TECHNICAL MEMORANDUM

TO: Vermont River Management Program

FROM: Milone & MacBroom, Inc.

DATE: September 18, 2012

RE: **Woodford Packard Floodplain Re-Connection Alternatives Analysis**
Bennington, Vermont
MMI #2919-15

INTRODUCTION:

An alternatives analysis was conducted to explore re-connection of historic floodplain that has been filled at the Woodford – Packard (i.e., Capella) site along the Roaring Branch in Bennington, Vermont. The primary objective is to decrease flood depths and velocities to reduce local flood and erosion risks.

The project site is located north of VT Route 9 and west of the Route 9 Bridge (Figure 1). The watershed area at the project site is 41 square miles. The Roaring Branch, a highly dynamic channel located on an historic alluvial fan that is prone to flooding, flows west along the northern border of the project site. A grass-covered fill pile exists on the Woodford – Packard property immediately adjacent to VT Route 9. Survey indicates that approximately 58,000 cubic yards of material have been placed on the historic floodplain. Varying densities of trees, shrubs, and briars are located around the fill pile. The project area consists of undulating topography with existing berms and historic channels occupying the floodplain area. The fill at the Woodford – Packard site and floodplain berms have disconnected the channel from its floodplain that reduces the amount of flood storage available and increases flood risks.

Survey was performed at the Woodford – Packard site to expand an existing HEC-RAS hydraulic model for this study. A series of alternatives were investigated in the updated model to understand the benefits of floodplain re-connection along this section of the Roaring Branch. Alternatives were explored to evaluate a range of floodplain re-connection options at the Woodford – Packard site and two downstream properties that included three levels of fill removal. The proposed floodplain adjacent to the channel was set at an elevation just below the peak flood water surface elevation of the 2-year flood (Figure 2). Past observations and floodplain restoration experience on the Roaring Branch indicates that this is the level where most floodplains activate during high water, sediment transport, debris jamming, or ice jamming. The proposed floodplain slopes up 1% to the edge of the Vermont Route 9 right-of-way.

A brief description of each alternative is provided below, along with a summary of results comparing existing and proposed flood water surface elevations and velocities. A conceptual design of each of the alternatives accompanies this memorandum. An alternatives matrix (Table 1) has been prepared for direct comparison of the alternatives. Detailed hydraulic modeling results have been provided as an attachment to this memorandum.

Figure 1: Woodford-Packard Project Site

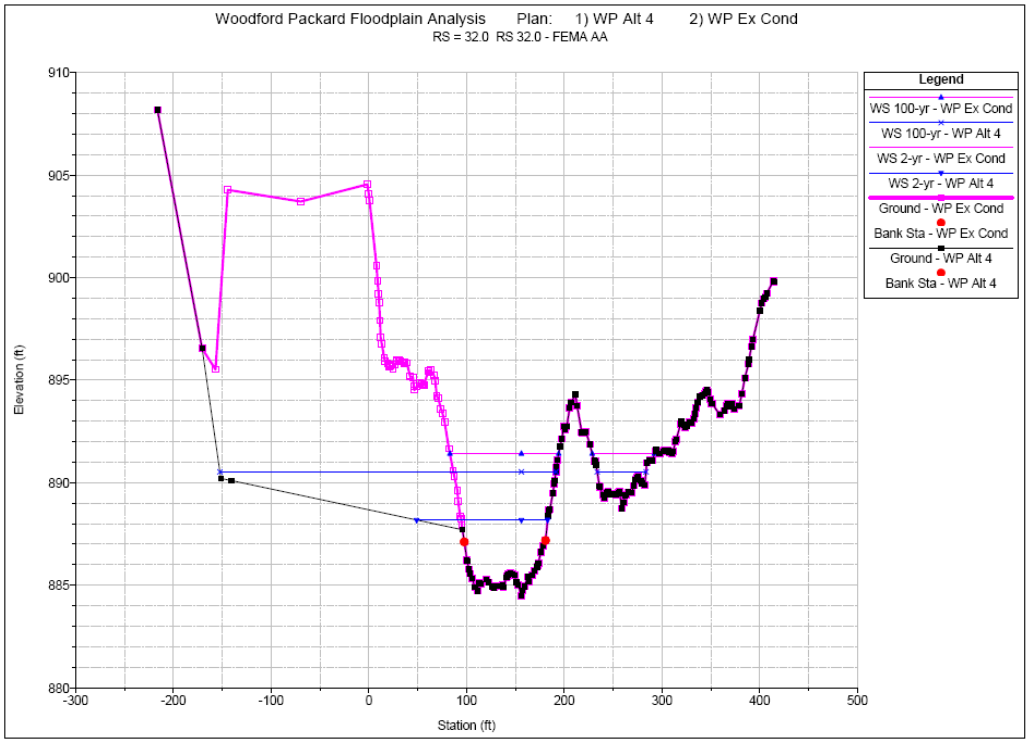


Figure 2: HEC-RAS Cross Section Showing Typical Floodplain Re-Connection Alternative

