALICA), BARLEY (HORDEUM SP.), OATS (UNIOLA SP.), AND/OR RYE (SECALE CEREALE). THESE SPECIES WILL ALLOW FOR THE STABILIZATION OF THE SITE WHILE ALSO ALLOWING FOR THE VOLUNTARY REVEGETATION OF NATURAL WETLAND SPECIES. OTHER NON-PERSISTENT VEGETATION MAY BE ACCEPTABLE, BUT MUST BE APPROVED BY THE NONTIDAL WETLANDS AND WATERWAYS DIVISION. **KENTUCKY 31 FESCUE SHALL NOT BE UTILIZED IN WETLAND OR BUFFER AREAS.** THE AREA SHOULD BE SEEDED AND MULCHED TO REDUCE EROSION AFTER CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.

8. AFTER INSTALLATION HAS BEEN COMPLETED, MAKE POST-CONSTRUCTION GRADES AND ELEVATIONS THE SAME AS THE ORIGINAL GRADES AND ELEVATIONS IN TEMPORARILY IMPACTED AREAS.

9. TO PROTECT AQUATIC SPECIES, IN-STREAM WORK IS PROHIBITED AS DETERMINED BY THE CLASSIFICATION OF THE STREAM:

   USE I WATERS: IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE, DURING ANY YEAR.

10. STORMWATER RUNOFF FROM IMPERVIOUS SURFACES SHALL BE CONTROLLED TO PREVENT THE WASHING OF DEBRIS INTO THE WATERWAY.

11. CULVERTS SHALL BE CONSTRUCTED AND ANY RIPRAP PLACED SO AS NOT TO OBSTRUCT THE MOVEMENT OF AQUATIC SPECIES, UNLESS THE PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER.

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PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183
EXPIRATION DATE: 1/13/2021

DESIGN CERTIFICATION

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, THE 2000 MARYLAND STORMWATER DESIGN MANUAL, VOLUMES I & II INCLUDING SUPPLEMENTS, THE ENVIRONMENT ARTICLE SECTIONS 4-101 THROUGH 116 AND SECTIONS 4-201 AND 215, AND THE CODE OF MARYLAND REGULATIONS (COMAR) 26.17.01 AND COMAR 26.17.02 FOR EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT, RESPECTIVELY.

DATE 1/13/2021 DESIGNER'S SIGNATURE
MD REGISTRATION NO. 31183 PRINTED NAME JEREMY S. KOSER
[✓ P.E.] R.L.S., R.L.A., OR R.A. (CIRCLE ONE)

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

DESIGNED BY MRG/PVC
DRAWN BY JMB
CHECKED BY MRG/JSK
CONST. REVIEW BY JSK
DATE MAY, 2019
SCALE N.T.S.

CONTRACT NO. HT-3012-0000
DRAWING NO. ES-01
SHEET NO. 20 OF 26

B-4 STANDARDS AND SPECIFICATIONS FOR VEGETATIVE STABILIZATION

DEFINITION
USING VEGETATION AS COVER TO PROTECT EXPOSED SOIL FROM EROSION.

PURPOSE
TO PROMOTE THE ESTABLISHMENT OF VEGETATION ON EXPOSED SOIL.

CONDITIONS WHERE PRACTICE APPLIES
ON ALL DISTURBED AREAS NOT STABILIZED BY OTHER METHODS. THIS SPECIFICATION IS DIVIDED INTO SECTIONS ON INCREMENTAL STABILIZATION; SOIL PREPARATION, SOIL AMENDMENTS AND TOPSOILING; SEEDING AND MULCHING; TEMPORARY STABILIZATION; AND PERMANENT STABILIZATION.

EFFECTS ON WATER QUALITY AND QUANTITY
STABILIZATION PRACTICES ARE USED TO PROMOTE THE ESTABLISHMENT OF VEGETATION ON EXPOSED SOIL. WHEN SOIL IS STABILIZED WITH VEGETATION, THE SOIL IS LESS LIKELY TO ERODE AND MORE LIKELY TO ALLOW INFILTRATION OF RAINFALL, THEREBY REDUCING SEDIMENT LOADS AND RUNOFF TO DOWNSTREAM AREAS.

PLANTING VEGETATION IN DISTURBED AREAS WILL HAVE AN EFFECT ON THE WATER BUDGET, ESPECIALLY ON VOLUMES AND RATES OF RUNOFF, INFILTRATION, EVAPORATION, TRANSPIRATION, PERCOLATION AND GROUNDWATER RECHARGE. OVER TIME, VEGETATION WILL INCREASE ORGANIC MATTER CONTENT AND IMPROVE THE WATER HOLDING CAPACITY OF THE SOIL AND SUBSEQUENT PLANT GROWTH.

VEGETATION WILL HELP REDUCE THE MOVEMENT OF SEDIMENT, NUTRIENTS AND OTHER CHEMICALS CARRIED BY RUNOFF TO RECEIVING WATERS. PLANTS WILL ALSO HELP PROTECT GROUNDWATER SUPPLIES BY ASSIMILATING THOSE SUBSTANCES PRESENT WITHIN THE ROOT ZONE.

SEDIMENT CONTROL PRACTICES MUST REMAIN IN PLACE DURING GRADING, SEEDBED PREPARATION, SEEDING, MULCHING AND VEGETATIVE ESTABLISHMENT.

ADEQUATE VEGETATIVE ESTABLISHMENT
INSPECT SEEDED AREAS FOR VEGETATIVE ESTABLISHMENT AND MAKE NECESSARY REPAIRS, REPLACEMENTS AND RESEEDINGS WITHIN THE PLANTING SEASON.

1. ADEQUATE VEGETATIVE STABILIZATION REQUIRES 95 PERCENT GROUNDCOVER.
2. IF AN AREA HAS LESS THAN 40 PERCENT GROUNDCOVER, RESTABILIZE FOLLOWING THE ORIGINAL RECOMMENDATIONS FOR LIME, FERTILIZER, SEEDBED PREPARATION AND SEEDING.
3. IF AN AREA HAS BETWEEN 40 AND 94 PERCENT GROUNDCOVER, OVER-SEED AND FERTILIZE USING HALF THE RATES ORIGINALLY SPECIFIED.
4. MAINTENANCE FERTILIZER RATES FOR PERMANENT SEEDING ARE SHOWN IN TABLE B.6.

B-4-1 STANDARDS AND SPECIFICATIONS FOR INCREMENTAL STABILIZATION

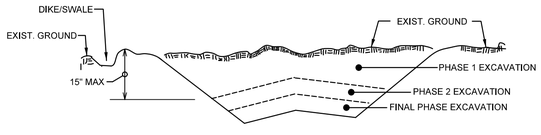
DEFINITION
ESTABLISHMENT OF VEGETATIVE COVER ON CUT AND FILL SLOPES

PURPOSE
TO PROVIDE TIMELY VEGETATIVE COVER ON CUT AND FILL SLOPES AS WORK PROGRESSES

CONDITIONS WHERE PRACTICE APPLIES
ANY CUT OR FILL SLOPE GREATER THAN 15 FEET IN HEIGHT. THIS PRACTICE ALSO APPLIES TO STOCKPILES.

CRITERIA
A. INCREMENTAL STABILIZATION - CUT SLOPES
   1. EXCAVATE AND STABILIZE CUT SLOPES IN INCREMENTS NOT TO EXCEED 15 FEET IN HEIGHT. PREPARE SEEDBED AND APPLY SEED AND MULCH ON ALL CUT SLOPES AS THE WORK PROGRESSES.
   2. CONSTRUCTION SEQUENCE EXAMPLE (REFER TO FIGURE B.1)
      A. CONSTRUCT AND STABILIZE ALL TEMPORARY SWALES OR DIKES THAT WILL BE USED TO CONVEY RUNOFF AROUND THE EXCAVATION.
      B. PERFORM PHASE 1 EXCAVATION, PREPARE SEEDBED AND STABILIZE.
      C. PERFORM PHASE 2 EXCAVATION, PREPARE SEEDBED AND STABILIZE. OVERSEED PHASE 1 AREAS AS NECESSARY
      D. PERFORM FINAL PHASE EXCAVATION, PREPARE SEEDBED AND STABILIZE. OVERSEED PREVIOUSLY SEEDED AREAS AS NECESSARY.

NOTE: ONCE EXCAVATION HAS BEGUN THE OPERATION SHOULD BE CONTINUOUS FROM GRUBBING THROUGH THE COMPLETION OF GRADING AND PLACEMENT OF TOPSOIL (IF REQUIRED) AND PERMANENT SEED AND MULCH. ANY INTERRUPTIONS IN THE OPERATION OR COMPLETING THE OPERATION OUT OF THE SEEDING SEASON WILL NECESSITATE THE APPLICATION OF TEMPORARY STABILIZATION.

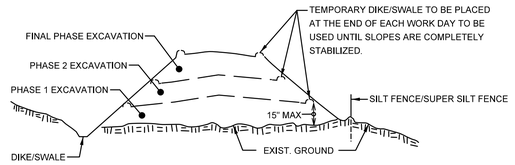


INCREMENTAL STABILIZATION - CUT

B. INCREMENTAL STABILIZATION - FILL SLOPES
   1. CONSTRUCT AND STABILIZE FILL SLOPES IN INCREMENTS NOT TO EXCEED 15 FEET IN HEIGHT. PREPARE SEEDBED AND APPLY SEED AND MULCH ON ALL SLOPES AS THE WORK PROGRESSES.
   2. STABILIZE SLOPES IMMEDIATELY WHEN THE VERTICAL HEIGHT OF A LIFT REACHES 15 FEET, OR WHEN THE GRADING OPERATION CEASES AS PRESCRIBED IN THE PLANS.
   3. AT THE END OF EACH WORKING DAY, INSTALL TEMPORARY WATER CONVEYANCE PRACTICE(S), AS NECESSARY TO INTERCEPT SURFACE RUNOFF AND CONVEY IT DOWN THE SLOPE IN A NON-EROSIVE MANNER.
   4. CONSTRUCTION SEQUENCE EXAMPLE (REFER TO FIGURE B.2):
      A. CONSTRUCT AND STABILIZE ALL TEMPORARY SWALES OR DIKES THAT WILL BE USED TO DIVERT RUNOFF AROUND THE FILL. CONSTRUCT SILT FENCE ON LOW SIDE OF FILL UNLESS OTHER METHODS SHOWN ON THE PLANS ADDRESS THIS AREA.
      B. AT THE END OF EACH WORKING DAY, INSTALL TEMPORARY WATER CONVEYANCE PRACTICE(S), AS NECESSARY, TO INTERCEPT SURFACE RUNOFF AND CONVEY IT DOWN THE SLOPE IN A NON-EROSIVE MANNER.

B. INCREMENTAL STABILIZATION - FILL SLOPES (CONTINUED)
   C. PLACE PHASE 1 FILL, PREPARE SEEDBED AND STABILIZE.
   D. PLACE PHASE 2 FILL, PREPARE SEEDBED AND STABILIZE.
   E. PLACE FINAL PHASE FILL, PREPARE SEEDBED AND STABILIZE. OVERSEED PREVIOUSLY AREAS AS NECESSARY.

NOTE: ONCE THE PLACEMENT OF FILL HAS BEGUN, THE OPERATION SHOULD BE CONTINUOUS FROM GRUBBING THROUGH THE COMPLETION OF GRADING AND PLACEMENT OF TOPSOIL (IF REQUIRED) AND PERMANENT SEED AND MULCH. ANY INTERRUPTIONS IN THE OPERATION OR COMPLETING THE OPERATION OUT OF THE SEEDING SEASON WILL NECESSITATE THE APPLICATION OF TEMPORARY STABILIZATION.



INCREMENTAL STABILIZATION - FILL

B-4-2 STANDARDS AND SPECIFICATIONS FOR SOIL PREPARATION, TOPSOILING AND SOIL AMENDMENTS

DEFINITION
THE PROCESS OF PREPARING THE SOILS TO SUSTAIN ADEQUATE VEGETATIVE STABILIZATION.

PURPOSE
TO PROVIDE A SUITABLE SOIL MEDIUM FOR VEGETATIVE GROWTH.

CONDITIONS WHERE PRACTICE APPLIES
WHERE VEGETATIVE STABILIZATION IS TO BE ESTABLISHED.

