FINAL DRAFT LOCAL FLOOD HAZARD MITIGATION ANALYSIS
EXECUTIVE SUMMARY

SCHOHARIE CREEK WATERSHED
TOWN OF PRATTSVILLE
GREENE COUNTY, NEW YORK
September 2013

MMI #3597-19

Prepared for:

New York City Department of Environmental Protection
Stream Management Program

Prepared by:

MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.miloneandmacbroom.com

MILONE & MACBROOM®

EXECUTIVE SUMMARY

Introduction

The Town of Prattsville is located in Greene County, New York in the Schoharie Creek valley in the northwest part of the Catskill Mountains. Schoharie Creek runs through the Village of Prattsville near Route 23. Huntersfield Creek, a tributary to Schoharie Creek, is also located in Prattsville, its confluence near the intersection of Route 10 with Route 23. Schoharie Creek is located upstream of and is a tributary to the Schoharie Reservoir, a potable drinking water source for New York City.

In late August 2011, Tropical Storm Irene, followed by Tropical Storm Lee in early September caused catastrophic flooding in Prattsville, with extensive damage to homes, businesses, and local infrastructure. The U.S. Geological Survey (USGS) reported a peak flow rate in Schoharie Creek of 120,000 cubic feet per second (cfs), which is 24 percent larger than the FEMA-predicted 500-year frequency (0.2% annual chance) flood and 2.2 times larger than the previously recorded high flow in 1996.

At the request of the Town of Prattsville and Greene County, the New York City Department of Environmental Protection (NYCDEP) Stream Management Program has been providing post-flood assistance since 2011. Milone & MacBroom, Inc. (MMI) was retained by NYCDEP to assess flood hazard conditions and potential mitigation measures for the Village of Prattsville. The analysis, presented in the subject report, evaluates existing flood vulnerabilities and flood mitigation alternatives. The analysis focuses on mitigation of larger floods (i.e. the 50-year and greater events).

Summary of Alternatives Evaluated

Table ES-1 presents a summary of the primary alternatives evaluated to date. A brief description of each alternative follows.

TABLE ES-1
Flood Mitigation Alternatives Evaluated

Alt.	Description	Model Reference	Effect During 100-Year Event (1% Chance of Occurrence)
1	Berm and Floodplain Alteration	DC-D	Localized flood mitigation ~ 1 foot
2	Route 23 Bridge Replacement	MC-A	Flood mitigation of ~ 2 to 4 feet
3	Channel Deepening and Widening (210’ to 260’ wide channel)*	MC-E	Flood mitigation of ~ 2 to 7 feet
4	Channel Deepening, Widening and Bridge Replacement	MC-F	Flood mitigation of ~ 4 to 7 feet
5	Construction of a Bypass Channel	MC-G	Additional survey needed to fully assess
6	Removal of Concrete Fish Barrier	UC-A	Localized flood depth reduction ~ 2 feet
7	Replacement of Main Street Bridge over Huntersfield Creek	HC-1	Minimal localized flood mitigation
8	Realignment of Huntersfield Creek Outlet	HC-2	Insignificant flood mitigation

*Also evaluated under this alternative was a wider, 500-foot compound channel.

- Alternative 1 – Berm and Floodplain Alteration – In 2004, Greene County partially removed a large berm on the left bank (looking downstream) of Schoharie Creek downstream of the Route 23 bridge. Further lowering of the berm in combination with floodplain vegetation clearing is predicted to reduce water levels during both the 10-year (10% annual chance) and 100-year (1% annual chance) frequency floods by approximately one foot as compared to existing conditions. This is a modest benefit, but could be locally significant to houses near the flood threshold. Additional survey is necessary to determine the number of properties and extent of flood reduction that would result from implementation of this alternative.

- Alternative 2 – Route 23 Bridge Replacement – The analysis of existing water profiles indicates that there is a significant energy loss (increase in water elevation) due to the Route 23 bridge and the narrow channel of Schoharie Creek near the bridge. The HEC-RAS computer model indicates that replacing the bridge with a larger structure would lead to a four-foot water elevation reduction near and upstream of the bridge, declining to 2.65 feet at the Dutch Church, and decreasing to 0.13 feet at the Huntersfield Creek bridge area for the 100-year event (1% annual chance). While implementation of this alternative would decrease flood *depths*, the horizontal *extent* of flooding would not be significantly reduced. (Refer to Figure 5-3.) The bridge occurs at a narrow point in the channel. When it is replaced, channel widening at the crossing location should be undertaken as well.

- Alternative 3 – Channel Deepening and Widening – A variety of channel configurations were evaluated to identify the potential benefit of widening and/or deepening Schoharie Creek through Prattsville. Modeled depth of excavation varied by location, with the channel bottom up to four feet deeper. The ideal channel cross section relative to flow and sediment conveyance, aesthetics, stability, and habitat enhancement would be a "compound channel" that includes a base channel to convey normal flows, combined with a normally dry overflow area to convey flood flows and transport sediment. However, a width of approximately 500 feet would be needed to support a compound channel capable of conveying the 100-year (1% annual chance) flood event. This would encompass significant land upstream of the Route 23 bridge and would require relocation of Main Street. Therefore, an alternate channel configuration, spanning 210 to 260 feet in width was modeled as a compromise. Modeling demonstrates an anticipated drop in water surface elevations from two to almost seven feet during the 100-year event. This configuration would also require land along the right bank (looking downstream), but primarily on the river side of Main Street. (Refer to Figure 5-5). For the 100-year frequency event, a flood reduction of 1.93 feet is predicted upstream of the Route 23 bridge. Moving upstream, flood reduction is more pronounced, with a maximum benefit of 6.75 feet upstream of the Huntersfield Creek bridge along Route 23.

- Alternative 4 – Channel Deepening, Widening, and Bridge Replacement – This alternative combines Alternative 2 and 3, to include channel widening and deepening in combination with replacement of the Route 23 bridge. Implementation of this alternative would provide reduction in the depth as well as the extent of flooding. For the 100-year frequency flood event, a flood depth reduction of 3.65 feet is predicted upstream of the Route 23 bridge. Moving upstream, flood reduction is more pronounced, with a maximum benefit of 7.43 feet upstream of the Huntersfield Creek bridge along Route 23. Bridge replacement in combination with channel deepening and widening would decrease the limit of the 100-year floodplain by several hundred feet in some places (refer to Figure 5-8).

- Alternative 5 – Construction of a Bypass Channel – A bypass channel in combination with bridge replacement and channel excavation was also evaluated. The bypass would be a normally dry excavated channel wherein normal river flow would stay in the channel, while excess flood flows would "bypass" under Main Street, across the mid-section of Pine Street, where trailer homes were previously flooded and removed, and back to the river. During non-flooding conditions, the bypass channel could be used as open space for recreation. The advantage of this concept is that it reduces the impact on developed properties compared to the full-length compound channel. However, it would still require bridge replacement, channel excavation, and significant overall disturbance to the community.

- Alternative 6 – Removal of Concrete Fish Barrier – A low concrete weir extends across Schoharie Creek a short distance upstream of the Village of Prattsville. The weir was constructed by the New York Conservation Department (now NYS DEC) to block the upstream passage of small mouth bass from Schoharie Reservoir. Removing the weir would reduce the upstream base flood to 1169.6 feet, similar to the road elevation. Flood water elevations immediately upstream would be reduced by 2.27 feet to 3.7 feet, which would have a minor effect on how water is diverted onto Main Street. Alternatively, a high flow bypass could be constructed on the floodplain terrace adjacent to the weir to provide a pathway for water to move around the weir and back into the channel during high flows. Additional survey and modeling would be required to verify the feasibility and effectiveness of this option.

- Alternative 7 – Replacement of Main Street Over Huntersfield Creek – The existing conditions hydraulic analysis indicates that the Main Street bridge over Huntersfield Creek is subject to pressure flow during a 50-year design storm under a normal depth downstream boundary condition. Although the model predicts that the bridge and channel will convey the 100-year storm, the pressure flow at the bridge for even the 50-year storm is indicative of potential problems, should any debris reduce the effective opening of the crossing. MMI evaluated the option of widening the existing crossing from 50 to 70 feet, along with modifications to the channel on the upstream and downstream sides of the bridge to reflect a widened channel and floodplain. By increasing the channel and bridge width, the predicted 50-year water surface elevation at the bridge would be reduced by an estimated 0.68 feet, and remove the pressure flow aspect at that streamflow. The 100-year flow would remain under pressure flow at the bridge, with an estimated 0.77-foot reduction in water surface elevation. The minor flood reduction would only marginally affect a few properties in the vicinity of Huntersfield Creek and the bridge would remain at risk for debris blockage.

- Alternative 8 – Realignment of Huntersfield Creek Outlet – Realignment of Huntersfield Creek was assessed to determine if a more direct hydraulic connection with Schoharie Creek would be beneficial for flood mitigation. Model analysis indicated that this realignment would not be effective at reducing water surface elevations at the Main Street bridge.

None of the alternatives evaluated will substantially reduce the extent of the floodplain downstream of Route 23, adjacent to Hylan Boulevard. The majority of structures in this area are located close to the river, with a large portion of the floodplain in the field area behind the structures. A number of structures have been removed following Tropical Storm Irene. Others have been repaired and rebuilt.

Summary of Findings

A summary of findings follows:

1. The subject study was undertaken to evaluate a number of potential measures relative to their potential to mitigate flooding conditions in the Village of Prattsville. The study used FEMA hydraulic modeling (effective May 2008) and existing LiDAR-based topographic mapping. Both will require updating to fully analyze the dredging that occurred after Tropical Storm Irene and natural river changes since then, as well as to enable a more refined analysis of the mitigation alternatives.

2. The effects of the Gilboa Dam on flooding was modeled and demonstrated that the presence of this dam does not cause and/or negatively impact flooding in the Village of Prattsville.

3. Alternatives were evaluated to replace the Route 23 bridge and various combinations of channel widening, deepening, and reshaping. Results indicate that replacement of the Route 23 bridge alone (Alternative 2) provides some relief in flood depths, but not in the flood inundation area. Creation of a compound channel large enough to accommodate the 100-year flood would span approximately 500 feet, and would displace many of the very structures we are trying to protect. It would also require relocation of Main Street and replacement of the Route 23 bridge. The Route 23 bridge is over 50 years old and will need to be replaced in the future, regardless of flooding issues. Replacement of the bridge in combination with a channel approximately 250 feet wide will reduce both the extent and depth of flooding, but will not entirely eliminate flooding in Prattsville. Approximately ten structures would be displaced to accommodate the channel.

4. It is not clear that the costs associated with Alternatives 2 (bridge replacement), 3 (channel alteration), 4 (combination bridge and channel alteration), or 5 (bridge replacement, channel alteration, and bypass channel) are justified when compared to the cost of acquiring all of the properties that would be "removed" from the 50-year and 100-year floodplains when the edges of inundation shift toward Schoharie Creek. It may be less costly to acquire and remove the structures that would have fallen outside the new floodplain limits; however, such acquisition would remove a significant number of properties from the center of the Village and would likely have significant impacts on its character, composition, and economy. As such, economics alone may not be the driving factor.

5. Alternatives were evaluated in the lower portion of the study area, downstream of the Route 23 bridge involving removal of the remaining vestiges of a berm along the left bank

of the river in combination with floodplain clearing (Alternative 1). Implementation of this alternative would result in a modest benefit, with a predicted one-foot reduction in flood depth. This mitigation could be locally significant to houses near the flood threshold; however, additional survey is necessary to determine the number of properties and extent of flood reduction that would result.

6. Removal of the concrete fish barrier at the upper end of the study area (Alternative 6) is predicted to reduce inundation of three nearby homes. The cost of the weir removal may be similar to the cost of acquiring the three homes that would benefit from reduced inundation, but removing the weir would also benefit other properties that may be affected by floodwaters that are deflected along Route 23, as well as the road itself in the vicinity of the weir. Alternatively, a high flow bypass may be feasible to provide a pathway for water to move around the weir and back into the channel during high flows.

7. Replacement of the Main Street bridge over Huntersfield Creek (Alternative 7) would allow for increased capacity and reduced potential for overtopping. However, modeling demonstrated little overall benefit associated with this alternative.

8. Relocation of the Huntersfield Creek outlet (Alternative 8) would reduce its length and increase efficiency but would not result in measurable flood mitigation.

9. Non-channel measures, such as flood proofing individual buildings, elevating structures above flood levels, and strategically relocating structures out of the floodplain are possible and could have positive benefits for individual property owners. However, placement of large amounts if fill in the floodplain is ill advised. Additionally, raising a structure will not protect against damage caused by scour around the foundation and the structural damage that may result during flood conditions.

10. New development within the existing floodplain as well as extensive improvements to existing structures and properties will be vulnerable to repetitive losses in the future. These properties are viable candidates for acquisition, should the owners be amenable to such a course of action.

11. A total of 17 properties were evaluated using formal FEMA Benefit Cost Analysis (BCA). In general, properties located near the southern end of Main Street had Benefit Cost Ratios (BCRs) lower than 1.0, whereas properties located near the northern end of Main Street had BCRs greater than 1.0. A BCR must be greater than 1.0 for a project to be eligible for FEMA mitigation funds. Surveyed first floor elevations and property appraisals were historically necessary for developing BCRs that FEMA could accept. However, as of August 15, 2013, an acquisition/demolition in a Special Flood Hazard Area (SFHA) with a cost of less than $275,000 is automatically considered cost effective for FEMA mitigation funds. Similarly, elevating structures in a SFHA with a cost of less than $176,000 are considered cost effective. FEMA's new approach may cause these types of projects to be much more straightforward, with less reliance on BCA.

12. Education of the community is an ongoing effort. Initial outreach efforts will need to be expanded upon in order to move forward with any alternative.

13. The subject study relies on the FEMA model associated with the FIS. At some point in the future, it would be prudent to update the FEMA model with current channel and floodplain geometry to refine the incremental benefits of the various options modeled.

In summary, reductions in both the extent and depth of flooding can be achieved in Prattsville with channel modifications in conjunction with replacement of the Route 23 bridge. The specific alternative or combination of alternatives will require input from the Town of Prattsville.

FINAL DRAFT LOCAL FLOOD HAZARD MITIGATION ANALYSIS

SCHOHARIE CREEK WATERSHED
TOWN OF PRATTSVILLE
GREENE COUNTY, NEW YORK
September 2013

MMI #3597-19

Prepared for:

New York City Department of Environmental Protection
Stream Management Program

Prepared by:

MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.miloneandmacbroom.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Introduction

The Town of Prattsville is located in Greene County, New York in the Schoharie Creek valley in the northwest part of the Catskill Mountains. Schoharie Creek runs through the Village of Prattsville near Route 23. Huntersfield Creek, a tributary to Schoharie Creek, is also located in Prattsville, its confluence near the intersection of Route 10 with Route 23. Schoharie Creek is located upstream of and is a tributary to the Schoharie Reservoir, a potable drinking water source for New York City.

In late August 2011, Tropical Storm Irene, followed by Tropical Storm Lee in early September caused catastrophic flooding in Prattsville, with extensive damage to homes, businesses, and local infrastructure. The U.S. Geological Survey (USGS) reported a peak flow rate in Schoharie Creek of 120,000 cubic feet per second (cfs), which is 24 percent larger than the FEMA-predicted 500-year frequency (0.2% annual chance) flood and 2.2 times larger than the previously recorded high flow in 1996.

At the request of the Town of Prattsville and Greene County, the New York City Department of Environmental Protection (NYCDEP) Stream Management Program has been providing post-flood assistance since 2011. Milone & MacBroom, Inc. (MMI) was retained by NYCDEP to assess flood hazard conditions and potential mitigation measures for the Village of Prattsville. The analysis, presented in the subject report, evaluates existing flood vulnerabilities and flood mitigation alternatives. The analysis focuses on mitigation of larger floods (i.e. the 50-year and greater events).

Summary of Alternatives Evaluated

Table ES-1 presents a summary of the primary alternatives evaluated to date. A brief description of each alternative follows.

TABLE ES-1
Flood Mitigation Alternatives Evaluated

Alt.	Description	Model Reference	Effect During 100-Year Event (1% Chance of Occurrence)
1	Berm and Floodplain Alteration	DC-D	Localized flood mitigation ~ 1 foot
2	Route 23 Bridge Replacement	MC-A	Flood mitigation of ~ 2 to 4 feet
3	Channel Deepening and Widening (210' to 260' wide channel)*	MC-E	Flood mitigation of ~ 2 to 7 feet
4	Channel Deepening, Widening and Bridge Replacement	MC-F	Flood mitigation of ~ 4 to 7 feet
5	Construction of a Bypass Channel	MC-G	Additional survey needed to fully assess
6	Removal of Concrete Fish Barrier	UC-A	Localized flood depth reduction ~ 2 feet
7	Replacement of Main Street Bridge over Huntersfield Creek	HC-1	Minimal localized flood mitigation
8	Realignment of Huntersfield Creek Outlet	HC-2	Insignificant flood mitigation

*Also evaluated under this alternative was a wider, 500-foot compound channel.

- Alternative 1 – Berm and Floodplain Alteration – In 2004, Greene County partially removed a large berm on the left bank (looking downstream) of Schoharie Creek downstream of the Route 23 bridge. Further lowering of the berm in combination with floodplain vegetation clearing is predicted to reduce water levels during both the 10-year (10% annual chance) and 100-year (1% annual chance) frequency floods by approximately one foot as compared to existing conditions. This is a modest benefit, but could be locally significant to houses near the flood threshold. Additional survey is necessary to determine the number of properties and extent of flood reduction that would result from implementation of this alternative.

- Alternative 2 – Route 23 Bridge Replacement – The analysis of existing water profiles indicates that there is a significant energy loss (increase in water elevation) due to the Route 23 bridge and the narrow channel of Schoharie Creek near the bridge. The HEC-RAS computer model indicates that replacing the bridge with a larger structure would lead to a four-foot water elevation reduction near and upstream of the bridge, declining to 2.65 feet at the Dutch Church, and decreasing to 0.13 feet at the Huntersfield Creek bridge area for the 100-year event (1% annual chance). While implementation of this alternative would decrease flood *depths*, the horizontal *extent* of flooding would not be significantly reduced. (Refer to Figure 5-3.) The bridge occurs at a narrow point in the channel. When it is replaced, channel widening at the crossing location should be undertaken as well.

- Alternative 3 – Channel Deepening and Widening – A variety of channel configurations were evaluated to identify the potential benefit of widening and/or deepening Schoharie Creek through Prattsville. Modeled depth of excavation varied by location, with the channel bottom up to four feet deeper. The ideal channel cross section relative to flow and sediment conveyance, aesthetics, stability, and habitat enhancement would be a "compound channel" that includes a base channel to convey normal flows, combined with a normally dry overflow area to convey flood flows and transport sediment. However, a width of approximately 500 feet would be needed to support a compound channel capable of conveying the 100-year (1% annual chance) flood event. This would encompass significant land upstream of the Route 23 bridge and would require relocation of Main Street. Therefore, an alternate channel configuration, spanning 210 to 260 feet in width was modeled as a compromise. Modeling demonstrates an anticipated drop in water surface elevations from two to almost seven feet during the 100-year event. This configuration would also require land along the right bank (looking downstream), but primarily on the river side of Main Street. (Refer to Figure 5-5). For the 100-year frequency event, a flood reduction of 1.93 feet is predicted upstream of the Route 23 bridge. Moving upstream, flood reduction is more pronounced, with a maximum benefit of 6.75 feet upstream of the Huntersfield Creek bridge along Route 23.

- Alternative 4 – Channel Deepening, Widening, and Bridge Replacement – This alternative combines Alternative 2 and 3, to include channel widening and deepening in combination with replacement of the Route 23 bridge. Implementation of this alternative would provide reduction in the depth as well as the extent of flooding. For the 100-year frequency flood event, a flood depth reduction of 3.65 feet is predicted upstream of the Route 23 bridge. Moving upstream, flood reduction is more pronounced, with a maximum benefit of 7.43 feet upstream of the Huntersfield Creek bridge along Route 23. Bridge replacement in combination with channel deepening and widening would decrease the limit of the 100-year floodplain by several hundred feet in some places (refer to Figure 5-8).

- Alternative 5 – Construction of a Bypass Channel – A bypass channel in combination with bridge replacement and channel excavation was also evaluated. The bypass would be a normally dry excavated channel wherein normal river flow would stay in the channel, while excess flood flows would "bypass" under Main Street, across the mid-section of Pine Street, where trailer homes were previously flooded and removed, and back to the river. During non-flooding conditions, the bypass channel could be used as open space for recreation. The advantage of this concept is that it reduces the impact on developed properties compared to the full-length compound channel. However, it would still require bridge replacement, channel excavation, and significant overall disturbance to the community.

- Alternative 6 – Removal of Concrete Fish Barrier – A low concrete weir extends across Schoharie Creek a short distance upstream of the Village of Prattsville. The weir was constructed by the New York Conservation Department (now NYS DEC) to block the upstream passage of small mouth bass from Schoharie Reservoir. Removing the weir would reduce the upstream base flood to 1169.6 feet, similar to the road elevation. Flood water elevations immediately upstream would be reduced by 2.27 feet to 3.7 feet, which would have a minor effect on how water is diverted onto Main Street. Alternatively, a high flow bypass could be constructed on the floodplain terrace adjacent to the weir to provide a pathway for water to move around the weir and back into the channel during high flows. Additional survey and modeling would be required to verify the feasibility and effectiveness of this option.

- Alternative 7 – Replacement of Main Street Over Huntersfield Creek – The existing conditions hydraulic analysis indicates that the Main Street bridge over Huntersfield Creek is subject to pressure flow during a 50-year design storm under a normal depth downstream boundary condition. Although the model predicts that the bridge and channel will convey the 100-year storm, the pressure flow at the bridge for even the 50-year storm is indicative of potential problems, should any debris reduce the effective opening of the crossing. MMI evaluated the option of widening the existing crossing from 50 to 70 feet, along with modifications to the channel on the upstream and downstream sides of the bridge to reflect a widened channel and floodplain. By increasing the channel and bridge width, the predicted 50-year water surface elevation at the bridge would be reduced by an estimated 0.68 feet, and remove the pressure flow aspect at that streamflow. The 100-year flow would remain under pressure flow at the bridge, with an estimated 0.77-foot reduction in water surface elevation. The minor flood reduction would only marginally affect a few properties in the vicinity of Huntersfield Creek and the bridge would remain at risk for debris blockage.

- Alternative 8 – Realignment of Huntersfield Creek Outlet – Realignment of Huntersfield Creek was assessed to determine if a more direct hydraulic connection with Schoharie Creek would be beneficial for flood mitigation. Model analysis indicated that this realignment would not be effective at reducing water surface elevations at the Main Street bridge.

None of the alternatives evaluated will substantially reduce the extent of the floodplain downstream of Route 23, adjacent to Hylan Boulevard. The majority of structures in this area are located close to the river, with a large portion of the floodplain in the field area behind the structures. A number of structures have been removed following Tropical Storm Irene. Others have been repaired and rebuilt.

Summary of Findings

A summary of findings follows:

1. The subject study was undertaken to evaluate a number of potential measures relative to their potential to mitigate flooding conditions in the Village of Prattsville. The study used FEMA hydraulic modeling (effective May 2008) and existing LiDAR-based topographic mapping. Both will require updating to fully analyze the dredging that occurred after Tropical Storm Irene and natural river changes since then, as well as to enable a more refined analysis of the mitigation alternatives.

2. The effects of the Gilboa Dam on flooding was modeled and demonstrated that the presence of this dam does not cause and/or negatively impact flooding in the Village of Prattsville.

3. Alternatives were evaluated to replace the Route 23 bridge and various combinations of channel widening, deepening, and reshaping. Results indicate that replacement of the Route 23 bridge alone (Alternative 2) provides some relief in flood depths, but not in the flood inundation area. Creation of a compound channel large enough to accommodate the 100-year flood would span approximately 500 feet, and would displace many of the very structures we are trying to protect. It would also require relocation of Main Street and replacement of the Route 23 bridge. The Route 23 bridge is over 50 years old and will need to be replaced in the future, regardless of flooding issues. Replacement of the bridge in combination with a channel approximately 250 feet wide will reduce both the extent and depth of flooding, but will not entirely eliminate flooding in Prattsville. Approximately ten structures would be displaced to accommodate the channel.

4. It is not clear that the costs associated with Alternatives 2 (bridge replacement), 3 (channel alteration), 4 (combination bridge and channel alteration), or 5 (bridge replacement, channel alteration, and bypass channel) are justified when compared to the cost of acquiring all of the properties that would be "removed" from the 50-year and 100-year floodplains when the edges of inundation shift toward Schoharie Creek. It may be less costly to acquire and remove the structures that would have fallen outside the new floodplain limits; however, such acquisition would remove a significant number of properties from the center of the Village and would likely have significant impacts on its character, composition, and economy. As such, economics alone may not be the driving factor.

5. Alternatives were evaluated in the lower portion of the study area, downstream of the Route 23 bridge involving removal of the remaining vestiges of a berm along the left bank

of the river in combination with floodplain clearing (Alternative 1). Implementation of this alternative would result in a modest benefit, with a predicted one-foot reduction in flood depth. This mitigation could be locally significant to houses near the flood threshold; however, additional survey is necessary to determine the number of properties and extent of flood reduction that would result.

6. Removal of the concrete fish barrier at the upper end of the study area (Alternative 6) is predicted to reduce inundation of three nearby homes. The cost of the weir removal may be similar to the cost of acquiring the three homes that would benefit from reduced inundation, but removing the weir would also benefit other properties that may be affected by floodwaters that are deflected along Route 23, as well as the road itself in the vicinity of the weir. Alternatively, a high flow bypass may be feasible to provide a pathway for water to move around the weir and back into the channel during high flows.

7. Replacement of the Main Street bridge over Huntersfield Creek (Alternative 7) would allow for increased capacity and reduced potential for overtopping. However, modeling demonstrated little overall benefit associated with this alternative.

8. Relocation of the Huntersfield Creek outlet (Alternative 8) would reduce its length and increase efficiency but would not result in measurable flood mitigation.

9. Non-channel measures, such as flood proofing individual buildings, elevating structures above flood levels, and strategically relocating structures out of the floodplain are possible and could have positive benefits for individual property owners. However, placement of large amounts if fill in the floodplain is ill advised. Additionally, raising a structure will not protect against damage caused by scour around the foundation and the structural damage that may result during flood conditions.

10. New development within the existing floodplain as well as extensive improvements to existing structures and properties will be vulnerable to repetitive losses in the future. These properties are viable candidates for acquisition, should the owners be amenable to such a course of action.

11. A total of 17 properties were evaluated using formal FEMA Benefit Cost Analysis (BCA). In general, properties located near the southern end of Main Street had Benefit Cost Ratios (BCRs) lower than 1.0, whereas properties located near the northern end of Main Street had BCRs greater than 1.0. A BCR must be greater than 1.0 for a project to be eligible for FEMA mitigation funds. Surveyed first floor elevations and property appraisals were historically necessary for developing BCRs that FEMA could accept. However, as of August 15, 2013, an acquisition/demolition in a Special Flood Hazard Area (SFHA) with a cost of less than $275,000 is automatically considered cost effective for FEMA mitigation funds. Similarly, elevating structures in a SFHA with a cost of less than $176,000 are considered cost effective. FEMA's new approach may cause these types of projects to be much more straightforward, with less reliance on BCA.

12. Education of the community is an ongoing effort. Initial outreach efforts will need to be expanded upon in order to move forward with any alternative.

13. The subject study relies on the FEMA model associated with the FIS. At some point in the future, it would be prudent to update the FEMA model with current channel and floodplain geometry to refine the incremental benefits of the various options modeled.

In summary, reductions in both the extent and depth of flooding can be achieved in Prattsville with channel modifications in conjunction with replacement of the Route 23 bridge. The specific alternative or combination of alternatives will require input from the Town of Prattsville.

1.0 INTRODUCTION

Prattsville is a rural town in southwestern Greene County, New York, covering almost 20 square miles. It is located in the Schoharie Creek valley in the northwest part of the Catskill Mountains. Figure 1-1 is a location map of the town. Prattsville is located upstream of the Schoharie Reservoir, a potable drinking water source for New York City.

