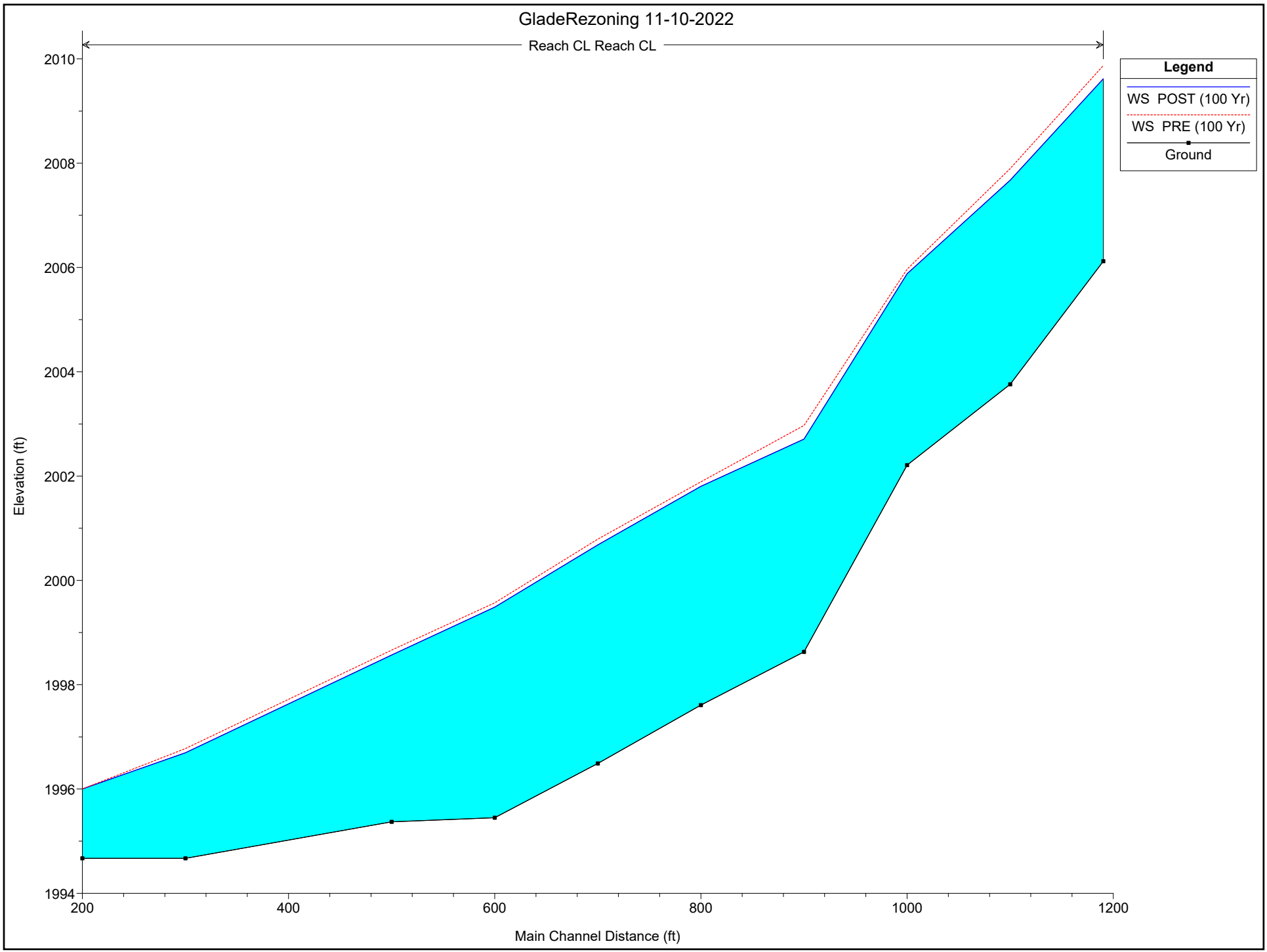
SECTION E:
HEC-RAS Results

Date: 11-10-2022

100-YEAR FLOW RATES FOR ANALYSIS

Cross Section	Stream Station	Pre Developed FLOW	Pre-Dev ADDED FLOW	Pre-Dev Notes	Post Developed FLOW	Post Dev ADDED FLOW	Post-Dev Notes
Unnamed Toms Creek Tributary/Glade Spring Crossing Stream B Reach							
SL-1	2+00.00	335.07			296.70		
SL-2	3+00.00	335.07	3.77	Village Ph1 Pond 1 Out (Floodplain Hydrograph No. 25)	296.70	3.77	Village Ph1 Pond 1 Out (Floodplain Hydrograph No. 25)
SL-3	5+00.00	331.30			292.93		
SL-4	6+00.00	331.30	20.62	DA 3 Pre (Floodplain Hydrograph No. 62)	292.93	18.05	DA 3 POST (Floodplain Hydrograph No. 67)
SL-5	7+00.00	310.68			274.88		
SL-6	8+00.00	310.68	14.13	DA 2 Pre (Floodplain Hydrograph No. 61)	274.88	70.72	DA 2 POST (Floodplain Hydrograph No. 66)
SL-7	9+00.00	296.55			204.16		
SL-8	10+00.00	296.55			204.16		
SL-9	11+00.00	296.55	28.51	DA 1 PRE (Floodplain Hydrograph No. 60)	204.16	12.74	DA 1 POST (Floodplain Hydrograph No. 65)
SL-10	11+90.35	268.04		PRE COMBINED AT CONFLUENCE (Floodplain Hydrograph No. 30)	191.42		POST ROUTED POND TOTALS + DA 0 POST (Floodplain Hydrograph Nos. 56 & 64)

Date: 11-10-2022							
HEC RAS files:		**Glade Spring Crossing 100 Year Elevations**					
		Pre Developed FLOW	Pre-Developed WSE	Post Developed FLOW	Post-Developed WSE	100-YR ELEVATION RISE	
Cross Section	Stream Station		100 Yr Elevation		100 Yr Elevation		Notes
Unnamed Toms Creek Tributary/Glade Spring Crossing Stream B Reach							
SL-1	2+00.00	335.07	1996.0	296.70	1996.0	0.0	
SL-2	3+00.00	335.07	1996.8	296.70	1996.7	-0.1	
SL-3	5+00.00	331.30	1998.7	292.93	1998.6	-0.1	
SL-4	6+00.00	331.30	1999.6	292.93	1999.5	-0.1	
SL-5	7+00.00	310.68	2000.8	274.88	2000.7	-0.1	
SL-6	8+00.00	310.68	2001.9	274.88	2001.8	-0.1	
SL-7	9+00.00	296.55	2003.0	204.16	2002.7	-0.3	
SL-8	10+00.00	296.55	2006.0	204.16	2005.9	-0.1	
SL-9	11+00.00	296.55	2007.9	204.16	2007.7	-0.2	
SL-10	11+90.35	268.04	2009.9	191.42	2009.6	-0.3	

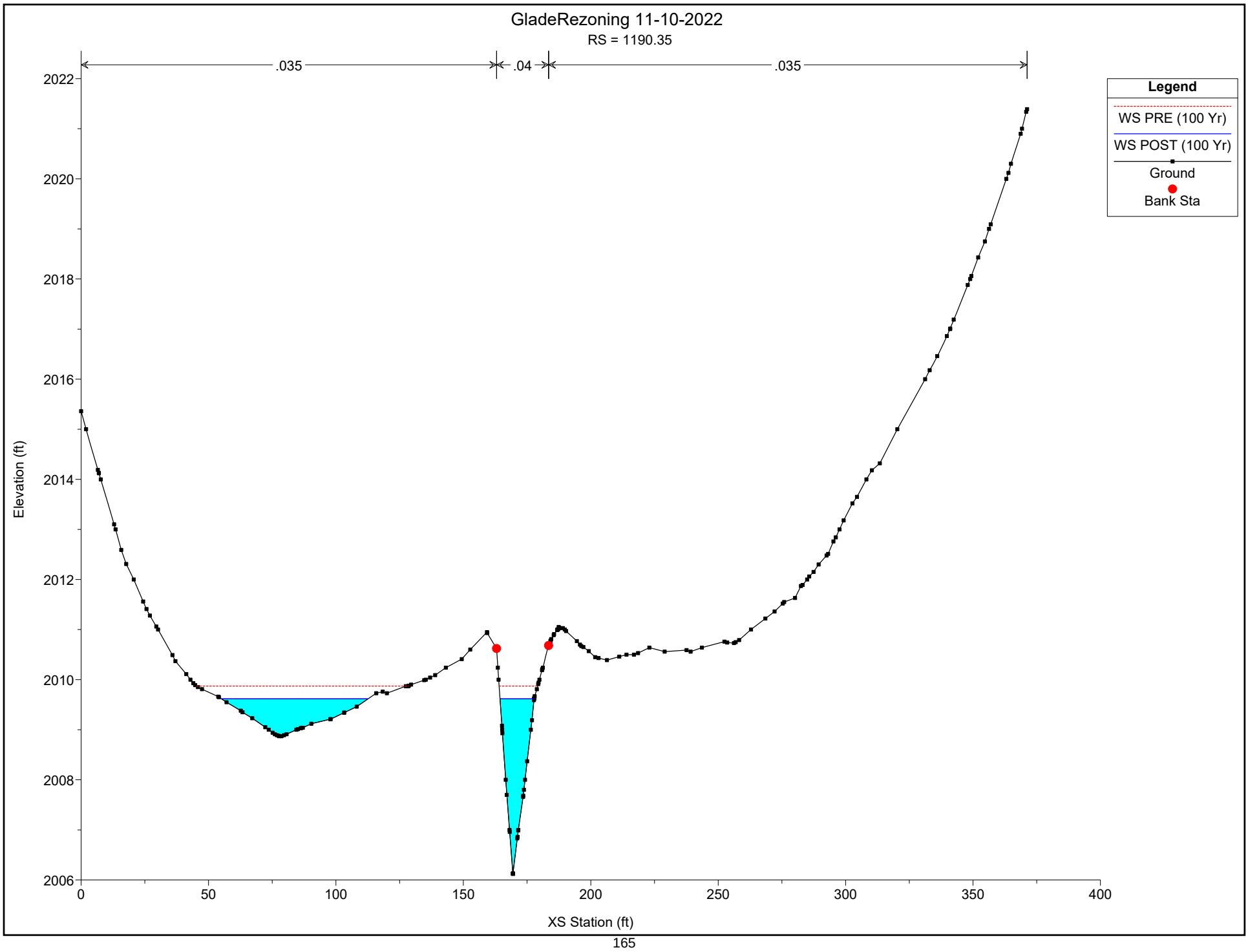

GladeRezoning 11-10-2022
Reach CL Reach CL
Legend
WS POST (100 Yr)
WS PRE (100 Yr)
Ground
Elevation (ft)
2010
2008
2006
2004
2002
2000
1998
1996
1994
200
400
600
800
1000
1200
Main Channel Distance (ft)

HEC-RAS Plan: GladePlan11-10 River: Reach CL Reach: Reach CL Profile: PRE (100 Yr)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach CL	1190.35	PRE (100 Yr)	268.04	2006.12	2009.87	2009.87	2010.20	0.011543	5.52	68.36	98.29	0.72
Reach CL	1100	PRE (100 Yr)	296.55	2003.76	2007.90	2007.90	2008.26	0.013198	5.39	67.11	82.55	0.77
Reach CL	1000	PRE (100 Yr)	296.55	2002.21	2005.97	2005.97	2006.26	0.019074	5.05	73.46	136.63	0.87
Reach CL	900	PRE (100 Yr)	296.55	1998.63	2002.97	2002.88	2003.48	0.021259	6.10	53.64	57.89	0.84
Reach CL	800	PRE (100 Yr)	310.68	1997.61	2001.89		2002.15	0.007516	4.55	83.55	89.50	0.60
Reach CL	700	PRE (100 Yr)	310.68	1996.49	2000.79	2000.74	2001.23	0.013335	6.05	62.39	62.07	0.77
Reach CL	600	PRE (100 Yr)	331.30	1995.45	1999.57	1999.57	2000.04	0.010684	6.49	69.40	69.45	0.73
Reach CL	500	PRE (100 Yr)	331.30	1995.37	1998.66	1998.38	1998.83	0.005099	3.90	106.83	105.78	0.51
Reach CL	300	PRE (100 Yr)	335.07	1994.67	1996.78	1996.78	1997.29	0.012289	6.02	64.25	68.72	0.79
Reach CL	200	PRE (100 Yr)	335.07	1994.67	1996.00	1995.49	1996.15	0.004761	3.10	110.31	88.97	0.47