CRITERIA
A. SOIL PREPARATION
   1. TEMPORARY STABILIZATION
      A. SEEDBED PREPARATION CONSISTS OF LOOSENING SOIL TO A DEPTH OF 3 TO 5 INCHES BY MEANS OF SUITABLE AGRICULTURAL OR CONSTRUCTION EQUIPMENT, SUCH AS DISC HARROWS OR CHISEL PLOWS OR RIPPERS MOUNTED ON CONSTRUCTION EQUIPMENT. AFTER THE SOIL IS LOOSENED, IT MUST NOT BE ROLLED OR DRAGGED SMOOTH BUT LEFT IN THE ROUGHENED CONDITION. SLOPES 3:1 OR FLATTER ARE TO BE TRACKED WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE.
      B. APPLY FERTILIZER AND LIME AS PRESCRIBED ON THE PLANS.
      C. INCORPORATE LIME AND FERTILIZER INTO THE TOP 3 TO 5 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS.
   2. PERMANENT STABILIZATION
      A. A SOIL TEST IS REQUIRED FOR ANY EARTH DISTURBANCE OF 5 ACRES OR MORE. THE MINIMUM SOIL CONDITIONS REQUIRED FOR PERMANENT VEGETATIVE ESTABLISHMENT ARE:
         i. SOIL pH BETWEEN 6.0 AND 7.0.
         ii. SOLUBLE SALTS LESS THAN 500 PARTS PER MILLION (ppm).
         iii. SOIL CONTAINS LESS THAN 40 PERCENT CLAY BUT ENOUGH FINE GRAINED MATERIAL (GREATER THAN 30 PERCENT SILT PLUS CLAY) TO PROVIDE THE CAPACITY TO HOLD A MODERATE AMOUNT OF MOISTURE. AN EXCEPTION: IF LOVEGRASS WILL BE PLANTED, THEN A SANDY SOIL (LESS THAN 30 PERCENT SILT PLUS CLAY) WOULD BE ACCEPTABLE.
         iv. SOIL CONTAINS 1.5 PERCENT MINIMUM ORGANIC MATTER BY WEIGHT.
         v. SOIL CONTAINS SUFFICIENT PORE SPACE TO PERMIT ADEQUATE ROOT PENETRATION.
      B. APPLICATION OF AMENDMENTS OR TOPSOIL IS REQUIRED IF ON-SITE SOILS DO NOT MEET THE ABOVE CONDITIONS.
      C. GRADED AREAS MUST BE MAINTAINED IN A TRUE AND EVEN GRADE AS SPECIFIED ON THE APPROVED PLAN, THE SCARIFIED OR OTHERWISE LOOSENED TO A DEPTH OF 3 TO 5 INCHES.
      D. APPLY SOIL AMENDMENTS AS SPECIFIED ON THE APPROVED PLAN OR AS INDICATED BY THE RESULTS OF A SOIL TEST.
      E. MIX SOIL AMENDMENTS INTO THE TOP 3 TO 5 INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS. RAKE LAWN AREAS TO SMOOTH THE SURFACE, REMOVE LARGE OBJECTS LIKE STONES AND BRANCHES AND READY THE AREA FOR SEED APPLICATION. LOOSEN SURFACE SOIL BY DRAGGING WITH A HEAVY CHAIN OR OTHER EQUIPMENT TO ROUGHEN THE SURFACE WHERE SITE CONDITIONS WILL NOT PERMIT NORMAL SEEDBED PREPARATION. TRACK SLOPES 3:1 OR FLATTER WITH TRACKED EQUIPMENT LEAVING THE SOIL IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE. LEAVE THE TOP 1 TO 3 INCHES OF SOIL LOOSE AND FRIABLE. SEEDBED LOOSENING MAY BE UNNECESSARY ON NEWLY DISTURBED AREAS.

B. TOPSOILING
   1. TOPSOIL IS PLACED OVER PREPARED SUBSOIL PRIOR TO ESTABLISHMENT OF PERMANENT VEGETATION. THE PURPOSE IS TO PROVIDE A SUITABLE SOIL MEDIUM FOR VEGETATIVE GROWTH. SOILS OF CONCERN HAVE LOW MOISTURE CONTENT, LOW NUTRIENT LEVELS, LOW pH, MATERIALS TOXIC TO PLANTS AND/OR UNACCEPTABLE SOIL GRADATION.
   2. TOPSOIL SALVAGED FROM AN EXISTING SITE MAY BE USED PROVIDED IT MEETS THE STANDARDS AS SET FORTH IN THESE SPECIFICATIONS. TYPICALLY, THE DEPTH OF TOPSOIL TO BE SALVAGED FOR A GIVEN SOIL TYPE CAN BE FOUND IN THE REPRESENTATIVE SOIL PROFILE SECTION IN THE SOIL SURVEY PUBLISHED BY USDA-NRCS.
   3. TOPSOILING IS LIMITED TO AREAS HAVING 2:1 OR FLATTER SLOPES WHERE:
      A. THE TEXTURE OF THE EXPOSED SUBSOIL/PARENT MATERIAL IS NOT ADEQUATE TO PRODUCE VEGETATIVE GROWTH.
      B. THE SOIL MATERIAL IS SO SHALLOW THAT THE ROOTING ZONE IS NOT DEEP ENOUGH TO SUPPORT PLANTS OR FURNISH CONTINUING SUPPLIES OF MOISTURE AND PLANT NUTRIENTS.
      C. THE ORIGINAL SOIL TO BE VEGETATED CONTAINS MATERIAL TOXIC TO PLANT GROWTH.
      D. THE SOIL IS SO ACIDIC THAT TREATMENT WITH LIMESTONE IS NOT FEASIBLE.
   4. AREAS HAVING SLOPES STEEPER THAN 2:1 REQUIRE SPECIAL CONSIDERATION AND DESIGN.
   5. TOPSOIL SPECIFICATIONS: SOILS TO BE USED AS TOPSOIL MUST MEET THE FOLLOWING CRITERIA:
      A. TOPSOIL MUST BE A LOAM, SANDY LOAM, CLAY LOAM, SILT LOAM, SANDY CLAY LOAM OR LOAMY SAND. OTHER SOILS MAY BE USED IF RECOMMENDED BY AN AGRONOMIST OR SOIL SCIENTIST AND APPROVED BY THE APPROPRIATE APPROVAL AUTHORITY. TOPSOIL MUST NOT BE A MIXTURE OF CONTRASTING TEXTURED SUBSOILS AND MUST CONTAIN LESS THAN 5 PERCENT BY VOLUME OF CINDERS, STONES, SLAG, COARSE FRAGMENTS, GRAVEL, STICKS, ROOTS, TRASH OR OTHER MATERIALS LARGER THAN 1½ INCHES IN DIAMETER.
      B. TOPSOIL MUST BE FREE OF NOXIOUS PLANTS OR PLANT PARTS SUCH AS BERMUDA GRASS, QUACK GRASS, JOHNSON GRASS, NUT SEDGE, POISON IVY, THISTLE OR OTHERS AS SPECIFIED.
      C. TOPSOIL SUBSTITUTES OR AMENDMENTS, AS RECOMMENDED BY A QUALIFIED AGRONOMIST OR SOIL SCIENTIST AND APPROVED BY THE APPROPRIATE APPROVAL AUTHORITY, MAY BE USED IN LIEU OF NATURAL TOPSOIL.
   6. TOPSOIL APPLICATION
      A. EROSION AND SEDIMENT CONTROL PRACTICES MUST BE MAINTAINED WHEN APPLYING TOPSOIL.
      B. UNIFORMLY DISTRIBUTE TOPSOIL IN A 5 TO 8 INCH LAYER AND LIGHTLY COMPACT TO A MINIMUM THICKNESS OF 4 INCHES. SPREADING IS TO BE PERFORMED IN SUCH A MANNER THAT SODDING OR SEEDING CAN PROCEED WITH A MINIMUM OF ADDITIONAL SOIL PREPARATION AND TILLAGE. ANY IRREGULARITIES IN THE SURFACE RESULTING FROM TOPSOILING OR OTHER OPERATIONS MUST BE CORRECTED IN ORDER TO PREVENT THE FORMATION OF DEPRESSIONS OR WATER POCKETS.
      C. TOPSOIL MUST NOT BE PLACED IF THE TOPSOIL OR SUBSOIL IS IN A FROZEN OR MUDDY CONDITION, WHEN SUBSOIL IS EXCESSIVELY WET OR IN A CONDITION THAT MAY OTHERWISE BE DETRIMENTAL TO PROPER GRADING AND SEEDING PREPARATION.

C. SOIL AMENDMENTS (FERTILIZER AND LIME SPECIFICATIONS)
   1. SOIL TESTS MUST BE PERFORMED TO DETERMINE THE EXACT RATIOS AND APPLICATION RATES FOR BOTH LIME AND FERTILIZER ON SITES HAVING DISTURBED AREAS OF 5 ACRES OR MORE. SOIL ANALYSIS MAY BE PERFORMED BY A RECOGNIZED PRIVATE OR COMMERCIAL ANALYSES. SOIL SAMPLES TAKEN FOR ENGINEERING PURPOSES MAY ALSO BE USED FOR CHEMICAAL ANALYSIS.
   2. FERTILIZERS MUST BE UNIFORM IN COMPOSITION, FREE FLOWING AND SUITABLE FOR ACCURATE APPLICATION BY APPROPRIATE EQUIPMENT. MANURE MAY BE SUBSTITUTED FOR FERTILIZER WITH PRIOR APPROVAL FROM THE APPROPRIATE APPROVAL AUTHORITY. FERTILIZERS MUST ALL BE DELIVERED TO THE SITE FULLY LABELED ACCORDING TO THE APPLICABLE LAWS AND MUST BEAR THE NAME, TRADE NAME OR TRADEMARK AND WARRANTY OF THE PRODUCER.
   3. LIME MATERIALS MUST BE GROUND LIMESTONE (HYDRATED OR BURNT LIME MAY BE SUBSTITUTED EXCEPT WHEN HYDROSEEDING) WHICH CONTAINS AT LEAST 50 PERCENT TOTAL OXIDES (CALCIUM OXIDE PLUS MAGNESIUM OXIDE). LIMESTONE MUST BE GROUND TO SUCH FINENESS THAT AT LEAST 50 PERCENT WILL PASS THROUGH A #100 MESH SIEVE AND 98 TO 100 PERCENT WILL PASS THROUGH A #20 MESH SIEVE.
   4. LIME AND FERTILIZER ARE TO BE EVENLY DISTRIBUTED AND INCORPORATED INTO THE TOP 3 TO 5INCHES OF SOIL BY DISKING OR OTHER SUITABLE MEANS.
   5. WHERE THE SUBSOIL IS EITHER HIGHLY ACIDIC OR COMPOSED OF HEAVY CLAYS, SPREAD GROUND LIMESTONE AT THE RATE OF 4 TO 8 TONS/ACRE (200-400 POUNDS PER 1,000 SQUARE FEET) PRIOR TO THE PLACEMENT OF TOPSOIL.

B-4-3 STANDARDS AND SPECIFICATIONS FOR SEEDING AND MULCHING

DEFINITION
THE APPLICATION OF SEED AND MULCH TO ESTABLISH VEGETATIVE COVER.

PURPOSE
TO PROTECT DISTURBED SOILS FROM EROSION DURING AND AT THE END OF CONSTRUCTION.

CONDITIONS WHERE PRACTICE APPLIES
TO THE SURFACE OF ALL PERIMETER CONTROLS, SLOPES AND ANY DISTURBED AREA NOT UNDER ACTIVE GRADING.

CRITERIA
A. SEEDING
   1. SPECIFICATIONS
      A. ALL SEED MUST MEET THE REQUIREMENTS OF THE MARYLAND STATE SEED LAW. ALL SEED MUST BE SUBJECT TO RE-TESTING BY A RECOGNIZED SEED LABORATORY. ALL SEED USED MUST HAVE BEEN TESTED WITHIN THE 6 MONTHS IMMEDIATELY PRECEDING THE DATE OF SOWING SUCH MATERIAL ON ANY PROJECT. REFER TO TABLE B.4 REGARDING THE QUALITYOF SEED. SEED TAGS MUST BE AVAILABLE UPON REQUEST TO THE INSPECTOR TO VERIFY TYPE OF SEED AND SEEDING RATE.
      B. MULCH ALONE MAY BE APPLIED BETWEEN THE FALL AND SPRING SEEDING DATES ONLY IF THE GROUND IS FROZEN. THE APPROPRIATE SEEDING MIXTURE MUST BE APPLIED WHEN THE GROUND THAWS.
      C. INOCULANTS: THE INOCULANT FOR TREATING LEGUME SEED IN THE SEED MIXTURES MUST BE A PURE CULTURE OF NITROGEN FIXING BACTERIA PREPARED SPECIFICALLY FOR THE SPECIES. INOCULANTS MUST NOT BE USED LATER THAN THE DATE INDICATED ON THE CONTAINER. ADD FRESH INOCULANTS AS DIRECTED ON THE PACKAGE. USE FOUR TIMES THE RECOMMENDED RATE WHEN HYDROSEEDING. NOTE: IT IS VERY IMPORTANT TO KEEP INOCULANT AS COOL AS POSSIBLE UNTIL USED. TEMPERATURES ABOVE 75 TO 80 DEGREES FAHRENHEIT CAN WEAKEN BACTERIA AND MAKE THE INOCULANT LESS EFFECTIVE.
      D. SOD OR SEED MUST NOT BE PLACED ON SOIL WHICH HAS BEEN TREATED WITH SOIL STERILANTS OR CHEMICALS USED FOR WEED CONTROL UNTIL SUFFICIENT TIME HAS ELAPSED (14 DAYS MIN.) TO PERMIT DISSIPATION OF PHYTO-TOXIC MATERIALS.
   2. APPLICATION
      A. DRY SEEDING: THIS INCLUDES USE OF CONVENTIONAL DROP OR BROADCAST SPREADERS.
         i. INCORPORATE SEED INTO THE SUBSOIL AT THE RATES PRESCRIBED ON TEMPORARY SEEDING TABLE B.1, PERMANENT SEEDING TABLE B.3 OR SITE-SPECIFIC SEEDING SUMMARIES.
         ii. APPLY SEED IN TWO DIRECTIONS, PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION. ROLL THE SEEDED AREA WITH A WEIGHTED ROLLER TO PROVIDE GOOD SEED TO SOIL CONTACT.
      B. DRILL OR CULTIPACKER SEEDING: MECHANIZED SEEDERS THAT APPLY AND COVER SEED WITH SOIL.
         i. CULTIPACKING SEEDERS ARE REQUIRED TO BURY THE SEED IN SUCH A FASHION AS TO PROVIDE, AT LEAST ¾ INCH OF SOIL COVERING. SEEDBED MUST BE FIRM AFTER PLANTING.
         ii. APPLY SEED IN TWO DIRECTIONS, PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.
      C. HYDROSEEDING: APPLY SEED UNIFORMLY WITH HYDROSEEDER (SLURRY INCLUDES SEED & FERTILIZER).
         i. IF FERTILIZER IS BEING APPLIED AT THE TIME OF SEEDING, THE APPLICATION RATES SHOULD NOT EXCEED THE FOLLOWING: NITROGEN, 100 POUNDS PER ACRE TOTAL OF SOLUBLE NITROGEN; P_2O_5(PHOSPHOROUS), 200 POUNDS PER ACRE; K_2O (POTASSIUM), 200 POUNDS PER ACRE.¾
         ii. LIME: USE ONLY GROUND AGRICULTURE LIMESTONE (UP TO 3 TONS PER ACRE MAY BE APPLIED BY HYDROSEEDING). NORMALLY, NOT MORE THAN 2 TONS ARE APPLIED BY HYDROSEEDING AT ANY ONE TIME. DO NOT USE BURNT OR HYDRATED LIME WHEN HYDROSEEDING.
         iii. MIX SEED AND FERTILIZER ON SITE AND SEED IMMEDIATELY AND WITHOUT INTERRUPTION.
         iv. WHEN HYDROSEEDING DO NOT INCORPORATE SEED INTO THE SOIL.