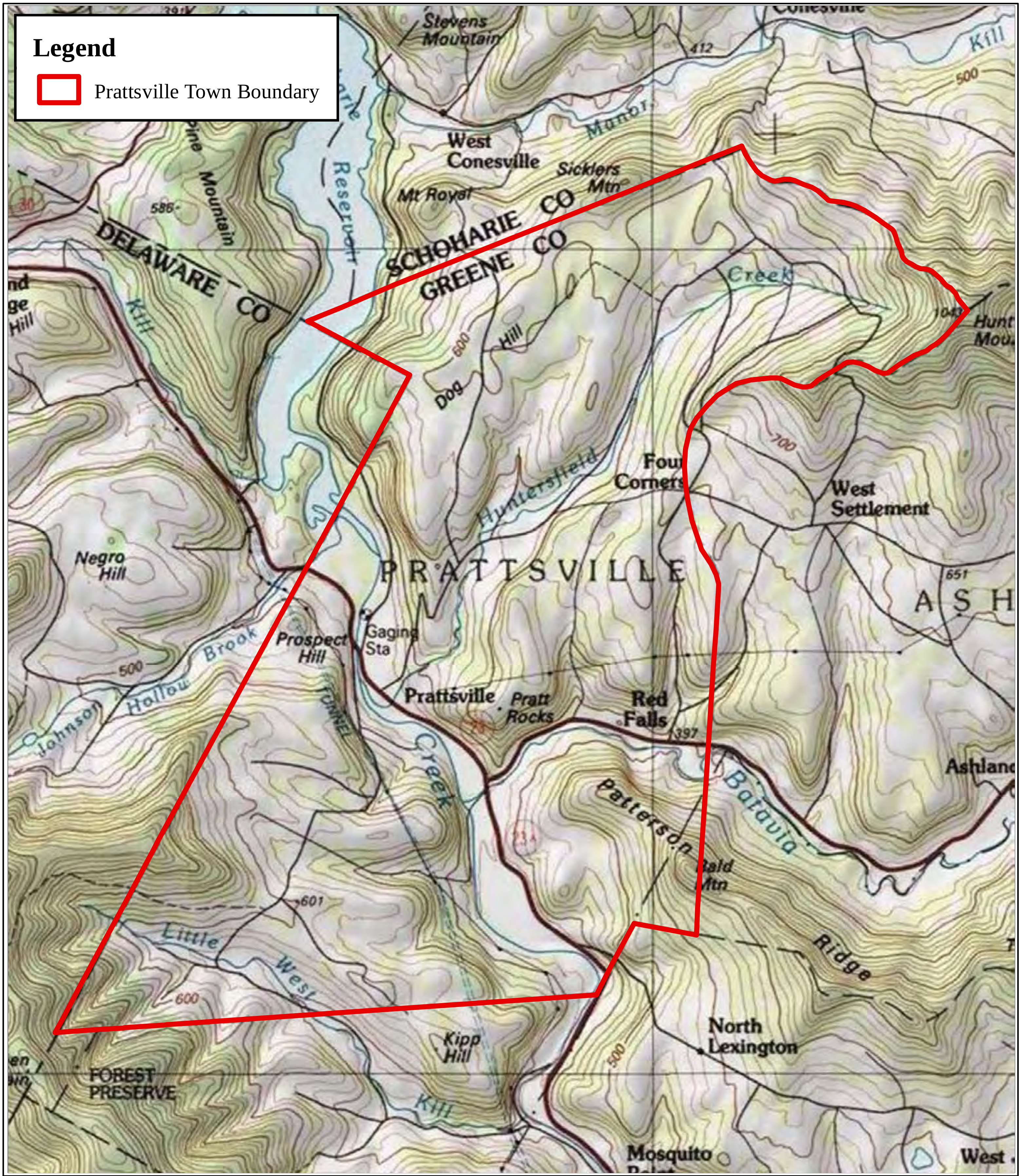
The business district in Prattsville is located at the intersection of two major roads – Main Street (Route 23), which is parallel to Schoharie Creek, and Washington Street, which is perpendicular to it. Many of the small businesses and homes are located along these two roads, very similar to a 1903 topographic map published by the United States Geological Survey (USGS). Figure 1-2 is a plan showing the business district today. It extends for approximately one mile along State Route 23, parallel to the river and is located on a terrace situated on the right side (facing downstream) of the Schoharie Creek channel.

The 2010 census reports a population of 700 in Prattsville. The region was settled in the mid-1700s, and the town was formally established in 1824. A large leather tannery supported a population of almost 2,000 in the mid-1800s.

On August 28, 2011, Tropical Storm Irene caused flooding throughout the northeast, followed shortly thereafter by precipitation from the remnants of Tropical Storm Lee. The U.S. Geological Survey (USGS) reports a peak flow rate at Prattsville during Irene of 120,000 cubic feet per second (cfs). This is 24 percent larger than the FEMA-predicted 500-year frequency (0.2% annual chance) flood. Prattsville suffered extensive damage along its Main Street, as much of the valley bottom was inundated. Other Catskill communities also suffered significant damages including Windham, Ashland, and Maplecrest along the Batavia Kill and West Kill, and Spruceton along West Kill Creek.

Site inspections, eyewitness accounts, YouTube videos, and aerial photographs help reconstruct what happened in August of 2011. There were actually two separate floods. Runoff from Tropical Storm Irene first entered the town along the Huntersfield Creek, a small, steep tributary to the much larger Schoharie Creek. Water left Huntersfield Creek at its Main Street bridge due to debris obstructions, and then flowed along Main Street from south to north.

Shortly after Huntersfield Creek began to recede, Schoharie Creek overtopped its banks beginning near an existing fish migration barrier weir and flowed through the business district, reported to be six to eight feet deep in some locations. Water moved down Main Street flooding buildings, knocking off building foundations, ripping up pavement, and stranding residents in buildings. Slightly higher ground at the intersection of Main Street and Washington Street deflected some water through Young's Agway center, past the firehouse and Prattsville Hotel building. Water rushing along and across Main Street north of Washington Street ripped out sidewalks and created a scour trough toward the Reformed Dutch Church.



SOURCE(S):	Figure 1-1: Location Map of Prattsville	LOCATION:
USGS Topographic Map		Prattsville, NY

N

Schoharie Creek Watershed Local Flood Hazard Mitigation Assessment

Map By: JEP
MMI#: 3597-05-3
MXD: H:\3597-05\GIS\Maps\Prattsville_Figure1-1.mxd
1st Version: 12/06/2012
Revision: 12/6/2012
Scale: 1 inch = 5,000 feet

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

SOURCE(S):
Bing Maps Hybrid 2010

Figure 1-2: Location Plan of Business District

LOCATION:
Prattsville, NY

N

Schoharie Creek Watershed
Local Flood Hazard
Mitigation Assessment

Map By: JEP
MMI#: 3597-05-3
MXD:H:\3597-05\GIS\Maps\Prattsville_Figure1-2.mxd
1st Version: 12/06/2012
Revision:12/6/2012
Scale: 1 inch = 600 feet

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

O'Hara's service station was destroyed as were buildings located east of Main Street, with foundation scour leaving them askew. Water crossing Main Street then followed a slight depression northerly and crossed Pine Street, floating numerous mobile homes downstream to where they became tangled in trees along County Route 7. Most of the buildings along Main Street were destroyed or damaged.

Appendix A contains the preliminary summary report by the United States Geological Survey (USGS) for the floods of Tropical Storm Irene in the State of New York. The storm produced flood flows that were 2.2 times the highest previously recorded flood in 1996. (Refer to Section 3 for additional discussion on historic flows in Schoharie Creek.)

At the request of the Town of Prattsville and Greene County, the New York City Department of Environmental Protection (NYCDEP) Stream Management Program has provided post-flood assistance. Milone & MacBroom, Inc. (MMI) was retained by NYCDEP to assess flood hazard conditions and potential mitigation measures for the Village of Prattsville. The subject Local Flood Hazard Mitigation Analysis (LFHMA) addresses watershed hydrology, existing river morphology, existing channel hydraulics, and floodwater elevations. The goals of this assessment were to:

1. Identify areas subject to flooding;
2. Verify the information in the Federal Emergency Management Agency's (FEMA's) 2008 Flood Insurance Study (FIS); and
3. Conduct a preliminary evaluation of potential alternative methods to mitigate flood hazards and reduce damages.

A public meeting was held at the Prattsville Firehouse on January 20, 2012. Milone & MacBroom, Inc. presented background information and preliminary analysis including:

- an overview of watershed characteristics in Schoharie Creek;
- river system elements;
- principles of watershed management and hydrology;
- characteristics and data associated with Tropical Storm Irene;
- hydraulic modeling results of existing conditions;
- flood hazard reduction mechanisms; and
- results of preliminary hydraulic modeling of initial alternatives.

Based on feedback from the public meeting, additional alternatives were evaluated and subsequently presented at a meeting held on May 1, 2012. The following questions were addressed:

- What is the effect of the Route 23 bridge over Schoharie Creek?
- Does the presence of the Gilboa Dam cause and/or negatively impact flooding in the Village of Prattsville?
- What affect will dredging have on flooding?
- Could a bypass channel be constructed to route water around the center of town?

- How does Huntersfield Creek factor into flooding?
- What impact does the fish migration barrier have on flooding?
- What impact does the berm along the left bank of the Schoharie downstream of the Route 23 bridge have on flooding?

The subject study presents background information on the Schoharie Creek near Prattsville, its hydrology and flow characteristics, and the results of hydraulic analysis of the evaluated alternatives. It is based upon existing topographic data. In some instances, new measurements and mapping will be necessary to refine conclusions and select the appropriate alternative(s) to mitigate flood hazards in Prattsville.

2.0 BACKGROUND

2.1 Resource Data

Flood Insurance Study (FIS)

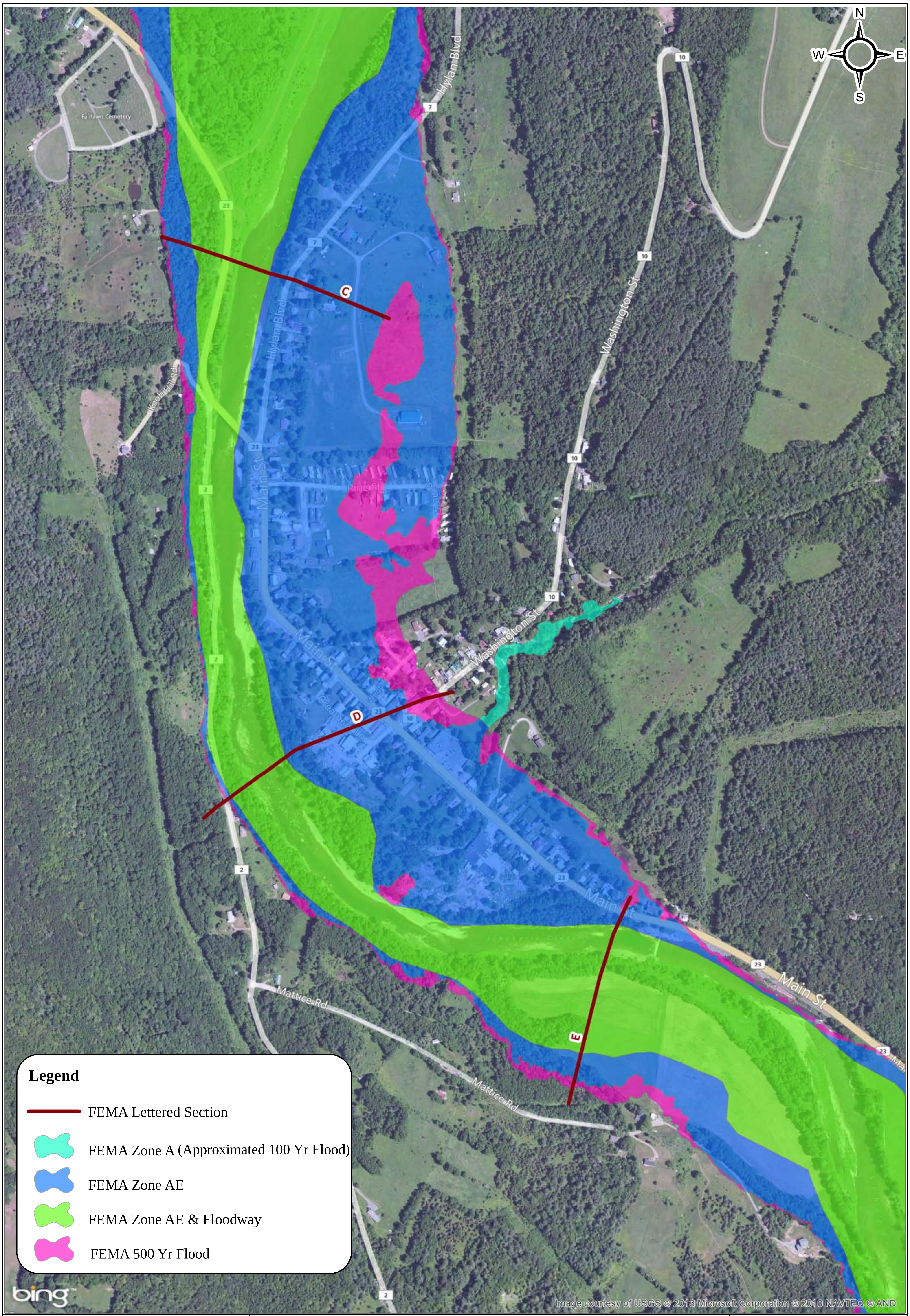
Effective May 16, 2008, FEMA published a Flood Insurance Study (FIS) for all of Greene County that included the full Schoharie Creek watershed. The purpose of the FEMA study was to determine potential floodwater elevations and delineate existing floodplains in order to identify flood hazards and establish insurance rates. The county-wide study combines previous FISs of individual towns that were largely prepared during the 1980s, many of which had been prepared for FEMA by the U.S. Soil Conservation Service (now NRCS).

FEMA's revised hydraulic analysis to compute floodwater elevations and plot the floodplain maps effective in May 2008 was completed several years earlier in 2004 using aerial topographic maps produced from 2001 photographs. An important byproduct of the FIS is a series of HEC-RAS computer models that are available for professional use and are a key component of this Prattsville study. The digital flood insurance rate map (DFIRM) shows that the entire length of Main Street in Prattsville is subject to flooding during the 100-year frequency event. Refer to Figure 2-1. The area predicted to be flooded during the 100-year frequency event is known as the special flood hazard area (SFHA), labeled as FEMA Zone AE on Figure 2-1.

Topographic information is used to define the landscape features and elevations referenced to a fixed datum. For the subject study, topographic data was obtained from the FEMA FIS and NYCDEP. The cross section elevations in the FEMA hydraulic model and the topographic map elevations do not always agree, particularly near Main Street at Pine Street. Further field survey is needed to verify grades in order to take steps towards implementation of any of the alternatives evaluated in this assessment. Topographic mapping from NYCDEP is depicted in Figure 2-2.

Stream Management Plan (SMP)

A detailed description of the Schoharie Creek watershed characteristics and channel is contained in the 2007 Schoharie Creek SMP prepared by the Greene County Soil and Water Conservation District (GCSWCD), with the assistance of NYCDEP. The report presents information on the watershed history, geography, flood history, floodplains, vegetation, land use, fisheries and wildlife, recreation, and water quality. The SMP also includes an inventory of 18 stream management "units" that assess specific on-site conditions based upon field inspections and provide reach by reach recommendations. SMPs are also available for four major tributaries: West Kill, East Kill, Manor Kill, and Batavia Kill. A digital copy of the Schoharie Creek SMP is available at the website http://www.catskillstreams.org.



SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

FEMA Mapping:
National Flood Hazard Data Layer
FIRM Map 36039C0158F
FIRM Map 36039C0166F
Effective Date May 16, 2008

Figure 2-1: FEMA Flood Hazard Map

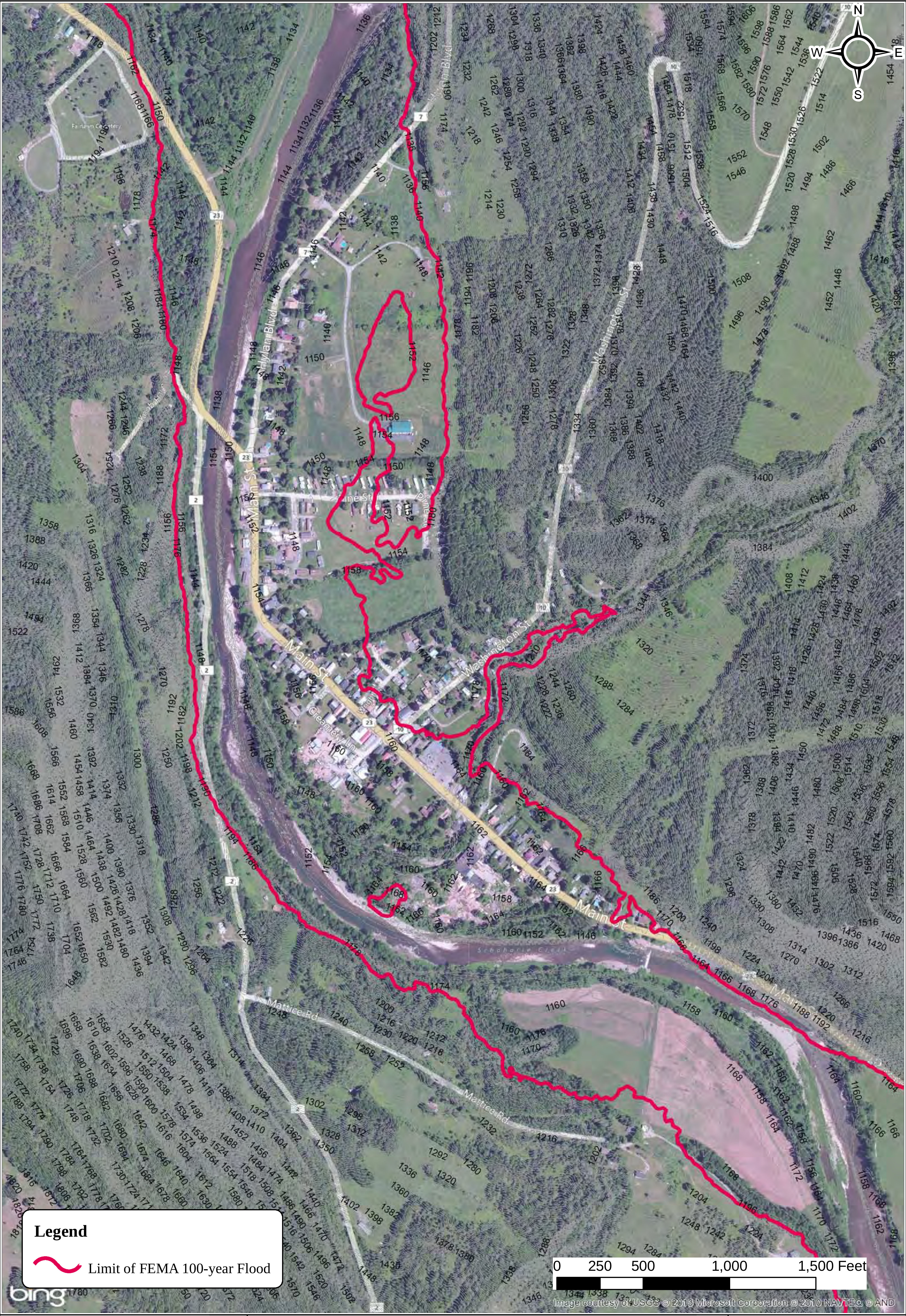
Location:
Prattsville, NY

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-05
MXD: P:\3597-19\Design\GIS\Maps\Prattsville Figure2-1.mxd
1st Version: 4/17/2012
Revision: 9/18/2013
Scale: 1 in = 500 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com



SOURCE(S):
2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
New York City Department of Environmental Protection, Bureau of Water Supply, 2012. Developed under NYCDEP contract CAT-393: Airborne Lidar GIS Terrain and Hydrology Data Development, by RACNE team.
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29

Figure 2-2: Topographic Map

Location:
Prattsville, NY

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-05
MXD: P:\3597-19\Design\GIS\Maps\Prattsville Figure2-2.mxd
1st Version: 4/17/2012
Revision: 9/24/2013
Scale: 1 in = 500 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

USGS Stream Gauging Network

The USGS operates and maintains seven stream flow gauges in the Schoharie Creek watershed and upstream of the Gilboa Dam, including along West Kill, East Kill, Batavia Kill, and Schoharie Creek. The gauges record daily stream flow, including flood flows that are essential to understanding long-term runoff trends. Gauge data can be utilized to determine flood magnitudes and frequencies. Additionally, the "real time" data is available to monitor water levels and provide flood alerts. Live "real time" stream flow data and water levels are available for Prattsville at the USGS website http://waterdata.usgs.gov/ny/nwis/uv?site_no=01350000

Multi-Jurisdictional Hazard Mitigation Plan

The Greene County Multi-Jurisdictional All-Hazard Mitigation Plan (HMP) provides a concise summary of the flood characteristics of Schoharie Creek at Prattsville. The following recommendations for Prattsville are included in the hazard mitigation plan annex:

- Where appropriate, support retrofitting of structures located in hazard-prone areas to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Identify facilities that are viable candidates for retrofitting based on cost-effectiveness versus relocation. Where retrofitting is determined to be a viable option, consider implementation of that action based on available funding.
- Where appropriate, support purchase, or relocation of structures located in hazard-prone areas to protect structures from future damage, with repetitive loss and severe repetitive loss properties as priority. Identify facilities that are viable candidates for relocation based on cost-effectiveness versus retrofitting. Where relocation is determined to be a viable option, consider implementation of that action based on available funding.
- As appropriate, support participation in incentive-based programs such as the Community Rating System (CRS).
- Continue to support the implementation, monitoring, maintenance, and updating of this Plan.
- Strive to maintain compliance with, and good standing in the National Flood Insurance program.
- Continue to develop, enhance, and implement existing emergency plans.
- Create/enhance/maintain mutual aid agreements with neighboring communities.
- Provide emergency back-up power to firehouse.

These recommendations are believed appropriate for the many structures located in the Prattsville business district that were subject to flooding by Irene and other flood events.

Water Quality Reports

New York State's 2012 Section 303(d) inventory lists Schoharie Reservoir as impaired and requiring a Total Maximum Daily Load (TMDL) assessment due to silt and sediment from streambank erosion. Schoharie Creek was not specifically listed in the inventory. The Schoharie Creek is, however, a source of silt and sediment to the Schoharie Reservoir.

Prattsville Comprehensive Land Use Plan

The Prattsville Comprehensive Land Use Plan was developed by the Town Board and published in the year 2000. The Comprehensive Plan notes that "much of the valley floor, including almost all of the hamlet area, is within the 100-year floodplain of Schoharie Creek" and "most of the development has occurred on the valley floors or along the roads that generally follow the upland streams."

The Comprehensive Plan explains that most of the concentrated development of Prattsville is in the hamlet. According to the Comprehensive Plan, the hamlet contains 111 single family homes, 46 mobile homes, and 46 apartments on the east side of Schoharie Creek (approximately half of the town's housing units). Another 21 homes and eight mobile homes on the west side of the creek are formally included in the hamlet as well.

As noted in Section 1.0, the 2010 census reports a population of 700 in Prattsville. Population has been hovering around 700 for decades, with a count of 790 in 1960, 721 in 1970, 666 in 1980, 774 in 1990, and 665 in 2000. Peak population was 1,989 in the mid-1800s.

Like many Catskill communities, second home ownership is significant in Prattsville. The Comprehensive Plan states that "it is estimated that the full-time population figures may represent less than half of Prattsville residents when part-timers and weekenders are included."

Several properties in Prattsville are listed as historic. Table 2-1 lists these properties. The first four on the list are taken from the Comprehensive Plan; the last two entries were taken from a review of the national list, which is publically available.

The Comprehensive Plan notes that the local economy is "somewhat limited" and that commercial establishments include a grocery store, two restaurants, two taverns, three inns, an auto parts store, an auto repair shop, an Agway store, a gasoline service station with convenience store, and two building contractors.

TABLE 2-1
Historical Property Designations

Name	Location	Designation	In SFHA?
Prattsville Commercial Building	Main Street	State and National Register of Historic Places	Yes
Zadock Pratt Museum	Main Street	State and National Register of Historic Places	Yes
Reformed Dutch Church	Main Street	State and National Register of Historic Places	Yes
Pratt Rock Park	Route 23	State and National Register of Historic Places	No
Old Episcopal Manse	Main Street	State and National Register of Historic Places	Yes
John and Martinus Laraway Inn	Main Street	State and National Register of Historic Places	Yes

The Comprehensive Plan explains that standard zoning is not appropriate in Prattsville because the mixed-use pattern of development in the hamlet is desired for a rural community, and division of the town into zoning districts that separate the land uses would be counter to the hamlet's character. However, to ensure that this character is protected, the plan recommended that the town regulate land uses through the use of performance standards as part of a site plan review. These performance standards would serve as an alternative to traditional zoning, allowing new land uses to be developed anywhere in the town and hamlet, provided that the development would conform to the standards.

Local Land Use Regulations

The Prattsville Site Plan Review Law was adopted as local law number 2 of 2004 and filed with the state on January 14, 2005. The law is applicable to all new land uses or "changes, alterations, and expansions" of existing land uses. Exceptions include one and two-family homes, ordinary repairs, exterior alterations that do not change use, agricultural and gardening uses, and certain landscaping and grading. All other activities require a site plan approval by the Planning Board. Considerations for approval include location, size, design, site compatibility, traffic, parking, pedestrian uses, stormwater, drainage, sewage disposal, water supply, landscaping, fire protection, susceptibility to flooding, lighting, utilities, signs, overall impact to the neighborhood, and noxious fumes and smoke.

Although the Comprehensive Plan and Site Plan Review Law lightly address flooding and FEMA flood zones, specific requirements are not included for development or redevelopment in Special Flood Hazard Areas (SFHAs). These provisions appear to be relegated to the town's Flood Damage Prevention Ordinance. Like all communities in the State of New York that participate in the National Flood Insurance Program (NFIP), Prattsville has a Flood Damage Prevention Ordinance. Adopted on March 10, 2008, the ordinance is consistent with the guidance provided by the State in 2007 for counties where new FEMA studies were being conducted. Two feet of freeboard is currently required for new construction in SFHAs per the New York State Building Code. This is more stringent than the previous requirement that buildings must be at or above the base flood elevation.

Rebuild Prattsville

Prattsville Town leaders came together after Tropical Storm Irene in 2011 to form the Rebuild Prattsville Long-Term Community Recovery Steering Committee. The Steering Committee held its first meeting on November 10, 2011. At that meeting, three sub-committees were formed: (1) Housing; (2) Economic Development; and (3) Community Enhancement. The Steering Committee provided charges to each sub-committee to guide their work. The sub-committees began meeting the following week and agreed to meet weekly through early 2012. Newsletters were prepared and published through February 2012 to highlight progress of repairs and rebuilding in Prattsville.

The Town has developed a "Rebuild Prattsville Vision Concept" plan for the town. The concept plan depicts a number of potential enhancements, improvements, and new construction along the southern portion of Main Street including a new "Eco Hotel/Heritage Center" with connection to a riverfront trail system; a new "Civic Hub" with town hall, civic buildings, and service business infill; a Pratt Museum expansion; and Main Street improvements.

Further north, the Rebuild Prattsville Vision Concept plan depicts a "Mixed-Use Center at Town Common" including retail and dining; and "Traditional Neighborhood Redevelopment" including new roads and homes where the mobile home park is currently located. Slightly further north, the concept plan depicts a "Community Center Building" with gymnasium, fitness rooms, community rooms, baseball and soccer fields, basketball courts, tennis courts, and an outdoor walking track.

Most of the Rebuild Prattsville Vision Concept improvements are located entirely or partly within the SFHA, with some parts in the 500-year (0.2% annual chance) flood zone. As such, they would need to follow the provisions of the Flood Damage Prevention Ordinance as well as the Site Plan Review Law. This would require two feet of freeboard for all of the new residential structures and either freeboard or flood proofing for the new and renovated non-residential structures. Parks and outdoor facilities would be allowed to flood, but these outdoor facilities would need to be designed in such a way to be cleaned and returned to use soon after flooding.

2.2 Schoharie Creek Bankfull Flows and Characteristics

Alluvial channels such as Schoharie Creek at Prattsville are located in sedimentary soils composed of sand, gravel, or cobbles that were previously transported and deposited by the river. The channel form (shape, width, depth, slope, sinuosity, side slopes) are influenced by the river's natural processes such as channel forming discharges and periodic sediment loads, with occasional scour or deposition. The channel forming discharge has a magnitude roughly equal to the mean annual flood event, with an average return frequency of one to three years, similar to the height of a typical floodplain above the riverbed. Larger floods overtop the floodplain and are conveyed over land roughly parallel to the main channel. Rivers that have eroded vertically below their corresponding floodplain are said to be entrenched and force most floods to remain in the channel with infrequent use of the floodplain. A former floodplain that is seldom inundated is called a terrace.

