TECHNICAL REPORT

JEFFERSONVILLE HAZARD MITIGATION PLAN - FLOOD HAZARD MODELING AND PROJECT IDENTIFICATION VILLAGE OF JEFFERSONVILLE, VERMONT

FINAL

March 2014

MMI #2911-03

Prepared for:

Lamoille County Planning Commission
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1.0 INTRODUCTION

The village of Jeffersonville in the town of Cambridge, Vermont is located at the confluence of the Brewster River (drainage area 20 square miles) and the Lamoille River (drainage area 470 square miles). This low-lying village center is prone to flooding and repeat flood damages with the most recent events taking place in 2011 during a spring flood (Figure 1.1). The Lamoille County Planning Commission, in conjunction with the Jeffersonville Board of Trustees, retained Milone & MacBroom, Inc. (MMI) to conduct a study including hydraulic modeling of flood hazards and an alternatives analysis to explore flood mitigation options. Conceptual design was performed for the preferred alternatives. The goal of the project is to reduce flood and erosion risks in the village. The information provided from this project will be incorporated into the planned stand-alone Jeffersonville Village Hazard Mitigation Plan and hopefully lead to future final design and implementation.

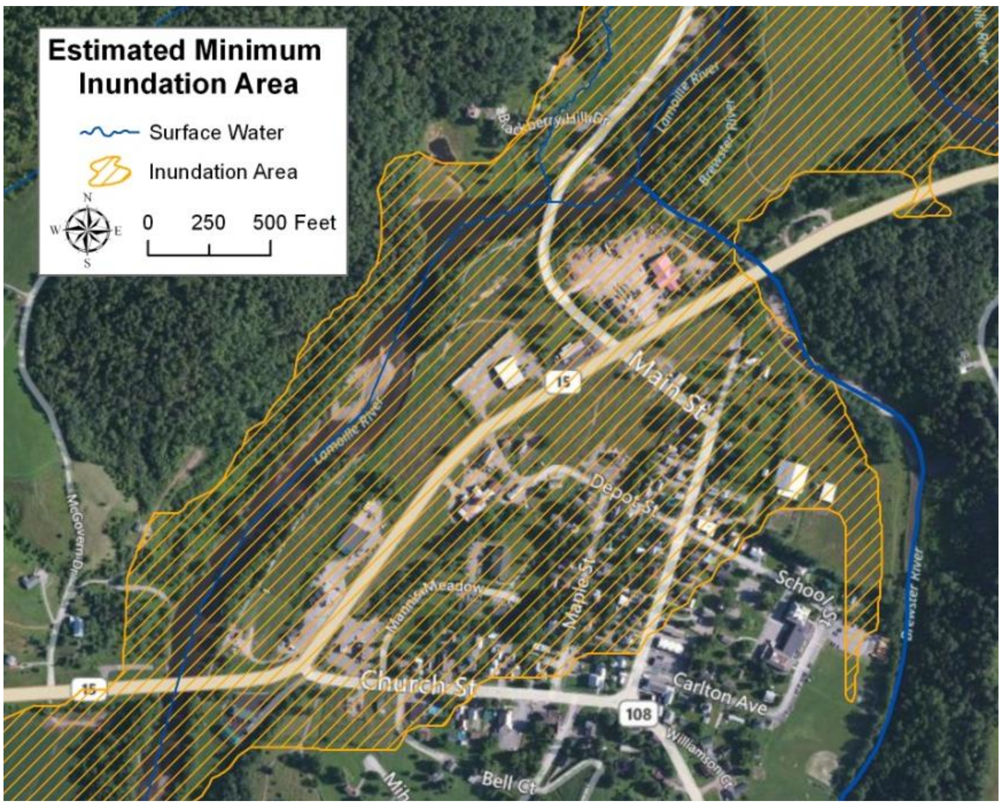


FIGURE 1.1: Approximate Flood Area in Jeffersonville During 2011 Flood Event (Source: Lamoille County Planning Commission)

The Brewster River originates on the north side of Mount Mansfield in the Northern Green Mountains and flows north to its confluence with the Lamoille River. The steep and confined headwater channel flows out of the mountains and then loses slope as it reaches the flat area on which the village is located (Figure 1.2). The Brewster River flows along the east side of the village, and the Lamoille River flows along the north side.

Vermont Route 15 runs east-west parallel to the Lamoille River. Flows that come down the Brewster River pass under the roadway bridge and Railroad/Cambridge Greenway Bridge before entering the Lamoille River. During high flows, the combined flow from the Brewster River and Lamoille River backwater heads west along the southern side of the Route 15 road embankment in the the "flood chute" and eventually returns to the Lamoille River downsteam of the village. Flow in the flood chute inundates structures in the village. Past floods have occurred when the flow from the Brewster River heads west before passing under Route 15. Flooding could take place due to undersized bridges, sediment deposition during floods, and backwatering from the Lamoille River. Each of these is common in flat confluence areas and likely contributes to flooding in Jeffersonville. The project focal area for this study includes the Lamoille River reach between the Route 15 crossing downstream of the village and the upstream village of Jeffersonville boundary (0.8 miles). The project focal area on the Brewster River is between the Lamoille River confluence and the village highway garage (0.6 miles). To properly evaluate all of the flood reduction alternatives, the hydraulic model covered a combined river length of 15.8 miles.

A recent geomorphic assessment by our project team member Evan Fitzgerald of Fitzgerald Environmental Associates indicates that the Brewster River channel is cut down and disconnected from its floodplain as it approaches the confluence (Figure 1.3). This condition may reduce flooding during smaller storms but may also increase risks during larger events as higher than expected flows contained in the channel can lead to higher flood velocity, lateral movement of the channel, and erosion of the surrounding landscape.

Damaging landslides have occurred along the Brewster River in the past that are partially linked to river processes. The condition of the banks and valley wall in the landslide area was considered during the study of flood mitigation alternatives.

Like many Vermont villages, towns, and cities, early settlement patterns and the more recent history of development have landed Jeffersonville in a floodplain setting. Furthermore, transportation infrastructure with elevated embankments has been placed in many river valleys. Development in the floodplains of large rivers and small streams is the primary reason that flood damages were so extensive in the region during the 2011 flooding. Furthermore, flood water surface elevations were locally elevated due to reduced flow capacity at undersized structures that were either backwatered or clogged with sediment and large woody debris. Other mechanisms of increased flooding observed around Vermont over the past several years include reduced floodplain access even in areas where development did not exist.

This project evaluates the flooding in Jeffersonville and establishes several alternatives that will reduce flood and erosion risks over the long term in this dynamic river confluence in a developed village setting. This project generally consisted of data review, survey, hydraulic modeling, alternatives analysis, and conceptual design. This report summarizes the findings and recommendations of the study.

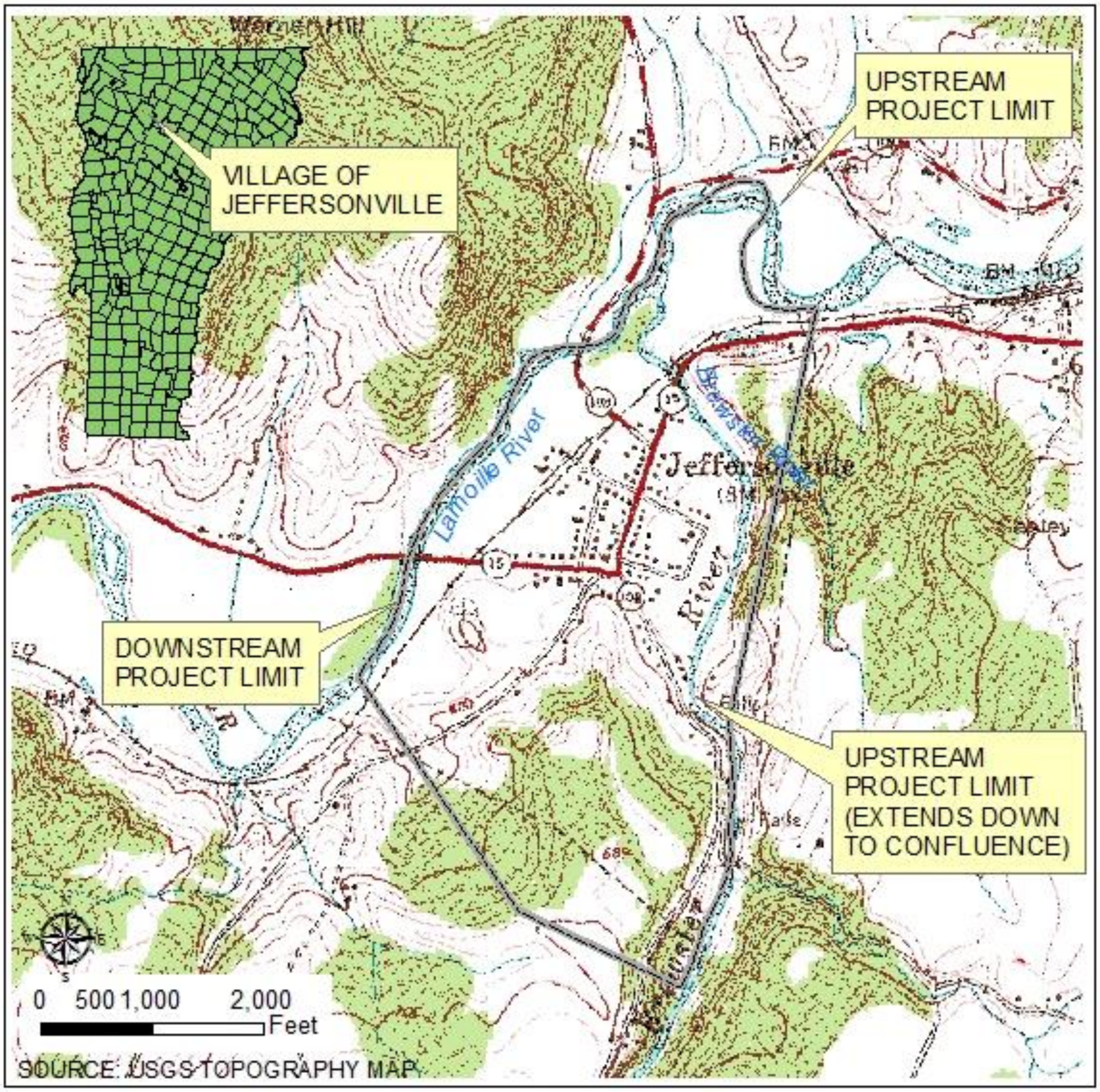


FIGURE 1.2: U.S. Geological Survey Topographic Map Showing the Project Focal Area

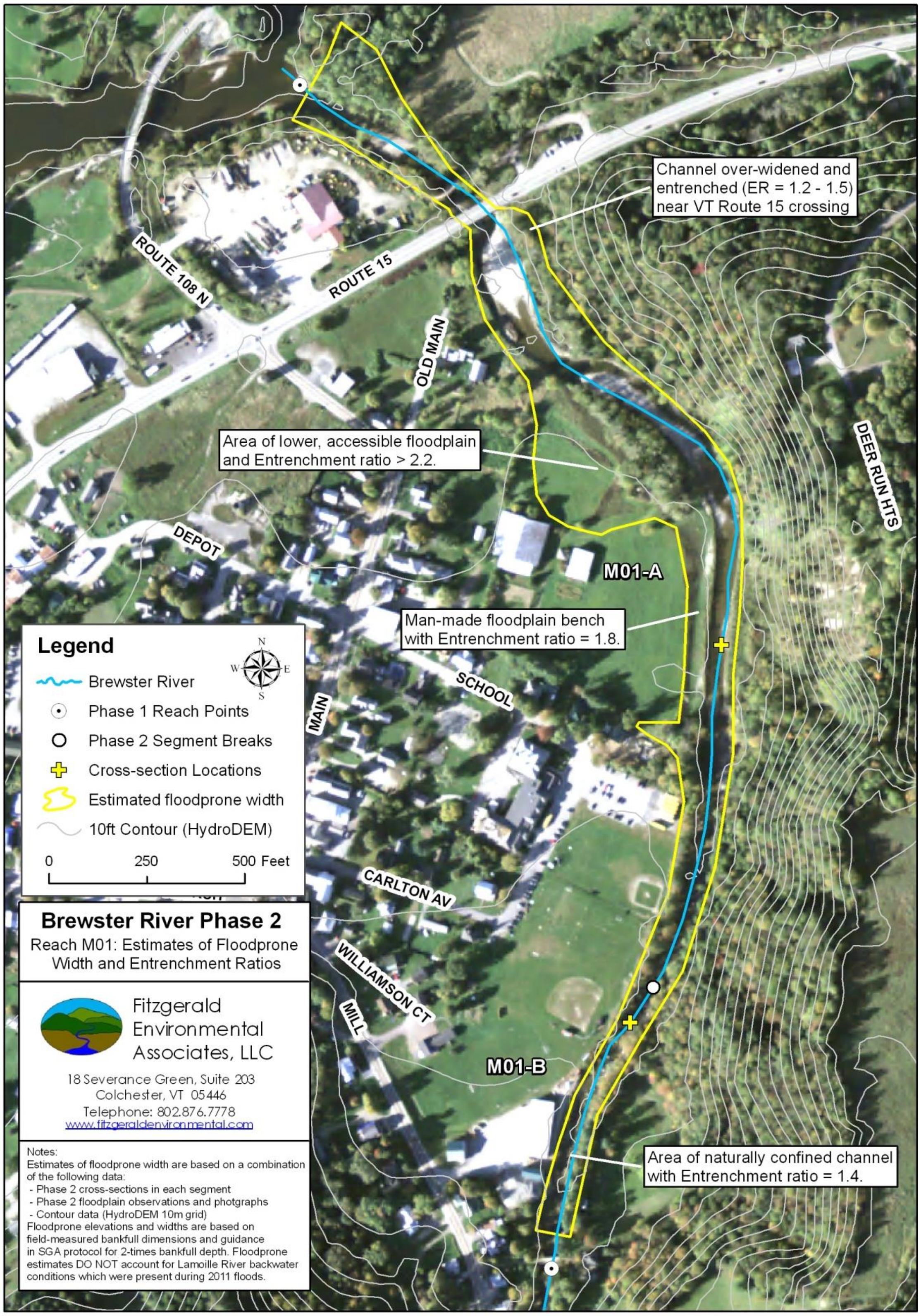


FIGURE 1.3: Primary Geomorphic Assessment Results Along the Brewster River

1.1 Goals and Objectives

The primary goal of the study is to create a model of the Brewster and Lamoille Rivers and their floodplain and identify potential flood hazard mitigation projects for the Village of Jeffersonville.

Project objectives include:

1. Build on existing information to define the primary flood and erosion risks in the village of Jeffersonville.

2. Survey the channel and floodplain to create a hydraulic model of the Lamoille River and Brewster River.

3. Perform an alternatives analysis with the model to explore flood hazard mitigation options within the study area as listed in the project Request for Proposals and as expanded during the project.

4. Provide recommended alternatives for flood risk reduction.

5. Work with the Jeffersonville Hazard Mitigation Plan Advisory Committee to reach consensus on preferred alternatives for implementation and incorporation into the Hazard Mitigation Plan.

6. Increase awareness of the risks associated with the flooding due to the geophysical setting in the village and possible solutions through this report and public presentations.

2.0 EXISTING CONDITIONS

2.1 Data Collection

The project was initiated by gathering available data about the study reach. Data sources included:

- The Federal Emergency Management Agency (FEMA) hydraulic models (Jeffersonville Village, Brewster River only; Cambridge Village, Cambridge Town, and Fairfax, Lamoille River)
- The FEMA Flood Insurance Studies and Rate Maps (Jeffersonville Village, December 15, 1982; Cambridge Village, December 1, 1982; Cambridge Town, December 15, 1982; Fairfax, July 20, 1981)
- Bridge plans for Vermont Route 108 original 1937 plans, Vermont Route 108 new 2012 plans, Brewster River Vermont Route 15 1958 plans, and Lamoille River Vermont Route 15 1990 plans
- Roadway intersection plans for the 2013 roundabout at Vermont Route 15 and Vermont Route 108

- Recovery plans by Natural Resources Conservation Service (NRCS) for 1999 landslide
- Design plans for the Union Bank property
- The 2013 stream geomorphic assessment of the Brewster River
- Photodocumentation from the 2011spring flooding and repairs documentation of flood levels provided by the advisory committee
- The best available topography and aerial photography

The collected data were essential for understanding the nature of the risks at the project site, setting up the hydraulic and sediment transport models, validating the models, and conducting the alternatives analysis.

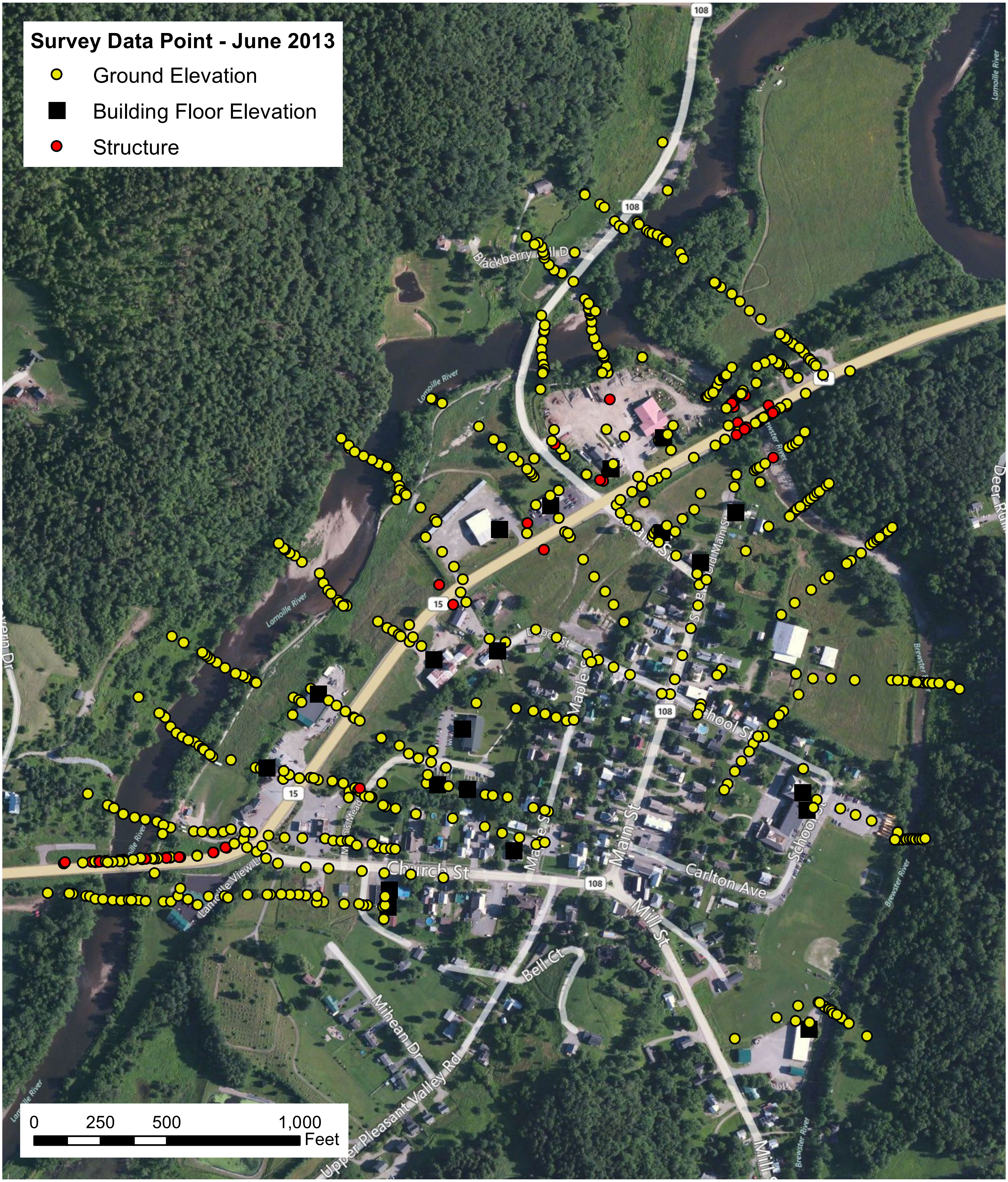
Throughout the project, several meetings were held with members of the Jeffersonville Hazard Mitigation Plan Advisory Committee group leading the hazard mitigation planning efforts. The advisory committee is comprised of town/village staff and board members, state river scientists, state floodplain managers, fisheries specialists, and local residents and property owners along the study reach. The committee was an important resource for data collection and alternatives planning. Numerous conversations were held with committee members and landowners along the river about past flooding and damages.

2.2 Field Survey

Field survey was conducted in June 2013 by Grenier Engineering, PC of Waterbury, Vermont at select locations to obtain cross-sectional geometry required to develop the hydraulic model (Figure 2.1). Twenty cross sections were surveyed in addition to data at the Route 15 Bridge over the Lamoille River, the Route 15 Bridge over the Brewster River, the Railroad/Cambridge Greenway Bridge over the Brewster River, and building first floor elevations of several key structures.

MMI conducted site walks on May 24, June 6, and September 5, 2013 to make site observations and perform supplemental survey and data collection. The purpose of the site walk in May was to observe flood patterns during a bankfull flood. Observations of the project area during bankfull flood informed the hydraulic modeling showing details such as how bridges and culverts influence flow.

In June, the river levels were low enough to obtain information about the channel and floodplain areas needed to develop the hydraulic model, as well as to identify areas where flood mitigation measures could be located. For example, the path of the flood chute was traced. Specific information including the channel dimensions, channel substrate, and bank vegetation and condition was collected. MMI also recorded supplemental measurements on bridges and culverts for input into the hydraulic model. In September 2013, additional measurements were obtained at cross culverts under Route 15 to accurately model the transfer of water under Route 15 between the flood chute and the Lamoille River. A project basemap was created using all of the collected information (Appendix A).



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Survey Data			LOCATION: Jeffersonville, VT	
MMI#: 2911-03 MXD: J:\SurveyData SOURCE: Bing Maps	N	Jeffersonville Flood Study	Map By: JCL Date: 11/4/2013 Scale: See Bar	SHEET: 2-1

2.3 Structures

A brief description of the bridges and culverts located in the study area follows.

Route 15 Bridge Over the Lamoille River

The Route 15 Bridge spans the Lamoille River using a concrete deck supported by structural steel beams constructed in 1991. The right abutment is founded on exposed bedrock that makes up the right bank of the channel. The abutments, wingwalls, and two piers are concrete. The bridge span is approximately 252 feet providing a maximum clearance of approximately 20 feet above the channel bottom. The bridge opening and dimensions were surveyed as part of this project. Bridge plans were obtained during the data collection phase of the project that were used to supplement the field survey in providing the geometric data required for developing the hydraulic model. There was no known damage to this structure in recent floods.

Route 108 Bridge Over the Lamoille River

The Route 108 Bridge was under construction during this project and has been recently completed. The original bridge was removed at the time of survey, and a temporary bridge structure was in use while the new structure was being constructed. The original bridge was built in 1937. Although this bridge has been removed, the original structure was included in portions of this project to validate the hydraulic model using historical storm events and as a comparison to the hydraulic conditions of the new bridge. The recently completed bridge is included in the existing conditions modeling.

The new bridge has a concrete deck supported by steel beams. The abutments, wingwalls, and two piers are concrete. The new bridge span is approximately 250 feet providing a maximum clearance of approximately 24.2 feet above the channel bottom. This is a larger conveyance area than the original bridge, which had a span of approximately 193 feet and a maximum clearance of approximately 20.6 feet. The bridge spans the Lamoille River and the Cambridge Greenway recreation path that travels along the left bank.

Bridge plans for both the original 1937 bridge and contract plans from 2012 for the new bridge were obtained during the data collection phase of the project and were used for developing the hydraulic model of the study reach. There was no known damage to this structure in recent floods. A large standing wave was observed under the temporary bridge during the observed bankfull flood.

Railroad/Cambridge Greenway Bridge Over the Brewster River

The former railroad bridge is currently used as a recreation path bridge as part of the Cambridge Greenway. This bridge spans the Brewster River with a wood deck supported by tall steel box plate girders. The abutments are made of stacked stones. The bridge span is approximately 50 feet with a maximum clearance of approximately 10.1 feet above the channel bottom. The bridge is low, with flow hitting the bottom of the girders at approximately bankfull channel depth under clear flow conditions. Flow has hit the side of the girder during recent floods. The bridge opening and dimensions were surveyed as part of this project to provide the geometry data required for the hydraulic modeling. The construction date and bridge plans were not available. This bridge has had no know damage during recent floods although sedimentation of the channel appears to have occurred, reducing the flood conveyance through the bridge opening.

Route 15 Bridge Over the Brewster River

The Route 15 Bridge spans the Brewster River using a concrete deck supported by structural steel beams constructed in 1959. The abutments, wingwalls, and one pier are concrete. Both abutments have riprap scour protection. The bridge span is approximately 114 feet providing a maximum clearance of approximately 16 feet above the channel bottom. The hydraulic opening at the bankfull flood is 80 feet wide because of the sloped abutment protection. The bridge opening and dimensions were surveyed as part of this project. Bridge plans were obtained during the data collection phase of the project that were used to supplement the field survey in providing the geometric data required for developing the hydraulic model. At the time of construction of this bridge, Route 15 was realigned, moving the location of the bridge. An old unused concrete abutment from the old bridge is constricting the channel just downstream of this bridge.

There was no known damage to this structure in recent floods although sedimentation of the channel appears to have occurred, reducing the flood conveyance through the bridge opening. Flow typically travels through the right opening because the left opening has significant sediment deposition.

3.0 HYDROLOGY

Peak flows were estimated for the Lamoille River and Brewster River at the project site for input into the hydraulic model. A gauge analysis was performed using available stream gauging data and compared to estimates calculated using United States Geological Survey (USGS) regional regression equations (Olson 2002) and the effective peak flows in the published FEMA Flood Insurance Study (FIS) (Town of Cambridge, Vermont, Lamoille County, December 15, 1982). Estimates were calculated for the Brewster River (at the confluence with the Lamoille River) and at three different locations on the Lamoille River to represent major tributaries discharging into the Lamoille River (Brewster River and Seymour River) and at the Cambridge town corporate limits (downstream project limit) (Table 3.1).

TABLE 3.1
FEMA Effective Flows

Return Frequency	Drainage Area (square miles)	Brewster River	Lamoille Upstream Confluence with Brewster	Lamoille Upstream Confluence with Seymour	Cambridge Town Corporate Limit
10-yr	19.5	2,200	14,500	15,000	16,800
50-yr	464	3,850	21,500	22,250	24,800
100-yr	489	4,750	25,250	2,6250	29,250
500-yr	520	6,800	36,500	38,000	42,500

Flood frequency analysis was performed for the stream gauge on the Lamoille River in Johnson, Vermont (USGS 0133340) (USGS 1982). The gauge has a data record dating back to 1929. Statistical analysis was performed for the full 84-year data record, the record from 1929 to 1970, and the record from 1971 to 2013 to investigate known increases in flood magnitudes since 1970 in the region (Collins 2009; NMFS 2011). The time period ranging from 1971 to 2013 was selected for this study to more accurately represent current hydrology. The 100-year flow estimate using the full data record is 22,363 cubic feet per second (cfs), the 100-year flow estimate using the pre-1970 data record is 18,603 cfs, and the post-1970 data record flow is 25,709 cfs. The post-1970 peak flow estimate is approximately 15% larger than the prediction using the full data record. The peak flows were then scaled using drainage area to the project site to provide estimated design flows (Table 3.2).

TABLE 3.2
Bulletin 17B Estimations of Peak Discharge

Return Frequency	Lamoille Upstream Confluence with Brewster	Lamoille Upstream Confluence with Seymour	Downstream Project Limits
2-yr	10,407	10,825	11,336
5-yr	14,235	14,807	15,505
10-yr	16,765	17,438	18,261
25-yr	19,959	20,760	21,739
50-yr	22,337	23,234	24,330
100-yr	24,717	25,709	26,922
500-yr	30,335	31,553	33,041

A partially operational USGS stream gauge is located on the Lamoille River in Jeffersonville that is only a flood-warning stage gauge. The gauge records instantaneous stage data over the most recent 120 days. A rating curve does not exist to translate the water surface elevation to discharge. The gauge does provide information on the shape of a hydrograph and facilitates comparisons to other gauges where discharge is calculated.

The Brewster River does not have a stream gauge, so flows were scaled from similar gauged sites in the state. Flood frequency analysis was performed on multiple gauged sites to identify a good surrogate gauge (Table 3.3). Several factors were considered to select a representative gauge such as drainage area, topography, watershed characteristics, and unit discharge normalized by drainage area (cubic feet per second per square mile, or csm).

TABLE 3.3
Possible Surrogate USGS Gauges for the Brewster River

USGS Gauge Number	River	Location	Drainage Area (square miles)
1142500	Ayers Brook	Randolph, VT	30.5
4276842	Putnam Creek	Crown Point, NY	51.6
4282525	New Haven River	Brooksville, VT	115
4287000	Dog River	Northfield, VT	76.1
4288000	Mad River	Moretown, VT	139

None of the gauges provided a good representation for predicting peak flows for the Brewster River, so regression analysis was performed to develop a better flow estimate. Peak flood flows were estimated for the Brewster River using USGS regional regression equations (Olson 2002) (Table 3.4).

TABLE 3.4
***StreamStats* Peak Flow Estimates**
for the Brewster River

Return Frequency	*StreamStats* Brewster River
2-yr	634
5-yr	930
10-yr	1,150
25-yr	1,470
50-yr	1,730
100-yr	2,000
500-yr	2,700

A regression equation for steep gradient streams in ungauged, unregulated drainage basins in New England was also used to estimate flows (Jacobs 2010), yet this approach was not found to be suitable.