B. MULCHING
   1. MULCH MATERIALS (IN ORDER OF PREFERENCE)
      A. STRAW CONSISTING OF THOROUGHLY THRESHED WHEAT, RYE, OAT, OR BARLEY AND REASONABLY BRIGHT IN COLOR. STRAW IS TO BE FREE OF NOXIOUS WEED SEEDS AS SPECIFIED IN THE MARYLAND SEED LAW AND NOT MUSTY. MOLDY, CAKED, DECAYED, OR EXCESSIVELY DUSTY. NOTE: USE ONLY STERILE STRAW MULCH IN AREAS WHERE ONE SPECIES OF GRASS IS DESIRED.
      B. WOOD CELLULOSE FIBER MULCH (WCFM) CONSISTING OF SPECIALLY PREPARED WOOD CELLULOSE PROCESSED INTO UNIFORM FIBROUS PHYSICAL STATE.
         i. WCFM IS TO BE DYED GREEN OR CONTAIN A GREEN DYE IN THE PACKAGE THAT WILL PROVIDE AN APPROPRIATE COLOR TO FACILITATE VISUAL INSPECTION OF THE UNIFORMLY SPREAD SLURRY.
         ii. WCFM, INCLUDING DYE, MUST CONTAIN NO GERMINATION OR GROWTH INHIBITING FACTORS.
         iii. WCFM MATERIALS ARE TO BE MANUFACTURED AND PROCESSED IN SUCH A MANNER THAT THE WOOD CELLULOSE FIBER MULCH WILL REMAIN IN UNIFORM SUSPENSION IN WATER UNDER AGITATION AND WILL BLEND WITH SEED, FERTILIZER AND OTHER ADDITIVES TO FORM A HOMOGENEOUS SLURRY. THE MULCH MATERIAL MUST FORM A BLOTTER-LIKE GROUND COVER, ON APPLICATION AND PERCOLATION PROPERTIES AND MUST COVER AND HOLD GRASS SEED IN CONTACT WITH THE SOIL WITHOUT INHIBITING THE GROWTH OF THE GRASS SEEDLINGS.
         iv. WCFM MATERIAL MUST NOT CONTAIN ELEMENTS OR COMPOUNDS AT CONCENTRATION LEVELS THAT WILL BE PHYTO-TOXIC.
         v. WCFM MUST CONFORM TO THE FOLLOWING PHYSICAL REQUIREMENTS: FIBER LENGTH OF APPROXIMATELY 10 MILLIMETERS, DIAMETER APPROXIMATELY 1 MILLIMETER, pH RANGE OF 4.0 TO 8.5, ASH CONTENT OF 1.6 PERCENT MAXIMUM AND WATER HOLDING CAPACITY OF 90 PERCENT MINIMUM.
   2. APPLICATION
      A. APPLY MULCH TO ALL SEEDED AREAS IMMEDIATELY AFTER SEEDING.
      B. WHEN STRAW MULCH IS USED, SPREAD IT OVER ALL SEEDED AREAS AT THE RATE OF 2 TONS PER ACRE TO A UNIFORM LOOSE DEPTH OF 1 TO 2 INCHES. APPLY MULCH TO ACHIEVE A UNIFORM DISTRIBUTION AND DEPTH SO THAT THE SOIL SURFACE IS NOT EXPOSED. WHEN USING A MULCH ANCHORING TOOL, INCREASE THE APPLICATION RATE TO 2.5 TONS PER ACRE.
      C. WOOD CELLULOSE FIBER USED AS MULCH MUST BE APPLIED AT A NET DRY WEIGHT OF 1500 POUNDS PER ACRE. MIX THE WOOD CELLULOSE FIBER WITH WATER TO ATTAIN A MIXTURE WITH A MAXIMUM OF 50 POUNDS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER.
   3. ANCHORING
      A. PERFORM MULCH ANCHORING IMMEDIATELY FOLLOWING APPLICATION OF MULCH TO MINIMIZE LOSS BY WIND OR WATER. THAI MAY BE DONE BY ONE OF THE FOLLOWING METHODS (LISTED BY PREFERENCE), DEPENDING UPON THE SIZE OF THE AREA AND EROSION HAZARD:
         i. A MULCHING ANCHORING TOOL IS A TRACTOR DRAWN IMPLEMENT DESIGNED TO PUNCH AND ANCHOR MULCH INTO THE SOIL SURFACE A MINIMUM OF 2 INCHES. THIS PRACTICE IS MOST EFFECTIVE ON LARGE AREAS, BUT IS LIMITED TO FLATTER SLOPES WHERE EQUIPMENT CAN OPERATE SAFELY. IF USED ON SLOPING LAND, THIS PRACTICE SHOULD FOLLOW THE CONTOUR.
         ii. WOOD CELLULOSE FIBER MAY BE USED FOR ANCHORING STRAW. APPLY THE FIBER BINDER AT A NET DRY WEIGHT OF 750 POUNDS PER ACRE. MIX THE WOOD CELLULOSE FIBER WITH WATER AT A MAXIMUM OF 50 POUNDS OF WOOD CELLULOSE FIBER PER 100 GALLONS OF WATER.
         iii. SYNTHETIC BINDERS SUCH AS ACRYLIC DLR (AGRO-TACK), DCA-70, PETROSET, TERRA TAX II, TERRA TACK AR OR OTHER APPROVED EQUAL MAY BE USED. FOLLOW APPLICATION RATES AS SPECIFIED BY THE MANUFACTURER. APPLICATION OF LIQUID BINDERS NEEDS TO BE HEAVIER AT THE EDGES WHERE WIND CATCHES MULCH, SUCH AS IN VALLEYS AND ON CRESTS OF BANKS. USE OF ASPHALT BINDERS IS STRICTLY PROHIBITED.
         iv. LIGHTWEIGHT PLASTIC NETTING MAY BE STAPLED OVER THE MULCH ACCORDING TO MANUFACTURER RECOMMENDATIONS. NETTING IS USUALLY AVAILABLE IN ROLLS 4 TO 15 FEETWIDE AND 300 TO 3,000 FEET LONG.

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PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND
LICENSE NO. 31183
EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE N.T.S.

CONTRACT NO. HT-3012-0000
DRAWING NO. **ES-02**
SHEET NO. 21 OF 26

FILE: G:\2015\151777-003_I-895_TMDL_Stream_Res\CADD\pES-N002.dgn
DATE: Tuesday, March 26, 2019 AT 01:36 PM
01:36 PM

B-4-4 STANDARDS AND SPECIFICATIONS FOR TEMPORARY STABILIZATION

DEFINITION
TO STABILIZE DISTURBED SOILS WITH VEGETATION FOR UP TO 6 MONTHS.

PURPOSE
TO USE FAST GROWING VEGETATION THAT PROVIDES COVER ON DISTURBED SOILS.

CONDITIONS WHERE PRACTICE APPLIES
EXPOSED SOILS WHERE GROUND COVER IS NEEDED FOR A PERIOD OF 6 MONTHS OR LESS. FOR LONGER DURATION OF TIME, PERMANENT STABILIZATION PRACTICES ARE REQUIRED.

CRITERIA
1. SELECT ONE OR MORE OF THE SPECIES OR SEED MIXTURES LISTED IN TABLE B.1 FOR THE APPROPRIATE PLANT HARDINESS ZONE (FROM FIGURE B.3), AND ENTER THEM IN THE TEMPORARY SEEDING SUMMARYBELOW ALONG WITH APPLICATION RATES, SEEDING DATES AND SEEDING DEPTHS. IF THIS SUMMARY IS NOT PUT ON THE PLAN AND COMPLETED, THEN TABLE B.1 PLUS FERTILIZER AND LIME RATES MUST BE PUT ON THE PLAN.

   FOR SITES HAVING SOIL TESTS PERFORMED, USE AND SHOW THE RECOMMENDED RATES BY THE TESTING AGENCY.
2. SOIL TESTS ARE NOT REQUIRED FOR TEMPORARY SEEDING.

   WHEN STABILIZATION IS REQUIRED OUTSIDE OF A SEEDING SEASON, APPLY SEED AND MULCH OR STRAW MULCH
3. ALONE AS PRESCRIBED IN SECTION B-4-3.1.b AND MAINTAIN UNTIL THE NEXT SEEDING SEASON.

TEMPORARY SEEDING SUMMARY

HARDINESS ZONE: 7a SEED MIXTURE: N/A					
SPECIES	APPLICATION RATE (LBS/AC.)	SEEDING DATE	SEEDING DEPTH (IN.)	FERTILIZER RATE (10-20-20)	LIME RATE
ANNUAL RYEGRASS	40	02-15 TO 04-30 08-15 TO 11-30	1.0	436 LB/AC (10 LB/1,000 SF)	2 TON/AC. (90 LB/1,000 SF)
FOXTAIL MILLET	30	05-01 TO 08-14	0.5		
PEARL MILLET	20	05-01 TO 08-14	0.5		

B-4-5 STANDARDS AND SPECIFICATIONS FOR PERMANENT STABILIZATION

DEFINITION
TO STABILIZE DISTURBED SOILS WITH PERMANENT VEGETATION.

PURPOSE
TO USE LONG-LIVED PERENNIAL GRASSES AND LEGUMES TO ESTABLISH PERMANENT GROUND COVER ON DISTURBED SOILS.

CONDITIONS WHERE PRACTICE APPLIES
EXPOSED SOILS WHERE GROUND COVER IS NEEDED FOR 6 MONTHS OR MORE.

CRITERIA
A. SEED MIXTURES
   1. GENERAL USE
      A. SELECT ONE OR MORE OF THE SPECIES OR MIXTURES LISTED IN TABLE B.3 FOR THE APPROPRIATE PLANT HARDINESS ZONE (FROM FIGURE B.3) AND BASED ON THE SITE CONDITION OR PURPOSE FOUND ON TABLE B.2. ENTER SELECTED MIXTURE(S), APPLICATION RATES AND SEEDING DATES IN THE PERMANENT SEEDING SUMMARY. THE SUMMARY IS TO BE PLACED ON THE PLAN.

      B. ADDITIONAL PLANTING SPECIFICATIONS FOR EXCEPTIONAL SITES SUCH AS SHORELINES, STREAM BANKS OR DUNES OR FOR SPECIAL PURPOSES SUCH AS WILDLIFE OR AESTHETIC TREATMENT MAY BE FOUND IN USDA-NRCS TECHNICAL FIELD OFFICE GUIDE, SECTION 342 - CRITICAL AREA PLANTING.

      C. FOR SITES HAVING DISTURBED AREA OVER 5 ACRES, USE AND SHOW THE RATES RECOMMENDED BY THE SOIL TESTING AGENCY.

      D. FOR AREAS RECEIVING LOW MAINTENANCE, APPLY UREA FORM FERTILIZER (46-0-0) AT 3 ½ POUNDS PER 1,000 SQUARE FEET (150 POUNDS PER ACRE) AT THE TIME OF SEEDING IN ADDITION TO THE SOIL AMENDMENTS SHOWN IN THE PERMANENT SEEDING SUMMARY.

   2. TURFGRASS MIXTURES
      A. AREAS WHERE TURFGRASS MAY BE DESIRED INCLUDE LAWNS, PARKS, PLAYGROUNDS AND COMMERCIAL SITES WHICH RECEIVE A MEDIUM TO HIGH LEVEL OF MAINTENANCE.