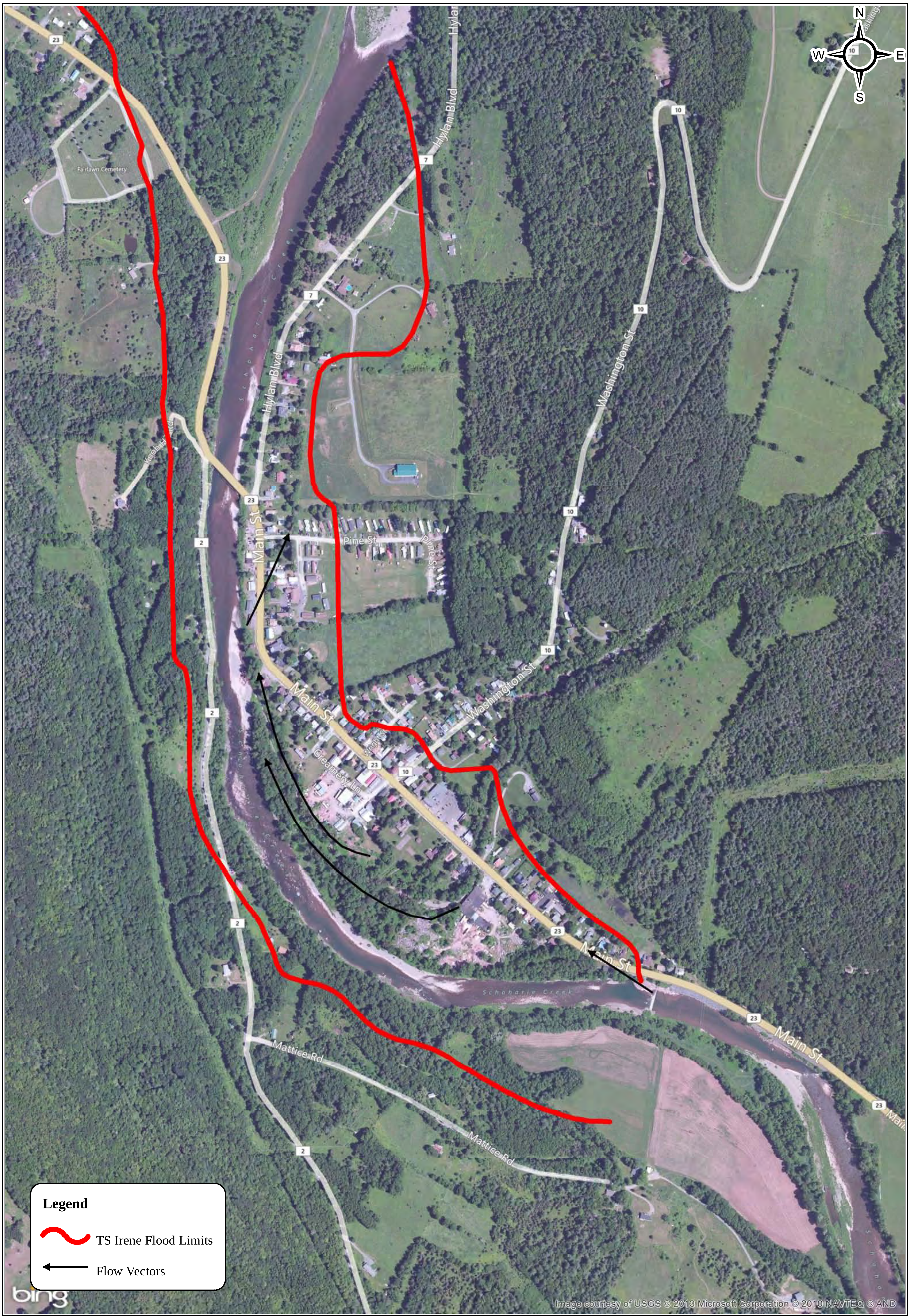
It is commonly accepted that alluvial river channels adjust their width and depth to a long-term dynamic equilibrium condition that corresponds to "bankfull" conditions. Extensive data sets indicate the channel forming or bankfull discharge in specific regions is primarily a function of watershed area. It may also be determined at gauging stations or by using field indicators.

From Lexington, Schoharie Creek approaches Prattsville in a narrow confined valley with long, straight reaches and narrow floodplains that support agricultural fields. Two nearly 90 degree bends are located 1.6 and 2.8 miles upstream of the Batavia Kill confluence, separated by slightly sinuous reaches. The floodplain widens on the right side as the channel reaches Batavia Kill, where large gravel bars of sediment are present. Schoharie Creek then flows northwesterly from the Batavia Kill confluence for 0.7 miles to a concrete fish migration barrier weir at the upstream end of Main Street. The channel is initially on the left side of the valley with a broad floodplain and Route 23 on the right, and then the channel crosses the valley bottom diagonally to the right side at Pratts Rock, a natural outcrop and well known landmark.

Downstream of the fish barrier weir, the channel quickly crosses back to the left side of the narrowing valley bottom. The river then stays along the left bank past the Route 23 bridge. The right side of the valley bottom has an alluvial terrace, possibly of a delta or alluvial fan origin, and a narrow active floodplain. The Hamlet of Prattsville and its Main Street are on this terrace. The floodplain narrows toward the Route 23 bridge.

Main and Washington Streets are on a terrace deposit, influenced by Huntersfield Creek deposits, about ten feet higher than the river's more active floodplain, which narrows at Prattsville.

Limits of the floodwaters for Tropical Storm Irene were evident following the storm, as depicted on Figure 2-3. The flood on Schoharie Creek produced flows of 120,000 cubic feet per second, which is 24 percent greater than the FEMA predicted 500-year frequency flood (0.2% annual chance). The flood and subsequent dredging and bank armoring changed the channel and riverbanks relative to their configuration when the FIS was conducted in 2004. Figure 2-4 pictorially shows a comparison of pre- and post-Irene conditions.



SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
CUGIR's USGS 7.5 Minute Topographic Maps (2000)
Prattsville 7.5-minute Quad
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29

Figure 2-3: Estimated Irene Flood Limits

Location: Prattsville, NY

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-05
MXD: P:\3597-19\Design\GIS\Maps\Prattsville Figure2-3.mxd
1st Version: 4/17/2012
Revision: 1/9/2013
Scale: 1 in = 500 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

HUNTERSFIELD CREEK OVERFLOWED ONTO MAIN STREET

BEFORE

AFTER

BRIGGS EQUIPMENT COMPANY YARD FLOODED

TRAILERS AND ASSOCIATED STRUCTURES DESTROYED

BEFORE

AFTER

BUSINESSES DESTROYED INCLUDING O'HARA'S SERVICE STATION

NORTH ARROW APPROXIMATE DUE TO ANGLE/SKEW OF SATELLITE AERIAL IMAGING

MILONE & MACBROOM®
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773 Fax (203) 272-9733
www.miloneandmacbroom.com

REVISIONS

COMPARISON OF PRE & POST-IRENE CONDITIONS

PRATTSVILLE FLOOD HAZARD MITIGATION

PRATTSVILLE, NEW YORK

DM	DRM	DM
DESIGNED	DRAWN	CHECKED

SCALE: NOT TO SCALE

DATE: 12/20/2012

PROJECT NO.: 3597-05

SHEET NO.: FIG. 2-4

Table 2-2 presents bankfull characteristics for Schoharie Creek. The regional values of bankfull characteristics have been determined based upon the Miller and Davis (2002) regression equation for the Catskill region using their 2.3 cubic feet per square mile (CFSM) version. A second source of published data for Catskill regional flows is the recent USGS Scientific Investigation Report #2009-5411. This data is also presented in Table 2-2.

TABLE 2-2
Bankfull Characteristics for Schoharie Creek

	Q_{bf}, cfs	Width, ft	Depth, ft
Miller & Davis	7,171	214	5.3
USGS SIR 2009-5411	8,341	211	6.0

In contrast to the regional bankfull channel dimensions, the Schoharie channel reach just upstream of the Route 23 bridge had a measured bankfull width of only 156 to 175 feet and no low level floodplain. Consequently, the channel reach near the bridge is undersized for routine floods, resulting in greater floodwater depths.

Schoharie Creek has an alluvial channel with a low, wide cross section and gravel and cobble bed, characteristic of rivers with a mixed grain size sediment load. The bed slope has an average gradient of 0.002 feet per foot, or 0.2 percent, but is locally variable. The banks are generally lightly vegetated sand and gravel, with lacustrine clay visible in some areas. The clay particles are easily suspended and contribute to turbidity and water color. Bank erosion is common along the outside of bends. The right bank along Route 23 upstream of the fish barrier weir is covered with stone riprap, and riprap was recently placed downstream of the weir for 700 linear feet.

The bankfull channel width varies from 192 feet to almost 300 feet. The latest regional prediction of bankfull width is 211 feet. The width approaching the Route 23 bridge is only 192 feet, without a floodplain, suggesting it is too narrow and entrenched. The regional bankfull depth is 6.0 feet.

One potential problem that is evident in Prattsville is the narrow channel compared to upstream and downstream reaches and the narrow to nonexistent floodplain. Selected actual bankfull channel widths are presented in Table 2-3, based upon HEC-RAS model cross sections.

The narrow channel at the Route 23 bridge and the limited floodplain width results in contracted flow conditions that increase upstream flood water elevations, resulting in increased flood hazards.

TABLE 2-3
Selected Channel Widths

Station	Location	Bankfull Channel Widths, ft	Total 10-Year Floodplain Width, ft
9504	FEMA "C"	263	854
10430	Route 23	262	384
11309	Upstream Route 23	192	212
11915		292	332
12594	FEMA "D"	302	453
13050	Washington Street	247	646
15650	Upstream Fish Weir	323	698

3.0 HYDROLOGY

3.1 Introduction

Surface water hydrologic studies are conducted to understand historic and potential future river flow rates using data measured at stream gauging stations and those developed from predictive models. They inform communities of how much water flows in the river at a specific time and place.

The Schoharie Creek has a contributing watershed area of 237 square miles at Prattsville, dominated by steep rural mountains and narrow valleys. The general flow path is from southeast to northwest toward Schoharie Reservoir. It is a single stem, slightly sinuous gravel bed river from 150 to 300 feet wide with a moderate gradient. Hydrologic data on peak flood flow rates is available from FEMA, StreamStats regional data, and USGS gauging stations. StreamStats is a USGS website that uses Geographic Information System (GIS) data and regional regression equations to predict peak flood flow rates.

Major tributaries to the Schoharie Creek upstream of Prattsville include Batavia Kill, West Kill, and East Kill Creeks. The smaller Huntersfield Creek watershed drains through Prattsville into Schoharie Creek.

The Gilboa Dam is located 5.5 miles downstream of Prattsville and creates the 3.5-mile long Schoharie Reservoir. It has a watershed area of 315 square miles that contributes runoff to the impoundment. In comparison, the watershed area at the Prattsville USGS gauge is 237 square miles, equal to 75.2% of the reservoir's watershed.

Several additional tributaries join Schoharie Creek/Reservoir between Prattsville and Gilboa Dam including Manor Kill, Johnson Hollow Brook, and Bear Kill. Consequently, peak flow rates at the Gilboa Dam and gauge are usually larger than at Prattsville, and the peak flow dates and times do not always correspond.

Prattsville has mild summers and cold winters with year-round precipitation. The long-term mean annual precipitation in the watershed is reported to be 46 inches per year (USGS, WRIR 98-4036). However, precipitation is highly variable with greater amounts at high elevations. Tropical Storm Irene caused 11 to 16 inches of rainfall in the Schoharie Creek valley in 12 hours (NYDEC).

3.2 Historic Prattsville Floods

The National Weather Service (NWS) website for Prattsville and the USGS stream gauge have data on historic past floods. Floods on Schoharie Creek have occurred in almost every month of the year but tend to be concentrated in the spring and fall seasons. A list of many of the Schoharie Creek floods' *discharges* was included in the hazard mitigation plan and summarized in Table 3-1.

The more significant flood *elevations* at Prattville are also summarized in Table 3-1. Note that some of the high water elevations (floods) were due to ice jams or debris blockages. The gauged water levels are referenced to an arbitrary "zero point," not a standard elevation datum. The reported zero point for the Prattsville gauge is elevation 1134.98 feet National Geodetic Vertical Datum (NGVD). Critical flood heights have been converted to the standard datum elevations.

The NWS has interpreted how the flood heights reported at the USGS gauge relate to specific land features in Prattsville. MMI has added a column to express water levels in terms of elevation, for comparison with current topographic maps and the FEMA FIS.

TABLE 3-1
USGS Flood Flow Data
Gauge 01350000

Date	Gauge Height	Peak Flow Rate	Elevation (Feet) NAVD88**
08/28/2011	N/A	120,000*	N/A
03/05/1979	19.57	---	1153.85
01/26/1978	19.50	---	1153.78
01/19/1996	19.39	52,800	1153.67
10/16/1955	19.14	51,600	1153.42
04/04/1987	18.37	47,600	1152.65

*Indirect estimate due to gauge damage
**North American Vertical Datum

A review of the USGS data found on the USGS National Water Information System Web Interface (waterdata.usgs.gov/ny) for the annual peak flood flow rates at the Schoharie Creek gauge at Prattsville shows that the median value is slowly increasing from 15,000 cubic feet per second (cfs) in the early 1900s to about 21,000 cfs today. For example, annual peak floods of under 10,000 cfs were very common prior to 1970 but are now less common as flood flows increase. This trend parallels increases in annual precipitation, as reported by the National Climate Data Center and presented in Figure 3-1 on the following page.

Other major floods that predate the modern USGS stream gauge program were reported in the Schoharie Tattler web page as being in 1839, 1849, large floods in 1854 and 1869, 1901, 1902, and a great flood in 1903 with 10 inches of rain in 24 hours causing significant damage.

The National Weather Service has published an interpretation of how water stages at the Prattsville USGS stream gauge relate to local features. That information is summarized in Table 3-2.

FIGURE 3-1
Long-Term Precipitation Trends in the State of New York
Published by NOAA

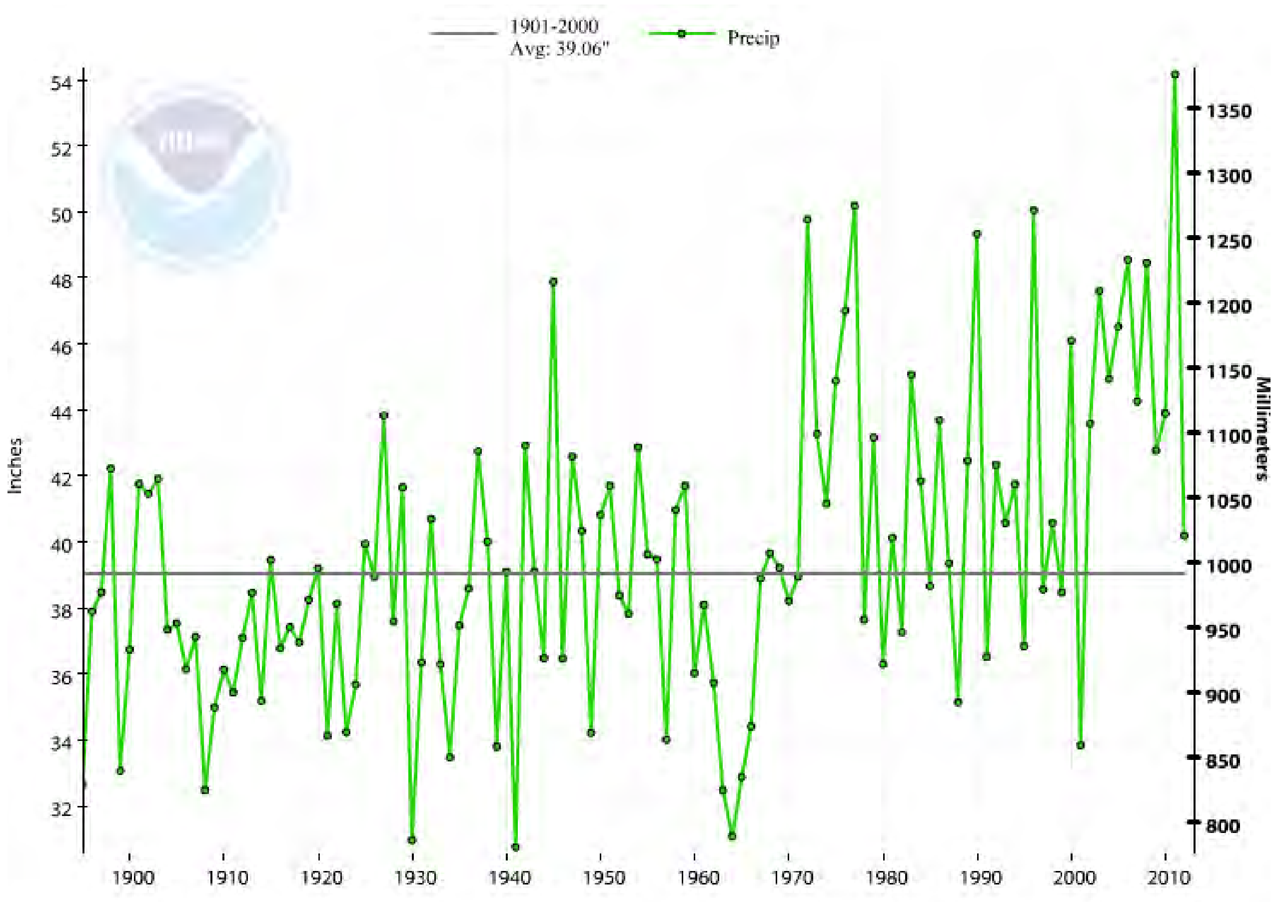


TABLE 3-2
NOAA, National Weather Service Data At Prattsville Gauge*

Flood Category	Gauge Height, ft.	Discharge, cfs	Impact Description
	19		Lower portion of village inundated with three feet of water; dairy herd drowned in 1978 (1978, 1979 ice jams, 1996 flood)
	18	45,500	Substantial damage with two to three feet of water on properties in the village along the river (April 1987 flood)
Major flood	16		Overflows onto County Route 7 north of Route 23
Moderate flood	14	26,000	Overflows onto Main Street, NY State Route 23
	13		Minor flooding of basements
Flood stage	12	18,000	River overflows into lowlands
	11		The river is close to bankfull
Action stage	9		The river is about two thirds bankfull
	7		The river is about half bankfull
	6		The river is about two feet above normal
	5		The river is about a foot above normal
	4		The river is about a foot above normal
	4		The river is about a foot above normal
	4		The river level is normal for spring
	3.5		The river level is normal for June
	3.5		The river level is normal for late fall
	3		The river level is normal for winter
	3		The river level is normal for winter
	3		The river level is normal for early fall
	3		The river level is normal for summer

*http://water.weather.gov/ahps2/hydrograph.php?wfo=aly&gage=ptvn6&hydro_type=0

3.3 Peak Discharge Recurrence Intervals

The FEMA FIS of Greene County was published in 2008 and included data for Schoharie Creek. The peak flow statistics were developed using 98 years of data at the Prattsville USGS gauge, one of the longest-duration records in the state. The peak flow frequencies from the FIS are tabulated in Table 3-3 below. Flood flows estimated from StreamStats and U.S. Army Corps of Engineers are also listed.

TABLE 3-3
Schoharie Creek Peak Discharges (cfs) at Prattsville

Frequency, years	FEMA Flood Insurance Study	USGS StreamStats Regional Data	US ACOE Statistics
10	34,030	28,900	36,850
50	56,710	47,500	64,460
100	67,900	57,100	78,850
500	97,700	82,400	119,320

The above figures indicate that predicted peak flows for Schoharie Creek based on the FIS (which are, in turn, based on gauged flow data) are higher than the averages for the surrounding region that are based on StreamStats.

3.4 Tropical Storm Irene

Tropical Storm Irene originated in the tropical mid-Atlantic region and became the first named storm of 2011. It moved through the eastern Caribbean Sea with landfall in Puerto Rico and the Bahamas, reaching Category 3 intensity. The storm moved up the east coast of the United States, striking a glancing blow at North Carolina and southeast Virginia. Heavy rains caused extensive flooding in New Jersey, New York, and Vermont, even though wind speed diminished. It caused over 15 billion dollars of damage and 56 fatalities. In New Jersey, 33 of 93 long-term USGS gauges exceeded their 100-year frequency flood flow rates. In New York, the floods caused by Tropical Storm Irene closed 200 state highway segments and bridges.

Tropical Storm Irene reportedly delivered 11 to 16 inches of rain onto the Catskill region, causing exceptional rates of surface runoff and stream flow. About 37 USGS stream gauges in eastern New York recorded new record peak flow rates, including Schoharie Creek. Preliminary USGS data indicates that the peak flow rates along Schoharie Creek had an average recurrence interval of above 500 years (0.2% annual chance) at Gilboa and North Blenheim, far exceeding the previous 1996 record event. The stream gauge at Prattsville (#01350000) near the Route 23 bridge recorded 50,000 cfs before being destroyed or damaged. In contrast, the nearby downstream gauge at Gilboa recorded an astonishing estimated flow of 111,000 cfs, compared to the previous gauged maximum of 70,800 cfs in 1996.

The U.S. Geological survey estimates that Tropical Storm Irene produced flows of 120,000 cubic feet per second in Schoharie Creek, which is 24 percent greater than the FEMA predicted 500-year frequency (0.2% annual chance) flood.

The local and regional intensity of the peak flows from Tropical Storm Irene can be appreciated by comparing USGS data measured at gauging stations as tabulated in Table 3-4. The area distribution of the Irene flood flows is evident by comparing the gauged peak flows per square mile (CFSM) shown at the right side of the table. Unit flow rates above 100 cubic feet per second per mile (CFSM) are considered to be high. These figures confirm that the three primary tributaries to Schoharie Creek (West Kill, East Kill, and Batavia Kill) all carried significant discharges leading to high flows at Prattsville.

TABLE 3-4
Regional Peak Flows

USGS Station	Schoharie Watershed	Basin Area (SM)	Peak Flow Rates Aug. 28, 2011 Irene (cfs)	CFSM
0134 9700	East Kill at Jewett Center	35.6	28,400	798
0134 9711	West Kill at Spruceton	5.0	4,320	864
0134 9810	West Kill at West Kill	27.0	19,100	707
0134 9950	Batavia Kill at Red Falls	68.6	44,200	644
0134 9705	Schoharie at Lexington	96.8	40,500	418
0135 0000	Schoharie at Prattsville	237	120,000	506
0135 0035	Bear Kill downstream Prattsville	25.7	2,620	102
0135 0080	Manor Kill at Conesville	32.4	6,590	203
0135 0101	Schoharie at Gilboa	316.0	111,000	315
	Regional Watersheds			
0136 2200	Esopus Creek at Allaben	63.7	29,300	460
0136 2370	Stony Cove Creek at Chichester	30.9	14,300	463
0136 4500	Esopus Creek at Mount Marion	41.9	25,200	60
0143 4498	NE Branch Neversink at Claryville	33.8	11,600	343
0141 3398	Bush Kill at Arkville	46.7	13,800	296
0141 3408	Dry Brook at Arkville	82.2	24,600	299
0136 2195	Birch Creek at Big Indian	12.5	1,460	117

3.5 Flood Control Dams

The Batavia Kill Flood Control District maintains and operates three large flood control dams in the Batavia Kill watershed. They were constructed by the U.S. Department of Agriculture NRCS following a 1960 flood. The pools created by the earth dams normally contain little water, providing "void" space that is used to temporarily detain floodwater. The dams each consist of an earth embankment, low level outlet pipe under the dam, and twin grass-lined emergency spillways for flows in excess of a 100-year frequency flood. All emergency spillways were active during Tropical Storm Irene, with variable levels of erosion.

The magnitude of Tropical Storm Irene is evident at the flood control dams in the Batavia Kill watershed. Table 3-5 presents basic data on each. All three dams were inspected after the flood and found to have been at full capacity, with active spillway usage. The dams performed as designed, storing 2.5 billion gallons of flood runoff. If this runoff had proceeded downstream over 12 hours, it would have increased river flow rates by an estimated 7,600 cfs, a 6.3% increase at Prattsville.

TABLE 3-5
Summary of Flood Control Dams in the Batavia Kill Watershed

Dam Site	Date	Height, ft.	Length, ft.	Total Storage Volume, Acre-Feet	Normal Storage, Acre-Feet	Drainage Basin, sm
#1 – CD Lane	1974	74	1,800	3,598	307	9.6
#3 – Nauvoo Road	1970	63	1,100	1,415	23	3.6
#4A – Siam Road	1967	57	1,400	2,928	43	6.8
			Totals	**7,941**	**373**	**20.0**

The CD Lane Park dam has a small "normal" conservation pool used for fish, wildlife, and recreation. The total conservation storage is reported to be 373 acre-feet, equal to 4.7 percent of the total storage. Had this additional volume been used for flood storage, it would only have reduced peak flows at Prattsville by a potential 37 cfs, or 0.03 percent of the total 120,000 cfs flood. Consequently, retaining the conservative pools at their normal storage levels does not have a significant effect on flood flows downstream.

3.6 Schoharie Reservoir

The Schoharie Creek segment that influences Prattsville begins at the Batavia Kill confluence and extends downstream to Schoharie Reservoir. Schoharie Reservoir is impounded by the 140-foot high Gilboa Dam, completed in 1927 and recently repaired in 2010-2011. The reservoir is owned and operated by New York City and is a major source of potable drinking water. Water withdrawals are conveyed by a tunnel to Esopus Creek and the Ashokan Reservoir. The 2,000-foot long dam has a 1,326-foot long spillway with a crest elevation of 1,130 feet. New 220-foot long stainless steel gates notched into the spillway crest provides operational flexibility for drawdowns. The gates can be raised or lowered by remote control to adjust reservoir water levels.

Schoharie Creek has had significant floods in the past, as noted in Table 3-6, with the corresponding reservoir levels and discharges at the Prattsville USGS gauge. In addition, ice jam-related high water levels have occurred that were less related to river flow rates. Note that the dates of peak flow rates in Gilboa and Prattsville do not always coincide due to variations in rainfall patterns, ice, and pre-flood reservoir levels.

The Schoharie Reservoir water levels during Tropical Storm Irene were the highest ever recorded. NYCDEP activated is Emergency Action Plan (EAP) for one day to monitor conditions.

Relationships between reservoir stage and discharge are commonly plotted on a graph creating a smooth "curve" that depicts rising water stages as the discharges increase. Actual reservoir stages may be affected by wind, waves, flashboards, debris, and condition of the spillway crest.

TABLE 3-6
Peak Discharges at Schoharie Reservoir

Date	Gilboa[1] Peak Discharge, cfs	Reservoir Stage, feet	Prattsville[2] Peak Flow, cfs
August 28, 2011	111,000	1,137.9*	120,000**
January 19, 1996	70,800	1,136.7	52,800
October 16, 1955	65,000	1,135.2	51,600
April 4, 1987	56,400	1,135.7	47,600
March 21, 1980	46,500	1,134.8	39,600
October 1, 2010	---	---	40,900
April 2, 2005	36,800	1,135.3	41,500
March 18, 1936	32,000	1,134.3	38,500
September 21, 1938	31,300	1,131.1	45,000
November 8, 1977	31,300	1,133.2	-
September 18, 2004	29,900	1,133.7	26,500
April 5, 1984	29,100	1,134.7	-

1 – USGS Stream Gauge #01350101
2 – USGS Stream Gauge #01350000
*Prior to the flood, the reservoir was at elevation 1117.9 due to maintenance
**Estimated after the flood by USGS

4.0 HYDRAULIC ANALYSIS

4.1 Schoharie Creek

The purpose of a hydraulic assessment is to evaluate historic and predicted water elevations, identify flood prone areas, and help develop mitigation strategies to minimize future flood damages and protect water quality. Hydraulic analysis techniques also help predict flow velocities, sediment transport, scour, and deposition.

The FEMA FIS process included developing a new hydraulic computer model of Schoharie Creek and its major tributaries in 2004 to predict floodwater elevations based upon the valley and channel dimensions and roughness recorded in 2001. The U.S. Army Corps of Engineers HEC-RAS computer software was used for this task. The Greene County Soil and Water Conservation District provided a copy of the model data to NYCDEP and MMI to further assess Schoharie Creek.

The Schoharie Creek model is an unusually detailed model that extends for 25.37 miles along the river, which is represented by 950 cross sections of the valley and river topography. It is important to note that the cross sections represent 2001 conditions prior to Tropical Storm Irene and not necessarily reflective of present conditions. Portions of Schoharie Creek have been dredged since Tropical Storm Irene, and other areas have been subject to natural scour or deposition. Consequently, the model may not simulate current conditions in all locations. The model includes bridges that influence water elevations but does not include Huntersfield Creek, which joins Schoharie Creek in the Village of Prattsville.

The FEMA model is large and complex. In order to adjust it to evaluate Prattsville, MMI made the following revisions that were deemed appropriate for the subject study:

- The model was shortened to extend only from the Schoharie Reservoir to the Route 42 bridge in Lexington; beyond Lexington was not simulated.
- The model was revised to run in the mixed flow condition instead of subcritical flow such that it remains valid under a wide range of flow and velocity conditions. This also tends to make the model more true to actual field conditions and less conservative from a flood elevation standpoint as required for the FEMA flood insurance rate mapping. The upstream boundary condition was set at normal depth.
- The model dimensions were changed from miles to feet such that cross section names agree with profile stations.
- Key nodes were labeled so the profile is easier to read.
- Unnecessary "ineffective" flow limits were deleted so overbank flow conditions can be viewed.
- The bankfull discharge was added to the flow profile.
- The Tropical Storm Irene discharge rate was added with flow files.

The revised model was run and tested to validate the above changes.

