

**CONNECTICUT DEPARTMENT OF TRANSPORTATION**  
**Reconstruction of I-84**  
**Washington Avenue to Pierpont Road**  
**Waterbury, CT**  
**ConnDOT Project No. 151-273**  
**Federal Aid Project No. NHI-84-2 (172) 33**



**MAD RIVER**

**FLOODPLAIN/FLOODWAY ANALYSIS REPORT**  
**FOR**  
**CT DEEP FLOOD MANAGEMENT CERTIFICATION**

**Waterbury, Connecticut**

**June 2006**  
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\* Larger scale plots of these maps are included separately.

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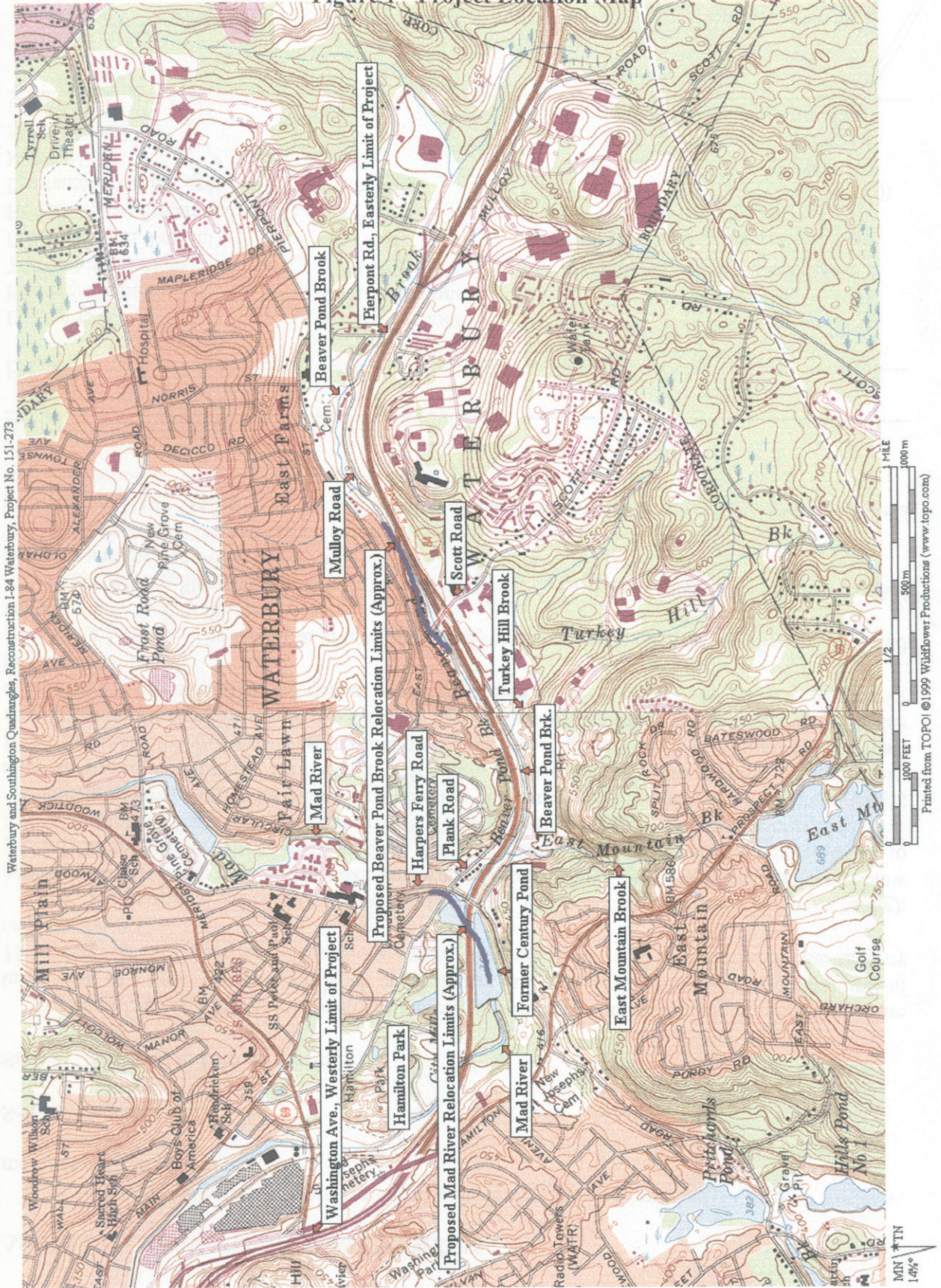
<sup>^</sup>Three (3) separate versions of each table are provided – Two(2) in U.S. Customary Units (NGVD-29, NAVD-88) and one in Metric (NGVD-29).

## APPENDIX

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HEC-RAS Data CD	Rear Pocket



Figure 1- Project Location Map



Waterbury and Southington Quadrangles, Reconstruction I-84 Waterbury, Project No. 151-273







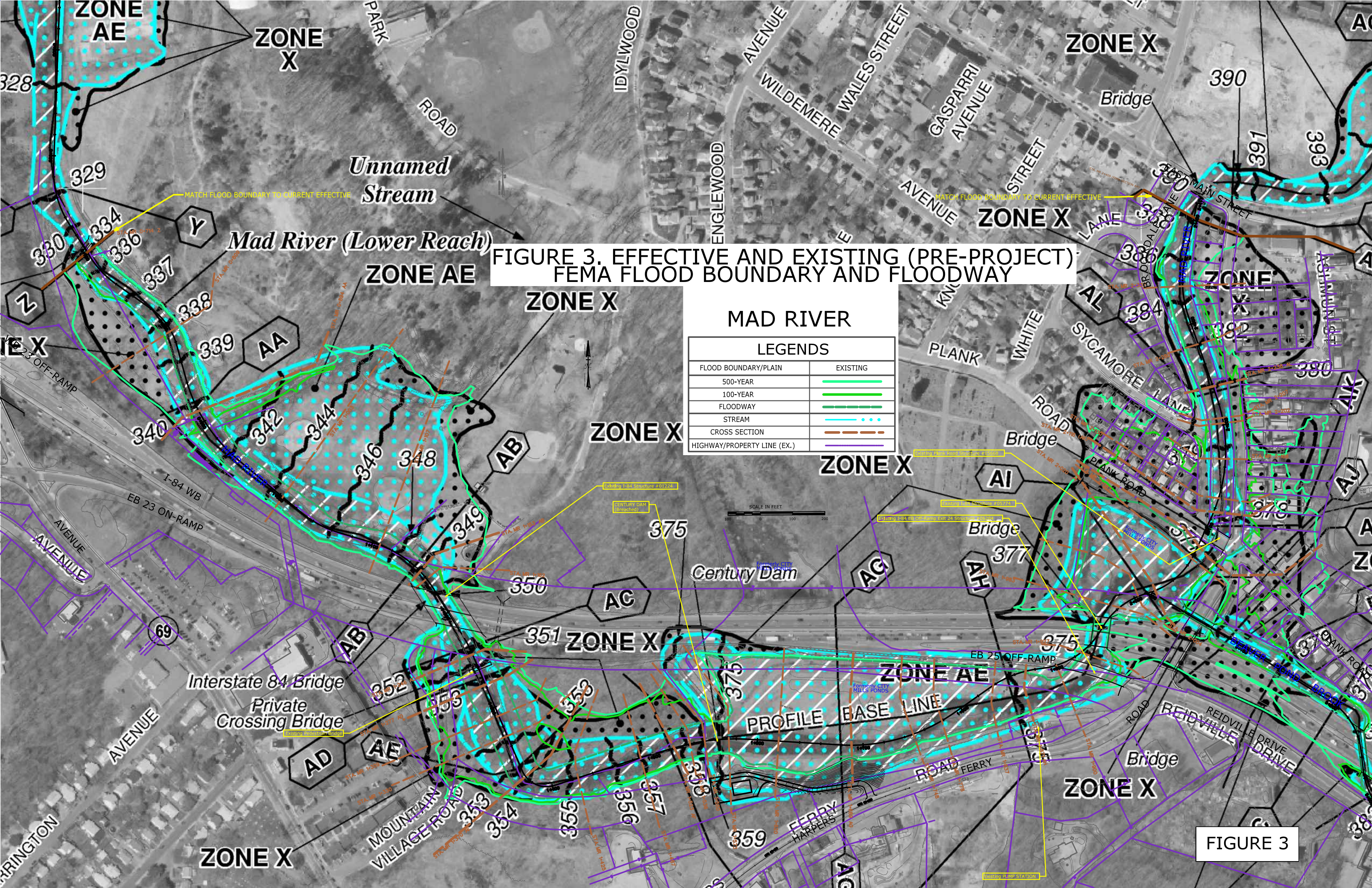


FIGURE 3. EFFECTIVE AND EXISTING (PRE-PROJECT) FEMA FLOOD BOUNDARY AND FLOODWAY

**MAD RIVER**

**LEGENDS**

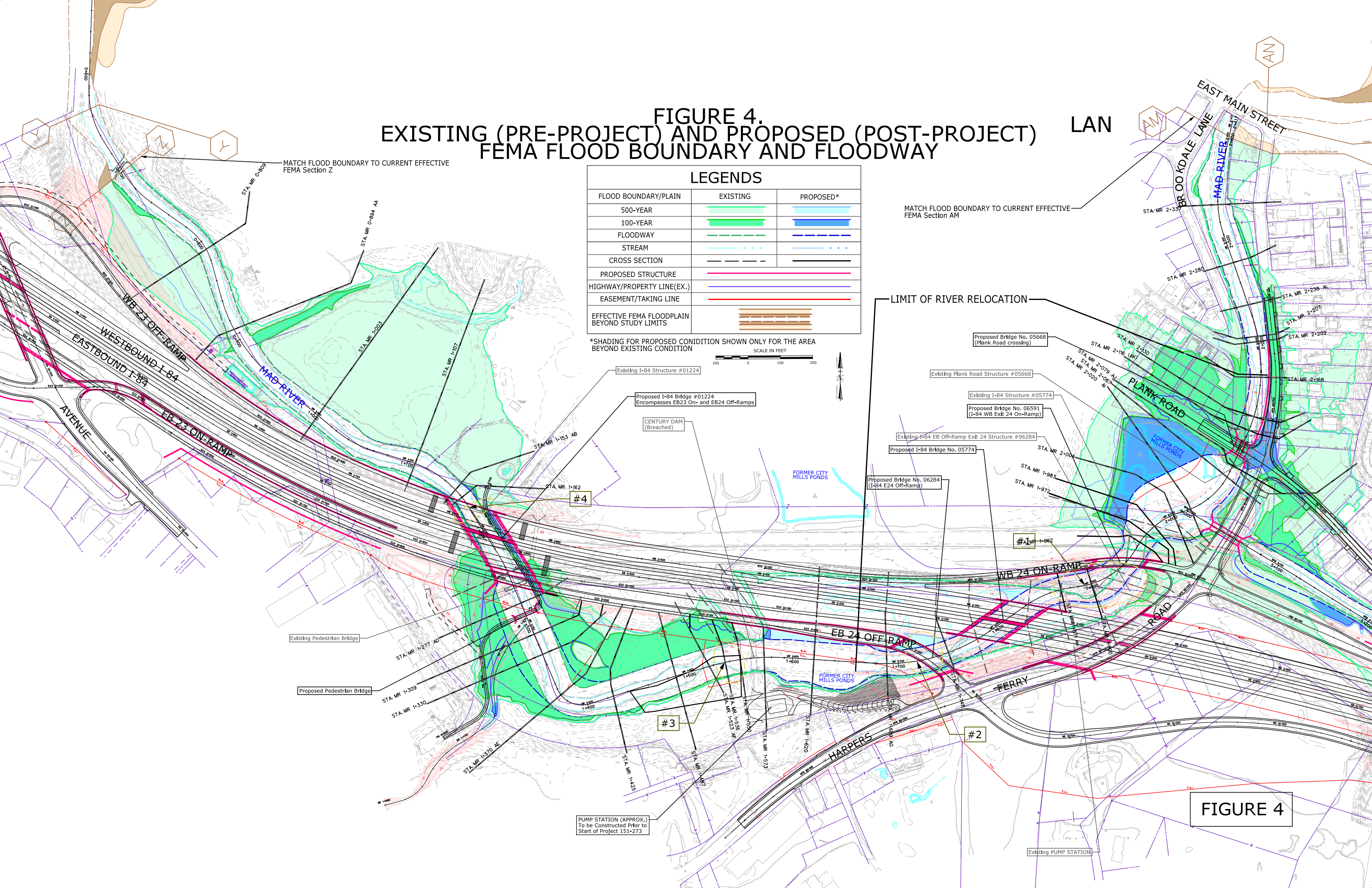
FLOOD BOUNDARY/PLAIN	EXISTING
500-YEAR	
100-YEAR	
FLOODWAY	
STREAM	
CROSS SECTION	
HIGHWAY/PROPERTY LINE (EX.)	

SCALE IN FEET  
 0 100 200

FIGURE 3



**FIGURE 4.**  
**EXISTING (PRE-PROJECT) AND PROPOSED (POST-PROJECT)**  
**FEMA FLOOD BOUNDARY AND FLOODWAY**



FLOOD BOUNDARY/PLAIN	EXISTING	PROPOSED*
500-YEAR		
100-YEAR		
FLOODWAY		
STREAM		
CROSS SECTION		
PROPOSED STRUCTURE		
HIGHWAY/PROPERTY LINE(EX.)		
EASEMENT/TAKING LINE		
EFFECTIVE FEMA FLOODPLAIN BEYOND STUDY LIMITS		

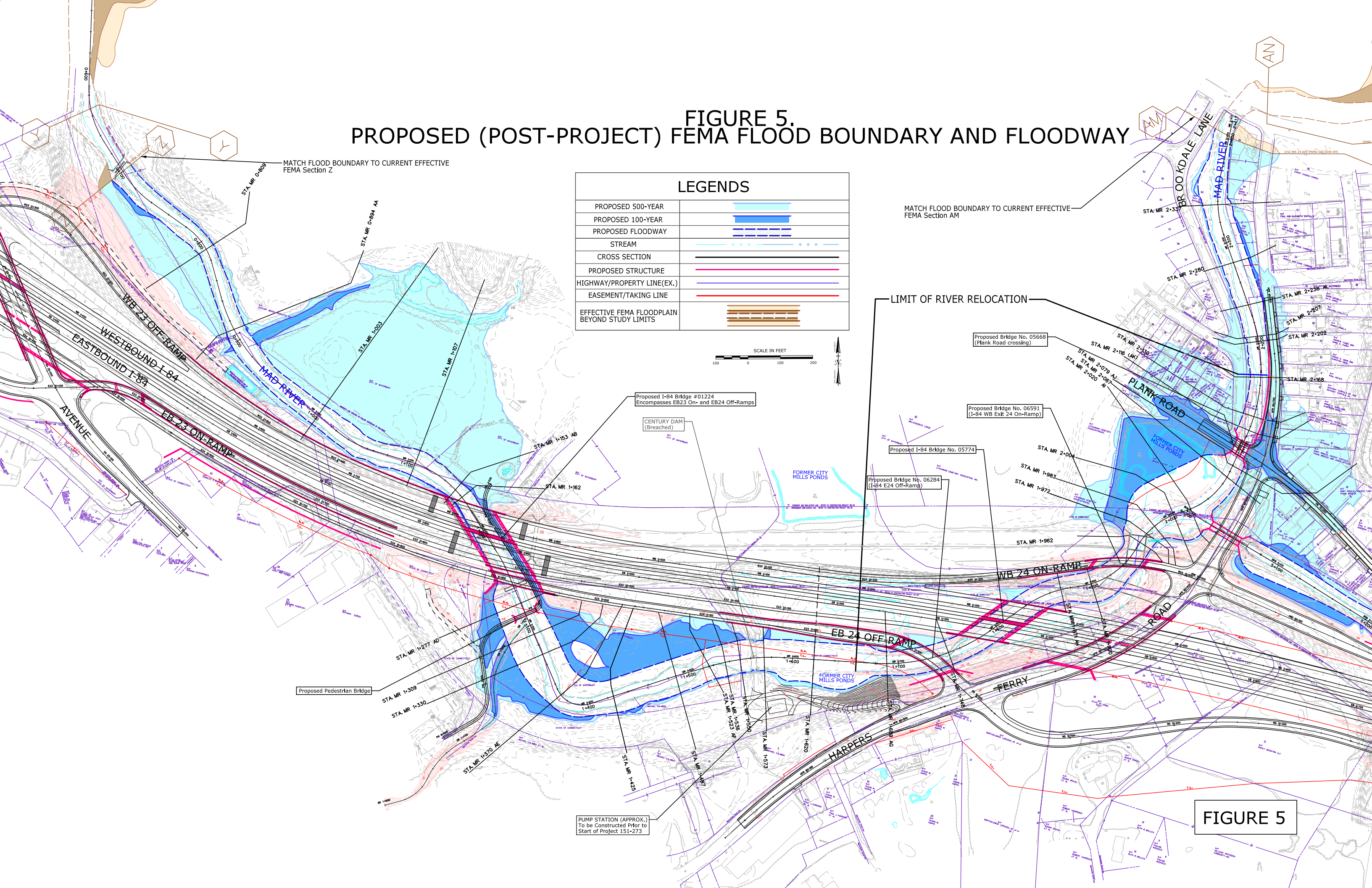
\*SHADING FOR PROPOSED CONDITION SHOWN ONLY FOR THE AREA BEYOND EXISTING CONDITION

SCALE IN FEET  
 100 0 100 200

**FIGURE 4**



# FIGURE 5. PROPOSED (POST-PROJECT) FEMA FLOOD BOUNDARY AND FLOODWAY



LEGENDS	
PROPOSED 500-YEAR	
PROPOSED 100-YEAR	
PROPOSED FLOODWAY	
STREAM	
CROSS SECTION	
PROPOSED STRUCTURE	
HIGHWAY/PROPERTY LINE(EX.)	
EASEMENT/TAKING LINE	
EFFECTIVE FEMA FLOODPLAIN BEYOND STUDY LIMITS	

SCALE IN FEET  
0 100 200

MATCH FLOOD BOUNDARY TO CURRENT EFFECTIVE FEMA Section Z

MATCH FLOOD BOUNDARY TO CURRENT EFFECTIVE FEMA Section AM

LIMIT OF RIVER RELOCATION

PUMP STATION (APPROX.)  
To be Constructed Prior to  
Start of Project 151-273

FIGURE 5



Figure 6- The Base (100-year) Flood Profile Plot: Existing vs. Proposed

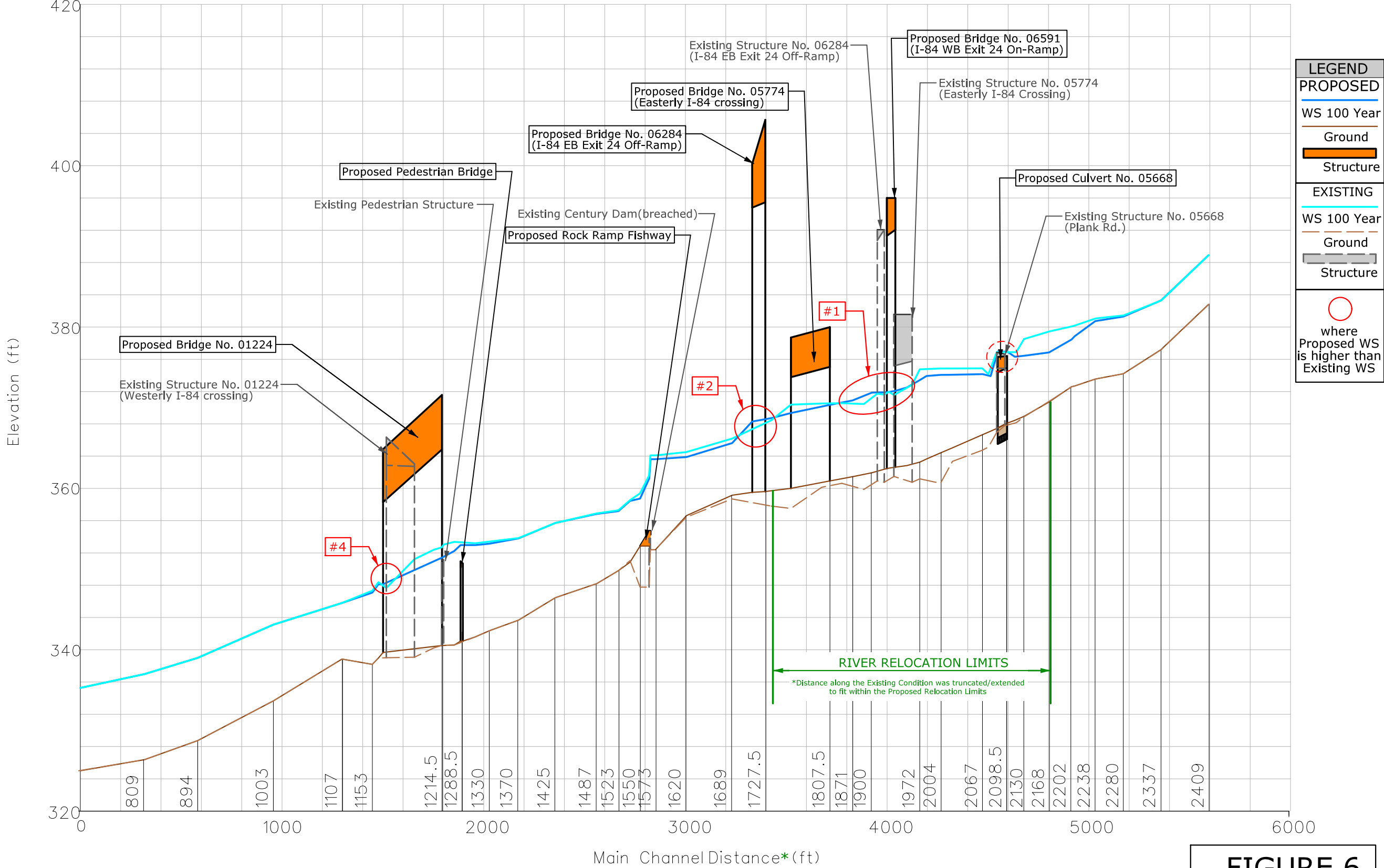
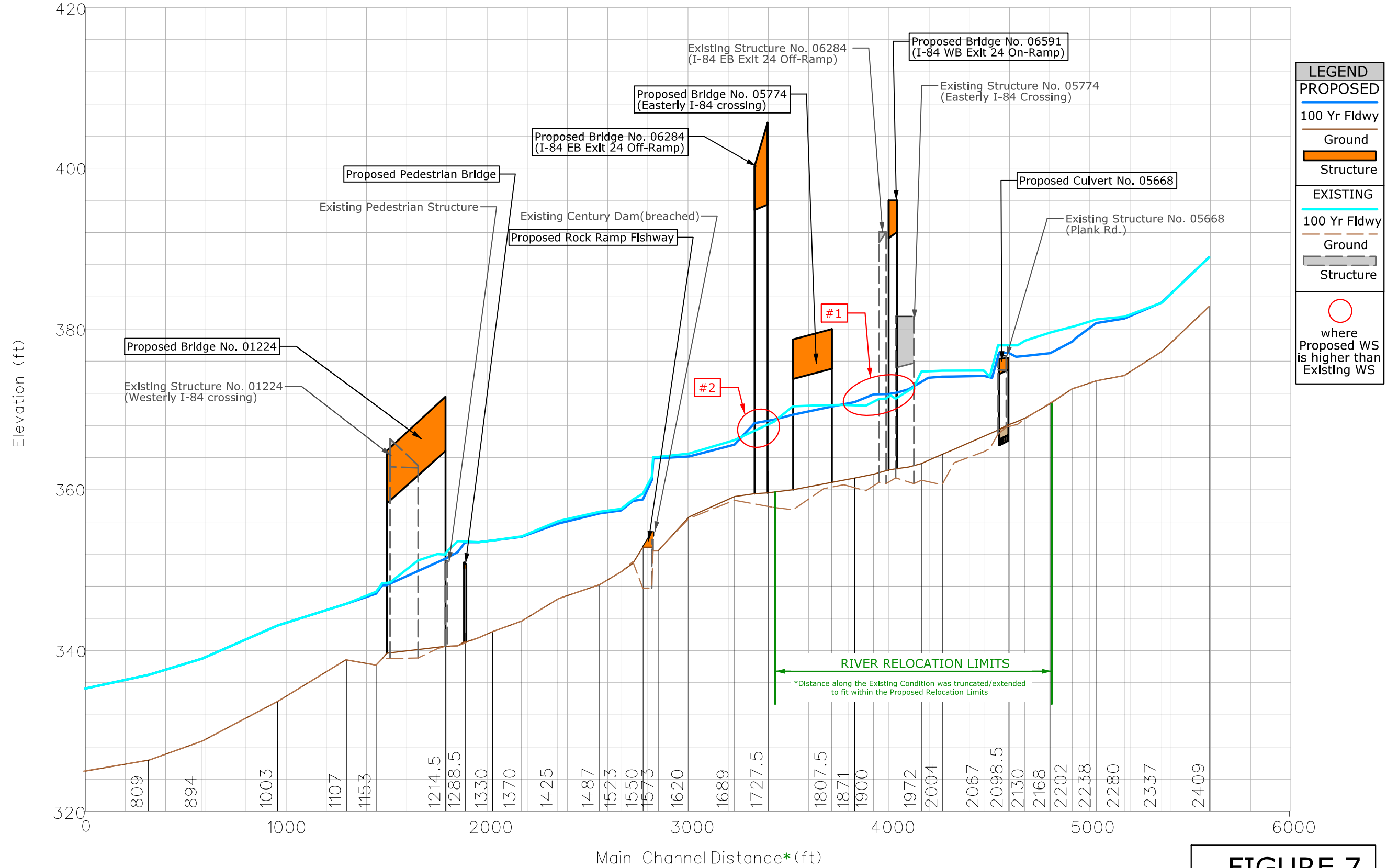


FIGURE 6

### Figure 7- The 100-YR Encroached (Floodway) Flood Profile: Proposed vs. Existing



**FIGURE 7**



Figure 8- The 10-YR Encroached Flood Profile: Proposed vs. Existing Conditions

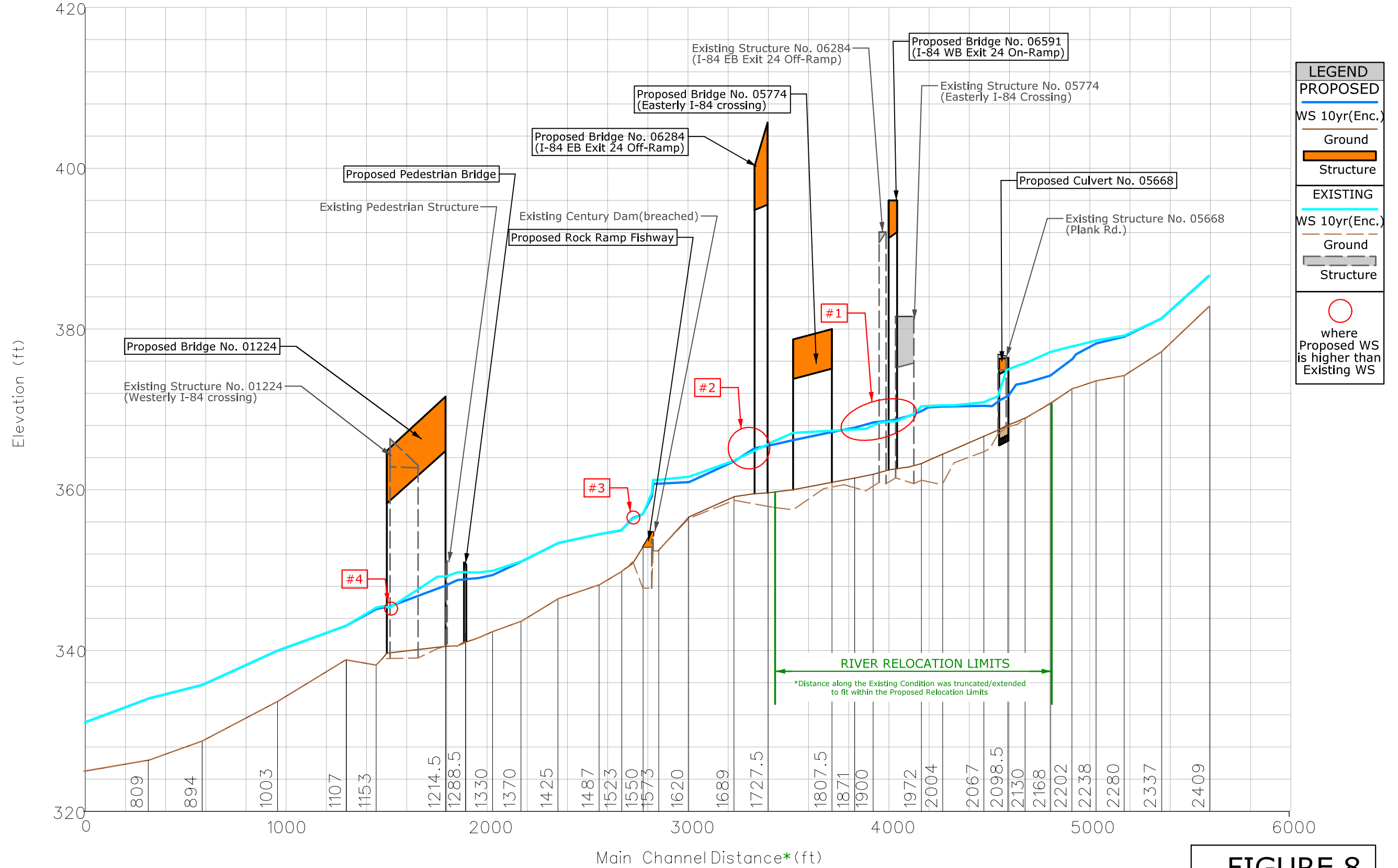


FIGURE 8

Figure 9- The 500-year Regulatory Flood Profile Plot: Proposed vs. Existing Conditions

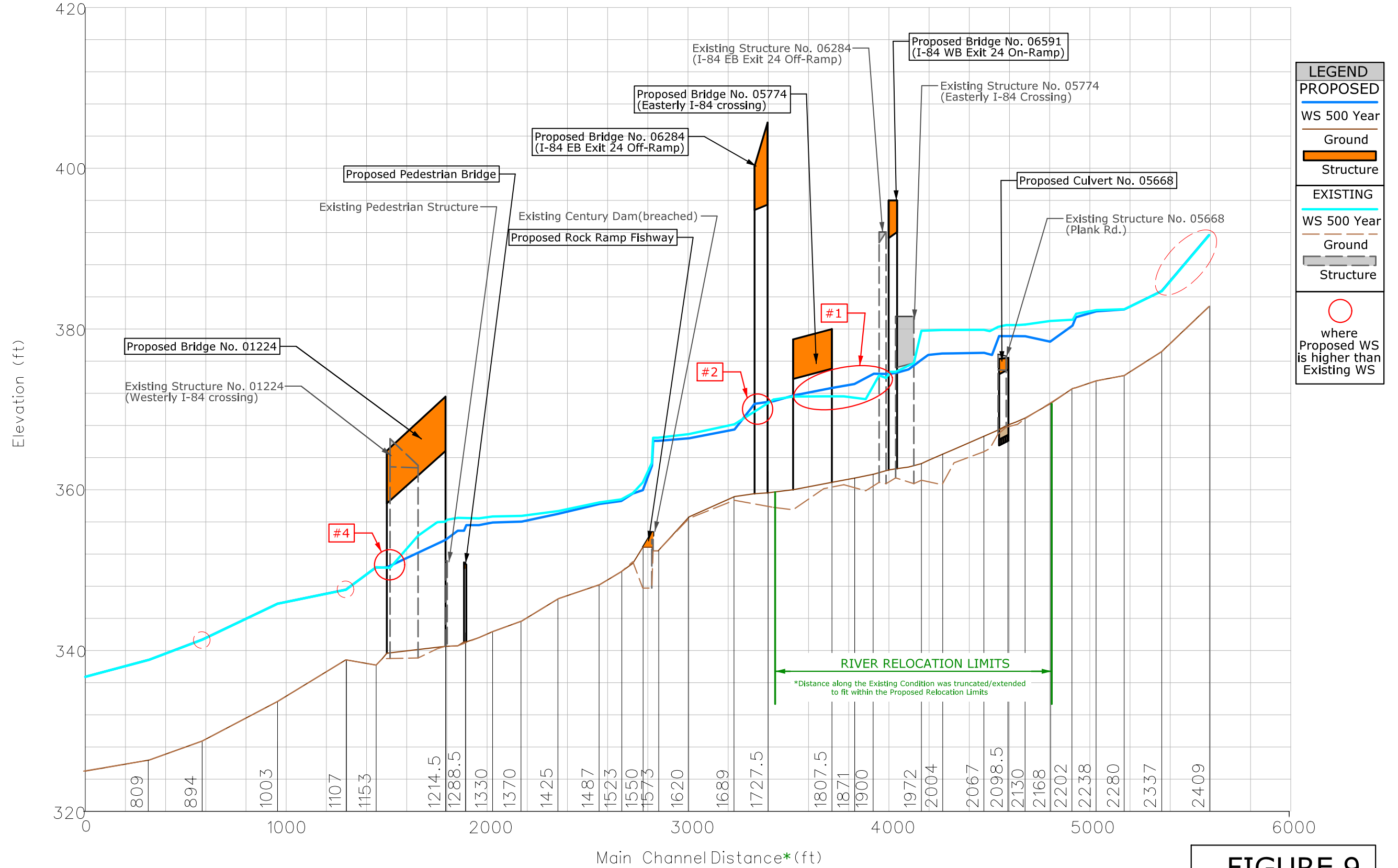
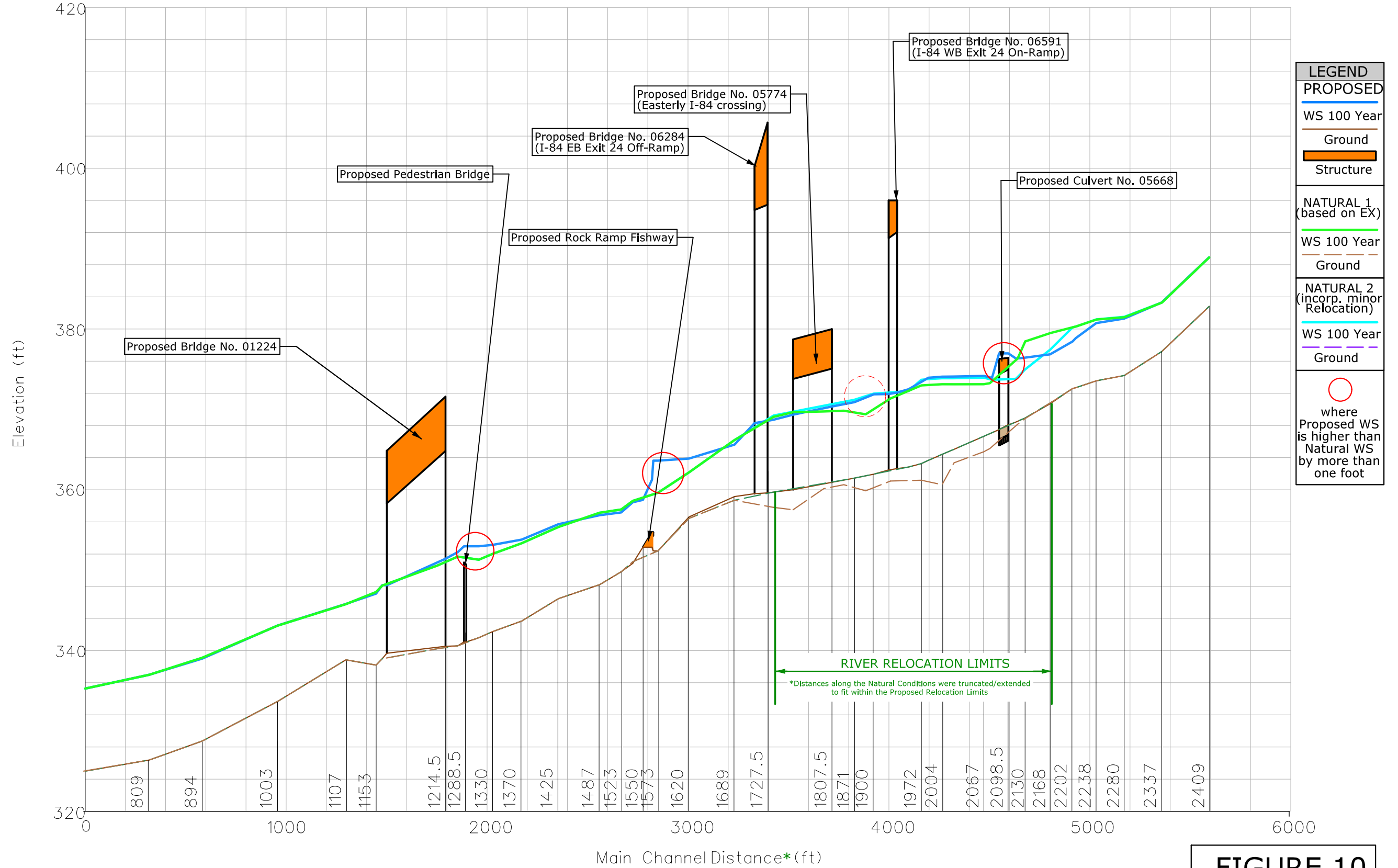


FIGURE 9

Figure 10- The Base (100-year) Flood Profile Plot: Proposed vs. Natural Conditions



**FIGURE 10**

## Study Background

State Project No. 151-273, the Reconstruction of Interstate 84 in the City of Waterbury from Washington Avenue east to Pierpont Road, results in the relocation of the Mad River for an approximate length of 1,850 ft (564 m) and the construction of six (6) waterway crossings, replacing five (5) existing crossings.

The Mad River has been studied in detail as a part of the City of Waterbury Flood Insurance Study (FIS), effective since May 1979. Regulatory flood elevations, flood plain limits and a floodway have been defined in the FIS, on the Flood Boundary and Floodway Maps (FBFM), and Flood Insurance Rate Maps (FIRM) prepared by the study. The FIRM and FBFM have since been replaced with FIRM in 2010 which incorporates an aerial photo image in the background. The FIS was also republished in 2010 based on a different vertical datum of NAVD 88. However, the original 1979 study data still remains effective, as the equivalent elevation data in the republished study and maps remain the same as the previous study.

This report has been prepared to describe the effects and consequent changes to the flood elevations, floodplain and the floodway of the Mad River resulting from the proposed project, based on the hydraulic analyses that were performed and documented herein.

Due to the flood plain involvement of this project, a Flood Management Certification (FMC) submission to the Connecticut Department of Environmental Protection (DEP) is required. The scope of the proposed project and changes also require that a Conditional Letter of Map Revision (CLOMR) be obtained from the Federal Emergency Management Agency (FEMA). Thus, the CLOMR for the project was obtained on January 22, 2007. As a subsequent requirement, a Letter of Map Revision (LOMR) will need to be obtained once the construction of the project is completed. As the project is still in the design phase, obviously the LOMR has not yet been obtained, which means that the 2010 publication of the FEMA maps and FIS does not reflect the changes resulting from this project – it is still based on the 1979 original study.

Subsequent to obtaining the CLOMR, minor revisions were made to the design as well as updating the existing condition analysis with more recent survey. However, those changes are considered to be within the essence of the obtained CLOMR.

The final hydraulic modeling for the project and related reports have been prepared by the Hydraulic and Drainage Section of the Connecticut Department of Transportation (ConnDOT), based on the design plans for the roadway reconstruction, including the river relocation and hydraulic structures, that were prepared by Ammann & Whitney (formerly Berger, Lehman Associates, P.C.) of Rye, NY, the prime consultant engineer for State Project No. 151-273.

To avoid confusion between existing and proposed crossings in the report, the existing structures are referred to as "Structure" followed by the ConnDOT bridge numbers whereas proposed crossings are called out either as "Bridge" or "Culvert" depending on the proposed type (e.g. existing Structure No. 05668 versus proposed Culvert No. 05668; see Table 1).

**Table 1- Mad River Structure Numbers**

Structure Number*		Roadway
Existing	Proposed	
Structure No.01224	Bridge No.01224	Westerly I-84 crossing
none	none	Pedestrian Crossing
Structure No.06284	Bridge No.06284	I-84 Eastbound Exit 24 Off-Ramp to Harpers Ferry Road
Structure No.05774	Bridge No.05774	Easterly I-84 crossing
n/a	Bridge No.06591	Proposed I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road
Structure No.05668	Culvert No. 05668	Plank Road

\*Listed from downstream to upstream

## DISCHARGES

The discharges reported in the 1979 Waterbury Flood Insurance Study (FIS) were used for this study, as required by both the FEMA and the State regulations. These discharges are shown in Table 2.

**Table 2- Mad River Discharges (based on the 1979 Waterbury FIS)**

Flooding Source & Location	Drainage Area (sq. miles)	Peak Discharges (cfs)				
		10-yr	25-yr**	50-yr	100-yr	500-yr
Downstream of Beaver Pond Brook	23.9	2,350	2,105	4,060	4,990	7,775
Upstream of Beaver Pond Brook	18.0	1,505	3,290	2,595	3,190	4,970

\*\* Not from FIS; Estimated

The table lists two sets of discharges used for this study. The differences in these discharges reflect the additional flow entering the river from the Beaver Pond Brook, which also has been studied and described under a separate report. The confluence with the Beaver Pond Brook is located near the middle of the project site, or approximately one-third way down (1,300 ft) from the upstream limit of this study of the Mad River.

The studied range of discharges includes the 10-, 25-, 50-, 100- and 500-year storm frequency events. The analysis for the 25-Year discharge is not typically required, but found necessary for this project. The computed water surface elevation for this event was later used as the tailwater condition for the 50-year analysis of the Beaver Pond Brook, in accordance with the ConnDOT Drainage Manual. This discharge was estimated from the log-probability curve plotted using the other known FIS reported discharges. The relevant computations and plots are included in Appendix C.

It should be noted that the discharges used for the actual design of the waterway crossings and in-stream stabilization features are higher than the FIS reported discharges.

## HYDRAULIC ANALYSIS

The hydraulic analysis data from the 1979 effective FIS was obtained from FEMA. The USACOE computer program HEC-2, a predecessor of the HEC-RAS program for these studies, had been used for the effective FIS hydraulic analysis. A copy of the HEC-2 data is located in Appendix D. This data will be referred to as the “effective FIS data” in this report.

The hydraulic analyses for this project were performed using the U. S. Army Corps of Engineers (USACOE) computer program HEC-RAS version 4.1.0. Separate hydraulic models were developed for the effective (duplicate), existing (pre-project), proposed (post-project) and natural<sup>1</sup> conditions.

In developing the existing and proposed condition models, the hydraulic cross sections were obtained from the project survey digital terrain models or “surface-models” with reference to one common baseline. This makes comparison of the data feasible in the HEC-RAS environment. However, the orientation and other geometry data such as the distances along the main channel and floodplains are entered consistent with the represented condition. For the common baseline, the stream centerline developed for the final proposed (post-project) condition was used.

The survey and design plans for State. Project No. 151-273 were developed in Metric units. Accordingly, all the hydraulic models except for the Duplicate Effective were initially developed, analyzed and completed in the Metric units including establishing the river stations and floodway encroachments. Since the results of the hydraulic analyses must be presented in U.S. Customary units for the CLOMR, these models had to be converted using the HEC-RAS convert function. This function converts all the geometry data, including the encroachment stations, except for the river stationing. Therefore, the stations or the river section number remain the same as the Metric design models.

The primary control for the project survey was based on the North American Datum of 1983 (NAD-83) for the horizontal coordinates. All elevation data in both the original FIS and the project survey are referenced to National Geodetic Vertical Datum of 1929 (NGVD-29). As the new FIS (2010) is based on NAVD-88, some of the tables in this report are presented in both datums.

The limits of the HEC-RAS models were established in consideration of the proposed construction activities and by estimating the resulting hydraulic effects. For the upstream limit, FIS Cross Section AM (River Sta. 2+409 or Sta. 5143 in the effective FIS), which is located just

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<sup>1</sup> The natural conditions model is intended to show the floodplain in the vicinity of the project as it would be without any artificial encroachments or modifications. The natural profile is developed by modifying the *existing conditions model* to remove the bridge or culvert structure and any approach embankments.

downstream of the East Main Street crossing or approximately 1,050 ft upstream of the Plank Road crossing (Bridge No. 05668), was selected. There is no work proposed in the vicinity of this section, however, this was found to be the most upstream FIS lettered section where the existing profile matches to the effective FIS within an acceptable range. This was considered essential for establishing the updated existing conditions, as the CLOMR application for this project is intended not only to describe the effects of the proposed changes but also to reflect the major changes that have occurred since the date of the 1979 FIS, such as the dam breach at Century Dam.

For the downstream limit, FIS Cross Section Z (River Sta. 0+714 or Sta. 5130 in the effective FIS), which is located approximately 1,500 ft downstream of the westerly I-84 crossing (Structure No. 01224), was chosen. Similarly, there is no work proposed in the river at this location, however, the embankment for the proposed I-84 Westbound Exit 23 Off-Ramp does appear to encroach into the 0.2% annual chance (500-year) floodplain. This downstream limit was chosen to demonstrate that the fill for the embankment has no effect on the flood elevation. Furthermore, this is the most downstream FIS lettered section where the convergence of the existing and effective profiles occurs within an acceptable range. Further downstream of this limit, the river turns northeasterly away from the project site.

Some of the cross sections in both the Existing and Proposed Condition models, particularly upstream of the Plank Road, do not extend far enough to fully contain the 500-year flood. Nevertheless, the computed flood elevations are deemed accurate because the flooding beyond the cross section limits do not actively convey the flow due to the significant obstructions on the floodplain. These obstructions are reflected in the model using Ineffective Flow Area and Obstruction settings in the HEC-RAS.

To maintain consistency with the original FIS analysis, all cross sections in these models were input as if looking upstream.

For the Floodway analysis models in the study, both the upstream and downstream boundary conditions were set to "Known Water Surface Elevations" matching the effective FIS data. For the Regulatory analysis models, the matching HEC-2 data will also be used for the 10-, 50-, 100- and 500-year flows. However, because the HEC-2 run did not include the 25-year flow, the "Rating Curve" option is used instead. This allows the program to estimate the 25-year boundary condition based on the "known" elevations of the other frequencies.

In performing the analysis, the subcritical flow regime was assumed in accordance with the general modeling practices of the National Flood Insurance Program.

The HEC-RAS input data and output tables are included in the Appendices A and B. An electronic copy of the HEC-RAS data files are also enclosed in the back of this report.

## **Flood Insurance Study (Duplicate Effective/FEMA Reproduced Model)**

### HEC-2 vs. HEC-RAS

The Duplicate Effective/FEMA Reproduced Model was created in HEC-RAS by “importing” the effective FIS HEC-2 input data, which was obtained from the FEMA. The import function is a built-in feature in HEC-RAS which apparently brings in the geometric data in HEC-2. However, HEC-2 also has numeric input data that may differ from the geometric data. For example, a bridge’s opening may be defined by the difference in the low chord and ground geometric data; however, it may also be defined numerically elsewhere causing a discrepancy. HEC-RAS mainly uses the geometric data in bringing the HEC-2 data ignoring such numeric values which often leads to differing results between the two software programs. Nonetheless, the Duplicate Effective model was created as how HEC-RAS imports the HEC-2 data.

After the import, some data had to be changed for the model to run. The original FIS analysis did not utilize contraction or expansion loss coefficients. In order to successfully convert the FIS HEC-2 to HEC-RAS and then make a fair comparison to the Existing Condition model later, the contraction and expansion coefficients were incorporated into the HEC-RAS model. These loss coefficients were estimated using the HEC-RAS Hydraulic Reference Manual, CPD-69, U.S. Army Corps of Engineers, August 1998.

In modeling the Century Dam, it was entered as a bridge consistent with the approach in the original HEC-2 modeling, rather than using the Inline Structure option in HEC-RAS.

### WATER SURFACE PROFILE COMPARISON

The results of the analysis were compared to the original study, published data and the results of the Existing Condition model. The comparison is tabulated in Tables 3 and 4 for unencroached<sup>2</sup> and encroached<sup>3</sup> conditions respectively. The comparison tables show that the computed water surface elevations at the waterway crossings are generally higher using HEC-RAS than in the effective FIS study. In the unencroached condition, the greatest difference in the 1% annual chance (100-year) or Base Flood elevations is a 2.14-ft increase occurring just downstream of the Plank Road Structure No. 05668. The increase remains high in both the upstream and downstream directions. Toward downstream, it continues to the easterly I-84 crossing (Structure No. 05774). Toward upstream, the convergence (0.0 ft difference) occurs at the upstream study limit. The main cause of the increase may be due to the bridge opening area used in the computations, especially at the I-84 bridge. In the effective FIS study, the area manually inputted in the model was 400-sq. ft. However, using the bridge and cross section geometry, the HEC-RAS computed area was actually 360-sq. ft. With the smaller bridge opening, the resulting

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<sup>2</sup> The unencroached condition refers to the hydraulic model without the floodway encroachments applied.

<sup>3</sup> The encroached condition refers to the hydraulic model with the floodway encroachments applied.



water surface would be evidently higher. The resulting increase upstream of the I-84 bridge affects the upstream reach, including the Plank Road crossing, in the form of backwater.

In the encroached condition, the difference is about the same for the above mentioned area of the maximum difference for the unencroached condition, but jumps to 3.73 ft upstream of the Plank Road crossing. The main cause of such increase is again the above-noted difference in the bridge opening of the I-84 bridge. The increased backwater from the I-84 bridge submerges the Plank Road bridge making the roadway overtopping (weir flow) less efficient thus increasing the water surface elevation upstream of Plank Road, which translates to more flow being conveyed on the floodplains. Since the encroached condition reduces this floodplain area upstream of Plank Road, the water surface would go up even more to make up the loss.

Similar situation exists in the vicinity of the westerly I-84 bridge (No. 01224) and the upstream pedestrian crossing. Between these two crossing, the Duplicate Effective Model produced 0.72 ft higher Base Flood elevation in the unencroached condition, and 0.63 ft higher in the encroached condition compared to the original study. The difference becomes less upstream of the pedestrian bridge in the unencroached condition; on the contrary, the increase become larger in the encroached condition, due to the same reason described above for the Plank Road crossing. However, the difference occurring upstream of the westerly I-84 crossing can be attributed to the different computational approaches that HEC-2 and HEC-RAS utilize. For example, the 100-year flow through the I-84 bridge is in a Low Flow condition (water surface is below the low chord). The HEC-2 special bridge routines use a trapezoidal approximation for the Low Flow; however, the HEC-RAS uses the actual bridge opening geometry.

One of the requirements specified in the FEMA's *Application Forms and Instructions for Conditional Letters of Map Revision and Letters of Map Revision (MT-2)* calls for calibrating the duplicate model to reproduce the FIS profiles within 0.5 foot. Since all of the FIS cross sections within the project study reach will be replaced with cross sections developed from the recent project survey, the calibration was not implemented. At the project study limits where the updated existing conditions model and proposed condition model tie into the duplicate effective model, the duplicate effective profile matches within 0.5 ft of the published (effective) profile.

## **Corrected Effective Model**

Except for the bridge opening area differences and modeling techniques previously noted, there are no significant, known technical errors or any construction in the floodplain that occurred prior to November 1, 1979, which is the date of the effective model. Hence, a separate Corrected Effective Model was not created.

**TABLE 3. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Unencroached Condition) Water Surface Elevations  
Mad River, Waterbury**

U.S. Customary, (ft) NGVD-29

			(1)	(2)	(3)	(4)	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
	FEMA Sta.	River Station	Published FIS	Original HEC-2	Duplicate Effective	Existing Condition				
AM	5143.0	2409	388.9	388.90	388.90	388.90	0.00	0.00	0.00	0.00
		2337				383.29				
		2280				381.44				
AL	5142.0	2238	380.8	380.77	381.23	381.07	0.03	0.46	-0.16	0.27
		2207				380.20				
		2202				380.08				
		2168				379.46				
		2130				378.53				
AK	5141.0	2116	378.8	378.14	380.03	376.91	0.66	1.89	-3.12	-1.89
		2095.5	Plank Road Structure No. 05668							
AJ	5140.0	2079	378.2	378.00	380.14	374.15	0.20	2.14	-5.99	-4.05
		2067				374.88				
AI	5139.0	2020	378.2	378.16	380.15	374.87	0.04	1.99	-5.28	-3.33
		2004				374.86				
		1983				374.75				
		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)							
		1927				371.99				
SEE NOTE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				370.45				
AH	5138.0	1858 (E&P 1871)	376.2	376.15	376.14	370.56	0.05	-0.01	-5.58	-5.64
		1837				370.52				
		1778				370.38				
		1748				368.45				
AG	5137.0	1689	376.2	376.23	376.21	366.17	-0.03	-0.02	-10.04	-10.03
		1620				364.50				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				358.54				
AF	5136.0	1523	358.7	358.66	358.69	357.29	0.04	0.03	-1.40	-1.41
		1487				356.90				
		1425				355.72				
AE	5135.0	1370	354.4	354.40	354.41	353.83	0.00	0.01	-0.58	-0.57
		1330				353.39				
		1309				353.19				
AD	5134.0	1277	353.6	353.61	353.83	353.37	-0.01	0.22	-0.46	-0.23
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	352.2	352.19	352.91	352.39	0.01	0.72	-0.52	0.19
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				348.37				
AB	5132.0	1153	349.7	349.65	349.73	347.31	0.05	0.08	-2.42	-2.39
		1107				345.80				
		1003				343.11				
AA	5131.0	894	341.4	341.44	341.37	338.99	-0.04	-0.07	-2.38	-2.41
		809				336.99				
Z	5130.0	714	335.3	335.27	335.27	335.27	0.03	0.00	0.00	-0.03

Note: Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road) was not included in the FIS.

**TABLE 3A. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Unencroached Condition) Water Surface Elevations  
Mad River, Waterbury**

U.S. Customary, (ft) NAVD-88

			(1)	(2)	(3)	(4)	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
	FEMA Sta.	River Station	Published FIS	Original HEC-2	Duplicate Effective	Existing Condition				
AM	5143.0	2409	387.9	387.90	387.90	387.90	0.00	0.00	0.00	0.00
		2337				382.29				
		2280				380.44				
AL	5142.0	2238	379.8	379.77	380.23	380.07	0.03	0.46	-0.16	0.27
		2207				379.20				
		2202				379.08				
		2168				378.46				
		2130				377.53				
AK	5141.0	2116	377.8	377.14	379.03	375.91	0.66	1.89	-3.12	-1.89
		2095.5	Plank Road Structure No. 05668							
AJ	5140.0	2079	377.2	377.00	379.14	373.15	0.20	2.14	-5.99	-4.05
		2067				373.88				
AI	5139.0	2020	377.2	377.16	379.15	373.87	0.04	1.99	-5.28	-3.33
		2004				373.86				
		1983				373.75				
		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)							
		1927				370.99				
SEE NOTE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				369.45				
AH	5138.0	1858 (E&P 1871)	375.2	375.15	375.14	369.56	0.05	-0.01	-5.58	-5.64
		1837				369.52				
		1778				369.38				
		1748				367.45				
AG	5137.0	1689	375.2	375.23	375.21	365.17	-0.03	-0.02	-10.04	-10.03
		1620				363.50				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				357.54				
AF	5136.0	1523	357.7	357.66	357.69	356.29	0.04	0.03	-1.40	-1.41
		1487				355.90				
		1425				354.72				
AE	5135.0	1370	353.4	353.40	353.41	352.83	0.00	0.01	-0.58	-0.57
		1330				352.39				
		1309				352.19				
AD	5134.0	1277	352.6	352.61	352.83	352.37	-0.01	0.22	-0.46	-0.23
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	351.2	351.19	351.91	351.39	0.01	0.72	-0.52	0.19
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				347.37				
AB	5132.0	1153	348.7	348.65	348.73	346.31	0.05	0.08	-2.42	-2.39
		1107				344.80				
		1003				342.11				
AA	5131.0	894	340.4	340.44	340.37	337.99	-0.04	-0.07	-2.38	-2.41
		809				335.99				
Z	5130.0	714	334.3	334.27	334.27	334.27	0.03	0.00	0.00	-0.03

Note: Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road) was not included in the FIS.

**TABLE 3M. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Unencroached Condition) Water Surface Elevations  
Mad River, Waterbury**

*Metric, (m) NGVD-29*

			(1)	(2)	(3)	(4)				
	FEMA Sta.	River Station	Published FIS	Original HEC-2	Duplicate Effective	Existing Condition	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
AM	5143.0	2409	118.5	118.54	118.54	118.54	0.00	0.00	0.00	0.00
		2337				116.83				
		2280				116.26				
AL	5142.0	2238	116.1	116.06	116.20	116.15	0.01	0.14	-0.05	0.08
		2207				115.88				
		2202				115.85				
		2168				115.66				
		2130				115.38				
AK	5141.0	2116	115.5	115.26	115.83	114.88	0.20	0.58	-0.95	-0.58
		2095.5	Plank Road Structure No. 05668							
AJ	5140.0	2079	115.3	115.21	115.87	114.04	0.06	0.65	-1.83	-1.23
		2067				114.26				
AI	5139.0	2020	115.3	115.26	115.87	114.26	0.01	0.61	-1.61	-1.01
		2004				114.26				
		1983				114.22				
		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)							
		1927				113.38				
SEE NOTE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				112.91				
AH	5138.0	1858 (E&P 1871)	114.7	114.65	114.65	112.95	0.02	0.00	-1.70	-1.72
		1837				112.93				
		1778				112.89				
		1748				112.30				
AG	5137.0	1689	114.7	114.67	114.67	111.61	-0.01	-0.01	-3.06	-3.06
		1620				111.10				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				109.28				
AF	5136.0	1523	109.3	109.32	109.33	108.90	0.01	0.01	-0.43	-0.43
		1487				108.78				
		1425				108.42				
AE	5135.0	1370	108.0	108.02	108.02	107.85	0.00	0.00	-0.18	-0.17
		1330				107.71				
		1309				107.65				
AD	5134.0	1277	107.8	107.78	107.85	107.71	0.00	0.07	-0.14	-0.07
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	107.4	107.35	107.57	107.41	0.00	0.22	-0.16	0.06
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				106.18				
AB	5132.0	1153	106.6	106.57	106.60	105.86	0.02	0.02	-0.74	-0.73
		1107				105.40				
		1003				104.58				
AA	5131.0	894	104.1	104.07	104.05	103.32	-0.01	-0.02	-0.73	-0.73
		809				102.71				
Z	5130.0	714	102.2	102.19	102.19	102.19	0.01	0.00	0.00	-0.01

Note: Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road) was not included in the FIS.

**TABLE 4. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Encroached Condition - Floodway) Water Surface Elevations  
Mad River, Waterbury**

U.S. Customary, (ft) NGVD-29

			(1)	(2)	(3)	(4)	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
	FEMA Sta.	River Station	Published FIS	Original HEC-2	Duplicate Effective	Existing Condition				
AM	5143.0	2409	388.9	388.90	388.93	388.93	0.00	0.03	0.00	0.03
		2337				383.29				
		2280				381.53				
AL	5142.0	2238	380.8	380.77	382.31	381.19	0.03	1.54	-1.12	0.39
		2207		378.15		380.41				
		2202		377.72		380.29				
		2168				379.57				
		2130		376.22		378.56				
AK	5141.0	2116	378.8	378.15	381.88	377.97	0.65	3.73	-3.91	-0.83
		2095.5	Plank Road Bridge No. 05668							
AJ	5140.0	2079	378.2	377.99	380.13	374.08	0.21	2.14	-6.05	-4.12
		2067				374.83				
AI	5139.0	2020	378.2	378.16	380.15	374.82	0.04	1.99	-5.33	-3.38
		2004				374.81				
		1983				374.70				
		1953.5	Existing I-84 Bridge 05774 (Easterly I-84 crossing over the Mad River)							
		1927				371.74				
		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				370.45				
AH	5138.0	1858 (EX1871)	376.2	376.15	376.14	370.56	0.05	-0.01	-5.58	-5.64
		1837				370.52				
		1778				370.38				
		1748				368.45				
AG	5137.0	1689	376.2	376.23	376.21	366.17	-0.03	-0.02	-10.04	-10.03
		1620				364.50				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				358.78				
AF	5136.0	1523	359.2	359.17	358.95	357.63	0.03	-0.22	-1.32	-1.57
		1487				357.27				
		1425				356.12				
AE	5135.0	1370	354.4	354.30	354.94	354.21	0.10	0.64	-0.73	-0.19
		1330				353.69				
		1309				353.48				
AD	5134.0	1277	353.6	353.65	355.37	353.61	-0.05	1.72	-1.76	0.01
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	352.2	352.14	352.77	352.00	0.06	0.63	-0.77	-0.20
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				348.37				
AB	5132.0	1153	349.9	349.85	349.85	347.31	0.05	0.00	-2.54	-2.59
		1107				345.80				
		1003								
AA	5131.0	894	341.4	341.37	341.38	338.99	0.03	0.01	-2.39	-2.41
		809								
Z	5130.0	714	335.3	335.27	335.27	335.27	0.03	0.00	0.00	-0.03

**TABLE 4A. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Encroached Condition - Floodway) Water Surface Elevations  
Mad River, Waterbury**

U.S. Customary, (ft) NAVD-88

			(1)	(2)	(3)	(4)	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
	FEMA Sta.	River Station	Published FIS	Original HEC-2	Duplicate Effective	Existing Condition				
AM	5143.0	2409	387.9	387.90	387.93	387.93	0.00	0.03	0.00	0.03
		2337				382.29				
		2280				380.53				
AL	5142.0	2238	379.8	379.77	381.31	380.19	0.03	1.54	-1.12	0.39
		2207		377.15		379.41				
		2202		376.72		379.29				
		2168				378.57				
		2130		375.22		377.56				
AK	5141.0	2116	377.8	377.15	380.88	376.97	0.65	3.73	-3.91	-0.83
		2095.5	Plank Road Bridge No. 05668							
AJ	5140.0	2079	377.2	376.99	379.13	373.08	0.21	2.14	-6.05	-4.12
		2067				373.83				
AI	5139.0	2020	377.2	377.16	379.15	373.82	0.04	1.99	-5.33	-3.38
		2004				373.81				
		1983				373.70				
		1953.5	Existing I-84 Bridge 05774 (Easterly I-84 crossing over the Mad River)							
		1927				370.74				
		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				369.45				
AH	5138.0	1858 (EX1871)	375.2	375.15	375.14	369.56	0.05	-0.01	-5.58	-5.64
		1837				369.52				
		1778				369.38				
		1748				367.45				
AG	5137.0	1689	375.2	375.23	375.21	365.17	-0.03	-0.02	-10.04	-10.03
		1620				363.50				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				357.78				
AF	5136.0	1523	358.2	358.17	357.95	356.63	0.03	-0.22	-1.32	-1.57
		1487				356.27				
		1425				355.12				
AE	5135.0	1370	353.4	353.30	353.94	353.21	0.10	0.64	-0.73	-0.19
		1330				352.69				
		1309				352.48				
AD	5134.0	1277	352.6	352.65	354.37	352.61	-0.05	1.72	-1.76	0.01
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	351.2	351.14	351.77	351.00	0.06	0.63	-0.77	-0.20
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				347.37				
AB	5132.0	1153	348.9	348.85	348.85	346.31	0.05	0.00	-2.54	-2.59
		1107				344.80				
		1003								
AA	5131.0	894	340.4	340.37	340.38	337.99	0.03	0.01	-2.39	-2.41
		809								
Z	5130.0	714	334.3	334.27	334.27	334.27	0.03	0.00	0.00	-0.03

**TABLE 4M. Published FIS/HEC-2 Data Versus  
FEMA Reproduced (Duplicate Effective) and Existing Condition Models  
100-Year FEMA Discharge (Encroached Condition - Floodway) Water Surface Elevations  
Mad River, Waterbury**

*Metric, (m) NGVD-29*

	FEMA Sta.	River Station	(1) Published FIS	(2) Original HEC-2	(3) Duplicate Effective	(4) Existing Condition	(1) - (2)	(3) - (2)	(4) - (3)	(4) - (1)
AM	5143.0	2409	118.5	118.54	118.55	118.55	0.00	0.01	0.00	0.01
		2337				116.83				
		2280				116.29				
AL	5142.0	2238	116.1	116.06	116.53	116.19	0.01	0.47	-0.34	0.12
		2207		115.26		115.95				
		2202		115.13		115.91				
		2168				115.69				
		2130		114.67		115.39				
AK	5141.0	2116	115.5	115.26	116.40	115.21	0.20	1.14	-1.19	-0.25
		2095.5	Plank Road Bridge No. 05668							
AJ	5140.0	2079	115.3	115.21	115.86	114.02	0.06	0.65	-1.84	-1.26
		2067				114.25				
AI	5139.0	2020	115.3	115.26	115.87	114.25	0.01	0.61	-1.62	-1.03
		2004				114.24				
		1983				114.21				
		1953.5	Existing I-84 Bridge 05774 (Easterly I-84 crossing over the Mad River)							
		1927				113.31				
		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)							
		1900				112.91				
AH	5138.0	1858 (EX1871)	114.7	114.65	114.65	112.95	0.02	0.00	-1.70	-1.72
		1837				112.93				
		1778				112.89				
		1748				112.30				
AG	5137.0	1689	114.7	114.67	114.67	111.61	-0.01	-0.01	-3.06	-3.06
		1620				111.10				
		1561.5	Breached Century Dam (CTDEP Dam No. 15103)							
		1536				109.36				
AF	5136.0	1523	109.5	109.48	109.41	109.01	0.01	-0.07	-0.40	-0.48
		1487				108.90				
		1425				108.55				
AE	5135.0	1370	108.0	107.99	108.19	107.96	0.03	0.20	-0.22	-0.06
		1330				107.80				
		1309				107.74				
AD	5134.0	1277	107.8	107.79	108.32	107.78	-0.02	0.52	-0.54	0.00
		1260.5	Existing Pedestrian Footbridge							
AC	5133.0	1246	107.4	107.33	107.52	107.29	0.02	0.19	-0.23	-0.06
		1198.5	I-84 Structure No. 01224 (Westerly I-84 crossing over Mad River)							
		1162				106.18				
AB	5132.0	1153	106.6	106.63	106.63	105.86	0.02	0.00	-0.77	-0.79
		1107				105.40				
		1003								
AA	5131.0	894	104.1	104.05	104.05	103.32	0.01	0.00	-0.73	-0.73
		809								
Z	5130.0	714	102.2	102.19	102.19	102.19	0.01	0.00	0.00	-0.01

## Existing (Pre-Project) Condition

### DEVELOPMENT OF EXISTING CONDITION MODEL

Cross sections from the effective FIS data were compared to the project survey information. The surveyed information was found generally lower than the effective FIS data, and numerous sections had significant differences in geometry or elevation differences greater than 0.5 ft. Furthermore, since the completion of the 1979 FIS, several significant changes have occurred in the area. These are:

- Century Dam (a.k.a. Scovill Pond Dam, East Brass Mill Pond Dam, City Mills Pond Dam) was breached in 1998 pursuant to a 1988 administrative order issued by the Connecticut Department of Environmental Protection.
- Following the 1998 breach, the channel upstream of the dam has migrated laterally.
- In 1994 the construction of Structure No. 06284 was completed over the Mad River for the I-84 Eastbound Exit 24 Off-Ramp to Harpers Ferry Road.
- Structure No. 05668 (Plank Road over the Mad River) was replaced in 1987.

With these findings, it was decided to use cross sectional information from the project survey data for the entire reach except at the upstream and downstream boundaries. This approach ensures consistency between the existing and proposed conditions, where the project survey must be used for the design. The use of the project survey cross section will more accurately define the river through the project limits, based on the current field conditions. The effective FIS data will, however, be used for the boundary sections in order to properly match the new study to the effective study.

Excluding the boundary sections and internal sections at the waterway crossings, thirty-eight (38) stream cross sections were obtained, among which twelve (12) represent the comparable locations of the FIS lettered sections. With the boundary sections, there are fourteen (14) lettered sections. The additional cross sections beyond the fourteen were necessary to accurately portray the existing river, and in some areas, to provide a matching section to a section in the Proposed Condition model. Nonetheless, not all the sections in the Proposed Condition model could feasibly be matched with an existing condition section because of the proposed river relocation and the new bridge locations. For example, the section 1962 in the Proposed Condition model is located within the span of the existing I-84 bridge Structure No. 05774. This bridge is bound by the sections 1927 and 1983 in the Existing Condition model, and placing a section between them is not possible in HEC-RAS. The cross section locations are shown on Figure 2.



The cross sections were cut from the Digital Terrain Model (DTM) surface file developed from the project survey information. The project survey/base map was generated with the photogrammetry mapping based April 1998 flight from Aero-Metric, Inc. (Sheboygan, WI). This was then partially edited with ground survey data from AI Engineers, Inc (Middletown, CT). Where the survey coverage was not sufficient to accurately portray the geometry of the river, additional hydraulic cross-sectional surveys were performed by Ammann & Whitney initially, then by the ConnDOT survey forces. After the original CLOMR was received, the Mad River reach from the breached dam to the Plank Road crossing was re-surveyed by AI Engineers, as the river geometry was noticeably changed within that reach.

The bank stations at each section were generally set at the physical location of the top of channel banks. In some situations, however, it had to be set at a point along the channel bank, as the HEC-RAS program discourages setting the encroachment stations inside the bank stations. This allows setting the Floodway encroachments stations on the bank that matches the width of the current effective study. These situations exist when the original encroachment stations are set inside the main channel and also when the flow is contained within the channel.

The Floodway encroachment stations for the FIS representative sections were initially set to match the width determined in the effective study as well as the location depicted on the effective FIRM. For all the other sections, they were scaled from the map (included in Appendix D). The analysis, however, showed that the initial Floodway settings fall outside the resulting 100-year flood boundary at numerous sections and also did not seem to match the intended location of the original study. In such cases, the Floodway was graphically adjusted to match the 100-year flood boundary as well as the intent of the original study. For example, at Section 1246 (FEMA Section AC), placing a 93-ft wide floodway consistent with the latest FIRM would block a portion of the main channel where the encroachments in original HEC-2 section did not. As the floodway depiction was derived from the original HEC-2 model, it is deemed more appropriate to adjust/shift encroachment stations to simulate the original HEC-2 section even if the resulting floodway boundary does not align well with the latest FIRM. See Figure 3 which shows both the effective and existing Floodway limits.

For the main channel, a Manning's roughness coefficient of 0.04 was generally used consistent with the effective FIS model. From upstream of the breached Century Dam to downstream of the Structure No. 06284 (I-84 Eastbound Exist 24 Off-Ramp), some areas within the channel, especially near the toe of slopes, the coefficient was lowered to 0.03 where the bare soil was exposed showing signs of active erosion.

For the floodplain areas and upper portion of the channel banks, the Manning's roughness coefficients ranged from 0.02 to 0.08, depending on the coverage type.

Throughout the model, the Ineffective Flow Area and Blocked Obstruction features in the HEC-RAS were utilized to incorporate the effects of buildings and other obstructions on the floodplains. At waterway crossings, the ineffective flow areas were set consistent with the recommendations in the HEC-RAS manual.

## EFFECTS ON STORAGE AND DISCHARGES

Considering that the Century Dam was breached by others in 1998, studying the effect of the associated loss of flood storage on the downstream areas was not considered under this project. However, it should be noted that the effective FIS discharges were estimated without the consideration of the storage of the City Mills Pond. Therefore, it is deemed adequate to use the discharges from the effective FIS study in analyzing the existing and proposed conditions for the regulatory conformance.

## WATER SURFACE PROFILE COMPARISON TO EFFECTIVE (FIS and Duplicate Model)

As indicated previously, the resulting water surface profiles of the Existing Condition Model were compared to the Duplicated Effective Model and also to the published profile, as shown in Tables 3 and 4.

### *Existing Condition vs. FIS Published*

The Existing Condition profiles were generally lower than the published profiles. Especially at the first upstream section from the Century Dam, the Base Flood Elevation was lowered by 10 ft, due to the 1998 breach. This affects the water surface profile all the way up to the Plank Road crossing at which the upstream water surface was lowered by slightly less than 2 ft.

Another notable location is downstream of the westerly I-84 Structure No. 01224, where the decrease was more than 2 ft (at FIS Sections AA and AB). In order to determine the cause, the differences in the channel geometry had to be evaluated. Comparing the cross-section data found that the channel bottom elevation is lower by approximately 3 ft at FIS Section AA. This appears to be the main cause of the decrease. This also seems to affect the upstream FIS Section AB equally, though the bottom elevation remains close to the original study.

There were two locations where the existing condition profile was higher than the published profile. They are immediately upstream of the westerly I-84 bridge (at FIS Section AC) and approximately 450 ft upstream of Plank Road (at FIS Section AL). The differences were approximately 0.2 and 0.3 ft respectively in the unencroached condition.

In the encroached condition, the flood profile was lower similarly with the maximum difference of 10 ft occurring upstream of the breach dam, and maintained similar differences as the unencroached condition profile except at the upstream section of Plank Road where the difference was less than one foot. Downstream of the dam, one of the notable differences is at the upstream approach sections to the pedestrian bridge (FIS Section AD) and at the Section AC. At the FIS Section AC, there is a decrease of 0.2 ft instead of the increase; conversely, there is a slight increase (0.01 ft) at Section AD instead of the decrease of 0.23 ft.

### Existing Condition vs. Duplicate Effective

Compared to the Duplicate Effective's profile, the Existing Condition was lower throughout the whole reach. Since both the Duplicate Effective and Existing Condition models were developed using the same hydraulic analysis program, their differences represent a better reflection of how the Mad River's hydraulic conditions have changed since the original study.

Next, the differences occurring at the waterway crossings are discussed below.

### HYDRAULIC CONDITION AT INDIVIDUAL STRUCTURES

#### Plank Road Crossing, Structure No. 05668:

The structure was replaced by the City of Waterbury in 1987. The structure is a single span bridge consisting of concrete abutments with a precast concrete deck unit superstructure. The clear span, measured between the abutment faces, is 43 ft. The width of the crossing perpendicular to the roadway baseline is 44 ft.

The hydraulic analyses prepared for this project indicates that roadway overtopping of the existing bridge begins at approximately the 25-year frequency discharge. The Base Flood overtops the roadway by approximately one foot. This overtopping condition can be attributed to several factors:

- The elevation difference between the Plank Road profile and the channel invert of the Mad River is not sufficient (approximately 9 ft).
- Upstream of Plank Road, the floodplain of the Mad River has been nearly completely filled in to accommodate roadways and residential developments. The hydraulic capacity of the existing river channel is insufficient to convey the 100 year design discharge which results in overbank flows that inundate Plank Road, Harpers Ferry Road and the surrounding residential properties.
- Existing I-84 Structure No. 05774, located approximately 400 ft downstream of Plank Road, causes approximately 2 ft of backwater for the Base Flood. This backwater extends upstream to Plank Road, reducing the hydraulic capacity of the existing bridge and aggravating roadway overtopping.

Regardless of the overtopping condition, breaching of the dam improved the flooding condition in the vicinity of this bridge. The 100-year flood elevation over the bridge was lowered by more than 3 ft. The computed flow velocity through the bridge is relatively high at 10 ft/s. Although the existing channel upstream of the bridge appears stable, the downstream region on the contrary has been going through dynamic changes.

*Easterly I-84 Crossing, Structure No. 05774:*

This bridge is the easterly crossing of Interstate 84 over the Mad River within the project limits. The bridge consists of single span, precast concrete box beams constructed as part of the original highway work. It has a clear span length of 51.5 ft measured between the abutment faces and a total width of approximately 102 ft.

Prior to the 1998 breach, the backwater from the Century Dam would have impinged on this structure for the Base Flood. However, the analysis indicates that the effects of the backwater no longer reach this far in the existing condition. The breach dewatered the former City Mills Pond upstream of the dam, resulting in a lower upstream flood profile. The bridge now conveys the 100-year Base Flood with approximately 2.5 ft of clearance, which represents a significant improvement, as the Duplicate Effective Model showed the bridge opening fully submerged. The water surface in the vicinity of the bridge is approximately 5 ft lower than the Duplicate Effective Model. The constriction at the bridge still causes 2 ft of backwater upstream, extending to the existing Plank Road Structure No. 05668, aggravating flooding over the structure, roadways and residential properties near this crossing.

*I-84 Eastbound Exit 24 Off-Ramp to Harpers Ferry Road, Structure No. 06284:*

The bridge is a single span, curved steel box girder structure constructed in 1994. It has a clear span length of 181 ft measured along the baseline between the abutment faces. The construction of this structure required placing fill in the City Mills Pond just downstream of the I-84 Structure No. 05774 for its abutments and the adjacent ramp, narrowing the channel width. Due to breaching the downstream dam, however, the resulting water surface at this crossing was still lower, approximately by 5 ft, than the effective FIS profile. The clearance between the Base Flood water surface and the low chord is approximately 10 ft. Although the bridge structure sits well above the flood elevation, the flow is still constricted, as the effects of the ineffective flow regions downstream of the I-84 bridge continues through this crossing.

*Century Dam:*

The partially breached Century Dam still forms a weir in the river, as its lateral center portion protrudes approximately 1 to 2 ft above the upstream channel bottom. Then, the channel invert drops approximately 5 ft immediately downstream. Therefore, it was modeled as an inline weir structure. The resulting profile of the model suggests that the breach has lowered the 100-year Base Flood Elevation by 10 ft at the upstream face of the dam.

### Pedestrian Bridge:

The existing pedestrian crossing consists of a steel through-girder bridge with a concrete deck founded on concrete abutments on spread footings. It has a clear span length of approximately 69 ft measured between the abutment faces, total outside width of 11 ft and inside lane width of 8 feet. The crossing is located approximately 130 ft upstream (southerly) of existing I-84 Structure No. 01224.

The bridge deck elevation is approximately even with the adjacent floodplains with the superstructure located only 10 feet above the streambed. The 25 year discharge overtops the structure by approximately 0.5 ft, and the surface of the Base Flood is 2 ft above the bridge deck. Due to its relatively close proximity to the westerly I-84 bridge, it affects the headwater of the downstream bridge.

### Westerly I-84 Crossing, Structure No. 01224:

Existing Structure No. 01224 is the westerly I-84 crossing over the Mad River within the project limits. The crossing is a two span bridge with a rolled steel beam superstructure erected as part of the original construction of I-84. It has a total span length of approximately 100 ft measured between the abutment faces.

The analysis shows that the bridge adequately conveys the Base Flood with approximately 10 ft of clearance below the superstructure. Upstream of the bridge, the main channel does not have sufficient capacity to convey the flood flow, and thus causes overflow onto the floodplain. The nearby upstream pedestrian bridge exacerbates the condition forcing more flow onto the floodplain. As the flow enters the bridge, it undergoes significant contraction causing energy loss, and consequent increase in the headwater. As the flow passes through the bridge with diminishing effects of the contraction and the constriction of the pedestrian bridge, the water surface drops by nearly 4 ft while the velocity increases from 9.3 to 14.3 ft/s. The subcritical flow entering the bridge transitions to critical flow in the analysis, but is suspected to undergo supercritical condition just downstream of the bridge before it rises back to subcritical condition. Nonetheless, the existing riverbanks, which are armored with large riprap, appear to be in good condition.

## AREAS OF FLOODING

A map has been prepared showing the existing Base and 500-year Flood boundaries plotted on the effective FIRM in the background (see Figure 3). The existing flooding limits were drawn based on the contour lines developed from the project survey and 2004 LiDAR data. These limits match the computed top width of flow at most cross sections included in the model. In some cases, however, the flooding would occur wider than the computed width if it rises beyond the available data in a cross section. In such cases, the flood boundaries were extended to where the flood elevation matches the ground elevation. As indicated earlier, the computed elevation

is still deemed adequate as the area beyond the data included in a cross section does not contribute to the active conveyance of flow due to the significant constrictions.

Comparing the effective and existing flood boundaries, the flooding areas upstream of the breached dam to Plank Road have narrowed, as expected. However, upstream of Plank Road, the existing Base Flood spreads wider into the residential area even though the flood elevation is lower. This may be attributed to a number of factors. One primary reason appears to be the accuracy of modeling. The existing condition model reveals that the critical location is between the Sections 2130 and 2168 (approximately 100 to 230 ft upstream of Plank Road) where the 100-year flow spreads beyond the channel banks, over Brookdale Lane and onto the residential area. At the Section 2116 or AK (first section upstream of Plank Road), the analysis indicates that the flood elevation drops below the top of channel bank; however, in actuality, the flow on the floodplain would seek the shortest path downstream, which in this case is not going back to the main channel immediately, but continuing downstream over Plank Road and then eventually back into the river. The effective FIS which lacks the noted critical sections in the model appears to have not considered the flow over the channel bank. Another notable reason is in the differences between the FIS and surveyed cross-sections. Again at the Section 2116 or AK, the westerly floodplain is at elevation 380 FT in the FIS as opposed to 377.5 FT in the Existing Condition model.

There is a notable difference near the upstream limit of the study. Between the Sections AL (2238) and AM (2409), the existing 500-year floodplain is significantly narrower. In the effective map, the 500-year floodplain extends out easterly by up to 360 ft; however, there are no additional sections in the FIS model to represent the spread. The Existing Condition model, on the other hand, includes two additional sections allowing more accurate modeling.

Downstream of the dam to the westerly I-84 crossing, the 100-year Base Flood boundary is much wider than depicted on the effective FIRM. Conversely, it is found narrower for the reach downstream of the westerly I-84 crossing to the downstream study limit. The 500-year flood boundary appears to be in relatively close agreement with what is shown on the effective map.

### SANITRAY SEWER PUMP STATION

A sanitary pump station currently exists easterly of the Mad River at the southwest quadrant of the I-84 interchange with Harpers Ferry Road, and is in conflict with the proposed realignment and widening of the I-84. Hence, a new pump station is currently being installed approximately 900 feet southwest of the existing station. The new location is at the southwest quadrant of the new I-84 interchange with Harpers Ferry Road, just south of the breached Century Dam. The sanitary sewer relocation and new pump station construction are being performed under the State Project No. 151-285, and anticipated to be completed prior to the start of the State Project 151-273 construction.

The proposed pump station location falls within the current effective Floodway and floodplain - approximately 3,037 SY is in the Floodway and 614 SY in the Floodway Fringe. However, as the current effective Floodway and floodplain were established when the Century Dam was at its

full height, they no longer reflect the actual existing condition. The analysis of the existing condition, which incorporated the breached dam, shows that the fill slope for the pump station site just borders the actual 100-year floodplain, without any impingement. This is shown in Figure 3.

The pump station and related grading work were not reflected in the existing condition model with the intent to establish 100-year floodplain first, then evaluate and make necessary adjustment to the proposed pump station to keep it out of the floodplain. As proposed, this study demonstrates that no part of the pump station work will impact the 100-year floodplain. In the case of the 500-year floodplain, there is a sliver of fill (approximately 94 SY) from the slope required for the access driveway to the pump station. However, due to its negligible amount, this is not expected to result in an increase in the water surface elevation.