HEC-RAS Plan: GladePlan11-10 River: Reach CL Reach: Reach CL Profile: POST (100 Yr)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach CL	1190.35	POST (100 Yr)	191.42	2006.12	2009.62	2009.62	2009.98	0.011964	5.53	47.13	70.89	0.73
Reach CL	1100	POST (100 Yr)	204.16	2003.76	2007.67	2007.67	2008.01	0.011749	5.02	49.68	73.57	0.72
Reach CL	1000	POST (100 Yr)	204.16	2002.21	2005.88	2005.88	2006.08	0.014746	4.19	61.86	135.46	0.76
Reach CL	900	POST (100 Yr)	204.16	1998.63	2002.71		2003.07	0.012115	5.00	42.19	31.96	0.62
Reach CL	800	POST (100 Yr)	274.88	1997.61	2001.80		2002.06	0.007589	4.43	75.87	87.76	0.60
Reach CL	700	POST (100 Yr)	274.88	1996.49	2000.68	2000.66	2001.12	0.013785	6.04	55.66	58.12	0.77
Reach CL	600	POST (100 Yr)	292.93	1995.45	1999.49	1999.49	1999.93	0.010372	6.25	63.68	67.65	0.71
Reach CL	500	POST (100 Yr)	292.93	1995.37	1998.57	1998.31	1998.73	0.005282	3.83	96.93	104.04	0.51
Reach CL	300	POST (100 Yr)	296.70	1994.67	1996.70	1996.70	1997.17	0.011831	5.73	58.81	66.47	0.77
Reach CL	200	POST (100 Yr)	296.70	1994.67	1996.00	1995.43	1996.12	0.003733	2.74	110.31	88.97	0.42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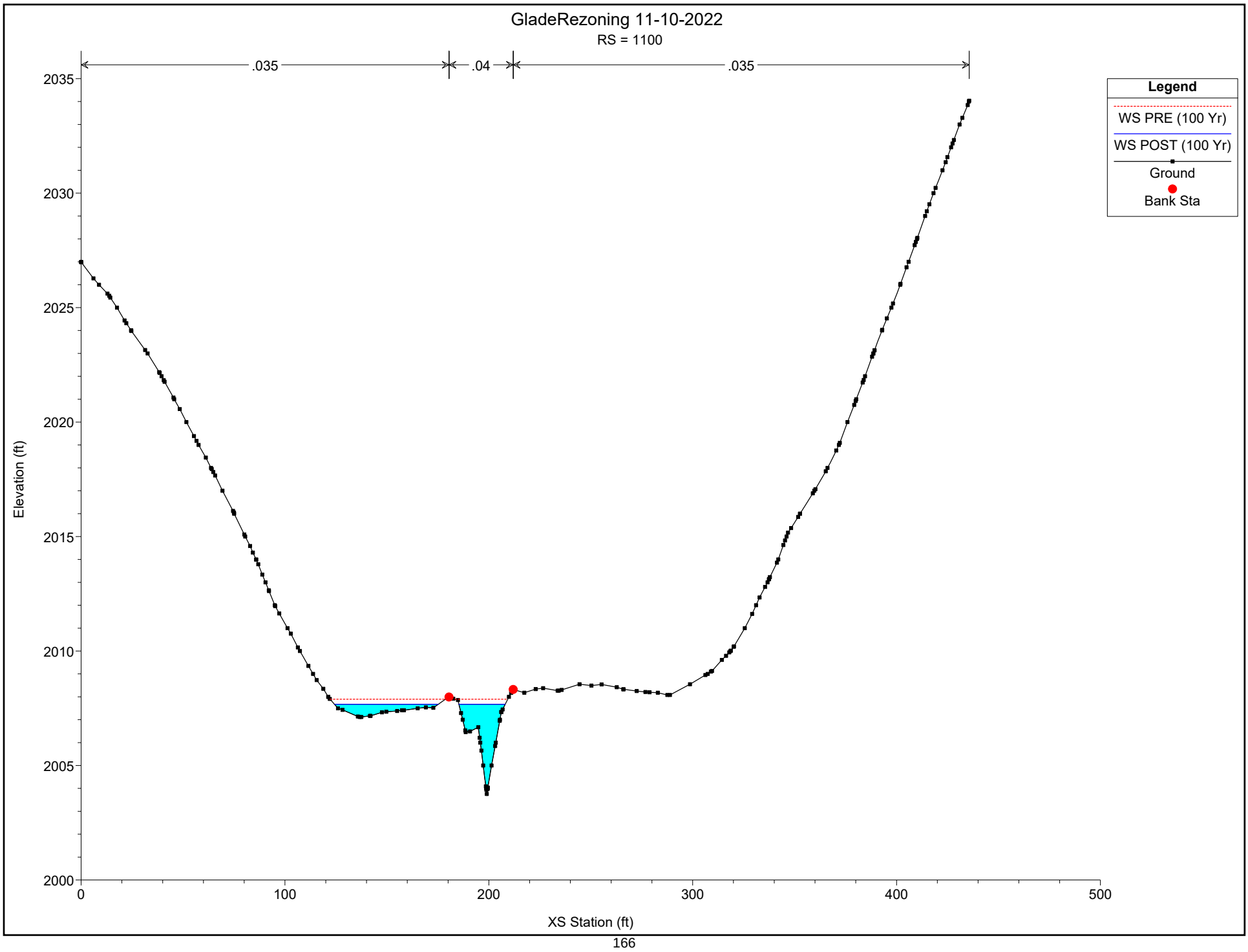
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2022
2020
2018
2016
2014
2012
2010
2008
2006
0
50
100
150
200
250
300
350
400
XS Station (ft)
165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.04
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Legend
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WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
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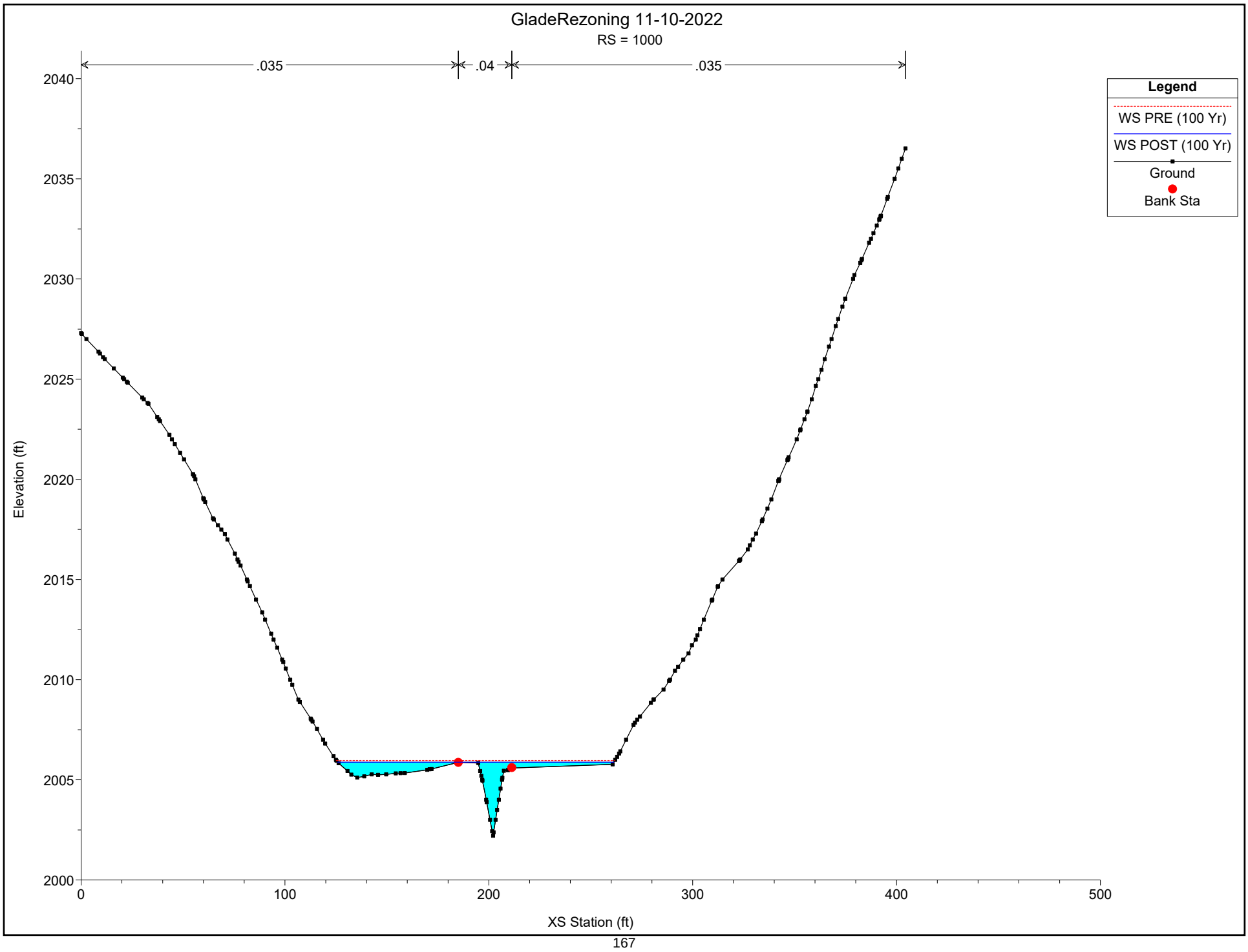
2030
2025
2020
2015
2010
2005
2000
0
100
200
300
400
500
XS Station (ft)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.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
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2030
2025
2020
2015
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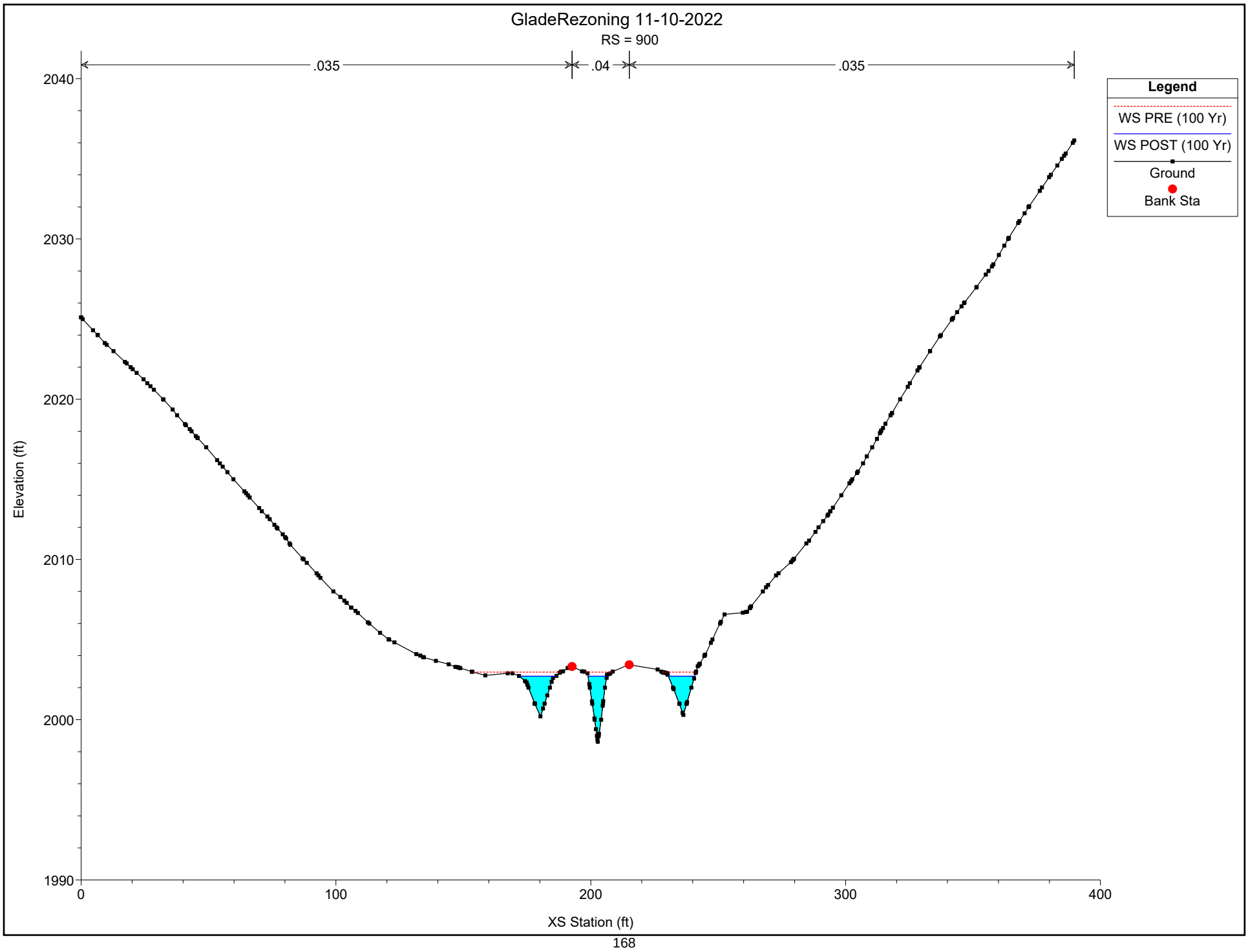
2005
2000
0
100
200
300
400
500
XS Station (ft)
167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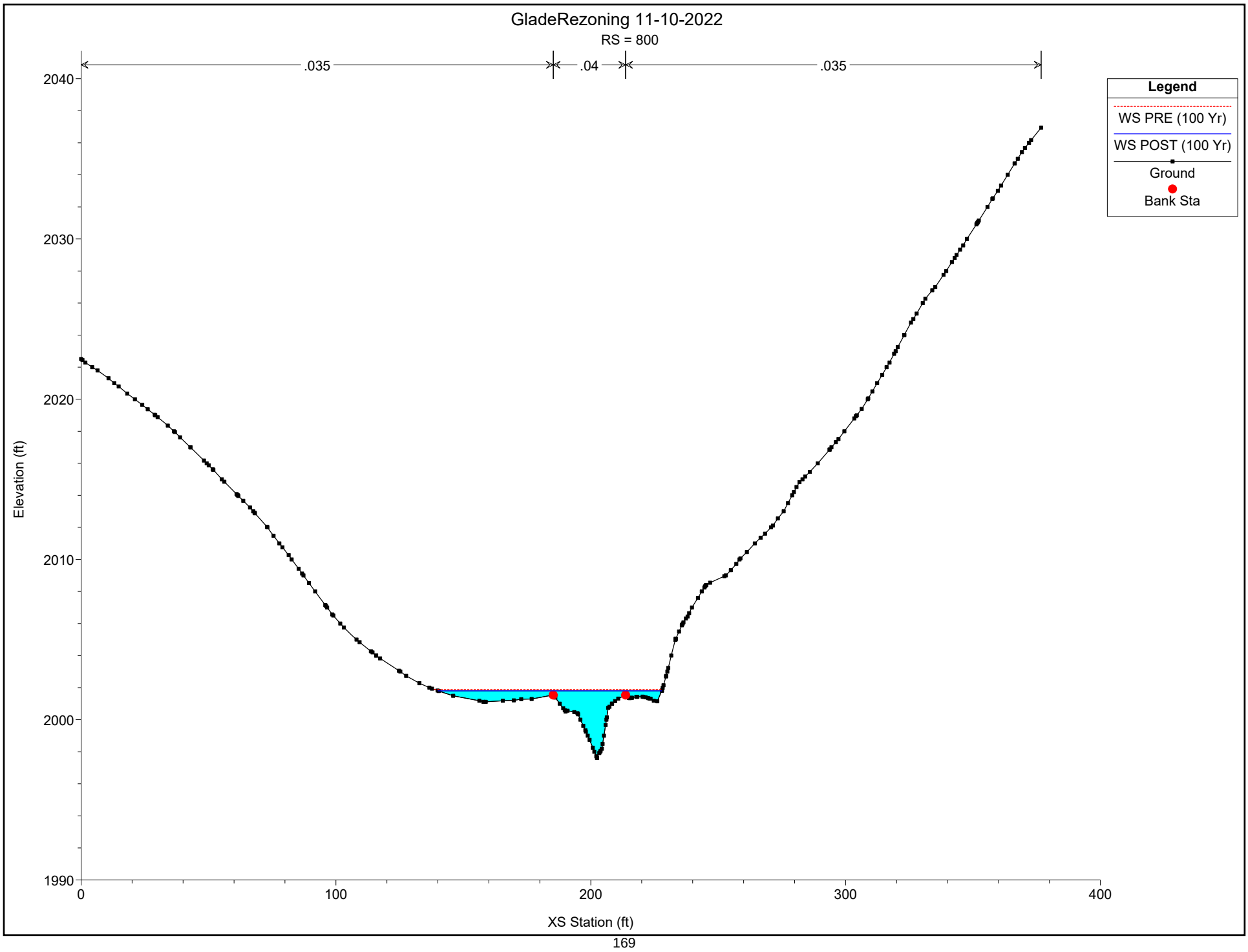
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2040
2030
2020
2010
2000
1990
0
100
200
300
400
XS Station (ft)
168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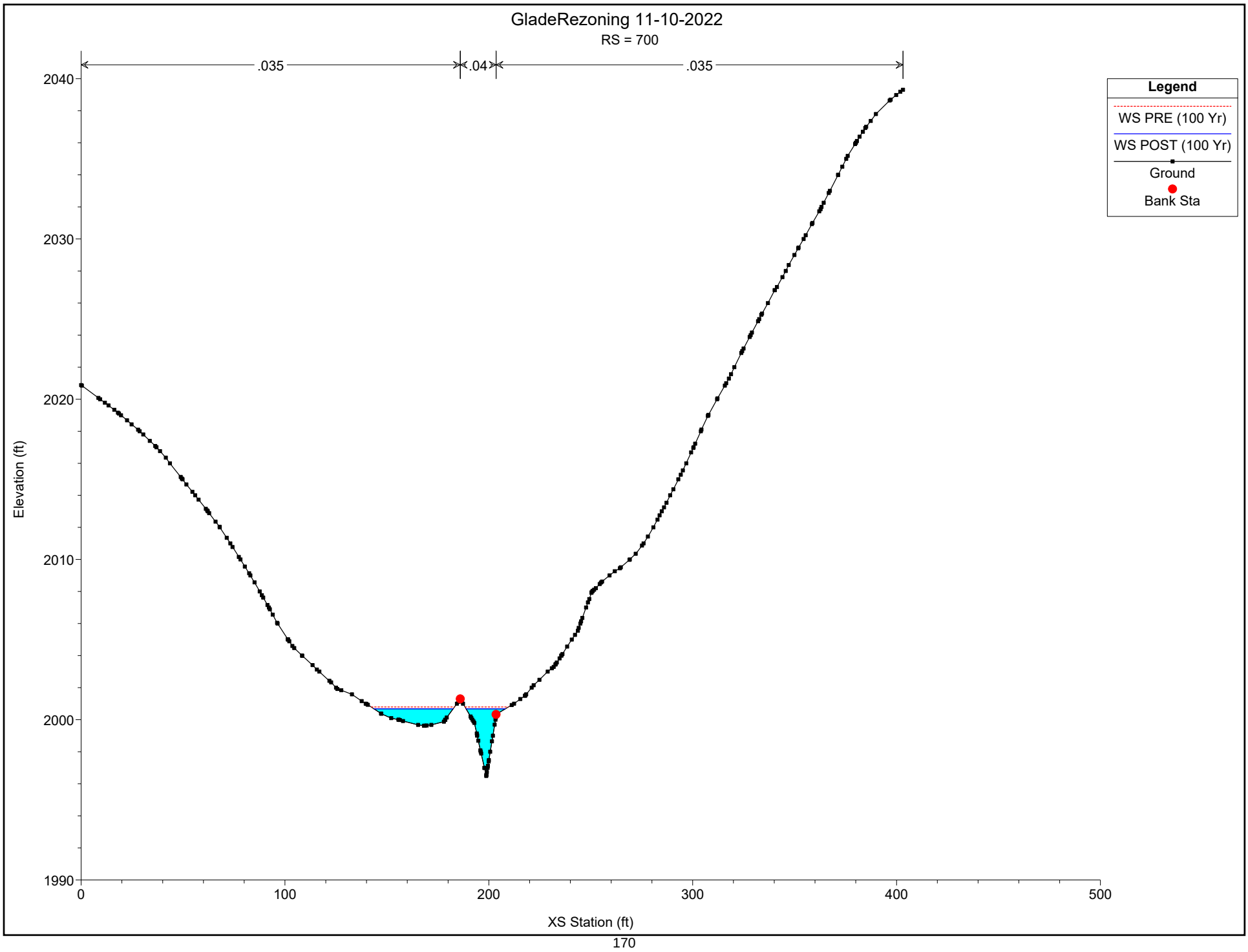
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2040
2030
2020
2010
2000
1990
0
100
200
300
400
XS Station (ft)
169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RS = 700
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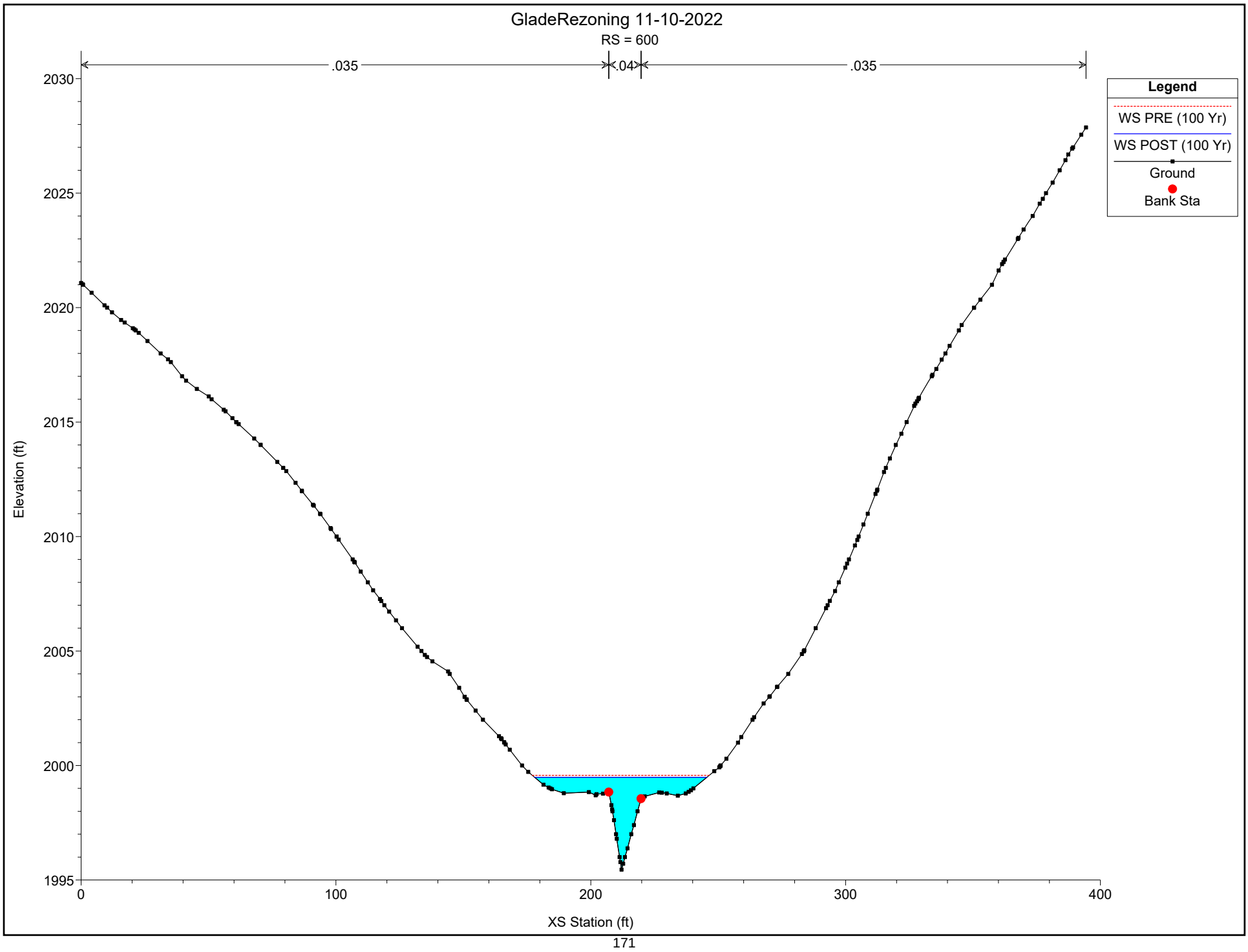
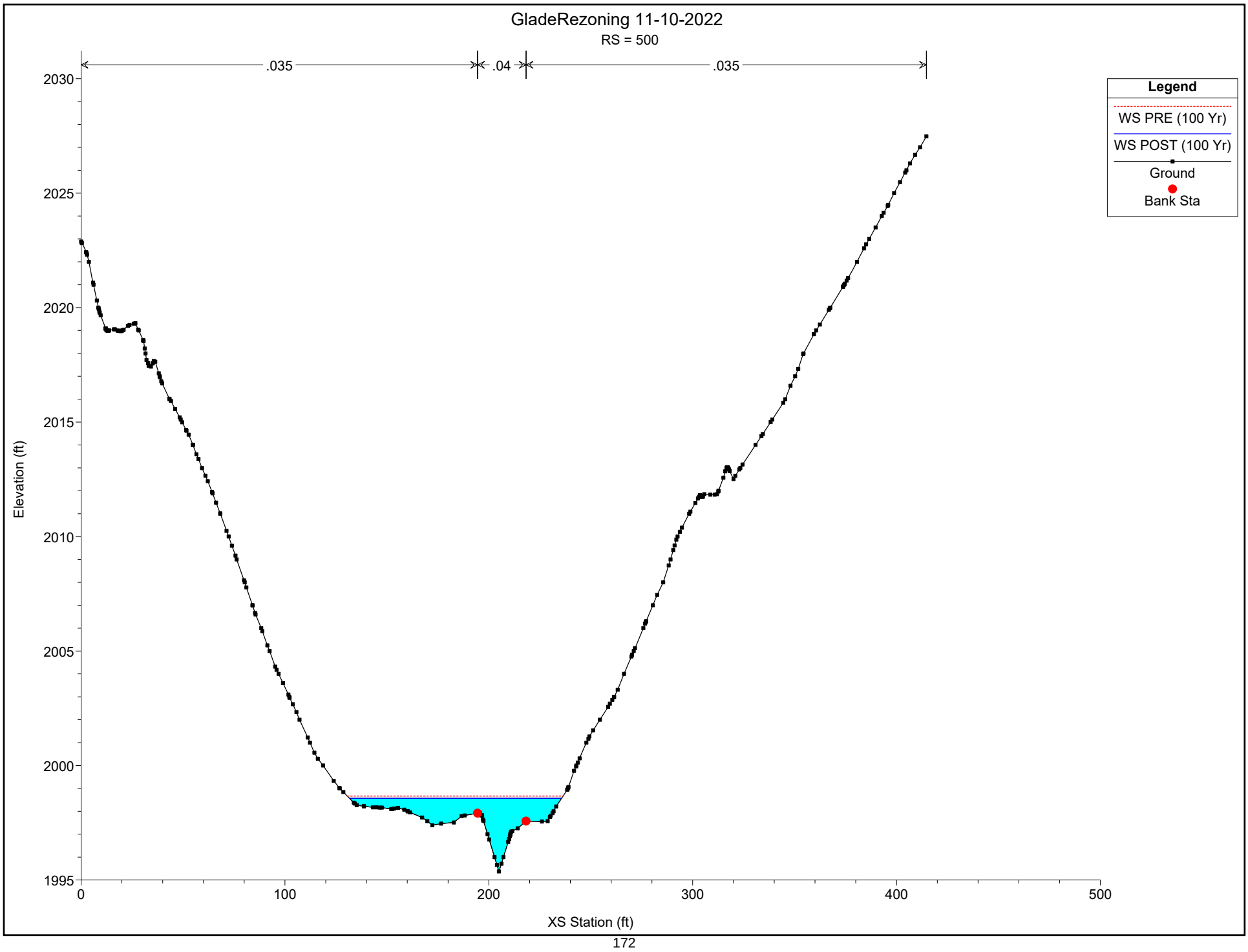
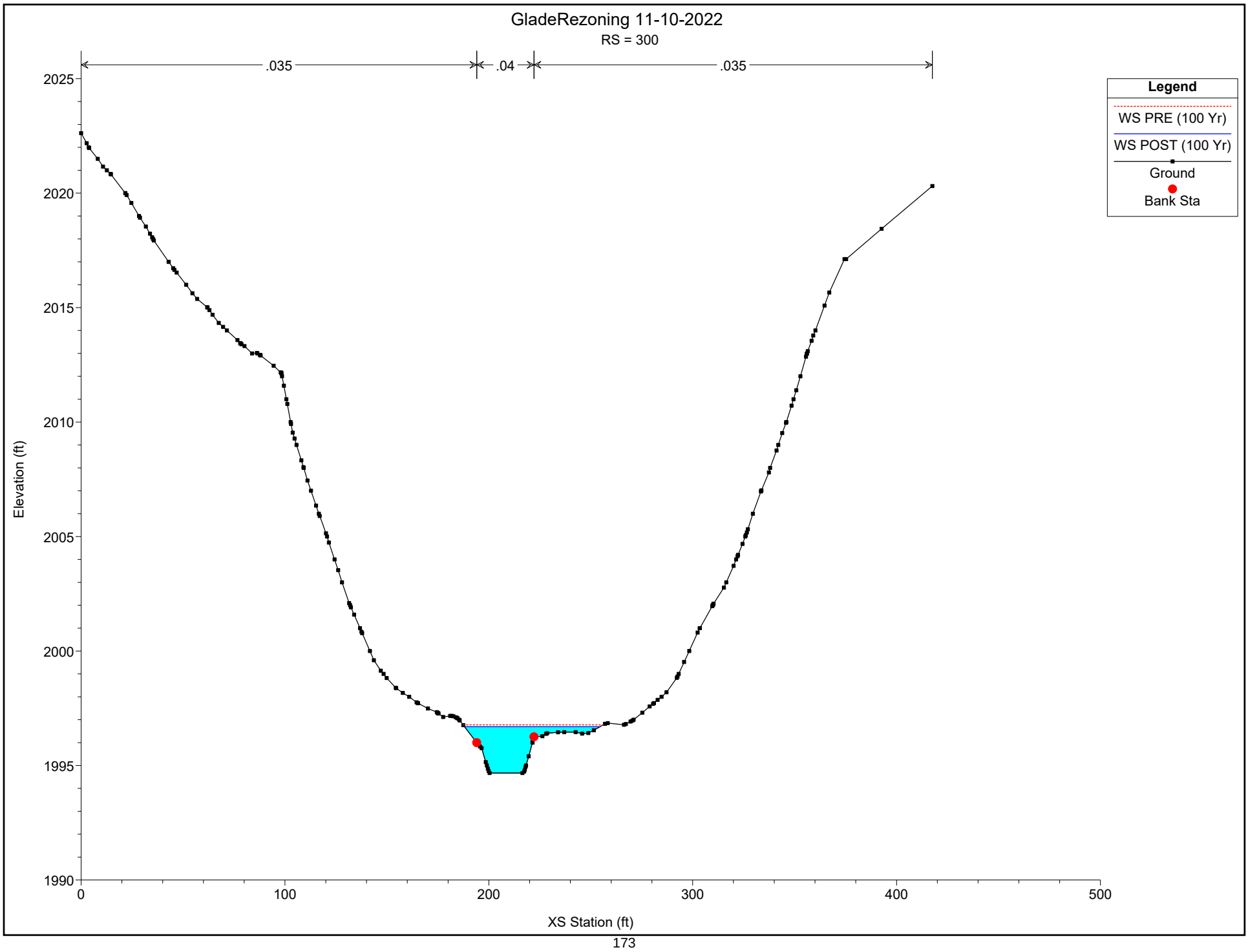
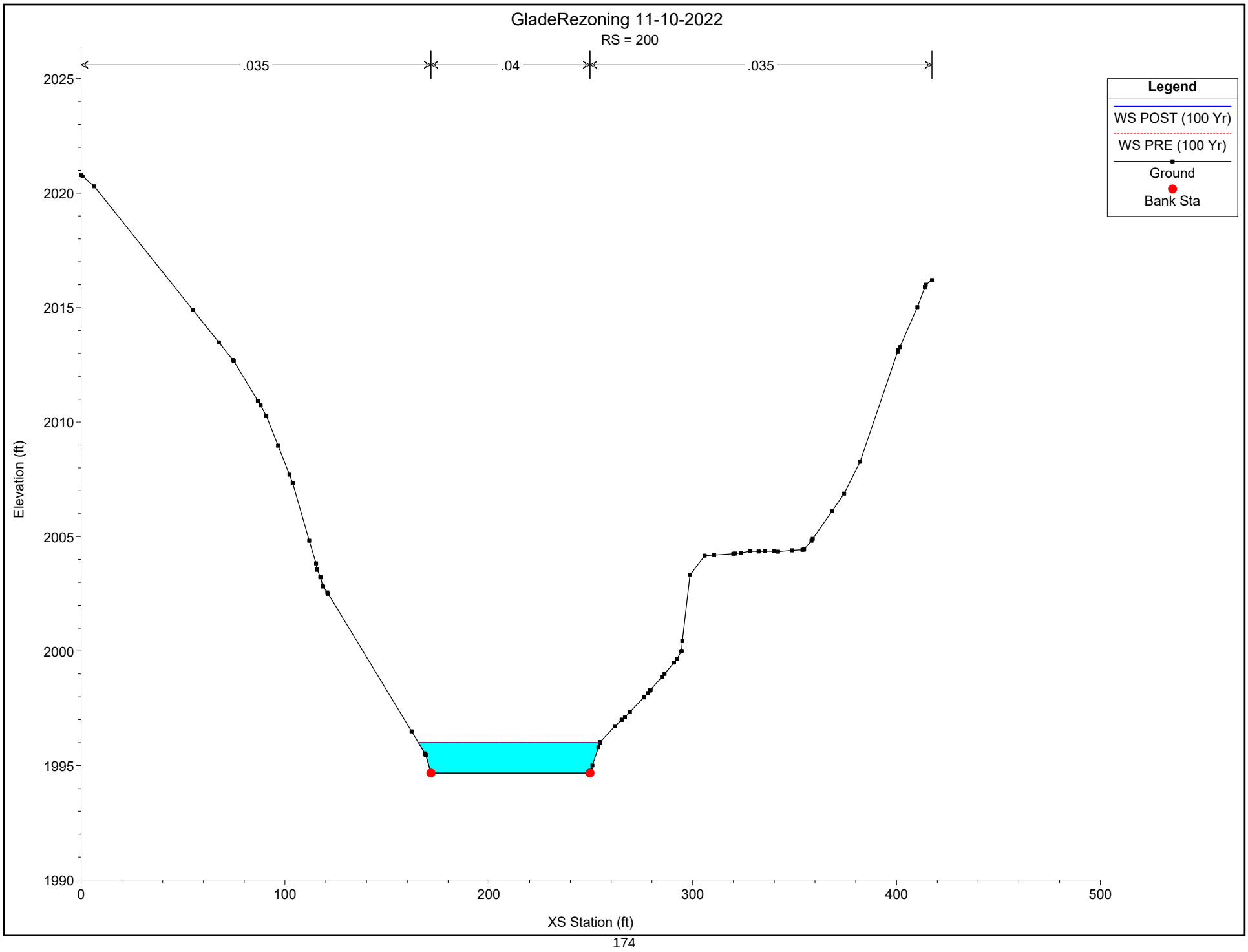
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2040
2030
2020
2010
2000
1990
0
100
200
300
400
500
XS Station (ft)
170