Field inspection, regional bankfull channel data, and results of the HEC-RAS model together convey a more comprehensive understanding of hydraulic characteristics and flow patterns. FEMA's Cross Section D, identified in Figure 2-1, is located near the Village of Prattsville. The cross section has a bankfull width of 230 feet at the floodplain elevation, similar to regional data. The true top of bank is just above the 10-year flood profile, indicating that the channel is incised and confined. Main Street, at elevation ±1,160, is on an upper sedimentary terrace roughly equal to the elevation of the 50-year flood and subject to two to three feet of inundation by the 100-year flood. The 100-year flood covers most of the terrace top. The 500-year (0.2% annual chance) flood would be six to eight feet above the Main Street area. The predicted water profile for Tropical Storm Irene is about six feet higher than the FEMA 100-year base flood in most locations.

The channel narrows as it extends downstream toward the Route 23 bridge and the low floodplain fades away, leaving just the terrace. This confinement results in higher water levels and velocity. According to the FEMA model, the bed profile is irregular with a convex (up) shape between the Route 23 bridge and the fish barrier weir. This could be due to the sediment inflow from Huntersfield Creek. The FEMA model of existing hydraulic conditions indicates there is a significant rise in floodwater elevations at the Route 23 bridge. This is a single-span truss bridge with abutments that contract the channel.

Schoharie Creek flows past Prattsville and into the Schoharie Reservoir about two miles downstream of the Route 23 bridge. Consequently, there is a potential for the water ponded in the reservoir behind Gilboa Dam to locally influence upstream water elevations. MMI has assessed the potential reservoir influence by reviewing published reservoir water levels during floods and comparing them to data in the FEMA model, then adjusting the model's starting water elevations at the reservoir to see if it impacts water levels at Prattsville.

The existing FEMA FIS model begins computing floodwater elevations in Schoharie Creek two miles downstream from the Route 23 bridge, at a point representing the reservoir. The starting and revised alternate water elevations are tabulated in Table 4-1. In comparison, the elevation of County Route 7 north of Route 23 is estimated to be at elevation ±1142.0.

TABLE 4-1
Model Predicted Water Surface Elevations – Existing Conditions

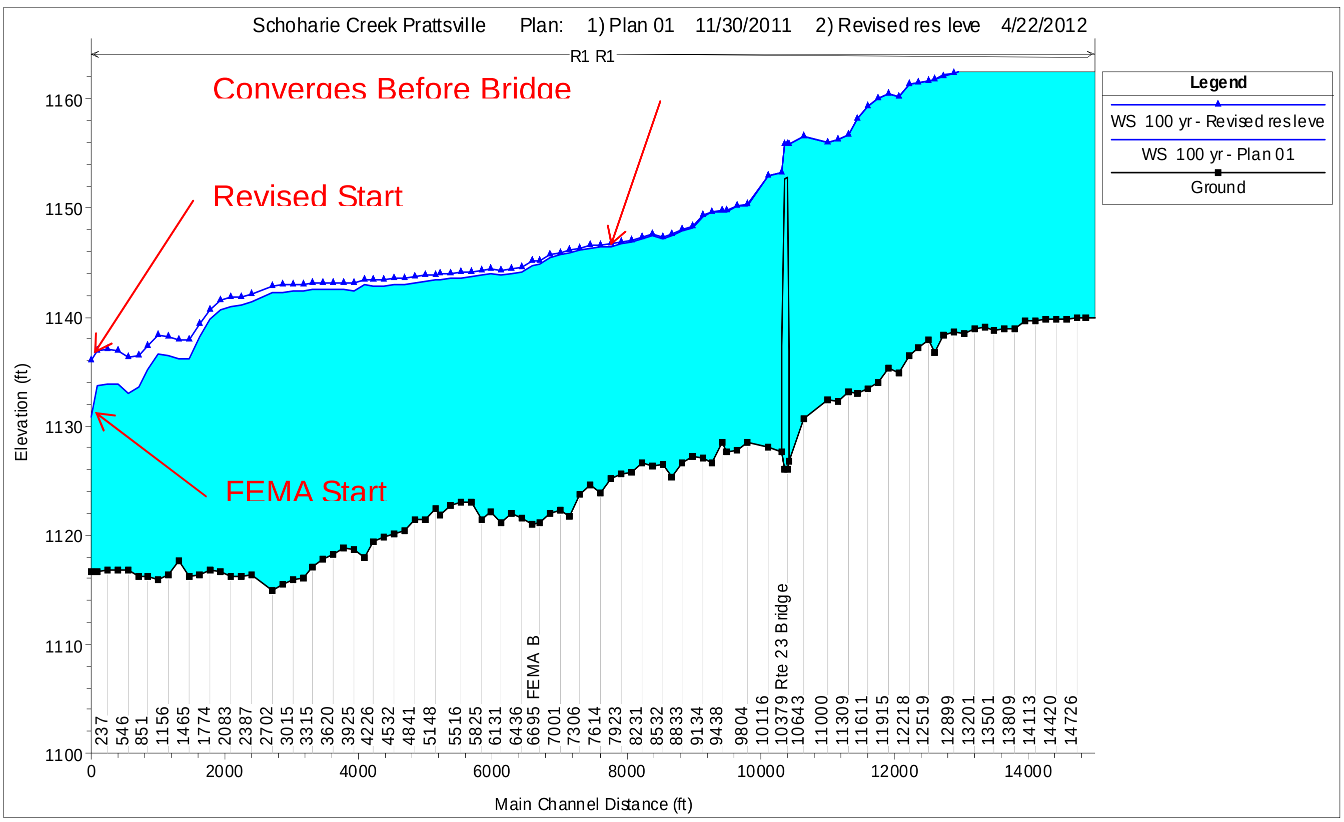
Flood Frequency, years	Peak Discharge (cfs)	Initial FEMA Water Elevation, feet (NAD88)	Revised Initial Water Elevation (feet)	Change in Water Elevation (feet)
10	34,030	1,126.51	1,133.66	+7.15
50	56,710	1,129.51	1,135.35	+5.84
100	67,900	1,130.77	1,136.05	+5.28
500	97,700	1,133.70	1,137.70	+4.00

4.2 Effect of the Gilboa Dam

The FEMA model did not consider the influence of the Schoharie Reservoir on starting water levels. MMI was specifically asked to analyze the impact of the Gilboa Dam on flooding in the Town of Prattsville. As such, the MMI version of the model was run utilizing initial water elevations that were from four to seven feet higher to reflect the presence of the downstream reservoir. The results verified that the reservoir does not influence floodwater levels at Prattsville for Irene and lesser flooding events. Therefore, use of the FEMA model is appropriate relative to assumptions about the reservoir.

Model results are presented in Figure 4-1 below. The graph depicts existing FEMA modeling water profile compared against the MMI model, run with the higher water surface elevations that account for the downstream reservoir, under stream flows that reflect the 100-year flood event. As is evident in the figure, the two models converge downstream of the Route 23 bridge.

FIGURE 4-1
Effect of the Schoharie Reservoir on Flooding in Prattsville



4.3 Huntersfield Creek

Huntersfield Creek has a modest watershed area of 7.79 square miles and is normally a minor tributary to Schoharie Creek. It flows from north to south parallel to County Routes 11 and 10, then crossing Main Street at Prattsville. During Tropical Storm Irene, the bridge crossing Huntersfield Creek on Main Street became obstructed and significant overbank flooding occurred along Main Street prior to and separate from the peak Schoharie Creek flows a short time later.

The FEMA FIS does not include any information on Huntersfield Creek. MMI has used the USGS StreamStats software to determine the watershed characteristics summarized in Table 4-2. USGS regional regression equations predict the peak flood flow rates reported in Table 4-3.

TABLE 4-2
Watershed Characteristics

Parameter	Value
Drainage Area	7.79 square miles
Main Channel Length	6.73 miles
Average Basin Slope	807 feet per mile
Percent Forest Cover	88%

TABLE 4-3
Peak Flow Predictions from StreamStats

Frequency	Flow
2-year	409 cfs
10-year	968 cfs
50-year	1,710 cfs
100-year	2,090 cfs

Alluvial channels located on sand and gravel sediments are able to adjust their bankfull dimensions in proportion to the long-term annual floods. For a watershed size similar to Huntersfield Creek, regional data identifies that bankfull widths and depths should be in the range of 44 and 2.0 feet for natural channels with usable floodplains. In comparison, the channel upstream of the Main Street bridge is narrower and deeper. In areas where floodplains are developed, channels need to be either much larger than bankfull dimension to minimize overbank flow or they need a floodplain.

The Route 23 bridge over Huntersfield Creek is a modern-style, single-span, simply supported structure in good condition. Built in 1949, it has concrete abutments and wingwalls with a concrete deck on steel beams. Utility pipes are attached to it. The waterway face opening is approximately 52 feet by six feet high with a gravel bed. However, the bridge has a skew angle of about 45 degrees. The downstream channel is 38 feet wide by eight feet deep with a concrete wall. The top of the bridge and training wall footings are exposed, probably due to degradation or dredging, leading to concerns about their susceptibility to scour and failure. The upstream channel was cleared and excavated after the flood, and stacked rock revetments were installed.

Based upon MMI field survey at sections through Huntersfield Creek, the average bed slope upstream of the Route 23 bridge is 1.32% and downstream of the bridge is 0.36%. Based on these bed slopes, and geometry per the surveyed sections, the maximum channel capacity is estimated at 3,600 cfs upstream of the bridge and 5,700 cfs downstream of the bridge. Both of these flows exceed the 100-year storm as computed by StreamStats. The actual capacity will be influenced by water levels in Schoharie Creek and debris or ice.

The confluence of Huntersfield Creek at Schoharie Creek has an awkward and inefficient alignment. After flowing under Main Street in a southerly direction, Huntersfield Creek bends to the right and flows westerly, roughly parallel to Schoharie Creek for 1,700 feet before finally merging. This elongated confluence increases the length of Huntersfield Creek and thereby reduces its slope, velocity, and capacity. This is not a new situation; aerial photographs depict the present alignment in 1993, and the 1903 USGS topography map of the Gilboa Quadrangle also shows a similar alignment.

Hydraulic analysis of Huntersfield Creek was completed using HEC-RAS. MMI developed an existing conditions model of Huntersfield Creek based on newly surveyed cross sections and supplemented with two-foot LiDAR topographic data of the upper banks. The model was created with only Huntersfield Creek, rather than as tributary model to Schoharie Creek, due to the observed variance in streamflow peak flows between Huntersfield and Schoharie Creek. The impacts of various combinations of tailwater (i.e. different water levels in Schoharie Creek) were evaluated via the inclusion of multiple flow scenarios.

Sections in the upstream portion of Huntersfield Creek above Main Street were input from the surveyed spot grades within the channel and tied into the upper LiDAR data. In the downstream reach, where Huntersfield Creek runs nearly parallel to Schoharie Creek, the adjacent sections of Schoharie Creek were imported from the FEMA model. Bank stations and levees were applied to contain flows within the Huntersfield Creek portion of the section, represented by a shallower channel to the right of the main channel geometry. The centerline geometry in this lower reach was estimated based on FEMA GIS shape files. The existing conditions model of Huntersfield Creek joins Schoharie Creek at approximate river station 12218.

The upstream limit of the model was truncated to a section downstream of a private footbridge. Upstream of this river section, the channel is confined within either manmade concrete walls or bedrock outcrops, and includes a series of waterfalls approximately ten feet in height that would be inappropriate for modeling.

The model was run in a mixed flow regime, with an upstream boundary condition set as normal depth (slope = 0.01 ft/ft). Various existing conditions models were evaluated:

a) No tailwater, using a normal depth (S=0.009 ft/ft) as the downstream boundary condition
b) Constant tailwater, using the 10-year water surface elevation of Schoharie Creek for all flows as the downstream boundary condition, and
c) Variable tailwater, using the respective 10-, 50- and 100-year water surface elevations of Schoharie Creek as the downstream boundary conditions as summarized in Table 4-4.

TABLE 4-4
Huntersfield Creek Downstream Water Surface Elevations
Schoharie Creek RS 12218

Frequency	Elevation (ft)
10-year	1153.21
50-year	1158.18
100-year	1159.71

With no tailwater from Schoharie Creek, the model predicts that the Main Street bridge will be subject to pressure from the 50-year storm discharge, extending approximately 0.2-foot up from the low chord. It is not a surprise, then, that a reduction of the flow area due to debris obstruction would significantly affect water surface elevations at the face of the bridge.

With the 10-year tailwater in Schoharie Creek, the 50-year elevation of Huntersfield Creek at the Main Street bridge is nearly the same as with no tailwater. Differences in 50-year and 100-year water surface elevations between a tailwater condition and a no-tailwater condition extend from the confluence upstream to approximate RS 2059, located 100 feet downstream of the Main Street crossing. Tailwater from a 10-year storm in Schoharie Creek does not appear to affect water surface elevations upstream of the bridge. For modeling results, refer to Appendix B.

With variable tailwater, the model predicts more influence upstream of Main Street. The predicted 100-year elevations are raised up to a location in the mid-section of the right-berm reach. The influence of the 50-year and 100-year elevations raise water surfaces in Huntersfield Creek by 0.6 foot at the Main Street bridge and create a tailwater from the confluence to the downstream face of the bridge.

5.0 FLOOD MITIGATION

5.1 Flood Hazard Reduction

Beyond the compelling recent evidence of flooding during Tropical Storm Irene and other storm events, the FEMA study and the preliminary use of the FEMA hydraulic model underscores that Prattsville is prone to flooding, with major damages beginning at the 50-year flood frequency. A number of measures can be taken to reduce the impact of a flood event. These include measures that prevent increases in flood losses by managing new development, measures that reduce the exposure of existing development to flood risk, and measures to preserve and restore natural resources. These are listed below under the categories of *prevention, property protection, structural projects, public education and awareness, natural resource protection,* and *emergency services.*

- ***Prevention*** of damage from flood losses takes the form of floodplain regulations and redevelopment policies that restrict the building of new structures within defined areas. These are usually administered by building, zoning, planning, and/or code enforcement offices through capital improvement programs and through zoning, subdivision, floodplain, and wetland ordinances. It also occurs when land is prevented from being developed through the use of conservation easements or conversion of land into open space. Prevention may also include maintenance of existing mitigation systems such as drainage systems.

- Measures for ***property protection*** include elevation or relocation of structures at risk for flooding (either to a higher location on the same lot or to a different lot outside of the floodplain), flood proofing, and relocating valuable belongings above flood levels to reduce the amount of damage caused during a flood event. Purchase of flood insurance, while not a protective measure, can help mitigate financial losses.

- Floodplains can support a number of ***natural resources*** and benefits, including storage of floodwaters, open space and recreation, water quality protection, erosion control, and preservation of natural habitats. Retaining the natural resources and functions of floodplains can not only reduce the frequency and consequences of flooding but also minimize stormwater management and nonpoint source pollution. Projects that improve the natural condition of areas or to restore diminished or altered resources can reestablish an environment in which the functions and values of these resources are again achieved. Acquisitions of flood prone property with conversion to open space are the most common of these types of projects. Administrative measures that assist such projects include the development of land reuse policies focused on resource restoration and review of community programs to identify opportunities for floodplain restoration.

- ***Structural projects*** include the construction of new structures or modification of existing structures to lessen the impacts of a flood event. Stormwater controls such as drainage systems, detention dams and reservoirs, and culvert resizing may be employed to lessen or control floodwater runoff. On-site detention can provide temporary storage of stormwater runoff. Barriers such as levees, floodwalls, and dikes physically control the hazard to protect certain areas from floodwaters; however, such structures can place upstream and downstream properties at higher risk. Channel alterations can be made to confine more water to the channel. Care should be taken when using these techniques to ensure that problems are not exacerbated in other areas of the impacted watersheds.

- ***Emergency services*** may be appropriate mitigation measures for flooding, including forecasting systems to provide information on the time of occurrence and magnitude of flooding; a system to issue flood warnings to the community and responsible officials; implementing an emergency notification system that combines database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas or specific groups of people, such as emergency responder teams; and emergency protective measures, such as outlining procedures for the mobilization and position of staff, equipment, and resources to facilitate evacuations and emergency floodwater control.

- The objective of ***public education*** is to provide an understanding of the nature of flood risk and the means by which that risk can be mitigated on a community and individual basis. Public information materials should encourage individuals to be aware of flood mitigation techniques, including discouraging the public from placing fill in the floodplain, changing channels or detention basins near their yards, and dumping in or otherwise altering watercourses and storage basins. The public should also understand what to expect when a hazard event occurs and the procedures and time frames necessary for evacuation.

Another important category of flood mitigation is pollution prevention. Pollution prevention can take the form of stabilizing channels and banks to reduce erosion and thus siltation and sedimentation; or it can take the form of preventing human-made pollutants from entering watercourses. For example, elevating and/or securing fuel tanks to prevent flotation or rupture are important in flood prone areas. Likewise, potential pollutants should not be stored where they can come into contact with flood waters.

Specific mitigation techniques for Prattsville can be grouped into (1) centralized hydrologic, hydraulic conveyance, and barrier techniques; and (2) decentralized flood proofing, raising building elevations, and relocations. Techniques from the first group are generally considered structural projects:

- *Hydrologic techniques* focus upon reducing or containing the peak flow rates at the watershed scale through the use of measures such as floodwater storage dams, wetland preservation, and enhancement of floodplain functions. The three large Natural Resources Conservation Service (NRCS) floodwater storage dams in the Batavia Kill watershed are an example of this type of strategy.

- *Hydraulic techniques* include methods that decrease floodwater elevations by removing or reducing flow contraction points at bridges or narrow channel sections, increasing the flow capacity of channels and floodplains, use of broad low velocity floodways, or by diverting floodwaters around sensitive areas. The great difficulty in populated areas is that very large channels are required to avoid inundating developed floodplains.

- *Barrier techniques* include the installation of levees, floodwalls, or general fill material to physically separate floodwaters from developed areas. They may require interior drainage pump stations, use of removable panels at road crossings, and considerable maintenance. Use of such measures requires careful consideration and risk assessment, engineering design, and ongoing monitoring and maintenance.

Techniques from the second group are generally chosen from the mitigation categories of property protection and natural resource protection:

- For *dry flood proofing,* areas below the flood elevation are made watertight. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents are either permanently closed or covered with removable shields. Flood protection should extend only two to three feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water.

- *Wet flood proofing* refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures, and should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 100-year flood elevation. Wet flood proofing is not appropriate for residential structures.

- *Raising building elevations* involves the removal of the building structure from its foundation or basement and elevating it on piers or a new foundation to a height such that the first floor is located above the desired flood protection level. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first floor level.

- *Relocation* of a structure involves removing it from the flood zone and siting it elsewhere. In some cases, structures (and property) are acquired and the flood prone site is restored for floodplain functionality.

The centralized hydrologic, hydraulic conveyance, and barrier techniques and the decentralized techniques of flood proofing, raising building elevations, and relocations are both suitable for preventing pollution and protecting water quality, as they make it more difficult for flood waters to come into contact with pollutants.

The subsequent sections of this chapter describe alternatives for flood mitigation that are taken from the centralized hydrologic, hydraulic conveyance, and barrier techniques. The order of presentation is arbitrarily from downstream to upstream. Tabular model results are presented in Appendix B.

5.2 Alternative 1 – Berm and Floodplain Alteration

MMI was asked to specifically assess the Schoharie Creek channel downstream of the Route 23 bridge and Prattsville to determine if modifications would provide flood relief. For the first 1,200 feet downstream of the Route 23 bridge, the channel is confined by moderate high banks supporting Route 23 on the left and County Route 7 on the right. The right bank of the river (looking downstream), including about 10 residences and numerous out-buildings was inundated during Tropical Storm Irene.

For the next 2,200 feet downstream, Route 7 diverges from the right bank floodplain. The left bank is a grass- and shrub-covered gravel bench created by the partial removal of a berm by Greene County Soil & Water Conservation District in 2004. This project was implemented to reconnect the channel and west floodplain, in order to provide improved floodwater relief and to reduce ice jams. This area successfully conveyed overbank flows in 2011, which left extensive woody and construction debris in depositional zones. The debris was subsequently cleaned up by NYCDEP. The main channel then bends to the left and becomes increasingly wide as it extends another mile to the head of Schoharie Reservoir. Mid-channel sediment bars reflect delta deposits of sediment due to decreasing gradient and velocity.

The HEC-RAS hydraulic model obtained from FEMA reflects the presence of the left bank berms because FEMA's topography predates the Greene County berm modifications. The intent of the berm modifications is shown on plans dated 2001 by Lamont Engineers; limited as-built survey points are available to assemble the geometric model of existing conditions.

The lower (downstream) section of Schoharie Creek has been modeled with HEC-RAS to evaluate the effect of removing additional material from this area and then partially clearing the left floodplain behind the berm. In the 2008 FEMA model, the berm is in place and ineffective flow boundaries are used to prevent computation of flow behind the berm until it is overtopped. Following Irene, this area was largely cleared by NYCDEP contractors to remove both debris and standing trees.

The key issue is whether additional modification of the left bank berm and/or clearing vegetation from the floodplain will provide flood relief to the residences along the opposite bank. First, the model was run to represent current conditions, including the 2004 berm modification and a forested floodplain behind the berm (model run DC-A). More recent NYCDEP surveys depict a berm crest at elevation 1142.5 to 1139.0 feet, declining in the downstream direction. The berm continues downstream beyond the limit of survey. The model was run to reflect a cleared floodplain with a lower resistance to water flow (model run DC-B), further lowering of the berm to encourage overbank flow (model run DC-C), and finally for a combination of berm lowering and clearing (model run DC-D). The results of the composite alternative (i.e. berm lowering and clearing) are presented in Table 5-1. Area of inundation is depicted in Figure 5-1.

TABLE 5-1
Alternative 1 – Berm & Floodplain Alteration – Flood Water Elevations

Model Cross Section	Location	Alternate	Frequency, Years		
			10	50	100
1.5458, 8076	Mid-Berm	Existing Conditions	1142.49 ft	1145.75 ft	1147.30 ft
		Vegetation Clearing	1141.70 ft	1144.79 ft	1146.32 ft
		Lower Berm	1142.00 ft	1145.28 ft	1146.85 ft
		Combination	1141.65 ft	1144.68 ft	1146.23 ft
1.7460, 9133	Upstream End	Existing Conditions	1144.74 ft	1147.99 ft	1149.48 ft
		Vegetation Clearing	1144.58 ft	1147.55 ft	1148.74 ft
		Lower Berm	1144.46 ft	1147.71 ft	1149.16 ft
		Combination	1144.21 ft	1147.12 ft	1148.47 ft

The above results indicate that further lowering or removal of the berm and/or clearing the forested floodplain provide modest results, up to one foot of floodwater reduction, with less than one foot for the more frequent flood events. The road elevation is ±1142, suggesting it would be inundated by a 10-year frequency event under existing conditions. The road would still flood during the 50- and 100-year events following berm removal.

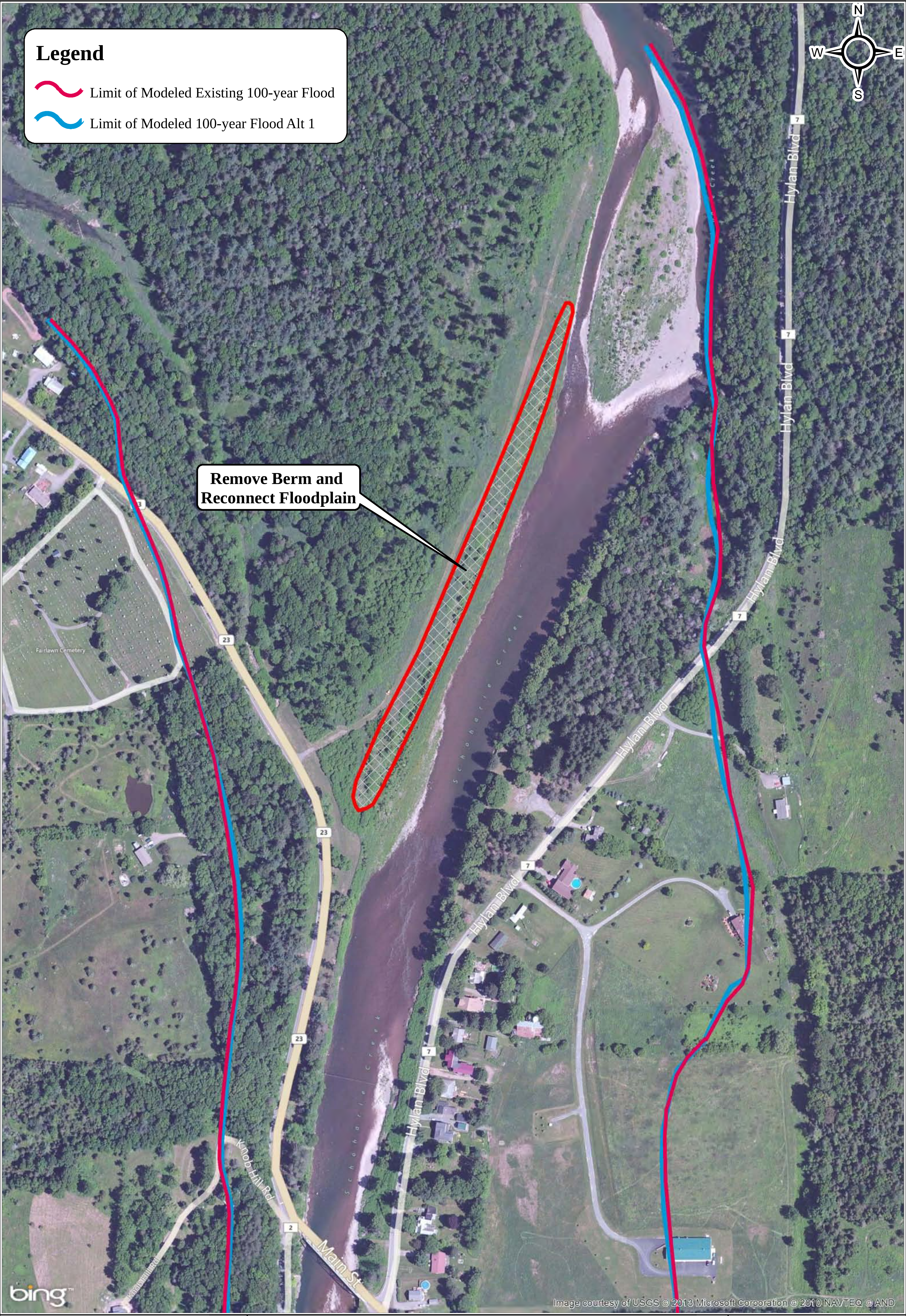
The predicted flood water elevation reduction would be modest under this alternative, but could be locally significant to houses near the flood threshold. Additional survey of existing berm, road, and dwelling foundation elevations is necessary to determine the number of properties affected and the extent of flood reduction that would result from this alternative.

5.3 Alternative 2 – Replace Route 23 Bridge

Route 23 crosses Schoharie Creek near the downstream end of Main Street. It is a single-span green steel truss structure supported by concrete abutments. The clear span is on a skew angle and is approximately 240 feet by about 20 feet high. The bottom of the bridge beam is at elevation 1152.61; the top of the road deck is elevation 1156.

Alternative 2 replaces the Route 23 bridge with a much longer and higher span.

The analysis of existing water profiles indicates that there is significant energy loss (increase in water elevation) due to the combined Route 23 bridge and the narrow channel of Schoharie Creek at that elevation. The HEC-RAS computer model indicates that removing the bridge leads to a local four-foot water elevation reduction near and upstream of the bridge, declining to 2.65 feet at the Dutch Church, and decreasing to 0.13 feet at the Huntersfield Creek bridge area for the 100-year event. Table 5-2 presents model results.



SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
CUGIR's USGS 7.5 Minute Topographic Maps (2000)
Prattsville 7.5-minute Quad
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29
New York National Flood Hazard Layer

Figure 5-1: Alternative 1 - Berm & Floodplain Modification Inundation Mapping

Location:
Prattsville, NY

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-05
MXD: P:\3597-19\Design\GIS\Maps\Prattsville_Figure5-1-Limits.mxd
1st Version: 4/17/2012
Revision: 9/18/2013
Scale: 1 in = 250 ft

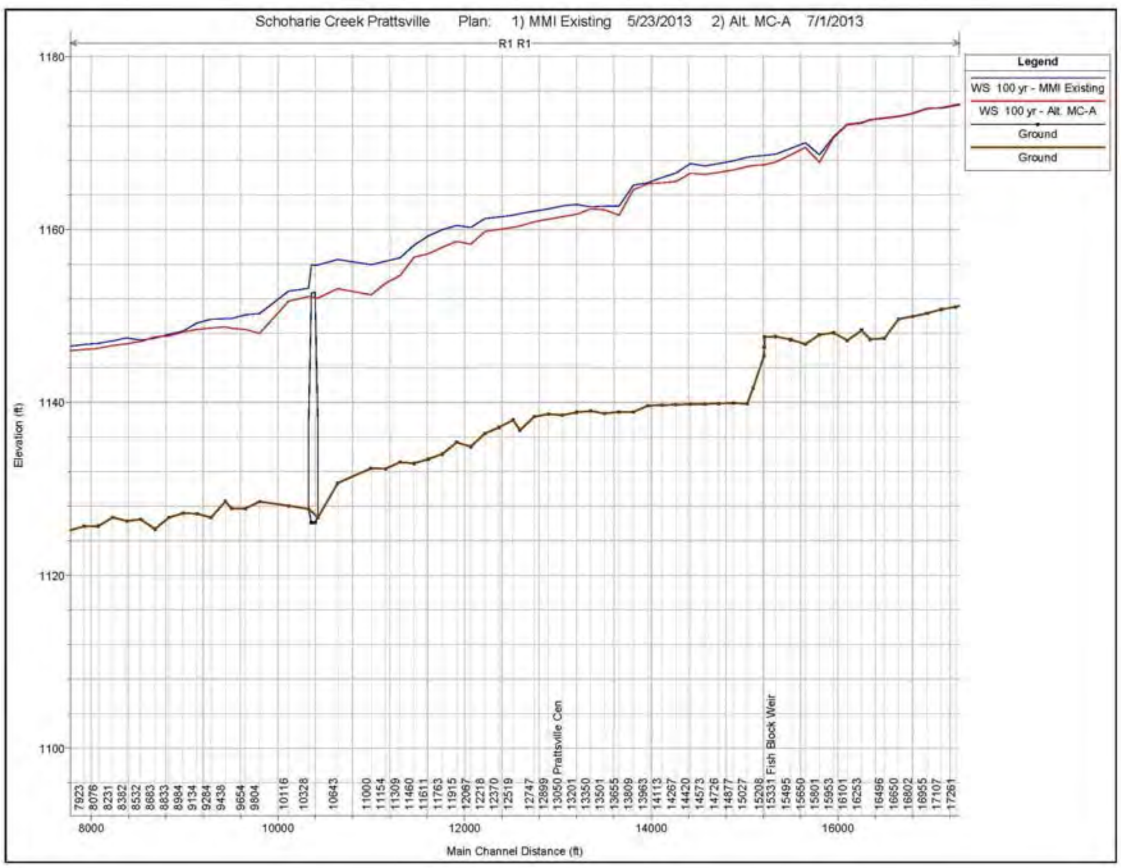
Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

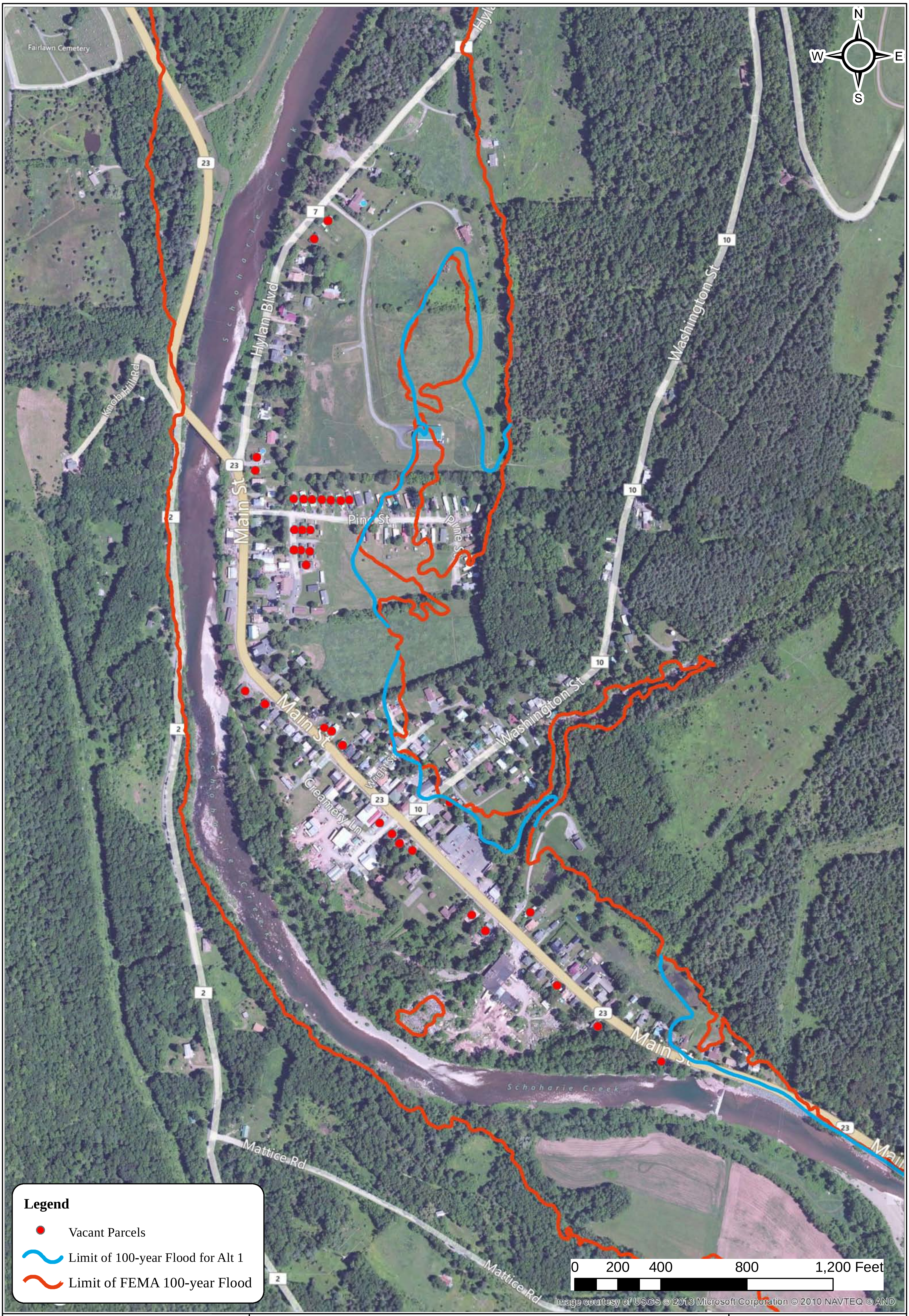
TABLE 5-2
Alternative 2 – Replace Route 23 Bridge – Floodwater Reductions

Station	Location	Floodwater Elevation Reduction, ft			
		50-Year	100-Year	500-Year	Irene
10,430	Upstream of Route 23 Bridge	4.34	3.98	4.15	5.27
11,309	Dutch Church	2.96	2.68	2.74	2.76
12,594	FEMA D/Beth's Café & Washington St	0.62	0.49	0.68	0.94
13,050	Briggs Equipment	0.49	0.41	0.52	0.71
13,809	Upstream of Huntersfield Creek Bridge	0.25	0.13	0.15	0.29

Figure 5-2 is a profile of the river showing existing and proposed water surface elevations for this alternative. Figure 5-3 shows the inundation area associated with this alternative. As seen in the inundation mapping, while implementation of this alternative will decrease flood *depths*, the horizontal *extent* of flooding will not be significantly reduced. Removing and replacing the bridge would help limited sections of Main Street. It would also allow enlargement of the narrow channel on both sides of the bridge.

FIGURE 5-2
Alternative 2 –Replace Route 23 Bridge – Water Surface Profile





SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
CUGIR's USGS 7.5 Minute Topographic Maps (2000)
Prattsville 7.5-minute Quad
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29
New York National Flood Hazard Layer

Figure 5-3: Alternative 2 - Bridge Replacement Inundation Mapping

Location: **Prattsville, NY**

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-19
MXD: P:\3597-19\Design\GIS\Maps\Alt MC-A.mxd
1st Version: 4/17/2012
Revision: 9/24/2013
Scale: 1 in = 400 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

5.4 Alternative 3 – Channel Deepening and Widening

In response to a request of the community at a public meeting held on January 30, 2012, a preliminary flow analysis was conducted to evaluate alternate channel sizes to convey flood flows and sediment and address questions about dredging the channel. The goal was to determine the theoretically required channel size for a basic cross section adequate to convey the 100-year frequency peak flows, plus sediment, without use of the (developed) floodplain. This evaluation was conducted with the HEC-RAS subroutine sediment analysis model. Channel cross section side slopes of 2.5:1 were assumed with a peak discharge of 67,900 cfs from FEMA. The sediment size was estimated to range from sand to cobble. The existing channel slope of 0.002 feet per foot was held. The resulting channel characteristics would be as follows:

Uniform Equilibrium Channel #1	Base Width = 289 feet
	Depth = 27 feet
	Slope = 0.002
	Velocity = 7.0 feet per second

This channel would be roughly twice as deep as the existing channel to fit within a reasonable corridor size. However, the depth makes it impossible to construct due to the need for continuity with the downstream channel. Consequently, a larger and different channel shape is needed, and this channel type is not recommended.

An alternate approach is to maintain the existing channel depth of 16 feet and its slope of 0.002 feet per foot and solve for the channel width, which means ignoring the optimum shape for sediment transport. The resulting channel bottom width is 496 feet. A channel of this size would convey flood flows well but would be prone to sediment deposits that would form bars.

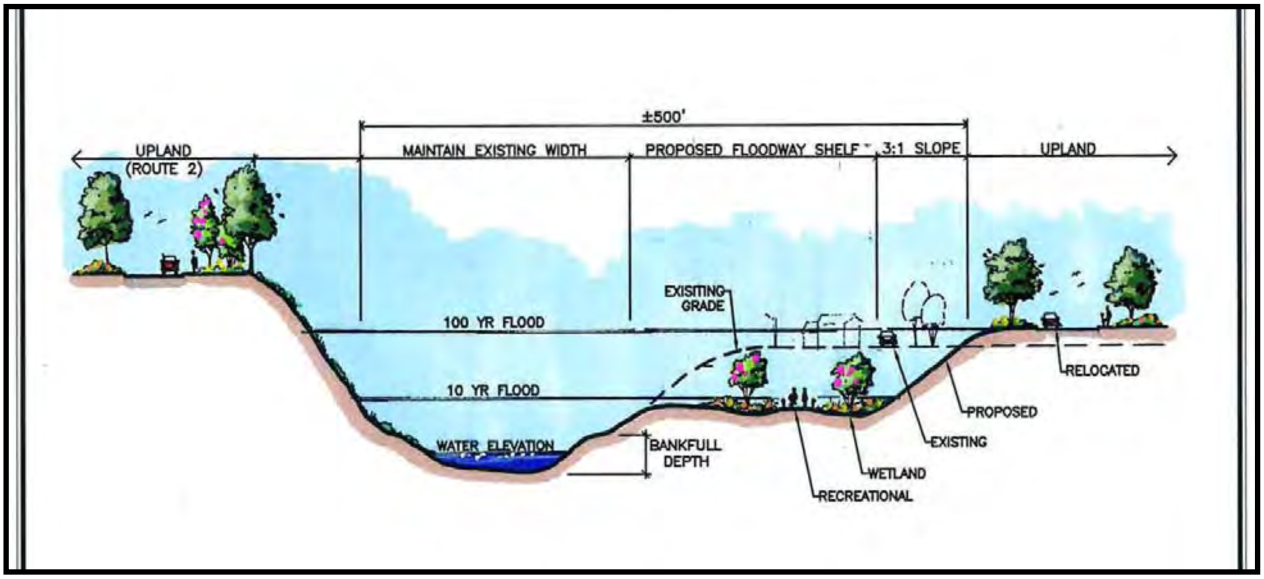
A full-scale flood control program would require replacing the Route 23 bridge plus widening the existing channel to increase its capacity. The resulting channel characteristics would be as follows:

Uniform Equivalent Channel #2	Base Width = 496 feet
	Top Width = 560 feet
	Depth = 16 feet
	Area = 8,442 square feet
	Velocity = 8.0 feet per second

This channel shape has the appropriate depth and slope of the existing channel but is three times wider than the existing channel approaching the bridge and requires all space between Main Street and the river's current location, plus Main Street, including several private properties. A very wide trapezoidal shaped channel does not concentrate low flows well, would be too shallow for canoeing, too warm for fish, and would be prone to sediment bars. Accordingly, this conventional channel type is not recommended.

The ideal channel cross section relative to flow and sediment conveyance, aesthetics, stability, and habitat enhancement is a "compound channel" that includes a base channel to convey flows up to the 1.5- to two-year frequency flood, combined with a normally dry overflow area to convey flood flows and transport sediment. In the case of Prattsville, this compound channel would have the goal of maintaining floodwater elevations lower than the developed terrace along Main Street. Figure 5-4 shows the basic layout of a compound channel.

FIGURE 5-4
Cross Section of a Typical Compound Channel



The thought process behind this option is that to convey the 100-year frequency flood of 67,900 cfs without concrete lining, a waterway area of 8,500 square feet is required at eight feet per second. The basic bankfull channel would be roughly 250 by six feet deep, or 1,500 square feet. The remaining floodway area of 7,000 square feet cannot be more than 10 feet deep, so its width could be up to 700 feet, depending on final slope and roughness. Its slope and roughness must then be adjusted to provide required velocity, area, and capacity combinations. At a slope of 0.002 feet per foot, a rough total width of 500 feet is needed.

A compound channel type of flood control system would provide a high degree of protection by reducing water elevations by five to six feet from the bridge to the fish weir. It has the advantage of concentrating low flow for fisheries and sediment transport while creating a normally dry floodway to carry flood flows and be available for open space. However, the ±500 foot width would require considerable land acquisition and road relocation.

The HEC-RAS computer model was used to analyze larger scale channel improvements that combine channel widening and deepening upstream of the Route 23 bridge. For this alternative, the existing bridge was left in place. The new channel base width would vary from approximately 210 to 260 feet, depending on available space. Modeled depth of excavation varied by location, with the channel bottom up to four feet deeper. Several berms on the right bank would be removed for this alternative, and an inner floodplain/compound channel would be provided in selected areas[1].

Alternative 3 includes a deeper and wider channel of Schoharie Creek, but leaves the current Route 23 bridge in place.

Multiple computer runs were made, adjusting the channel width and depth to obtain reasonable combinations at each cross section. The left (west) bank was generally left in place but smoothened. The proposed channel bed matches existing conditions at the Route 23 bridge and the fish barrier weir but increases in depth by two to four feet past the center of town where Huntersfield Creek sediments caused aggradation. The graphic below shows a typical deepened and widened channel cross section.

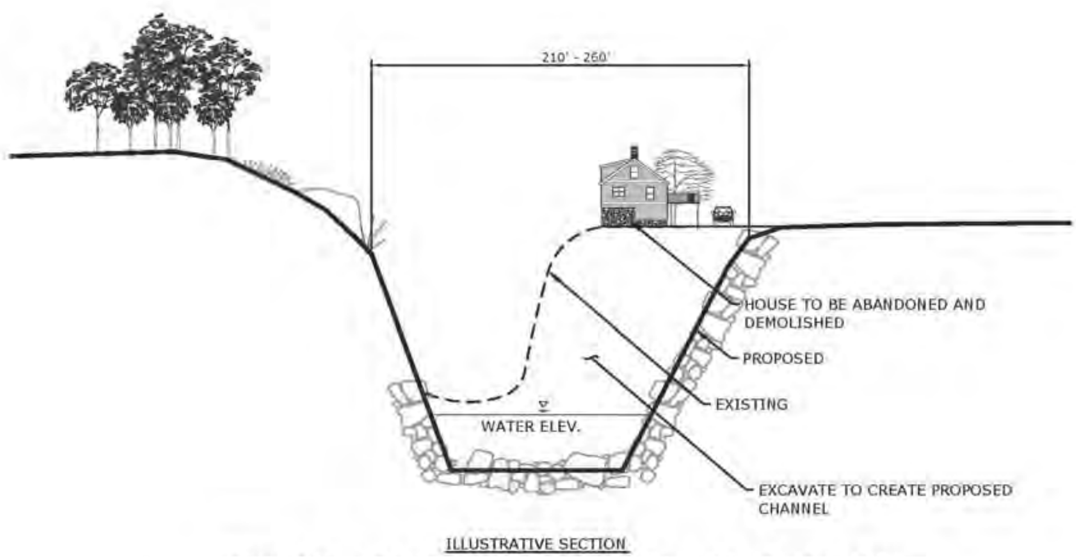
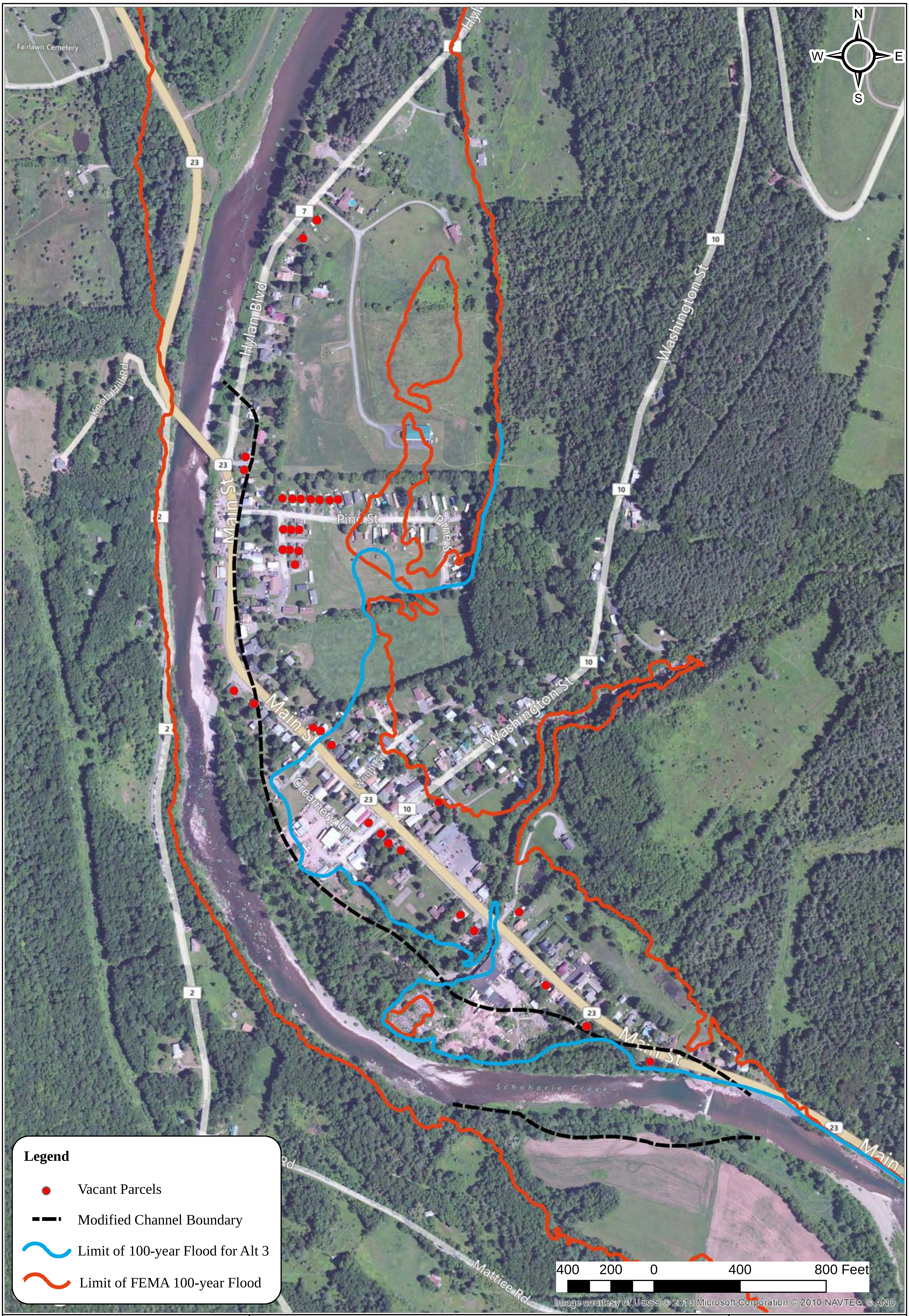


Figure 5-5 is an inundation map for this alternative. Figure 5-6 shows a profile of existing and proposed conditions for this alternative. Results are presented in Table 5-3.

[1] This analysis does not consider the channel dredging that occurred after Tropical Storm Irene, since as-built cross sections reflective of this dredging are not available.



SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
CUGIR's USGS 7.5 Minute Topographic Maps (2000)
Prattsville 7.5-minute Quad
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29
New York National Flood Hazard Layer

Figure 5-5: Alternative 3 - Channel Deepening and Widening Inundation Mapping

Location: **Prattsville, NY**

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-19
MXD: P:\3597-19\Design\GIS\Maps\Alt MC-E.mxd
1st Version: 4/17/2012
Revision: 9/24/2013
Scale: 1 in = 400 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

FIGURE 5-6
Alternative 3 – Channel Deepening and Widening – Water Surface Profile

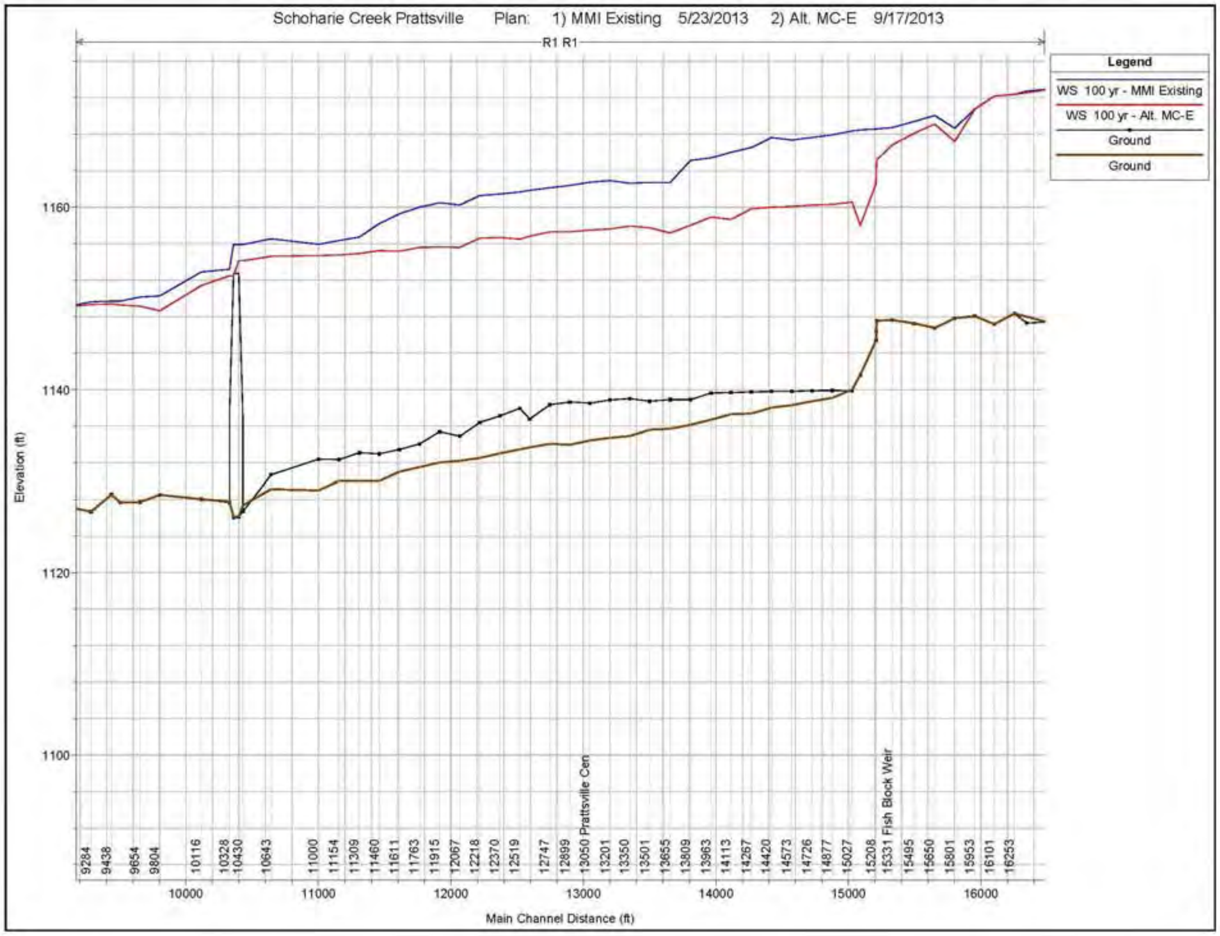


TABLE 5-3
Alternative 3 – Channel Deepening and Widening – Floodwater Reductions

Station	Location	Floodwater Elevation Reduction, ft			
		50-Year	100-Year	500-Year	Irene
10,430	Upstream of Route 23 Bridge	2.84	1.93	2.25	2.25
11,309	Dutch Church	2.98	2.43	3.22	3.74
12,594	FEMA D/Beth's Café & Washington St	4.55	4.09	4.15	4.25
13,050	Briggs Equipment	4.84	4.43	4.71	4.79
13,809	Upstream of Huntersfield Creek Bridge	6.84	6.75	6.71	6.46

The final results indicate the 100-year frequency flood levels would be generally reduced by four feet and thus lower than the south end of Main Street, but flooding would continue near the bridge where local current conditions persist.

In order to achieve this level of flood protection using a wider and deeper channel, there would need to be significant land acquisition. Channel widening would typically require an additional 100 feet of land between the existing top of bank and Main Street.

5.5 Alternative 4 – Channel Deepening, Widening, & Bridge Replacement

Alternative 4 includes replacement of the Route 23 bridge with a much longer and higher span, or removal of the bridge entirely, along with a deeper and wider channel of Schoharie Creek

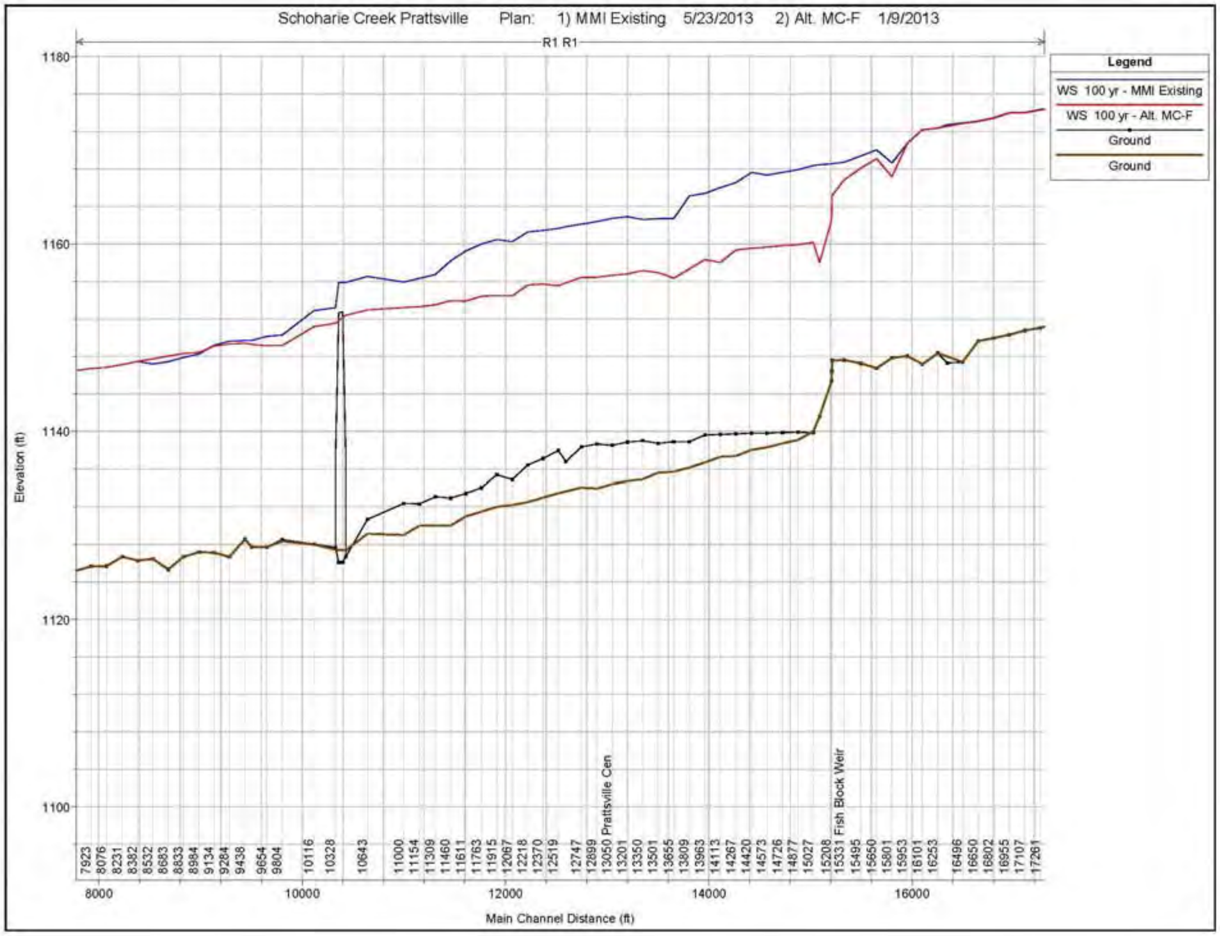
This alternative expands upon Alternatives 2 and 3 by replacing the Route 23 bridge with a structure large enough to effectively eliminate energy losses at that point. The model for Alternative 3 was revised to remove the bridge and widen the channel through the narrow reach from station 9804 to station 10430. This would require relocating Route 23 as it approaches the existing bridge.