      B. SELECT ONE OR MORE OF THE SPECIES OR MIXTURES LISTED BELOW BASED ON THE SITE CONDITIONS OR PURPOSE. ENTER SELECTED MIXTURE(S), APPLICATION RATES AND SEEDING DATES IN THE PERMANENT SEEDING SUMMARY. THE SUMMARY IS TO BE PLACED ON THE PLAN.
         i. KENTUCKY BLUEGRASS: FULL SUN MIXTURE: FOR USE IN AREAS THAT RECEIVE INTENSIVE MANAGEMENT. IRRIGATION REQUIRED IN THE AREAS OF CENTRAL MARYLAND AND EASTERN SHORE. RECOMMENDED CERTIFIED KENTUCKY BLUEGRASS CULTIVARS SEEDING RATE: 1.5 TO 2.0 POUNDS PER 1,000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.

         ii. KENTUCKY BLUEGRASS / PERENNIAL RYE: FULL SUN MIXTURE: FOR USE IN FULL SUN AREAS WHERE RAPID ESTABLISHMENT IS NECESSARY AND WHEN TURF WILL RECEIVE MEDIUM TOINTENSIVE MANAGEMENT. CERTIFIED PERENNIAL RYEGRASS CULTIVARS / CERTIFIED KENTUCKY BLUEGRASS SEEDING RATE: 2 POUNDS MIXTURE PER 1,000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.

         iii. TALL FESCUE / KENTUCKY BLUEGRASS: FULL SUN MIXTURE: FOR USE IN DROUGHT PRONE AREAS AND/OR FOR AREAS RECEIVING LOW TO MEDIUM MANAGEMENT IN FULL SUN TO MEDIUM SHADE. RECOMMENDED MIXTURE INCLUDES; CERTIFIED TALL FESCUE CULTIVARS 95 TO 100 PERCENT. SEEDING RATE: 5 TO 8 POUNDS PER 1,000 SQUAREFEET. ONE OR MORE CULTIVARS MAY BE BLENDED.

         iv. KENTUCKY BLUEGRASS / FINE FESCUE: SHADE MIXTURE: FOR USE IN AREAS WITH SHADE IN BLUEGRASS LAWNS FOR ESTABLISHMENT IN HIGH QUALITY, INTENSELY MANAGED TURF AREA. MIXTURE INCLUDES; CERTIFIED KENTUCKY BLUEGRASS CULTIVARS 30 TO 40 PERCENT AND CERTIFIED FINE FESCUE AND 60 TO 70 PERCENT. SEEDING RATE: 1 1#2 TO 3 POUNDS PER 1,000 SQUARE FEET.

NOTES:
SELECT TURFGRASS VARIETIES FROM THOSE LISTED IN THE MOST CURRENT UNIVERSITY OF MARYLAND PUBLICATION, AGRONOMY MEMO #77, "TURFGRASS CULTIVAR RECOMMENDATIONS FOR MARYLAND".

CHOOSE CERTIFIED MATERIAL. CERTIFIED MATERIAL IS THE BEST GUARANTEE OF CULTIVAR PURITY. THE CERTIFICATION PROGRAM OF THE MARYLAND DEPARTMENT OF AGRICULTURE, TURF AND SEED SECTION, PROVIDES A RELIABLE MEANS OF CONSUMER PROTECTION ANDASSURES A PURE GENERIC LINE.

C. IDEAL TIMES OF SEEDING FOR TURF GRASS MIXTURES

WESTERN MARYLAND:	MARCH 15 TO JUNE 1, AUGUST 1 TO OCTOBER 1 (HARDINESS ZONES: 5b, 6a)
CENTRAL MARYLAND:	MARCH 1 TO MAY 15, AUGUST 15 TO OCTOBER 15 (HARDINESS ZONE: 6b)
SOUTHERN MARYLAND, EASTERN SHORE	MARCH 1 TO MAY 15, AUGUST 15 TO OCTOBER 15 (HARDINESS ZONES: 7a, 7b)

D. TILL AREAS TO RECEIVE SEED BY DISKING OR OTHER APPROVED METHODS TO A DEPTH OF 2 TO 4 INCHES, LEVEL AND RAKE THE AREAS TO PREPARE A PROPER SEEDBED. REMOVE STONES AND DEBRIS OVER 1½ INCHES IN DIAMETER. THE RESULTING SEEDBED MUST BE IN SUCH CONDITION THAT FUTURE MOWING OF GRASSES WILL POSE NO DIFFICULTY.

E. IF SOIL MOISTURE IS DEFICIENT, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER FOR PLANT GROWTH (1/2 TO 1 INCH EVERY 3 TO 4 DAYS DEPENDING ON SOIL TEXTURE) UNTIL THEY ARE FIRMLY ESTABLISHED. THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE LATE IN THE PLANTING SEASON, IN ABNORMALLY DRY OR HOT SEASONS OR ON ADVERSE SITES.

PERMANENT SEEDING SUMMARY

HARDINESS ZONE: 7a SEED MIXTURE: 6								
SPECIES	APPLICATION RATE (LBS/AC.)	SEEDING DATE	SEEDING DEPTH (IN.)	FERTILIZER RATE (10-20-20)			LIME RATE
				N	P_2O_5	K_2O	
TALL FESCUE	40	02-15 TO 04-30 08-15 TO 10-31	0.25 TO 0.5	45 LB/AC (1 LB/ 1,000 SF)	90 LB/AC (2 LB/ 1,000 SF)	90 LB/AC (2 LB/ 1,000 SF)	2 TON/AC (90 LB/ 1,000 SF)
PERENNIAL RYEGRASS	25	02-15 TO 04-30 08-15 TO 10-31	0.25 TO 0.5				
BIRDSFOOT TREFOIL	8	02-15 TO 04-30 08-15 TO 10-31	0.25 TO 0.5				

B. SOD: TO PROVIDE QUICK COVER ON DISTURBED AREAS (2:1 GRADE OR FLATTER).
   1. GENERAL SPECIFICATIONS
      A. CLASS OF TURFGRASS SOD MUST BE MARYLAND STATE CERTIFIED. SOD LABELS MUST BE MADE AVAILABLE TO THE JOB FOREMAN AND INSPECTOR.

      B. SOD MUST BE MACHINE CUT AT A UNIFORM SOIL THICKNESS OF ¾ INCH, PLUS OR MINUS ¼ INCH, AT THE TIME OF CUTTING. MEASUREMENT FOR THICKNESS MUST EXCLUDE TOP GROWTH AND THATCH. BROKEN PADS AND TORN OR UNEVEN ENDS WILL NOT BE ACCEPTABLE.

      C. STANDARD SIZE SECTIONS OF SOD MUST BE STRONG ENOUGH TO SUPPORT THEIR OWN WEIGHT AND RETAIN THEIR SIZE AND SHAPE WHEN SUSPENDED VERTICALLY WITH A FIRM GRASP ON THE UPPER 10 PERCENT OF THE SECTION.

      D. SOD MUST NOT BE HARVESTED OR TRANSPLANTED WHEN MOISTURE CONTENT (EXCESSIVELY DRY OR WET) MAY ADVERSELY AFFECT ITS SURVIVAL.

      E. SOD MUST BE HARVESTED, DELIVERED, AND INSTALLED WITHIN A PERIOD OF 36 HOURS. SOD NOT TRANSPLANTED WITHIN THIS PERIOD MUST BE APPROVED BY AN AGRONOMIST OR SOIL SCIENTIST PRIOR TO ITS INSTALLATION.

   2. SOD INSTALLATION
      A. DURING PERIODS OF EXCESSIVELY HIGH TEMPERATURE OR IN AREAS HAVING DRY SUBSOIL, LIGHTLY IRRIGATE THE SUBSOIL IMMEDIATELY PRIOR TO LAYING THE SOD.

      B. LAY THE FIRST ROW OF SOD IN A STRAIGHT LINE WITH SUBSEQUENT ROWS PLACED PARALLEL TO IT AND TIGHTLY WEDGED AGAINST EACH OTHER. STAGGER LATERAL JOINTS TO PROMOTE MORE UNIFORM GROWTH AND STRENGTH. ENSURE THAT SOD IS NOT STRETCHED OR OVERLAPPED AND THAT ALL JOINTS ARE BUTTED TIGHT IN ORDER TO PREVENT VOIDS WHICH WOULD CAUSE AIR DRYING OF THE ROOTS.

      C. WHEREVER POSSIBLE, LAY SOD WITH THE LONG EDGES PARALLEL TO THE CONTOUR AND WITH STAGGERING JOINTS. ROLL AND TAMP, PEG OR OTHERWISE SECURE THE SOD TO PREVENT SLIPPAGE ON SLOPES. ENSURE SOLID CONTACT EXISTS BETWEEN SOD ROOTS AND THE UNDERLYING SOIL SURFACE.

      D. WATER THE SOD IMMEDIATELY FOLLOWING ROLLING AND TAMPING UNTIL THE UNDERSIDE OF THE NEW SOD PAD AND SOIL SURFACE BELOW THE SOD ARE THOROUGHLY WET. COMPLETE THE OPERATIONS OF LAYING, TAMPING, AND IRRIGATING FOR ANY PIECE OF SOD WITH EIGHT HOURS.

   3. SOD MAINTENANCE
      A. IN THE ABSENCE OF ADEQUATE RAINFALL, WATER DAILY DURING THE FIRST WEEK OR AS OFTEN AND SUFFICIENTLY AS NECESSARY TO MAINTAIN MOIST SOIL TO A DEPTH OF 4 INCHES. WATER SOD DURING THE HEAT OF THE DAY TO PREVENT WILTING.

      B. AFTER THE FIRST WEEK, SOD WATERING IS REQUIRED AS NECESSARY TO MAINTAIN ADEQUATE MOISTURE CONTENT.

      C. DO NOT MOW UNTIL THE SOD IS FIRMLY ROOTED. NO MORE THAN ⅓ OF THE GRASS LEAF MUST BE REMOVED BY THE INITIAL CUTTING OR SUBSEQUENT CUTTINGS. MAINTAIN A GRASS HEIGHT OF, AT LEAST, 3 INCHES UNLESS OTHERWISE SPECIFIED.

B-4-8 STANDARDS AND SPECIFICATIONS FOR STOCKPILE AREA

DEFINITION
A MOUND OR PILE OF SOIL PROTECTED BY APPROPRIATELY DESIGNED EROSION AND SEDIMENT CONTROL MEASURES.

PURPOSE
TO PROVIDE A DESIGNATED LOCATION FOR THE TEMPORARY STORAGE OF SOIL THAT CONTROLS THE POTENTIAL FOR EROSION, SEDIMENTATION AND CHANGES TO DRAINAGE PATTERNS.

CONDITIONS WHERE PRACTICE APPLIES
STOCKPILE AREAS ARE UTILIZED WHEN IT IS NECESSARY TO SALVAGE AND STORE SOIL FOR LATER USE.

CRITERIA
1. THE STOCKPILE LOCATION AND ALL RELATED SEDIMENT CONTROL PRACTICES MUST BE CLEARLY INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN.

2. THE FOOTPRINT OF THE STOCKPILE MUST BE SIZED TO ACCOMMODATE THE ANTICIPATED VOLUME OF MATERIAL AND BASED ON A SIDE SLOPE RATIO NO STEEPER THAN 2:1. BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.

3. RUNOFF FROM THE STOCKPILE AREA MUST DRAIN TO A SUITABLE SEDIMENT CONTROL PRACTICE.

4. ACCESS THE STOCKPILE FROM THE UPGRADE SIDE.

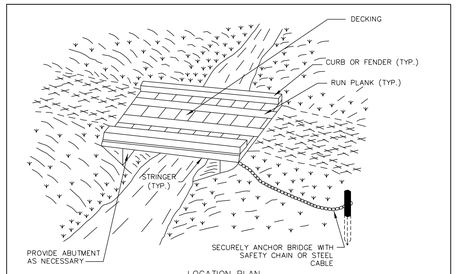
5. CLEAR WATER RUNOFF INTO THE STOCKPILE AREA MUST BE MINIMIZED BY USE OF A DIVERSION DEVICE SUCH AS AN EARTH DIKE, TEMPORARY SWALE OR DIVERSION FENCE. PROVISIONS MUST BE MADE FOR DISCHARGING CONCENTRATED FLOW IN A NON-EROSIVE MANNER.

6. WHERE RUNOFF CONCENTRATES ALONG THE TOE OF THE STOCKPILE FILL, AN APPROPRIATE EROSION/SEDIMENT CONTROL PRACTICE MUST BE USED TO INTERCEPT THE DISCHARGE.

7. STOCKPILES MUST BE STABILIZED IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION REQUIREMENT AS WELL AS STANDARD B-4-1 INCREMENTAL STABILIZATION AND STANDARD B-4-4 TEMPORARY STABILIZATION.

8. IF THE STOCKPILE IS LOCATED ON AN IMPERVIOUS SURFACE, A LINER SHOULD BE PROVIDED BELOW THE STOCKPILE TO FACILITATE CLEANUP. STOCKPILES CONTAINING CONTAMINATED MATERIAL MUST BE COVERED WITH IMPERMEABLE SHEETING.

MAINTENANCE
THE STOCKPILE AREA MUST CONTINUOUSLY MEET THE REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION. SIDE SLOPES MUST BE MAINTAINED AT NO STEEPER THAN A 2:1 RATIO. THE STOCKPILE AREA MUST BE KEPT FREE OF EROSION. IF THE VERTICAL HEIGHT OF A STOCKPILE EXCEEDS 20 FEET FOR 2:1 SLOPES, 30 FEET FOR 3:1 SLOPES OR 40 FEET FOR 4:1 SLOPES, BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.