Table 1
Alternative Matrix

ID	Alternative	Max Change in Water Surface Elevation (ft)	Max Change in Flow Velocity (ft/s)	Max Change in Flow Area (SF)	Max Change in Top Width (ft)	Re-connected Floodplain Area (AC)	Additional Storage Volume (CY) during Q100	Volume of Material Excavated (CY)	Reduce Flood and Erosion Risks	Constructability	Permitting	Ballpark Excavation Cost Range
1	No Action (Existing Conditions). Limited floodplain in area due to filling and channel incision.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	+	+	$0
2	Partial removal of fill at the Woodford-Packard site to re-connect part of hisotric floodplain. Downstream portion of fill pile remains at to direct flow back into channel.	-0.9	-1.4	+309	+208	2.5	3,650	41,975	o	+	+	$272,000 to $420,000
3	Full removal of fill pile at the Woodford-Packard site, with berm created at downstream end of re-connected floodplain directing flow back into channel.	-0.9	-5.7	+1,234	+318	3.7	9,175	61,425	+	o	+	$400,000 to $614,000
4	Full removal of fill at the Woodford-Packard site in addition to removal of existing berms on adjacent parcel downstream for re-connection of all local historic floodplain. New berm created to direct flow back into channel at downstream end to protect existing infrastructure.	-0.9	-2.2	+480	+273	14.4	18,500	149,400	+	o	+	$970,000 to $1,494,000

LEGEND: + good; o moderate; - poor

ALTERNATIVE 1:

Alternative 1 is the "Do Nothing" alternative, where existing conditions are evaluated to understand current flood patterns and provide a baseline for comparison to other alternatives. No clearing, excavation, or floodplain re-connection takes place as part of this alternative.

ALTERNATIVE 2:

Alternative 2 is removal of a portion of the existing fill pile located on the Woodford – Packard site. The area between the existing fill pile and the river would also be lowered to provide a connection to the floodplain. The re-connected floodplain would be accessed during the 2-year flood. Under this alternative, approximately half of the area occupied by the existing fill pile would be removed, and the portion of the fill pile remaining would be shaped to direct floodplain flow back into the main channel at the downstream part of the site. The average length of re-connected floodplain in the direction of flow is 350 feet. This alternative would re-connect approximately 2.5 acres of floodplain. Approximately 42,000 cubic yards of material that would be generated and need to be properly disposed. Local knowledge of the site indicates that concrete, construction waste, and household garbage likely exist in the fill pile that may include hazardous materials. Special arrangements may be required to legally dispose of the excavated material.

The results for Alternative 2 show a decrease in the 100-year flood peak water surface elevations through most of the project reach (Table 2). This flood is similar to the size of the flood that took place during Tropical Storm Irene in 2011. Average flow velocities in the channel generally decrease within the project reach. Similar results occur for smaller modeled floods.

Table 2
Existing Conditions vs. Alternative 2
100-Year Flood

River Section ID	Water Surface Elevation (ft NAVD88)			Flow Velocity (ft/sec)		
	Existing	Alternate 2	Difference	Existing	Alternate 2	Difference
33.0	909.93	909.93	0.00	12.25	12.25	0.00
32.5	898.22	898.65	0.43	8.98	8.13	-0.85
32.1	892.23	891.52	-0.71	10.38	12.03	1.65
32.0	891.40	890.50	-0.90	9.84	9.70	-0.14
31.3	885.42	884.81	-0.61	12.02	10.64	-1.38
31.2	880.03	880.03	0.00	10.54	10.54	0.00
31.1	875.14	875.14	0.00	11.33	11.33	0.00
31.0	871.10	871.10	0.00	11.39	11.39	0.00
30.0	845.44	845.44	0.00	10.64	10.64	0.00

ALTERNATIVE 3:

Under Alternative 3 the existing fill pile located on the Woodford – Packard site would be almost completely removed. The area between the existing fill pile and the river would be excavated to provide a connection to the floodplain. The re-connected floodplain would be accessed during the 2-year flood. The downstream-most portion of the existing fill pile would remain in place to direct flood flows accessing the re-connected floodplain back into the main channel. The remaining portion of the fill pile would tie into an existing berm along the channel bank. The average length of re-connected floodplain in the direction of flow is 550 feet. Under Alternative 3, approximately 3.7 acres of floodplain would be re-connected and 61,400 cubic yards of material would be generated for disposal.

The results for Alternative 3 show a decrease in the 100-year peak flood water surface elevation through most of the project reach, although a 1.6-foot increase in flood elevation is predicted at the downstream limit of the project (Table 3). The predicted increase is due to a bedrock outcrop on the north side of the channel and remaining berms on the south side of the channel resulting in a strong constriction as the new wide floodplain area transitions back to the channel. The backwatering at this location is evident due to the decrease in flow velocity at the pinch point. Similar results occur for smaller modeled floods.