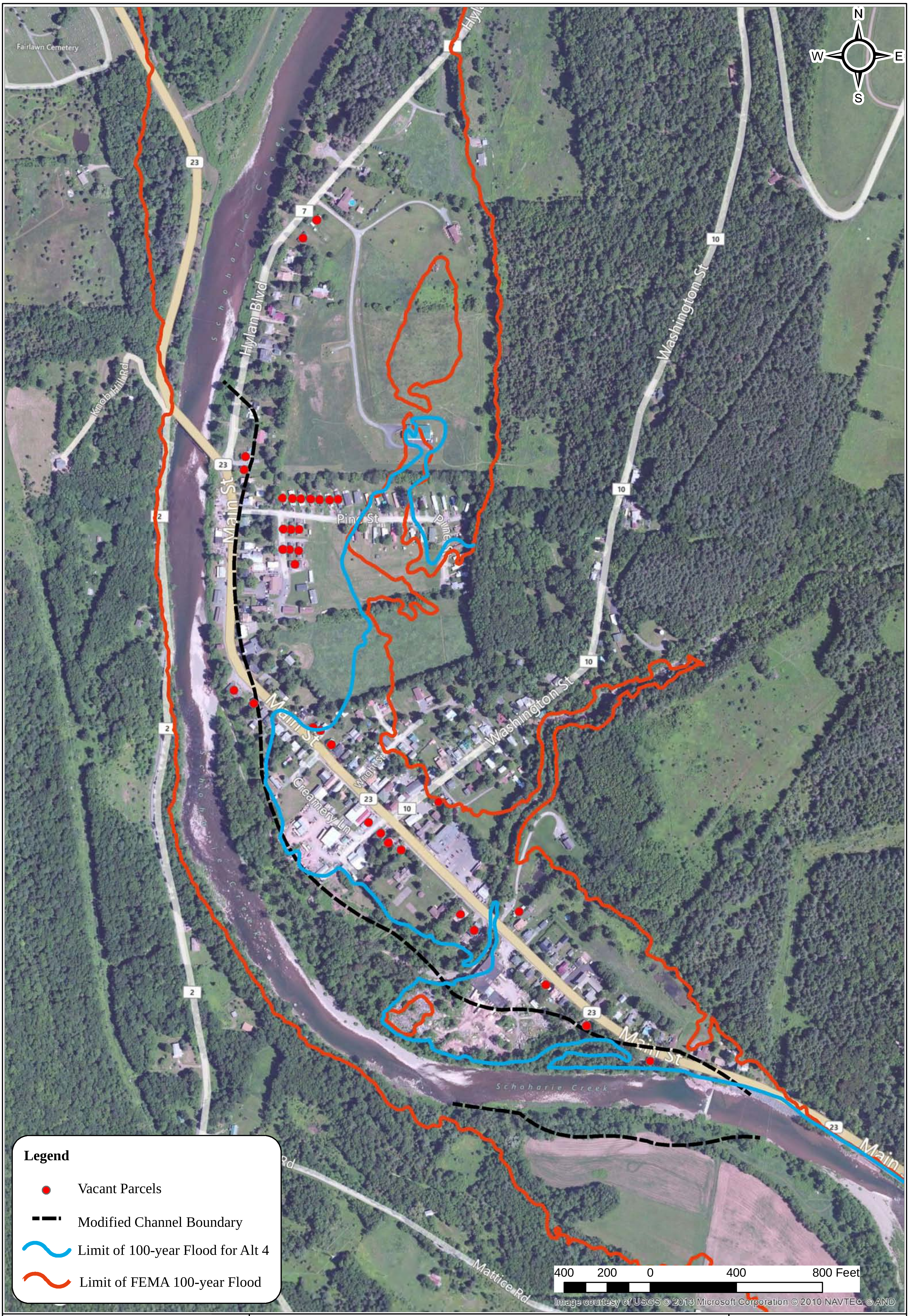
The hydraulic analysis summarized in Table 5-4 indicates that this alternate would reduce floodwater profiles lower than only removing the bridge (Alternative 2) or enlarging the channel (Alternative 3). The greatest benefit of including the bridge removal is lower flood levels from the bridge to the Washington Street Extension area. However, the computations demonstrate that the Main Street section from the bridge to the Dutch Church would still be subject to deep flooding during the 100-year frequency event due to low ground surface elevations. Table 5-5 compares flood water elevations to the elevation of Main Street at various locations. Figure 5-7 depicts the river profile for Alternative 4. Refer to Figure 5-8 for inundation mapping associated with Alternative 4. When comparing inundation mapping for Alternatives 3 and 4, the shape of the flood limit is essentially the same; however, the depths of flooding are different. A comparison is provided in Table 5-4.

TABLE 5-4
Summary of Floodwater Reductions (Alternatives 2, 3, and 4)

Station	Location	Alternate	Floodwater Elevation Reduction, ft			
			50-Year	100-Year	500-Year	Irene
10,430	Upstream of Route 23 Bridge	2 – Replace Bridge 3 – Modify Channel 4 – Bridge & Channel	4.34 2.84 3.98	3.98 1.93 3.65	4.15 2.25 3.44	5.27 2.25
11,309	Dutch Church	2 – Replace Bridge 3 – Modify Channel 4 – Bridge & Channel	2.96 2.98 3.99	2.68 2.43 3.84	2.74 3.22 4.33	2.76 3.74
12,594	FEMA D/Beth's Café and Washington Street	2 – Replace Bridge 3 – Modify Channel 4 – Bridge & Channel	0.62 4.55 5.26	0.49 4.09 5.04	0.68 4.15 4.84	0.94 4.25
13,050	Briggs Equipment	2 – Replace Bridge 3 – Modify Channel 4 – Bridge & Channel	0.49 4.84 5.45	0.41 4.43 5.25	0.52 4.71 5.27	0.71 4.79
13,809	Upstream of Huntersfield Creek Bridge Along Route 23	2 – Replace Bridge 3 – Modify Channel 4 – Bridge & Channel	0.25 6.84 7.33	0.13 6.75 7.43	0.15 6.71 7.19	0.29 6.46

FIGURE 5-7
Alternative 4 – Channel Deepening, Widening & Bridge Replacement – Water Surface Profile





SOURCE(S):

2007-2009 Aerial Photograph:
Mircrosoft Virtual Earth Hybrid via ESRI

Topographic Contours:
CUGIR's USGS 7.5 Minute Topographic Maps (2000)
Prattsville 7.5-minute Quad
Coordinate System: UTM Zone 18N (Meters)
Vertical Datum: NGVD29
New York National Flood Hazard Layer

Figure 5-8: Alternative 4 - Channel Deepening, Widening, & Bridge Replacement Inundation Mapping

Location:
Prattsville, NY

N

Prattsville Flood Hazard Mitigation

Map By: DRM
MMI#: 3597-19
MXD: P:\3597-19\Design\GIS\Maps\Alt MC-F.mxd
1st Version: 4/17/2012
Revision: 9/24/2013
Scale: 1 in = 400 ft

Engineering, Landscape Architecture and Environmental Science
MILONE & MACBROOM®
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

TABLE 5-5
Comparison of Floodwater Elevations to Main Street Elevation

Station	Location	Main Street Approximate Elev.	Flood Elevations 100-Year Frequency			
			Ex.	Alt. 2	Alt. 3	Alt. 4
10430	Route 23 Bridge	±1144	1156.0	1152.0	1154.1	1152.4
11309	Dutch Church	±1144	1157.4	1154.7	1154.9	1153.5
12594	FEMA D/Beth's Cafe	1160	1160.9	1160.4	1156.8	1155.8
13050	Briggs Equipment	1161	1161.9	1161.5	1157.5	1156.6
13809	Huntersfield Creek	1160	1164.7	1164.6	1158.0	1157.3
14877		1168	1167.0	1166.9	1160.3	1159.9
15027	Toe Fish Weir	1168	1167.3	1167.3	1160.6	1160.2

5.6 Alternative 5 – Bypass Channel

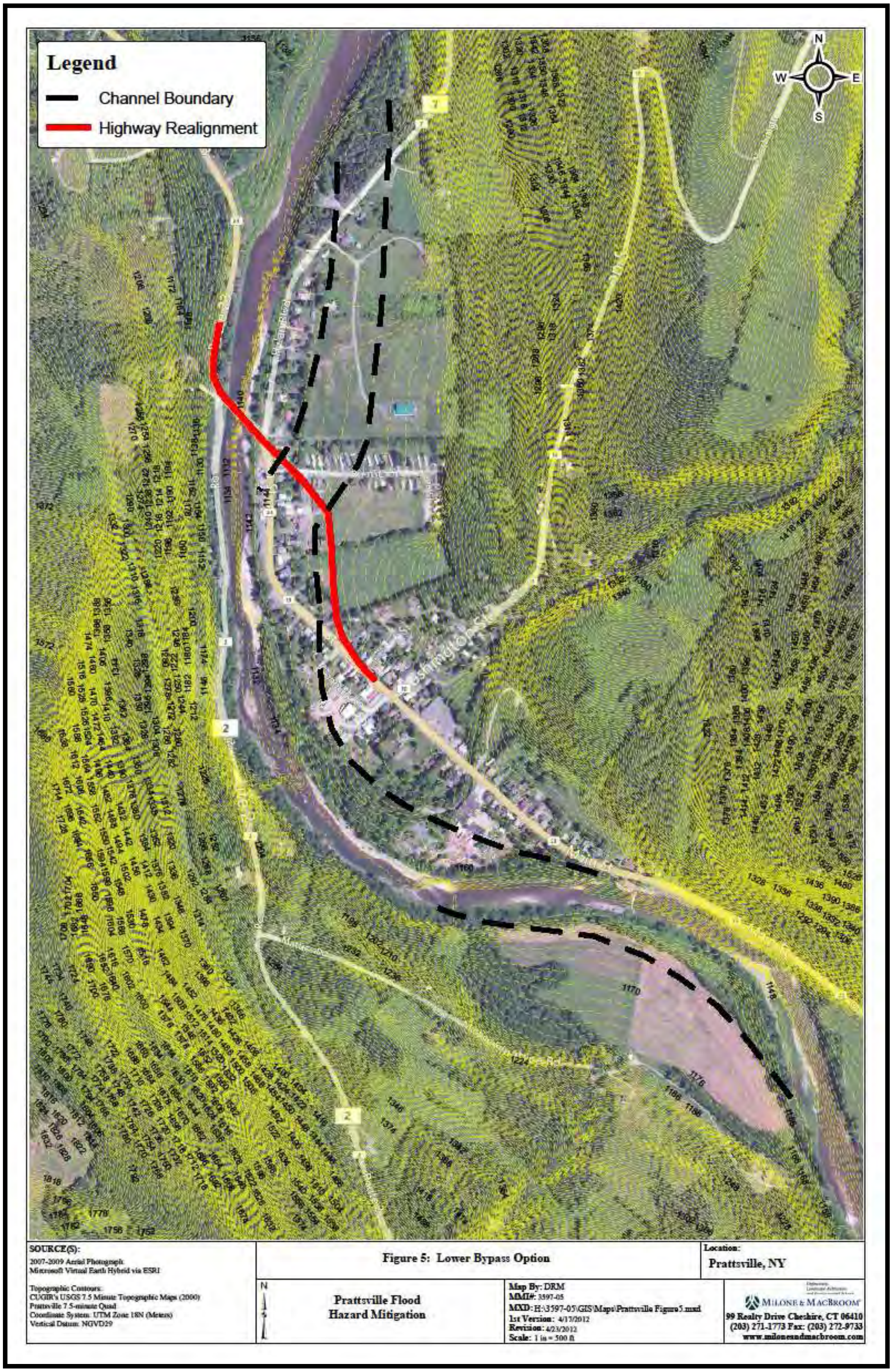
The use of a deepened/widened channel past the upstream half of Prattsville could be combined with bridge replacement and a bypass channel. Figure 5-9 shows a concept sketch of this alternative. The bypass would be a normally dry excavated channel that would allow normal river flow to stay in the natural channel, while allowing excess flood flows to "bypass" under Main Street, across the mid-section of Pine Street, where trailer homes were previously flooded and removed, and back to the river. The "bypass channel" could be used as open space for recreation. The advantage of this concept is that it reduces the impact on developed properties compared to the full-length compound channel, but it would still require bridge replacement and significant overall disturbance to the community.

5.7 Alternative 6 – Removal of Concrete Fish Migration Barrier

A low concrete weir extends across Schoharie Creek at FEMA FIS station 15090, a short distance upstream of the Village of Prattsville. The weir has a total height of about eight feet and length of 120 feet. The right end is connected to bedrock while the left end has a concrete abutment repaired with riprap. The weir was constructed by New York Conservation Department (now NYDEC) to block the upstream passage of small mouth bass from Schoharie Reservoir.

The fish barrier weir is represented in the FEMA model as a series of steep channel cross sections rather than the more common inline structure. This weir raises water elevations upstream of the structure during normal flow conditions.

FIGURE 5-9
Concept Sketch of Bypass Channel



The analysis of existing channel conditions indicates that all tested flood flow rates, even the common bankfull flood, overtops the weir on the downstream side, causing submerged flow conditions. The weir raises the upstream bankfull flood elevation by five feet. It causes about a two-foot rise in water profiles for the larger floods that totally submerge it and flow around on the floodplains. The "Google Earth" October 8, 2011 aerial photograph taken five weeks after Tropical Storm Irene shows the broad floodplain was inundated around the barrier weir.

The riverbed profile has adjusted to the weir's presence. The downstream side has a scour hole followed by a level gradient on bedrock, while the channel bed upstream of the weir is nearly level with the crest. The weir is serving as a riverbed grade control. Removing it would likely lead to several feet of upstream channel degradation and release of sediment. Table 5-6 presents results in tabular format.

TABLE 5-6
Alternative 6 – Elimination of Fish Barrier – Floodwater Reductions

		Flood Frequency, years			
Station	**Location**	**10-Year**	**50-Year**	**100-Year**	**500-Year**
13809	Upstream Hunters Field	0.00	0.00	0.00	0.00
15090	FEMA E - Toe Weir	0.03	0.01	0.01	0.01
16101	Upstream Fish Weir	2.27	2.35	2.45	2.70
18468	FEMA F/Beth's Café	0.28	0.10	0.02	+0.17
18923	Batavia Kill Confluence	0.23	0.08	+0.06	+0.49
24391		0.00	0.01	0.04	+0.15

The above analysis indicates that removing the weir does not affect downstream water elevations in the model. The elevation of the 100-year frequency flood on the downstream side of the weir is 1167.5 while upstream it is 1172.1, about three feet above the road. Removing the weir would reduce the upstream base flood to 1169.6 feet, similar to the road. Flood water elevations immediately upstream are reduced by 2.27 feet to 3.7 feet, which will have a minor effect on how water is diverted onto Main Street. The estimated elevation of Main Street is 1168 to 1169 feet (NAVD88) in the vicinity of the fish barrier based upon the two-foot contour map and HEC-RAS cross sections.

Removing or lowering the weir would reduce floodwater diversions onto Main Street and reduce hazards along Route 23 upstream of, and alongside, the weir. The vulnerability of streambed degradation would have to be addressed with lower level grade controls. This alternative will not have widespread benefit; however, it may locally lower water levels to protect existing homes and the roadway. Alternatively, a high flow bypass could be constructed on the floodplain terrace adjacent to the weir to provide a pathway for water to move around the weir and back into the channel during high flows. Additional survey and modeling would be required to verify the feasibility and effectiveness of that option.

5.8 Huntersfield Creek Alternatives

Alternative 7 – Replacement of Main Street Bridge

The existing conditions hydraulic analysis indicates that the Main Street bridge is subject to pressure flow during a 50-year design storm under a normal depth downstream boundary condition. For all boundary conditions, the model indicates that the bridge has the capacity to convey the 100-year design storm, albeit under pressure flow. During Irene, the bridge overtopped. Residents reported that the opening was obstructed by debris, which would lead to overtopping. However, discharges exceeding the 100-year flow would also have caused overtopping.

Although the model predicts that the bridge and channel will convey the 100-year storm, the pressure flow at the bridge for even the 50-year storm is indicative of potential problems should any debris reduce the effective opening of the crossing. Typically, structures are designed to convey the 100-year storm with a minimum freeboard of one foot. The model indicates that the channel upstream of the bridge does not overtop during a 100-year design flood. Thus extensive channel modification upstream of the bridge would most likely not provide flood reduction benefits.

The channel upstream of the bridge is characterized by a narrow width, high banks of either bedrock or concrete walls, and little to no floodplain. Downstream of the bridge, the channel is less confined, with lower and wider floodplain benches. Increasing the conveyance capacity of the channel at the bridge would require widening of the existing 52-foot wide bridge. The current channel alignment directs flow at the left bank downstream of the bridge, and at the building located near this bank. In addition to widening the structure, the Town may consider a slight realignment of the channel in this location to mitigate this erosive force at the downstream side of the crossing. Structures on the right bank both upstream and downstream of the bridge and a large building on the left bank immediately downstream of the bridge may be affected by changes to the crossing configuration.

MMI evaluated the option of widening the existing crossing from 50 to 70 feet, along with modifications to the channel on the upstream and downstream sides of the bridge to reflect a widened channel and floodplain. By increasing the channel and bridge width, the predicted 50-year water surface elevation at the bridge would be reduced by an estimated 0.68 feet, and remove the pressure flow aspect at that streamflow. The 100-year flow would remain pressure flow at the bridge, with an estimated 0.77-foot reduction in water surface elevation. The decreases in flood elevation described above would likely affect only a few properties in the vicinity of Huntersfield Creek.

Alternative 8 – Realignment of Huntersfield Creek / Confluence with Schoharie Creek

Realignment of Huntersfield Creek was evaluated to determine if it has the potential to reduce flood flows at Main Street with a more direct connection to Schoharie Creek. The realignment would cut through the existing bar on the right bank of Schoharie Creek, and shorten the Huntersfield Creek total length by approximately 1,200 linear feet. The channel would remain unaltered at Main Street, but would break from its current alignment approximately 230 feet downstream of Main Street to connect to Schoharie Creek at approximately RS 13350.

The new sections in this reach provide a 30-foot bankfull width at a slope of 0.006 ft/ft to tie into the bank at Schoharie Creek at elevation 1145.0 feet. This elevation would still be slightly above the main channel invert to provide positive flow from Huntersfield Creek.

As with the existing conditions model, this analysis was run in a mixed flow regime with various downstream boundary conditions evaluated. Because the confluence point would be above the channel invert, a normal depth (slope) downstream boundary condition was not appropriate. Rather, the following two model runs were completed: (a) constant tailwater, using the 10-year water surface elevation of Schoharie Creek for all flows as the downstream boundary condition; and (b) variable tailwater, using the respective 10-, 50- and 100-year water surface elevations of Schoharie Creek as the downstream boundary conditions as summarized in Table 5-7.

TABLE 5-7
Huntersfield Creek Downstream Water Surface Elevations
Schoharie Creek RS 13350

Frequency	Elevation (ft)
10-year	1155.66
50-year	1160.19
100-year	1161.82

Model analysis indicated that this realignment would not be effective at reducing water surface elevations at the Main Street bridge. If a 10-year elevation for all three flows is applied, there is no reduction in predicted water surface elevations at the bridge for the 10-year through 100-year storms as compared to existing conditions. If the respective water surface elevations for each design storm in Schoharie Creek are assigned as downstream boundary conditions, backwater would extend all the way upstream to the Main Street bridge, overtopping the bridge for the 100-year storm. Thus, realignment of Huntersfield Creek has no significant benefit.

5.9 Benefit-Cost Analysis

Two approaches were followed for benefit-cost analysis of Schoharie Creek flood mitigation alternatives:

- Direct Project-Cost Comparisons: The total cost for the components of the more costly alternatives (excavating a larger channel, acquiring some properties to be able to excavate the larger channel, replacing the bridge, and removing the weir) were compared to the shift in number of properties that would be flooded, and the cost to acquire those homes instead of excavating a larger channel, acquiring properties to be able to excavate the larger channel, and replacing the bridge. The weakness of this approach should be understood up front; it does not take changes in flood *depths* into account, and instead relies on the number of properties flooded vs. not flooded. While it is understood that replacement of the bridge is not yet scheduled by NYSDOT, portions of this analysis consider a possible replacement in the near future, which would have the effect of eliminating the bridge replacement cost (upwards from $6 million) from consideration.

- <u>FEMA BCA</u>: FEMA Benefit Cost Analysis (BCA) was conducted for 18 homes and non-residential structures or properties, spatially distributed from the upstream end to the downstream end of Main Street and Route 7. This BCA was based on assumed acquisitions followed by structure demolition and conversion to open space. The flood elevation data was taken directly from FIS as required by the BCA Flood Module. The first floor elevations were all estimated rather than surveyed. Full assessed values[2] from property records were used for this analysis instead of market property values, and a demolition and site restoration cost of 20% of each property value was assumed.

<u>Direct Project Cost Comparisons</u>

Mitigation Alternatives 2, 3, 4, and 6 were evaluated by comparing mitigation project costs to the aggregate values of properties that would need to be acquired to implement the projects and the aggregate values of properties that could achieve the same results through outright acquisition. This direct approach is useful for comparing costly alternatives and ruling out options that may not make sense given the objective of hamlet-wide flood mitigation along Schoharie Creek. In lieu of determining the market values of properties in Prattsville, assessed values were used. No adjustments upward or downward were made. This assumption may need to be corrected in future evaluations.

One important concept to note in this report is that the more costly, complex mitigation projects associated with 2, 3, and 4 are relatively more effective for low-frequency, highly damaging events such as Irene, the 50-year flood, the 100-year flood, and the 500-year (0.2% annual chance) flood. In comparison, the mitigation projects associated with 2, 3, and 4 are too complex to affect the annual flood and 10-year flood. A discussion of each follows.

Alternative 2 – Replace Route 23 Bridge: The *number* of properties flooded during the 100-year flood with the existing bridge is the same as with a new bridge. This is somewhat counterintuitive, as there would be a benefit of four feet of flood reduction at the bridge and 2.7 feet of flood reduction at the Dutch Church if MC-A were

[2] The *adjusted* assessments that may be used for property tax *calculations* were not used for the analysis. *Full assessed values were* used as surrogates for appraised market values.

implemented. This is because the *extent* of inundation would shift only slightly, and not enough to release entire properties from the flood zone. However, approximately 12 mobile homes (all located on the same property) may avoid flooding if the bridge were replaced. During the 50-year flood, a greater number of mobile homes (potentially 20) may avoid flooding if the bridge were replaced.

The value of 12 to 20 mobile homes is difficult to determine from assessor records because they are on a single parcel that includes many other mobile homes and a hotel. However, the 12 to 15 mobile homes are very likely lower in value than the bridge replacement cost. Therefore, the benefit-cost ratio of this alternative is likely low[3].

Alternative 4 – Channel Deepening and Widening and Replacement of Route 23 Bridge: In order to implement this alternative, the Route 23 bridge would be replaced and ten properties would need to be acquired (with structures demolished) to excavate a wider channel of Schoharie Creek. The value of these ten properties (located in a narrow band from Briggs Equipment northward to the bridge) is approximately $500,000. Excavation volumes would be on the order of 550,000 cubic yards. At $10/cubic yard, the cost would exceed $5.5 million. This alternative would remove approximately 66 structures on individual parcels plus three mobile homes from the 100-year floodplain by shifting the edge of inundation to the west. These 66 properties have a value of $4.1 million, and most are located along Main Street, Creamery Lane, Pine Street, and the lower parts of Washington Street and Wright Street. For the 50-year flood, this alternative would remove approximately 70 structures on individual parcels plus about 20 mobile homes. The central question, therefore, is whether the cost of replacing the bridge, excavating the channel, and acquiring ten properties for $500,000 is justified to save 66 to 70 structures and a number of mobile homes from flooding during the 50-year and 100-year events, given that these 66 to 70 properties are valued at $4.1 million. This is a more complex benefit cost analysis than the analysis for Alternative 2 described above.

The bridge replacement (at least $6 million) and channel excavation (at least $5.5 million) would together exceed the $4 million figure. Therefore, it may be more cost effective to simply acquire the 66 to 70 properties plus the mobile homes that would be removed from the 50 or 100-year floodplain along with the ten that would have been acquired for the channel excavation, rather than replace the bridge and excavate the wider channel.

If the bridge were already replaced by DOT (removing the $6 million cost from consideration), channel excavation alone would still exceed the $4 million cost of the 66 to 70 properties. Therefore, it may be more cost effective to acquire the 66 to 70 properties that would be removed from the 100-year floodplain along with the ten that

[3] A more detailed benefit-cost analysis should include other considerations such as the change in the depth of flooding at properties such as the Dutch Church, where the reduction in flood depth may be 2.7 feet. However, surveyed first floor elevations would be necessary to evaluate in this greater level of detail.

would have been acquired for the channel excavation, rather than excavate the wider channel.

Alternative 3 – Channel Deepening and Widening: In order to implement this alternative, the same ten properties valued at $500,000 would need to be acquired (with structures demolished) to excavate the wider channel of Schoharie Creek. This alternative would remove approximately 62 structures on individual parcels plus seven mobile homes from the 100-year floodplain by shifting the edge of inundation to the west[4]. This alternative would remove approximately 65 structures on individual parcels plus 11 mobile homes from the 50-year floodplain. The central question, therefore, is whether the cost of excavating the channel and acquiring ten properties for $500,000 is justified to save 62 to 65 structures plus seven to 11 mobile homes from flooding during the 50-year and 100-year events, given that these 62 to 65 properties are valued at $3.9 million.

Channel excavation would cost more than $5.5 million. Therefore, it may be more cost effective to simply acquire the 62 properties that would be removed from the 100-year floodplain along with the ten that would have been acquired for the channel excavation, rather than excavate the wider channel.

Alternative 6 – Removal of Fish Barrier: During the 100-year flood, three properties are depicted in the area of inundation caused by the presence of the weir (the three located closest to the weir), and floodwaters may travel down Route 23 to damage the road and affect other properties. These three properties would no longer be flooded if the weir were removed. The assessed value of the three homes is $198,685. During the 50-year flood, these three properties are not flooded by the effects of the weir, and therefore removal of the weir provides no suitable comparison. The central question, therefore, is whether the cost of removing the weir is justified when the three homes could possibly be acquired and removed for approximately $200,000.

As noted in Section 5.7, the weir is 120 feet long and eight feet high, and removing it may lead to several feet of upstream channel degradation and release of sediment. The cost of the concrete removal, water control, and sediment management together would likely be similar to the cost of acquiring the three properties and removing the homes. Therefore, the benefits and costs of this alternative may be similar. When the additional benefit of reducing the deflection of floodwaters onto Route 23 is considered, removal of the weir may be a prudent alternative.

As noted above, the weakness of this approach is that it does not take changes in flood *depths* into account. In reality, a home that is flooded five feet above the first floor is much more significantly damaged than a home that is flooded one foot above the first floor. On the other hand, the water quality impacts of both may be similar, because a basement is flooded either way, which can release contaminants into the watershed. If FEMA mitigation funds are not being pursued, the above approach may be attempted for

[4] Flood elevations differ when comparing Alternatives 3 and 4, but the areas of inundation are very similar.

demonstrating benefits and costs. The methodology would need to be discussed with the entity or agency funding the mitigation projects. The formal FEMA BCA method discussed below has the advantage of factoring flood depths into the benefit cost analysis.

FEMA BCA

Appendix D of this report discusses the FEMA mitigation programs collectively managed under the Unified Hazard Mitigation Assistance (HMA) program. For most of the mitigation projects funded under the three HMA programs, a standard requirement is that the benefit-cost ratio (BCR) be greater than 1.0 when calculated using the FEMA BCA program. Therefore, there is strong interest in understanding whether acquisitions in Prattsville could be supported by BCRs above 1.0, and therefore eligible for the HMA programs, regardless of whether alternatives 2, 3, 4, and/or 6 are pursued.

A total of 17 properties were selected to conduct FEMA BCA. This sample size was selected to provide spatial representation (from 14412 Main Street to 56 Route 7) as well as a range of property types. Nine of the 17 properties are residential structures, and the remaining eight include the Reformed Dutch Church[5] and seven commercial properties. This approach is believed appropriate because the conclusions drawn for 17 properties can be applied throughout the downtown Prattsville study area.

Version 4.8 of the BCA program was utilized. Two choices are available for analyzing flood mitigation projects: the Flood Module and the Damage Frequency Assessment (DFA) Module. The Flood Module relies upon the flood elevations and flood profiles presented in the FEMA FIS. First floor elevations are needed to use the Flood Module. The DFA Module requires damage estimates (in dollars) for two or more flood events. Given the availability of the Greene County FIS and the lack of damage estimates for structures in Prattsville, the Flood Module was selected as the more appropriate tool.