GladeRezoning 11-10-2022
RS = 600
.035
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2030
2025
2020
2015
2010
2005
2000
1995
0
100
200
300
400
XS Station (ft)
171


GladeRezoning 11-10-2022
RS = 500
.035
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2030
2025
2020
2015
2010
2005
2000
1995
0
100
200
300
400
500
XS Station (ft)


GladeRezoning 11-10-2022
RS = 300
.035
.04
.035
Legend
WS PRE (100 Yr)
WS POST (100 Yr)
Ground
Bank Sta
Elevation (ft)
2025
2020
2015
2010
2005
2000
1995
1990
0
100
200
300
400
500
XS Station (ft)
173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.035
.04
.035
Legend
WS POST (100 Yr)
WS PRE (100 Yr)
Ground
Bank Sta
Elevation (ft)
2025
2020
2015
2010
2005
2000
1995
1990
0
100
200
300
400
500
XS Station (ft)
174

HEC-RAS HEC-RAS 6.2 March 2022
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
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GLADE SPRING CROSSING REZONING 100 YEAR FLOODPLAIN ANALYSIS

PROJECT DATA
Project Title: GladeRezoning 11-10-2022
Project File : GladeRezoning.prj
Run Date and Time: 11/10/2022 10:45:14 AM

Project in English units

PLAN DATA

Plan Title: GladeRezoning PLAN
Plan File : C:\Dropbox\E&A\Cary Hopper\Glade Spring\Design\Stormwater\Floodplain\HEC-RAS\GladeRezoning.p05

Geometry Title: Glade Rezoning GEOMETRY
Geometry File : C:\Dropbox\E&A\Cary Hopper\Glade Spring\Design\Stormwater\Floodplain\HEC-RAS\GladeRezoning.g01

Flow Title : Glade Rezoning FLOWS
Flow File : C:\Dropbox\E&A\Cary Hopper\Glade Spring\Design\Stormwater\Floodplain\HEC-RAS\GladeRezoning.f05

Plan Summary Information:
Number of: Cross Sections = 10 Multiple Openings = 0
Culverts = 0 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: Glade Rezoning FLOWS
Flow File : C:\Dropbox\E&A\Cary Hopper\Glade Spring\Design\Stormwater\Floodplain\HEC-RAS\GladeRezoning.f05

Flow Data (cfs)

River	Reach	RS	POST (100 Yr)	PRE (100 Yr)
Reach CL	Reach CL	1190.35	191.42	268.04
Reach CL	Reach CL	1100	204.16	296.55
Reach CL	Reach CL	1000	204.16	296.55
Reach CL	Reach CL	900	204.16	296.55
Reach CL	Reach CL	800	274.88	310.68
Reach CL	Reach CL	700	274.88	310.68
Reach CL	Reach CL	600	292.93	331.3
Reach CL	Reach CL	500	292.93	331.3
Reach CL	Reach CL	300	296.7	335.07
Reach CL	Reach CL	200	296.7	335.07

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Reach CL	Reach CL	POST (100 Yr)		Known WS = 1996
Reach CL	Reach CL	PRE (100 Yr)		Known WS = 1996