**TABLE 5. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Unencroached Condition)  
Mad River, Waterbury**

U.S. Customary, NGVD-29

			U.S. Customary					
FEMA Sta.	River Sta.	Existing Condition		Proposed Condition		Difference		
		W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)	
AM	5143.0	2409	388.90	13.11	388.90	13.11	0.00	0.00
		2337	383.29	11.37	383.29	11.37	0.00	0.00
		2280	381.44	10.11	381.30	10.42	-0.14	0.31
AL	5142.0	2238	381.07	7.02	380.74	7.45	-0.33	0.43
		2207	380.20	8.00	378.87	10.41	-1.33	2.41
		2202	380.08	7.97	378.45	10.87	-1.63	2.90
		2168	379.46	7.30	376.85	10.60	-2.61	3.30
	2130	378.53	6.91	376.44	7.97	-2.09	1.06	
AK	5141.0	2116	376.91	11.09	376.32	7.64	-0.59	-3.45
REPLACE	2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	374.15	10.91	373.79	7.76	-0.36	-3.15
		2067	374.88	4.80	374.05	3.68	-0.83	-1.12
AI	5139.0	2020	374.87	2.52	373.97	3.68	-0.90	1.16
		2004	374.86	2.53	373.95	3.47	-0.91	0.94
		1983	374.75	3.25	373.81	4.26	-0.94	1.01
		1972			373.32	6.61		
	1962			373.13	6.47			
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	371.99	8.51				
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
		1900	370.45	10.08	371.88	7.10	1.43	-2.98
AH	5138.0	1871	370.56	7.33	370.90	9.02	0.34	1.69
		1837	370.52	5.77				
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	370.38	5.54				
		1748	368.45	11.69	368.72	9.34	0.27	-2.35
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	366.17	12.57	365.62	13.09	-0.55	0.52
		1620	364.50	7.35	363.88	8.79	-0.62	1.44
	5136.8	1573	364.09	6.38	363.62	7.01	-0.47	0.63
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
	5136.2	1550	359.39	5.52	358.74	11.28	-0.65	5.76
		1536	358.54	8.19	358.45	9.19	-0.09	1.00
AF	5136.0	1523	357.29	9.94	357.18	10.20	-0.11	0.26
		1487	356.90	6.85	356.84	7.02	-0.06	0.17
		1425	355.72	7.15	355.72	7.15	0.00	0.00
AE	5135.0	1370	353.83	10.17	353.82	10.20	-0.01	0.03
		1330	353.39	7.77	353.04	8.73	-0.35	0.96
		1309	353.19	7.70	352.91	8.13	-0.28	0.43
NEW	1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	353.37	4.56	352.24	6.09	-1.13	1.53
REMOVE	1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	352.39	7.72				
REPLACE	1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	348.37	10.91	348.13	11.33	-0.24	0.42
AB	5132.0	1153	347.31	12.52	347.08	12.95	-0.23	0.43
		1107	345.80	11.76	345.80	11.76	0.00	0.00
		1003	343.11	10.66	343.11	10.66	0.00	0.00
AA	5131.0	894	338.99	13.03	338.99	13.03	0.00	0.00
		809	336.99	11.83	336.99	11.83	0.00	0.00
Z	5130.0	714	335.27	10.23	335.27	10.23	0.00	0.00

- New/Replacement Structure
  - Existing Structure



**TABLE 5A. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Unencroached Condition)  
Mad River, Waterbury**

U.S. Customary, NAVD-88

			U.S. Customary					
FEMA Sta.	River Sta.	Existing Condition		Proposed Condition		Difference		
		W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)	
AM	5143.0	2409	387.90	13.11	387.90	13.11	0.00	0.00
		2337	382.29	11.37	382.29	11.37	0.00	0.00
		2280	380.44	10.11	380.30	10.42	-0.14	0.31
AL	5142.0	2238	380.07	7.02	379.74	7.45	-0.33	0.43
		2207	379.20	8.00	377.87	10.41	-1.33	2.41
		2202	379.08	7.97	377.45	10.87	-1.63	2.90
		2168	378.46	7.30	375.85	10.60	-2.61	3.30
	2130	377.53	6.91	375.44	7.97	-2.09	1.06	
AK	5141.0	2116	375.91	11.09	375.32	7.64	-0.59	-3.45
REPLACE	2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	373.15	10.91	372.79	7.76	-0.36	-3.15
		2067	373.88	4.80	373.05	3.68	-0.83	-1.12
AI	5139.0	2020	373.87	2.52	372.97	3.68	-0.90	1.16
		2004	373.86	2.53	372.95	3.47	-0.91	0.94
		1983	373.75	3.25	372.81	4.26	-0.94	1.01
		1972			372.32	6.61		
	1962			372.13	6.47			
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	370.99	8.51				
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
		1900	369.45	10.08	370.88	7.10	1.43	-2.98
AH	5138.0	1871	369.56	7.33	369.90	9.02	0.34	1.69
		1837	369.52	5.77				
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	369.38	5.54				
		1748	367.45	11.69	367.72	9.34	0.27	-2.35
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	365.17	12.57	364.62	13.09	-0.55	0.52
		1620	363.50	7.35	362.88	8.79	-0.62	1.44
	5136.8	1573	363.09	6.38	362.62	7.01	-0.47	0.63
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
	5136.2	1550	358.39	5.52	357.74	11.28	-0.65	5.76
		1536	357.54	8.19	357.45	9.19	-0.09	1.00
AF	5136.0	1523	356.29	9.94	356.18	10.20	-0.11	0.26
		1487	355.90	6.85	355.84	7.02	-0.06	0.17
		1425	354.72	7.15	354.72	7.15	0.00	0.00
AE	5135.0	1370	352.83	10.17	352.82	10.20	-0.01	0.03
		1330	352.39	7.77	352.04	8.73	-0.35	0.96
		1309	352.19	7.70	351.91	8.13	-0.28	0.43
NEW	1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	352.37	4.56	351.24	6.09	-1.13	1.53
REMOVE	1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	352.39	7.72				
REPLACE	1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	347.37	10.91	347.13	11.33	-0.24	0.42
AB	5132.0	1153	346.31	12.52	346.08	12.95	-0.23	0.43
		1107	344.80	11.76	344.80	11.76	0.00	0.00
		1003	342.11	10.66	342.11	10.66	0.00	0.00
AA	5131.0	894	337.99	13.03	337.99	13.03	0.00	0.00
		809	335.99	11.83	335.99	11.83	0.00	0.00
Z	5130.0	714	334.27	10.23	334.27	10.23	0.00	0.00

- New/Replacement Structure

- Existing Structure

**TABLE 5M. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Unencroached Condition)  
Mad River, Waterbury**

Metric, NGVD-29

			U.S. Customary					
FEMA Sta.	River Sta.	Existing Condition		Proposed Condition		Difference		
		W.S. Elev. (m) (1)	Velocity (m/s) (2)	W.S. Elev. (m) (3)	Velocity (m/s) (4)	W.S. Elev. (m) (3) - (1)	Velocity (m/s) (4) - (2)	
AM	5143.0	2409	118.54	4.00	118.54	4.00	0.00	0.00
		2337	116.83	3.47	116.83	3.47	0.00	0.00
		2280	116.26	3.08	116.22	3.18	-0.04	0.09
AL	5142.0	2238	116.15	2.14	116.05	2.27	-0.10	0.13
		2207	115.88	2.44	115.48	3.17	-0.41	0.73
		2202	115.85	2.43	115.35	3.31	-0.50	0.88
		2168	115.66	2.23	114.86	3.23	-0.80	1.01
		2130	115.38	2.11	114.74	2.43	-0.64	0.32
AK	5141.0	2116	114.88	3.38	114.70	2.33	-0.18	-1.05
REPLACE	2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	114.04	3.33	113.93	2.37	-0.11	-0.96
		2067	114.26	1.46	114.01	1.12	-0.25	-0.34
AI	5139.0	2020	114.26	0.77	113.99	1.12	-0.27	0.35
		2004	114.26	0.77	113.98	1.06	-0.28	0.29
		1983	114.22	0.99	113.94	1.30	-0.29	0.31
		1972			113.79	2.01		
		1962			113.73	1.97		
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	113.38	2.59				
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
AH	5138.0	1900	112.91	3.07	113.35	2.16	0.44	-0.91
		1871	112.95	2.23	113.05	2.75	0.10	0.52
		1837	112.93	1.76				
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	112.89	1.69				
		1748	112.30	3.56	112.39	2.85	0.08	-0.72
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	111.61	3.83	111.44	3.99	-0.17	0.16
		1620	111.10	2.24	110.91	2.68	-0.19	0.44
	5136.8	1573	110.97	1.94	110.83	2.14	-0.14	0.19
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
	5136.2	1550	109.54	1.68	109.34	3.44	-0.20	1.76
		1536	109.28	2.50	109.26	2.80	-0.03	0.30
AF	5136.0	1523	108.90	3.03	108.87	3.11	-0.03	0.08
		1487	108.78	2.09	108.76	2.14	-0.02	0.05
		1425	108.42	2.18	108.42	2.18	0.00	0.00
AE	5135.0	1370	107.85	3.10	107.84	3.11	0.00	0.01
		1330	107.71	2.37	107.61	2.66	-0.11	0.29
		1309	107.65	2.35	107.57	2.48	-0.09	0.13
NEW	1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	107.71	1.39	107.36	1.86	-0.34	0.47
REMOVE	1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	352.39	2.35				
REPLACE	1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	106.18	3.33	106.11	3.45	-0.07	0.13
AB	5132.0	1153	105.86	3.82	105.79	3.95	-0.07	0.13
		1107	105.40	3.58	105.40	3.58	0.00	0.00
		1003	104.58	3.25	104.58	3.25	0.00	0.00
AA	5131.0	894	103.32	3.97	103.32	3.97	0.00	0.00
		809	102.71	3.61	102.71	3.61	0.00	0.00
Z	5130.0	714	102.19	3.12	102.19	3.12	0.00	0.00

- New/Replacement Structure

- Existing Structure

**TABLE 6. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

U.S. Customary, NGVD-29

	FEMA Sta.	River Sta.	U.S. Customary					
			Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)
AM	5143.0	2409	388.93	13.19	388.93	13.19	0.00	0.00
		2337	383.29	11.38	383.29	11.38	0.00	0.00
		2280	381.53	9.93	381.30	10.41	-0.23	0.48
AL	5142.0	2238	381.19	6.87	380.74	7.45	-0.45	0.58
		2207	380.41	7.76	378.88	10.41	-1.53	2.65
		2202	380.29	7.75	378.45	10.86	-1.84	3.11
		2168	379.57	7.66	376.99	10.32	-2.58	2.66
		2130	378.56	7.27	376.65	7.72	-1.91	0.45
AK	5141.0	2116	377.97	8.86	376.54	7.40	-1.43	-1.46
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	374.08	11.04	373.79	7.76	-0.29	-3.28
		2067	374.83	4.84	374.05	3.68	-0.78	-1.16
AI	5139.0	2020	374.82	2.53	373.97	3.68	-0.85	1.15
		2004	374.81	2.54	373.95	3.47	-0.86	0.93
		1983	374.70	3.27	373.81	4.26	-0.89	0.99
		1972			373.32	6.61		
		1962			373.13	6.47		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	371.74	8.80				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	370.45	10.08	371.88	7.10	1.43	-2.98
AH	5138.0	1871	370.56	7.33	370.90	9.02	0.34	1.69
		1837	370.52	5.77				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	370.38	5.54				
		1748	368.45	11.69	368.72	9.35	0.27	-2.34
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	366.17	12.57	365.62	13.09	-0.55	0.52
		1620	364.50	7.36	364.15	8.38	-0.35	1.02
	5136.8	1573	364.09	6.38	363.92	6.75	-0.17	0.37
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
	5136.2	1550	359.51	5.79	358.79	11.75	-0.72	5.96
		1536	358.78	8.01	358.61	9.02	-0.17	1.01
AF	5136.0	1523	357.63	9.59	357.43	9.96	-0.20	0.37
		1487	357.27	6.84	357.06	7.13	-0.21	0.29
		1425	356.12	7.22	355.80	7.56	-0.32	0.34
AE	5135.0	1370	354.21	10.24	354.08	9.92	-0.13	-0.32
		1330	353.69	8.23	353.60	7.88	-0.09	-0.35
		1309	353.48	8.20	353.36	7.98	-0.12	-0.22
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	353.61	5.48	352.25	6.55	-1.36	1.07
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	352.00	8.46				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	348.37	10.91	348.15	11.33	-0.22	0.42
AB	5132.0	1153	347.31	12.52	347.08	12.96	-0.23	0.44
		1107	345.80	11.76	345.80	11.76	0.00	0.00
		1003	343.11	10.66	343.11	10.66	0.00	0.00
AA	5131.0	894	338.99	13.02	338.99	13.02	0.00	0.00
		809	337.00	11.82	337.00	11.82	0.00	0.00
Z	5130.0	714	335.27	10.23	335.27	10.23	0.00	0.00

- New/Replacement Structure

- Existing Structure

**TABLE 6A. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

U.S. Customary, NAVD-88

	FEMA Sta.	River Sta.	U.S. Customary					
			Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)
AM	5143.0	2409	387.93	13.19	387.93	13.19	0.00	0.00
		2337	382.29	11.38	382.29	11.38	0.00	0.00
		2280	380.53	9.93	380.30	10.41	-0.23	0.48
AL	5142.0	2238	380.19	6.87	379.74	7.45	-0.45	0.58
		2207	379.41	7.76	377.88	10.41	-1.53	2.65
		2202	379.29	7.75	377.45	10.86	-1.84	3.11
		2168	378.57	7.66	375.99	10.32	-2.58	2.66
		2130	377.56	7.27	375.65	7.72	-1.91	0.45
AK	5141.0	2116	376.97	8.86	375.54	7.40	-1.43	-1.46
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	373.08	11.04	372.79	7.76	-0.29	-3.28
		2067	373.83	4.84	373.05	3.68	-0.78	-1.16
AI	5139.0	2020	373.82	2.53	372.97	3.68	-0.85	1.15
		2004	373.81	2.54	372.95	3.47	-0.86	0.93
		1983	373.70	3.27	372.81	4.26	-0.89	0.99
		1972			372.32	6.61		
		1962			372.13	6.47		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	370.74	8.80				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	369.45	10.08	370.88	7.10	1.43	-2.98
AH	5138.0	1871	369.56	7.33	369.90	9.02	0.34	1.69
		1837	369.52	5.77				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	369.38	5.54				
		1748	367.45	11.69	367.72	9.35	0.27	-2.34
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	365.17	12.57	364.62	13.09	-0.55	0.52
		1620	363.50	7.36	363.15	8.38	-0.35	1.02
		1573	363.09	6.38	362.92	6.75	-0.17	0.37
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
		1536	358.51	5.79	357.79	11.75	-0.72	5.96
		1536	357.78	8.01	357.61	9.02	-0.17	1.01
AF	5136.0	1523	356.63	9.59	356.43	9.96	-0.20	0.37
		1487	356.27	6.84	356.06	7.13	-0.21	0.29
		1425	355.12	7.22	354.80	7.56	-0.32	0.34
AE	5135.0	1370	353.21	10.24	353.08	9.92	-0.13	-0.32
		1330	352.69	8.23	352.60	7.88	-0.09	-0.35
		1309	352.48	8.20	352.36	7.98	-0.12	-0.22
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	352.61	5.48	351.25	6.55	-1.36	1.07
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	351.00	8.46				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	347.37	10.91	347.15	11.33	-0.22	0.42
AB	5132.0	1153	346.31	12.52	346.08	12.96	-0.23	0.44
		1107	344.80	11.76	344.80	11.76	0.00	0.00
		1003	342.11	10.66	342.11	10.66	0.00	0.00
AA	5131.0	894	337.99	13.02	337.99	13.02	0.00	0.00
		809	336.00	11.82	336.00	11.82	0.00	0.00
Z	5130.0	714	334.27	10.23	334.27	10.23	0.00	0.00

- New/Replacement Structure

- Existing Structure

**TABLE 6M. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
100-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

Metric, NGVD-29

	FEMA Sta.	River Sta.	U.S. Customary					
			Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (m) (1)	Velocity (m/s) (2)	W.S. Elev. (m) (3)	Velocity (m/s) (4)	W.S. Elev. (m) (3) - (1)	Velocity (m/s) (4) - (2)
AM	5143.0	2409	118.55	4.02	118.55	4.02	0.00	0.00
		2337	116.83	3.47	116.83	3.47	0.00	0.00
		2280	116.29	3.03	116.22	3.17	-0.07	0.15
AL	5142.0	2238	116.19	2.09	116.05	2.27	-0.14	0.18
		2207	115.95	2.37	115.48	3.17	-0.47	0.81
		2202	115.91	2.36	115.35	3.31	-0.56	0.95
		2168	115.69	2.33	114.91	3.15	-0.79	0.81
		2130	115.39	2.22	114.80	2.35	-0.58	0.14
AK	5141.0	2116	115.21	2.70	114.77	2.26	-0.44	-0.45
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	114.02	3.36	113.93	2.37	-0.09	-1.00
		2067	114.25	1.48	114.01	1.12	-0.24	-0.35
AI	5139.0	2020	114.25	0.77	113.99	1.12	-0.26	0.35
		2004	114.24	0.77	113.98	1.06	-0.26	0.28
		1983	114.21	1.00	113.94	1.30	-0.27	0.30
		1972			113.79	2.01		
		1962			113.73	1.97		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	113.31	2.68				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	112.91	3.07	113.35	2.16	0.44	-0.91
AH	5138.0	1871	112.95	2.23	113.05	2.75	0.10	0.52
		1837	112.93	1.76				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	112.89	1.69				
		1748	112.30	3.56	112.39	2.85	0.08	-0.71
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	111.61	3.83	111.44	3.99	-0.17	0.16
		1620	111.10	2.24	110.99	2.55	-0.11	0.31
	5136.8	1573	110.97	1.94	110.92	2.06	-0.05	0.11
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
	5136.2	1550	109.58	1.76	109.36	3.58	-0.22	1.82
		1536	109.36	2.44	109.30	2.75	-0.05	0.31
AF	5136.0	1523	109.01	2.92	108.94	3.04	-0.06	0.11
		1487	108.90	2.08	108.83	2.17	-0.06	0.09
		1425	108.55	2.20	108.45	2.30	-0.10	0.10
AE	5135.0	1370	107.96	3.12	107.92	3.02	-0.04	-0.10
		1330	107.80	2.51	107.78	2.40	-0.03	-0.11
		1309	107.74	2.50	107.70	2.43	-0.04	-0.07
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	107.78	1.67	107.37	2.00	-0.41	0.33
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	107.29	2.58				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	106.18	3.33	106.12	3.45	-0.07	0.13
AB	5132.0	1153	105.86	3.82	105.79	3.95	-0.07	0.13
		1107	105.40	3.58	105.40	3.58	0.00	0.00
		1003	104.58	3.25	104.58	3.25	0.00	0.00
AA	5131.0	894	103.32	3.97	103.32	3.97	0.00	0.00
		809	102.72	3.60	102.72	3.60	0.00	0.00
Z	5130.0	714	102.19	3.12	102.19	3.12	0.00	0.00

- New/Replacement Structure

- Existing Structure

**TABLE 7. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
10-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

U.S. Customary, NGVD-29

	FEMA Sta.	River Sta.	U.S. Customary						
			Existing Condition		Proposed Condition		Difference		
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)	
AM	5143.0	2409	386.62	10.57	386.62	10.57	0.00	0.00	
		2337	381.33	9.62	381.33	9.62	0.00	0.00	
		2280	379.19	8.28	379.05	8.63	-0.14	0.35	
AL	5142.0	2238	378.59	5.70	378.21	6.33	-0.38	0.63	
		2207	377.94	5.99	376.84	7.98	-1.10	1.99	
		2202	377.87	5.84	376.28	9.10	-1.59	3.26	
		2168	377.14	5.91	374.19	9.48	-2.95	3.57	
		2130	375.75	6.89	373.29	7.18	-2.46	0.29	
AK	5141.0	2116	375.45	6.75	373.09	6.65	-2.36	-0.10	
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	371.22	9.69	370.30	8.92	-0.92	-0.77	
		2067	370.88	9.77	370.33	4.80	-0.55	-4.97	
AI	5139.0	2020	370.51	2.09	370.25	3.01	-0.26	0.92	
		2004	370.51	2.04	370.22	2.70	-0.29	0.66	
		1983	370.38	3.18	370.12	3.25	-0.26	0.07	
		1972			369.65	5.83			
		1962			369.58	5.20			
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	368.51	7.22					
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
		1900	367.58	7.97	368.39	6.13	0.81	-1.84	
AH	5138.0	1871	367.44	5.83	367.71	7.21	0.27	1.38	
		1837	367.29	4.95					
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	367.08	4.90					
		1748	366.02	8.35	365.62	7.49	-0.40	-0.86	
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	363.63	10.78	363.56	9.73	-0.07	-1.05	
		1620	361.62	6.07	360.95	8.44	-0.67	2.37	
		5136.8	1573	361.23	360.75	5.19	-0.48	0.67	
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
		5136.2	1550	356.92	3.86	356.95	9.41	0.03	5.55
		1536	356.42	5.92	356.50	6.80	0.08	0.88	
AF	5136.0	1523	354.98	8.59	354.94	8.69	-0.04	0.10	
		1487	354.50	5.33	354.48	5.35	-0.02	0.02	
		1425	353.38	5.44	353.38	5.44	0.00	0.00	
AE	5135.0	1370	351.11	8.80	351.09	8.85	-0.02	0.05	
		1330	349.93	7.54	349.39	8.55	-0.54	1.01	
		1309	349.72	6.79	349.02	7.81	-0.70	1.02	
NEW		1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	349.75	4.45	348.78	5.66	-0.97	1.21	
REMOVE		1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	349.19	5.80					
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	345.52	8.26	345.32	8.56	-0.20	0.30	
AB	5132.0	1153	345.33	8.13	345.14	8.42	-0.19	0.29	
		1107	343.07	10.49	343.07	10.49	0.00	0.00	
		1003	339.98	8.59	339.98	8.59	0.00	0.00	
AA	5131.0	894	335.71	11.07	335.71	11.07	0.00	0.00	
		809	334.05	8.55	334.05	8.55	0.00	0.00	
Z	5130.0	714	331.07	10.07	331.07	10.07	0.00	0.00	

- New/Replacement Structure
  - Existing Structure

**TABLE 7A. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
10-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

U.S. Customary, NAVD-88

	FEMA Sta.	River Sta.	U.S. Customary						
			Existing Condition		Proposed Condition		Difference		
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)	
AM	5143.0	2409	385.62	10.57	385.62	10.57	0.00	0.00	
		2337	380.33	9.62	380.33	9.62	0.00	0.00	
		2280	378.19	8.28	378.05	8.63	-0.14	0.35	
AL	5142.0	2238	377.59	5.70	377.21	6.33	-0.38	0.63	
		2207	376.94	5.99	375.84	7.98	-1.10	1.99	
		2202	376.87	5.84	375.28	9.10	-1.59	3.26	
		2168	376.14	5.91	373.19	9.48	-2.95	3.57	
		2130	374.75	6.89	372.29	7.18	-2.46	0.29	
AK	5141.0	2116	374.45	6.75	372.09	6.65	-2.36	-0.10	
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	370.22	9.69	369.30	8.92	-0.92	-0.77	
		2067	369.88	9.77	369.33	4.80	-0.55	-4.97	
AI	5139.0	2020	369.51	2.09	369.25	3.01	-0.26	0.92	
		2004	369.51	2.04	369.22	2.70	-0.29	0.66	
		1983	369.38	3.18	369.12	3.25	-0.26	0.07	
		1972			368.65	5.83			
		1962			368.58	5.20			
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	367.51	7.22					
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
		1900	366.58	7.97	367.39	6.13	0.81	-1.84	
AH	5138.0	1871	366.44	5.83	366.71	7.21	0.27	1.38	
		1837	366.29	4.95					
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	366.08	4.90					
		1748	365.02	8.35	364.62	7.49	-0.40	-0.86	
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	362.63	10.78	362.56	9.73	-0.07	-1.05	
		1620	360.62	6.07	359.95	8.44	-0.67	2.37	
		5136.8	1573	360.23	4.52	359.75	5.19	-0.48	0.67
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
		5136.2	1550	355.92	3.86	355.95	9.41	0.03	5.55
		1536	355.42	5.92	355.50	6.80	0.08	0.88	
AF	5136.0	1523	353.98	8.59	353.94	8.69	-0.04	0.10	
		1487	353.50	5.33	353.48	5.35	-0.02	0.02	
		1425	352.38	5.44	352.38	5.44	0.00	0.00	
AE	5135.0	1370	350.11	8.80	350.09	8.85	-0.02	0.05	
		1330	348.93	7.54	348.39	8.55	-0.54	1.01	
		1309	348.72	6.79	348.02	7.81	-0.70	1.02	
NEW		1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	348.75	4.45	347.78	5.66	-0.97	1.21	
REMOVE		1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	348.19	5.80					
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	344.52	8.26	344.32	8.56	-0.20	0.30	
AB	5132.0	1153	344.33	8.13	344.14	8.42	-0.19	0.29	
		1107	342.07	10.49	342.07	10.49	0.00	0.00	
		1003	338.98	8.59	338.98	8.59	0.00	0.00	
AA	5131.0	894	334.71	11.07	334.71	11.07	0.00	0.00	
		809	333.05	8.55	333.05	8.55	0.00	0.00	
Z	5130.0	714	330.07	10.07	330.07	10.07	0.00	0.00	

- New/Replacement Structure
  - Existing Structure



**TABLE 7M. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
10-Year FEMA Discharge (Encroached Condition - Floodway)  
Mad River, Waterbury**

Metric, NGVD-29

	FEMA Sta.	River Sta.	U.S. Customary						
			Existing Condition		Proposed Condition		Difference		
			W.S. Elev. (m) (1)	Velocity (m/s) (2)	W.S. Elev. (m) (3)	Velocity (m/s) (4)	W.S. Elev. (m) (3) - (1)	Velocity (m/s) (4) - (2)	
AM	5143.0	2409	117.84	3.22	117.84	3.22	0.00	0.00	
		2337	116.23	2.93	116.23	2.93	0.00	0.00	
		2280	115.58	2.52	115.53	2.63	-0.04	0.11	
AL	5142.0	2238	115.39	1.74	115.28	1.93	-0.12	0.19	
		2207	115.20	1.83	114.86	2.43	-0.34	0.61	
		2202	115.17	1.78	114.69	2.77	-0.48	0.99	
		2168	114.95	1.80	114.05	2.89	-0.90	1.09	
		2130	114.53	2.10	113.78	2.19	-0.75	0.09	
AK	5141.0	2116	114.44	2.06	113.72	2.03	-0.72	-0.03	
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668						
AJ	5140.0	2079	113.15	2.95	112.87	2.72	-0.28	-0.23	
		2067	113.04	2.98	112.88	1.46	-0.17	-1.51	
AI	5139.0	2020	112.93	0.64	112.85	0.92	-0.08	0.28	
		2004	112.93	0.62	112.84	0.82	-0.09	0.20	
		1983	112.89	0.97	112.81	0.99	-0.08	0.02	
		1972			112.67	1.78			
		1962			112.65	1.58			
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)						
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)						
		1927	112.32	2.20					
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)						
		1900	112.04	2.43	112.29	1.87	0.25	-0.56	
AH	5138.0	1871	112.00	1.78	112.08	2.20	0.08	0.42	
		1837	111.95	1.51					
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)						
		1778	111.89	1.49					
		1748	111.56	2.55	111.44	2.28	-0.12	-0.26	
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)						
AG	5137.0	1689	110.83	3.29	110.81	2.97	-0.02	-0.32	
		1620	110.22	1.85	110.02	2.57	-0.20	0.72	
		5136.8	1573	110.10	1.38	109.96	1.58	-0.15	0.20
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)						
		5136.2	1550	108.79	1.18	108.80	2.87	0.01	1.69
		1536	108.64	1.80	108.66	2.07	0.02	0.27	
AF	5136.0	1523	108.20	2.62	108.19	2.65	-0.01	0.03	
		1487	108.05	1.62	108.05	1.63	-0.01	0.01	
		1425	107.71	1.66	107.71	1.66	0.00	0.00	
AE	5135.0	1370	107.02	2.68	107.01	2.70	-0.01	0.02	
		1330	106.66	2.30	106.49	2.61	-0.16	0.31	
		1309	106.59	2.07	106.38	2.38	-0.21	0.31	
NEW		1288.5	Proposed Pedestrian Bridge						
AD	5134.0	1277	106.60	1.36	106.31	1.73	-0.30	0.37	
REMOVE		1260.5	Existing Pedestrian crossing						
AC	5133.0	1246	106.43	1.77					
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps						
		1162	105.31	2.52	105.25	2.61	-0.06	0.09	
AB	5132.0	1153	105.26	2.48	105.20	2.57	-0.06	0.09	
		1107	104.57	3.20	104.57	3.20	0.00	0.00	
		1003	103.63	2.62	103.63	2.62	0.00	0.00	
AA	5131.0	894	102.32	3.37	102.32	3.37	0.00	0.00	
		809	101.82	2.61	101.82	2.61	0.00	0.00	
Z	5130.0	714	100.91	3.07	100.91	3.07	0.00	0.00	

- New/Replacement Structure
  - Existing Structure



**TABLE 8. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
500-Year FEMA Discharge  
Mad River, Waterbury**

U.S. Customary, NGVD-29

			U.S. Customary					
	FEMA Sta.	River Sta.	Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)
AM	5143.0	2409	391.68	12.90	391.69	12.88	0.01	-0.02
		2337	384.71	13.01	384.72	12.98	0.01	-0.03
		2280	382.46	12.92	382.44	12.97	-0.02	0.05
AL	5142.0	2238	382.36	8.28	382.20	8.56	-0.16	0.28
		2207	381.90	7.86	381.46	9.10	-0.44	1.24
		2202	381.16	9.92	380.45	11.44	-0.71	1.52
		2168	381.01	6.92	378.38	12.83	-2.63	5.91
		2130	380.56	5.44	379.05	7.05	-1.51	1.61
AK	5141.0	2116	380.50	6.67	379.06	6.46	-1.44	-0.21
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	379.74	6.55	376.65	7.81	-3.09	1.26
		2067	379.91	4.05	376.93	3.86	-2.98	-0.19
AI	5139.0	2020	379.89	2.61	376.86	4.26	-3.03	1.65
		2004	379.89	2.63	376.84	4.13	-3.05	1.50
		1983	379.79	3.10	376.66	5.11	-3.13	2.01
		1972			376.08	7.50		
		1962			375.78	7.59		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	374.68	9.64				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	371.27	14.00	374.44	8.16	3.17	-5.84
AH	5138.0	1871	371.62	9.96	373.16	10.67	1.54	0.71
		1837	371.63	7.69				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	371.60	6.42				
		1748	371.23	8.19	371.02	10.92	-0.21	2.73
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	368.15	13.55	367.50	15.03	-0.65	1.48
		1620	366.93	8.12	366.41	9.16	-0.52	1.04
	5136.8	1573	366.47	7.70	366.09	8.23	-0.38	0.53
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
	5136.2	1550	360.91	7.26	359.95	13.64	-0.96	6.38
		1536	359.59	10.68	359.53	11.69	-0.06	1.01
AF	5136.0	1523	358.81	10.99	358.60	11.58	-0.21	0.59
		1487	358.43	8.13	358.23	8.55	-0.20	0.42
		1425	357.36	8.00	356.98	8.59	-0.38	0.59
AE	5135.0	1370	356.75	8.27	355.82	10.07	-0.93	1.80
		1330	356.68	5.80	355.60	7.43	-1.08	1.63
		1309	356.44	6.72	355.44	7.55	-1.00	0.83
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	356.51	4.38	354.91	6.08	-1.60	1.70
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	355.97	6.89				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	350.32	13.23	350.32	13.20	0.00	-0.03
AB	5132.0	1153	350.37	12.18	350.35	12.36	-0.02	0.18
		1107	347.56	9.59	347.58	9.52	0.02	-0.07
		1003	345.82	9.06	345.82	9.07	0.00	0.01
AA	5131.0	894	341.34	14.86	341.36	14.83	0.02	-0.03
		809	338.86	14.92	338.85	14.93	-0.01	0.01
Z	5130.0	714	336.73	13.11	336.73	13.11	0.00	0.00

- New/Replacement Structure
  - Existing Structure

**TABLE 8A. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
500-Year FEMA Discharge  
Mad River, Waterbury**

U.S. Customary, NAVD-88

			U.S. Customary					
	FEMA Sta.	River Sta.	Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (ft) (1)	Velocity (fps) (2)	W.S. Elev. (ft) (3)	Velocity (fps) (4)	W.S. Elev. (ft) (3) - (1)	Velocity (fps) (4) - (2)
AM	5143.0	2409	390.68	12.90	390.69	12.88	0.01	-0.02
		2337	383.71	13.01	383.72	12.98	0.01	-0.03
		2280	381.46	12.92	381.44	12.97	-0.02	0.05
AL	5142.0	2238	381.36	8.28	381.20	8.56	-0.16	0.28
		2207	380.90	7.86	380.46	9.10	-0.44	1.24
		2202	380.16	9.92	379.45	11.44	-0.71	1.52
		2168	380.01	6.92	377.38	12.83	-2.63	5.91
		2130	379.56	5.44	378.05	7.05	-1.51	1.61
AK	5141.0	2116	379.50	6.67	378.06	6.46	-1.44	-0.21
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	378.74	6.55	375.65	7.81	-3.09	1.26
		2067	378.91	4.05	375.93	3.86	-2.98	-0.19
AI	5139.0	2020	378.89	2.61	375.86	4.26	-3.03	1.65
		2004	378.89	2.63	375.84	4.13	-3.05	1.50
		1983	378.79	3.10	375.66	5.11	-3.13	2.01
		1972			375.08	7.50		
		1962			374.78	7.59		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	373.68	9.64				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	370.27	14.00	373.44	8.16	3.17	-5.84
AH	5138.0	1871	370.62	9.96	372.16	10.67	1.54	0.71
		1837	370.63	7.69				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	370.60	6.42				
		1748	370.23	8.19	370.02	10.92	-0.21	2.73
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	367.15	13.55	366.50	15.03	-0.65	1.48
		1620	365.93	8.12	365.41	9.16	-0.52	1.04
	5136.8	1573	365.47	7.70	365.09	8.23	-0.38	0.53
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
	5136.2	1550	359.91	7.26	358.95	13.64	-0.96	6.38
		1536	358.59	10.68	358.53	11.69	-0.06	1.01
AF	5136.0	1523	357.81	10.99	357.60	11.58	-0.21	0.59
		1487	357.43	8.13	357.23	8.55	-0.20	0.42
		1425	356.36	8.00	355.98	8.59	-0.38	0.59
AE	5135.0	1370	355.75	8.27	354.82	10.07	-0.93	1.80
		1330	355.68	5.80	354.60	7.43	-1.08	1.63
		1309	355.44	6.72	354.44	7.55	-1.00	0.83
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	355.51	4.38	353.91	6.08	-1.60	1.70
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	354.97	6.89				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	349.32	13.23	349.32	13.20	0.00	-0.03
AB	5132.0	1153	349.37	12.18	349.35	12.36	-0.02	0.18
		1107	346.56	9.59	346.58	9.52	0.02	-0.07
		1003	344.82	9.06	344.82	9.07	0.00	0.01
AA	5131.0	894	340.34	14.86	340.36	14.83	0.02	-0.03
		809	337.86	14.92	337.85	14.93	-0.01	0.01
Z	5130.0	714	335.73	13.11	335.73	13.11	0.00	0.00

- New/Replacement Structure
  - Existing Structure

**TABLE 8M. Proposed (Post-Project) versus Existing (Pre-Project) Condition  
500-Year FEMA Discharge  
Mad River, Waterbury**

Metric, NGVD-29

	FEMA Sta.	River Sta.	U.S. Customary					
			Existing Condition		Proposed Condition		Difference	
			W.S. Elev. (m) (1)	Velocity (m/s) (2)	W.S. Elev. (m) (3)	Velocity (m/s) (4)	W.S. Elev. (m) (3) - (1)	Velocity (m/s) (4) - (2)
AM	5143.0	2409	119.38	3.93	119.39	3.93	0.00	-0.01
		2337	117.26	3.97	117.26	3.96	0.00	-0.01
		2280	116.57	3.94	116.57	3.95	-0.01	0.02
AL	5142.0	2238	116.54	2.52	116.49	2.61	-0.05	0.09
		2207	116.40	2.40	116.27	2.77	-0.13	0.38
		2202	116.18	3.02	115.96	3.49	-0.22	0.46
		2168	116.13	2.11	115.33	3.91	-0.80	1.80
		2130	115.99	1.66	115.53	2.15	-0.46	0.49
AK	5141.0	2116	115.98	2.03	115.54	1.97	-0.44	-0.06
REPLACE		2095.5 (PR2098.5)	Proposed Plank Road Culvert No. 05668					
AJ	5140.0	2079	115.74	2.00	114.80	2.38	-0.94	0.38
		2067	115.80	1.23	114.89	1.18	-0.91	-0.06
AI	5139.0	2020	115.79	0.80	114.87	1.30	-0.92	0.50
		2004	115.79	0.80	114.86	1.26	-0.93	0.46
		1983	115.76	0.94	114.81	1.56	-0.95	0.61
		1972			114.63	2.29		
		1962			114.54	2.31		
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)					
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)					
		1927	114.20	2.94				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)					
		1900	113.16	4.27	114.13	2.49	0.97	-1.78
AH	5138.0	1871	113.27	3.04	113.74	3.25	0.47	0.22
		1837	113.27	2.34				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)					
		1778	113.26	1.96				
		1748	113.15	2.50	113.09	3.33	-0.06	0.83
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)					
AG	5137.0	1689	112.21	4.13	112.01	4.58	-0.20	0.45
		1620	111.84	2.47	111.68	2.79	-0.16	0.32
	5136.8	1573	111.70	2.35	111.58	2.51	-0.12	0.16
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)					
	5136.2	1550	110.01	2.21	109.71	4.16	-0.29	1.94
		1536	109.60	3.26	109.58	3.56	-0.02	0.31
AF	5136.0	1523	109.37	3.35	109.30	3.53	-0.06	0.18
		1487	109.25	2.48	109.19	2.61	-0.06	0.13
		1425	108.92	2.44	108.81	2.62	-0.12	0.18
AE	5135.0	1370	108.74	2.52	108.45	3.07	-0.28	0.55
		1330	108.72	1.77	108.39	2.26	-0.33	0.50
		1309	108.64	2.05	108.34	2.30	-0.30	0.25
NEW		1288.5	Proposed Pedestrian Bridge					
AD	5134.0	1277	108.66	1.34	108.18	1.85	-0.49	0.52
REMOVE		1260.5	Existing Pedestrian crossing					
AC	5133.0	1246	108.50	2.10				
REPLACE		1198.5 (PR1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps					
		1162	106.78	4.03	106.78	4.02	0.00	-0.01
AB	5132.0	1153	106.79	3.71	106.79	3.77	-0.01	0.05
		1107	105.94	2.92	105.94	2.90	0.01	-0.02
		1003	105.41	2.76	105.41	2.76	0.00	0.00
AA	5131.0	894	104.04	4.53	104.05	4.52	0.01	-0.01
		809	103.28	4.55	103.28	4.55	0.00	0.00
Z	5130.0	714	102.64	4.00	102.64	4.00	0.00	0.00

- New/Replacement Structure
  - Existing Structure

## Proposed (Post-Project) Condition

### DEVELOPMENT OF PROPOSED CONDITION MODEL

Similar to the Existing Condition Model, the effective FIS data was used for the upstream and downstream boundary sections to ensure the tie-in between the new and currently effective studies. Within these boundaries, thirty-six (36) stream cross sections, excluding the boundary and internal sections at the waterway crossings, were obtained among which eleven (11) represent the comparable locations of the FIS lettered sections. With the boundary sections, the total lettered sections are thirteen (13). As described in the Existing Condition section, the reason that there are fewer cross-sections compared to the Existing Condition is that not all the sections in the Existing Condition model could feasibly be matched with a proposed condition section because of the proposed river relocation and the new bridge locations. In this case, one of the missing sections is the Section 1246 which is the comparable section to FIS Section AC. This is located within the span of the proposed easterly I-84 Culvert No. 01224, and thus could not be included in the Proposed Condition model.

The number of the cross sections within the main relocation limits is fourteen (14). Although most of these sections have a corresponding section in the existing condition model (by the River Station number), their exact location and orientation are not truly the same due to the relocation. In placing these Proposed Condition sections, the intent was to have at least one common point or intersection with an existing cross section where the comparison of the pre- and post-project conditions may be critical while abiding by the general practices of cutting sections - normal to direction of flow and sufficient coverage to contain all flow ranges of the study. This ensures that the sections in the Existing and Proposed Condition models at a common river station are placed at a reasonably comparable location.

Some of the sections were at first cut from the DTM surface file of the project survey; then, modified to reflect the proposed changes. For other sections, particularly within the proposed relocation limits, a merged three-dimensional surface file of the proposed design over the original survey was used.

The Manning's roughness coefficient for the main channel including the relocation limits was set at 0.04 consistent with the exiting condition model. This is within the recommended range of the roughness values for the proposed Standard Riprap channel banks, gravel streambed with occasionally placed boulders, and other in-stream features.

The Ineffective Flow Area and Blocked Obstruction settings were consistently used to reflect the buildings and other obstructions on floodplains as well as at the waterway crossing.

In setting the Floodway encroachment stations, the following steps were taken.

- Initially, the encroachment stations for the sections outside of the relocation limits were set matching the existing condition encroachments.

- Where the resulting Base Flood was contained within the channelized sections of the relocation, no encroachment was proposed by setting the encroachment stations at or close to the water surface limits.
- Where the flood elevation rises above the relocated channel banks, the encroachment stations were located using a combination of the HEC-RAS' Encroachment Methods 2 to 5. The objectives were to:
  - achieve an equal conveyance reduction on both sides of the river.
  - have no negative surcharge.
  - prevent the surcharge from rising more one foot above the Base Flood elevation.
  - limit the resulting water surface below the encroached flood elevation of the Existing Condition.
- The derived encroachment stations were then adjusted to provide a relatively smooth transition and uniformity where feasible.
- The Encroachment Method 1 was used in the final step for the entire reach, and verified that the surcharge is no greater than one foot above the 100-year unencroached condition water surface.

#### WATER SURFACE PROFILE COMPARISON TO EXISTING CONDITION

Compared to the result of the Existing Condition models, the proposed 100-year flood profiles for both the unencroached and encroached conditions are found generally lower (see Figures 6 & 7; Tables 5 & 6). The most significant decrease occurs approximately 210 ft upstream of Plank Road (at the Section 2168), by 2.61 ft for the unencroached and 2.58 for the encroached conditions. The primary factors for such decreases upstream of the Plank Road can be attributed to the increases in the waterway opening at the Plank Road crossing and in the upstream cross-sectional area of the river due to the relocation work. The effects of the increased river cross-sectional area reach further upstream to the Section 2337, approximately 290 ft downstream of East Main Street. At and upstream of this section, the profiles converge to the Existing Condition. Over the new Prank Culvert, there is a slight increase which is discussed later in the separate narrative section for the structure.

Downstream of Plank Road to the upstream of the proposed Westbound Exit 24 On-Ramp (Bridge No. 06591), the profiles are continually lowered in the range of 0.3 to 0.9 ft. This is due to the proposed removal of the existing easterly I-84 crossing, which is currently located within this area. A replacement bridge (Bridge No.05774) will, however, be constructed approximately 500 ft downstream (along the relocated river) from the existing I-84 bridge. The river leading to this new bridge from the old one will be constructed as a trapezoidal channel with a minimum bottom width of 40 ft and 2:1(h:v) side-slopes, which is required due to the realignment of I-84 and consequent partial filling in the former City Mill Pond upstream of the breached dam. These changes result in the increases in the water surface profiles upstream of the new bridge (see Tag #1 on Figures 6 & 7). The maximum increase is 1.43 ft in both the unencroached and encroached conditions occurring at Section 1900, just downstream of the existing Eastbound

Exit 24 Off-Ramp. As the increase is contained within the new channel banks and within the ConnDOT right-of-way, it will not adversely affect any roadways, buildings and adjacent private properties.

The flood profile through the proposed easterly I-84 bridge is lower than the existing condition. Downstream of the bridge, the flood profiles rise above the existing condition again at the upstream approach to and through the proposed Eastbound Exit 24 Off-Ramp Bridge No. 06284 (see Tag #2 on Figures 6 & 7). The increase at the upstream approach section is 0.27 ft for both the unencroached and encroached conditions. More detailed hydraulic conditions at this and the easterly I-84 bridge is discussed later in the narrative for the individual structures.

For the unencroached condition, there is one additional location where the increase prevails. Although it is not revealed in the comparison table, the profile plots show that the increase occurs under the proposed westerly I-84 Bridge No. 01224 at its downstream end (see Tag #4 on Figure 6). This too is discussed later.

Similar to the Base Flood profile, the proposed 500-year profile is computed higher for the reach downstream of the Westbound Exit 24 On-Ramp Bridge No. 06591 through the proposed easterly I-84 Bridge No. 05774 (Tag #1, Figure 9) with maximum increase of 3.17 ft; through and at the downstream end of the Eastbound Exit 24 Off-Ramp Bridge No. 06284 (Tag #2) with the increase of as much as 0.95 ft; and under the westerly I-84 Bridge No. 01224 near its downstream end (Tag #4) with a brief increase of 0.25 ft. All these increases are contained with the channelized section of the river, and thus pose no adverse impact.

The model also shows an increase of 0.01 ft at the upstream limit of the study and 0.02 ft at two sections between the westerly I-84 bridge to the downstream limit of the study. These increases for the 500-year condition may not occur in reality, as they are within the limit of the computational tolerance and subjected to most error being close to the study limits where the latest survey data were not used. In the 100- and 500-year flood conditions for the hydraulic design in which the discharges are higher than the FEMA discharges used in this analysis, the flood profile are allowed to dip below the computed critical flow depth (see the separately prepared *Hydraulic Analysis For Design Report – Mad River*), and the actual survey data are used for the boundary sections, there are no increases at these locations. Nevertheless, if these are to occur, they will have minimal, insignificant effects on the affected properties. The comparison of the 500-year floods is shown on Figure 9 and in Table 8.

The downstream convergence of the proposed water surface profiles to the existing profiles for the 100-year unencroached, encroached and 10-year encroached conditions occur at Section 1107, approximately 220 ft downstream from the existing westerly I-84 Structure No.01224. For the 500-year flood profile, the exact match (0.00 ft difference) occurs further downstream, at the downstream boundary of the study (FEMA Section Z or 714). However, the differences at any sections downstream of the westerly I-84 bridge is minuscule (in the range of -0.02 to 0.02 ft), demonstrating that the effects of the proposed embankment for the new I-84 Westbound Exit 23 Off-Ramp in the 500-year flood plain is insignificant. Currently, the 500-year flood spreads northerly onto the predominantly grass fields of Hamilton Park, a City of Waterbury property. No significant change to this condition is anticipated.

The differences occurring at and inside the waterway crossings are further discussed below.

## HYDRAULIC CONDITION AT INDIVIDUAL STRUCTURES

### *Plank Road Crossing, Culvert No. 05668:*

This structure consists of a triple-barrel concrete box culvert; each barrel is 3.1 ft (4 m) wide by 8.9 ft (2.7 m) high. The width of the structure, measured along the proposed river baseline, is 46 ft (14.0 m). The top edge of the culvert inlets is beveled to improve the entrance loss coefficient to 0.2. The proposed culvert barrels are fitted with 220-mm high concrete baffles and backfilled with 600 mm of gravel streambed material to facilitate fish passage.

The proposed structure provides a 12% increase in the waterway opening (from 242 to 271 sq. ft.), and thus lessens the potential for the roadway-overtopping flow condition. It can convey the 50-year frequency discharge with 3 feet of freeboard, in contrast to the existing bridge which would begin to overtop at approximately the 25-year frequency discharge. However, the 100-year Base Flood continues to overtop the roadway as in the existing condition. This is one of the reasons the culvert crossing is proposed rather than a bridge. The culvert will be capable of withstanding overtopping flows with less potential damage as compared to a bridge.

Alternatives that would eliminate the overtopping condition are impractical within the scope of this highway project. Such alternatives would necessitate raising the superstructure of the Plank Road crossing above the 100-year flood elevation to eliminate overtopping flows. This would require corresponding increases in the roadway profiles of Plank Road, Harpers Ferry Road and Brookdale Drive. This is complicated by the need to maintain access to the adjacent residences and provide positive drainage of these properties.

Compared to the existing condition, the Base Flood Elevation at Plank Road is slightly higher in the unencroached condition, by 0.06 ft, due to the proposed geometric changes; however, the overflow is reduced from 702 to 120.3 CFS. In the encroached condition, it is lowered by 0.93 ft. Similarly, in the 500-year, it is 1.44 ft lower.

Although the computed overtopping elevation in the unencroached condition is slightly higher, the actual overtopping elevation will be lower than the existing condition due to the elimination of the overbank flow that exists further upstream of the culvert. The flow that overtops the existing channel bank and surges over the floodplain does not return back into the channel until it passes over Plank Road, as it is the shortest path based on the existing topography. This overflow occurs and passes over the road at a higher elevation than the computed overtopping elevation of the Proposed Condition. This is further discussed in the later section, *Area of Flooding*.

I-84 Westbound I-84 Exit 24 On-Ramp Crossing, Bridge No. 06591:

This structure is needed for a new on-ramp from Harpers Ferry Road, as the existing interchange does not include an on-ramp to the Westbound I-84.

The proposed Bridge No.06591 is a single span bridge on a curved alignment with a clear span of approximately 157 feet measured along the roadway baseline between the abutment faces. The roadway is at a 45° skew to the river baseline. To account for this skew and the curved alignment, the proposed conditions analysis assumed the minimum hydraulic clear span of the structure to be 94 ft.

The downstream face of the bridge is located at close proximity to the downstream face of existing easterly I-84 crossing (Structure No. 05774) over the Mad River, which will be removed as indicated previously. Compared to the existing condition at this location, the 100-year unencroached and encroached condition elevations are 0.45 and 0.7 ft higher; conversely, the 500-year flood elevations is lowered by 0.13 ft.

The bridge abutments are located so that they will not obstruct flow up to the 500-year flood. Therefore, the proposed bridge does not cause any significant upstream backwater conditions. In addition, the superstructure is elevated well above the channel with the minimum underclearance (at the downstream-westerly end of the structure) of approximately 16 ft during the 100-year flood, and 13 ft for the 500-year flood events.

Easterly I-84 Crossing, Bridge No. 05774:

Located approximately 500 ft downstream (along the relocated river) from the existing I-84 Structure No. 05774, this new bridge is a single span, welded steel plate girder bridge with a clear span of 85 ft perpendicular to the abutment faces. The width measured perpendicular to the roadway baseline is approximately 132 ft.

The precise comparison of the flood elevations at the structure to the existing condition is difficult, as the location of pre- and post-project river will be different. Nevertheless, the locations of the upstream and downstream faces of bridge are considered most comparably to the Sections 1837 and 1778 respectively in the Existing Condition model. The comparison yields 0.16 and 1.04 ft decreases in both the 100-year unencroached and encroached condition elevations at the upstream and downstream faces respectively. In the 500-year flood, however, the increases of 1.04 and 0.11 ft, respectively, occur instead.

The bridge superstructure has a minimum of 3.5 ft of underclearance to the 100-year, and 1.1 ft to the 500-year flood elevations, which is at the downstream-westerly end of the structure.



*I-84 Eastbound Exit 24 Off-Ramp to Harpers Ferry Road, Bridge No. 06284:*

As the proposed alignment of the off-ramp traverses the former City Mills Pond located upstream of the breached Century Dam, the replacement bridge is located approximately 625 feet downstream (southwesterly) of the existing off-ramp Structure No. 06284. The proposed bridge is a single span bridge with a clear span of approximately 169 feet measured along the roadway baseline between the abutment faces. The width of the structure, perpendicular to the roadway baseline, is 47 feet. The roadway is on a curved alignment at approximately a 43° skew to the river baseline.

Although this structure is located relatively close to the proposed I-84 Bridge No. 05774, approximately 130 feet downstream, the backwater of the Base Flood does not extend to the upstream bridge. The superstructure is elevated well above the river with a minimum underclearance of approximately 21 ft to the 100-year, and 19 ft to the 500-year flood elevations.

Linearly interpolating the existing water surface profiles between the Sections 1689 and 1748, the comparison to the proposed condition reveals that increases of 0.48 ft at the upstream and 0.95 ft at the downstream faces occur in both the 100-year encroached and unencroached conditions. As shown on the Figures 6 and 7 (see Tag #2), the increase occurs for a short section of the river, and is well contained within the new channel banks and ConnDOT ROW (see Figure 4). The increases are mostly attributed to the geometric changes in the river. In the existing condition, the water surface begins to decline at Section 1748, approximately 30 ft upstream of the proposed bridge, affected by the riverbed grade change downstream of Section 1689 and as the flow becomes more confined as it approaches the breached dam. In the proposed condition, the decline does not occur until the flow passes through the bridge and the newly channelized river section.

*Century Dam:*

Approximately one-half the length of the remaining lateral portion of the breached dam is proposed to be removed above the upstream streambed. Downstream of the dam, a rock ramp fishway is proposed for fish passage, requested by the CT DEEP.

With the other half of the lateral portion untouched as well as the remaining concrete vertical side walls, combined with the effects from the several boulder weirs spanning across the rock ramp, this location will likely continue acting as a weir and constrict flow. The proposed work, however, is assessed to lower the flood elevation at this location, by 0.55 ft in both the unencroached and encroached conditions and by 0.65 ft in the 500-year flood at the immediate downstream Section 1689.

Pedestrian Bridge:

Due to the realignment and widening of I-84, a new pedestrian bridge is proposed 92 ft upstream of its present location. The proposed superstructure is a prefabricated, steel truss bridge founded on cast-in-place concrete abutments supported by spread footings. It has a clear span length of 67.6 feet (measured between the abutment faces) with an inside lane width of 10 feet and overall width of approximately 11.5 ft. The crossing will be part of a pedestrian walkway that will follow the easterly bank of the Mad River under the new I-84 Bridge No. 01224 to the Hamilton Park, instead of crossing the highway via the existing 10 ft by 10 ft concrete box culvert, which will be abandoned.

Similar to the existing pedestrian bridge, the elevation of the new bridge deck is set relatively low to minimize both the need for high approach embankments and fill in the floodplain. The bridge can convey the 10-year flow with 0.6 feet of underclearance and the overtopping flood will have an estimated recurrence interval of 15 years. The Base Flood Elevation will be approximately 2 feet above the bridge approaches.

As the pedestrian bridge is proposed where no structure currently exists, it signifies placing more physical constriction to the flow at this location. However, the analysis indicates that the resulting flood elevations in the vicinity is actually lower than the existing condition - by 0.28 ft at the upstream approach in the 100-year unencroached condition, 0.12 ft in the 100-year encroached condition and 1.0 ft under the 500-year flood.

The decreases occur because of the differing downstream conditions. Downstream of this location where the existing pedestrian bridge is, the upstream face of the proposed westerly I-84 Bridge No. 01224 is located in close proximity. The proposed I-84 bridge presents less constriction than the existing pedestrian bridge such that it generates a lower backwater toward the location of the new pedestrian bridge. Moreover, the existing pedestrian bridge is affected by the backwater from the existing I-84 structure which is hydraulically inferior compared to the proposed I-84 bridge due to the constriction caused by its piers. This causes greater rise over the existing pedestrian bridge than the similarly configured proposed bridge. This is evident in the results of the analysis which shows approximately 50% of the 100-year flow going over the existing bridge, whereas the weir flow will be just over 28.5% in the proposed condition. Consequently, the backwater from the existing pedestrian bridge is even higher than the resulting water surface at the proposed pedestrian bridge.

Westerly I-84 Bridge No. 01224:

Due to the proposed highway widening, this bridge is proposed to replace the existing I-84 Structure No. 01224 over the Mad River. The proposed bridge is a single span, welded steel plate girder bridge with spill-through type concrete abutments. The span is 96 ft measured between the abutment faces. The highway is skewed approximately 60° to the watercourse. The width of the crossing (measured along the river baseline) is

increased from 131 feet to 298 feet to accommodate two additional lanes along the interstate and the realignments of the Eastbound Exit 23 On-Ramp and the Exit 24 Eastbound Off-Ramp. The widening is proposed mostly on the upstream side of the crossing, and thus necessitates extending the existing riprap revetments under the bridge upstream or southeasterly, and relocating the pedestrian bridge approximately 92 feet upstream, as described previously.

The minimum superstructure underclearance is approximately 9.3 feet for the Base Flood, which is at the downstream side of the bridge. For the 500-year flood, the minimum underclearance is approximately 7.1 feet.

Compared to the existing bridge, the flood elevations at the downstream end of the bridge is lower by 0.32 ft in the 100-year encroached condition (see Tag #4 on Figures 7), but higher by 0.48 ft in the 100-year unencroached condition (see Tag #4 on Figures 6). The increase becomes smaller in the 500-year flood to 0.06 ft (See Tag #4 on Figure 8). As discussed earlier, the flow changes from subcritical to critical state under the existing bridge as the velocity increases from 9.3 (upstream) to 14.3 ft/s (downstream) due to relative steep decline in the energy gradeline. However, in the proposed condition, the flow maintains its subcritical state through the crossing from a smaller drop in the energy. The velocity changes from 7.9 to 12.1 ft/s. The reduced velocity is compensated with the expanded flow area and thus the increase in the water surface. As the increase occurs for a short reach, within the main channel and inside of the State's Non-Access Highway Line, no measures to lower the water surface are proposed.

#### 10-YEAR ENCROACHED FLOW CONDITION

In accordance with the CT DEEP's requirements, the 10-year Existing and Proposed water surface profiles based on the encroached condition were also compared (see Figure 8 and Table 7), and found several locations with the increase.

The most upstream location where the increase occurs is from the existing easterly I-84 structure location to just upstream of the proposed easterly I-84 bridge (see Tag #1 on Figure 8). The increase is as much as 0.81 ft. In the previous analysis before the hydraulic survey was updated, there was a decrease of as much as 0.68 ft. Therefore, the cause of the increase at this location can be attributed to the degradation of the riverbed.

The next downstream location is at the downstream end of the proposed Eastbound Ex 24 Off-Ramp Bridge No. 06284 (see Tag #2). The increase there is approximately 0.3 ft. As it occurs inside the bounding section of the bridge with no comparable section in the Existing Condition model, it is not listed in the comparison table; thus, the increase is estimated by linearly interpolating the existing condition profile at that location. The increase is contained within the channelized section of the river, within the State ROW.

The increase occurring downstream of the breached dam where the Rock Ramp Fishway is proposed (see Tag #3) is relatively smaller, which is no more than 0.08 ft. As the construction of

the Fishway involves filling in the channel bottom and mostly inside the floodway, the increase is expected as a result. The maximum increase of 0.08 ft occurs at Section 1536. At this section, the southern portion from the center of the channel is owned by a private property, though the State has acquired an easement to construct the proposed fishway. The property is currently undeveloped and land-locked due to the lack of access. From the increase, the corresponding lateral expansion of the floodplain width toward to the property will be approximately 0.1 ft. Countering this expansion, there will also be receding flood areas within the property. Sections 1487, 1523 and 1550 also cut through the property. Among them, Sections 1487 and 1523 show decreases. Furthermore, in the 100-year flood, all these sections show a decrease in the Base Flood elevation by as much as 0.65 ft, with the corresponding floodplain reduction of 0.2 ft laterally. In the 500-year flood, the 0.96-ft elevation decrease produces 2.5 ft reduction in the width. This demonstrates that, in overall, the floodplain in the private property will be reduced.

Lastly, for the most downstream location, the increase occurs under the proposed westerly I-84 bridge (No. 01224) near its downstream end (See Tag #4). The approximate increase is 0.13 ft. Similar to the location identified by Tag #2, the increase is estimated by linearly interpolating the proposed profile under the proposed bridge and comparing it to the elevation at the downstream end of the existing easterly I-84 structure. As it occurs inside the bridge, it has no impact on any private properties.

As described above, none of the increase occurring in the 10-year encroached condition will adversely impact any private properties

## AREAS OF FLOODING

A map has been prepared showing both the existing and proposed condition flood boundaries based on the 100-year base flood (see Figure 4). At the upstream and downstream limits of the study, the approximate FEMA effective boundaries were drawn by referencing in the current effective FIRM into the project base map. The existing flooding limits were drawn based on the contour lines developed from the project survey whereas the proposed condition flooding limits were established based on the design contour lines provided by Ammann & Whitney, which was converted from Metric to US Customary units by the State for this map. These flooding limits match the computed top width of flow at most cross sections included in the model. In some cases, however, the flooding would occur wider than the computed width if it rises beyond the available data in a cross section. In such cases, the flood boundaries were extended to where the flood elevation matches the ground elevation.

Comparing the existing and proposed flood boundaries, the flooding areas at and upstream of the Plank Road crossing will be reduced most significantly. In the existing flooding condition, the crossing does attribute to the flooding, as its backwater sets the high tailwater condition for the upstream channel. However, the primary attributing factor is the insufficient hydraulic capacity of the upstream channel causing the Base Flood to rise above the top of the channel banks inundating Plank Road, Harpers Ferry Road and the surrounding residential properties. With the river relocation and modification that provides greater hydraulic capacity in the channel, it will contain the 100-year flow within the channel limits. At the crossing, however, the 100-year flow

will continue to flow over the road, though at a reduced volume than the existing condition, as discussed earlier. The reduced overflow and elimination of the upstream channel overtopping will limit the spread of flood mostly within the roadways and onto a reduced number of private properties - more specifically but roughly from eighteen (18) to three (3) properties north of Plank Road. Even at these properties, the overflow will cause just partial flooding, and not likely reach any residential or commercial buildings. Most of these building would have been completely inundated by the flood in the existing condition. The 100-year flood in the existing condition covers an area of approximately 19,040 SY from the Plank Road (including flooding over the road) to the upstream study limit, just downstream of the East Main Street. In the proposed condition, it will cover approximately 10,560 SY, which represents a 45% reduction.

In the event of the 500-year flood, a significant number of the residential properties would continue to be affected, though not as severe as the existing condition. The 500-year flood limits in the proposed condition will closely imitate the 100-year flood limit of the existing condition on the west side of the river. On the east side near the Plank Road, the 500-year floodplain will be just slightly narrower than the existing condition as it is controlled by the flooding condition along the Beaver Pond Book. See the *Floodplain/Floodway Analysis Report for Beaver Pond Brook* for more details.

In the former City Mills Pond area downstream of the Plank Road crossing (Culvert No. 05668) to under the proposed Westbound Exit 24 On-Ramp (Bridge No. 06591), the 100-year floodplain west of Harpers Ferry Road will be reduced from approximately 17,220 to 16,970 SY - a 1 % reduction. For the 500-year floodplain, the areal reduction will be 11%. There are two main factors for the reduction. First, the proposed westerly shift of the Harpers Ferry Road alignment necessitates minor filling along the eastern edge of the floodplain in this area. Second, the proposed removal of the existing easterly I-84 structure will result in lowering the flood elevation.

From the new Westbound Exit 24 On-Ramp (Bridge No. 06591) or the existing westerly I-84 crossing to the breached Century Dam, which also falls in the former City Mills Pond area, the existing 100-year floodplain measures approximately 31,360 SY. In the proposed condition, the floodplain will be reduced roughly by 60% or 12,660 SY. This reduced area will mostly be encompassed inside the existing floodplain including where the Base Flood Elevation will be higher than the existing condition at downstream end of the proposed Eastbound Exit 24 Off-Ramp (see Tag #2 on Figures 4 & 6). The increase is due to the relocation and channelization of the river, which means that the flooding width is reduced (thus the floodplain) and is compensated with the increased flow depth. Other proposed work that results in the reduction of the floodplain is the realignment of the I-84 and construction of the Westbound Exit 24 On-Ramp as well as of the Eastbound Exit 24 Off-Ramp proposed largely inside the former pond area.

There is an area in this reach where the proposed floodplain will extend beyond the existing floodplain. The area is located southwest of the proposed Westbound Exit 24 On-Ramp, and is approximately 1,500 SY (approximately 5% in size compared to the existing floodplain in this reach). This is where an additional increase up to 1.43 ft in the Base Flood occurs due to the river relocation, as discussed earlier (Tag #1). As it is located between the On-Ramp and the

proposed I-84, it is entirely within the State's Non-Access Highway Line. The reduction in the 500-year floodplain will be about 55%.

Downstream of the dam to the upstream face of the existing I-84 crossing, the existing 100-year floodplain area is approximately 28,600 SY. This will be reduced by approximately 13% to 24,880 SY in the proposed condition. The reduction in the floodplain area is primarily due to the construction of the proposed Eastbound Exit 24 Off-Ramp that requires filling along the northern edge of the floodplain, and a Sediment Basin, intended for improving storm water quality, proposed southwest of the I-84 Bridge No 01224. The floodplain in the proposed condition does not include the internal area of this basin, although the flood water will be elevated higher than its bottom elevation and can enter it through the outlet pipe.

Within this reach, the proposed 100-year unencroached, encroached and 500-year flows are all lower than the existing condition. Among the regulated conditions, the 10-year encroached condition is the only profile that shows an increase in this reach which occurs downstream of the dam over the Rock Ramp Fishway (Tag# 3). As discussed earlier, being more than balanced by the decreases occurring at the higher flow conditions and other parts of the affected property, the impact from the increase is not critical.

From the upstream end of the existing westerly I-84 crossing to the downstream study limit (approximately 1,500 ft downstream), the existing 100-year floodplain of 13,740 SY. In the proposed condition, it will be expanded by approximately 3% to 14,120 SY. The expansion most occurs under the bridge with the widening of the bridge opening; downstream of the bridge, the floodplain will remain nearly unchanged. In the 500-year flood, the floodplain will be reduced by approximately 4% due to the proposed fill along the southern edge nearly the downstream end of the study for the construction of the Westbound Exit 23 Off-Ramp. As demonstrated in the hydraulic model, the fill does not affect the flood elevation.

#### FLOODWAY - UNENCROACHED VS. ENCROACHED

The comparison of the 100-year proposed unencroached and encroached condition profiles is shown in Table 9. The table also shows the comparison to the published data.

In most locations the width of the encroachments or Floodway for the proposed condition will either remain close to the existing condition or match the Base Flood width (no encroachment) if it is contained within the channelized section. There are mainly two locations where the Floodway will be set differently. One of them is at the former City Mills Pond area between the Plank Road crossing (Culvert No. 05668) and the proposed Westbound Exit 24 On-Ramp (Bridge No. 06591). The Floodway here is proposed narrower than the effective floodway width, as the pond no longer serves as a storage for the Century Dam since the 1998 breach. The encroachments are set at the boundary of the ineffective flow area so that it does not result in any surcharge. Further narrowing of the Floodway width was not considered, as that may result in a surcharge. Any increase in the water surface elevation here will likely adversely affect the flood prone areas upstream of the Plank Road crossing, negating the hydraulic improvements this project would generate. One notable finding from the analysis of the existing condition is that

the effective Floodway causes a maximum surcharge of 1.06 ft over the Base Flood upstream of the Plank Road crossing, though the elevation is still lower than the effective encroached water surface elevation. In the proposed condition, however, the maximum surcharge will be 0.22 ft.

The other location is upstream of the proposed westerly I-84 Bridge No. 01224 for a length of approximately 560 ft in which the Floodway will be widened to in the range of 105 to 147 ft. Although the current effective study showed zero (0) surcharge at this location, the analysis of the existing condition indicates a maximum 0.4 ft surcharge. The same Floodway width was also initially applied to the proposed condition. However, the results show a greater surcharge, a maximum of 0.83 as well a negative surcharge of 0.19 feet between the new I-84 bridge and new pedestrian crossing. Accordingly, the widening of the Floodway width was found necessary to eliminate the negative surcharge. This also ensured that the resulting encroached water surface would be lower than the existing encroached condition. The maximum surcharge will be 0.56 ft occurring at approximately 130 ft of the proposed pedestrian bridge. The area south of the river at this location was owned by a private entity. It has since been acquired by the State. The northern side of the river is owned by the City of Waterbury.

Compared to the published FIS data, the Proposed Condition profiles were mostly lower except at the upstream limit of the study (Section 2409 or AM) for the encroached condition. The computed increase there was 0.03. It should be noted that the increase may not due to any proposed changes under this project, but mostly likely from using the different computational programs. As shown on Table 4, the Duplicate Effective's encroached condition also shows 0.03 ft increase compared to the published data, indicating it is the same as the proposed condition elevation.

**TABLE 9. 100-Year FEMA Discharge - Encroached and Unencroached (Floodway) Elevations  
Proposed Condition versus Published FIS Profile  
Mad River, Waterbury**

U.S. Customary, NGVD-29

			U.S. Customary								
			Published FIS Data			Proposed Condition			Comparison		
FEMA Sta.	River Sta.		100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Published Surcharge	100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Proposed Condition Surcharge	Unencro.: Proposed - Published	Encroach.: Proposed - Published	Proposed Surcharge - Published Surcharge
			(ft) (1)	(ft) (2)	(ft) (2-1)	(ft) (3)	(ft) (4)	(ft) (4-3)	(ft) (3) - (1)	(ft) (4) - (2)	(ft) (4-3) - (2-1)
AM	5143.0	2409	388.9	388.9	0.0	388.90	388.93	0.03	0.00	0.03	0.03
		2337				383.29	383.29	0.00			
		2280				381.30	381.30	0.00			
AL	5142.0	2238	380.8	380.8	0.0	380.74	380.74	0.00	-0.06	-0.06	0.00
		2207				378.87	378.88	0.01			
		2202				378.45	378.45	0.00			
		2168				376.85	376.99	0.14			
		2130				376.44	376.65	0.21			
AK	5141.0	2116	378.8	378.8	0.0	376.32	376.54	0.22	-2.48	-2.26	0.22
REPLACE	2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668									
AJ	5140.0	2079	378.2	378.2	0.0	373.79	373.79	0.00	-4.41	-4.41	0.00
		2067				374.05	374.05	0.00			
AI	5139.0	2020	378.2	378.2	0.0	373.97	373.97	0.00	-4.23	-4.23	0.00
		2004				373.95	373.95	0.00			
		1983				373.81	373.81	0.00			
		1972				373.32	373.32	0.00			
		1962				373.13	373.13	0.00			
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)									
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)									
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)									
		1900				371.88	371.88	0.00			
AH	5138.0	1871	376.2	376.2	0.0	370.90	370.90	0.00	-5.30	-5.30	0.00
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)									
		1748				368.72	368.72	0.00			
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)									
AG	5137.0	1689	376.2	376.2	0.0	365.62	365.62	0.00	-10.58	-10.58	0.00
		1620				363.88	364.15	0.27			
	5136.8	1573				363.62	363.92	0.30			
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)									
	5136.2	1550				358.74	358.79	0.05			
		1536				358.45	358.61	0.16			
AF	5136.0	1523	358.7	359.2	0.5	357.18	357.43	0.25	-1.52	-1.77	-0.25
		1487				356.84	357.06	0.22			
		1425				355.72	355.80	0.08			
AE	5135.0	1370	354.4	354.4	0.0	353.82	354.08	0.26	-0.58	-0.32	0.26
		1330				353.04	353.60	0.56			
		1309				352.91	353.36	0.45			
NEW	1288.5	Proposed Pedestrian Bridge									
AD	5134.0	1277	353.6	353.6	0.0	352.24	352.25	0.01	-1.36	-1.35	0.01
REMOVE	1260.5	Existing Pedestrian crossing									
AC	5133.0	1246	352.2	352.2							
REPLACE	1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps									
		1162				348.13	348.15	0.02			
AB	5132.0	1153	349.7	349.9	0.2	347.08	347.08	0.00	-2.62	-2.82	-0.20
		1107				345.80	345.80	0.00			
		1003				343.11	343.11	0.00			
AA	5131.0	894	341.4	341.4	0.0	338.99	338.99	0.00	-2.41	-2.41	0.00
		809				336.99	337.00	0.01			
Z	5130.0	714	335.3	335.3	0.0	335.27	335.27	0.00	-0.03	-0.03	0.00

- New/Replacement Structure
  - Existing Structure



**TABLE 9A. 100-Year FEMA Discharge - Encroached and Unencroached (Floodway) Elevations  
Proposed Condition versus Published FIS Profile  
Mad River, Waterbury**

U.S. Customary, NAVD-88

			U.S. Customary								
			Published FIS Data			Proposed Condition			Comparison		
FEMA Sta.	River Sta.		100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Published Surcharge	100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Proposed Condition Surcharge	Unencro.: Proposed - Published	Encroach.: Proposed - Published	Proposed Surcharge - Published Surcharge
			(ft) (1)	(ft) (2)	(ft) (2-1)	(ft) (3)	(ft) (4)	(ft) (4-3)	(ft) (3) - (1)	(ft) (4) - (2)	(ft) (4-3) - (2-1)
AM	5143.0	2409	387.9	387.9	0.0	387.90	387.93	0.03	0.00	0.03	0.03
		2337				382.29	382.29	0.00			
		2280				380.30	380.30	0.00			
AL	5142.0	2238	379.8	379.8	0.0	379.74	379.74	0.00	-0.06	-0.06	0.00
		2207				377.87	377.88	0.01			
		2202				377.45	377.45	0.00			
		2168				375.85	375.99	0.14			
		2130				375.44	375.65	0.21			
AK	5141.0	2116	377.8	377.8	0.0	375.32	375.54	0.22	-2.48	-2.26	0.22
REPLACE	2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668									
AJ	5140.0	2079	377.2	377.2	0.0	372.79	372.79	0.00	-4.41	-4.41	0.00
		2067				373.05	373.05	0.00			
AI	5139.0	2020	377.2	377.2	0.0	372.97	372.97	0.00	-4.23	-4.23	0.00
		2004				372.95	372.95	0.00			
		1983				372.81	372.81	0.00			
		1972				372.32	372.32	0.00			
		1962				372.13	372.13	0.00			
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)									
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)									
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)									
		1900				370.88	370.88	0.00			
AH	5138.0	1871	375.2	375.2	0.0	369.90	369.90	0.00	-5.30	-5.30	0.00
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)									
		1748				367.72	367.72	0.00			
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)									
AG	5137.0	1689	375.2	375.2	0.0	364.62	364.62	0.00	-10.58	-10.58	0.00
		1620				362.88	363.15	0.27			
	5136.8	1573				362.62	362.92	0.30			
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)									
	5136.2	1550				357.74	357.79	0.05			
		1536				357.45	357.61	0.16			
AF	5136.0	1523	357.7	358.2	0.5	356.18	356.43	0.25	-1.52	-1.77	-0.25
		1487				355.84	356.06	0.22			
		1425				354.72	354.80	0.08			
AE	5135.0	1370	353.4	353.4	0.0	352.82	353.08	0.26	-0.58	-0.32	0.26
		1330				352.04	352.60	0.56			
		1309				351.91	352.36	0.45			
NEW	1288.5	Proposed Pedestrian Bridge									
AD	5134.0	1277	352.6	352.6	0.0	351.24	351.25	0.01	-1.36	-1.35	0.01
REMOVE	1260.5	Existing Pedestrian crossing									
AC	5133.0	1246	351.2	351.2							
REPLACE	1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps									
		1162				347.13	347.15	0.02			
AB	5132.0	1153	348.7	348.9	0.2	346.08	346.08	0.00	-2.62	-2.82	-0.20
		1107				344.80	344.80	0.00			
		1003				342.11	342.11	0.00			
AA	5131.0	894	340.4	340.4	0.0	337.99	337.99	0.00	-2.41	-2.41	0.00
		809				335.99	336.00	0.01			
Z	5130.0	714	334.3	334.3	0.0	334.27	334.27	0.00	-0.03	-0.03	0.00

- New/Replacement Structure
  - Existing Structure

**TABLE 9M. 100-Year FEMA Discharge - Encroached and Unencroached (Floodway) Elevations  
Proposed Condition versus Published FIS Profile  
Mad River, Waterbury**

Metric, NGVD-29

			U.S. Customary								
			Published FIS Data			Proposed Condition			Comparison		
FEMA Sta.	River Sta.		100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Published Surcharge	100-yr Base (Uncroach.)	100-yr Encroach (Floodway)	Proposed Condition Surcharge	Unencro.: Proposed - Published	Encroach.: Proposed - Published	Proposed Surcharge - Published Surcharge
			(M) (1)	(M) (2)	(M) (2-1)	(M) (3)	(M) (4)	(M) (4-3)	(m) (3) - (1)	(m) (4) - (2)	(m) (4-3) - (2-1)
AM	5143.0	2409	118.5	118.5	0.0	118.54	118.55	0.01	0.00	0.01	0.01
		2337				116.83	116.83	0.00			
		2280				116.22	116.22	0.00			
AL	5142.0	2238	116.1	116.1	0.0	116.05	116.05	0.00	-0.02	-0.02	0.00
		2207				115.48	115.48	0.00			
		2202				115.35	115.35	0.00			
		2168				114.86	114.91	0.04			
		2130				114.74	114.80	0.06			
AK	5141.0	2116	115.5	115.5	0.0	114.70	114.77	0.07	-0.76	-0.69	0.07
REPLACE	2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668									
AJ	5140.0	2079	115.3	115.3	0.0	113.93	113.93	0.00	-1.34	-1.34	0.00
		2067				114.01	114.01	0.00			
AI	5139.0	2020	115.3	115.3	0.0	113.99	113.99	0.00	-1.29	-1.29	0.00
		2004				113.98	113.98	0.00			
		1983				113.94	113.94	0.00			
		1972				113.79	113.79	0.00			
		1962				113.73	113.73	0.00			
REMOVE	1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)									
NEW	1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)									
REMOVE	1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)									
		1900				113.35	113.35	0.00			
AH	5138.0	1871	114.7	114.7	0.0	113.05	113.05	0.00	-1.62	-1.62	0.00
NEW	1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)									
		1748				112.39	112.39	0.00			
NEW	1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)									
AG	5137.0	1689	114.7	114.7	0.0	111.44	111.44	0.00	-3.22	-3.22	0.00
		1620				110.91	110.99	0.08			
	5136.8	1573				110.83	110.92	0.09			
MINOR MOD.	1561.5	Breached Century Dam (CTDEP Dam No. 15103)									
	5136.2	1550				109.34	109.36	0.02			
		1536				109.26	109.30	0.05			
AF	5136.0	1523	109.3	109.5	0.2	108.87	108.94	0.08	-0.46	-0.54	-0.08
		1487				108.76	108.83	0.07			
		1425				108.42	108.45	0.02			
AE	5135.0	1370	108.0	108.0	0.0	107.84	107.92	0.08	-0.18	-0.10	0.08
		1330				107.61	107.78	0.17			
		1309				107.57	107.70	0.14			
NEW	1288.5	Proposed Pedestrian Bridge									
AD	5134.0	1277	107.8	107.8	0.0	107.36	107.37	0.00	-0.41	-0.41	0.00
REMOVE	1260.5	Existing Pedestrian crossing									
AC	5133.0	1246	107.4	107.4							
REPLACE	1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps									
		1162				106.11	106.12	0.01			
AB	5132.0	1153	106.6	106.6	0.1	105.79	105.79	0.00	-0.80	-0.86	-0.06
		1107				105.40	105.40	0.00			
		1003				104.58	104.58	0.00			
AA	5131.0	894	104.1	104.1	0.0	103.32	103.32	0.00	-0.73	-0.73	0.00
		809				102.71	102.72	0.00			
Z	5130.0	714	102.2	102.2	0.0	102.19	102.19	0.00	-0.01	-0.01	0.00

- New/Replacement Structure
  - Existing Structure

## Natural Condition

### DEVELOPMENT OF PROPOSED CONDITION MODEL

Section 9.3.6 of the ConnDOT 2000 *Drainage Manual* recommends, for large structures (drainage area greater than 25.9 km<sup>2</sup>), that the proposed 100-year water surface profile should be no more than one foot above the natural profile. This design criterion has been established to insure that the proposed structures do not cause excessive upstream backwater.

It is often difficult to model "natural" cross sections in urban areas where typically, over a long period of time, watercourses have been repeatedly realigned and altered with significant fill placed within their floodplains. For the Mad River, a Natural Conditions model was at first created by first deleting all existing bridges, bridge approach embankments and accompanying ineffective flow areas from the Existing Condition model. Then, a secondary Natural Condition model was also developed incorporating segments of the relocated channel geometry from the Proposed Condition. The proposed channel was not used in its entirety as it defeats the intended purpose of comparing to the "natural" channel geometry. Only where the relocation is so significant that the comparison of the water surface elevation between the Natural and Proposed Conditions is considered not feasible, as they represents completely different physical locations. The second Natural Condition allows evaluation of the effects of the proposed structures in the river.

### WATER SURFACE PROFILE COMPARISON TO PROPOSED CONDITION

The comparisons of the proposed to natural condition base flood profiles are shown on Figure 10 and in Table 10. It shows that there are primarily three locations where the increase over the natural profile is greater than one foot. These occur at the Plank Road crossing, upstream of the breached dam, and upstream of the proposed pedestrian bridge.

The increase at the Plank Road crossing is approximately 2.56 ft, and is evidently due to the inadequately hydraulic capacity of the proposed culvert. As indicated earlier, the alternative that would lower the water surface profile sufficiently to within one foot range of the natural profile is not practical for this site due to resulting additional potential impact on the private properties. Therefore, the cost of placing a larger structure would outweigh the benefit.

The increase at the dam is about 4 ft and primarily due to the remaining, existing weir portion and concrete vertical side walls which constricts the flow. In order to lower the water surface within one foot of the natural condition, these existing features would have to be completely removed. This will necessitate the removal of upstream sediments as well which are potentially contaminated. Furthermore, it would likely affect a private property southwest (downstream) of the dam requiring additional easements or take under this project. As the backwater from the constriction does not adversely affect any upstream structures, neighboring private properties or roads, the removal was not considered under this project.

The increase at the pedestrian bridge is 1.61 ft which is actually an improvement compared to the existing condition. The analysis of the existing pedestrian bridge generated a maximum of 1.9 ft increase over the natural condition. One of the options to reduce the increase below one foot is to raise the structure and provide a longer span. However, this would require filling in the floodplain to construct high approach embankments which negate some of the benefits. Relocating it further upstream toward the dam or downstream of the I-84 crossing may be considered, but would likely mean an increase over the existing condition that may affect a private property or a recreational area of the Hamilton Park. As proposed, the increase is over an undeveloped area owned by the State and the City of Waterbury, and is thus deemed the most practical design option.

There is one other location besides the three above where an increase greater than one foot will occur. It occurs between the Westbound Exit 24 On-Ramp (Bridge No. 06591) and the easterly I-84 crossing (Bridge No. 05774), and the maximum increase there is 2.49 ft. That is evident when comparing to the natural profile based on the existing river geometry. When comparing the "natural" profile based on the relocated channel geometry, there will instead be a decrease of 0.29 ft. As the intended purpose of comparing the proposed and natural condition profiles is to assess and limit the backwater effect of a hydraulic crossing, the increase resulting from the river relocation should be disregarded. Accordingly, the later mentioned decrease is considered for this location.

**TABLE 10. Proposed versus Natural Condition  
100-Year FEMA Discharge Water Surface Elevation  
Mad River, Waterbury**

U.S. Customary, NGVD-29

			U.S. Customary				
	FEMA Sta.	River Sta.	Natural 1 (from EX)	Natural 2 (using relocated PR segm.)	Proposed	Difference	
			(ft) (1)	(ft) (2)	(ft) (3)	(3) - (2)	(3) - (1)
AM	5143.0	2409	388.91	388.91	388.90	-0.01	-0.01
		2337	383.29	383.29	383.29	0.00	0.00
		2280	381.46	381.51	381.30	-0.21	-0.16
AL	5142.0	2238	381.18	381.20	380.74	-0.46	-0.44
		2207	380.32	380.30	378.87	-1.43	-1.45
		2202	380.22	380.21	378.45	-1.76	-1.77
		2168	379.50	377.44	376.85	-0.59	-2.65
		2130	378.46	374.98	376.44	1.46	-2.02
AK	5141.0	2116	376.31	373.76	376.32	2.56	0.01
REPLACE		2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668				
AJ	5140.0	2079	373.26	373.27	373.79	0.52	0.53
		2067	373.13	373.57	374.05	0.48	0.92
AI	5139.0	2020	373.13	373.49	373.97	0.48	0.84
		2004	373.13	373.49	373.95	0.46	0.82
		1983	372.99	373.36	373.81	0.45	0.82
		1972		373.19	373.32	0.13	
		1962		372.50	373.13	0.63	
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)				
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)				
		1927	371.36				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)				
AH	5138.0	1900	369.39	371.96	371.88	-0.08	2.49
		1871	369.83	371.19	370.90	-0.29	1.07
		1837	369.74				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)				
		1778	369.65				
		1748	369.06	369.23	368.72	-0.51	-0.34
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)				
AG	5137.0	1689	366.17	366.17	365.62	-0.55	-0.55
		1620	362.15	362.15	363.88	1.73	1.73
		1573	359.62	359.62	363.62	4.00	4.00
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)				
		5136.2	SEE NOTE BELOW		358.74		
AF	5136.0	1536	358.62	358.62	358.45	-0.17	-0.17
		1523	357.55	357.55	357.18	-0.37	-0.37
		1487	357.15	357.15	356.84	-0.31	-0.31
		1425	355.38	355.38	355.72	0.34	0.34
AE	5135.0	1370	353.35	353.35	353.82	0.47	0.47
		1330	352.03	352.03	353.04	1.01	1.01
		1309	351.30	351.30	352.91	1.61	1.61
NEW		1288.5	Proposed Pedestrian Bridge				
AD	5134.0	1277	351.69	351.69	352.24	0.55	0.55
REMOVE		1260.5	Existing Pedestrian crossing				
AC	5133.0	1246	350.57	350.57			
REPLACE		1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps				
AB	5132.0	1162	348.07	348.07	348.13	0.06	0.06
		1153	347.28	347.28	347.08	-0.20	-0.20
		1107	345.77	345.77	345.80	0.03	0.03
AA	5131.0	1003	343.09	343.09	343.11	0.02	0.02
		894	339.10	339.10	338.99	-0.11	-0.11
		809	336.99	336.99	336.99	0.00	0.00
Z	5130.0	714	335.27	335.27	335.27	0.00	0.00

- New/Replacement Structure
  - Existing Structure

Natural 1: Developed from the Existing Condition model by removing all the existing man-made structures that cross the Mad River within the studied reach. The breached Century Dam was also completed removed from the model.

Natural 2: Where the river will be realigned significantly such that the representative cross sections for the proposed condition had to be cut from different locations than the existing/natural condition models, the direct comparison of the proposed water surface profile to the natural condition is not viable. Accordingly, a secondary natural condition model was created by combining the proposed channel geometry to the initial natural condition model from Section 1689 (120m upstream of Century Dam) to 2020 (downstream of confluence with Beaver Pond Brook). This segment is shown above in the blue colored columns above. Within this segment, the proposed retaining walls along the river were also removed.

Note: Section 1550 was removed in the natural condition models as it represented a deep scour hole cause by the dam. Without the dam, such scour hole would not have been formed.

**TABLE 10A. Proposed versus Natural Condition  
100-Year FEMA Discharge Water Surface Elevation  
Mad River, Waterbury**

U.S. Customary, NAVD-88

			U.S. Customary				
	FEMA Sta.	River Sta.	Natural 1 (from EX)	Natural 2 (using relocated PR segm.)	Proposed	Difference	
			(ft) (1)	(ft) (2)	(ft) (3)	(3) - (2)	(3) - (1)
AM	5143.0	2409	387.91	387.91	387.90	-0.01	-0.01
		2337	382.29	382.29	382.29	0.00	0.00
		2280	380.46	380.51	380.30	-0.21	-0.16
AL	5142.0	2238	380.18	380.20	379.74	-0.46	-0.44
		2207	379.32	379.30	377.87	-1.43	-1.45
		2202	379.22	379.21	377.45	-1.76	-1.77
		2168	378.50	376.44	375.85	-0.59	-2.65
		2130	377.46	373.98	375.44	1.46	-2.02
AK	5141.0	2116	375.31	372.76	375.32	2.56	0.01
REPLACE		2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668				
AJ	5140.0	2079	372.26	372.27	372.79	0.52	0.53
		2067	372.13	372.57	373.05	0.48	0.92
AI	5139.0	2020	372.13	372.49	372.97	0.48	0.84
		2004	372.13	372.49	372.95	0.46	0.82
		1983	371.99	372.36	372.81	0.45	0.82
		1972		372.19	372.32	0.13	
		1962		371.50	372.13	0.63	
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)				
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)				
		1927	370.36				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)				
		1900	368.39	370.96	370.88	-0.08	2.49
AH	5138.0	1871	368.83	370.19	369.90	-0.29	1.07
		1837	368.74				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)				
		1778	368.65				
		1748	368.06	368.23	367.72	-0.51	-0.34
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)				
AG	5137.0	1689	365.17	365.17	364.62	-0.55	-0.55
		1620	361.15	361.15	362.88	1.73	1.73
	5136.8	1573	358.62	358.62	362.62	4.00	4.00
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)				
	5136.2	1550	SEE NOTE BELOW		357.74		
		1536	357.62	357.62	357.45	-0.17	-0.17
AF	5136.0	1523	356.55	356.55	356.18	-0.37	-0.37
		1487	356.15	356.15	355.84	-0.31	-0.31
		1425	354.38	354.38	354.72	0.34	0.34
AE	5135.0	1370	352.35	352.35	352.82	0.47	0.47
		1330	351.03	351.03	352.04	1.01	1.01
		1309	350.30	350.30	351.91	1.61	1.61
NEW		1288.5	Proposed Pedestrian Bridge				
AD	5134.0	1277	350.69	350.69	351.24	0.55	0.55
REMOVE		1260.5	Existing Pedestrian crossing				
AC	5133.0	1246	349.57	349.57			
REPLACE		1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps				
		1162	347.07	347.07	347.13	0.06	1.06
AB	5132.0	1153	346.28	346.28	346.08	-0.20	0.80
		1107	344.77	344.77	344.80	0.03	1.03
		1003	342.09	342.09	342.11	0.02	1.02
AA	5131.0	894	338.10	338.10	337.99	-0.11	0.89
		809	335.99	335.99	335.99	0.00	1.00
Z	5130.0	714	334.27	334.27	334.27	0.00	1.00

- New/Replacement Structure
  - Existing Structure

Natural 1: Developed from the Existing Condition model by removing all the existing man-made structures that cross the Mad River within the studied reach. The breached Century Dam was also completely removed from the model.

Natural 2: Where the river will be realigned significantly such that the representative cross sections for the proposed condition had to be cut from different locations than the existing/natural condition models, the direct comparison of the proposed water surface profile to the natural condition is not viable. Accordingly, a secondary natural condition model was created by combining the proposed channel geometry to the initial natural condition model from Section 1689 (120m upstream of Century Dam) to 2020 (downstream of confluence with Beaver Pond Brook). This segment is shown above in the blue colored columns above. Within this segment, the proposed retaining walls along the river were also removed.

Note: Section 1550 was removed in the natural condition models as it represented a deep scour hole caused by the dam. Without the dam, such scour hole would not have been formed.

**TABLE 10M. Proposed versus Natural Condition  
100-Year FEMA Discharge Water Surface Elevation  
Mad River, Waterbury**

Metric, NGVD-29

			U.S. Customary				
	FEMA Sta.	River Sta.	Natural 1 (from EX)	Natural 2 (using relocated PR segm.)	Proposed	Difference	
			(m) (1)	(m) (2)	(m) (3)	(3) - (2)	(3) - (1)
AM	5143.0	2409	118.54	118.54	118.54	0.00	0.00
		2337	116.83	116.83	116.83	0.00	0.00
		2280	116.27	116.28	116.22	-0.06	-0.05
AL	5142.0	2238	116.18	116.19	116.05	-0.14	-0.13
		2207	115.92	115.92	115.48	-0.44	-0.44
		2202	115.89	115.89	115.35	-0.54	-0.54
		2168	115.67	115.04	114.86	-0.18	-0.81
		2130	115.35	114.29	114.74	<b>0.45</b>	-0.62
AK	5141.0	2116	114.70	113.92	114.70	<b>0.78</b>	0.00
REPLACE		2095.5 (PR 2098.5)	Proposed Plank Road Culvert No. 05668				
AJ	5140.0	2079	113.77	113.77	113.93	0.16	0.16
		2067	113.73	113.86	114.01	0.15	<b>0.28</b>
AI	5139.0	2020	113.73	113.84	113.99	0.15	0.26
		2004	113.73	113.84	113.98	0.14	0.25
		1983	113.69	113.80	113.94	0.14	0.25
		1972		113.75	113.79	0.04	
		1962		113.54	113.73	0.19	
REMOVE		1953.5	Existing I-84 Structure No. 05774 (Easterly I-84 crossing over the Mad River)				
NEW		1938.5	Proposed Bridge No. 06591 (I-84 Westbound Exit 24 On-Ramp from Harpers Ferry Road)				
		1927	113.19				
REMOVE		1916.5	Existing Structure No. 06284 (I-84 EB Exit 24 Off-Ramp to Harpers Ferry Road)				
		1900	112.59	113.37	113.35	-0.02	0.76
AH	5138.0	1871	112.72	113.14	113.05	-0.09	0.33
		1837	112.70				
NEW		1807.5	Proposed I-84 Bridge No. 05774 (Proposed easterly I-84 bridge over the Mad River)				
		1778	112.67				
		1748	112.49	112.54	112.39	-0.16	-0.10
NEW		1727.5	Proposed Bridge No. 06284 (I-84 E24 Off-Ramp Exit to Harpers Ferry Road)				
AG	5137.0	1689	111.61	111.61	111.44	-0.17	-0.17
		1620	110.38	110.38	110.91	<b>0.53</b>	<b>0.53</b>
	5136.8	1573	109.61	109.61	110.83	<b>1.22</b>	<b>1.22</b>
MINOR MOD.		1561.5	Breached Century Dam (CTDEP Dam No. 15103)				
	5136.2	1550	SEE NOTE BELOW		109.34		
		1536	109.31	109.31	109.26	-0.05	-0.05
AF	5136.0	1523	108.98	108.98	108.87	-0.11	-0.11
		1487	108.86	108.86	108.76	-0.09	-0.09
		1425	108.32	108.32	108.42	0.10	0.10
AE	5135.0	1370	107.70	107.70	107.84	0.14	0.14
		1330	107.30	107.30	107.61	<b>0.31</b>	<b>0.31</b>
		1309	107.08	107.08	107.57	<b>0.49</b>	<b>0.49</b>
NEW		1288.5	Proposed Pedestrian Bridge				
AD	5134.0	1277	107.20	107.20	107.36	0.17	0.17
REMOVE		1260.5	Existing Pedestrian crossing				
AC	5133.0	1246	106.85	106.85			
REPLACE		1198.5 (PR 1214.5)	Proposed I-84 Bridge No. 01224, encompassing E23 On- and E24 Off-Ramps				
		1162	106.09	106.09	106.11	0.02	1.06
AB	5132.0	1153	105.85	105.85	105.79	-0.06	0.80
		1107	105.39	105.39	105.40	0.01	1.03
		1003	104.57	104.57	104.58	0.01	1.02
AA	5131.0	894	103.36	103.36	103.32	-0.03	0.89
		809	102.71	102.71	102.71	0.00	1.00
Z	5130.0	714	102.19	102.19	102.19	0.00	1.00

- New/Replacement Structure
  - Existing Structure

Natural 1: Developed from the Existing Condition model by removing all the existing man-made structures that cross the Mad River within the studied reach. The breached Century Dam was also completely removed from the model.

Natural 2: Where the river will be realigned significantly such that the representative cross sections for the proposed condition had to be cut from different locations than the existing/natural condition models, the direct comparison of the proposed water surface profile to the natural condition is not viable. Accordingly, a secondary natural condition model was created by combining the proposed channel geometry to the initial natural condition model from Section 1689 (120m upstream of Century Dam) to 2020 (downstream of confluence with Beaver Pond Brook). This segment is shown above in the blue colored columns above. Within this segment, the proposed retaining walls along the river were also removed.

Note: Section 1550 was removed in the natural condition models as it represented a deep scour hole caused by the dam. Without the dam, such scour hole would not have been formed.

## **Water Handling (Temporary Hydraulic Facilities)**

A separate report has been prepared for the water handling aspect of the river relocation. The report details a water handling plan of which the intent is to suggest a method of construction for the Contractor that will enable him to complete his work, provide protection of his work during construction and minimize potential flooding of adjacent roadways and properties. See the *Temporary Hydraulic Facilities* reports for details.

### **Summary**

This hydraulic study demonstrates that the proposed changes under the State Project No. 151-273 will mostly result in decreases in the 100-year Base Flood Elevation except for three locations. At all of these locations, the flood flow will be contained in the channel section of the river within the City of Waterbury and State ROW having no adverse impact on any roads, buildings and adjacent private properties.