Design flows were selected by identifying flows that were consistent with previous estimates and with documented regional changes over the past several decades (Table 3.5). Selected design flows for the Lamoille River are scaled from the USGS Johnson gauge. The peak flow rates on the Brewster River for both the 2- and 5-year floods were calculated from the regression analysis. Flows for the larger return frequencies for the Brewster River were taken as the effective FEMA FIS flows. The 25-year flood was interpolated from the FEMA FIS flows.

TABLE 3.5
Design Flows

Return Frequency	Brewster River	Lamoille Upstream of Confluence with Brewster	Lamoille Upstream of Confluence with Seymour	Lamoille Downstream Corporate Limits
2-yr	634	10,407	11,041	11,552
5-yr	930	14,235	15,165	15,564
10-yr	2,200	16,765	18,954	19,788
25-yr	2,819	19,959	21,340	22,408
50-yr	3,850	22,337	25,060	27,283
100-yr	4,750	24,717	26,852	30,680
500-yr	6,800	30,335	30,338	38,624

The damaging flood of April 2011 and the smaller recent flood in May 2013 in Jeffersonville were used for calibration and validation. The data records from the Johnson gauge during these floods were scaled to the Lamoille River at the project site (Table 3.6). The stream gauge on the West Branch of the Little River also recorded a large flood in May 2011 and, thus, data from that gauge and event were scaled to the Brewster River for the calibration and validation.

TABLE 3.6
Calibration and Validation Flows

Event	Estimated Recurrence Interval (years)	Brewster River	Lamoille Upstream of Confluence with Brewster	Lamoille Upstream of Confluence with Seymour	Lamoille Downstream Corporate Limits
April 2011	L=25, B=50-100	4,177	18,674	22,851	23,767
May 2013	L=<2, B=10	1,843	6,297	8,140	8,507

4.0 HYDRAULIC MODELING

4.1 Modeling Approach

Hydraulic modeling was performed to predict water depth, flow velocity, potential for scour, stable channel dimensions, and sediment transport for the design flows. The modeling was performed for existing and proposed conditions to evaluate flood mitigation alternatives.

Hydraulic modeling was completed using the United States Army Corps of Engineers (USACE) *Hydrologic Engineering Center – River Analysis System* (HEC-RAS) version 4.1.0 computer modeling software (USACE 2010) . The model is capable of computing flood profiles for multiple flow conditions, including both subcritical (i.e., slow, tranquil, and deep) and supercritical (i.e., fast, turbulent, and shallow) flow. The basic computational procedure of HEC-RAS is the solution of the one-dimensional energy equation. Energy losses are evaluated by friction (Manning's Equation) and the contraction/expansion coefficient multiplied by the change in velocity head. The momentum equation is used in situations where the water surface profile is rapidly varied.

The Lamoille River was modeled from the village of Jeffersonville upstream boundary to the Cambridge Town boundary at the downstream end (length ~ 7.0 miles). The

Brewster River was modeled from the village of Jeffersonville upstream boundary to the confluence with the Lamoille River (length ~ 0.7 miles). The study reach includes stream crossings at Vermont Route 108 on the Lamoille River, Vermont Route 15 on both rivers, and the Railroad/Cambridge Greenway Bridge and private driveway bridge on the Brewster River.

The system geometry of a one-dimensional hydraulic model is largely determined by cross sections that define channel dimensions, floodplain width and elevation, and channel constrictions and expansions. The cross sections establish the longitudinal profile of the channel bed by connecting the thalweg (i.e., the lowest point in the channel) along the length of flow. Structures such as bridges, culverts, and walls are also defined to determine their hydraulic influence. Cross-section locations and river centerline stationing are shown on the project basemap (Appendix A).

The hydraulic roughness (i.e., Manning's N) is determined at each location as defined by the substrate on the channel bed, the surface of structures, the type of vegetation present on the channel banks, and the land cover on the floodplains. Higher N values indicate more hydraulic roughness, which slows flow and dissipates energy.

The model was performed in steady state mode, meaning the estimated peak flow value was used to evaluate the flood conditions for each storm event without variation over time.

4.2 Existing Conditions

The existing conditions model was created by using the FEMA effective model where it was available and updating it with existing information. The FIS of the Village of Jeffersonville and Flood Insurance Rate Maps (FIRMs) were published in 1982. The FIS included a detailed study of the Brewster River between the upstream boundary of Jeffersonville (near the Town Garage) and the confluence with the Lamoille River downstream of Route 15. The Brewster River model received by MMI from the State of Vermont National Flood Insurance Program (NFIP) Coordinator uses the HEC-2 step backwater model as described in the current FIS. HEC-2 is the precursor modeling software to HEC-RAS. The FIS also included a detailed study of the Lamoille River that was contiguous with the study completed for the Town of Cambridge. The model data used to create that model is not available for the Village of Jeffersonville. HEC-2 model data were found for a portion of the Town of Cambridge downstream of Jeffersonville. The available HEC-2 data were manually entered into HEC-RAS.

The HEC-RAS system geometry was updated to current existing conditions by entering the field survey data to create cross sections along the study reach within the model. In addition, bridge geometry was entered into HEC-RAS utilizing data from survey and available bridge plans and details. Reach lengths for the main channel, left floodplain (i.e., overbank), and right overbank areas are used to define the distance along the channel between cross sections and locate bridges in the model.

The model contains multiple reaches to adequately portray the main flow paths through the village. The Lamoille River is included with three reaches including upstream of the Brewster River confluence, downstream of the Brewster River confluence, and downstream of the Route 15 Bridge. The Brewster River is included as two reaches, upstream and downstream of the Route 15 Bridge.

The flood chute was included in the model as another reach that originates in the Brewster River just upstream of the Route 15 road embankment. The model splits the flow in the Brewster River and, if the water levels are high enough, water is diverted into the flood chute. The Route 15 road embankment was modeled as a lateral structure. Water is transferred from the flood chute to the Lamoille River via five small culverts.

The newly reconstructed intersection at Route 108 and Route 15 includes a roundabout and new curbing. The construction plans for the roundabout were used to enter the new roadway and curbing elevations into the geometry data. Water traveling down the flood chute that is not transferred across Route 15 re-enters the Lamoille River downstream of the Route 15 Bridge.

All elevations in the hydraulic model are presented in the vertical datum NAVD88 feet. The elevations in the FEMA FIS are published in NVGD27. The equation NAVD88 = NGVD27 – 0.32 can be used to convert between vertical datum.

Manning's roughness (N) values utilized in the hydraulic model were selected based on the conditions that currently exist along the channel and overbank areas following field investigations. Channel roughness ranged between 0.035 and 0.050 in the Brewster River and 0.028 to 0.045 in the Lamoille River, with the roughness generally increasing moving upstream where channel substrate becomes larger. Overbank roughness ranged between 0.038 to 0.20 on the Lamoille River and 0.05 to 0.10 on the Brewster River, with the lower end of the range representing developed areas along the channel overbanks and the higher end of the range representing wooded areas or highly developed areas.

The upstream boundary condition was set to critical depth for both rivers. The downstream boundary condition for the Lamoille River was set specifically to the storm event being modeled, using a known water surface elevation based on the previously calculated flood levels in the effective FEMA FIS for the 10-year, 50-year, 100-year, and 500-year storm event and estimating flood levels for storms not included in the FEMA FIS. The boundary conditions at the flood chute split flow, and the confluences were all balanced internally by the model computations.

4.3 Model Validation and Convergence

The hydraulic model was validated using a combination of high water marks recorded after April 2011 flooding, observation of an approximately bankfull flood in May 2013, USGS gauge records, visual evidence of flood patterns in the field, discussions with local residents and advisory committee members recounting past flooding events, and review of numerous photographs taken during recent floods.

High water marks were recorded within the study reach after the April 27, 2011 flood and during a site walk by MMI on May 24, 2013. The quality and accuracy of the flood elevations vary. Some locations were surveyed while other elevations were estimated from nearby known elevations. The predicted peak flood water surface elevations in the hydraulic model were compared to the high water marks (Table 4.1, Figures 4-1 and 4-2).

TABLE 4.1
Hydraulic Model Results Versus High Water Mark Data (all elevations in NAD88 feet)

Location Description	Observed WSE* 4/27/2011	Model WSE 4/27/2011	**Difference**	Observed WSE 5/24/2013	Model WSE 5/24/2013	**Difference**
Lamoille River:						
Downstream of Route 15	452	452.93	**0.9**	448	448.76	**0.8**
USGS Gage at Route 15	453.89	453.33	**-0.6**	449.55	448.97	**-0.6**
Left bank erosion	N/A	N/A	N/A	451.5	450.2	**-1.3**
Upstream of Route 108	459	457.76	**-1.2**	454	451.58	**-2.4**
Brewster River:						
Route 15 Bridge	459	459.15	**0.1**	454	452.68	**-1.3**
Old Main Street	459.16	459.53	**0.4**	454.57	453.55	**-1.0**
Windridge Property	458.35	459.58	**1.2**	N/A	N/A	N/A
At Landslide	N/A	N/A	N/A	458	457.34	**-0.7**
Flood chute:						
Church Street	457.78	456.93	**-0.8**	Dry	Dry	Dry
Retirement Home	457.43	458.09	**0.7**	Dry	Dry	Dry
Physical Therapist	460.2	459.39	**-0.8**	Dry	Dry	Dry
Old Main Street	459.16	459.44	**0.3**	Dry	Dry	Dry

*WSE = water surface elevation

The Existing Condition model includes the Route 108 Bridge that was recently completed. The model used for validating the 2011 storm was altered to include the original Route 108 Bridge, which has been removed in order to accurately portray the geometry at the time of the flood. The Existing Condition model includes a split flow to allow water to travel down the flood chute during high flows. The model used for validating the 2013 storm was altered to not include the split flow or flood chute reach since water did not travel down this path during the bankfull flood. The dry channel leads to model instability. This nonsplit flow model was used in the analysis for flows that had water surfaces below the elevation of the flood chute entrance.

The mean difference between the observed flood levels and the predictions in the hydraulic model is -0.4 feet. Predictions range between -2.4 and +1.2 feet compared to the observations. These values are within an acceptable range that can be expected from a model with so many reaches and junctions and were deemed suitable for comparisons between existing conditions and alternatives. Fine-tuning of the model coefficients was not required.

Differences between observed and modeled water surface elevations can be expected because some of the high water mark elevations were estimated and may not have represented the actual peak elevation. The model does not include debris or blockages that may have occurred during a storm for short or long periods of time. Changes in the channel that may have occurred during or after one of these storms may not have been represented in the model.

Another reason for the varying results between the model and observations is that the hydraulic model is a one-dimensional (1-D) model where flow moves in the downstream direction simply entering and exiting each cross section. The hydraulics at confluence areas are notoriously complex and may be better represented by a two-dimensional model. The observed variation in flow levels within a cross section in a developed floodplain confluence area is beyond the capabilities of HEC-RAS. Using knowledge of the site, assumptions have been made to allow creation of the best possible representation for this area using a 1-D model.

The existing conditions model includes multiple areas where water is transferred between reaches such as:

- From the Brewster River to the flood chute
- From the Brewster River to the Lamoille River
- From the flood chute to the Lamoille River (both at the downstream end and under or over Route 15)

If any of these reaches are dry during a model run the results will not converge on a solution. For example, during a 10-year flood the flood chute is dry and the model gives a warning about lack of convergence. In these cases where convergence did not take place we verified the acceptability of the predicted water surface elevations with a more simpler model that did converge to a solution.

In summary, the model validation and convergence were deemed acceptable as the model reproduced observed water surface elevations to a reasonable level of accuracy for the comparative study to be performed here.

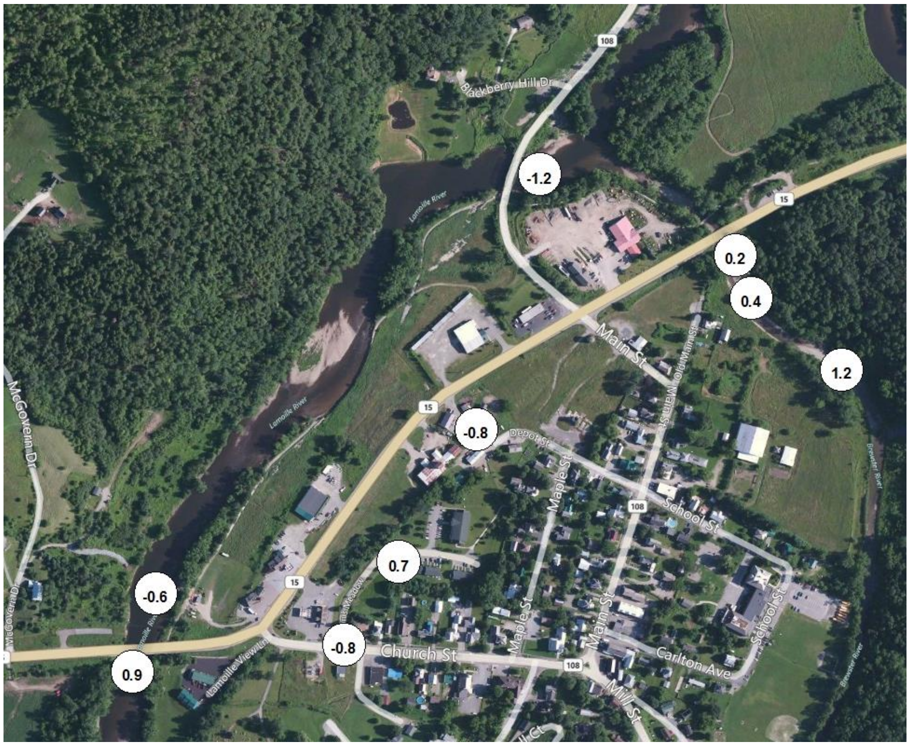


FIGURE 4.1: Model validation from 4/27/2011. Values represent difference between Existing Conditions model results and observed water surface elevations.

FIGURE 4.2: Model validation from 5/24/2013. Values represent difference between Existing Conditions model results and observed water surface elevations.

5.0 ALTERNATIVES ANALYSIS AND HYDRAULIC EVALUATION

5.1 Introduction

The validated existing conditions model was used to evaluate potential flood mitigation alternatives. Numerous iterations of each alternative were modeled to maximize flood mitigation benefits and reduce impacts to the river channel and floodplain. A map of the locations of all of the alternatives has been created building on the project basemap (Appendix B). A summary table of model results has been compiled by choosing specific locations in the village to report changes in flood levels between existing and proposed conditions during the modeled April 2011 flood (Tables 5-1 and 5-2). Sample model output data are provided for existing conditions and the preferred alternatives (Appendix D). A CD-ROM accompanies this report, which contains the full model including all input and output.

TABLE 5.1
Alternatives Analysis Selected Results

		Changes in 2011 Flood Level (feet)							
		Lamoille River		Brewster River			Flood chute along RT 15		
Plan	Description	US of RT 15	US of Route 108	US of RT 15	DS of School	At School	Elderly Housing	US of Route 108	Beginning of Flood chute
Existing	Includes Route 108 Bridge Under Construction	454.1	457.8	459.5	459.6	464.8	458.1	459.4	459.4
Natural	Removed Buildings and Bridges	-0.3	-0.8	-1.0	-0.9	0.3	N/A	N/A	N/A
Natural	Removed Buildings, Bridges, and Fill	-0.6	-1.0	-2.4	-2.0	-1.7	N/A	N/A	N/A
1a	Removed Route 15 Brewster River Bridge	0.0	0.0	-0.1	-0.1	0.0	-0.1	-0.1	-0.1
1b	Removed Sediment Blocking Route 15 Brewster River Bridge	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
1c	Replace Route 15 Brewster River Bridge with Larger Structure	0.0	0.0	-0.1	-0.1	0.1	0.0	0.0	0.0
2a	Removed Railroad Brewster River Bridge	0.0	0.1	-0.4	-0.4	0.1	-0.5	-0.4	-0.4
2b	Replaced Railroad Brewster River Bridge with Shallower Structure	0.0	0.0	-0.1	-0.1	0.1	-0.1	-0.1	-0.1
2c	Replaced Railroad Brewster River Bridge and Widened Channel	0.0	0.0	-0.3	-0.3	0.1	-0.4	-0.4	-0.4
3a	Remove Gravel Bar by Route 15 Brewster River Bridge	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
4a	Divert Water Around Gravel Bar on Brewster	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
5a	Remove Sediment in Lower Brewster	0.0	0.0	-0.1	-0.2	0.4	-0.1	-0.1	-0.1
6a	Remove Route 15 Bridge Over Lamoille	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
7a	Remove Route 108 Bridge Over Lamoille	0.0	-0.6	-0.2	-0.2	0.1	-0.2	-0.2	-0.2
7b	Remove Route 108 Over Lamoille and Approach Fill	0.0	-0.3	-0.3	-0.3	0.1	-0.4	-0.3	-0.3
8a	Reconnect Lamoille Floodplain DS of Rt 15 at Apartments	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8b	Reconnect Lamoille Floodplain US of RT 15	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
8c	Reconnect Lamoille Floodplain DS of Rt 108 bridge	0.0	-0.2	-0.1	-0.1	0.0	-0.1	-0.1	-0.1
8d	Reconnect Lamoille Floodplain US of Route 108	0.0	0.2	-0.1	-0.1	0.0	-0.1	-0.1	-0.1
8a+8b+8c+8d	Reconnect Lamoille Floodplain, No Change to RT 15	0.0	-0.1	-0.2	-0.2	0.1	-0.2	-0.2	-0.2
7b + 8d	Remove Route 108 Bridge and US Fill	0.0	-0.6	-0.5	-0.5	0.2	-0.7	-0.5	-0.5
9a	Reconnect Brewster Floodplain DS of School	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0
9b	Reconnect Brewster Floodplain at School	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0
9a + 9b	Reconnect Brewster Floodplain from Route 15 - Town Garage	0.0	0.0	0.0	0.0	-3.3	0.0	0.0	0.0
10a	Floodwall Along Brewster - Route 15 - Town Garage	0.0	0.0	-0.1	0.1	-0.2	No Flow From River		
11a	Floodplain Storage in Lamoille at Jolley Property	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12a	Remove Fairfax Dam	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12b	Remove Fairfax Dam and Adjacent Sections	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Note: US= Upstream, DS=Downstream

TABLE 5.2
Alternatives Analysis Selected Results

		Changes in 2011 Flood Level (feet)							
		Lamoille River		Brewster River			Flood chute along RT 15		
Plan	Description	US of RT 15	US of Route 108	US of RT 15	DS of School	At School	Elderly Housing	US of Route 108	Beginning of Flood chute
Existing with New RT 108 Bridge and Roundabout		454.1	457.8	459.5	459.6	464.8	458.0	459.4	459.4
Test	Change Due to Rt 108 Bridge	0.0	-0.1	-0.1	-0.1	0.0	-0.1	0.0	0.0
Test	Change Due to Roundabout	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
5b	Dredged Lamoille River Upstream of Route 108 Bridge	0.0	-0.1	-0.2	-0.2	0.1	-0.2	-0.2	-0.2
13a	Increase Size of Culverts #1, #2, #3 Under Route 15	0.0	0.0	-0.1	-0.1	0.0	-0.4	-0.1	-0.1
13b	Pedestrian Underpass at Culvert #2 Under Route 15	0.0	0.0	-0.2	-0.2	0.1	-1.0	-0.3	-0.2
13c	Pedestrian Underpass at Culvert #1 Under Route 15	0.0	0.1	-0.2	-0.2	0.1	-0.3	-0.2	-0.2
13d	Large Pedestrian Underpass Culverts at #1 and #2	0.1	0.1	-0.4	-0.4	0.1	-1.5	-0.5	-0.4
13e	Larger (4') Culverts at #1 and Ped. Underpass at #2	0.0	0.0	-0.3	-0.2	0.1	-1.2	-0.3	-0.2
14a	Lower Section of RT 15	0.0	0.0	-0.1	-0.1	0.1	-0.3	-0.2	-0.1
14b	Lower Wider Section of RT 15 - Requires Removing Joinery 2nd Entrance	0.0	0.0	-0.2	-0.2	0.1	-0.7	-0.3	-0.2
14c	Removed Route 15 Embankment From Floodplain, Brought to Chute Level	0.1	0.0	-0.6	-0.5	0.2	-1.6	-1.0	-0.6
15a	One Overflow Culvert Under Rt 108 Approach	0.0	-0.2	-0.1	-0.1	0.0	-0.1	-0.1	-0.1
15b	Two Overflow Culverts Under RT 108 Bridge Approach	0.0	-0.4	-0.1	-0.1	0.1	-0.2	-0.2	-0.1
13b + 11a	Storage and Underpass Culvert at Jolley Property	0.0	0.0	-0.3	-0.3	0.1	-0.6	-0.4	-0.3
Test	Filled Floodplain at Jolley Property to 2 feet Above FEMA Floodplain Elevation to Test the Condition of Filling the Floodplain	0.0	0.1	0.1	0.1	0.0	-0.9	0.1	0.1
1c+2c+8d	Replace Railroad and Route 15 Brewster River Bridges and Remove Fill at River Confluence	0.0	0.4	-0.6	-0.6	0.2	-0.7	-0.5	-0.5
2c + 13a		0.0	0.1	-0.4	-0.4	0.1	-1.0	-0.4	-0.4
13a + 9a		0.0	0.1	-0.4	-0.3	-2.1	-1.0	-0.4	-0.4
2c + 13d + 9a		0.1	0.1	-0.6	-0.5	-2.1	-1.8	-0.7	-0.5
2c + 13d + 9a+15b		0.1	-0.3	-0.8	-0.7	-3.1	-1.8	-1.0	-0.8
2c + 13e + 9a+15b	**Preferred Alternative**	**0.1**	**-0.3**	**-0.7**	**-0.7**	**-3.1**	**-1.8**	**-0.8**	**-0.7**
ALTERNATIVE FLOWS:									
Existing	Lamoille 100-year, Brewster 50-year	455.4	459.3	460.5	460.5	464.0	458.7	460.4	460.5
Preferred	Change from Existing	0.0	-0.4	-0.4	-0.4	-2.5	-0.3	-0.4	-0.4
Existing	Lamoille 50-year, Brewster 100-year	455.1	458.9	460.3	460.3	465.1	458.7	460.2	460.3
Preferred	Change from Existing	0.0	-0.4	-0.4	-0.4	-3.2	-0.4	-0.4	-0.4

5.2 Natural Conditions

Natural conditions modeling where all structures are removed was performed to provide an initial look at the influence of man-made structures on the hydraulics. A second natural conditions model was created that also removed all known fill from the channel and floodplain. These natural conditions models were compared to existing conditions as a "first cut" at the potential reduction in flooding that would occur if all bridges, culverts, and fill are removed. This modeling was performed to visualize the hydraulic conditions that are being caused by the natural channel and floodplain geometry and what locations are being influenced by man-made structures.

5.3 Bridge Structures

For each bridge that was identified in the natural conditions modeling to have a potential influence on upstream flooding, additional alternatives were examined to determine what changes could be made at the structures to reduce flooding.

The Route 15 Bridge over the Brewster River was found to only have minimal effect on reducing upstream flood levels (0.0 to 0.1 feet) (Alternative 1). The sediment accumulated in the bridge opening was also examined and determined to not change the water surface elevations. The bridge is not showing a large effect on flooding because it is backwatered by the Lamoille River and the downstream Railroad/Cambridge Greenway Bridge during many of the storm events used to evaluate the structure. If the backwatering was eliminated at the Route 15 Bridge, upstream water surface elevations would be lowered. This bridge is a channel and floodplain constriction and, if it was replaced in the future, it is recommended that it be replaced with a larger structure.

The Railroad/Cambridge Greenway Bridge (Railroad Bridge) over the Brewster River was found to influence the water surface elevations upstream (Alternative 2). The tall plate girders of the bridge block water flow during flood flows for events larger than approximately the bankfull flood. The channel in this area is narrower than the bankfull channel width, and the floodplain has been completely filled on both sides of this bridge. The abutments of this bridge and the abutments of the Old Route 15 Bridge both constrict the channel in this area. The bankfull width of the channel is 62.4 feet while the width between the abutments of the Railroad/Cambridge Greenway Bridge is 48 feet. Replacement of this bridge with a wider, higher structure and restoration of the floodplain are recommended as part of the preferred alternatives. Reductions in flooding of up to 0.4 feet extend along the flood chute and partway up the Brewster River.

The private driveway bridge located on the Brewster River, upstream of the village highway garage, was not found to influence flooding downstream in the village.

The Route 15 Bridge over the Lamoille River in Cambridge (Wrong-Way Bridge) was found to not have an influence on flooding in Jeffersonville.

The Route 15 Bridge over the Lamoille River (in Jeffersonville) was not found to influence flooding in the village (Alternative 6). This bridge only locally increases the water surface elevations just upstream of the bridge but does not influence far enough upstream to change the hydraulics in the part of the village that floods. The channel capacity of the Lamoille River and the downstream channel geometry influences the water surface elevations in the Lamoille more than this bridge.

Preliminary alternatives showed that the Route 108 Bridge over the Lamoille River and fill associated with the road approaches to the bridge have an effect on the flood elevations upstream (Alternatives 7 and 15). Decreasing flood water surface elevation upstream of this bridge decreases flood elevations in the lower Brewster River as well. The new Route 108 Bridge over the Lamoille River was compared to the recently removed bridge to determine expected changes in flood patterns. The new Route 108 Bridge is wider and taller than the previous one and has a small decrease in flood water surface elevations upstream in the Lamoille River (decreased 0.1 feet), in the Brewster River (decreased 0.1 feet), and in the flood chute (decreased 0.1). The construction of a new Route 108 Bridge was recently completed, and it is therefore acknowledged to not be under consideration for major changes. Possible alternatives at the bridge have been explored such as installation of overflow culverts under the northern bridge approach, would allow additional flood capacity through the bridge opening, and could potentially be installed without compromise to the bridge structure or impact to existing commercial businesses. The installation of overflow culverts is recommended as part of the preferred alternatives. The overflow culverts reduce flood elevations upstream in the Lamoille River by 0.4 feet and 0.2 feet in the flood chute.

5.4 Floodwalls

In some cases, an area can be protected by use of a floodwall or berm to isolate the area to be protected from the river area. The concept of a floodwall was considered to see if some of the village could be isolated from the rivers. The flat area on which the village is located in the floodplain of both the Lamoille River and Brewster River is difficult to isolate from flooding. A floodwall along the Brewster River would increase shear stress and velocity in the river, which could increase erosion and flood risks at the Route 15 Bridge area and the former landslide areas (Alternative 10). The required height of the wall (8 feet) would diminish the attractive riverfront setting of the village. The floodwall alternative would be difficult to permit since it works against the natural processes of the river, leads to increased risks at the ends of the wall, and could lead to long-term repair and maintenance requirements that could be a financial burden to the village and state. The floodwall is not recommended.

5.5 Fairfax Dam

The Fairfax Dam was examined to determine if the impoundment could be affecting the flood water elevations in Jeffersonville (Alternative 12). The dam is located 13.5 miles downstream, and the channel slope is very flat (0.03%) between Fairfax and

Jeffersonville. The existing conditions model was extended downstream to Fairfax to include the dam using a few cross sections from the effective FEMA hydraulic model for Fairfax. The dam was determined to not have an influence on the flooding in Jeffersonville since the flood water surface elevation did not appear ponded until 3.3 miles downstream of the village.

5.6 Flood Chute to Lamoille River Water Transfer Across Route 15

During large floods, water exits the Brewster River and flows on the village side of the Route 15 road embankment. This is caused by high water levels in the Lamoille River and backwatering at the bridges in the confluence area. When the water levels in the Brewster River get high enough, a portion of the flow travels on the village side of the Route 15 road embankment. As flows increase, the left floodplain fills with water moving south from Route 15 into the village. As water flows in the chute, some of the water is able to get under the Route 15 road embankment through the five existing cross culverts (all 18 inches in diameter or less corrugated metal pipes in various stages of disrepair). The current cross culverts to connect water back to the Lamoille River do not have adequate capacity. Some of the culverts are very long with limited hydraulic capacity. During high flows, some of the water is able to get over the top of Route 15 in a few locations such as near the roundabout. Floodwaters that do not make it to the Lamoille River via the culverts or overtopping the roadway continue to flow southwest along the Route 15 embankment following the low points in the land until the floodwater crosses Church Street and re-enters the Lamoille River downstream of the Route 15 Bridge.

The new roundabout construction led to increasing the road elevation up to 2.5 feet, which could change flood patterns in the flood chute area. The roundabout causes small increases in the elevation of the water in the Brewster River and flood chute (< 0.1 feet and 0.1 feet for the modeled 2011 storm). The expected flood water paths have been altered from preconstruction locations observed during the 2011 storm. During the 2011 storm, floodwaters left the village by flowing over Route 15 at the intersection of Route 15 and 108. The roundabout configuration now directs water across the road both to the east and west of the roundabout. The new predicted flood paths are closer to the entrances of existing commercial businesses on the north side of Route 15. The Main Street approach to the roundabout was also altered and, although the elevation of the new low point in the road has not changed, the width of the flood path has been narrowed by the new road profile approaching the roundabout. This narrowing of the primary flow path over Route 108 in the village is leading to the small predicted increases in flood levels.

Field observations and modeling show that the flood water surface elevation on the village side of Route 15 is typically higher than the flood levels on the Lamoille River side of the road due to the higher elevation in the bottom of the flood chute than the river. This difference in water surface elevation suggests that it is hydraulically possible to lower the water elevation on the village side of the road with higher capacity cross culverts to transfer water from the village side of the road to the Lamoille River.

A variety of alternatives was considered to increase the conveyance capacity of the culverts (Alternative 13). The replacement of culverts is estimated to reduce flood levels in the flood chute by 1.2 feet and a small amount in the Brewster River by 0.3 feet. Increasing the sizes of the culverts located on either side of the roundabout was found to lower flood levels. The structure to the west could possibly serve several purposes – flood conveyance, pedestrian and bike access under Route 15, and wildlife passage under Route 15. The design of the structures to allow pedestrian access and efficient water flow may require additional land outside of the road right-of-way to accommodate the approach to the culverts. This alternative is recommended as part of the preferred alternatives.

The other culverts were not considered for enlargement given their proximity to infrastructure, large length, and location, which limit their flood reduction potential.