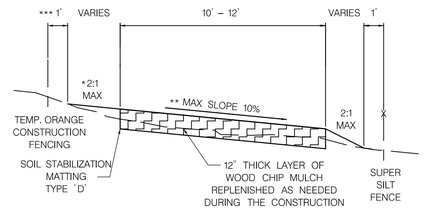


LOCATION PLAN

NOTE:
TIME OF YEAR RESTRICTIONS DO NOT APPLY TO THE CONSTRUCTION OR REMOVAL OF A TEMPORARY ACESS BRIDGE UNLESS THERE IS DISTURBANCE TO THE STREAM CHANNEL.

CONSTRUCTION SPECIFICATIONS
1. CONSTRUCT TEMPORARY BRIDGE STRUCTURE AT OR ABOVE THE BANK ELEVATION TO PREVENT IMPACTS FROM FLOATING MATERIALS AND DEBRIS.
2. PLACE ABUTMENTS PARALLEL TO, AND ON, STABLE BANKS.
3. CONSTRUCT BRIDGE TO SPAN ENTIRE CHANNEL UNLESS OTHERWISE INDICATED ON APPROVED PLAN.
4. USE STRINGERS CONSISTING OF LOGS, SAWN TIMBER, PRESTRESSED CONCRETE BEAMS, METAL BEAMS, OR OTHER APPROVED MATERIALS.
5. SELECT DECKING MATERIALS TO PROVIDE SUFFICIENT STRENGTH TO SUPPORT THE ANTICIPATED LOAD. PLACE ALL DECKING MEMBERS PERPENDICULAR TO THE STRINGERS, BUTT TIGHTLY, AND SECURELY FASTEN. DECKING MATERIALS MUST BE BUTTED TIGHTLY TO PREVENT ANY SOIL MATERIAL TRACKED ONTO THE BRIDGE FROM FALLING INTO THE WATERWAY BELOW.
6. SECURELY FASTEN OPTIONAL RUN PLANKING FOR THE LENGTH OF THE SPAN. PROVIDE A RUN PLANK FOR EACH TRACK OF THE EQUIPMENT WHEELS. ALTHOUGH RUN PLANKS ARE OPTIONAL, THEY MAY BE NECESSARY TO PROPERLY DISTRIBUTE LOADS.
7. INSTALL CURBS THE ENTIRE LENGTH OF THE OUTER SIDES OF THE DECK TO PREVENT SEDIMENT FROM ENTERING THE STREAM CHANNEL.
8. ANCHOR BRIDGE SECURELY AT ONLY ONE END USING STEEL CABLE OR CHAIN. ANCHORING AT ONLY ONE END WILL PREVENT CHANNEL OBSTRUCTION IN THE EVENT THAT FLOODWATERS FLOAT THE BRIDGE. ACCEPTABLE ANCHORS ARE LARGE TREES, LARGE BOULDERS, OR DRIVEN STEEL POSTS. ANCHOR MUST BE SUFFICIENT TO PREVENT THE BRIDGE FROM FLOATING DOWNSTREAM.
9. AREAS DISTURBED DURING BRIDGE INSTALLATION AND\OR REMOVAL MUST NOT BE LEFT UNSTABILIZED OVERNIGHT UNLESS THE RUNOFF IS DIRECTED TO AN APPROVED SEDIMENT CONTROL DEVICE.
10. STABILIZE APPROACH TO BRIDGE AND KEEP FREE OF EROSION. CLEAN SEDIMENT FROM DECKING AND CURBS DAILY BY SCRAPING, SWEEPING, AND/OR VACUUMINGENSURE THAT DECKING AND CURBS REMAIN TIGHTLY BUTTED WITHOUT GAPS. REMOVE DEBRIS TRAPPED BY BRIDGE. MAINTAIN AREAS ADJACENT TO CROSSING TO CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION.
11. AFTER THE TEMPORARY CROSSING IS NO LONGER NEEDED, REMOVE IT WITHIN 14 CALENDAR DAYS. IF SUBJECT TO THE USE DESIGNATION CLOSURE, REMOVE AT THE END OF CLOSURE PERIOD. PROTECT STREAM BANKS DURING BRIDGE REMOVAL AND STABILIZE ALL DISTURBED AREAS WITH EROSION CONTROL MATTING. ACCOMPLISH REMOVAL OF THE BRIDGE AND CLEAN UP OF THE AREA WITHOUT CONSTRUCTION EQUIPMENT WORKING IN THE WATERWAY CHANNEL. STORE ALL REMOVED MATERIALS IN AN APPROVED STAGING AREA.

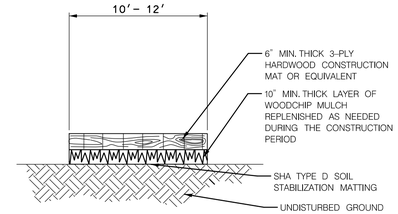
TEMPORARY ACCESS ROAD DETAIL
N.T.S.



TYPICAL SECTION
TEMPORARY ACCESS ROAD
FROM MD 648 TO PROJECT LIMIT
NOT TO SCALE

1. ACCESS ROUTES TO BE VERIFIED BY ENGINEER AND INSPECTOR AT PRE-CONSTRUCTION MEETING. REVISIONS TO THE ALIGNMENT THAT MINIMIZE TREE DISTURBANCE ARE ENCOURAGED AND REQUIRE REVIEW AND APPROVAL BY THE ENGINEER AND SEDIMENT CONTROL INSPECTOR.
2. NATURAL FIBER MATTING MAY BE ALTERED AT DIRECTION OF THE SEDIMENT CONTROL INSPECTOR.
3. CONTRACTOR SHALL MAINTAIN MULCH MATTING THROUGHOUT CONSTRUCTION PERIOD. AFTERCOMPLETION OF THE PROJECT, MULCH CAN REMAIN IN PLACE AT A MAXIMUM DEPTH OF 2".
4. SCARIFICATION OF COMPACTED MULCH TO OCCUR UPON REMOVAL OF HAUL ROAD, AT DIRECTION OF THE ENGINEER.
5. THE HAUL ROAD IS DESIGNED TO PREVENT COMPACTION OF EXISTING SOILS USING LOWPRESSURE EQUIPMENT. IF THE CONTRACTOR INTENDS TO USE ANY EQUIPMENT WITH HIGHER LOADS, ADDITIONAL PROTECTION MEASURES MUST BE PROVIDED, AT NO ADDITIONAL COST, AND THOSE MEASURES MUST BE APPROVED BY THE ENGINEER PRIOR TO IMPLEMENTATION.

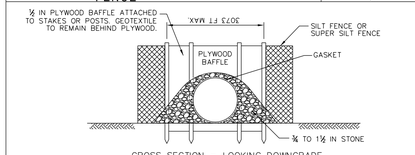
* CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE
** 6% MAX IS DESIRABLE. CONTRACTORS DISCRETION CAN ALLOW 10% MAX DEPENDING ON TYPE OF EQUIPMENT BEING USED.
*** OFFSET CANNOT EXCEED RIGHT OF WAY



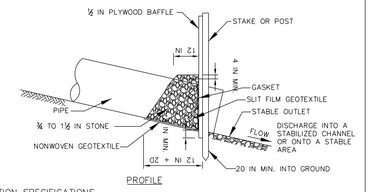
1. HARDWOOD MATS TO BE INSTALLED AS INDICATED ON CONTRACT DOCUMENTS.
2. ACCESS ROUTES TO BE VERIFIED BY THE ENGINEER AT PRE-CONSTRUCTION MEETING. REVISIONS TO THE ALIGNMENT THAT MINIMIZE TREE DISTURBANCE ARE ENCOURAGED AND REQUIRE REVIEW AND APPROVAL BY THE ENGINEER.
3. NATURAL FIBER MATTING SHALL BE PLACED WITH SEAMS PARALLEL TO THE FLOW OF TRAFFIC. OVERLAP FABRIC BY 18" MIN. AT SEAMS.
4. CONTRACTOR SHALL MAINTAIN MULCH MAT THROUGHOUT CONSTRUCTION PERIOD.

HARDWOOD CONSTRUCTION MAT TYPICAL SECTION
NOT TO SCALE

DETAIL E-4 CLEAR WATER PIPE THROUGH SILT FENCE OR SUPER SILT FENCE — STANDARD SYMBOL: CWP



CROSS SECTION – LOOKING DOWNGRADE



PROFILE

CONSTRUCTION SPECIFICATIONS
1. INSTALL SILT FENCE OR SUPER SILT FENCE IN ACCORDANCE WITH DETAIL E-1 OR DETAIL E-2.
2. AT THE PIPE LOCATION, CUT AND PULL BACK THE WOVEN SLIT FILM GEOTEXTILE AND CHAIN LINK FENCING. SECURE GEOTEXTILE TO PIPE WITH GASKET. INSTALL ADDITIONAL STAKES OR POSTS IF NECESSARY TO ACCOMMODATE THE INSTALLATION OF THE BAFFLE BOARD.
3. ENTRENCH ½ INCH PLYWOOD BAFFLE A MINIMUM OF 8 INCHES AND SECURE TO THE UPGRADE SIDE OF THE FENCE STAKES OR POSTS. BAFFLE SHOULD BE AT LEAST THE HEIGHT OF THE FENCE.
4. PLACE ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE BEHIND THE PLYWOOD BAFFLE ON NONWOVEN GEOTEXTILE AND EXTEND 12 INCH MIN. ALONG TOP OF PIPE AND TO A HEIGHT OF 4 INCHES ABOVE THE TOP OF PIPE.
5. USE NONWOVEN AND WOVEN SLIT FILM GEOTEXTILES AS SPECIFIED IN SECTION H-1 MATERIALS.
6. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN SEDIMENT REACHES 6 INCHES IN HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL BAFFLE, CHAIN LINK, AND GEOTEXTILE. REPLACE STONE IF DISPLACED. KEEP POINT OF DISCHARGE FREE OF EROSION.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

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PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND
LICENSE NO. 31183
EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

CONTRACT NO. HT-3012-0000
DRAWING NO. ES-03
SHEET NO. 22 OF 26

DESIGNED BY MRG/PVC | DRAWN BY JMB | CHECKED BY MRG/JSK
CONST. REVIEW BY JSK | DATE MAY, 2019 | SCALE N.T.S.

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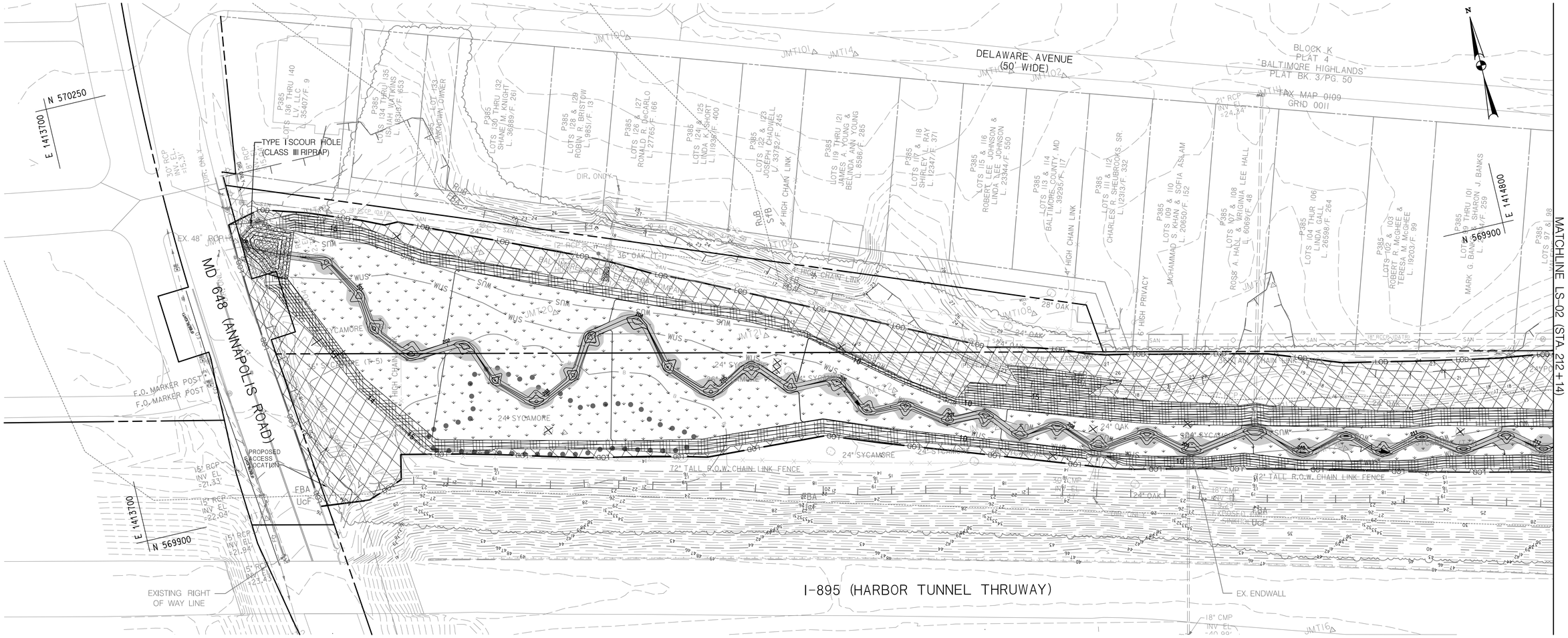

PLAN

LEGEND

- SHA LOWLAND MEADOW ESTABLISHMENT/WETLAND TREE PLANTINGS 4" TOPSOIL
- SHA UPLAND MEADOW ESTABLISHMENT/ UPLAND TREE PLANTINGS 4" TOPSOIL
- SHA UPLAND MEADOW ESTABLISHMENT/ UPLAND TREE PLANTINGS 2" TOPSOIL
- PROPOSED STREAM CHANNEL (NO PLANTING/SEEDING)
- TREE TO BE REMOVED

WETLAND TREE PLANTING SCHEDULE (THIS SHEET)						
QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
73	AS	*Acer saccharinum*	Silver Maple	1" cal.	#7	12' o.c.
73	BN	*Betula nigra*	River Birch	1" cal.	#7	12' o.c.
73	PO	*Platanus occidentalis*	American Sycamore	1" cal.	#7	12' o.c.
74	QP	*Quercus palustris*	Pin Oak	1" cal.	#7	12' o.c.
74	SN	*Salix nigra*	Black Willow*	1" cal.	#7	12' o.c.