Table 3
Existing Conditions vs. Alternative 3
100-Year Flood

River Section ID	Water Surface Elevation (ft NAVD88)			Flow Velocity (ft/sec)		
	Existing	Alternate 3	Difference	Existing	Alternate 3	Difference
33.0	909.93	909.93	0.00	12.25	12.25	0.00
32.5	898.22	898.65	0.43	8.98	8.13	-0.85
32.1	892.23	891.52	-0.71	10.38	12.03	1.65
32.0	891.40	890.53	-0.87	9.84	9.63	-0.21
31.3	885.42	885.01	-0.41	12.02	9.91	-2.11
31.2	880.03	881.64	1.61	10.54	4.86	-5.68
31.1	875.14	875.14	0.00	11.33	11.33	0.00
31.0	871.10	871.10	0.00	11.39	11.39	0.00
30.0	845.44	845.44	0.00	10.64	10.64	0.00

ALTERNATIVE 4:

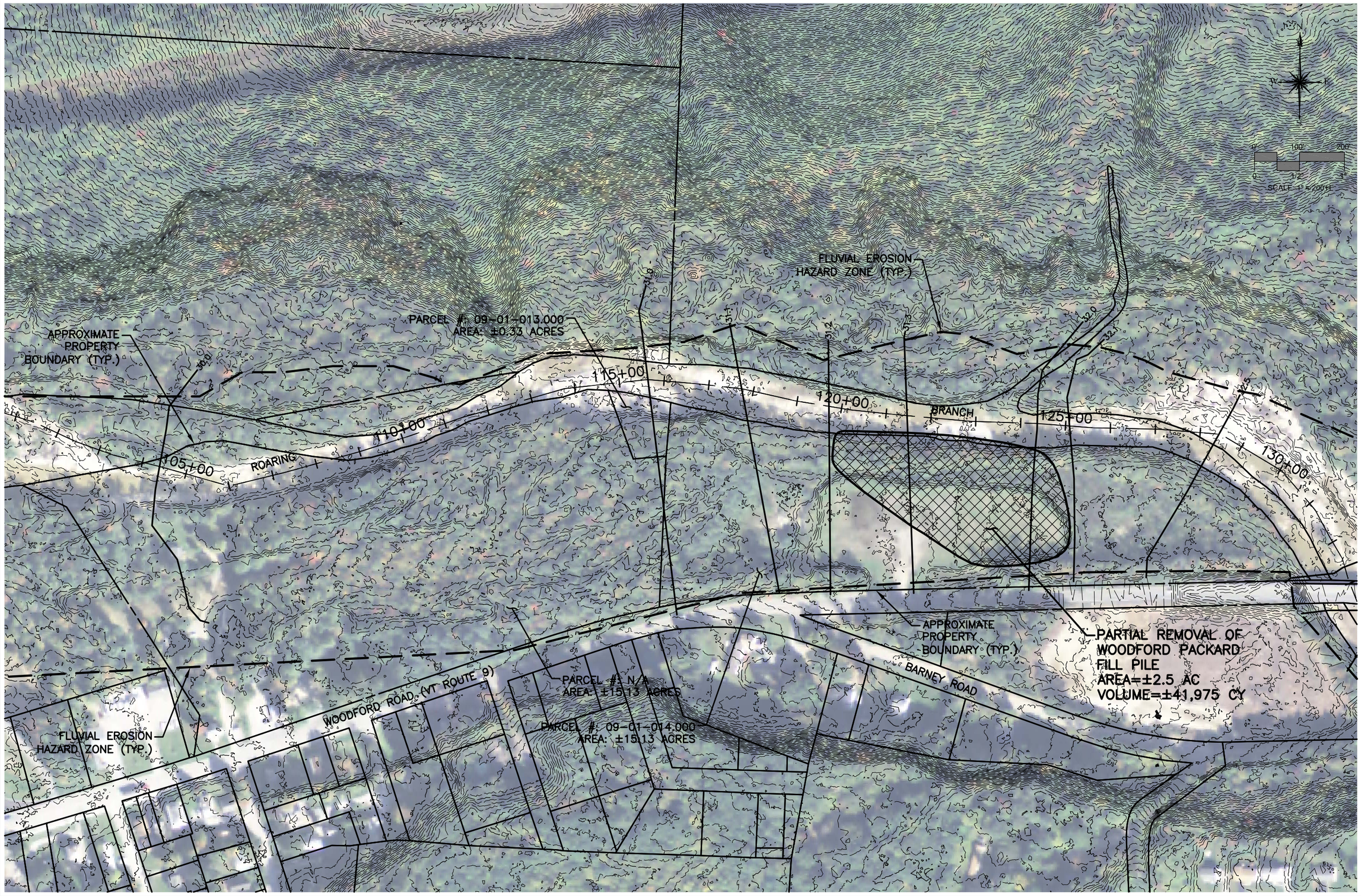
Alternative 4 investigates a more comprehensive floodplain re-connection over a longer distance. In addition to full removal of the existing fill pile on the Woodford – Packard site, the existing berms located on the southern floodplain along the Roaring Branch would be removed as well. The project reach under this alternative would extend from the VT Route 9 Bridge downstream for approximately 2,900 linear feet. Similar to Alternatives 2 and 3, the area directly adjacent to the river would be excavated to re-connect the floodplain. The restored floodplain would be set at an elevation such that it would be accessed during the 2-year flood.