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 1190.35

INPUT
Description:
Station Elevation Data num= 188

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2015.36	1.96	2015	6.59	2014.19	6.92	2014.13	6.97	2014.12
7.72	2014	12.93	2013.1	13.52	2013	15.76	2012.59	17.7	2012.31
20.64	2012	24.36	2011.56	25.66	2011.41	26.97	2011.28	29.5	2011.06
30.18	2011	35.83	2010.49	37	2010.37	41.28	2010.11	42.91	2010
44.03	2009.93	44.78	2009.89	45.86	2009.85	47.42	2009.81	53.8	2009.66
54.1	2009.65	57.05	2009.55	62.65	2009.38	63.33	2009.35	67.17	2009.23
72.29	2009.05	73.62	2009	75.15	2008.94	76.06	2008.91	76.82	2008.89
77.45	2008.88	77.76	2008.87	78.65	2008.87	79.63	2008.89	80.62	2008.91
84.46	2009	85.06	2009.01	86.18	2009.03	86.48	2009.04	87.01	2009.04
90.33	2009.12	97.8	2009.21	97.92	2009.21	103.2	2009.34	103.24	2009.34
108.13	2009.46	115.81	2009.73	118.36	2009.76	120	2009.73	127.44	2009.87
128.39	2009.87	128.6	2009.88	129.5	2009.9	134.66	2009.99	135.27	2010
136.96	2010.04	138.93	2010.09	143.13	2010.24	149.38	2010.41	152.72	2010.6
159.27	2010.95	159.37	2010.93	163.04	2010.62	163.53	2010.24	163.84	2010
165.16	2009.08	165.26	2009	165.34	2008.93	166.64	2008	167.03	2007.7
168.14	2007	168.21	2006.96	169.44	2006.13	169.46	2006.12	169.47	2006.13
171.18	2006.83	171.28	2006.86	171.54	2006.99	171.57	2007	173.42	2007.66
173.48	2007.68	173.77	2007.8	174.22	2008	175.04	2008.37	176.49	2009
176.93	2009.19	177.71	2009.59	177.76	2009.62	177.77	2009.62	177.86	2009.64
178	2009.67	178.83	2009.81	179.36	2009.91	179.54	2009.94	179.84	2010
180.86	2010.19	180.99	2010.21	181.19	2010.24	183.46	2010.68	183.83	2010.73
184.16	2010.77	184.27	2010.78	184.46	2010.81	185.46	2010.89	185.62	2010.91
186.8	2010.99	186.82	2010.99	186.9	2011	187.03	2011	187.25	2011.01
187.4	2011.05	187.54	2011.04	187.8	2011.03	189.05	2011.03	189.78	2011
190.34	2010.97	194.56	2010.77	195.77	2010.7	196.27	2010.67	197.08	2010.65
199.2	2010.57	201.74	2010.45	203.07	2010.43	206.36	2010.39	211.19	2010.46
214.03	2010.5	216.94	2010.5	218.56	2010.53	222.97	2010.64	229.01	2010.56
237.58	2010.59	239.18	2010.56	243.59	2010.64	252.43	2010.76	253.54	2010.74
256.2	2010.73	256.86	2010.75	258.21	2010.79	262.89	2011	268.53	2011.22
272.14	2011.36	275.35	2011.52	275.91	2011.55	280.16	2011.63	282.48	2011.87
283.11	2011.89	284.9	2012	285.71	2012.06	287.42	2012.15	289.43	2012.3
292.56	2012.48	293.14	2012.51	295.24	2012.76	296.14	2012.84	297.62	2013
299.23	2013.18	302.7	2013.52	304.49	2013.65	308.16	2014	310.33	2014.18
313.46	2014.32	320.3	2015	331.23	2016	332.99	2016.18	335.96	2016.46
339.75	2016.86	341	2017	341.07	2017.01	342.42	2017.19	347.92	2017.88
348.92	2018	349.35	2018.06	352.04	2018.43	354.67	2018.75	356.28	2019
356.95	2019.09	363.08	2020	363.91	2020.12	364.9	2020.3	368.7	2020.9
369.24	2021	370.86	2021.34	371.21	2021.39				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	163.04	.04	183.46	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
163.04	183.46	90.14	90.14	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2010.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.035	0.040	
W.S. Elev (ft)	2009.87	Reach Len. (ft)	90.14	90.14	90.14
Crit W.S. (ft)	2009.87	Flow Area (sq ft)	40.63	27.73	
E.G. Slope (ft/ft)	0.011543	Area (sq ft)	40.63	27.73	
Q Total (cfs)	268.04	Flow (cfs)	114.92	153.12	
Top Width (ft)	98.29	Top Width (ft)	83.16	15.13	
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)	2.83	5.52	
Max Chl Dpth (ft)	3.75	Hydr. Depth (ft)	0.49	1.83	
Conv. Total (cfs)	2494.8	Conv. (cfs)	1069.7	1425.1	
Length Wtd. (ft)	90.14	Wetted Per. (ft)	83.19	17.05	
Min Ch El (ft)	2006.12	Shear (lb/sq ft)	0.35	1.17	
Alpha	1.36	Stream Power (lb/ft s)	1.00	6.47	
Frctn Loss (ft)	1.12	Cum Volume (acre-ft)	0.58	0.92	0.23
C & E Loss (ft)	0.00	Cum SA (acres)	0.95	0.55	0.44

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	2009.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.035	0.040	
W.S. Elev (ft)	2009.62	Reach Len. (ft)	90.14	90.14	90.14
Crit W.S. (ft)	2009.62	Flow Area (sq ft)	23.03	24.11	
E.G. Slope (ft/ft)	0.011964	Area (sq ft)	23.03	24.11	
Q Total (cfs)	191.42	Flow (cfs)	58.06	133.36	
Top Width (ft)	70.89	Top Width (ft)	57.53	13.37	
Vel Total (ft/s)	4.06	Avg. Vel. (ft/s)	2.52	5.53	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)	0.40	1.80	
Conv. Total (cfs)	1750.0	Conv. (cfs)	530.8	1219.2	
Length Wtd. (ft)	90.14	Wetted Per. (ft)	57.55	15.17	
Min Ch El (ft)	2006.12	Shear (lb/sq ft)	0.30	1.19	
Alpha	1.41	Stream Power (lb/ft s)	0.75	6.56	
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.46	0.86	0.19
C & E Loss (ft)	0.01	Cum SA (acres)	0.84	0.54	0.42

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 1100

INPUT
Description:
Station Elevation Data num= 210

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2026.99	.01	2026.99	.12	2026.98	6.05	2026.28	8.8	2026	12.92	2025.61
13.79	2025.52	14.32	2025.44	17.62	2025	21.33	2024.44	22.15	2024.32	24.5	2024.01
24.56	2024	24.66	2023.98	31.4	2023.15	32.63	2023	38.3	2022.18	38.56	2022.15
39.44	2022	40.52	2021.83	40.93	2021.76	45.32	2021.07	45.66	2021	48.38	2020.57
51.62	2020	55.36	2019.39	56.6	2019.18	57.61	2019	61.15	2018.45	63.73	2018
64.08	2017.95	64.85	2017.82	65.74	2017.67	69.34	2017	74.54	2016.12	74.97	2016.05
74.98	2016.05	75.08	2016	80.03	2015.09	80.49	2015	82.86	2014.59	84.28	2014.3
85.86	2014	85.9	2013.99	86.88	2013.79	88.89	2013.34	90.45	2013	92.07	2012.65
92.18	2012.62	95.02	2012	95.22	2011.96	97.18	2011.64	101.27	2011	102.87	2010.76
106.3	2010.16	107.32	2010	111.5	2009.35	113.8	2009	115.55	2008.73	118.78	2008.35
121.21	2008	121.25	2008	121.97	2007.91	126.02	2007.5	128.21	2007.43	135.74	2007.14
136.63	2007.12	137.47	2007.12	141.68	2007.17	141.99	2007.17	147.57	2007.32	149.71	2007.35
155.03	2007.38	157.4	2007.41	158.35	2007.41	165.09	2007.5	169.13	2007.54	172.77	2007.52
179.9	2007.97	180.47	2007.99	180.85	2007.98	182.55	2007.92	184.82	2007.86	186.35	2007.29
187.18	2007	188.43	2006.53	188.64	2006.46	190.78	2006.49	194.84	2006.67	195.49	2006.21
195.81	2006	196.34	2005.65	197.22	2005	198.56	2004.09	198.69	2004	198.77	2003.94
199.01	2003.76	199.36	2003.98	199.39	2003.99	199.4	2004	199.48	2004.04	201.33	2005
203.1	2005.85	203.42	2006	205.33	2006.95	205.43	2007	206.09	2007.33	206.11	2007.34
206.77	2007.45	209.87	2008	210.9	2008.17	211.96	2008.32	217.39	2008.18	222.99	2008.34
226.62	2008.38	233.75	2008.27	234.32	2008.27	235.74	2008.3	244.52	2008.55	250.34	2008.49
255.28	2008.54	262.74	2008.42	265.93	2008.33	266.1	2008.33	272.54	2008.25	276.81	2008.21
278.84	2008.2	282.88	2008.18	287.58	2008.08	288.81	2008.08	298.66	2008.55	306.24	2008.95
307.39	2009	308.94	2009.1	309.48	2009.13	314.27	2009.61	316.37	2009.79	317.96	2009.94
318.53	2010	318.7	2010.02	320.14	2010.19	320.21	2010.2	325.58	2011	329.16	2011.62
331.08	2012	332.8	2012.34	335.51	2012.8	336.71	2013	337.36	2013.13	337.5	2013.15
337.86	2013.23	341.34	2013.86	341.99	2014	344.46	2014.63	345.27	2014.83	346.05	2015
346.76	2015.17	348.29	2015.37	351.73	2015.86	352.63	2016	352.64	2016	358.93	2016.89
359.65	2017	360.22	2017.07	365.29	2017.85	366.15	2018	370.39	2018.76	371.73	2019
372.18	2019.09	375.95	2020	379.22	2020.75	379.92	2020.92	380.26	2021	383.37	2021.73
383.87	2021.84	384.53	2022	388.01	2022.86	388.59	2022.99	388.62	2023	389.19	2023.13
389.23	2023.14	392.87	2024	392.97	2024.03	395.25	2024.53	397.49	2025	398.23	2025.18
401.78	2026	401.93	2026.04	404.87	2026.76	405.88	2027	408.89	2027.73	409.47	2027.87
410.01	2028	410.22	2028.05	414.04	2029	414.83	2029.21	416.11	2029.51	418.12	2030
419.15	2030.23	422.52	2031	424.09	2031.35	424.92	2031.57	426.75	2032	427.45	2032.17
428.12	2032.32	430.92	2033	432.28	2033.29	434.92	2033.85	435.48	2034	435.64	2034.04

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	180.47	.04	211.96	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
180.47	211.96	100.03	100.03	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2008.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.035	0.040	
W.S. Elev (ft)	2007.90	Reach Len. (ft)	100.03	100.03	100.03
Crit W.S. (ft)	2007.90	Flow Area (sq ft)	27.37	39.74	
E.G. Slope (ft/ft)	0.013198	Area (sq ft)	27.37	39.74	
Q Total (cfs)	296.55	Flow (cfs)	82.16	214.39	
Top Width (ft)	82.55	Top Width (ft)	56.66	25.89	
Vel Total (ft/s)	4.42	Avg. Vel. (ft/s)	3.00	5.39	
Max Chl Dpth (ft)	4.14	Hydr. Depth (ft)	0.48	1.54	
Conv. Total (cfs)	2581.4	Conv. (cfs)	715.1	1866.2	
Length Wtd. (ft)	100.03	Wetted Per. (ft)	56.70	27.96	
Min Ch El (ft)	2003.76	Shear (lb/sq ft)	0.40	1.17	
Alpha	1.21	Stream Power (lb/ft s)	1.19	6.32	
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	0.51	0.85	0.23
C & E Loss (ft)	0.02	Cum SA (acres)	0.80	0.51	0.44

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	2008.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.	0.035	0.040	
W.S. Elev (ft)	2007.67	Reach Len. (ft)	100.03	100.03	100.03
Crit W.S. (ft)	2007.67	Flow Area (sq ft)	15.28	34.40	
E.G. Slope (ft/ft)	0.011749	Area (sq ft)	15.28	34.40	
Q Total (cfs)	204.16	Flow (cfs)	31.52	172.64	
Top Width (ft)	73.57	Top Width (ft)	50.87	22.70	
Vel Total (ft/s)	4.11	Avg. Vel. (ft/s)	2.06	5.02	
Max Chl Dpth (ft)	3.91	Hydr. Depth (ft)	0.30	1.52	
Conv. Total (cfs)	1883.5	Conv. (cfs)	290.8	1592.7	
Length Wtd. (ft)	100.03	Wetted Per. (ft)	50.89	24.72	
Min Ch El (ft)	2003.76	Shear (lb/sq ft)	0.22	1.02	
Alpha	1.30	Stream Power (lb/ft s)	0.45	5.12	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	0.42	0.80	0.19
C & E Loss (ft)	0.04	Cum SA (acres)	0.73	0.50	0.42

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 1000

INPUT
Description:
Station Elevation Data num= 196

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2027.3	.38	2027.25	2.6	2027	8.51	2026.37	9.22	2026.28	10.76	2026.1
11.61	2026	16.05	2025.53	20.42	2025.07	21.11	2025	22.44	2024.87	22.88	2024.82
29.97	2024.08	30.72	2024	32.6	2023.81	33.01	2023.77	37.33	2023.11	38.07	2023
38.69	2022.91	43.3	2022.22	44.55	2022	45.95	2021.76	48.53	2021.32	50.49	2021
54.85	2020.26	54.98	2020.24	55.45	2020.15	56.07	2020	59.9	2019.06	60.2	2019.01
60.22	2019	60.85	2018.86	64.66	2018.05	65.06	2018	67.12	2017.71	68.79	2017.49
70.51	2017.27	71.78	2017	75.42	2016.29	76.7	2016	77.24	2015.88	78.2	2015.7
81.3	2015	81.71	2014.91	82.8	2014.67	85.8	2014	88.82	2013.36	90.25	2013
93.22	2012.29	94.38	2012	96.17	2011.6	98.59	2011	99.19	2010.88	100.41	2010.55
102.57	2010	103.57	2009.74	106.57	2009	107.27	2008.89	112.61	2008.06	112.93	2008
113.53	2007.91	115.72	2007.54	118.7	2007	119.7	2006.81	123.83	2006.18	124.97	2006
125.28	2005.95	126.29	2005.83	130.67	2005.44	132.54	2005.26	135.46	2005.11	138.9	2005.17
142.56	2005.27	145.67	2005.25	149.65	2005.27	154.34	2005.32	156.68	2005.33	158.79	2005.34
169.77	2005.5	170.93	2005.53	171.92	2005.54	184.08	2005.85	185.04	2005.87	185.36	2005.87
194.81	2005.84	195.74	2005.44	196.33	2005.2	196.76	2005	196.85	2004.96	198.7	2004
198.92	2003.88	200.63	2003	201.65	2002.43	202.1	2002.21	202.32	2002.38	203.29	2003
204.05	2003.5	204.91	2004	205.74	2004.56	206.49	2005	206.52	2005.02	206.66	2005.1
207.35	2005.45	209.34	2005.48	209.59	2005.5	211.28	2005.61	212.04	2005.59	260.71	2005.77
262.01	2006	262.9	2006.15	263.88	2006.31	264.5	2006.42	267.3	2007	270.98	2007.74
271.66	2007.85	272.82	2008	274.1	2008.16	279.48	2008.84	280.75	2009	280.91	2009.01
285.7	2009.51	288.43	2009.93	288.9	2010	291.34	2010.45	292.85	2010.64	295.36	2011
297.96	2011.31	299.63	2011.72	301.52	2012	302.33	2012.21	303.58	2012.53	305.45	2013
309.34	2013.94	309.44	2013.96	309.63	2014	312.25	2014.64	312.41	2014.66	314.6	2015
322.71	2015.93	323.07	2015.96	323.32	2016	327.05	2016.5	328.06	2016.71	329.44	2017
331.08	2017.29	333.93	2017.91	334.3	2018	336.64	2018.54	338.6	2019	342.06	2019.92
342.07	2019.92	342.19	2019.95	342.38	2019.99	342.4	2020	346.45	2020.95	346.67	2021
346.74	2021.01	347.07	2021.1	351.02	2022	352.75	2022.44	352.92	2022.49	354.82	2023
356.23	2023.36	356.31	2023.39	358.42	2024	360.42	2024.67	361.6	2025	363.17	2025.47
364.77	2026	366.83	2026.62	368.1	2027	370.19	2027.65	371.34	2028	373.43	2028.62
374.8	2029	374.88	2029.02	378.67	2030	379.33	2030.2	382.22	2030.8	382.77	2030.94
383.03	2031	386.52	2031.81	387.42	2032	388.68	2032.29	390.27	2032.67	391.52	2032.96
391.66	2033	392.17	2033.12	392.28	2033.15	392.34	2033.16	395.4	2034	395.73	2034.09
399.06	2035	400.89	2035.52	402.54	2036						
404.38	2036.52										

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	185.04	.04	211.28	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
185.04	211.28	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2006.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2005.97	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2005.97	Flow Area (sq ft)	31.82	27.37	14.27
E.G. Slope (ft/ft)	0.019074	Area (sq ft)	31.82	27.37	14.27
Q Total (cfs)	296.55	Flow (cfs)	122.36	138.17	36.02
Top Width (ft)	136.63	Top Width (ft)	59.86	26.24	50.53
Vel Total (ft/s)	4.04	Avg. Vel. (ft/s)	3.85	5.05	2.52
Max Chl Dpth (ft)	3.76	Hydr. Depth (ft)	0.53	1.04	0.28
Conv. Total (cfs)	2147.2	Conv. (cfs)	886.0	1000.5	260.8
Length Wtd. (ft)	100.00	Wetted Per. (ft)	59.90	28.03	50.55
Min Ch El (ft)	2002.21	Shear (lb/sq ft)	0.63	1.16	0.34
Alpha	1.15	Stream Power (lb/ft s)	2.43	5.87	0.85
Frctn Loss (ft)	2.01	Cum Volume (acre-ft)	0.44	0.77	0.21
C & E Loss (ft)	0.02	Cum SA (acres)	0.67	0.45	0.38