*PLACE ON OUTSIDE OF CHANNEL MEANDERS

UPLAND TREE PLANTING SCHEDULE (THIS SHEET)						
QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
146	AR	*Acer rubrum*	Red Maple	1" cal.	#7	12' o.c.
146	AS	*Acer saccharum*	Sugar Maple	1" cal.	#7	12' o.c.
146	CC	*Cercis canadensis*	Eastern Redbud	1" cal.	#7	12' o.c.

MATTING SCHEDULE (THIS SHEET)	
TYPE	SQUARE YARDS (SY)
TYPE 'D' SOIL STABILIZATION MATTING	12,876

SEED MIX SCHEDULE (THIS SHEET)		
SEED MIX	SQUARE YARDS (SY)	SQUARE FEET (FT)
LOWLAND MEADOW ESTABLISHMENT	5,868	52,812
UPLAND MEADOW ESTABLISHMENT	7,008	63,075

NOTES:

SEE SHEET LS-03 FOR THE LANDSCAPING NOTES AND DETAILS.

40' 0 40' 80'
SCALE: 1" = 40'

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MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
LANDSCAPE PLAN

CONTRACT NO. HT-3012-0000

DRAWING NO. **LS-01**

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	SHEET NO. 23 OF 26
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"=40'	

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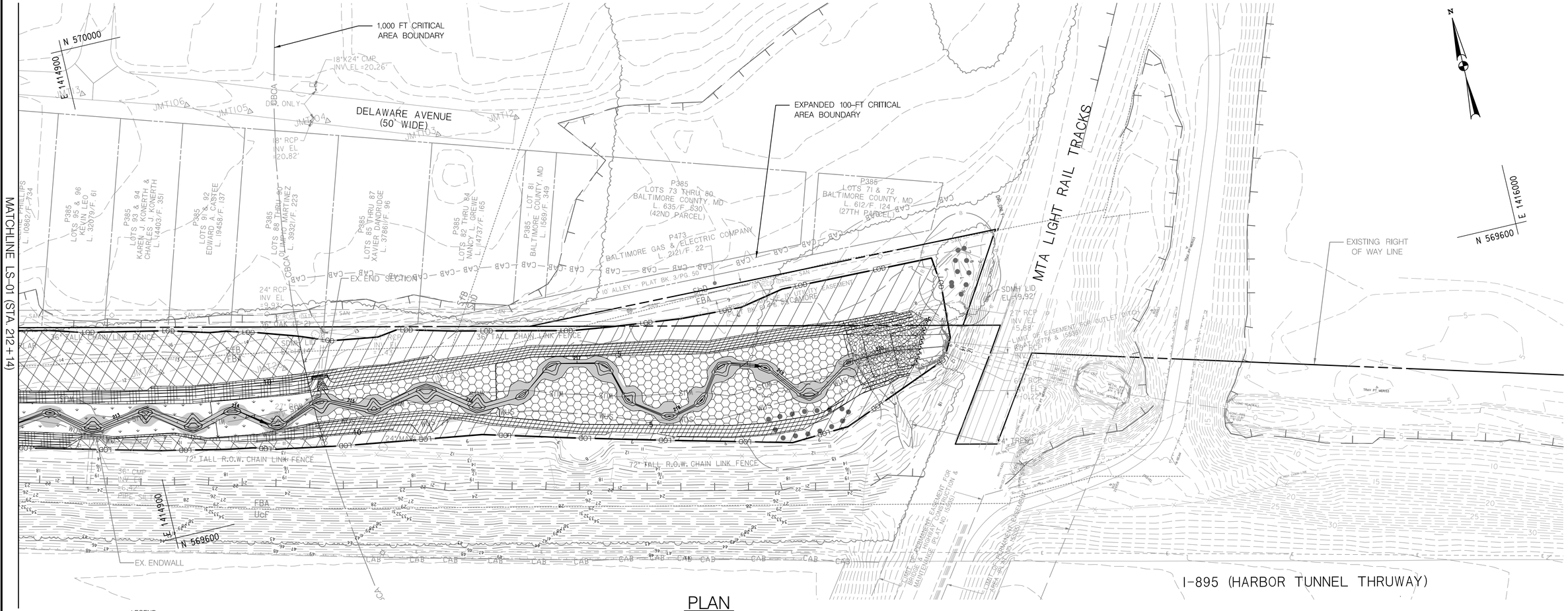

PLAN

LEGEND

- SHA LOWLAND MEADOW ESTABLISHMENT/WETLAND TREE PLANTINGS WITH 4" TOPSOIL
- SHA UPLAND MEADOW ESTABLISHMENT/ UPLAND TREE PLANTINGS WITH 4" TOPSOIL
- CRITICAL AREA SHA LOWLAND MEADOW ESTABLISHMENT/WETLAND TREE AND SHRUB CLUSTER PLANTINGS WITH 4" TOPSOIL
- CRITICAL AREA SHA UPLAND MEADOW ESTABLISHMENT/UPLAND TREE AND SHRUB CLUSTER PLANTINGS WITH 4" TOPSOIL
- CRITICAL AREA SHA UPLAND MEADOW ESTABLISHMENT/UPLAND TREE AND SHRUB CLUSTER PLANTINGS WITH 2" TOPSOIL
- SHA UPLAND MEADOW ESTABLISHMENT/ UPLAND TREE PLANTINGS WITH 2" TOPSOIL
- PROPOSED STREAM CHANNEL (NO PLANTING/SEEDING)
- TREE TO BE REMOVED

WETLAND TREE PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
6	AS	*Acer saccharinum*	Silver Maple	1" cal.	#7	12' o.c.
6	BN	*Betula nigra*	River Birch	1" cal.	#7	12' o.c.
6	PO	*Platanus occidentalis*	American Sycamore	1" cal.	#7	12' o.c.
6	QP	*Quercus palustris*	Pin Oak	1" cal.	#7	12' o.c.
7	SN	*Salix nigra*	Black Willow*	1" cal.	#7	12' o.c.

*PLACE ON OUTSIDE OF CHANNEL MEANDERS

UPLAND TREE PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
36	AR	*Acer rubrum*	Red Maple	1" cal.	#7	12' o.c.
37	AS	*Acer saccharum*	Sugar Maple	1" cal.	#7	12' o.c.
36	CC	*Cercis canadensis*	Eastern Redbud	1" cal.	#7	12' o.c.

CRITICAL AREA UPLAND SMALL SHRUB PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING/REMARKS*
348	VIDE	*Viburnum dentatum*	Southern Arrowwood	1.5	#1	3'-5' o.c.
348	ARME6	*Aronia melanocarpa*	Black Chokeberry	1.5	#1	3'-5' o.c.
348	VIPR	*Viburnum prunifolium*	Blackhaw	1.5	#1	3'-5' o.c.

*SEE NOTE 2 ON THIS SHEET.

CRITICAL AREA WETLAND TREE PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
20	AS	*Acer saccharinum*	Silver Maple	1" cal.	#7	12' o.c.
20	BN	*Betula nigra*	River Birch	1" cal.	#7	12' o.c.
20	PO	*Platanus occidentalis*	American Sycamore	1" cal.	#7	12' o.c.
20	QP	*Quercus palustris*	Pin Oak	1" cal.	#7	12' o.c.
21	SN	*Salix nigra*	Black Willow*	1" cal.	#7	12' o.c.

*PLACE ON OUTSIDE OF CHANNEL MEANDERS

CRITICAL AREA UPLAND TREE PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
58	AR	*Acer rubrum*	Red Maple	1" cal.	#7	12' o.c.
58	AS	*Acer saccharum*	Sugar Maple	1" cal.	#7	12' o.c.
58	CC	*Cercis canadensis*	Eastern Redbud	1" cal.	#7	12' o.c.

CRITICAL AREA WETLAND SMALL SHRUB PLANTING SCHEDULE (THIS SHEET)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING/REMARKS*
202	LIBE3	*Lindera benzoin*	Northern Spicebush	1.5	#1	3'-5' o.c.
202	VACO	*Vaccinium corymbosum*	Highbush Blueberry	1.5	#1	3'-5' o.c.
202	ILVE	*Ilex verticillata*	Common Winterberry	1.5	#1	3'-5' o.c.

*SEE NOTE 2 ON THIS SHEET.

SEED MIX SCHEDULE (THIS SHEET)

SEED MIX	SQUARE YARDS (SY)	SQUARE FEET (FT)
SHA LOWLAND MEADOW ESTABLISHMENT	504	4,531
SHA UPLAND MEADOW ESTABLISHMENT	1,757	15,806

CRITICAL AREA SEED MIX SCHEDULE (THIS SHEET)

SEED MIX	SQUARE YARDS (SY)	SQUARE FEET (FT)
LOWLAND AND UPLAND SEED MIX	4,403	39,625

MATTING SCHEDULE (THIS SHEET)

TYPE	SQUARE YARDS (SY)
TYPE 'D' SOIL STABILIZATION MATTING	6,669

NOTES:

1. SEE SHEET LS-03 FOR THE LANDSCAPING NOTES AND DETAILS.
2. CRITICAL AREA SHRUBS TO BE PLANTED IN CLUSTERS OF 6 AROUND CRITICAL AREA TREES. (SEE LS-03 FOR CLUSTER PLANTING DETAIL)

40' 0 40' 80'
SCALE: 1" = 40'

MATCHLINE LS-01 (STA. 212+14)

FILE: G:\2015\15177_003_I-895_TMDL_Stream_Res\CADD\pLS-002_I895 STREAM RESTORATION.dgn
DATE: Tuesday, February 05, 2019 AT 02:29 PM 02:29 PM

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LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS

NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
LANDSCAPE PLAN

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK	
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE 1"=40'	

CONTRACT NO. HT-3012-0000
DRAWING NO. **LS-02**
SHEET NO. 24 OF 26

MASTER PLANTING SCHEDULE

WETLAND TREE PLANTING SCHEDULE (TOTAL*)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
99	AS	*Acer saccharinum*	Silver Maple	1" cal.	#7	12' o.c.
99	BN	*Betula nigra*	River Birch	1" cal.	#7	12' o.c.
99	PO	*Platanus occidentalis*	American Sycamore	1" cal.	#7	12' o.c.
100	QP	*Quercus palustris*	Pin Oak	1" cal.	#7	12' o.c.
102	SN	*Salix nigra*	Black Willow*	1" cal.	#7	12' o.c.

*CRITICAL AREA WETLAND TREES INCLUDED TOTAL.
**PLACE ON OUTSIDE OF CHANNEL MEANDERS.

UPLAND TREE PLANTING SCHEDULE (TOTAL*)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING/REMARKS
240	AR	*Acer rubrum*	Red Maple	1" cal.	#7	12' o.c.
241	AS	*Acer saccharum*	Sugar Maple	1" cal.	#7	12' o.c.
240	CC	*Cercis canadensis*	Eastern Redbud	1" cal.	#7	12' o.c.

*CRITICAL AREA UPLAND TREES INCLUDED IN TOTAL.

MEADOW ESTABLISHMENT SCHEDULE (TOTAL)

SEED MIX	SQUARE YARDS (SY)	SQUARE FEET (FT)
SHA LOWLAND MEADOW ESTABLISHMENT	6,372	57,343
SHA UPLAND MEADOW ESTABLISHMENT	8,765	78,881
CRITICAL AREA LOWLAND AND UPLAND MEADOW ESTABLISHMENT	4,403	39,625

MATTING SCHEDULE (TOTAL)

TYPE	SQUARE YARDS (SY)
TYPE 'D' SOIL STABILIZATION MATTING	19,545

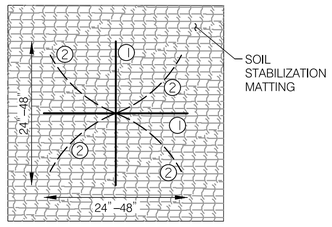
CRITICAL AREA UPLAND SMALL SHRUB PLANTING SCHEDULE (TOTAL)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING/REMARKS
348	VIDE	*Viburnum dentatum*	Southern Arrowwood	1.5	#1	3'-5' o.c.
348	ARME6	*Aronia melanocarpa*	Black Chokeberry	1.5	#1	3'-5' o.c.
348	VIPR	*Viburnum prunifolium*	Blackhaw	1.5	#1	3'-5' o.c.