A roadway overflow section along Route 15 was considered (Alternative 14). The location selected for modeling is between the Joinery and Auto Repair to the west of the roundabout. The reduction in flood water surface elevation for this alternative is less than the alternatives to enlarge the culverts under the road. Creating an overflow section of the road would require a significant dip in the road surface and removal of a portion of the parking areas at both the Joinery and Auto Repair. This alternative is not recommended because it does not provide enough flood reduction benefit to justify an irregular roadway configuration and impacting existing businesses.

A more extreme alternative to transfer water from the village to the Lamoille River would be to lower the Route 15 embankment to the elevation of the floodplain (Alternative 14c). Lowering Route 15 to the floodplain level brings the road below the 25-year water surface elevation on the Lamoille River. A portion of the flow from the Lamoille River is expected to flow onto Route 15 and across to the village side of the road for all flows greater than the 25-year event. The water that would otherwise be trapped on the village side of Route 15 is able to equalize, and the depth of the water in the flood chute is reduced between 0.4 and 1.6 feet. The decrease in flood depths along the Lamoille River reduces water surface elevations in the Brewster River up to 0.6 feet due to less backwatering. This alternative is not recommended, is not possible to implement at this time, and was investigated here as a check on how large changes to the roadway could change flood patterns. Although the road embankment does trap water, it also provides flood protection benefits by not allowing the main flow of the Lamoille River to travel into the village. If a 2-D model is ever assembled in this location, this alternative should be revisited.

5.7 Floodplain Restoration

Floodplain restoration areas were explored throughout the study reach to increase sediment and floodwater storage since infrastructure and filled areas occupy much of the historic floodplain area in Jeffersonville. The areas were chosen based on existing topography, field investigation during site walks, and discussions with landowners and local river users. Different elevations and combinations of floodplain restoration areas were evaluated.

The Lamoille River floodplain has been encroached upon by many commercial businesses, roads, bridges and bridge approaches, and other development in the village. The floodplain area has been reduced in many locations. A series of alternatives was explored to restore some of the floodplain for river usage, which included removal of the fill and any buildings (Alternative 8). The floodplain was returned to the 2-year flood elevation. These restoration areas would fill with water when the Lamoille River had a storm larger than the 2-year event. The floodplain restoration areas examined had a small local reduction of flooding up to 0.2 feet. The flow in the Lamoille River is so large during flooding that restoration of smaller floodplain areas by fill removal alone does not reduce flood levels in the areas historically flooded.

The floodplain along the upper portion of the Brewster River has been filled to create the recreation fields at the school. The floodplain below the school has been filled in part by remaining material from the 1999 landslide. The Brewster River floodplain is also filled downstream of the Route 15 Bridge by the railroad embankment, Route 15 embankment, and the Old Route 15 embankment. Downstream of the Railroad/Cambridge Greenway Bridge, the floodplain is shared with the Lamoille River and is filled on the left by a commercial business. Floodplain restoration areas were explored between the highway garage and Route 15 (Alternative 9).

The most beneficial floodplain restoration area begins behind the school and extends downstream to near the Route 15 Bridge (Alternative 9a). Most of the material deposited by the landslide and fill in the parking area behind the school would be removed to lower the floodplain to the 2-year storm water surface elevation. The most benefit of this alternative is behind the school where flood levels decrease by 3.1 feet. The area between Route 15 and the school will have benefits by lowering the velocity and providing more flood storage. This area is expected to have lower water surface elevations when the Brewster River has a higher flow while the Lamoille River water surface elevation is not high. This alternative is described in greater detail in Section 6.

A floodplain restoration alternative along the Brewster River was also explored in conjunction with replacement of the Railroad/Cambridge Greenway Bridge and found to be integral to the success of the bridge replacement project. The removal of floodplain fill is included in the bridge replacement alternative discussed in the previous section and recommended as a preferred alternative (Alternative 2).

The Bell Gates property, a property on the village side of Route 15 on the downstream side of Main Street, was examined as a potential floodplain restoration (Alternative 11). The model does not show reductions in flood elevations by only providing storage. Floodplain storage is beneficial and should be considered when partnered with other alternatives that allow the stored water to be transferred under Route 15. When combining the floodplain storage with large transfer culverts under Route 15, there are reductions in flood elevation of up to 0.6 feet in the flood chute and 0.3 feet in the Brewster River (Alternative 13b+11a). The collection of the water and temporary storage until it could be transferred across the road should be considered by the village. Alternatively, filling floodplain areas where water can safely be stored in the village setting tends to increase flooding. The same property was tested to see if filling the property would affect flood levels, and a small increase in flood levels was predicted in the Brewster River and the upper portion of the flood chute.

5.8 Channel Management

Channel management alternatives were explored to increase conveyance and reduce flooding. Channel management techniques would include removal of sediment from the channel or bars to increase conveyance. The Lamoille River and Brewster River have multiple areas where sediment has accumulated, especially in the confluence area. At least a portion of the sediment that has accumulated is reported to be from the 1999 landslide where large amounts of sediment entered the Brewster River and were washed downstream.

Areas of accumulation were examined, and an estimation of the bed profile without sediment accumulation was determined based on the channel slope and dimensions of the nearby channel areas. Alternatives were tested where accumulated gravel was removed from the channel. Alternatives examined included removal of sediment on the gravel bar on the Brewster River upstream of Route 15 (Alternative 3), creating a new channel through the gravel bar to better align the flow with the bridge (Alternative 4), and removal of sediment accumulated in the lower Brewster River and at the confluence with the Lamoille River (Alternative 5).

These gravel removal alternatives had minor changes in flood water surface elevations (decreased 0.0 to 0.2 feet). The flood reductions were low because the volume of sediment removed is small compared to the total cross-sectional flow area during a flood. The sediment accumulation areas are in the area backwatered by the Lamoille River and, therefore, the water surface elevation is controlled by the flood levels on the larger river more than the deposit of gravel.

Channel management is not viable to manage flooding over the long term since deposits tend to return, permits are difficult to get for such actions since dredging is damaging to the channel and flood risks do not abate, and the ongoing maintenance costs in deposition-prone areas add up.

If sediment has built up over time due to a constriction in the channel and that constriction is removed, then a one-time removal of the sediment may fit into a project to reset the sediment regime. This is a case where the cost and impacts are justified since the mechanism of deposition has been changed. An example of a one-time removal of sediment may be to remove the sediment that has accumulated upstream of the Railroad/Cambridge Greenway Bridge if it is replaced.

5.9 Considerations for Choosing the Preferred Alternatives

The individual and combinations of the alternatives were considered against flood mitigation objectives such as reduction of flood and erosion risks, improvement of public safety, reduction of environmental impacts, controlling implementation cost, and minimizing the cost of maintenance (Table 5-3).

TABLE 5.3
Alternatives Analysis Matrix

Alternative	Alternative Description	Reduce Flood Risk	Reduce Erosion Risk	Limit Ecological Impacts	Comparitive Implementation Cost	Comparitive Maintenance Cost	Preferred
1	Replace Route 15 Brewster River Bridge with Larger Structure	o	o	+	HIGH	LOW	
2	Replace Railroad Brewster River Bridge and Widened Channel	++	+	+	MODERATE	LOW	YES
3, 4	Remove Gravel Bar by Route 15 Brewster River Bridge	o	o	-	LOW	MODERATE	
5a	Remove Sediment in Lower Brewster	o	o	-	LOW	MODERATE	
5b	Dredge Lamoille River Upstream of Route 108 Bridge	o	o	-	LOW	MODERATE	
6	Remove Constriction at Route 15 Bridge Over Lamoille	o	o	+	HIGH	LOW	
7	Remove Constriction at Route 108 Bridge Over Lamoille and Approach Fill	++	+	+	HIGH	LOW	
8	Reconnect Lamoille Floodplain by Removing Sections of Fill	o	o	+	MODERATE	LOW	
9a	Reconnect Brewster Floodplain Downstream of School	++	++	+	MODERATE	MODERATE	YES
9b	Reconnect Brewster Floodplain at School	++	++	+	MODERATE	MODERATE	
10	Floodwall Along Brewster - Route 15 - Town Garage	o	-	-	HIGH	MODERATE	
11	Floodplain Storage in Lamoille - at Jolley Property	+	+	+	LOW	MODERATE	
12	Remove Fairfax Dam	o	o	+	HIGH	LOW	
13	Increase Size of Culverts #1 and #2 Under Route 15	++	+	+	MODERATE	LOW	YES
14a,b	Lower Section of Route 15	+	+	+	MODERATE	LOW	
14c	Removed Route 15 Embankment From Floodplain; Brought to Chute Level	++	+	+	HIGH	LOW	
15	Two Overflow Culverts Under Route 108 Bridge Approach	++	+	+	MODERATE	MODERATE	YES
	KEY: ++ = best; + = good; **o** = none; - = poor						

5.10 Combined Preferred Alternatives

The alternatives analysis has resulted in a set of preferred alternatives that is recommended for final design and implementation to reduce flood and erosion risks. The recommended alternatives include:

- Replace the Railroad/Cambridge Greenway Bridge with a wider, low-profile recreation bridge and widen the constricted channel adjacent to the bridge (Alternative 2c).
- Restore the floodplain downstream of the school property including lowering the ground elevation at the Windridge/Pony Farm property and removal of part of the gravel parking lot at the school (Alternative 9a).
- Install larger culverts under Route 15 on both sides of the roundabout. Possibly design the southwest structure for pedestrian underpass when it is not flooding (Alternative 13e).
- Install large culverts under Route 108 at the north approach of the new bridge (Alternative 15b).

The combined set of alternatives addresses the primary causes of flooding in the village where the modeling shows that benefits are achievable. With the complex flood patterns and the abundance of infrastructure in the village, no single alternative alone can remedy all of the flooding. Perhaps the implementation of these alternatives should be considered a collective phased approach to reducing flood and erosion risks.

The Railroad/Cambridge Greenway Bridge and adjacent channel and floodplain restoration together remove the constriction at the confluence and reduce backwatering in the lower Brewster River that contributes to water entering the flood chute. The restoration of the floodplain along the lower Brewster River provides additional flood storage outside the developed portion of the village and is expected to spread out the sediment deposition that has been focusing around the downstream bridges. The larger culverts under Route 15 provide a flow path for water that gets trapped on the village side of the Route 15 road embankment in the flood chute to reach the Lamoille River more quickly during a flood. The overflow culverts under the Route 108 Bridge approaches lower flood water surface elevations throughout the entire confluence area.

Model results show that the combination of the alternatives produces a greater flood reduction in the village than any of the individual alternatives alone (Figure 5-1). Flood reductions are predicted to be up to 0.7 feet in the lower Brewster River, 3.1 feet near the elementary school, and between 0.7 and 1.8 feet in the flood chute. In the simulation of the 2011 flood event, the flood chute is expected to be dry downstream of the proposed bypass culverts, which would reduce flood risks along Route 15.

The flood reduction values discussed in the report have focused on the modeled simulation of the 2011 flood event. Additional flood events have been modeled to determine how the preferred alternatives would affect flooding during flood events of different magnitudes. Maps of the approximate areas of flood reduction benefits have been created to help visualize the benefit of the preferred alternatives over a range of flood events for the 10-year, 50-year, 100-year, and 500-year storm events (Appendix C). These maps do not represent accurate floodplain boundaries because the detailed ground topography required for floodplain delineation is not available. These maps show the approximate areas over which floodwaters are shown in the modeling to be reduced. Model results are provided for existing conditions and preferred alternatives (Appendix D).

Much of the flooding damage and disruption in the village occurred along the flood chute. The water in the flood chute not only floods homes and businesses along Route 15 and the lower Brewster River but also flows across roads impacting transportation. Under existing conditions, water will flow down the flood chute during any storm larger than the 10-year flood. The preferred alternatives lower flood water surface elevations in the flood chute for floods of all sizes. The bypass culverts in conjunction with the lower floodwaters from the other alternatives were found to direct all water from the flood chute back under Route 15 to the Lamoille River for the 10-year, 25-year, and simulated 2011 storm events. For the 2011 storm event, water no longer crosses over the road surface of Route 15. The 50-year and 100-year water surface elevations are reduced along the entire flood chute by approximately 0.8 and 0.5 feet. The 500-year flood water surface elevations in the Lamoille River are approximately 1 foot higher than the Route 15 road embankment, so the preferred alternatives have little effect on the water surface elevations in the flood chute (reduced 0.1 feet).

The largest water surface elevation reductions for all floods occur in the Brewster River near the Cambridge Elementary School where floodplain restoration is proposed. This area under existing conditions is constricted with high velocities and elevated water surface elevations. The school's first-floor elevations are at 460.7 feet and 471.1 feet. The lower floor of the school would be flooded by all floods greater than the 10-year flood (462.5 feet), except it is currently protected from flooding by the fill in the recreation fields and parking area. The 500-year storm is predicted to be higher than the fill in the parking area and would therefore flood the school. The preferred alternatives work together to reduce water surface elevations in this area from 1.7 feet for the 10-year storm to 3.75 feet for the 500-year storm. The results suggest that the school would no longer flood for the 500-year storm. There is no change in potential for inundation flooding under this proposed alternative for smaller floods because the elevation of the remaining fill will be the same as under existing conditions. Armoring would be implemented at the back of the proposed floodplain and will reduce erosion risks that currently exist at the site. The floodplain restoration at and downstream of the school contributes the most to the reduction of flooding at the school (Alternative 9a, Figures 5-2, 5-3).

Floods of the same size will take place on the Brewster and Lamoille Rivers when a flood originates from a large storm such as a nor'easter or tropical storm that travels up the Atlantic coast and covers the state or region. A more localized storm such as a high-elevation thunderstorm on Mount Mansfield in the headwaters of the Brewster River or a localized storm in the headwaters of the Lamoille River may create different flood scenarios on the converging rivers. For example, a large storm may hit Jeffersonville locally and cause flooding in the Brewster River while the upper Lamoille River is not in flood. Another scenario that is likely due to the Lamoille River watershed being much larger than the Brewster River watershed is that the flood peak on the Brewster River has passed by the confluence before the peak arrives at the village on the Lamoille River. For the April 2011 storm that was primarily used for the alternatives analysis, the Brewster River experienced a 50- to 100-year flood while the Lamoille River experienced a 25- to 50-year flood.

Additional flood scenarios on the Lamoille and Brewster Rivers have been examined to see how the preferred alternatives function for two additional combinations – a large flood event on one river (100-year) and a moderate flood event on the other river (50-year). Model results of these flood scenarios show that the preferred alternatives will reduce flood water surface elevations for the 100-year and 50-year flood combinations (Table 5-2). In the case where the Lamoille River is a 100-year flood and the Brewster River is a 50-year flood, the preferred alternatives reduce flooding 0.4 feet in the Lamoille River near the confluence, 0.4 feet in the flood chute and lower Brewster River, and 2.5 feet near the school. In the case where the Brewster River is having a 100-year flood and the Lamoille River is having a 50-year flood, the preferred alternatives reduce flooding 0.4 feet in the Lamoille River near the confluence, 0.4 feet in the flood chute and lower Brewster River, and 3.2 feet near the school.

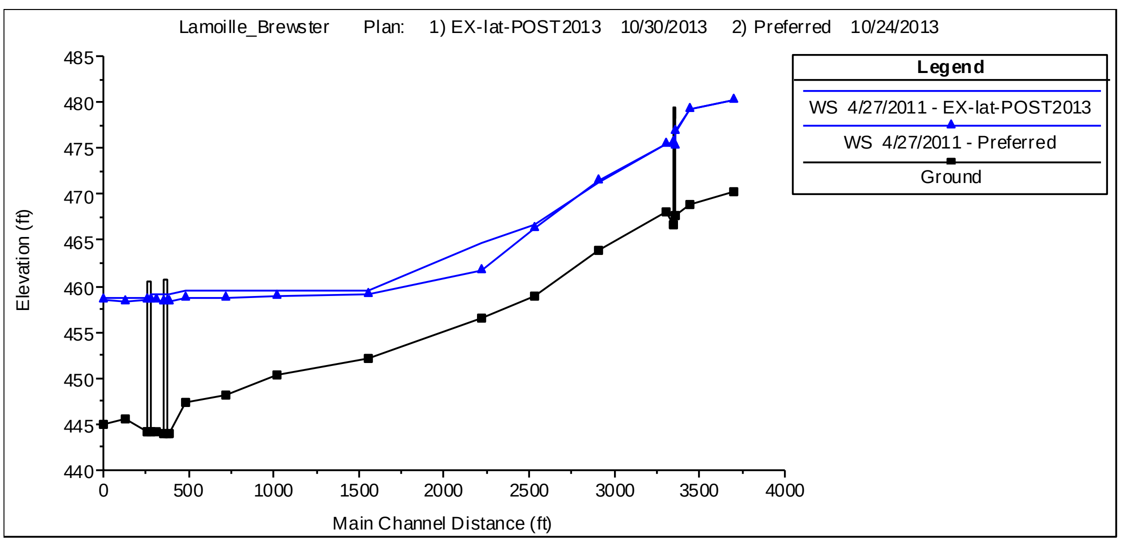


FIGURE 5-1: Brewster River Water Surface Profile for April 2011 Flood Model comparing Existing Conditions and Preferred Alternative.

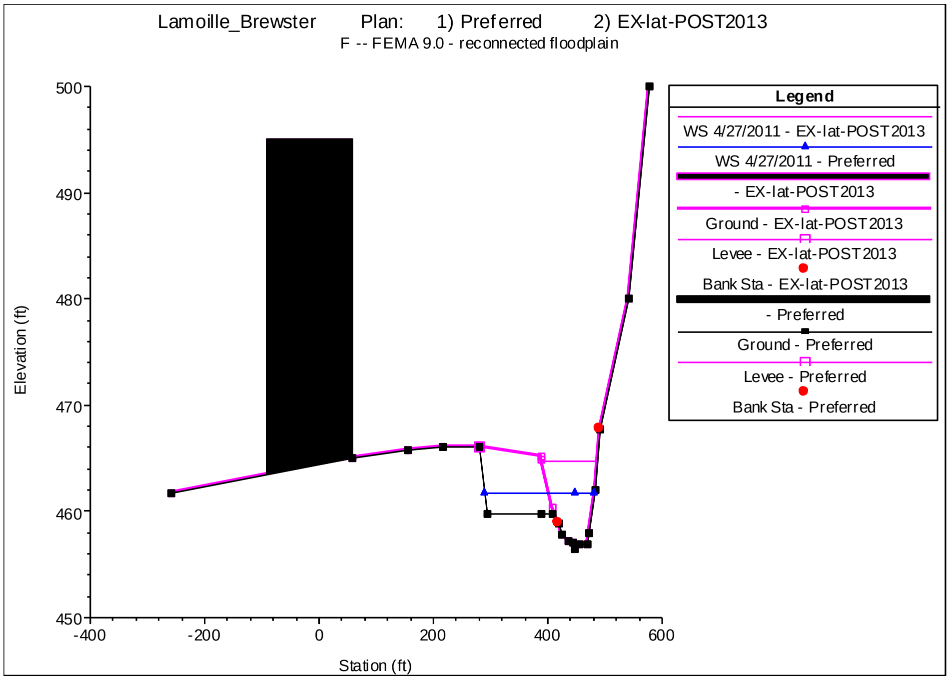


FIGURE 5-2: Brewster River Cross section at school showing water surface elevations for April 2011 Flood Model comparing Existing Conditions and Preferred Alternative.

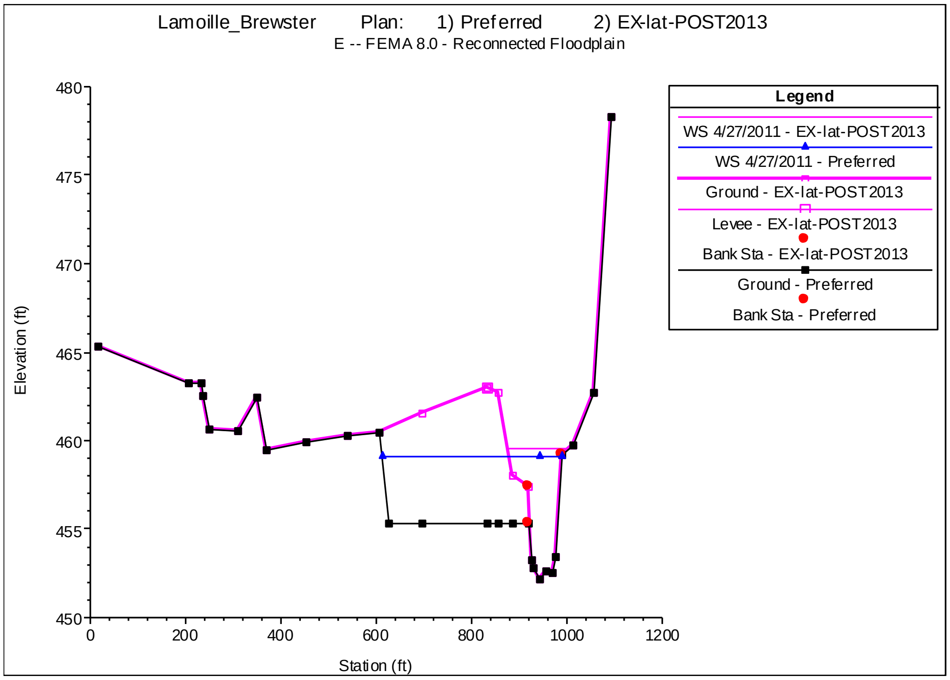


FIGURE 5-3: Brewster River Cross section at downstream of school showing water surface elevations for April 2011 Flood Model comparing Existing Conditions and Preferred Alternative.

5.11 Alternatives Not Recommended

Environmental impacts, eliminating the source of the problem to reduce future maintenance, and permitting feasibility were taken into consideration when choosing alternatives to include in the preferred alternatives. The following alternatives are not expected to be worth the impacts and may not be permittable:

- Alternative 3: Remove gravel bar in the Brewster
- Alternative 5: Remove sediment in lower Brewster River or Lamoille River
- Alternative 10: Floodwall along the Brewster River

Other alternatives have not been included in the preferred alternative because the probability of their implementation in the near future is low. Large infrastructure projects sometimes need to wait until replacement is needed due to the normal end of the operational lifetime or structure failure. The alternatives considering replacement or alteration of the major bridges fall into this category including:

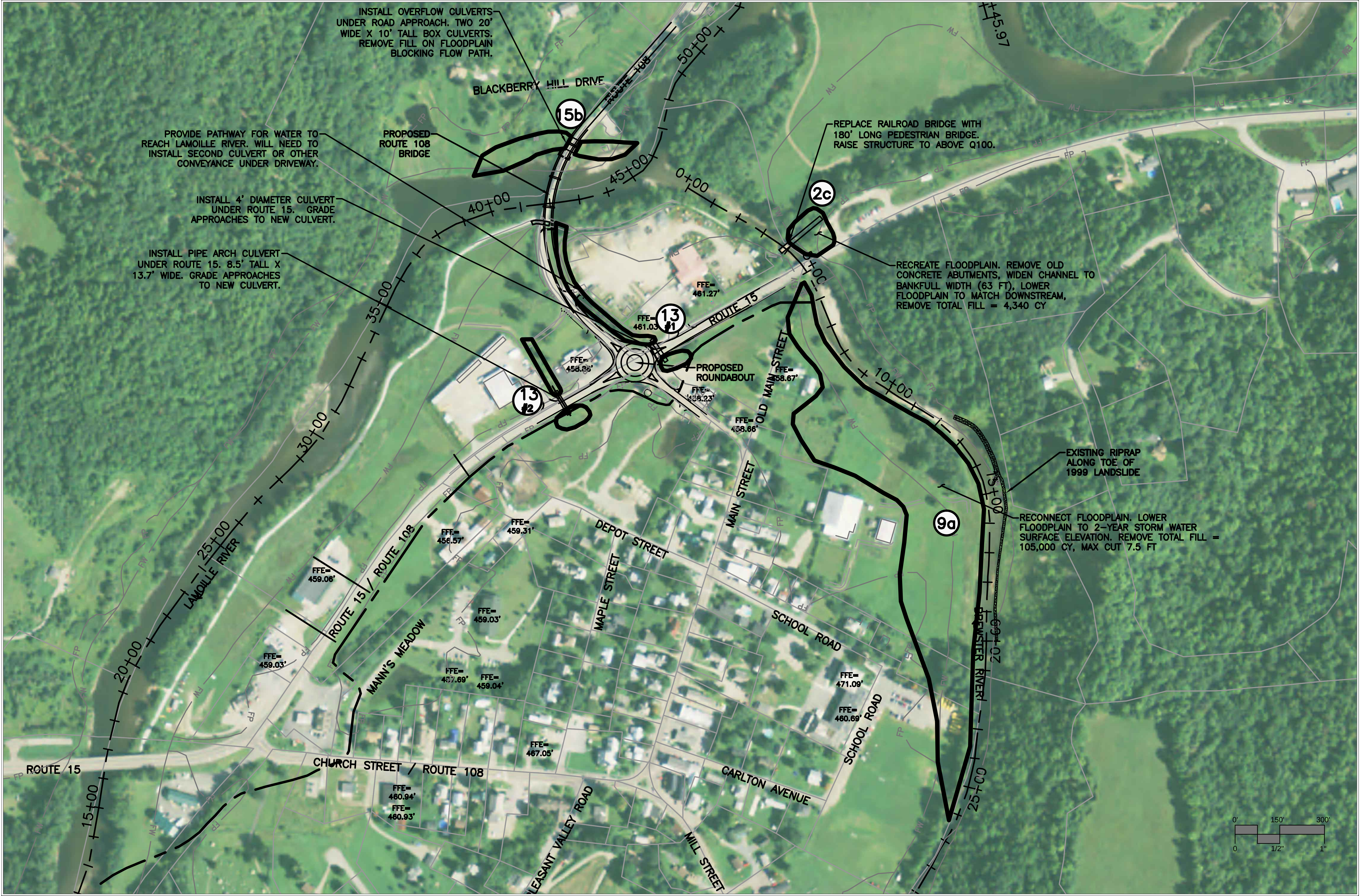
- Alternative 1: Route 15 over the Brewster River
- Alternative 6: Route 15 over the Lamoille River
- Alternative 7: Route 108 over the Lamoille River

6.0 CONCEPTUAL DESIGN

The alternatives analysis has resulted in a set of preferred alternatives that is recommended for final design and implementation to reduce flood and erosion risks (Figure 6-1). The recommended alternatives include:

- Replace the Railroad/Cambridge Greenway Bridge
- Restore the floodplain downstream of the school property
- Install bypass culverts under Route 15
- Install overflow culverts under Route 108

A ballpark opinion of probable final design and implementation costs has been prepared for the preferred alternatives (Table 6.1). The high price of the combined four projects will make it difficult to take on all projects at the same time, so project phasing is anticipated with increasing flood risk reduction benefits as each project is completed. The projects are expected to occur as opportunities present themselves to the village.



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REVISIONS

CONCEPT DESIGN

CONCEPTUAL DESIGN

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

DESIGNED	DRAWN	CHECKED
JCL	JCL	RKS

SCALE: 1"=300'

DATE: NOVEMBER 5, 2013

PROJECT NO.: 2911-03

SHEET NO.: 6-1

Drawing: W:\DESIGN\2911-03-DE\CAD\JV-CONCEPT.DWG Layout Tab:11X17

Plotted by: JESSICAL On this date: Mon, 2013 November 11 - 12:26pm

TABLE 6.1
Ballpark Opinion of Probable Implementation Costs for the Preferred Alternatives

Alternative	Ballpark Cost
Replace Railroad / Cambridge Greenway Bridge	$ 450,000
Restore Floodplain Downstream of School on Brewster River	$ 1,720,000
Install Bypass Culverts under Route 15	$ 400,000
Install Overflow Culverts under Route 108	$ 470,000
Total	**$ 3,040,000**

6.1 Railroad/Cambridge Greenway Bridge Area

Replacement of the Railroad/Cambridge Greenway Bridge with a wider, higher structure in combination with floodplain restoration would improve flood capacity. The river water surface hits the girders at approximately the bankfull channel elevation (Figure 6-2). The bridge opening is narrower than the channel bankfull width. This alternative should improve sediment transport and reduce the risk to infrastructure during flooding over the long term.

The channel is severely constricted by the abutments of both the Railroad/Cambridge Greenway Bridge and the old Route 15 Bridge (Figure 6-3, 6-4). Both sets of abutments and walls should be removed. The floodplain in this location has been filled over time by both the railroad and original Route 15 road embankment on the right and a commercial business to the left. The channel width and right floodplain should be restored. A compound channel should be created that restores the bankfull channel width and creates a floodplain bench to the right side of the channel (Figure 6-5). The bankfull channel width was determined as part of the Phase 2 Geomorphic Assessment to be 62.4 feet. The floodplain bench elevation should be set to match the downstream natural floodplain ground elevation. The floodplain should extend from the channel edge back as far as can be reclaimed without threatening infrastructure or structures. The concept design assumes that the parking area and river and path access drives would be maintained. Approximately 4,340 cubic yards of fill would be removed to achieve this floodplain restoration.