Besides the location identified for the higher Base Flood, the 10-year encroached condition water surface elevation will also increase downstream of the dam, due to the Rock Ramp Fishway; but the impact is minimal and not critical, as it will be contained within the main channel and be countered by the decreases in other location and flood condition. Nonetheless, these increases in the 10-year water surface elevation will require an exemption from the State of Connecticut Flood Management Statutes and Regulations.

There are several locations where the Base Flood profile will be greater than one foot above the natural condition profile (no man-made crossings in the brook). This will also require an exemption from the State requirements.

As this project involves partially relocating the Mad River, reestablishing the floodway and replacing numerous waterway crossing that results in the increases in the Base Flood Elevation, it necessitates the issuance of the Conditional Letter of Map Revision (CLOMR) from the FEMA according to the National Flood Insurance Program (NFIP) standards and regulations (44 CFR, Chapter 1) and to the State statutes and regulations. Although CLOMR was originally obtained in 2007 for the project, it will be further coordinated with and additional approval will be sought from FEMA, if necessary, as there have been subsequent minor design changes which are incorporated and presented in this revised report.

This report along with all other reports, maps and supporting documentation for this project has been prepared in conformance with the applicable sections of the NFIP standards and regulations and in accordance with the Hydraulic Analysis Guidance Document (revision date 1/26/05) published by DEP.

The areas where the increases will occur for the various conditions are summarized in the following table.



**Table 11.  
Summarized Locations of Increases**

<i>Location</i>	<i>Profile</i>	<i>condition</i>	<i>Criteria</i>	<i>Comment</i>
At the Plank Road crossing	Base Flood	Overtops	1 foot below freeboard	Alternatives that would eliminate the overtopping condition are not practical for this site due to resulting additional impact on the private properties. The overflow will be reduced from 702 to 121 CFS.
	Base Flood	0.046 increase	0.00' over Existing	due to the proposed geometric changes; approach flood elevation will be lower. The extent of flooding will, however, be reduced. Also, the energy gradeline will be lowered by 1.52 ft.
	Base Flood	2.56' increase	< 1' over Natural	Occurs only at the crossing (Immediately downstream: 0.39 ft increase); immediately upstream: 0.2 ft decrease)
Downstream of Existing Easterly I-84 Structure No. 05774 to 100' upstream of Proposed I-84 Bridges No. 05774 (maximum increase occurring downstream of Ex. E.B. Ext 24 Off-Ramp Structure No. 06284)	Base Flood	1.43' increase	0.00' over Existing	Due to the river relocation. It is fully contained in the main channel within the State ROW (no impact on private properties).
	100-Year Encroached	1.43' increase	0.00' over Existing	
	10-Year Encroached	0.81' increase	0.00' over Existing	
Vicinity of Proposed Bridge No. 06284 with max. increase occurring at the downstream end of the bridge.	Base Flood	0.27' increase	0.00' over Existing	The increase occurs for a relatively short section of the river, mostly under the bridge.
	100-Year Encroached	0.27' increase	0.00' over Existing	Due to the river relocation. It is fully contained in the main channel within the State ROW (no impact on private properties).
	10-Year Encroached	0.3' approx. incrs	0.00' over Existing	
At and Upstream of Century Dam	Base Flood	4' max. increase	< 1' over Natural	Contained with the properties owned by the State and the City of Waterbury.
				Improvement compared to the existing condition.
100 ft downstream of Century Dam	10-Year Encroached	0.08' increase	0.00' over Existing	Due the proposed Rock Rmap Fishway which involves filling in an existing 3-foot drop immeidte downstream of the dam.
				The increase partially occurs at an undeveloped, land-locked private property, but within the easement obtained by State; Tthe 100-year floodplain in the property will be reduced.
Upstream of Proposed Pedestrian Bridge	Base Flood	Overtops	1 foot below freeboard	Improvement compared to the existing condition.
				The increase is over an undeveloped area owned by the State and the City of Waterbury
	Base Flood	1.61' increase	< 1' over Natural	A higher and longer span bridge would require filling in the floodplain, and will likely cause the 100- and 500-year flows to rise higher than the currently proposed condition. Relocating it downstream of the westerly I-84 bridge (#01224) would have adverse effect on the Hamilton Park
Near the downstream end under the proposed westerly I-84 Bridge No. 01224	Base Flood	0.48' increase	0.00' over Existing	The increase occurs for a short reach, within the main channel and inside of the State's Non-Access Highway Line
	10-Year Encroached	0.13' approx. incrs	0.00' over Existing	

## **Appendix A**

### **Hydraulic Backup: HEC-RAS Input Report**

- Proposed Condition, FEMA Q - Regulatory
- Proposed Condition, FEMA Q - Floodway (Plan & Flow data only)

## *Proposed Condition, FEMA Q - Regulatory*

HEC-RAS Version 4.1.0 Jan 2010  
 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      X
XXXXXXXX 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      X  XXXXXX   XXXX     X  X      X  X      XXXXX
  
```

**PROJECT DATA**

Project Title: Mad River, 151-273, Waterbury, English  
 Project File : 151273MR\_CLOMR.prj  
 Run Date and Time: 10/4/2013 9:26:24 AM

Project in English units

**Project Description:**

I-84 Reconstruction, Waterbury, Washington Ave. to Pierpont Rd., DOT Project 151-273, Mad River

All cross sections are looking upstream. Expand AND scroll through all description boxes to review complete annotations. Photographs are attached to the Existing Conditions Model.

Discharges are as reported in the 1979 Waterbury FIS.

Floodway encroachments for FEMA cross sections for the Existing Condition model were taken from the original FIS. Encroachment stations for new cross sections were estimated by scaling from the Floodway Maps, scale 1"=400'.

Recommend using "View Cross Sections" when comparing the EXISTING, NATURAL and PROPOSED conditions, instead of "Profile Plot". Due to the relocation of the brook, the overall channel length in the proposed condition differs from the existing. This makes comparing these different models in the Profile Plot impractical, which matches the downstream end adequately, but the upstream end would be off by the difference in the total channel length.

**PLAN DATA**

Plan Title: PROPOSED(match FIS), FEMA Q - REGULATORY  
 Plan File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.p18

Geometry Title: PROPOSED (Ends Matching FEMA)  
 Geometry File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.g18

Flow Title : FEMA Q's Regulatory  
 Flow File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.f01

**Plan Description:**

Includes runs for 10, 25(est.), 50, 100 and 500-year flood event runs. Use 100-YR Encroached Condition for 100-YR Floodplain data and delineation

Plan Summary Information:

Number of: Cross Sections = 38 Multiple Openings = 0  
 Culverts = 1 Inline Structures = 1  
 Bridges = 5 Lateral Structures = 0

Computational Information

Water surface calculation tolerance = 0.01  
 Critical depth calculation tolerance = 0.01  
 Maximum number of iterations = 40  
 Maximum difference tolerance = 0.9843  
 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: FEMA O's Regulatory

Flow File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.f01

Flow Data (cfs)

River	Reach	RS	10 Year	25 Year (est)	50 Year	100
Year	500 Year					
Mad River	Reach 1	2409	1505	2105	2595	
3190	4970					
Mad River	Reach 1	2020	2350	3290	4060	
4990	7775					

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mad River	Reach 1	10 Year	Rating Curve #1	Rating Curve #2
Mad River	Reach 1	25 Year (est)	Known WS = 388.173	
Mad River	Reach 1	50 Year	Known WS = 388.881	
Mad River	Reach 1	100 Year	Known WS = 388.881	
Mad River	Reach 1	500 Year	Known WS = 392.07	

Rating Curve #1

Flow (cfs)	Elev (ft)
1505	386.63
2595	388.19
3190	388.9
4970	392.09

Rating Curve #2

Flow (cfs)	Elev (ft)
2350	331.07
4060	333.89
4990	335.27
7775	336.73

GEOMETRY DATA

Geometry Title: PROPOSED (Ends Matching FEMA)

Geometry File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.g18

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2409

INPUT

Description: FEMA STATION 5143, CROSS SECTION AM  
 D/S of East Main Street

Station Elevation Data		num= 12							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
200	400	400	396	572	393.5	590	393.5	604	383.3
623	382.8	641	383	641	383.9	647	390.2	800	392
840	396	1110	400						

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
200	.08	590	.04	641	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	590	641		246.719	235.564		.3	.5

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2337

INPUT

Description: 85m (279') D/S of East Main St.

Station Elevation Data		num= 80							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-122.244	391.043	-119.127	391.01	-118.832	391.01	-105.906	390.945	-105.84	390.879
-104.199	390.912	-102.953	390.846	-92.552	390.19	-92.29	390.518	-92.192	390.486
-92.126	390.617	-91.207	390.715	-63.091	388.944	-60.105	389.009	-53.543	385.072
-48.852	383.793	-42.848	381.988	-32.119	381.693	-27.822	381.693	-23.36	381.135
-22.408	380.282	-20.44	378.412	-6.988	377.625	0	377.329	3.084	377.198
6.168	377.493	13.058	378.018	15.617	378.182	16.371	378.248	16.404	378.248
16.634	378.314	17.159	378.412	17.881	378.51	26.345	380.61	31.759	381.955
35.728	382.448	50.951	384.35	51.312	384.514	52.461	384.58	54.987	384.777
62.762	385.564	62.959	385.335	63.091	385.138	76.247	385.63	79.528	385.696
79.56	385.761	79.79	386.089	82.448	386.024	82.71	386.024	92.06	386.22
99.016	386.778	99.147	386.68	99.541	386.352	112.73	386.811	112.992	386.811
113.156	386.844	116.339	386.909	116.503	386.909	116.798	386.909	116.962	386.909
116.995	386.909	117.224	386.877	117.356	386.877	119.751	387.041	126.181	387.303
129.56	387.402	129.593	387.402	130.873	387.434	140.617	387.008	145.899	386.844
146.424	387.074	146.49	387.205	147.9	387.205	151.87	387.172	152.034	387.172
161.745	387.434	167.093	387.533	174.475	387.762	193.077	388.419	194.882	388.451

Manning's n Values		num= 11							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-122.244	.04	-119.127	.02	-92.552	.04	-91.207	.08	-32.119	.04
31.759	.08	63.091	.02	79.528	.08	99.541	.02	145.899	.04
161.745	.06								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-27.822	31.759		192.913	186.68		.1	.3

Ineffective Flow		num= 2			
Sta L	Sta R	Elev	Permanent		
-122.244	-117.454	393.701	F		
75.787	194.882	393.701	F		

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2280

INPUT

Description: New BLA surveyed cross section  
 Ineffective at left end of the cross section models the residences along Brookdale Drive and the Ineffective at the right end represents the structures along Harpers Ferry Road.

Station Elevation Data		num= 77							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-88.944	384.875	-86.549	384.843	-86.352	384.777	-83.301	384.613	-81.955	384.547
-81.824	384.416	-81.594	384.121	-78.675	384.318	-71.883	384.744	-66.634	384.35

-63.419	384.121	-61.713	383.924	-61.549	384.121	-61.385	384.35	-56.955	384.121
-55.479	384.055	-26.378	379.692	-16.437	378.084	-14.009	377.329	-11.745	377.231
-9.843	377.034	-9.055	375.361	-8.99	375.23	-8.366	374.508	-6.824	374.409
-6.004	374.377	.033	374.245	2.165	374.213	2.854	374.213	10.958	374.541
15.322	374.77	23.163	375.164	23.261	375.197	26.378	377.034	31.168	379.692
54.724	381.266	55.282	381.299	79.396	383.301	81.463	383.301	82.316	383.366
90.19	383.694	94.39	383.858	99.081	383.825	113.091	383.727	113.189	384.186
113.419	384.186	116.929	384.186	117.06	384.186	120.801	384.252	120.932	384.285
121.358	384.285	124.836	384.613	125.558	384.678	127.559	384.777	127.953	384.777
128.346	384.81	132.874	385.4	133.399	385.466	133.497	385.466	134.022	385.499
134.055	385.499	134.186	385.531	134.219	385.531	135.039	385.597	135.171	385.597
135.663	385.663	135.794	385.663	137.894	385.728	138.287	385.794	138.747	385.827
139.14	385.86	139.173	385.86	139.206	386.122	139.239	386.68	139.272	386.319
140.42	386.745	142.224	387.795						

Manning's n Values num= 10

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-88.944	.04	-86.549	.02	-61.713	.04	-55.479	.08	-11.745	.04
31.168	.08	79.396	.04	82.316	.02	120.801	.04	132.874	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-26.378	31.168	137.795	138.78	141.076		.1	.3
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Ineffective Flow num= 5

Sta L	Sta R	Elev	Permanent
-88.944	-88.583	388.78	F
-88.583	-71.883	384.744	F
-61.385	-69.882	384.35	F
94.39	113.189	383.858	F
139.108	142.224	390.42	F

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2238

INPUT

Description: FEMA Station 5142, Cross Section AL  
 Ineffective area at left end  
 of the cross section models the residences along Brookdale Drive,  
 and at the right end represents the structures along Harpers Ferry  
 Road.

Station Elevation Data num= 78

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-88.714	382.612	-83.301	382.579	-81.234	382.513	-78.576	382.48	-78.445	382.448
-78.248	382.48	-74.77	382.415	-73.983	382.382	-73.95	382.415	-73.753	382.48
-73.556	382.152	-73.491	382.054	-71.654	382.185	-71.522	382.185	-63.615	382.612
-63.353	382.546	-62.238	382.448	-54.921	381.857	-53.773	381.693	-53.675	381.824
-53.379	381.824	-53.15	382.119	-50.722	381.791	-49.869	381.726	-43.274	381.693
-40.682	381.627	-40.059	381.594	-33.2	379.477	-26.772	377.493	-25	376.837
-24.934	376.804	-17.388	374.639	-17.224	374.573	-17.028	374.508	-16.568	374.377
-13.123	374.278	-10.433	374.18	-10.302	374.18	-9.744	374.147	-7.841	374.081
-1.772	373.852	.098	373.786	.623	373.753	.886	373.753	1.148	373.72
1.312	373.72	6.496	373.556	9.875	373.589	16.732	373.622	26.575	373.786
30.643	375.361	30.676	375.361	30.938	375.459	31.168	375.558	33.104	376.378
33.235	376.444	35.761	377.854	43.898	379.167	49.934	381.168	51.312	380.873
53.018	380.84	59.843	381.102	61.877	381.201	64.633	381.168	77.953	380.709
78.15	380.971	78.281	381.135	80.118	381.135	82.218	381.135	84.711	381.234
84.777	381.43	85.564	381.43	97.113	381.89	97.835	381.923	100.558	381.988
102.822	382.054	103.675	382.152	104.331	382.218				

Manning's n Values num= 10

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-88.714	.04	-78.248	.02	-53.773	.04	-40.059	.08	-24.934	.04
33.104	.08	49.934	.04	53.018	.02	84.711	.04	100.558	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-33.2	43.898	98.425	101.706	104.987		.1	.3
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Ineffective Flow num= 5

Sta L	Sta R	Elev	Permanent
-88.714	-86.942	387.139	F
-86.942	-63.615	382.612	F
-58.727	-53.15	382.119	F
49.934	78.74	381.201	F
98.425	104.331	387.139	F

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2207

INPUT  
 Description: 5m (16') U/S of U/S End of Proposed Ret. Wall 105  
 102m (336')

upstream of Plank Road bridge  
 Ineffective area at left end of the cross section models the residences along Brookdale Drive, and at the right end represents the structures along Harpers Ferry Road.

Station Elevation Data		num= 71							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-137.795	381.43	-128.379	381.693	-121.096	381.496	-118.701	381.332	-107.677	380.971
-105.446	380.971	-94.751	381.037	-87.336	381.037	-86.549	381.07	-84.186	381.135
-84.121	381.037	-83.793	380.676	-78.215	380.807	-74.934	380.906	-64.829	381.102
-63.812	381.135	-59.875	380.774	-54.659	380.249	-54.429	380.413	-54.167	380.577
-52.69	380.61	-49.475	380.118	-36.549	378.117	-31.955	377.657	-31.562	377.428
-30.971	377.067	-30.906	377.001	-30.774	376.903	-30.545	376.772	-27.723	374.869
-25	372.999	-14.534	372.9	-7.546	372.835	-6.791	372.835	-	623 372.703
0	372.736	2.559	372.802	4.003	372.835	5.085	372.835	6.07	372.867
14.108	373.097	16.634	373.163	20.702	375.197	21.161	375.394	21.522	375.591
21.818	375.722	24.213	376.936	24.311	376.969	26.378	377.887	27.69	378.773
27.92	378.871	28.215	379.035	28.707	379.265	28.839	379.298	32.644	379.593
34.843	379.626	44.521	379.79	45.472	379.79	56.266	379.626	56.332	379.659
58.235	380.118	59.514	380.118	63.944	380.217	64.731	380.348	65.256	380.446
70.899	380.446	71.555	380.479	83.563	380.906	92.552	380.971	94.455	381.004
101.64	381.529								

Manning's n Values		num= 7					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-137.795	.04	-107.677	.02	-54.659	.04	-49.475	.08
20.702	.08	28.215	.02			-27.723	.04

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-31.955	26.378		16.404	16.404	16.404		.1	.3
Ineffective Flow	Sta L	Sta R	Elev	num= 4	Permanent				
	-137.795	-102.165	387.139		F				
	-102.165	-63.78	381.135		F				
	-58.399	-52.657	380.61		F				
	83.99	100.787	387.139		F				

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2202

INPUT  
 Description: 97m (320') upstream of Plank Road crossing  
 U/S End Prop.

Retaining Wall No.105  
 Ineffective area at left end of the cross section models the residences along Brookdale Drive, and at the right end represents the structures along Harpers Ferry Road.

Begining of ret. wall along Hartford Ferry Road. Thus, it is not effective in containing the flow at this location.

Station Elevation Data		num= 89							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-144.915	380.709	-141.01	380.807	-130.217	380.545	-126.608	380.348	-126.28	379.987
-124.081	380.052	-121.818	380.184	-118.504	380.184	-116.864	380.217	-115.289	380.217
-114.6	380.249	-113.32	380.249	-112.795	380.282	-112.336	380.315	-104.199	380.348
-102.822	380.381	-101.444	380.381	-100.066	380.413	-98.72	380.446	-97.408	380.479
-96.161	380.512	-94.915	380.512	-93.766	380.545	-92.651	380.577	-91.634	380.577
-90.617	380.61	-89.731	380.643	-88.878	380.643	-87.336	380.676	-86.024	380.709
-85.663	380.741	-84.908	380.741	-83.957	380.774	-75.23	380.906	-70.276	380.971
-65.19	380.906	-64.206	380.873	-61.68	380.643	-54.232	379.987	-53.97	380.151
-53.74	380.315	-50.328	380.971	-44.259	381.923	-42.29	382.152	-34.843	378.051
-30.938	375.591	-25.886	372.966	-25.82	372.966	-14.731	372.835	-13.944	372.835
-13.32	372.802	-1.542	372.605	0	372.638	6.07	372.835	6.398	372.867
6.791	372.867	7.316	372.9	11.942	373.031	16.076	373.13	16.175	373.163
19.39	374.77	19.619	374.869	24.934	377.165	26.444	377.789	29.888	379.167
29.987	380.348	31.463	380.381	31.496	380.217	31.529	379.396	33.432	379.429
33.793	379.429	44.259	379.593	44.357	379.593	48.556	379.528	55.085	379.429

55.118	379.429	57.054	379.888	57.644	379.888	60.794	379.954	62.566	380.02
63.189	380.118	65.157	380.413	66.339	380.413	69.193	380.479	72.507	380.479
81.627	380.741	83.825	380.84	85.728	380.906	93.34	380.906		

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-144.915	.02	-54.232	.04	-44.259	.08	-30.938	.04	19.39	.08
29.888	.02	62.566	.04						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -34.843 26.444 108.268 111.549 114.829 .1 .3

Ineffective Flow num= 3

Sta L	Sta R	Elev	Permanent
-144.915	-103.346	387.139	F
-103.346	-42.29	382.152	F
72.507	93.34	387.139	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
85.335	93.34	387.139

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2168

INPUT

Description: U/S Limit of Proposed Channelization-Full width; (Taper to EX to Sta 2+180)

Ineffective area at left end of the cross section models the residences along Brookdale Drive, and at the right end represents the structures along Harpers Ferry Road.

Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-193.898	378.51	-187.434	378.576	-163.911	378.839	-162.336	378.839	-144.521	378.871
-143.045	378.871	-130.184	379.101	-117.421	379.396	-107.185	379.757	-92.224	379.692
-91.273	379.659	-90.125	379.659	-88.714	379.626	-86.909	379.626	-84.416	379.593
-83.235	379.56	-83.202	379.56	-80.479	379.396	-78.215	379.265	-77.756	379.265
-73.556	378.806	-72.605	378.871	-65.059	379.298	-63.419	379.396	-63.189	379.363
-52.493	378.773	-52.034	379.232	-51.772	379.199	-39.304	378.576	-38.353	378.543
-33.596	377.329	-32.054	376.87	-32	376.843	-27.986	374.869	-22.966	372.342
-21.325	371.522	-19.685	370.702	-7.087	370.735	0	370.735	19.685	370.735
23.819	372.802	24.081	372.933	24.19	376.873	24.245	378.904	25.755	378.97
28.806	378.609	31.135	378.379	31.627	378.379	33.071	378.018	33.596	377.92
35.794	377.953	36.45	377.953	45.768	378.117	47.277	378.117	57.841	377.953
58.104	377.953	60.072	378.412	65.486	378.412	70.44	378.839	70.899	378.871
70.965	378.904	72.014	379.429	73.983	379.495	79.035	379.626	80.446	379.659
81.07	379.659	81.299	379.626						

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-193.898	.04	-73.556	.02	-52.493	.04	-39.304	.08	-22.966	.04
23.819	.02	65.486	.04						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -32 24.19 114.829 124.016 131.234 .1 .3

Ineffective Flow num= 5

Sta L	Sta R	Elev	Permanent
-193.898	-107.94	383.858	F
-80.709	-63.419	379.396	F
-63.419	-52.034	379.232	F
25.656	78.74	378.97	F
78.74	81.299	383.858	F

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
-193.898	-183.071	387.139	-167.979	-117.782	387.139

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2130

INPUT

Description: 26m (84') U/S Plank Road crossing  
 Ineffective area at left end of the cross section models the residences along Brookdale Drive, and



at the right end represents the structures along Harpers Ferry Road.

Station Elevation Data num= 102									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-419.587	379.363	-418.766	379.331	-380.873	379.462	-379.298	379.363	-367.815	379.101
-367.618	379.101	-359.843	378.773	-354.79	378.609	-353.15	378.51	-349.902	378.379
-339.272	378.15	-338.123	378.215	-324.147	377.953	-321.391	377.854	-314.469	377.657
-295.768	377.92	-288.156	377.854	-275.984	377.657	-268.143	377.264	-267.388	377.264
-260.728	377.198	-251.739	377.297	-239.665	377.493	-236.614	377.526	-235.63	377.559
-224.869	377.231	-223.95	377.264	-219.094	377.526	-182.546	377.526	-141.765	377.887
-141.207	377.854	-117.356	377.756	-111.909	377.887	-111.089	377.92	-100.295	378.051
-94.324	378.379	-93.406	378.445	-90.19	378.576	-80.151	378.543	-79.79	378.51
-74.77	378.609	-67.815	378.445	-67.224	378.412	-63.878	378.346	-62.106	378.314
-59.547	378.314	-45.801	378.281	-38.222	377.854	-37.467	377.822	-32.65	375.405
-27.789	372.966	-23.392	370.768	-22.966	370.571	-22.867	370.538	-19.685	368.93
19.685	368.93	27.887	373.031	29.265	373.72	29.56	376.936	31.004	377.133
33.169	376.903	36.45	376.509	36.942	376.509	37.369	376.411	38.911	376.083
40.945	376.115	49.213	376.28	50.951	376.312	60.039	376.444	69.783	376.28
70.866	376.28	72.671	376.706	72.835	376.739	78.248	376.739	83.366	377.165
83.661	377.198	83.694	377.231	84.58	377.657	84.678	377.657	85.302	377.657
85.531	377.657	86.155	377.69	89.895	377.887	93.143	377.986	95.374	378.084
97.08	378.018	97.703	378.018	98.753	377.953	100.164	377.92	100.427	377.887
104.56	378.412	107.972	378.773	109.449	378.74	117.881	378.576	120.768	378.609
129.823	378.773	132.087	378.871	145.079	379.035	154.954	378.904	159.252	378.74
159.941	378.707	166.896	379.003						

Manning's n Values num= 7									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-419.587	.04	-324.147	.02	-321.391	.04	-45.801	.08	-27.789	.04
29.265	.02	85.302	.04						

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.	
	-32.65	29.265		44.291	45.276		45.932	.1	.3

Ineffective Flow num= 4									
Sta L	Sta R	Elev	Permanent						
-419.587	-72.507	383.858	F						
31.004	83.661	377.133	F						
95.374	98.425	378.084	F						
98.425	166.896	383.858	F						

Blocked Obstructions num= 8									
Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev	
-389.928	-363.681	387.139	-340.715	-317.749	387.139	-298.064	-268.537	387.139	
-242.29	-216.043	387.139	-193.077	-166.831	387.139	-140.584	-116.47	387.139	
-102.362	-79.396	387.139	100.361	143.34	385.499				

CROSS SECTION

RIVER: Mad River  
REACH: Reach 1 RS: 2116

INPUT  
Description: U/S of Plank Rd. Culvert No. 05668 (FEMA Sta 5141, Sec AK)

Ineffective area at left end of the cross section models the residences along Brookdale Drive, and the area at the right end represents the structures along Harpers Ferry Road.

Station Elevation Data num= 114									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-450.656	380.741	-449.803	380.741	-448.72	380.676	-431.201	380.085	-426.804	380.118
-410.696	379.987	-409.547	379.987	-383.136	379.003	-382.251	379.003	-380.906	378.97
-379.823	378.937	-369.783	379.003	-367.684	378.937	-361.549	378.642	-351.969	378.871
-350.295	378.806	-348.786	378.74	-346.982	378.74	-343.537	378.642	-329.823	378.182
-322.539	378.117	-321.982	378.084	-321.096	377.986	-316.437	377.297	-310.499	377.756
-306.759	377.69	-285.072	377.789	-283.497	377.789	-275.23	377.69	-270.604	377.625
-250.262	377.329	-238.714	377.461	-234.711	377.493	-229.298	377.461	-225.558	377.297
-225.394	377.297	-221.227	377.231	-213.451	377.1	-209.186	377.034	-207.546	377.067
-204.298	377.067	-203.609	377.1	-203.543	377.165	-203.084	377.1	-202.953	377.133
-202.264	377.133	-201.28	377.1	-196.424	377.198	-188.517	377.395	-187.205	377.526
-186.942	377.559	-185.597	377.69	-183.891	377.69	-180.577	377.756	-163.747	377.133
-159.154	377.133	-152.165	377.395	-147.375	377.526	-132.874	377.559	-132.251	377.592
-125.361	377.461	-124.967	377.461	-117.684	377.756	-117.192	377.789	-117.06	377.756
-108.366	377.756	-85.105	378.281	-78.051	378.445	-77.756	378.412	-76.444	378.412
-73.097	378.346	-53.97	378.084	-41.634	377.723	-37.959	377.559	-36.22	376.706
-29.626	373.409	-22.966	370.079	-22.572	369.882	-19.685	368.438	0	368.438
19.685	368.438	21.818	369.488	29.134	373.163	29.429	377.001	30.906	377.001
34.941	376.739	43.241	376.214	43.734	376.214	45.374	375.853	45.702	375.787

54.429	375.951	56.529	375.984	64.895	376.115	67.356	376.148	75.394	376.017
78.182	375.984	85.564	376.476	87.041	376.575	91.798	376.87	92.257	376.87
96.03	376.936	96.096	376.936	101.64	377.067	107.94	377.067	119.554	377.198
143.471	377.461	154.396	377.657	155.02	377.723	165.256	378.182	175.394	378.543
178.379	378.609	198.917	378.937	199.245	378.97	210.794	378.97		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-450.656	.04	-53.97	.08	-29.626	.04	29.134	.02	107.94	.04
155.02	.02								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
-29.626 29.134 118.11 120.079 121.391 .3 .5

Ineffective Flow num= 3  
Sta L Sta R Elev Permanent  
-450.656 -65.945 383.858 F  
29.429 116.798 377.001 F  
116.798 210.794 383.858 F

Blocked Obstructions num= 8  
Sta L Sta R Elev Sta L Sta R Elev Sta L Sta R Elev  
-450.656-436.024 387.139-396.654-370.407 387.139-347.441-324.475 387.139  
-304.79-275.262 387.139-249.016-222.769 387.139-199.803-173.556 387.139  
-147.31-117.782 387.139 -111.22 -78.412 387.139

CULVERT

RIVER: Mad River  
REACH: Reach 1 RS: 2098.5

INPUT

Description: Proposed Plank Road Culvert No. 05668

Roadway profile assumes

flow through bridge parapets.

Three concrete box culverts with effective hydraulic openings of 4m(13.1')span by 2.1m (6.9') height

The inverts of the barrels will be backfilled with gravel streambed material to promote fish passage. The applied Manning's roughness represent the composite of streambed and the culvert interior.

At the inlet, the top edge of the barrels will be beveled to improve hydraulic capacity.

Distance from Upstream XS = 38.845  
Deck/Roadway Width = 46.047  
Weir Coefficient = 2.63  
Upstream Deck/Roadway Coordinates

num=	21								
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
-275.951	376.542		0	-210.335	376.28		0	-144.718	376.608
-79.101	376.936		0	-40.026	377.001		0	-40.026	379.331
-26.903	379.396		0	-26.903	380.249		0	-25.853	380.512
-21.654	380.512		0	-21.654	377.001		0	21.654	376.87
21.654	380.381		0	32.152	380.381		0	32.152	376.64
35.728	376.608		0	52.133	376.411		0	81.66	376.772
117.749	376.509		0	125.131	376.509		0	216.175	375.328

Upstream Bridge Cross Section Data

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-65.945	377.133	-37.543	377.08	-21.654	368.077	21.654	368.077	26.673	376.312
35.86	375.984	35.86	375.492	39.403	375.623	75.492	376.345	89.993	376.083
89.993	376.017	92.356	376.509	98.688	376.673	124.672	376.936		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-65.945	.04	26.673	.02	98.688	.04

Bank Sta: Left Right Coeff Contr. Expan.  
-37.543 26.673 .3 .5

Ineffective Flow num= 3  
Sta L Sta R Elev Permanent  
-450.656 -65.945 383.858 F  
29.429 116.798 377.001 F  
116.798 210.794 383.858 F

Blocked Obstructions num= 8  
 Sta L Sta R Elev Sta L Sta R Elev Sta L Sta R Elev  
 -450.656-436.024 387.139-396.654-370.407 387.139-347.441-324.475 387.139  
 -304.79-275.262 387.139-249.016-222.769 387.139-199.803-173.556 387.139  
 -147.31-117.782 387.139 -111.22 -78.412 387.139

Downstream Deck/Roadway Coordinates  
 num= 23  
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord  
 -275.951 376.542 0-210.335 376.28 0-144.718 376.608 0  
 -79.101 376.936 0 -40.026 377.165 0 -40.026 379.495 0  
 -26.903 379.56 0 -26.903 380.446 0 -25.853 380.676 0  
 -21.654 380.676 0 -21.654 377.165 0 21.654 377.034 0  
 21.654 380.545 0 25.853 380.545 0 26.903 380.282 0  
 26.903 379.331 0 39.37 379.199 0 39.37 376.87 0  
 52.133 376.411 0 81.66 376.772 0 111.188 376.509 0  
 125.131 376.509 0 216.175 375.328 0

Downstream Bridge Cross Section Data  
 Station Elevation Data num= 10  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -251.969 375.656-220.472 375.328 -39.304 376.312 -21.654 367.487 21.654 367.487  
 38.058 376.673 38.091 377.953 39.37 377.953 39.37 377.297 121.391 377.297

Manning's n Values num= 3  
 Sta n Val Sta n Val Sta n Val  
 -251.969 .08 -39.304 .04 38.058 .02

Bank Sta: Left Right Coeff Contr. Expan.  
 -39.304 38.058 .3 .5

Ineffective Flow num= 3  
 Sta L Sta R Elev Permanent  
 -460.761 -75.459 383.858 F  
 -75.459 -45.801 376.181 F  
 113.189 442.913 383.858 F

Blocked Obstructions num= 2  
 Sta L Sta R Elev Sta L Sta R Elev  
 152.231 205.118 385.499 289.436 404.593 387.139

Upstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Downstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins =  
 Energy head used in spillway design =  
 Spillway height used in design =  
 Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name Shape Rise Span  
 Culvert #1 Box 8.858 13.123  
 FHWA Chart # 9 - flared wingwalls and Inlet top edge bevel  
 FHWA Scale # 2 - Wingwall flared 18 to 33.7 deg.; inlet top edge bevel =0.083D  
 Solution Criteria = Highest U.S. EG  
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef Exit Loss Coef  
 38.845 46.047 .028 .028 1.969 .2 1

Number of Barrels = 3  
 Upstream Elevation = 366.109  
 Centerline Stations  
 Sta. Sta. Sta.  
 -15.092 0 15.092  
 Downstream Elevation = 365.518  
 Centerline Stations  
 Sta. Sta. Sta.  
 -15.092 0 15.092

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2079

INPUT  
 Description: D/S of Plank Rd. crossing (FEMA Sta 5140, Sec. AJ)  
 The left-most ineffective flow area models the expected limit of conveyance from the eastern end of the residences along Brookdale Drive down to

Proposed Bridge No. 06591.  
 The ineffective flow area left of channel models limit of conveyance for nonoverlapping flows at Plank Road  
 The right-most ineffective flow area models the expected limit of effective flow through the intersection of Plank Road and Harpers Ferry Road.

Station Elevation Data num= 155											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-469.816	381.299	-466.175	380.906	-455.676	379.987	-443.307	379.593	-435.433	379.593		
-418.963	379.265	-409.58	379.035	-390.059	378.445	-384.121	378.445	-381.824	378.379		
-380.02	378.215	-379.921	378.215	-374.541	378.051	-371.161	378.051	-366.076	378.084		
-334.842	377.526	-329.888	377.592	-324.081	377.461	-318.11	377.329	-317.749	377.329		
-308.694	376.772	-269.259	376.214	-262.861	375.853	-262.598	375.853	-261.909	375.886		
-254.003	376.575	-247.211	376.542	-244.193	376.608	-222.31	376.181	-215.518	376.181		
-205.906	376.148	-195.965	376.017	-190.748	376.017	-181.496	375.951	-174.541	375.886		
-167.388	375.787	-154.757	375.919	-146.26	376.247	-138.878	376.017	-135.105	375.623		
-133.924	375.623	-130.381	376.214	-103.806	375.689	-102.1	375.656	-101.903	375.656		
-101.476	375.689	-82.972	375.951	-77.986	376.017	-71.654	376.444	-65.026	375.787		
-64.14	375.951	-63.091	376.148	-45.801	375	-43.5	373.868	-33.793	369.094		
-19.751	367.126	0	367.126	6.594	367.093	19.751	367.093	19.915	367.192		
20.276	367.356	20.472	367.454	33.235	373.819	36.942	375.656	37.795	376.083		
39.501	376.936	44.259	377.231	46.391	377.362	46.883	377.362	49.278	377.165		
50.886	377.067	56.43	377.198	61.056	377.297	74.803	377.625	81.07	377.756		
84.646	377.822	86.778	377.854	94.488	377.756	105.217	377.428	105.249	378.051		
110.138	378.117	118.701	377.428	129.757	377.067	133.038	376.936	134.449	376.903		
134.646	377.165	134.777	377.329	142.421	377.001	143.93	376.87	149.377	376.608		
151.542	376.673	152.559	376.804	154.068	376.87	156.627	376.804	165.584	376.969		
175.623	377.001	193.143	377.133	197.474	377.133	208.727	377.198	208.924	377.231		
211.581	377.231	212.992	377.198	214.304	377.198	216.634	377.165	217.388	377.165		
217.651	377.133	220.407	376.739	221.588	376.739	222.014	376.772	225.919	376.837		
228.182	376.87	230.249	376.903	231.627	376.936	234.613	376.969	236.778	377.001		
239.089	377.001	239.862	376.969	243.438	376.936	245.472	376.936	247.867	376.903		
248.95	376.903	252.297	376.87	253.018	376.87	254.331	377.067	255.938	377.329		
256.955	377.329	261.286	377.395	263.976	377.461	264.403	377.395	265.781	377.264		
266.371	377.198	266.765	377.165	268.34	377.231	268.734	377.264	268.898	377.264		
269.226	377.297	276.739	377.789	282.251	378.084	285.302	378.346	286.286	378.281		
287.533	378.314	289.108	378.806	312.861	379.167	332.415	378.773	362.008	379.035		
373.196	379.134	381.365	379.232	409.908	379.232	412.533	379.199	415.19	379.199		
416.043	380.413	417.421	382.283	425.066	382.349	428.215	382.546	437.369	386.253		

Manning's n Values num= 7											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-469.816	.08	-418.963	.04	-269.259	.08	-45.801	.04	33.235	.08		
50.886	.02	266.765	.04								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-43.5	33.235		36.089	39.37	42.651		.3	.5

Ineffective Flow num= 3			
Sta L	Sta R	Elev	Permanent
-460.761	-75.459	383.858	F
-75.459	-45.801	376.181	F
113.189	442.913	383.858	F

Blocked Obstructions num= 2					
Sta L	Sta R	Elev	Sta L	Sta R	Elev
152.231	205.118	385.499	289.436	404.593	387.139

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2067

INPUT  
 Description: Upstream of Beaver Pond Brook confluence.  
 Left-most ineffective flow area models limit of conveyance from eastern end of the residences along Brookdale Drive down to Proposed Bridge No. 06591 (WB Exit 24 On-Ramp).  
 Ineffective flow area left of channel models expected limit of conveyance for flows that do not overtop Plank Road.  
 Ineffective flow area right end of section models expected limit of conveyance due to Harpers Ferry Road profile.

Station Elevation Data num= 84											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-462.27	381.398	-441.568	379.757	-440.814	379.724	-439.436	379.724	-419.783	379.659		

-403.248 379.363-397.703 379.101-383.333 379.068-378.412 378.937-374.147 378.51  
 -368.602 379.003-362.369 379.298-356.365 379.134-343.012 379.101-342.388 379.232  
 -338.091 379.167-333.202 379.003-327.198 378.839-324.475 378.642-316.699 378.543  
 -310.991 378.412 -310.4 378.412-310.203 378.412-309.383 378.084-302.789 376.772  
 -301.214 376.64-284.285 374.081-281.627 373.491-278.478 372.539-268.471 370.177  
 -266.699 369.849-259.974 368.701-246.522 368.537-238.091 368.307-204.364 367.782  
 -196.424 367.749-170.112 367.159-150.066 367.257-129.167 367.388 -120.21 367.585  
 -110.663 367.782 -76.083 367.52 -71.949 367.52 -70.472 367.323 -59.843 367.06  
 -53.412 366.896 -50.623 367.06 -47.539 368.471 -40.584 368.865 -31.398 369.062  
 -29.528 369.948 -26.247 369.948 -19.685 366.667 0 366.667 19.685 366.667  
 20.374 366.896 21.522 367.454 30.938 372.113 39.009 376.083 39.797 376.476  
 40.518 376.837 43.11 378.117 45.833 379.232 46.686 379.167 51.444 378.839  
 51.969 378.839 55.906 378.543 56.365 378.543 64.14 378.773 68.045 378.904  
 72.113 379.003 80.02 379.232 80.61 379.265 104.823 379.495 105.085 379.495  
 109.186 379.298 109.678 379.856 111.942 379.888 119.587 380.348 120.374 380.413  
 121.522 380.971 122.08 381.266 123.294 381.266 132.677 381.004

Manning's n Values num= 9  
 Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val  
 -462.27 .08-309.383 .08 -76.083 .06 -70.472 .04 -31.398 .06  
 30.938 .08 45.833 .04 55.906 .02 120.374 .04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -26.247 21.522 144.357 153.215 164.042 .3 .5

Ineffective Flow num= 4  
 Sta L Sta R Elev Permanent  
 -462.27-101.378 383.858 F  
 -101.378 -83.661 374.016 F  
 -83.661 -26.247 369.948 F  
 95.144 132.677 383.858 F

Blocked Obstructions num= 1  
 Sta L Sta R Elev  
 -395.669-341.207 383.858

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2020

INPUT  
 Description: FEMA Station 5139, Cross Section AI  
 BLA surveyed cross section

Just downstream of Beaver Pond Brook confluence.  
 The

left-most ineffective flow area models the expected limit of conveyance from the eastern end of the residences along Brookdale Drive down to Proposed Bridge No. 06591

The ineffective flow area left of the channel models the expected limit of conveyance for flows that do not overtop Plank Road.

Station Elevation Data num= 71  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -458.727 381.234-452.362 380.774-448.425 380.446 -429.79 379.856 -426.05 379.724  
 -425.328 379.692-412.894 379.495-399.639 378.806-385.827 378.543-379.429 378.379  
 -376.345 378.15-373.327 377.953-369.554 377.723-363.451 377.362-361.286 377.264  
 -360.827 377.231-350.984 375.656-348.786 375.164-339.961 373.36-329.856 369.455  
 -323.228 367.749-321.949 367.454-313.517 367.257-287.894 366.995-257.776 366.995  
 -249.836 367.06-244.423 367.06-206.857 367.06-195.833 367.06-166.765 367.06  
 -148.196 367.06-139.337 367.06-111.024 367.093-109.744 367.126-102.001 364.009  
 -101.345 363.681 -96.85 363.484 -91.864 363.32 -78.51 362.959 -73.786 362.631  
 -71.883 362.73 -70.013 362.795 -51.148 363.845 -47.802 363.812 -40.879 363.386  
 -39.206 363.451 -29.528 368.274 -26.247 368.274 -19.685 364.993 0 364.993  
 19.685 364.993 40.026 364.993 47.999 365.814 59.416 366.962 63.615 366.732  
 76.05 372.375 79.56 373.228 81.299 373.589 83.301 374.016 87.762 375.262  
 88.681 375.558 94.029 377.297 96.325 378.379 97.343 378.937 100.853 380.709  
 102.428 381.496 106.168 383.399 118.176 389.469 118.799 389.534 121.621 389.797  
 122.671 389.862

Manning's n Values num= 5  
 Sta n Val Sta n Val Sta n Val Sta n Val  
 -458.727 .08-412.894 .04-376.345 .08 -39.206 .04 76.05 .08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -26.247 59.416 55.774 55.774 55.774 .3 .5

Ineffective Flow num= 3

Sta L	Sta R	Elev	Permanent
-458.727	-132.874	383.858	F
-132.874	-29.528	368.274	F
59.416	68.898	366.962	F
Blocked Obstructions			num= 1
Sta L	Sta R	Elev	
-458.727	-29.528	363.025	

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 2004

INPUT

Description: 12.8m (42') D/S of the Beaver Pond Brook confluence.

Station Elevation Data		num= 62	
Sta	Elev	Sta	Elev
-373.491	383.333-369.357	382.251-366.371	381.66-352.297
-342.815	378.478-328.379	378.051-308.957	378.248-304.232
-282.94	377.854-277.657	377.789-264.862	377.657-260.597
-234.58	369.816-228.871	367.684-224.869	367.06-206.234
-189.075	367.06-179.823	366.995-152.297	366.831 -152.1
-135.499	366.699-135.236	366.175-130.741	363.386-127.625
-87.795	361.122 -83.99	361.056 -81.923	360.892 -73.885
-60.203	362.795 -55.774	363.419 -37.402	363.747 -29.528
-19.685	364.403 0	364.403 19.685	364.403 20.308
67.126	366.043 93.602	377.297 115.223	378.937 125.066
144.259	393.471 144.718	393.701 146.26	393.865 147.211
156.365	395.243 156.791	395.341 157.94	395.44 158.661
159.646	395.571 162.927	395.932	

Manning's n Values		num= 4	
Sta	n Val	Sta	n Val
-373.491	.08	-37.402	.04
		67.126	.08
		139.764	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
-26.247	36.319	75.459	69.226	62.336	.3	.5	

Ineffective Flow		num= 4	
Sta L	Sta R	Elev	Permanent
-369.423	-133.858	380.577	F
-133.858	-26.247	367.684	F
36.319	72.178	367.29	F
72.178	170.604	377.297	F

Blocked Obstructions		num= 1	
Sta L	Sta R	Elev	
-373.491	-29.528	363.025	

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1983

INPUT

Description: 37.9m (124.3') U/S I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.

Existing Structure No. 05774, easterly crossing over the Mad River

Station Elevation Data		num= 68	
Sta	Elev	Sta	Elev
-350.131	389.501-340.912	388.583-336.745	388.255-330.971
-316.962	384.744-316.437	384.613-299.442	380.348-285.663
-283.858	376.969-264.961	376.673 -256.66	376.673-238.976
-217.684	376.083-204.593	376.115-194.291	376.083 -187.5
-175.394	373.95-165.354	369.652 -162.73	368.209 -160.86
-140.65	367.749-138.747	368.077-115.945	367.454-112.566
-105.676	364.928-104.429	363.911-102.461	363.714-100.984
-92.717	361.581 -86.286	361.319 -80.118	360.892 -78.707
-72.211	360.663 -68.406	361.155 -59.678	361.056 -47.31
-45.308	361.975 -42.552	363.156 -41.798	363.386 -41.207
-29.528	366.929 -26.247	366.929 -19.685	363.648 0
26.247	366.929 33.136	366.667 56.398	377.297 97.178
124.016	392.028 134.022	396.982 140.978	400.492 141.109
142.224	402.658 142.52	399.967 142.782	399.606

Manning's n Values	num= 6
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Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-350.131	.08	-140.65	.06	-34.744	.04	33.136	.08	124.016	.04
140.978	.02								

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-26.247	26.247		39.37	33.793	27.887		.3	.5

Ineffective Flow num= 4  
 Sta L Sta R Elev Permanent  
 -350.131-134.514 393.701 F  
 -134.514 -111.22 380.577 F  
 -111.22 -26.247 366.929 F  
 26.247 36.089 366.929 F

Blocked Obstructions num= 1  
 Sta L Sta R Elev  
 -350.131 -29.528 363.025

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1972

INPUT

Description: 26.7m (87.6') U/S I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.

Station Elevation Data num= 67											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-327.854	390.682	-320.046	390.978	-316.339	391.043	-309.941	390.584	-303.642	388.845		
-290.879	385.892	-290.092	385.663	-286.286	384.318	-273.917	379.921	-272.638	379.528		
-271.424	379.265	-266.404	378.215	-260.728	377.001	-257.152	376.837	-239.764	376.181		
-235.105	375.919	-219.521	376.017	-213.78	376.115	-185.794	375.623	-184.908	375.623		
-168.373	375.262	-152.887	374.016	-152.756	374.016	-148.327	373.655	-141.01	370.735		
-131.529	368.996	-123.95	368.865	-107.316	368.635	-106.923	368.734	-103.412	369.521		
-100.689	369.882	-86.024	368.373	-78.871	367.651	-77.986	367.684	-74.081	367.192		
-71.03	363.222	-68.734	362.927	-65.19	362.533	-59.744	362.205	-58.202	362.106		
-54.232	361.877	-52.395	361.713	-49.114	361.516	-39.928	361.909	-37.697	362.533		
-31.102	365.814	-29.528	366.535	-26.247	366.535	-19.685	363.255	0	363.255		
19.685	363.255	26.247	366.339	49.409	377.297	84.318	378.937	94.39	383.858		
99.606	386.384	107.907	390.42	125.262	398.983	125.328	400.755	125.394	401.378		
125.492	402.887	126.509	402.887	126.64	401.903	126.804	400.23	127.067	399.869		
127.231	399.639	127.297	399.639								

Manning's n Values num= 5									
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-327.854	.08	-148.327	.06	-54.232	.04	99.606	.04	125.262	.02

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-26.247	26.247		33.793	33.793	33.793		.3	.5

Ineffective Flow num= 5  
 Sta L Sta R Elev Permanent  
 -327.854-128.281 393.701 F  
 -128.281 -75.459 380.577 F  
 -75.459 -29.626 366.503 T  
 52.165 77.461 379.068 F  
 77.461 125.492 402.887 F

Blocked Obstructions num= 1  
 Sta L Sta R Elev  
 -327.854 -29.528 363.025

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1962

INPUT

Description: U/S of I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.

Station Elevation Data num= 49											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-200.427	381.43	-189.6	381.398	-169.455	381.102	-168.34	381.102	-168.077	381.102		
-141.831	381.004	-133.005	380.938	-107.119	380.971	-101.739	380.938	-89.698	380.774		
-81.004	380.643	-77.329	380.61	-76.017	380.577	-75.82	380.545	-73.95	380.118		
-72.966	379.921	-72.474	379.823	-69.521	378.97	-69.488	378.97	-69.39	378.937		
-66.142	377.297	-62.73	375.591	-59.58	374.016	-56.102	372.277	-53.018	370.735		
-49.902	369.193	-46.424	367.454	-43.143	365.814	-39.862	364.173	-38.55	364.009		
-19.685	363.025	0	363.025	19.685	363.025	22.113	364.239	22.966	364.665		
37.041	371.719	41.043	373.72	49.934	378.15	51.444	378.379	54.757	378.675		
57.612	378.937	86.549	393.406	91.962	395.997	93.11	396.654	93.143	400.919		

93.274 402.034 93.406 403.051 94.915 403.051 94.948 402.756

Manning's n Values num= 4  
 Sta n Val Sta n Val Sta n Val Sta n Val  
 -200.427 .08 -59.58 .04 37.041 .08 93.11 .02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -56.102 37.041 164.042 203.084 262.467 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 -278.871 -126.64 393.701 F  
 57.743 95.144 403.051 F

BRI DGE

RIVER: Mad River  
 REACH: Reach 1 RS: 1938.5

INPUT

Description: Proposed Bridge No. 06591  
 I-84 Westbound Exit 24 On-Ramp from  
 Harpers Ferry Road

Distance from Upstream XS = 57.087  
 Deck/Roadway Width = 41.995  
 Weir Coefficient = 2.63

Upstream Deck/Roadway Coordinates  
 num= 10  
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord  
 -131.234 395.997 0 -65.617 395.997 0 -65.617 395.997 0  
 -62.697 395.997 0 -62.697 395.997 389.272 45.112 398.622 392.06  
 45.112 398.622 0 65.617 398.622 0 65.617 398.622 0  
 134.514 398.622 0

Upstream Bridge Cross Section Data  
 Station Elevation Data num= 10  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -107.776 388.074 -107.776 380.577 -62.697 380.577 -55.545 380.577 -19.685 362.631  
 0 362.631 19.685 362.631 42.126 374.016 45.112 374.016 45.112 392.06

Manning's n Values num= 2  
 Sta n Val Sta n Val  
 -107.776 .08 -55.545 .04

Bank Sta: Left Right Coeff Contr. Expan.  
 -55.545 42.126 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 -278.871 -126.64 393.701 F  
 57.743 95.144 403.051 F

Downstream Deck/Roadway Coordinates  
 num= 10  
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord  
 -131.234 395.997 0 -65.617 395.997 0 -65.617 395.997 0  
 -44.521 395.997 0 -44.521 395.997 387.927 49.475 399.278 391.306  
 49.475 399.278 0 65.617 399.278 0 65.617 399.278 0  
 131.234 399.278 0

Downstream Bridge Cross Section Data  
 Station Elevation Data num= 13  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -96.555 386.726 -96.555 380.577 -55.545 380.577 -44.521 375 -19.685 362.467  
 0 362.467 19.685 362.467 26.476 365.814 30.971 367.454 49.475 376.64  
 54.134 378.937 95.079 380.577 144.915 405.184

Manning's n Values num= 3  
 Sta n Val Sta n Val Sta n Val  
 -96.555 .08 -55.545 .04 54.134 .08

Bank Sta: Left Right Coeff Contr. Expan.  
 -44.521 49.475 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 27.887 46.916 366.043 T  
 77.854 108.924 381.234 T



Upstream Embankment side slope = 0 horiz. to 1.0 vertical  
 Downstream Embankment side slope = 0 horiz. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins =  
 Energy head used in spillway design =  
 Spillway height used in design =  
 Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy  
 Selected Low Flow Methods = Highest Energy Answer

High Flow Method  
 Energy Only

Additional Bridge Parameters

Add Friction component to Momentum  
 Do not add Weight component to Momentum  
 Class B flow critical depth computations use critical depth  
 inside the bridge at the upstream end  
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1900

INPUT

Description: D/S of I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.

Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-48.031	395.538	-47.867	395.735	-47.638	396.129	-47.343	398.786	-46.424	398.786
-46.194	396.818	-46.161	386.581	-45.997	376.739	-45.965	375.066	-45.571	374.869
-39.403	371.785	-31.496	367.815	-27.92	366.043	-27.887	366.043	-22.211	363.189
-19.685	361.942	0	361.942	19.685	361.942	25.361	364.764	27.887	366.043
40.223	365.551	45.997	365.322	53.937	369.291	57.48	371.063	59.777	372.178
60.761	372.703	72.539	378.576	77.854	381.234	81.529	381.234	86.089	379.101
88.583	377.953	99.573	377.953	102.395	379.265	105.249	380.577	108.858	381.332
112.664	382.119	113.845	382.349						

Manning's n Values

num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-48.031	.02	-45.965	.08	-39.403	.04	27.887	.06
57.48	.08						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -39.403 57.48 96.457 96.457 96.457 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 27.887 46.916 366.043 T  
 77.854 108.924 381.234 T

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1871

INPUT

Description: U/S of Prop I-84 Bridge 05774

Approach Sect to Prop I-84 Bridge  
 05774

Cross section within former Century Pond  
 aka Scovill Pond,  
 East Brass Mill Pond, City Mills Pond

Wall at right end of section represents the existing sanitary sewer pump station.

Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-53.018	391.962	-52.756	392.323	-52.592	392.552	-52.428	394.226	-52.329	395.243
-51.345	395.243	-51.28	394.488	-51.148	393.11	-50.919	382.349	-50.787	377.001
-42.224	372.703	-39.403	371.293	-38.32	370.768	-27.92	365.551	-27.887	365.551
-19.718	361.483	-19.685	361.45	0	361.45	19.685	361.45	25.722	364.469
27.887	365.551	28.346	365.551	32.054	367.388	38.35	370.55	39.829	371.293
41.109	371.916	43.11	372.933	52.657	377.69	60.827	381.791	67.815	381.89

68.438 382.054 68.635 382.677 68.668 382.874

Manning's n Values num= 5  
 Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val  
 -53.018 .02 -50.787 .08 -39.403 .04 39.829 .08 68.438 .02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -38.32 38.35 401.575 401.575 401.575 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 -53.018 -46.588 395.243 F  
 52.822 68.668 380.971 F

BRIDGE

RIVER: Mad River  
 REACH: Reach 1 RS: 1807.5

INPUT  
 Description: Proposed I-84 Bridge No. 05774  
 Proposed easterly I-84 bridge over  
 the Mad River

Distance from Upstream XS = 112.336  
 Deck/Roadway Width = 192.913  
 Weir Coefficient = 2.63

Upstream Deck/Roadway Coordinates num= 6  
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord  
 -196.847 379.987 0 -42.782 379.987 -42.782 379.987 374.049  
 42.552 380.971 375.066 42.552 380.971 0 196.847 380.971 0

Upstream Bridge Cross Section Data  
 Station Elevation Data num= 10  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -88.255 385.499 -57.71 372.375 -42.782 370.899 -39.403 370.735 -19.685 360.925  
 0 360.925 19.685 360.925 39.239 370.735 42.552 370.735 42.552 375.066

Manning's n Values num= 2  
 Sta n Val Sta n Val  
 -88.255 .08 -39.403 .04

Bank Sta: Left Right Coeff Contr. Expan.  
 -39.403 39.239 .3 .5

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 -88.255 -46.588 395.243 F  
 52.822 42.552 380.971 F

Downstream Deck/Roadway Coordinates num= 6  
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord  
 -196.847 378.707 0 -41.01 378.707 0 -41.01 378.707 372.802  
 44.554 379.692 373.786 44.554 379.692 0 196.847 379.692 0

Downstream Bridge Cross Section Data  
 Station Elevation Data num= 13  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -41.043 372.802 -41.01 370.735 -37.861 369.094 -19.685 360.007 0 360.007  
 19.685 360.007 44.554 372.392 50.262 375.656 52.887 376.804 56.759 375.656  
 60.039 374.016 72.047 374.016 124.606 406.824

Manning's n Values num= 4  
 Sta n Val Sta n Val Sta n Val Sta n Val  
 -41.043 .04 -19.685 .042 19.685 .04 44.554 .08

Bank Sta: Left Right Coeff Contr. Expan.  
 -41.01 44.554 .3 .5

Ineffective Flow num= 1  
 Sta L Sta R Elev Permanent  
 -41.043 -42.651 378.937 F

Upstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Downstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins =  
 Energy head used in spillway design =

Spillway height used in design =  
 Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data  
 Energy  
 Selected Low Flow Methods = Energy

High Flow Method  
 Energy Only

Additional Bridge Parameters  
 Add Friction component to Momentum  
 Do not add Weight component to Momentum  
 Class B flow critical depth computations use critical depth  
 inside the bridge at the upstream end  
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1748

INPUT  
 Description: Between Proposed Bridges 06284 & 05774  
 U/S of Proposed Bridge  
 06284, I-84 Eastbound Exit 24 Off-Ramp to Harpers Ferry Road

D/S  
 of Proposed I-84 Bridge 05774

Cross section within former Century  
 Pond  
 aka Scovill Pond, East Brass Mill Pond, City Mills Pond

Station Elevation Data		num= 34		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-108.793	378.937	-102.428	378.871	-95.276	378.806	-91.142	378.773	-81.759	378.642		
-70.604	378.281	-68.274	378.215	-64.436	377.986	-50.558	373.36	-43.635	371.194		
-42.126	370.472	-40.354	369.554	-38.4	368.583	-35.072	366.929	-28.871	363.812		
-28.839	363.812	-24.934	361.877	-20.636	359.711	0	359.711	20.636	359.711		
24.377	361.614	28.839	363.812	28.871	363.812	33.366	366.076	38.2	368.482		
40.354	369.554	44.488	371.621	47.9	373.327	49.934	374.344	51.312	375.033		
53.806	375.066	54.396	375.23	54.462	396.194	54.495	403.478				

Manning's n Values		num= 6		Sta n Val		Sta n Val		Sta n Val		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-108.793	.02	-68.274	.04	-64.436	.08	-35.072	.04	33.366	.08		
54.396	.02										

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.	
	-38.4	38.2		186.352	195.21	205.381	.3	.5	
Ineffective Flow	num= 1								
	Sta L	Sta R	Elev	Permanent					
	-108.793	-42.651	378.937	F					

BRIDGE

RIVER: Mad River  
 REACH: Reach 1 RS: 1727.5

INPUT  
 Description: Proposed I-84 E24 Off-Ramp Bridge No. 06284  
 Exit to Harpers Ferry  
 Road

Distance from Upstream XS = 30.84  
 Deck/Roadway Width = 64.633  
 Weir Coefficient = 2.63

Upstream Deck/Roadway Coordinates		num= 7		Sta Hi Cord		Lo Cord		Sta Hi Cord		Lo Cord	
Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-83.301	405.676	328.084	-77.756	405.938	328.084	-71.49	406.365	328.084			
-71.49	406.365	391.847	54.167	409.744	395.479	54.167	409.744	328.084			
64.633	409.875	328.084									

Upstream Bridge Cross Section Data  
 Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-83.301	377.953	-78.937	377.625	-62.566	370.341	-58.957	369.357	-38.353	368.045
-21.457	359.613	21.457	359.613	41.175	369.455	53.675	375.689	53.74	395.144

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-83.301	.06	-38.353	.04	53.675	.02

Bank Sta: Left Right Coeff Contr. Expan.

-38.353	41.175		.3	.5
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Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
-83.301	-42.651	378.937	F

Downstream Deck/Roadway Coordinates num= 8

Sta Hi	Cord	Lo Cord	Sta Hi	Cord	Lo Cord	Sta Hi	Cord	Lo Cord
-103.74	400.262	328.084	-48.13	403.15	328.084	-45.702	403.379	328.084
-45.702	403.379	389.423	54.692	408.76	394.803	54.692	408.76	328.084
59.613	408.891	328.084	116.864	410.105	328.084			

Downstream Bridge Cross Section Data

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-103.74	377.526	-99.573	377.198	-79.823	367.946	-40.518	368.307	-22.933	359.514
22.933	359.514	42.651	369.357	62.434	379.232	62.5	389.698	64.337	389.665
89.633	393.701	116.864	407.021						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-103.74	.06	-40.518	.04	62.434	.02	64.337	.06

Bank Sta: Left Right Coeff Contr. Expan.

-40.518	42.651		.3	.5
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Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-160.925	-45.604	402.822	F
-45.604	-40.52	368.307	F

Upstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Downstream Embankment side slope = 0 hori z. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins =  
 Energy head used in spillway design =  
 Spillway height used in design =  
 Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy  
 Selected Low Flow Methods = Highest Energy Answer

High Flow Method  
 Energy Only

Additional Bridge Parameters

Add Friction component to Momentum  
 Do not add Weight component to Momentum  
 Class B flow critical depth computations use critical depth  
 inside the bridge at the upstream end  
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1689

INPUT

Description: FEMA Station 5137, Cross Section AG  
 D/S of Proposed Bridge 06284,

I-84 Eastbound Exit 24, Off-Ramp to Harpers Ferry Road  
 Cross section within former Century Pond  
 aka Scovill Pond, East Brass

Mill Pond, City Mills Pond  
 Right side fill slope is from  
 construction of a pump station which will be completed before the  
 start of this project

Station Elevation Data num= 78											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-160.925	377.657	-154.167	377.592	-148.917	377.493	-140.322	377.362	-134.941	377.264		
-134.449	377.264	-126.476	376.969	-123.458	376.837	-120.505	376.608	-119.488	376.509		
-114.797	376.148	-109.121	375.656	-107.579	375.656	-106.693	376.115	-106.332	376.28		
-104.954	376.509	-102.986	376.64	-100.164	377.231	-97.835	377.231	-97.736	401.542		
-97.703	401.903	-97.572	403.675	-96.555	403.675	-96.457	402.854	-96.26	401.017		
-96.129	400.722	-95.833	400.197	-92.782	400.328	-91.798	400.361	-90.846	400.328		
-86.417	400.23	-83.071	400.131	-79.692	400.066	-75.623	399.934	-69.718	399.803		
-68.406	399.77	-68.11	399.738	-67.552	399.738	-63.648	399.639	-61.516	399.573		
-59.285	399.541	-55.381	399.409	-54.823	399.409	-52.69	399.344	-51.345	399.311		
-51.148	399.672	-50.919	400.131	-50.787	401.214	-50.623	402.822	-49.606	402.822		
-49.573	402.264	-49.442	400.689	-49.377	387.795	-49.311	372.178	-47.802	371.424		
-46.227	370.636	-44.849	369.948	-42.946	368.996	-39.14	367.126		365.556		
-31.923	363.517	-31.89	363.517	-29.626	362.369	-23.163	359.154	-19.718	359.154		
-3.97	359.186	0	359.186	23.097	359.186	25.23	360.236	31.299	363.287		
31.332	363.287	35.74	365.492	40.125	367.684	47.769	372	86.273	392		
109.569	404	113.975	404.233	115.945	404.288						

Manning's n Values num= 7											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-160.925	.08	-97.835	.02	-49.311	.08	-31.923	.04	31.299	.08		
40.125	.04	113.975	.02								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-36	35.74		225.394	226.378		229.659	
							.3	.5
Ineffective Flow	num=	Sta L	Sta R	Elev	Permanent			
	2							
-160.925		-45.604	402.822	F				
-45.604		-40.52	368.307	F				

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1620

INPUT  
 Description: Cross Section within Former Century Pond  
 55m (180') upstream of  
 breached dam  
 aka Scovill Pond, East Brass Mill Pond, City Mills  
 Pond

Station Elevation Data num= 53											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-72.539	388.944	-72.211	389.6	-72.113	389.797	-72.047	390.354	-71.818	392.454		
-70.833	392.454	-70.801	391.864	-70.669	390.322	-70.636	388.484	-70.341	365.814		
-66.995	365.781	-57.809	365.223	-57.808	365.223	-49.705	362.238	-45.177	360.564		
-39.206	358.366	-37.533	357.677	-35.86	357.579	-32.677	357.349	-29.56	357.185		
-10.499	356.66	-8.235	356.529	-6.102	356.693	-3.379	356.66	8.038	357.021		
22.408	356.496	24.934	356.43	34.744	357.677	35.86	357.907	37.238	358.333		
43.077	360.203	44.127	360.531	48.556	362.008	79.035	364.272	79.495	364.337		
80.348	364.501	86.089	366.142	89.567	367.684	91.503	368.34	99.016	370.571		
104.003	372.047	105.151	372.342	107.648	372.797	111.553	374	113.782	375.127		
118.253	375.521	130.575	375.837	134.655	375.564	139.516	374	148.664	372.275		
151.308	372.293	161.989	374	174.541	383.005						

Manning's n Values num= 8											
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-72.539	.02	-70.341	.08	-57.808	.04	48.556	.08	107.648	.04		
118.253	.02	130.575	.04	161.989	.06						

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-49.705	48.556		157.48	154.199		152.559	
							.1	.3
Ineffective Flow	num=	Sta L	Sta R	Elev	Permanent			
	2							
-72.539		-70.932	392.454	F				
-42.651		-2.395	358.268	T				
Blocked Obstructions	num=	Sta L	Sta R	Elev				
	1							
-42.651		-9.843	358.268					

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1573

INPUT

Description: Upstream Heel Breached Century Dam  
 aka Scovill Pond Dam, East Brass Mill Pond Dam, City Mills Pond Dam

CTDEP Dam No. 15103  
 Dam

breached 1998.

Blocked area on the right side represents the pump station which will be completed before the start of this project

Station Elevation Data num= 62

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-94.488	381.43	-94.324	381.66	-94.062	382.021	-93.963	383.005	-93.799	384.678
-92.782	384.678	-92.749	384.022	-92.618	382.546	-92.585	377.92	-92.552	366.503
-92.093	366.568	-86.319	367.651	-76.378	367.356	-76.05	367.454	-75.492	367.454
-59.285	363.714	-51.804	362.27	-50.689	361.516	-48.819	358.957	-48.622	358.957
-39.731	358.53	-39.042	358.497	-38.976	358.465	-30.151	355.577	-29.954	355.512
-29.888	355.479	-19.816	353.346	-13.451	352.854	-12.008	352.559	-6.004	352.461
-1.936	352.395	24.377	354.429	27.461	355.315	27.92	355.61	30.676	357.316
40.9	363.488	43.34	364.961	45.308	365.945	46.424	366.404	46.883	366.535
48.228	366.765	55.938	368.11	60.335	368.57	65.354	368.832	73.524	369.98
74.869	370.144	75.886	370.276	82.972	372.014	89.928	374.77	92.52	374.77
94.226	374.803	97.441	374.836	108.169	374.389	111.354	374.073	123.221	374
192.23	374.2	197.574	374	200.394	374.836	202.231	375.262	207.808	376.509
215.026	378.445	229.134	387.139						

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-94.488	.02	-92.552	.08	-51.804	.04	43.34	.08	111.354	.02
192.23	.04	200.394	.06						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

-51.804	40.9	82.021	75.787	70.538		.3	.5
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Ineffective Flow num= 4

Sta L	Sta R	Elev	Permanent
-94.488	-92.782	384.678	F
-92.782	-55.446	375.656	T
-40.682	-7.546	355.577	T
50.525	229.134	374.836	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
137.664	175.427	383.858

INLINE STRUCTURE

RIVER: Mad River  
 REACH: Reach 1 RS: 1561.5

INPUT

Description: Breached Century Dam  
 aka Scovill Pond Dam, East Brass Mill Pond Dam, City Mills Pond Dam

BLA cross section  
 CTDEP Dam No.

15103  
 Dam breached 1998

Geometry compiled from new survey data,  
 12/24/98 as-built drawing from Karl Acimovic and 10/31/94  
 construction plans by Mr. Acimovic for the CTDEP Water Resources  
 Unit.

Distance from Upstream XS = 23.786  
 Deck/Roadway Width = 6.562  
 Weir Coefficient = 2.64

Weir Embankment Coordinates num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-295.276	377.297	-285.761	375.656	-283.137	375.098	-258.202	375.656	-55.118	375.656
-55.118	369.193	-40.354	356.791	-13.944	356.496	-13.123	355.709	6.562	354.724
26.247	355.709	27.034	356.496	30.906	356.594	45.899	369.193	45.899	374.016
151.903	374.016	159.449	372.375	181.102	372.375	193.57	374.016	208.005	377.297
220.801	387.139	229.134	387.139						

Upstream Embankment side slope = 0 horiz. to 1.0 vertical

Downstream Embankment side slope = 24 horiz. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins = 351.247  
 Weir crest shape = Broad Crested

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1550

INPUT

Description: Middle of proposed Rock Rmap Fishway (downstream of dam)  
 Downstream Toe Breached Century Dam in existing condition  
 aka Scovill Pond Dam, East Brass Mill Pond Dam, City Mills Pond Dam

CTDEP Dam No. 15103  
 Dam breached 1998

Station Elevation Data		num= 54							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-118.143	378.051	-117.979	378.281	-117.684	378.642	-117.585	379.56	-117.388	381.332
-116.306	381.332	-116.142	379.528	-116.109	379.199	-116.076	366.601	-115.978	366.601
-114.075	366.24	-103.182	363.025	-95.44	363.025	-89.928	361.253	-85.466	359.875
-77.854	355.971	-40.289	355.085	-35.236	354.724	-32.972	354.593	-30.217	354.331
-23.556	353.576	-20.965	353.314	-19.521	353.182	-16.273	353.018	-15.387	352.986
-12.139	352.887	-11.581	352.887	-8.661	352.854	-8.268	352.854	-5.217	352.887
-4.068	352.887	-3.051	352.92	-.591	352.986	0	353.051	.492	353.084
3.51	353.215	8.366	353.642	11.68	353.871	15.781	354.331	20.899	354.888
41.535	355.971	42.651	359.049	43.209	359.186	52.559	362.861	57.316	364.6
67.257	367.684	75.033	369.751	76.903	370.079	86.056	370.276	90.879	370.44
97.9	370.669	103.74	371.883	109.186	372.146	111.614	372.31		

Manning's n Values		num= 4					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-118.143	.02	-116.076	.08	-77.854	.04	41.535	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	-40.289	41.535		49.869	49.869	50.197	.3	.5
Ineffective Flow		num= 4						
Sta L	Sta R	Elev	Permanent					
-118.143	-65.945	375.656	F					
-65.945	-30.512	355.971	F					
31.824	40.026	355.971	F					
40.026	111.614	374.016	F					

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1536

INPUT

Description: Downstream Toe of Proposed Rock Ramp  
 Location of downstream toe of rock ramp proposed to be constructed downstream of Century Dam to promote fish passage.

Station Elevation Data		num= 50							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-137.664	379.757	-136.68	379.757	-136.516	377.592	-136.483	358.858	-127.329	358.596
-124.081	358.497	-111.844	358.104	-100.066	358.169	-94.783	358.202	-91.437	358.202
-80.577	358.005	-75.951	357.972	-75.394	358.104	-73.556	357.841	-68.537	357.841
-61.975	357.448	-56.529	355.61	-54.724	354.987	-49.409	353.543	-48.425	353.281
-45.636	352.69	-44.521	352.526	-42.093	352.198	-35.827	351.608	-32.612	351.345
-30.151	351.05	-29.134	351.017	-26.312	350.919	-22.343	350.853	-18.799	350.853
-16.076	350.886	-11.417	350.984	-8.366	351.05	-1.411	351.969	0	352.231
2.756	352.69	10.138	353.609	16.043	354.331	18.274	354.593	43.143	355.971
45.44	357.743	47.802	359.547	54.692	360.794	59.252	361.549	67.323	362.73
75.394	364.14	79.724	364.862	83.924	365.125	84.908	365.42	97.146	369.094

Manning's n Values		num= 5							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val		
-137.664	.02	-127.329	.08	-45.636	.04	2.756	.06	47.802	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.

-54.724	43.143		63.648	57.743	55.774	.3	.5
Ineffective Flow num= 4							
Sta L	Sta R	Elev	Permanent				
-137.664	-91.207	374.016	F				
-91.207	-54.79	355.971	F				
37.73	53.806	355.971	F				
53.806	97.146	373.36	F				

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1523

INPUT

Description: FEMA STATION 5136, CROSS SECTION AF  
 Ineffective flow area added  
 to model obstruction from northerly embankment of Century Dam.

Station Elevation Data num= 50											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-177.657	375.098	-175.427	375.098	-173.688	375.066	-171.26	374.967	-169.718	374.902		
-169.715	375.164	-169.301	375.755	-169.019	378.412	-168.025	378.412	-167.861	376.28		
-167.815	357.94	-163.747	357.71	-160.105	357.48	-155.84	357.316	-144.488	357.152		
-141.043	357.021	-128.576	356.857	-127.953	356.89	-109.022	356.562	-105.512	356.332		
-98.097	356.332	-79.757	356.234	-61.778	356.398	-56.102	356.365	-49.18	354.265		
-41.601	351.772	-40.65	350.361	-30.348	350	-23.196	350	-18.93	349.803		
-8.301	350.558	-7.546	350.689	-3.543	350.755	0	350.82	.197	350.82		
.394	350.787	2.297	351.247	4.823	352.461	7.415	353.379	20.013	353.248		
27.789	353.379	39.41	356.477	46.129	358.268	46.325	358.268	46.358	358.301		
61.483	360.597	64.633	361.024	78.773	364.239	81.791	365.059	92.487	368.438		

Manning's n Values num= 4							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-177.657	.02	-167.815	.08	-41.601	.04	2.297	.08

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-56.102	39.41		82.021	107.283	121.391		.1	.3

Ineffective Flow num= 2							
Sta L	Sta R	Elev	Permanent				
-177.657	-122.703	372.375	F				
63.32	92.487	372.375	F				

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1487

INPUT

Description: 73m (240') D/S of Century Dam

Station Elevation Data num= 63											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-202.723	373.852	-201.28	373.72	-200.459	373.688	-197.047	372.113	-194.619	370.997		
-191.634	369.652	-190.289	369.029	-185.728	366.929	-185.433	366.798	-184.088	366.175		
-182.349	365.715	-178.15	364.567	-175.525	363.845	-150.426	355.577	-149.442	355.249		
-149.409	355.249	-130.61	355.348	-126.247	355.413	-116.831	355.446	-109.383	355.577		
-102.625	355.774	-97.638	355.741	-92.913	355.84	-75.591	355.184	-66.732	354.987		
-53.379	354.856	-49.738	354.364	-42.257	353.543	-35.794	352.625	-33.071	351.509		
-27.592	348.917	-18.406	348.786	-8.136	348.196	1.148	348.392	10.958	348.819		
31.857	348.589	41.437	352.067	46.916	354.134	51.6	355.799	56.791	357.644		
60.007	358.432	69.16	359.514	71.949	359.843	74.377	360.171	75.722	360.335		
85.761	361.713	92.388	362.664	94.685	363.419	107.808	367.454	112.959	367.815		
121.129	368.241	128.412	366.601	132.513	365.551	141.306	366.995	150.295	368.045		
164.239	368.307	164.304	368.307	186.745	368.996	204.954	369.029	210.072	368.996		
214.501	369.849	228.314	372.441	236.975	378.281						

Manning's n Values num= 4							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-202.723	.04	-185.728	.08	-35.794	.04	41.437	.08

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-53.379	46.916		190.289	205.052	203.412		.1	.3

Ineffective Flow num= 2							
Sta L	Sta R	Elev	Permanent				
-202.723	-92.913	355.84	F				
121.129	236.975	368.241	F				



CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1425

INPUT

Description: 135m (443') D/S of Century Dam

Station Elevation Data		num= 70		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-285.991	373.688	-284.941	373.655	-282.907	373.491	-280.906	373.327	-278.281	372.047		
-275.328	370.604	-271.129	368.537	-267.29	366.667	-265.518	366.601	-255.184	366.24		
-249.836	365.19	-236.417	361.811	-218.57	357.907	-212.566	356.627	-194.685	354.856		
-193.963	354.79	-193.701	354.757	-174.967	353.675	-173.917	353.576	-167.454	353.412		
-158.53	353.182	-156.857	353.248	-144.882	354.199	-138.78	354.101	-135.335	354.232		
-124.016	354.823	-118.438	355.085	-109.974	355.184	-96.227	355.118	-89.304	355.184		
-85.138	355.249	-77.657	355.413	-77.592	355.413	-77.297	355.381	-64.337	354.495		
-62.861	354.364	-61.385	354.101	-52.493	352.657	-50.492	352.231	-41.896	350.525		
-34.843	350.361	-33.005	350.328	-22.802	349.934	-17.257	348.786	-14.239	347.671		
-5.413	346.818	2.297	346.686	10.138	346.457	17.717	346.49	28.806	347.605		
31.824	349.049	39.764	352.92	49.213	354.954	55.184	356.463	68.668	359.974		
75.492	360.827	80.741	361.45	85.039	361.483	105.807	364.862	106.594	365.059		
107.579	365.092	128.117	365.945	134.941	366.109	142.979	366.404	147.539	367.552		
156.463	369.291	172.867	379.232	175.295	380.676	176.936	380.741	180.512	380.938		

Manning's n Values		num= 5		Sta n Val		Sta n Val		Sta n Val		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-285.991	.04	-267.29	.08	-17.257	.04	31.824	.08	176.936	.04		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-52.493	39.764		65.617	183.071	242.782		.1	.3

Ineffective Flow		num= 1		Sta Elev		Permanent	
Sta L	Sta R	Elev					
-285.991	-77.657	355.413				F	

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1370

INPUT

Description: FEMA STATION 5135, CROSS SECTION AE

Station Elevation Data		num= 96		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-342.848	373.589	-341.076	373.655	-340.026	373.655	-339.304	373.622	-335.86	373.491		
-332.119	373.196	-331.693	373.163	-331.365	372.999	-331.135	372.9	-330.938	372.802		
-325.394	370.177	-325.361	370.177	-321.129	368.176	-318.996	367.159	-314.731	365.125		
-309.219	363.714	-303.346	362.172	-300.427	361.385	-291.306	359.416	-279.364	356.857		
-264.37	356.102	-263.812	356.102	-263.648	356.07	-263.419	356.037	-250.984	354.692		
-244.259	354.265	-231.529	354.331	-224.245	353.773	-217.717	353.215	-211.647	352.756		
-195.768	353.346	-193.471	353.445	-193.11	353.51	-192.618	353.51	-171.785	353.937		
-167.979	353.97	-158.727	354.232	-154.364	354.232	-137.27	354.364	-130.02	354.167		
-126.444	353.97	-121.522	353.15	-112.402	351.411	-108.366	351.772	-102.428	352.329		
-96.85	352.723	-88.878	352.789	-85.203	352.756	-74.114	352.034	-67.782	351.673		
-65.65	351.378	-55.873	350.328	-55.446	350.328	-40.453	350.131	-31.365	349.803		
-31.004	349.77	-30.676	349.77	-12.861	348.983	-10.171	348.524	-6.496	347.9		
-3.937	346.654	3.281	345.374	12.041	343.668	23.983	345.538	31.791	347.014		
38.091	350.262	44.193	353.248	48.064	353.182	56.89	353.084	65.19	353.051		
71.457	353.084	87.992	352.854	97.769	356.332	102.723	358.432	112.434	359.482		
124.409	363.255	124.672	363.353	125.328	363.287	156.332	360.171	166.995	363.222		
176.017	364.829	203.346	372.638	213.222	375.23	219.521	376.608	260.302	373.688		
302.231	378.215	309.121	378.15	318.57	378.871	324.344	379.101	338.911	379.757		
341.503	379.921	343.57	380.085	356.135	381.168	369.619	381.988	371.129	382.087		
372.047	382.087										

Manning's n Values		num= 5		Sta n Val		Sta n Val		Sta n Val		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-342.848	.02	-335.86	.04	-309.219	.08	-6.496	.04	31.791	.08		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-12.861	38.091		109.908	144.357	164.042		.1	.3

Ineffective Flow		num= 6		Sta Elev		Permanent	
Sta L	Sta R	Elev					
-342.848	-277.887	370.735				F	
-277.887	-137.27	354.364				F	
-119.751	-88.878	352.789				F	

44.193 90.551 353.248 F  
 124.409 170.604 363.255 F  
 219.521 288.714 376.608 F

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1330

INPUT

Description: 39m (128') U/S Proposed Pedestrian Bridge

Station		Elevation		Data		num=		93	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-254.495	372.999	-253.248	372.9-253.084	372.9-233.399	363.058	-220.801	356.759		
-219.029	356.496	-216.142	356.07-215.354	356.037	-206.234	356.004	-200.591	356.168	
-194.455	355.676	-181.398	354.856	-167.29	352.428	-165.879	352.231	-164.436	352.1
-149.081	350.951	-132.677	351.345	-132.087	351.378	-131.857	351.411	-106.43	353.281
-105.512	353.281	-83.727	352.559	-83.366	352.526	-72.441	352.198	-67.126	351.05
-55.02	347.9	-51.148	347.867	-27.887	348.917	-19.029	346.49	-14.764	344.226
-11.811	343.438	-8.858	342.946	-5.249	342.585	-1.312	342.356		656 342.388
4.921	342.717	9.514	343.438	16.404	345.243	27.165	347.31	32.808	348.612
36.68	349.508	43.766	350.197	52.198	351.148	61.844	351.542	68.963	351.837
73.163	352.001	95.768	352.362	106.529	352.493	124.245	352.625	135.105	352.723
138.714	352.526	146.588	351.739	148.556	351.509	149.606	351.115	151.575	350.361
153.74	349.573	159.974	349.639	166.076	349.738	171.522	352.034	176.837	354.331
184.678	354.56	189.633	354.692	190.748	354.724	194.291	354.856	199.803	354.987
207.316	355.184	224.344	355.643	226.312	356.627	244.357	360.761	257.513	362.205
284.121	374.377	292.126	376.64	297.835	380.938	304.101	382.972	306.988	383.793
309.285	383.793	312.697	384.055	320.407	384.941	326.575	385.564	329.987	385.925
331.923	386.319	332.185	386.352	332.251	386.319	332.94	385.696	334.974	385.663
338.419	385.63	345.144	385.663	355.741	385.728	355.84	385.728	374.934	386.253
375.033	386.253	382.251	386.45	389.042	386.581				

Manning's n		Values		num=		12	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-254.495	.04	-233.399	.08	-19.029	.04	27.165	.08
171.522	.06	189.633	.02	199.803	.04	207.316	.06
309.285	.04	332.94	.02				

Bank	Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
	-27.887	32.808	68.898	68.898	68.898	.1	.3	

Ineffective Flow		num=		4	
Sta L	Sta R	Elev	Permanent		
-254.495	-204.396	370.735	F		
-204.396	-106.43	353.281	F		
-60.696	-27.887	348.917	F		
135.105	180.446	352.723	T		

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1309

INPUT

Description: U/S of Proposed Pedestrian Bridge

Station		Elevation		Data		num=		83	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-194.718	372.605	-194.062	372.539	-183.563	367.323	-175.328	363.189	-165.551	358.301
-162.434	356.726	-154.626	352.854	-151.214	352.395	-150.787	352.362	-146.916	351.476
-139.469	350.919	-133.694	350.853	-122.999	350.459	-117.585	350.459	-113.714	350.656
-102.789	351.083	-92.06	351.575	-83.235	351.903	-74.213	352.461	-72.014	352.198
-65.322	351.411	-62.041	350.197	-51.214	347.047	-31.923	347.31	-29.003	347.343
-27.625	346.621	-20.965	345.341	-16.699	343.274	-14.337	342.651	-9.908	342.323
-5.085	341.634	-.919	341.601	-.197	341.634	4.954	342.126	9.186	342.552
14.173	343.635	19.029	345.112	24.606	347.201	28.576	348.688	38.648	350.427
45.112	351.083	52.395	351.148	54.593	351.05	54.921	350.984	62.106	349.442
69.423	347.802	73.425	346.883	75.951	346.916	82.841	347.08	91.962	347.277
96.555	348.622	99.475	349.508	109.941	352.756	113.222	353.773	115.092	354.331
125.656	354.331	134.055	352.69	163.451	352.362	167.323	352.69	170.997	352.986
181.332	353.871	186.811	354.331	193.701	355.971	200.722	356.955	201.64	357.011
211.188	357.385	238.091	358.602	261.319	358.691	267.323	359.134	285.466	366.444
289.993	368.425	308.76	376.572	321.883	384.331	323.097	384.38	323.885	384.465
334.711	385.39	357.185	385.676	366.535	385.794	371.555	386.033	375.394	386.03
383.53	386.293	388.878	386.614	393.504	386.719				

Manning's n Values num= 11

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-194.718	.04	183.563	.08	-29.003	.04	24.606	.08	62.106	.04
99.475	.06	134.055	.04	170.997	.02	181.332	.04	200.722	.08
334.711	.02								

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -29.003 24.606 104.987 104.987 104.987 .3 .5

Ineffective Flow num= 6

Sta L	Sta R	Elev	Permanent
-194.718	-152.887	370.735	F
-152.887	-74.213	352.461	F
-74.213	-29.003	347.343	F
52.395	113.091	351.148	T
125.787	192.257	354.298	F
192.257	298.556	370.735	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
334.646	366.142	393.701

BRI DGE

RIVER: Mad River  
 REACH: Reach 1 RS: 1288.5

INPUT  
 Description: Proposed Pedestrian Bridge

Distance from Upstream XS = 62.336  
 Deck/Roadway Width = 11.483  
 Weir Coefficient = 2.63  
 Upstream Deck/Roadway Coordinates

num= 22

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-109.58	370.735	0	-70.735	351.05	0	-46.161	351.05	0
-41.667	351.05	0	-35.761	351.312	0	-35.761	355.807	0
-33.793	355.873	0	-33.793	355.873	349.541	0	356.529	350.197
33.793	355.873	349.541	33.793	355.873	0	35.761	355.807	0
35.761	351.312	0	40.715	351.05	0	63.32	350.689	0
88.517	351.05	0	154.692	352.69	0	163.55	354.331	0
192.815	355.971	0	197.178	357.612	0	211.024	359.252	0
261.549	360.892	0						

Upstream Bridge Cross Section Data

Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-109.58	370.735	-70.735	351.05	-46.161	351.05	-41.667	351.05	-35.761	351.312
-33.793	345.44	-24.934	344.488	-18.045	342.684	-15.748	342.159	-10.827	341.962
-5.249	341.076	-.656	341.175	4.921	341.765	8.858	342.028	12.795	342.684
20.013	344.98	21.982	345.44	26.575	346.522	31.496	347.769	33.793	349.049
35.761	351.312	40.715	351.05	63.32	350.689	88.517	351.05	130.545	351.706
154.692	352.69	163.55	354.331	192.815	355.971	197.178	357.612	211.024	359.252
261.549	360.892								

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-109.58	.08	-46.161	.02	-33.793	.04	21.982	.08
130.545	.08						

Bank Sta: Left Right Coeff Contr. Expan.  
 -33.793 33.793 .3 .5

Ineffective Flow num= 6

Sta L	Sta R	Elev	Permanent
-194.718	-152.887	370.735	F
-152.887	-74.213	352.461	F
-74.213	-29.003	347.343	F
52.395	113.091	351.148	T
125.787	192.257	354.298	F
192.257	298.556	370.735	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
334.646	366.142	393.701

Downstream Deck/Roadway Coordinates

num= 22

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord

-106.168	370.735	0	-67.028	351.05	0	-59.022	351.05	0
-41.831	351.05	0	-35.761	351.312	0	-35.761	355.807	0
-33.793	355.873	0	-33.793	355.873	349.541	0	356.529	350.197
33.793	355.873	349.541	33.793	355.873	0	35.761	355.807	0
35.761	351.312	0	48.753	351.05	0	63.32	350.951	0
77.559	351.05	0	149.245	352.69	0	152.92	354.331	0
158.957	355.971	0	197.507	357.612	0	208.596	359.252	0
260.663	360.892	0						

Downstream Bridge Cross Section Data

Station Elevation Data num= 31											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-106.168	370.735	-67.028	351.05	-59.022	351.05	-41.831	351.05	-35.761	351.312		
-33.793	345.44	-24.934	344.488	-18.045	342.684	-15.748	342.159	-10.827	341.962		
-5.249	341.076	-6.656	341.175	4.921	341.765	8.858	342.028	12.795	342.684		
20.013	344.98	21.982	345.44	26.575	346.522	31.496	347.769	33.793	349.049		
35.761	351.312	48.753	351.05	63.32	350.951	77.559	351.05	101.28	351.378		
149.245	352.69	152.92	354.331	158.957	355.971	197.507	357.612	208.596	359.252		
260.663	360.892										

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-106.168	.08	-59.022	.02	-33.793	.04	21.982	.08	33.793	.02
101.28	.08								

Bank Sta: Left Right Coeff Contr. Expan.  
-33.793 33.793 .3 .5

Ineffective Flow num= 2  
Sta L Sta R Elev Permanent  
43.963 133.202 350.066 F  
133.202 275.623 370.735 F

Blocked Obstructions num= 1  
Sta L Sta R Elev  
-106.168 -72.178 372.277

Upstream Embankment side slope = 0 horiz. to 1.0 vertical  
Downstream Embankment side slope = 0 horiz. to 1.0 vertical  
Maximum allowable submergence for weir flow = .95  
Elevation at which weir flow begins =  
Energy head used in spillway design =  
Spillway height used in design =  
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy  
Selected Low Flow Methods = Energy

High Flow Method

Pressure and Weir flow  
Submerged Inlet Cd =  
Submerged Inlet + Outlet Cd = .8  
Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum  
Do not add Weight component to Momentum  
Class B flow critical depth computations use critical depth  
inside the bridge at the upstream end  
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mad River  
REACH: Reach 1 RS: 1277

INPUT

Description: Between I-84 / Pedestrian bridges (FEMA Sta 5134, Sec AD)  
U/S of

Proposed I-84 Bridge No. 01224  
D/S of Proposed Pedestrian Bridge

Station Elevation Data num= 62											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-121.391	372.31	-114.993	372.31	-113.451	372.277	-106.299	369.16	-102.92	367.454		
-101.542	366.437	-79.134	357.612	-64.633	351.05	-60.531	350.853	-50.689	350.558		

-48.392	349.409	-45.3	347.863	-41.831	346.129	-39.698	345.112	-30.84	344.324
-27.723	344.094	-20.768	342.585	-19.816	342.356	-19.587	342.29	-18.766	342.06
-8.596	340.584	-3.117	341.437	9.482	341.175	12.27	342.257	14.665	344.39
14.731	344.39	14.928	344.423	15.157	344.455	29.495	346.85	34.81	347.703
40.65	348.261	43.241	348.655	46.227	348.72	61.155	348.819	63.976	349.081
72.835	349.508	76.804	349.541	91.831	349.377	92.585	349.409	95.013	349.475
109.186	350.033	115.846	350.164	123.917	350.656	129.364	351.05	130.807	351.706
143.996	357.612	156.102	357.612	160.925	355.971	167.224	354.331	173.36	353.675
181.496	354.331	191.207	355.315	194.816	355.971	201.312	357.612	221.325	359.252
227.625	360.105	229.921	360.171	231.037	360.105	250.328	360.007	256.89	360.63
272.966	361.253	275.623	361.286						

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-121.391	.04	-60.531	.02	-48.392	.08	-27.723	.04	14.665	.08
123.917	.04	221.325	.08						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
-45.3 34.81 375.984 375.984 375.984 .3 .5

Ineffective Flow num= 2  
Sta L Sta R Elev Permanent  
43.963 133.202 350.066 F  
133.202 275.623 370.735 F

Blocked Obstructions num= 1  
Sta L Sta R Elev  
-121.391 -72.178 372.277

BRI DGE

RIVER: Mad River  
REACH: Reach 1 RS: 1214.5

INPUT

Description: Proposed I-84 Bridge No. 01224  
includes E23 On-Ramp and E24 Off-Ramp

Proposed westerly I-84 bridge over the Mad River

Distance from Upstream XS = 60.958

Deck/Roadway Width = 292.06

Weir Coefficient = 2.63

Upstream Deck/Roadway Coordinates

num=	8										
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord		
-212.664	372.28			0-183.661	372.28			0	-68.241	372.28	0
-68.241	372.277	364.829		37.598	371.588	364.173		37.598	371.588		0
192.979	371.588			0	211.286	371.588					0

Upstream Bridge Cross Section Data

Station	Elevation	Data	num=	23															
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-212.664	372.277	-183.661	372.277	-68.241	372.277	-68.241	352.592	-64.961	352.592										
-61.844	351.05	-58.497	349.409	-56.037	348.196	-46.063	348.13	-41.732	347.769										
-38.386	346.129	-24.278	342.848	-9.514	340.525	.656	340.669	7.218	341.601										
10.171	342.848	11.155	342.972	34.318	351.05	47.244	351.05	161.089	351.05										
170.932	355.971	175.853	357.612	183.727	359.252														

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-212.664	.02	-68.241	.04	-64.961	.02	-46.063	.04	34.318	.08

Bank Sta: Left Right Coeff Contr. Expan.  
-41.732 34.318 .3 .5

Ineffective Flow num= 2  
Sta L Sta R Elev Permanent  
43.963 133.202 350.066 F  
133.202 275.623 370.735 F

Blocked Obstructions num= 1  
Sta L Sta R Elev  
-212.664 -72.178 372.277

Downstream Deck/Roadway Coordinates

num=	8										
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord		
-239.829	365.72			0-183.661	365.72			0	-54.888	365.72	0
-54.888	365.715	358.301		40.846	364.862	357.448		40.846	364.862		0
191.995	364.862			0	211.286	364.862					0

Downstream Bridge Cross Section Data

Station Elevation Data num= 21  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -131.234 366.142 -90.092 365.814 -54.888 352.592 -51.608 352.592 -48.491 351.05  
 -45.144 349.409 -42.323 347.999 -33.202 347.802 -20.013 341.207 -18.766 340.715  
 -.82 339.665 18.57 339.895 20.112 341.207 24.6 344.08 30.348 347.769  
 36.909 351.05 37.566 351.378 40.846 351.378 40.846 364.862 191.995 364.862  
 211.286 364.862

Manning's n Values num= 4  
 Sta n Val Sta n Val Sta n Val Sta n Val  
 -131.234 .08 -51.608 .02 -33.202 .04 40.846 .02

Bank Sta: Left Right Coeff Contr. Expan.  
 -33.202 24.6 .3 .5

Ineffective Flow num= 1  
 Sta L Sta R Elev Permanent  
 -246.063-107.612 366.109 T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical  
 Downstream Embankment side slope = 0 horiz. to 1.0 vertical  
 Maximum allowable submergence for weir flow = .95  
 Elevation at which weir flow begins =  
 Energy head used in spillway design =  
 Spillway height used in design =  
 Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy  
 Selected Low Flow Methods = Energy

High Flow Method

Pressure and Weir flow  
 Submerged Inlet Cd =  
 Submerged Inlet + Outlet Cd = .8  
 Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum  
 Do not add Weight component to Momentum  
 Class B flow critical depth computations use critical depth  
 inside the bridge at the upstream end  
 Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1162

INPUT

Description: 7m (23') D/S Proposed I-84 Bridge 01224

Station Elevation Data num= 55  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -269.915 369.324-269.619 369.39-264.272 370.538-254.823 370.571-251.378 370.407  
 -248.163 369.259-228.018 363.78-216.798 360.433-215.256 359.646-204.495 355.807  
 -202.986 355.709-201.739 355.709-195.965 354.364-195.308 354.429-195.177 354.396  
 -194.947 354.265-194.554 353.937 -191.47 351.575-189.337 351.772-186.877 351.444  
 -184.318 351.017-177.953 350.951-171.063 350.951 -163.55 350.689-160.531 350.623  
 -151.017 350.427-149.278 350.427-139.993 350-134.154 349.934-119.685 350.033  
 -112.762 349.934 -94.127 349.639 -92.651 349.639 -91.207 349.606 -77.067 349.442  
 -69.259 349.442 -60.039 348.688 -58.497 348.622 -56.463 348.556 -55.184 348.556  
 -49.016 348.36 -41.175 348.031 -36.647 348.064 -34.088 346.818 -33.2 346.383  
 -25.262 342.487 -18.766 339.764 1.181 338.976 17.487 339.403 22.441 343.701  
 26.23 346.452 28.379 348.012 33.465 351.706 39.436 352.69 39.469 364.829

Manning's n Values num= 5  
 Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val  
 -269.915 .08-195.965 .02 -94.127 .08 -34.088 .04 39.436 .02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -33.2 26.23 32.808 30.512 29.528 .3 .5

Ineffective Flow num= 1  
 Sta L Sta R Elev Permanent

-246.063-107.612 366.109 T

CROSS SECTION

RIVER: Mad River
REACH: Reach 1 RS: 1153

INPUT

Description: FEMA Station 5132, Cross Section AB
15m(50') downstream of
Proposed I-84 Bridge No. 01224

Blocked obstruction models
building in Hamilton Park
Ineffective flow area represents
expected limit of effective flow downstream of the bridge

Table with 12 columns: Station, Elev, Sta, Elev, Sta, Elev, Sta, Elev, Sta, Elev, Sta, Elev. Contains 12 rows of station and elevation data.

Manning's n Values table with 5 columns: Sta, n Val, Sta, n Val, Sta, n Val. Contains 1 row of data.

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan. table with 7 columns. Contains 1 row of data.

Ineffective Flow num= 1 table with 4 columns: Sta L, Sta R, Elev, Permanent. Contains 1 row of data.

Blocked Obstructions num= 1 table with 4 columns: Sta L, Sta R, Elev. Contains 1 row of data.

CROSS SECTION

RIVER: Mad River
REACH: Reach 1 RS: 1107

INPUT

Description: 62m (203') downstream of Proposed I-84 Br 01224

Table with 12 columns: Station, Elev, Sta, Elev, Sta, Elev, Sta, Elev, Sta, Elev, Sta, Elev. Contains 12 rows of station and elevation data.

Manning's n Values num= 8 table with 10 columns: Sta, n Val, Sta, n Val, Sta, n Val, Sta, n Val, Sta, n Val. Contains 2 rows of data.

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan. table with 7 columns. Contains 1 row of data.

-42.651 38.17 319.554 340.223 351.706 .1 .3  
 Ineffective Flow num= 3  
 Sta L Sta R Elev Permanent  
 -583.99-495.079 370.735 F  
 -495.079 -126.05 346.719 F  
 -72.178 -44.619 346.391 F

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 1003

INPUT

Description: 166 m (545 ft) downstream of Proposed I-84 Br 01224

Station Elevation Data num= 83  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -638.878 361.122-614.173 354.659-601.017 350.951-598.097 350.033-594.357 349.409  
 -576.87 346.161-566.929 345.013 -561.45 344.849-525.427 342.881-511.647 342.585  
 -501.05 342.552-475.951 343.537-475.623 343.537 -475.23 343.537-458.989 344.094  
 -457.546 344.062-455.381 344.094 -451.64 344.127-451.378 343.963 -449.18 342.257  
 -444.816 342.29-439.108 342.356-436.089 342.651-430.774 342.815-409.646 344.029  
 -404.232 343.832-393.537 343.963-377.133 344.062-369.915 344.357-349.803 344.423  
 -348.097 344.423 -346.49 344.423-300.197 344.652-295.472 344.685-267.684 344.882  
 -254.626 344.948-227.559 344.915-211.056 345.046-210.531 345.046-207.776 345.013  
 -178.937 344.882-151.673 344.751-142.487 344.718-123.294 344.554 -90.879 344.619  
 -60.269 344.16 -46.129 343.504 -45.801 343.504 -45.604 343.471 -42.323 343.34  
 -35.236 343.045 -34.449 342.651 -33.53 342.224 -21.588 336.45 -16.404 333.957  
 0 333.661 15.748 333.727 20.833 336.483 23.786 338.091 32.61 343.087  
 32.94 343.274 34.121 343.963 34.416 344.193 37.434 345.702 40.125 346.26  
 43.701 347.802 43.93 347.9 59.055 351.673 63.287 352.822 69.488 354.659  
 73.36 367.913 73.425 368.898 73.524 370.079 73.983 370.079 74.508 370.079  
 74.639 368.734 74.77 367.388 75 367.093 75.197 366.798 81.102 366.896  
 83.169 366.929 88.058 367.159 92.717 367.388

Manning's n Values num= 7  
 Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val  
 -638.878 .08-458.989 .06-409.646 .04 -60.269 .08 -35.236 .04  
 32.94 .08 69.488 .02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.  
 -35.236 32.61 315.617 375 407.48 .1 .3

Ineffective Flow num= 2  
 Sta L Sta R Elev Permanent  
 -638.878-531.988 360.892 F  
 -531.988-211.056 345.046 F

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 894

INPUT

Description: FEMA STATION 5131, CROSS SECTION AA

Station Elevation Data num= 67  
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev  
 -498.031 357.841 -494.98 356.496 -486.45 353.642-478.281 349.738-474.836 348.031  
 -464.829 343.077-463.648 342.946-462.238 342.881 -450 342.585-445.046 343.406  
 -436.844 343.996-431.627 344.488-428.281 344.488-420.801 344.488-412.336 344.324  
 -407.054 343.832-394.062 343.668-389.764 343.635 -359.58 343.274 -359.35 343.274  
 -358.99 343.209-357.054 343.209-316.043 343.209-305.118 343.143-289.501 342.684  
 -273.031 342.618-243.307 342.684-219.291 342.552-219.259 342.552-179.298 342.224  
 -174.606 342.192-167.684 342.06-149.245 341.831-131.398 341.667-102.625 341.404  
 -94.259 341.437 -90.518 341.535 -73.95 341.798 -57.251 341.831 -55.348 341.831  
 -36.45 339.6 -32.251 338.025 -25.558 336.286 -20.866 333.432 -16.765 332.579  
 -10.892 328.74 0 329.724 16.404 331.168 18.274 333.038 22.178 336.909  
 22.867 337.402 23.8 338.084 26.28 339.895 27.133 340.617 28.117 340.945  
 41.962 341.142 42.52 341.175 44.226 341.175 51.148 341.207 57.218 341.207  
 87.27 342.848 107.513 352.69 108.957 352.92 118.602 352.69 121.785 352.625  
 122.507 352.69 132.316 357.612

Manning's n Values num= 6  
 Sta n Val Sta n Val Sta n Val Sta n Val Sta n Val  
 -498.031 .08 -55.348 .04 28.117 .08 44.226 .06 108.957 .04  
 122.507 .06



Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-32.251	23.8		280.84	263.451	244.094		.1	.3
Ineffective Flow	num=		4						
	Sta L	Sta R	Elev	Permanent					
	-475.722	-431.627	344.488	T					
	-144.357	-82.021	354.331	T					
	-82.021	-55.348	341.831	F					
	56.66	82.021	341.273	F					

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 809

INPUT

Description:

Station Elevation Data	num= 51									
	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	-244.98	359.055	-230.774	352.1	-216.404	346.719	-214.6	346.063	-202.231	345.341
	-187.369	344.619	-185.203	344.357	-165.518	343.57	-146.522	343.077	-145.801	343.045
	-138.222	342.881	-133.661	342.782	-133.465	342.782	-132.907	342.782	-86.188	341.503
	-77.756	341.437	-56.365	341.175	-37.631	340.879	-35.4	340.846	-34.318	340.814
	-31.07	340.682	-27.297	338.091	-25.262	336.565	-15.518	329.265	-13.123	327.461
	-4.035	326.378	9.843	327.428	15.748	328.084	23.622	329.987	24.409	330.709
	26.575	336.352	29.134	338.189	33.825	338.287	37.041	338.615	47.408	338.648
	53.248	338.878	66.962	339.206	79.888	339.961	83.366	339.731	93.504	338.845
	105.446	338.681	118.832	338.714	122.736	338.878	135.663	338.944	147.966	338.812
	154.199	338.845	163.747	339.042	169.915	339.14	172.08	339.075	176.837	338.911
	220.801	360.892								

Manning's n Values	num= 4							
	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
	-244.98	.08	-27.297	.04	29.134	.08	169.915	.06

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	-25.262	26.575		323.491	318.57	297.9		.1	.3
Ineffective Flow	num=		1						
	Sta L	Sta R	Elev	Permanent					
	71.194	90.879	351.05	T					

CROSS SECTION

RIVER: Mad River  
 REACH: Reach 1 RS: 714

INPUT

Description: FEMA STATION 5130, CROSS SECTION  
 Z

5130/Z/1

Station Elevation Data	num= 11									
	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
	200	356	250	340	280	337.5	302	337.9	317	328.2
	339	325	356	325.4	373	334.9	403	335.9	426.18	336.65
	461.541	354.33								

Manning's n Values	num= 3					
	Sta	n Val	Sta	n Val	Sta	n Val
	200	.08	302	.04	373	.08

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	302	373		53.9	53.9	53.9		.3	.5

SUMMARY OF MANNING' S N VALUES

Ri ver: Mad Ri ver

n8	Reach n9	Ri ver n10	Sta. n11	n1 n12	n2	n3	n4	n5	n6	n7
Reach 1		2409		.08	.04	.08				
Reach 1		2337		.04	.02	.04	.08	.04	.08	
.02	.08	.02	.04	.06						
Reach 1		2280		.04	.02	.04	.08	.04	.08	
.04	.02	.04	.02							
Reach 1		2238		.04	.02	.04	.08	.04	.08	
.04	.02	.04	.02							
Reach 1		2207		.04	.02	.04	.08	.04	.08	
.02										
Reach 1		2202		.02	.04	.08	.04	.08	.02	
.04										
Reach 1		2168		.04	.02	.04	.08	.04	.02	
.04										
Reach 1		2130		.04	.02	.04	.08	.04	.02	
.04										
Reach 1		2116		.04	.08	.04	.02	.04	.02	
Reach 1		2098.5		Culvert						
Reach 1		2079		.08	.04	.08	.04	.08	.02	
.04										
Reach 1		2067		.08	.08	.06	.04	.06	.08	
.04	.02	.04								
Reach 1		2020		.08	.04	.08	.04	.08		
Reach 1		2004		.08	.04	.08	.04			
Reach 1		1983		.08	.06	.04	.08	.04	.02	
Reach 1		1972		.08	.06	.04	.04	.02		
Reach 1		1962		.08	.04	.08	.02			
Reach 1		1938.5		Bridge						
Reach 1		1900		.02	.08	.04	.06	.08		
Reach 1		1871		.02	.08	.04	.08	.02		
Reach 1		1807.5		Bridge						
Reach 1		1748		.02	.04	.08	.04	.08	.02	
Reach 1		1727.5		Bridge						
Reach 1		1689		.08	.02	.08	.04	.08	.04	
.02										
Reach 1		1620		.02	.08	.04	.08	.04	.02	
.04	.06									
Reach 1		1573		.02	.08	.04	.08	.02	.04	
.06										
Reach 1		1561.5		Inl Struct						
Reach 1		1550		.02	.08	.04	.08			
Reach 1		1536		.02	.08	.04	.06	.08		
Reach 1		1523		.02	.08	.04	.08			
Reach 1		1487		.04	.08	.04	.08			
Reach 1		1425		.04	.08	.04	.08	.04		
Reach 1		1370		.02	.04	.08	.04	.08		
Reach 1		1330		.04	.08	.04	.08	.04	.06	
.02	.04	.06	.08	.04	.02					
Reach 1		1309		.04	.08	.04	.08	.04	.06	
.04	.02	.04	.08	.02						
Reach 1		1288.5		Bridge						
Reach 1		1277		.04	.02	.08	.04	.08	.04	
.08										
Reach 1		1214.5		Bridge						
Reach 1		1162		.08	.02	.08	.04	.02		
Reach 1		1153		.02	.08	.04	.02			
Reach 1		1107		.08	.04	.08	.04	.08	.04	
.08	.02									
Reach 1		1003		.08	.06	.04	.08	.04	.08	
.02										
Reach 1		894		.08	.04	.08	.06	.04	.06	
Reach 1		809		.08	.04	.08	.06			
Reach 1		714		.08	.04	.08				

SUMMARY OF REACH LENGTHS

Ri ver: Mad Ri ver

Reach	Ri ver Sta.	Left	Channel	Ri ght
Reach 1	2409	246. 719	235. 564	227. 69
Reach 1	2337	192. 913	186. 68	177. 822
Reach 1	2280	137. 795	138. 78	141. 076
Reach 1	2238	98. 425	101. 706	104. 987
Reach 1	2207	16. 404	16. 404	16. 404
Reach 1	2202	108. 268	111. 549	114. 829
Reach 1	2168	114. 829	124. 016	131. 234
Reach 1	2130	44. 291	45. 276	45. 932
Reach 1	2116	118. 11	120. 079	121. 391
Reach 1	2098. 5	Cul vert		
Reach 1	2079	36. 089	39. 37	42. 651
Reach 1	2067	144. 357	153. 215	164. 042
Reach 1	2020	55. 774	55. 774	55. 774
Reach 1	2004	75. 459	69. 226	62. 336
Reach 1	1983	39. 37	33. 793	27. 887
Reach 1	1972	33. 793	33. 793	33. 793
Reach 1	1962	164. 042	203. 084	262. 467
Reach 1	1938. 5	Bri dge		
Reach 1	1900	96. 457	96. 457	96. 457
Reach 1	1871	401. 575	401. 575	401. 575
Reach 1	1807. 5	Bri dge		
Reach 1	1748	186. 352	195. 21	205. 381
Reach 1	1727. 5	Bri dge		
Reach 1	1689	225. 394	226. 378	229. 659
Reach 1	1620	157. 48	154. 199	152. 559
Reach 1	1573	82. 021	75. 787	70. 538
Reach 1	1561. 5	Inl Struct		
Reach 1	1550	49. 869	49. 869	50. 197
Reach 1	1536	63. 648	57. 743	55. 774
Reach 1	1523	82. 021	107. 283	121. 391
Reach 1	1487	190. 289	205. 052	203. 412
Reach 1	1425	65. 617	183. 071	242. 782
Reach 1	1370	109. 908	144. 357	164. 042
Reach 1	1330	68. 898	68. 898	68. 898
Reach 1	1309	104. 987	104. 987	104. 987
Reach 1	1288. 5	Bri dge		
Reach 1	1277	375. 984	375. 984	375. 984
Reach 1	1214. 5	Bri dge		
Reach 1	1162	32. 808	30. 512	29. 528
Reach 1	1153	170. 604	150. 262	134. 514
Reach 1	1107	319. 554	340. 223	351. 706
Reach 1	1003	315. 617	375	407. 48
Reach 1	894	280. 84	263. 451	244. 094
Reach 1	809	323. 491	318. 57	297. 9
Reach 1	714	53. 9	53. 9	53. 9

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

Ri ver: Mad Ri ver

Reach	Ri ver Sta.	Contr.	Expan.
Reach 1	2409	. 3	. 5
Reach 1	2337	. 1	. 3
Reach 1	2280	. 1	. 3
Reach 1	2238	. 1	. 3
Reach 1	2207	. 1	. 3
Reach 1	2202	. 1	. 3
Reach 1	2168	. 1	. 3
Reach 1	2130	. 1	. 3
Reach 1	2116	. 3	. 5
Reach 1	2098. 5	Cul vert	
Reach 1	2079	. 3	. 5
Reach 1	2067	. 3	. 5
Reach 1	2020	. 3	. 5
Reach 1	2004	. 3	. 5
Reach 1	1983	. 3	. 5
Reach 1	1972	. 3	. 5
Reach 1	1962	. 3	. 5
Reach 1	1938. 5	Bri dge	

Reach 1	1900		.3	.5
Reach 1	1871		.3	.5
Reach 1	1807.5	Bridge		
Reach 1	1748		.3	.5
Reach 1	1727.5	Bridge		
Reach 1	1689		.3	.5
Reach 1	1620		.1	.3
Reach 1	1573		.3	.5
Reach 1	1561.5	Inl Struct		
Reach 1	1550		.3	.5
Reach 1	1536		.3	.5
Reach 1	1523		.1	.3
Reach 1	1487		.1	.3
Reach 1	1425		.1	.3
Reach 1	1370		.1	.3
Reach 1	1330		.1	.3
Reach 1	1309		.3	.5
Reach 1	1288.5	Bridge		
Reach 1	1277		.3	.5
Reach 1	1214.5	Bridge		
Reach 1	1162		.3	.5
Reach 1	1153		.1	.3
Reach 1	1107		.1	.3
Reach 1	1003		.1	.3
Reach 1	894		.1	.3
Reach 1	809		.1	.3
Reach 1	714		.3	.5

**Proposed Condition, FEMA Q - Floodway (Plan & Flow data only)**

HEC-RAS Version 4.1.0 Jan 2010  
 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      X
XXXXXXXX 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      X  XXXXXX   XXXX     X  X      X  X      XXXXX
    
```