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	2006.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2005.88	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2005.88	Flow Area (sq ft)	26.75	25.13	9.99
E.G. Slope (ft/ft)	0.014746	Area (sq ft)	26.75	25.13	9.99
Q Total (cfs)	204.16	Flow (cfs)	81.17	105.40	17.58
Top Width (ft)	135.46	Top Width (ft)	59.17	26.24	50.05
Vel Total (ft/s)	3.30	Avg. Vel. (ft/s)	3.04	4.19	1.76
Max Chl Dpth (ft)	3.67	Hydr. Depth (ft)	0.45	0.96	0.20
Conv. Total (cfs)	1681.2	Conv. (cfs)	668.5	868.0	144.8
Length Wtd. (ft)	100.00	Wetted Per. (ft)	59.21	28.03	50.06
Min Ch El (ft)	2002.21	Shear (lb/sq ft)	0.42	0.83	0.18
Alpha	1.19	Stream Power (lb/ft s)	1.26	3.46	0.32
Frctn Loss (ft)	1.33	Cum Volume (acre-ft)	0.37	0.73	0.18
C & E Loss (ft)	0.02	Cum SA (acres)	0.60	0.44	0.36

CROSS SECTION
RIVER: Reach CL
REACH: Reach CL RS: 900

INPUT
Description:
Station Elevation Data num= 270

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2025.11	.01	2025.1	.62	2025	4.65	2024.3	6.46	2024.01	6.53	2024	9.28	2023.51
10.06	2023.39	12.69	2023	17.19	2022.33	17.88	2022.23	19.45	2022	20.25	2021.87	21.8	2021.64
24.53	2021.24	25.96	2021	27.17	2020.81	28.58	2020.59	32.17	2020	32.34	2019.97	35.91	2019.36
37.65	2019	40.8	2018.44	41.1	2018.38	42.61	2018.13	43.34	2018	45	2017.7	45.66	2017.59
45.69	2017.58	49.11	2017	53.37	2016.2	54.47	2016	55.57	2015.79	57.37	2015.45	59.79	2015
64.09	2014.25	64.72	2014.13	65.44	2014	66.15	2013.87	69.84	2013.21	70.94	2013	73.07	2012.68
74	2012.51	75.85	2012.16	76.7	2012	77.05	2011.93	79.14	2011.57	80.08	2011.39	80.45	2011.31
81.75	2011	82.1	2010.92	86.94	2010.06	87.33	2010	88.53	2009.79	92.39	2009.13	93.13	2009
93.92	2008.85	98.98	2008	101.72	2007.66	103.29	2007.43	104.23	2007.29	105.95	2007	106.03	2006.99
107.71	2006.79	108.61	2006.66	112.51	2006.08	113.11	2006	117.33	2005.42	120.66	2005.02	120.87	2005
122.94	2004.83	131.55	2004.09	133.11	2004	134.2	2003.91	134.47	2003.89	139.25	2003.67	144.26	2003.46
146.86	2003.3	147.81	2003.28	148.26	2003.25	148.81	2003.22	153.33	2003	153.52	2002.99	158.63	2002.76
167.38	2002.9	169.25	2002.9	171.85	2002.73	174.2	2002.41	174.81	2002.32	175.18	2002.17	175.56	2002
177.99	2001.02	178	2001.01	178.04	2001	178.08	2000.99	180.27	2000.21	181.26	2000.7	181.88	2001
182.93	2001.52	183.94	2002	184.66	2002.36	185.17	2002.6	186.55	2002.74	187.82	2002.93	188.32	2003
189.16	2003.02	190.93	2003.23	191.7	2003.3	192.66	2003.32	193.54	2003.27	196.59	2003.02	197.03	2003.01
197.44	2003	197.47	2003	198.74	2002.9	199.4	2002.23	199.62	2002	200.45	2001.15	200.59	2001
201.44	2000.08	201.52	2000	202.03	1999.41	202.42	1999	202.6	1998.78	202.74	1998.63	203.03	1998.96
203.09	1999	203.17	1999.13	204.06	2000	204.69	2000.88	204.79	2001	204.91	2001.16	205.59	2002
206.23	2002.62	206.38	2002.8	207.15	2002.85	207.67	2002.9	208.63	2003	214.65	2003.42	214.78	2003.43
214.81	2003.43	214.86	2003.44	215.1	2003.43	226.23	2003.14	227.71	2003	228.28	2002.96	228.62	2002.93
228.77	2002.95	228.84	2002.95	229.44	2002.92	229.81	2002.9	229.9	2002.89	229.98	2002.9	230.02	2002.87
230.2	2002.81	232.27	2002	232.52	2001.91	234.74	2001	234.75	2001	234.76	2000.99	236.01	2000.44
236.33	2000.3	237.59	2000.99	237.63	2001.01	237.79	2001.1	239.46	2002	240.54	2002.57	241.18	2002.92
241.33	2003	241.35	2003.01	241.98	2003.33	242.42	2003.41	242.63	2003.46	242.78	2003.5	244.59	2003.98
244.64	2004	244.81	2004.04	244.89	2004.06	247.12	2004.8	247.75	2005	250.75	2006	251.09	2006.11
252.49	2006.57	259.68	2006.68	260.82	2006.72	261.33	2006.74	262.41	2006.96	262.59	2007	262.93	2007.07
267.54	2008	268.81	2008.27	269.58	2008.4	272.71	2009	273.67	2009.14	278.53	2009.83	279.16	2009.93
279.51	2010	279.78	2010.04	284.59	2011	285.65	2011.17	288.15	2011.72	289.37	2012	291.22	2012.39
292.89	2012.74	293.19	2012.81	293.98	2013	293.99	2013	295.01	2013.23	298.29	2014	301.5	2014.75
302.12	2014.88	302.6	2015	304.48	2015.4	304.85	2015.49	306.86	2016	308.33	2016.43	310.43	2017
312.31	2017.52	313.47	2017.88	313.85	2018	314.02	2018.05	314.72	2018.2	315.63	2018.47	317.62	2019
318.17	2019.12	318.23	2019.14	321.41	2020	324.39	2020.77	325.2	2021	328.23	2021.79	328.9	2021.96
329.04	2022	333.13	2023	333.16	2023	337.01	2023.92	337.4	2024	341.68	2024.96	341.84	2025
342.16	2025.07	343.76	2025.43	345.49	2025.79	346.49	2026	346.68	2026.04	351.31	2026.97	351.43	2027
355.04	2027.78	356.09	2028	357.44	2028.28	357.95	2028.41	360.13	2029	362.26	2029.58	363.8	2030
363.92	2030.03	364.1	2030.07	367.73	2031	368.23	2031.11	370.25	2031.6	371.81	2031.99	371.87	2032
372.04	2032.04	376.22	2033	377.08	2033.21	379.86	2033.85	380.51	2034	383.06	2034.58	384.88	2035
385.76	2035.19	386.36	2035.33	389.16	2036	389.74	2036.14						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	192.66	.04	215.1	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
192.66	215.1	107.45	107.45	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2003.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2002.97	Reach Len. (ft)	107.45	107.45	107.45
Crit W.S. (ft)	2002.88	Flow Area (sq ft)	21.37	17.10	15.17
E.G. Slope (ft/ft)	0.021259	Area (sq ft)	21.37	17.10	15.17
Q Total (cfs)	296.55	Flow (cfs)	94.84	104.32	97.39
Top Width (ft)	57.89	Top Width (ft)	34.19	10.53	13.17
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	4.44	6.10	6.42
Max Chl Dpth (ft)	4.34	Hydr. Depth (ft)	0.62	1.62	1.15
Conv. Total (cfs)	2033.9	Conv. (cfs)	650.4	715.5	668.0
Length Wtd. (ft)	107.45	Wetted Per. (ft)	35.21	14.31	14.36
Min Ch El (ft)	1998.63	Shear (lb/sq ft)	0.81	1.59	1.40
Alpha	1.08	Stream Power (lb/ft s)	3.57	9.68	9.00
Frctn Loss (ft)	1.26	Cum Volume (acre-ft)	0.38	0.72	0.18
C & E Loss (ft)	0.07	Cum SA (acres)	0.56	0.41	0.31

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	2003.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2002.71	Reach Len. (ft)	107.45	107.45	107.45
Crit W.S. (ft)		Flow Area (sq ft)	15.06	14.90	12.24
E.G. Slope (ft/ft)	0.012115	Area (sq ft)	15.06	14.90	12.24
Q Total (cfs)	204.16	Flow (cfs)	69.83	74.46	59.87
Top Width (ft)	31.96	Top Width (ft)	14.24	7.38	10.34
Vel Total (ft/s)	4.84	Avg. Vel. (ft/s)	4.64	5.00	4.89
Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)	1.06	2.02	1.18
Conv. Total (cfs)	1854.8	Conv. (cfs)	634.5	676.5	543.9
Length Wtd. (ft)	107.45	Wetted Per. (ft)	15.23	11.02	11.42
Min Ch El (ft)	1998.63	Shear (lb/sq ft)	0.75	1.02	0.81
Alpha	1.00	Stream Power (lb/ft s)	3.47	5.11	3.96
Frctn Loss (ft)	0.98	Cum Volume (acre-ft)	0.32	0.69	0.15
C & E Loss (ft)	0.03	Cum SA (acres)	0.52	0.40	0.29

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 800

INPUT
Description:
Station Elevation Data num= 242

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2022.51	.53	2022.44	1.67	2022.29	4.33	2022	6.47	2021.79	10.76	2021.31	13	2021
14.73	2020.8	18.11	2020.35	21.12	2020	24	2019.64	26.12	2019.37	28.91	2019.03	29.11	2019
30.03	2018.88	34	2018.35	36.42	2018	36.82	2017.95	38.85	2017.62	42.86	2017	42.97	2016.99
48.2	2016.17	49.28	2016	50.09	2015.87	51.67	2015.62	51.89	2015.59	55.24	2015	56.19	2014.85
61.01	2014.08	61.33	2014.03	61.47	2014	61.74	2013.96	63.61	2013.66	66.26	2013.24	67.53	2013
68.05	2012.91	68.2	2012.88	72.91	2012.04	73.12	2012	75.52	2011.48	77.79	2011	79.03	2010.76
81.45	2010.27	82.64	2010	85.39	2009.42	86.72	2009.12	87.25	2009	89.4	2008.53	91.84	2008
95.83	2007.16	96.11	2007.1	96.55	2007	98.58	2006.57	98.98	2006.5	101.71	2006	103.11	2005.76
108.08	2005	109.28	2004.84	113.72	2004.27	114.36	2004.2	115.77	2004	115.78	2004	117.33	2003.83
124.69	2003.06	125.26	2003	127.54	2002.74	132.75	2002.28	136.69	2002	137.7	2001.94	139.86	2001.82
140.31	2001.79	146	2001.49	156.28	2001.18	157.89	2001.12	158.78	2001.12	165.48	2001.18	169.79	2001.21
172.71	2001.28	176.79	2001.29	184.37	2001.52	185.3	2001.54	186.09	2001.38	187.82	2001	189.18	2000.72
189.79	2000.59	190.13	2000.51	190.89	2000.56	193.52	2000.47	194.77	2000.41	195.01	2000.34	195.93	2000
197.06	1999.62	197.88	1999.34	198.08	1999.26	198.79	1999	199.53	1998.74	200.8	1998.25	201.41	1998
202.19	1997.72	202.44	1997.61	202.47	1997.62	203.36	1997.92	203.66	1998	203.86	1998.06	204.36	1998.19
204.65	1998.49	205.19	1999	205.82	1999.67	206.15	2000	206.29	2000.15	206.83	2000.74	207.31	2000.81
208.3	2001	208.39	2001	209.57	2001.16	210.77	2001.32	213.68	2001.54	214.97	2001.36	215.25	2001.35
215.39	2001.35	215.99	2001.37	216.18	2001.37	217.87	2001.43	218.29	2001.43	220.3	2001.44	220.55	2001.43
220.65	2001.43	221.47	2001.4	222.47	2001.35	223.01	2001.32	223.49	2001.31	224.75	2001.18	226.11	2001.15
227.9	2001.82	227.94	2001.81	228.24	2001.98	228.56	2002.15	229.54	2002.7	229.61	2002.74	230.04	2003
230.41	2003.23	231.59	2004	233.21	2004.98	233.25	2005	233.32	2005.04	233.33	2005.05	233.34	2005.05
234.63	2005.5	235.74	2005.89	235.83	2005.92	236.09	2006	236.39	2006.07	237.37	2006.32	238.02	2006.44
238.6	2006.65	239.71	2007	242.08	2007.6	243.56	2008	244.57	2008.25	244.85	2008.32	245.15	2008.38
245.3	2008.41	245.34	2008.41	246.87	2008.55	252.42	2008.96	253.01	2009	254.98	2009.33	257.12	2009.72
258.39	2010	258.74	2010.07	261.26	2010.46	264.4	2011	266.66	2011.36	268.41	2011.61	270.77	2012
271.49	2012.11	273.43	2012.56	275.69	2013	277.39	2013.52	279.04	2014	279.72	2014.21	280.72	2014.52
281.91	2014.82	283.09	2015	284.15	2015.17	285.96	2015.47	289.09	2016	293.71	2016.85	293.74	2016.86
294.47	2017	296.21	2017.32	297.21	2017.51	299.53	2018	303.42	2018.8	304.04	2018.93	304.39	2019
306.33	2019.39	308.7	2020	308.91	2020.05	310.52	2020.49	312.39	2021	314.36	2021.52	316.1	2022
317.24	2022.29	319.06	2022.83	319.66	2023	320.48	2023.25	323.01	2024	323.05	2024.02	325.66	2024.78
326.58	2025	327.87	2025.34	330.3	2026	331.29	2026.27	334.03	2026.79	335.19	2027	338.44	2027.76
339.48	2028	341.71	2028.56	342.82	2028.82	343.56	2029	344.92	2029.33	346.14	2029.6	347.63	2030
351.36	2030.91	351.7	2031	351.87	2031.05	352.26	2031.14	355.7	2032	357.6	2032.49	357.8	2032.54
359.74	2033	361.01	2033.33	363.65	2034	366.32	2034.7	366.41	2034.72	367.56	2035	369.2	2035.42
370.37	2035.68	372.01	2036	372.82	2036.17	376.75	2036.94						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	185.3	.04	213.68	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
185.3	213.68	92.55	92.55	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2002.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2001.89	Reach Len. (ft)	92.55	92.55	92.55
Crit W.S. (ft)		Flow Area (sq ft)	25.44	50.78	7.33
E.G. Slope (ft/ft)	0.007516	Area (sq ft)	25.44	50.78	7.33
Q Total (cfs)	310.68	Flow (cfs)	62.43	231.18	17.07
Top Width (ft)	89.50	Top Width (ft)	46.72	28.38	14.40
Vel Total (ft/s)	3.72	Avg. Vel. (ft/s)	2.45	4.55	2.33
Max Chl Dpth (ft)	4.28	Hydr. Depth (ft)	0.54	1.79	0.51
Conv. Total (cfs)	3583.7	Conv. (cfs)	720.2	2666.7	196.9
Length Wtd. (ft)	92.55	Wetted Per. (ft)	46.74	30.21	14.57
Min Ch El (ft)	1997.61	Shear (lb/sq ft)	0.26	0.79	0.24
Alpha	1.22	Stream Power (lb/ft s)	0.63	3.59	0.55
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.32	0.63	0.15
C & E Loss (ft)	0.02	Cum SA (acres)	0.46	0.36	0.27

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	2002.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2001.80	Reach Len. (ft)	92.55	92.55	92.55
Crit W.S. (ft)		Flow Area (sq ft)	21.46	48.32	6.09
E.G. Slope (ft/ft)	0.007589	Area (sq ft)	21.46	48.32	6.09
Q Total (cfs)	274.88	Flow (cfs)	48.29	213.85	12.73
Top Width (ft)	87.76	Top Width (ft)	45.20	28.38	14.18
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	2.25	4.43	2.09
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)	0.47	1.70	0.43
Conv. Total (cfs)	3155.4	Conv. (cfs)	554.4	2454.9	146.2
Length Wtd. (ft)	92.55	Wetted Per. (ft)	45.22	30.21	14.32
Min Ch El (ft)	1997.61	Shear (lb/sq ft)	0.22	0.76	0.20
Alpha	1.24	Stream Power (lb/ft s)	0.51	3.35	0.42
Frctn Loss (ft)	0.93	Cum Volume (acre-ft)	0.28	0.61	0.13
C & E Loss (ft)	0.02	Cum SA (acres)	0.44	0.36	0.26