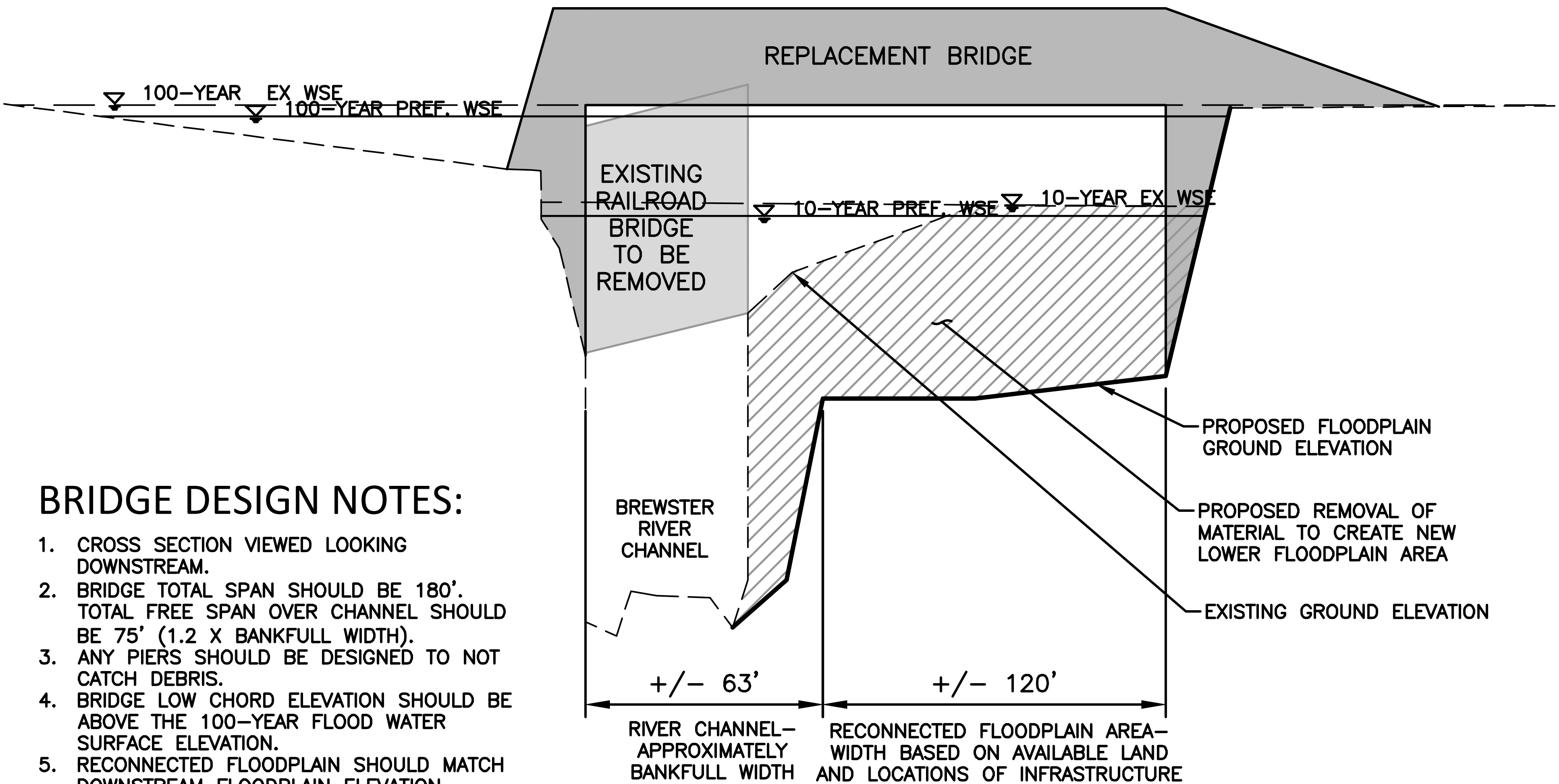
The Railroad/Cambridge Greenway Bridge should be replaced with a 180-foot -long pedestrian bridge. The section of the bridge over the river should include a 75-foot free span. The free span was sized to be 1.2 times the bankfull channel width. The remaining portion of the bridge, over the newly restored floodplain, can have piers. Any piers included in the bridge design should be spaced and oriented to minimize collection of debris. The elevation of the new bridge should be raised 0.5 to 2 feet above the 100-year flood elevation. The village suggested that this bridge be designed to allow for use by snowmobiles and trail grooming equipment.

The bridge replacement and floodplain restoration project is expected to cost approximately $450,000 (Table 6-2).

FIGURE 6-2: Railroad/Cambridge Greenway Bridge with an Approximately Bankfull Flow 5/24/2013 (Source: MMI)

FIGURE 6-3: Railroad/Cambridge Greenway Bridge during low flow 12/6/12. Constricting abutments are shown (Source: FEA).

FIGURE 6-4: Old Route 15 abutment adjacent to Route 15 bridge, shown during low flow 6/6/2013. This concrete abutment is a constriction (Source: MMI).



BRIDGE DESIGN NOTES:

1. CROSS SECTION VIEWED LOOKING DOWNSTREAM.
2. BRIDGE TOTAL SPAN SHOULD BE 180'. TOTAL FREE SPAN OVER CHANNEL SHOULD BE 75' (1.2 X BANKFULL WIDTH).
3. ANY PIERS SHOULD BE DESIGNED TO NOT CATCH DEBRIS.
4. BRIDGE LOW CHORD ELEVATION SHOULD BE ABOVE THE 100-YEAR FLOOD WATER SURFACE ELEVATION.
5. RECONNECTED FLOODPLAIN SHOULD MATCH DOWNSTREAM FLOODPLAIN ELEVATION.
6. REMOVE OLD BRIDGE ABUTMENTS FROM BOTH RAILROAD BRIDGE AND OLD ROUTE 15 BRIDGE.

0' 25' 50'
0 1/2" 1"
SCALE 1" = 50'H
1" = 5'V

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TYPICAL SECTION - BRIDGE REPLACEMENT

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

PROJECT PHASE: **CONCEPT DESIGN**

DRAWING NAME: **6-5**

TABLE 6.2
Ballpark Opinion of Probable Implementation Costs for the Bridge Replacement

Description	Unit	Quantity	Unit Price ($)	Amount ($)
SITE PREPARATION				
MOBILIZATION	LS	1	5,000	5,000
CONSTRUCTION ENTRANCE PADS	EA	1	1,000	1,000
TEMPORARY CONSTRUCTION FENCING	LF	500	3	1,500
INSTALL SILT FENCING/STRAW BALES	LF	350	5	1,750
CONSTRUCTION STAKING/SURVEY	LS	1	2,500	2,500
WATER CONTROL	LS	1	5,000	5,000
TRAFFIC CONTROL	EA	1	2,000	2,000
PEDESTRIAN BRIDGE / FLOODPLAIN RESTORATION				
REMOVAL OF EXISTING RAILROAD/TRAIL BRIDGE	LS	1	30,000	30,000
FURNISH AND INSTALL NEW BRIDGE	LS	1	200,000	200,000
EXCAVATION AND HAUL TO RESTORE FLOODPLAIN	CY	4,340	10	43,400
SEED AND MULCH	LS	1	5,000	5,000
SUBTOTAL				**$ 297,000**
FINAL DESIGN AND PERMITTING				**$ 50,000**
MINOR ADDITIONAL DESIGN ITEMS (10%)				**$ 29,700**
INCIDENTALS TO CONSTRUCTION (10%)				**$ 29,700**
CONSTRUCTION CONTINGENCY (15%)				**$ 44,550**
TOTAL (ROUNDED)				**$ 450,000**

6.2 Floodplain Restoration

Restoring the floodplain between the Cambridge Elementary School and the Route 15 Bridge improves flood capacity and reduces the risk to infrastructure during flooding over the long term. Floodplain restoration is recommended as it is a way to reduce long-term flood risks by increasing the area available to floodwaters that have historically entered the developed portion of the village. The floodplain restoration will lower flood elevation and slow the water velocity. Velocities at the floodbench and the landslide area are reduced by 4.5 cfs for the 10-year storm and 7.7 cfs for the 500-year storm. The reduction of velocity is expected to reduce bank erosion along this section of the channel including along the toe of the landslide area. Velocities are reduced 0.1 cfs at the Route 15 Brewster River Bridge. The Bridge will benefit from this alternative because it is expected that sediment will be deposited on the floodbench instead of all of it being deposited in front of the bridge opening. Our model does not take into account the sediment, so we would expect the reduction in velocity to be more than our model shows.

Following the landslide, a small flood bench was created adjacent to the riverbank that does convey water during high flows (Figure 6-6). This alternative includes excavating the higher land adjacent to the river to a lower level to function similarly to the small flood bench that was created following the landslide.

The area of excavation is primarily open land that has flooded in the past. The land is part of the Windridge/pony farm property (Figure 6-7). The area of excavation also includes a portion of the parking area behind the school. The parking area has been filled over time to expand parking and as a result now creates a severe river constriction. This area has been included in the new floodplain to smooth the transition from the confined channel upstream to the wider new floodplain.

A typical channel cross section including a compound channel has been selected (Figure 6-8). Excavation of 105,000 cubic yards of earth would take place on the flood bench areas to reconnect approximately 8.6 acres of floodplain. The cut depth varies with some areas cut down a maximum of 7.5 feet. The edges of the new floodplain area would be armored to protect homes and infrastructure next to the channel. Nearly 2,200 feet of channel banks would be armored with approximately 3,700 cubic yards of large riprap (diameter = 2 to 3 feet). The riprap would be keyed in a minimum of 2 feet below the lowest spot in the channel cross section. The keyway will need to extend deeper in areas where modeling shows high scour potential.

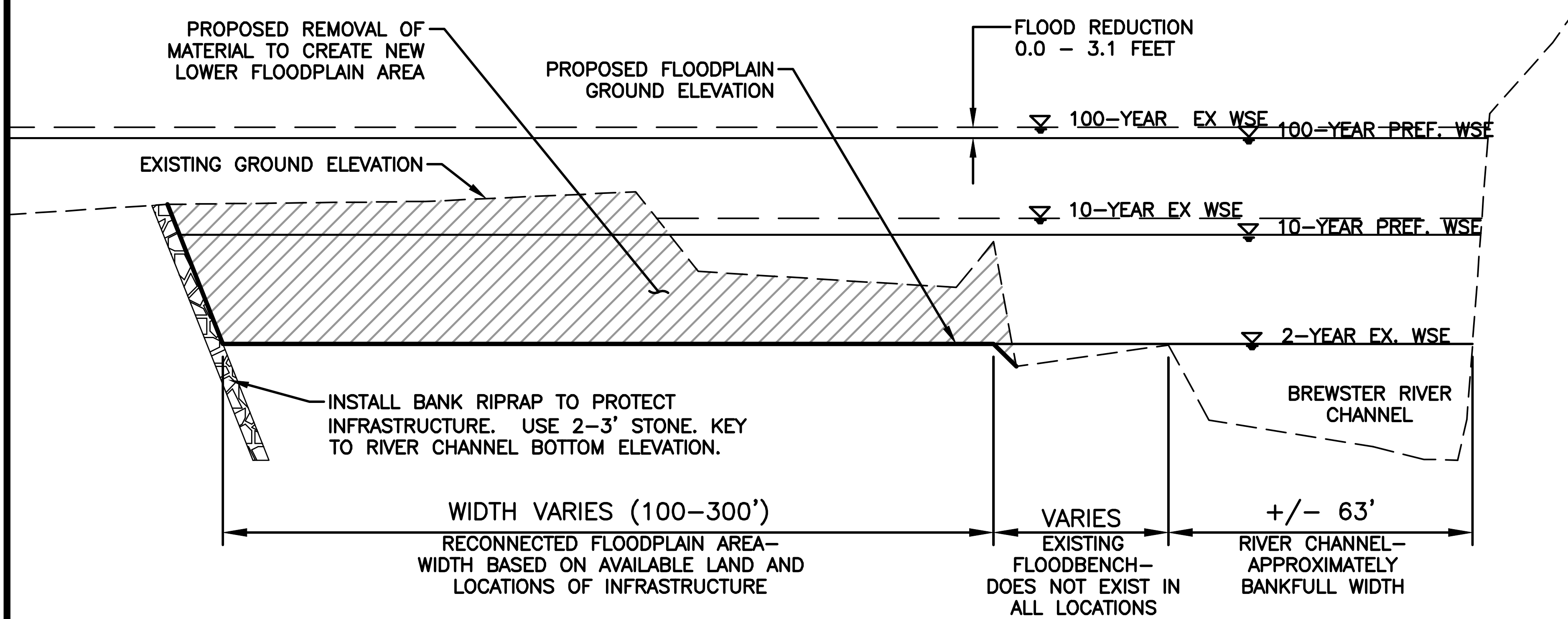
Floodplain creation lowers flood levels, increases sediment storage, and clarifies expectations since the floodplain will be created for the river to flood and store sediment. The spreading out of sediment following floodplain restoration will reduce the likelihood of a large deposition event upstream of the Route 15 Bridge.

Coordination with landowners would be required to determine if this alternative will fit within their plans for the land. Floodplain areas are compatible with many types of land uses such as parks, recreation fields, agriculture, and natural areas.

The floodplain reconnection project is expected to cost approximately $1,720,000 (Table 6-3). But that cost does not include possible grant or in-kind match opportunities. FEMA recently adopted Mitigation Policy FP-108-024-01 that allows the inclusion of environmental benefits in benefit-cost analysis (BCA) to determine the cost effectiveness of acquisition projects. FEMA has assigned value to riparian areas at $37,493 per acre per year, which could potentially amount to $322,440 toward the project cost.

FIGURE 6-6: Small flood bench adjacent to the Brewster River across from the landslide area (viewed looking downstream). This flood bench conveyed water 5/24/2013 (Source: MMI).

FIGURE 6-7: Meadow area just upstream of the Route 15 bridge that is included in the floodplain restoration preferred alternatives. This floodplain did not convey water 5/24/2013 (Source: MMI).



CROSS SECTION VIEWED LOOKING DOWNSTREAM

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0 1/2" 1"
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TYPICAL SECTION - FLOODPLAIN RECONNECTION

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

PROJECT PHASE: **CONCEPT DESIGN**

DRAWING NAME: **6-8**

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TABLE 6.3
Ballpark Opinion of Probable Implementation Costs for the Floodplain Restoration

Description	Unit	Quantity	Unit Price ($)	Amount ($)
SITE PREPARATION				
MOBILIZATION	LS	1	5,000	5,000
CONSTRUCTION ENTRANCE PADS	EA	1	1,000	1,000
TEMPORARY CONSTRUCTION FENCING	LF	4,300	3	12,900
INSTALL SILT FENCING/STRAW BALES	LF	2,200	5	11,000
CONSTRUCTION STAKING/SURVEY	LS	1	2,500	2,500
WATER CONTROL	LS	1	5,000	5,000
TRAFFIC CONTROL	EA	1	2,000	2,000
FLOODPLAIN RESTORATION AT WINDRIDGE				
EXCAVATION AND HAUL TO RESTORE FLOODPLAIN	CY	105,000	10	1,050,000
BANK RIPRAP	CY	3,700	41	149,961
SEED, MULCH, PLANTINGS	LS	1	10,000	10,000
SUBTOTAL				**$ 1,249,000**
FINAL DESIGN AND PERMITTING				**$ 30,000**
MINOR ADDITIONAL DESIGN ITEMS (10%)				**$ 124,900**
INCIDENTALS TO CONSTRUCTION (10%)				**$ 124,900**
CONSTRUCTION CONTINGENCY (15%)				**$ 187,350**
TOTAL (ROUNDED)				**$ 1,720,000**

6.3 Flood Chute Bypass Culverts

Two culverts were selected to improve flow conveyance from the flood chute to the Lamoille River based on their location and proximity to infrastructure. Culvert #1 is an 18-inch corrugated metal pipe located on the upstream (northwest) edge of the roundabout and should be replaced with a 4-foot-diameter culvert. The installation of a larger culvert in this location will be able to divert water back to the Lamoille River before it flows across Main Street. The installation of this culvert will require some grading and ditching at both ends to tie into the existing landscape. Ditching would be required on the downstream end between the existing commercial businesses, which is expected to require a right-of-way for construction and maintenance of this conveyance area. The ditch on the downstream end of the culvert may need upgrading to convey the water all the way to the Lamoille River, including upgrade of a culvert under the side entrance to the commercial business.

Culvert #2 is an 18-inch metal pipe in disrepair. This alternative would replace that culvert with a very large culvert 8.5 feet tall by 13.7 feet wide. The land on either side of the culvert would require grading to direct the water to and from the ends of the culvert. It is estimated that approximately 2,000 cubic yards of material would need to be removed to install this culvert. This culvert is large enough that it could potentially serve as a pedestrian underpass under Route 15. It is located in a prime location to connect to the existing recreation path that runs along the river. The feasibility of making this culvert a safe pedestrian facility should be explored.

The primary purpose of the larger culverts is to convey more water from the village to the Lamoille River, but cross culverts can allow water to flow in both directions. In the case where the Lamoille River is having a very large flood and the Brewster River is not, water could flow back through these culverts into the flood chute and village. The initial modeling suggests that the cross culverts reduce flooding in the village. The modeling also suggests that during very large flood events on the Lamoille River the water already has flow paths to reach the village side of Route 15 other than the proposed culverts. Further assessment of the flow patterns around the bypass culverts is required to advance this conceptual design and confirm that flood risks are not increased in the village.

The replacement of the bypass culverts is expected to cost approximately $400,000 (Table 6-4).

TABLE 6.4
Ballpark Opinion of Probable Implementation Costs for the Bypass Culverts

Description	Unit	Quantity	Unit Price ($)	Amount ($)
SITE PREPARATION				
MOBILIZATION	LS	1	5,000	5,000
CONSTRUCTION ENTRANCE PADS	EA	1	1,000	1,000
TEMPORARY CONSTRUCTION FENCING	LF	2,000	3	6,000
INSTALL SILT FENCING/STRAW BALES	LF	300	5	1,500
CONSTRUCTION STAKING/SURVEY	LS	1	2,500	2,500
TRAFFIC CONTROL	EA	1	15,000	15,000
CHUTE BYPASS CULVERTS				
REMOVAL OF EXISTING CULVERTS AND FILL	LS	2	5,000	10,000
FURNISH AND INSTALL CULVERTS	LS	2	100,000	200,000
DITCHING	CY	8	2,000	16,000
SEED AND MULCH	LS	1	5,000	5,000
SUBTOTAL				**$ 262,000**
FINAL DESIGN AND PERMITTING				**$ 50,000**
MINOR ADDITIONAL DESIGN ITEMS (10%)				**$ 26,200**
INCIDENTALS TO CONSTRUCTION (10%)				**$ 26,200**
CONSTRUCTION CONTINGENCY (15%)				**$ 39,300**
TOTAL (ROUNDED)				**$ 400,000**

6.4 Overflow Culverts at Route 108 Bridge

The water surface elevation just upstream of the Route 108 Bridge is directly influencing the water surface elevation in the Brewster River, so any effort to reduce the backwatering at this bridge would influence the water surface elevations in the village. The installation of overflow culverts under the northern bridge approach would allow additional flood capacity through the bridge opening and could potentially be installed without compromise to the bridge structure or impact to existing commercial businesses.

The installation of two 20-foot-wide box culverts under the northern bridge approach will reduce flood water surface elevations upstream (Figures 6-9, 6-10). The culvert inverts have been chosen based on the 2-year water surface elevation of the river. Grading of the approach and exit areas of the culverts would be required. Approximately 7,200 cubic yards of fill would be removed to create a smooth transition in and out of the new culverts. The rerouting of traffic around the project will complicate construction.

The installation of overflow culverts under Route 108 is expected to cost approximately $470,000 (Table 6-5).

FIGURE 6-9: Looking Upstream at the Temporary Route 108 Bridge Over the Lamoille River (Source: MMI)

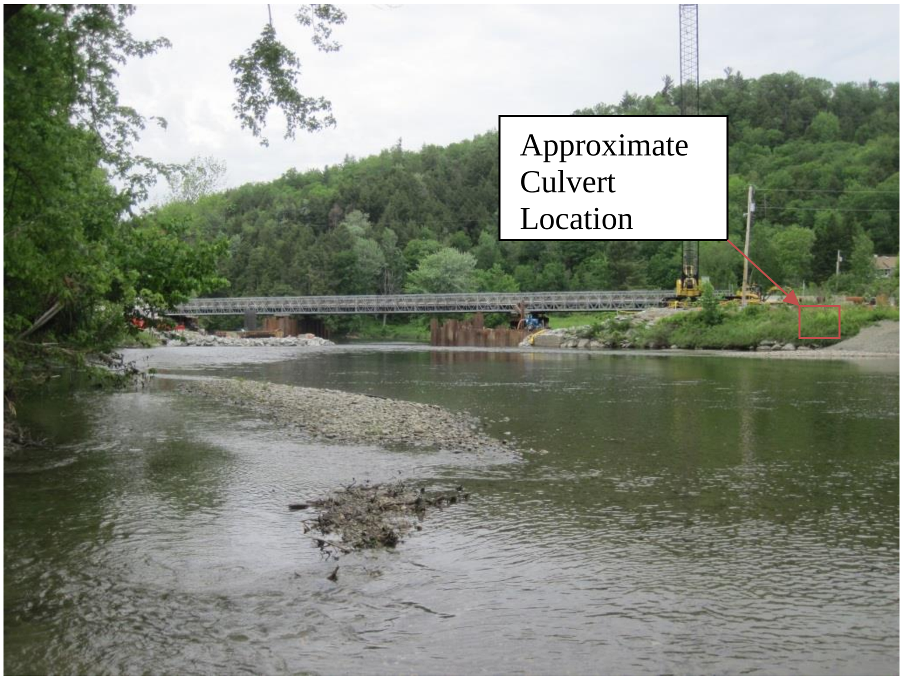

FIGURE 6-10: Looking Downstream at the Temporary Route 108 Bridge Over the Lamoille River (Source: MMI)

TABLE 6.5
Ballpark Opinion of Probable Implementation Costs for the Overflow Culverts

Description	Unit	Quantity	Unit Price ($)	Amount ($)
SITE PREPARATION				
MOBILIZATION	LS	1	5,000	5,000
CONSTRUCTION ENTRANCE PADS	EA	1	1,000	1,000
TEMPORARY CONSTRUCTION FENCING	LF	1,200	3	3,600
INSTALL SILT FENCING/STRAW BALES	LF	700	5	3,500
CONSTRUCTION STAKING/SURVEY	LS	1	2,500	2,500
TRAFFIC CONTROL	EA	1	15,000	15,000
OVERFLOW CULVERTS AT ROUTE 108 BRIDGE				
FILL EXCAVATION	CY	7,200	10	72,000
FURNISH AND INSTALL BOX CULVERTS	LS	2	100,000	200,000
SEED AND MULCH	LS	1	5,000	5,000
SUBTOTAL				**$ 308,000**
FINAL DESIGN AND PERMITTING				**$ 50,000**
MINOR ADDITIONAL DESIGN ITEMS (10%)				**$ 30,800**
INCIDENTALS TO CONSTRUCTION (10%)				**$ 30,800**
CONSTRUCTION CONTINGENCY (15%)				**$ 46,200**
TOTAL (ROUNDED)				**$ 470,000**

6.5 Next Steps

- Create conceptual visualization for project outreach
- Seek consensus for projects and set priority for phased approach
- Work with landowners on project implementation
- Seek grant funding to pay for project costs
- Design, permitting, bidding, construction

7.0 CITED REFERENCES

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2911-03-j814-rpt.docx

APPENDIX A: PROJECT BASEMAP

REFERENCES

1. FIELD SURVEY OF CROSS SECTIONS AND STRUCTURES BY GRENIER ENGINEERING, PC. OF WATERBURY, VERMONT JUNE 2013.
2. BACKGROUND AERIAL PHOTOGRAPH FROM NAIP 2008.
3. SITE FEATURES PARTIALLY DIGITIZED FROM AERIAL PHOTOGRAPHY, REFERENCE #2.
4. APPROXIMATE TOPOGRAPHY CONTOUR DATA CREATED BY MMI FROM VTHYDRODEM SOURCED FROM VCGI.
5. PROPOSED ROUTE 108 BRIDGE AND ROUTE 15/108 ROUNDABOUT LOCATIONS, AND EXISTING TOPOGRAPHY IN THE VICINITY, FROM PLANS: "STATE OF VERMONT AGENCY OF TRANSPORTATION PROPOSED IMPROVEMENT, TOWN OF CAMBRIDGE, COUNTY OF LAMOILLE, VT ROUTE 15 AND VT ROUTE 108, BRIDGE #21 MINOR ARTERIAL, MAJOR COLLECTOR, DATED APRIL 2012.
6. SITE FEATURES ALONG THE BREWSTER RIVER AT THE LANDSLIDE AREA SOURCED FROM PLAN "TOWN OF CAMBRIDGE EWP PROJECT PLANVIEW, U.S. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCE CONSERVATION SERVICE, DATED AUGUST 1999".
7. APPROXIMATE PARCEL BOUNDARIES CIRCA 2006 PROVIDED BY LAMOILLE COUNTY REGIONAL PLANNING COMMISSION.
8. FEMA FLOODPLAIN (FP) AND FLOODWAY (FW) IMPORTED FROM GIS SHAPEFILE PROVIDED BY THE LAMOILLE COUNTY REGIONAL PLANNING COMMISSION.
9. HORIZONTAL DATUM NAD83 STATE PLANE VERMONT FEET. VERTICAL DATUM NAVD88 FEET.

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DESCRIPTION	DATE	BY

PROJECT BASEMAP

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

DESIGNED	DRAWN	CHECKED
RKS	JCL	RKS

SCALE: 1"=200'

DATE: AUGUST 23, 2013

PROJECT NO.: 2911-03

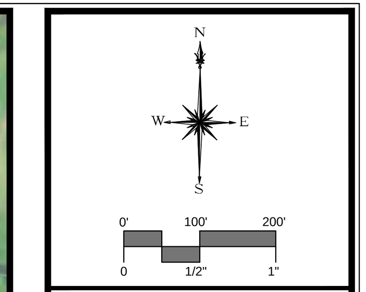
SHEET NO.: 1 OF 1

SHEET NAME: EX-1

APPENDIX B: ALTERNATIVES ANALYSIS MAP

ALTERNATIVES

1a	Removed Route 15 Brewster River Bridge
1b	Removed Sediment Blocking Route 15 Brewster River Bridge
1c	Replace Route 15 Brewster River Bridge with Larger Structure
2a	Removed Railroad Brewster River Bridge
2b	Replaced Railroad Brewster River Bridge with Shallower Structure
2c	Replaced Railroad Brewster River Bridge and Widened Channel
3a	Remove Gravel Bar by Route 15 Brewster River Bridge
4a	Divert water around gravel bar on Brewster
5a	Remove Sediment in Lower Brewster
5b	Dredged Lamoille River Upstream of Route 108 Bridge
6a	Remove Route 15 Bridge over Lamoille
7a	Remove Route 108 Bridge over Lamoille
7b	Remove Route 108 over Lamoille and Approach Fill
8a	Reconnect Lamoille floodplain ds of Rt 15 at apartments
8b	Reconnect Lamoille floodplain us of RT 15
8c	Reconnect Lamoille floodplain ds of Rt 108 bridge
8d	Reconnect Lamoille Floodplain US of Route 108
9a	Reconnect Brewster floodplain ds of school
9b	Reconnect Brewster floodplain at school
10a	Floodwall along Brewster - Route 15 - Town Garage
11a	Floodplain Storage in Lamoille- at Jolley Property
12a	Remove Fairfax Dam
12b	Remove Fairfax Dam and Adjacent Sections
13a	Increase size of culverts #1, #2, #3 under Route 15
13b	Pedestrian Underpass at Culvert #2 Under Route 15
13c	Pedestrian Underpass at Culvert #1 Under Route 15
13d	Large Pedestrian Underpass culverts at #1 and #2
13e	Increase size of culverts #1 & #2, Pedestrian Underpass culvert at #2
14a	Lower section of RT 15
14b	Lower wider section of RT 15 - requires removing joinery 2nd entrance
14c	Removed Route 15 embankment from Floodplain, brought to chute level
15a	One Overflow culvert under Rt 108 approach
15b	Two Overflow culverts under RT108 bridge approach
2c+9a+13e+15b	**Preferred Alternative**



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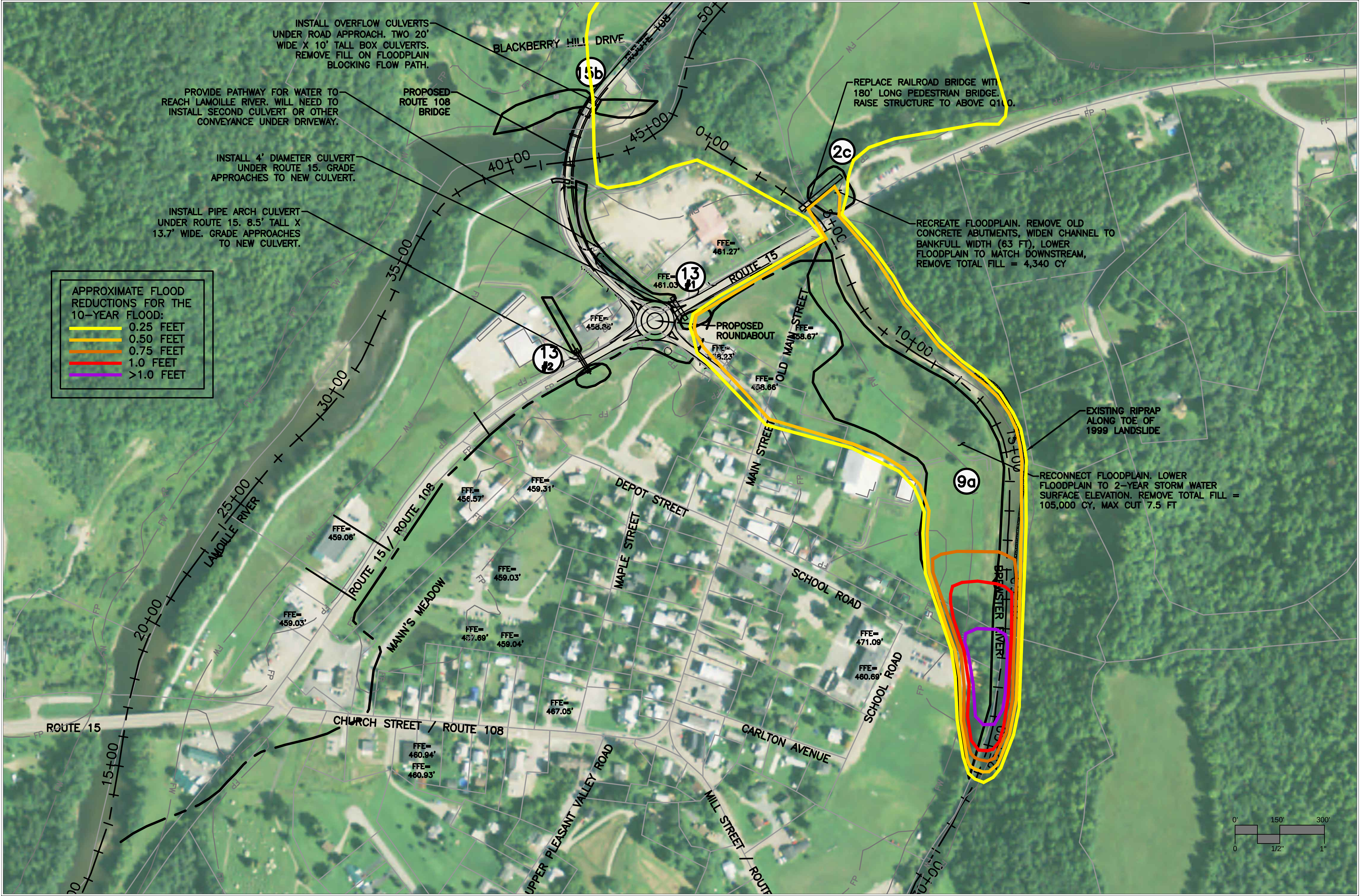
DESCRIPTION	DATE	BY