**PROJECT DATA**

Project Title: Mad River, 151-273, Waterbury, English  
 Project File : 151273MR\_CLOMR.prj  
 Run Date and Time: 10/4/2013 3:51:12 PM

Project in English units

**Project Description:**

I-84 Reconstruction, Waterbury, Washington Ave. to Pierpont Rd., DOT Project 151-273, Mad River

All cross sections are looking upstream. Expand AND scroll through all description boxes to review complete annotations. Photographs are attached to the Existing Conditions Model.

Discharges are as reported in the 1979 Waterbury FIS.

Floodway encroachments for FEMA cross sections for the Existing Condition model were taken from the original FIS. Encroachment stations for new cross sections were estimated by scaling from the Floodway Maps, scale 1"=400'.

Recommend using "View Cross Sections" when comparing the EXISTING, NATURAL and PROPOSED conditions, instead of "Profile Plot". Due to the relocation of the brook, the overall channel length in the proposed condition differs from the existing. This makes comparing these different models in the Profile Plot impractical, which matches the downstream end adequately, but the upstream end would be off by the difference in the total channel length.

**PLAN DATA**

Plan Title: PROPOSED (match FIS), FEMA Q-FLOODWAY  
 Plan File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.p01

Geometry Title: PROPOSED (Ends Matching FEMA)  
 Geometry File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.g18

Flow Title : FEMA Q's Floodway  
 Flow File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.f02

**Plan Description:**

Includes runs for 100-year base, 100-year encroached (floodway), 10-year unencroached and 10-year encroached.

Plan Summary Information:  
 Number of: Cross Sections = 38 Multiple Openings = 0  
 Culverts = 1 Inline Structures = 1  
 Bridges = 5 Lateral Structures = 0

Computational Information  
 Water surface calculation tolerance = 0.01  
 Critical depth calculation tolerance = 0.01  
 Maximum number of iterations = 40  
 Maximum difference tolerance = 0.9843  
 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

Encroachment Data  
 Equal Conveyance = False  
 Left Offset = 0  
 Right Offset = 0

River	RS	Profile	Reach	Method	Reach 1 Value1	Value2
Mad River	2409	Floodway	1		596.3	641
	2337	Floodway	1		-48.56	43.31
	2280	Floodway	1		-41.01	47.57
	2238	Floodway	1		-48.13	47.57
	2207	Floodway	1		-41.43	27.92
	2202	Floodway	1		-35.57	28.09
	2168	Floodway	1		-32.02	24.19
	2130	Floodway	1		-34.71	29.51
	2116	Floodway	1		-35.44	29.38
	2079	Floodway	1		-43.61	33.44
	2067	Floodway	1		-101.7	35.1
	2020	Floodway	1		-134.45	83.55
	2004	Floodway	1		-134.49	86.01
	1983	Floodway	1		-111.56	49.04
	1972	Floodway	1		-75.46	41.22
	1962	Floodway	1		-58.08	39.41
	1900	Floodway	1		-39.59	59.16
	1871	Floodway	1		-38.6	39.05
	1748	Floodway	1		-38.68	38.68
	1689	Floodway	1		-40.49	40.52
	1620	Floodway	1		-54.17	73.81
	1573	Floodway	1		-58.81	41.12
	1550	Floodway	1		-58.56	41.44
	1536	Floodway	1		-56.43	43.64
	1523	Floodway	1		-57.33	42.06
	1487	Floodway	1		-53.9	54.52
	1425	Floodway	1		-52.75	52.25
	1370	Floodway	1		-85.2	44.2
	1330	Floodway	1		-61.98	85.3
	1309	Floodway	1		-59.48	85.3
	1277	Floodway	1		-50.69	80
	1162	Floodway	1		-33.2	26.23
	1153	Floodway	1		-27.5	28.5
	1107	Floodway	1		-43.09	38.37
	1003	Floodway	1		-36.81	32.65
	894	Floodway	1		-34.84	25.05
	809	Floodway	1		-25.84	27.47
	714	Floodway	1		306.1	373

River	RS	Profile	Reach	Method	Reach 1 Value1	Value2
Mad River	2409	10 Year	0		0	0
	2337	10 Year	0		0	0
	2280	10 Year	0		0	0
	2238	10 Year	0		0	0
	2207	10 Year	0		0	0
	2202	10 Year	0		0	0
	2168	10 Year	0		0	0
	2130	10 Year	0		0	0
	2116	10 Year	0		0	0
	2079	10 Year	0		0	0
	2067	10 Year	0		0	0

2020	10 Year	0	0	0
2004	10 Year	0	0	0
1983	10 Year	0	0	0
1972	10 Year	0	0	0
1962	10 Year	0	0	0
1900	10 Year	0	0	0
1871	10 Year	0	0	0
1748	10 Year	0	0	0
1689	10 Year	0	0	0
1620	10 Year	0	0	0
1573	10 Year	0	0	0
1550	10 Year	0	0	0
1536	10 Year	0	0	0
1523	10 Year	0	0	0
1487	10 Year	0	0	0
1425	10 Year	0	0	0
1370	10 Year	0	0	0
1330	10 Year	0	0	0
1309	10 Year	0	0	0
1277	10 Year	0	0	0
1162	10 Year	0	0	0
1153	10 Year	0	0	0
1107	10 Year	0	0	0
1003	10 Year	0	0	0
894	10 Year	0	0	0
809	10 Year	0	0	0
714	10 Year	0	0	0

Ri ver =	Mad Ri ver	Reach =	Reach 1	
RS	Profi le	Method	Val ue1	Val ue2
2409	10-Year Fl dwy	1	596.3	641
2337	10-Year Fl dwy	1	-48.56	43.31
2280	10-Year Fl dwy	1	-41.01	47.57
2238	10-Year Fl dwy	1	-48.13	47.57
2207	10-Year Fl dwy	1	-41.43	27.92
2202	10-Year Fl dwy	1	-35.57	28.09
2168	10-Year Fl dwy	1	-32.02	24.19
2130	10-Year Fl dwy	1	-34.71	29.51
2116	10-Year Fl dwy	1	-35.44	29.38
2079	10-Year Fl dwy	1	-43.61	33.44
2067	10-Year Fl dwy	1	-101.7	35.1
2020	10-Year Fl dwy	1	-134.45	83.55
2004	10-Year Fl dwy	1	-134.49	86.01
1983	10-Year Fl dwy	1	-111.56	49.04
1972	10-Year Fl dwy	1	-75.46	41.22
1962	10-Year Fl dwy	1	-58.08	39.41
1900	10-Year Fl dwy	1	-39.59	59.16
1871	10-Year Fl dwy	1	-38.6	39.05
1748	10-Year Fl dwy	1	-38.68	38.68
1689	10-Year Fl dwy	1	-40.49	40.52
1620	10-Year Fl dwy	1	-54.17	73.81
1573	10-Year Fl dwy	1	-58.81	41.12
1550	10-Year Fl dwy	1	-58.56	41.44
1536	10-Year Fl dwy	1	-56.43	43.64
1523	10-Year Fl dwy	1	-57.33	42.06
1487	10-Year Fl dwy	1	-53.9	54.52
1425	10-Year Fl dwy	1	-52.75	52.25
1370	10-Year Fl dwy	1	-85.2	44.2
1330	10-Year Fl dwy	1	-61.98	85.3
1309	10-Year Fl dwy	1	-59.48	85.3
1277	10-Year Fl dwy	1	-50.69	80
1162	10-Year Fl dwy	1	-33.2	26.23
1153	10-Year Fl dwy	1	-27.5	28.5
1107	10-Year Fl dwy	1	-43.09	38.37
1003	10-Year Fl dwy	1	-36.81	32.65
894	10-Year Fl dwy	1	-34.84	25.05
809	10-Year Fl dwy	1	-25.84	27.47
714	10-Year Fl dwy	1	306.1	373

FLOW DATA

Flow Title: FEMA O's Floodway  
Flow File : C:\Users\Won\Documents\151-273\Mad River\_CLOMR\_Rev03\151273MR\_CLOMR.f02

Flow Data (cfs)

River	Reach	RS	100 Year	Floodway	10 Year	10-Year
Mad River	Reach 1	2409	3190	3190	1505	
Mad River	Reach 1	2020	4990	4990	2350	

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mad River	Reach 1	100 Year	Known WS = 388.9	Known WS = 335.27
Mad River	Reach 1	Floodway	Known WS = 388.9	Known WS = 335.27
Mad River	Reach 1	10 Year	Known WS = 386.63	Known WS = 331.07
Mad River	Reach 1	10-Year Floodway	Known WS = 386.63	Known WS = 331.07



## Appendix B

### Appendix B - Output Printouts and Additional Plots

#### *Duplicate Effective Model:*

- "Standard Table 1" Output
- "Six XS Bridge" Output
- Water Surface Profiles (10-, 50-, 100- and 500-Year)

#### *Existing Condition Model - Regulatory Run*

- "Standard Table 1" Output
- "Six XS Bridge" Output
- Water Surface Profiles (10-, 25-, 50-, 100- and 500-Year)

#### *Existing Condition Model - Floodway Run*

- "Standard Table 1" Output (100-Year, 100-encroached, 10-Year and 10-encroached)
- "Encroachment 1" Output

#### *Proposed Condition Condition Model - Regulatory Run*

- "Standard Table 1" Output
- "Six XS Bridge" Output
- "Culvert Only" Output
- Water Surface Profiles (10-, 25-, 50-, 100- and 500-Year)

#### *Proposed Condition Model - Floodway Run*

- "Standard Table 1" Output (100-Year, 100-encroached, 10-Year and 10-encroached)
- "Encroachment 1" Output

#### *Cross Section Plots: 100-Year Base Flood Existing vs. Proposed Condition*

**MAD RIVER - DUPLICATE EFFECTIVE, FEMA DISCHARGE**  
**HEC-RAS 4.1.0 - "Standard Table 1" Output**

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1												
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 1	2409	10 Year	1505	382.8	386.62	386.62	388.33	0.016526	10.52	145.85	44.15	1
Reach 1	2409	50 Year	2595	382.8	388.15	388.15	390.51	0.014928	12.37	216.32	47.71	1
Reach 1	2409	100 Year	3190	382.8	388.9	388.9	391.53	0.01429	13.11	252.34	49.44	1
Reach 1	2409	Floodway	3190	382.8	388.93	388.93	391.63	0.016433	13.19	241.87	44.7	1
Reach 1	2409	500 Year	4970	382.8	391.71	391.71	394.16	0.008715	12.83	495.89	182.59	0.82
Reach 1	2238	10 Year	1505	374.3	378.28	377.9	379.2	0.01151	7.71	195.13	71.76	0.82
Reach 1	2238	50 Year	2595	374.3	380.99	379.07	381.57	0.003863	6.1	425.65	97.91	0.52
Reach 1	2238	100 Year	3190	374.3	381.23	379.6	382.01	0.005046	7.11	448.78	100.16	0.59
Reach 1	2238	Floodway	3190	374.3	382.31	379.6	382.83	0.002485	5.78	551.8	95.7	0.42
Reach 1	2238	500 Year	4970	374.3	383.2	380.95	384.06	0.003957	7.48	683.63	161.74	0.55
Reach 1	2116	10 Year	1505	369.2	377.06	373.41	377.47	0.001967	5.21	312.66	90.12	0.34
Reach 1	2116	50 Year	2595	369.2	380.48	374.96	380.77	0.001019	4.87	1074.29	621.74	0.26
Reach 1	2116	100 Year	3190	369.2	380.37	375.7	380.85	0.001659	6.17	1004.45	614.26	0.34
Reach 1	2116	Floodway	3190	369.2	381.88	375.7	382.2	0.000938	5.07	969.01	141.8	0.26
Reach 1	2116	500 Year	4970	369.2	383.16	378.68	383.33	0.000647	4.51	2982.2	799.6	0.22
Reach 1	2102	10 Year	1505	369.3	376.97	372.97	377.36	0.001871	5	300.79	40	0.32
Reach 1	2102	50 Year	2595	369.3	380.5	374.51	380.66	0.000681	3.88	1682.47	750.29	0.21
Reach 1	2102	100 Year	3190	369.3	380.41	375.26	380.67	0.001112	4.94	1609.35	744.42	0.26
Reach 1	2102	Floodway	3190	369.3	381.8	375.25	382.14	0.00103	5.15	915.09	133.8	0.26
Reach 1	2102	500 Year	4970	369.3	383.18	379.43	383.26	0.000403	3.45	3903.39	910.74	0.16
Reach 1	2095.5	Bridge										
Reach 1	2088	10 Year	1505	369.3	376.32	372.97	376.79	0.002445	5.47	274.96	40	0.37
Reach 1	2088	50 Year	2595	369.3	378.31	374.51	379.05	0.00302	7.06	479.49	263	0.42
Reach 1	2088	100 Year	3190	369.3	380.02	375.25	380.39	0.00153	5.65	1322.42	720.92	0.31
Reach 1	2088	Floodway	3190	369.3	379.75	375.25	380.68	0.003352	7.74	411.99	40	0.43
Reach 1	2088	500 Year	4970	369.3	383.14	379.43	383.22	0.000413	3.49	3863.68	908.12	0.17
Reach 1	2079	10 Year	1505	367.4	376.38	372.72	376.51	0.002048	2.95	514.07	235.79	0.34
Reach 1	2079	50 Year	2595	367.4	378.57	374.38	378.67	0.000634	2.52	1163.29	359.63	0.21
Reach 1	2079	100 Year	3190	367.4	380.14	375.82	380.21	0.000323	2.19	1802.63	450	0.16
Reach 1	2079	Floodway	3190	367.4	380.13	375.83	380.22	0.000396	2.38	1339.35	222	0.17
Reach 1	2079	500 Year	4970	367.4	383.13	376.56	383.19	0.000169	2.08	3151.38	450	0.12
Reach 1	2020	10 Year	2350	366.1	376.43	368.36	376.44	0.00002	0.68	3465.59	436.98	0.04
Reach 1	2020	50 Year	4060	366.1	378.6	368.95	378.62	0.000028	0.92	4456.12	475.33	0.05
Reach 1	2020	100 Year	4990	366.1	380.15	369.22	380.17	0.000026	0.98	5214.76	500	0.05
Reach 1	2020	Floodway	4990	366.1	380.15	369.22	380.17	0.000027	0.99	5037.89	424	0.05
Reach 1	2020	500 Year	7775	366.1	383.14	369.92	383.17	0.000029	1.21	6708.64	500	0.06
Reach 1	1970	10 Year	2350	365.8	375.72	371.89	376.26	0.002328	5.94	395.77	50	0.37
Reach 1	1970	50 Year	4060	365.8	377.04	373.69	378.25	0.004368	8.78	462.17	50	0.51
Reach 1	1970	100 Year	4990	365.8	378.35	374.56	379.75	0.004465	9.46	527.48	50	0.51
Reach 1	1970	Floodway	4990	365.8	378.35	374.55	379.74	0.004468	9.46	527.37	50	0.51
Reach 1	1970	500 Year	7775	365.8	379.71	376.88	382.36	0.007608	13.06	595.49	50	0.67
Reach 1	1953.5	Bridge										
Reach 1	1936	10 Year	2350	365.8	374.57	371.89	375.32	0.003739	6.94	338.47	50	0.47
Reach 1	1936	50 Year	4060	365.8	375.28	373.69	377.11	0.008228	10.85	374.2	50	0.7
Reach 1	1936	100 Year	4990	365.8	375.27	374.56	378.04	0.012502	13.36	373.48	50	0.86
Reach 1	1936	Floodway	4990	365.8	375.27	374.56	378.04	0.012511	13.36	373.4	50	0.86
Reach 1	1936	500 Year	7775	365.8	376.88	376.88	381.43	0.016875	17.12	454.15	50	1
Reach 1	1858	10 Year	2350	365.6	374.76	368.92	374.81	0.000201	1.92	1229.36	177.05	0.13
Reach 1	1858	50 Year	4060	365.6	375.82	369.94	375.95	0.00038	2.87	1420.52	181.52	0.18
Reach 1	1858	100 Year	4990	365.6	376.14	370.38	376.32	0.000507	3.4	1479.13	182.87	0.21
Reach 1	1858	Floodway	4990	365.6	376.14	370.38	376.32	0.000507	3.4	1478.88	182.86	0.21
Reach 1	1858	500 Year	7775	365.6	376.9	371.53	377.26	0.000932	4.85	1618.04	186.03	0.28
Reach 1	1689	10 Year	2350	361	374.78	362.96	374.78	0.000012	0.61	3889.82	381.98	0.03
Reach 1	1689	50 Year	4060	361	375.87	363.67	375.88	0.000026	0.95	4309.83	386.9	0.05
Reach 1	1689	100 Year	4990	361	376.21	364.01	376.23	0.000035	1.13	4441.88	388.43	0.06
Reach 1	1689	Floodway	4990	361	376.21	364.01	376.23	0.000035	1.13	4441.36	388.43	0.06

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1													
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
Reach 1	1689	500 Year	7775	361	377.03	364.91	377.08	0.000068	1.64	4763.68	392.15		0.08
Reach 1	1573	10 Year	2350	355.9	374.77	360.72	374.78	0.000022	0.94	4014.96	444.25		0.05
Reach 1	1573	50 Year	4060	355.9	375.85	361.96	375.87	0.000048	1.47	4522.38	493.42		0.07
Reach 1	1573	100 Year	4990	355.9	376.18	362.47	376.21	0.000066	1.76	4688.04	500.45		0.08
Reach 1	1573	Floodway	4990	355.9	376.18	362.47	376.21	0.000066	1.76	4687.38	500.44		0.08
Reach 1	1573	500 Year	7775	355.9	376.97	363.64	377.04	0.000131	2.56	5086.71	502.44		0.11
Reach 1	1561.5		Bridge										
Reach 1	1550	10 Year	2350	352	357.39	354.57	357.69	0.001667	4.36	539.33	100		0.33
Reach 1	1550	50 Year	4060	352	358.96	355.7	359.49	0.00221	5.83	695.82	100		0.39
Reach 1	1550	100 Year	4990	352	359.61	356.25	360.28	0.00251	6.55	761.43	100		0.42
Reach 1	1550	Floodway	4990	352	359.91	356.26	360.53	0.002226	6.31	790.9	100		0.4
Reach 1	1550	500 Year	7775	352	361.06	357.71	362.2	0.003533	8.59	905.63	100		0.5
Reach 1	1523	10 Year	2350	350.8	356.76	354.98	357.29	0.003604	5.83	410.13	114.61		0.49
Reach 1	1523	50 Year	4060	350.8	358.11	356.32	358.96	0.004406	7.5	593.57	157.63		0.57
Reach 1	1523	100 Year	4990	350.8	358.69	356.97	359.7	0.004739	8.21	691.13	177.83		0.6
Reach 1	1523	Floodway	4990	350.8	358.95	356.91	359.97	0.004556	8.12	614.53	100.1		0.58
Reach 1	1523	500 Year	7775	350.8	359.23	358.68	361.21	0.008536	11.54	793.25	197.43		0.81
Reach 1	1370	10 Year	2350	347.6	352.58	352.58	353.87	0.016305	9.16	266.74	125.88		0.97
Reach 1	1370	50 Year	4060	347.6	353.88	353.88	355.42	0.012796	10.21	477.68	197.13		0.91
Reach 1	1370	100 Year	4990	347.6	354.41	354.41	356.08	0.012246	10.77	588.74	225.27		0.9
Reach 1	1370	Floodway	4990	347.6	354.94	354.32	356.62	0.010302	10.41	479.26	96.8		0.82
Reach 1	1370	500 Year	7775	347.6	356.87	355.84	357.86	0.004787	8.99	1397.55	393.01		0.61
Reach 1	1277	10 Year	2350	342.3	350.64	347.06	350.86	0.001149	3.76	653.81	174.18		0.29
Reach 1	1277	50 Year	4060	342.3	353.07	348.44	353.32	0.000864	4.19	1217.57	266.02		0.26
Reach 1	1277	100 Year	4990	342.3	353.83	349.07	354.13	0.000905	4.56	1425.05	277.47		0.28
Reach 1	1277	Floodway	4990	342.3	355.37	349.05	355.65	0.000715	4.27	1169.49	116		0.24
Reach 1	1277	500 Year	7775	342.3	356.93	350.59	357.23	0.000649	4.75	2358.56	326.31		0.25
Reach 1	1262	10 Year	2350	341.8	350.15	347.07	350.74	0.002828	6.13	383.11	66.28		0.45
Reach 1	1262	50 Year	4060	341.8	352.41	349	353.2	0.002847	7.23	684.45	262.03		0.47
Reach 1	1262	100 Year	4990	341.8	353.12	349.93	354	0.002888	7.75	873.86	265.62		0.48
Reach 1	1262	Floodway	4990	341.8	355.23	349.94	355.6	0.001029	5.4	1428.95	264		0.3
Reach 1	1262	500 Year	7775	341.8	356.57	352.97	357.15	0.001436	6.93	1818.41	281.14		0.36
Reach 1	1260.5		Bridge										
Reach 1	1259	10 Year	2350	341.8	348.79	347.05	349.75	0.005347	7.87	298.75	57.34		0.61
Reach 1	1259	50 Year	4060	341.8	351.46	348.99	352.59	0.00473	8.53	483.12	108.5		0.59
Reach 1	1259	100 Year	4990	341.8	352.62	349.93	353.71	0.003812	8.53	740.84	263.11		0.55
Reach 1	1259	Floodway	4990	341.8	352.42	349.93	353.8	0.004608	9.42	530	64.8		0.58
Reach 1	1259	500 Year	7775	341.8	356.31	352.97	356.94	0.00159	7.18	1745	280.62		0.38
Reach 1	1246	10 Year	2350	340.8	349.02	345.49	349.32	0.001463	4.41	560.63	131.17		0.32
Reach 1	1246	50 Year	4060	340.8	351.77	347.07	352.12	0.001075	4.87	1022.33	204.49		0.3
Reach 1	1246	100 Year	4990	340.8	352.91	347.72	353.28	0.000993	5.09	1264.29	217.45		0.29
Reach 1	1246	Floodway	4990	340.8	352.77	347.71	353.27	0.001413	5.69	876.8	93		0.33
Reach 1	1246	500 Year	7775	340.8	356.4	349.5	356.77	0.000707	5.28	2068.79	242.55		0.26
Reach 1	1219	10 Year	2350	340.4	348.28	345.81	349	0.003563	6.77	346.93	61.56		0.5
Reach 1	1219	50 Year	4060	340.4	350.81	347.7	351.77	0.003528	7.88	515.09	71.67		0.52
Reach 1	1219	100 Year	4990	340.4	351.77	348.57	352.89	0.003741	8.52	585.45	75.5		0.54
Reach 1	1219	Floodway	4990	340.4	351.75	348.57	352.88	0.003683	8.56	583.19	72.8		0.53
Reach 1	1219	500 Year	7775	340.4	355.11	350.76	356.38	0.003163	9.04	860.12	88.88		0.51
Reach 1	1198.5		Bridge										
Reach 1	1177	10 Year	2350	340.4	347.99	345.81	348.78	0.004131	7.14	329.18	60.39		0.54
Reach 1	1177	50 Year	4060	340.4	350.44	347.7	351.51	0.004072	8.3	489.16	70.2		0.55
Reach 1	1177	100 Year	4990	340.4	351.31	348.57	352.58	0.004407	9.04	551.74	73.69		0.58
Reach 1	1177	Floodway	4990	340.4	351.3	348.56	352.57	0.004371	9.07	550.21	72.1		0.58
Reach 1	1177	500 Year	7775	340.4	352.18	350.76	354.64	0.007869	12.61	616.76	77.14		0.79
Reach 1	1153	10 Year	2350	338.8	347.07	345.46	348.26	0.00624	8.75	268.56	48.51		0.65
Reach 1	1153	50 Year	4060	338.8	349.06	347.59	350.88	0.006551	10.92	424.04	136.28		0.7
Reach 1	1153	100 Year	4990	338.8	349.73	348.94	351.88	0.007045	12	531.78	182.8		0.74
Reach 1	1153	Floodway	4990	338.8	349.85	349.12	351.9	0.007112	11.75	517.29	122		0.72

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1												
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
Reach 1	1153	500 Year	7775	338.8	351.68	351.68	354	0.00646	13.26	1019.19	317.12	0.74
Reach 1	894	10 Year	2350	331.8	338.23	338.17	340.33	0.014975	11.65	201.64	46.59	0.99
Reach 1	894	50 Year	4060	331.8	340.49	340.49	342.76	0.015006	12.09	336.49	79.5	1
Reach 1	894	100 Year	4990	331.8	341.37	341.37	343.7	0.013857	12.27	417.8	110.14	0.98
Reach 1	894	Floodway	4990	331.8	341.38	341.38	343.7	0.013763	12.24	418.87	110.69	0.98
Reach 1	894	500 Year	7775	331.8	343.93	343.93	345.65	0.006536	11.16	1131.91	525.2	0.72
Reach 1	714	10 Year	2350	325	331.07	330.57	332.65	0.011012	10.07	233.26	53.58	0.85
Reach 1	714	50 Year	4060	325	333.89	332.44	335.51	0.007047	10.21	397.64	62.99	0.72
Reach 1	714	100 Year	4990	325	335.27	333.3	336.9	0.005891	10.23	489.67	78.03	0.67
Reach 1	714	Floodway	4990	325	335.27	333.3	336.9	0.005932	10.23	487.62	66.9	0.67
Reach 1	714	500 Year	7775	325	336.73	335.53	339.37	0.007935	13.11	637.56	124.9	0.79

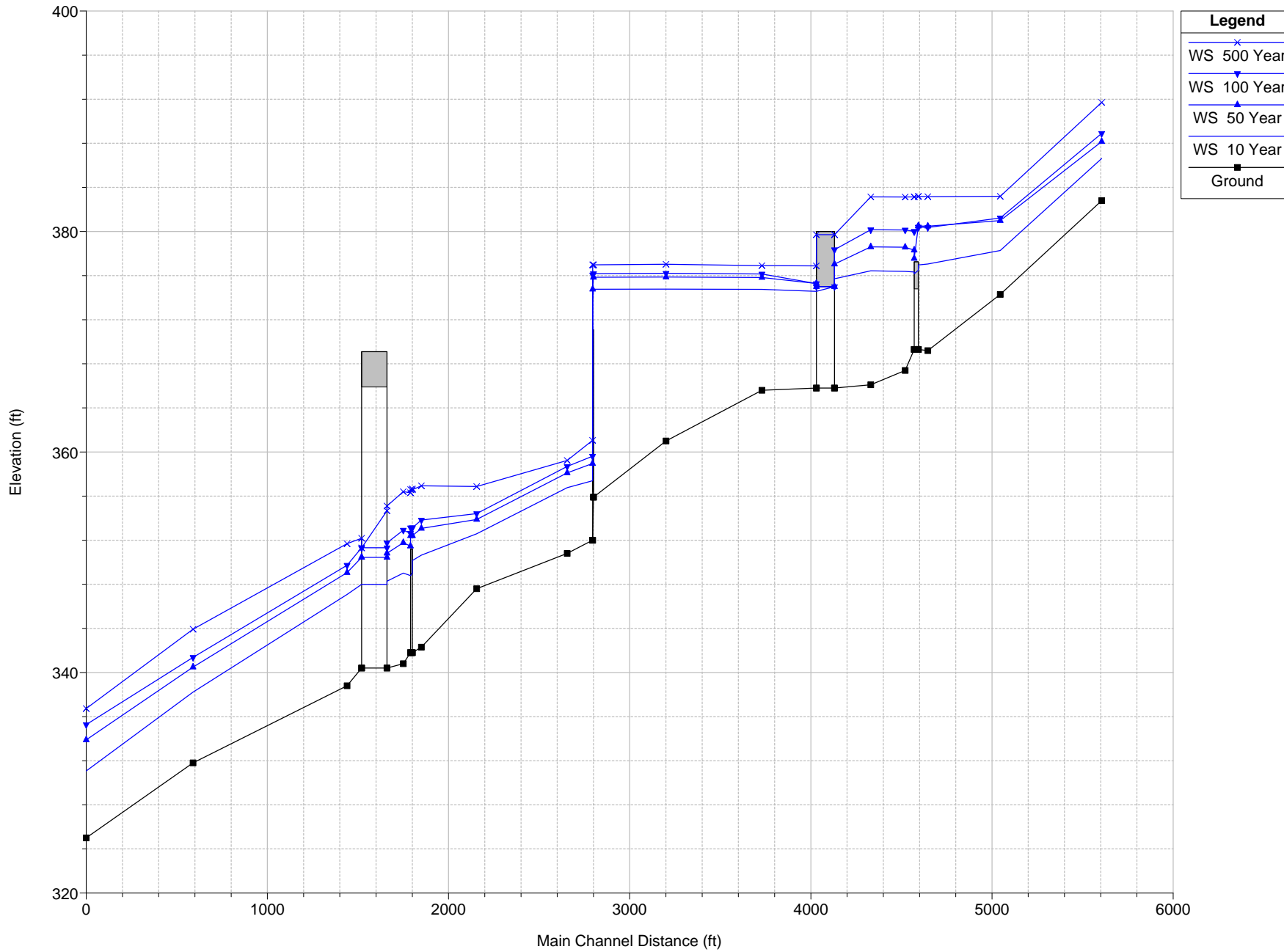
**MAD RIVER - DUPLICATE EFFECTIVE, FEMA DISCHARGE**  
**HEC-RAS 4.1.0 - "Six XS Bridge" Output**

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	2116	10 Year	377.47	377.06	373.41	0.1	0.01	90.12	1.48	1490.8	12.72	5.21
Reach 1	2116	50 Year	380.77	380.48	374.96	0.04	0.07	621.74	92.11	2059.15	443.74	4.87
Reach 1	2116	100 Year	380.85	380.37	375.7	0.07	0.11	614.26	82	2581.19	526.81	6.17
Reach 1	2116	Floodway	382.2	381.88	375.7	0.05	0.01	141.8	67.69	2430.95	691.36	5.07
Reach 1	2116	500 Year	383.33	383.16	378.68	0.03	0.04	799.6	1377	2392.79	1200	4.51
Reach 1	2102	10 Year	377.36	376.97	372.97	0	0.11	40		1505		5
Reach 1	2102	50 Year	380.66	380.5	374.51	0	0	750.29	483.5	1717.47	394.04	3.88
Reach 1	2102	100 Year	380.67	380.41	375.26	0	0.01	744.42	558.3	2163.34	468.37	4.94
Reach 1	2102	Floodway	382.14	381.8	375.25	0	0.01	133.8	111.6	2542.15	536.26	5.15
Reach 1	2102	500 Year	383.26	383.18	379.43	0	0	910.74	1886	1896.21	1188.3	3.45
Reach 1	2095.5 BR U	10 Year	377.24	376.48	372.97	0.3	0			1505		7.03
Reach 1	2095.5 BR U	50 Year	380.66	380.49	374.53	0.22	0.63	453.81	299	1362.19	933.81	4.21
Reach 1	2095.5 BR U	100 Year	380.66	380.37	379.16	0.2	0.04	442.1	344.5	1733.76	1111.8	5.43
Reach 1	2095.5 BR U	Floodway	382.13	381.81	379.04	0.26	0.56	133.8	200.5	1941.58	1048	5.16
Reach 1	2095.5 BR U	500 Year	383.26	383.18	380.08	0.04	0	721.05	1241	1366.57	2362.4	3.17
Reach 1	2095.5 BR D	10 Year	376.94	376.17	372.97	0	0.15			1505		7.03
Reach 1	2095.5 BR D	50 Year	379.81	377.55	374.53	0	0.76	58.68		2586.07	8.93	12.09
Reach 1	2095.5 BR D	100 Year	380.42	379.99	379.16	0	0.03	403.84	268.3	1946.99	974.67	6.41
Reach 1	2095.5 BR D	Floodway	381.31	379.13	374.81	0	0.62	40		3190		11.85
Reach 1	2095.5 BR D	500 Year	383.22	383.14	380.08	0	0	717.07	1233	1377.29	2359.5	3.2
Reach 1	2088	10 Year	376.79	376.32	372.97	0.11	0.17	40		1505		5.47
Reach 1	2088	50 Year	379.05	378.31	374.51	0.06	0.33	263	17.45	2500.71	76.85	7.06
Reach 1	2088	100 Year	380.39	380.02	375.25	0.03	0.15	720.92	404.3	2387.94	397.76	5.65
Reach 1	2088	Floodway	380.68	379.75	375.25	0.04	0.42	40		3190		7.74
Reach 1	2088	500 Year	383.22	383.14	379.43	0.01	0.01	908.12	1876	1909.93	1183.6	3.49
Reach 1	2079	10 Year	376.51	376.38	372.72	0.01	0.06	235.79	0.98	1504.02		2.95
Reach 1	2079	50 Year	378.67	378.57	374.38	0.01	0.04	359.63	91.57	2502.59	0.84	2.52
Reach 1	2079	100 Year	380.21	380.14	375.82	0.01	0.03	450	236.5	2940.9	12.62	2.19
Reach 1	2079	Floodway	380.22	380.13	375.83	0.01	0.04	222		3190		2.38
Reach 1	2079	500 Year	383.19	383.13	376.56	0.01	0.02	450	731.2	4170.02	68.8	2.08
Reach 1	2020	10 Year	376.44	376.43	368.36	0.01	0.16	436.98	0.03	2349.69	0.28	0.68
Reach 1	2020	50 Year	378.62	378.6	368.95	0.02	0.36	475.33	3.93	4050.4	5.67	0.92
Reach 1	2020	100 Year	380.17	380.15	369.22	0.02	0.41	500	13.55	4960.83	15.63	0.98
Reach 1	2020	Floodway	380.17	380.15	369.22	0.02	0.41	424		4990		0.99
Reach 1	2020	500 Year	383.17	383.14	369.92	0.02	0.79	500	58.48	7658.22	58.3	1.21
Reach 1	1970	10 Year	376.26	375.72	371.89			50		2350		5.94
Reach 1	1970	50 Year	378.25	377.04	373.69			50		4060		8.78
Reach 1	1970	100 Year	379.75	378.35	374.56			50		4990		9.46
Reach 1	1970	Floodway	379.74	378.35	374.55			50		4990		9.46
Reach 1	1970	500 Year	382.36	379.71	376.88			50		7775		13.06
Reach 1	1953.5 BR U	10 Year	376.26	375	371.9			49.99		2350		6.53
Reach 1	1953.5 BR U	50 Year	378.24	375	373.7			49.99		4060		11.28
Reach 1	1953.5 BR U	100 Year	379.74	375	374.57			49.99		4990		13.86
Reach 1	1953.5 BR U	Floodway	379.74	375	374.57			49.99		4990		13.86
Reach 1	1953.5 BR U	500 Year	382.36	379.71	382.53				784.7	6024.88	961.79	12.61
Reach 1	1953.5 BR D	10 Year	375.32	374.57	371.9			49.99		2350		6.94
Reach 1	1953.5 BR D	50 Year	377.11	375	373.7			49.99		4060		11.28
Reach 1	1953.5 BR D	100 Year	378.04	375	374.57			49.99		4990		13.86
Reach 1	1953.5 BR D	Floodway	378.04	375	374.57			49.99		4990		13.86
Reach 1	1953.5 BR D	500 Year	382.36	379.71	382.53				784.7	6024.88	961.79	12.61
Reach 1	1936	10 Year	375.32	374.57	371.89	0.16	0.35	50		2350		6.94
Reach 1	1936	50 Year	377.11	375.28	373.69	0.31	0.85	50		4060		10.85
Reach 1	1936	100 Year	378.04	375.27	374.56	0.42	1.3	50		4990		13.36
Reach 1	1936	Floodway	378.04	375.27	374.56	0.42	1.3	50		4990		13.36
Reach 1	1936	500 Year	381.43	376.88	376.88	0.73	2.09	50		7775		17.12
Reach 1	1858	10 Year	374.81	374.76	368.92	0.02	0.02	177.05	0.85	2349.15		1.92
Reach 1	1858	50 Year	375.95	375.82	369.94	0.03	0.03	181.52	3.95	4056.05		2.87
Reach 1	1858	100 Year	376.32	376.14	370.38	0.05	0.05	182.87	6.02	4983.98		3.4

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	1858	Floodway	376.32	376.14	370.38	0.05	0.05	182.86	6.01	4983.99		3.4
Reach 1	1858	500 Year	377.26	376.9	371.53	0.09	0.1	186.03	14.24	7760.77		4.85
Reach 1	1689	10 Year	374.78	374.78	362.96	0.01	0	381.98	0.88	2349.12		0.61
Reach 1	1689	50 Year	375.88	375.87	363.67	0.01	0	386.9	2.97	4057.03		0.95
Reach 1	1689	100 Year	376.23	376.21	364.01	0.02	0	388.43	4.31	4985.69		1.13
Reach 1	1689	Floodway	376.23	376.21	364.01	0.02	0	388.43	4.3	4985.7		1.13
Reach 1	1689	500 Year	377.08	377.03	364.91	0.04	0	392.15	9.49	7765.51		1.64
Reach 1	1573	10 Year	374.78	374.77	360.72			444.25	1075	1257.32	17.6	0.94
Reach 1	1573	50 Year	375.87	375.85	361.96			493.42	1859	2137.81	63.35	1.47
Reach 1	1573	100 Year	376.21	376.18	362.47			500.45	2284	2610.34	95.2	1.76
Reach 1	1573	Floodway	376.21	376.18	362.47			500.44	2284	2610.41	95.13	1.76
Reach 1	1573	500 Year	377.04	376.97	363.64			502.44	3551	4000.53	223.58	2.56
Reach 1	1561.5 BR U	10 Year	374.78	374.77	373.67			108.31	45.11	2301.21	0.22	6.24
Reach 1	1561.5 BR U	50 Year	375.87	375.85	374.81			487.42	437.6	3377.63	247.76	7.07
Reach 1	1561.5 BR U	100 Year	376.21	376.18	376.09			494.45	773.8	3740.96	480.94	7.31
Reach 1	1561.5 BR U	Floodway	376.21	376.18	376.08			492.31	772	3739.12	477.54	7.3
Reach 1	1561.5 BR U	500 Year	377.04	376.97	376.98			502.44	1839	4673.38	1253.3	7.86
Reach 1	1561.5 BR D	10 Year	374.78	373.6	354.58			100		2346.31	0.22	2.91
Reach 1	1561.5 BR D	50 Year	375.87	374.76	355.72			107.93	393.1	3422.12	247.76	3.73
Reach 1	1561.5 BR D	100 Year	376.21	376.07	356.27			514.17	729.7	3785.03	480.94	3.98
Reach 1	1561.5 BR D	Floodway	376.21	375.3	356.27			100	728.3	3782.8	477.54	3.98
Reach 1	1561.5 BR D	500 Year	377.04	376.97	372.43			522.44	1796	4716.63	1253.3	4.56
Reach 1	1550	10 Year	357.69	357.39	354.57	0.33	0.07	100		2350		4.36
Reach 1	1550	50 Year	359.49	358.96	355.7	0.42	0.1	100		4060		5.83
Reach 1	1550	100 Year	360.28	359.61	356.25	0.47	0.1	100		4990		6.55
Reach 1	1550	Floodway	360.53	359.91	356.26	0.43	0.12	100		4990		6.31
Reach 1	1550	500 Year	362.2	361.06	357.71	0.73	0.25	100		7775		8.59
Reach 1	1523	10 Year	357.29	356.76	354.98	3.33	0.08	114.61	4.77	2345.23		5.83
Reach 1	1523	50 Year	358.96	358.11	356.32	3.47	0.07	157.63	80.1	3979.9		7.5
Reach 1	1523	100 Year	359.7	358.69	356.97	3.56	0.07	177.83	157.9	4832.13		8.21
Reach 1	1523	Floodway	359.97	358.95	356.91	3.29	0.07	100.1		4990		8.12
Reach 1	1523	500 Year	361.21	359.23	358.68	3.06	0.3	197.43	346.8	7428.16		11.54
Reach 1	1277	10 Year	350.86	350.64	347.06	0.09	0.04	174.18	0.61	2335.29	14.1	3.76
Reach 1	1277	50 Year	353.32	353.07	348.44	0.07	0.05	266.02	50.92	3776.74	232.34	4.19
Reach 1	1277	100 Year	354.13	353.83	349.07	0.07	0.06	277.47	90.22	4519.86	379.92	4.56
Reach 1	1277	Floodway	355.65	355.37	349.05	0.04	0.01	116		4990		4.27
Reach 1	1277	500 Year	357.23	356.93	350.59	0.05	0.03	326.31	280.5	6411.13	1083.3	4.75
Reach 1	1262	10 Year	350.74	350.15	347.07			66.28		2350		6.13
Reach 1	1262	50 Year	353.2	352.41	349			262.03	53.18	3944.51	62.31	7.23
Reach 1	1262	100 Year	354	353.12	349.93			265.62	131.9	4638.92	219.14	7.75
Reach 1	1262	Floodway	355.6	355.23	349.94			264	293.2	4071.66	625.14	5.4
Reach 1	1262	500 Year	357.15	356.57	352.97	0	0.09	281.14	564	5910.18	1300.8	6.93
Reach 1	1260.5 BR U	10 Year	350.74	349	347.06			58.72		2350		7.56
Reach 1	1260.5 BR U	50 Year	353.2	352.41	352.69			262.03	366.9	3052.54	638.71	7.29
Reach 1	1260.5 BR U	100 Year	353.99	353.12	353.08			265.62	638	3093.91	1251.5	6.47
Reach 1	1260.5 BR U	Floodway	355.6	355.23	353.21			264		4989.42		8.36
Reach 1	1260.5 BR U	500 Year	357.06	356.66	353.97	0.05	0	281.32	1114	4081.34	2579.9	6.04
Reach 1	1260.5 BR D	10 Year	349.75	348.79	347.07			57.33		2350		7.87
Reach 1	1260.5 BR D	50 Year	353.2	352.41	352.7			262.03	366.9	3052.54	638.71	7.29
Reach 1	1260.5 BR D	100 Year	353.99	353.12	353.09			265.62	638	3093.91	1251.5	6.47
Reach 1	1260.5 BR D	Floodway	355.52	354.16	352.67			64.8		4989.42		8.93
Reach 1	1260.5 BR D	500 Year	357.01	356.59	353.97	0	0.07	281.19	1110	4101.78	2563.1	6.12
Reach 1	1259	10 Year	349.75	348.79	347.05	0.1	0.33	57.34		2350		7.87
Reach 1	1259	50 Year	352.59	351.46	348.99	0.08	0.39	108.5	3.69	4056.31		8.53
Reach 1	1259	100 Year	353.71	352.62	349.93	0.07	0.36	263.11	85.18	4788.32	116.5	8.53
Reach 1	1259	Floodway	353.8	352.42	349.93	0.09	0.44	64.8		4990		9.42
Reach 1	1259	500 Year	356.94	356.31	352.97	0.04	0.13	280.62	545.9	5987.17	1242	7.18
Reach 1	1246	10 Year	349.32	349.02	345.49	0.2	0.12	131.17		2330.36	19.64	4.41
Reach 1	1246	50 Year	352.12	351.77	347.07	0.16	0.19	204.49	2.84	3818.39	238.77	4.87

HEC-RAS Plan: FEMA, FEMA Q River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach 1	1246	100 Year	353.28	352.91	347.72	0.16	0.23	217.45	9.19	4530.9	449.91	5.09
Reach 1	1246	Floodway	353.27	352.77	347.71	0.19	0.19	93		4990		5.69
Reach 1	1246	500 Year	356.77	356.4	349.5	0.12	0.27	242.55	57.66	6416.92	1300.4	5.28
Reach 1	1219	10 Year	349	348.28	345.81			61.56		2350		6.77
Reach 1	1219	50 Year	351.77	350.81	347.7			71.67		4060		7.88
Reach 1	1219	100 Year	352.89	351.77	348.57			75.5		4990		8.52
Reach 1	1219	Floodway	352.88	351.75	348.57			72.8		4990		8.56
Reach 1	1219	500 Year	356.38	355.11	350.76			88.88		7775		9.04
Reach 1	1198.5 BR U	10 Year	348.95	347.99	346.19			56.39		2350		7.85
Reach 1	1198.5 BR U	50 Year	351.71	350.44	348.14			66.2		4060		9.03
Reach 1	1198.5 BR U	100 Year	352.81	351.31	349.03			69.69		4990		9.81
Reach 1	1198.5 BR U	Floodway	352.8	351.3	349.03			68.8		4990		9.84
Reach 1	1198.5 BR U	500 Year	356.27	354.66	351.31			83.11		7775		10.17
Reach 1	1198.5 BR D	10 Year	348.95	347.99	346.18			56.39		2350		7.85
Reach 1	1198.5 BR D	50 Year	351.71	350.44	348.15			66.2		4060		9.03
Reach 1	1198.5 BR D	100 Year	352.81	351.31	349.04			69.69		4990		9.81
Reach 1	1198.5 BR D	Floodway	352.8	351.3	349.02			68.1		4990		9.84
Reach 1	1198.5 BR D	500 Year	354.94	351.3	351.3			69.63		7775		15.32
Reach 1	1177	10 Year	348.78	347.99	345.81	0.4	0.12	60.39		2350		7.14
Reach 1	1177	50 Year	351.51	350.44	347.7	0.41	0.23	70.2		4060		8.3
Reach 1	1177	100 Year	352.58	351.31	348.57	0.44	0.26	73.69		4990		9.04
Reach 1	1177	Floodway	352.57	351.3	348.56	0.44	0.23	72.1		4990		9.07
Reach 1	1177	500 Year	354.64	352.18	350.76	0.57	0.08	77.14		7775		12.61
Reach 1	1153	10 Year	348.26	347.07	345.46	7.84	0.09	48.51		2350	0	8.75
Reach 1	1153	50 Year	350.88	349.06	347.59	8.08	0.04	136.28	62.98	3993.11	3.91	10.92
Reach 1	1153	100 Year	351.88	349.73	348.94	8.16	0.02	182.8	197.1	4784.26	8.64	12
Reach 1	1153	Floodway	351.9	349.85	349.12	8.18	0.03	122	233.4	4756.6		11.75
Reach 1	1153	500 Year	354	351.68	351.68	5.52	0.18	317.12	1187	6553.41	34.76	13.26

Mad River, Duplicate Effective, English Plan: FEMA Analysis, FEMA Q's





**MAD RIVER - EXISTING CONDITION, REGULATORY**

**HEC-RAS 4.1.0 - "Standard Table 1" Output**

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
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 1	2409	10 Year	1505	382.8	386.63	386.63	388.33	0.016419	10.5	146.16	44.16	1
Reach 1	2409	25 Year (est)	2105	382.8	387.52	387.52	389.59	0.01531	11.58	186.54	46.24	0.99
Reach 1	2409	50 Year	2595	382.8	388.16	388.16	390.51	0.01482	12.34	216.85	47.74	1
Reach 1	2409	100 Year	3190	382.8	388.91	388.91	391.53	0.014135	13.06	253.28	49.48	0.99
Reach 1	2409	500 Year	4970	382.8	391.68	391.68	394.16	0.008831	12.9	490.96	180.25	0.82
Reach 1	2337	10 Year	1505	377.2	381.32	381.32	382.76	0.016994	9.64	156.1	54.04	1
Reach 1	2337	25 Year (est)	2105	377.2	382.17	382.17	383.78	0.015043	10.21	211.07	76.92	0.97
Reach 1	2337	50 Year	2595	377.2	382.71	382.71	384.48	0.013682	10.74	254.8	83.13	0.95
Reach 1	2337	100 Year	3190	377.2	383.29	383.29	385.24	0.012825	11.37	304.52	89.65	0.94
Reach 1	2337	500 Year	4970	377.2	384.71	384.71	387.19	0.011688	13.01	443.58	106.4	0.94
Reach 1	2280	10 Year	1505	374.21	379.19	378.58	380.26	0.00925	8.28	181.87	53.56	0.79
Reach 1	2280	25 Year (est)	2105	374.21	380.26	379.47	381.43	0.00817	8.69	245.45	69.74	0.75
Reach 1	2280	50 Year	2595	374.21	380.87	380.05	382.2	0.008206	9.3	292	82.94	0.75
Reach 1	2280	100 Year	3190	374.21	381.44	380.71	383	0.008626	10.11	343.53	95.08	0.77
Reach 1	2280	500 Year	4970	374.21	382.46	382.44	384.95	0.011695	12.92	449.77	114.09	0.9
Reach 1	2238	10 Year	1505	373.56	378.59	376.99	379.1	0.005692	5.7	264.16	70.67	0.52
Reach 1	2238	25 Year (est)	2105	373.56	379.77	377.7	380.33	0.005437	5.96	353.59	79.88	0.49
Reach 1	2238	50 Year	2595	373.56	380.47	378.28	381.1	0.005143	6.37	410.66	84.24	0.49
Reach 1	2238	100 Year	3190	373.56	381.06	378.87	381.83	0.005415	7.02	461.97	107	0.51
Reach 1	2238	500 Year	4970	373.56	382.36	380.27	383.37	0.005767	8.28	643.31	170.83	0.55
Reach 1	2207	10 Year	1505	372.7	377.95	376.2	378.5	0.005868	5.99	251.65	61.45	0.51
Reach 1	2207	25 Year (est)	2105	372.7	379.06	376.99	379.73	0.006062	6.58	326.53	72.77	0.51
Reach 1	2207	50 Year	2595	372.7	379.71	377.56	380.49	0.006529	7.15	376	82.51	0.53
Reach 1	2207	100 Year	3190	372.7	380.2	378.2	381.17	0.007322	8.01	422.27	109.48	0.57
Reach 1	2207	500 Year	4970	372.7	381.9	380.47	382.78	0.005085	7.86	695.05	238.58	0.5
Reach 1	2202	10 Year	1505	372.61	377.87	376.11	378.4	0.005722	5.84	257.61	61.26	0.5
Reach 1	2202	25 Year (est)	2105	372.61	378.98	376.88	379.62	0.005453	6.42	328.8	66.61	0.5
Reach 1	2202	50 Year	2595	372.61	379.62	377.43	380.39	0.005624	7.05	372.78	74.95	0.51
Reach 1	2202	100 Year	3190	372.61	380.08	378.06	381.06	0.006505	7.97	411.2	100.71	0.56
Reach 1	2202	500 Year	4970	372.61	381.16	379.7	382.62	0.008159	9.92	527.32	221.63	0.64
Reach 1	2168	10 Year	1505	370.8	377.14	375.42	377.69	0.007088	5.91	254.9	63.37	0.51
Reach 1	2168	25 Year (est)	2105	370.8	378.31	376.21	378.94	0.006941	6.38	332.99	72.37	0.51
Reach 1	2168	50 Year	2595	370.8	378.97	376.78	379.67	0.006911	6.81	393.54	137.36	0.51
Reach 1	2168	100 Year	3190	370.8	379.46	377.42	380.25	0.007093	7.3	463.4	174.66	0.52
Reach 1	2168	500 Year	4970	370.8	381.01	379.89	381.72	0.004689	6.92	747.19	214.17	0.44
Reach 1	2130	10 Year	1505	368.87	375.75	374.06	376.49	0.013109	6.89	218.38	54.07	0.6
Reach 1	2130	25 Year (est)	2105	368.87	376.8	375.17	377.68	0.015062	7.51	280.14	63.13	0.63
Reach 1	2130	50 Year	2595	368.87	377.6	375.9	378.49	0.013098	7.64	347.15	153.6	0.6
Reach 1	2130	100 Year	3190	368.87	378.51	376.62	379.24	0.008746	6.97	476.66	286.01	0.5
Reach 1	2130	500 Year	4970	368.87	380.56	378.77	381.17	0.003614	5.44	829.5	349.97	0.34
Reach 1	2116	10 Year	1505	368.14	375.45	373.3	376.15	0.004981	6.75	233.31	55.28	0.5
Reach 1	2116	25 Year (est)	2105	368.14	376.27	374.26	377.28	0.006074	8.15	282.21	64.57	0.56
Reach 1	2116	50 Year	2595	368.14	376.78	375.03	378.06	0.007018	9.21	317.03	74.94	0.61
Reach 1	2116	100 Year	3190	368.14	376.89	375.9	378.74	0.009998	11.11	325.73	80.23	0.73
Reach 1	2116	500 Year	4970	368.14	380.5	378.74	381.04	0.002092	6.67	915.26	448.75	0.36
Reach 1	2095.5		Bridge									
Reach 1	2079	10 Year	1505	365.13	371.23	370.93	372.68	0.019949	9.66	155.85	42.67	0.89
Reach 1	2079	25 Year (est)	2105	365.13	371.86	371.86	373.91	0.024693	11.51	182.95	44.39	1
Reach 1	2079	50 Year	2595	365.13	372.96	372.53	374.88	0.018835	11.11	233.65	47.44	0.88
Reach 1	2079	100 Year	3190	365.13	374.16	373.26	376	0.01643	10.88	293.51	55.39	0.81
Reach 1	2079	500 Year	4970	365.13	379.74	375.29	380.27	0.00239	6.55	1081.11	707.04	0.34
Reach 1	2067	10 Year	1505	364.73	370.89	370.89	372.11	0.008805	9.73	220.24	331.15	0.77
Reach 1	2067	25 Year (est)	2105	364.73	371.72	371.56	373.03	0.008274	10.47	293.56	335.16	0.77
Reach 1	2067	50 Year	2595	364.73	373.16	372.01	374.06	0.004558	9.02	421.86	341.7	0.59
Reach 1	2067	100 Year	3190	364.73	374.88	372.52	375.07	0.000967	4.8	1096.4	355.27	0.28
Reach 1	2067	500 Year	4970	364.73	379.91	373.86	380.04	0.00038	4.05	1967.08	473.3	0.19
Reach 1	2020	10 Year	2350	363.35	370.53	367.82	370.61	0.000346	2.09	1040.47	400.15	0.16
Reach 1	2020	25 Year (est)	3290	363.35	372.22	367.82	372.31	0.000296	2.32	1347.21	416.05	0.15

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	2020	50 Year	4060	363.35	373.47	367.82	373.58	0.000271	2.47	1590.71	427.96	0.15
Reach 1	2020	100 Year	4990	363.35	374.87	367.82	374.97	0.00023	2.52	2052.02	442.41	0.14
Reach 1	2020	500 Year	7775	363.35	379.89	368.5	379.99	0.000142	2.61	3236.55	541.78	0.12
Reach 1	2004	10 Year	2350	360.63	370.53	364.65	370.58	0.00016	2.03	1278.07	314.28	0.12
Reach 1	2004	25 Year (est)	3290	360.63	372.22	365.54	372.28	0.000154	2.24	1627.79	321.39	0.12
Reach 1	2004	50 Year	4060	360.63	373.47	365.98	373.55	0.00015	2.37	1887.4	334.37	0.12
Reach 1	2004	100 Year	4990	360.63	374.86	366.38	374.95	0.000147	2.53	2174.49	343.61	0.12
Reach 1	2004	500 Year	7775	360.63	379.89	367.5	379.98	0.000104	2.63	3212.6	497.36	0.11
Reach 1	1983	10 Year	2350	361.19	370.41	366.14	370.54	0.000479	3.17	839.89	248.85	0.2
Reach 1	1983	25 Year (est)	3290	361.19	372.11	367.15	372.25	0.000367	3.16	1130.66	256.06	0.18
Reach 1	1983	50 Year	4060	361.19	373.37	367.58	373.51	0.000318	3.19	1345.31	261.92	0.17
Reach 1	1983	100 Year	4990	361.19	374.76	368.74	374.91	0.000281	3.25	1581.99	279.21	0.16
Reach 1	1983	500 Year	7775	361.19	379.79	369.8	379.95	0.000161	3.1	2440.96	472.45	0.13
Reach 1	1953.5	Bridge										
Reach 1	1927	10 Year	2350	361.09	368.59	366.81	369.37	0.005599	7.1	332	74.01	0.57
Reach 1	1927	25 Year (est)	3290	361.09	369.95	367.84	370.85	0.004739	7.68	443	93.17	0.54
Reach 1	1927	50 Year	4060	361.09	370.95	368.56	371.94	0.004248	8.04	530.94	107.12	0.53
Reach 1	1927	100 Year	4990	361.09	371.97	369.36	373.07	0.004006	8.53	623.71	122.09	0.52
Reach 1	1927	500 Year	7775	361.09	374.68	371.26	376.04	0.003501	9.64	883.35	187.81	0.51
Reach 1	1916.5	Bridge										
Reach 1	1900	10 Year	2350	359.88	367.58	366.4	368.57	0.005968	7.97	295.02	65.44	0.66
Reach 1	1900	25 Year (est)	3290	359.88	368.83	367.34	370	0.00547	8.68	379.02	69.16	0.65
Reach 1	1900	50 Year	4060	359.88	369.67	368.03	371	0.005382	9.26	438.41	71.67	0.66
Reach 1	1900	100 Year	4990	359.88	370.46	368.79	372.03	0.005558	10.07	495.59	74.01	0.68
Reach 1	1900	500 Year	7775	359.88	371.27	370.76	374.31	0.009221	14	556.98	76.48	0.9
Reach 1	1871	10 Year	2350	360.63	367.44	364.9	367.86	0.002461	5.83	466.69	109.69	0.43
Reach 1	1871	25 Year (est)	3290	360.63	368.8	365.66	369.27	0.002167	6.31	622.64	116.7	0.42
Reach 1	1871	50 Year	4060	360.63	369.71	366.24	370.23	0.002101	6.73	729.71	119.48	0.42
Reach 1	1871	100 Year	4990	360.63	370.56	367.11	371.17	0.002169	7.32	831.72	122.12	0.43
Reach 1	1871	500 Year	7775	360.63	371.62	368.71	372.73	0.00345	9.96	960.22	125.46	0.56
Reach 1	1837	10 Year	2350	360.14	367.29	364.46	367.64	0.001359	4.95	508.82	138.81	0.35
Reach 1	1837	25 Year (est)	3290	360.14	368.65	365.26	369.08	0.001293	5.5	644.54	153.41	0.35
Reach 1	1837	50 Year	4060	360.14	369.65	365.81	370.03	0.001051	5.38	943.3	170.07	0.32
Reach 1	1837	100 Year	4990	360.14	370.52	366.43	370.95	0.001063	5.77	1093.35	173.02	0.33
Reach 1	1837	500 Year	7775	360.14	371.63	368.06	372.37	0.001633	7.69	1285.92	176.26	0.42
Reach 1	1778	10 Year	2350	357.51	367.08	364.23	367.41	0.001331	4.9	534.84	174.19	0.33
Reach 1	1778	25 Year (est)	3290	357.51	368.52	365.05	368.85	0.001103	5.07	797.05	222.19	0.31
Reach 1	1778	50 Year	4060	357.51	369.5	365.61	369.84	0.001003	5.22	968.76	225.9	0.3
Reach 1	1778	100 Year	4990	357.51	370.38	366.22	370.76	0.000999	5.54	1124.57	229.23	0.31
Reach 1	1778	500 Year	7775	357.51	371.6	368.04	372.05	0.00115	6.42	1658.4	233.8	0.34
Reach 1	1748	10 Year	2350	357.81	366.02	364.24	367.09	0.004897	8.36	288.58	123.86	0.6
Reach 1	1748	25 Year (est)	3290	357.81	366.99	365.44	368.5	0.005724	9.98	343.18	171.55	0.66
Reach 1	1748	50 Year	4060	357.81	367.65	366.28	369.48	0.006256	11.07	421.51	255.81	0.7
Reach 1	1748	100 Year	4990	357.81	368.44	368.11	370.39	0.006111	11.69	546.4	258.47	0.71
Reach 1	1748	500 Year	7775	357.81	371.23	369.95	371.87	0.002055	8.19	1593.13	270.09	0.43
Reach 1	1689	10 Year	2350	358.69	363.63	363.63	365.44	0.015807	10.77	218.13	71.95	1
Reach 1	1689	25 Year (est)	3290	358.69	364.66	364.66	366.74	0.015019	11.56	284.62	85.97	1
Reach 1	1689	50 Year	4060	358.69	365.41	365.41	367.65	0.014596	12.02	337.9	97.1	1
Reach 1	1689	100 Year	4990	358.69	366.17	366.17	368.62	0.013715	12.57	400.26	121.34	0.98
Reach 1	1689	500 Year	7775	358.69	368.15	368.15	370.9	0.010275	13.55	643.72	209.19	0.9
Reach 1	1620	10 Year	2350	356.43	361.62	360.07	362.19	0.004226	6.08	386.66	103.1	0.53
Reach 1	1620	25 Year (est)	3290	356.43	362.76	360.81	363.44	0.003697	6.6	502.61	128.19	0.52
Reach 1	1620	50 Year	4060	356.43	363.58	361.37	364.34	0.003383	6.97	598.51	149.08	0.51
Reach 1	1620	100 Year	4990	356.43	364.5	361.99	365.33	0.003101	7.35	718.09	167.5	0.5
Reach 1	1620	500 Year	7775	356.43	366.93	363.57	367.9	0.002522	8.12	1096.24	277.27	0.47
Reach 1	1573	10 Year	2350	352.4	361.22	357.55	361.54	0.003294	4.53	519.29	87.62	0.33
Reach 1	1573	25 Year (est)	3290	352.4	362.35	358.45	362.79	0.00378	5.31	620.04	91.24	0.36
Reach 1	1573	50 Year	4060	352.4	363.17	359.23	363.7	0.004012	5.84	697.29	96.86	0.37
Reach 1	1573	100 Year	4990	352.4	364.09	359.87	364.72	0.004151	6.38	785.73	102.8	0.39
Reach 1	1573	500 Year	7775	352.4	366.47	361.57	367.38	0.004331	7.7	1022.6	145.82	0.41

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1561.5		Inl Struct									
Reach 1	1550	10 Year	2350	347.77	356.95	353.93	357.15	0.000854	3.68	655.89	127.24	0.26
Reach 1	1550	25 Year (est)	3290	347.77	357.99	355	358.28	0.000984	4.37	771.05	133.35	0.28
Reach 1	1550	50 Year	4060	347.77	358.71	355.82	359.07	0.001084	4.88	850.43	161.12	0.3
Reach 1	1550	100 Year	4990	347.77	359.39	355.98	359.84	0.001242	5.52	924.71	192.96	0.33
Reach 1	1550	500 Year	7775	347.77	360.91	356.43	361.71	0.001734	7.26	1092.93	279.89	0.4
Reach 1	1536	10 Year	2350	351.05	356.42	355.02	356.96	0.006117	5.92	405.34	103.04	0.51
Reach 1	1536	25 Year (est)	3290	351.05	357.37	355.74	358.06	0.006015	6.72	505	107.15	0.52
Reach 1	1536	50 Year	4060	351.05	357.98	356.11	358.82	0.006272	7.4	575.62	174.17	0.54
Reach 1	1536	100 Year	4990	351.05	358.54	356.67	359.56	0.006793	8.19	658.58	194.91	0.57
Reach 1	1536	500 Year	7775	351.05	359.59	358.44	361.27	0.009415	10.68	814.63	243.98	0.69
Reach 1	1523	10 Year	2350	349.8	354.98	354.59	356.12	0.027414	8.6	273.15	85.3	0.85
Reach 1	1523	25 Year (est)	3290	349.8	356.08	355.39	357.3	0.022845	8.85	371.9	93.1	0.78
Reach 1	1523	50 Year	4060	349.8	356.73	355.97	358.06	0.021697	9.31	455.16	158.82	0.77
Reach 1	1523	100 Year	4990	349.8	357.29	356.74	358.78	0.021189	9.94	551.63	201.21	0.78
Reach 1	1523	500 Year	7775	349.8	358.81	358.33	360.51	0.018293	10.99	823.75	226.68	0.75
Reach 1	1487	10 Year	2350	348.2	354.49	352.1	354.93	0.004499	5.33	440.63	98.61	0.44
Reach 1	1487	25 Year (est)	3290	348.2	355.58	352.95	356.13	0.004791	5.93	567.91	178.5	0.45
Reach 1	1487	50 Year	4060	348.2	356.34	353.58	356.93	0.004518	6.25	726.16	205.84	0.45
Reach 1	1487	100 Year	4990	348.2	356.9	354.29	357.6	0.004819	6.85	843.58	209.15	0.47
Reach 1	1487	500 Year	7775	348.2	358.43	356.29	359.36	0.005125	8.13	1171.38	219.13	0.5
Reach 1	1425	10 Year	2350	346.46	353.38	351.22	353.84	0.00646	5.44	433.57	109.63	0.44
Reach 1	1425	25 Year (est)	3290	346.46	354.38	352.03	354.98	0.006557	6.24	538.19	164.27	0.46
Reach 1	1425	50 Year	4060	346.46	355.09	352.58	355.8	0.006662	6.81	620.6	201.85	0.47
Reach 1	1425	100 Year	4990	346.46	355.71	353.21	356.45	0.006507	7.16	852.75	255.56	0.48
Reach 1	1425	500 Year	7775	346.46	357.36	354.85	358.2	0.006143	8	1290.37	274.61	0.48
Reach 1	1370	10 Year	2350	343.67	351.09	350.51	352.24	0.011808	8.85	309.39	102.73	0.7
Reach 1	1370	25 Year (est)	3290	343.67	352.3	351.45	353.52	0.009804	9.33	443.65	134.88	0.66
Reach 1	1370	50 Year	4060	343.67	353.12	352.06	354.4	0.009089	9.76	573.85	214.39	0.65
Reach 1	1370	100 Year	4990	343.67	353.84	353.16	355.14	0.008574	10.13	731.9	265.33	0.64
Reach 1	1370	500 Year	7775	343.67	356.75	354.78	357.41	0.003721	8.27	1756.31	376.07	0.45
Reach 1	1330	10 Year	2350	342.36	349.94	348.56	350.76	0.008047	7.45	356.33	104.02	0.59
Reach 1	1330	25 Year (est)	3290	342.36	351.66	349.65	352.4	0.00513	7.25	556.67	182.01	0.5
Reach 1	1330	50 Year	4060	342.36	352.48	350.3	353.32	0.005098	7.81	683.01	277.74	0.5
Reach 1	1330	100 Year	4990	342.36	353.4	350.99	354.15	0.004279	7.74	1070.65	369.73	0.47
Reach 1	1330	500 Year	7775	342.36	356.68	352.21	356.99	0.001551	5.8	2401.87	446.7	0.3
Reach 1	1309	10 Year	2350	341.6	349.72	347.65	350.4	0.00313	6.8	405.17	104.67	0.48
Reach 1	1309	25 Year (est)	3290	341.6	351.48	348.65	352.15	0.002322	6.94	647.52	220.53	0.44
Reach 1	1309	50 Year	4060	341.6	352.31	349.35	353.07	0.002359	7.48	789.41	292.52	0.45
Reach 1	1309	100 Year	4990	341.6	353.2	350.1	353.94	0.002189	7.68	1173.65	326.87	0.44
Reach 1	1309	500 Year	7775	341.6	356.44	352.27	356.88	0.001137	6.72	2297.73	365.22	0.33
Reach 1	1277	10 Year	2350	340.58	349.75	346.35	350.05	0.00161	4.41	579.26	191.4	0.32
Reach 1	1277	25 Year (est)	3290	340.58	351.61	347.26	351.86	0.001151	4.22	1030.1	262.06	0.27
Reach 1	1277	50 Year	4060	340.58	352.5	347.86	352.75	0.001102	4.36	1278.68	285.67	0.26
Reach 1	1277	100 Year	4990	340.58	353.37	348.52	353.63	0.001091	4.56	1530.16	292.55	0.26
Reach 1	1277	500 Year	7775	340.58	356.51	350.32	356.72	0.00074	4.38	2465.45	315.61	0.22
Reach 1	1260.5		Bridge									
Reach 1	1246	10 Year	2350	340.22	349.18	345.84	349.68	0.001864	5.8	466.49	137	0.38
Reach 1	1246	25 Year (est)	3290	340.22	350.51	347.03	351.15	0.001962	6.66	587.63	219.6	0.4
Reach 1	1246	50 Year	4060	340.22	351.41	347.83	352.22	0.002164	7.49	721.36	262.98	0.43
Reach 1	1246	100 Year	4990	340.22	352.39	348.63	353.2	0.002015	7.72	951.18	270.33	0.42
Reach 1	1246	500 Year	7775	340.22	355.97	350.66	356.51	0.001082	6.89	1787.99	325.07	0.33
Reach 1	1198.5		Bridge									
Reach 1	1162	10 Year	2350	338.98	345.52		346.58	0.007052	8.26	284.35	56.52	0.65
Reach 1	1162	25 Year (est)	3290	338.98	346.6		347.99	0.008242	9.47	347.27	60.28	0.7
Reach 1	1162	50 Year	4060	338.98	347.37		349.01	0.008856	10.29	394.82	62.98	0.72
Reach 1	1162	100 Year	4990	338.98	348.37		350.22	0.008265	10.91	460.63	78.48	0.71
Reach 1	1162	500 Year	7775	338.98	350.32	348.96	353	0.008881	13.23	636.89	178.61	0.76
Reach 1	1153	10 Year	2350	338.19	345.32	343.65	346.35	0.00691	8.14	288.63	53.54	0.62
Reach 1	1153	25 Year (est)	3290	338.19	346.24	344.77	347.7	0.008511	9.71	338.99	56.25	0.69