CRITICAL AREA WETLAND SMALL SHRUB PLANTING SCHEDULE (TOTAL)

QUANTITY	KEY	BOTANICAL NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING/REMARKS
202	LIBE3	*Lindera benzoin*	Northern Spicebush	1.5	#1	3'-5' o.c.
202	VACO	*Vaccinium corymbosum*	Highbush Blueberry	1.5	#1	3'-5' o.c.
202	ILVE	*Ilex verticillata*	Common Winterberry	1.5	#1	3'-5' o.c.

TREE & SHRUB INSTALLATION THROUGH SOIL STABILIZATION MATTING



1. MAKE CUT WITH SHARP KNIFE THROUGH SOIL STABILIZATION MATTING – SEE SOLID LINE IN DIAGRAM. NOTE THAT ALL CUTS IN THE MATTING SHALL BE A MINIMUM OF 2 FEET CLEAR OF ALL MATTING SEAMS, OVERLAPS AND EDGES.
2. TEMPORARILY PIN BACK MATTING WITH 4 STAPLES TO INSTALL TREE OR SHRUB – SEE DASHED LINE IN DIAGRAM.
3. INSTALL PLANT THROUGH PINNED BACK MATTING. INSTALL PLANT AT PROPER GRADE TO GROUND PLANE.
4. REMOVE 4 STAPLES PLACED IN STEP 2 ABOVE THAT WERE USED TO TEMPORARILY PIN BACK THE MATTING DURING ROOT BALL INSTALLATION.
5. PLACE 4 STAPLES IN EACH OF FOUR CUT SECTIONS TO WELL ANCHOR SOIL STABILIZATION MATTING BACK OVER TOP OF THE ROOT BALL.
6. FOR TREE INSTALLATIONS, INSTALL TREE STAKES THROUGH MATTING, ONCE RE-ANCHORED OVER ROOT BALL.

LOWLAND SEED MIX

SEED MIX	PERCENT (%) BY WEIGHT
Panicum clandestinum /Deertongue	20.6
Elymus riparius /Riverbank Wildrye, PA Ecotype	20.0
Andropogon gerardii/Big Bluestem	10.0
Carex lurida /Lurid (Shallow) Sedge, PA Ecotype	10.0
Carex vulpinoidea /Fox Sedge	10.0
Carex scoparia /Blunt Broom Sedge, PA Ecotype	8.0
Panicum virgatum /Switchgrass	8.0
Verbena hastata /Blue Vervain, PA Ecotype	4.0
Juncus effusus /Soft Rush	3.0
Asclepias incarnata /Swamp Milkweed, PA Ecotype	1.0
Aster novae-angliae /New England Aster, PA Ecotype	1.0
Desmodium paniculatum /Panicledleaf Ticktrefoil, PA Ecotype	1.0
Eupatorium fistulosum /Joe Pye Weed, PA Ecotype	1.0
Eupatorium perfoliatum /Boneset, PA Ecotype	0.7
Helenium autumnale /Common Sneezeweed, PA Ecotype	0.5
Monarda fistulosa /Wild Bergamot, PA Ecotype	0.5
Vernonia noveboracensis /New York Ironweed, PA Ecotype	0.5
Mimulus ringens /Square Stemmed Monkeyflower, PA Ecotype	0.2

*APPLIED AT 20 LBS/ACRE

UPLAND SEED MIX

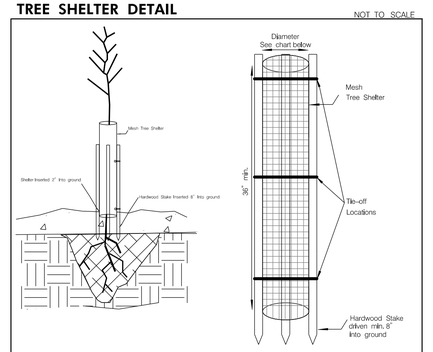
SEED MIX	PERCENT (%) BY WEIGHT
Sorghastrum nutans /Indiangrass, PA Ecotype	53.0
Elymus virginicus /Virginia Wildrye, PA Ecotype	15.0
Tridens flavus /Purpletop, VA Ecotype	8.0
Andropogon gerardii/Big Bluestem	5.0
Chamaecrista fasciculata /Partridge Pea, PA Ecotype	5.0
Rudbeckia hirta /Blackeyed Susan, NC Ecotype	3.0
Lespedeza virginica /Slender Lespedeza, VA Ecotype	2.0
Asclepias syriaca /Common Milkweed, PA Ecotype	1.0
Aster novae-angliae /New England Aster, PA Ecotype	1.0
Aster sagittifolius /Arrowleaf (Sagittate) Aster, PA Ecotype	1.0
Heliopsis helianthoides /Oxeye Sunflower, PA Ecotype	1.0
Penstemon digitalis /Tall White Beardtongue, PA Ecotype	1.0
Penstemon hirsutus /Hairy Beardtongue	1.0
Senna hebecarpa /Wild Senna, VA & WV Ecotype	1.0
Solidago juncea /Early Goldenrod, VA Ecotype	1.0
Monarda fistulosa /Wild Bergamot, PA Ecotype	0.8
Pycnanthemum tenuifolium /Narrowleaf Mountainmint	0.3

*APPLIED AT 20 LBS/ACRE

For Critical Area Commission Information Only		
Critical Area Mitigation Cluster Planting and Seeding		
Proposed Restoration	**Credit Ratio**	**Proposed Credits**
275 clusters (1" Caliper trees with 6 small shrubs per tree)	1 cluster = 3 credits	825
39,625 SF of seeding (lowland and upland seed mix)	500 SF of seed mix = 1 credit	79
Total Proposed Credits		**904**
Total Critical Area Expanded Buffer Mitigation Credits Required = **797 Credits**		
39,856 SF (ground disturbance) + 39,856 SF (vegetative clearing) = 79,712 SF		
79,712 SF/ 100= **797**		

TREE SHELTER DETAIL

NOT TO SCALE

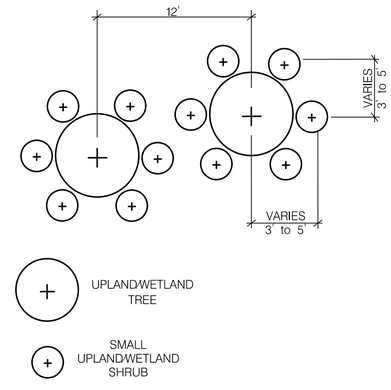


NOTES:
1. Tree shelter shall be A.M. Leonard Tree Bark protector or approved equal.
2. Tree shelter must have longer hardwood stakes for insertion into ground to provide support.

INSTALLATION SEQUENCE:
1. Plant tree according to standard specifications.
2. Place shelter around the tree.
3. Drive longer stakes into the ground.
4. Tie off rope around the tree.

CRITICAL AREA CLUSTER PLANTING LAYOUT DETAIL

NOT TO SCALE



LANDSCAPE PLANTING NOTES:
1. ALL TREES SHALL BE PLANTED WITH RANDOM SPECIES AND RANDOM SPACING 12'-0" ON CENTER.
2. SMALL SHRUBS SHALL BE PLANTED AROUND TREES AND SHALL BE PLANTED WITH RANDOM SPACING RANGING FROM 3'-0" TO 5'-0" ON CENTER FROM TREES AND OTHER SMALL SHRUBS.
3. ALL TREES AND SHRUBS SHALL BE PLANTED IN GROUPS OF 7 PLANTS (1 TREE AND 6 SMALL SHRUBS).
4. DO NOT PLANT IN STRAIGHT ROWS OR GRIDS.

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EXPIRATION DATE: 1/13/2021

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

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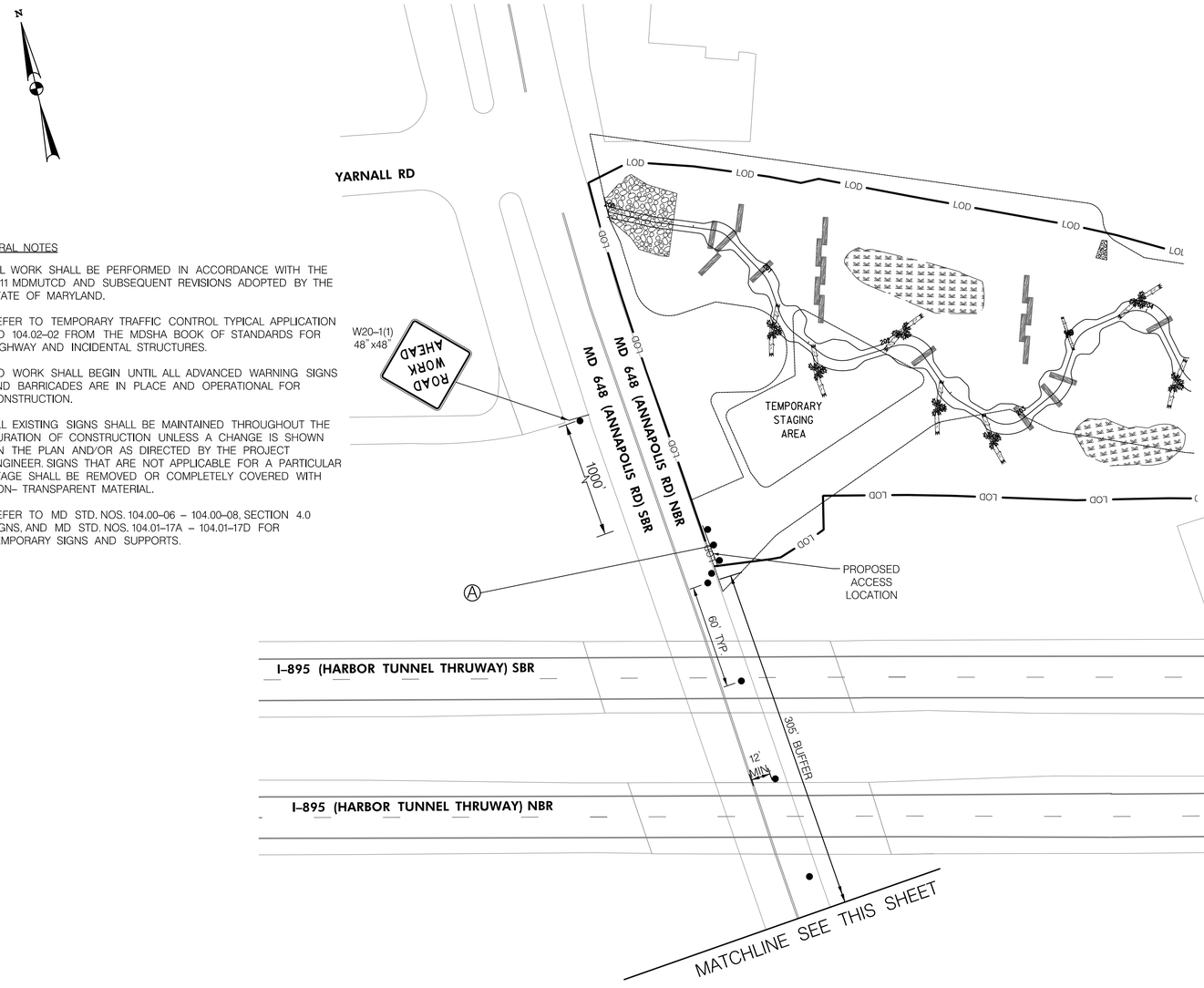
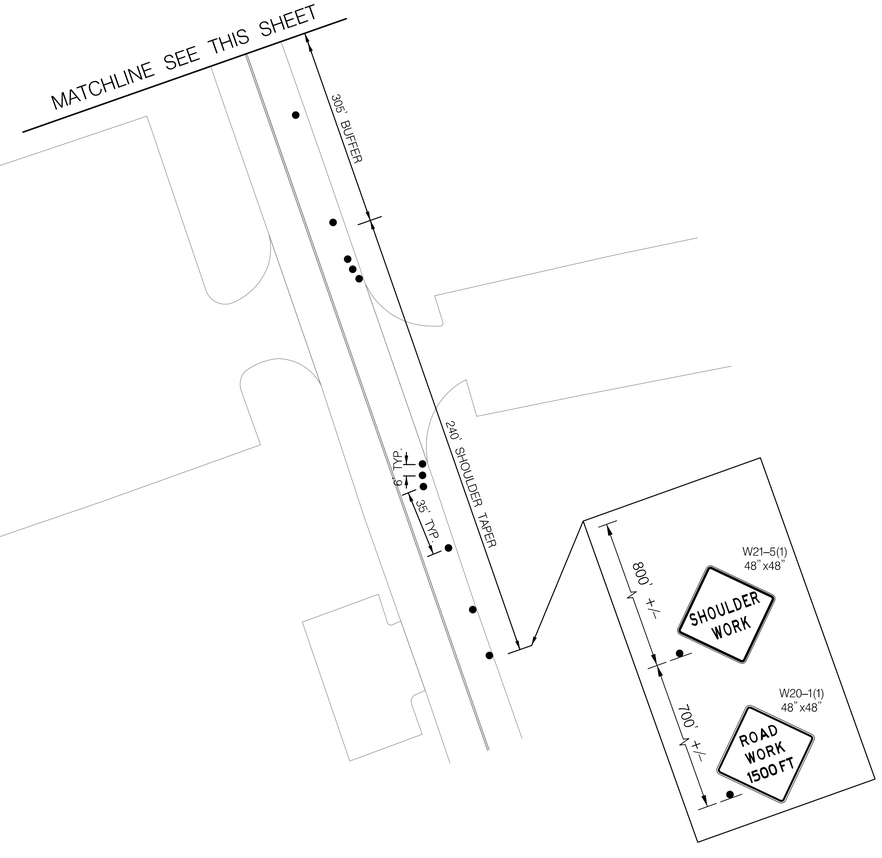
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
LANDSCAPING NOTES AND DETAILS

DESIGNED BY MRG/PVC	DRAWN BY JMB	CHECKED BY MRG/JSK
CONST. REVIEW BY JSK	DATE MAY, 2019	SCALE N.T.S.