Since there is existing infrastructure at the downstream end of the project site, Alternative 4 requires the creation of a berm to direct flood flows back into the channel and away from the existing structures. Construction of this alternative would occur on two properties in addition to the Woodford – Packard site. Under Alternative 4, approximately 14.4 acres of floodplain would be re-connected. Approximately 149,400 cubic yards of material would be removed from the floodplain and need to be disposed of.

The results for Alternative 4 show a decrease in the 100-year flood throughout the entire project reach (Table 4). Average flow velocities also decrease through most of the project reach. A slight increase in flow velocity occurs at the upstream and downstream project limit, primarily due to the narrowing of the floodplain at these locations when transitioning between the wide floodplain and narrow confined channel. Similar results occur for smaller modeled floods.

Table 4
Existing Conditions vs. Alternative 4
100-Year Flood

River Section ID	Water Surface Elevation (ft NAVD88)			Flow Velocity (ft/sec)		
	Existing	Alternate 4	Difference	Existing	Alternate 4	Difference
33.0	909.93	909.93	0.00	12.25	12.25	0.00
32.5	898.22	897.28	-0.94	8.98	9.22	0.24
32.1	892.23	891.88	-0.35	10.38	8.17	-2.21
32.0	891.40	890.53	-0.87	9.84	9.63	-0.21
31.3	885.42	885.01	-0.41	12.02	9.91	-2.11
31.2	880.03	879.47	-0.56	10.54	9.76	-0.78
31.1	875.14	874.81	-0.33	11.33	9.90	-1.43
31.0	871.10	870.50	-0.60	11.39	10.22	-1.17
30.0	845.44	845.38	-0.06	10.64	10.99	0.35