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1153	50 Year	4060	338.19	346.73	345.58	348.64	0.010013	11.09	367.18	57.75	0.76
Reach 1	1153	100 Year	4990	338.19	347.31	346.44	349.75	0.011421	12.52	401.24	59.52	0.82
Reach 1	1153	500 Year	7775	338.19	350.37	350.37	352.48	0.006746	12.18	713.73	244.4	0.67
Reach 1	1107	10 Year	2350	338.85	343.08	343.08	344.78	0.015885	10.46	224.58	65.73	1
Reach 1	1107	25 Year (est)	3290	338.85	344.09	344.02	346.03	0.014129	11.18	294.36	71.25	0.97
Reach 1	1107	50 Year	4060	338.85	344.91	344.68	346.95	0.012678	11.45	354.54	76.14	0.94
Reach 1	1107	100 Year	4990	338.85	345.8	345.43	347.95	0.011404	11.76	424.49	235.63	0.9
Reach 1	1107	500 Year	7775	338.85	347.56	347.56	348.61	0.005162	9.59	1247.41	541.52	0.64
Reach 1	1003	10 Year	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	1003	25 Year (est)	3290	333.66	341.27	339.84	342.65	0.006793	9.43	348.92	60.94	0.69
Reach 1	1003	50 Year	4060	333.66	342.18	340.63	343.73	0.006738	9.99	406.37	64.45	0.7
Reach 1	1003	100 Year	4990	333.66	343.11	341.5	344.88	0.00684	10.66	467.97	136.93	0.72
Reach 1	1003	500 Year	7775	333.66	345.82	343.7	346.81	0.003172	9.06	1467.48	611.97	0.52
Reach 1	894	10 Year	2350	328.74	335.71	335.36	337.61	0.012721	11.07	212.29	45.58	0.9
Reach 1	894	25 Year (est)	3290	328.74	337.06	336.59	339.25	0.012049	11.89	276.67	50.9	0.9
Reach 1	894	50 Year	4060	328.74	338.06	337.51	340.4	0.011544	12.29	330.31	56.1	0.89
Reach 1	894	100 Year	4990	328.74	338.99	338.45	341.63	0.010661	13.03	384.6	59.88	0.88
Reach 1	894	500 Year	7775	328.74	341.34	340.82	344.71	0.009365	14.86	555.7	131.78	0.86

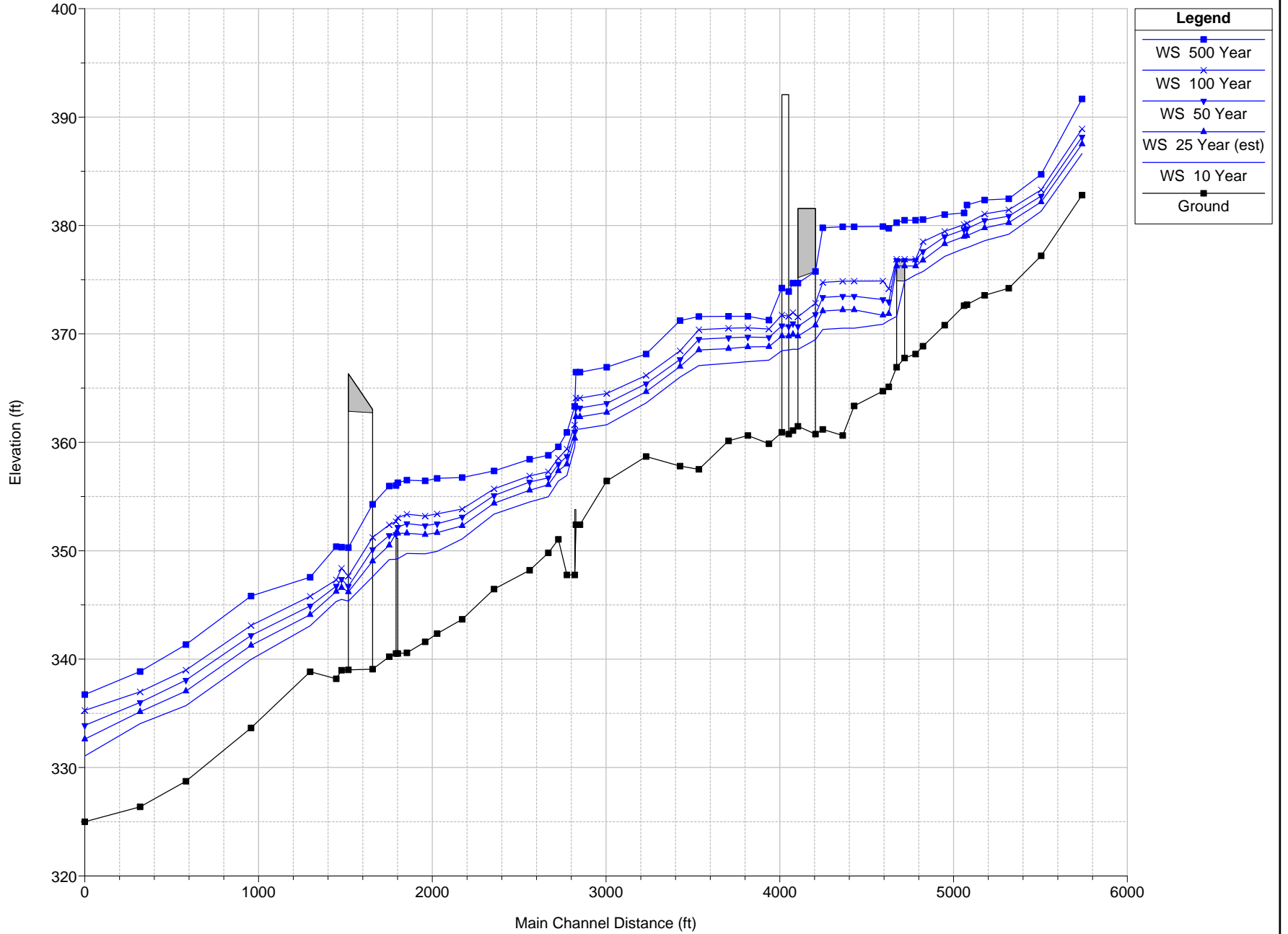
**MAD RIVER - EXISTING CONDITION, REGULATORY**  
**HEC-RAS 4.1.0 - "Six XS Bridge" Output**

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	2130	10 Year	376.49	375.75	374.06	0.33	0.01	54.07		1505		6.89
Reach 1	2130	25 Year (est)	377.68	376.8	375.17	0.39	0.01	63.13		2105		7.51
Reach 1	2130	50 Year	378.49	377.6	375.9	0.4	0.04	153.6	5.09	2536.31	53.59	7.64
Reach 1	2130	100 Year	379.24	378.51	376.62	0.4	0.11	286.01	113.7	2724.77	351.51	6.97
Reach 1	2130	500 Year	381.17	380.56	378.77	0.12	0.02	349.97	898.1	2854.34	1217.5	5.44
Reach 1	2116	10 Year	376.15	375.45	373.3			55.28	9.09	1491.92	3.99	6.75
Reach 1	2116	25 Year (est)	377.28	376.27	374.26			64.57	34.09	2058.81	12.1	8.15
Reach 1	2116	50 Year	378.06	376.78	375.03			74.94	63.45	2510.05	21.49	9.21
Reach 1	2116	100 Year	378.74	376.89	375.9			80.23	84.2	3076.02	29.78	11.11
Reach 1	2116	500 Year	381.04	380.5	378.74			448.75	1080	2779.29	1111	6.67
Reach 1	2095.5 BR U	10 Year	376.15	374.87	372.34					1505		6.07
Reach 1	2095.5 BR U	25 Year (est)	377.28	376.27	373.19					2104.83	0.17	8.49
Reach 1	2095.5 BR U	50 Year	378.06	376.78	373.81				159.5	2364.61	71.99	9.16
Reach 1	2095.5 BR U	100 Year	378.74	376.89	374.52				432.6	2581.19	172.18	9.08
Reach 1	2095.5 BR U	500 Year	381.04	380.5	378.73			193.57	1848	2425.66	680.11	6.39
Reach 1	2095.5 BR D	10 Year	373.3	371.61	371.61			42.98		1505		10.44
Reach 1	2095.5 BR D	25 Year (est)	377.04	376.27	372.46					2104.83	0.17	7.61
Reach 1	2095.5 BR D	50 Year	378.06	376.78	373.1				159.5	2364.61	71.99	8.2
Reach 1	2095.5 BR D	100 Year	378.74	376.89	373.79				432.6	2581.19	172.18	8.2
Reach 1	2095.5 BR D	500 Year	381.04	380.29	374.65			239.44	1848	2425.66	680.11	5.92
Reach 1	2079	10 Year	372.68	371.23	370.93	0.45	0.11	42.67		1505		9.66
Reach 1	2079	25 Year (est)	373.91	371.86	371.86	0.48	0.37	44.39		2105		11.51
Reach 1	2079	50 Year	374.88	372.96	372.53	0.3	0.51	47.44		2595		11.11
Reach 1	2079	100 Year	376	374.16	373.26	0.1	0.83	55.39	0.18	3189.8	0.02	10.88
Reach 1	2079	500 Year	380.27	379.74	375.29	0.03	0.2	707.04	980.2	3813.51	176.33	6.55
Reach 1	2067	10 Year	372.11	370.89	370.89	0.12	0.57	331.15	276.5	1221.33	7.18	9.73
Reach 1	2067	25 Year (est)	373.03	371.72	371.56	0.1	0.61	335.16	556.1	1536.32	12.57	10.47
Reach 1	2067	50 Year	374.06	373.16	372.01	0.09	0.4	341.7	918.4	1656.92	19.7	9.02
Reach 1	2067	100 Year	375.07	374.88	372.52	0.06	0.04	355.27	2078	1092.05	19.97	4.8
Reach 1	2067	500 Year	380.04	379.91	373.86	0.03	0.02	473.3	3451	1444.94	74.25	4.05
Reach 1	2004	10 Year	370.58	370.53	364.65	0.02	0.02	314.28	15.61	1382.8	951.59	2.03
Reach 1	2004	25 Year (est)	372.28	372.22	365.54	0.02	0.02	321.39	23.24	1805.34	1461.4	2.24
Reach 1	2004	50 Year	373.55	373.47	365.98	0.02	0.02	334.37	29.53	2140.87	1899.6	2.37
Reach 1	2004	100 Year	374.95	374.86	366.38	0.01	0.02	343.61	37.15	2539.25	2413.6	2.53
Reach 1	2004	500 Year	379.98	379.89	367.5	0.01	0.02	497.36	60.69	3636.79	4077.5	2.63
Reach 1	1983	10 Year	370.54	370.41	366.14	0.04	0.21	248.85	6.4	1576.34	767.27	3.17
Reach 1	1983	25 Year (est)	372.25	372.11	367.15	0.04	0.29	256.06	11.77	1908.39	1369.8	3.16
Reach 1	1983	50 Year	373.51	373.37	367.58	0.03	0.36	261.92	16.22	2178.24	1865.5	3.19
Reach 1	1983	100 Year	374.91	374.76	368.74	0.03	0.44	279.21	21.6	2503.98	2464.4	3.25
Reach 1	1983	500 Year	379.95	379.79	369.8			472.45	38.9	3360.65	4375.5	3.1
Reach 1	1953.5 BR U	10 Year	370.29	369.47	366.92	0.45	0.1	49.01	0.02	2349.98		7.27
Reach 1	1953.5 BR U	25 Year (est)	371.92	370.81	368.01	0.48	0.13	49.69	0.03	3289.97	0	8.44
Reach 1	1953.5 BR U	50 Year	373.12	371.79	368.82	0.48	0.14	49.72	0.05	4059.95	0	9.26
Reach 1	1953.5 BR U	100 Year	374.45	372.84	369.73	0.5	0.17	49.75	0.07	4989.92	0.01	10.18
Reach 1	1953.5 BR U	500 Year	379.95	375.76	372.08				0.24	7774.65	0.11	12.43
Reach 1	1953.5 BR D	10 Year	369.73	368.57	367.1	0.17	0.19	50.17	0.17	2349.68	0.16	8.65
Reach 1	1953.5 BR D	25 Year (est)	371.32	369.79	368.24	0.15	0.31	50.71	1.12	3288.2	0.68	9.91
Reach 1	1953.5 BR D	50 Year	372.49	370.69	369.03	0.15	0.41	50.99	2.41	4056.23	1.36	10.79
Reach 1	1953.5 BR D	100 Year	373.76	371.57	369.91	0.14	0.55	51.26	4.38	4983.37	2.25	11.88
Reach 1	1953.5 BR D	500 Year	376.8	374.68	372.24			51.51	16.54	7752.48	5.98	13.54
Reach 1	1927	10 Year	369.37	368.59	366.81	0.11	0.03	74.01		2349.35	0.65	7.1
Reach 1	1927	25 Year (est)	370.85	369.95	367.84	0.1	0.01	93.17	2.97	3254.15	32.88	7.68
Reach 1	1927	50 Year	371.94	370.95	368.56	0.1	0.04	107.12	12.94	3963.8	83.26	8.04
Reach 1	1927	100 Year	373.07	371.97	369.36	0.1	0.06	122.09	36.17	4803.35	150.48	8.53
Reach 1	1927	500 Year	376.04	374.68	371.26	0.09	0.15	187.81	168.3	7223.2	383.54	9.64
Reach 1	1916.5 BR U	10 Year	369.24	368.51	366.11	0.14	0.08	73.93		2350		6.86
Reach 1	1916.5 BR U	25 Year (est)	370.74	369.8	367.15	0.13	0.14	93.27		3290		7.78

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	1916.5 BR U	50 Year	371.79	370.69	367.96	0.13	0.19	117.15	0.85	4059.16		8.42
Reach 1	1916.5 BR U	100 Year	372.92	371.62	368.85	0.12	0.25	133.52	11.43	4978.57		9.16
Reach 1	1916.5 BR U	500 Year	375.79	373.92	371.01	0.12	0.44	160.84	81.57	7693.43		11.05
Reach 1	1916.5 BR D	10 Year	369.03	368.45	366.24	0.34	0.12	83.75		2350		6.1
Reach 1	1916.5 BR D	25 Year (est)	370.46	369.8	367.22	0.31	0.15	97.94	2.25	3287.75		6.53
Reach 1	1916.5 BR D	50 Year	371.47	370.75	367.93	0.29	0.18	112	14.23	4045.71	0.06	6.86
Reach 1	1916.5 BR D	100 Year	372.55	371.74	368.68	0.28	0.23	134.3	41.02	4935.75	13.23	7.22
Reach 1	1916.5 BR D	500 Year	375.23	374.24	370.44	0.31	0.61	139.59	155.8	7464.94	154.25	8.14
Reach 1	1900	10 Year	368.57	367.58	366.4	0.42	0.28	65.44		2350		7.97
Reach 1	1900	25 Year (est)	370	368.83	367.34	0.38	0.35	69.16		3290		8.68
Reach 1	1900	50 Year	371	369.67	368.03	0.37	0.41	71.67		4060		9.26
Reach 1	1900	100 Year	372.03	370.46	368.79	0.38	0.48	74.01	0	4989.87	0.13	10.07
Reach 1	1900	500 Year	374.31	371.27	370.76	0.61	0.97	76.48	1.59	7770.72	2.7	14
Reach 1	1871	10 Year	367.86	367.44	364.9	0.2	0.02	109.69	1206	1084.49	59.31	5.83
Reach 1	1871	25 Year (est)	369.27	368.8	365.66	0.18	0.01	116.7	1715	1456.04	119.17	6.31
Reach 1	1871	50 Year	370.23	369.71	366.24	0.16	0.04	119.48	2136	1754.14	170.32	6.73
Reach 1	1871	100 Year	371.17	370.56	367.11	0.16	0.05	122.12	2646	2111.55	232.06	7.32
Reach 1	1871	500 Year	372.73	371.62	368.71	0.25	0.11	125.46	4156	3219.01	399.89	9.96
Reach 1	1309	10 Year	350.4	349.72	347.65	0.23	0.12	104.67	117.8	2221.86	10.32	6.8
Reach 1	1309	25 Year (est)	352.15	351.48	348.65	0.17	0.13	220.53	260.6	2925.14	104.22	6.94
Reach 1	1309	50 Year	353.07	352.31	349.35	0.16	0.15	292.52	345	3485.72	229.3	7.48
Reach 1	1309	100 Year	353.94	353.2	350.1	0.16	0.14	326.87	633.1	3947.76	409.13	7.68
Reach 1	1309	500 Year	356.88	356.44	352.27	0.1	0.07	365.22	1612	4622.54	1540.6	6.72
Reach 1	1277	10 Year	350.05	349.75	346.35	0.11	0.09	191.4	20.07	2304.14	25.79	4.41
Reach 1	1277	25 Year (est)	351.86	351.61	347.26			262.06	116.9	2901.81	271.34	4.22
Reach 1	1277	50 Year	352.75	352.5	347.86	0.1	0.06	285.67	185	3341.36	533.69	4.36
Reach 1	1277	100 Year	353.63	353.37	348.52	0.09	0.06	292.55	270.8	3843.89	875.36	4.56
Reach 1	1277	500 Year	356.72	356.51	350.32	0.05	0.04	315.61	641.6	4914.23	2219.2	4.38
Reach 1	1260.5 BR U	10 Year	349.85	349.26	346.35	0.03	0	64.35		2350		6.19
Reach 1	1260.5 BR U	25 Year (est)	351.86	351.61	347.41			180.71	79.72	2594.19	622	5.24
Reach 1	1260.5 BR U	50 Year	352.6	352.16	348.19	0.05	0.14	194.78	146.9	2708.81	1204.3	5.47
Reach 1	1260.5 BR U	100 Year	353.48	353.04	348.99	0.04	0.07	205.09	396.1	2483.92	2110	5.02
Reach 1	1260.5 BR U	500 Year	356.63	356.27	351.95	0.01	0.05	327.94	1328	1838.97	4608	2.76
Reach 1	1260.5 BR D	10 Year	349.82	349.22	346.34	0.09	0.05	64.21		2350		6.23
Reach 1	1260.5 BR D	25 Year (est)	351.86	351.61	347.42			196.42	79.72	2594.31	621.88	5.24
Reach 1	1260.5 BR D	50 Year	352.41	351.51	348.19	0.14	0.04	193.48	63.7	3851.54	144.76	7.78
Reach 1	1260.5 BR D	100 Year	353.37	352.69	349.05	0.13	0.04	207.88	464.4	3446.41	1079.2	6.97
Reach 1	1260.5 BR D	500 Year	356.56	356.02	352.52	0.05	0	330.4	1643	2309.84	3822.6	3.56
Reach 1	1246	10 Year	349.68	349.18	345.84			137	57.42	2236.22	56.36	5.8
Reach 1	1246	25 Year (est)	351.15	350.51	347.03			219.6	126.5	3045.81	117.68	6.66
Reach 1	1246	50 Year	352.22	351.41	347.83			262.98	185.7	3783.94	90.34	7.49
Reach 1	1246	100 Year	353.2	352.39	348.63			270.33	381.2	4310.14	298.69	7.72
Reach 1	1246	500 Year	356.51	355.97	350.66	0.21	0.34	325.07	1304	5176.48	1294.8	6.89
Reach 1	1198.5 BR U	10 Year	348.42	347.6	344.99			52.89		2350		7.26
Reach 1	1198.5 BR U	25 Year (est)	350.08	349.04	346.2			57.53		3290		8.15
Reach 1	1198.5 BR U	50 Year	351.28	350.11	347.09			60.95		4060		8.7
Reach 1	1198.5 BR U	100 Year	352.57	351.23	348.04			74.39		4990		9.3
Reach 1	1198.5 BR U	500 Year	355.96	354.28	350.45	1.37	0.61	84.22		7775		10.38
Reach 1	1198.5 BR D	10 Year	346.97	345.35	344.62			47.36		2350		10.19
Reach 1	1198.5 BR D	25 Year (est)	348.48	346.21	345.84			50.17		3290		12.08
Reach 1	1198.5 BR D	50 Year	349.6	346.71	346.71			51.81		4060		13.63
Reach 1	1198.5 BR D	100 Year	350.84	347.65	347.65			54.9		4990		14.33
Reach 1	1198.5 BR D	500 Year	353.98	350.29	350.06	0.48	0.51	63.32		7775		15.43
Reach 1	1162	10 Year	346.58	345.52		0.21	0.02	56.52		2350		8.26
Reach 1	1162	25 Year (est)	347.99	346.6		0.26	0.02	60.28		3290		9.47
Reach 1	1162	50 Year	349.01	347.37		0.29	0.08	62.98	0.21	4059.79		10.29
Reach 1	1162	100 Year	350.22	348.37		0.29	0.18	78.48	3.83	4985.73	0.44	10.91
Reach 1	1162	500 Year	353	350.32	348.96	0.24	0.28	178.61	120.9	7644.13	9.93	13.23
Reach 1	1153	10 Year	346.35	345.32	343.65	1.51	0.07	53.54		2350		8.14

HEC-RAS Plan: EX_FEMA_REG River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Reach 1	1153	25 Year (est)	347.7	346.24	344.77	1.62	0.05	56.25	0.32	3289.66	0.03	9.71
Reach 1	1153	50 Year	348.64	346.73	345.58	1.69	0.01	57.75	1.97	4057.66	0.37	11.09
Reach 1	1153	100 Year	349.75	347.31	346.44	1.71	0.09	59.52	6.92	4981.38	1.7	12.52
Reach 1	1153	500 Year	352.48	350.37	350.37	0.91	0.32	244.4	856.5	6888.86	29.62	12.18

Mad River, 151-273, Waterbury, English Plan: EXISTING (match FIS), FEMA Q-REGULATORY





**MAD RIVER - EXISTING CONDITION, FLOODWAY**  
**HEC-RAS 4.1.0 - "Standard Table 1" Output**

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	2409	100 Year	3190	382.8	388.9	388.9	391.53	0.01429	13.11	252.34	49.44	1
Reach 1	2409	Floodway	3190	382.8	388.93	388.93	391.63	0.016433	13.19	241.87	44.7	1
Reach 1	2409	10 Year	1505	382.8	386.62	386.62	388.33	0.016526	10.52	145.85	44.15	1
Reach 1	2409	10-Year Fldwy	1505	382.8	386.62	386.62	388.36	0.018073	10.57	142.42	41.56	1.01
Reach 1	2337	100 Year	3190	377.2	383.29	383.29	385.24	0.012791	11.37	304.83	89.69	0.94
Reach 1	2337	Floodway	3190	377.2	383.29	383.29	385.24	0.012829	11.38	304.49	89.64	0.94
Reach 1	2337	10 Year	1505	377.2	381.32	381.32	382.76	0.016925	9.63	156.36	54.1	1
Reach 1	2337	10-Year Fldwy	1505	377.2	381.33	381.33	382.76	0.016918	9.62	156.38	54.1	1
Reach 1	2280	100 Year	3190	374.21	381.44	380.71	383.01	0.008621	10.11	343.63	95.1	0.77
Reach 1	2280	Floodway	3190	374.21	381.53	380.72	383.03	0.008176	9.93	347.93	86.22	0.75
Reach 1	2280	10 Year	1505	374.21	379.19	378.59	380.26	0.009259	8.28	181.8	53.55	0.79
Reach 1	2280	10-Year Fldwy	1505	374.21	379.19	378.58	380.26	0.009259	8.28	181.8	53.56	0.79
Reach 1	2238	100 Year	3190	373.56	381.07	378.88	381.83	0.00541	7.02	462.11	107.1	0.51
Reach 1	2238	Floodway	3190	373.56	381.19	378.87	381.92	0.005029	6.87	472.49	86.34	0.49
Reach 1	2238	10 Year	1505	373.56	378.59	376.99	379.09	0.005698	5.7	264.01	70.65	0.52
Reach 1	2238	10-Year Fldwy	1505	373.56	378.59	377	379.09	0.005698	5.7	264.02	70.65	0.52
Reach 1	2207	100 Year	3190	372.7	380.2	378.21	381.17	0.007316	8	422.4	109.49	0.57
Reach 1	2207	Floodway	3190	372.7	380.41	378.21	381.32	0.006571	7.76	433.01	84.53	0.54
Reach 1	2207	10 Year	1505	372.7	377.94	376.21	378.5	0.005881	5.99	251.44	61.4	0.51
Reach 1	2207	10-Year Fldwy	1505	372.7	377.94	376.21	378.5	0.005881	5.99	251.45	61.4	0.51
Reach 1	2202	100 Year	3190	372.61	380.08	378.06	381.06	0.0065	7.97	411.32	100.75	0.56
Reach 1	2202	Floodway	3190	372.61	380.29	378.06	381.22	0.005871	7.75	419.34	70.46	0.54
Reach 1	2202	10 Year	1505	372.61	377.87	376.11	378.4	0.005726	5.84	257.54	61.26	0.5
Reach 1	2202	10-Year Fldwy	1505	372.61	377.87	376.11	378.4	0.005725	5.84	257.55	61.26	0.5
Reach 1	2168	100 Year	3190	370.8	379.46	377.43	380.25	0.007069	7.3	464.03	174.92	0.52
Reach 1	2168	Floodway	3190	370.8	379.57	377.4	380.47	0.007611	7.66	421.83	75.46	0.54
Reach 1	2168	10 Year	1505	370.8	377.14	375.42	377.69	0.007088	5.91	254.9	63.37	0.51
Reach 1	2168	10-Year Fldwy	1505	370.8	377.14	375.42	377.69	0.007089	5.91	254.71	62.4	0.51
Reach 1	2130	100 Year	3190	368.87	378.53	376.62	379.25	0.008558	6.91	480.49	286.6	0.5
Reach 1	2130	Floodway	3190	368.87	378.56	376.63	379.39	0.009421	7.27	440.15	98.43	0.52
Reach 1	2130	10 Year	1505	368.87	375.75	374.06	376.49	0.013109	6.89	218.38	54.07	0.6
Reach 1	2130	10-Year Fldwy	1505	368.87	375.75	374.05	376.49	0.013109	6.89	218.38	54.07	0.6
Reach 1	2116	100 Year	3190	368.14	376.91	375.89	378.75	0.009922	11.09	326.9	80.92	0.73
Reach 1	2116	Floodway	3190	368.14	377.97	375.89	379.07	0.005268	8.86	434.01	141.8	0.54
Reach 1	2116	10 Year	1505	368.14	375.45	373.29	376.15	0.004981	6.75	233.31	55.28	0.5
Reach 1	2116	10-Year Fldwy	1505	368.14	375.45	373.29	376.15	0.004981	6.75	233.31	55.28	0.5
Reach 1	2095.5	Bridge										
Reach 1	2079	100 Year	3190	365.13	374.15	373.27	376	0.016587	10.91	292.63	55.11	0.81
Reach 1	2079	Floodway	3190	365.13	374.08	373.27	375.97	0.017238	11.04	289.1	53.98	0.82
Reach 1	2079	10 Year	1505	365.13	371.22	370.94	372.68	0.020128	9.69	155.36	42.63	0.89
Reach 1	2079	10-Year Fldwy	1505	365.13	371.22	370.94	372.68	0.020128	9.69	155.36	42.63	0.89
Reach 1	2067	100 Year	3190	364.73	374.88	372.53	375.06	0.000968	4.8	1095.93	355.25	0.28
Reach 1	2067	Floodway	3190	364.73	374.83	372.53	375.02	0.000991	4.84	1088.05	354.85	0.29
Reach 1	2067	10 Year	1505	364.73	370.88	370.88	372.11	0.008903	9.77	219.23	331.09	0.78
Reach 1	2067	10-Year Fldwy	1505	364.73	370.88	370.88	372.11	0.008903	9.77	219.23	331.09	0.78
Reach 1	2020	100 Year	4990	363.35	374.87	367.82	374.96	0.00023	2.52	2051.37	442.39	0.14
Reach 1	2020	Floodway	4990	363.35	374.82	367.82	374.92	0.000234	2.53	2032.17	424	0.14
Reach 1	2020	10 Year	2350	363.35	370.53	367.82	370.61	0.000346	2.09	1040.54	400.15	0.16
Reach 1	2020	10-Year Fldwy	2350	363.35	370.51	367.82	370.59	0.00035	2.09	1036.99	400.03	0.16
Reach 1	2004	100 Year	4990	360.63	374.86	366.4	374.95	0.000147	2.53	2173.89	343.59	0.12
Reach 1	2004	Floodway	4990	360.63	374.81	366.4	374.9	0.000149	2.54	2164.13	321.81	0.12
Reach 1	2004	10 Year	2350	360.63	370.53	364.67	370.58	0.00016	2.03	1278.16	314.28	0.12
Reach 1	2004	10-Year Fldwy	2350	360.63	370.51	364.67	370.56	0.000161	2.04	1274.01	302.76	0.12
Reach 1	1983	100 Year	4990	361.19	374.75	368.75	374.91	0.000282	3.25	1581.42	279.15	0.16
Reach 1	1983	Floodway	4990	361.19	374.7	368.75	374.86	0.000287	3.27	1573.12	252.57	0.16
Reach 1	1983	10 Year	2350	361.19	370.41	366.14	370.54	0.000478	3.17	839.96	248.85	0.2
Reach 1	1983	10-Year Fldwy	2350	361.19	370.38	366.14	370.52	0.000485	3.18	836.29	242.44	0.2

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1953.5		Bridge									
Reach 1	1927	100 Year	4990	361.09	371.99	369.37	373.08	0.003981	8.51	625.08	122.33	0.52
Reach 1	1927	Floodway	4990	361.09	371.74	369.37	372.91	0.004433	8.8	602.61	95.18	0.55
Reach 1	1927	10 Year	2350	361.09	368.59	366.79	369.38	0.005594	7.1	332.12	74.04	0.57
Reach 1	1927	10-Year Fldwy	2350	361.09	368.51	366.79	369.32	0.005873	7.22	326.2	72.65	0.58
Reach 1	1916.5		Bridge									
Reach 1	1900	100 Year	4990	359.88	370.45	368.8	372.03	0.005568	10.08	495.34	74	0.68
Reach 1	1900	Floodway	4990	359.88	370.45	368.8	372.03	0.005568	10.08	495.34	74	0.68
Reach 1	1900	10 Year	2350	359.88	367.58	366.39	368.56	0.00598	7.97	294.83	65.43	0.66
Reach 1	1900	10-Year Fldwy	2350	359.88	367.58	366.39	368.56	0.00598	7.97	294.83	65.43	0.66
Reach 1	1871	100 Year	4990	360.63	370.56	367.12	371.17	0.002172	7.33	831.3	122.1	0.44
Reach 1	1871	Floodway	4990	360.63	370.56	367.12	371.17	0.002172	7.33	831.3	122.1	0.44
Reach 1	1871	10 Year	2350	360.63	367.44	364.88	367.86	0.002461	5.83	466.74	109.7	0.43
Reach 1	1871	10-Year Fldwy	2350	360.63	367.44	364.88	367.86	0.002461	5.83	466.74	109.7	0.43
Reach 1	1837	100 Year	4990	360.14	370.52	366.43	370.95	0.001063	5.77	1093.2	173.02	0.33
Reach 1	1837	Floodway	4990	360.14	370.52	366.43	370.95	0.001063	5.77	1093.2	173.02	0.33
Reach 1	1837	10 Year	2350	360.14	367.29	364.47	367.64	0.001358	4.95	508.87	138.81	0.35
Reach 1	1837	10-Year Fldwy	2350	360.14	367.29	364.47	367.64	0.001358	4.95	508.87	138.81	0.35
Reach 1	1778	100 Year	4990	357.51	370.38	366.22	370.76	0.000999	5.54	1124.57	229.23	0.31
Reach 1	1778	Floodway	4990	357.51	370.38	366.22	370.76	0.000999	5.54	1124.57	229.23	0.31
Reach 1	1778	10 Year	2350	357.51	367.08	364.21	367.41	0.00133	4.9	534.97	174.21	0.33
Reach 1	1778	10-Year Fldwy	2350	357.51	367.08	364.21	367.41	0.00133	4.9	534.97	174.21	0.33
Reach 1	1748	100 Year	4990	357.81	368.45	368.12	370.39	0.006108	11.69	546.52	258.47	0.71
Reach 1	1748	Floodway	4990	357.81	368.45	368.12	370.39	0.006108	11.69	546.52	258.47	0.71
Reach 1	1748	10 Year	2350	357.81	366.02	364.25	367.09	0.00489	8.35	288.71	123.92	0.6
Reach 1	1748	10-Year Fldwy	2350	357.81	366.02	364.25	367.09	0.00489	8.35	288.71	123.92	0.6
Reach 1	1689	100 Year	4990	358.69	366.17	366.17	368.62	0.013715	12.57	400.26	121.34	0.98
Reach 1	1689	Floodway	4990	358.69	366.17	366.17	368.62	0.013715	12.57	400.26	121.34	0.98
Reach 1	1689	10 Year	2350	358.69	363.63	363.63	365.44	0.015833	10.78	217.99	71.91	1
Reach 1	1689	10-Year Fldwy	2350	358.69	363.63	363.63	365.44	0.015833	10.78	217.99	71.91	1
Reach 1	1620	100 Year	4990	356.43	364.5	361.99	365.33	0.003102	7.35	718.01	167.49	0.5
Reach 1	1620	Floodway	4990	356.43	364.5	361.99	365.33	0.003104	7.36	717.86	167.48	0.5
Reach 1	1620	10 Year	2350	356.43	361.62	360.07	362.19	0.004216	6.07	386.97	103.16	0.53
Reach 1	1620	10-Year Fldwy	2350	356.43	361.62	360.07	362.19	0.004213	6.07	387.07	103.17	0.53
Reach 1	1573	100 Year	4990	352.4	364.09	359.85	364.72	0.00415	6.38	785.75	102.81	0.39
Reach 1	1573	Floodway	4990	352.4	364.09	359.85	364.72	0.004152	6.38	785.62	102.8	0.39
Reach 1	1573	10 Year	2350	352.4	361.23	357.56	361.54	0.003286	4.52	519.66	87.63	0.33
Reach 1	1573	10-Year Fldwy	2350	352.4	361.23	357.56	361.54	0.003284	4.52	519.79	87.63	0.33
Reach 1	1561.5		Inl Struct									
Reach 1	1550	100 Year	4990	347.77	359.39	355.98	359.84	0.001242	5.52	924.71	192.96	0.33
Reach 1	1550	Floodway	4990	347.77	359.39	355.98	360.02	0.001346	5.79	867.78	100	0.34
Reach 1	1550	10 Year	2350	347.77	356.95	353.9	357.15	0.000855	3.68	655.67	127.23	0.26
Reach 1	1550	10-Year Fldwy	2350	347.77	356.92	353.9	357.15	0.00095	3.86	612.69	100	0.27
Reach 1	1536	100 Year	4990	351.05	358.54	356.68	359.56	0.006793	8.19	658.58	194.91	0.57
Reach 1	1536	Floodway	4990	351.05	358.78	356.67	359.76	0.006197	8.01	639.83	100.07	0.55
Reach 1	1536	10 Year	2350	351.05	356.42	355.03	356.96	0.006118	5.92	405.32	103.04	0.51
Reach 1	1536	10-Year Fldwy	2350	351.05	356.42	355.02	356.96	0.006128	5.92	403.93	100.07	0.51
Reach 1	1523	100 Year	4990	349.8	357.29	356.93	358.78	0.021183	9.94	551.7	201.22	0.78
Reach 1	1523	Floodway	4990	349.8	357.63	356.59	359.06	0.018072	9.59	523.39	100.1	0.72
Reach 1	1523	10 Year	2350	349.8	354.98	354.61	356.13	0.02736	8.6	273.34	85.31	0.85
Reach 1	1523	10-Year Fldwy	2350	349.8	354.98	354.61	356.13	0.027336	8.59	273.43	85.32	0.85
Reach 1	1487	100 Year	4990	348.2	356.9	354.3	357.6	0.004818	6.85	843.72	209.16	0.47
Reach 1	1487	Floodway	4990	348.2	357.27	354.29	357.99	0.004465	6.84	733.32	108.99	0.46
Reach 1	1487	10 Year	2350	348.2	354.5	352.11	354.94	0.004493	5.33	440.94	98.64	0.44
Reach 1	1487	10-Year Fldwy	2350	348.2	354.5	352.1	354.94	0.00449	5.33	441.07	98.65	0.44
Reach 1	1425	100 Year	4990	346.46	355.72	353.2	356.46	0.006498	7.15	853.37	255.59	0.48
Reach 1	1425	Floodway	4990	346.46	356.12	353.19	356.92	0.006152	7.22	707.97	104.98	0.47

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1425	10 Year	2350	346.46	353.38	351.23	353.84	0.006425	5.43	434.32	110.1	0.44
Reach 1	1425	10-Year Fldwy	2350	346.46	353.38	351.23	353.84	0.006428	5.44	432.94	94.67	0.44
Reach 1	1370	100 Year	4990	343.67	353.83	353.15	355.14	0.008659	10.17	728.52	264.23	0.65
Reach 1	1370	Floodway	4990	343.67	354.21	352.69	355.62	0.008226	10.24	601.32	96.8	0.64
Reach 1	1370	10 Year	2350	343.67	351.09	350.51	352.24	0.011807	8.85	309.41	102.73	0.7
Reach 1	1370	10-Year Fldwy	2350	343.67	351.11	350.47	352.25	0.011598	8.8	306.53	92.43	0.7
Reach 1	1330	100 Year	4990	342.36	353.39	350.98	354.14	0.00433	7.77	1064.24	369.04	0.47
Reach 1	1330	Floodway	4990	342.36	353.69	351	354.63	0.004629	8.23	731.9	104	0.49
Reach 1	1330	10 Year	2350	342.36	349.94	348.56	350.77	0.008036	7.44	356.51	104.05	0.59
Reach 1	1330	10-Year Fldwy	2350	342.36	349.93	348.57	350.78	0.008287	7.54	344.78	95	0.6
Reach 1	1309	100 Year	4990	341.6	353.19	350.12	353.93	0.002199	7.7	1170.94	326.8	0.44
Reach 1	1309	Floodway	4990	341.6	353.48	350.1	354.4	0.002399	8.2	795.81	109	0.46
Reach 1	1309	10 Year	2350	341.6	349.72	347.65	350.4	0.003126	6.79	405.36	104.75	0.48
Reach 1	1309	10-Year Fldwy	2350	341.6	349.72	347.65	350.4	0.003124	6.79	403.57	91.53	0.48
Reach 1	1277	100 Year	4990	340.58	353.37	348.51	353.63	0.001092	4.56	1529.91	292.54	0.26
Reach 1	1277	Floodway	4990	340.58	353.61	348.5	354.06	0.001537	5.48	1002.8	116	0.31
Reach 1	1277	10 Year	2350	340.58	349.76	346.37	350.05	0.001607	4.41	579.81	191.52	0.32
Reach 1	1277	10-Year Fldwy	2350	340.58	349.75	346.36	350.05	0.001642	4.45	554.52	116	0.32
Reach 1	1260.5	Bridge										
Reach 1	1246	100 Year	4990	340.22	352.39	348.61	353.2	0.002016	7.72	950.8	270.32	0.42
Reach 1	1246	Floodway	4990	340.22	352	348.62	353.02	0.002548	8.46	725.56	93	0.47
Reach 1	1246	10 Year	2350	340.22	349.19	345.82	349.68	0.001861	5.8	466.74	137.08	0.38
Reach 1	1246	10-Year Fldwy	2350	340.22	349.19	345.84	349.68	0.001862	5.8	466.62	89.56	0.38
Reach 1	1198.5	Bridge										
Reach 1	1162	100 Year	4990	338.98	348.37	348.37	350.22	0.008265	10.91	460.63	78.48	0.71
Reach 1	1162	Floodway	4990	338.98	348.37	348.37	350.22	0.008264	10.91	460.65	78.49	0.71
Reach 1	1162	10 Year	2350	338.98	345.52	345.52	346.58	0.007033	8.26	284.64	56.54	0.65
Reach 1	1162	10-Year Fldwy	2350	338.98	345.52	345.52	346.58	0.007036	8.26	284.6	56.53	0.65
Reach 1	1153	100 Year	4990	338.19	347.31	346.44	349.75	0.011421	12.52	401.24	59.52	0.82
Reach 1	1153	Floodway	4990	338.19	347.31	346.44	349.75	0.011421	12.52	401.24	59.52	0.82
Reach 1	1153	10 Year	2350	338.19	345.33	343.65	346.35	0.006891	8.13	288.93	53.56	0.62
Reach 1	1153	10-Year Fldwy	2350	338.19	345.33	343.65	346.35	0.006893	8.13	288.89	53.55	0.62
Reach 1	1107	100 Year	4990	338.85	345.8	345.42	347.95	0.011404	11.76	424.49	235.63	0.9
Reach 1	1107	Floodway	4990	338.85	345.8	345.42	347.95	0.011402	11.76	424.5	81.39	0.9
Reach 1	1107	10 Year	2350	338.85	343.07	343.07	344.78	0.016015	10.49	223.96	65.68	1
Reach 1	1107	10-Year Fldwy	2350	338.85	343.07	343.07	344.78	0.015998	10.49	224.04	65.69	1
Reach 1	1003	100 Year	4990	333.66	343.11	341.49	344.88	0.00684	10.66	467.97	136.93	0.72
Reach 1	1003	Floodway	4990	333.66	343.11	341.5	344.88	0.006841	10.66	467.94	69.46	0.72
Reach 1	1003	10 Year	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	1003	10-Year Fldwy	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	894	100 Year	4990	328.74	338.99	338.45	341.63	0.010661	13.03	384.6	59.88	0.88
Reach 1	894	Floodway	4990	328.74	338.99	338.45	341.63	0.010656	13.02	384.65	59.88	0.88
Reach 1	894	10 Year	2350	328.74	335.71	335.38	337.61	0.012721	11.07	212.29	45.58	0.9
Reach 1	894	10-Year Fldwy	2350	328.74	335.71	335.38	337.61	0.012721	11.07	212.29	45.58	0.9

**MAD RIVER - EXISTING CONDITION, FLOODWAY**  
**HEC-RAS 4.1.0 - "Encroachment 1" Output**

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	2409	100 Year	388.9		391.53	49.44		3152.09	37.91		590	641	
Reach 1	2409	Floodway	388.93	0.03	391.63	44.7		3190		596.3	590	641	641
Reach 1	2409	10 Year	386.62	-2.28	388.33	44.15		1496.95	8.05		590	641	
Reach 1	2409	10-Year Fldwy	386.62	-2.27	388.36	41.56		1505		596.3	590	641	641
Reach 1	2337	100 Year	383.29		385.24	89.69	83.42	3095.06	11.52		-27.82	31.76	
Reach 1	2337	Floodway	383.29	0	385.24	89.64	83.18	3095.37	11.45	-48.56	-27.82	31.76	43.31
Reach 1	2337	10 Year	381.32	-1.97	382.76	54.1		1505			-27.82	31.76	
Reach 1	2337	10-Year Fldwy	381.33	-1.97	382.76	54.1		1505		-48.56	-27.82	31.76	43.31
Reach 1	2280	100 Year	381.44		383.01	95.1	16.06	3137.42	36.52		-26.38	31.17	
Reach 1	2280	Floodway	381.53	0.09	383.03	86.22	17.8	3131.27	40.93	-41.01	-26.38	31.17	47.57
Reach 1	2280	10 Year	379.19	-2.25	380.26	53.55		1505			-26.38	31.17	
Reach 1	2280	10-Year Fldwy	379.19	-2.25	380.26	53.56		1505		-41.01	-26.38	31.17	47.57
Reach 1	2238	100 Year	381.07		381.83	87.97	4.65	3178.42	6.93		-33.2	43.9	
Reach 1	2238	Floodway	381.19	0.13	381.92	86.34	5.52	3177.11	7.37	-48.13	-33.2	43.9	47.57
Reach 1	2238	10 Year	378.59	-2.48	379.09	70.65		1505			-33.2	43.9	
Reach 1	2238	10-Year Fldwy	378.59	-2.48	379.09	70.65		1505		-48.13	-33.2	43.9	47.57
Reach 1	2207	100 Year	380.2		381.17	109.49	48.61	3124.04	17.35		-31.92	31.82	
Reach 1	2207	Floodway	380.41	0.21	381.32	84.15	58.28	3130.95	0.77	-54.79	-31.92	31.82	32.81
Reach 1	2207	10 Year	377.94	-2.25	378.5	61.4	0.16	1504.84			-31.92	31.82	
Reach 1	2207	10-Year Fldwy	377.94	-2.25	378.5	61.4	0.16	1504.84		-54.79	-31.92	31.82	32.81
Reach 1	2202	100 Year	380.08		381.06	96.73	5.19	3163.03	21.79		-34.84	28.18	
Reach 1	2202	Floodway	380.29	0.21	381.22	70.42	6.42	3176.83	6.75	-53.81	-34.84	28.18	31.5
Reach 1	2202	10 Year	377.87	-2.22	378.4	61.26		1505			-34.84	28.18	
Reach 1	2202	10-Year Fldwy	377.87	-2.22	378.4	61.26		1505		-53.81	-34.84	28.18	31.5
Reach 1	2168	100 Year	379.46		380.25	157.71	44.86	2969.14	176		-38.39	29.12	
Reach 1	2168	Floodway	379.57	0.11	380.47	75.46	16.13	3172.89	0.99	-45.93	-38.39	29.12	29.53
Reach 1	2168	10 Year	377.14	-2.32	377.69	63.37		1504.75	0.25		-38.39	29.12	
Reach 1	2168	10-Year Fldwy	377.14	-2.32	377.69	62.4		1504.88	0.12	-45.93	-38.39	29.12	29.53
Reach 1	2130	100 Year	378.53		379.25	172.05	119.29	2711.95	358.75		-14.96	49.97	
Reach 1	2130	Floodway	378.56	0.02	379.39	98.43	36.95	2864.69	288.36	-22.97	-14.96	49.97	75.46
Reach 1	2130	10 Year	375.75	-2.79	376.49	54.07		1505			-14.96	49.97	
Reach 1	2130	10-Year Fldwy	375.75	-2.79	376.49	54.07		1505		-22.97	-14.96	49.97	75.46
Reach 1	2116	100 Year	376.91		378.75	80.92	85.02	3074.67	30.31		18.41	57.12	
Reach 1	2116	Floodway	377.97	1.07	379.07	110.89	136.63	2823.36	230.01	0	18.41	57.12	141.8
Reach 1	2116	10 Year	375.45	-1.46	376.15	55.28	9.09	1491.92	3.99		18.41	57.12	
Reach 1	2116	10-Year Fldwy	375.45	-1.46	376.15	55.28	9.09	1491.92	3.99	0	18.41	57.12	141.8
Reach 1	2095.5 B	100 Year	376.91		378.75		434.74	2582.71	172.96		33.14	76.12	
Reach 1	2095.5 B	Floodway	377.97	1.07	379.07	99.01	184.71	2775.47	229.91	0	33.14	76.12	141.8
Reach 1	2095.5 B	10 Year	374.87	-2.04	376.15			1505			33.14	76.12	
Reach 1	2095.5 B	10-Year Fldwy	374.87	-2.04	376.15			1505		0	33.14	76.12	141.8
Reach 1	2095.5 B	100 Year	376.91		378.75		434.74	2582.71	172.96		33.14	76.12	
Reach 1	2095.5 B	Floodway	377.97	1.07	378.6	156.45	184.71	2775.47	229.91	-133	33.14	76.12	89
Reach 1	2095.5 B	10 Year	371.62	-5.29	373.3	42.98		1505			33.14	76.12	
Reach 1	2095.5 B	10-Year Fldwy	371.62	-5.29	373.3	42.98		1505		-133	33.14	76.12	89
Reach 1	2079	100 Year	374.15		376	55.11	0.15	3189.84	0.02		25.43	77.2	
Reach 1	2079	Floodway	374.08	-0.06	375.97	53.98	0.05	3189.95	0	-133	25.43	77.2	89
Reach 1	2079	10 Year	371.22	-2.92	372.68	42.63		1505			25.43	77.2	
Reach 1	2079	10-Year Fldwy	371.22	-2.92	372.68	42.63		1505		-133	25.43	77.2	89
Reach 1	2067	100 Year	374.88		375.06	167.06	2077.84	1092.21	19.95		31.56	57.19	
Reach 1	2067	Floodway	374.83	-0.05	375.02	166.97	2075.43	1094.87	19.69	-301.84	31.56	57.19	65.62
Reach 1	2067	10 Year	370.88	-4	372.11	88.18	274.51	1223.33	7.16		31.56	57.19	
Reach 1	2067	10-Year Fldwy	370.88	-4	372.11	88.18	274.51	1223.33	7.16	-301.84	31.56	57.19	65.62
Reach 1	2020	100 Year	374.87		374.96	227.93	3589.71	1343.22	57.08		7.84	62.47	
Reach 1	2020	Floodway	374.82	-0.05	374.92	218.97	3591.41	1343.16	55.44	-337.9	7.84	62.47	86.1
Reach 1	2020	10 Year	370.53	-4.34	370.61	177.42	1731.37	616.96	1.67		7.84	62.47	
Reach 1	2020	10-Year Fldwy	370.51	-4.36	370.59	177.35	1731.8	616.57	1.62	-337.9	7.84	62.47	86.1
Reach 1	2004	100 Year	374.86		374.95	206.69	37.15	2539.42	2413.43		-130.74	-55.77	

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	2004	Floodway	374.81	-0.05	374.9	206.69	37.12	2542.19	2410.69	-224.74	-130.74	-55.77	107.61
Reach 1	2004	10 Year	370.53	-4.33	370.58	206.69	15.61	1382.77	951.62		-130.74	-55.77	
Reach 1	2004	10-Year Fldwy	370.51	-4.35	370.56	206.69	15.6	1384.11	950.29	-224.74	-130.74	-55.77	107.61
Reach 1	1983	100 Year	374.75		374.91	170.6	21.6	2504.34	2464.07		-88.94	-26.28	
Reach 1	1983	Floodway	374.7	-0.05	374.86	170.6	21.55	2509.55	2458.91	-147.64	-88.94	-26.28	114.83
Reach 1	1983	10 Year	370.41	-4.35	370.54	170.6	6.4	1576.26	767.34		-88.94	-26.28	
Reach 1	1983	10-Year Fldwy	370.38	-4.37	370.52	170.6	6.36	1579.76	763.88	-147.64	-88.94	-26.28	114.83
Reach 1	1953.5 B	100 Year	372.83		374.44	49.75	0.07	4989.92	0.01		-48.52	1.08	
Reach 1	1953.5 B	Floodway	372.75	-0.08	374.39	49.75	0.07	4989.92	0.01	-147.64	-48.52	1.08	114.83
Reach 1	1953.5 B	10 Year	369.47	-3.36	370.29	49.01	0.02	2349.98			-48.52	1.08	
Reach 1	1953.5 B	10-Year Fldwy	369.44	-3.39	370.27	48.99	0.02	2349.98		-147.64	-48.52	1.08	114.83
Reach 1	1953.5 B	100 Year	371.59		373.77	51.27	4.41	4983.33	2.26		8.63	57.87	
Reach 1	1953.5 B	Floodway	371.33	-0.26	373.65	51.2	3.98	4983.93	2.1	-6.56	8.63	57.87	101.71
Reach 1	1953.5 B	10 Year	368.57	-3.02	369.73	50.17	0.17	2349.68	0.16		8.63	57.87	
Reach 1	1953.5 B	10-Year Fldwy	368.5	-3.09	369.69	50.13	0.14	2349.72	0.14	-6.56	8.63	57.87	101.71
Reach 1	1927	100 Year	371.99		373.08	91.91	36.54	4802.33	151.13		16.47	85.14	
Reach 1	1927	Floodway	371.74	-0.24	372.91	91.9	30.33	4819.41	140.26	-6.56	16.47	85.14	101.71
Reach 1	1927	10 Year	368.59	-3.4	369.38	74.04		2349.34	0.66		16.47	85.14	
Reach 1	1927	10-Year Fldwy	368.51	-3.48	369.32	72.65		2349.64	0.36	-6.56	16.47	85.14	101.71
Reach 1	1916.5 B	100 Year	371.62		372.92	76.14	11.4	4978.6			32.02	112.8	
Reach 1	1916.5 B	Floodway	371.34	-0.28	372.74	75.52	7.6	4982.4		-6.56	32.02	112.8	101.71
Reach 1	1916.5 B	10 Year	368.51	-3.11	369.24	60.15		2350			32.02	112.8	
Reach 1	1916.5 B	10-Year Fldwy	368.43	-3.19	369.18	59.83		2350		-6.56	32.02	112.8	101.71
Reach 1	1916.5 B	100 Year	371.74		372.55	134.3	40.98	4935.83	13.19		70.14	163.52	
Reach 1	1916.5 B	Floodway	371.3	-0.44	372.48	86.22	30.8	4959.2		3.28	70.14	163.52	141.08
Reach 1	1916.5 B	10 Year	368.45	-3.29	369.03	83.74		2350			70.14	163.52	
Reach 1	1916.5 B	10-Year Fldwy	368.33	-3.42	369	69.37		2350		3.28	70.14	163.52	141.08
Reach 1	1900	100 Year	370.45		372.03	74	0	4989.88	0.12		39.25	112.5	
Reach 1	1900	Floodway	370.45	0	372.03	74	0	4989.88	0.12	3.28	39.25	112.5	141.08
Reach 1	1900	10 Year	367.58	-2.88	368.56	65.43		2350			39.25	112.5	
Reach 1	1900	10-Year Fldwy	367.58	-2.88	368.56	65.43		2350		3.28	39.25	112.5	141.08
Reach 1	1871	100 Year	370.56		371.17	120.38	2646.31	2111.72	231.97		81.53	114.27	
Reach 1	1871	Floodway	370.56	0	371.17	120.38	2646.31	2111.72	231.97	-59	81.53	114.27	158
Reach 1	1871	10 Year	367.44	-3.12	367.86	109.7	1206.21	1084.47	59.32		81.53	114.27	
Reach 1	1871	10-Year Fldwy	367.44	-3.12	367.86	109.7	1206.21	1084.47	59.32	-59	81.53	114.27	158
Reach 1	1837	100 Year	370.52		370.95	173.02	560.5	3683.33	746.17		20.8	87.8	
Reach 1	1837	Floodway	370.52	0	370.95	173.02	560.5	3683.33	746.17	-59.06	20.8	87.8	157.48
Reach 1	1837	10 Year	367.29	-3.23	367.64	97.29	5.42	2086.42	258.17		20.8	87.8	
Reach 1	1837	10-Year Fldwy	367.29	-3.23	367.64	97.29	5.42	2086.42	258.17	-59.06	20.8	87.8	157.48
Reach 1	1778	100 Year	370.38		370.76	177.59	534.31	3043.06	1412.63		-59.45	-4.43	
Reach 1	1778	Floodway	370.38	0	370.76	177.59	534.31	3043.06	1412.63	-190.29	-59.45	-4.43	72.18
Reach 1	1778	10 Year	367.08	-3.3	367.41	102.05		1801.25	548.75		-59.45	-4.43	
Reach 1	1778	10-Year Fldwy	367.08	-3.3	367.41	102.05		1801.25	548.75	-190.29	-59.45	-4.43	72.18
Reach 1	1748	100 Year	368.45		370.39	156.98	285.56	4520.29	184.15		-28.08	17.55	
Reach 1	1748	Floodway	368.45	0	370.39	156.98	285.56	4520.29	184.15	-242.78	-28.08	17.55	52.49
Reach 1	1748	10 Year	366.02	-2.42	367.09	53.84	0.41	2306.79	42.8		-28.08	17.55	
Reach 1	1748	10-Year Fldwy	366.02	-2.42	367.09	53.84	0.41	2306.79	42.8	-242.78	-28.08	17.55	52.49
Reach 1	1689	100 Year	366.17		368.62	94.22	3.76	4986.23	0.01		-47.41	31.04	
Reach 1	1689	Floodway	366.17	0	368.62	94.22	3.76	4986.23	0.01	-282.15	-47.41	31.04	113.95
Reach 1	1689	10 Year	363.63	-2.54	365.44	60.61		2350			-47.41	31.04	
Reach 1	1689	10-Year Fldwy	363.63	-2.54	365.44	60.61		2350		-282.15	-47.41	31.04	113.95
Reach 1	1620	100 Year	364.5		365.33	136.19	14.96	4923.59	51.44		-49.71	48.56	
Reach 1	1620	Floodway	364.5	0	365.33	136.19	14.95	4923.66	51.39	-285.43	-49.71	48.56	141.08
Reach 1	1620	10 Year	361.62	-2.88	362.19	95.42		2350			-49.71	48.56	
Reach 1	1620	10-Year Fldwy	361.62	-2.88	362.19	95.42		2350		-285.43	-49.71	48.56	141.08
Reach 1	1573	100 Year	364.09		364.72	97.34	10.88	4978.93	0.19		-51.8	40.9	
Reach 1	1573	Floodway	364.09	0	364.72	97.34	10.86	4978.94	0.19	-305.12	-51.8	40.9	195.67
Reach 1	1573	10 Year	361.23	-2.86	361.54	87.63		2350			-51.8	40.9	
Reach 1	1573	10-Year Fldwy	361.23	-2.86	361.54	87.63		2350		-305.12	-51.8	40.9	195.67

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	1561.5		Inl Struct										
Reach 1	1550	100 Year	359.39		359.84	110.24	307.31	4624.38	58.31		-58.07	38.06	
Reach 1	1550	Floodway	359.51	0.12	360.02	98.59	2.82	4924.79	62.39	-58.56	-58.07	38.06	41.44
Reach 1	1550	10 Year	356.95	-2.44	357.15	110.24	105.66	2219.99	24.35		-58.07	38.06	
Reach 1	1550	10-Year Fldwy	356.92	-2.47	357.15	98.59	1.47	2323.1	25.43	-58.56	-58.07	38.06	41.44
Reach 1	1536	100 Year	358.54		359.56	148.89	68.75	4836.12	85.13		-54.27	39.04	
Reach 1	1536	Floodway	358.78	0.23	359.76	100.07	14.5	4907.42	68.08	-56.43	-54.27	39.04	43.64
Reach 1	1536	10 Year	356.42	-2.12	356.96	103.04	4.99	2322.89	22.12		-54.27	39.04	
Reach 1	1536	10-Year Fldwy	356.42	-2.12	356.96	100.07	3.64	2324.09	22.27	-56.43	-54.27	39.04	43.64
Reach 1	1523	100 Year	357.29		358.78	175.98	152.32	4835.91	1.78		-56.1	39.41	
Reach 1	1523	Floodway	357.63	0.35	359.06	100.1	2.83	4982.79	4.39	-57.33	-56.1	39.41	42.77
Reach 1	1523	10 Year	354.98	-2.31	356.13	85.31		2350			-56.1	39.41	
Reach 1	1523	10-Year Fldwy	354.98	-2.31	356.13	85.32		2350		-57.33	-56.1	39.41	42.77
Reach 1	1487	100 Year	356.9		357.6	209.16	254.37	4734.2	1.43		-53.38	51.6	
Reach 1	1487	Floodway	357.27	0.36	357.99	108.99	0.89	4986.07	3.04	-53.9	-53.38	51.6	55.09
Reach 1	1487	10 Year	354.5	-2.41	354.94	98.64		2350			-53.38	51.6	
Reach 1	1487	10-Year Fldwy	354.5	-2.41	354.94	98.65		2350		-53.9	-53.38	51.6	55.09
Reach 1	1425	100 Year	355.72		356.46	255.59	325.73	4630.54	33.73		-52.49	39.76	
Reach 1	1425	Floodway	356.12	0.4	356.92	104.98	0.5	4941.16	48.34	-52.75	-52.49	39.76	52.23
Reach 1	1425	10 Year	353.38	-2.33	353.84	98.89	1.22	2348.5	0.28		-52.49	39.76	
Reach 1	1425	10-Year Fldwy	353.38	-2.33	353.84	94.67	0.09	2349.63	0.28	-52.75	-52.49	39.76	52.23
Reach 1	1370	100 Year	353.83		355.14	216.33	937.97	3975.37	76.66		-12.86	38.09	
Reach 1	1370	Floodway	354.21	0.38	355.62	96.8	752.16	4198.75	39.09	-52.6	-12.86	38.09	44.2
Reach 1	1370	10 Year	351.09	-2.74	352.24	102.73	127.05	2222.22	0.73		-12.86	38.09	
Reach 1	1370	10-Year Fldwy	351.11	-2.71	352.25	92.43	127.7	2221.52	0.78	-52.6	-12.86	38.09	44.2
Reach 1	1330	100 Year	353.39		354.14	366.03	644.57	3954.66	390.77		-27.89	32.81	
Reach 1	1330	Floodway	353.69	0.3	354.63	104	472.92	4339.1	177.98	-54	-27.89	32.81	50
Reach 1	1330	10 Year	349.94	-3.44	350.77	104.05	112.6	2232.67	4.74		-27.89	32.81	
Reach 1	1330	10-Year Fldwy	349.93	-3.46	350.78	95	91.07	2254.31	4.62	-54	-27.89	32.81	50
Reach 1	1309	100 Year	353.19		353.93	326.8	631.59	3951.05	407.35		-29	24.61	
Reach 1	1309	Floodway	353.48	0.28	354.4	109	469.78	4333.49	186.73	-57	-29	24.61	52
Reach 1	1309	10 Year	349.72	-3.48	350.4	94.93	117.91	2221.75	10.34		-29	24.61	
Reach 1	1309	10-Year Fldwy	349.72	-3.48	350.4	91.53	119.46	2220.21	10.32	-57	-29	24.61	52
Reach 1	1277	100 Year	353.37		353.63	292.54	270.72	3844.13	875.15		-54.07	34.81	
Reach 1	1277	Floodway	353.61	0.24	354.06	116	12.1	4738.03	239.87	-56.4	-54.07	34.81	59.6
Reach 1	1277	10 Year	349.76	-3.61	350.05	139.76	20.17	2303.92	25.91		-54.07	34.81	
Reach 1	1277	10-Year Fldwy	349.75	-3.62	350.05	116	1.98	2323.12	24.9	-56.4	-54.07	34.81	59.6
Reach 1	1260.5 B	100 Year	353.04		353.48	205.08	395.89	2484.75	2109.36		-38.39	26.58	
Reach 1	1260.5 B	Floodway	352.36	-0.68	353.64	45.13	56.18	4560.37	373.45	-56.4	-38.39	26.58	59.6
Reach 1	1260.5 B	10 Year	349.26	-3.78	349.85	64.37		2350			-38.39	26.58	
Reach 1	1260.5 B	10-Year Fldwy	349.26	-3.78	349.85	64.36		2350		-56.4	-38.39	26.58	59.6
Reach 1	1260.5 B	100 Year	352.69		353.37	163.06	463.88	3448.03	1078.1		-38.39	26.58	
Reach 1	1260.5 B	Floodway	351.95	-0.74	353.45	22.13	74.46	4900.8	14.75	-52.5	-38.39	26.58	40.5
Reach 1	1260.5 B	10 Year	349.22	-3.46	349.83	64.22		2350			-38.39	26.58	
Reach 1	1260.5 B	10-Year Fldwy	349.22	-3.46	349.82	64.21		2350		-52.5	-38.39	26.58	40.5
Reach 1	1246	100 Year	352.39		353.2	233.92	380.91	4310.71	298.38		-29.76	24.11	
Reach 1	1246	Floodway	352	-0.39	353.02	93	256.33	4545.12	188.55	-52.5	-29.76	24.11	40.5
Reach 1	1246	10 Year	349.19	-3.2	349.68	88.45	57.44	2236.14	56.42		-29.76	24.11	
Reach 1	1246	10-Year Fldwy	349.19	-3.21	349.68	88.43	57.43	2236.18	56.39	-52.5	-29.76	24.11	40.5
Reach 1	1198.5 B	100 Year	351.22		352.57	64.53		4990			-51.54	49.21	
Reach 1	1198.5 B	Floodway	351.21	-0.01	352.56	64.5		4990		-52.5	-51.54	49.21	40.5
Reach 1	1198.5 B	10 Year	347.6	-3.62	348.42	52.89		2350			-51.54	49.21	
Reach 1	1198.5 B	10-Year Fldwy	347.6	-3.62	348.42	52.89		2350		-52.5	-51.54	49.21	40.5
Reach 1	1198.5 B	100 Year	347.68		350.84	54.98		4990			-51.54	49.21	
Reach 1	1198.5 B	Floodway	348.47	0.79	350.96	57.5		4990		-66.3	-51.54	49.21	35.6
Reach 1	1198.5 B	10 Year	345.36	-2.31	346.97	47.39		2350			-51.54	49.21	
Reach 1	1198.5 B	10-Year Fldwy	345.36	-2.31	346.97	47.39		2350		-66.3	-51.54	49.21	35.6
Reach 1	1162	100 Year	348.37		350.22	68.45	3.83	4985.73	0.44		-34.09	27.92	
Reach 1	1162	Floodway	348.37	0	350.22	68.45	3.83	4985.72	0.44	-66.3	-34.09	27.92	35.6

HEC-RAS Plan: EX_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	1162	10 Year	345.52	-2.85	346.58	56.54		2350			-34.09	27.92	
Reach 1	1162	10-Year Fldwy	345.52	-2.85	346.58	56.53		2350		-66.3	-34.09	27.92	35.6
Reach 1	1153	100 Year	347.31		349.75	59.52	6.92	4981.38	1.7		-26.48	28.45	
Reach 1	1153	Floodway	347.31	0	349.75	59.52	6.92	4981.38	1.7	-87.5	-26.48	28.45	34.5
Reach 1	1153	10 Year	345.33	-1.99	346.35	53.56		2350			-26.48	28.45	
Reach 1	1153	10-Year Fldwy	345.33	-1.99	346.35	53.55		2350		-87.5	-26.48	28.45	34.5
Reach 1	1107	100 Year	345.8		347.95	81.46	0.03	4989.97	0		-42.65	38.17	
Reach 1	1107	Floodway	345.8	0	347.95	81.39	0.03	4989.97	0	-98.1	-42.65	38.17	38.3
Reach 1	1107	10 Year	343.07	-2.73	344.78	65.68		2350			-42.65	38.17	
Reach 1	1107	10-Year Fldwy	343.07	-2.73	344.78	65.69		2350		-98.1	-42.65	38.17	38.3
Reach 1	1003	100 Year	343.11		344.88	69.47	0.01	4989.99	0		-35.24	32.61	
Reach 1	1003	Floodway	343.11	0	344.88	69.46	0.01	4989.99	0	-68.34	-35.24	32.61	33.2
Reach 1	1003	10 Year	339.98	-3.13	341.12	56		2350			-35.24	32.61	
Reach 1	1003	10-Year Fldwy	339.98	-3.13	341.12	56		2350		-68.34	-35.24	32.61	33.2
Reach 1	894	100 Year	338.99		341.63	59.88	2.83	4986.05	1.12		-32.25	23.8	
Reach 1	894	Floodway	338.99	0	341.63	59.88	2.84	4986.04	1.12	-41.73	-32.25	23.8	68.59
Reach 1	894	10 Year	335.71	-3.28	337.61	45.58		2350			-32.25	23.8	
Reach 1	894	10-Year Fldwy	335.71	-3.28	337.61	45.58		2350		-41.73	-32.25	23.8	68.59

**MAD RIVER - PROPOSED CONDITION, REGULATORY**  
**HEC-RAS 4.1.0 - "Standard Table 1" Output**

HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
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 1	2409	10 Year	1505	382.8	386.64	386.64	388.33	0.016212	10.45	146.77	44.19	0.99
Reach 1	2409	25 Year (est)	2105	382.8	387.53	387.53	389.59	0.015242	11.57	186.82	46.25	0.99
Reach 1	2409	50 Year	2595	382.8	388.18	388.18	390.51	0.014683	12.31	217.52	47.77	0.99
Reach 1	2409	100 Year	3190	382.8	388.9	388.9	391.53	0.014257	13.1	252.54	49.45	0.99
Reach 1	2409	500 Year	4970	382.8	391.69	391.69	394.16	0.008804	12.88	492.09	180.79	0.82
Reach 1	2337	10 Year	1505	377.2	381.32	381.32	382.76	0.016925	9.63	156.36	54.1	1
Reach 1	2337	25 Year (est)	2105	377.2	382.19	382.19	383.78	0.014746	10.15	212.61	77.15	0.96
Reach 1	2337	50 Year	2595	377.2	382.72	382.72	384.48	0.013629	10.73	255.17	83.18	0.95
Reach 1	2337	100 Year	3190	377.2	383.29	383.29	385.24	0.012791	11.37	304.83	89.69	0.94
Reach 1	2337	500 Year	4970	377.2	384.72	384.72	387.19	0.011605	12.98	444.83	106.59	0.93
Reach 1	2280	10 Year	1505	374.21	379.05	378.59	380.21	0.010363	8.63	174.32	52.43	0.83
Reach 1	2280	25 Year (est)	2105	374.21	380.11	379.47	381.37	0.009066	9	235.59	66.61	0.79
Reach 1	2280	50 Year	2595	374.21	380.67	380.06	382.13	0.009312	9.71	276.49	78.79	0.8
Reach 1	2280	100 Year	3190	374.21	381.3	380.71	382.96	0.00943	10.42	329.9	92.36	0.8
Reach 1	2280	500 Year	4970	374.21	382.44	382.44	384.95	0.011841	12.97	447.16	113.66	0.9
Reach 1	2238	10 Year	1505	373.56	378.21	376.99	378.83	0.007507	6.33	237.79	67.06	0.59
Reach 1	2238	25 Year (est)	2105	373.56	379.34	377.7	380.02	0.007939	6.58	319.94	77.21	0.57
Reach 1	2238	50 Year	2595	373.56	380.01	378.27	380.77	0.007457	6.99	372.64	81.36	0.56
Reach 1	2238	100 Year	3190	373.56	380.74	378.88	381.6	0.007015	7.45	433.62	86.8	0.56
Reach 1	2238	500 Year	4970	373.56	382.2	380.28	383.28	0.006775	8.56	619.82	165.73	0.57
Reach 1	2207	10 Year	1505	372.7	376.84	376.21	377.83	0.012327	7.98	188.53	54.69	0.76
Reach 1	2207	25 Year (est)	2105	372.7	377.68	376.99	378.92	0.013742	8.93	235.59	58.07	0.78
Reach 1	2207	50 Year	2595	372.7	378.26	377.57	379.7	0.013675	9.63	271.18	64.38	0.79
Reach 1	2207	100 Year	3190	372.7	378.87	378.19	380.55	0.013538	10.41	312.32	69.35	0.8
Reach 1	2207	500 Year	4970	372.7	381.46	380.44	382.62	0.006049	9.1	617.23	222.14	0.57
Reach 1	2202	10 Year	1505	372.61	376.28	376.11	377.56	0.017556	9.1	165.35	54.9	0.92
Reach 1	2202	25 Year (est)	2105	372.61	377.07	376.86	378.63	0.018578	10.01	210.29	58.01	0.93
Reach 1	2202	50 Year	2595	372.61	377.74	377.43	379.42	0.018249	10.37	250.16	60.69	0.9
Reach 1	2202	100 Year	3190	372.61	378.45	378.04	380.29	0.016725	10.87	293.98	63.66	0.88
Reach 1	2202	500 Year	4970	372.61	380.45	380.28	382.42	0.011619	11.44	455.4	143.38	0.77
Reach 1	2168	10 Year	1505	370.7	374.19	374.07	375.59	0.017721	9.48	158.78	50.75	0.94
Reach 1	2168	25 Year (est)	2105	370.7	375.23	374.86	376.75	0.015122	9.89	212.84	52.87	0.87
Reach 1	2168	50 Year	2595	370.7	376.09	375.44	377.65	0.013388	10.03	258.73	54.63	0.81
Reach 1	2168	100 Year	3190	370.7	376.85	376.09	378.59	0.013369	10.6	301.05	56.21	0.81
Reach 1	2168	500 Year	4970	370.7	378.38	377.76	380.93	0.01404	12.83	390.99	90.22	0.86
Reach 1	2130	10 Year	1505	368.93	373.29	372.29	374.09	0.007072	7.18	209.68	56.84	0.66
Reach 1	2130	25 Year (est)	2105	368.93	374.61	373.06	375.44	0.005853	7.32	287.49	60.41	0.59
Reach 1	2130	50 Year	2595	368.93	375.61	373.64	376.47	0.005137	7.45	348.7	62.49	0.55
Reach 1	2130	100 Year	3190	368.93	376.44	374.25	377.42	0.004902	7.97	401.35	97.64	0.55
Reach 1	2130	500 Year	4970	368.93	379.05	375.83	379.78	0.002437	7.05	757.07	335.53	0.41
Reach 1	2116	10 Year	1505	368.44	373.09	371.8	373.77	0.005474	6.65	226.36	57.97	0.59
Reach 1	2116	25 Year (est)	2105	368.44	374.47	372.58	375.2	0.003934	6.84	308.59	60.98	0.53
Reach 1	2116	50 Year	2595	368.44	375.48	373.16	376.26	0.0033	7.06	371.62	63.09	0.5
Reach 1	2116	100 Year	3190	368.44	376.32	373.75	377.22	0.003276	7.64	424.82	106.37	0.51
Reach 1	2116	500 Year	4970	368.44	379.06	375.32	379.65	0.00151	6.46	865.01	413.88	0.36
Reach 1	2098.5		Culvert									
Reach 1	2079	10 Year	1505	367.09	370.3	370.22	371.54	0.015727	8.92	168.65	62.44	0.96
Reach 1	2079	25 Year (est)	2105	367.09	371.62	370.91	372.68	0.008781	8.27	254.61	67.77	0.75
Reach 1	2079	50 Year	2595	367.09	372.67	371.43	373.64	0.00627	7.91	327.87	72	0.65
Reach 1	2079	100 Year	3190	367.09	373.79	371.99	374.73	0.004862	7.76	411.24	76.54	0.59
Reach 1	2079	500 Year	4970	367.09	376.65	373.47	377.59	0.002795	7.81	668.7	341.74	0.48
Reach 1	2067	10 Year	1505	366.67	370.33	369.95	370.71	0.007491	4.8	307.6	296.43	0.46
Reach 1	2067	25 Year (est)	2105	366.67	371.78	369.96	372.1	0.003687	4.27	471.28	305.54	0.34
Reach 1	2067	50 Year	2595	366.67	372.85	370.12	373.16	0.002634	4.12	594.44	311.96	0.3
Reach 1	2067	100 Year	3190	366.67	374.05	370.52	374.27	0.001652	3.68	847.87	319	0.24
Reach 1	2067	500 Year	4970	366.67	376.93	371.55	377.18	0.001155	3.86	1248.99	344.28	0.21
Reach 1	2020	10 Year	2350	364.99	370.25	368.2	370.34	0.000801	3.01	1039.94	403.27	0.24
Reach 1	2020	25 Year (est)	3290	364.99	371.72	368.27	371.83	0.000667	3.28	1342.94	410.32	0.23



HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	2020	50 Year	4060	364.99	372.8	368.27	372.93	0.000605	3.46	1568.75	416.31	0.22
Reach 1	2020	100 Year	4990	364.99	373.97	368.28	374.11	0.000561	3.68	1817.5	426	0.22
Reach 1	2020	500 Year	7775	364.99	376.86	368.89	377.05	0.000513	4.26	2456.23	451.17	0.22
Reach 1	2004	10 Year	2350	364.4	370.22	367.68	370.29	0.000589	2.7	1178.31	312.48	0.21
Reach 1	2004	25 Year (est)	3290	364.4	371.7	367.68	371.79	0.000526	3.01	1482.6	319.39	0.2
Reach 1	2004	50 Year	4060	364.4	372.78	367.69	372.89	0.000496	3.23	1705.83	324.46	0.2
Reach 1	2004	100 Year	4990	364.4	373.95	367.69	374.07	0.000477	3.47	1946.42	329.92	0.2
Reach 1	2004	500 Year	7775	364.4	376.84	368.14	377.02	0.000466	4.13	2541.89	349.53	0.21
Reach 1	1983	10 Year	2350	363.65	370.12	366.93	370.23	0.00072	3.25	895.83	207.12	0.23
Reach 1	1983	25 Year (est)	3290	363.65	371.58	366.94	371.73	0.000684	3.66	1120.64	213.74	0.24
Reach 1	1983	50 Year	4060	363.65	372.65	366.94	372.83	0.000666	3.94	1288.42	218.6	0.24
Reach 1	1983	100 Year	4990	363.65	373.81	367.4	374.01	0.000657	4.26	1471.74	223.83	0.24
Reach 1	1983	500 Year	7775	363.65	376.66	368.61	376.94	0.00067	5.11	1936.68	311.03	0.25
Reach 1	1972	10 Year	2350	363.26	369.65	367.79	370.09	0.002344	5.83	479.6	164.26	0.42
Reach 1	1972	25 Year (est)	3290	363.26	371.12	368.5	371.59	0.001907	6.08	641.84	178.32	0.39
Reach 1	1972	50 Year	4060	363.26	372.18	369.02	372.69	0.001716	6.31	762.23	183.25	0.38
Reach 1	1972	100 Year	4990	363.26	373.32	369.58	373.87	0.001593	6.61	892.96	188.48	0.37
Reach 1	1972	500 Year	7775	363.26	376.08	371.04	376.78	0.001468	7.5	1222.77	280.96	0.37
Reach 1	1962	10 Year	2350	363.03	369.58	366.75	370	0.002152	5.2	452.15	83.47	0.39
Reach 1	1962	25 Year (est)	3290	363.03	371.01	367.59	371.52	0.002081	5.72	575.13	89.19	0.4
Reach 1	1962	50 Year	4060	363.03	372.03	368.21	372.61	0.002027	6.07	668.59	93.28	0.4
Reach 1	1962	100 Year	4990	363.03	373.13	368.9	373.78	0.00192	6.47	773.18	97.66	0.4
Reach 1	1962	500 Year	7775	363.03	375.78	370.72	376.67	0.001824	7.59	1046.31	108.29	0.4
Reach 1	1938.5		Bridge									
Reach 1	1900	10 Year	2350	361.94	368.39		368.98	0.003554	6.13	383.63	84.79	0.51
Reach 1	1900	25 Year (est)	3290	361.94	369.8		370.45	0.003229	6.5	506.53	90.4	0.48
Reach 1	1900	50 Year	4060	361.94	370.8		371.52	0.003077	6.77	599.44	94.41	0.47
Reach 1	1900	100 Year	4990	361.94	371.88		372.66	0.002952	7.1	703.05	98.74	0.46
Reach 1	1900	500 Year	7775	361.94	374.44		375.47	0.002725	8.16	968.88	108.94	0.46
Reach 1	1871	10 Year	2350	361.45	367.71	365.89	368.52	0.004646	7.21	326.05	64.93	0.57
Reach 1	1871	25 Year (est)	3290	361.45	369	366.91	369.98	0.004628	7.97	412.58	70.04	0.58
Reach 1	1871	50 Year	4060	361.45	369.92	367.63	371.03	0.00461	8.48	478.9	73.72	0.59
Reach 1	1871	100 Year	4990	361.45	370.9	368.44	372.17	0.004551	9.02	553.37	77.65	0.59
Reach 1	1871	500 Year	7775	361.45	373.16	370.5	374.92	0.004429	10.67	738.73	86.69	0.61
Reach 1	1807.5		Bridge									
Reach 1	1748	10 Year	2350	359.71	365.62	364.04	366.49	0.005259	7.49	313.86	64.95	0.6
Reach 1	1748	25 Year (est)	3290	359.71	366.88	365.04	367.94	0.005471	8.25	398.86	69.97	0.61
Reach 1	1748	50 Year	4060	359.71	367.78	365.76	368.97	0.006066	8.76	463.34	73.58	0.62
Reach 1	1748	100 Year	4990	359.71	368.72	366.55	370.08	0.006545	9.34	534.15	77.36	0.62
Reach 1	1748	500 Year	7775	359.71	371.02	368.59	372.87	0.006106	10.92	722.79	86.57	0.63
Reach 1	1727.5		Bridge									
Reach 1	1689	10 Year	2350	359.15	363.56	363.23	365.03	0.012481	9.73	241.63	63.9	0.88
Reach 1	1689	25 Year (est)	3290	359.15	364.25	364.18	366.3	0.016279	11.48	286.67	66.66	0.98
Reach 1	1689	50 Year	4060	359.15	364.87	364.87	367.24	0.017966	12.37	328.21	69.11	1
Reach 1	1689	100 Year	4990	359.15	365.62	365.62	368.28	0.018683	13.09	381.31	72.11	1
Reach 1	1689	500 Year	7775	359.15	367.5	367.5	371	0.016439	15.03	524.12	79.66	0.99
Reach 1	1620	10 Year	2350	356.43	360.95	360.62	362.06	0.012175	8.44	278.56	91.61	0.85
Reach 1	1620	25 Year (est)	3290	356.43	362.12	361.36	363.23	0.008537	8.44	389.84	99.5	0.75
Reach 1	1620	50 Year	4060	356.43	362.96	361.89	364.1	0.006872	8.59	478.88	113.05	0.69
Reach 1	1620	100 Year	4990	356.43	363.88	362.48	365.08	0.005703	8.79	590.14	127.98	0.65
Reach 1	1620	500 Year	7775	356.43	366.41	364.07	367.65	0.003804	9.16	951.06	157.03	0.56
Reach 1	1573	10 Year	2350	352.4	360.75	357.96	361.17	0.00226	5.19	452.85	86.5	0.4
Reach 1	1573	25 Year (est)	3290	352.4	361.87	358.97	362.43	0.002425	5.97	551.51	89.44	0.42
Reach 1	1573	50 Year	4060	352.4	362.7	359.54	363.36	0.002491	6.48	627.24	93.66	0.44
Reach 1	1573	100 Year	4990	352.4	363.62	360.19	364.39	0.002516	7.01	715.04	99.94	0.45
Reach 1	1573	500 Year	7775	352.4	366.09	361.88	367.14	0.002394	8.23	958.32	115.23	0.46
Reach 1	1561.5		Inl Struct									
Reach 1	1550	10 Year	2350	352.85	356.95	356.95	358.18	0.01516	9.18	269.1	121.64	0.96

HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1550	25 Year (est)	3290	352.85	357.66	357.57	359.11	0.013274	9.98	344.87	123.29	0.93
Reach 1	1550	50 Year	4060	352.85	358.23	358.02	359.82	0.01193	10.44	405.08	124.61	0.9
Reach 1	1550	100 Year	4990	352.85	358.74	358.54	360.61	0.011927	11.28	459.21	125.79	0.92
Reach 1	1550	500 Year	7775	352.85	359.95	359.95	362.7	0.012813	13.64	587.71	130.87	0.99
Reach 1	1536	10 Year	2350	350.85	356.5	355.49	357.22	0.010975	6.79	348.63	102.99	0.64
Reach 1	1536	25 Year (est)	3290	350.85	357.36	356.27	358.25	0.010358	7.63	438.27	106.64	0.64
Reach 1	1536	50 Year	4060	350.85	357.94	356.75	359	0.010348	8.29	503.7	119.96	0.66
Reach 1	1536	100 Year	4990	350.85	358.45	357.3	359.74	0.011167	9.19	571.25	168.95	0.69
Reach 1	1536	500 Year	7775	350.85	359.53	358.98	361.58	0.014221	11.69	720.65	184.26	0.8
Reach 1	1523	10 Year	2350	349.8	354.94	354.61	356.12	0.028239	8.7	270.27	85.06	0.86
Reach 1	1523	25 Year (est)	3290	349.8	355.98	355.4	357.26	0.024518	9.08	362.46	92.38	0.81
Reach 1	1523	50 Year	4060	349.8	356.63	355.98	358.03	0.023479	9.54	439.7	152.72	0.8
Reach 1	1523	100 Year	4990	349.8	357.18	356.89	358.76	0.022942	10.2	529.91	188.68	0.81
Reach 1	1523	500 Year	7775	349.8	358.6	358.3	360.52	0.021206	11.58	766.48	216.11	0.81
Reach 1	1487	10 Year	2350	348.2	354.48	352.11	354.92	0.004406	5.35	439.41	98.48	0.44
Reach 1	1487	25 Year (est)	3290	348.2	355.54	352.95	356.1	0.00451	6.02	561.24	174.32	0.46
Reach 1	1487	50 Year	4060	348.2	356.28	353.59	356.9	0.004269	6.38	714.92	205.52	0.45
Reach 1	1487	100 Year	4990	348.2	356.84	354.29	357.57	0.004615	7.02	830.07	208.78	0.48
Reach 1	1487	500 Year	7775	348.2	358.23	356.28	359.26	0.005316	8.55	1126.76	217.67	0.53
Reach 1	1425	10 Year	2350	346.46	353.38	351.23	353.84	0.006425	5.43	434.33	110.11	0.44
Reach 1	1425	25 Year (est)	3290	346.46	354.39	352.03	354.99	0.006517	6.23	539.3	164.8	0.46
Reach 1	1425	50 Year	4060	346.46	355.11	352.6	355.81	0.006603	6.79	622.59	203.7	0.47
Reach 1	1425	100 Year	4990	346.46	355.72	353.2	356.46	0.00649	7.15	853.84	255.62	0.48
Reach 1	1425	500 Year	7775	346.46	356.98	354.85	357.97	0.007506	8.59	1188.58	271.43	0.53
Reach 1	1370	10 Year	2350	343.67	351.09	350.48	352.24	0.011808	8.85	309.4	102.73	0.7
Reach 1	1370	25 Year (est)	3290	343.67	352.16	351.45	353.46	0.01078	9.63	426.2	130.01	0.69
Reach 1	1370	50 Year	4060	343.67	353.03	352.06	354.37	0.009609	9.96	559.87	188.9	0.67
Reach 1	1370	100 Year	4990	343.67	353.82	353.15	355.14	0.008718	10.2	726.24	263.49	0.65
Reach 1	1370	500 Year	7775	343.67	355.82	354.96	356.88	0.006243	10.07	1415.1	357.76	0.57
Reach 1	1330	10 Year	2350	342.36	349.39	348.56	350.5	0.012416	8.55	301.28	96.94	0.72
Reach 1	1330	25 Year (est)	3290	342.36	351.36	349.66	352.19	0.006124	7.68	517.13	168.93	0.54
Reach 1	1330	50 Year	4060	342.36	352.37	350.3	353.24	0.005367	7.94	662.81	254.97	0.52
Reach 1	1330	100 Year	4990	342.36	353.04	350.98	354.07	0.005776	8.73	817.65	333.35	0.54
Reach 1	1330	500 Year	7775	342.36	355.6	352.2	356.17	0.002898	7.43	1831.1	415.99	0.4
Reach 1	1309	10 Year	2350	341.6	349.02	347.65	349.93	0.004852	7.81	341.42	122.37	0.59
Reach 1	1309	25 Year (est)	3290	341.6	351.1	348.65	351.91	0.002891	7.49	546.48	202.71	0.48
Reach 1	1309	50 Year	4060	341.6	352.16	349.34	352.98	0.002583	7.73	727.68	250.54	0.47
Reach 1	1309	100 Year	4990	341.6	352.91	350.12	353.87	0.002552	8.13	997.77	302.4	0.47
Reach 1	1309	500 Year	7775	341.6	355.44	352.97	356.21	0.001598	7.55	1834.89	351.28	0.39
Reach 1	1288.5		Bridge									
Reach 1	1277	10 Year	2350	340.58	348.78	346.35	349.28	0.006161	5.66	420.56	102.27	0.44
Reach 1	1277	25 Year (est)	3290	340.58	350.61	347.28	351.07	0.003965	5.56	682.27	175.83	0.37
Reach 1	1277	50 Year	4060	340.58	351.54	347.92	351.99	0.00353	5.7	858.05	196.14	0.36
Reach 1	1277	100 Year	4990	340.58	352.24	348.6	352.75	0.003607	6.09	997.45	199.27	0.37
Reach 1	1277	500 Year	7775	340.58	354.91	350.98	355.4	0.002507	6.08	1539.13	232.31	0.32
Reach 1	1214.5		Bridge									
Reach 1	1162	10 Year	2350	338.98	345.32		346.46	0.006846	8.56	274.52	55.7	0.68
Reach 1	1162	25 Year (est)	3290	338.98	346.31		347.84	0.007828	9.94	331.07	59.07	0.74
Reach 1	1162	50 Year	4060	338.98	347.09		348.88	0.007764	10.75	378.26	61.74	0.75
Reach 1	1162	100 Year	4990	338.98	348.13		350.12	0.007046	11.33	444.82	71.99	0.73
Reach 1	1162	500 Year	7775	338.98	350.32	349.13	352.93	0.006759	13.2	676.2	178.4	0.75
Reach 1	1153	10 Year	2350	338.19	345.14	343.65	346.24	0.006128	8.42	279.03	53.03	0.65
Reach 1	1153	25 Year (est)	3290	338.19	346	344.75	347.59	0.00757	10.1	325.75	55.53	0.73
Reach 1	1153	50 Year	4060	338.19	346.47	345.59	348.54	0.008921	11.54	352.36	56.96	0.8
Reach 1	1153	100 Year	4990	338.19	347.08	346.44	349.68	0.009948	12.95	387.47	58.81	0.86
Reach 1	1153	500 Year	7775	338.19	350.35	350.35	352.53	0.005445	12.36	709.92	244.05	0.68
Reach 1	1107	10 Year	2350	338.85	343.07	343.07	344.78	0.016015	10.49	223.96	65.68	1
Reach 1	1107	25 Year (est)	3290	338.85	344.1	344.01	346.03	0.014123	11.18	294.41	71.25	0.97
Reach 1	1107	50 Year	4060	338.85	344.91	344.68	346.95	0.012695	11.46	354.36	76.13	0.94
Reach 1	1107	100 Year	4990	338.85	345.8	345.42	347.95	0.011404	11.76	424.49	235.63	0.9

HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach 1	1107	500 Year	7775	338.85	347.58	347.58	348.61	0.005071	9.52	1257.13	541.79	0.63
Reach 1	1003	10 Year	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	1003	25 Year (est)	3290	333.66	341.27	339.82	342.65	0.006766	9.42	349.4	60.97	0.69
Reach 1	1003	50 Year	4060	333.66	342.18	340.62	343.73	0.006738	9.99	406.38	64.45	0.7
Reach 1	1003	100 Year	4990	333.66	343.11	341.49	344.88	0.00684	10.66	467.97	136.93	0.72
Reach 1	1003	500 Year	7775	333.66	345.82	343.7	346.81	0.003177	9.07	1466.47	611.95	0.52
Reach 1	894	10 Year	2350	328.74	335.71	335.38	337.61	0.012721	11.07	212.29	45.58	0.9
Reach 1	894	25 Year (est)	3290	328.74	337.06	336.59	339.25	0.012049	11.89	276.67	50.9	0.9
Reach 1	894	50 Year	4060	328.74	338.06	337.54	340.4	0.011544	12.29	330.3	56.1	0.89
Reach 1	894	100 Year	4990	328.74	338.99	338.45	341.63	0.010661	13.03	384.6	59.88	0.88
Reach 1	894	500 Year	7775	328.74	341.36	340.85	344.71	0.009294	14.83	553.4	111.3	0.86

# MAD RIVER - PROPOSED CONDITION, FEMA DISCHARGE

## HEC-RAS 4.1.0 - "Six XS Bridge" Output

HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	1972	10 Year	370.09	369.65	367.79	0.08	0.01	164.26	489.3	1833.49	27.2	5.83
Reach 1	1972	25 Year (est)	371.59	371.12	368.5	0.07	0.01	178.32	840	2384.51	65.45	6.08
Reach 1	1972	50 Year	372.69	372.18	369.02	0.06	0.02	183.25	1128	2825.46	106.21	6.31
Reach 1	1972	100 Year	373.87	373.32	369.58	0.06	0.03	188.48	1474	3351.83	164.2	6.61
Reach 1	1972	500 Year	376.78	376.08	371.04	0.06	0.06	280.96	2499	4892.53	383.6	7.5
Reach 1	1962	10 Year	370	369.58	366.75	0.17	0.12	83.47		2350		5.2
Reach 1	1962	25 Year (est)	371.52	371.01	367.59	0.17	0.14	89.19		3290		5.72
Reach 1	1962	50 Year	372.61	372.03	368.21	0.17	0.16	93.28		4059.98	0.02	6.07
Reach 1	1962	100 Year	373.78	373.13	368.9	0.16	0.18	97.66	0.62	4988.19	1.19	6.47
Reach 1	1962	500 Year	376.67	375.78	370.72	0.15	0.22	108.29	27.85	7727.66	19.49	7.59
Reach 1	1938.5 BR U	10 Year	369.71	368.9	367.07	0.2	0	64.24		2350		7.24
Reach 1	1938.5 BR U	25 Year (est)	371.2	370.22	368.07	0.19	0.01	69.49		3290		7.97
Reach 1	1938.5 BR U	50 Year	372.28	371.17	368.83	0.19	0.01	73.28		4060		8.44
Reach 1	1938.5 BR U	100 Year	373.44	372.2	369.64	0.19	0.02	77.37		4990		8.93
Reach 1	1938.5 BR U	500 Year	376.3	374.69	371.72	0.19	0.02	88.89		7771.67	3.33	10.19
Reach 1	1938.5 BR D	10 Year	369.51	368.71	366.91	0.42	0.11	65.54		2350		7.21
Reach 1	1938.5 BR D	25 Year (est)	371	370.04	367.93	0.39	0.16	70.86		3290		7.89
Reach 1	1938.5 BR D	50 Year	372.08	371	368.64	0.38	0.18	74.71		4060		8.34
Reach 1	1938.5 BR D	100 Year	373.24	372.04	369.44	0.37	0.21	78.85		4990		8.81
Reach 1	1938.5 BR D	500 Year	376.09	374.53	371.49	0.35	0.27	88.8		7775		10.03
Reach 1	1900	10 Year	368.98	368.39		0.39	0.07	84.79		2350		6.13
Reach 1	1900	25 Year (est)	370.45	369.8		0.37	0.1	90.4		3290		6.5
Reach 1	1900	50 Year	371.52	370.8		0.36	0.12	94.41		4060		6.77
Reach 1	1900	100 Year	372.66	371.88		0.35	0.14	98.74	0	4989.65	0.35	7.1
Reach 1	1900	500 Year	375.47	374.44		0.33	0.22	108.94	7.64	7752.73	14.64	8.16
Reach 1	1871	10 Year	368.52	367.71	365.89	0.52	0	64.93		2350		7.21
Reach 1	1871	25 Year (est)	369.98	369	366.91	0.52	0	70.04		3290		7.97
Reach 1	1871	50 Year	371.03	369.92	367.63	0.52	0	73.72		4060		8.48
Reach 1	1871	100 Year	372.17	370.9	368.44	0.52	0.01	77.65	0.01	4989.9	0.09	9.02
Reach 1	1871	500 Year	374.92	373.16	370.5	0.5	0.01	86.69	12.59	7745.59	16.82	10.67
Reach 1	1807.5 BR U	10 Year	367.99	367.18	365.37	0.97	0.01	64.41		2350		7.24
Reach 1	1807.5 BR U	25 Year (est)	369.45	368.45	366.37	0.97	0.01	69.5		3290		8.03
Reach 1	1807.5 BR U	50 Year	370.51	369.37	367.11	0.96	0.01	73.19		4060		8.54
Reach 1	1807.5 BR U	100 Year	371.64	370.36	367.92	0.97	0.01	77.13		4990		9.08
Reach 1	1807.5 BR U	500 Year	374.41	372.67	370	0.95	0	85.33	11.73	7745.06	18.21	10.6
Reach 1	1807.5 BR D	10 Year	367.02	366.17	364.45	0.51	0.01	64.09		2350		7.37
Reach 1	1807.5 BR D	25 Year (est)	368.47	367.44	365.46	0.52	0.01	69.16		3290		8.16
Reach 1	1807.5 BR D	50 Year	369.53	368.37	366.2	0.55	0.01	72.9		4060		8.65
Reach 1	1807.5 BR D	100 Year	370.66	369.34	366.99	0.57	0.01	76.78		4990		9.2
Reach 1	1807.5 BR D	500 Year	373.45	371.71	369.08	0.55	0.03	84.2		7775		10.59
Reach 1	1748	10 Year	366.49	365.62	364.04	0.16	0.02	64.95		2350		7.49
Reach 1	1748	25 Year (est)	367.94	366.88	365.04	0.16	0.02	69.97		3290		8.25
Reach 1	1748	50 Year	368.97	367.78	365.76	0.17	0.03	73.58		4060		8.76
Reach 1	1748	100 Year	370.08	368.72	366.55	0.17	0.03	77.36	0	4989.98	0.02	9.34
Reach 1	1748	500 Year	372.87	371.02	368.59	0.16	0.06	86.57	9.7	7755.04	10.26	10.92
Reach 1	1727.5 BR U	10 Year	366.32	365.48	363.84	0.33	0	66.44		2350		7.32
Reach 1	1727.5 BR U	25 Year (est)	367.76	366.75	364.83	0.31	0.01	71.5		3290		8.06
Reach 1	1727.5 BR U	50 Year	368.78	367.64	365.54	0.31	0.02	75.08		4060		8.57
Reach 1	1727.5 BR U	100 Year	369.88	368.58	366.32	0.31	0.03	86.11	1.57	4988.43		9.15
Reach 1	1727.5 BR U	500 Year	372.65	370.92	368.34	0.28	0.05	107.98	38.31	7732.63	4.06	10.58
Reach 1	1727.5 BR D	10 Year	365.98	365.16	363.59	0.76	0.19	68.48		2350		7.28
Reach 1	1727.5 BR D	25 Year (est)	367.43	366.45	364.54	0.81	0.32	73.62		3290		7.94
Reach 1	1727.5 BR D	50 Year	368.45	367.35	365.22	0.83	0.38	77.23		4060		8.42
Reach 1	1727.5 BR D	100 Year	369.54	368.29	366	0.84	0.42	84.55		4990		8.96
Reach 1	1727.5 BR D	500 Year	372.31	370.69	367.98	0.75	0.56	91.02	35.68	7736.26	3.07	10.25
Reach 1	1689	10 Year	365.03	363.56	363.23	2.79	0.18	63.9		2350		9.73
Reach 1	1689	25 Year (est)	366.3	364.25	364.18	2.6	0.47	66.66		3290		11.48
Reach 1	1689	50 Year	367.24	364.87	364.87	2.38	0.62	69.11		4060		12.37

HEC-RAS Plan: PR_FEMA_Reg River: Mad River Reach: Reach 1												
Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Crit W.S. (ft)	Frctn Loss (ft)	C & E Loss (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Vel Chnl (ft/s)
Reach 1	1689	100 Year	368.28	365.62	365.62	2.14	0.73	72.11	0	4989.99	0.01	13.09
Reach 1	1689	500 Year	371	367.5	367.5	1.57	1.12	79.66	8.19	7757.88	8.94	15.03
Reach 1	1620	10 Year	362.06	360.95	360.62	0.68	0.21	91.61		2350		8.44
Reach 1	1620	25 Year (est)	363.23	362.12	361.36	0.64	0.17	99.5		3289.98	0.02	8.44
Reach 1	1620	50 Year	364.1	362.96	361.89	0.6	0.15	113.05	1.06	4053.21	5.73	8.59
Reach 1	1620	100 Year	365.08	363.88	362.48	0.56	0.13	127.98	8.68	4949.54	31.78	8.79
Reach 1	1620	500 Year	367.65	366.41	364.07	0.46	0.06	157.03	102.1	7424.97	247.9	9.16
Reach 1	1330	10 Year	350.5	349.39	348.56	0.51	0.06	96.94	69.66	2278.91	1.43	8.55
Reach 1	1330	25 Year (est)	352.19	351.36	349.66	0.28	0.01	168.93	287.2	2964.01	38.8	7.68
Reach 1	1330	50 Year	353.24	352.37	350.3	0.25	0.02	254.97	417.3	3551.11	91.64	7.94
Reach 1	1330	100 Year	354.07	353.04	350.98	0.25	0.05	333.35	517.1	4259.24	213.68	8.73
Reach 1	1330	500 Year	356.17	355.6	352.2	0.14	0	415.99	1626	4780.21	1368.9	7.43
Reach 1	1309	10 Year	349.93	349.02	347.65	0.25	0.12	122.37	83.84	2261.3	4.86	7.81
Reach 1	1309	25 Year (est)	351.91	351.1	348.65			202.71	247.7	3006.06	36.28	7.49
Reach 1	1309	50 Year	352.98	352.16	349.34			250.54	343.2	3540.32	176.52	7.73
Reach 1	1309	100 Year	353.87	352.91	350.12			302.4	566.1	4052.22	371.7	8.13
Reach 1	1309	500 Year	356.21	355.44	352.97			351.28	1389	4782.16	1603.6	7.55
Reach 1	1288.5 BR U	10 Year	349.56	348.89	346.78	0.04	0	67.3		2350		6.57
Reach 1	1288.5 BR U	25 Year (est)	351.91	351.1	347.71			81.35	71.25	3093.61	124.52	7.29
Reach 1	1288.5 BR U	50 Year	352.98	352.16	348.38			134.72	251.4	3279.09	528.04	7.73
Reach 1	1288.5 BR U	100 Year	353.76	352.91	349.12			158.79	427.1	3472.14	927.78	8.19
Reach 1	1288.5 BR U	500 Year	356.02	355.44	349.83			191.13	1110	3114.83	3135.3	7.32
Reach 1	1288.5 BR D	10 Year	349.51	348.83	346.75	0.14	0.09	67.19		2350		6.64
Reach 1	1288.5 BR D	25 Year (est)	351.88	351.1	347.7			60.34	71.25	3093.61	124.52	7.29
Reach 1	1288.5 BR D	50 Year	352.89	352.16	348.38			123.8	251.4	3279.09	528.04	7.73
Reach 1	1288.5 BR D	100 Year	353.58	352.83	349.13			148.62	427.1	3472.14	927.78	8.19
Reach 1	1288.5 BR D	500 Year	356.02	354.91	349.82			155.7	1110	3114.83	3135.3	7.32
Reach 1	1277	10 Year	349.28	348.78	346.35	0.32	0.09	102.27	0.67	2343.52	5.81	5.66
Reach 1	1277	25 Year (est)	351.07	350.61	347.28			175.83	13.88	3119.63	156.49	5.56
Reach 1	1277	50 Year	351.99	351.54	347.92			196.14	72.42	3617.08	370.5	5.7
Reach 1	1277	100 Year	352.75	352.24	348.6	0.21	0.14	199.27	168.1	4214.5	607.39	6.09
Reach 1	1277	500 Year	355.4	354.91	350.98	0.16	0.23	232.31	682.5	5502.06	1590.5	6.08
Reach 1	1214.5 BR U	10 Year	348.86	348.08	346.3	1.87	0.2	71.24	0.42	2349.58		7.12
Reach 1	1214.5 BR U	25 Year (est)	350.91	350.29	347.3			92.42	171.6	3118.39		6.41
Reach 1	1214.5 BR U	50 Year	351.86	351.16	348.02			99.66	308.6	3751.3	0.08	6.8
Reach 1	1214.5 BR U	100 Year	352.4	351.42	349.02	1.5	0.41	100.19	411.1	4578.26	0.67	8.01
Reach 1	1214.5 BR U	500 Year	355.01	353.76	350.78	1.3	0.49	105.84	1072	6686.2	17.17	8.92
Reach 1	1214.5 BR D	10 Year	346.8	345.35	344.67	0.18	0.16	54.86		2347.04	2.96	9.68
Reach 1	1214.5 BR D	25 Year (est)	348.14	345.74	345.74			56.25		3282.52	7.49	12.46
Reach 1	1214.5 BR D	50 Year	349.21	346.52	346.52			59.04		4039.47	20.53	13.2
Reach 1	1214.5 BR D	100 Year	350.48	348.13	347.41	0.18	0.18	73.64	5.34	4920.76	63.9	12.39
Reach 1	1214.5 BR D	500 Year	353.23	350.35	349.79	0.17	0.13	82.58	285.6	7292.18	197.26	13.86
Reach 1	1162	10 Year	346.46	345.32		0.2	0.02	55.7		2350		8.56
Reach 1	1162	25 Year (est)	347.84	346.31		0.23	0.02	59.07		3290		9.94
Reach 1	1162	50 Year	348.88	347.09		0.25	0.08	61.74	0.84	4058.79	0.37	10.75
Reach 1	1162	100 Year	350.12	348.13		0.25	0.18	71.99	6.52	4978.84	4.65	11.33
Reach 1	1162	500 Year	352.93	350.32	349.13	0.19	0.22	178.4	219.6	7513.14	42.28	13.2
Reach 1	1153	10 Year	346.24	345.14	343.65	1.41	0.06	53.03		2350		8.42
Reach 1	1153	25 Year (est)	347.59	346	344.75	1.52	0.04	55.53	0.06	3289.94	0	10.1
Reach 1	1153	50 Year	348.54	346.47	345.59	1.59	0.01	56.96	0.86	4058.89	0.25	11.54
Reach 1	1153	100 Year	349.68	347.08	346.44	1.6	0.14	58.81	4.26	4983.8	1.94	12.95
Reach 1	1153	500 Year	352.53	350.35	350.35	0.81	0.34	244.05	746.4	6976.66	51.91	12.36

**MAD RIVER - PROPOSED CONDITION, REGULATORY**  
**HEC-RAS 4.1.0 - "Culvert Only" Output**

HEC-RAS	Plan: PR_FEMA_Reg	River: Mad River	Reach: Reach 1										
Reach	River Sta	Profile	E.G. US. (ft)	W.S. US. (ft)	E.G. IC (ft)	E.G. OC (ft)	Min El Weir Flow (ft)	Q Culv Group (cfs)	Q Weir (cfs)	Delta WS (ft)	Culv Vel US (ft/s)	Culv Vel DS (ft/s)	
Reach 1	2098.5	Culvert #1	10 Year	373.78	373.09	373.59	373.78	376.97	1505	2.78	10.57	10.72	
Reach 1	2098.5	Culvert #1	25 Year (est)	375.2	374.47	374.98	375.2	376.97	2105	2.85	11.66	11.99	
Reach 1	2098.5	Culvert #1	50 Year	376.26	375.48	376.03	376.26	376.97	2595	2.81	12.35	12.71	
Reach 1	2098.5	Culvert #1	100 Year	377.22	376.32	377.08	377.22	376.97	3069.7	120.3	12.74	12.36	
Reach 1	2098.5	Culvert #1	500 Year	379.65	379.06	378.78	379.65	376.97	3018.98	1951	2.41	11.13	11.13

**Culvert Output**

File Type Options Help

River: Mad River Profile: 100 Year Culv Group: Culvert #1

Reach: Reach 1 RS: 2098.5 Plan: PR\_FEMA\_Reg

Plan: PR\_FEMA\_Reg Mad River Reach 1 RS: 2098.5 Culv Group: Culvert #1 Profile: 100 Year

Q Culv Group (cfs)	3069.70	Culv Full Len (ft)	
# Barrels	3	Culv Vel US (ft/s)	12.74
Q Barrel (cfs)	1023.23	Culv Vel DS (ft/s)	12.36
E.G. US. (ft)	377.22	Culv Inv El Up (ft)	366.11
W.S. US. (ft)	376.32	Culv Inv El Dn (ft)	365.52
E.G. DS (ft)	374.73	Culv Frctn Ls (ft)	0.55
W.S. DS (ft)	373.79	Culv Exit Loss (ft)	1.44
Delta EG (ft)	2.49	Culv Entr Loss (ft)	0.50
E.G. IC (ft)	377.08	Q Weir (cfs)	120.30
E.G. OC (ft)	377.22	Weir Sta Lft (ft)	-65.95
Culvert Control	Outlet	Weir Sta Rgt (ft)	116.80
Culv WS Inlet (ft)	374.20	Weir Submerg	0.00
Culv WS Outlet (ft)	373.79	Weir Max Depth (ft)	0.81
Culv Nml Depth (ft)	8.01	Weir Avg Depth (ft)	0.42
Culv Crt Depth (ft)	7.71	Weir Flow Area (sq ft)	64.76
		Min El Weir Flow (ft)	376.97

Errors, Warnings and Notes

Select Profile

**Culvert Output**

File Type Options Help

River: Mad River Profile: 500 Year Culv Group: Culvert #1

Reach: Reach 1 RS: 2098.5 Plan: PR\_FEMA\_Reg

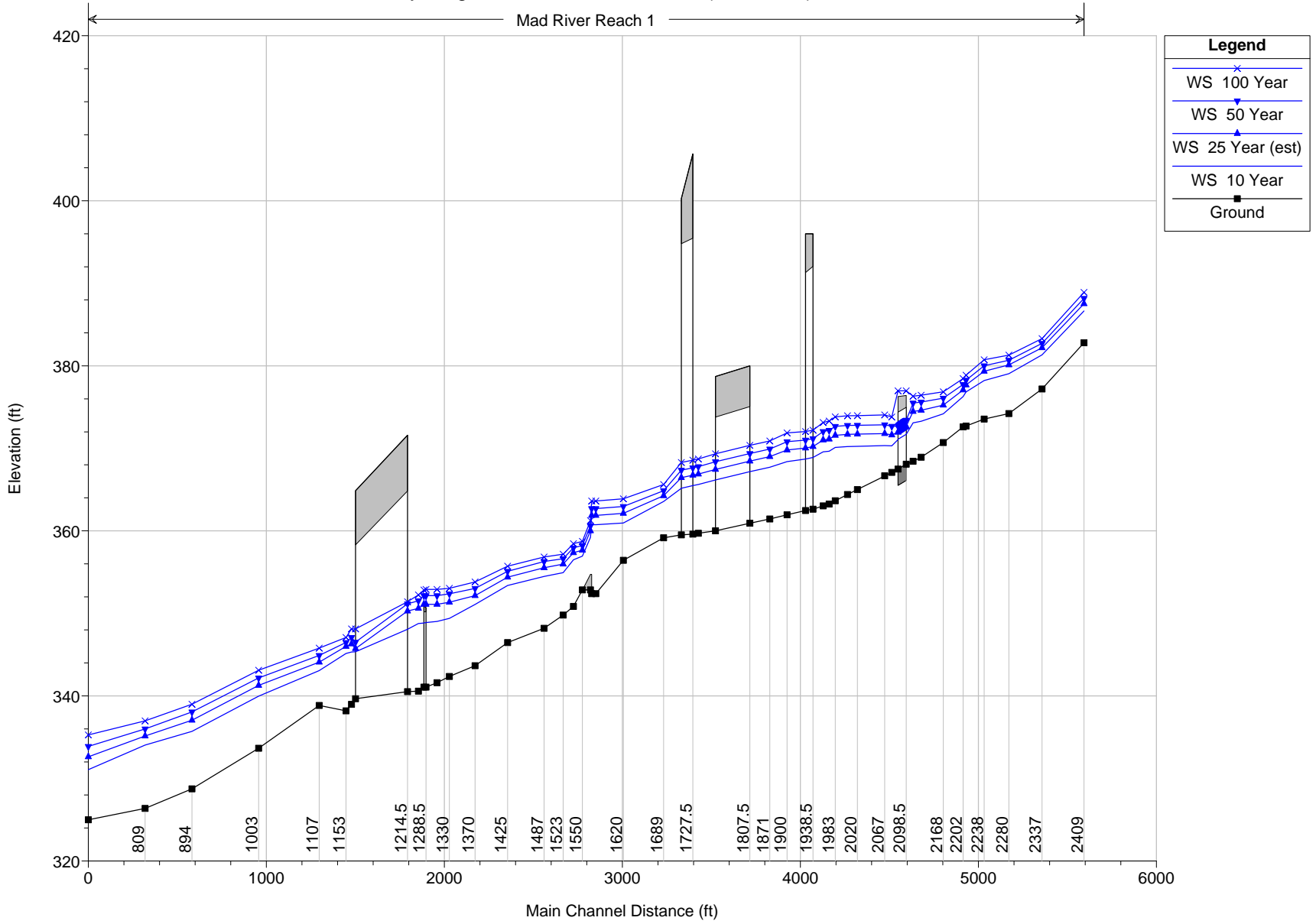
Plan: PR\_FEMA\_Reg Mad River Reach 1 RS: 2098.5 Culv Group: Culvert #1 Profile: 500 Year

Q Culv Group (cfs)	3018.98	Culv Full Len (ft)	46.05
# Barrels	3	Culv Vel US (ft/s)	11.13
Q Barrel (cfs)	1006.33	Culv Vel DS (ft/s)	11.13
E.G. US. (ft)	379.65	Culv Inv El Up (ft)	366.11
W.S. US. (ft)	379.06	Culv Inv El Dn (ft)	365.52
E.G. DS (ft)	377.59	Culv Frctn Ls (ft)	0.68
W.S. DS (ft)	376.65	Culv Exit Loss (ft)	0.99
Delta EG (ft)	2.05	Culv Entr Loss (ft)	0.38
E.G. IC (ft)	378.78	Q Weir (cfs)	1951.02
E.G. OC (ft)	379.65	Weir Sta Lft (ft)	-65.95
Culvert Control	Outlet	Weir Sta Rgt (ft)	116.80
Culv WS Inlet (ft)	374.97	Weir Submerg	0.01
Culv WS Outlet (ft)	374.38	Weir Max Depth (ft)	3.24
Culv Nml Depth (ft)		Weir Avg Depth (ft)	2.64
Culv Crt Depth (ft)	7.64	Weir Flow Area (sq ft)	441.51
		Min El Weir Flow (ft)	376.97

Errors, Warnings and Notes

Select Profile

Mad River Reach 1



**MAD RIVER - PROPOSED CONDITION, FLOODWAY**

**HEC-RAS 4.1.0 - "Standard Table 1" Output**

HEC-RAS Plan: PR FLWDY River: Mad River Reach: Reach 1												
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 1	2409	100 Year	3190	382.8	388.9	388.9	391.53	0.01429	13.11	252.34	49.44	1
Reach 1	2409	Floodway	3190	382.8	388.93	388.93	391.63	0.016433	13.19	241.87	44.7	1
Reach 1	2409	10 Year	1505	382.8	386.62	386.62	388.33	0.016526	10.52	145.85	44.15	1
Reach 1	2409	10-Year Fldwy	1505	382.8	386.62	386.62	388.36	0.018073	10.57	142.42	41.56	1.01
Reach 1	2337	100 Year	3190	377.2	383.29	383.29	385.24	0.012791	11.37	304.83	89.69	0.94
Reach 1	2337	Floodway	3190	377.2	383.29	383.29	385.24	0.012829	11.38	304.49	89.64	0.94
Reach 1	2337	10 Year	1505	377.2	381.32	381.32	382.76	0.016925	9.63	156.36	54.1	1
Reach 1	2337	10-Year Fldwy	1505	377.2	381.33	381.33	382.76	0.016918	9.62	156.38	54.1	1
Reach 1	2280	100 Year	3190	374.21	381.3	380.71	382.96	0.00943	10.42	329.9	92.36	0.8
Reach 1	2280	Floodway	3190	374.21	381.3	380.72	382.96	0.009411	10.41	328.07	84.67	0.8
Reach 1	2280	10 Year	1505	374.21	379.05	378.59	380.21	0.010363	8.63	174.32	52.43	0.83
Reach 1	2280	10-Year Fldwy	1505	374.21	379.05	378.58	380.21	0.010363	8.63	174.32	52.43	0.83
Reach 1	2238	100 Year	3190	373.56	380.74	378.88	381.6	0.007015	7.45	433.62	86.8	0.56
Reach 1	2238	Floodway	3190	373.56	380.74	378.87	381.6	0.007014	7.45	433.43	84.86	0.56
Reach 1	2238	10 Year	1505	373.56	378.21	376.99	378.83	0.007507	6.33	237.79	67.06	0.59
Reach 1	2238	10-Year Fldwy	1505	373.56	378.21	377	378.83	0.007507	6.33	237.79	67.06	0.59
Reach 1	2207	100 Year	3190	372.7	378.87	378.19	380.55	0.013538	10.41	312.32	69.35	0.8
Reach 1	2207	Floodway	3190	372.7	378.88	378.18	380.55	0.013517	10.41	312.49	69.35	0.8
Reach 1	2207	10 Year	1505	372.7	376.84	376.21	377.83	0.012327	7.98	188.53	54.69	0.76
Reach 1	2207	10-Year Fldwy	1505	372.7	376.84	376.21	377.83	0.012327	7.98	188.53	54.69	0.76
Reach 1	2202	100 Year	3190	372.61	378.45	378.04	380.29	0.016725	10.87	293.98	63.66	0.88
Reach 1	2202	Floodway	3190	372.61	378.45	378.05	380.29	0.016666	10.86	294.3	63.66	0.87
Reach 1	2202	10 Year	1505	372.61	376.28	376.11	377.56	0.017556	9.1	165.35	54.9	0.92
Reach 1	2202	10-Year Fldwy	1505	372.61	376.28	376.11	377.56	0.017556	9.1	165.35	54.9	0.92
Reach 1	2168	100 Year	3190	370.7	376.85	376.09	378.59	0.013369	10.6	301.05	56.21	0.81
Reach 1	2168	Floodway	3190	370.7	376.99	376.09	378.65	0.012263	10.32	309.04	56.21	0.78
Reach 1	2168	10 Year	1505	370.7	374.19	374.07	375.59	0.017721	9.48	158.78	50.75	0.94
Reach 1	2168	10-Year Fldwy	1505	370.7	374.19	374.07	375.59	0.017721	9.48	158.78	50.75	0.94
Reach 1	2130	100 Year	3190	368.93	376.44	374.25	377.42	0.004902	7.97	401.35	97.64	0.55
Reach 1	2130	Floodway	3190	368.93	376.65	374.26	377.58	0.004396	7.72	415.08	64.22	0.53
Reach 1	2130	10 Year	1505	368.93	373.29	372.29	374.09	0.007072	7.18	209.68	56.84	0.66
Reach 1	2130	10-Year Fldwy	1505	368.93	373.29	372.29	374.09	0.007072	7.18	209.68	56.84	0.66
Reach 1	2116	100 Year	3190	368.44	376.32	373.75	377.22	0.003276	7.64	424.82	106.37	0.51
Reach 1	2116	Floodway	3190	368.44	376.54	373.75	377.39	0.002943	7.4	439.61	64.82	0.48
Reach 1	2116	10 Year	1505	368.44	373.09	371.8	373.77	0.005474	6.65	226.36	57.97	0.59
Reach 1	2116	10-Year Fldwy	1505	368.44	373.09	371.8	373.77	0.005474	6.65	226.36	57.97	0.59
Reach 1	2098.5		Culvert									
Reach 1	2079	100 Year	3190	367.09	373.79	371.99	374.73	0.004862	7.76	411.24	76.54	0.59
Reach 1	2079	Floodway	3190	367.09	373.79	371.99	374.73	0.004862	7.76	411.22	76.53	0.59
Reach 1	2079	10 Year	1505	367.09	370.3	370.22	371.54	0.015727	8.92	168.65	62.44	0.96
Reach 1	2079	10-Year Fldwy	1505	367.09	370.3	370.22	371.54	0.015727	8.92	168.65	62.44	0.96
Reach 1	2067	100 Year	3190	366.67	374.05	370.52	374.27	0.001652	3.68	847.87	319	0.24
Reach 1	2067	Floodway	3190	366.67	374.05	370.52	374.27	0.001652	3.68	847.85	136.57	0.24
Reach 1	2067	10 Year	1505	366.67	370.33	369.95	370.71	0.007491	4.8	307.6	296.43	0.46
Reach 1	2067	10-Year Fldwy	1505	366.67	370.33	369.95	370.71	0.007491	4.8	307.6	129.03	0.46
Reach 1	2020	100 Year	4990	364.99	373.97	368.28	374.11	0.000561	3.68	1817.5	426	0.22
Reach 1	2020	Floodway	4990	364.99	373.97	368.28	374.11	0.000561	3.68	1817.46	217.52	0.22
Reach 1	2020	10 Year	2350	364.99	370.25	368.2	370.34	0.000801	3.01	1039.94	403.27	0.24
Reach 1	2020	10-Year Fldwy	2350	364.99	370.25	368.2	370.34	0.000801	3.01	1039.94	205.81	0.24
Reach 1	2004	100 Year	4990	364.4	373.95	367.69	374.07	0.000477	3.47	1946.42	329.92	0.2
Reach 1	2004	Floodway	4990	364.4	373.95	367.69	374.07	0.000477	3.47	1946.38	220.22	0.2
Reach 1	2004	10 Year	2350	364.4	370.22	367.68	370.29	0.000589	2.7	1178.31	312.48	0.21
Reach 1	2004	10-Year Fldwy	2350	364.4	370.22	367.68	370.29	0.000589	2.7	1178.31	211.45	0.21
Reach 1	1983	100 Year	4990	363.65	373.81	367.4	374.01	0.000657	4.26	1471.74	223.83	0.24
Reach 1	1983	Floodway	4990	363.65	373.81	367.4	374.01	0.000657	4.26	1471.71	160.32	0.24
Reach 1	1983	10 Year	2350	363.65	370.12	366.93	370.23	0.00072	3.25	895.83	207.12	0.23
Reach 1	1983	10-Year Fldwy	2350	363.65	370.12	366.93	370.23	0.00072	3.25	895.83	152.24	0.23



HEC-RAS Plan: PR FLWDY River: Mad River Reach: Reach 1												
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 1	1972	100 Year	4990	363.26	373.32	369.58	373.87	0.001593	6.61	892.96	188.48	0.37
Reach 1	1972	Floodway	4990	363.26	373.32	369.58	373.87	0.001593	6.61	892.92	116.46	0.37
Reach 1	1972	10 Year	2350	363.26	369.65	367.79	370.09	0.002344	5.83	479.6	164.26	0.42
Reach 1	1972	10-Year Fldwy	2350	363.26	369.65	367.79	370.09	0.002344	5.83	479.6	108.7	0.42
Reach 1	1962	100 Year	4990	363.03	373.13	368.9	373.78	0.00192	6.47	773.18	97.66	0.4
Reach 1	1962	Floodway	4990	363.03	373.13	368.9	373.78	0.001921	6.47	773.1	97.21	0.4
Reach 1	1962	10 Year	2350	363.03	369.58	366.75	370	0.002152	5.2	452.15	83.47	0.39
Reach 1	1962	10-Year Fldwy	2350	363.03	369.58	366.75	370	0.002152	5.2	452.15	83.47	0.39
Reach 1	1938.5		Bridge									
Reach 1	1900	100 Year	4990	361.94	371.88		372.66	0.002952	7.1	703.05	98.74	0.46
Reach 1	1900	Floodway	4990	361.94	371.88		372.66	0.002953	7.1	703	98.74	0.47
Reach 1	1900	10 Year	2350	361.94	368.39		368.98	0.003554	6.13	383.63	84.79	0.51
Reach 1	1900	10-Year Fldwy	2350	361.94	368.39		368.98	0.003554	6.13	383.63	84.79	0.51
Reach 1	1871	100 Year	4990	361.45	370.9	368.44	372.17	0.004551	9.02	553.37	77.65	0.59
Reach 1	1871	Floodway	4990	361.45	370.9	368.44	372.16	0.004553	9.02	553.3	77.64	0.59
Reach 1	1871	10 Year	2350	361.45	367.71	365.89	368.52	0.004646	7.21	326.05	64.93	0.57
Reach 1	1871	10-Year Fldwy	2350	361.45	367.71	365.9	368.52	0.004646	7.21	326.05	64.93	0.57
Reach 1	1807.5		Bridge									
Reach 1	1748	100 Year	4990	359.71	368.72	366.55	370.08	0.006545	9.34	534.15	77.36	0.62
Reach 1	1748	Floodway	4990	359.71	368.72	366.56	370.07	0.006553	9.35	533.96	77.35	0.62
Reach 1	1748	10 Year	2350	359.71	365.62	364.04	366.49	0.005259	7.49	313.86	64.95	0.6
Reach 1	1748	10-Year Fldwy	2350	359.71	365.62	364.03	366.49	0.005259	7.49	313.86	64.95	0.6
Reach 1	1727.5		Bridge									
Reach 1	1689	100 Year	4990	359.15	365.62	365.62	368.28	0.018683	13.09	381.31	72.11	1
Reach 1	1689	Floodway	4990	359.15	365.62	365.62	368.28	0.018709	13.09	381.16	72.11	1
Reach 1	1689	10 Year	2350	359.15	363.56	363.23	365.03	0.012481	9.73	241.63	63.9	0.88
Reach 1	1689	10-Year Fldwy	2350	359.15	363.56	363.23	365.03	0.012483	9.73	241.62	63.9	0.88
Reach 1	1620	100 Year	4990	356.43	363.88	362.48	365.08	0.005703	8.79	590.14	127.98	0.65
Reach 1	1620	Floodway	4990	356.43	364.15	362.48	365.23	0.004882	8.38	623.66	127.98	0.6
Reach 1	1620	10 Year	2350	356.43	360.95	360.62	362.06	0.012175	8.44	278.56	91.61	0.85
Reach 1	1620	10-Year Fldwy	2350	356.43	360.95	360.62	362.06	0.012171	8.44	278.59	91.62	0.85
Reach 1	1573	100 Year	4990	352.4	363.62	360.19	364.39	0.002516	7.01	715.04	99.94	0.45
Reach 1	1573	Floodway	4990	352.4	363.92	360.18	364.62	0.002217	6.75	743.54	99.93	0.42
Reach 1	1573	10 Year	2350	352.4	360.75	357.96	361.17	0.00226	5.19	452.85	86.5	0.4
Reach 1	1573	10-Year Fldwy	2350	352.4	360.75	357.96	361.17	0.00226	5.19	452.88	86.5	0.4
Reach 1	1561.5		Inl Struct									
Reach 1	1550	100 Year	4990	352.85	358.74	358.54	360.61	0.011927	11.28	459.21	125.79	0.92
Reach 1	1550	Floodway	4990	352.85	358.79	358.65	360.83	0.012753	11.75	441.43	100	0.96
Reach 1	1550	10 Year	2350	352.85	356.95	356.95	358.18	0.01516	9.18	269.1	121.64	0.96
Reach 1	1550	10-Year Fldwy	2350	352.85	356.95	356.95	358.27	0.015855	9.41	259.98	100	0.98
Reach 1	1536	100 Year	4990	350.85	358.45	357.3	359.74	0.011167	9.19	571.25	168.95	0.69
Reach 1	1536	Floodway	4990	350.85	358.61	357.29	359.87	0.010334	9.02	558.84	100.07	0.67
Reach 1	1536	10 Year	2350	350.85	356.5	355.49	357.22	0.010975	6.79	348.63	102.99	0.64
Reach 1	1536	10-Year Fldwy	2350	350.85	356.5	355.49	357.22	0.011007	6.8	347.21	100.07	0.64
Reach 1	1523	100 Year	4990	349.8	357.18	356.89	358.76	0.022942	10.2	529.91	188.68	0.81
Reach 1	1523	Floodway	4990	349.8	357.43	356.59	358.97	0.020474	9.96	503.4	99.39	0.77
Reach 1	1523	10 Year	2350	349.8	354.94	354.61	356.12	0.028239	8.7	270.27	85.06	0.86
Reach 1	1523	10-Year Fldwy	2350	349.8	354.94	354.61	356.12	0.02822	8.69	270.33	85.07	0.86
Reach 1	1487	100 Year	4990	348.2	356.84	354.29	357.57	0.004615	7.02	830.07	208.78	0.48
Reach 1	1487	Floodway	4990	348.2	357.06	354.28	357.84	0.004552	7.13	710.38	108.42	0.48
Reach 1	1487	10 Year	2350	348.2	354.48	352.11	354.92	0.004406	5.35	439.41	98.48	0.44
Reach 1	1487	10-Year Fldwy	2350	348.2	354.48	352.1	354.93	0.004403	5.35	439.53	98.49	0.44
Reach 1	1425	100 Year	4990	346.46	355.72	353.2	356.46	0.00649	7.15	853.84	255.62	0.48
Reach 1	1425	Floodway	4990	346.46	355.8	353.19	356.68	0.007141	7.56	674.83	105	0.5
Reach 1	1425	10 Year	2350	346.46	353.38	351.23	353.84	0.006425	5.43	434.33	110.11	0.44
Reach 1	1425	10-Year Fldwy	2350	346.46	353.38	351.23	353.84	0.00643	5.44	432.91	94.67	0.44
Reach 1	1370	100 Year	4990	343.67	353.82	353.15	355.14	0.008718	10.2	726.24	263.49	0.65

HEC-RAS Plan: PR FLWDY River: Mad River Reach: Reach 1												
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 1	1370	Floodway	4990	343.67	354.08	352.92	355.35	0.007885	9.92	671.25	129.4	0.62
Reach 1	1370	10 Year	2350	343.67	351.09	350.48	352.24	0.011808	8.85	309.4	102.73	0.7
Reach 1	1370	10-Year Fldwy	2350	343.67	351.09	350.48	352.24	0.011808	8.85	309.4	102.73	0.7
Reach 1	1330	100 Year	4990	342.36	353.04	350.98	354.07	0.005776	8.73	817.65	333.35	0.54
Reach 1	1330	Floodway	4990	342.36	353.6	350.96	354.42	0.004302	7.88	828.01	147.28	0.47
Reach 1	1330	10 Year	2350	342.36	349.39	348.56	350.5	0.012416	8.55	301.28	96.94	0.72
Reach 1	1330	10-Year Fldwy	2350	342.36	349.39	348.56	350.5	0.012418	8.55	301.26	96.94	0.72
Reach 1	1309	100 Year	4990	341.6	352.91	350.12	353.87	0.002552	8.13	997.77	302.4	0.47
Reach 1	1309	Floodway	4990	341.6	353.36	350.13	354.28	0.002307	7.98	867.7	144.78	0.45
Reach 1	1309	10 Year	2350	341.6	349.02	347.65	349.93	0.004852	7.81	341.42	122.37	0.59
Reach 1	1309	10-Year Fldwy	2350	341.6	349.02	347.65	349.93	0.004853	7.81	341.4	109.8	0.59
Reach 1	1288.5		Bridge									
Reach 1	1277	100 Year	4990	340.58	352.24	348.6	352.75	0.003607	6.09	997.45	199.27	0.37
Reach 1	1277	Floodway	4990	340.58	352.25	348.6	352.87	0.004168	6.55	861.02	130.69	0.39
Reach 1	1277	10 Year	2350	340.58	348.78	346.35	349.28	0.006161	5.66	420.56	102.27	0.44
Reach 1	1277	10-Year Fldwy	2350	340.58	348.78	346.35	349.27	0.006162	5.66	420.54	102.23	0.44
Reach 1	1214.5		Bridge									
Reach 1	1162	100 Year	4990	338.98	348.13		350.12	0.007046	11.33	444.82	71.99	0.73
Reach 1	1162	Floodway	4990	338.98	348.15		350.14	0.007532	11.33	440.45	59.43	0.73
Reach 1	1162	10 Year	2350	338.98	345.32		346.46	0.006846	8.56	274.52	55.7	0.68
Reach 1	1162	10-Year Fldwy	2350	338.98	345.32		346.46	0.006848	8.56	274.48	55.7	0.68
Reach 1	1153	100 Year	4990	338.19	347.08	346.44	349.68	0.009948	12.95	387.47	58.81	0.86
Reach 1	1153	Floodway	4990	338.19	347.08	346.44	349.69	0.009975	12.96	385.97	56	0.86
Reach 1	1153	10 Year	2350	338.19	345.14	343.65	346.24	0.006128	8.42	279.03	53.03	0.65
Reach 1	1153	10-Year Fldwy	2350	338.19	345.14	343.66	346.24	0.006131	8.42	278.99	53.03	0.65
Reach 1	1107	100 Year	4990	338.85	345.8	345.42	347.95	0.011404	11.76	424.49	235.63	0.9
Reach 1	1107	Floodway	4990	338.85	345.8	345.42	347.95	0.011401	11.76	424.52	81.46	0.9
Reach 1	1107	10 Year	2350	338.85	343.07	343.07	344.78	0.016015	10.49	223.96	65.68	1
Reach 1	1107	10-Year Fldwy	2350	338.85	343.07	343.07	344.78	0.015998	10.49	224.04	65.69	1
Reach 1	1003	100 Year	4990	333.66	343.11	341.49	344.88	0.00684	10.66	467.97	136.93	0.72
Reach 1	1003	Floodway	4990	333.66	343.11	341.5	344.88	0.006841	10.66	467.94	69.45	0.72
Reach 1	1003	10 Year	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	1003	10-Year Fldwy	2350	333.66	339.98	338.72	341.12	0.006912	8.59	273.58	56	0.68
Reach 1	894	100 Year	4990	328.74	338.99	338.45	341.63	0.010661	13.03	384.6	59.88	0.88
Reach 1	894	Floodway	4990	328.74	338.99	338.45	341.63	0.010656	13.02	384.65	59.88	0.88
Reach 1	894	10 Year	2350	328.74	335.71	335.38	337.61	0.012721	11.07	212.29	45.58	0.9
Reach 1	894	10-Year Fldwy	2350	328.74	335.71	335.38	337.61	0.012721	11.07	212.29	45.58	0.9

**MAD RIVER - PROPOSED CONDITION, FLOODWAY**  
**HEC-RAS 4.1.0 - "Encroachment 1" Output**

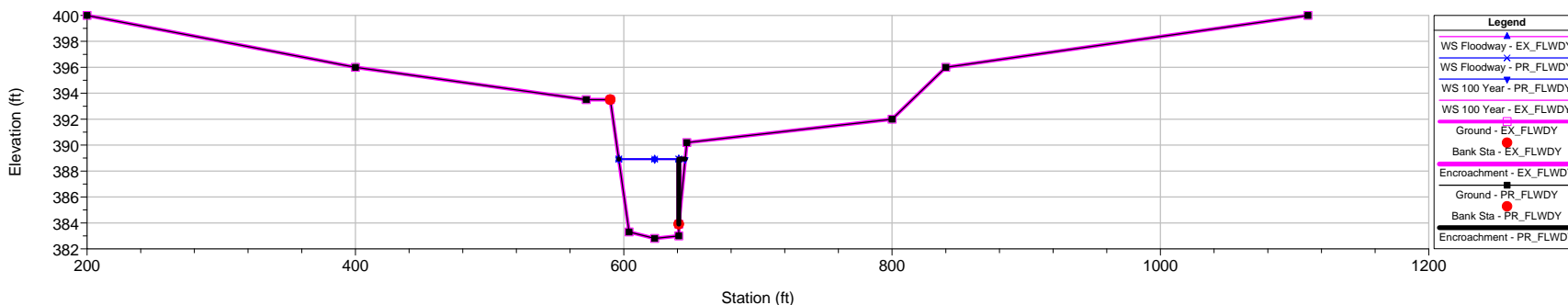
HEC-RAS Plan: PR_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	2409	100 Year	388.9		391.53	49.44		3152.09	37.91		590	641	
Reach 1	2409	Floodway	388.93	0.03	391.63	44.7		3190		596.3	590	641	641
Reach 1	2409	10 Year	386.62	-2.28	388.33	44.15		1496.95	8.05		590	641	
Reach 1	2409	10-Year Fldwy	386.62	-2.27	388.36	41.56		1505		596.3	590	641	641
Reach 1	2337	100 Year	383.29		385.24	89.69	83.42	3095.06	11.52		-27.82	31.76	
Reach 1	2337	Floodway	383.29	0	385.24	89.64	83.18	3095.37	11.45	-48.56	-27.82	31.76	43.31
Reach 1	2337	10 Year	381.32	-1.97	382.76	54.1		1505			-27.82	31.76	
Reach 1	2337	10-Year Fldwy	381.33	-1.97	382.76	54.1		1505		-48.56	-27.82	31.76	43.31
Reach 1	2280	100 Year	381.3		382.96	92.36	13.31	3146.71	29.98		-26.38	31.17	
Reach 1	2280	Floodway	381.3	0	382.96	84.67	13.32	3144.84	31.84	-41.01	-26.38	31.17	47.57
Reach 1	2280	10 Year	379.05	-2.25	380.21	52.43		1505			-26.38	31.17	
Reach 1	2280	10-Year Fldwy	379.05	-2.25	380.21	52.43		1505		-41.01	-26.38	31.17	47.57
Reach 1	2238	100 Year	380.74		381.6	85.92	2.86	3182.38	4.76		-33.2	43.9	
Reach 1	2238	Floodway	380.74	0	381.6	84.86	2.86	3182.26	4.88	-48.13	-33.2	43.9	47.57
Reach 1	2238	10 Year	378.21	-2.53	378.83	67.06		1505			-33.2	43.9	
Reach 1	2238	10-Year Fldwy	378.21	-2.53	378.83	67.06		1505		-48.13	-33.2	43.9	47.57
Reach 1	2207	100 Year	378.87		380.55	69.35	10.51	3178.65	0.84		-31.96	26.38	
Reach 1	2207	Floodway	378.88	0	380.55	69.35	10.56	3178.59	0.85	-41.43	-31.96	26.38	27.92
Reach 1	2207	10 Year	376.84	-2.03	377.83	54.69		1505			-31.96	26.38	
Reach 1	2207	10-Year Fldwy	376.84	-2.03	377.83	54.69		1505		-41.43	-31.96	26.38	27.92
Reach 1	2202	100 Year	378.45		380.29	63.66	0.11	3189.3	0.6		-34.84	26.44	
Reach 1	2202	Floodway	378.45	0.01	380.29	63.66	0.11	3189.28	0.61	-35.57	-34.84	26.44	28.09
Reach 1	2202	10 Year	376.28	-2.17	377.56	54.9		1505			-34.84	26.44	
Reach 1	2202	10-Year Fldwy	376.28	-2.17	377.56	54.9		1505		-35.57	-34.84	26.44	28.09
Reach 1	2168	100 Year	376.85		378.59	56.21		3190			-32	24.19	
Reach 1	2168	Floodway	376.99	0.14	378.65	56.21	0	3190		-32.02	-32	24.19	24.19
Reach 1	2168	10 Year	374.19	-2.66	375.59	50.75		1505			-32	24.19	
Reach 1	2168	10-Year Fldwy	374.19	-2.66	375.59	50.75		1505		-32.02	-32	24.19	24.19
Reach 1	2130	100 Year	376.44		377.42	64.22	0.82	3188.74	0.44		-32.65	29.27	
Reach 1	2130	Floodway	376.65	0.21	377.58	64.22	1.31	3188.19	0.5	-34.71	-32.65	29.27	29.51
Reach 1	2130	10 Year	373.29	-3.15	374.09	56.84		1505			-32.65	29.27	
Reach 1	2130	10-Year Fldwy	373.29	-3.15	374.09	56.84		1505		-34.71	-32.65	29.27	29.51
Reach 1	2116	100 Year	376.32		377.22	64.82	10.71	3178.9	0.4		-29.63	29.13	
Reach 1	2116	Floodway	376.54	0.23	377.39	64.82	12.65	3176.9	0.45	-35.44	-29.63	29.13	29.38
Reach 1	2116	10 Year	373.09	-3.23	373.77	57.97		1505			-29.63	29.13	
Reach 1	2116	10-Year Fldwy	373.09	-3.23	373.77	57.97		1505		-35.44	-29.63	29.13	29.38
Reach 1	2098.5												
Reach 1	2098.5												
Reach 1	2098.5	Culvert											
Reach 1	2079	100 Year	373.79		374.73	76.54		3190			-43.5	33.24	
Reach 1	2079	Floodway	373.79	0	374.73	76.53		3190		-43.61	-43.5	33.24	33.44
Reach 1	2079	10 Year	370.3	-3.49	371.54	62.44		1505			-43.5	33.24	
Reach 1	2079	10-Year Fldwy	370.3	-3.49	371.54	62.44		1505		-43.61	-43.5	33.24	33.44
Reach 1	2067	100 Year	374.05		374.27	136.25	1831.91	1256.73	101.36		-26.25	21.52	
Reach 1	2067	Floodway	374.05	0	374.27	136.25	1831.91	1256.74	101.36	-101.7	-26.25	21.52	35.1
Reach 1	2067	10 Year	370.33	-3.72	370.71	110.99	699.11	784.74	21.15		-26.25	21.52	
Reach 1	2067	10-Year Fldwy	370.33	-3.72	370.71	110.99	699.11	784.74	21.15	-101.7	-26.25	21.52	35.1
Reach 1	2020	100 Year	373.97		374.11	215.94	2061.91	2715.44	212.65		-26.25	59.42	
Reach 1	2020	Floodway	373.97	0	374.11	215.94	2061.92	2715.44	212.65	-134.45	-26.25	59.42	83.55
Reach 1	2020	10 Year	370.25	-3.72	370.34	204.23	1034.29	1266.21	49.5		-26.25	59.42	
Reach 1	2020	10-Year Fldwy	370.25	-3.72	370.34	204.23	1034.29	1266.21	49.5	-134.45	-26.25	59.42	83.55
Reach 1	2004	100 Year	373.95		374.07	206.04	2300.95	1957.56	731.49		-26.25	36.32	
Reach 1	2004	Floodway	373.95	0	374.07	206.04	2300.96	1957.56	731.49	-134.49	-26.25	36.32	86.01
Reach 1	2004	10 Year	370.22	-3.73	370.29	206.04	1212.98	892.8	244.22		-26.25	36.32	
Reach 1	2004	10-Year Fldwy	370.22	-3.73	370.29	206.04	1212.98	892.8	244.22	-134.49	-26.25	36.32	86.01
Reach 1	1983	100 Year	373.81		374.01	159.98	2581.15	2182.17	226.69		-26.25	26.25	
Reach 1	1983	Floodway	373.81	0	374.01	159.98	2581.15	2182.17	226.68	-111.56	-26.25	26.25	49.04
Reach 1	1983	10 Year	370.12	-3.69	370.23	151.9	1258.03	1032.59	59.38		-26.25	26.25	
Reach 1	1983	10-Year Fldwy	370.12	-3.69	370.23	151.9	1258.03	1032.59	59.38	-111.56	-26.25	26.25	49.04

HEC-RAS Plan: PR_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	1972	100 Year	373.32		373.87	116.46	1473.97	3351.83	164.2		-26.25	26.25	
Reach 1	1972	Floodway	373.32	0	373.87	116.46	1473.95	3351.86	164.2	-75.46	-26.25	26.25	41.22
Reach 1	1972	10 Year	369.65	-3.67	370.09	108.7	489.32	1833.49	27.2		-26.25	26.25	
Reach 1	1972	10-Year Fldwy	369.65	-3.67	370.09	108.7	489.32	1833.49	27.2	-75.46	-26.25	26.25	41.22
Reach 1	1962	100 Year	373.13		373.78	97.66	0.62	4988.19	1.19		-56.1	37.04	
Reach 1	1962	Floodway	373.13	0	373.78	97.21	0.62	4988.17	1.21	-58.08	-56.1	37.04	39.41
Reach 1	1962	10 Year	369.58	-3.54	370	83.47		2350			-56.1	37.04	
Reach 1	1962	10-Year Fldwy	369.58	-3.54	370	83.47		2350		-58.08	-56.1	37.04	39.41
Reach 1	1938.5 B	100 Year	372.2		373.44	77.37		4990			-55.55	42.13	
Reach 1	1938.5 B	Floodway	372.2	0	373.44	77.36		4990		-58.08	-55.55	42.13	39.41
Reach 1	1938.5 B	10 Year	368.9	-3.31	369.71	64.24		2350			-55.55	42.13	
Reach 1	1938.5 B	10-Year Fldwy	368.9	-3.31	369.71	64.24		2350		-58.08	-55.55	42.13	39.41
Reach 1	1938.5 B	100 Year	372.04		373.24	78.85		4990			-44.52	49.48	
Reach 1	1938.5 B	Floodway	372.03	0	373.24	78.84		4990		-39.59	-44.52	49.48	59.16
Reach 1	1938.5 B	10 Year	368.71	-3.33	369.51	65.54		2350			-44.52	49.48	
Reach 1	1938.5 B	10-Year Fldwy	368.71	-3.33	369.51	65.54		2350		-39.59	-44.52	49.48	59.16
Reach 1	1900	100 Year	371.88		372.66	98.74	0	4989.65	0.35		-39.4	57.48	
Reach 1	1900	Floodway	371.88	0	372.66	98.74	0	4989.65	0.35	-39.59	-39.4	57.48	59.16
Reach 1	1900	10 Year	368.39	-3.48	368.98	84.79		2350			-39.4	57.48	
Reach 1	1900	10-Year Fldwy	368.39	-3.48	368.98	84.79		2350		-39.59	-39.4	57.48	59.16
Reach 1	1871	100 Year	370.9		372.17	77.65	0.01	4989.9	0.09		-38.32	38.35	
Reach 1	1871	Floodway	370.9	0	372.16	77.64	0.01	4989.9	0.09	-38.6	-38.32	38.35	39.05
Reach 1	1871	10 Year	367.71	-3.19	368.52	64.93		2350			-38.32	38.35	
Reach 1	1871	10-Year Fldwy	367.71	-3.19	368.52	64.93		2350		-38.6	-38.32	38.35	39.05
Reach 1	1807.5 B	100 Year	370.36		371.64	77.13		4990			-39.4	39.24	
Reach 1	1807.5 B	Floodway	370.36	0	371.64	77.08		4990		-38.6	-39.4	39.24	39.05
Reach 1	1807.5 B	10 Year	367.18	-3.18	367.99	64.41		2350			-39.4	39.24	
Reach 1	1807.5 B	10-Year Fldwy	367.18	-3.18	367.99	64.41		2350		-38.6	-39.4	39.24	39.05
Reach 1	1807.5 B	100 Year	369.34		370.66	76.78		4990			-41.01	44.55	
Reach 1	1807.5 B	Floodway	369.34	0	370.66	76.77		4990		-38.68	-41.01	44.55	38.68
Reach 1	1807.5 B	10 Year	366.17	-3.17	367.02	64.09		2350			-41.01	44.55	
Reach 1	1807.5 B	10-Year Fldwy	366.17	-3.17	367.02	64.09		2350		-38.68	-41.01	44.55	38.68
Reach 1	1748	100 Year	368.72		370.08	77.36	0	4989.98	0.02		-38.4	38.2	
Reach 1	1748	Floodway	368.72	0	370.07	77.35	0	4989.98	0.02	-38.68	-38.4	38.2	38.68
Reach 1	1748	10 Year	365.62	-3.1	366.49	64.95		2350			-38.4	38.2	
Reach 1	1748	10-Year Fldwy	365.62	-3.1	366.49	64.95		2350		-38.68	-38.4	38.2	38.68
Reach 1	1727.5 B	100 Year	368.58		369.88	82.07	1.57	4988.43			-38.35	41.18	
Reach 1	1727.5 B	Floodway	368.57	0	369.88	77.36	0.19	4989.81		-38.68	-38.35	41.18	38.68
Reach 1	1727.5 B	10 Year	365.48	-3.09	366.32	66.44		2350			-38.35	41.18	
Reach 1	1727.5 B	10-Year Fldwy	365.48	-3.09	366.32	66.44		2350		-38.68	-38.35	41.18	38.68
Reach 1	1727.5 B	100 Year	368.29		369.54	81.01		4990			-40.52	42.65	
Reach 1	1727.5 B	Floodway	368.29	0	369.54	81.01		4990		-40.49	-40.52	42.65	40.52
Reach 1	1727.5 B	10 Year	365.16	-3.13	365.98	68.48		2350			-40.52	42.65	
Reach 1	1727.5 B	10-Year Fldwy	365.16	-3.13	365.98	68.48		2350		-40.49	-40.52	42.65	40.52
Reach 1	1689	100 Year	365.62		368.28	72.11	0	4989.99	0.01		-36	35.74	
Reach 1	1689	Floodway	365.62	0	368.28	72.11	0	4989.99	0.01	-40.49	-36	35.74	40.52
Reach 1	1689	10 Year	363.56	-2.05	365.03	63.9		2350			-36	35.74	
Reach 1	1689	10-Year Fldwy	363.56	-2.05	365.03	63.9		2350		-40.49	-36	35.74	40.52
Reach 1	1620	100 Year	363.88		365.08	127.98	8.68	4949.54	31.78		-49.71	48.56	
Reach 1	1620	Floodway	364.15	0.26	365.23	127.98	12.29	4933.69	44.02	-54.17	-49.71	48.56	73.81
Reach 1	1620	10 Year	360.95	-2.93	362.06	91.61		2350			-49.71	48.56	
Reach 1	1620	10-Year Fldwy	360.95	-2.93	362.06	91.62		2350		-54.17	-49.71	48.56	73.81
Reach 1	1573	100 Year	363.62		364.39	96.57	3.36	4986.64	0		-51.8	40.9	
Reach 1	1573	Floodway	363.92	0.3	364.62	96.57	4.85	4985.11	0.04	-58.81	-51.8	40.9	41.12
Reach 1	1573	10 Year	360.75	-2.87	361.17	86.5		2350			-51.8	40.9	
Reach 1	1573	10-Year Fldwy	360.75	-2.87	361.17	86.5		2350		-58.81	-51.8	40.9	41.12
Reach 1	1561.5		Inl Struct										
Reach 1	1550	100 Year	358.74		360.61	105.97	781.05	4208.95			-40.29	41.54	

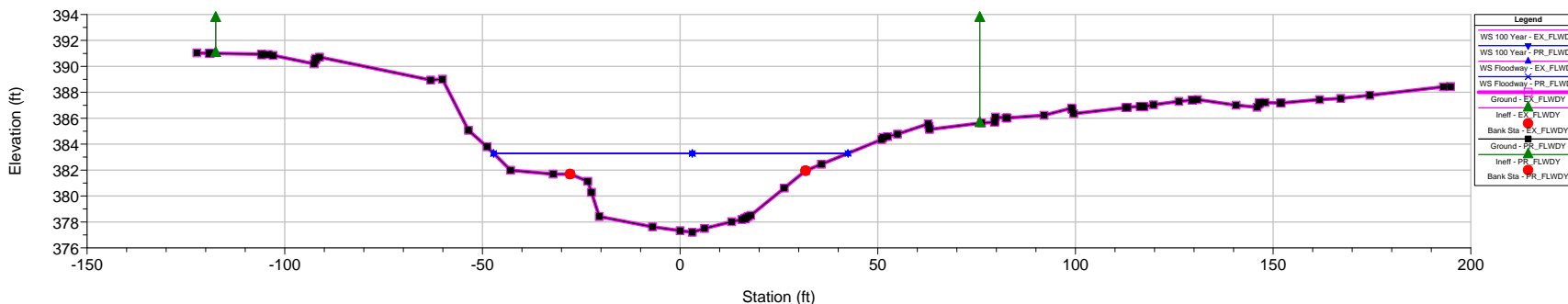
HEC-RAS Plan: PR_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Wdth (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	1550	Floodway	358.79	0.05	360.83	98.59	552.1	4437.9		-58.56	-40.29	41.54	41.44
Reach 1	1550	10 Year	356.95	-1.79	358.18	105.97	245.51	2104.49			-40.29	41.54	
Reach 1	1550	10-Year Fldwy	356.95	-1.79	358.27	98.59	187.66	2162.34		-58.56	-40.29	41.54	41.44
Reach 1	1536	100 Year	358.45		359.74	137.57	55.31	4924.4	10.28		-54.72	43.14	
Reach 1	1536	Floodway	358.61	0.16	359.87	100.07	11.94	4976.33	1.72	-56.43	-54.72	43.14	43.64
Reach 1	1536	10 Year	356.5	-1.95	357.22	102.99	5.18	2344.65	0.17		-54.72	43.14	
Reach 1	1536	10-Year Fldwy	356.5	-1.95	357.22	100.07	3.37	2346.47	0.16	-56.43	-54.72	43.14	43.64
Reach 1	1523	100 Year	357.18		358.76	164.76	125.63	4863.09	1.28		-56.1	39.41	
Reach 1	1523	Floodway	357.43	0.25	358.97	99.39	2.39	4984.81	2.8	-57.33	-56.1	39.41	42.06
Reach 1	1523	10 Year	354.94	-2.24	356.12	85.06		2350			-56.1	39.41	
Reach 1	1523	10-Year Fldwy	354.94	-2.24	356.12	85.07		2350		-57.33	-56.1	39.41	42.06
Reach 1	1487	100 Year	356.84		357.57	208.78	231.44	4743.32	15.25		-53.38	46.92	
Reach 1	1487	Floodway	357.06	0.22	357.84	108.42	0.81	4970.07	19.12	-53.9	-53.38	46.92	54.52
Reach 1	1487	10 Year	354.48	-2.36	354.92	98.48		2349.94	0.06		-53.38	46.92	
Reach 1	1487	10-Year Fldwy	354.48	-2.36	354.93	98.49		2349.94	0.06	-53.9	-53.38	46.92	54.52
Reach 1	1425	100 Year	355.72		356.46	255.62	326.32	4629.91	33.77		-52.49	39.76	
Reach 1	1425	Floodway	355.8	0.08	356.68	105	0.48	4950.87	38.64	-52.75	-52.49	39.76	52.25
Reach 1	1425	10 Year	353.38	-2.33	353.84	98.89	1.22	2348.5	0.28		-52.49	39.76	
Reach 1	1425	10-Year Fldwy	353.38	-2.33	353.84	94.67	0.09	2349.63	0.28	-52.75	-52.49	39.76	52.25
Reach 1	1370	100 Year	353.82		355.14	216.24	935.07	3979.47	75.47		-12.86	38.09	
Reach 1	1370	Floodway	354.08	0.26	355.35	129.4	950.8	4003.77	35.43	-85.2	-12.86	38.09	44.2
Reach 1	1370	10 Year	351.09	-2.73	352.24	102.73	127.05	2222.22	0.73		-12.86	38.09	
Reach 1	1370	10-Year Fldwy	351.09	-2.73	352.24	102.73	127.06	2222.22	0.73	-85.2	-12.86	38.09	44.2
Reach 1	1330	100 Year	353.04		354.07	272.17	517.08	4259.24	213.68		-27.89	32.81	
Reach 1	1330	Floodway	353.6	0.56	354.42	147.28	597	4110.78	282.22	-61.98	-27.89	32.81	85.3
Reach 1	1330	10 Year	349.39	-3.65	350.5	96.94	69.66	2278.91	1.43		-27.89	32.81	
Reach 1	1330	10-Year Fldwy	349.39	-3.65	350.5	96.94	69.64	2278.93	1.43	-61.98	-27.89	32.81	85.3
Reach 1	1309	100 Year	352.91		353.87	263.34	566.09	4052.22	371.7		-29	24.61	
Reach 1	1309	Floodway	353.36	0.45	354.28	144.78	477.38	4167.63	344.99	-59.48	-29	24.61	85.3
Reach 1	1309	10 Year	349.02	-3.89	349.93	88.49	83.84	2261.3	4.86		-29	24.61	
Reach 1	1309	10-Year Fldwy	349.02	-3.89	349.93	88.49	83.83	2261.31	4.86	-59.48	-29	24.61	85.3
Reach 1	1288.5 B	100 Year	352.91		353.76	128.68	427.11	3472.14	927.78		-33.79	33.79	
Reach 1	1288.5 B	Floodway	353.36	0.45	354.2	73.26	343.98	3873.78	703.2	-59.48	-33.79	33.79	85.3
Reach 1	1288.5 B	10 Year	348.89	-4.03	349.56	67.3		2350			-33.79	33.79	
Reach 1	1288.5 B	10-Year Fldwy	348.89	-4.03	349.56	67.29		2350		-59.48	-33.79	33.79	85.3
Reach 1	1288.5 B	100 Year	352.83		353.58	132.26	427.11	3472.14	927.78		-33.79	33.79	
Reach 1	1288.5 B	Floodway	353.21	0.37	354.2	59.17	343.98	3873.78	703.2	-50.69	-33.79	33.79	80
Reach 1	1288.5 B	10 Year	348.83	-4.01	349.51	67.19		2350			-33.79	33.79	
Reach 1	1288.5 B	10-Year Fldwy	348.83	-4.01	349.51	67.19		2350		-50.69	-33.79	33.79	80
Reach 1	1277	100 Year	352.24		352.75	199.27	168.11	4214.5	607.39		-45.3	34.81	
Reach 1	1277	Floodway	352.25	0.01	352.87	130.69	57.86	4537.5	394.64	-50.69	-45.3	34.81	80
Reach 1	1277	10 Year	348.78	-3.46	349.28	91.1	0.67	2343.52	5.81		-45.3	34.81	
Reach 1	1277	10-Year Fldwy	348.78	-3.46	349.27	91.09	0.67	2343.52	5.81	-50.69	-45.3	34.81	80
Reach 1	1214.5 B	100 Year	351.42		352.4	100.19	411.07	4578.26	0.67		-41.73	34.32	
Reach 1	1214.5 B	Floodway	351.43	0.01	352.5	88.29	225.63	4763.63	0.73	-50.69	-41.73	34.32	80
Reach 1	1214.5 B	10 Year	348.08	-3.34	348.86	71.24	0.42	2349.58			-41.73	34.32	
Reach 1	1214.5 B	10-Year Fldwy	348.08	-3.34	348.86	71.23	0.41	2349.59		-50.69	-41.73	34.32	80
Reach 1	1214.5 B	100 Year	348.13		350.48	73.64	5.34	4920.76	63.9		-33.2	24.6	
Reach 1	1214.5 B	Floodway	348.14	0.01	350.53	59.43		4947.63	42.37	-33.2	-33.2	24.6	26.23
Reach 1	1214.5 B	10 Year	345.35	-2.78	346.8	54.86		2347.04	2.96		-33.2	24.6	
Reach 1	1214.5 B	10-Year Fldwy	345.35	-2.78	346.8	54.52		2346.81	3.19	-33.2	-33.2	24.6	26.23
Reach 1	1162	100 Year	348.13		350.12	71.99	6.52	4978.84	4.65		-33.2	26.23	
Reach 1	1162	Floodway	348.15	0.02	350.14	59.43		4990		-33.2	-33.2	26.23	26.23
Reach 1	1162	10 Year	345.32	-2.81	346.46	55.7		2350			-33.2	26.23	
Reach 1	1162	10-Year Fldwy	345.32	-2.81	346.46	55.7		2350		-33.2	-33.2	26.23	26.23
Reach 1	1153	100 Year	347.08		349.68	58.81	4.26	4983.8	1.94		-26.48	28.45	
Reach 1	1153	Floodway	347.08	0	349.69	56	2.78	4987.18	0.03	-27.5	-26.48	28.45	28.5
Reach 1	1153	10 Year	345.14	-1.94	346.24	53.03		2350			-26.48	28.45	
Reach 1	1153	10-Year Fldwy	345.14	-1.94	346.24	53.03		2350		-27.5	-26.48	28.45	28.5

HEC-RAS Plan: PR_FLWDY River: Mad River Reach: Reach 1													
Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta (ft)	E.G. Elev (ft)	Top Width (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
Reach 1	1107	100 Year	345.8		347.95	81.46	0.03	4989.97	0		-42.65	38.17	
Reach 1	1107	Floodway	345.8	0	347.95	81.46	0.03	4989.97	0	-43.09	-42.65	38.17	38.37
Reach 1	1107	10 Year	343.07	-2.73	344.78	65.68		2350			-42.65	38.17	
Reach 1	1107	10-Year Fldwy	343.07	-2.73	344.78	65.69		2350		-43.09	-42.65	38.17	38.37
Reach 1	1003	100 Year	343.11		344.88	69.47	0.01	4989.99	0		-35.24	32.61	
Reach 1	1003	Floodway	343.11	0	344.88	69.45	0.01	4989.99	0	-36.81	-35.24	32.61	32.65
Reach 1	1003	10 Year	339.98	-3.13	341.12	56		2350			-35.24	32.61	
Reach 1	1003	10-Year Fldwy	339.98	-3.13	341.12	56		2350		-36.81	-35.24	32.61	32.65
Reach 1	894	100 Year	338.99		341.63	59.88	2.83	4986.05	1.12		-32.25	23.8	
Reach 1	894	Floodway	338.99	0	341.63	59.88	2.84	4986.04	1.12	-34.84	-32.25	23.8	25.05
Reach 1	894	10 Year	335.71	-3.28	337.61	45.58		2350			-32.25	23.8	
Reach 1	894	10-Year Fldwy	335.71	-3.28	337.61	45.58		2350		-34.84	-32.25	23.8	25.05
Reach 1	809	100 Year	336.99		339.16	53.29	0.12	4989.52	0.37		-25.26	26.58	
Reach 1	809	Floodway	337	0.01	339.17	53.31	0.12	4989.5	0.38	-25.84	-25.26	26.58	27.47
Reach 1	809	10 Year	334.05	-2.93	335.19	47.6		2350			-25.26	26.58	
Reach 1	809	10-Year Fldwy	334.05	-2.93	335.19	47.6		2350		-25.84	-25.26	26.58	27.47
Reach 1	714	100 Year	335.27		336.9	78.03		4989.05	0.95		302	373	
Reach 1	714	Floodway	335.27	0	336.9	66.9		4990		306.1	302	373	373

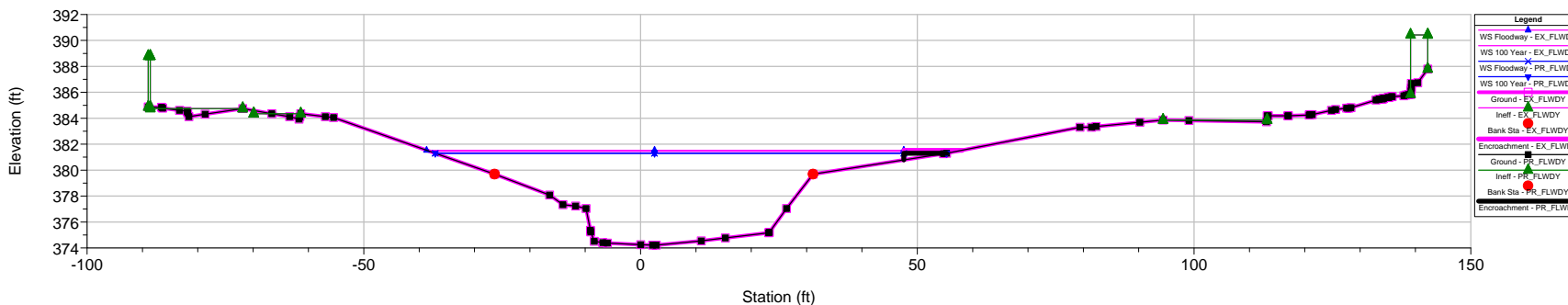
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA STATION 5143, CROSS SECTION AM



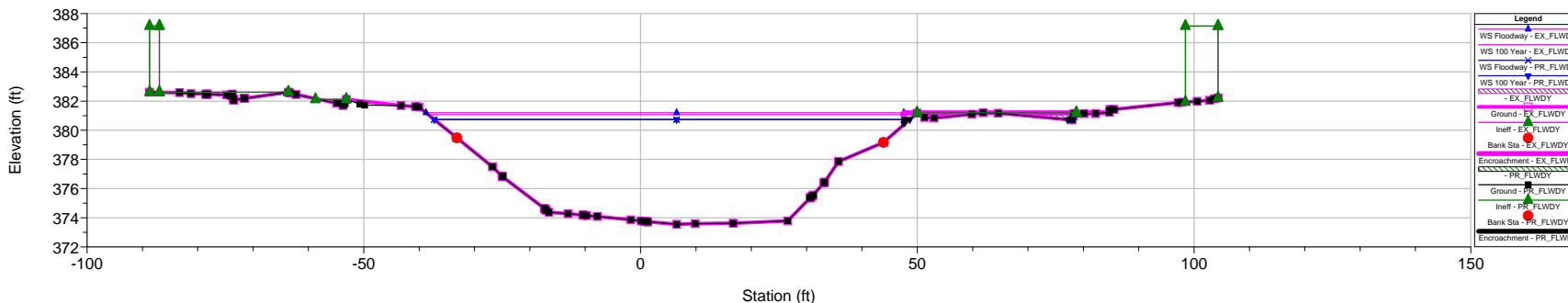
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 85m (279') D/S of East Main St.



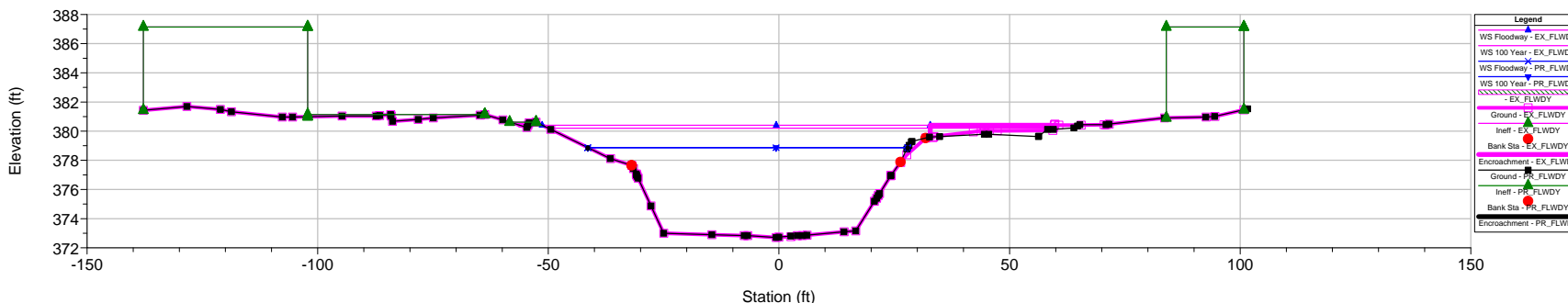
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 New BLA surveyed cross section



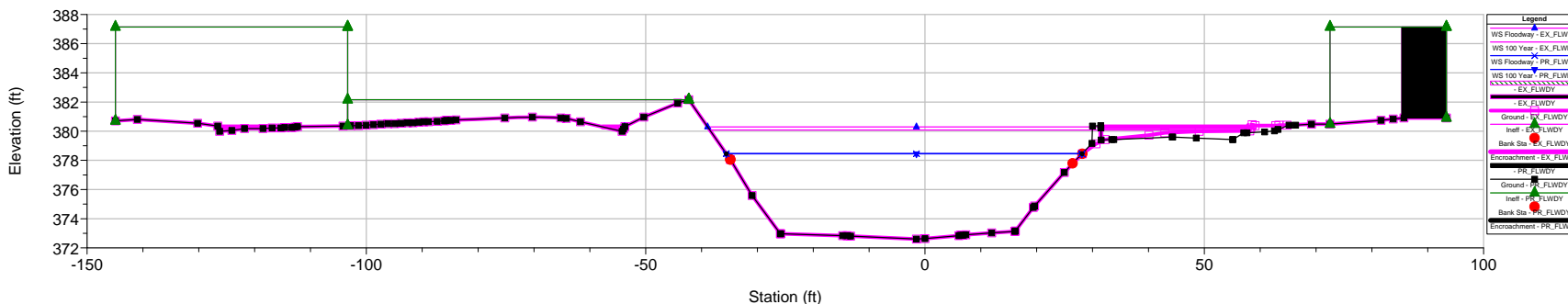
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA Station 5142, Cross Section AL



Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 5m (16') U/S of U/S End of Proposed Ret. Wall 105

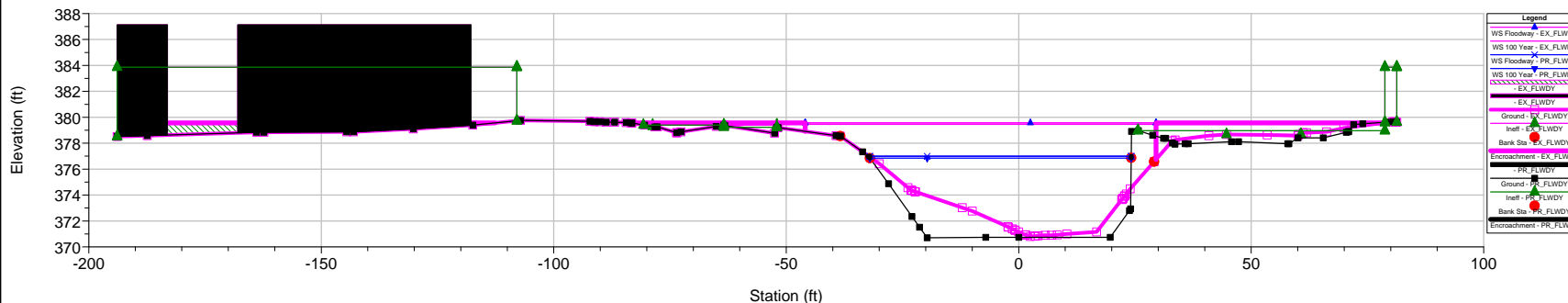


Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 97m (320') upstream of Plank Road crossing

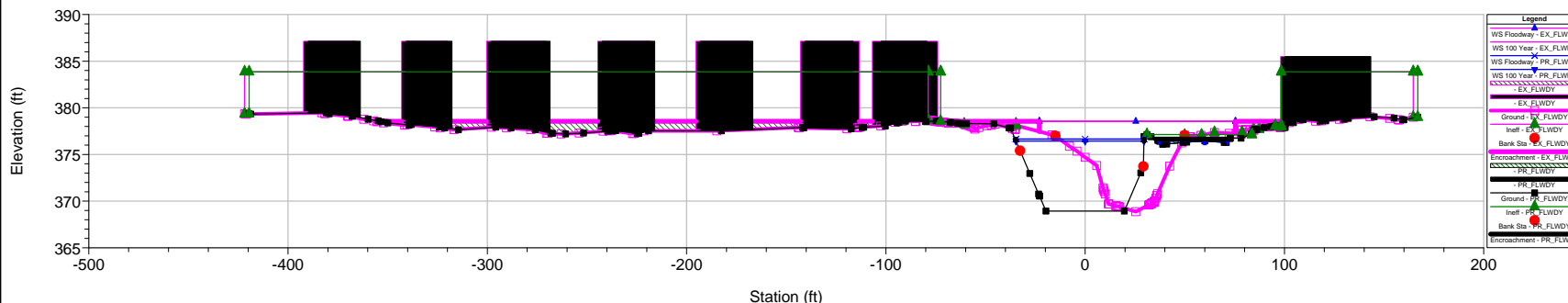




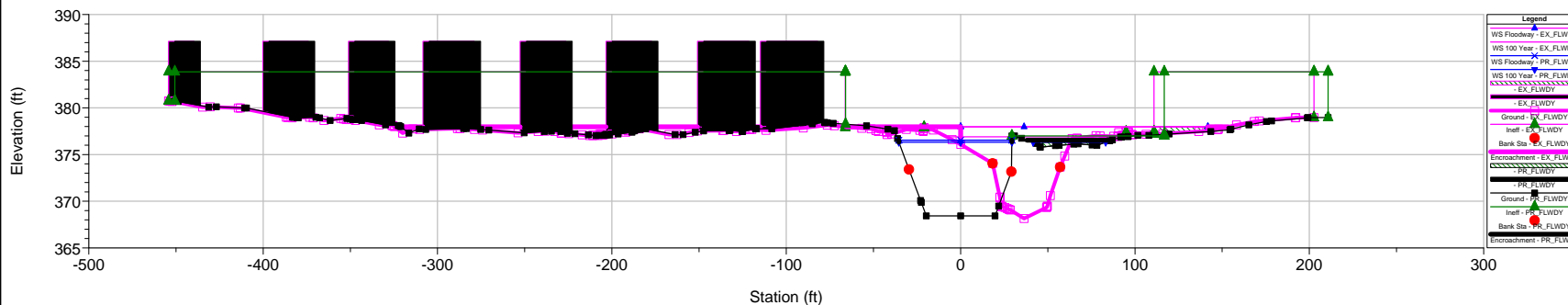
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 U/S Limit of Proposed Channelization-Full width; (Taper to EX to



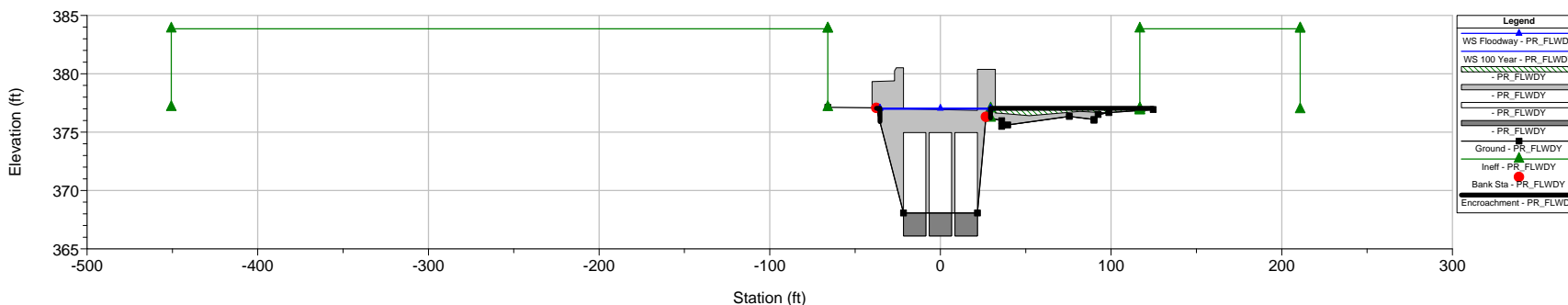
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 26m (84') U/S Plank Road crossing



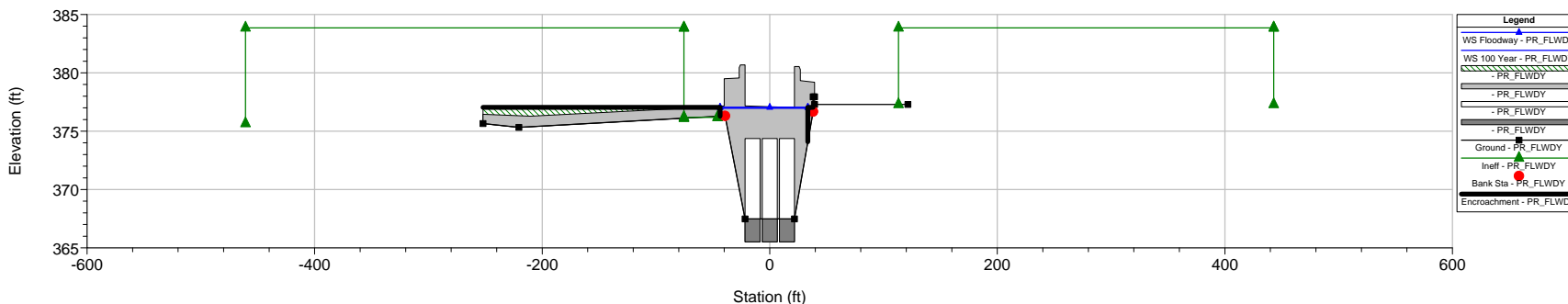
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 U/S of Plank Rd. Culvert No. 05668 (FEMA Sta 5141, Sec AK)



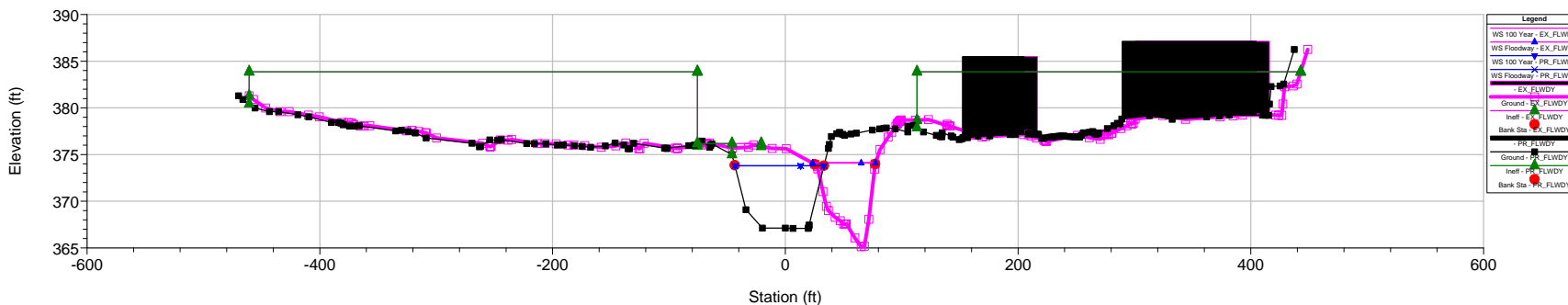
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Plank Road Culvert No. 05668



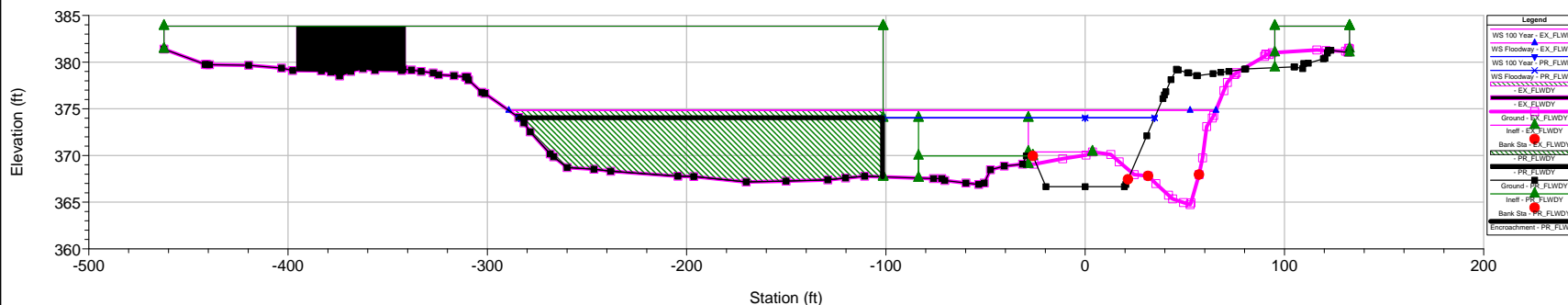
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Plank Road Culvert No. 05668



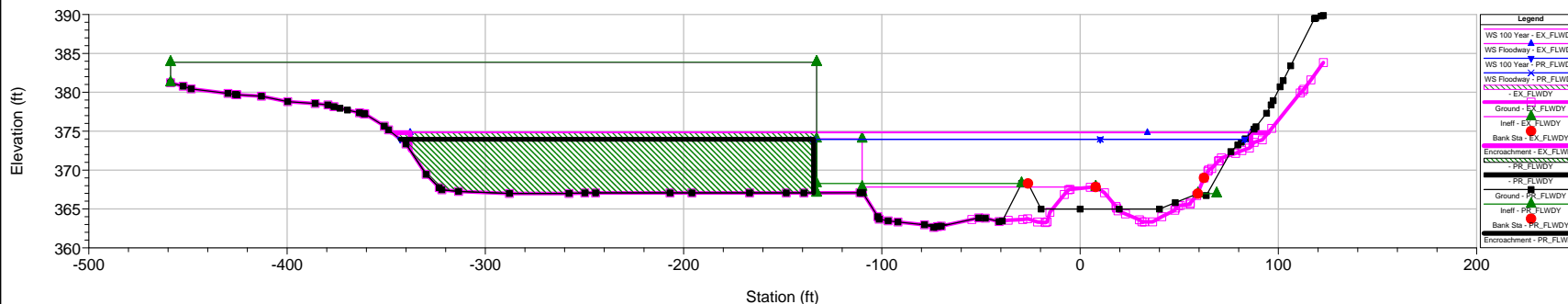
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
D/S of Plank Rd. crossing (FEMA Sta 5140, Sec. AJ)



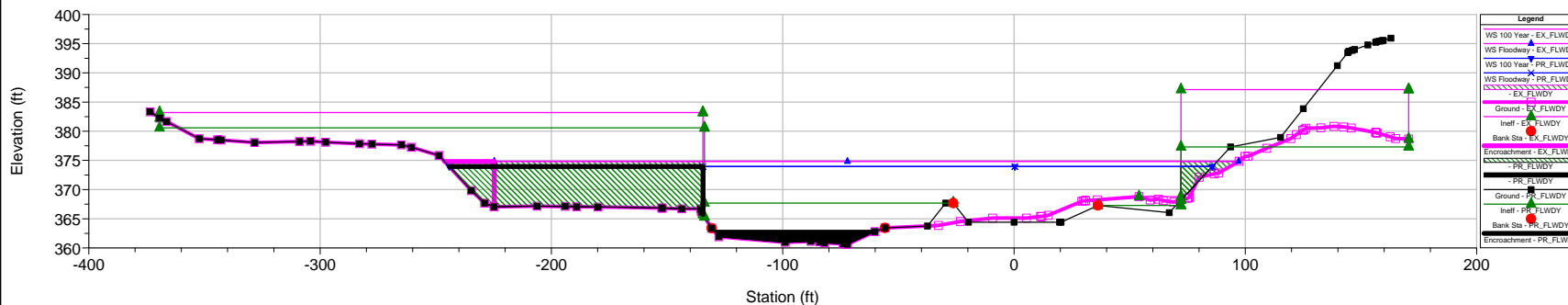
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Upstream of Beaver Pond Brook confluence.