First floor elevations were taken from the LiDAR mapping for Prattsville, but adjustments were made when other information was available. For example, surveyed ground surface elevations near Huntersfield Creek were used to adjust some first floor elevations in this part of Prattsville. First floor elevations were not surveyed for this analysis.

For acquisition projects, mitigation project costs are typically equal to the market value of the property being considered plus the costs of demolition and site restoration. Other minor project costs are typically included when necessary, such as disconnecting utilities or obtaining local approvals and permits. As noted above, in lieu of determining the market values of properties in Prattsville, full assessed values were used for a rapid and simplified BCA for each structure considered, and the assumed demolition and restoration cost for each site was 20% of each property value. No adjustments upward or

[5] The Hazard Mitigation Assistance (HMA) guidance released by FEMA in July 2013 states that mitigation funds cannot be used to acquire properties used for religious purposes unless the acquisition is part of a larger neighborhood-scale acquisition. The BCA was already completed prior to the release of this guidance. The Dutch Church was included in this discussion because it fit into the overall context of the analysis.

downward were made, and the 20% adjustment was assumed to include utility work, permits, and approvals.

Use of the Flood Module requires that the “building replacement value” (BRV) be entered for each structure. The BRV is equal to the building value divided by the square footage of the footprint of the structure (not the total square footage of all living spaces in a structure). To determine the BRV for each structure, the assessed land value for each property was subtracted from the total assessed value for each property, and the resulting figures (assumed equal to the building values) were divided by the square footage taken from assessor records.

The elevations of the Schoharie Creek streambed, the 10-year flood, the 50-year flood, the 100-year flood, and the 500-year (0.2% annual chance) flood were taken from the DFIRM and the Schoharie Creek profile in the FIS.

Where possible, the first floor elevations and the flood elevations were reality-checked against one another. For example, the level of water at 14474 Main Street was reportedly five feet above the first floor. For the assumed first floor elevation of 1164 feet, the flood level for Irene would then have been 1169 feet. According to the FIS, the 500-year flood elevation at this home is 1170.5 feet. These elevations are reasonably consistent with one another relative to our understanding of the flood caused by Irene.

Nearby at Briggs Equipment, a first floor elevation of 1163 was assumed. Adding the nine feet of reported flooding in the building, the flood level for Irene would have been 1172 feet. According to the FIS, the 500-year flood elevation at Briggs Equipment is 1170.5 feet. These elevations are reasonably consistent with one another relative to our understanding of the flood caused by Irene.

Table 5-8 on the next page lists the above BCA parameters and resulting BCRs for the 17 evaluated properties. Two BCRs were prepared for Young’s Agway (one for each building listed in the assessor records). The single greatest factor affecting the denominator of the typical BCR is the property value, because it makes up the majority of the project cost for an acquisition. The single greatest factor affecting the numerator of the typical BCR is the relationship between the first floor elevation and the 10-year flood depth, because frequent flooding is needed to generate strong benefits. A property that is flooded only by the 100-year event (1% annual chance), for example, will tend to have lower benefits.

The BCRs range from a low of 0.03 to a high of 10.63. The lowest BCRs were calculated for those properties with first floor elevations higher than the 10 and 50-year floods and the highest assessed values. The highest BCRs were calculated for those properties with first floor elevations below the 10-year flood and the lowest assessed values.

Table 5-8
FEMA BCA Analysis – Parameters and Results for Acquisitions/Conversion to Open Space

No.	Street	Description	Use	Land ($)	Total ($)	Building ($)	SF	BRV ($/sf)	10-yr (ft)	50-yr (ft)	100-yr (ft)	500-yr (ft)	FFE (ft)	Costs ($)	Benefits ($)	BCR
56	Route 7	Residential	2-story w/basement	12,200	79,800	67,600	2414	28.00	1146	1149	1150	1153.5	1142	97,187	344,324	3.54
14690	Main St	Auto Repair	1-story commercial	18,000	155,400	137,400	3463	39.68	1148.5	1155.5	1156.5	1162	1140	187,907	791,766	4.21
14686	Main St	Residential	2-story w/basement	9,500	79,800	70,300	872	80.62	1148.5	1155.5	1156.5	1162	1144	97,187	299,893	3.09
	Main St	Dutch Church		11,800	221,000	209,200	4860	43.05	1150	1156	1157.5	1162.5	1144	266,627	579,114	2.17
14628	Main St	Residential	2-story w/basement	10,000	11,500	1,500	2400	0.63	1150	1156	1157.5	1162.5	1144	15,227	119,354	7.84
14615	Main St	Residential	2-story w/basement	10,700	90,000	79,300	1282	61.86	1150.5	1157	1158	1163	1142	109,427	1,163,625	10.63
14579	Main St	Pratts Woodworking	2-story commercial	16,600	166,000	149,400	1260	118.57	1153	1159.5	1161	1166.5	1150	200,627	239,737	1.19
	Main St	Residential		9,700	34,600	24,900	1026	24.27	1152	1158	1160	1165	1152	42,947	27,285	0.64
	Creamery	Auto Repair	1-story commercial	8,700	38,800	30,100	3200	9.41	1154	1160	1161.5	1167	1146	47,987	312,387	6.51
	Creamery	Young's (outbuilding)	Commercial	19,100	102,200	83,100	3200	25.97	1154	1160	1162	1167.5	1154	124,067	61,156	0.49
	Creamery	Young's (store)	Commercial	9,800	208,800	199,000	3315	60.03	1154	1160	1162	1167.5	1156	251,987	72,847	0.29
	Main St	Beth's Café	2-story w/basement	10,600	114,700	104,100	1840	56.58	1154	1160	1161.5	1167	1160	139,067	24,229	0.17
14537	Main St	Residential	2-story	17,500	175,400	157,900	2251	70.15	1154	1160	1162	1167.5	11642	194,407	17,824	0.09
	Main St	Jim's Supermarket	1-story commercial	15,200	486,300	471,100	10710	43.99	1154	1160	1162	1167.5	1164	584,987	35,269	0.06
	Main St	Briggs Equipment	Commercial	32,600	71,000	38,400	12134	3.16	1158	1163	1165	1170.5	1163	22,727	8,711	0.38
14474	Main St	Residential	2-story w/basement	11,600	72,000	60,400	1080	55.93	1158	1163	1165	1170.5	1164	87,827	12,525	0.14
14467	Main St	Residential	1.7 stories w/ walkout basement	12,200	17,500	5,300	713	7.43	1159	1164	1166	1171	1164	22,427	57,886	2.58
14412	Main St	Residential	2-story w/basement	6,900	122,600	11,300	1580	7.15	1162.5	1167	1169	1174.5	1168	148,547	4,212	0.03

In general, the properties with the lowest BCRs are located along the southeast end of Main Street and the properties with the highest BCRs are located along the northwest end of Main Street and Route 7. This pattern is consistent with the tendency for floodwaters to be deeper toward the northwest part of downtown Prattsville as compared to the southeast part of downtown. One exception is the home at 14467 Main Street, which is located on lower land on the Schoharie Creek side of Main Street and experiences deeper flood depths for more frequent events, helping achieve a BCR above 1.0. The home also yields a higher BCR because it has a walk-out lower level, making the basement equal to the first floor.

A BCR above 1.0 was anticipated for Young's Agway, but the relatively higher assessed property value contributes to a lower BCR. Young's Agway illustrates an example of a property where better elevation data could reveal a potential for more frequent flooding that increases the BCR.

Surveyed first floor elevations, property appraisals, and site-specific demolition costs would be needed to refine all of the BCRs estimated in this study. While refining the ratios, it is possible that some higher ratios would fall below 1.0 and some lower ratios would rise above 1.0. However, the uncertainty is reduced for those properties with BCRs that are much greater or much lower than 1.0.

The Biggert-Waters Flood Insurance Reform Act of 2012 made several changes to the mitigation programs, and the new HMA guidance was released in July 2013. One potentially important change to the PDM, HMGP, and FMA programs is that "green open space and riparian area benefits can now be included in the project BCR once the project BCR reaches 0.75 or greater. The inclusion of environmental benefits in the project BCR is limited to acquisitions [as opposed to elevations]."

Inclusion of environmental benefits may be an important consideration in Prattsville. For example, Young's Agway has a preliminary BCR below 0.75. If this BCR could be improved to 0.75 by surveying the first floor elevation, then the remainder of the gap from 0.75 to 1.0 may be overcome with environmental benefits. These are potential improvements to the BCA that will need to be considered in the future.

One important consideration for structures that are evaluated using formal BCA is that many of the BCRs might improve (increase) for structure elevation projects rather than property acquisitions. This is because elevating a structure is less costly than acquiring an entire property and demolishing the structure on the property. Structure elevations were not evaluated using BCA because they are extremely sensitive to current *and proposed* first floor elevations. Without knowing the precise first floor elevations and the intended future elevations (presumably a level that is at least two feet[6] above the base flood), the BCA has too many uncertainties for structure elevations.

[6] The New York State building code requires freeboard of two feet for substantial improvements in SFHAs.

On August 15, 2013, FEMA issued new guidance for acquisitions and elevations of structures within SFHAs. According to the guidance, acquisitions with a project cost lower than $276,000 and elevations with a project cost lower than $175,000 may be considered automatically cost-effective for structures in SFHAs. Although this is a new and untested interpretation of cost effectiveness, it could mean that acquisitions and elevations in Prattsville may be more easily funded by FEMA without consideration of the BCA discussed above and the benefit cost ratios developed in Table 5-6.

With reference to the 15th column of Table 5-6 ("Cost"), all but one of the properties has a project cost lower than $276,000. This may mean that all but one of the properties in the table may be considered fundable for acquisition under the FEMA mitigation programs. It is likely that all of the structures in the table could be elevated for less than $175,000 (each), making them all potentially fundable.

Combination of Approaches

It may be possible to combine the two benefit-cost analysis approaches presented in this section. There are potentially two methods to accomplish this, with two options for the second method:

1. The Flood Module could continue to be used for evaluating the structures, and the combination of approaches would occur outside the BCA program. BCRs would be computed for the current flood profiles (from the FIS) and for future flood profiles (from the HEC-RAS modeling associated with Alternatives 2, 3, 4, and 5). These BCRs would be aggregated and the costs of the alternatives would be added to the denominator of the ratios computed for the future flood scenarios.

2. The more appropriate method of combining the two approaches is to utilize the DFA Module for the bridge and channel projects with or without the Flood Module (options a and b, respectively) for the properties and buildings. The DFA Module is well-suited to incorporating the costs of complex mitigation projects (such as channel excavation and bridge replacement) and it is easier to enter pre-project and post-project flood impacts such as those that would occur at a single property or group of properties:

    a) *With Flood Module* – With surveyed first floor elevations, the Flood Module would be used to generate benefits for each property, and that information would then be used in the damage frequency analysis with the channel and bridge projects. Historical damage figures are not needed.

    b) *Without Flood Module* – The benefit of this approach is that surveyed first floor elevations are not needed. However, the analysis relies on damage figures (in dollars) rather than flood elevations published in the FIS. Without compiling actual flood damage figures for the structures in Prattsville, damage estimates must be estimated and the results of this approach are less reliable.

The level of detail associated with combining the approaches in this report should be attempted only with surveyed first floor elevations (for the Flood Module), damage figures (for the DFA Module), and fair market value property appraisals. Otherwise, the additional precision afforded by further refinement of the benefit-cost analysis is merely diminished by the lack of necessary data.

6.0 SUMMARY OF FINDINGS

The subject study was undertaken to evaluate a number of potential measures relative to their potential to mitigate flooding conditions in the Village of Prattsville. The study used available FEMA hydraulic modeling (effective May 2008) and existing LiDAR-based topographic mapping. Both will require updating to fully analyze the dredging that occurred after Tropical Storm Irene and natural river changes since then, as well as to enable a more refined analysis of the chosen mitigation alternatives.

1. The effects of the Gilboa Dam on flooding was modeled and demonstrated that the presence of this dam does not cause and/or negatively impact flooding in the Village of Prattsville.

2. Alternatives were evaluated to replace the Route 23 bridge and various combinations of channel widening, deepening, and reshaping. Results indicate that replacement of the Route 23 bridge alone (Alternative 2) provides some relief in flood depths, but not in the flood inundation area. Creation of a compound channel large enough to accommodate the 100-year flood would span approximately 500 feet, and would displace many of the very structures we are trying to protect. It would also require relocation of Main Street and replacement of the Route 23 bridge. The Route 23 bridge is over 50 years old and will need to be replaced in the future, regardless of flooding issues. Replacement of the bridge in combination with a channel approximately 250 feet wide will reduce both the extent and depth of flooding, but will not entirely eliminate flooding in Prattsville. Approximately ten structures would be displaced to accommodate the channel.

3. It is not clear that the costs associated with Alternatives 2 (bridge replacement), 3 (channel alteration), 4 (combination bridge and channel alteration), or 5 (bridge replacement, channel alteration, and bypass channel) are justified when compared to the cost of acquiring all of the properties that would be "removed" from the 50-year and 100-year floodplains when the edges of inundation shift toward Schoharie Creek. It may be less costly to acquire and remove the structures that would have fallen outside the new floodplain limits; however, such acquisition would remove a significant number of properties from the center of the Village and would likely have significant impacts on its character, composition, and economy. As such, economics alone may not be the driving factor.

4. Alternatives were evaluated in the lower portion of the study area, downstream of the Route 23 bridge involving removal of the remaining vestiges of a berm along the left bank of the river in combination with floodplain clearing (Alternative 1). Implementation of this alternative would result in a modest benefit, with a predicted one-foot reduction in flood depth. This mitigation could be locally significant to houses near the flood threshold; however, additional survey is necessary to determine the number of properties and extent of flood reduction that would result.

5. Removal of the concrete fish barrier at the upper end of the study area (Alternative 6) is predicted to reduce inundation of three nearby homes. The cost of the weir removal may be similar to the cost of acquiring the three homes that would benefit from reduced inundation, but removing the weir would also benefit other properties that may be affected by floodwaters that are deflected along Route 23, as well as the road itself in the vicinity of the weir. Alternatively, a high flow bypass may be feasible to provide a pathway for water to move around the weir and back into the channel during high flows.

6. Replacement of the Main Street bridge over Huntersfield Creek (Alternative 7) would allow for increased capacity and reduced potential for overtopping. However, modeling demonstrated little overall benefit associated with this alternative.

7. Relocation of the Huntersfield Creek outlet (Alternative 8) would reduce its length and increase efficiency but would not result in measurable flood mitigation.

8. Non-channel measures, such as flood proofing individual buildings, elevating structures above flood levels, and strategically relocating structures out of the floodplain are possible and could have positive benefits for individual property owners. However, placement of large amounts if fill in the floodplain is ill advised. Additionally, raising a structure will not protect against damage caused by scour around the foundation and the structural damage that may result during flood conditions.

9. New development within the existing floodplain as well as extensive improvements to existing structures and properties will be vulnerable to repetitive losses in the future. These properties are viable candidates for acquisition, should the owners be amenable to such a course of action.

10. A total of 17 properties were evaluated using formal FEMA Benefit Cost Analysis (BCA). In general, properties located near the southern end of Main Street had Benefit Cost Ratios (BCRs) lower than 1.0, whereas properties located near the northern end of Main Street had BCRs greater than 1.0. A BCR must be greater than 1.0 for a project to be eligible for FEMA mitigation funds. Surveyed first floor elevations and property appraisals were historically necessary for developing BCRs that FEMA could accept. However, as of August 15, 2013, an acquisition/demolition in a Special Flood Hazard Area (SFHA) with a cost of less than $275,000 is automatically considered cost effective for FEMA mitigation funds. Similarly, elevating structures in a SFHA with a cost of less than $176,000 are considered cost effective. FEMA's new approach may cause these types of projects to be much more straightforward, with less reliance on BCA.

11. Education of the community is an ongoing effort. Initial outreach efforts will need to be expanded upon in order to move forward with any alternative.

12. The subject study relies on the FEMA model associated with the FIS. At some point in the future, it would be prudent to update the FEMA model with current channel and floodplain geometry to refine the incremental benefits of the various options modeled.

In summary, reductions in both the extent and depth of flooding can be achieved in Prattsville with channel modifications in conjunction with replacement of the Route 23 bridge. The specific alternative or combination of alternatives will require input from the Town of Prattsville.

APPENDIX A
USGS Summary of Flood of August 28-29 in Eastern New York

Preliminary summary of flood of August 28-29, 2011 in eastern New York

Update: Sept. 2, 2011

By: Thomas P. Suro US Geological Survey, New York WSC

Hurricane Irene weakened to a tropical storm as the center of circulation moved over New York City on August 28, 2011. Heavy rains associated with this tropical storm caused major flooding and damage throughout many parts of eastern New York. The National Weather Service (NWS) reported preliminary rainfall totals for parts of eastern New York that ranged from about 4.2 inches in Albany to over 6 inches at many locations in Columbia, Delaware, Dutchess, Schenectady, Schoharie, Ulster and Washington counties. Over 11 inches of rain was reported at Slide Mountain, and 12.2 and 13.3 inches of rainfall were reported at East Durham, and East Jewett, NY respectively.

About 50 US Geological Survey (USGS) streamgages in eastern New York recorded new record maximums during this event. In the St Lawrence River basin the Ausable River (04275500) and the East Branch Ausable River (04275000) near Au Sable Forks streamgages have both been in operation for more than 90 years and each recorded a new period-of-record maximum during this event. The preliminary peak discharge for these two streamgages is estimated at 33,500 and 48,500 ft^3/sec, respectively. The Schoharie Creek at Lexington (01349705), in operation since 1999, recorded a new period-of-record maximum of 34,100 ft^3/sec on August 28, 2011 (fig.1). The Schoharie Creek at Prattsville (0135000) streamgage, in operation since 1902, also recorded a new period-of-record maximum but sustained major damage during the flood and therefore an estimate of the peak streamflow has not yet been determined. The Schoharie Creek at Gilboa (01350101) streamgage was also severely damaged during this flood, but a peak discharge of about 108,000 ft^3/sec is estimated for August 28, 2011.

In the upper Delaware River basin the East Branch Delaware River at Margaretville (01413500) streamgage, in operation since 1937, recorded a new period-of-record maximum discharge of 33,400 ft^3/sec which exceeds the previous peak recorded during January 1996 by 7600 ft^3/sec. The USGS streamgages East Branch Neversink River northeast of Denning (0143400680) and the East Branch Neversink River near Claryville (01434017), West Branch Neversink River at Winnisook Lake near Frost Valley (01434021), and West Branch Neversink River at Claryville (01434498) all recorded new period-of-record maximums during this event.

Preliminary summary of flood of August 28-29, 2011 in eastern New York

Update: Sept. 2, 2011

By: Thomas P. Suro US Geological Survey, New York WSC

Figure 1.—Bridge over Schoharie Creek near Lexington, N.Y., Aug. 28, 2011. Photo taken by Travis L. Smith (USGS Troy NYWSC).

Flood frequency analysis of annual flood-peak discharges recorded at streamgages provides a means of estimating the probability of occurrence of a given discharge. Flood frequency is commonly expressed in terms of recurrence interval or the probability of being exceeded (one is the reciprocal of the other). What has been traditionally referred to as the 100-year flood, for example, has a probability of 0.01 (1-percent chance) of being equaled or exceeded in any given year and is now being termed the 1 percent annual chance flood.

USGS

Preliminary summary of flood of August 28-29, 2011 in eastern New York

Update: Sept. 2, 2011

By: Thomas P. Suro US Geological Survey, New York WSC

Preliminary estimates of the recurrence intervals (or exceedance probabilities) for peak discharges recorded during this flood at ten streamgages in the Hudson, Delaware and St. Lawrence River basins exceed 100-years. The initial estimates of peak discharges at the USGS streamgages on the East Branch Ausable River (04275000) and the Ausable River (04275500) near Au Sable Forks indicate recurrence intervals of greater than 500 years. The estimated peak discharge that occurred on August 28 at the USGS streamgages Schoharie Creek at Gilboa (01350101) and Schoharie Creek at North Blenheim (01350180) also have a preliminary recurrence interval of 500 years. The peak discharge at the USGS streamgage East Branch Delaware River at Margaretville, in operation since 1937, indicated a recurrence interval of greater than 100 years but less than 500 years (fig. 2) and was among the many USGS streamgages that recorded new period-of-record maximums during this flood.

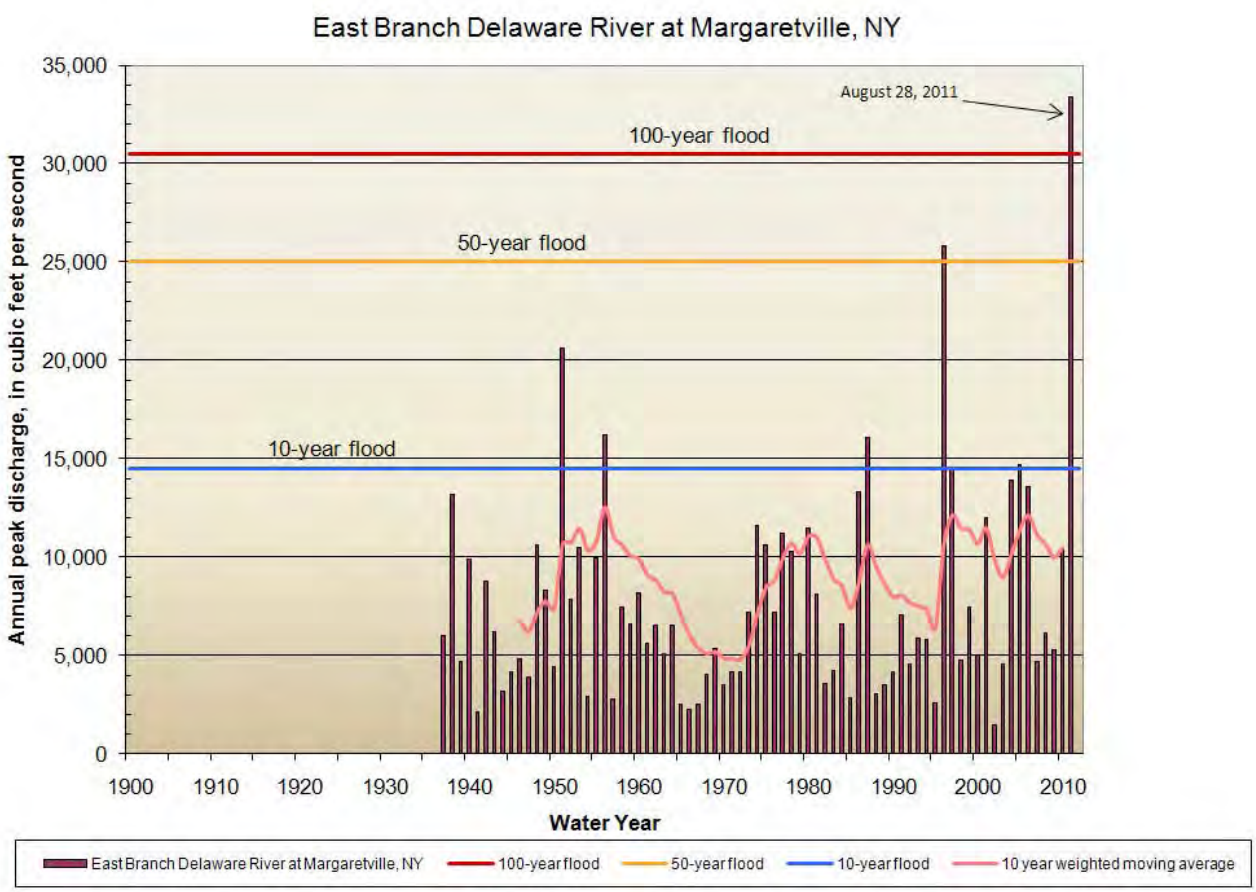


Figure 2. - Annual peak discharges through 2010, provisional peak of August 28, 2011 and discharges of the 10-, 50-, and 100-year recurrence intervals for selected stations in the Delaware River basin.

USGS

Many communities in eastern NY have experienced major flood damage as a result of rains from the remnants of Hurricane Irene. Many road, bridges and homes have been damaged or completely destroyed. The New York State Department of Transportation (NYSDOT) closed all of the bridges over the Schoharie Creek from the Gilboa Dam to the Mohawk River, major parts of the New York State Thruway as well as dozens of other major roads and bridges throughout eastern New York during this storm (fig. 3). Several of the bridges over the Schoharie Creek and many roads and bridges in eastern New York still remain closed due to flood damage.

Figure 3.-- Road and homes damaged along the Schoharie Creek near Prattsville, NY, Aug. 29, 2011. Photo taken by K.D. Reisig (USGS Troy NYWSC).

Preliminary summary of flood of August 28-29, 2011 in eastern New York

Update: Sept. 2, 2011

By: Thomas P. Suro US Geological Survey, New York WSC

The USGS New York Water Science Center has had all of its field crews out collecting streamflow data, documenting flood peaks, assessing damage and making emergency repairs to get equipment operational. At least 35 USGS streamgages recorded new period-of-record maximums during this event. Part of the mission of the Water Resources Division of the USGS is to provide reliable, timely and impartial streamflow information to minimize the loss of life and property as a result of water-related natural hazards such as flooding. USGS water data is used by the NWS for flood forecasting and flood warnings, while flood frequencies computed by the USGS are widely used for road and bridge design as well as for flood insurance studies. A preliminary table of flood peaks from the August 28-29, 2011, storm at selected USGS streamgages and estimated flood frequencies are available **below**.