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REVISIONS

CONCEPTUAL

SITE PLAN - ALTERNATE 2

WOODFORD - PACKARD PROPERTY
FLOODPLAIN RESTORATION PROJECT

WOODFORD ROAD (VT ROUTE 9)
BENNINGTON, VERMONT

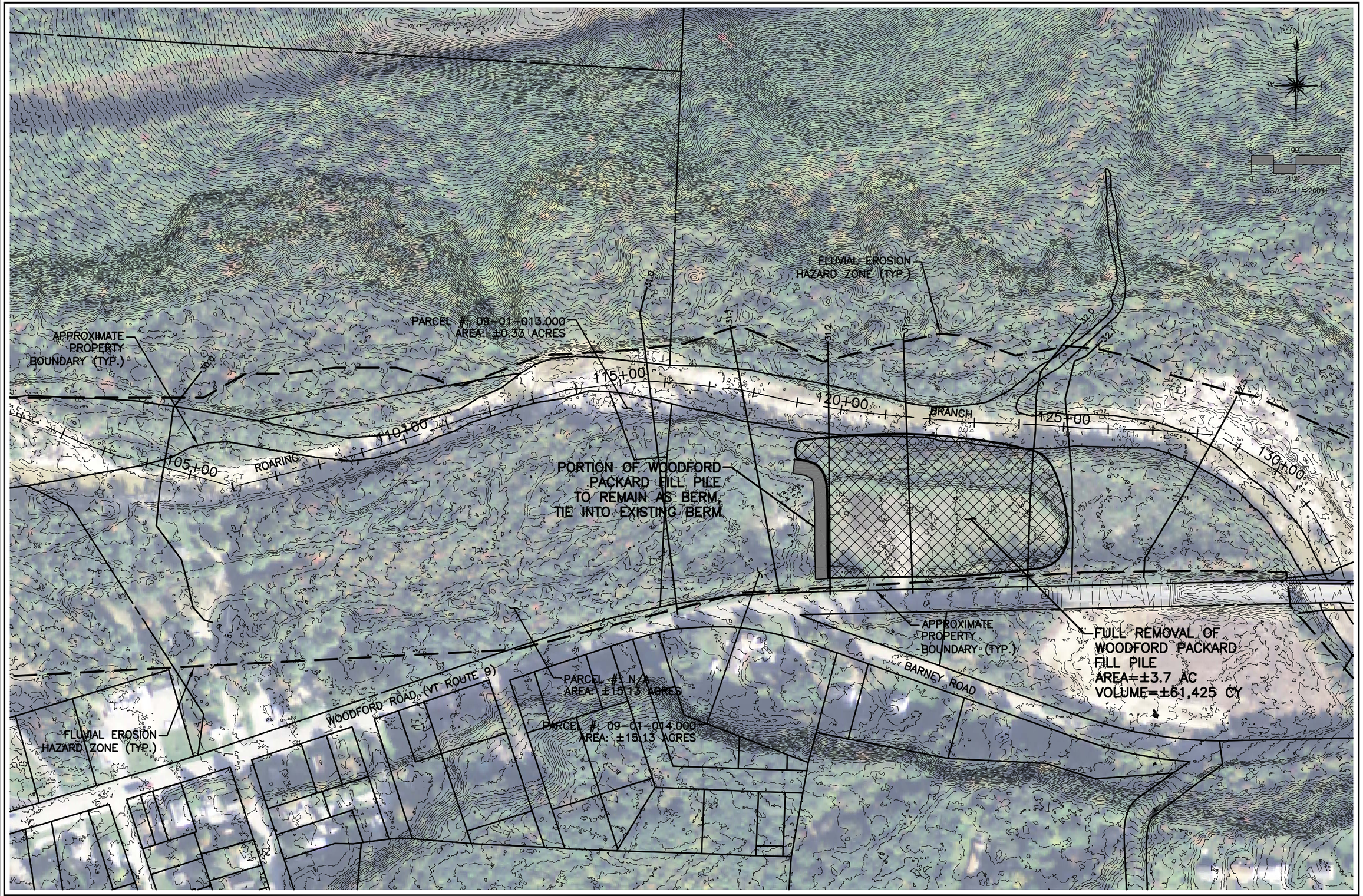
DESIGNED	DRAWN	CHECKED
-	BMC	RKS

SCALE: 1" = 200'