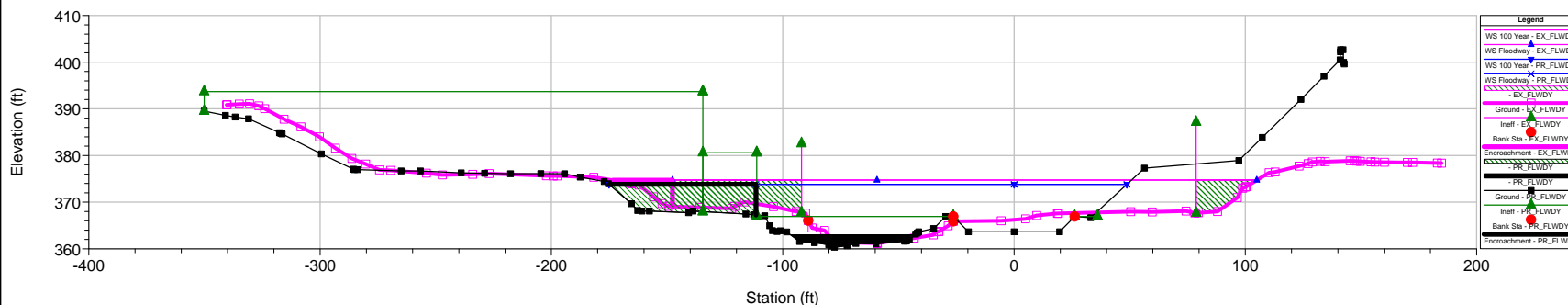
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
FEMA Station 5139, Cross Section AI



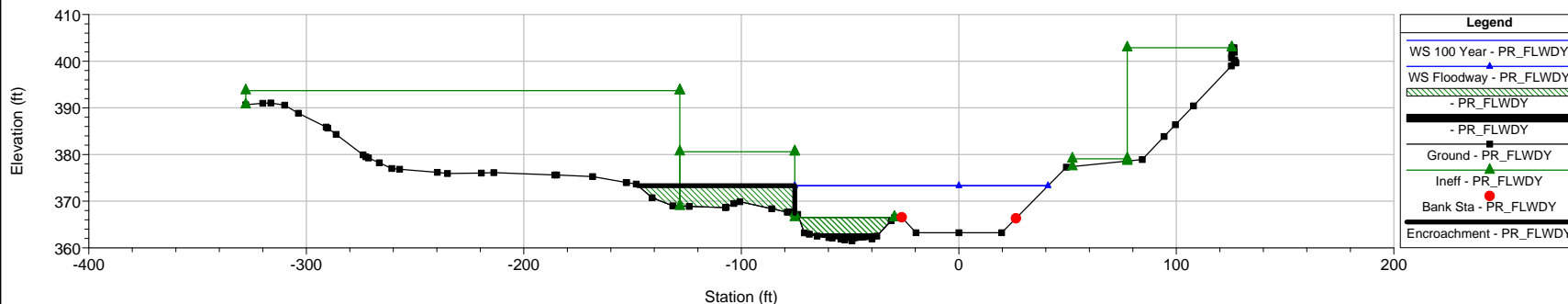
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
12.8m (42') D/S of the Beaver Pond Brook confluence.



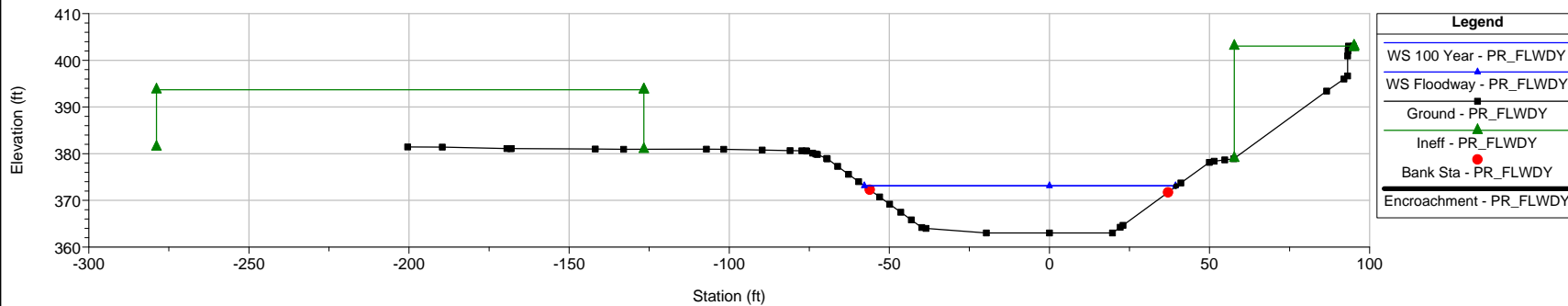
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 37.9m (124.3') U/S I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.



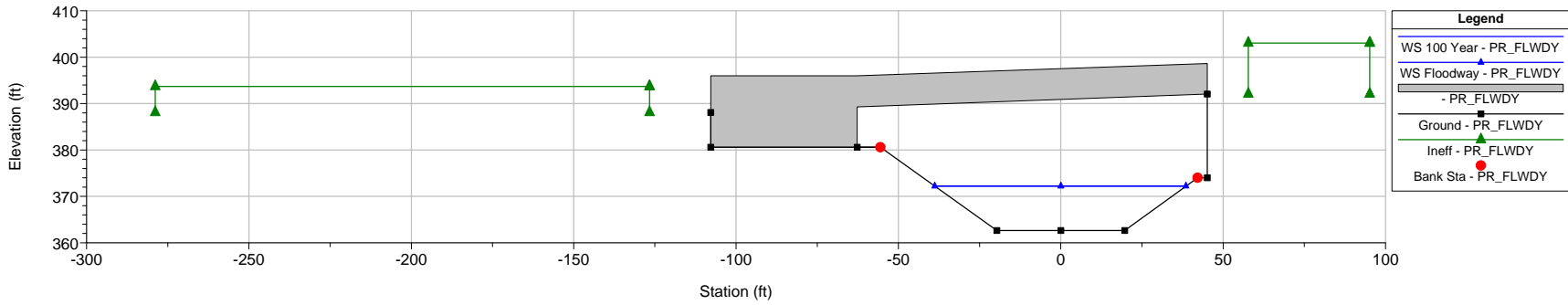
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 26.7m (87.6') U/S I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.



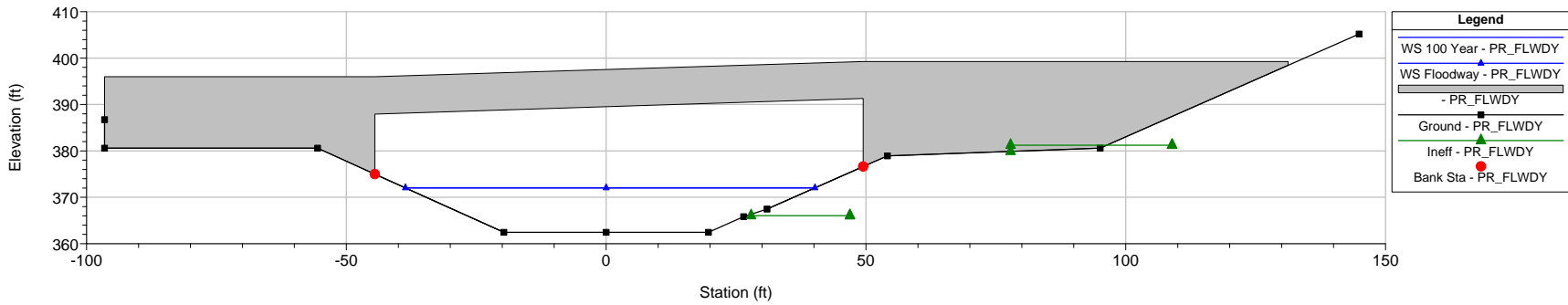
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 U/S of I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.



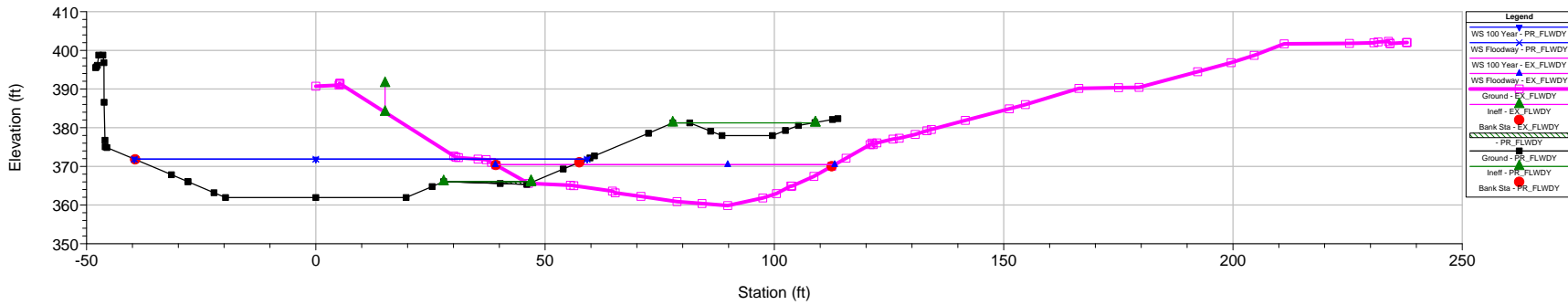
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Bridge No. 06591



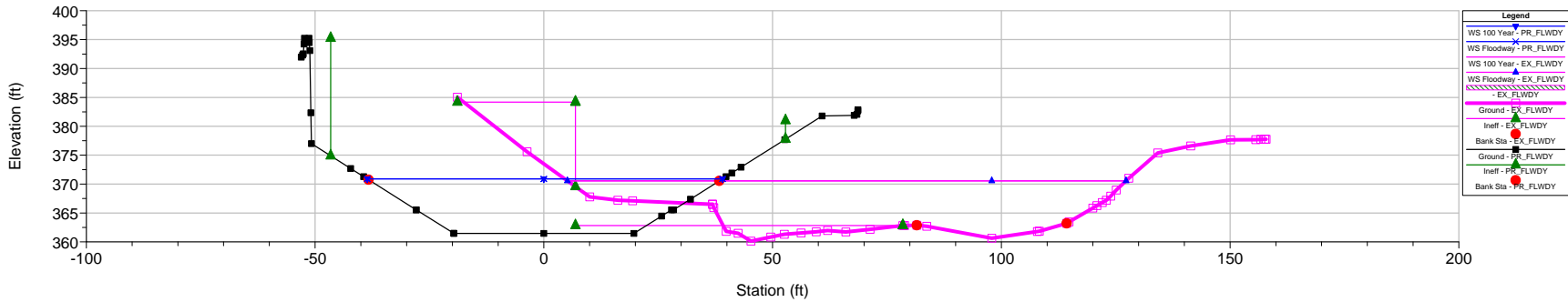
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Bridge No. 06591



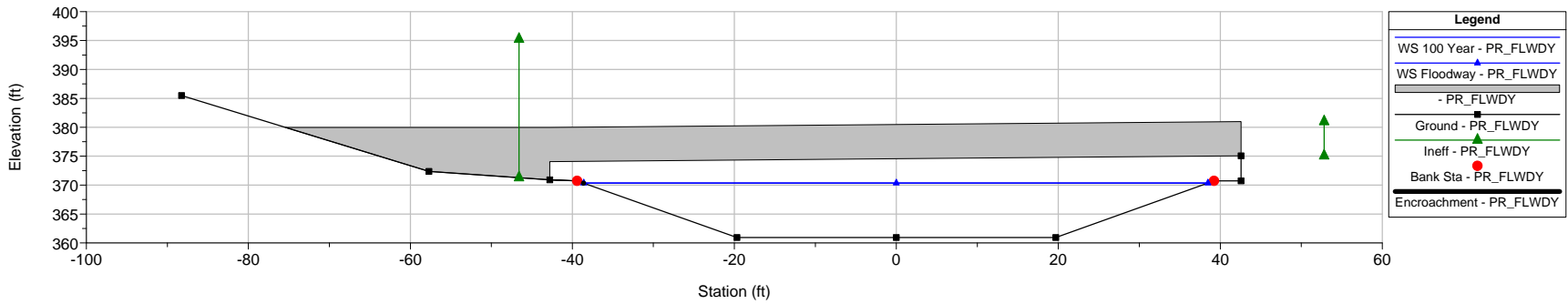
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
D/S of I-84 EB Exit 24 Off-Ramp to Harpers Ferry Rd.



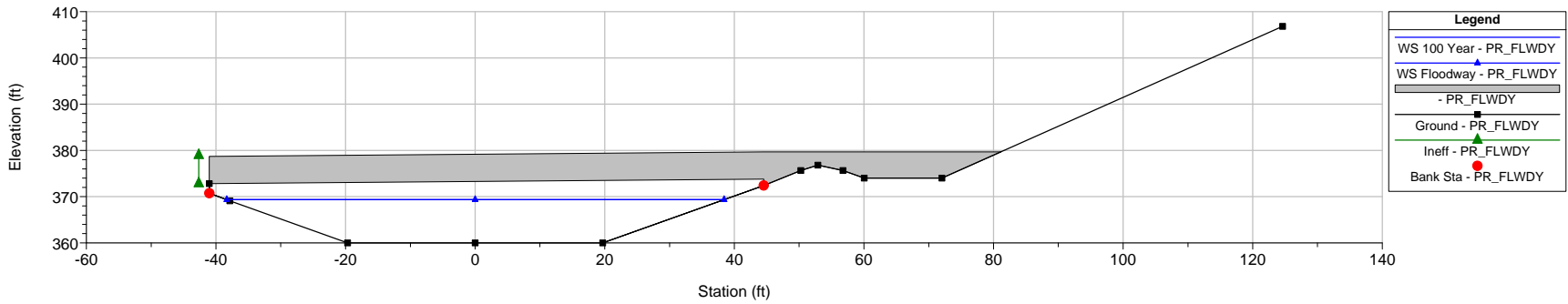
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
U/S of Prop I-84 Bridge 05774



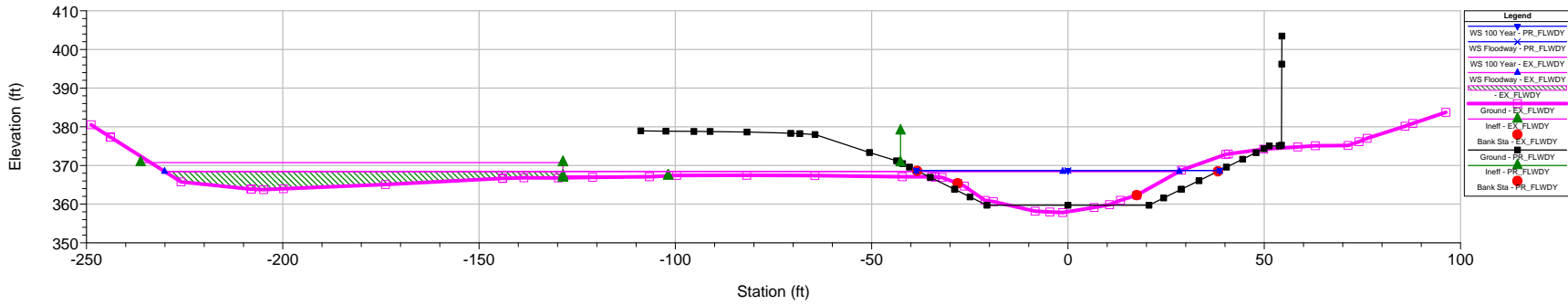
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 Bridge No. 05774



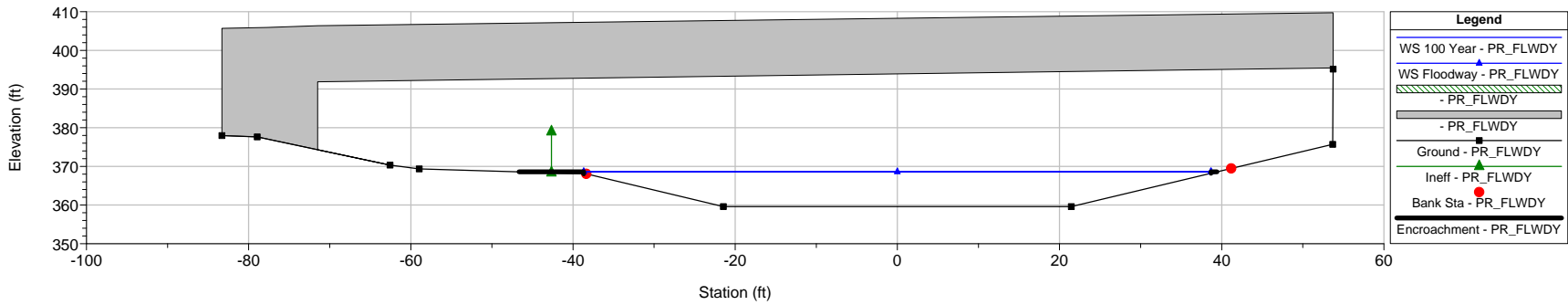
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 Bridge No. 05774



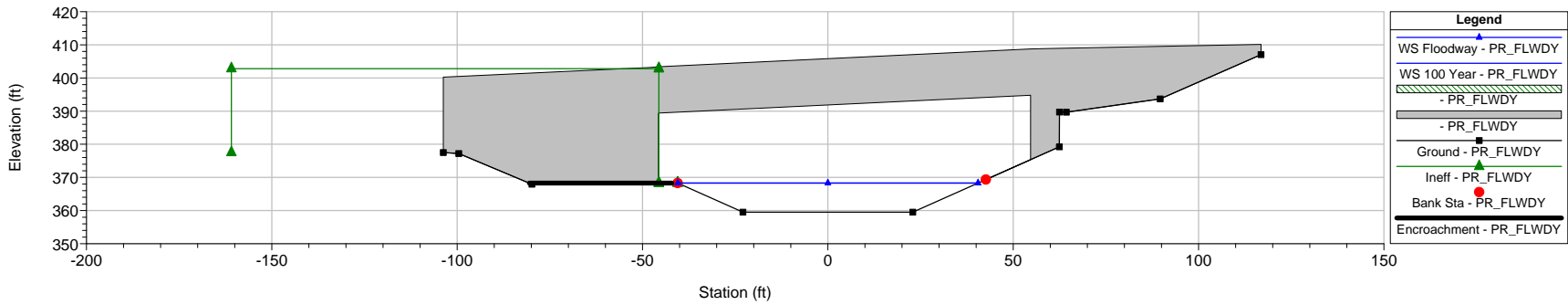
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Between Proposed Bridges 06284 & 05774



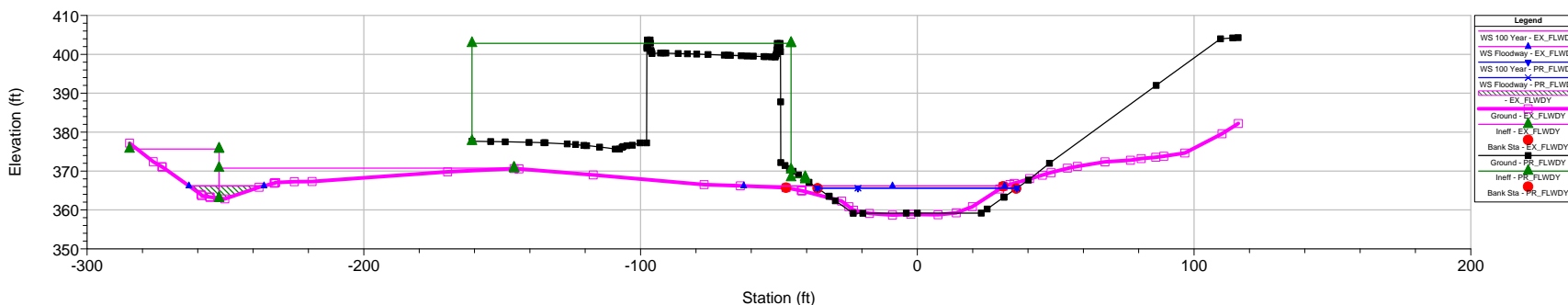
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 E24 Off-Ramp Bridge No.06284



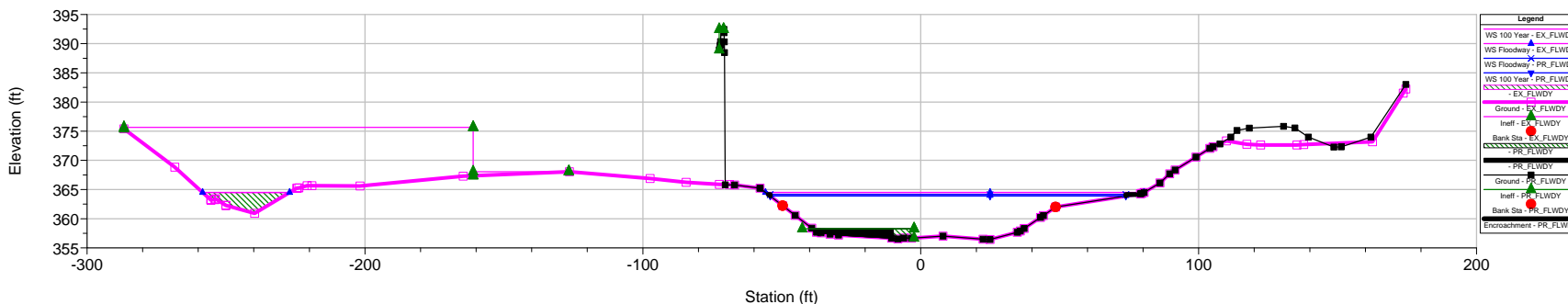
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 E24 Off-Ramp Bridge No.06284



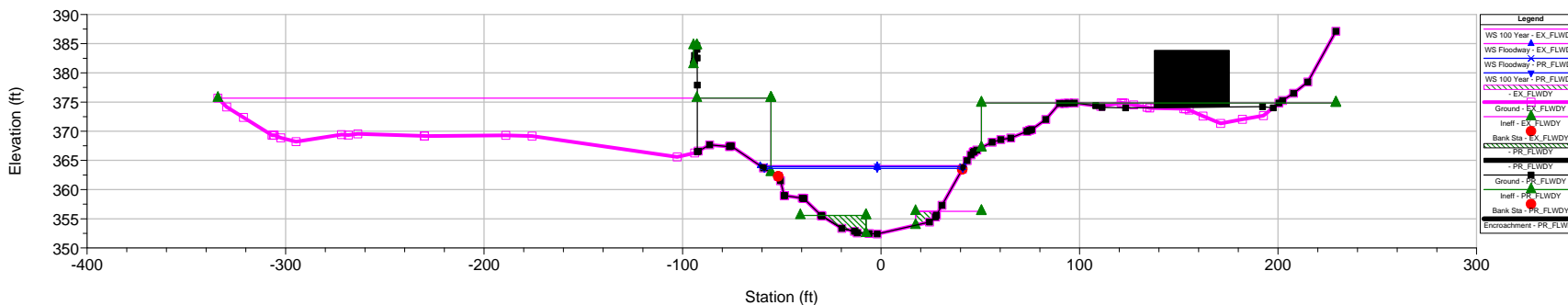
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA Station 5137, Cross Section AG



Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 Cross Section within Former Century Pond

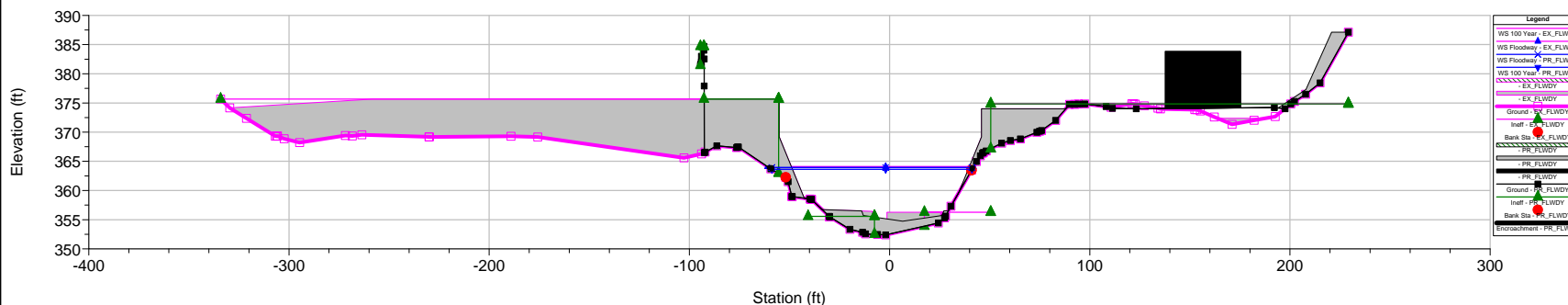


Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 Upstream Heel Breached Century Dam

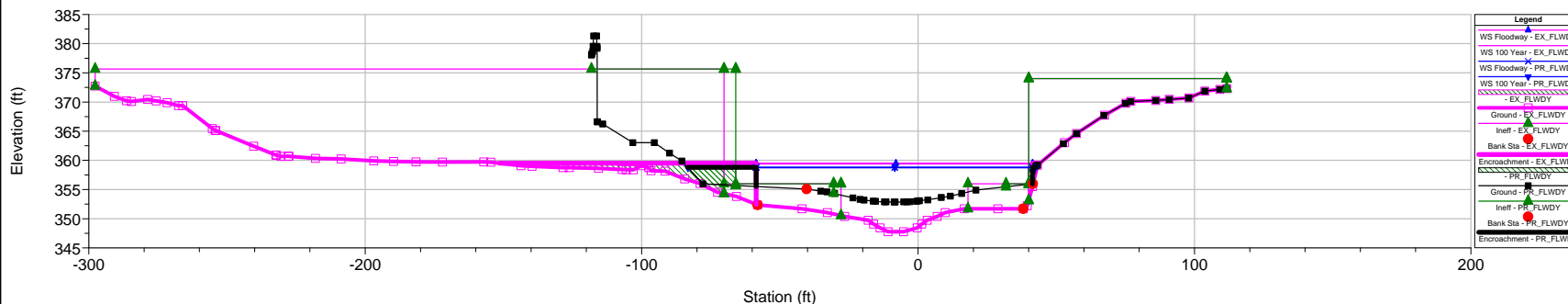




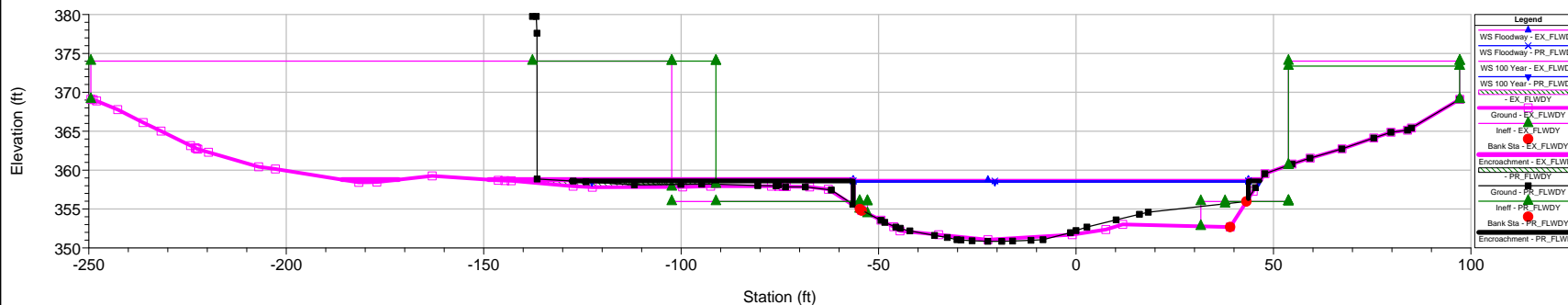
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Breached Century Dam



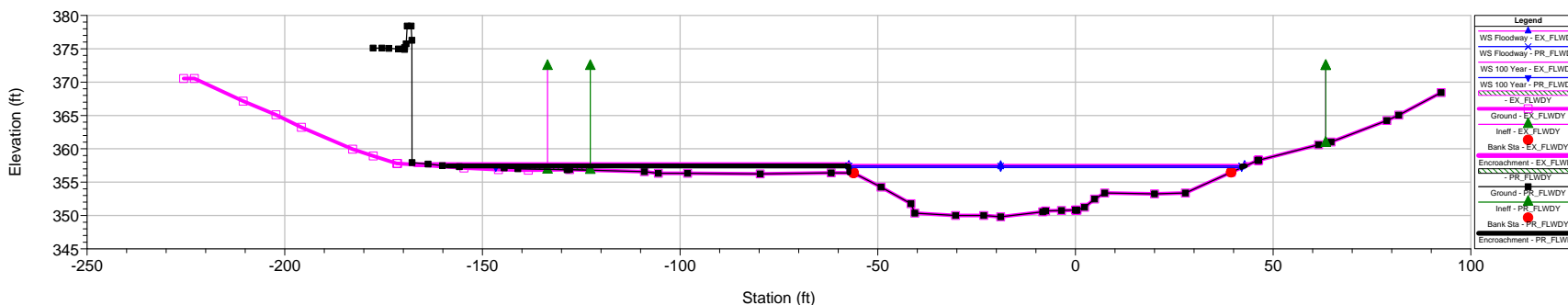
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Middle of proposed Rock Rmap Fishway (downstream of dam)



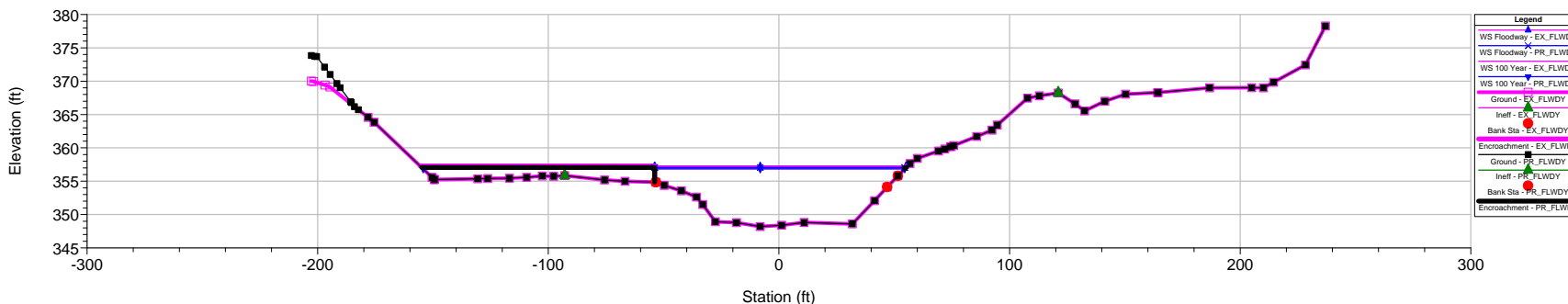
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Downstream Toe of Proposed Rock Ramp



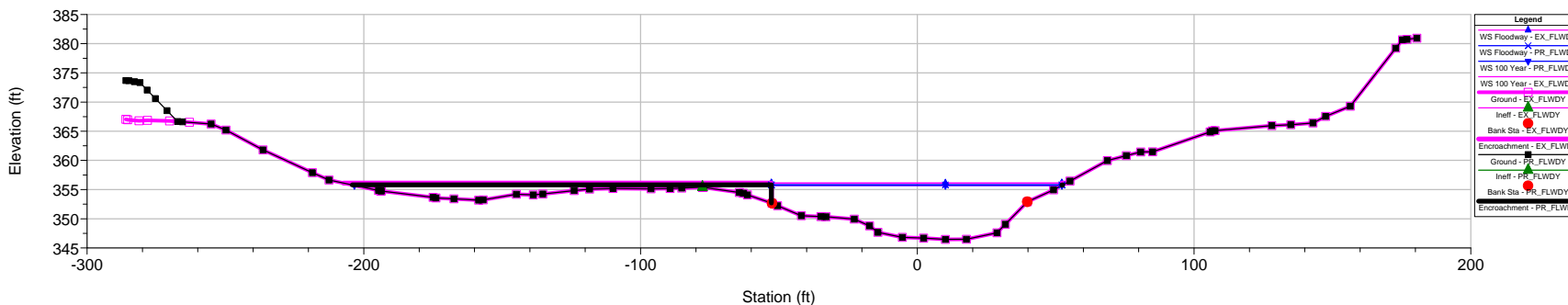
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA STATION 5136, CROSS SECTION AF



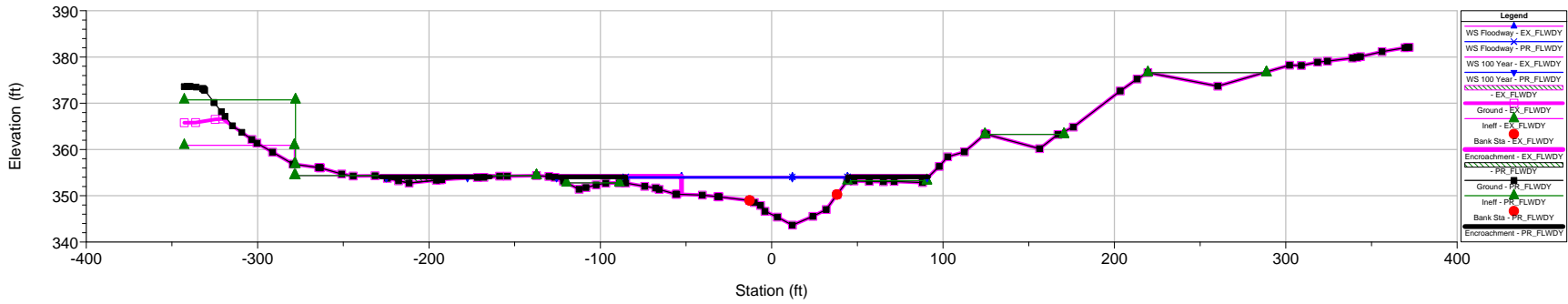
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 73m (240') D/S of Century Dam



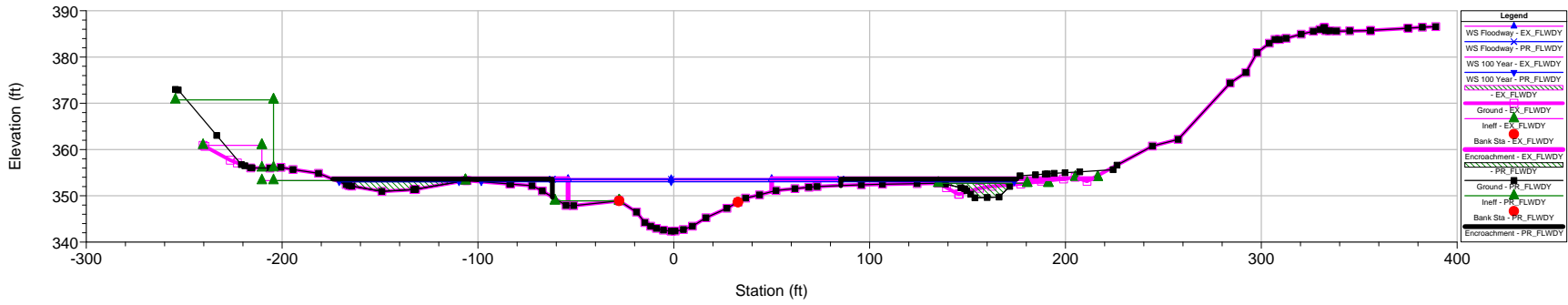
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 135m (443') D/S of Century Dam



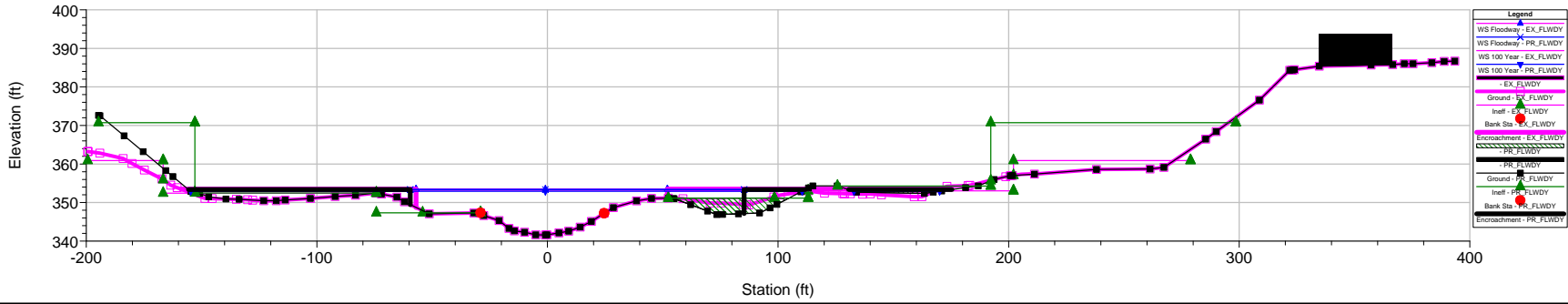
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA STATION 5135, CROSS SECTION AE



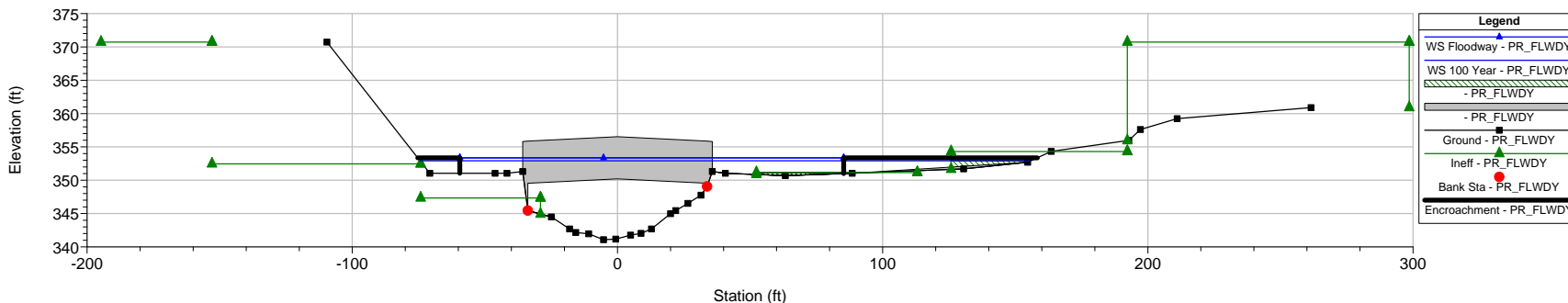
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 39m (128') U/S Proposed Pedestrian Bridge



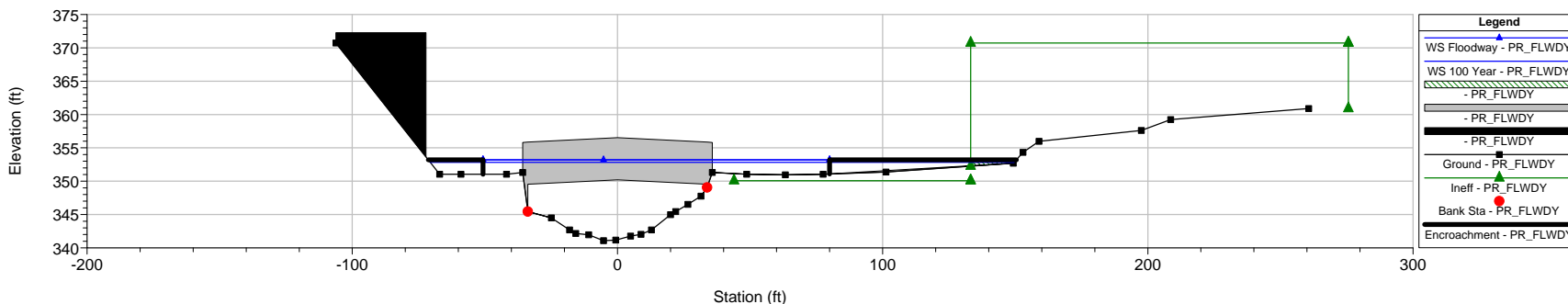
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 U/S of Proposed Pedestrian Bridge



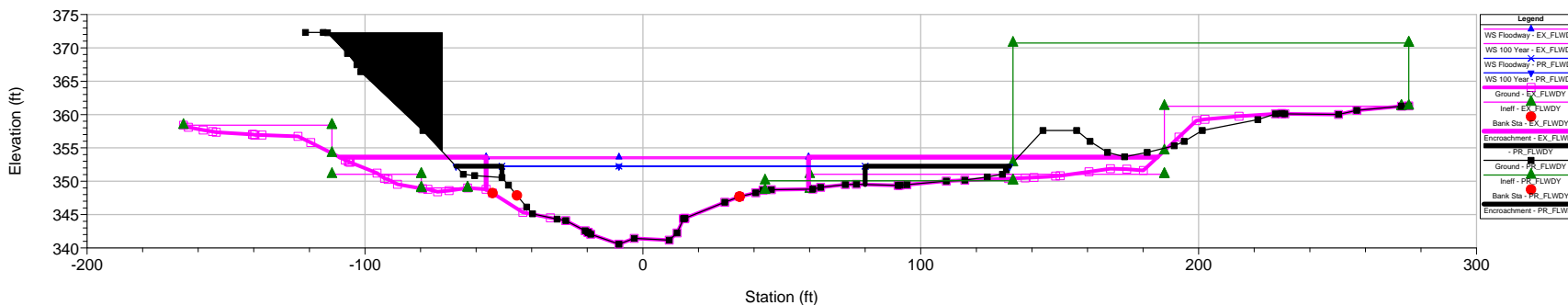
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Pedestrian Bridge



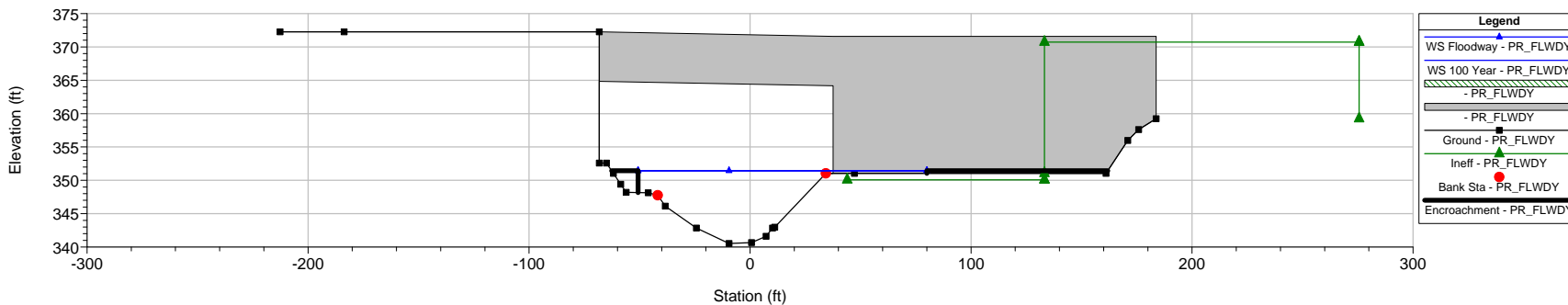
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed Pedestrian Bridge



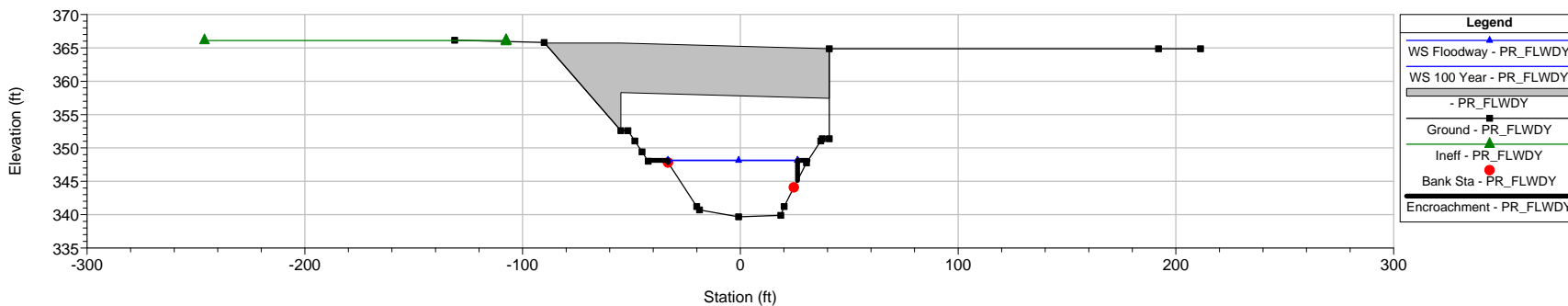
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Between I-84 / Pedestrian bridges (FEMA Sta 5134, Sec AD)



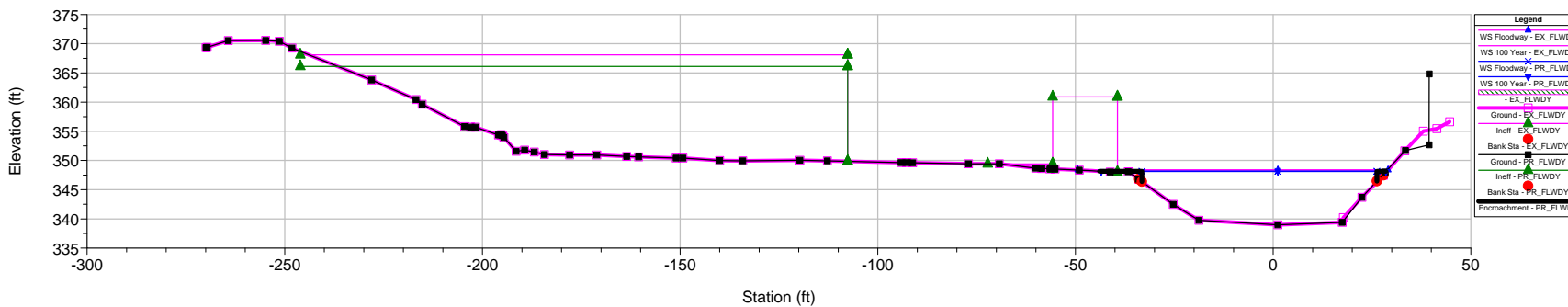
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 Bridge No. 01224



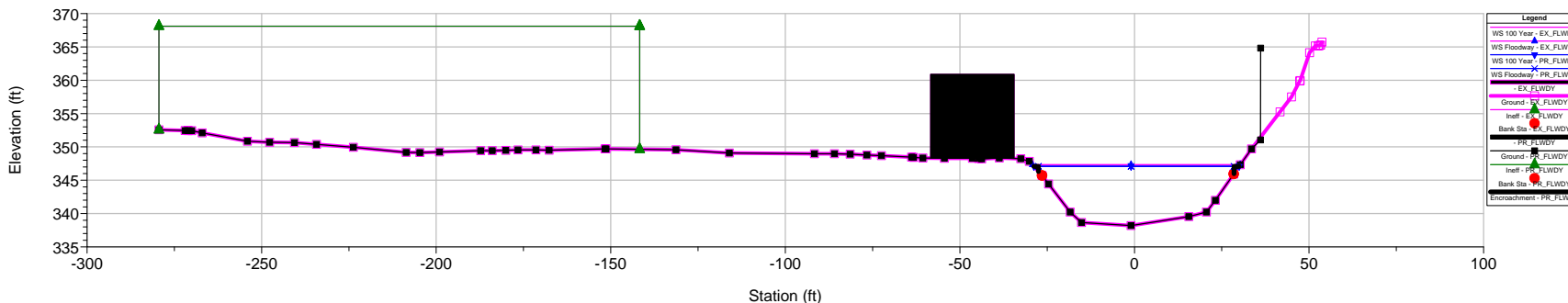
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
Proposed I-84 Bridge No. 01224



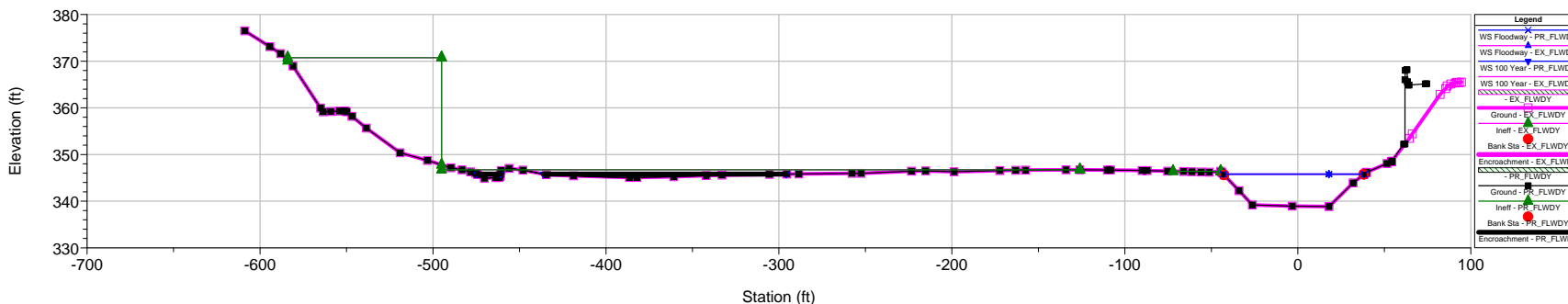
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
7m (23') D/S Proposed I-84 Bridge 01224



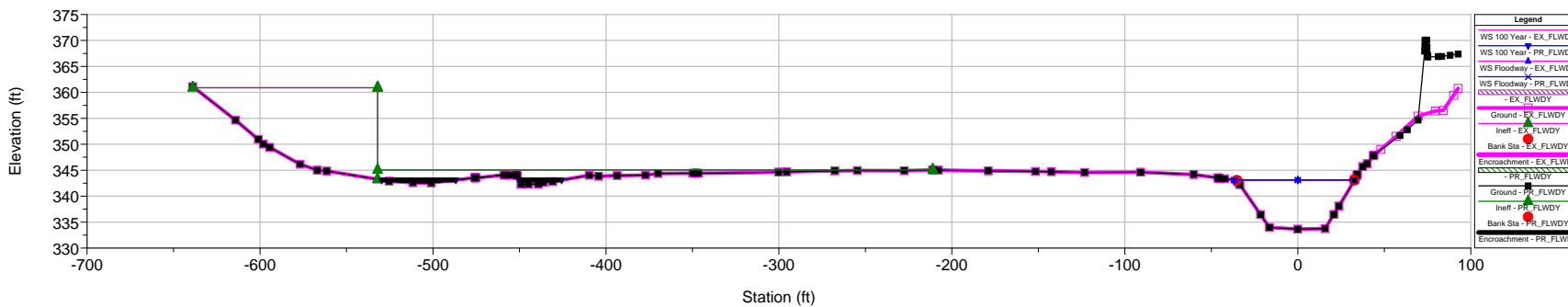
Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 FEMA Station 5132, Cross Section AB



Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 62m (203') downstream of Proposed I-84 Br 01224



Mad River, 151-273, Waterbury, English Plan: 1) PR\_FLWDY 2) EX\_FLWDY  
 166 m (545 ft) downstream of Proposed I-84 Br 01224





## **Appendix C**

### **The 25-Year FEMA Discharge Estimation**

- Upstream of the Beaver Pond Brook Confluence
- Downstream of the Beaver Pond Brook Confluence



## **Mad River 25-Year Discharge Estimation Using The 1979 FIS Reported Discharges**

### **Results of Graphical Fit**

F	Return Period (Years)	Prob. Of Exceedance	Discharge (cms)
0	2	0.5	
1.281551	10	0.1	1505
1.7507	25	0.04	
2.053748	50	0.02	2595
2.326342	100	0.01	3190
2.878151	500	0.002	4970

y =discharge

F =x-axis value of return frequency

$$y = C \times \text{EXP}(p \times F) = 570.71e^{0.7458x}$$

$$= 2106$$

$$C = 570.71$$

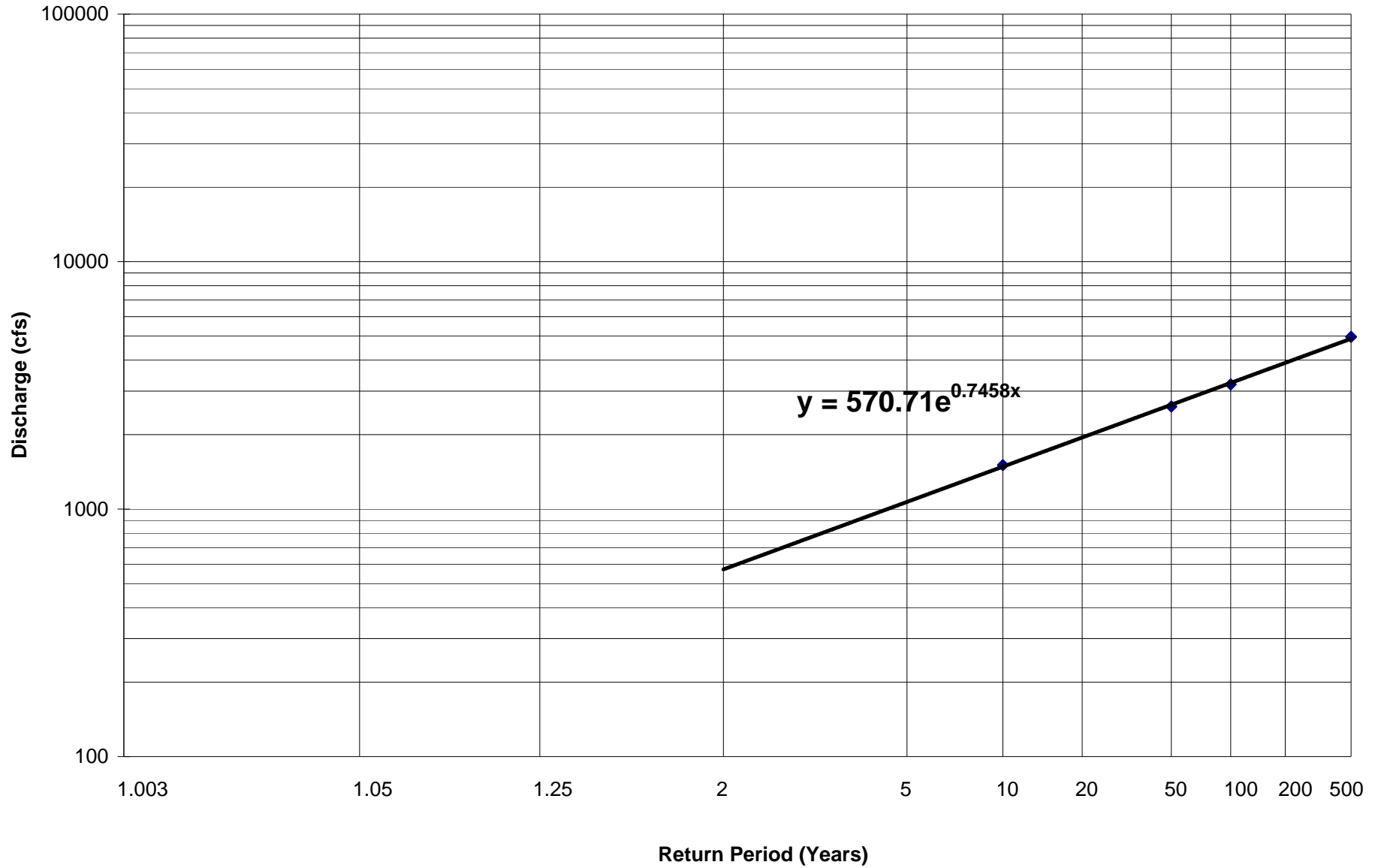
$$F = 1.7507$$

(from Column A)

$$p = 0.7458$$

**Thus, use 2105 CFS for the FEMA 25-Year Discharge  
Upstream of Beaver Pond Brook Confluence**

### 151-273 Mad River, FEMA 25-YR Q Upstream of Beaver Pond Brook Confluence



## ***Mad River 25-Year Discharge Estimation Using The 1979 FIS Reported Discharges***

### **Results of Graphical Fit**

F	Return Period (Years)	Prob. Of Exceedance	Discharge (cms)
0	2	0.5	
1.281551	10	0.1	2350
1.7507	25	0.04	
2.053748	50	0.02	4060
2.326342	100	0.01	4990
2.878151	500	0.002	7775

y =discharge

F =x-axis value of return frequency

$$y = C \times \text{EXP}(p \times F) = 890.13e^{0.747x}$$

$$= 3292$$

C = 890.13

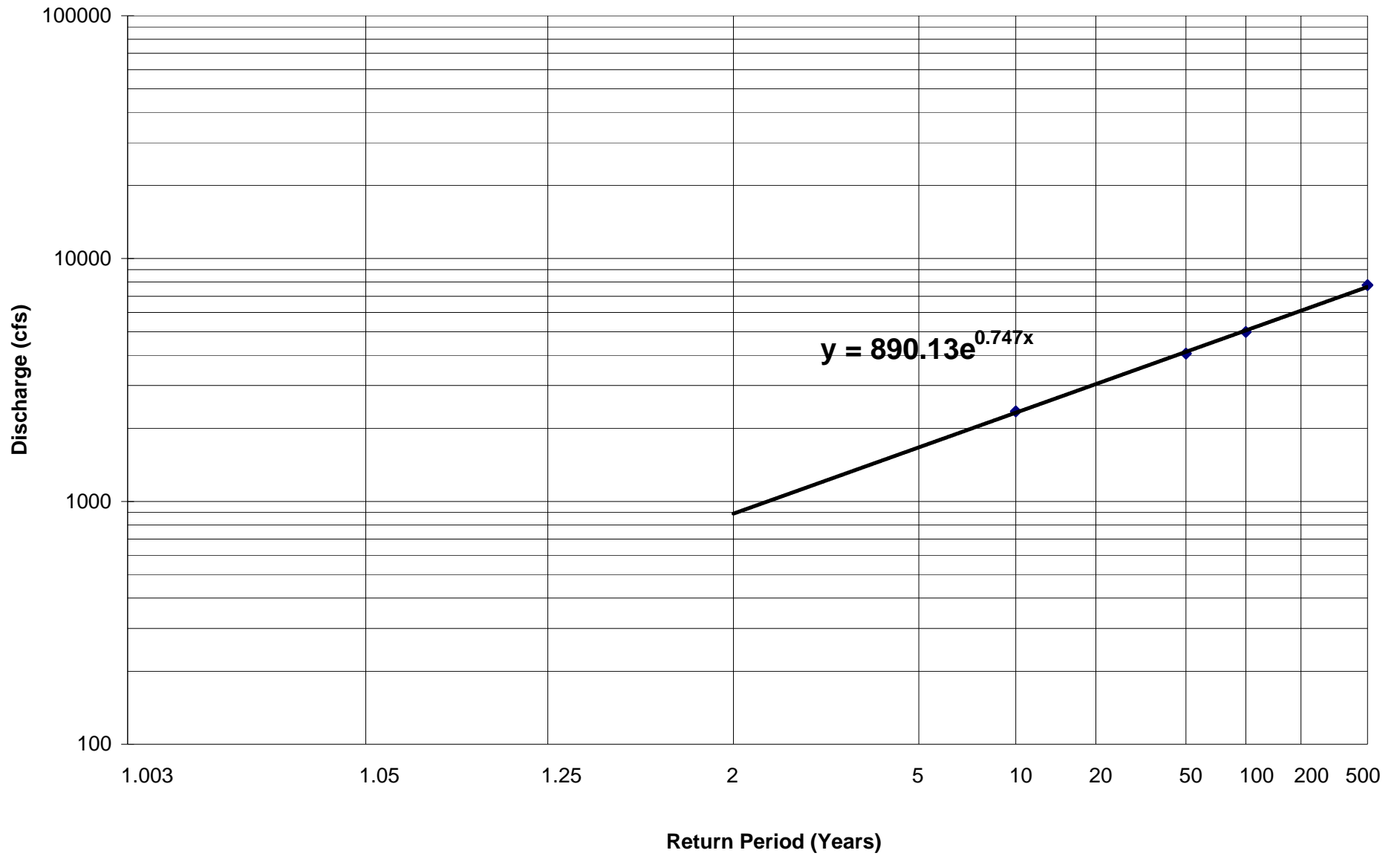
F = 1.7507

(from Column A)

p = 0.747

***Thus, use 3290 CFS for the FEMA 25-Year Discharge  
Downstream of Beaver Pond Brook Confluence***

151-273 Mad River, FEMA 25-YR Q Downstream of Beaver Pond Brook Confluence



## **Appendix D**

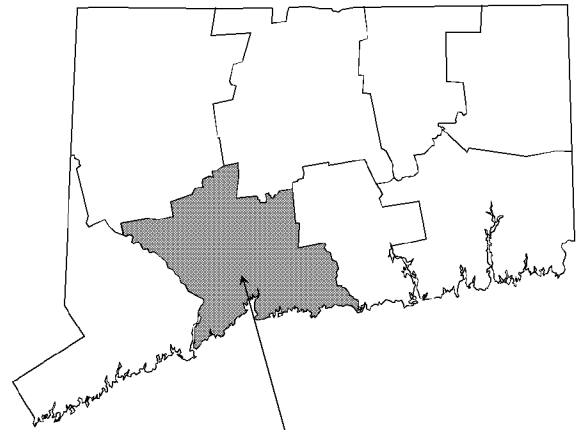
**Waterbury Flood Insurance Study,  
Effective FIRM and Floodway Maps,  
and the original HEC-2 input and output printout**

# FLOOD INSURANCE STUDY

VOLUME 1 OF 6



## NEW HAVEN COUNTY, CONNECTICUT (ALL JURISDICTIONS)



New Haven County

COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER
ANSONIA, CITY OF	090071	NEW HAVEN, CITY OF	090084
BEACON FALLS, TOWN OF	090072	NORTH BRANFORD, TOWN OF	090085
BETHANY, TOWN OF	090144	NORTH HAVEN, TOWN OF	090086
BRANFORD, TOWN OF	090073	ORANGE, TOWN OF	090087
CHESHIRE, TOWN OF	090074	OXFORD, TOWN OF	090150
DERBY, CITY OF	090075	PROSPECT, TOWN OF	090151
EAST HAVEN, TOWN OF	090076	SEYMOUR, TOWN OF	090088
GUILFORD, TOWN OF	090077	SOUTHBURY, TOWN OF	090089
HAMDEN, TOWN OF	090078	WALLINGFORD, TOWN OF	090090
MADISON, TOWN OF	090079	WATERBURY, CITY OF	090091
MERIDEN, CITY OF	090081	WEST HAVEN, CITY OF	090092
MIDDLEBURY, TOWN OF	090080	WOLCOTT, TOWN OF	090093
MILFORD, CITY OF	090082	WOODBIDGE, TOWN OF	090153
NAUGATUCK, BOROUGH OF	090137		

EFFECTIVE:  
DECEMBER 17, 2010



Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER  
09009CV001A

FEMA, under Contract Number H-3962. That work was completed in April 1977.

Waterbury, City of: The hydrologic and hydraulic analyses for the May 1979 study were prepared by Harris-Toups Associates for the FIA, under Contract No. H-3987. This work, which was completed in November 1977, covered all significant flooding sources affecting the City of Waterbury.

West Haven, City of: The supplemental wave height analysis for the October 18, 1982, study was prepared by Dewberry & Davis for FEMA, under an unknown contract number.

The hydrologic and hydraulic analyses for the July 1978 study were performed by the USACE, New England Division, for the FIA, under Inter-Agency Agreement No. IAAH-19-74, Project Order Nos. 17 and 23. This work, which was completed in February 1976, covered all significant flooding sources affecting the City of West Haven.

Wolcott, Town of: The hydrologic and hydraulic analyses for the January 5, 1982, study were prepared by Philip W. Genovese and Associates, Inc., for FEMA, under Contract No. H-4711. This work was completed in April 1980.

Woodbridge, Town of: The hydrologic and hydraulic analyses in the March 18, 1991, revision were prepared by the New England Division of the USACE under Inter-Agency Agreement No. EMW-84-E-1506, Project Order No. 26. This work was completed in July 1989.

The hydrologic and hydraulic analyses for the original study were prepared by the USGS for FEMA, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 27. The work for the original study was completed in December 1978.

For this countywide FIS, the hydraulic analysis for the revised portions of Willow Brook (No. 1) in the Town of Hamden was taken from Technical Support Data Notebook (TSDN) prepared by Roald Haestad, Inc., for FEMA under Contract No. EMB-1999-CO-0564. This work was completed in October 2002.

The New Haven County coastal special flood hazard areas have been re-delineated on new topographic mapping as part of this countywide study. The

Table 3, "Stream Name Changes," lists streams that have names in this countywide FIS other than those used in the previously printed FISs for the communities in which they are located.

TABLE 3 - STREAM NAME CHANGES

<u>Community</u>	<u>Old Name</u>	<u>New Name</u>
City of Ansonia	Beaver Brook	Beaver Brook No. 1
City of Milford	Beaver Brook	Beaver Brook No. 2
City of New Haven	Beaver Brook	Beaver Brook No. 3
Town of Seymour	Bladens River	Bladens River (Lower Reach)
Town of Woodbridge/ Town of Bethany	Bladens River	Bladens River (Upper Reach)
Town of Branford	Branford River	Branford River (Lower Reach)
Town of North Branford	Branford River	Branford River (Upper Reach)
Town of North Branford	Eightmile Brook	Eightmile Brook No. 1
Town of Oxford	Eightmile Brook	Eightmile Brook No. 2
Borough of Naugatuck	Hop Brook	Hop Brook (Lower Reach)
Town of Middlebury	Hop Brook	Hop Brook (Upper Reach)
City of Milford/Town of Orange/ City of Derby/Town of Seymour/ Town of Oxford	Housatonic River	Housatonic River (Lower Reach)
Town of Southbury	Housatonic River	Housatonic River (Upper Reach)
Town of Prospect	Tributary to Fulling Mill Brook	Fulling Mill Brook Tributary
City of Waterbury	Mad River	Mad River (Lower Reach)
Town of Wolcott	Mad River	Mad River (Upper Reach)
Town of North Haven	Muddy River	Muddy River (Lower Reach)
Town of Wallingford	Muddy River	Muddy River (Upper Reach)
Town of North Branford	Tributary C	Muddy River Tributary C
City of Milford	Quirks Pond	Farley Creek
Town of Orange/City of Milford	Wepawaug River	Wepawaug River (Lower Reach)
Town of Woodbridge	Wepawaug River	Wepawaug River (Upper Reach)
Town of Guilford	West River	West River No. 1
Town of Woodbridge/City of New Haven/ City of West Haven	West River	West River No. 2
Town of Cheshire/ Town of Hamden	Willow Brook	Willow Brook No. 1
City of Meriden	Willow Brook	Willow Brook No. 2



rainfall-runoff methods. The peak discharge at the Muddy River (Upper Reach) railroad bridge is lower than the upstream bridge discharge due to the storage capacity behind the bridge structure. Discharges for the portion of Meetinghouse Brook studied by approximate methods were computed using the same method.

For the June 4, 1990, FIS, flood-flow frequency values for the Quinnipiac River were based on statistical analysis of streamflow records covering a 55-year period of record at the USGS gage in Wallingford. The analyses followed log-Pearson Type III procedures as outlined in USGS Bulletin 17B, 1981.

For Hanover Street Brook and Mansion Road Brook, peak discharges for floods of the selected recurrence intervals were determined using regression analysis. The USGS 1975 floodflow formulas discharges were related to basin characteristics such as drainage area, stream length, streambed slope, and rainfall parameters.

For the September 7, 2000, revision, the Quinnipiac River flood-flow frequency values were based on statistical records covering a 66-year period of record at the USGS Quinnipiac River gage in Wallingford.

### **Waterbury, City of**

Peak discharge-frequency relationships for the Naugatuck River were determined using gaging records recorded by the USGS at Gage No. 1208500 located in Beacon Falls on the Naugatuck River. This gage has a recording period extending from 1920 to the present. A log-Pearson Type III distribution was fitted to the annual peak flows at the gage and then modified for the effect of the USACE flood control reservoir system located within the Naugatuck River Basin.

Hopeville Pond Brook, Mad River (Lower Reach), Beaver Pond Brook, Steel Brook, Hancock Brook, and Wooster Brook do not have stream gages with which frequency-discharge relationships can be developed. The peak discharges for these streams, when the drainage area is equal to or greater than 1 square mile, was calculated using the USGS 1975 floodflow formulas.

The discharge-frequency estimates for small drainage areas of less than one square mile in developed areas were calculated utilizing the rational method, for which the input parameters included:

1. Runoff Coefficient - the measure of runoff losses due to infiltration from soil; obtained from zoning maps of Waterbury, Scale 1:13,200, August 1976.
2. Time of Concentration - the time required for rain falling at the most remote point to reach the discharge point; taken from the USGS quadrangle sheets, Maps of Flood-Prone Areas, Scale 1:2,400, Contour Interval 20 feet, Waterbury, Connecticut, 1971.

3. Intensity of Rainfall - in inches per hour, based on time of concentration; obtained from the U. S. Weather Bureau's Technical Paper No. 40, 1961.
4. Area of watershed in acres.

The peak discharges for the upper reaches of Hopeville Pond Brook and Wooster Brook were calculated using the rational method.

### **West Haven, City of**

In order to be fairly consistent with the existing report information, the Bigwood-Thomas flood flow formula for Connecticut described in USGS Circular 365, A Flood-flow Formula for Connecticut, 1955, was used to calculate the design flows for the West River No. 2 and the Cove River. The rational formula was used to calculate the design flows on the other detailed study streams. This yielded results which are consistent with those reported by Bowe, Walsh & Associates in their study for the City of West Haven entitled, Drainage Computations from Master Drainage Plan, dated 1976.

For the detailed study stream, the 10-, 2-, 1-, and 0.2-percent annual chance return frequency storms were computed. The 0.2-percent annual chance rainfall intensity was determined by the extrapolation of a curve fit to the 10-, 2- and 1-percent annual chance rainfall intensities probability graph found in the Weather Bureau's Technical Paper No. 40, May 1961, out to the 0.2-percent annual chance rainfall intensity. For the streams studied by approximate methods, the 1-percent annual chance return frequency storm was used.

### **Wolcott, Town of**

There is no gage information for any of the streams located within the Town of Wolcott. Peak discharges were determined for floods of the selected recurrence intervals using the USGS 1975 floodflow formulas. The topographical information was scaled from USGS 7.5-Minute Series Topographic Maps, Scale 1:24,000, Contour Interval 10 feet: Southington, Waterbury and Bristol, Connecticut, 1968, Photorevised 1972. The peak discharges were later modified by the hydraulic effects of the four reservoirs and dams located in Wolcott. These reservoirs and dams are as follows: Chestnut Hill Reservoir, Hitchcock Lake, Southington Reservoir and two Scovill Reservoirs. The resulting flows were then checked against existing information from 1955 flood measurements and an earlier flood routing and were found to be in agreement.

### **Woodbridge, Town of**

For the Bladens River (Upper Reach), the Wepawaug River (Upper Reach), and Race Brook, peak discharges of floods of the selected recurrence intervals were determined by regression analysis. Discharges were related to basin characteristics such as drainage area, stream length, streambed slope, and rainfall parameters, as described in the USGS floodflow formulas.

TABLE 6 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-PERCENT ANNUAL CHANCE</u>	<u>2-PERCENT ANNUAL CHANCE</u>	<u>1-PERCENT ANNUAL CHANCE</u>	<u>0.2-PERCENT ANNUAL CHANCE</u>
<b>BAILEY CREEK</b>					
At Railroad	0.67	30	50	60	90
At Interstate Route 95	0.35	50	80	90	120
At a point approximately 170 feet downstream of Sandlewood Drive	0.35	60	110	130	190
<b>BEACON HILL BROOK</b>					
At mouth of Naugatuck River	10.44	975	1,610	1,940	2,870
At Beacon Falls/Naugatuck corporate limits	10.00	845	1,380	1,675	2,500
Below Straitsville Brook	9.13	815	1,335	1,620	2,400
Below Marks Brook	7.77	765	1,250	1,520	2,250
At upper study limit	5.33	665	1,080	1,320	1,950
<b>BEAVER BROOK NO. 1</b>					
At confluence with the Naugatuck River	3.53	497	892	1,220 <sup>1</sup>	2,000 <sup>1</sup>
<b>BEAVER BROOK NO. 2</b>					
At Naugatuck Avenue	2.17	450	890	1,100	1,425
At Bridgeport Avenue	1.60	390	760	920	1,100
At Bic Drive	1.50	460	750	900	1,150
At Interstate Route 95	0.98	315	524	607	768
At Naugatuck Avenue	0.57	270	400	450	600
At Plains Road	0.39	100	170	200	370
<b>BEAVER BROOK NO. 3</b>					
At Blake Street	2.03	150	230	280	370
At Crescent Street	1.77	80	100	110	130
<b>BEAVER POND BROOK</b>					
At mouth at Mad River (Lower Reach)	5.7	955	1,610	1,960	2,975
Upstream of East Mountain Brook	4.8	795	1,335	1,625	2,465
Upstream of Turkey Hill Brook	3.0	515	865	1,055	1,595
Upstream of Unnamed Tributary	2.5	430	715	870	1,315
Downstream of Unnamed Tributary	1.7	305	515	625	940
At upstream study limit	1.1	205	340	410	615

<sup>1</sup>Except where split flow occurs

TABLE 6 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs)			
		10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
<b>LONG SWAMP BROOK</b>					
At Mouth	1.81	278	536	691	1,202
Above Brook Lane	1.57	241	465	600	1,044
Above State Highway 64	1.45	223	430	555	965
Below Memorial School	1.18	182	351	453	787
At upper study limit	0.84	131	232	406	566
<b>LYMAN HALL BROOK</b>					
At Reskin Drive	1.14	330	530	620	810
<b>MAD RIVER (LOWER REACH)</b>					
Mouth at Naugatuck River	26.4	2,795	4,825	5,935	9,240
Downstream of Beaver Pond Brook	23.9	2,350	4,060	4,990	7,775
Upstream of Beaver Pond Brook	18.0	1,505	2,595	3,190	4,970
At upstream study limit	15.9	1,410	2,435	2,995	4,660
<b>MAD RIVER (UPPER REACH)</b>					
Above the confluence with Old Tannery Brook	12.6	1,295	2,195	2,665	4,190
Above the confluence with Lily Brook	8.4	700	1,500	2,310	3,280
At Scovill Reservoir	5.5	450	980	1,375	1,980
<b>MALONEY BROOK</b>					
At confluence with Farm River	1.0	255	425	532	761
<b>MANSION ROAD BROOK</b>					
At confluence with the Quinnipiac River	0.90	115	215	330	660
<b>MEETINGHOUSE BROOK</b>					
At confluence with the Quinnipiac River	3.72	1,580	2,310	2,680	3,440
At cross section I	1.93	1,170	1,660	1,900	2,400
<b>MILL RIVER</b>					
At Whitney Dam	36.4	1,400	2,200	2,500	3,200
At Connolly Parkway	32.9	1,300	2,000	2,300	3,000
At Clarks Pond Dam	25.0	1,100	1,700	1,900	2,500
At River Road	20.0	900	1,400	1,600	2,100

All elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88).

Qualifying bench marks within a given jurisdiction that are cataloged by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B, or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Bench marks cataloged by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation well (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation well (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS bench marks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for bench marks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at <http://www.ngs.noaa.gov>.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with this FIS and FIRM. Interested individuals may contact FEMA to access this data.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness factors for all streams studied by detailed methods are shown in Table 8, "Manning's "n" Values."

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mad River (Lower Reach) (continued)								
L	4,590	55	391	15.2	291.7	291.7	291.7	0.0
M	5,800	130	680	8.7	303.8	303.8	303.8	0.0
N	6,630	55	548	10.0	307.1	307.1	307.2	0.1
O	7,050	113	598	9.1	309.9	309.9	310.0	0.1
P	7,200	200	878	6.2	311.3	311.3	311.3	0.0
Q	7,350	110	742	7.4	312.5	312.5	312.5	0.0
R	7,485	40	498	11.0	312.5	312.5	312.5	0.0
S	7,745	145	1,146	4.8	322.3	322.3	322.3	0.0
T	8,100	130	1,360	4.0	322.7	322.7	322.7	0.0
U	8,515	84	1,016	5.4	322.8	322.8	322.8	0.0
V	8,905	150	1,383	4.0	323.9	323.9	323.9	0.0
W	9,260	85	575	9.5	324.1	324.1	324.1	0.0
X	9,404	95	808	6.8	326.1	326.1	326.2	0.1
Y	10,335	81	394	12.7	328.9	328.9	328.9	0.0
Z	10,545	67	487	10.2	334.3	334.3	334.3	0.0
AA	11,135	110	418	11.9	340.4	340.4	340.4	0.0
AB	11,985	122	517	9.7	348.7	348.7	348.9	0.2
AC	12,295	93	819	6.1	351.2	351.2	351.2	0.0
AD	12,395	116	970	5.1	352.6	352.6	352.6	0.0
AE	12,700	97	418	11.9	353.4	353.4	353.4	0.0
AF	13,200	100	637	7.8	357.7	357.7	358.2	0.5
AG	13,745	396	4,660	1.1	375.2	375.2	375.2	0.0

<sup>1</sup>Stream distance in feet above confluence with Naugatuck River

**TABLE 14**

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

**NEW HAVEN COUNTY, CT  
(ALL JURISDICTIONS)**

**FLOODWAY DATA**

**MAD RIVER (LOWER REACH)**

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Mad River (Lower Reach) (continued)								
AH	14,275	217	1,694	2.9	375.2	375.2	375.2	0.0
AI	14,875	424	4,190	1.2	377.2	377.2	377.2	0.0
AJ	15,065	222	865	3.7	377.2	377.2	377.2	0.0
AK	15,190	142	440	7.3	377.8	377.8	377.8	0.0
AL	15,590	96	404	7.9	379.8	379.8	379.8	0.0
AM	16,150	45	241	13.3	387.9	387.9	387.9	0.0
AN	16,350	70	344	9.3	390.4	390.4	390.4	0.0
AO	17,270	54	273	11.7	398.7	398.7	398.7	0.0
AP	18,220	190	458	7.0	411.9	411.9	411.9	0.0
AQ	19,230	86	298	10.7	425.3	425.3	425.3	0.0
AR	19,935	272	3,132	1.0	449.9	449.9	450.0	0.1
AS	20,435	169	1,057	3.0	449.9	449.9	450.0	0.1
AT	20,935	72	503	6.3	450.2	450.2	450.2	0.0
AU	21,080	69	486	6.6	450.6	450.6	450.7	0.1
AV	21,790	102	735	4.3	452.1	452.1	452.1	0.0
AW	22,790	164	765	3.9	453.4	453.4	453.4	0.0
AX	23,230	77	330	9.1	453.7	453.7	453.8	0.1
AY	23,750	73	399	7.5	457.6	457.6	457.6	0.0
AZ	23,950	75	548	5.5	458.3	458.3	458.3	0.0
BA	25,075	225	1,358	2.2	459.4	459.4	459.4	0.0
BB	26,435	119	733	4.1	459.9	459.9	460.0	0.1
BC	27,035	169	988	3.0	460.6	460.6	460.7	0.1

<sup>1</sup>Stream distance in feet above confluence with Naugatuck River

**TABLE 14**

**FEDERAL EMERGENCY MANAGEMENT AGENCY**

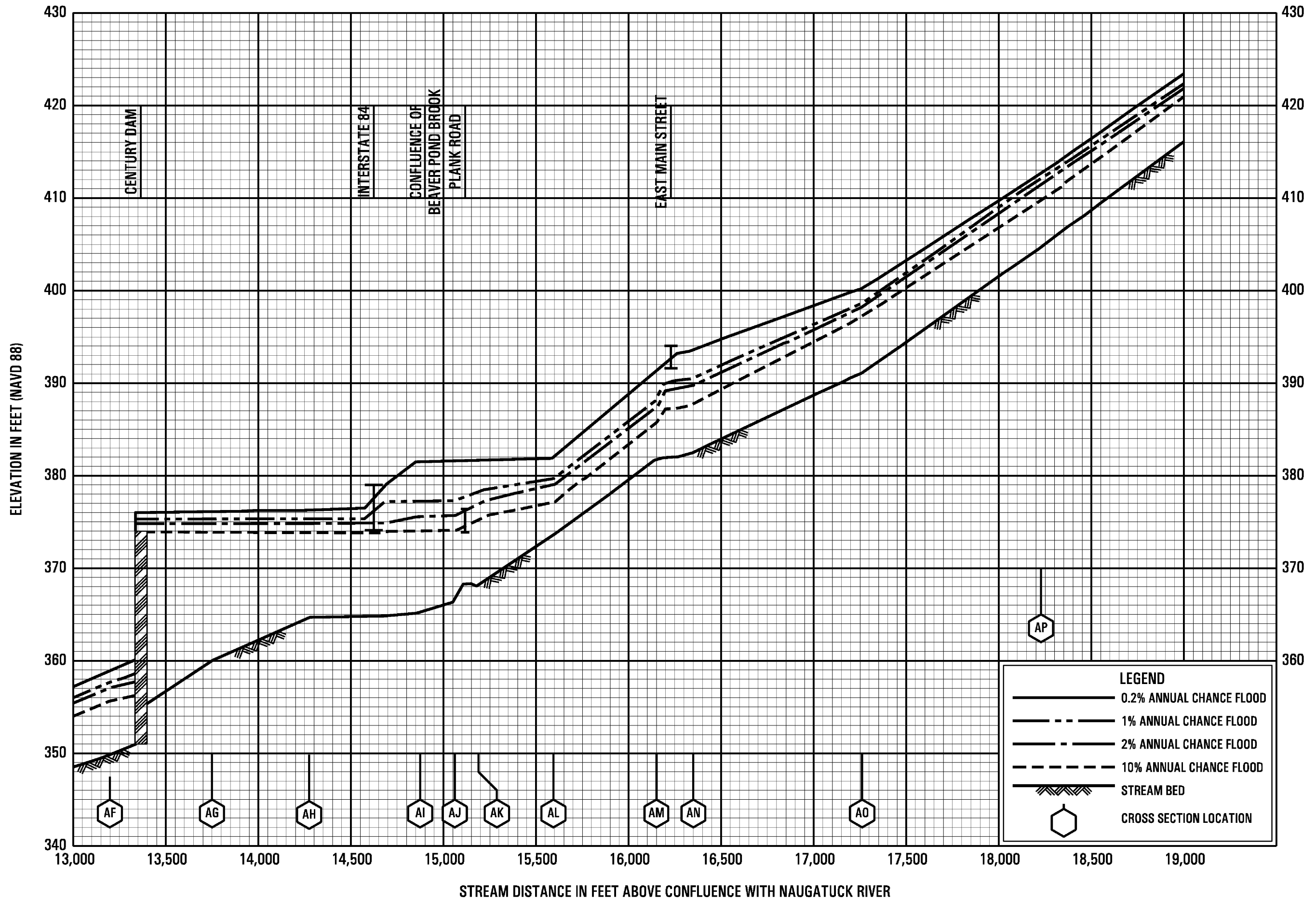
**NEW HAVEN COUNTY, CT  
(ALL JURISDICTIONS)**

**FLOODWAY DATA**

**MAD RIVER (LOWER REACH)**



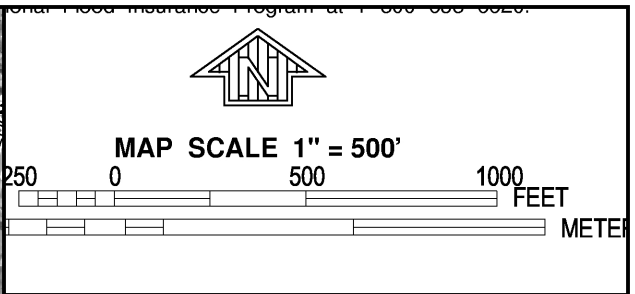
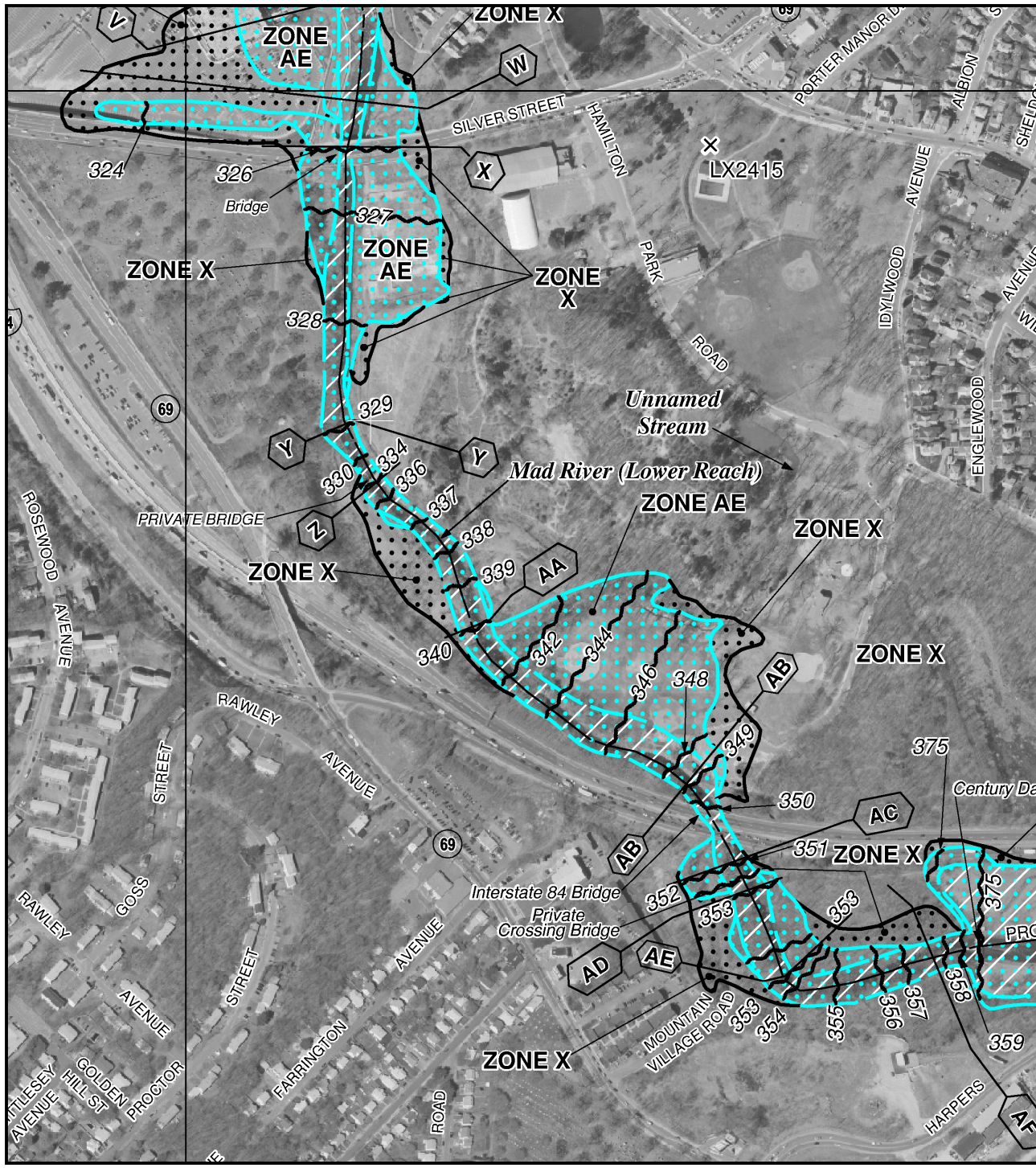




**FLOOD PROFILES**

**MAD RIVER (LOWER REACH)**

**FEDERAL EMERGENCY MANAGEMENT AGENCY  
NEW HAVEN COUNTY, CT  
(ALL JURISDICTIONS)**



**NATIONAL FLOOD INSURANCE PROGRAM**

PANEL 0117H

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**NEW HAVEN COUNTY,**  
**CONNECTICUT**  
**(ALL JURISDICTIONS)**

**PANEL 117 OF 635**  
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
WATERBURY, CITY OF	090091	0117	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

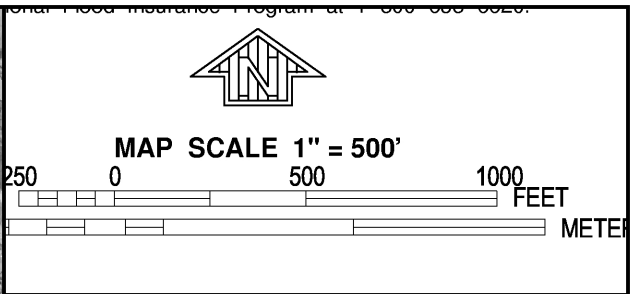
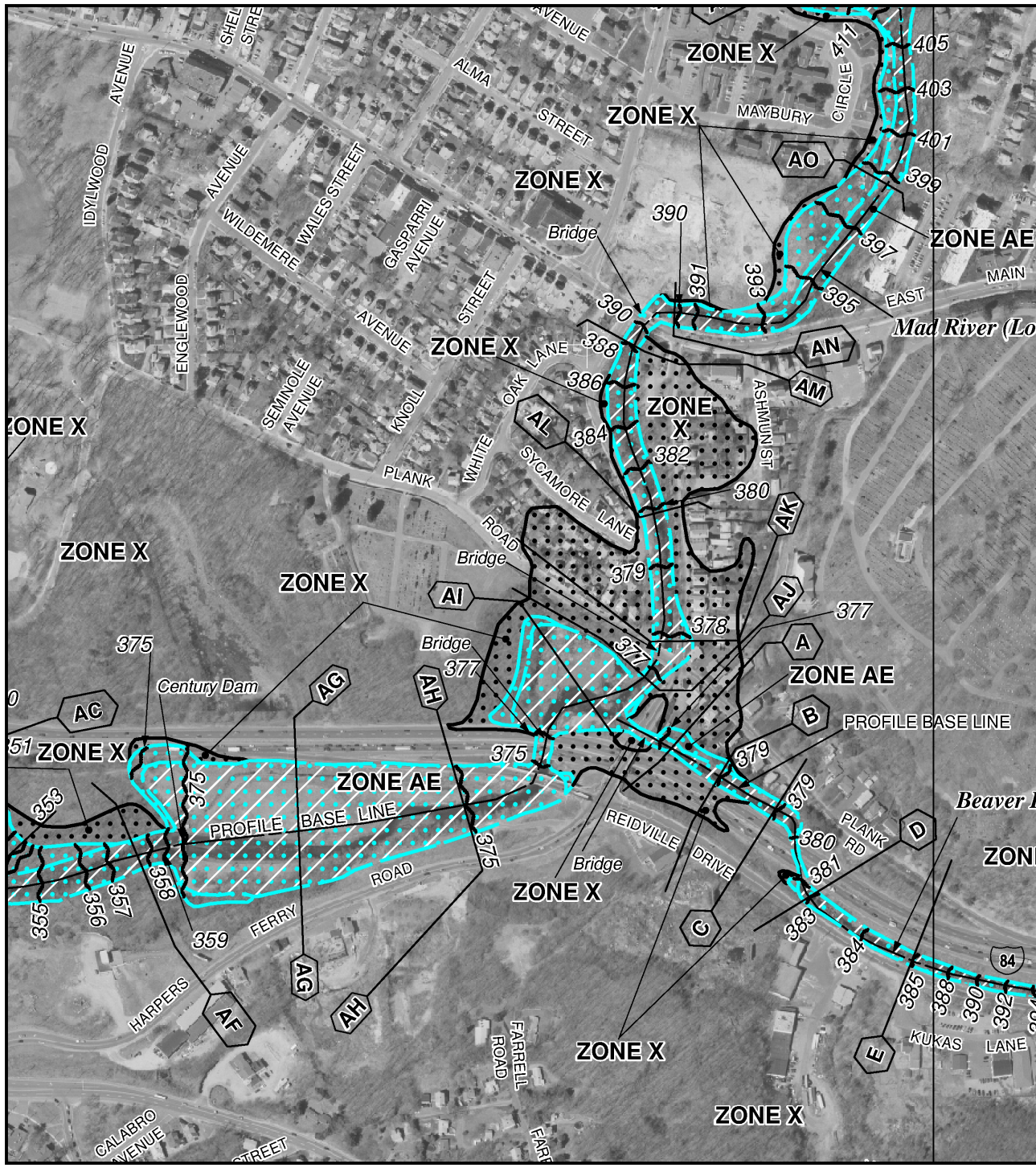
**MAP NUMBER**  
**09009C0117H**

**EFFECTIVE DATE**  
**DECEMBER 17, 2010**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)





NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0117H

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**NEW HAVEN COUNTY,**  
**CONNECTICUT**  
 (ALL JURISDICTIONS)

**PANEL 117 OF 635**  
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

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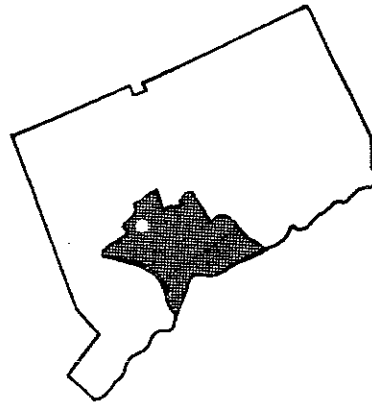
121

# FLOOD INSURANCE STUDY



CONNDOT  
HYDRAULICS & DRAINAGE  
REFERENCE MATERIAL

CITY OF  
WATERBURY,  
CONNECTICUT  
NEW HAVEN COUNTY



MAY 1979

CONNDOT  
HYDRAULICS & DRAINAGE  
REFERENCE MATERIAL

U.S. DEPARTMENT of HOUSING & URBAN DEVELOPMENT  
FEDERAL INSURANCE ADMINISTRATION

- A. Runoff Coefficient - the measure of runoff losses due to infiltration from soil; obtained from zoning maps of Waterbury (Reference 4).
- B. Time of Concentration - the time required for rain falling at the most remote point to reach the discharge point; taken from the USGS quadrangle sheets (Reference 5).
- C. Intensity of Rainfall - in inches per hour, based on time of concentration; obtained from the U. S. Weather Bureau (Reference 6).
- D. Area of watershed in acres.