ALTERNATIVES
JEFFERSONVILLE HAZARD MITIGATION PLAN
JEFFERSONVILLE, VERMONT

DESIGNED	DRAWN	CHECKED
RKS	JCL	RKS

SCALE: 1"=200'
DATE: NOVEMBER 6, 2013
PROJECT NO.: 2911-03
SHEET NO.: 1 OF 1
SHEET NAME: ALT-1

APPENDIX C: FLOOD REDUCTION MAPPING



PREFERRED ALTERNATIVE - APPROX. 10-YR FLOOD REDUCTIONS

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

CONCEPT DESIGN

REVISIONS

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JCL	JCL	RKS

SCALE: 1"=300'

DATE: NOVEMBER 4, 2013

PROJECT NO.: 2911-03

SHEET NO.: 1

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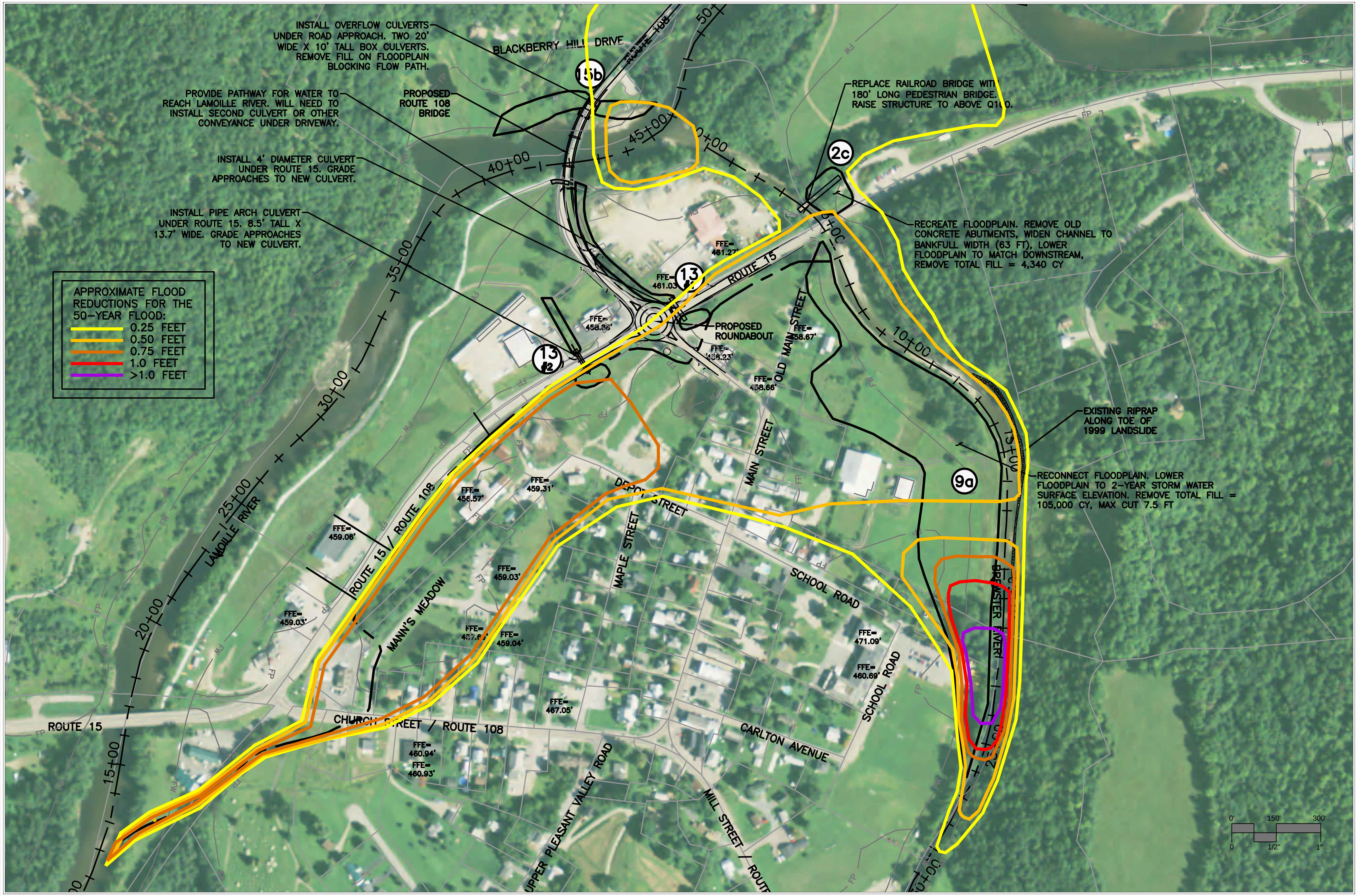
Plotted by: JESSICAL On this date: Mon, 2013 November 4 - 3:12pm



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W E
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PREFERRED ALTERNATIVE - APPROX. 50-YR FLOOD REDUCTIONS

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

CONCEPT DESIGN

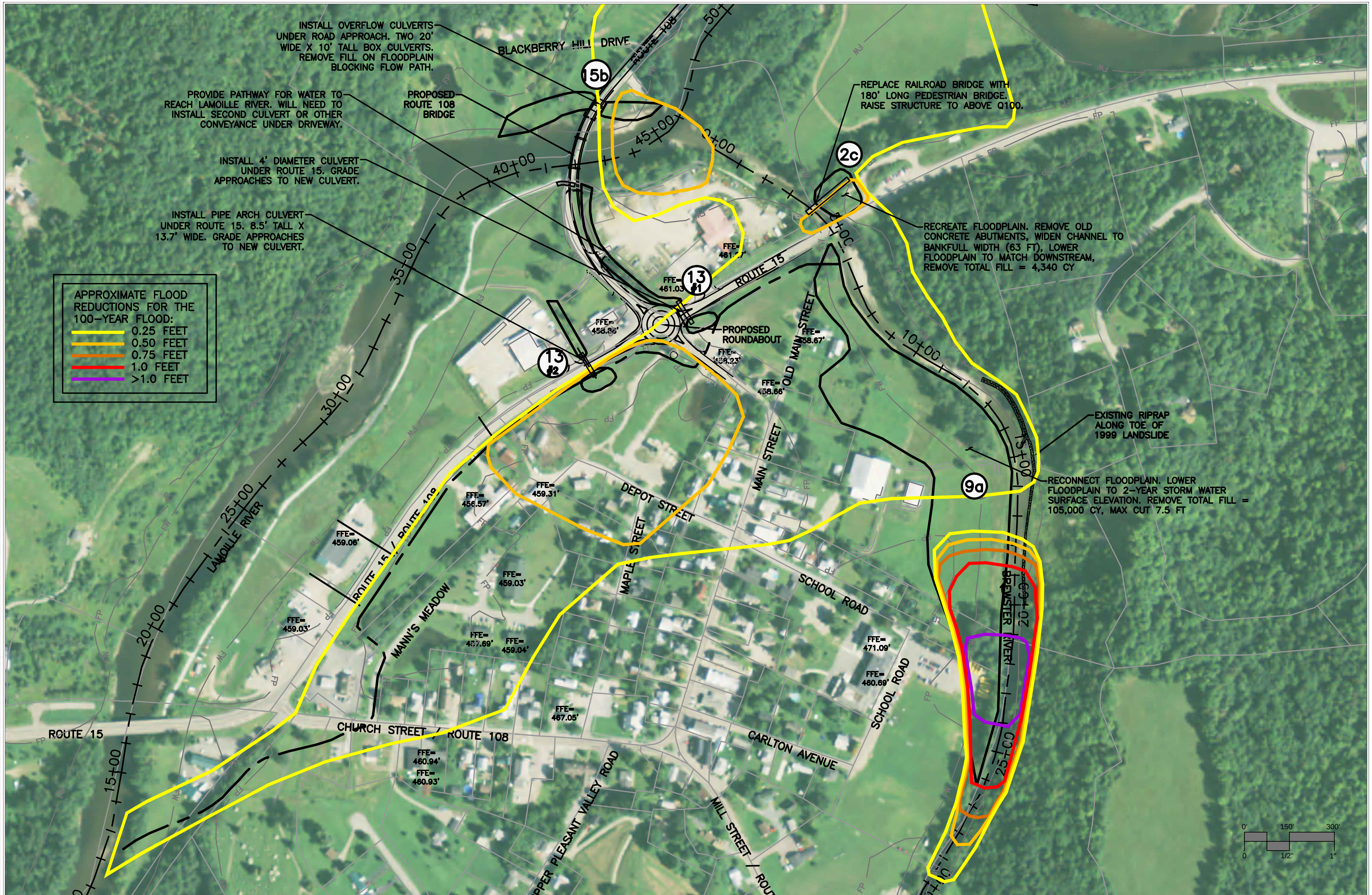
JCL	JCL	RKS
DESIGNED	DRAWN	CHECKED

SCALE 1"=300'

DATE NOVEMBER 4, 2013

PROJECT NO. 2911-03

SHEET NO. 2



PREFERRED ALTERNATIVE - APPROX. 100-YR FLOOD REDUCTIONS

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

CONCEPT DESIGN

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JCL	JCL	RKS

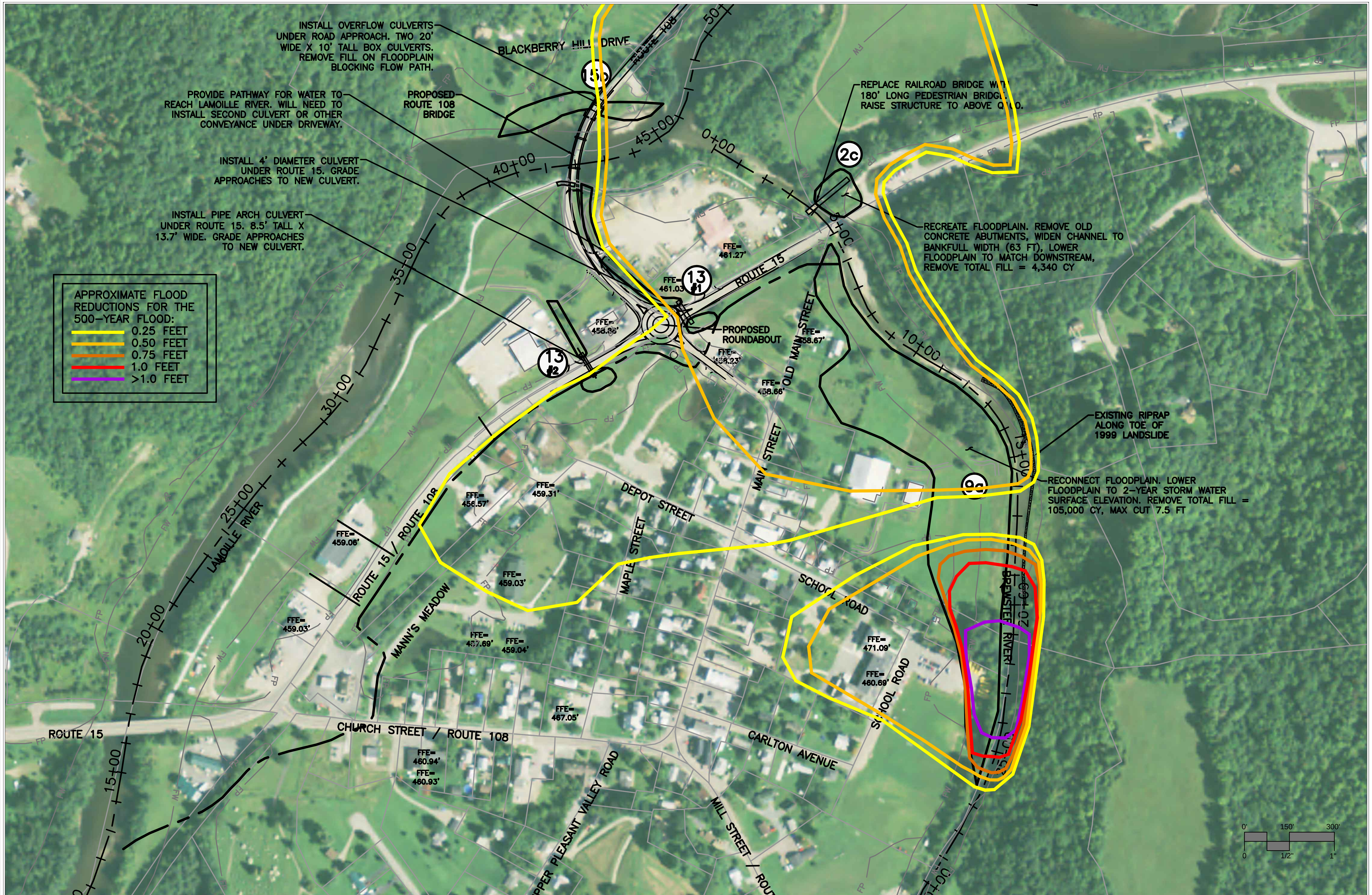
SCALE: 1"=300'

DATE: NOVEMBER 4, 2013

PROJECT NO.: 2911-03

SHEET NO.: 3

Plotted by: JESSICAL On this date: Mon, 2013 November 4 - 3:12pm



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REVISIONS

PREFERRED ALTERNATIVE - APPROX. 500-YR FLOOD REDUCTIONS

JEFFERSONVILLE HAZARD MITIGATION PLAN

JEFFERSONVILLE, VERMONT

CONCEPT DESIGN

JCL	JCL	RKS
DESIGNED	DRAWN	CHECKED

SCALE 1"=300'

DATE NOVEMBER 4, 2013

PROJECT NO. 2911-03

SHEET NO. 4

APPENDIX D: HEC-RAS RESULTS

Plan: Existing-LatStruct-New108+roundabout
2/27/2014

River	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)	
Lamoille	UpperLamoille	6058	10-yr	16765	435	457.75	445.61	457.89	0.000151	3.31	7924.27	1413.25	0.15
Lamoille	UpperLamoille	6058	50-yr	22337	435	460.01	447.07	460.14	0.000135	3.41	11139.25	1612.55	0.14
Lamoille	UpperLamoille	6058	100-yr	24717	435	460.84	447.65	460.97	0.000128	3.42	12485.21	1619.25	0.14
Lamoille	UpperLamoille	6058	500-yr	30335	435	462.54	448.86	462.67	0.00012	3.5	15248.84	1632.93	0.14
Lamoille	UpperLamoille	6058	25-yr	19959	435	458.65	446.49	458.8	0.000159	3.52	9202.1	1420.15	0.15
Lamoille	UpperLamoille	6058	4/27/2011	18674	435	458.98	446.12	459.1	0.000125	3.16	9671.24	1422.68	0.13
Lamoille	UpperLamoille	4934	10-yr	16765	432.3	457.53		457.69	0.000231	3.98	7882.24	1077.44	0.17
Lamoille	UpperLamoille	4934	50-yr	22337	432.3	459.82		459.97	0.000201	4.06	10381.55	1106.71	0.17
Lamoille	UpperLamoille	4934	100-yr	24717	432.3	460.66		460.81	0.000195	4.12	11309.66	1113.94	0.17
Lamoille	UpperLamoille	4934	500-yr	30335	432.3	462.35		462.51	0.000193	4.33	13242.83	1171.81	0.17
Lamoille	UpperLamoille	4934	25-yr	19959	432.3	458.42		458.6	0.000245	4.24	8844.64	1088.8	0.18
Lamoille	UpperLamoille	4934	4/27/2011	18674	432.3	458.8		458.94	0.00019	3.8	9260.22	1093.67	0.16
Lamoille	UpperLamoille	4630	10-yr	16765	439.52	457.14		457.38	0.000454	5.27	6888.23	1081.53	0.24
Lamoille	UpperLamoille	4630	50-yr	22337	439.52	459.49		459.69	0.000351	5.13	9486.57	1117.97	0.22
Lamoille	UpperLamoille	4630	100-yr	24717	439.52	460.33		460.53	0.000331	5.14	10436.34	1124.41	0.22
Lamoille	UpperLamoille	4630	500-yr	30335	439.52	462.03		462.24	0.000313	5.32	12391.12	1170.81	0.21
Lamoille	UpperLamoille	4630	25-yr	19959	439.52	458		458.26	0.000467	5.56	7832.11	1106.67	0.25
Lamoille	UpperLamoille	4630	4/27/2011	18674	439.52	458.48		458.68	0.000343	4.87	8371.65	1110.37	0.22
Lamoille	DSofBrewster	4484	10-yr	18954	440.13	456.56	449.55	457.24	0.001074	6.68	3166.28	357.73	0.32
Lamoille	DSofBrewster	4484	50-yr	25271.99	440.13	458.71	451	459.54	0.001103	7.49	3990.31	409.11	0.34
Lamoille	DSofBrewster	4484	100-yr	27118.02	440.13	459.54	451.37	460.39	0.001052	7.57	4343.16	442.97	0.33
Lamoille	DSofBrewster	4484	500-yr	30335	440.13	461.58	452.05	462.14	0.00067	6.55	7178.11	870.05	0.27
Lamoille	DSofBrewster	4484	25-yr	21302.2	440.13	457.37	450.1	458.11	0.001096	7.02	3462.38	376.94	0.33
Lamoille	DSofBrewster	4484	4/27/2011	22493.18	440.13	457.76	450.37	458.53	0.001104	7.18	3613.08	386.35	0.33
Lamoille	DSofBrewster	4266	10-yr	18963.5	440.1	456	449.29	456.92	0.001793	7.71	2540.4	236.1	0.37
Lamoille	DSofBrewster	4266	50-yr	25365.85	440.1	458	450.94	459.19	0.001969	8.87	3039.8	264.55	0.4
Lamoille	DSofBrewster	4266	100-yr	27608.64	440.1	458.78	451.48	460.04	0.001951	9.12	3252.28	275.58	0.4
Lamoille	DSofBrewster	4266	500-yr	32271.07	440.1	460.5	452.55	461.83	0.001839	9.47	3731.38	283.36	0.39
Lamoille	DSofBrewster	4266	25-yr	21312.5	440.1	456.75	449.92	457.77	0.001874	8.18	2720.83	246.76	0.38
Lamoille	DSofBrewster	4266	4/27/2011	22504.65	440.1	457.11	450.22	458.19	0.00191	8.4	2812.13	251.98	0.39
Lamoille	DSofBrewster	4200		Bridge									
Lamoille	DSofBrewster	4054	10-yr	18963.5	437.88	455.56	447.84	456.06	0.00084	6.09	3689.77	645.35	0.29
Lamoille	DSofBrewster	4054	50-yr	25469.37	437.88	457.55	450.05	458.16	0.000879	6.81	4489.35	682.29	0.3
Lamoille	DSofBrewster	4054	100-yr	27959.84	437.88	458.36	450.86	459	0.000865	6.99	4833.23	702.83	0.3
Lamoille	DSofBrewster	4054	500-yr	33454.99	437.88	460.12	452.2	460.82	0.000825	7.31	5614.06	854.22	0.3
Lamoille	DSofBrewster	4054	25-yr	21312.5	437.88	456.3	448.54	456.84	0.000858	6.37	3980.62	659.11	0.3
Lamoille	DSofBrewster	4054	4/27/2011	22511.03	437.88	456.66	448.97	457.23	0.000867	6.51	4126.49	665.87	0.3
Lamoille	DSofBrewster	3464	10-yr	18965	436.2	454.8	447.85	455.59	0.001227	7.36	3195.99	455.92	0.35
Lamoille	DSofBrewster	3464	50-yr	25638.27	436.2	456.73	449.66	457.66	0.001292	8.23	4092.52	476.02	0.36
Lamoille	DSofBrewster	3464	100-yr	28566.62	436.2	457.51	450.4	458.5	0.001302	8.53	4468.13	481.47	0.37
Lamoille	DSofBrewster	3464	500-yr	35186.24	436.2	459.25	452.15	460.31	0.001283	9.05	5335.53	576.25	0.37
Lamoille	DSofBrewster	3464	25-yr	21324	436.2	455.52	448.51	456.36	0.001256	7.7	3524.13	463.38	0.35
Lamoille	DSofBrewster	3464	4/27/2011	22526.55	436.2	455.87	448.84	456.74	0.001265	7.85	3689.21	467.09	0.36
Lamoille	DSofBrewster	2965	10-yr	18965	436.29	454.59	447.42	454.94	0.000662	4.9	4615.2	648.66	0.25
Lamoille	DSofBrewster	2965	50-yr	25651.72	436.29	456.55	448.6	456.95	0.000666	5.38	5934.02	680.52	0.25
Lamoille	DSofBrewster	2965	100-yr	28608.36	436.29	457.36	449.07	457.77	0.000662	5.55	6481.69	686.53	0.25
Lamoille	DSofBrewster	2965	500-yr	35450.77	436.29	459.12	450.14	459.58	0.000645	5.87	7706.84	699.79	0.25
Lamoille	DSofBrewster	2965	25-yr	21336.86	436.29	455.32	447.86	455.68	0.000667	5.1	5097.63	671.23	0.25
Lamoille	DSofBrewster	2965	4/27/2011	22540.76	436.29	455.68	448.07	456.06	0.000666	5.18	5341.93	673.96	0.25
Lamoille	DSofBrewster	2497	10-yr	18965	439.94	453.54	447.69	454.43	0.001533	7.77	2901.8	442.15	0.38
Lamoille	DSofBrewster	2497	50-yr	25652.86	439.94	455.36	449.33	456.42	0.001617	8.72	3764.45	489.79	0.4
Lamoille	DSofBrewster	2497	100-yr	28609.39	439.94	456.12	450.01	457.24	0.001621	9.03	4140.07	495.82	0.4
Lamoille	DSofBrewster	2497	500-yr	35451.64	439.94	457.79	452.32	459.04	0.001636	9.71	4979.63	529.67	0.41
Lamoille	DSofBrewster	2497	25-yr	21337.93	439.94	454.2	448.28	455.17	0.001581	8.16	3204.45	474.65	0.39
Lamoille	DSofBrewster	2497	4/27/2011	22541.97	439.94	454.54	448.58	455.54	0.001591	8.32	3367.49	483.33	0.39
Lamoille	DSofBrewster	2198	10-yr	18965	439.04	453.11	447.7	453.95	0.001569	7.77	3157.44	499.72	0.39
Lamoille	DSofBrewster	2198	50-yr	25666.23	439.04	454.97	449.92	455.91	0.001557	8.49	4130.16	542.9	0.39
Lamoille	DSofBrewster	2198	100-yr	28683.26	439.04	455.75	451.26	456.72	0.001535	8.73	4557.42	551.26	0.4
Lamoille	DSofBrewster	2198	500-yr	35740.19	439.04	457.45	452.57	458.51	0.00151	9.29	5527.3	658.92	0.4
Lamoille	DSofBrewster	2198	25-yr	21339.14	439.04	453.79	448.36	454.67	0.001577	8.07	3499.63	518.48	0.39
Lamoille	DSofBrewster	2198	4/27/2011	22543.33	439.04	454.14	448.69	455.03	0.001568	8.19	3681.94	528.2	0.39
Lamoille	DSofBrewster	1835	10-yr	18965	435.81	453.06	445.21	453.47	0.000682	5.42	4104.03	470.26	0.26
Lamoille	DSofBrewster	1835	50-yr	25677.14	435.81	454.89	446.62	455.42	0.00075	6.19	4992.83	514.7	0.28
Lamoille	DSofBrewster	1835	100-yr	28747.75	435.81	455.62	447.22	456.23	0.000816	6.66	5406.51	596.65	0.29

Plan: Existing-LatStruct-New108+roundabout
2/27/2014

River	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)	
Lamoille	DSofBrewster	1835	500-yr	35984.09	435.81	457.33	449.07	458.02	0.000833	7.2	6459.21	639.51	0.3
Lamoille	DSofBrewster	1835	25-yr	21339.14	435.81	453.72	445.72	454.18	0.000712	5.72	4420.29	479.99	0.27
Lamoille	DSofBrewster	1835	4/27/2011	22543.33	435.81	454.07	445.97	454.54	0.000721	5.85	4586.83	485.03	0.27
Lamoille	DSofBrewster	1674	10-yr	18965	432.42	452.48	444.26	453.3	0.001163	7.31	2731.37	240.05	0.33
Lamoille	DSofBrewster	1674	50-yr	25677.14	432.42	454.02	446.17	455.19	0.001496	8.86	3116.39	256.07	0.38
Lamoille	DSofBrewster	1674	100-yr	28747.75	432.42	454.64	447.01	455.98	0.001637	9.49	3275.91	258.61	0.41
Lamoille	DSofBrewster	1674	500-yr	35984.09	432.42	455.98	448.93	457.72	0.001938	10.87	3626.79	264.12	0.45
Lamoille	DSofBrewster	1674	25-yr	21339.14	432.42	453.04	444.96	453.99	0.001292	7.9	2868.89	252.01	0.35
Lamoille	DSofBrewster	1674	4/27/2011	22543.33	432.42	453.33	445.31	454.34	0.001346	8.17	2942.96	253.28	0.36
Lamoille	DSofBrewster	1650		Bridge									
Lamoille	DSofBrewster	1519	10-yr	18965	437.14	452.12	445.79	452.93	0.001408	7.39	3013.91	444.76	0.37
Lamoille	DSofBrewster	1519	50-yr	25677.14	437.14	453.58	447.44	454.69	0.001683	8.7	3649.05	719.53	0.41
Lamoille	DSofBrewster	1519	100-yr	28747.75	437.14	454.18	448.15	455.41	0.001794	9.23	3908.03	841.43	0.43
Lamoille	DSofBrewster	1519	500-yr	35984.09	437.14	455.46	450.14	456.97	0.002022	10.37	4465.87	1012.54	0.46
Lamoille	DSofBrewster	1519	25-yr	21339.14	437.14	452.65	446.39	453.57	0.001519	7.89	3243.37	523.99	0.39
Lamoille	DSofBrewster	1519	4/27/2011	22543.33	437.14	452.93	446.69	453.9	0.00156	8.11	3366.15	583.38	0.39
Lamoille	LowerLamoille	110	10-yr	18965	432.88	448.84	445.36	448.99	0.000366	4.31	8901.52	1647.88	0.21
Lamoille	LowerLamoille	110	50-yr	26187	432.88	450.34	446.02	450.49	0.000355	4.56	11396.85	1671.06	0.21
Lamoille	LowerLamoille	110	100-yr	29467	432.88	451	446.31	451.15	0.000346	4.64	12491.16	1681.13	0.21
Lamoille	LowerLamoille	110	500-yr	37135	432.88	452.47	446.91	452.62	0.000325	4.79	14979.25	1695.94	0.21
Lamoille	LowerLamoille	110	25-yr	21429	432.88	449.43	445.57	449.58	0.000353	4.35	9882.77	1657.03	0.21
Lamoille	LowerLamoille	110	4/27/2011	22851	432.88	449.7	445.71	449.84	0.000356	4.43	10319.41	1661.09	0.21
Lamoille	LowerLamoille	109	10-yr	18965	432.98	447.51		447.66	0.000766	3.4	6663.73	1144.81	0.2
Lamoille	LowerLamoille	109	50-yr	26187	432.98	449.07		449.25	0.000727	3.7	8492.02	1190.62	0.2
Lamoille	LowerLamoille	109	100-yr	29467	432.98	449.76		449.95	0.000702	3.8	9321.9	1210.78	0.2
Lamoille	LowerLamoille	109	500-yr	37135	432.98	451.32		451.52	0.000644	3.98	11246.92	1256.29	0.2
Lamoille	LowerLamoille	109	25-yr	21429	432.98	448.17		448.33	0.000716	3.45	7434.2	1164.42	0.2
Lamoille	LowerLamoille	109	4/27/2011	22851	432.98	448.42		448.58	0.00073	3.55	7720.67	1171.57	0.2
Lamoille	LowerLamoille	108	10-yr	18965	431.08	445.77		446.31	0.001025	6.79	4884.03	1174.98	0.36
Lamoille	LowerLamoille	108	50-yr	26187	431.08	447.55		448.05	0.00088	6.93	7009.62	1221.54	0.34
Lamoille	LowerLamoille	108	100-yr	29467	431.08	448.34		448.82	0.000815	6.94	7979.73	1235.69	0.33
Lamoille	LowerLamoille	108	500-yr	37135	431.08	450.08		450.52	0.0007	6.96	10155.33	1263.97	0.31
Lamoille	LowerLamoille	108	25-yr	21429	431.08	446.68		447.15	0.000855	6.53	5960.76	1198.79	0.33
Lamoille	LowerLamoille	108	4/27/2011	22851	431.08	446.88		447.37	0.000892	6.74	6193.05	1203.87	0.34
Lamoille	LowerLamoille	107	10-yr	18965	429.38	445.34		445.44	0.000437	3.24	9172.33	1677.28	0.18
Lamoille	LowerLamoille	107	50-yr	26187	429.38	447.2		447.29	0.000358	3.28	12334.27	1719.17	0.17
Lamoille	LowerLamoille	107	100-yr	29467	429.38	448.02		448.12	0.000329	3.29	13754.37	1735.11	0.16
Lamoille	LowerLamoille	107	500-yr	37135	429.38	449.82		449.91	0.000283	3.32	16894.96	1762.05	0.15
Lamoille	LowerLamoille	107	25-yr	21429	429.38	446.34		446.43	0.000345	3.07	10868.02	1699.87	0.16
Lamoille	LowerLamoille	107	4/27/2011	22851	429.38	446.52		446.61	0.000363	3.18	11167.33	1703.83	0.17
Lamoille	LowerLamoille	106	10-yr	18965	428.48	443.81		444.06	0.000571	4.96	8779.91	1771.22	0.26
Lamoille	LowerLamoille	106	50-yr	26187	428.48	446.11		446.31	0.00041	4.76	12979.25	1883.26	0.23
Lamoille	LowerLamoille	106	100-yr	29467	428.48	447.04		447.24	0.000369	4.73	14769.05	1929.03	0.22
Lamoille	LowerLamoille	106	500-yr	37135	428.48	449.01		449.19	0.000311	4.73	18624.39	1973.32	0.21
Lamoille	LowerLamoille	106	25-yr	21429	428.48	445.3		445.47	0.000377	4.38	11470.2	1843.78	0.22
Lamoille	LowerLamoille	106	4/27/2011	22851	428.48	445.4		445.59	0.000412	4.6	11655.68	1848.68	0.23
Lamoille	LowerLamoille	105.4	10-yr	19788	428.18	443.53	436.24	443.91	0.000627	4.89	4047.92	451.83	0.27
Lamoille	LowerLamoille	105.4	50-yr	27283	428.18	445.63	437.55	446.12	0.000655	5.61	4865.65	2172.71	0.28
Lamoille	LowerLamoille	105.4	100-yr	30680	428.18	446.49	438.09	447.03	0.000662	5.9	5202.43	2178.4	0.28
Lamoille	LowerLamoille	105.4	500-yr	38624	428.18	448.92	439.27	449.12	0.000277	4.26	15562.57	2250	0.19
Lamoille	LowerLamoille	105.4	25-yr	22408	428.18	444.96	436.71	445.33	0.000531	4.87	4604.11	2168.29	0.25
Lamoille	LowerLamoille	105.4	4/27/2011	23767	428.18	445.02	436.96	445.43	0.000587	5.14	4627.47	2168.68	0.26
Lamoille	LowerLamoille	105.25		Bridge									
Lamoille	LowerLamoille	105.1	10-yr	19788	428.18	443.46	436.24	443.83	0.000641	4.92	4017.94	385.7	0.27
Lamoille	LowerLamoille	105.1	50-yr	27283	428.18	445.53	437.55	446.03	0.000672	5.65	4826.97	2172.05	0.28
Lamoille	LowerLamoille	105.1	100-yr	30680	428.18	446.35	438.09	446.9	0.000687	5.96	5145.93	2177.44	0.29
Lamoille	LowerLamoille	105.1	500-yr	38624	428.18	448.59	439.27	448.81	0.000311	4.45	14829.99	2233.15	0.2
Lamoille	LowerLamoille	105.1	25-yr	22408	428.18	444.89	436.71	445.26	0.000542	4.9	4576.77	2167.83	0.25
Lamoille	LowerLamoille	105.1	4/27/2011	23767	428.18	444.94	436.96	445.36	0.000601	5.17	4596.73	2168.16	0.27
Lamoille	LowerLamoille	104	10-yr	19788	427.38	443.17		443.6	0.000619	5.43	4458.81	764.48	0.28
Lamoille	LowerLamoille	104	50-yr	27283	427.38	445.33		445.8	0.000578	5.87	6297.49	909.71	0.28
Lamoille	LowerLamoille	104	100-yr	30680	427.38	446.17		446.66	0.000566	6.04	7077.66	952.65	0.28
Lamoille	LowerLamoille	104	500-yr	38624	427.38	448.06		448.59	0.00055	6.46	9460.79	2352.73	0.28