DATE: AUG, 29, 2012

PROJECT NO.: 2919-15-2

SHEET NO.: SHT1



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REVISIONS

SITE PLAN - ALTERNATE 3

WOODFORD - PACKARD PROPERTY
FLOODPLAIN RESTORATION PROJECT

WOODFORD ROAD (VT ROUTE 9)
BENNINGTON, VERMONT

CONCEPTUAL

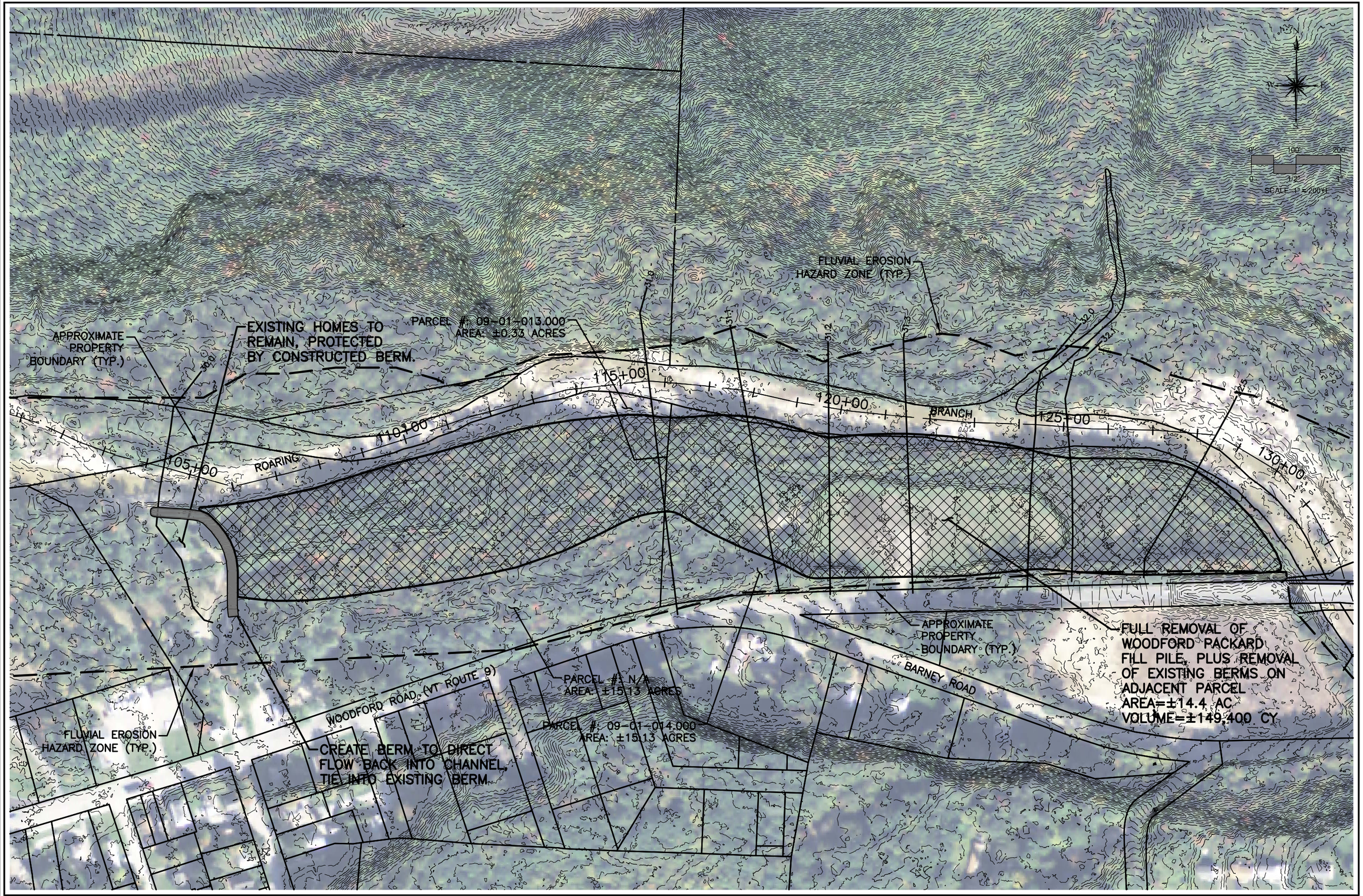
DESIGNED	DRAWN	CHECKED
I	BMC	RKS

SCALE: 1" = 200'

DATE: AUG. 29, 2012

PROJECT NO.: 2919-15-2

SHEET NO.: SHT2



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REVISIONS

SITE PLAN - ALTERNATE 4

WOODFORD - PACKARD PROPERTY
FLOODPLAIN RESTORATION PROJECT

WOODFORD ROAD (VT ROUTE 9)
BENNINGTON, VERMONT

CONCEPTUAL

DESIGNED	DRAWN	CHECKED
I	BMC	RKS

SCALE: 1" = 200'

DATE: AUG. 29, 2012

PROJECT NO.: 2919-15-2

SHEET NO.: SHT3

Hydraulic Modeling Comparison Table

Existing Conditions vs. Alternative 2

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 2	Difference	Existing	Alt 2	Difference	Existing	Alt 2	Difference	Existing	Alt 2	Difference
35.0	100-yr	912.97	912.97	0.00	5.41	5.41	0.00	1,334.6	1,334.6	0.0	188.2	188.2	0.0
34.0	100-yr	911.58	911.58	0.00	10.30	10.30	0.00	806.8	806.9	0.2	189.2	189.2	0.0
33.0	100-yr	909.93	909.93	0.00	12.25	12.25	0.00	624.9	624.9	0.0	182.0	182.0	0.0
32.5	100-yr	898.22	898.65	0.43	8.98	8.13	-0.85	590.4	653.3	63.0	147.0	150.5	3.5
32.1	100-yr	892.23	891.52	-0.71	10.38	12.03	1.65	529.0	446.6	-82.4	136.7	106.5	-30.2
32.0	100-yr	891.40	890.50	-0.90	9.84	9.70	-0.14	650.1	868.9	218.8	175.0	383.0	208.0
31.3	100-yr	885.42	884.81	-0.61	12.02	10.64	-1.38	449.9	758.9	309.0	106.9	268.4	161.6
31.2	100-yr	880.03	880.03	0.00	10.54	10.54	0.00	504.8	504.8	0.0	127.4	127.4	0.0
31.1	100-yr	875.14	875.14	0.00	11.33	11.33	0.00	468.0	468.0	0.0	105.0	105.0	0.0
31.0	100-yr	871.10	871.10	0.00	11.39	11.39	0.00	740.2	740.2	0.0	272.0	272.0	0.0
30.0	100-yr	845.44	845.44	0.00	10.64	10.64	0.00	806.3	806.3	0.0	327.2	327.2	0.0
29.7	100-yr	827.74	827.74	0.00	13.79	13.79	0.00	483.3	483.3	0.0	167.0	167.0	0.0
29.6	100-yr	827.09	827.09	0.00	8.68	8.68	0.00	1,006.1	1,006.1	0.0	303.5	303.5	0.0
29.4	100-yr	820.70	820.70	0.00	11.46	11.46	0.00	650.0	650.0	0.0	205.3	205.3	0.0

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 2	Difference	Existing	Alt 2	Difference	Existing	Alt 2	Difference	Existing	Alt 2	Difference
35.0	10-yr	911.18	911.18	0.00	3.72	3.72	0.00	1,006.2	1,006.2	0.0	179.8	179.8	0.0
34.0	10-yr	910.13	910.13	0.00	8.23	8.23	0.00	537.2	537.4	0.3	183.5	183.5	0.0
33.0	10-yr	908.62	908.62	0.00	10.20	10.20	0.00	390.8	390.8	0.0	173.0	173.0	0.0
32.5	10-yr	896.45	896.56	0.11	7.87	7.59	-0.28	355.9	369.1	13.3	118.8	119.9	1.1
32.1	10-yr	890.59	890.45	-0.14	7.98	8.31	0.33	351.7	337.7	-14.1	98.8	97.9	-0.9
32.0	10-yr	889.64	888.96	-0.68	7.80	8.93	1.13	379.8	381.9	2.1	130.6	216.5	86.0
31.3	10-yr	883.52	883.70	0.18	10.35	8.62	-1.73	270.6	468.0	197.4	81.4	255.1	173.7
31.2	10-yr	878.31	878.31	0.00	9.03	9.03	0.00	310.0	310.0	0.0	106.3	106.3	0.0
31.1	10-yr	873.79	873.79	0.00	8.48	8.48	0.00	330.2	330.2	0.0	99.0	99.0	0.0
31.0	10-yr	869.69	869.69	0.00	9.47	9.47	0.00	411.8	411.8	0.0	194.0	194.0	0.0
30.0	10-yr	843.65	843.65	0.00	9.98	9.98	0.00	356.9	356.9	0.0	167.5	167.5	0.0
29.7	10-yr	826.08	826.08	0.00	10.92	10.92	0.00	288.4	288.4	0.0	90.8	90.8	0.0
29.6	10-yr	824.92	824.92	0.00	8.58	8.58	0.00	413.5	413.5	0.0	190.3	190.3	0.0
29.4	10-yr	818.71	818.71	0.00	10.95	10.95	0.00	291.8	291.8	0.0	105.5	105.5	0.0