A summary of peak discharges for the 10-, 50-, 100-, and 500-year floods for those streams studied in detail is shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
<b>NAUGATUCK RIVER</b>					
Downstream corporate limit	206.0	6,900	15,700	21,900	50,900
Downstream of Mad River	205.0	6,650	15,100	21,100	49,100
Upstream of Mad River	179.0	5,800	10,850	15,100	36,800
Freight Street Bridge	175.0	5,700	9,600	13,350	33,100
Upstream of Steel Brook	155.0	5,500	5,600	8,580	23,200
Chase Brass Bridge	137.0	5,300	5,400	8,000	21,600
<b>HOPEVILLE POND BROOK</b>					
Mouth at Naugatuck River	1.3	280	480	585	890
Upstream of Unnamed Tributary	0.9	215	355	435	650
Upstream study limit	0.5	155	240	290	420
<b>MAD RIVER</b>					
Mouth at Naugatuck River	26.4	2,795	4,825	5,935	9,240
Downstream of Beaver Pond Brook	23.9	2,350	4,060	4,990	7,775
Upstream of Beaver Pond Brook	18.0	1,505	2,595	3,190	4,970
Upstream study limit	15.9	1,410	2,435	2,995	4,660

TABLE 1 - SUMMARY OF DISCHARGES (continued)

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
<b>BEAVER POND BROOK</b>					
Mouth at Mad River	5.7	955	1,610	1,960	2,975
Upstream of East Mountain Brook	4.8	795	1,335	1,625	2,465
Upstream of Turkey Hill Brook	3.0	515	865	1,055	1,595
Upstream of Unnamed Tributary	2.5	430	715	870	1,315
Downstream of Unnamed Tributary	1.7	305	515	625	940
Upstream study limit	1.1	205	340	410	615
<b>STEEL BROOK</b>					
Mouth at Naugatuck River	17.0	1,970	3,820	4,950	8,705
Downstream of Clough Brook	16.5	1,915	3,715	4,810	8,465
Upstream of Clough Brook	16.2	1,870	3,630	4,700	8,265
Downstream of Turkey Brook	14.9	1,725	3,345	4,335	7,620
Upstream study limit	12.4	1,410	2,740	3,550	6,245
<b>HANCOCK BROOK</b>					
Mouth at Naugatuck River	3.5	980	1,720	2,190	3,850
Downstream of Unnamed Tributary	1.4	625	930	1,125	1,810
Upstream study limits	1.1	570	800	950	1,470
<b>WOOSTER BROOK</b>					
Downstream corporate limit	1.3	285	525	665	1,100
Downstream of Route 64	1.0	230	380	465	720
Mouth of Tracy Pond	0.7	205	315	375	555
Upstream Study Limit	0.2	170	220	245	310

The discharges computed for Hancock Brook have been adjusted to take into consideration the effect of the Hancock Brook Dam located upstream of the Waterbury city limit. A non-damaging outlet capacity discharge at the dam of 380 cfs was utilized for the 10-, 50-, 100-, and 500-year floods as recommended by the COE who are in control of this reservoir. This discharge was then added to the discharges calculated below the dam which were based upon the effective drainage areas downstream of the reservoir not controlled by the dam.

FLOODING SOURCE		FLOODWAY			BASE FLOOD SURFACE ELEVATION			
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)	
Hopeville Pond Brook (continued)	H	89	214	2.7	282.8	282.8	0.0	
	I	1,923	97	6.0	321.5	321.5	0.0	
	J	2,223	56	7.1	330.9	330.9	0.0	
	K	2,405	36	2.6	338.2	338.2	0.0	
	L	3,300	84	5.4	343.5	343.5	0.0	
	M	4,070	32	6.4	352.9	352.8	0.1	
	N	4,300	126	562	0.8	362.8	362.8	0.0
	O	4,440	116	393	1.1	362.8	362.8	0.0
	P	4,620	25	53	8.2	362.8	362.8	0.0
	Q	4,735	22	50	8.6	365.2	365.2	0.0
	R	4,904	110	825	0.4	377.5	377.5	0.0
	S	5,141	134	523	0.6	377.6	377.6	0.0
	Mad River							
		A	500	59	397	14.9	252.0	252.0

<sup>1</sup> Feet above confluence with the Naugatuck River

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

CITY OF WATERBURY, CT

(NEW HAVEN CO.)

FLOODWAY DATA

HOPEVILLE POND BROOK AND MAD RIVER

TABLE 2



FLOODING SOURCE		FLOODWAY			BASE FLOOD SURFACE ELEVATION		
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)
Mad River (continued)							
B	950	115	424	14.0	257.9	257.8	0.1
C	1,140	300	1,201	4.9	261.4	260.9	0.5
D	1,360	198	994	6.0	262.2	262.0	0.2
E	1,790	80	441	13.5	272.7	272.7	0.0
F	2,400	89	949	6.3	276.9	276.7	0.2
G	2,620	136	1,924	3.1	278.7	278.3	0.4
H	3,140	59	446	13.3	278.7	278.6	0.1
I	3,192	84	489	12.1	280.4	280.2	0.2
J	3,240	54	388	15.3	281.8	281.7	0.1
K	3,775	57	567	10.5	288.4	288.3	0.1
L	4,590	55	391	15.2	292.7	292.7	0.0
M	5,800	130	680	8.7	304.8	304.8	0.0
N	6,630	55	548	10.0	308.2	308.1	0.1
O	7,050	113	598	9.1	311.0	310.9	0.1
P	7,200	200	878	6.2	312.3	312.3	0.0
Q	7,350	110	742	7.4	313.5	313.5	0.0
R	7,485	40	498	11.0	313.5	313.5	0.0

<sup>1</sup>Feet above confluence with the Naugatuck River

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

**CITY OF WATERBURY, CT**  
(NEW HAVEN CO.)

**FLOODWAY DATA**

**MAD RIVER**

**TABLE 2**



FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)
Mad River (continued)							
S 5500	7,745	145	1,146	4.8	323.3	323.3	0.0
T 5440	8,100	130	1,360	4.0	323.7	323.7	0.0
U 5486	8,515	84	1,016	5.4	323.8	323.8	0.0
V 5532	8,905	150	1,383	4.0	324.9	324.9	0.0
W 5462	9,260	85	575	9.5	325.1	325.1	0.0
X 5191	9,404	95	808	6.8	327.2	327.1	0.1
Y 5003	10,335	81	394	12.7	329.9	329.9	0.0
Z	10,545	67	487	10.2	335.3	335.3	0.0
AA	11,135	110	418	11.9	341.4	341.4	0.0
AB	11,985	122	517	9.7	349.9	349.7	0.2
AC	12,295	93	819	6.1	352.2	352.2	0.0
AD	12,395	116	970	5.1	353.6	353.6	0.0
AE	12,700	97	418	11.9	354.4	354.4	0.0
AF	13,200	100	637	7.8	359.2	358.7	0.5
AG	13,745	396	4,660	1.1	376.2	376.2	0.0
AH	14,275	217	1,694	2.9	376.2	376.2	0.0
AI	14,875	424	4,190	1.2	378.2	378.2	0.0

<sup>1</sup>Feet above confluence with the Naugatuck River

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

CITY OF WATERBURY, CT

(NEW HAVEN CO.)

FLOODWAY DATA

MAD RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE <sup>1</sup>	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)
Mad River (continued)							
AJ	15,065	222	865	3.7	378.2	378.2	0.0
AK	15,190	142	440	7.3	378.8	378.8	0.0
AL	15,590	96	404	7.9	380.8	380.8	0.0
AM	16,150	45	241	13.3	388.9	388.9	0.0
AN	16,350	70	344	9.3	391.4	391.4	0.0
AO	17,270	54	273	11.7	399.7	399.7	0.0
AP	18,220	190	458	7.0	412.9	412.9	0.0
AQ	19,230	86	298	10.7	426.3	426.3	0.0
AR	19,935	272	3,132	1.0	451.0	450.9	0.1
AS	20,435	169	1,057	3.0	451.0	450.9	0.1
AT	20,935	72	503	6.3	451.2	451.2	0.0
AU	21,080	69	486	6.6	451.7	451.6	0.1
AV	21,790	102	735	4.3	453.1	453.1	0.0
AW	22,790	164	765	3.9	454.4	454.4	0.0
AX	23,230	77	330	9.1	454.8	454.7	0.1
AY	23,750	73	399	7.5	458.6	458.6	0.0
AZ	23,950	75	548	5.5	459.3	459.3	0.0

<sup>1</sup>Feet above confluence with the Naugatuck River

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Federal Insurance Administration

CITY OF WATERBURY, CT

(NEW HAVEN CO.)

FLOODWAY DATA

MAD RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE (FT.)
Mad River (continued)							
BA	25,075 <sup>1</sup>	225	1,358	2.2	460.4	460.4	0.0
BB	26,435 <sup>1</sup>	119	733	4.1	461.0	460.9	0.1
BC	27,035 <sup>1</sup>	169	988	3.0	461.7	461.6	0.1
BD	27,665 <sup>1</sup>	179	1,037	2.9	462.1	462.0	0.1
BE	28,045 <sup>1</sup>	130	875	3.4	462.3	462.1	0.2
BF	28,180 <sup>1</sup>	131	888	3.4	462.4	462.2	0.2
BG	28,300 <sup>1</sup>	128	802	3.7	462.5	462.3	0.2
Beaver Pond Brook							
A	200 <sup>2</sup>	22	180	10.9	377.8	377.8 <sup>3</sup>	0.0
B	400 <sup>2</sup>	59	384	5.1	380.1	380.1	0.0
C	600 <sup>2</sup>	52	242	8.1	380.5	380.4	0.1
D	920 <sup>2</sup>	52	292	6.7	383.6	383.6	0.0
E	1,320 <sup>2</sup>	44	153	10.6	386.2	386.2	0.0
F	2,000 <sup>2</sup>	35	141	11.5	400.8	400.8	0.0

<sup>1</sup>Feet above confluence with the Naugatuck River

<sup>2</sup>Feet above confluence with the Mad River

<sup>3</sup>Elevations computed without consideration of backwater effects from the Mad River

TABLE 2

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration

CITY OF WATERBURY, CT

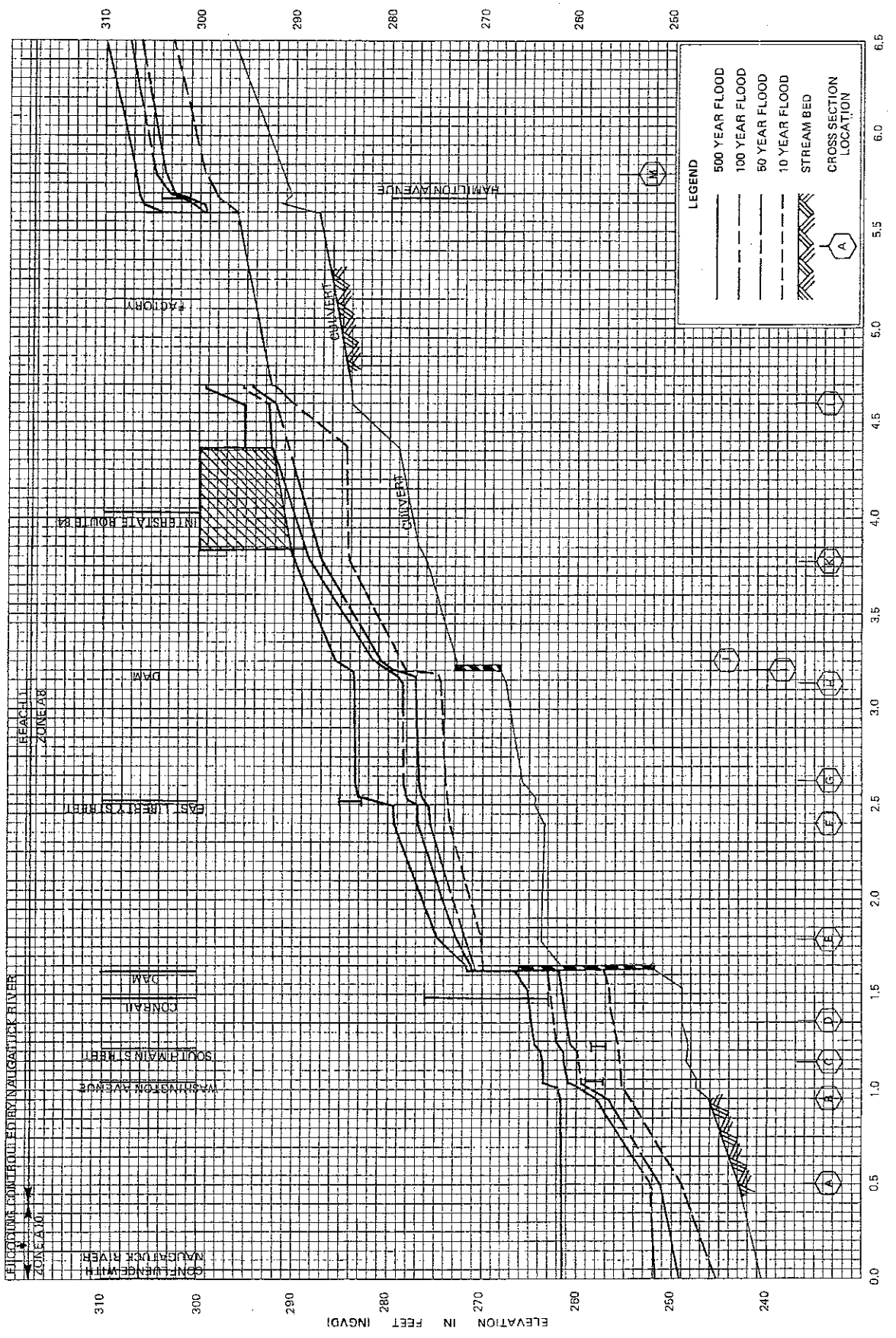
(NEW HAVEN CO.)

FLOODWAY DATA

MAD RIVER AND BEAVER POND BROOK

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration  
CITY OF WATERBURY, CT  
(NEW HAVEN CO.)

FLOOD PROFILES  
MAD RIVER



**LEGEND**

- 500 YEAR FLOOD
- - - 100 YEAR FLOOD
- · - · 50 YEAR FLOOD
- · - · 10 YEAR FLOOD
- ▨ STREAM BED
- A CROSS SECTION LOCATION

ELEVATION IN FEET (NGVD)  
310  
300  
290  
280  
270  
260  
250  
240

STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH NAUGATUCK RIVER  
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

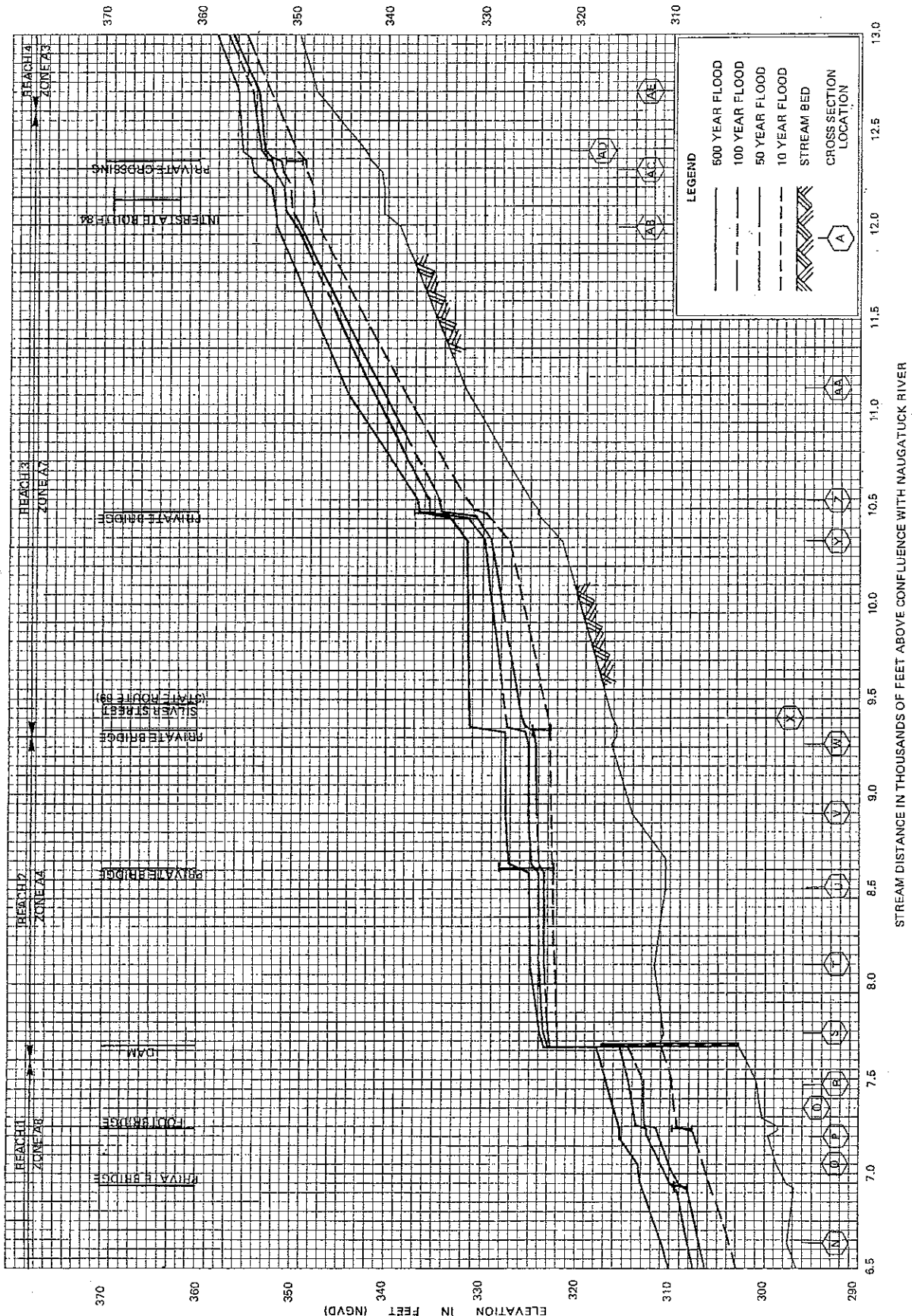
CONFLUENCE OF MAD RIVER WITH NAUGATUCK RIVER  
ZONE A-10

WASHINGTON AVENUE  
SOUTH MAIN STREET  
DAM  
CONRAIL  
EAST BERT'S STREET  
ZONE A-8

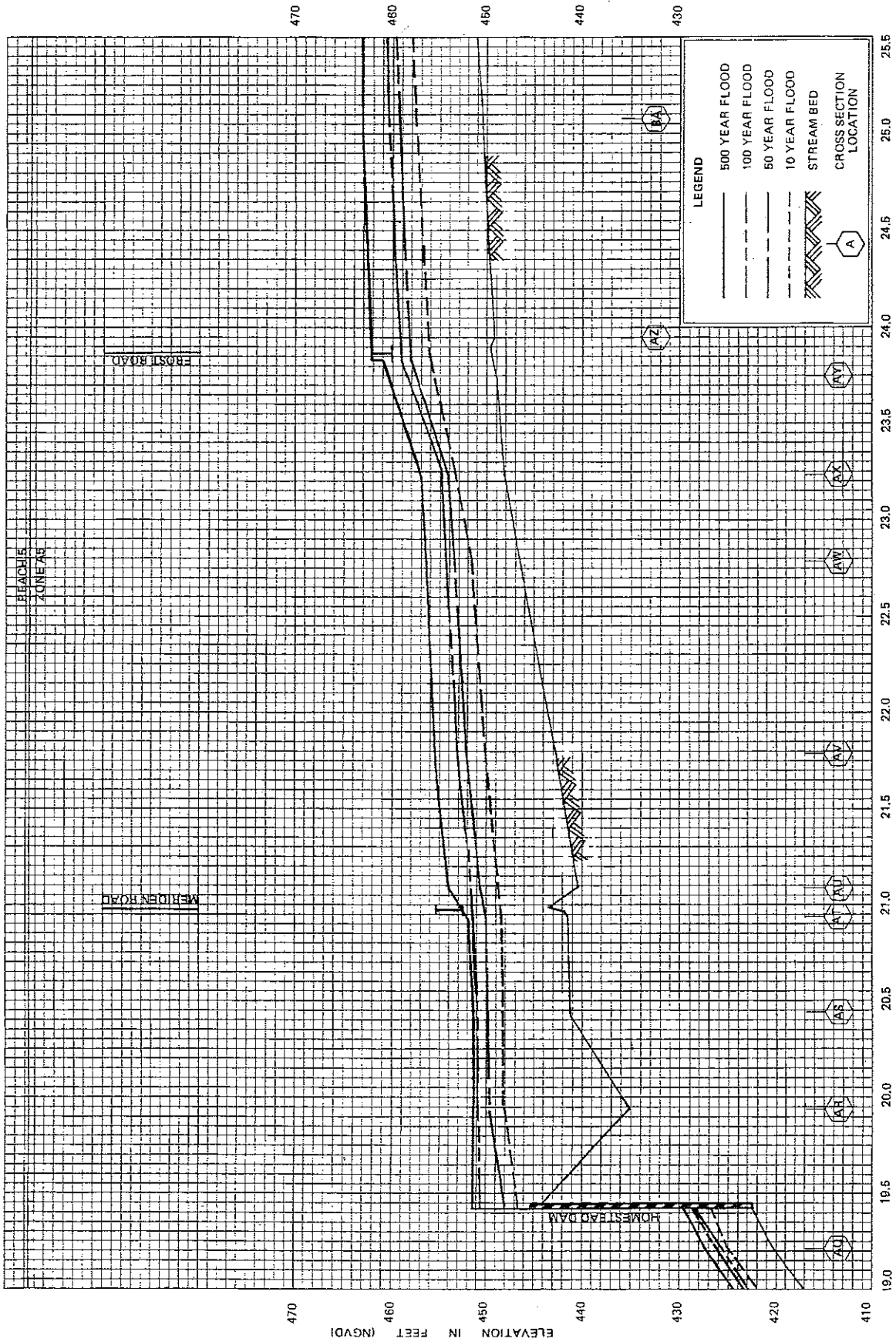
INTERSTATE ROUTE 84  
FACTORY  
HAMILTON AVENUE

CROSS SECTION LOCATIONS: A, B, C, D, E, F, G, H, I, J, K, L

FLOOD PROFILES  
MAD RIVER

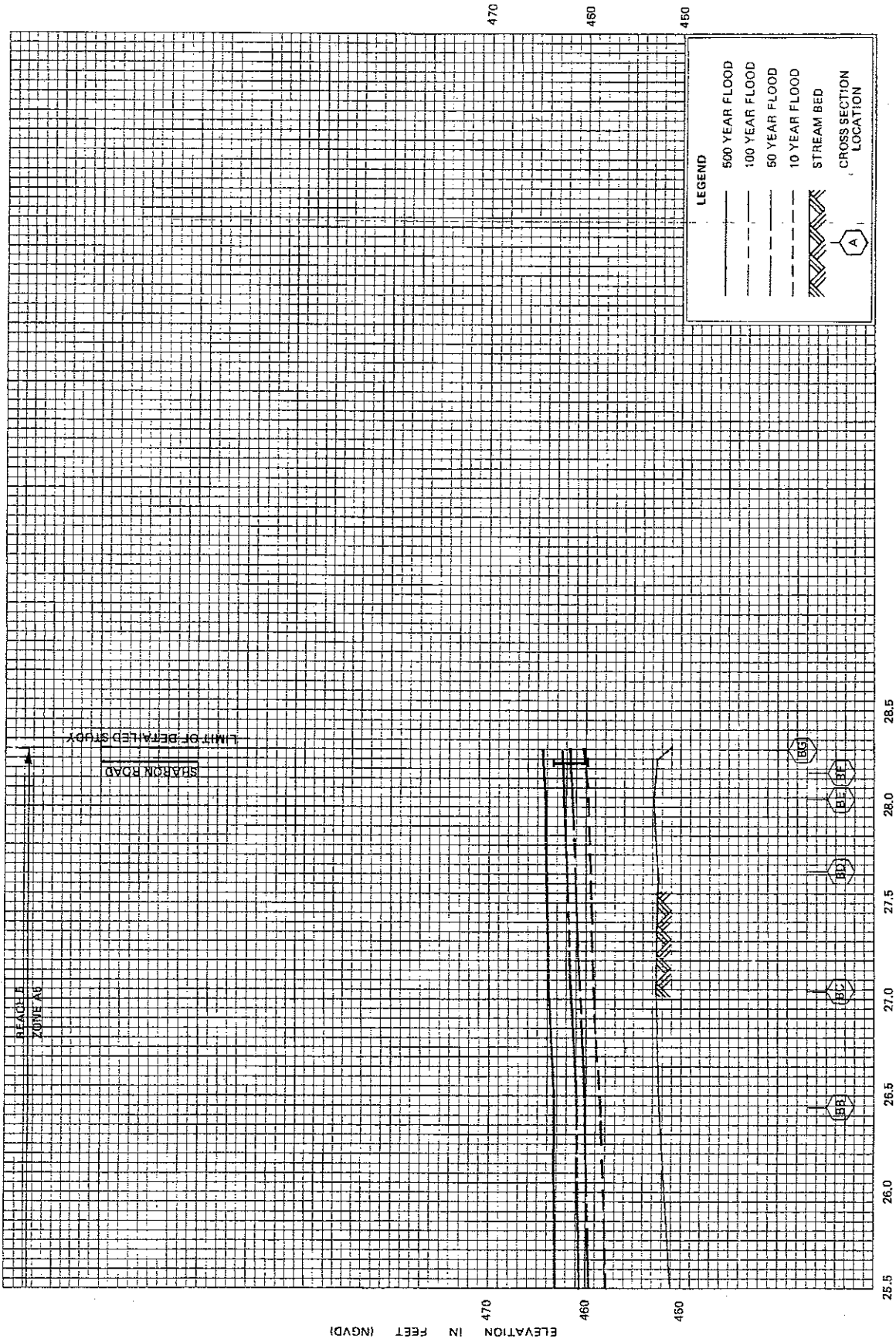


FLOOD PROFILES  
MAD RIVER

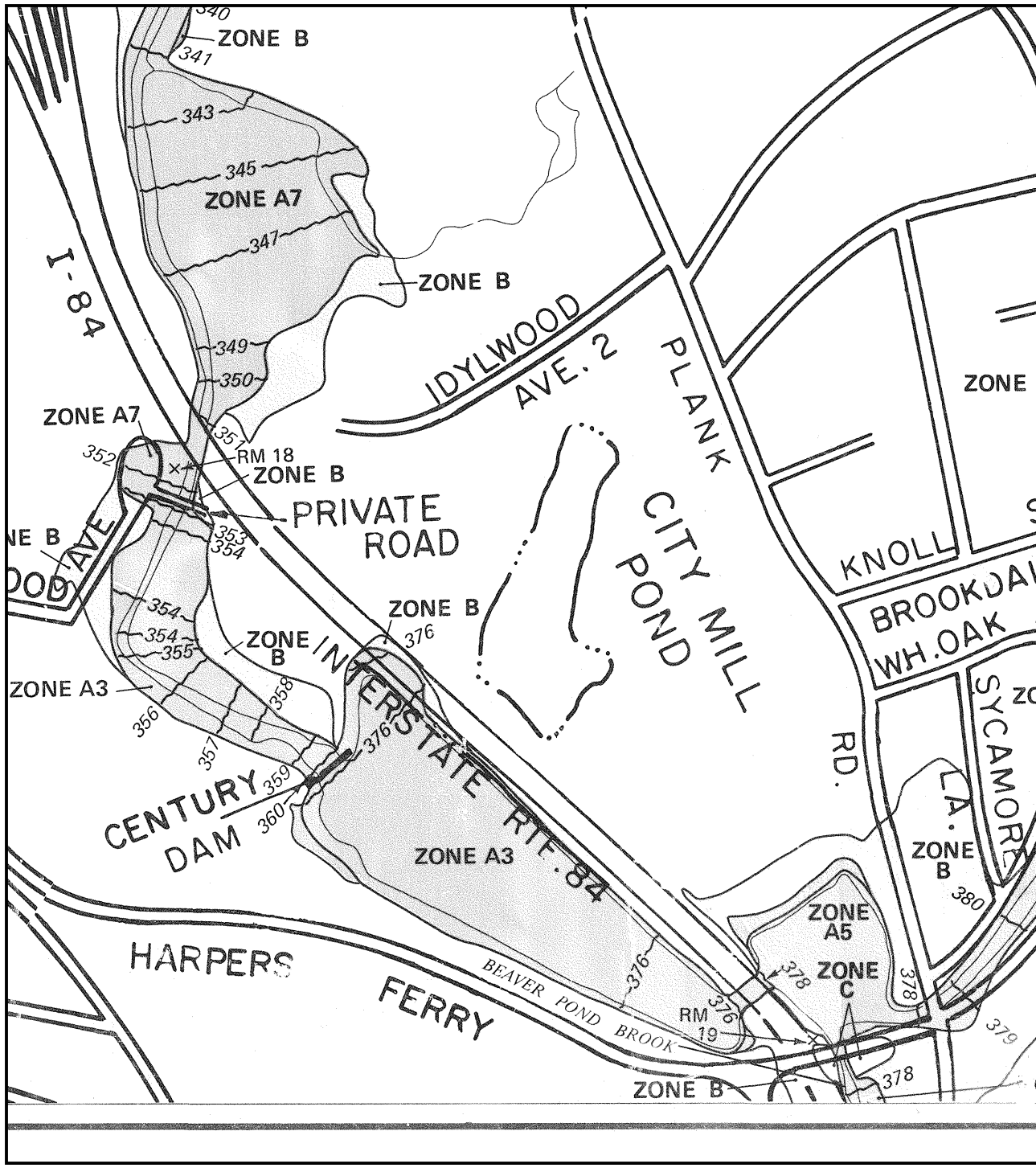


FLOOD PROFILES  
MAD RIVER

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
Federal Insurance Administration  
CITY OF WATERBURY, CT  
(NEW HAYEN CO.)



STREAM DISTANCE IN THOUSANDS OF FEET ABOVE CONFLUENCE WITH NAUGATUCK RIVER



APPROXIMATE SCALE

400 0 400 FEET

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP

CITY OF  
**WATERBURY,**  
CONNECTICUT  
NEW HAVEN COUNTY

PANEL 8 OF 12  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER  
090091 0008 B

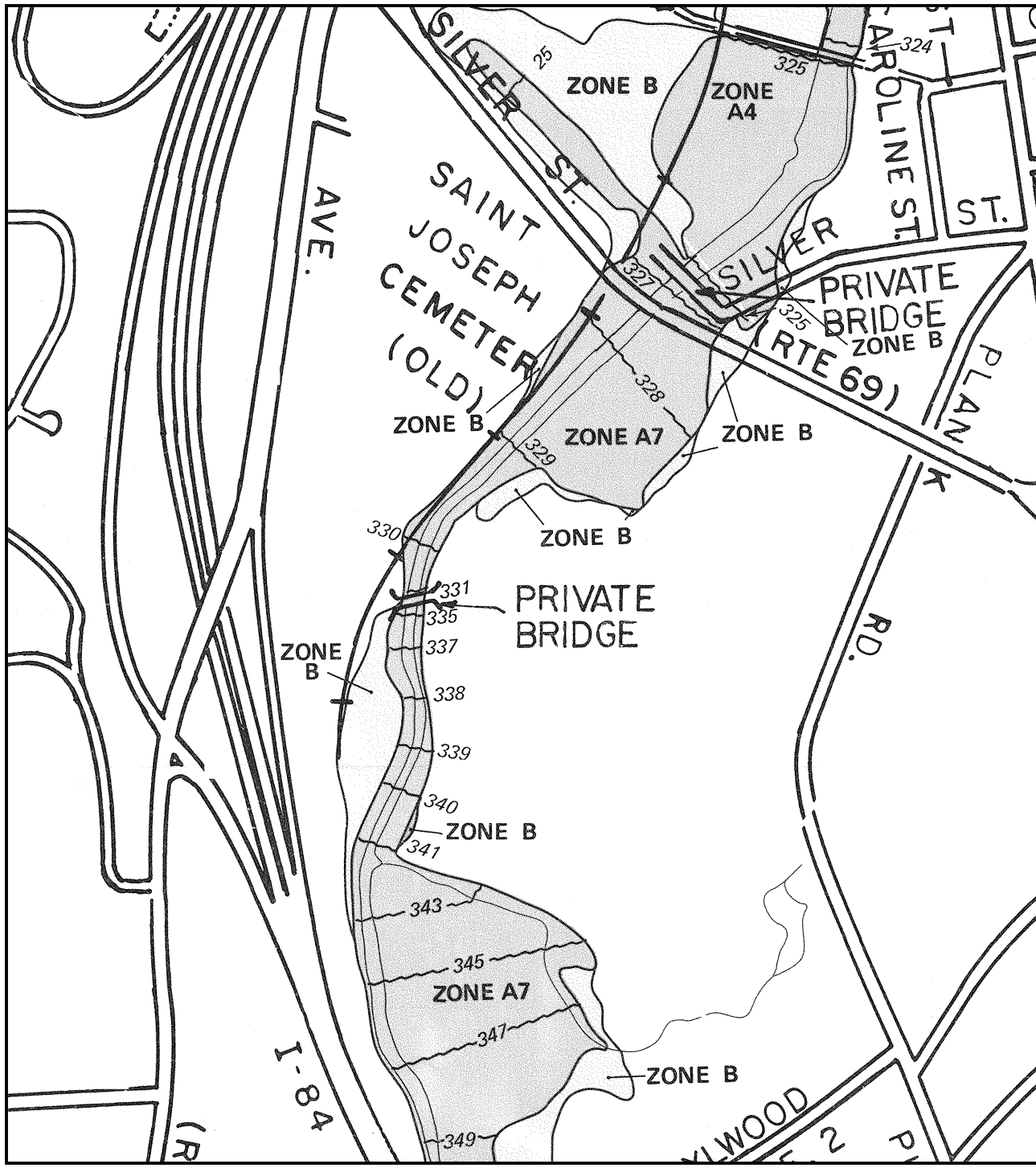
EFFECTIVE DATE:  
NOVEMBER 1, 1979



U.S. DEPARTMENT OF HOUSING  
AND URBAN DEVELOPMENT  
FEDERAL INSURANCE ADMINISTRATION

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)





APPROXIMATE SCALE

400 0 400 FEET

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**  
FLOOD INSURANCE RATE MAP

CITY OF  
**WATERBURY,**  
**CONNECTICUT**  
NEW HAVEN COUNTY

**PANEL 8 OF 12**  
(SEE MAP INDEX FOR PANELS NOT PRINTED)

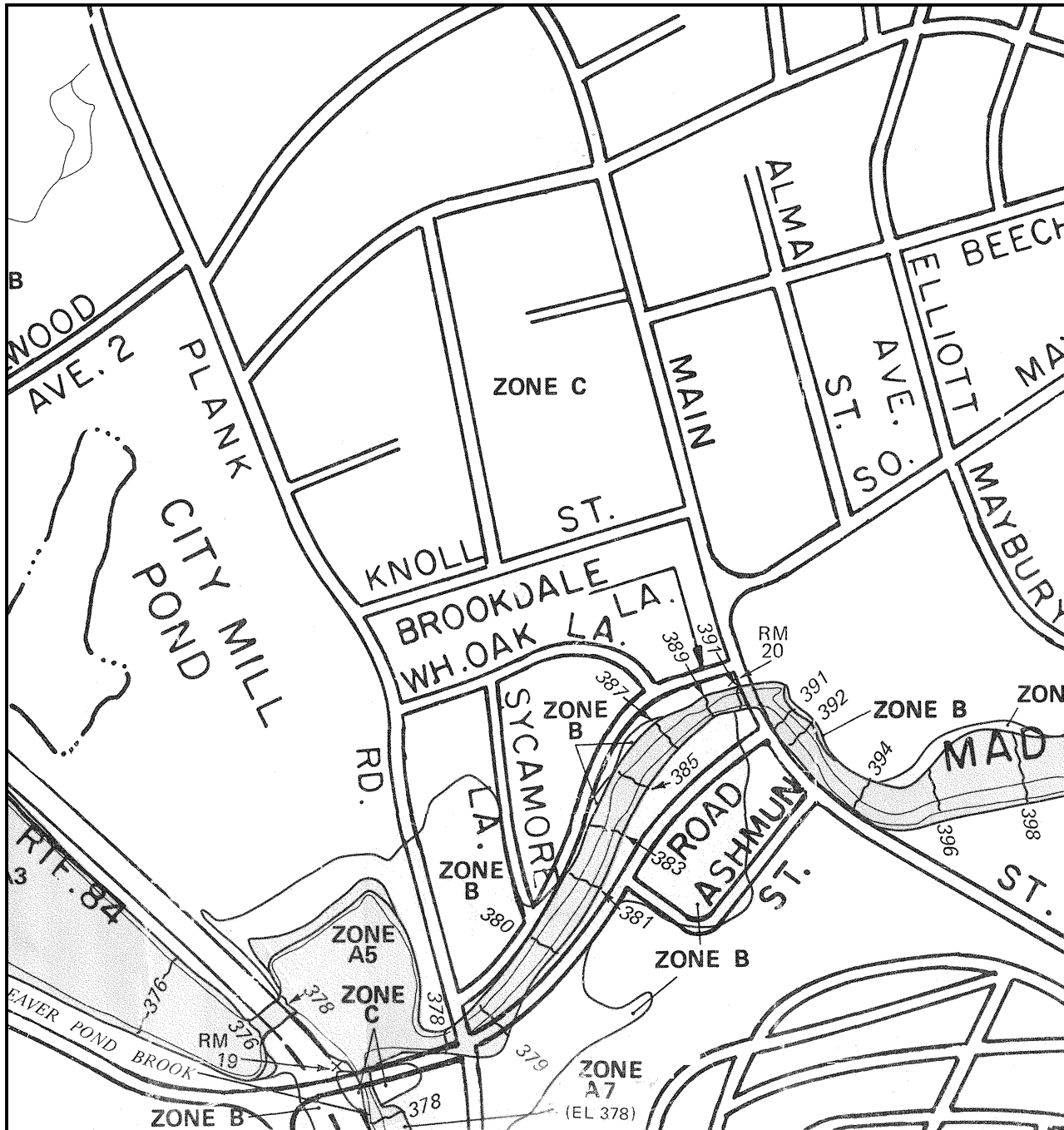
COMMUNITY-PANEL NUMBER  
090091 0008 B

EFFECTIVE DATE:  
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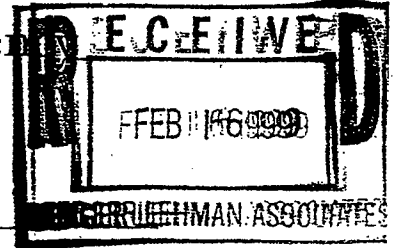
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Federal Emergency Management Agency

Washington, D.C. 20472



TO: Berger, Lehman Associates, P.C.

DATE: 2-11-99

20-30 Beaver Road

Request #: D9901018

Wethersfield, CT 06109-7201

RE: Waterbury, CT

Attention: Arnold Weitzman

WE ARE SENDING YOU THE FOLLOWING ITEMS

Copies	Date or Number	Description
1	ea.	HEC-2 multiple run w/ output only for a floodway run

TOTAL PAYMENT DUE: \$130.00

DATE RECEIVED: 2-9-99

DATE OF PURCHASE ORDER: —

AMOUNT OUTSTANDING \$0

COMMENTS:

for Mad River, elevations are off at x-sections H, W, AE, AJ, AK, AT + AY on the floodway + x-sections H, W, AJ, AK + AT on the multiple run. for Beaver Pond Brook, x-sections A-C + H on the multiple run. Due to the quality of the microfiche, areas will be faded + hard to read.

HEC2 RELEASE DATED NOV 74 UPDATED FEB 1977

ERROR CORR - 01  
MODIFICATION - 50,51,52

T1 CONNECTICUT FLOOD INSURANCE STUDY  
T2 TOWN OF WATERBURY  
T3 MAD RIVER 100 YR

J1	ICHECK	INO	NINV	IDIR	STRT	HETRIC	MVINS	Q	WSEL	FG
-1	4	0	0	0.000000	0.00	-1.0	0	251.700	0.000	

J2	NPROF	IPL0T	PRFVS	XSECV	XSECH	FN	ALLDO	IBW	CHNIN	ITRACE
-1	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

J3	LRANT	NUMSEC	*****REQUESTED SECTION NUMBERS*****								
-10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

NC	0.080	0.080	0.040	0.000	0.000	0.000	0.000	0.000	0.000	0.000
QT	4.000	2795.000	4825.000	5935.000	9240.000	0.000	0.000	0.000	0.000	0.000

X1	5104.000	10.000	200.000	580.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	240.000	200.000	248.000	225.000	243.900	240.000	241.500	283.000	242.100	321.000
GR	240.500	373.000	241.600	448.000	241.100	533.000	257.000	580.000	252.000	260.000

X1	5105.000	7.000	255.000	130.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	261.600	200.000	259.900	255.000	243.700	275.000	242.900	295.000	244.300	310.000
GR	255.300	330.000	255.300	338.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5106.000	7.000	312.000	148.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	259.000	200.000	258.000	0.000	258.000	312.000	246.100	312.000	246.100	336.000
GR	255.300	348.000	261.000	580.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5106.200	8.000	250.000	110.000	0.000	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	257.300	257.300	0.000
GR	258.000	200.000	258.000	250.000	248.300	250.000	247.500	280.000	248.500	310.000
GR	258.800	310.000	258.800	335.000	260.000	480.000	0.000	0.000	0.000	0.000
SR	.900	1.500	2.500	0.000	35.000	.010	462.000	0.000	248.200	248.200

X1	5106.800	0.000	0.000	0.000	46.000	46.000	46.000	0.000	0.000	0.000
A2	0.000	0.000	1.000	257.300	258.000	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	258.000	258.000	0.000
BT	5.000	200.000	258.100	0.000	250.000	258.000	0.000	280.000	259.100	0.000
BT	310.000	258.800	0.000	335.000	258.800	0.000	0.000	0.000	0.000	0.000

X1	5107.000	8.000	300.000	356.000	84.000	84.000	74.000	0.000	0.000	0.000
GR	259.500	200.000	258.500	300.900	248.500	300.000	249.000	316.000	248.800	336.000
GR	248.600	355.000	259.000	356.000	260.000	500.000	0.000	0.000	0.000	0.000

X1	5107.200	9.000	250.000	320.000	100.000	40.000	60.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	258.400	258.600	0.000

X1	5128.000	12.000	450.000	549.000	45.000	45.000	45.000	0.000	0.000	0.000
GR	340.000	200.000	328.000	220.000	326.000	415.000	326.000	450.000	316.800	470.000
GR	316.100	495.000	316.700	570.000	325.000	545.000	325.800	570.500	128.000	630.000
GR	332.000	650.000	336.000	880.000	0.000	0.000	0.000	0.000	0.000	0.000
BT	4.000	2350.000	460.000	490.000	775.000	0.000	0.000	0.000	0.000	0.000

X1	5129.000	15.000	438.000	527.000	860.000	990.000	930.000	0.000	0.000	0.000
GR	344.000	200.000	340.000	210.000	336.000	250.000	333.200	392.000	333.000	438.000
GR	324.100	460.000	322.700	460.000	321.600	474.000	321.600	488.000	323.100	496.000
GR	327.700	506.000	329.900	527.000	336.000	580.000	340.000	600.000	348.000	610.000

X1	5129.200	14.000	380.000	434.000	120.000	160.000	140.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	335.300	335.300	0.000
GR	348.000	200.000	340.000	340.000	337.900	355.000	337.700	380.000	327.000	380.000
GR	324.500	398.000	324.100	407.000	324.400	416.000	325.600	434.000	337.800	434.000
GR	337.500	450.000	338.000	540.000	340.000	570.000	348.000	620.000	0.000	0.000
SB	1.050	1.500	2.800	0.000	54.000	6.000	488.000	0.000	326.000	326.000

X1	5129.800	0.000	0.000	0.000	16.000	16.000	16.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	335.300	336.200	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	337.700	337.700	0.000
BT	4.000	355.000	337.900	0.000	380.000	337.700	0.000	434.000	337.800	0.000
BT	450.000	337.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5130.000	12.000	702.000	373.000	54.000	54.000	54.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	337.800	334.900	0.000
GR	356.000	200.000	340.000	250.000	337.900	280.000	337.900	302.000	328.200	317.000
GR	325.000	339.000	325.400	356.000	334.900	373.000	335.900	403.000	340.000	530.000
GR	344.000	564.000	352.000	580.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5131.000	12.000	610.000	593.000	620.000	550.000	590.000	0.000	0.000	0.000
GR	352.000	200.000	344.000	220.000	342.100	575.000	341.200	610.000	338.600	642.000
GR	333.300	654.000	331.800	667.000	333.000	680.000	340.200	693.000	344.000	760.000
GR	348.000	820.000	356.000	840.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5132.000	11.000	893.000	942.000	880.000	850.000	850.000	0.000	0.000	0.000
GR	360.000	200.000	356.000	230.000	352.000	610.000	348.000	680.000	347.400	893.000
GR	340.800	905.000	339.400	912.000	338.800	920.000	340.700	932.000	347.000	942.000
GR	360.000	960.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5132.200	9.000	200.000	324.000	80.000	80.000	80.000	0.000	0.000	0.000
GR	359.500	200.000	357.500	214.000	341.000	242.000	340.600	257.000	340.400	261.000
GR	341.100	269.000	341.700	276.000	359.900	318.000	359.900	324.000	0.000	0.000
SB	1.050	1.500	2.800	0.000	124.000	4.000	1723.000	0.000	0.000	0.000

X1	5132.800	0.000	0.000	0.000	140.000	140.000	140.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	365.900	369.100	0.000	0.000	0.000	0.000	0.000
X3	10.000	0.000	0.000	0.000	0.000	0.000	0.000	369.100	371.200	0.000
BT	2.000	200.000	371.200	0.000	324.000	369.100	0.000	0.000	0.000	0.000

X1	5133.000	12.000	285.000	348.000	90.000	90.000	90.000	0.000	0.000	0.000
GR	360.000	200.000	356.500	238.000	349.800	255.000	344.000	264.800	341.700	264.000
GR	340.800	293.000	342.000	312.000	342.900	312.000	347.400	348.000	352.000	460.000
GR	356.000	480.000	361.000	490.000	0.000	0.000	0.000	0.000	0.000	0.000

X1	5133.200	12.000	255.000	329.000	40.000	40.000	40.000	0.000	0.000	0.000
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X3	10,000	0,000	0,000	0,000	0,000	0,000	0,000	349,000	349,000	0,000
GR	352,000	200,000	351,200	230,000	351,200	255,000	348,700	266,000	342,700	275,000
GR	341,800	292,000	347,300	309,000	351,600	329,000	351,600	354,000	352,000	460,000
GR	356,000	480,000	361,300	490,000	0,000	0,000	0,000	0,000	0,000	0,000
SB	900	1,500	2,000	0,000	34,000	7,010	228,000	0,000	342,500	342,500

X1	5133,800	0,000	0,000	0,000	10,000	10,000	10,000	0,000	0,000	0,000
X2	0,000	0,000	1,000	349,000	351,200	0,000	0,000	0,000	0,000	0,000
X3	10,000	0,000	0,000	0,000	0,000	0,000	0,000	351,000	351,000	0,000
BT	8,000	230,000	351,200	0,000	255,000	351,200	0,000	275,000	351,900	0,000
BT	202,000	352,000	0,000	309,000	351,700	0,000	329,000	351,600	0,000	354,000
BT	351,600	0,000	460,000	352,000	0,000	0,000	0,000	0,000	0,000	0,000

X1	5134,000	15,000	300,000	416,000	350,000	56,000	50,000	0,000	0,000	0,000
GR	360,000	200,000	356,000	250,000	352,000	270,000	350,100	300,000	345,500	312,000
GR	343,700	337,000	342,500	337,000	342,300	353,000	342,700	369,000	344,500	369,000
GR	349,400	416,000	352,000	520,000	356,000	560,000	360,000	580,000	364,000	680,000

X1	5135,000	14,000	480,000	578,000	305,000	305,000	305,000	0,000	0,000	0,000
GR	360,000	200,000	360,000	230,000	356,000	270,000	351,900	480,000	350,900	519,000
GR	349,100	521,000	347,600	544,000	348,500	567,000	351,300	567,000	354,000	576,000
GR	355,000	578,000	355,000	603,000	356,000	650,000	360,000	670,000	0,000	0,000

X1	5136,000	15,000	430,000	535,000	400,000	600,000	500,000	0,000	0,000	0,000
GR	372,000	200,000	368,000	260,000	364,000	270,000	360,000	310,000	358,300	365,000
GR	356,000	430,000	351,500	438,000	350,900	455,000	351,100	473,000	352,700	482,000
GR	352,900	509,000	360,000	539,000	364,000	560,000	368,000	570,000	372,000	690,000

X1	5136,200	12,000	428,000	528,000	180,000	180,000	140,000	0,000	0,000	0,000
GR	375,200	200,000	375,200	225,000	367,500	425,000	367,500	428,000	352,000	428,000
GR	392,000	628,000	367,500	528,000	361,500	531,000	374,700	331,000	374,900	556,000
GR	376,000	720,000	380,000	730,000	0,000	0,000	0,000	0,000	0,000	0,000
SB	0,000	1,500	3,200	0,000	500	0,000	250	0,000	352,000	361,400

X1	5136,800	8,000	428,000	428,000	5,000	5,000	5,000	0,000	0,000	0,000
X2	0,000	0,000	1,000	398,400	371,100	0,000	0,000	0,000	0,000	0,000
BT	12,000	200,000	375,200	0,000	425,000	375,200	0,000	425,000	376,500	0,000
BT	428,000	376,500	0,000	428,000	371,100	0,000	528,000	371,100	0,000	528,000
BT	376,500	0,000	531,000	376,500	0,000	531,000	374,700	0,000	556,000	374,900
BT	0,000	720,000	376,600	0,000	730,000	380,000	300,000	0,000	0,000	0,000
GR	375,200	200,000	372,000	220,000	362,000	320,000	355,900	428,000	366,800	528,000
GR	372,000	628,000	376,000	706,000	380,000	710,000	0,000	0,000	0,000	0,000

X1	5137,000	11,000	225,000	585,000	800,000	400,000	400,000	0,000	0,000	0,000
GR	380,200	200,000	379,400	206,000	371,800	225,000	371,200	225,000	361,400	315,000
GR	361,000	405,000	361,700	495,000	368,500	585,000	372,700	585,000	376,000	610,000
GR	380,000	620,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

X1	5138,000	11,000	222,000	426,000	500,000	570,000	530,000	0,000	0,000	0,000
GR	381,800	200,000	381,400	204,000	372,900	222,000	371,400	222,000	365,500	273,000
GR	386,000	324,000	369,000	375,000	371,200	426,000	377,800	434,000	380,600	460,000
GR	384,000	470,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000

X1	5138,200	0,000	300,000	350,000	250,000	350,000	300,000	0,000	0,000	0,000
X3	10,000	0,000	0,000	0,000	0,000	0,000	0,000	375,000	375,000	0,000
GR	381,000	200,000	380,000	275,000	380,000	300,000	385,800	300,000	367,600	425,000
GR	370,200	350,000	380,000	350,000	380,000	375,000	380,000	475,000	0,000	0,000

	910	1,500	2,800	10,000	50,000	100	400,000	0,000	369,000	367,000
X1	5138,000	0,000	0,000	0,000	100,000	100,000	100,000	0,000	2,000	0,000
X2	0,000	0,000	1,000	375,000	380,000	0,000	0,000	0,000	0,000	0,000
X3	10,000	0,000	0,000	0,000	0,000	0,000	0,000	380,000	380,000	0,000
BT	7,000	200,000	381,000	0,000	275,000	380,000	0,000	300,000	380,000	0,000
BT	300,000	383,800	0,000	350,000	383,500	0,000	350,000	380,000	0,000	375,000
BT	380,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
BT	6,000	200,000	381,000	0,000	298,000	381,000	0,000	298,000	383,800	0,000
BT	352,000	393,500	0,000	352,000	380,700	0,000	475,000	380,000	0,000	0,000
X1	5139,000	12,000	240,000	664,000	200,000	200,000	200,000	0,000	0,000	0,000
GR	380,000	200,000	376,000	240,000	373,900	253,000	370,800	260,000	366,100	355,000
GR	366,800	450,000	367,700	545,000	368,000	595,000	371,400	645,000	372,400	634,000
GR	375,300	644,000	380,000	700,000	0,000	0,000	0,000	0,000	0,000	0,000
UT	4,000	1505,000	2595,000	3190,000	4970,000	0,000	0,000	0,000	0,000	0,000
X1	5140,000	11,000	400,000	622,000	190,000	190,000	190,000	0,000	0,000	0,000
GR	380,000	200,000	376,000	400,000	374,900	540,000	373,600	556,000	371,100	560,000
GR	367,400	585,000	371,100	602,000	372,200	602,000	377,800	622,000	378,500	630,000
GR	380,000	650,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
X1	5140,200	12,000	825,000	865,000	50,000	50,000	50,000	0,000	0,000	0,000
GR	388,000	200,000	380,000	380,000	377,900	800,000	377,200	825,000	369,900	825,000
GR	369,300	845,000	369,300	865,000	377,100	865,000	377,100	897,000	380,000	1100,000
GR	384,000	1250,000	388,000	1500,000	0,000	0,000	0,000	0,000	0,000	0,000
SB	900	1,500	2,800	0,000	40,000	0,010	200,000	0,000	369,500	370,200
X1	5140,800	0,000	0,000	0,000	23,000	23,000	23,000	0,000	0,000	0,000
X2	0,000	0,000	1,000	374,000	377,200	0,000	0,000	0,000	0,000	0,000
BT	1125,000	300,000	388,000	0,000	825,000	377,900	0,000	515,000	377,200	0,000
BT	1120,000	380,000	0,000	1520,000	388,000	0,000	0,000	0,000	0,000	0,000
X1	5141,000	11,000	930,000	970,000	32,000	32,000	32,000	0,000	0,000	0,000
GR	388,000	200,000	380,000	500,000	380,000	510,000	376,000	930,000	370,200	530,000
GR	369,200	950,000	373,000	970,000	326,000	970,000	380,000	1140,000	380,000	1230,000
GR	388,000	1240,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
X1	5142,000	12,000	800,000	1015,000	400,000	400,000	400,000	0,000	0,000	0,000
GR	396,000	200,000	388,000	350,000	384,000	650,000	384,000	870,000	383,500	900,000
GR	375,000	932,000	374,300	952,000	375,300	974,000	382,300	1015,000	388,000	1320,000
GR	392,000	1390,000	396,000	1410,000	0,000	0,000	0,000	0,000	0,000	0,000
X1	5143,000	12,000	590,000	641,000	560,000	560,000	560,000	0,000	0,000	0,000
GR	400,000	200,000	396,000	400,000	393,500	572,000	393,500	590,000	383,300	604,000
GR	382,800	623,000	383,000	641,000	383,900	651,000	390,200	647,000	392,000	800,000
GR	396,000	840,000	400,000	1110,000	0,000	0,000	0,000	0,000	0,000	0,000
X1	5143,200	15,000	970,000	1024,000	50,000	50,000	50,000	0,000	0,000	0,000
X3	10,000	0,000	0,000	0,000	0,000	0,000	0,000	395,000	395,000	0,000
GR	404,000	200,000	400,000	400,000	395,200	917,000	395,000	970,000	383,400	270,000
GR	383,000	979,000	383,700	988,000	384,000	997,000	383,900	1006,000	383,700	1015,000
GR	384,000	1024,000	395,000	1024,000	395,000	1095,000	400,000	1430,000	404,000	1510,000
SB	1,250	1,500	2,800	0,000	54,000	4,000	490,000	0,000	393,700	384,000
X1	5143,000	0,000	0,000	0,000	70,000	70,000	70,000	0,000	0,000	0,000

SECNO	ALCL	ELTRD	ELLC	ELMIN	U	CWSEI	CRHS	ES	10K95	VCH	AREA	.01K
5129.000	930.00	0.00	0.00	321.60	2350.00	327.39	0.00	327.04	120.25	10.01	227.90	214.30
5129.000	930.00	0.00	0.00	321.60	4060.00	329.05	329.05	331.40	151.25	12.30	330.15	330.11
5129.000	930.00	0.00	0.00	321.60	4990.00	329.89	329.89	332.38	150.54	12.67	333.95	406.71
5129.000	930.00	0.00	0.00	321.60	7775.00	331.75	331.75	334.82	129.48	14.11	563.89	683.27
5129.200	140.00	0.00	0.00	324.10	2350.00	329.12	0.00	330.87	142.38	10.61	221.93	198.98
5129.200	140.00	0.00	0.00	324.10	4060.00	330.89	0.00	333.42	137.97	12.78	317.73	345.65
5129.200	140.00	0.00	0.00	324.10	4990.00	331.41	331.41	334.65	160.83	14.44	345.65	393.44
5129.200	140.00	0.00	0.00	324.10	7775.00	333.61	333.61	337.96	159.50	16.75	464.23	618.66
5129.800	16.00	336.20	335.30	324.10	2350.00	331.70	0.00	332.36	31.10	6.50	361.45	421.34
5129.800	16.00	336.20	335.30	324.10	4060.00	334.21	0.00	335.25	35.49	8.17	498.87	601.51
5129.800	16.00	337.70	335.30	324.10	4990.00	335.42	0.00	336.64	37.16	8.88	562.20	818.56
5129.800	16.00	336.20	335.30	324.10	7775.00	336.55	0.00	338.97	66.74	12.48	622.99	951.73
5130.000	54.00	0.00	0.00	325.00	2350.00	331.07	0.00	332.64	110.00	10.07	233.33	224.07
5130.000	54.00	0.00	0.00	325.00	4060.00	333.89	0.00	335.51	70.32	10.20	397.91	484.17
5130.000	54.00	0.00	0.00	325.00	4990.00	335.27	0.00	336.89	59.00	10.24	489.35	648.65
5130.000	54.00	0.00	0.00	325.00	7775.00	336.73	335.55	339.36	79.08	13.09	637.65	874.32
5131.000	590.00	0.00	0.00	331.80	2350.00	338.15	338.14	340.33	156.74	11.85	198.37	187.71
5131.000	590.00	0.00	0.00	331.80	4060.00	340.50	340.50	342.76	149.52	12.07	337.00	332.07
5131.000	590.00	0.00	0.00	331.80	4990.00	341.44	341.44	343.70	131.74	12.08	425.92	434.75
5131.000	590.00	0.00	0.00	331.80	7775.00	344.01	344.01	345.62	61.19	10.88	1176.01	991.93
5132.000	850.00	0.00	0.00	338.80	2350.00	347.09	0.00	348.27	61.94	8.73	269.18	298.58
5132.000	850.00	0.00	0.00	338.80	4060.00	349.03	347.55	350.86	65.92	10.94	421.42	500.05
5132.000	850.00	0.00	0.00	338.80	4990.00	349.65	348.97	351.85	72.90	12.13	517.69	584.42
5132.000	850.00	0.00	0.00	338.80	7775.00	351.86	351.86	353.97	58.66	12.78	1076.53	1015.13
5132.200	80.00	0.00	0.00	340.40	2350.00	347.85	0.00	348.69	44.09	7.32	320.87	352.71
5132.200	80.00	0.00	0.00	340.40	4060.00	350.12	0.00	351.30	48.29	8.69	467.06	596.16
5132.200	80.00	0.00	0.00	340.40	4990.00	350.92	0.00	352.33	50.83	9.54	523.94	699.58
5132.200	80.00	0.00	0.00	340.40	7775.00	351.89	0.00	354.54	87.01	13.08	594.61	833.53
5132.800	140.00	369.10	369.90	340.40	2350.00	347.94	0.00	348.75	42.19	7.21	320.18	360.94
5132.800	140.00	369.10	369.90	340.40	4060.00	350.26	0.00	351.39	83.90	8.53	476.04	612.78
5132.800	140.00	369.10	369.90	340.40	4990.00	351.02	0.00	352.54	77.82	9.08	535.63	721.60
5132.800	140.00	369.10	369.90	340.40	7775.00	352.38	0.00	354.73	173.30	12.29	632.78	908.10
5133.000	90.00	0.00	0.00	340.80	2350.00	348.64	0.00	348.99	18.24	4.73	513.44	550.29
5133.000	90.00	0.00	0.00	340.80	4060.00	351.17	0.00	351.59	14.13	5.10	904.87	1079.98
5133.000	90.00	0.00	0.00	340.80	4990.00	352.19	0.00	352.65	13.47	5.63	1110.08	1359.40
5133.000	90.00	0.00	0.00	340.80	7775.00	354.38	0.00	354.97	13.60	6.55	1592.14	2107.87
5133.200	40.00	0.00	0.00	341.80	2350.00	347.48	0.00	349.14	116.09	10.32	227.65	218.11
5133.200	40.00	0.00	0.00	341.80	4060.00	349.60	0.00	351.71	109.31	11.68	347.68	390.11
5133.200	40.00	0.00	0.00	341.80	4990.00	349.93	349.93	352.78	140.66	13.53	368.76	420.74
5133.200	40.00	0.00	0.00	341.80	7775.00	352.96	352.96	355.22	76.45	12.45	831.06	889.25
5133.800	10.00	351.20	349.00	341.80	2350.00	349.11	0.00	349.96	45.78	7.40	317.49	347.31
5133.800	10.00	351.20	349.00	341.80	4060.00	352.46	0.00	353.23	27.52	7.15	699.57	773.87
5133.800	10.00	351.20	349.00	341.80	4990.00	352.88	0.00	353.84	32.92	8.11	809.75	864.74
5133.800	10.00	351.20	349.00	341.80	7775.00	354.68	0.00	355.78	31.76	9.15	1294.44	1376.81



SECNO	VLCH	ELTRD	ELIC	ELMIN	Q	CYSE	CRMS	FG	10K*5	VCH	AREA	DK
5134.000	50.00	0.00	0.00	342.30	2350.00	349.75	0.00	350.11	20.45	4.50	525.52	519.67
5134.000	50.00	0.00	0.00	342.30	4060.00	353.05	0.00	353.30	8.66	4.19	1212.93	1379.29
5134.000	50.00	0.00	0.00	342.30	4990.00	353.61	0.00	353.93	9.92	4.69	1365.39	1584.17
5134.000	50.00	0.00	0.00	342.30	7775.00	355.44	0.00	359.87	10.91	5.62	1893.28	2354.08
5135.000	305.00	0.00	0.00	347.60	2350.00	352.95	352.55	359.87	168.26	9.28	263.44	181.20
5135.000	305.00	0.00	0.00	347.60	4060.00	353.89	353.89	359.42	127.33	10.19	478.72	359.80
5135.000	305.00	0.00	0.00	347.60	4990.00	354.40	354.40	356.08	123.74	10.81	589.86	448.58
5135.000	305.00	0.00	0.00	347.60	7775.00	355.92	355.92	357.62	93.24	11.35	1031.98	805.21
5136.000	500.00	0.00	0.00	350.80	2350.00	356.74	0.00	357.27	36.58	5.86	407.79	388.57
5136.000	500.00	0.00	0.00	350.80	4060.00	358.07	0.00	358.94	45.04	7.55	587.80	604.96
5136.000	500.00	0.00	0.00	350.80	4990.00	358.66	0.00	359.68	47.93	8.24	685.89	720.74
5136.000	500.00	0.00	0.00	350.80	7775.00	359.78	0.00	361.34	63.16	10.36	906.16	978.37
5136.200	140.00	0.00	0.00	352.00	2350.00	357.31	0.00	357.61	17.50	4.42	531.19	561.60
5136.200	140.00	0.00	0.00	352.00	4060.00	358.83	0.00	359.38	23.39	5.94	683.41	839.51
5136.200	140.00	0.00	0.00	352.00	4990.00	359.48	0.00	360.17	26.55	6.67	747.90	968.34
5136.200	140.00	0.00	0.00	352.00	7775.00	360.82	0.00	362.02	38.42	8.82	881.58	1254.32
5136.800	5.00	371.10	356.40	355.90	2350.00	374.88	0.00	374.89	.19	.88	4070.33	5403.41
5136.800	5.00	371.10	356.40	355.90	4060.00	375.89	0.00	375.91	.43	1.41	4547.43	6159.74
5136.800	5.00	371.10	356.40	355.90	4990.00	376.21	0.00	376.24	.61	1.68	4702.57	6409.60
5136.800	5.00	371.10	356.40	355.90	7775.00	376.99	0.00	377.05	1.21	2.46	5094.92	7070.56
5137.000	400.00	0.00	0.00	361.00	2350.00	374.89	0.00	374.90	.09	.57	4134.16	7654.81
5137.000	400.00	0.00	0.00	361.00	4060.00	375.91	0.00	375.92	.21	.91	4530.74	8837.37
5137.000	400.00	0.00	0.00	361.00	4990.00	376.23	0.00	376.25	.29	1.09	4660.36	9228.03
5137.000	400.00	0.00	0.00	361.00	7775.00	377.04	0.00	377.08	.58	1.59	4982.53	10236.41
5138.000	530.00	0.00	0.00	365.60	2350.00	374.87	0.00	374.91	1.56	1.67	1417.82	1881.43
5138.000	530.00	0.00	0.00	365.60	4060.00	375.85	0.00	375.95	2.98	2.82	1628.46	2352.27
5138.000	530.00	0.00	0.00	365.60	4990.00	376.15	0.00	376.29	3.96	2.98	1694.28	2506.58
5138.000	530.00	0.00	0.00	365.60	7775.00	376.87	0.00	377.16	7.25	4.27	1851.55	2888.42
5138.200	300.00	0.00	0.00	365.80	2350.00	374.21	0.00	375.04	44.28	7.34	320.28	353.25
5138.200	300.00	0.00	0.00	365.80	4060.00	375.66	0.00	376.64	173.72	13.85	293.19	308.45
5138.200	300.00	0.00	0.00	365.80	4990.00	376.52	0.00	377.94	172.39	14.85	335.98	380.07
5138.200	300.00	0.00	0.00	365.80	7775.00	376.87	0.00	381.43	169.54	17.15	453.40	597.12
5138.800	100.00	380.00	375.00	365.80	2350.00	374.21	0.00	375.04	44.25	7.34	320.28	353.26
5138.800	100.00	380.00	375.00	365.80	4060.00	375.66	0.00	376.64	173.72	13.85	293.19	308.45
5138.800	100.00	380.00	375.00	365.80	4990.00	376.62	0.00	378.14	108.76	12.76	391.08	478.47
5138.800	100.00	380.00	375.00	365.80	7775.00	379.99	0.00	382.51	171.67	12.75	669.59	922.25
5139.000	200.00	0.00	0.00	366.10	2350.00	375.06	0.00	375.07	.37	.82	7878.44	3866.24
5139.000	200.00	0.00	0.00	366.10	4060.00	376.66	0.00	376.68	.56	1.14	3565.70	5441.77
5139.000	200.00	0.00	0.00	366.10	4990.00	378.16	0.00	378.18	.49	1.19	4244.72	7163.91
5139.000	200.00	0.00	0.00	366.10	7775.00	382.51	0.00	382.54	.34	1.27	4392.58	13321.10
5140.000	190.00	0.00	0.00	367.40	1505.00	374.48	0.00	375.08	51.25	6.21	242.16	210.23
5140.000	190.00	0.00	0.00	367.40	2595.00	376.27	0.00	376.71	71.36	5.33	488.26	307.20
5140.000	190.00	0.00	0.00	367.40	3190.00	378.00	0.00	378.20	15.48	3.59	968.32	810.80
5140.000	190.00	0.00	0.00	367.40	4970.00	382.48	0.00	382.55	2.25	2.28	2856.64	3316.21

SECNO	ALCH	EDRD	DECD	ELMIN	ED	CMSEL	CRMS	WFG	TKMS	VCH	AREA	DKK
5140.200	50.00	0.00	0.00	369.30	1505.00	374.80	0.00	375.36	62.00	7.44	202.19	191.13
5140.200	50.00	0.00	0.00	369.30	2595.00	375.10	0.00	377.17	125.53	11.31	229.39	231.61
5140.200	50.00	0.00	0.00	369.30	3190.00	376.21	0.00	378.36	115.21	11.79	270.60	297.19
5140.200	50.00	0.00	0.00	369.30	4970.00	382.45	0.00	382.57	75.83	4.01	3256.15	2054.20
5140.800	23.00	377.20	374.80	369.30	1505.00	375.15	0.00	375.82	43.08	6.61	227.84	229.36
5140.800	23.00	377.20	374.80	369.30	2595.00	377.24	0.00	378.31	49.90	8.93	316.49	367.36
5140.800	23.00	377.20	374.80	369.30	3190.00	377.71	0.00	379.11	60.53	9.55	368.79	410.02
5140.800	23.00	377.20	374.80	369.30	4970.00	382.52	0.00	382.63	5.57	3.93	3318.83	2106.15
5141.000	52.00	0.00	0.00	369.20	1505.00	375.31	0.00	376.06	49.01	6.95	216.47	214.94
5141.000	52.00	0.00	0.00	369.20	2595.00	377.50	0.00	378.56	46.53	8.35	358.02	380.44
5141.000	52.00	0.00	0.00	369.20	3190.00	378.14	0.00	379.40	50.94	9.21	438.94	446.94
5141.000	52.00	0.00	0.00	369.20	4970.00	382.43	0.00	382.67	9.52	5.26	2412.62	1611.04
5142.000	400.00	0.00	0.00	374.30	1505.00	378.10	0.00	379.16	139.74	8.23	182.26	127.31
5142.000	400.00	0.00	0.00	374.30	2595.00	379.97	0.00	380.93	77.71	7.85	330.79	294.34
5142.000	400.00	0.00	0.00	374.30	3190.00	380.77	0.00	381.73	67.42	7.90	404.09	384.52
5142.000	400.00	0.00	0.00	374.30	4970.00	382.23	0.00	383.48	68.67	8.97	553.97	599.74
5143.000	560.00	0.00	0.00	382.80	1505.00	386.63	386.63	388.36	179.35	10.54	142.77	112.34
5143.000	560.00	0.00	0.00	382.80	2595.00	388.19	388.19	390.58	167.64	12.41	209.16	200.41
5143.000	560.00	0.00	0.00	382.80	3190.00	388.90	388.90	391.63	166.76	13.25	240.62	247.03
5143.000	560.00	0.00	0.00	382.80	4970.00	392.09	392.09	394.18	81.25	11.96	557.80	551.36
5143.200	50.00	0.00	0.00	383.00	1505.00	388.16	0.00	388.76	46.00	6.20	242.80	221.91
5143.200	50.00	0.00	0.00	383.00	2595.00	390.10	0.00	390.97	44.63	7.47	347.35	387.14
5143.200	50.00	0.00	0.00	383.00	3190.00	391.01	0.00	392.02	65.72	8.04	396.63	474.36
5143.200	50.00	0.00	0.00	383.00	4970.00	393.00	0.00	394.51	53.05	9.85	504.60	682.33
5143.800	70.00	395.00	392.60	383.00	1505.00	388.40	0.00	388.94	139.29	5.89	255.38	240.09
5143.800	70.00	395.00	392.60	383.00	2595.00	390.43	0.00	391.22	38.43	7.10	365.45	418.62
5143.800	70.00	395.00	392.60	383.00	3190.00	391.40	0.00	392.31	38.60	7.63	417.83	513.46
5143.800	70.00	395.00	392.60	383.00	4970.00	394.13	0.00	395.38	37.20	8.74	568.56	814.82
5144.000	80.00	0.00	0.00	383.50	1505.00	388.71	388.71	389.74	169.23	10.00	150.44	115.48
5144.000	80.00	0.00	0.00	383.50	2595.00	390.13	0.00	391.10	108.09	8.98	262.13	249.60
5144.000	80.00	0.00	0.00	383.50	3190.00	391.40	0.00	392.14	78.62	8.49	353.66	359.77
5144.000	80.00	0.00	0.00	383.50	4970.00	394.65	0.00	395.69	141.24	8.20	606.21	773.94
5145.000	920.00	0.00	0.00	392.10	1505.00	398.27	0.00	399.14	68.32	7.47	201.36	182.07
5145.000	920.00	0.00	0.00	392.10	2595.00	399.35	398.93	400.80	91.28	8.78	302.72	271.61
5145.000	920.00	0.00	0.00	392.10	3190.00	399.68	399.68	401.50	108.51	11.05	343.73	306.23
5145.000	920.00	0.00	0.00	392.10	4970.00	401.11	401.11	403.17	101.51	12.22	547.15	493.30
5146.000	950.00	0.00	0.00	405.60	1505.00	410.72	410.72	412.11	184.47	9.45	159.23	114.81
5146.000	950.00	0.00	0.00	405.60	2595.00	412.52	412.52	413.52	92.14	8.41	438.94	270.35
5146.000	950.00	0.00	0.00	405.60	3190.00	412.92	412.92	413.95	88.28	8.76	558.32	330.51
5146.000	950.00	0.00	0.00	405.60	4970.00	413.74	413.74	414.98	94.85	10.13	604.44	510.30
5147.000	1010.00	0.00	0.00	420.20	1505.00	425.09	0.00	425.92	105.35	7.29	207.90	144.63
5147.000	1010.00	0.00	0.00	420.20	2595.00	425.77	425.77	427.29	158.58	9.92	272.49	206.07
5147.000	1010.00	0.00	0.00	420.20	3190.00	426.31	426.31	427.93	148.73	10.30	333.35	261.57
5147.000	1010.00	0.00	0.00	420.20	4970.00	427.53	427.53	429.44	136.88	11.35	508.28	424.80

STENO	ENSEL	DIFFERS	FE	TOPWID	OLV	OOH	TOPOR	PERENC	STENC	STCHL	STCHB	STENCR
5128.000	327.1	0.00	327.01	303.14	71.87	5335.42	57.71	0.00	0.00	450.00	545.00	0.00
5128.000	327.1	0.05	327.00	35.00	0.00	5465.00	0.00	95.00	450.00	450.00	545.00	545.00
5129.000	329.89	0.00	332.38	81.21	0.00	4990.00	0.00	0.00	0.00	438.00	527.00	0.00
5129.000	329.89	0.00	332.38	81.21	0.00	4990.00	0.00	88.20	438.70	438.00	527.00	526.90
5129.200	331.41	0.00	334.65	54.00	0.00	4990.00	0.00	0.00	0.00	380.00	434.00	0.00
5129.200	331.41	0.00	334.65	54.00	0.00	4990.00	0.00	54.00	380.00	380.00	434.00	434.00
5129.800	335.42	0.00	336.64	54.00	0.00	4990.00	0.00	0.00	0.00	380.00	434.00	0.00
5129.800	335.42	0.00	336.64	54.00	0.00	4990.00	0.00	54.00	380.00	380.00	434.00	434.00
5130.000	335.27	0.00	336.89	77.90	0.00	4989.08	0.92	0.00	0.00	302.00	373.00	0.00
5130.000	335.27	0.00	336.89	66.90	0.00	4990.00	0.00	66.90	306.10	302.00	373.00	373.00
5131.000	341.44	0.00	343.70	114.23	0.59	4968.39	21.02	0.00	0.00	610.00	693.00	0.00
5131.000	341.37	0.07	343.70	110.32	0.24	4971.28	18.48	114.30	600.60	610.00	693.00	714.00
5132.000	349.65	0.00	351.85	177.41	192.27	4789.99	8.13	0.00	0.00	893.00	942.00	0.00
5132.000	349.85	0.20	351.90	122.00	236.89	4753.11	0.00	122.00	820.00	893.00	942.00	942.00
5132.200	350.42	0.00	352.37	72.16	0.00	4990.00	0.00	0.00	0.00	200.00	324.00	0.00
5132.200	350.98	0.06	352.37	72.10	0.00	4990.00	0.00	72.10	225.20	200.00	324.00	297.70
5132.800	351.89	0.00	352.44	72.81	0.00	4990.00	0.00	0.00	0.00	200.00	324.00	0.00
5132.800	351.15	0.05	352.47	72.80	0.00	4990.00	0.00	72.80	224.90	200.00	324.00	297.70
5133.000	352.19	0.00	352.65	212.03	5.32	4634.94	349.74	0.00	0.00	255.00	348.00	0.00
5133.000	352.14	0.05	352.72	93.00	0.00	4990.00	0.00	93.00	255.00	255.00	348.00	348.00
5133.200	349.93	0.00	352.78	64.89	0.00	4990.00	0.00	0.00	0.00	255.00	329.00	0.00
5133.200	350.54	0.60	352.85	64.80	0.00	4990.00	0.00	64.80	260.60	255.00	329.00	325.60
5133.800	352.88	0.00	353.84	264.41	110.88	4708.67	170.45	0.00	0.00	255.00	329.00	0.00
5133.800	353.09	0.22	353.87	264.00	130.66	4643.79	215.56	264.00	200.00	255.00	329.00	464.00
5134.000	353.61	0.00	353.83	274.23	87.50	4533.96	344.51	0.00	0.00	300.00	416.00	0.00
5134.000	353.68	0.04	354.07	116.00	0.00	4990.00	0.00	116.00	300.00	300.00	416.00	416.00
5135.000	354.40	0.00	356.88	224.59	181.71	4608.29	0.00	0.00	0.00	480.00	578.00	0.00
5135.000	354.30	0.09	356.82	96.61	0.00	4990.00	0.00	96.60	480.00	480.00	578.00	576.80
5136.000	358.66	0.00	359.86	176.76	167.04	4622.96	0.00	0.00	0.00	430.00	535.00	0.00
5136.000	359.17	0.51	360.12	100.00	0.00	4990.00	0.00	100.00	430.00	430.00	535.00	530.10
5136.200	359.48	0.00	360.17	100.00	0.00	4990.00	0.00	0.00	0.00	428.00	528.00	0.00
5136.200	359.92	0.44	360.53	100.00	0.00	4990.00	0.00	100.00	428.00	428.00	528.00	528.00
5136.800	376.21	0.00	376.24	500.52	2395.13	2501.74	93.13	0.00	0.00	428.00	528.00	0.00
5136.800	376.21	0.00	376.24	500.52	2395.13	2501.74	93.13	500.80	200.00	428.00	528.00	700.80
5137.000	376.23	0.00	376.25	396.67	3.99	4978.83	7.17	0.00	0.00	225.00	585.00	0.00
5137.000	376.23	0.00	376.25	396.08	3.99	4978.88	7.13	396.10	213.90	225.00	585.00	610.00
5138.000	376.15	0.00	376.29	216.89	5.36	4976.18	8.46	0.00	0.00	222.00	426.00	0.00
5138.000	376.15	0.00	376.29	216.89	5.36	4976.18	8.46	217.00	215.00	222.00	426.00	432.00

SI CMO	CRSEL	DIRMS	PU	TOPWID	OLOR	DCH	QROA	PERENC	STENCI	STCHL	STCHR	STENCR
5138.200	374.52	0.00	377.94	50.00	0.00	4990.00	0.00	0.00	0.00	300.00	350.00	0.00
5138.200	374.52	0.00	377.94	50.00	0.00	4990.00	0.00	50.00	300.00	300.00	350.00	350.00
5138.800	375.62	0.00	378.14	50.00	0.00	4990.00	0.00	0.00	0.00	300.00	350.00	0.00
5138.800	375.62	0.00	378.14	50.00	0.00	4990.00	0.00	50.00	300.00	300.00	350.00	350.00
5139.000	378.16	0.00	378.18	467.44	3.15	4981.75	8.10	0.00	0.00	240.00	664.00	0.00
5139.000	378.16	0.00	378.18	424.00	0.00	4990.00	0.00	424.00	240.00	240.00	664.00	664.00
5140.000	378.40	0.00	378.20	324.47	73.37	3116.59	.04	0.00	0.00	400.00	622.00	0.00
5140.000	377.99	0.01	378.20	222.00	0.00	3190.00	0.00	222.00	400.00	400.00	622.00	622.00
5140.200	376.21	0.00	378.36	40.00	0.00	3190.00	0.00	0.00	0.00	825.00	865.00	0.00
5140.200	376.72	0.02	378.37	40.00	0.00	3190.00	0.00	40.00	825.00	825.00	865.00	865.00
5140.800	377.71	0.00	379.11	133.87	2.83	3157.51	29.66	0.00	0.00	825.00	865.00	0.00
5140.800	377.72	0.01	379.12	133.80	2.99	3156.47	30.54	133.80	806.50	825.00	865.00	940.00
5141.000	378.14	0.00	379.40	141.84	15.75	3038.62	135.62	0.00	0.00	930.00	970.00	0.00
5141.000	378.15	0.01	379.40	141.80	15.89	3037.38	136.75	141.80	919.30	930.00	970.00	1061.10
5142.000	380.77	0.00	381.73	95.76	0.00	3190.00	0.00	0.00	0.00	900.00	1015.00	0.00
5142.000	380.77	0.00	381.74	95.70	0.00	3190.00	0.00	95.70	910.30	900.00	1015.00	1006.00
5143.000	388.90	0.00	391.63	44.69	0.00	3190.00	0.00	0.00	0.00	590.00	641.00	0.00
5143.000	388.90	0.00	391.63	44.62	0.00	3190.00	0.00	44.70	596.30	590.00	641.00	641.00
5143.200	391.01	0.00	392.02	54.00	0.00	3190.00	0.00	0.00	0.00	970.00	1024.00	0.00
5143.200	391.01	0.00	392.02	54.00	0.00	3190.00	0.00	54.00	970.00	970.00	1024.00	1024.00
5143.800	391.40	0.00	392.41	59.00	0.00	3190.00	0.00	0.00	0.00	970.00	1024.00	0.00
5143.800	391.40	0.00	392.41	59.00	0.00	3190.00	0.00	59.00	970.00	970.00	1024.00	1024.00
5144.000	391.40	0.00	392.74	70.38	0.00	3190.00	0.00	0.00	0.00	700.00	802.00	0.00
5144.000	391.40	0.00	392.74	70.38	0.00	3190.00	0.00	70.40	714.80	700.00	802.00	785.20
5145.000	399.61	0.00	401.74	51.93	0.00	3190.00	0.00	0.00	0.00	540.00	601.00	0.00
5145.000	399.61	0.00	401.74	51.93	0.00	3190.00	0.00	51.90	540.90	540.00	601.00	595.00
5146.000	412.92	0.00	413.99	296.27	0.00	2727.47	462.53	0.00	0.00	458.00	532.00	0.00
5146.000	412.92	0.02	414.14	190.50	0.00	2886.59	303.41	190.50	459.50	458.00	532.00	650.00
5147.000	426.23	0.00	427.93	122.38	0.00	3133.14	56.86	0.00	0.00	550.00	646.00	0.00
5147.000	426.23	0.00	428.01	89.57	0.00	3190.00	0.00	89.20	559.80	550.00	646.00	646.00
5147.500	428.61	0.00	429.71	60.00	0.00	3190.00	0.00	0.00	0.00	900.00	960.00	0.00
5147.500	428.75	0.14	429.80	60.00	0.00	3190.00	0.00	60.00	900.00	900.00	960.00	960.00
5147.800	450.58	0.00	450.86	161.86	0.00	2023.57	1166.43	0.00	0.00	900.00	960.00	0.00
5147.800	450.71	0.14	450.97	161.90	0.00	1968.29	1221.71	161.90	900.00	900.00	960.00	1061.90
5148.000	450.99	0.00	450.91	274.94	0.00	3189.90	.02	0.00	0.00	220.00	492.00	0.00
5148.000	451.00	0.11	451.02	272.00	0.00	3190.00	0.00	272.00	220.00	220.00	492.00	492.00
5149.000	450.80	0.00	450.95	168.96	0.00	3190.00	0.00	0.00	0.00	250.00	430.00	0.00
5149.000	450.92	0.11	451.06	169.00	0.00	3190.00	0.00	169.00	256.50	250.00	430.00	425.50