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 700

INPUT
Description:
Station Elevation Data num= 251

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2020.88	.38	2020.85	8.47	2020.08	9.35	2020	11.67	2019.78	13.43	2019.61	16.3	2019.34
18.08	2019.16	18.55	2019.11	19.57	2019	22.54	2018.68	24.75	2018.43	27.93	2018.1	28.71	2018
30.47	2017.8	33.69	2017.4	36.35	2017.08	36.99	2017	38.68	2016.76	41.53	2016.35	43.57	2016
48.84	2015.15	49.42	2015.05	49.76	2015	51.66	2014.68	54.56	2014.22	55.95	2014	57.64	2013.73
61.19	2013.16	61.82	2013.06	62.15	2013	62.78	2012.89	65.96	2012.36	67.91	2012.04	68.03	2012
71.43	2011.35	73.21	2011	74.26	2010.78	77.38	2010.16	78.17	2010	80.3	2009.56	82.41	2009.14
83.05	2009	85.05	2008.57	87.61	2008	88.67	2007.77	89.32	2007.62	91.43	2007.16	92.13	2007
92.57	2006.89	93.97	2006.56	96.14	2006.05	96.4	2006	101.42	2005.02	101.47	2005.01	101.51	2005
102.09	2004.89	103.62	2004.6	104.56	2004.47	108.41	2004	108.47	2003.99	113.51	2003.41	115.66	2003.13
116.87	2003	121.8	2002.43	122.64	2002.33	125.05	2002	125.69	2001.92	127.61	2001.84	132.86	2001.58
137.64	2001.16	139.59	2001	139.95	2000.98	140.67	2000.93	147.08	2000.39	147.27	2000.37	152.15	2000.1
155.7	2000	155.71	2000	156.36	1999.98	157.92	1999.92	165.33	1999.68	168.14	1999.63	168.67	1999.63
169.53	1999.64	171.83	1999.68	177.93	1999.88	178.56	1999.99	178.65	2000	179.35	2000.14	184.33	2001
184.99	2001.12	186.02	2001.3	186.8	2001.13	187.33	2001	191.03	2000.2	191.44	2000.11	191.94	2000
192.47	1999.9	192.92	1999.8	194.06	1999.14	194.21	1999.04	194.27	1999	194.85	1998.69	195.85	1998.09
196.02	1998	196.25	1997.89	197.82	1997	197.87	1996.98	198.72	1996.49	198.81	1996.55	198.84	1996.57
199.05	1996.74	199.39	1997	199.53	1997.12	199.89	1997.39	200.01	1997.48	200.68	1998	201.51	1998.65
201.97	1999	202.86	1999.69	203.26	2000	203.48	2000.13	203.54	2000.33	211.22	2000.92	212.37	2001
215.44	2001.29	217.69	2001.49	217.88	2001.51	218.33	2001.58	221.02	2002	221.99	2002.15	224.82	2002.49
228.86	2003	230.92	2003.21	231.79	2003.3	232.66	2003.44	232.79	2003.47	233.35	2003.57	234.7	2003.83
235.53	2004	235.61	2004	236.13	2004.1	238.41	2004.56	240.7	2005	242.24	2005.29	243.66	2005.56
244.11	2005.73	244.88	2006	245.27	2006.14	245.88	2006.35	247.69	2007	248.59	2007.32	249.24	2007.53
250.35	2007.92	250.37	2007.95	250.83	2008.02	250.99	2008.04	251.67	2008.11	252.5	2008.21	254.38	2008.47
255	2008.56	255.55	2008.62	259.2	2009	261.81	2009.27	264.28	2009.45	264.75	2009.51	269	2009.98
269.14	2010	272.03	2010.36	275.14	2010.87	275.87	2011	278.03	2011.43	280.7	2012	282.72	2012.49
283.77	2012.75	284.81	2013	285.93	2013.25	287.15	2013.54	288.95	2014	290.5	2014.38	292.95	2015
294.18	2015.29	295.17	2015.56	296.85	2016	299.22	2016.68	300.29	2016.96	300.43	2017	301.21	2017.22
303.98	2018	304.31	2018.11	307.47	2018.96	307.64	2019	307.73	2019.02	311.96	2020	312.15	2020.05
315.78	2020.85	316.43	2021	317.74	2021.29	318.8	2021.56	320.45	2022	323.85	2022.88	324.31	2023
324.97	2023.16	327.93	2023.88	328.44	2024	329.07	2024.16	332.03	2024.86	332.6	2025	333.63	2025.26
334.01	2025.34	336.91	2026	340.2	2026.8	340.25	2026.81	341.32	2027	344.01	2027.62	345.64	2028
347.12	2028.37	349.91	2029	351.72	2029.41	351.94	2029.46	354.41	2030	355.41	2030.23	358.49	2030.93
358.78	2031	362.1	2031.72	362.73	2031.86	363.2	2032	364.25	2032.26	366.74	2032.87	367.29	2033
371.31	2033.99	371.35	2034	373.39	2034.51	375.34	2035	376.02	2035.18	379.68	2035.92	380.01	2036
380.03	2036	380.56	2036.11	381.84	2036.38	383.47	2036.69	384.67	2036.92	385.13	2037	387.36	2037.36
389.85	2037.79	396.64	2038.64	397.13	2038.69	399.82	2038.98	401.85	2039.19	403.16	2039.31		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	186.02	.04	203.54	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
186.02	203.54	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

			Left OB	Channel	Right OB
E.G. Elev (ft)	2001.23	Element			
Vel Head (ft)	0.44	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2000.79	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2000.74	Flow Area (sq ft)	31.51	29.49	1.39
E.G. Slope (ft/ft)	0.013335	Area (sq ft)	31.51	29.49	1.39
Q Total (cfs)	310.68	Flow (cfs)	129.74	178.38	2.56
Top Width (ft)	62.07	Top Width (ft)	40.81	15.25	6.01
Vel Total (ft/s)	4.98	Avg. Vel. (ft/s)	4.12	6.05	1.84
Max Chl Dpth (ft)	4.30	Hydr. Depth (ft)	0.77	1.93	0.23
Conv. Total (cfs)	2690.4	Conv. (cfs)	1123.5	1544.7	22.1
Length Wtd. (ft)	100.00	Wetted Per. (ft)	40.93	17.62	6.03
Min Ch El (ft)	1996.49	Shear (lb/sq ft)	0.64	1.39	0.19
Alpha	1.13	Stream Power (lb/ft s)	2.64	8.43	0.35
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	0.26	0.55	0.14
C & E Loss (ft)	0.00	Cum SA (acres)	0.37	0.32	0.25

CROSS SECTION OUTPUT Profile #POST (100 Yr)

			Left OB	Channel	Right OB
E.G. Elev (ft)	2001.12	Element			
Vel Head (ft)	0.44	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	2000.68	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	2000.66	Flow Area (sq ft)	27.05	27.82	0.80
E.G. Slope (ft/ft)	0.013785	Area (sq ft)	27.05	27.82	0.80
Q Total (cfs)	274.88	Flow (cfs)	105.76	167.88	1.24
Top Width (ft)	58.12	Top Width (ft)	38.84	14.73	4.55
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	3.91	6.04	1.56
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)	0.70	1.89	0.17
Conv. Total (cfs)	2341.2	Conv. (cfs)	900.7	1429.9	10.6
Length Wtd. (ft)	100.00	Wetted Per. (ft)	38.94	17.09	4.57
Min Ch El (ft)	1996.49	Shear (lb/sq ft)	0.60	1.40	0.15
Alpha	1.15	Stream Power (lb/ft s)	2.34	8.46	0.23
Frctn Loss (ft)	1.18	Cum Volume (acre-ft)	0.22	0.53	0.12
C & E Loss (ft)	0.00	Cum SA (acres)	0.36	0.31	0.24

CROSS SECTION
RIVER: Reach CL
REACH: Reach CL RS: 600
INPUT
Description:
Station Elevation Data num= 200

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2021.08	.6	2021.02	.78	2021	4.1	2020.65	9.17	2020.1
10.2	2020	12.13	2019.79	15.7	2019.46	17.1	2019.35	20.31	2019.1
20.94	2019.05	21.45	2019	22.62	2018.9	26.06	2018.54	31.2	2018
34.07	2017.74	35.23	2017.62	39.61	2017	41.17	2016.81	45.42	2016.45
50.07	2016.12	51.22	2016	55.97	2015.54	56.68	2015.47	59.38	2015.17
60.86	2015	60.96	2014.99	61.85	2014.91	67.93	2014.28	70.39	2014.01
70.45	2014	76.97	2013.26	79.28	2013	79.29	2013	80.52	2012.86
84.18	2012.35	86.58	2012	86.69	2011.98	90.99	2011.39	91.32	2011.35
93.77	2011	93.91	2010.98	97.86	2010.37	98.08	2010.33	100.28	2010
100.29	2010	101.1	2009.87	106.58	2009	107.16	2008.9	107.36	2008.87
109.72	2008.47	112.53	2008	114.59	2007.65	117.26	2007.27	117.81	2007.18
118.99	2007	120.9	2006.72	123.57	2006.34	125.91	2006	132.05	2005.19
133.55	2005	134.89	2004.83	135.76	2004.74	137.86	2004.55	144	2004.11
144.61	2004	148.36	2003.39	150.47	2003	150.56	2003	151.23	2002.89
151.36	2002.87	154.82	2002.4	157.71	2002	163.99	2001.28	164.78	2001.19
164.86	2001.18	165.06	2001.15	165.96	2001.02	166.11	2001	166.64	2000.92
168.22	2000.69	173.04	2000	175.45	1999.72	181.42	1999.16	183.47	1999.04
184.15	1999	184.79	1998.96	189.43	1998.79	199.24	1998.84	201.92	1998.7
202.28	1998.75	204.8	1998.77	207.1	1998.84	208.11	1998.27	208.4	1998.08
208.5	1998	209.09	1997.61	209.92	1997	210.19	1996.8	211.31	1996
211.61	1995.78	212.08	1995.45	212.72	1995.71	213.41	1996	214.41	1996.38
215.89	1997	216.93	1997.4	218.35	1998	219.74	1998.55	219.85	1998.59
221.17	1998.65	226.83	1998.82	227.89	1998.81	229.8	1998.78	234.14	1998.68
237.27	1998.78	238.41	1998.85	239.36	1998.92	240.29	1999	248.46	1999.75
250.44	1999.92	250.8	1999.97	250.89	1999.99	250.98	2000	253.21	2000.3
257.78	2001	259.08	2001.24	263.48	2002	264.08	2002.11	267.82	2002.71
270.12	2003	270.27	2003.02	273.11	2003.43	273.18	2003.44	277.49	2004
282.86	2004.87	283.59	2004.98	283.67	2005	283.82	2005.03	288.29	2006
292.36	2006.87	292.93	2007	293.82	2007.19	295.89	2007.62	297.35	2008
299.89	2008.64	300.59	2008.82	301.3	2009	303.65	2009.61	304.58	2009.85
305.11	2010	306.98	2010.53	308.69	2011	311.75	2011.86	312.29	2012
312.46	2012.05	315.06	2012.82	315.78	2013	317.39	2013.41	319.7	2014
321.9	2014.49	323.95	2015	326.91	2015.71	327.4	2015.81	328.01	2015.91
328.53	2016	328.7	2016.04	328.79	2016.06	333.81	2017	334.09	2017.07
335.59	2017.32	337.72	2017.73	339.19	2018	340.85	2018.33	344.45	2019
345.53	2019.24	350.39	2019.99	350.47	2020	352.87	2020.35	357.42	2021
360.07	2021.62	361.39	2021.9	361.96	2021.99	362	2022	362.56	2022.1
367.58	2023	367.87	2023.05	369.85	2023.41	373.44	2024	376.17	2024.54
377.38	2024.75	378.67	2025	381.26	2025.46	384	2026	386.29	2026.44
387.39	2026.69	388.9	2026.94	389.3	2027	392.5	2027.55	394.36	2027.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	207.1	.04	219.74	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
207.1	219.74	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	2000.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1999.57	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1999.57	Flow Area (sq ft)	19.49	31.42	18.49
E.G. Slope (ft/ft)	0.010684	Area (sq ft)	19.49	31.42	18.49
Q Total (cfs)	331.30	Flow (cfs)	64.03	203.92	63.35
Top Width (ft)	69.45	Top Width (ft)	30.05	12.64	26.76
Vel Total (ft/s)	4.77	Avg. Vel. (ft/s)	3.29	6.49	3.43
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)	0.65	2.49	0.69
Conv. Total (cfs)	3205.2	Conv. (cfs)	619.5	1972.8	612.9
Length Wtd. (ft)	100.00	Wetted Per. (ft)	30.09	14.29	26.81
Min Ch El (ft)	1995.45	Shear (lb/sq ft)	0.43	1.47	0.46
Alpha	1.33	Stream Power (lb/ft s)	1.42	9.51	1.58
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	0.20	0.48	0.12
C & E Loss (ft)	0.09	Cum SA (acres)	0.28	0.28	0.22

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	1999.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1999.49	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	1999.49	Flow Area (sq ft)	17.02	30.36	16.30
E.G. Slope (ft/ft)	0.010372	Area (sq ft)	17.02	30.36	16.30
Q Total (cfs)	292.93	Flow (cfs)	51.36	189.81	51.76
Top Width (ft)	67.65	Top Width (ft)	29.16	12.64	25.85
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)	3.02	6.25	3.18
Max Chl Dpth (ft)	4.04	Hydr. Depth (ft)	0.58	2.40	0.63
Conv. Total (cfs)	2876.3	Conv. (cfs)	504.3	1863.8	508.2
Length Wtd. (ft)	100.00	Wetted Per. (ft)	29.19	14.29	25.89
Min Ch El (ft)	1995.45	Shear (lb/sq ft)	0.38	1.38	0.41
Alpha	1.36	Stream Power (lb/ft s)	1.14	8.60	1.29
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	0.17	0.46	0.10
C & E Loss (ft)	0.08	Cum SA (acres)	0.28	0.28	0.21

CROSS SECTION
RIVER: Reach CL
REACH: Reach CL RS: 500
Station Elevation Data num= 293

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2022.89	.19	2022.85	.33	2022.82	2.46	2022.42	2.76	2022.38	2.91	2022.31	3.8	2022
5.89	2021.09	6.1	2021	7.69	2020.31	8.46	2020	8.47	2020	8.66	2019.93	8.92	2019.84
9.12	2019.78	9.6	2019.66	12	2019.09	12.02	2019.09	12.03	2019.08	12.07	2019.08	12.11	2019.07
12.37	2019.03	12.46	2019.01	12.51	2019.01	12.68	2019	12.77	2019	13.17	2018.99	13.64	2019
13.72	2019	16.04	2019.05	16.6	2019.05	17.91	2019	18.18	2018.99	18.54	2018.98	19.5	2018.97
19.92	2018.99	20.18	2019	20.65	2019.02	20.87	2019.04	22.94	2019.2	23.73	2019.24	25.83	2019.3
26.62	2019.32	27.98	2019.04	28.05	2019.03	28.25	2019	30.46	2018.58	30.49	2018.57	30.61	2018.54
30.62	2018.54	31.2	2018.21	31.58	2018	32.06	2017.71	32.82	2017.57	33.13	2017.46	34.25	2017.42
35.06	2017.56	35.21	2017.58	35.66	2017.67	36.35	2017.64	38.07	2017.13	38.48	2017	38.65	2016.96
39.3	2016.78	39.76	2016.69	43.28	2016.02	43.41	2016	44.08	2015.92	46.1	2015.57	48.33	2015.21
48.87	2015.11	49.56	2014.99	51.48	2014.66	51.71	2014.62	52.74	2014.45	54.81	2014.01	54.83	2014
54.84	2014	56.58	2013.59	57.58	2013.39	59.32	2012.99	60.96	2012.66	62.12	2012.42	64.21	2011.95
64.46	2011.89	66.18	2011.48	68.21	2011.01	68.28	2011	71.31	2010.25	72.36	2010	73.94	2009.6
75.71	2009.17	76.29	2009	79.9	2008.09	80.25	2008	81.07	2007.78	84.06	2007	84.12	2006.99
85.32	2006.66	85.56	2006.6	88.35	2006	88.87	2005.87	91.35	2005.25	92.47	2005	95.2	2004.32
95.88	2004.18	96.87	2004	99	2003.6	101.69	2003.1	102.13	2003	102.28	2002.96	103.81	2002.68
105.6	2002.33	107.14	2002	111.19	2001.22	112.24	2001	114.42	2000.56	116.12	2000.3	118.69	2000
123.92	1999.33	126.72	1999.02	126.84	1999	128.65	1998.84	133.74	1998.38	134.21	1998.34	135.18	1998.27
138.69	1998.22	138.72	1998.22	143.15	1998.17	144.93	1998.17	146.55	1998.16	147.49	1998.16	152.15	1998.1
152.69	1998.1	153.55	1998.12	155.44	1998.15	158.5	1998.07	160.17	1998	160.18	1998	161.38	1997.95
167.3	1997.73	169.81	1997.57	172.26	1997.39	176.58	1997.46	182.82	1997.51	186.67	1997.79	188.16	1997.82
194.5	1997.92	195.65	1997.93	196.41	1997.82	196.55	1997.82	196.56	1997.83	196.58	1997.82	197.12	1997.64
197.35	1997.58	199.34	1997	200.16	1996.77	202.79	1996	203.99	1995.66	204.94	1995.37	206.19	1995.71
207.15	1996	209.49	1996.66	209.93	1996.79	210.31	1996.91	210.47	1996.95	210.59	1997	210.63	1997.02
210.67	1997.04	210.93	1997.11	211.45	1997.13	214.14	1997.26	218.27	1997.57	226.04	1997.55	228.87	1997.57
229.92	1997.75	230.33	1997.81	231.24	1997.92	231.74	1998	233.03	1998.21	238.43	1998.94	238.83	1999
238.84	1999	238.94	1999.02	239.09	1999.06	241.82	1999.77	242.81	1999.96	242.98	2000	243.67	2000.13
244.56	2000.31	247.82	2001	248.86	2001.17	249.34	2001.27	251.13	2001.53	254.5	2002	258.56	2002.56
259.36	2002.7	260.58	2002.87	261.39	2002.99	261.5	2003	263.22	2003.31	266.32	2004	269.96	2004.76
270.29	2004.84	271.09	2005	271.69	2005.12	275.77	2006	276.66	2006.2	276.95	2006.26	277.14	2006.3
280.48	2007	282.52	2007.45	285.51	2008	288.23	2008.74	289.14	2009	290.46	2009.41	291.12	2009.61
291.98	2009.87	292.58	2010	293.71	2010.21	294.69	2010.39	298.26	2011	298.86	2011.09	301.31	2011.47
302.56	2011.66	303.11	2011.74	303.55	2011.81	303.84	2011.78	304.47	2011.74	305.02	2011.74	305.68	2011.85
308.63	2011.83	310.79	2011.83	311.93	2011.85	312.58	2011.97	312.68	2012	315.03	2012.57	315.99	2012.85
316.62	2013	316.64	2013.01	316.92	2013.03	317.18	2013.02	317.32	2013.01	317.46	2012.99	317.56	2012.96
317.78	2012.93	318.13	2012.86	320.05	2012.51	320.9	2012.65	322.85	2012.93	323.36	2013	324.45	2013.15
330.82	2014	333.72	2014.39	334.45	2014.48	338.22	2015	339.03	2015.11	344.4	2015.84	345.37	2016
348	2016.59	350.27	2017	351.79	2017.32	354.18	2017.97	354.37	2018	359.51	2018.84	360.56	2019
362.37	2019.26	366.81	2019.9	367.25	2019.97	367.51	2020	373.73	2020.91	373.8	2020.92	374.35	2021
374.68	2021.05	375.51	2021.18	376.25	2021.29	380.6	2022	384.08	2022.59	385.08	2022.76	386.56	2023
389.72	2023.5	392.79	2024	393.7	2024.14	395.64	2024.44	395.91	2024.49	398.8	2025	401.69	2025.48
404.21	2025.9	404.83	2026	406.57	2026.3	409.1	2026.67	411.53	2027	414.61	2027.48		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	194.5	.04	218.27	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
194.5	218.27	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	1998.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1998.66	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	1998.38	Flow Area (sq ft)	47.72	43.45	15.67
E.G. Slope (ft/ft)	0.005099	Area (sq ft)	47.72	43.45	15.67
Q Total (cfs)	331.30	Flow (cfs)	119.01	169.29	43.00
Top Width (ft)	105.78	Top Width (ft)	63.90	23.77	18.11
Vel Total (ft/s)	3.10	Avg. Vel. (ft/s)	2.49	3.90	2.74
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)	0.75	1.83	0.87
Conv. Total (cfs)	4639.7	Conv. (cfs)	1666.7	2370.8	602.2
Length Wtd. (ft)	200.00	Wetted Per. (ft)	63.95	24.40	18.19
Min Ch El (ft)	1995.37	Shear (lb/sq ft)	0.24	0.57	0.27
Alpha	1.14	Stream Power (lb/ft s)	0.59	2.21	0.75
Frctn Loss (ft)	1.51	Cum Volume (acre-ft)	0.12	0.39	0.08
C & E Loss (ft)	0.03	Cum SA (acres)	0.18	0.24	0.16