Hydraulic Modeling Comparison Table

Existing Conditions vs. Alternative 3

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 3	Difference	Existing	Alt 3	Difference	Existing	Alt 3	Difference	Existing	Alt 3	Difference
35.0	100-yr	912.97	912.97	0.00	5.41	5.41	0.00	1,334.6	1,334.6	0.0	188.2	188.2	0.0
34.0	100-yr	911.58	911.58	0.00	10.30	10.30	0.00	806.8	806.9	0.1	189.2	189.2	0.0
33.0	100-yr	909.93	909.93	0.00	12.25	12.25	0.00	624.9	624.9	0.0	182.0	182.0	0.0
32.5	100-yr	898.22	898.65	0.43	8.98	8.13	-0.85	590.4	653.3	62.9	147.0	150.5	3.5
32.1	100-yr	892.23	891.52	-0.71	10.38	12.03	1.65	529.0	446.6	-82.4	136.7	106.5	-30.2
32.0	100-yr	891.40	890.53	-0.87	9.84	9.63	-0.21	650.1	883.0	232.9	175.0	393.9	218.9
31.3	100-yr	885.42	885.01	-0.41	12.02	9.91	-2.11	449.9	907.2	457.3	106.9	380.0	273.2
31.2	100-yr	880.03	881.64	1.61	10.54	4.86	-5.68	504.8	1,738.4	1,233.6	127.4	445.1	317.7
31.1	100-yr	875.14	875.14	0.00	11.33	11.33	0.00	468.0	468.0	0.0	105.0	105.0	0.0
31.0	100-yr	871.10	871.10	0.00	11.39	11.39	0.00	740.2	740.2	0.0	272.0	272.0	0.0
30.0	100-yr	845.44	845.44	0.00	10.64	10.64	0.00	806.3	806.3	0.0	327.2	327.2	0.0
29.7	100-yr	827.74	827.74	0.00	13.79	13.79	0.00	483.3	483.3	0.0	167.0	167.0	0.0
29.6	100-yr	827.09	827.09	0.00	8.68	8.68	0.00	1,006.1	1,006.1	0.0	303.5	303.5	0.0
29.4	100-yr	820.70	820.70	0.00	11.46	11.46	0.00	650.0	650.0	0.0	205.3	205.3	0.0

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 3	Difference	Existing	Alt 3	Difference	Existing	Alt 3	Difference	Existing	Alt 3	Difference
35.0	10-yr	911.18	911.18	0.00	3.72	3.72	0.00	1,006.2	1,006.2	0.0	179.8	179.8	0.0
34.0	10-yr	910.13	910.13	0.00	8.23	8.23	0.00	537.2	537.4	0.3	183.5	183.5	0.0
33.0	10-yr	908.62	908.62	0.00	10.20	10.20	0.00	390.8	390.8	0.0	173.0	173.0	0.0
32.5	10-yr	896.45	896.61	0.16	7.87	7.47	-0.40	355.9	374.9	19.1	118.8	120.4	1.6
32.1	10-yr	890.59	890.38	-0.21	7.98	8.47	0.49	351.7	331.1	-20.6	98.8	97.5	-1.3
32.0	10-yr	889.64	889.07	-0.57	7.80	8.59	0.79	379.8	405.8	26.0	130.6	228.4	97.8
31.3	10-yr	883.52	883.59	0.07	10.35	9.05	-1.30	270.6	439.5	168.9	81.4	253.7	172.3
31.2	10-yr	878.31	879.29	0.98	9.03	5.50	-3.53	310.0	750.4	440.4	106.3	369.6	263.3
31.1	10-yr	873.79	873.79	0.00	8.48	8.48	0.00	330.2	330.2	0.0	99.0	99.0	0.0
31.0	10-yr	869.69	869.69	0.00	9.47	9.47	0.00	411.8	411.8	0.0	194.0	194.0	0.0
30.0	10-yr	843.65	843.65	0.00	9.98	9.98	0.00	356.9	356.9	0.0	167.5	167.5	0.0
29.7	10-yr	826.08	826.08	0.00	10.92	10.92	0.00	288.4	288.4	0.0	90.8	90.8	0.0
29.6	10-yr	824.92	824.92	0.00	8.58	8.58	0.00	413.5	413.5	0.0	190.3	190.3	0.0
29.4	10-yr	818.71	818.71	0.00	10.95	10.95	0.00	291.8	291.8	0.0	105.5	105.5	0.0