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River	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)	
Lamoille	LowerLamoille	104	25-yr	22408	427.38	444.72		445.09	0.000474	5.16	5749.17	878.28	0.25
Lamoille	LowerLamoille	104	4/27/2011	23767	427.38	444.75		445.16	0.000527	5.45	5777.29	879.92	0.26
Lamoille	LowerLamoille	103	10-yr	19788	418.98	443.09		443.23	0.0003	3.97	7782.67	1185.04	0.18
Lamoille	LowerLamoille	103	50-yr	27283	418.98	445.33		445.47	0.00025	3.96	10650.38	1357.79	0.16
Lamoille	LowerLamoille	103	100-yr	30680	418.98	446.19		446.33	0.000237	3.98	11846.62	1419.18	0.16
Lamoille	LowerLamoille	103	500-yr	38624	418.98	448.14		448.28	0.000209	3.99	14763.55	1627.54	0.15
Lamoille	LowerLamoille	103	25-yr	22408	418.98	444.7		444.81	0.00021	3.55	9809.75	1312.94	0.15
Lamoille	LowerLamoille	103	4/27/2011	23767	418.98	444.73		444.86	0.000234	3.75	9850.53	1315.15	0.16
Lamoille	LowerLamoille	102	10-yr	19788	422.18	442.67		442.71	0.000132	2.45	14560.38	2178.04	0.11
Lamoille	LowerLamoille	102	50-yr	27283	422.18	445		445.04	0.000109	2.44	20104.66	2515.18	0.1
Lamoille	LowerLamoille	102	100-yr	30680	422.18	445.88		445.93	0.000103	2.44	22339.46	2536.56	0.1
Lamoille	LowerLamoille	102	500-yr	38624	422.18	447.88		447.92	0.00009	2.44	27451.65	2581.95	0.09
Lamoille	LowerLamoille	102	25-yr	22408	422.18	444.42		444.46	0.00009	2.17	18661.94	2501.28	0.09
Lamoille	LowerLamoille	102	4/27/2011	23767	422.18	444.42		444.46	0.000102	2.3	18653.23	2501.2	0.09
Lamoille	LowerLamoille	101	10-yr	19788	424.88	442.51		442.52	0.000025	1.05	23714.29	2127.79	0.05
Lamoille	LowerLamoille	101	50-yr	27283	424.88	444.84		444.86	0.000026	1.17	28701.97	2148.64	0.05
Lamoille	LowerLamoille	101	100-yr	30680	424.88	445.73		445.74	0.000026	1.22	30603.74	2156.53	0.05
Lamoille	LowerLamoille	101	500-yr	38624	424.88	447.72		447.74	0.000027	1.33	34929.77	2177.32	0.05
Lamoille	LowerLamoille	101	25-yr	22408	424.88	444.3		444.31	0.00002	1.01	27540.57	2143.8	0.04
Lamoille	LowerLamoille	101	4/27/2011	23767	424.88	444.28		444.29	0.000022	1.07	27499.22	2143.63	0.04
Lamoille	LowerLamoille	39	10-yr	19788	422.68	442.41		442.46	0.000053	2.54	19388.62	2439.39	0.11
Lamoille	LowerLamoille	39	50-yr	27283	422.68	444.75		444.8	0.000049	2.66	25145.02	2484.12	0.11
Lamoille	LowerLamoille	39	100-yr	30680	422.68	445.64		445.69	0.000049	2.74	27349.25	2504	0.11
Lamoille	LowerLamoille	39	500-yr	38624	422.68	447.64		447.69	0.000047	2.88	32401.94	2549	0.11
Lamoille	LowerLamoille	39	25-yr	22408	422.68	444.23		444.27	0.000038	2.31	23852.27	2472.38	0.09
Lamoille	LowerLamoille	39	4/27/2011	23767	422.68	444.2		444.24	0.000043	2.46	23781.29	2471.74	0.1
Lamoille	LowerLamoille	38	10-yr	19788	422.68	442.3		442.4	0.000089	3.19	12516.66	1751.24	0.14
Lamoille	LowerLamoille	38	50-yr	27283	422.68	444.65		444.75	0.000081	3.34	16659.31	1778.38	0.13
Lamoille	LowerLamoille	38	100-yr	30680	422.68	445.54		445.63	0.000081	3.43	18236.45	1790.53	0.14
Lamoille	LowerLamoille	38	500-yr	38624	422.68	447.54		447.64	0.000078	3.6	21847.07	1818.05	0.14
Lamoille	LowerLamoille	38	25-yr	22408	422.68	444.15		444.22	0.000063	2.9	15772.71	1771.51	0.12
Lamoille	LowerLamoille	38	4/27/2011	23767	422.68	444.11		444.2	0.000072	3.09	15702.98	1770.97	0.13
Lamoille	LowerLamoille	37	10-yr	19788	419.68	441.31		441.87	0.000404	6.28	4292.78	670.12	0.29
Lamoille	LowerLamoille	37	50-yr	27283	419.68	443.64		444.25	0.000391	6.83	5879.59	691.67	0.29
Lamoille	LowerLamoille	37	100-yr	30680	419.68	444.5		445.14	0.000395	7.09	6474	699.58	0.3
Lamoille	LowerLamoille	37	500-yr	38624	419.68	446.47		447.15	0.000388	7.54	7868.59	717.78	0.3
Lamoille	LowerLamoille	37	25-yr	22408	419.68	443.42		443.85	0.00028	5.73	5725.67	689.61	0.25
Lamoille	LowerLamoille	37	4/27/2011	23767	419.68	443.26		443.77	0.000329	6.17	5616.98	688.15	0.27
Lamoille	LowerLamoille	36	10-yr	19788	422.28	439.8	430.97	440.44	0.000463	6.43	3153.63	877.25	0.3
Lamoille	LowerLamoille	36	50-yr	27283	422.28	442	432.74	442.8	0.000494	7.33	5128.96	918.5	0.32
Lamoille	LowerLamoille	36	100-yr	30680	422.28	442.8	433.5	443.65	0.000508	7.67	5869.75	933.5	0.33
Lamoille	LowerLamoille	36	500-yr	38624	422.28	444.8	435.28	445.71	0.000493	8.14	7868.67	1089.6	0.33
Lamoille	LowerLamoille	36	25-yr	22408	422.28	442.4	431.6	442.9	0.0003	5.81	5497.86	926	0.25
Lamoille	LowerLamoille	36	4/27/2011	23767	422.28	442	431.92	442.6	0.000375	6.38	5128.96	918.5	0.28
Floodchute	Jeffersonville	4484	10-yr	11	456.45	457.64	456.65	457.64	0.000006	0.06	199.76	335.75	0.01
Floodchute	Jeffersonville	4484	50-yr	915.01	456.45	459.99	457.65	459.99	0.000152	0.65	1543.45	778.63	0.07
Floodchute	Jeffersonville	4484	100-yr	2348.98	456.45	460.67	458.23	460.69	0.000414	1.22	2116.93	881.51	0.13
Floodchute	Jeffersonville	4484	500-yr	6800	456.45	461.84	459.19	461.91	0.000984	2.34	3204	955	0.2
Floodchute	Jeffersonville	4484	25-yr	126.8	456.45	458.71	457.03	458.71	0.000026	0.2	697.72	555.52	0.03
Floodchute	Jeffersonville	4484	4/27/2011	357.82	456.45	459.43	457.28	459.43	0.000053	0.34	1140.92	677.76	0.04
Floodchute	Jeffersonville	4300		Lat Struct									
Floodchute	Jeffersonville	4266	10-yr	1.5	456.45	457.64	456.54	457.64	0	0.01	253.67	406.67	0
Floodchute	Jeffersonville	4266	50-yr	821.15	456.45	459.96	457.48	459.97	0.000067	0.53	1730	776.01	0.06
Floodchute	Jeffersonville	4266	100-yr	1858.36	456.45	460.62	457.91	460.63	0.000157	0.94	2261.93	846.16	0.09
Floodchute	Jeffersonville	4266	500-yr	4863.94	456.45	461.72	458.62	461.76	0.000373	1.74	3249.06	925.2	0.14
Floodchute	Jeffersonville	4266	25-yr	116.5	456.45	458.71	456.98	458.71	0.000011	0.15	846.12	637.36	0.02
Floodchute	Jeffersonville	4266	4/27/2011	346.35	456.45	459.43	457.2	459.43	0.000026	0.29	1328.56	712.25	0.03
Floodchute	Jeffersonville	4200	10-yr	1.5	457.53	457.61	457.61	457.63	0.14305	1.16	1.29	39.22	1.12
Floodchute	Jeffersonville	4200	50-yr	821.15	457.53	459.95	458.33	459.96	0.000267	0.75	1132.28	678.11	0.1
Floodchute	Jeffersonville	4200	100-yr	1857.23	457.53	460.59	458.68	460.62	0.000492	1.22	1601	784.31	0.14
Floodchute	Jeffersonville	4200	500-yr	4785.41	457.53	461.66	459.34	461.72	0.000893	2.09	2502.8	904.36	0.19
Floodchute	Jeffersonville	4200	25-yr	116.5	457.53	458.7	457.92	458.71	0.000141	0.3	393.5	513.39	0.06
Floodchute	Jeffersonville	4200	4/27/2011	346.35	457.53	459.42	458.12	459.42	0.00014	0.44	791.14	603.48	0.07

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River	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)	
Floodchute	Jeffersonville	4054	10-yr	1.5	454.86	457.29	455	457.29	0	0.01	249.38	194.59	0
Floodchute	Jeffersonville	4054	50-yr	717.63	454.86	459.92	456.48	459.92	0.000051	0.52	1520.64	748.19	0.06
Floodchute	Jeffersonville	4054	100-yr	1507.16	454.86	460.53	457.19	460.54	0.000107	0.87	2008.15	856.57	0.08
Floodchute	Jeffersonville	4054	500-yr	3680.01	454.86	461.53	458.34	461.57	0.000233	1.52	2961.2	1014.3	0.13
Floodchute	Jeffersonville	4054	25-yr	116.5	454.86	458.7	455.63	458.7	0.00001	0.16	739.36	530.14	0.02
Floodchute	Jeffersonville	4054	4/27/2011	339.97	454.86	459.4	456.04	459.41	0.000024	0.31	1159.35	656.42	0.04
Floodchute	Jeffersonville	3464	10-yr	0.01	457.26	457.29	457.29	457.29	0.044563	0.21	0.05	4.11	0.33
Floodchute	Jeffersonville	3464	50-yr	548.73	457.26	459.85	458.48	459.87	0.002424	1.15	475.22	334.88	0.17
Floodchute	Jeffersonville	3464	100-yr	900.38	457.26	460.42	458.75	460.45	0.002913	1.26	712	502.39	0.19
Floodchute	Jeffersonville	3464	500-yr	1948.76	457.26	461.37	459.32	461.4	0.003245	1.51	1293.89	761.54	0.2
Floodchute	Jeffersonville	3464	25-yr	105	457.26	458.68	457.9	458.68	0.001786	0.65	161.49	214.17	0.13
Floodchute	Jeffersonville	3464	4/27/2011	324.45	457.26	459.36	458.26	459.37	0.002217	0.99	327	270.58	0.16
Floodchute	Jeffersonville	2965	10-yr	0.01	456.04	456.17	456.07	456.17	0.000004	0.01	1.82	27.57	0
Floodchute	Jeffersonville	2965	50-yr	535.28	456.04	458.6	457.36	458.62	0.002596	1.17	458.14	366.2	0.18
Floodchute	Jeffersonville	2965	100-yr	858.65	456.04	459.04	457.64	459.07	0.002624	1.36	630.29	401.35	0.19
Floodchute	Jeffersonville	2965	500-yr	1684.23	456.04	459.79	458.1	459.84	0.003036	1.77	950.02	453.7	0.22
Floodchute	Jeffersonville	2965	25-yr	92.14	456.04	457.03	456.58	457.06	0.008918	1.35	68.06	109.41	0.3
Floodchute	Jeffersonville	2965	4/27/2011	310.24	456.04	458.08	457.04	458.1	0.00302	1.08	287.85	291.66	0.19
Floodchute	Jeffersonville	2497	10-yr	0.01	453.58	456.17	453.6	456.17	0	0	344.79	325.74	0
Floodchute	Jeffersonville	2497	50-yr	534.14	453.58	458.49	455.48	458.49	0.00009	0.47	1137.65	386.07	0.05
Floodchute	Jeffersonville	2497	100-yr	857.61	453.58	458.85	455.7	458.86	0.000174	0.67	1282.15	407.22	0.07
Floodchute	Jeffersonville	2497	500-yr	1683.36	453.58	459.35	456.06	459.37	0.000473	1.13	1494.88	440.51	0.11
Floodchute	Jeffersonville	2497	25-yr	91.07	453.58	457.02	454.46	457.02	0.000014	0.15	623.13	329.45	0.02
Floodchute	Jeffersonville	2497	4/27/2011	309.03	453.58	458.02	455.02	458.02	0.000047	0.32	962.34	361.42	0.03
Floodchute	Jeffersonville	2198	10-yr	0.01	450.72	456.17	450.75	456.17	0	0	1001.98	310.74	0
Floodchute	Jeffersonville	2198	50-yr	520.77	450.72	458.48	452.33	458.48	0.000011	0.27	1903.46	512.98	0.03
Floodchute	Jeffersonville	2198	100-yr	783.74	450.72	458.84	452.61	458.85	0.000019	0.37	2094.05	540.5	0.03
Floodchute	Jeffersonville	2198	500-yr	1394.81	450.72	459.33	453.1	459.33	0.000045	0.59	2362.19	561.68	0.05
Floodchute	Jeffersonville	2198	25-yr	89.87	450.72	457.02	451.56	457.02	0.000001	0.07	1288.05	368.56	0.01
Floodchute	Jeffersonville	2198	4/27/2011	307.67	450.72	458.02	452.05	458.02	0.000005	0.18	1678.62	447.95	0.02
Floodchute	Jeffersonville	1835	10-yr	0.01	454.27	456.17	454.31	456.17	0	0	62.09	59.28	0
Floodchute	Jeffersonville	1835	50-yr	509.86	454.27	458.43	456.47	458.47	0.004017	1.55	329.15	235.22	0.23
Floodchute	Jeffersonville	1835	100-yr	719.25	454.27	458.77	456.82	458.82	0.004668	1.69	424.59	295.89	0.25
Floodchute	Jeffersonville	1835	500-yr	1150.91	454.27	459.22	457.57	459.28	0.005216	2.05	561.39	321.6	0.27
Floodchute	Jeffersonville	1835	25-yr	89.87	454.27	457.01	455.41	457.02	0.000913	0.76	118.2	74.62	0.11
Floodchute	Jeffersonville	1835	4/27/2011	307.67	454.27	457.98	456.06	458.01	0.002951	1.29	237.67	176.52	0.2
Floodchute	Jeffersonville	1674	10-yr	0.01	456.15	456.17	456.17	456.17	0.000131	0.02	0.53	48.15	0.04
Floodchute	Jeffersonville	1674	50-yr	509.86	456.15	457.14	457	457.33	0.014745	3.5	145.73	213.34	0.75
Floodchute	Jeffersonville	1674	100-yr	719.25	456.15	457.32	457.17	457.55	0.015131	3.88	185.19	236.33	0.77
Floodchute	Jeffersonville	1674	500-yr	1150.91	456.15	457.61	457.46	457.92	0.015337	4.43	259.65	274.52	0.8
Floodchute	Jeffersonville	1674	25-yr	89.87	456.15	456.53	456.47	456.61	0.019863	2.31	38.86	132.33	0.75
Floodchute	Jeffersonville	1674	4/27/2011	307.67	456.15	456.9	456.8	457.05	0.016704	3.17	97.08	181.02	0.76
Floodchute	Jeffersonville	1519	10-yr	0.01	451.5	451.53	451.53	451.54	0.117453	0.77	0.01	0.95	1.11
Floodchute	Jeffersonville	1519	50-yr	509.86	451.5	453.89	453.89	454.26	0.026838	4.9	104	142.81	1.01
Floodchute	Jeffersonville	1519	100-yr	719.25	451.5	454.13	454.13	454.52	0.02536	5.02	143.14	181.32	1
Floodchute	Jeffersonville	1519	500-yr	1150.91	451.5	454.48	454.48	454.92	0.024305	5.32	216.47	243.85	0.99
Floodchute	Jeffersonville	1519	25-yr	89.87	451.5	452.65	452.65	452.93	0.027795	4.27	21.03	36.58	0.99
Floodchute	Jeffersonville	1519	4/27/2011	307.67	451.5	453.41	453.41	453.84	0.024878	5.23	58.82	69.39	1
Brewster	Jeffersonville	15	10-yr	2200	470.28	477.78	477.77	479.85	0.020639	11.99	217.38	61.03	0.93
Brewster	Jeffersonville	15	50-yr	3850	470.28	479.94	479.92	482.42	0.016561	13.58	372.18	81.04	0.89
Brewster	Jeffersonville	15	100-yr	4750	470.28	480.75	480.75	483.5	0.016452	14.53	439.3	84.29	0.9
Brewster	Jeffersonville	15	500-yr	6800	470.28	482.32	482.32	485.66	0.016495	16.37	576.72	90.58	0.93
Brewster	Jeffersonville	15	25-yr	2819	470.28	478.65	478.65	480.93	0.018878	12.74	274.29	69.73	0.92
Brewster	Jeffersonville	15	4/27/2011	4177	470.28	480.31	480.24	482.82	0.015945	13.78	402.58	82.53	0.88
Brewster	Jeffersonville	14	10-yr	2200	468.78	476.09	472.89	476.43	0.002193	4.75	504.97	96.53	0.33
Brewster	Jeffersonville	14	50-yr	3850	468.78	480.83	474.31	481.12	0.000934	4.5	1007.39	117.97	0.24
Brewster	Jeffersonville	14	100-yr	4750	468.78	481.71	474.97	482.08	0.001085	5.1	1113	123.99	0.26
Brewster	Jeffersonville	14	500-yr	6800	468.78	483.02	476.35	483.61	0.001526	6.48	1282.13	133.07	0.31
Brewster	Jeffersonville	14	25-yr	2819	468.78	477.16	473.44	477.55	0.002078	5.13	610.45	100.55	0.33
Brewster	Jeffersonville	14	4/27/2011	4177	468.78	481.21		481.52	0.000978	4.71	1051.65	120.53	0.24
Brewster	Jeffersonville	13.4	10-yr	2200	467.68	475	472.76	476.08	0.005944	8.34	265.15	43.74	0.56
Brewster	Jeffersonville	13.4	50-yr	3850	467.68	479.99	474.9	480.94	0.002684	8.04	607.47	130.61	0.41
Brewster	Jeffersonville	13.4	100-yr	4750	467.68	480.87	475.95	481.88	0.002779	8.58	823.72	144.3	0.42
Brewster	Jeffersonville	13.4	500-yr	6800	467.68	481.59	478.07	483.3	0.004486	11.31	932.36	158.82	0.54
Brewster	Jeffersonville	13.4	25-yr	2819	467.68	475.7	473.6	477.16	0.007083	9.71	294.43	56.06	0.62

Plan: Existing-LatStruct-New108+roundabout
2/27/2014

River	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)	
Brewster	Jeffersonville	13.4	4/27/2011	4177	467.68	480.27	475.3	481.32	0.002887	8.47	634.25	135.03	0.43
Brewster	Jeffersonville	13.25		Bridge									
Brewster	Jeffersonville	13.1	10-yr	2200	466.68	473.85	471.75	474.98	0.008008	8.51	258.85	39.55	0.58
Brewster	Jeffersonville	13.1	50-yr	3850	466.68	475.34	473.9	477.65	0.012941	12.2	321.06	57.02	0.75
Brewster	Jeffersonville	13.1	100-yr	4750	466.68	475.97	474.96	478.98	0.015368	13.96	348.7	67.01	0.82
Brewster	Jeffersonville	13.1	500-yr	6800	466.68	477.13	477.13	481.91	0.020784	17.61	399.52	85.39	0.98
Brewster	Jeffersonville	13.1	25-yr	2819	466.68	474.49	472.61	476.03	0.009916	9.97	284.98	44.95	0.64
Brewster	Jeffersonville	13.1	4/27/2011	4177	466.68	475.58	474.29	478.14	0.013847	12.86	331.46	60.78	0.78
Brewster	Jeffersonville	12	10-yr	2200	468.08	473.59		474.31	0.009415	6.83	325.48	92.12	0.63
Brewster	Jeffersonville	12	50-yr	3850	468.08	475.17		476.22	0.008766	8.24	479.23	101.91	0.64
Brewster	Jeffersonville	12	100-yr	4750	468.08	475.88		477.1	0.00865	8.92	553.06	109.92	0.65
Brewster	Jeffersonville	12	500-yr	6800	468.08	473.84	475.6	479.87	0.073096	19.75	348.71	93.7	1.77
Brewster	Jeffersonville	12	25-yr	2819	468.08	474.25		475.09	0.009109	7.37	388.31	96.33	0.63
Brewster	Jeffersonville	12	4/27/2011	4177	468.08	475.43		476.54	0.008709	8.49	506.3	103.51	0.64
Brewster	Jeffersonville	11	10-yr	2200	463.82	469.18	468.21	470.18	0.010948	8.03	280.35	77.27	0.69
Brewster	Jeffersonville	11	50-yr	3850	463.82	470.96	469.87	472.34	0.01032	9.58	440.31	102.18	0.7
Brewster	Jeffersonville	11	100-yr	4750	463.82	471.78	470.64	473.31	0.01	10.16	528.63	113.03	0.7
Brewster	Jeffersonville	11	500-yr	6800	463.82	473.79	472.14	475.36	0.007965	10.53	781.88	139.56	0.65
Brewster	Jeffersonville	11	25-yr	2819	463.82	469.9	468.86	471.07	0.010718	8.71	339.72	87.39	0.69
Brewster	Jeffersonville	11	4/27/2011	4177	463.82	471.28	470.15	472.71	0.01017	9.8	472.94	106.32	0.7
Brewster	Jeffersonville	10	10-yr	2200	458.98	464.74		465.82	0.012303	8.34	264.13	65.32	0.72
Brewster	Jeffersonville	10	50-yr	3850	458.98	466.47		468.04	0.01275	10.06	387.88	77.78	0.77
Brewster	Jeffersonville	10	100-yr	4750	458.98	467.24		469.03	0.012981	10.79	449.44	83.29	0.79
Brewster	Jeffersonville	10	500-yr	6800	458.98	467.9	467.9	470.83	0.018962	13.79	509.21	113.53	0.97
Brewster	Jeffersonville	10	25-yr	2819	458.98	465.45		466.73	0.012473	9.07	312.57	70.46	0.74
Brewster	Jeffersonville	10	4/27/2011	4177	458.98	466.75		468.41	0.012914	10.36	409.72	79.78	0.78
Brewster	Jeffersonville	9	10-yr	2200	456.45	462.5	460.92	463.13	0.006001	6.52	353.92	84.82	0.52
Brewster	Jeffersonville	9	50-yr	3850	456.45	464.16	462.38	465.11	0.006663	8.1	502.53	94.82	0.57
Brewster	Jeffersonville	9	100-yr	4750	456.45	464.93	463.05	466.02	0.006819	8.72	577.33	99.31	0.59
Brewster	Jeffersonville	9	500-yr	6800	456.45	466.17	464.37	466.87	0.00491	8.07	1447.4	596.99	0.51
Brewster	Jeffersonville	9	25-yr	2819	456.45	463.19	461.51	463.94	0.006279	7.18	413.23	88.95	0.54
Brewster	Jeffersonville	9	4/27/2011	4177	456.45	464.76	462.63	465.66	0.005728	7.89	560.9	98.47	0.53
Brewster	Jeffersonville	8	10-yr	2200	452.16	458.04	456.41	458.77	0.00719	6.92	326.53	99.49	0.56
Brewster	Jeffersonville	8	50-yr	3850	452.16	459.95	458.31	460.85	0.006181	7.88	546.55	143.62	0.55
Brewster	Jeffersonville	8	100-yr	4750	452.16	460.56	459.03	461.61	0.006514	8.59	637.75	155.92	0.57
Brewster	Jeffersonville	8	500-yr	6800	452.16	461.9	460.41	463.14	0.006428	9.59	865.07	183	0.58
Brewster	Jeffersonville	8	25-yr	2819	452.16	458.89	457.06	459.68	0.006558	7.25	415.81	107.67	0.55
Brewster	Jeffersonville	8	4/27/2011	4177	452.16	459.52	458.61	460.81	0.009587	9.36	486.95	127.36	0.67
Brewster	Jeffersonville	7	10-yr	2200	450.38	457.91		457.99	0.000426	2.38	1037.93	257.06	0.18
Brewster	Jeffersonville	7	50-yr	3850	450.38	460.04		460.13	0.000355	2.66	1970.41	606.88	0.17
Brewster	Jeffersonville	7	100-yr	4750	450.38	460.75		460.85	0.000353	2.81	2425.49	688.8	0.17
Brewster	Jeffersonville	7	500-yr	6800	450.38	462.28		462.38	0.000315	2.96	3566.78	824.02	0.17
Brewster	Jeffersonville	7	25-yr	2819	450.38	458.82		458.91	0.00042	2.6	1326.33	444.07	0.18
Brewster	Jeffersonville	7	4/27/2011	4177	450.38	459.56		459.7	0.000563	3.22	1696.37	543.6	0.21
Brewster	Jeffersonville	6.5	10-yr	2200	448.1	457.85		457.9	0.000216	2.08	1898.57	667.33	0.13
Brewster	Jeffersonville	6.5	50-yr	3850	448.1	460.01		460.05	0.000154	2.08	3655.14	956.32	0.12
Brewster	Jeffersonville	6.5	100-yr	4750	448.1	460.73		460.76	0.000154	2.18	4365.11	1034.74	0.12
Brewster	Jeffersonville	6.5	500-yr	6800	448.1	462.26		462.3	0.000143	2.29	6037.61	1106.87	0.12
Brewster	Jeffersonville	6.5	25-yr	2819	448.1	458.78		458.82	0.000182	2.06	2579.19	788.38	0.12
Brewster	Jeffersonville	6.5	4/27/2011	4177	448.1	459.52		459.57	0.000245	2.53	3198.38	886.57	0.15
Brewster	Jeffersonville	6	10-yr	2200	447.3	457.84		457.86	0.000071	1.22	2520.25	626.69	0.08
Brewster	Jeffersonville	6	50-yr	3850	447.3	460		460.02	0.00007	1.42	3885.78	637.62	0.08
Brewster	Jeffersonville	6	100-yr	4750	447.3	460.71		460.74	0.000078	1.58	4339	640.34	0.08
Brewster	Jeffersonville	6	500-yr	6800	447.3	462.24		462.27	0.000089	1.84	5321.88	646.21	0.09
Brewster	Jeffersonville	6	25-yr	2819	447.3	458.77		458.78	0.000069	1.3	3101.98	632.88	0.08
Brewster	Jeffersonville	6	4/27/2011	4177	447.3	459.5		459.53	0.000104	1.68	3566.74	635.69	0.1
Brewster	DSFloodchute	5.4	10-yr	2189	444.07	457.68	449.73	457.81	0.000293	3	868.86	129.24	0.16
Brewster	DSFloodchute	5.4	50-yr	2934.99	444.07	459.82	450.56	459.97	0.000269	3.24	1120.47	613.68	0.16
Brewster	DSFloodchute	5.4	100-yr	2401.02	444.07	460.62	449.97	460.71	0.000144	2.46	1216.36	663.26	0.12
Brewster	DSFloodchute	5.4	500-yr	0	444.07	462.25	444.1	462.25	0	0	3319.64	713.45	0
Brewster	DSFloodchute	5.4	25-yr	2692.2	444.07	458.57	450.3	458.73	0.000331	3.36	970.74	361.49	0.17
Brewster	DSFloodchute	5.4	4/27/2011	3819.18	444.07	459.14	451.46	459.43	0.000558	4.5	1038.81	555.82	0.23
Brewster	DSFloodchute	5.25		Bridge									