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	1998.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1998.57	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	1998.31	Flow Area (sq ft)	41.74	41.20	13.99
E.G. Slope (ft/ft)	0.005282	Area (sq ft)	41.74	41.20	13.99
Q Total (cfs)	292.93	Flow (cfs)	97.98	157.74	37.21
Top Width (ft)	104.04	Top Width (ft)	62.85	23.77	17.42
Vel Total (ft/s)	3.02	Avg. Vel. (ft/s)	2.35	3.83	2.66
Max Chl Dpth (ft)	3.20	Hydr. Depth (ft)	0.66	1.73	0.80
Conv. Total (cfs)	4030.5	Conv. (cfs)	1348.1	2170.4	512.0
Length Wtd. (ft)	200.00	Wetted Per. (ft)	62.90	24.40	17.49
Min Ch El (ft)	1995.37	Shear (lb/sq ft)	0.22	0.56	0.26
Alpha	1.16	Stream Power (lb/ft s)	0.51	2.13	0.70
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.11	0.38	0.07
C & E Loss (ft)	0.03	Cum SA (acres)	0.17	0.24	0.16

CROSS SECTION
RIVER: Reach CL
REACH: Reach CL RS: 300
INPUT
Station Elevation Data num= 204

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2022.62	2.73	2022.18	3.77	2022	3.94	2021.97	8.18	2021.5
10.73	2021.16	12.63	2021	14.44	2020.84	14.6	2020.82	21.67	2020
21.69	2020	22.33	2019.92	24.64	2019.57	28.42	2019	28.85	2018.93
31.73	2018.54	33.79	2018.23	34.86	2018.07	35.24	2018	35.65	2017.93
42.92	2017	42.94	2017	45.17	2016.72	45.74	2016.65	46.86	2016.53
51.56	2016	54.56	2015.63	56.92	2015.38	61.84	2015.02	62.04	2015
62.94	2014.89	64.46	2014.69	67.54	2014.33	69.63	2014.16	71.54	2014
76.71	2013.58	78.02	2013.45	78.17	2013.44	78.28	2013.43	78.68	2013.4
80.16	2013.32	83.86	2013	86.23	2013.02	86.49	2013	87.78	2012.93
87.81	2012.93	88	2012.92	88.03	2012.91	94.43	2012.46	97.88	2012.17
98.19	2012.16	98.29	2012.12	98.55	2012	99.48	2011.59	100.7	2011
101.16	2010.79	102.78	2010	102.95	2009.92	103.77	2009.54	104.69	2009.28
105.66	2009	108.07	2008.33	109.05	2008.03	109.19	2008	111.04	2007.45
112.76	2007	115.26	2006.35	116.61	2006	117.01	2005.9	120.12	2005.14
120.61	2005	121.54	2004.74	124.33	2004	126.08	2003.53	127.96	2003
131.47	2002.09	131.92	2002	132.34	2001.91	133.92	2001.59	136.79	2001
137.54	2000.84	137.85	2000.78	141.69	2000	143.58	1999.6	147.01	1999.14
148.36	1999	149.89	1998.82	154.34	1998.39	154.54	1998.38	157.79	1998.17
160.96	1998	164.55	1997.76	165.14	1997.73	165.33	1997.72	170.14	1997.49
174.47	1997.33	174.76	1997.31	175.1	1997.28	175.16	1997.28	175.23	1997.27
175.33	1997.27	177.57	1997.12	181.04	1997.17	181.92	1997.17	182.62	1997.15
183.76	1997.11	184.38	1997.08	184.62	1997.06	185.44	1997	185.73	1996.97
187.5	1996.76	194.05	1996	194.71	1995.92	195.67	1995.83	196.45	1995.76
198.48	1995.15	199.04	1995	199.51	1994.86	199.89	1994.76	200.34	1994.67
216.5	1994.67	217.37	1994.74	217.65	1994.82	218.03	1994.94	218.25	1995
219.53	1995.4	221.41	1996	221.49	1996.02	222.19	1996.25	222.23	1996.25
226.29	1996.28	228.04	1996.38	228.62	1996.41	233.96	1996.45	236.98	1996.46
242.56	1996.46	245.78	1996.39	248.81	1996.42	251.51	1996.54	256.95	1996.82
258.35	1996.85	266.33	1996.78	267.21	1996.81	269.51	1996.92	270.42	1996.96
271.01	1997	275.29	1997.31	278.91	1997.58	280.56	1997.69	281	1997.73
282.79	1997.87	284.71	1998	287.14	1998.2	292.22	1998.83	292.58	1998.89
293.13	1999	295.78	1999.52	298.31	2000	302.44	2000.81	303.44	2001
303.52	2001	309.58	2001.96	309.81	2002	310.02	2002.03	310.26	2002.07
315.33	2002.77	316.46	2003	320.06	2003.72	321.29	2004	322	2004.14
322.25	2004.2	324.43	2004.68	325.81	2005	326.05	2005.06	326.56	2005.18
327.07	2005.32	329.51	2006	333.46	2006.97	333.61	2007	333.7	2007.02
337.36	2007.8	337.98	2008	341.11	2008.76	342	2009	343.94	2009.52
345.82	2009.97	345.93	2010	348.48	2010.72	349.43	2011	350.8	2011.39
352.86	2012	355.58	2012.86	355.97	2012.98	356.05	2013	356.46	2013.1
358.31	2013.55	359.16	2013.78	360.18	2014	364.68	2015.09	366.99	2015.66
374.47	2017.12	375.28	2017.12	392.68	2018.44	417.57	2020.31		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	194.05	.04	222.19	.035

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
194.05	222.19	100.18	100.18	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	1997.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1996.78	Reach Len. (ft)	100.18	100.18	100.18
Crit W.S. (ft)	1996.78	Flow Area (sq ft)	2.59	50.40	11.26
E.G. Slope (ft/ft)	0.012289	Area (sq ft)	2.59	50.40	11.26
Q Total (cfs)	335.07	Flow (cfs)	6.46	303.20	25.41
Top Width (ft)	68.72	Top Width (ft)	6.68	28.14	33.90
Vel Total (ft/s)	5.22	Avg. Vel. (ft/s)	2.49	6.02	2.26
Max Chl Dpth (ft)	2.11	Hydr. Depth (ft)	0.39	1.79	0.33
Conv. Total (cfs)	3022.6	Conv. (cfs)	58.3	2735.1	229.2
Length Wtd. (ft)	100.18	Wetted Per. (ft)	6.73	28.54	33.91
Min Ch El (ft)	1994.67	Shear (lb/sq ft)	0.30	1.35	0.25
Alpha	1.22	Stream Power (lb/ft s)	0.74	8.15	0.57
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	0.01	0.18	0.02
C & E Loss (ft)	0.11	Cum SA (acres)	0.01	0.12	0.04

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	1997.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1996.70	Reach Len. (ft)	100.18	100.18	100.18
Crit W.S. (ft)	1996.70	Flow Area (sq ft)	2.08	48.13	8.60
E.G. Slope (ft/ft)	0.011831	Area (sq ft)	2.08	48.13	8.60
Q Total (cfs)	296.70	Flow (cfs)	4.73	275.56	16.41
Top Width (ft)	66.47	Top Width (ft)	5.99	28.14	32.34
Vel Total (ft/s)	5.05	Avg. Vel. (ft/s)	2.27	5.73	1.91
Max Chl Dpth (ft)	2.03	Hydr. Depth (ft)	0.35	1.71	0.27
Conv. Total (cfs)	2727.8	Conv. (cfs)	43.5	2533.4	150.8
Length Wtd. (ft)	100.18	Wetted Per. (ft)	6.03	28.54	32.35
Min Ch El (ft)	1994.67	Shear (lb/sq ft)	0.26	1.25	0.20
Alpha	1.21	Stream Power (lb/ft s)	0.58	7.13	0.37
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	0.01	0.17	0.01
C & E Loss (ft)	0.11	Cum SA (acres)	0.01	0.12	0.04

CROSS SECTION

RIVER: Reach CL
REACH: Reach CL RS: 200

INPUT
Description:
Station Elevation Data num= 87

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	2020.79	.69	2020.73	6.44	2020.3	54.86	2014.89	67.6	2013.48
74.49	2012.71	74.86	2012.67	86.67	2010.93	88.04	2010.73	90.86	2010.27
96.61	2008.97	102.23	2007.7	103.8	2007.34	111.89	2004.82	115.27	2003.83
115.65	2003.58	115.66	2003.58	115.81	2003.55	117.39	2003.24	117.42	2003.23
117.44	2003.23	117.46	2003.22	118.46	2002.86	118.69	2002.82	120.78	2002.56
121.25	2002.5	162.13	1996.49	168.63	1995.53	168.68	1995.51	168.82	1995.49
169.04	1995.47	169.15	1995.44	171.6	1994.67	249.64	1994.67	250.13	1994.79
250.8	1995	253.73	1995.8	254.42	1996	254.48	1996.02	254.49	1996.02
254.51	1996.01	261.87	1996.72	265.15	1996.99	265.28	1997	266.77	1997.11
269.21	1997.34	276.01	1997.97	276.26	1998	277.9	1998.16	279.03	1998.27
279.21	1998.29	279.36	1998.31	284.9	1998.87	286.2	1999	290.86	1999.5
292.24	1999.65	294.4	1999.98	294.42	1999.98	294.54	2000	294.92	2000.44
298.68	2003.32	305.87	2004.17	310.56	2004.19	319.94	2004.25	320.75	2004.26
323.76	2004.29	328.3	2004.36	332.35	2004.35	335.48	2004.36	339.94	2004.36
341.86	2004.34	348.69	2004.4	353.84	2004.42	354.51	2004.43	354.69	2004.44
358.27	2004.82	358.89	2004.9	368.36	2006.11	374.28	2006.88	382.12	2008.27
400.6	2013.09	400.73	2013.13	401.59	2013.27	410.22	2015.02	413.9	2015.9
414.33	2016	417.38	2016.2						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	171.6	.04	249.64	.035

Bank Sta: Left	Right	Coeff Contr.	Expan.
171.6	249.64	.1	.3

CROSS SECTION OUTPUT Profile #PRE (100 Yr)

E.G. Elev (ft)	1996.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1996.00	Reach Len. (ft)			
Crit W.S. (ft)	1995.49	Flow Area (sq ft)	3.33	103.79	3.19
E.G. Slope (ft/ft)	0.004761	Area (sq ft)	3.33	103.79	3.19
Q Total (cfs)	335.07	Flow (cfs)	6.37	321.74	6.96
Top Width (ft)	88.97	Top Width (ft)	6.15	78.04	4.78
Vel Total (ft/s)	3.04	Avg. Vel. (ft/s)	1.91	3.10	2.18
Max Chl Dpth (ft)	1.33	Hydr. Depth (ft)	0.54	1.33	0.67
Conv. Total (cfs)	4856.0	Conv. (cfs)	92.3	4662.8	100.9
Length Wtd. (ft)		Wetted Per. (ft)	6.32	78.04	4.96
Min Ch El (ft)	1994.67	Shear (lb/sq ft)	0.16	0.40	0.19
Alpha	1.02	Stream Power (lb/ft s)	0.30	1.23	0.42
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION OUTPUT Profile #POST (100 Yr)

E.G. Elev (ft)	1996.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.035	0.040	0.035
W.S. Elev (ft)	1996.00	Reach Len. (ft)			
Crit W.S. (ft)	1995.43	Flow Area (sq ft)	3.33	103.79	3.19
E.G. Slope (ft/ft)	0.003733	Area (sq ft)	3.33	103.79	3.19
Q Total (cfs)	296.70	Flow (cfs)	5.64	284.90	6.16
Top Width (ft)	88.97	Top Width (ft)	6.15	78.04	4.78
Vel Total (ft/s)	2.69	Avg. Vel. (ft/s)	1.69	2.74	1.93
Max Chl Dpth (ft)	1.33	Hydr. Depth (ft)	0.54	1.33	0.67
Conv. Total (cfs)	4856.0	Conv. (cfs)	92.3	4662.8	100.9
Length Wtd. (ft)		Wetted Per. (ft)	6.32	78.04	4.96
Min Ch El (ft)	1994.67	Shear (lb/sq ft)	0.12	0.31	0.15
Alpha	1.02	Stream Power (lb/ft s)	0.21	0.85	0.29
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES
River:Reach CL

Reach	River Sta.	n1	n2	n3
Reach CL	1190.35	.035	.04	.035
Reach CL	1100	.035	.04	.035
Reach CL	1000	.035	.04	.035
Reach CL	900	.035	.04	.035
Reach CL	800	.035	.04	.035
Reach CL	700	.035	.04	.035
Reach CL	600	.035	.04	.035
Reach CL	500	.035	.04	.035
Reach CL	300	.035	.04	.035
Reach CL	200	.035	.04	.035

SUMMARY OF REACH LENGTHS
River: Reach CL

Reach	River Sta.	Left	Channel	Right
Reach CL	1190.35	90.14	90.14	90.14
Reach CL	1100	100.03	100.03	100.03
Reach CL	1000	100	100	100
Reach CL	900	107.45	107.45	107.45
Reach CL	800	92.55	92.55	92.55
Reach CL	700	100	100	100
Reach CL	600	100	100	100
Reach CL	500	200	200	200
Reach CL	300	100.18	100.18	100.18
Reach CL	200			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Reach CL

Reach	River Sta.	Contr.	Expan.
Reach CL	1190.35	.1	.3
Reach CL	1100	.1	.3
Reach CL	1000	.1	.3
Reach CL	900	.1	.3
Reach CL	800	.1	.3
Reach CL	700	.1	.3
Reach CL	600	.1	.3
Reach CL	500	.1	.3
Reach CL	300	.1	.3
Reach CL	200	.1	.3

SECTION F:
Waters of the US Summary

The following section contains the summary of a report prepared by ECS Mid-Atlantic, LLC on March 7, 2022. The entire report with supporting data is available on request. The ECS report was submitted to the US Army Corps of Engineers (ACOE), using the new "SPGP Preliminary Screening Process" in July 2022; however, no information or determination has been received. A final determination by the US Army Corps of Engineers (ACOE), the Virginia Department of Environmental Quality (DEQ) or the Virginia Marine Resources Commission (VMRC) will be required.

WATERS OF THE U.S. REPORT

GLADE ROAD PROPERTY

1000 GLADE ROAD
BLACKSBURG, VIRGINIA 24060

ECS PROJECT NO. 47:13856

FOR: CARY HOPPER

MARCH 7, 2022

March 7, 2022

Mr. Cary Hopper
Cary Hopper
707 South Main Street
Blacksburg, Virginia 24060

ECS Project No. 47:13856

Reference: Waters of the U.S. Report, Glade Road Property, 1000 Glade Road, Blacksburg, Montgomery County, Virginia

Dear Mr. Hopper:

ECS Mid-Atlantic, LLC (ECS) is pleased to provide you with the results of our Waters of the U.S. (WOUS) Delineation Report for the referenced site. ECS' services were provided in general accordance with ECS Proposal No. 47:21825-EP authorized on January 19, 2022 and generally meet the requirements of the 1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0, dated April 2012.