Hydraulic Modeling Comparison Table

Existing Conditions vs. Alternative 4

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 4	Difference	Existing	Alt 4	Difference	Existing	Alt 4	Difference	Existing	Alt 4	Difference
35.0	100-yr	912.97	912.97	0.00	5.41	5.41	0.00	1,334.6	1,334.6	0.0	188.2	188.2	0.0
34.0	100-yr	911.58	911.58	0.00	10.30	10.30	0.00	806.8	806.9	0.1	189.2	189.2	0.0
33.0	100-yr	909.93	909.93	0.00	12.25	12.25	0.00	624.9	624.9	0.0	182.0	182.0	0.0
32.5	100-yr	898.22	897.28	-0.94	8.98	9.22	0.24	590.4	823.1	232.7	147.0	368.4	221.4
32.1	100-yr	892.23	891.88	-0.35	10.38	8.17	-2.21	529.0	1,009.3	480.3	136.7	365.9	229.2
32.0	100-yr	891.40	890.53	-0.87	9.84	9.63	-0.21	650.1	883.0	232.9	175.0	393.9	218.9
31.3	100-yr	885.42	885.01	-0.41	12.02	9.91	-2.11	449.9	907.2	457.3	106.9	380.0	273.2
31.2	100-yr	880.03	879.47	-0.56	10.54	9.76	-0.78	504.8	817.3	312.5	127.4	388.7	261.3
31.1	100-yr	875.14	874.81	-0.33	11.33	9.90	-1.43	468.0	792.9	325.0	105.0	369.3	264.3
31.0	100-yr	871.10	870.50	-0.60	11.39	10.22	-1.17	740.2	997.3	257.1	272.0	448.9	176.9
30.0	100-yr	845.44	845.38	-0.06	10.64	10.99	0.35	806.3	741.3	-65.0	327.2	244.1	-83.1
29.7	100-yr	827.74	827.74	0.00	13.79	13.79	0.00	483.3	483.3	0.0	167.0	167.0	0.0
29.6	100-yr	827.09	827.09	0.00	8.68	8.68	0.00	1,006.1	1,006.1	0.0	303.5	303.5	0.0
29.4	100-yr	820.70	820.70	0.00	11.46	11.46	0.00	650.0	650.0	0.0	205.3	205.3	0.0

River Sta	Profile	W.S. Elev (ft NAVD88)			Channel Velocity (ft/s)			Flow Area (sq ft)			Top Width (ft)		
		Existing	Alt 4	Difference	Existing	Alt 4	Difference	Existing	Alt 4	Difference	Existing	Alt 4	Difference
35.0	10-yr	911.18	911.18	0.00	3.72	3.72	0.00	1,006.2	1,006.2	0.0	179.8	179.8	0.0
34.0	10-yr	910.13	910.13	0.00	8.23	8.23	0.00	537.2	537.4	0.2	183.5	183.5	0.0
33.0	10-yr	908.62	908.62	0.00	10.20	10.20	0.00	390.8	390.8	0.0	173.0	173.0	0.0
32.5	10-yr	896.45	896.04	-0.41	7.87	8.35	0.48	355.9	421.4	65.5	118.8	261.9	143.1
32.1	10-yr	890.59	890.59	0.00	7.98	6.95	-1.03	351.7	561.5	209.8	98.8	300.9	202.1
32.0	10-yr	889.64	889.07	-0.57	7.80	8.59	0.79	379.8	405.9	26.2	130.6	228.5	97.9
31.3	10-yr	883.52	883.59	0.07	10.35	9.05	-1.30	270.6	439.5	168.9	81.4	253.7	172.3
31.2	10-yr	878.31	878.24	-0.07	9.03	8.50	-0.53	310.0	420.2	110.2	106.3	257.8	151.5
31.1	10-yr	873.79	873.49	-0.30	8.48	8.70	0.22	330.2	395.9	65.7	99.0	234.3	135.3
31.0	10-yr	869.69	869.58	-0.11	9.47	8.30	-1.17	411.8	609.9	198.1	194.0	398.6	204.6
30.0	10-yr	843.65	843.68	0.03	9.98	9.90	-0.08	356.9	360.5	3.6	167.5	166.2	-1.4
29.7	10-yr	826.08	826.08	0.00	10.92	10.92	0.00	288.4	288.4	0.0	90.8	90.8	0.0
29.6	10-yr	824.92	824.92	0.00	8.58	8.58	0.00	413.5	413.5	0.0	190.3	190.3	0.0
29.4	10-yr	818.71	818.71	0.00	10.95	10.95	0.00	291.8	291.8	0.0	105.5	105.5	0.0