Plan: Existing-LatStruct-New108+roundabout
2/27/2014

River	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)	
Brewster	DSFloodchute	5.1	10-yr	2189	444.07	457.66	449.73	457.79	0.000295	3	866.33	128.78	0.16
Brewster	DSFloodchute	5.1	50-yr	2934.99	444.07	459.78	450.55	459.93	0.000272	3.25	1114.73	610.23	0.16
Brewster	DSFloodchute	5.1	100-yr	2401.02	444.07	460.6	449.99	460.66	0.000116	2.21	2204.51	661.92	0.1
Brewster	DSFloodchute	5.1	500-yr	0	444.07	462.25	444.1	462.25	0	0	3319.64	713.45	0
Brewster	DSFloodchute	5.1	25-yr	2692.2	444.07	458.54	450.3	458.71	0.000333	3.36	967.66	346.98	0.17
Brewster	DSFloodchute	5.1	4/27/2011	3819.18	444.07	459.08	451.47	459.38	0.000568	4.52	1031.02	550.76	0.23
Brewster	DSFloodchute	4	10-yr	2189	444.07	457.65	449.73	457.78	0.000301	3.03	869.87	128.4	0.16
Brewster	DSFloodchute	4	50-yr	2934.99	444.07	459.78	450.57	459.91	0.000249	3.11	1693.89	610.19	0.15
Brewster	DSFloodchute	4	100-yr	2401.02	444.07	460.6	449.98	460.66	0.000117	2.21	2211.67	661.61	0.1
Brewster	DSFloodchute	4	500-yr	0	444.07	462.25	444.1	462.25	0	0	3365.98	713.45	0
Brewster	DSFloodchute	4	25-yr	2692.2	444.07	458.52	450.3	458.69	0.000343	3.41	1018.54	333.44	0.18
Brewster	DSFloodchute	4	4/27/2011	3819.18	444.07	459.06	451.46	459.35	0.000568	4.52	1276.49	548.95	0.23
Brewster	DSFloodchute	3.4	10-yr	2189	444.14	457.59	448.92	457.76	0.000649	3.37	791.86	325.21	0.17
Brewster	DSFloodchute	3.4	50-yr	2934.99	444.14	459.77	449.77	459.9	0.000458	3.15	1591.5	440.83	0.14
Brewster	DSFloodchute	3.4	100-yr	2401.02	444.14	460.59	449.18	460.65	0.000211	2.22	2015.29	745.99	0.1
Brewster	DSFloodchute	3.4	500-yr	0	444.14	462.25	444.16	462.25	0	0	3410.99	860.93	0
Brewster	DSFloodchute	3.4	25-yr	2692.2	444.14	458.49	449.5	458.67	0.000671	3.59	1093.27	335.55	0.17
Brewster	DSFloodchute	3.4	4/27/2011	3819.18	444.14	459.03	450.68	459.33	0.001081	4.67	1286.29	380.64	0.22
Brewster	DSFloodchute	3.25		Bridge									
Brewster	DSFloodchute	3.1	10-yr	2189	444.14	457.41	448.93	457.59	0.000671	3.39	743.05	132.96	0.17
Brewster	DSFloodchute	3.1	50-yr	2934.99	444.14	459.72	449.77	459.85	0.000469	3.18	1567.44	436.39	0.15
Brewster	DSFloodchute	3.1	100-yr	2401.02	444.14	460.56	449.17	460.62	0.000214	2.23	1992.07	736.13	0.1
Brewster	DSFloodchute	3.1	500-yr	0	444.14	462.25	444.16	462.25	0	0	3410.99	860.93	0
Brewster	DSFloodchute	3.1	25-yr	2692.2	444.14	458.28	449.5	458.48	0.000736	3.72	1022.43	334.77	0.18
Brewster	DSFloodchute	3.1	4/27/2011	3819.18	444.14	458.7	450.68	459.04	0.001249	4.94	1163.06	353.45	0.24
Brewster	DSFloodchute	2	10-yr	2189	445.64	457.42		457.45	0.000094	1.64	1872.2	307.83	0.09
Brewster	DSFloodchute	2	50-yr	2934.99	445.64	459.72		459.75	0.000067	1.57	2697.07	436.57	0.08
Brewster	DSFloodchute	2	100-yr	2401.02	445.64	460.56		460.58	0.000033	1.15	3105.42	691.55	0.06
Brewster	DSFloodchute	2	500-yr	0	445.64	462.25		462.25	0	0	4337.51	744.93	0
Brewster	DSFloodchute	2	25-yr	2692.2	445.64	458.29		458.32	0.0001	1.78	2153.3	331.98	0.09
Brewster	DSFloodchute	2	4/27/2011	3819.18	445.64	458.71		458.77	0.000169	2.37	2295.13	354.24	0.12
Brewster	DSFloodchute	1	10-yr	2189	444.98	457.42		457.43	0.000024	1.02	3593.26	590.48	0.05
Brewster	DSFloodchute	1	50-yr	2934.99	444.98	459.73		459.74	0.000018	0.99	5112.09	767.8	0.05
Brewster	DSFloodchute	1	100-yr	2401.02	444.98	460.57		460.57	0.000009	0.73	5821.24	1090.77	0.03
Brewster	DSFloodchute	1	500-yr	0	444.98	462.25		462.25	0	0	7832.37	1226.01	0
Brewster	DSFloodchute	1	25-yr	2692.2	444.98	458.3		458.31	0.000026	1.1	4122.17	623.79	0.06
Brewster	DSFloodchute	1	4/27/2011	3819.18	444.98	458.72		458.74	0.000044	1.47	4393.92	658.92	0.07

Plan: Combo-13e+2c+9a+15b
2/27/2014

River	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)	
Lamoille	UpperLamoille	6058	10-yr	16765	435	457.5	445.61	457.65	0.000165	3.42	7574.81	1411.36	0.15
Lamoille	UpperLamoille	6058	50-yr	22337	435	459.71	447.09	459.86	0.000142	3.47	10722.22	1428.32	0.14
Lamoille	UpperLamoille	6058	100-yr	24717	435	460.53	447.65	460.68	0.00014	3.55	11992.17	1616.8	0.14
Lamoille	UpperLamoille	6058	500-yr	30335	435	462.14	448.86	462.28	0.000133	3.65	14600.4	1629.73	0.14
Lamoille	UpperLamoille	6058	25-yr	19959	435	458.39	446.47	458.55	0.000173	3.64	8832.37	1418.16	0.16
Lamoille	UpperLamoille	6058	4/27/2011	18674	435	458.71	446.14	458.85	0.000136	3.27	9295.34	1420.66	0.14
Lamoille	UpperLamoille	4934	10-yr	16765	432.3	457.26		457.44	0.000252	4.11	7597.27	1061.12	0.18
Lamoille	UpperLamoille	4934	50-yr	22337	432.3	459.51		459.68	0.00022	4.2	10037.51	1102.72	0.17
Lamoille	UpperLamoille	4934	100-yr	24717	432.3	460.33		460.5	0.000213	4.25	10953	1111.53	0.17
Lamoille	UpperLamoille	4934	500-yr	30335	432.3	461.93		462.11	0.000214	4.5	12755.24	1168.54	0.17
Lamoille	UpperLamoille	4934	25-yr	19959	432.3	458.14		458.33	0.000268	4.39	8538.09	1085.19	0.19
Lamoille	UpperLamoille	4934	4/27/2011	18674	432.3	458.52		458.67	0.000207	3.92	8954.12	1090.09	0.17
Lamoille	UpperLamoille	4630	10-yr	16765	439.52	456.82		457.1	0.000514	5.53	6550.46	1074.72	0.26
Lamoille	UpperLamoille	4630	50-yr	22337	439.52	459.14		459.37	0.000393	5.35	9098.7	1115.33	0.23
Lamoille	UpperLamoille	4630	100-yr	24717	439.52	459.98		460.2	0.000368	5.35	10039.28	1121.72	0.23
Lamoille	UpperLamoille	4630	500-yr	30335	439.52	461.58		461.81	0.000353	5.56	11860.51	1166.33	0.23
Lamoille	UpperLamoille	4630	25-yr	19959	439.52	457.67		457.96	0.000526	5.82	7468.17	1098.73	0.26
Lamoille	UpperLamoille	4630	4/27/2011	18674	439.52	458.17		458.39	0.000384	5.08	8024.05	1107.98	0.23
Lamoille	DSofBrewster	4484	10-yr	18965	440.13	456.22	449.56	456.94	0.001182	6.89	3045.73	349.57	0.34
Lamoille	DSofBrewster	4484	50-yr	25178	440.13	458.33	450.97	459.2	0.001202	7.69	3834.43	399.77	0.35
Lamoille	DSofBrewster	4484	100-yr	27381.34	440.13	459.13	451.43	460.04	0.001176	7.87	4161.99	422.2	0.35
Lamoille	DSofBrewster	4484	500-yr	30338.31	440.13	461.08	452.07	461.69	0.000761	6.85	6738.82	868.63	0.29
Lamoille	DSofBrewster	4484	25-yr	21267.09	440.13	457.01	450.09	457.8	0.001199	7.22	3328.88	368.4	0.34
Lamoille	DSofBrewster	4484	4/27/2011	22273.47	440.13	457.43	450.32	458.23	0.001178	7.3	3486.44	378.46	0.34
Lamoille	DSofBrewster	4266	10-yr	18965	440.1	456.03	449.32	456.64	0.001301	6.63	3325.85	443.46	0.32
Lamoille	DSofBrewster	4266	50-yr	25253.29	440.1	458.2	451.46	458.89	0.001244	7.16	4151.81	477.62	0.32
Lamoille	DSofBrewster	4266	100-yr	27693.45	440.1	459.01	452.29	459.72	0.001212	7.31	4472.74	488.3	0.32
Lamoille	DSofBrewster	4266	500-yr	32194.26	440.1	460.79	453.2	461.5	0.001069	7.35	5175.46	501.18	0.3
Lamoille	DSofBrewster	4266	25-yr	21339.14	440.1	456.84	449.95	457.49	0.001294	6.88	3629.28	456.2	0.32
Lamoille	DSofBrewster	4266	4/27/2011	22350.53	440.1	457.28	450.2	457.93	0.001253	6.9	3796.4	463.12	0.32
Lamoille	DSofBrewster	4200		Mult Open									
Lamoille	DSofBrewster	4054	10-yr	18965	437.88	455.63	447.86	456.05	0.000703	5.68	4186.31	728.01	0.27
Lamoille	DSofBrewster	4054	50-yr	25253.41	437.88	457.75	449.96	458.23	0.000684	6.16	5194.91	746.86	0.27
Lamoille	DSofBrewster	4054	100-yr	27869.81	437.88	458.55	450.8	459.05	0.00068	6.34	5580.98	781.28	0.27
Lamoille	DSofBrewster	4054	500-yr	33270.21	437.88	460.32	452.23	460.85	0.000639	6.56	6450.13	894.63	0.27
Lamoille	DSofBrewster	4054	25-yr	21339.14	437.88	456.41	448.58	456.86	0.000705	5.9	4557.21	735	0.27
Lamoille	DSofBrewster	4054	4/27/2011	22350.53	437.88	456.86	448.92	457.31	0.000682	5.92	4768.38	738.95	0.27
Lamoille	DSofBrewster	3464	10-yr	18965	436.2	454.8	447.86	455.59	0.001227	7.36	3195.99	455.92	0.35
Lamoille	DSofBrewster	3464	50-yr	25932.08	436.2	456.79	449.74	457.73	0.0013	8.28	4121.39	476.66	0.37
Lamoille	DSofBrewster	3464	100-yr	28830.45	436.2	457.55	450.4	458.54	0.001313	8.58	4486.11	481.68	0.37
Lamoille	DSofBrewster	3464	500-yr	35400.94	436.2	459.26	452.2	460.34	0.001293	9.09	5347.01	581.3	0.37
Lamoille	DSofBrewster	3464	25-yr	21429	436.2	455.54	448.55	456.39	0.00126	7.72	3534.17	463.61	0.36
Lamoille	DSofBrewster	3464	4/27/2011	22851	436.2	455.94	448.93	456.82	0.001276	7.91	3722.9	467.84	0.36
Lamoille	DSofBrewster	2965	10-yr	18965	436.29	454.59	447.42	454.94	0.000662	4.9	4615.2	648.66	0.25
Lamoille	DSofBrewster	2965	50-yr	25943.32	436.29	456.62	448.64	457.02	0.000669	5.41	5975.57	680.98	0.25
Lamoille	DSofBrewster	2965	100-yr	28844.24	436.29	457.39	449.1	457.81	0.000666	5.58	6507.55	686.81	0.25
Lamoille	DSofBrewster	2965	500-yr	35615.63	436.29	459.14	450.16	459.6	0.000648	5.89	7721.28	699.95	0.25
Lamoille	DSofBrewster	2965	25-yr	21429	436.29	455.34	447.87	455.71	0.000668	5.11	5112.45	671.4	0.25
Lamoille	DSofBrewster	2965	4/27/2011	22851	436.29	455.75	448.12	456.13	0.000669	5.21	5391.11	674.51	0.25
Lamoille	DSofBrewster	2497	10-yr	18965	439.94	453.54	447.69	454.43	0.001533	7.77	2901.8	442.15	0.38
Lamoille	DSofBrewster	2497	50-yr	25944.3	439.94	455.41	449.39	456.48	0.001631	8.77	3788.03	490.17	0.4
Lamoille	DSofBrewster	2497	100-yr	28845.27	439.94	456.15	450.07	457.28	0.001637	9.08	4152.08	496.01	0.41
Lamoille	DSofBrewster	2497	500-yr	35616.39	439.94	457.8	452.36	459.06	0.001648	9.75	4984.56	530.62	0.42
Lamoille	DSofBrewster	2497	25-yr	21429	439.94	454.22	448.28	455.19	0.001586	8.18	3212.84	475.52	0.39
Lamoille	DSofBrewster	2497	4/27/2011	22851	439.94	454.6	448.65	455.61	0.001606	8.38	3396.2	483.8	0.4
Lamoille	DSofBrewster	2198	10-yr	18965	439.04	453.11	447.7	453.95	0.001569	7.77	3157.44	499.72	0.39
Lamoille	DSofBrewster	2198	50-yr	25945.43	439.04	455.02	450.11	455.97	0.001568	8.54	4155.41	543.39	0.4
Lamoille	DSofBrewster	2198	100-yr	28874.84	439.04	455.77	451.3	456.75	0.001544	8.77	4570.64	551.52	0.4
Lamoille	DSofBrewster	2198	500-yr	35857.46	439.04	457.46	452.59	458.53	0.001515	9.32	5534.46	659.78	0.4
Lamoille	DSofBrewster	2198	25-yr	21429	439.04	453.8	448.38	454.69	0.001582	8.08	3508.37	518.95	0.39
Lamoille	DSofBrewster	2198	4/27/2011	22851	439.04	454.19	448.78	455.1	0.001582	8.24	3711.87	529.78	0.39
Lamoille	DSofBrewster	1835	10-yr	18965	435.81	453.06	445.21	453.47	0.000682	5.42	4104.03	470.26	0.26
Lamoille	DSofBrewster	1835	50-yr	25945.43	435.81	454.94	446.67	455.47	0.000756	6.23	5016.5	519.82	0.28
Lamoille	DSofBrewster	1835	100-yr	28900.41	435.81	455.65	447.25	456.26	0.00082	6.68	5421.39	597.19	0.29

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River	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)	
Lamoille	DSofBrewster	1835	500-yr	36062.87	435.81	457.34	449.07	458.03	0.000834	7.2	6466.8	639.9	0.3
Lamoille	DSofBrewster	1835	25-yr	21429	435.81	453.74	445.74	454.2	0.000714	5.74	4428.19	480.23	0.27
Lamoille	DSofBrewster	1835	4/27/2011	22851	435.81	454.12	446.04	454.61	0.00073	5.9	4613.66	485.84	0.27
Lamoille	DSofBrewster	1674	10-yr	18965	432.42	452.48	444.26	453.3	0.001163	7.31	2731.37	240.05	0.33
Lamoille	DSofBrewster	1674	50-yr	25945.43	432.42	454.05	446.25	455.24	0.001518	8.93	3123.99	256.19	0.39
Lamoille	DSofBrewster	1674	100-yr	28900.41	432.42	454.65	447.05	456.01	0.001649	9.53	3279.86	258.67	0.41
Lamoille	DSofBrewster	1674	500-yr	36062.87	432.42	455.98	448.94	457.74	0.001944	10.88	3628.49	264.15	0.45
Lamoille	DSofBrewster	1674	25-yr	21429	432.42	453.05	444.99	454	0.001299	7.93	2871.76	252.09	0.36
Lamoille	DSofBrewster	1674	4/27/2011	22851	432.42	453.37	445.39	454.4	0.001371	8.26	2952.52	253.43	0.37
Lamoille	DSofBrewster	1650		Bridge									
Lamoille	DSofBrewster	1519	10-yr	18965	437.14	452.12	445.79	452.93	0.001408	7.39	3013.91	444.76	0.37
Lamoille	DSofBrewster	1519	50-yr	25945.43	437.14	453.61	447.51	454.73	0.001708	8.77	3658.76	724.18	0.41
Lamoille	DSofBrewster	1519	100-yr	28900.41	437.14	454.19	448.18	455.43	0.001807	9.27	3912.84	843.68	0.43
Lamoille	DSofBrewster	1519	500-yr	36062.87	437.14	455.46	450.18	456.98	0.002029	10.39	4467.65	1012.57	0.46
Lamoille	DSofBrewster	1519	25-yr	21429	437.14	452.66	446.4	453.59	0.001528	7.92	3247.27	525.87	0.39
Lamoille	DSofBrewster	1519	4/27/2011	22851	437.14	452.96	446.78	453.95	0.00159	8.2	3378.83	589.5	0.4
Lamoille	LowerLamoille	110	10-yr	18965	432.88	448.84	445.36	448.99	0.000366	4.31	8901.52	1647.88	0.21
Lamoille	LowerLamoille	110	50-yr	26187	432.88	450.34	446.02	450.49	0.000355	4.56	11396.85	1671.06	0.21
Lamoille	LowerLamoille	110	100-yr	29467	432.88	451	446.31	451.15	0.000346	4.64	12491.16	1681.13	0.21
Lamoille	LowerLamoille	110	500-yr	37135	432.88	452.47	446.91	452.62	0.000325	4.79	14979.25	1695.94	0.21
Lamoille	LowerLamoille	110	25-yr	21429	432.88	449.43	445.57	449.58	0.000353	4.35	9882.77	1657.03	0.21
Lamoille	LowerLamoille	110	4/27/2011	22851	432.88	449.7		449.84	0.000356	4.43	10319.41	1661.09	0.21
Lamoille	LowerLamoille	109	10-yr	18965	432.98	447.51		447.66	0.000766	3.4	6663.73	1144.81	0.2
Lamoille	LowerLamoille	109	50-yr	26187	432.98	449.07		449.25	0.000727	3.7	8492.02	1190.62	0.2
Lamoille	LowerLamoille	109	100-yr	29467	432.98	449.76		449.95	0.000702	3.8	9321.97	1210.78	0.2
Lamoille	LowerLamoille	109	500-yr	37135	432.98	451.32		451.52	0.000644	3.98	11246.92	1256.29	0.2
Lamoille	LowerLamoille	109	25-yr	21429	432.98	448.17		448.33	0.000716	3.45	7434.2	1164.42	0.2
Lamoille	LowerLamoille	109	4/27/2011	22851	432.98	448.42		448.58	0.00073	3.55	7720.67	1171.57	0.2
Lamoille	LowerLamoille	108	10-yr	18965	431.08	445.77		446.31	0.001025	6.79	4884.03	1174.98	0.36
Lamoille	LowerLamoille	108	50-yr	26187	431.08	447.55		448.05	0.00088	6.93	7009.62	1221.54	0.34
Lamoille	LowerLamoille	108	100-yr	29467	431.08	448.34		448.82	0.000815	6.94	7979.73	1235.69	0.33
Lamoille	LowerLamoille	108	500-yr	37135	431.08	450.08		450.52	0.0007	6.96	10155.33	1263.97	0.31
Lamoille	LowerLamoille	108	25-yr	21429	431.08	446.68		447.15	0.000855	6.53	5960.76	1198.79	0.33
Lamoille	LowerLamoille	108	4/27/2011	22851	431.08	446.88		447.37	0.000892	6.74	6193.05	1203.87	0.34
Lamoille	LowerLamoille	107	10-yr	18965	429.38	445.34		445.44	0.000437	3.24	9172.33	1677.28	0.18
Lamoille	LowerLamoille	107	50-yr	26187	429.38	447.2		447.29	0.000358	3.28	12334.27	1719.17	0.17
Lamoille	LowerLamoille	107	100-yr	29467	429.38	448.02		448.12	0.000329	3.29	13754.37	1735.11	0.16
Lamoille	LowerLamoille	107	500-yr	37135	429.38	449.82		449.91	0.000283	3.32	16894.96	1762.05	0.15
Lamoille	LowerLamoille	107	25-yr	21429	429.38	446.34		446.43	0.000345	3.07	10868.02	1699.87	0.16
Lamoille	LowerLamoille	107	4/27/2011	22851	429.38	446.52		446.61	0.000363	3.18	11167.33	1703.83	0.17
Lamoille	LowerLamoille	106	10-yr	18965	428.48	443.81		444.06	0.000571	4.96	8779.91	1771.22	0.26
Lamoille	LowerLamoille	106	50-yr	26187	428.48	446.11		446.31	0.00041	4.76	12979.25	1883.26	0.23
Lamoille	LowerLamoille	106	100-yr	29467	428.48	447.04		447.24	0.000369	4.73	14769.05	1929.03	0.22
Lamoille	LowerLamoille	106	500-yr	37135	428.48	449.01		449.19	0.000311	4.73	18624.39	1973.32	0.21
Lamoille	LowerLamoille	106	25-yr	21429	428.48	445.3		445.47	0.000377	4.38	11470.2	1843.78	0.22
Lamoille	LowerLamoille	106	4/27/2011	22851	428.48	445.4		445.59	0.000412	4.6	11655.68	1848.68	0.23
Lamoille	LowerLamoille	105.4	10-yr	19788	428.18	443.53	436.24	443.91	0.000627	4.89	4047.92	451.83	0.27
Lamoille	LowerLamoille	105.4	50-yr	27283	428.18	445.63	437.55	446.12	0.000655	5.61	4865.65	2172.71	0.28
Lamoille	LowerLamoille	105.4	100-yr	30680	428.18	446.49	438.09	447.03	0.000662	5.9	5202.43	2178.4	0.28
Lamoille	LowerLamoille	105.4	500-yr	38624	428.18	448.92	439.27	449.12	0.000277	4.26	15562.57	2250	0.19
Lamoille	LowerLamoille	105.4	25-yr	22408	428.18	444.96	436.71	445.33	0.000531	4.87	4604.11	2168.29	0.25
Lamoille	LowerLamoille	105.4	4/27/2011	23767	428.18	445.02	436.95	445.43	0.000587	5.14	4627.47	2168.68	0.26
Lamoille	LowerLamoille	105.25		Bridge									
Lamoille	LowerLamoille	105.1	10-yr	19788	428.18	443.46	436.24	443.83	0.000641	4.92	4017.94	385.7	0.27
Lamoille	LowerLamoille	105.1	50-yr	27283	428.18	445.53	437.55	446.03	0.000672	5.65	4826.97	2172.05	0.28
Lamoille	LowerLamoille	105.1	100-yr	30680	428.18	446.35	438.09	446.9	0.000687	5.96	5145.93	2177.44	0.29
Lamoille	LowerLamoille	105.1	500-yr	38624	428.18	448.59	439.27	448.81	0.000311	4.45	14829.99	2233.15	0.2
Lamoille	LowerLamoille	105.1	25-yr	22408	428.18	444.89	436.71	445.26	0.000542	4.9	4576.77	2167.83	0.25
Lamoille	LowerLamoille	105.1	4/27/2011	23767	428.18	444.94	436.96	445.36	0.000601	5.17	4596.73	2168.16	0.27
Lamoille	LowerLamoille	104	10-yr	19788	427.38	443.17		443.6	0.000619	5.43	4458.81	764.48	0.28
Lamoille	LowerLamoille	104	50-yr	27283	427.38	445.33		445.8	0.000578	5.87	6297.49	909.71	0.28
Lamoille	LowerLamoille	104	100-yr	30680	427.38	446.17		446.66	0.000566	6.04	7077.66	952.65	0.28
Lamoille	LowerLamoille	104	500-yr	38624	427.38	448.06		448.59	0.00055	6.46	9460.79	2352.73	0.28