If there are questions regarding this report, or a need for further information, please contact the undersigned.

Sincerely,

ECS Mid-Atlantic, LLC

Steven Hay
Project Manager
shay@ecslimited.com
540-362-2000

Garnett B. Williams, C.P.G.
Principal Geologist
gwilliams@ecslimited.com
703-471-8400

1.0 INTRODUCTION

This report presents the findings of a wetland and stream study conducted by ECS Mid-Atlantic, LLC (ECS) for Cary Hopper at the tract referred to as the Glade Road Property located at 1000 Glade Road, Blacksburg, Montgomery County, Virginia (Latitude: 37.239018693404084 N, Longitude: -80.44007671820754 W); the site is further identified by the Montgomery County Online GIS website as Parcel Identification Numbers (PINs) 011232, 015305, 011210, and 150188. The site consists of four parcels totaling approximately 45-acres, as shown on the Site Location Map (Appendix I). The site is open pastoral farm land with forested areas.

ECS conducted the wetland and stream delineation on February 17, 2022. The purpose of this study was to identify and delineate potentially jurisdictional Waters of the U.S. (WOUS) within the proposed project site. In summary, ECS observed and delineated features that, in our professional opinion, meet jurisdictional parameters of wetland and stream resources.

2.0 METHODOLOGY

This wetland delineation is based on ECS's professional judgment and application of the technical criteria presented in the 1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual, and on the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region, Version 2.0, dated April 2012. Wetland boundaries were delineated using the routine onsite determination method described in the USACE Manual and Regional Supplement, in conjunction with the Eastern Mountains and Piedmont 2020 Regional Wetland Plant List, and the USDA Soil Survey. Field work was completed on February 17, 2022 by Steven Hay and Justin M. Hughes.

ECS completed the following tasks to identify and delineate potentially jurisdictional wetland boundaries onsite:

Desktop Review: ECS wetland scientists reviewed the U.S. Geological Survey (USGS) topographic map, U.S. Department of Agriculture Natural Resource Conservation Service (USDA-NRCS) Soil Survey of Montgomery County, Virginia, U.S. Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI) maps, Federal Emergency Management Agency (FEMA) floodplain maps, and available aerial photographs to identify potentially jurisdictional Waters of the U.S. (i.e., streams, wetlands, natural ponds, lakes). Please reference Appendix I for the above-mentioned maps.

Field Investigation: ECS performed onsite wetland delineations as described above. First, site hydrology was observed and the plant community within the data plot was characterized. The dominant plant species within each community were then identified, and it was determined whether or not hydrophytic (wetland) plants dominated the plant community. The USFWS has defined the following wetland plant indicator categories:

Obligate wetland (OBL) – has >99% probability of occurring in wetlands
Facultative wetland (FACW) – has 66% to 99% chance of occurring in wetlands
Facultative (FAC) – has 33% to 66% chance of occurring in wetlands
Facultative upland (FACU) – has 1 to 33% chance of occurring in wetlands
Upland (UPL) – has <1% chance of occurring in wetlands
No Indicator (NI) – no wetland indicator for the specified species

Plants identified as OBL, FACW, or FAC are considered wetland plants (or hydrophytes) by USACE.

In areas determined to have hydrophytic vegetation and potential wetland hydrology, an approximately 16-20 inch soil test hole was completed with a hand auger to determine if hydric soils were present. The soil boring was also inspected to determine if indicators of wetland hydrology (inundation, soil saturation, etc.) were present.

Once an area is determined to be a wetland, further testing was performed to locate the wetland/ upland (non-wetland) boundary. A second test hole was completed in the upland area to document non-wetland conditions. Wetland boundaries were marked with consecutively numbered surveyor's ribbon flags. The wetland flags were surveyed as part of this assessment using a sub-meter accuracy GPS unit.

Data forms specified in the Regional Supplement were completed for each wetland and non-wetland test hole location, referred to as data points. The data forms recorded the vegetation, soils, and hydrology observations used in making the wetland determinations. ECS did identify areas during the site reconnaissance which, in our professional opinion, would be considered jurisdictional wetlands by the USACE.

2.1 Methodology for Delineating Streams

During the field evaluation for wetlands, ECS observed the site for streams that would potentially be considered jurisdictional by state and federal regulatory agencies. ECS used field indicators such as the presence of an ordinary high water mark (OHWM) and continuous bed and banks to delineate stream channels and also observed characteristics such as flow, substrate composition, presence/absence of defined bed and banks, origin of hydrologic source, presence/absence of vegetation in the stream channel, and composition and relative abundance of resident benthic macroinvertebrates to classify onsite streams into three stream types: ephemeral, intermittent, and perennial.

Streams located onsite are depicted on the Waters of the U.S. Delineation Map (Appendix V). The individual stream lengths and classifications are summarized on Table 1. Photographs of the streams are presented in Appendix IV.

3.0 FINDINGS

3.1 Desktop Review

The USGS Blacksburg, VA (2019) quadrangle map shows elevation ranges from approximately 2,110 feet above mean sea level (MSL) on the southwestern portion of the study area and approximately 2,070 feet above MSL on the northeastern portion of the study area, decreasing in elevation to approximately 2,015 feet above MSL on the central portion of the study area. The topographic map depicts two intermittent streams on the eastern portion of the study area that merge together on the central portion of the study area. The site drains to an unnamed tributary of Toms Creek and is located within the Upper New watershed, identified as Hydrologic Unit Code (HUC) 05050001. The NWI map depicts one R4SBC (riverine, intermittent, streambed, seasonally flooded) system on the central and eastern portions of the study area, one PUBHh (palustrine, unconsolidated bottom, permanently flooded, diked/impounded) system on the central portion of the study area, and one PEM1Ch (palustrine, emergent, persistent, seasonally flooded, diked/impounded) system on the western portion of the study area. According to FEMA (FIRMs 51121C0127C and 51121C0131C, dated September 25, 2009), the site is not mapped within the 100-year floodplain.

The weather at the time of the site reconnaissance was 59 degrees Fahrenheit and overcast. According to the National Oceanic & Atmospheric (NOAA) Blacksburg 1.6 W, VA US Station (US1VAMN0011), the last precipitation event prior to the site reconnaissance was on February 14, 2022, and only trace precipitation was recorded. According to the USACE Antecedent Precipitation Tool (APT), the 30-day rolling rainfall average was drier than the normal range for this location and time of year (Appendix II).

3.2 Site Soils

A review of the USDA Soil Survey for the project site identified seven mapping units within the site boundaries. These soil mapping units are:

- Duffield-Ernest complex, 2 to 7 percent slopes (11B)
- Frederick and Vertrees silt loams, 2 to 7 percent slopes (12B)
- Frederick and Vertrees silt loams, 7 to 15 percent slopes (12C)
- Frederick and Vertrees gravelly silt loams, 15 to 25 percent slopes (13D)
- Groseclose and Poplimento soils, 2 to 7 percent slopes (16B)
- Groseclose and Poplimento soils, 15 to 25 percent slopes
- Udorthents and Urban land (29)

Units 11B and 29 are classified as hydric by the NRCS.

3.3 Waters of the U.S.

Five potentially jurisdictional wetland areas totaling 0.67 acres and two potentially jurisdictional streams totaling 2,056 linear feet were identified and delineated within the study area. The size and USFWS Cowardin classifications are summarized below (Table 1) and the locations are illustrated on the Waters of the U.S. Delineation Map (Appendix V).

It should be noted that the field delineated wetlands and streams differ from those depicted on the USGS topographic map and the NWI wetland map.

Hydrologic features within the study area are governed primarily by topography assurface water flow on the site drains generally towards the onsite streams and wetlands located in low-lying areas, and appears to be influenced by karst geology. Stream A is driven by storm water input from the adjacent roadway and flows into the site before the stream loses its morphology as the hydrology flows underground. Wetland B appears to have been a man-made BMP constructed some time ago and appears to have normalized over time. This area is considered naturally problematic and conclusions regarding its jurisdiction will be subject to further review by USACE. Additionally, a more recently-constructed man-made BMP is located on the northeastern portion of the property. The BMP receives hydrologic input from Stream B during storm events and ECS does not considered it to be jurisdictional.

Table 1: WOUS Summary Table

WOUS	Cowardin Classification	Onsite Linear Feet (LF)	Onsite Acreage (AC)	Onsite Square Footage (Sq. Ft.)
Stream A	R6	408		
Stream B	R6	557		
	R4	650		
	R3	441		
Wetland B	PEM		0.25	10,777
Wetland D	PEM		0.04	1,861
Wetland E	PEM		0.02	1,077
Wetland F	PEM		0.33	14,224
Wetland BB	PEM		0.03	1,575

4.0 REGULATORY DISCUSSION

The WOUS are regulated by Sections 401 and 404 of the Clean Water Act. State and Federal law dictates that any disturbance to WOUS must be permitted through the appropriate agencies.

Upon your request, we will contact the USACE to schedule a field meeting to conduct a wetlands and Waters boundary confirmation and preliminary jurisdictional determination. This process takes an average of three to six months depending on the availability of USACE personnel. If any potential impacts are proposed, we can assist you with permitting options and support to complete the process. In the interim, we recommend further review of state and federal agency records pertaining to Section 7 (Federal Endangered Species Act) and Section 106 (National Historic Preservation Act). These reviews will generally be required to verify compliance with either the Nationwide Permit (NWP) or General Permit conditions and early coordination may help prevent potential permitting delays.

If jurisdictional wetlands and streams are present at the site, planned land disturbance in these areas would likely require a permit from the U.S. Army Corps of Engineers and/or the Virginia Department of Environmental Quality (VDEQ). The Virginia Water Protection Program (VWP) serves as Virginia's Section 401 Water Quality Certification program for Federal Section 404 permits issued under the authority of the Clean Water Act. For those projects impacting less than 0.1-acre of non-tidal wetlands and less than 300 linear feet of stream bed, a Nationwide permit from the USACE can typically be issued for certain commercial, transportation, agricultural and utility-related impacts for which DEQ Section 401 Water Quality Certifications have been granted.

VWP General Permits can also be used for permanent or temporary impacts in non-tidal surface Waters (i.e., streams) and wetlands. There are four General Permits available. General Permit WP1 can be used for impacts not exceeding one-half acre of non-tidal surface Waters, including up to 300 linear feet (lf) of non-tidal stream channel. WP2 is applicable to "Facilities and Activities of Utilities" impacting up to 1,500 lf of non-tidal stream and up to one acre of non-tidal wetlands. WP3 is for linear transportation projects impacting up to two acres of non-tidal wetlands and up to 1,500 lf of stream bed. WP4 is for impacts from "Development and Certain Mining Activities" and authorizes impacts up to two acres in wetlands and 1,500 lf of non-tidal stream bed. For activities exceeding the maximum allowable disturbances (two acres and 1,500 lf), a VWP Individual Permit may be required.

The USACE-Norfolk District and the VDEQ have also implemented the State Programmatic General Permit (17-SPGP-01) program to further streamline the permit process and avoid duplication of agency review; this program replaces certain Nationwide Permits. The 17-SPGP-01 authorizes discharge of dredged or fill material impacting up to one acre of non-tidal wetlands and 2,000 lf of non-tidal stream bed for certain residential, commercial and institutional developments and up to 1/3 acre of non-tidal Waters for linear transportation projects. If the project does not qualify for 17-SPGP-01, or there are unresolved resource issues (e.g., endangered species impact, historic resources), a separate Individual Permit from the Corps will likely be required.

5.0 CONCLUSIONS

Five potentially jurisdictional wetland areas totaling 0.67 acres and two potentially jurisdictional streams totaling 2,056 linear feet were identified and delineated within the study area. The size and USFWS Cowardin classifications are summarized below (Table 1) and the locations are illustrated on the Waters of the U.S. Delineation Map (Appendix V).

The flagged WOUS boundaries may be subject to change during the jurisdictional determination meeting with the USACE. Therefore, ECS cannot guarantee that field conditions and/or WOUS boundaries will not change over time. It should be noted that the site appears to be influenced by karst geology. Additional man-made BMPs are present along the northeastern and central portions of the site. Conclusions regarding the jurisdiction of these areas will be subject to further review by USACE.

1 - Stream A (R6)

2 - Stream B (R6)

3 - Stream B (R3)

4 - Stream B (R4)

5 - Stream B at BMP

6 - Man-made BMP

7 - View of UDP-1

8 - View of UDP-2

9 - View of WDP-4

10 - View of UDP-3

11 - View of WDP-5

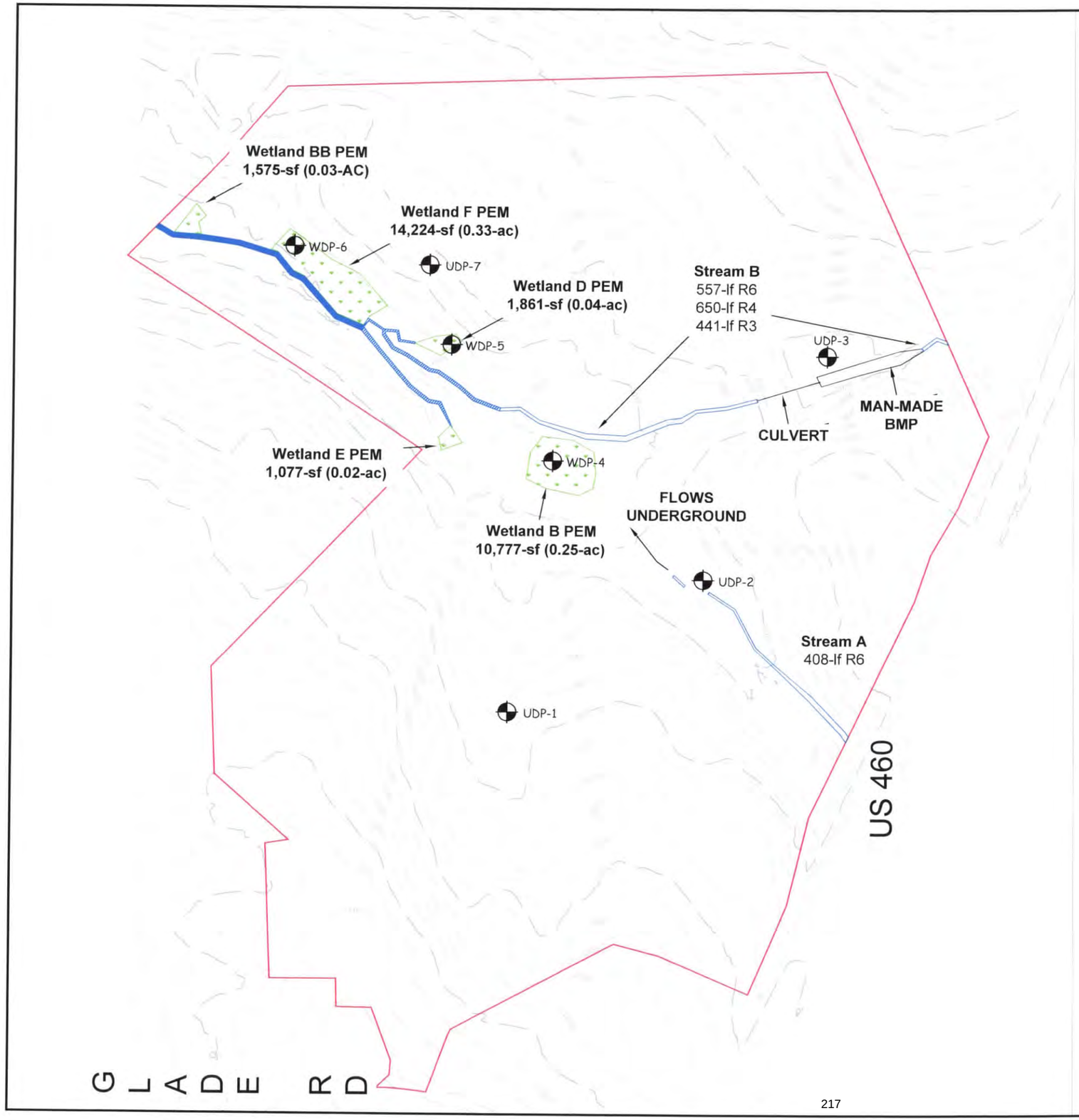
12 - View of WDP-6

13 - View of UDP-7

14 - Wetland B (PEM)

15 - Wetland D (PEM)

16 - Wetland E (PEM)



LEGEND

- PERENNIAL STREAM CHANNEL (R3)
- INTERMITTENT STREAM CHANNEL (R4)
- EPHEMERAL STREAM CHANNEL (R6)
- PALUSTRINE EMERGENT WETLAND (PEM)
- DP-# APPROXIMATE WETLAND DATAPOINT LOCATION
- STUDY AREA
- MAN-MADE BMP

*WATER FEATURES WERE DELINEATED BY ECS ON FEBRUARY 17, 2022 AND LOCATED USING A SUB-METER ACCURACY GPS UNIT.

**WATER FEATURES DEPICTED HEREIN SHOULD BE CONSIDERED PRELIMINARY UNTIL CONFIRMED BY THE U.S. ARMY CORPS OF ENGINEERS.

N
W E
S

SCALE (IN FEET)
100 200
200 0

GLADE ROAD PROPERTY
1000 GLADE ROAD
BLACKSBURG, VIRGINIA

ECS

WATERS OF THE U.S. DELINEATION MAP
CARY HOPPER

ECS REVISIONS

ENGINEER	DRAFTING
AMM	JMH

SCALE: AS SHOWN
PROJECT NO.: 47:13438-A
SHEET: 1 OF 1
DATE: FEBRUARY 2022