CONTRACT NO. HT-3012-0000
DRAWING NO. **LS-03**
SHEET NO. 25 OF 26

FILE: G:\2015\15I777_003_I-895_TMDL_Stream_Res\CADD\pLS-003_I895 STREAM RESTORATION.dgn
DATE: Tuesday, December 18, 2018 AT 02:27 PM 02:27 PM





Ⓐ

R5–1 (36" x 36") PLACED ON A TYPE III BARRICADE. STRIPES TO SLOPE DOWNWARD TOWARD THE CENTER OF THE BARRICADE. PLACE ACROSS TEMPORARY ACCESS LOCATION DURING NON–WORK HOURS.

GENERAL NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE 2011 MDMUTCD AND SUBSEQUENT REVISIONS ADOPTED BY THE STATE OF MARYLAND.
2. REFER TO TEMPORARY TRAFFIC CONTROL TYPICAL APPLICATION MD 104.02–02 FROM THE MDSHA BOOK OF STANDARDS FOR HIGHWAY AND INCIDENTAL STRUCTURES.
3. NO WORK SHALL BEGIN UNTIL ALL ADVANCED WARNING SIGNS AND BARRICADES ARE IN PLACE AND OPERATIONAL FOR CONSTRUCTION.
4. ALL EXISTING SIGNS SHALL BE MAINTAINED THROUGHOUT THE DURATION OF CONSTRUCTION UNLESS A CHANGE IS SHOWN ON THE PLAN AND/OR AS DIRECTED BY THE PROJECT ENGINEER. SIGNS THAT ARE NOT APPLICABLE FOR A PARTICULAR STAGE SHALL BE REMOVED OR COMPLETELY COVERED WITH NON– TRANSPARENT MATERIAL.
5. REFER TO MD STD. NOS. 104.00–06 – 104.00–08, SECTION 4.0 SIGNS, AND MD STD. NOS. 104.01–17A – 104.01–17D FOR TEMPORARY SIGNS AND SUPPORTS.

LEGEND

SIGN POST –

TYPE III BARRICADE –

PROPOSED SIGN – ROAD WORK 1500 FT

DRUM –

40' 0 40' 80'
SCALE: 1" = 40'

jmt.com

PROFESSIONAL CERTIFICATION

I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND

LICENSE NO. 31183

EXPIRATION DATE: 1/13/2021

STATE OF MARYLAND · JEREMY SCOTT KOSER · No. 31183 · PROFESSIONAL ENGINEER

MARYLAND TRANSPORTATION AUTHORITY
Engineering Division

ADDENDUMS & REVISIONS			
NO.	DESCRIPTION	BY	DATE

MARYLAND TRANSPORTATION AUTHORITY
ENGINEERING DIVISION
I-895 MILE MARKER 5.2 UNNAMED PATAPSCO RIVER TRIBUTARY
STREAM RESTORATION PROJECT
MAINTENANCE OF TRAFFIC PLAN

DESIGNED BY AEZ	DRAWN BY AEZ	CHECKED BY GAB	
CONST. REVIEW BY	DATE MAY, 2019	SCALE 1"=40'	

CONTRACT NO. HT-3012-0000

DRAWING NO. **MT–01**

SHEET NO. 26 OF 26

FILE: Q:\2015\151777_003_I-895_TMDL_Stream_Re\CADD\pMT-001_I895 STREAM RESTORATION.dgn
DATE: Friday, December 14, 2018 AT 02:15 PM 02:15 PM

Appendix K

Maintenance Plan (Added 6/2/2021)

Maintenance Plan

MDTA will be the responsible party for the maintenance of the site in perpetuity. The site is designed to be self- sustaining after the monitoring period is over and performance standards have been met. Until then, MDTA anticipates the need to control invasive species within created wetlands, control deer browse, and repair stream restoration structures/features as needed. Invasive species will be monitored and treated as necessary within created wetlands, up to twice per year. Deer browse of riparian plantings will be monitored during stream and wetland monitoring events. Locations of specific stream restoration structures/features will be visited after major storm events to determine if the restoration structures/features are performing according to the design and performance standards. Any anomalies in either vegetation or stream stability within restoration areas will be brought to the attention of both USACE and MDE to determine if remedial measures are warranted. In the event remedial measures are implemented at the mitigation site, the monitoring period may be extended. The extension will be determined on a case-by-case basis.

Appendix L

Performance Standards (Revised 12/17/2021)

EXHIBIT C
COMPENSATORY MITIGATION PERFORMANCE STANDARDS FOR HT-3012 STREAM MITIGATION SITE

Stream Restoration:

The following language outlines the performance standards and reporting requirements as stated in the MDE and USACE authorizations. MDTA proposes that, for all performance standard criteria, Year 1 begins the year the mitigation construction and planting is complete, unless this occurs after April 15, in which case Year 1 will not begin until the following year. As-built surveys would also be considered part of Year 1 provided construction and planting is complete before April 15.

MDE HT-3012 Letter of Authorization (March 29, 2019):

Stream Monitoring: The Authorized Person shall monitor 2,020 linear feet of restored perennial stream to ensure it is meeting Project Standards. Authorized Person shall monitor the stream restoration project for three (3) out of five (5) years on years one, three, and five following the completion of construction of the project. The monitoring shall identify and evaluate changes in 1) channel cross-section, pattern and profile; 2) bed materials; 3) channel stability; 4) structure stability and condition; and 5) vegetation viability. The monitoring effort may include topographic surveys of monumented cross-sections within the realigned channel segment, visual field observations, photographic documentation, vegetation viability measurements, and identify any necessary corrective measures. Authorized Person shall submit annual reports on the results of the monitoring efforts for the stream restoration project to the Department by the end of each year. The Authorized Person shall coordinate with the regulatory agencies concerning applicable remedial measures for any identified project failures and shall correct any project failures within one year of their identification. If the project is determined to be stable at the end of year 3, the Authorized Person may request an exemption from the year 5 stream monitoring requirement.

Wetland Monitoring: The Authorized Person shall monitor 8,890 square feet of onsite forested nontidal wetland creation to replace the temporary loss of 8,890 square feet of forested nontidal wetland to ensure it is meeting Project Standards. The Authorized Person will also monitor 381 square feet of onsite forested nontidal wetland creation to replace the temporary loss of 381 square feet of emergent nontidal wetland to be replaced under Authorization l6-NT-0012/201660035. Onsite replacement wetlands shall be monitored for two (2) out of five (5) years on years three and five following completion of construction to ensure they are functioning as wetlands and meeting Project Standards. All of the following Project Standards will be used to determine project success: 1) evidence of wetland hydrology, as described in the regional supplement to the Corps of Engineers Wetland Delineation Manual; 2) a minimum of 85% native (indicator status of FAC or wetter) species; and 3) native woody species (FAC or wetter) must be dominant in scrub-shrub or forested wetlands. If the project does not meet these Project Standards, the Authorized Person shall remediate the site or otherwise complete their restoration requirement to the satisfaction of the Administration. If it is determined that remediation will not result in the site meeting the Project Standards, the Authorized Person may be required to mitigate for the wetland impacts resulting from the stream restoration project. The Authorized Person shall submit annual monitoring reports no later than December 31 of each calendar year to: Maryland Department of the Environment, 1800 Washington Boulevard, Suite 430, Baltimore, Maryland 21230, Attn: Emily Dolbin.

Advanced Mitigation: The mitigation site will create an additional 1.53 acres (66,572 square feet) of forested wetland as part of the site design. These additional created wetlands are proposed to be advanced compensatory mitigation for several proposed MDTA projects. A separate approval from the Administration is required before the additional created wetlands can be used to satisfy mitigation for another authorization. Authorization of the I-895 MM 5.2 Unnamed Patapsco River Tributary Stream Restoration Project (including the proposed advance mitigation component) does not influence or pre-determine the outcome of any future MDTA permit evaluations. Any wetland creation areas that receive in-stream and riparian nutrient processing (Protocol 2) TMDL credit (5-foot buffer around stream) or floodplain reconnection (Protocol 3) TMDL credit are not eligible to use as wetland replacement or for future wetland mitigation credit.

USACE TMDL RGP Authorization (January 29, 2019):

5-Year Project Monitoring: For those projects requiring a PCN and application submittal to the Corps in accordance with this Bay TMDL RGP (i.e., Category III activities), the permittee must monitor the project for a minimum of five years (five full growing seasons) after construction to ensure the integrity of the work and successful growth of planted vegetation. In addition, the permittee must demonstrate functional lift is occurring compared to baseline values for restoration and enhancement projects. The monitoring reports shall be submitted to the Baltimore District Regulatory Branch by December 31 of each monitoring year. A monitoring report must include monitoring documentation for a minimum of one full growing season. At a minimum, the monitoring protocols shall include:

a) Baseline conditions
b) As-built plans
c) Routine inspections
d) Quantifiable measurements of appropriate project-specific parameters based on project goals and design objectives to assess the aquatic resource functional lift as compared to the baseline values (restoration and enhancement activities)
e) Stream and project stability monitoring
f) Invasive plant species cover
g) Photo documentation

Monitoring of stream restoration or enhancement projects must include a comparison of pre- and post-restoration and enhancement conditions to assess the project's success in meeting the goals and objectives to restore functions that support and/or enhance aquatic biological resources and sediment and nutrient reduction at the project site in accordance with the Chesapeake Bay TMDL goals. Function-based parameters, such as BIBI, modified EPA RBP habitat assessment, lateral stability, floodplain connectivity, and riparian vegetation, that were used to quantify and describe the pre-restoration condition of the stream and used to identify the restoration potential must be measured and assessed to quantify the aquatic resource functional lift. In the event there are unforeseen changes in site conditions or other factors that affect the integrity of the project and/or project performance, the permittee shall develop necessary contingency/adaptive management plans and coordinate these with the Corps and any other appropriate regulatory agencies (e.g., Maryland Department of the Environment, District Department of the Environment, etc.) for written approval prior to implementation. Approved maintenance and remedial measures necessary for any project authorized under this Bay TMDL RGP must be conducted in accordance with the terms and conditions of the authorization. Maintenance that requires deviations from the original design may require a separate authorization. The prospective permittee shall provide revised as-built drawings to the Corps within 60 days of completion of the approved modifications. Additional monitoring and maintenance requirements may be required based on a project-specific evaluation.

Proposed Monitoring and Reporting to Meet MDE and USACE Requirements.

All construction and planting activities were completed prior to April 15, 2021 and therefore the As-built survey and certification and Year 1 monitoring will occur in 2021, with Year 2 monitoring and reporting of all previous monitoring to be completed by December 31, 2022 and so forth. Please note that a report will not be provided for Year 2; habitat assessment results for Year 2 will be provided in the Year 3 report. Baseline data from the design and assessment shall meet the requirements for preconstruction monitoring. To meet the requirements as stated by both MDE and USACE, MDTA has drafted the below Table 1 to summarize monitoring approach.

Table 1. MDTA Success Criteria for Stream Restoration

Parameter	Measurement	Success Criteria	Monitoring Year					
			AB/1	2	3	5	7	10
Flow	Visual Characterization (Perennial, Intermittent, or Ephemeral)	Meets or exceeds baseline	X		X	X	X	X
Floodplain Connectivity	Bank height ratio	<1.2	X		X	X	X	X
	Documented or modeled at discretion of consultant	Demonstrate substantial increase in floodplain connection following construction			X			
Vertical Stability	Photos of all grade control structures, survey of 3 Cross Sections and Long. Profile*	<0.5 ft thalweg degradation from as-built.	X		X	X	X	X
Lateral Stability	BEHI	Moderate or better after construction	X		X	X	X	X
Bed Materials	Pebble Count	Same or less fines (particles less than 6 mm in size) compared to baseline	X		X	X	X	X
Habitat Assessment	RBP- High gradient (or Corps-approved alternative metric)	Exceeds baseline	X	X**	X	X	X	X
Vegetative Richness & Cover	Species and % cover	>80% cover in LOD	X		X	X	X	X
Invasive Plant Reduction	% cover invasive species in LOD	Less than baseline	X		X	X	X	X

*There will be inherent discrepancies with the longitudinal profile due to the difficulty in reproducing survey from one year to the next (i.e. the channel length due to tape layout, or elevations due to rod placement may be slightly different from year to year).

**Year 2 Habitat Assessment results will be provided in the Year 3 report. No report will be submitted for review in Year 2.