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River	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)	
Lamoille	LowerLamoille	104	25-yr	22408	427.38	444.72		445.09	0.000474	5.16	5749.17	878.28	0.25
Lamoille	LowerLamoille	104	4/27/2011	23767	427.38	444.75		445.16	0.000527	5.45	5777.29	879.92	0.26
Lamoille	LowerLamoille	103	10-yr	19788	418.98	443.09		443.23	0.0003	3.97	7782.67	1185.04	0.18
Lamoille	LowerLamoille	103	50-yr	27283	418.98	445.33		445.47	0.00025	3.96	10650.38	1357.79	0.16
Lamoille	LowerLamoille	103	100-yr	30680	418.98	446.19		446.33	0.000237	3.98	11846.62	1419.18	0.16
Lamoille	LowerLamoille	103	500-yr	38624	418.98	448.14		448.28	0.000209	3.99	14763.55	1627.54	0.15
Lamoille	LowerLamoille	103	25-yr	22408	418.98	444.7		444.81	0.00021	3.55	9809.75	1312.94	0.15
Lamoille	LowerLamoille	103	4/27/2011	23767	418.98	444.73		444.86	0.000234	3.75	9850.53	1315.15	0.16
Lamoille	LowerLamoille	102	10-yr	19788	422.18	442.67		442.71	0.000132	2.45	14560.38	2178.04	0.11
Lamoille	LowerLamoille	102	50-yr	27283	422.18	445		445.04	0.000109	2.44	20104.66	2515.18	0.1
Lamoille	LowerLamoille	102	100-yr	30680	422.18	445.88		445.93	0.000103	2.44	22339.46	2536.56	0.1
Lamoille	LowerLamoille	102	500-yr	38624	422.18	447.88		447.92	0.00009	2.44	27451.65	2581.95	0.09
Lamoille	LowerLamoille	102	25-yr	22408	422.18	444.42		444.46	0.00009	2.17	18661.94	2501.28	0.09
Lamoille	LowerLamoille	102	4/27/2011	23767	422.18	444.42		444.46	0.000102	2.3	18653.23	2501.2	0.09
Lamoille	LowerLamoille	101	10-yr	19788	424.88	442.51		442.52	0.000025	1.05	23714.29	2127.79	0.05
Lamoille	LowerLamoille	101	50-yr	27283	424.88	444.84		444.86	0.000026	1.17	28701.97	2148.64	0.05
Lamoille	LowerLamoille	101	100-yr	30680	424.88	445.73		445.74	0.000026	1.22	30603.74	2156.53	0.05
Lamoille	LowerLamoille	101	500-yr	38624	424.88	447.72		447.74	0.000027	1.33	34929.77	2177.32	0.05
Lamoille	LowerLamoille	101	25-yr	22408	424.88	444.3		444.31	0.00002	1.01	27540.57	2143.8	0.04
Lamoille	LowerLamoille	101	4/27/2011	23767	424.88	444.28		444.29	0.000022	1.07	27499.22	2143.63	0.04
Lamoille	LowerLamoille	39	10-yr	19788	422.68	442.41		442.46	0.000053	2.54	19388.62	2439.39	0.11
Lamoille	LowerLamoille	39	50-yr	27283	422.68	444.75		444.8	0.000049	2.66	25145.02	2484.12	0.11
Lamoille	LowerLamoille	39	100-yr	30680	422.68	445.64		445.69	0.000049	2.74	27349.25	2504	0.11
Lamoille	LowerLamoille	39	500-yr	38624	422.68	447.64		447.69	0.000047	2.88	32401.94	2549	0.11
Lamoille	LowerLamoille	39	25-yr	22408	422.68	444.23		444.27	0.000038	2.31	23852.27	2472.38	0.09
Lamoille	LowerLamoille	39	4/27/2011	23767	422.68	444.2		444.24	0.000043	2.46	23781.29	2471.74	0.1
Lamoille	LowerLamoille	38	10-yr	19788	422.68	442.3		442.4	0.000089	3.19	12516.66	1751.24	0.14
Lamoille	LowerLamoille	38	50-yr	27283	422.68	444.65		444.75	0.000081	3.34	16659.31	1778.38	0.13
Lamoille	LowerLamoille	38	100-yr	30680	422.68	445.54		445.63	0.000081	3.43	18236.45	1790.53	0.14
Lamoille	LowerLamoille	38	500-yr	38624	422.68	447.54		447.64	0.000078	3.6	21847.07	1818.05	0.14
Lamoille	LowerLamoille	38	25-yr	22408	422.68	444.15		444.22	0.000063	2.9	15772.71	1771.51	0.12
Lamoille	LowerLamoille	38	4/27/2011	23767	422.68	444.11		444.2	0.000072	3.09	15702.98	1770.97	0.13
Lamoille	LowerLamoille	37	10-yr	19788	419.68	441.31		441.87	0.000404	6.28	4292.78	670.12	0.29
Lamoille	LowerLamoille	37	50-yr	27283	419.68	443.64		444.25	0.000391	6.83	5879.59	691.67	0.29
Lamoille	LowerLamoille	37	100-yr	30680	419.68	444.5		445.14	0.000395	7.09	6474	699.58	0.3
Lamoille	LowerLamoille	37	500-yr	38624	419.68	446.47		447.15	0.000388	7.54	7868.59	717.78	0.3
Lamoille	LowerLamoille	37	25-yr	22408	419.68	443.42		443.85	0.00028	5.73	5725.67	689.61	0.25
Lamoille	LowerLamoille	37	4/27/2011	23767	419.68	443.26		443.77	0.000329	6.17	5616.98	688.15	0.27
Lamoille	LowerLamoille	36	10-yr	19788	422.28	439.8	430.97	440.44	0.000463	6.43	3153.63	877.25	0.3
Lamoille	LowerLamoille	36	50-yr	27283	422.28	442	432.74	442.8	0.000494	7.33	5128.96	918.5	0.32
Lamoille	LowerLamoille	36	100-yr	30680	422.28	442.8	433.5	443.65	0.000508	7.67	5869.75	933.5	0.33
Lamoille	LowerLamoille	36	500-yr	38624	422.28	444.8	435.28	445.71	0.000493	8.14	7868.67	1089.6	0.33
Lamoille	LowerLamoille	36	25-yr	22408	422.28	442.4	431.59	442.9	0.0003	5.81	5497.86	926	0.25
Lamoille	LowerLamoille	36	4/27/2011	23767	422.28	442	431.92	442.6	0.000375	6.38	5128.96	918.5	0.28
Floodchute	Jeffersonville	4484	10-yr	0	456.45	457.55	456.47	457.55	0	0	171.49	304.51	0
Floodchute	Jeffersonville	4484	50-yr	1009	456.45	459.53	457.71	459.54	0.000362	0.91	1204.29	694.73	0.11
Floodchute	Jeffersonville	4484	100-yr	2085.66	456.45	460.34	458.15	460.36	0.000497	1.24	1832.05	839.86	0.14
Floodchute	Jeffersonville	4484	500-yr	6796.69	456.45	461.77	459.2	461.84	0.001054	2.4	3135.37	955	0.21
Floodchute	Jeffersonville	4484	25-yr	161.91	456.45	458.03	457.08	458.03	0.000282	0.48	354.26	451.58	0.09
Floodchute	Jeffersonville	4484	4/27/2011	577.53	456.45	458.69	457.44	458.7	0.000565	0.91	684.04	551.78	0.13
Floodchute	Jeffersonville	4300		Lat Struct									
Floodchute	Jeffersonville	4266	10-yr	0	456.45	457.55	456.47	457.55	0	0	219.25	375.51	0
Floodchute	Jeffersonville	4266	50-yr	933.71	456.45	459.47	457.53	459.48	0.000173	0.76	1362.6	717.92	0.09
Floodchute	Jeffersonville	4266	100-yr	1773.55	456.45	460.27	457.88	460.29	0.000211	1.02	1975.83	809.19	0.1
Floodchute	Jeffersonville	4266	500-yr	4940.74	456.45	461.64	458.63	461.68	0.000415	1.82	3171.05	925.2	0.15
Floodchute	Jeffersonville	4266	25-yr	89.86	456.45	458	456.93	458.01	0.000047	0.22	422.79	515.07	0.04
Floodchute	Jeffersonville	4266	4/27/2011	500.47	456.45	458.6	457.3	458.61	0.000267	0.69	780.74	628.45	0.1
Floodchute	Jeffersonville	4200	10-yr	0	457.53	457.55	457.55	457.55	0.000143	0.02	0.06	4.94	0.03
Floodchute	Jeffersonville	4200	50-yr	933.71	457.53	459.44	458.38	459.46	0.000979	1.18	801.68	605.93	0.17
Floodchute	Jeffersonville	4200	100-yr	1773.55	457.53	460.24	458.65	460.27	0.000771	1.38	1330.59	723.47	0.17
Floodchute	Jeffersonville	4200	500-yr	4873.64	457.53	461.57	459.36	461.64	0.001024	2.2	2419.04	904.36	0.21
Floodchute	Jeffersonville	4200	25-yr	89.86	457.53	457.88	457.88	457.97	0.06829	2.35	38.23	229.6	1.02
Floodchute	Jeffersonville	4200	4/27/2011	500.47	457.53	458.52	458.2	458.56	0.006012	1.67	300.47	488.9	0.37

Plan: Combo-13e+2c+9a+15b
2/27/2014

River	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)	
Floodchute	Jeffersonville	4054	10-yr	0	454.86	457.28	454.89	457.28	0	0	248.27	193.44	0
Floodchute	Jeffersonville	4054	50-yr	933.59	454.86	459.3	456.69	459.31	0.000212	0.91	1091.23	637.64	0.11
Floodchute	Jeffersonville	4054	100-yr	1597.19	454.86	460.12	457.28	460.13	0.000195	1.07	1673.19	783.72	0.11
Floodchute	Jeffersonville	4054	500-yr	3864.8	454.86	461.41	458.38	461.45	0.000289	1.66	2837.75	1014.3	0.14
Floodchute	Jeffersonville	4054	25-yr	89.86	454.86	457.4	455.56	457.4	0.000058	0.33	272.43	217.2	0.05
Floodchute	Jeffersonville	4054	4/27/2011	500.47	454.86	457.84	456.25	457.87	0.000879	1.29	388.48	306.67	0.2
Floodchute	Jeffersonville	3464	10-yr	0	457.26	457.28	457.28	457.28	0.001134	0.03	0.03	3.33	0.05
Floodchute	Jeffersonville	3464	50-yr	254.92	457.26	459.19	458.16	459.2	0.00208	0.9	282.52	256.94	0.15
Floodchute	Jeffersonville	3464	100-yr	636.55	457.26	459.99	458.56	460.02	0.002524	1.21	524.94	354.29	0.18
Floodchute	Jeffersonville	3464	500-yr	1734.07	457.26	461.24	459.21	461.27	0.003249	1.45	1192.91	741.26	0.2
Floodchute	Jeffersonville	3464	25-yr	0.24	457.26	457.38	457.31	457.38	0.00607	0.22	1.1	18.92	0.16
Floodchute	Jeffersonville	3464	4/27/2011	0.91	457.26	457.52	457.35	457.52	0.001145	0.16	5.62	42.8	0.08
Floodchute	Jeffersonville	2965	10-yr	0	456.04	456.17	456.07	456.17	0	0	1.82	27.57	0
Floodchute	Jeffersonville	2965	50-yr	243.69	456.04	457.85	456.89	457.87	0.003594	1.08	225.15	258.86	0.2
Floodchute	Jeffersonville	2965	100-yr	622.76	456.04	458.76	457.46	458.78	0.002432	1.2	519.9	380.22	0.18
Floodchute	Jeffersonville	2965	500-yr	1519.38	456.04	459.66	458.03	459.71	0.00299	1.7	892.16	447.45	0.21
Floodchute	Jeffersonville	2965	25-yr	0.24	456.04	456.18	456.09	456.18	0.001276	0.12	2.03	29.11	0.08
Floodchute	Jeffersonville	2965	4/27/2011	0.91	456.04	456.19	456.13	456.19	0.011838	0.38	2.41	31.73	0.24
Floodchute	Jeffersonville	2497	10-yr	0	453.58	456.17	453.6	456.17	0	0	344.79	325.74	0
Floodchute	Jeffersonville	2497	50-yr	242.7	453.58	457.81	454.89	457.81	0.000037	0.27	886.15	350.46	0.03
Floodchute	Jeffersonville	2497	100-yr	621.73	453.58	458.64	455.55	458.64	0.000107	0.52	1195.23	395.96	0.05
Floodchute	Jeffersonville	2497	500-yr	1518.61	453.58	459.27	455.99	459.29	0.000412	1.04	1457.82	436.85	0.1
Floodchute	Jeffersonville	2497	25-yr	0.24	453.58	456.18	453.66	456.18	0	0	347.25	325.77	0
Floodchute	Jeffersonville	2497	4/27/2011	0.91	453.58	456.19	453.72	456.19	0	0	351.77	325.83	0
Floodchute	Jeffersonville	2198	10-yr	0	450.72	456.17	450.74	456.17	0	0	1001.98	310.74	0
Floodchute	Jeffersonville	2198	50-yr	241.57	450.72	457.8	451.95	457.8	0.000004	0.15	1586.77	413.52	0.01
Floodchute	Jeffersonville	2198	100-yr	592.16	450.72	458.63	452.41	458.63	0.000013	0.3	1979.88	531.23	0.03
Floodchute	Jeffersonville	2198	500-yr	1277.54	450.72	459.25	453.01	459.25	0.00004	0.55	2316.64	558.14	0.05
Floodchute	Jeffersonville	2198	25-yr	0.24	450.72	456.18	450.75	456.18	0	0	1004.32	311.13	0
Floodchute	Jeffersonville	2198	4/27/2011	0.91	450.72	456.19	450.79	456.19	0	0	1008.65	311.83	0
Floodchute	Jeffersonville	1835	10-yr	0	454.27	456.17	454.29	456.17	0	0	62.09	59.28	0
Floodchute	Jeffersonville	1835	50-yr	241.57	454.27	457.78	455.89	457.8	0.002487	1.19	203.72	151.92	0.18
Floodchute	Jeffersonville	1835	100-yr	566.59	454.27	458.57	456.57	458.61	0.004388	1.54	367.12	280.05	0.24
Floodchute	Jeffersonville	1835	500-yr	1072.14	454.27	459.14	457.46	459.2	0.005134	1.99	537.93	317.34	0.27
Floodchute	Jeffersonville	1835	25-yr	0.24	454.27	456.18	454.39	456.18	0	0	62.54	59.42	0
Floodchute	Jeffersonville	1835	4/27/2011	0.91	454.27	456.19	454.48	456.19	0.000001	0.01	63.36	59.67	0
Floodchute	Jeffersonville	1674	10-yr	0	456.15	456.17	456.17	456.17	0.000001	0	0.53	48.15	0
Floodchute	Jeffersonville	1674	50-yr	241.57	456.15	456.8	456.71	456.94	0.017381	2.99	80.67	168.72	0.76
Floodchute	Jeffersonville	1674	100-yr	566.59	456.15	457.19	457.05	457.4	0.014998	3.63	156.3	219.73	0.76
Floodchute	Jeffersonville	1674	500-yr	1072.14	456.15	457.57	457.41	457.86	0.015196	4.33	247.35	268.58	0.8
Floodchute	Jeffersonville	1674	25-yr	0.24	456.15	456.18	456.17	456.18	0.016118	0.27	0.87	61.89	0.41
Floodchute	Jeffersonville	1674	4/27/2011	0.91	456.15	456.18	456.18	456.19	0.102056	0.77	1.19	72.46	1.05
Floodchute	Jeffersonville	1519	10-yr	0	451.5	451.53	451.53	451.53	0.001537	0.08	0.01	0.87	0.13
Floodchute	Jeffersonville	1519	50-yr	241.57	451.5	453.19	453.19	453.63	0.025467	5.29	45.63	53.88	1.01
Floodchute	Jeffersonville	1519	100-yr	566.59	451.5	453.97	453.97	454.34	0.026052	4.9	115.6	155.22	1
Floodchute	Jeffersonville	1519	500-yr	1072.14	451.5	454.42	454.42	454.85	0.024565	5.28	203.16	233.3	1
Floodchute	Jeffersonville	1519	25-yr	0.24	451.5	451.6	451.6	451.63	0.068682	1.36	0.17	3.34	1.05
Floodchute	Jeffersonville	1519	4/27/2011	0.91	451.5	451.89	451.68	451.89	0.000954	0.38	2.38	12.31	0.15
Brewster	Jeffersonville	15	10-yr	2200	470.28	477.78	477.77	479.85	0.020639	11.99	217.38	61.03	0.93
Brewster	Jeffersonville	15	50-yr	3850	470.28	479.92	479.92	482.42	0.016723	13.63	370.77	80.97	0.89
Brewster	Jeffersonville	15	100-yr	4750	470.28	480.75	480.75	483.5	0.016452	14.53	439.3	84.29	0.9
Brewster	Jeffersonville	15	500-yr	6800	470.28	483.31	482.32	485.82	0.01116	14.37	668.12	94.53	0.78
Brewster	Jeffersonville	15	25-yr	1470	470.28	476.57	476.56	478.32	0.02424	10.85	150.8	48.92	0.97
Brewster	Jeffersonville	15	4/27/2011	4177	470.28	480.24	480.24	482.82	0.016532	13.95	396.95	82.26	0.89
Brewster	Jeffersonville	14	10-yr	2200	468.78	475.49	472.89	475.92	0.003097	5.29	448.23	93.84	0.39
Brewster	Jeffersonville	14	50-yr	3850	468.78	478.63	474.31	479.11	0.00204	5.74	762.84	106.08	0.34
Brewster	Jeffersonville	14	100-yr	4750	468.78	480.25	474.97	480.75	0.001721	5.89	939.58	113.93	0.32
Brewster	Jeffersonville	14	500-yr	6800	468.78	484.04		484.53	0.001164	5.95	1421.48	140.11	0.28
Brewster	Jeffersonville	14	25-yr	1470	468.78	474.06	472.14	474.41	0.003716	4.79	320.29	84.89	0.41
Brewster	Jeffersonville	14	4/27/2011	4177	468.78	479.26	474.55	479.74	0.001888	5.77	829.57	108.41	0.33
Brewster	Jeffersonville	13.4	10-yr	2200	467.68	473.78	472.77	475.37	0.011288	10.12	217.48	38.07	0.74
Brewster	Jeffersonville	13.4	50-yr	3850	467.68	476.18	474.88	478.6	0.010792	12.48	308.39	64.57	0.77
Brewster	Jeffersonville	13.4	100-yr	4750	467.68	477.56	475.92	480.25	0.009751	13.17	360.62	88.87	0.75
Brewster	Jeffersonville	13.4	500-yr	6800	467.68	483.24	478.03	484.34	0.002646	9.38	1370.38	292.16	0.42
Brewster	Jeffersonville	13.4	25-yr	1470	467.68	472.95	471.65	473.92	0.00851	7.91	185.85	38.05	0.63

Plan: Combo-13e+2c+9a+15b
2/27/2014

River	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)	
Brewster	Jeffersonville	13.4	4/27/2011	4177	467.68	476.76	475.28	479.24	0.010098	12.64	330.38	74.8	0.75
Brewster	Jeffersonville	13.25		Bridge									
Brewster	Jeffersonville	13.1	10-yr	2200	466.68	473.85	471.74	474.97	0.008033	8.52	258.12	39.49	0.58
Brewster	Jeffersonville	13.1	50-yr	3850	466.68	475.28	473.89	477.63	0.013335	12.32	312.46	56	0.76
Brewster	Jeffersonville	13.1	100-yr	4750	466.68	475.88	474.89	478.99	0.016046	14.17	335.28	65.54	0.84
Brewster	Jeffersonville	13.1	500-yr	6800	466.68	477.05	477.05	482.03	0.021698	17.9	379.83	84.15	1
Brewster	Jeffersonville	13.1	25-yr	1470	466.68	473	470.64	473.65	0.005462	6.51	225.79	38.07	0.47
Brewster	Jeffersonville	13.1	4/27/2011	4177	466.68	475.51	474.27	478.13	0.01432	13.01	321.18	59.65	0.79
Brewster	Jeffersonville	12	10-yr	2200	468.08	473.58		474.3	0.009483	6.85	324.71	92.06	0.63
Brewster	Jeffersonville	12	50-yr	3850	468.08	475.09		476.17	0.009237	8.37	471.22	101.43	0.66
Brewster	Jeffersonville	12	100-yr	4750	468.08	475.77		477.04	0.009192	9.08	541.54	107.27	0.67
Brewster	Jeffersonville	12	500-yr	6800	468.08	473.79	475.6	479.96	0.075709	19.97	344.66	93.42	1.79
Brewster	Jeffersonville	12	25-yr	1470	468.08	472.74		473.28	0.009468	5.92	249.41	86.74	0.61
Brewster	Jeffersonville	12	4/27/2011	4177	468.08	475.35		476.49	0.009195	8.63	497.46	102.99	0.66
Brewster	Jeffersonville	11	10-yr	2200	463.82	469.2	468.21	470.19	0.010792	7.99	281.8	77.53	0.68
Brewster	Jeffersonville	11	50-yr	3850	463.82	471.18	469.87	472.45	0.009107	9.19	463.01	105.08	0.66
Brewster	Jeffersonville	11	100-yr	4750	463.82	472.11	470.64	473.47	0.008444	9.6	566.58	117.39	0.65
Brewster	Jeffersonville	11	500-yr	6800	463.82	473.79	472.14	475.36	0.007953	10.52	782.35	139.6	0.64
Brewster	Jeffersonville	11	25-yr	1470	463.82	468.11	467.34	468.91	0.012278	7.17	205.36	64.41	0.7
Brewster	Jeffersonville	11	4/27/2011	4177	463.82	471.53	470.15	472.83	0.008864	9.36	500.02	109.63	0.65
Brewster	Jeffersonville	10	10-yr	2200	458.98	464.7	463.82	465.8	0.012636	8.41	261.71	65.06	0.73
Brewster	Jeffersonville	10	50-yr	3850	458.98	466.02	465.51	467.89	0.016475	11	353.54	74.54	0.87
Brewster	Jeffersonville	10	100-yr	4750	458.98	466.56	466.31	468.86	0.018461	12.2	395	78.44	0.93
Brewster	Jeffersonville	10	500-yr	6800	458.98	467.9	467.9	470.83	0.019004	13.8	508.75	113.03	0.97
Brewster	Jeffersonville	10	25-yr	1470	458.98	463.9	462.86	464.65	0.010487	6.96	211.31	59.78	0.65
Brewster	Jeffersonville	10	4/27/2011	4177	458.98	466.23	465.81	468.26	0.017155	11.44	369.52	76.06	0.89
Brewster	Jeffersonville	9	10-yr	2200	456.45	460.79	460.79	461.61	0.014792	8.09	346.01	187.75	0.77
Brewster	Jeffersonville	9	50-yr	3850	456.45	461.55	461.55	462.68	0.017118	9.77	490.17	191.04	0.85
Brewster	Jeffersonville	9	100-yr	4750	456.45	461.9	461.9	463.19	0.01785	10.44	557.33	192.56	0.88
Brewster	Jeffersonville	9	500-yr	6800	456.45	462.34	462.61	464.27	0.023882	12.76	642	194.27	1.03
Brewster	Jeffersonville	9	25-yr	1470	456.45	460.33	460.33	461.01	0.013516	7.11	259.36	185.75	0.72
Brewster	Jeffersonville	9	4/27/2011	4177	456.45	461.68	461.68	462.87	0.017475	10.04	514.61	191.6	0.87
Brewster	Jeffersonville	8	10-yr	2200	452.16	457.58	456.18	457.67	0.001464	3.02	967.64	366.76	0.25
Brewster	Jeffersonville	8	50-yr	3850	452.16	459.74	456.69	459.82	0.000665	2.57	1789.16	454.03	0.18
Brewster	Jeffersonville	8	100-yr	4750	452.16	460.54	456.91	460.62	0.000866	3.18	2231.11	673.47	0.21
Brewster	Jeffersonville	8	500-yr	6800	452.16	461.98	457.37	462.06	0.000582	2.95	3324.37	793.13	0.18
Brewster	Jeffersonville	8	25-yr	1470	452.16	458.11	455.85	458.14	0.000369	1.62	1164.21	370	0.13
Brewster	Jeffersonville	8	4/27/2011	4177	452.16	459.08	456.75	459.2	0.001276	3.32	1525.59	375.89	0.25
Brewster	Jeffersonville	7	10-yr	2200	450.38	457.4		457.43	0.000239	1.7	1629.7	405.3	0.13
Brewster	Jeffersonville	7	50-yr	3850	450.38	459.63		459.67	0.00018	1.85	2622.85	556.97	0.12
Brewster	Jeffersonville	7	100-yr	4750	450.38	460.41		460.46	0.000184	1.99	3092.29	627.8	0.12
Brewster	Jeffersonville	7	500-yr	6800	450.38	461.86		461.92	0.000193	2.27	4126.57	772.98	0.13
Brewster	Jeffersonville	7	25-yr	1470	450.38	458.06		458.08	0.000066	0.97	1900.77	408.45	0.07
Brewster	Jeffersonville	7	4/27/2011	4177	450.38	458.87		458.93	0.000324	2.32	2236.88	453.54	0.16
Brewster	Jeffersonville	6.5	10-yr	2200	448.1	457.34		457.37	0.000174	1.81	2116.56	597.19	0.12
Brewster	Jeffersonville	6.5	50-yr	3850	448.1	459.6		459.62	0.000124	1.83	3803.67	897.71	0.11
Brewster	Jeffersonville	6.5	100-yr	4750	448.1	460.38		460.41	0.000124	1.93	4548.33	996.54	0.11
Brewster	Jeffersonville	6.5	500-yr	6800	448.1	461.83		461.86	0.000125	2.12	6099.12	1105.58	0.11
Brewster	Jeffersonville	6.5	25-yr	1470	448.1	458.05		458.06	0.000047	1	2570.87	707.77	0.06
Brewster	Jeffersonville	6.5	4/27/2011	4177	448.1	458.8		458.85	0.000232	2.36	3132.21	790.76	0.14
Brewster	Jeffersonville	6	10-yr	2200	447.3	457.32		457.34	0.000077	1.23	2437.94	622.13	0.08
Brewster	Jeffersonville	6	50-yr	3850	447.3	459.58		459.6	0.000068	1.37	3860.48	636	0.08
Brewster	Jeffersonville	6	100-yr	4750	447.3	460.36		460.38	0.000073	1.5	4358.57	639	0.08
Brewster	Jeffersonville	6	500-yr	6800	447.3	461.81		461.84	0.000084	1.76	5287.38	644.56	0.09
Brewster	Jeffersonville	6	25-yr	1470	447.3	458.04		458.05	0.000022	0.7	2889.11	628.46	0.04
Brewster	Jeffersonville	6	4/27/2011	4177	447.3	458.77		458.8	0.00012	1.72	3346.38	632.89	0.1
Brewster	DSFloodchute	5.4	10-yr	2200	444.07	457.13	449.75	457.29	0.000358	3.2	806.77	116.73	0.18
Brewster	DSFloodchute	5.4	50-yr	2841.01	444.07	459.4	450.47	459.55	0.000286	3.26	1069.27	577.41	0.16
Brewster	DSFloodchute	5.4	100-yr	2664.34	444.07	460.23	450.27	460.35	0.000197	2.83	1169.79	640.12	0.14
Brewster	DSFloodchute	5.4	500-yr	3.31	444.07	461.82	444.52	461.82	0	0	3025.36	709.45	0
Brewster	DSFloodchute	5.4	25-yr	1308.09	444.07	457.99	448.54	458.03	0.000094	1.73	904.14	136.28	0.09
Brewster	DSFloodchute	5.4	4/27/2011	3599.47	444.07	458.4	451.25	458.7	0.000625	4.57	951.08	248.88	0.24
Brewster	DSFloodchute	5.25		Bridge									

Plan: Combo-13e+2c+9a+15b
2/27/2014

River	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)	
Brewster	DSFloodchute	5.1	10-yr	2200	444.07	457.11	449.74	457.26	0.000361	3.21	803.87	116.15	0.18
Brewster	DSFloodchute	5.1	50-yr	2841.01	444.07	459.36	450.46	459.51	0.000289	3.28	1064.18	574.32	0.16
Brewster	DSFloodchute	5.1	100-yr	2664.34	444.07	460.21	450.28	460.3	0.00017	2.62	1956.49	638.75	0.13
Brewster	DSFloodchute	5.1	500-yr	3.31	444.07	461.82	444.52	461.82	0	0	3025.36	709.45	0
Brewster	DSFloodchute	5.1	25-yr	1308.09	444.07	457.98	448.54	458.03	0.000094	1.73	903.1	136.14	0.09
Brewster	DSFloodchute	5.1	4/27/2011	3599.47	444.07	458.35	451.25	458.66	0.000633	4.59	945.56	219	0.24
Brewster	DSFloodchute	4	10-yr	2200	444.14	457.16	448.43	457.2	0.000117	1.89	1455.06	205.65	0.1
Brewster	DSFloodchute	4	50-yr	2841.01	444.14	459.41	449.04	459.45	0.000091	1.87	1988.6	283.62	0.09
Brewster	DSFloodchute	4	100-yr	2664.34	444.14	460.24	448.87	460.27	0.000062	1.61	2254.65	373.82	0.07
Brewster	DSFloodchute	4	500-yr	3.31	444.14	461.82	444.48	461.82	0	0	3440.23	858.42	0
Brewster	DSFloodchute	4	25-yr	1308.09	444.14	458	447.45	458.01	0.000031	1.01	1636.81	207.73	0.05
Brewster	DSFloodchute	4	4/27/2011	3599.47	444.14	458.45	449.71	458.53	0.000198	2.64	1753.59	208.85	0.13
Brewster	DSFloodchute	3.4	10-yr	2200	444.14	457.15	448.43	457.19	0.000161	1.77	1451.36	205.64	0.09
Brewster	DSFloodchute	3.4	50-yr	2841.01	444.14	459.41	449.04	459.45	0.000121	1.73	1945.36	283.51	0.08
Brewster	DSFloodchute	3.4	100-yr	2664.34	444.14	460.24	448.88	460.26	0.000082	1.48	2198.76	373.69	0.07
Brewster	DSFloodchute	3.4	500-yr	3.31	444.14	461.82	444.48	461.82	0	0	3448.87	858.42	0
Brewster	DSFloodchute	3.4	25-yr	1308.09	444.14	458	447.45	458.01	0.000041	0.94	1607.58	207.73	0.05
Brewster	DSFloodchute	3.4	4/27/2011	3599.47	444.14	458.45	449.71	458.52	0.000268	2.45	1690.65	208.85	0.12
Brewster	DSFloodchute	3.25		Bridge									
Brewster	DSFloodchute	3.1	10-yr	2200	444.14	457.15	448.43	457.19	0.000161	1.77	1484.59	212.64	0.09
Brewster	DSFloodchute	3.1	50-yr	2841.01	444.14	459.41	449.04	459.44	0.000124	1.75	2254.51	411.08	0.08
Brewster	DSFloodchute	3.1	100-yr	2664.34	444.14	460.24	448.87	460.26	0.000077	1.44	2627.39	502.41	0.07
Brewster	DSFloodchute	3.1	500-yr	3.31	444.14	461.82	444.47	461.82	0	0	3860.62	858.42	0
Brewster	DSFloodchute	3.1	25-yr	1308.09	444.14	457.99	447.44	458.01	0.00005	1.03	1719.49	333.72	0.05
Brewster	DSFloodchute	3.1	4/27/2011	3599.47	444.14	458.43	449.71	458.51	0.000306	2.62	1861.15	335.33	0.13
Brewster	DSFloodchute	2	10-yr	2200	445.64	457.14		457.17	0.000107	1.72	1786.89	302.18	0.1
Brewster	DSFloodchute	2	50-yr	2841.01	445.64	459.4		459.43	0.000071	1.59	2560.47	410.45	0.08
Brewster	DSFloodchute	2	100-yr	2664.34	445.64	460.23		460.25	0.000045	1.33	2929.69	477.79	0.06
Brewster	DSFloodchute	2	500-yr	3.31	445.64	461.82		461.82	0	0	4017.6	742.42	0
Brewster	DSFloodchute	2	25-yr	1308.09	445.64	457.99		458	0.000027	0.9	2056.15	327.87	0.05
Brewster	DSFloodchute	2	4/27/2011	3599.47	445.64	458.42		458.48	0.000169	2.33	2196.55	333.79	0.12
Brewster	DSFloodchute	1	10-yr	2200	444.98	457.15		457.16	0.000028	1.07	3429.8	581.2	0.06
Brewster	DSFloodchute	1	50-yr	2841.01	444.98	459.41		459.42	0.000019	1	4870.2	732.93	0.05
Brewster	DSFloodchute	1	100-yr	2664.34	444.98	460.24		460.24	0.000012	0.84	5519.32	846.8	0.04
Brewster	DSFloodchute	1	500-yr	3.31	444.98	461.82		461.82	0	0	7307.82	1212.78	0
Brewster	DSFloodchute	1	25-yr	1308.09	444.98	457.99		458	0.000007	0.56	3935.85	611.38	0.03
Brewster	DSFloodchute	1	4/27/2011	3599.47	444.98	458.43		458.45	0.000043	1.44	4208	629.42	0.07