(Click to view table)

USGS

APPENDIX B
HEC-RAS Model Output Summary Tables

HEC-RAS Model Output Summary Table

Alternative 1: Berm and Floodplain Alterations (DC-D no berm fp)

HEC-RAS Locations: User Defined Profile: 100 yr

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	16101	100 yr	DC-D no berm fp	67900.00	1147.17	1172.11		1173.29	0.001653	9.73	10028.78	897.24	0.38
R1	R1	16101	100 yr	MMI Existing	67900.00	1147.17	1172.19		1173.35	0.001627	9.68	10095.75	898.50	0.38
R1	R1	15953	100 yr	DC-D no berm fp	67900.00	1148.05	1170.64		1172.87	0.003245	13.42	8873.80	812.90	0.53
R1	R1	15953	100 yr	MMI Existing	67900.00	1148.05	1170.75		1172.94	0.003170	13.31	8963.35	815.50	0.52
R1	R1	15801	100 yr	DC-D no berm fp	67900.00	1147.82	1167.87	1167.20	1172.07	0.006053	18.35	6968.27	764.13	0.76
R1	R1	15801	100 yr	MMI Existing	67900.00	1147.82	1168.64	1167.24	1172.25	0.005021	17.19	7562.15	771.54	0.70
R1	R1	15650	100 yr	DC-D no berm fp	67900.00	1146.74	1169.55		1170.80	0.001552	10.19	9043.85	821.88	0.39
R1	R1	15650	100 yr	MMI Existing	67900.00	1146.74	1170.04		1171.18	0.001386	9.78	9446.14	828.00	0.37
R1	R1	15495	100 yr	DC-D no berm fp	67900.00	1147.26	1168.73		1170.28	0.017522	5.92	7866.56	830.12	0.24
R1	R1	15495	100 yr	MMI Existing	67900.00	1147.26	1169.38		1170.73	0.014371	5.49	8417.17	844.90	0.22
R1	R1	15331 Fish Block Weir	100 yr	DC-D no berm fp	67900.00	1147.62	1167.82		1169.57	0.002320	11.83	7782.67	938.44	0.49
R1	R1	15331 Fish Block Weir	100 yr	MMI Existing	67900.00	1147.62	1168.71		1170.17	0.001851	10.91	8629.53	962.84	0.44
R1	R1	15214	100 yr	DC-D no berm fp	67900.00	1147.55	1167.56		1169.21	0.003465	11.08	7503.12	1010.69	0.50
R1	R1	15214	100 yr	MMI Existing	67900.00	1147.55	1168.57		1169.86	0.002567	9.95	8578.41	1083.87	0.43
R1	R1	15211	100 yr	DC-D no berm fp	67900.00	1146.37	1167.53		1169.20	0.003235	11.08	7489.60	1012.04	0.50
R1	R1	15211	100 yr	MMI Existing	67900.00	1146.37	1168.54		1169.85	0.002405	9.97	8559.78	1079.59	0.43
R1	R1	15208	100 yr	DC-D no berm fp	67900.00	1145.38	1167.55		1169.17	0.003096	10.93	7598.47	1006.57	0.48
R1	R1	15208	100 yr	MMI Existing	67900.00	1145.38	1168.56		1169.83	0.002314	9.84	8658.80	1073.88	0.42
R1	R1	15090 FEMA E	100 yr	DC-D no berm fp	67900.00	1141.62	1167.46		1168.74	0.002572	9.64	9100.05	1070.45	0.39
R1	R1	15090 FEMA E	100 yr	MMI Existing	67900.00	1141.62	1168.46		1169.51	0.002035	8.88	10210.41	1154.27	0.35
R1	R1	15027	100 yr	DC-D no berm fp	67900.00	1139.85	1167.34		1168.59	0.001950	9.54	9320.26	957.69	0.37
R1	R1	15027	100 yr	MMI Existing	67900.00	1139.85	1168.35		1169.39	0.001557	8.81	10314.61	1024.01	0.34
R1	R1	14877	100 yr	DC-D no berm fp	67900.00	1139.90	1166.95		1168.28	0.002302	9.80	10373.65	1287.25	0.39
R1	R1	14877	100 yr	MMI Existing	67900.00	1139.90	1167.92		1169.13	0.001968	9.35	10198.47	1322.02	0.36
R1	R1	14726	100 yr	DC-D no berm fp	67900.00	1139.87	1166.68		1167.94	0.002058	9.70	10937.31	1365.04	0.38
R1	R1	14726	100 yr	MMI Existing	67900.00	1139.87	1167.63		1168.85	0.001834	9.45	9882.02	1385.62	0.36
R1	R1	14573	100 yr	DC-D no berm fp	67900.00	1139.80	1166.45		1167.64	0.001668	10.00	12163.91	1416.06	0.37
R1	R1	14573	100 yr	MMI Existing	67900.00	1139.80	1167.35		1168.59	0.001585	10.01	10243.98	1427.71	0.37
R1	R1	14420	100 yr	DC-D no berm fp	67900.00	1139.79	1166.58		1167.27	0.001321	7.55	13133.66	1464.12	0.28
R1	R1	14420	100 yr	MMI Existing	67900.00	1139.79	1167.64		1168.20	0.001032	6.89	14728.29	1535.69	0.25
R1	R1	14267	100 yr	DC-D no berm fp	67900.00	1139.73	1165.66		1166.94	0.002123	10.04	11891.05	1341.33	0.38
R1	R1	14267	100 yr	MMI Existing	67900.00	1139.73	1166.53		1167.89	0.002028	10.07	8171.56	1361.41	0.37
R1	R1	14113	100 yr	DC-D no berm fp	67900.00	1139.67	1165.50		1166.66	0.001377	9.19	12115.16	1358.31	0.35
R1	R1	14113	100 yr	MMI Existing	67900.00	1139.67	1166.01		1167.59	0.001629	10.16	7030.58	1365.77	0.39
R1	R1	13963	100 yr	DC-D no berm fp	67900.00	1139.62	1165.36		1166.45	0.001389	9.19	12035.47	1363.34	0.35
R1	R1	13963	100 yr	MMI Existing	67900.00	1139.62	1165.39		1167.29	0.002020	11.10	6371.38	1363.52	0.43
R1	R1	13809	100 yr	DC-D no berm fp	67900.00	1138.90	1164.75		1166.21	0.001472	10.35	11563.08	1404.82	0.39
R1	R1	13809	100 yr	MMI Existing	67900.00	1138.90	1165.13		1167.01	0.001680	11.18	6825.46	1407.92	0.42
R1	R1	13655	100 yr	DC-D no berm fp	67900.00	1138.90	1162.01	1157.69	1165.67	0.003483	15.69	6253.22	1085.88	0.64
R1	R1	13655	100 yr	MMI Existing	67900.00	1138.90	1162.71		1166.47	0.003297	15.64	4501.17	1191.97	0.62
R1	R1	13501	100 yr	DC-D no berm fp	67900.00	1138.72	1162.55		1164.77	0.002793	12.95	10171.77	1413.26	0.51
R1	R1	13501	100 yr	MMI Existing	67900.00	1138.72	1162.71	1157.17	1165.74	0.003393	14.34	5784.24	1415.87	0.56
R1	R1	13350	100 yr	DC-D no berm fp	67900.00	1139.00	1162.71		1164.20	0.002200	11.08	12409.21	1472.02	0.44
R1	R1	13350	100 yr	MMI Existing	67900.00	1139.00	1162.61	1157.03	1165.09	0.003118	13.15	6379.99	1470.72	0.53
R1	R1	13201	100 yr	DC-D no berm fp	67900.00	1138.86	1162.14		1163.81	0.002952	11.34	11100.74	1439.66	0.48
R1	R1	13201	100 yr	MMI Existing	67900.00	1138.86	1162.90		1164.38	0.002481	10.69	10071.41	1456.54	0.44
R1	R1	13050 Prattsville Cen	100 yr	DC-D no berm fp	67900.00	1138.51	1161.90		1163.40	0.001921	11.04	11567.55	1372.34	0.44
R1	R1	13050 Prattsville Cen	100 yr	MMI Existing	67900.00	1138.51	1162.73		1164.02	0.001601	10.36	12711.59	1378.85	0.41
R1	R1	12899	100 yr	DC-D no berm fp	67900.00	1138.64	1161.60		1163.13	0.001686	10.83	11258.66	1143.51	0.43
R1	R1	12899	100 yr	MMI Existing	67900.00	1138.64	1162.38	1154.43	1163.78	0.001471	10.38	10263.45	1188.61	0.41
R1	R1	12747	100 yr	DC-D no berm fp	67900.00	1138.34	1161.34		1162.85	0.002031	10.78	10065.53	1250.56	0.43
R1	R1	12747	100 yr	MMI Existing	67900.00	1138.34	1162.12	1153.86	1163.54	0.001804	10.42	9110.51	1281.47	0.40
R1	R1	12594 FEMA D	100 yr	DC-D no berm fp	67900.00	1136.78	1160.89		1162.56	0.001709	11.35	9741.10	1176.60	0.44
R1	R1	12594 FEMA D	100 yr	MMI Existing	67900.00	1136.78	1161.84		1163.30	0.001430	10.70	10870.22	1200.35	0.41
R1	R1	12519	100 yr	DC-D no berm fp	67900.00	1137.95	1160.76		1162.41	0.001998	11.05	9345.89	1135.12	0.44
R1	R1	12519	100 yr	MMI Existing	67900.00	1137.95	1161.65	1153.15	1163.17	0.001727	10.59	8818.31	1169.01	0.41
R1	R1	12370	100 yr	DC-D no berm fp	67900.00	1137.12	1160.54		1162.09	0.002055	10.68	9730.47	1118.95	0.42
R1	R1	12370	100 yr	MMI Existing	67900.00	1137.12	1161.44	1152.80	1162.90	0.001806	10.31	8666.69	1127.66	0.40
R1	R1	12218	100 yr	DC-D no berm fp	67900.00	1136.40	1160.34		1161.81	0.001741	10.56	9926.68	1122.68	0.41
R1	R1	12218	100 yr	MMI Existing	67900.00	1136.40	1161.28	1152.40	1162.65	0.001511	10.14	9088.26	1143.97	0.39
R1	R1	12067	100 yr	DC-D no berm fp	67900.00	1134.88	1159.09		1161.42	0.002616	13.16	7805.65	926.18	0.52

HEC-RAS Locations: User Defined Profile: 100 yr (Continued)

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	12067	100 yr	MMI Existing	67900.00	1134.88	1160.24	1152.65	1162.32	0.002162	12.41	7481.36	1043.74	0.47
R1	R1	11915	100 yr	DC-D no berm fp	67900.00	1135.37	1159.36		1160.85	0.001755	9.94	8604.04	932.98	0.39
R1	R1	11915	100 yr	MMI Existing	67900.00	1135.37	1160.47	1149.91	1161.84	0.001492	9.49	7830.41	971.70	0.36
R1	R1	11763	100 yr	DC-D no berm fp	67900.00	1134.04	1158.80		1160.54	0.002092	10.80	8586.39	964.95	0.42
R1	R1	11763	100 yr	MMI Existing	67900.00	1134.04	1159.99	1149.80	1161.58	0.001762	10.28	7472.83	994.94	0.39
R1	R1	11611	100 yr	DC-D no berm fp	67900.00	1133.43	1158.28		1160.18	0.002498	11.47	8602.72	977.22	0.45
R1	R1	11611	100 yr	MMI Existing	67900.00	1133.43	1159.25	1150.27	1161.23	0.002341	11.46	6703.40	1024.73	0.44
R1	R1	11460	100 yr	DC-D no berm fp	67900.00	1132.95	1158.11		1159.71	0.002679	11.02	8958.85	1036.02	0.44
R1	R1	11460	100 yr	MMI Existing	67900.00	1132.95	1158.19	1150.55	1160.74	0.003659	12.92	5597.61	1041.60	0.51
R1	R1	11309	100 yr	DC-D no berm fp	67900.00	1133.08	1157.35		1159.29	0.002555	12.19	8733.48	1064.15	0.47
R1	R1	11309	100 yr	MMI Existing	67900.00	1133.08	1156.72	1150.64	1160.08	0.003961	14.87	4993.92	1042.10	0.58
R1	R1	11154	100 yr	DC-D no berm fp	67900.00	1132.32	1156.95		1158.88	0.002872	11.97	9430.77	1108.98	0.47
R1	R1	11154	100 yr	MMI Existing	67900.00	1132.32	1156.33	1150.21	1159.36	0.004134	14.07	5134.27	1046.23	0.56
R1	R1	11000	100 yr	DC-D no berm fp	67900.00	1132.37	1156.70		1158.47	0.002173	11.55	9739.37	1083.71	0.45
R1	R1	11000	100 yr	MMI Existing	67900.00	1132.37	1155.92	1149.72	1158.74	0.003213	13.68	5798.39	1028.10	0.54
R1	R1	10643	100 yr	DC-D no berm fp	67900.00	1130.67	1156.97		1157.84	0.000701	7.96	13196.09	1262.54	0.30
R1	R1	10643	100 yr	MMI Existing	67900.00	1130.67	1156.53	1145.41	1157.72	0.000898	8.90	8574.46	1190.25	0.34
R1	R1	10430	100 yr	DC-D no berm fp	67900.00	1126.70	1156.05	1145.50	1157.58	0.001261	9.97	6989.40	1295.40	0.39
R1	R1	10430	100 yr	MMI Existing	67900.00	1126.70	1155.89	1145.51	1157.45	0.001294	10.05	6927.31	1238.16	0.40
R1	R1	10379 Rte 23 Bridge			Bridge									
R1	R1	10328	100 yr	DC-D no berm fp	67900.00	1127.67	1151.89	1145.00	1154.05	0.002880	11.79	5787.93	1006.71	0.51
R1	R1	10328	100 yr	MMI Existing	67900.00	1127.67	1153.19	1145.00	1155.04	0.002255	10.93	6289.92	1078.76	0.45
R1	R1	10116	100 yr	DC-D no berm fp	67900.00	1128.04	1151.70	1145.23	1153.39	0.002098	10.77	9578.86	1285.75	0.47
R1	R1	10116	100 yr	MMI Existing	67900.00	1128.04	1152.88	1145.22	1154.56	0.001817	10.49	6942.30	1486.30	0.44
R1	R1	9804	100 yr	DC-D no berm fp	67900.00	1128.52	1148.10	1146.27	1152.13	0.005063	16.58	6251.76	1221.86	0.75
R1	R1	9804	100 yr	MMI Existing	67900.00	1128.52	1150.27	1146.02	1153.62	0.003430	14.91	5294.69	1515.63	0.63
R1	R1	9654	100 yr	DC-D no berm fp	67900.00	1127.73	1148.56	1146.65	1151.00	0.003685	13.38	7645.38	1334.88	0.61
R1	R1	9654	100 yr	MMI Existing	67900.00	1127.73	1150.14	1145.38	1152.95	0.003342	13.61	5840.34	1397.54	0.59
R1	R1	9504 FEMA C	100 yr	DC-D no berm fp	67900.00	1127.70	1148.69		1150.29	0.002551	11.36	8861.74	1416.54	0.51
R1	R1	9504 FEMA C	100 yr	MMI Existing	67900.00	1127.70	1149.69	1145.17	1152.43	0.003294	13.46	6020.01	1468.62	0.59
R1	R1	9438	100 yr	DC-D no berm fp	67900.00	1128.55	1148.85		1150.03	0.001980	9.92	10117.32	1504.13	0.46
R1	R1	9438	100 yr	MMI Existing	67900.00	1128.55	1149.69	1145.07	1152.13	0.002996	12.66	6361.30	1553.01	0.57
R1	R1	9284	100 yr	DC-D no berm fp	67900.00	1126.68	1148.81		1149.60	0.002551	8.26	11498.31	1601.87	0.37
R1	R1	9284	100 yr	MMI Existing	67900.00	1126.68	1149.61	1144.51	1151.51	0.002907	11.21	7307.78	1644.84	0.51
R1	R1	9134	100 yr	DC-D no berm fp	67900.00	1127.12	1148.47		1149.29	0.001801	8.37	11972.16	1729.37	0.39
R1	R1	9134	100 yr	MMI Existing	67900.00	1127.12	1149.20	1143.98	1151.10	0.002611	11.31	7929.20	1771.87	0.51

HEC-RAS Plan: Hunt-Realign River: Huntersfield Cre Reach: main

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)	
main	2925	10 yr	968.00	1163.25	1168.70	1167.49	1169.39	0.014497	6.69	146.17	39.88	0.59
main	2925	50 yr	1710.00	1163.25	1169.86	1168.86	1171.12	0.018825	9.04	195.06	44.17	0.70
main	2925	100 yr	2090.00	1163.25	1170.25	1169.48	1171.84	0.021858	10.22	212.39	45.60	0.76
main	2729	10 yr	968.00	1160.62	1164.38	1164.20	1165.51	0.027930	8.67	120.84	52.22	0.86
main	2729	50 yr	1710.00	1160.62	1165.88	1165.57	1167.17	0.021497	9.58	218.08	77.28	0.78
main	2729	100 yr	2090.00	1160.62	1166.64	1166.10	1167.88	0.017801	9.57	281.73	89.98	0.72
main	2687	10 yr	968.00	1159.06	1164.25	1162.61	1164.67	0.009282	5.37	208.49	74.63	0.45
main	2687	50 yr	1710.00	1159.06	1165.90	1163.96	1166.42	0.008118	6.21	354.31	101.87	0.44
main	2687	100 yr	2090.00	1159.06	1166.69	1164.50	1167.21	0.007260	6.36	439.40	114.82	0.43
main	2652	10 yr	968.00	1158.53	1163.52	1162.31	1164.24	0.014401	6.87	151.55	50.19	0.58
main	2652	50 yr	1710.00	1158.53	1164.86	1163.88	1165.96	0.016273	8.74	229.15	65.92	0.65
main	2652	100 yr	2090.00	1158.53	1165.69	1164.51	1166.80	0.014124	8.92	287.82	75.67	0.62
main	2606	10 yr	968.00	1156.59	1163.11	1161.28	1163.61	0.010470	5.72	171.50	42.58	0.48
main	2606	50 yr	1710.00	1156.59	1164.23	1162.68	1165.20	0.015138	7.98	221.83	47.10	0.59
main	2606	100 yr	2090.00	1156.59	1165.09	1163.29	1166.14	0.013633	8.33	264.05	50.53	0.58
main	2333	10 yr	968.00	1152.98	1157.76	1157.37	1158.98	0.030790	8.86	109.49	32.72	0.84
main	2333	50 yr	1710.00	1152.98	1161.35		1162.16	0.008303	7.38	247.75	44.33	0.49
main	2333	100 yr	2090.00	1152.98	1163.12		1163.81	0.005413	6.92	385.14	147.37	0.41
main	2238	10 yr	968.00	1153.11	1157.75	1155.62	1158.00	0.003132	4.04	239.80	61.24	0.36
main	2238	50 yr	1710.00	1153.11	1161.58	1156.63	1161.77	0.000988	3.56	496.20	72.75	0.23
main	2238	100 yr	2090.00	1153.11	1163.32	1157.08	1163.51	0.000744	3.54	637.80	112.40	0.20
main	2200		Bridge									
main	2152	10 yr	968.00	1151.96	1157.13		1157.38	0.003923	3.98	243.53	76.18	0.38
main	2152	50 yr	1710.00	1151.96	1160.53		1160.69	0.001138	3.33	571.81	143.02	0.23
main	2152	100 yr	2090.00	1151.96	1161.99		1162.12	0.000779	3.11	854.29	243.33	0.19
main	2059	10 yr	968.00	1150.83	1156.06		1156.76	0.007059	6.73	146.54	38.68	0.58
main	2059	50 yr	1710.00	1150.83	1159.88		1160.42	0.002718	6.03	333.00	109.43	0.38
main	2059	100 yr	2090.00	1150.83	1161.63		1161.96	0.001554	5.09	647.52	257.14	0.29
main	1789	10 yr	968.00	1149.21	1155.68		1155.97	0.001255	4.90	370.35	291.04	0.38
main	1789	50 yr	1710.00	1149.21	1160.20		1160.22	0.000057	1.61	2063.02	414.00	0.09
main	1789	100 yr	2090.00	1149.21	1161.83		1161.84	0.000036	1.41	2736.78	414.00	0.07
main	1701	10 yr	968.00	1148.60	1155.55		1155.86	0.001201	4.92	347.37	271.27	0.38
main	1701	50 yr	1710.00	1148.60	1160.19		1160.21	0.000056	1.61	2073.70	414.00	0.09
main	1701	100 yr	2090.00	1148.60	1161.82		1161.84	0.000035	1.42	2748.27	414.00	0.07
main	1618	10 yr	968.00	1148.00	1155.68		1155.75	0.000261	2.68	752.36	332.94	0.19
main	1618	50 yr	1710.00	1148.00	1160.20		1160.21	0.000032	1.33	2488.56	414.00	0.07
main	1618	100 yr	2090.00	1148.00	1161.82		1161.83	0.000022	1.23	3162.87	414.00	0.06
main	1532	10 yr	968.00	1147.40	1155.66		1155.73	0.000240	2.65	757.55	331.10	0.18
main	1532	50 yr	1710.00	1147.40	1160.19		1160.20	0.000031	1.33	2499.99	414.00	0.07
main	1532	100 yr	2090.00	1147.40	1161.82		1161.83	0.000022	1.23	3174.61	414.00	0.06
main	1417	10 yr	968.00	1146.60	1155.66	1151.14	1155.70	0.000129	2.11	959.93	342.33	0.13
main	1417	50 yr	1710.00	1146.60	1160.19	1152.98	1160.20	0.000023	1.22	2717.04	414.00	0.06
main	1417	100 yr	2090.00	1146.60	1161.82	1153.45	1161.83	0.000018	1.15	3391.86	414.00	0.05

HEC-RAS River: Huntersfield Cre Reach: main Profile: 100yr - 100yr

Reach	River Sta	Profile	Plan	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)	
main	2925	100yr - 100yr	Hunter-Sch	2090.00	1163.25	1170.27	1169.48	1171.85	0.021660	10.19	213.05	45.65	0.76
main	2925	100yr - 100yr	Hunt-new Sch DS	2090.00	1163.25	1170.10	1169.48	1171.79	0.024008	10.52	205.74	45.06	0.80
main	2729	100yr - 100yr	Hunter-Sch	2090.00	1160.62	1166.61	1166.10	1167.87	0.018119	9.63	279.57	89.58	0.73
main	2729	100yr - 100yr	Hunt-new Sch DS	2090.00	1160.62	1166.90	1166.10	1167.97	0.014771	8.98	305.54	94.30	0.66
main	2687	100yr - 100yr	Hunter-Sch	2090.00	1159.06	1166.66	1164.50	1167.19	0.007369	6.40	436.67	114.43	0.43
main	2687	100yr - 100yr	Hunt-new Sch DS	2090.00	1159.06	1166.94	1164.50	1167.40	0.006202	6.03	469.39	119.05	0.40
main	2652	100yr - 100yr	Hunter-Sch	2090.00	1158.53	1165.63	1164.51	1166.77	0.014671	9.04	283.24	74.95	0.63
main	2652	100yr - 100yr	Hunt-new Sch DS	2090.00	1158.53	1166.20	1164.51	1167.08	0.010356	8.04	328.15	81.70	0.54
main	2606	100yr - 100yr	Hunter-Sch	2090.00	1156.59	1165.00	1163.29	1166.09	0.014349	8.47	259.40	50.16	0.59
main	2606	100yr - 100yr	Hunt-new Sch DS	2090.00	1156.59	1165.78	1163.29	1166.61	0.009479	7.43	299.87	53.26	0.49
main	2333	100yr - 100yr	Hunter-Sch	2090.00	1152.98	1161.81		1162.86	0.009877	8.40	268.51	45.83	0.54
main	2333	100yr - 100yr	Hunt-new Sch DS	2090.00	1152.98	1159.51	1159.51	1161.93	0.035966	12.56	171.60	38.37	0.97
main	2238	100yr - 100yr	Hunter-Sch	2090.00	1153.11	1162.12	1157.08	1162.37	0.001168	4.05	536.39	74.39	0.25
main	2238	100yr - 100yr	Hunt-new Sch DS	2090.00	1153.11	1160.86	1156.22	1161.00	0.000778	2.96	735.17	126.40	0.20
main	2200			Bridge									
main	2152	100yr - 100yr	Hunter-Sch	2090.00	1151.96	1160.50		1160.75	0.001725	4.09	567.89	141.12	0.28
main	2152	100yr - 100yr	Hunt-new Sch DS	2090.00	1151.96	1160.53		1160.68	0.000796	3.12	729.42	143.21	0.20
main	2059	100yr - 100yr	Hunter-Sch	2090.00	1150.83	1159.36	1156.83	1160.29	0.004990	7.88	290.07	56.12	0.51
main	2059	100yr - 100yr	Hunt-new Sch DS	2090.00	1150.83	1159.36	1156.83	1160.29	0.004990	7.88	290.07	56.12	0.51
main	1773	100yr - 100yr	Hunter-Sch	2090.00	1148.02	1159.63	1153.31	1159.75	0.000430	2.97	800.35	132.35	0.17
main	1773	100yr - 100yr	Hunt-new Sch DS	2090.00	1148.02	1159.63	1153.31	1159.75	0.000430	2.97	800.35	132.35	0.17
main	1528	100yr - 100yr	Hunter-Sch	2090.00	1147.11	1159.71	1151.51	1159.71	0.000004	0.35	5775.35	678.70	0.02
main	1528	100yr - 100yr	Hunt-new Sch DS	2090.00	1147.11	1159.71	1151.51	1159.71	0.000004	0.35	5775.35	678.70	0.02
main	1100	100yr - 100yr	Hunter-Sch	2090.00	1145.60	1159.71	1149.63	1159.71	0.000001	0.28	9145.94	1036.94	0.01
main	1100	100yr - 100yr	Hunt-new Sch DS	2090.00	1145.60	1159.71	1149.63	1159.71	0.000001	0.28	9145.94	1036.94	0.01
main	955	100yr - 100yr	Hunter-Sch	2090.00	1144.79	1159.71	1149.66	1159.71	0.000002	0.31	8151.05	1049.05	0.01
main	955	100yr - 100yr	Hunt-new Sch DS	2090.00	1144.79	1159.71	1149.66	1159.71	0.000002	0.31	8151.05	1049.05	0.01
main	800	100yr - 100yr	Hunter-Sch	2090.00	1143.46	1159.71	1147.36	1159.71	0.000001	0.30	8394.73	1120.42	0.01
main	800	100yr - 100yr	Hunt-new Sch DS	2090.00	1143.46	1159.71	1147.36	1159.71	0.000001	0.30	8394.73	1120.42	0.01
main	733	100yr - 100yr	Hunter-Sch	2090.00	1142.56	1159.71	1146.88	1159.71	0.000001	0.34	8215.63	1032.78	0.01
main	733	100yr - 100yr	Hunt-new Sch DS	2090.00	1142.56	1159.71	1146.88	1159.71	0.000001	0.34	8215.63	1032.78	0.01
main	612	100yr - 100yr	Hunter-Sch	2090.00	1142.13	1159.71	1146.65	1159.71	0.000001	0.33	8814.86	1091.06	0.01
main	612	100yr - 100yr	Hunt-new Sch DS	2090.00	1142.13	1159.71	1146.65	1159.71	0.000001	0.33	8814.86	1091.06	0.01
main	495	100yr - 100yr	Hunter-Sch	2090.00	1141.83	1159.71	1146.51	1159.71	0.000001	0.25	9297.64	1071.32	0.01
main	495	100yr - 100yr	Hunt-new Sch DS	2090.00	1141.83	1159.71	1146.51	1159.71	0.000001	0.25	9297.64	1071.32	0.01

HEC-RAS MODEL OUTPUT SUMMARY TABLE

Alternative 2: Bridge Replacement (MC-A)

HEC-RAS Locations: User Defined Profile: 100 yr

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	16101	100 yr	Alt. MC-A	67900.00	1147.17	1172.11		1173.29	0.001652	9.73	10029.44	897.25	0.38
R1	R1	16101	100 yr	MMI Existing	67900.00	1147.17	1172.19		1173.35	0.001627	9.68	10095.75	898.50	0.38
R1	R1	15953	100 yr	Alt. MC-A	67900.00	1148.05	1170.64		1172.87	0.003245	13.42	8874.49	812.92	0.53
R1	R1	15953	100 yr	MMI Existing	67900.00	1148.05	1170.75		1172.94	0.003170	13.31	8963.35	815.50	0.52
R1	R1	15801	100 yr	Alt. MC-A	67900.00	1147.82	1167.77	1167.18	1172.05	0.006206	18.51	6891.18	763.17	0.77
R1	R1	15801	100 yr	MMI Existing	67900.00	1147.82	1168.64	1167.24	1172.25	0.005021	17.19	7562.15	771.54	0.70
R1	R1	15650	100 yr	Alt. MC-A	67900.00	1146.74	1169.49		1170.76	0.001573	10.24	8996.71	821.35	0.39
R1	R1	15650	100 yr	MMI Existing	67900.00	1146.74	1170.04		1171.18	0.001386	9.78	9446.14	828.00	0.37
R1	R1	15495	100 yr	Alt. MC-A	67900.00	1147.26	1168.65		1170.23	0.017980	5.98	7801.21	817.16	0.24
R1	R1	15495	100 yr	MMI Existing	67900.00	1147.26	1169.38		1170.73	0.014371	5.49	8417.17	844.90	0.22
R1	R1	15331 Fish Block Weir	100 yr	Alt. MC-A	67900.00	1147.62	1167.79		1169.52	0.002305	11.78	7753.48	934.69	0.49
R1	R1	15331 Fish Block Weir	100 yr	MMI Existing	67900.00	1147.62	1168.71		1170.17	0.001851	10.91	8629.53	962.84	0.44
R1	R1	15214	100 yr	Alt. MC-A	67900.00	1147.55	1167.50		1169.17	0.003520	11.14	7447.20	994.78	0.50
R1	R1	15214	100 yr	MMI Existing	67900.00	1147.55	1168.57		1169.86	0.002567	9.95	8578.41	1083.87	0.43
R1	R1	15211	100 yr	Alt. MC-A	67900.00	1146.37	1167.47		1169.16	0.003299	11.16	7425.67	1005.95	0.50
R1	R1	15211	100 yr	MMI Existing	67900.00	1146.37	1168.54		1169.85	0.002405	9.97	8559.78	1079.59	0.43
R1	R1	15208	100 yr	Alt. MC-A	67900.00	1145.38	1167.49		1169.13	0.003156	11.01	7535.26	1004.39	0.49
R1	R1	15208	100 yr	MMI Existing	67900.00	1145.38	1168.56		1169.83	0.002314	9.84	8658.80	1073.88	0.42
R1	R1	15090 FEMA E	100 yr	Alt. MC-A	67900.00	1141.62	1167.40		1168.69	0.002611	9.69	9034.38	1064.35	0.40
R1	R1	15090 FEMA E	100 yr	MMI Existing	67900.00	1141.62	1168.46		1169.51	0.002035	8.88	10210.41	1154.27	0.35
R1	R1	15027	100 yr	Alt. MC-A	67900.00	1139.85	1167.27		1168.54	0.001978	9.59	9259.97	956.69	0.37
R1	R1	15027	100 yr	MMI Existing	67900.00	1139.85	1168.35		1169.39	0.001557	8.81	10314.61	1024.01	0.34
R1	R1	14877	100 yr	Alt. MC-A	67900.00	1139.90	1166.88		1168.22	0.002339	9.85	10283.08	1284.64	0.39
R1	R1	14877	100 yr	MMI Existing	67900.00	1139.90	1167.92		1169.13	0.001968	9.35	10198.47	1322.02	0.36
R1	R1	14726	100 yr	Alt. MC-A	67900.00	1139.87	1166.60		1167.88	0.002093	9.76	10834.76	1362.50	0.39
R1	R1	14726	100 yr	MMI Existing	67900.00	1139.87	1167.63		1168.85	0.001834	9.45	9882.02	1385.62	0.36
R1	R1	14573	100 yr	Alt. MC-A	67900.00	1139.80	1166.37		1167.58	0.001699	10.07	12048.31	1415.00	0.38
R1	R1	14573	100 yr	MMI Existing	67900.00	1139.80	1167.35		1168.59	0.001585	10.01	10243.98	1427.71	0.37
R1	R1	14420	100 yr	Alt. MC-A	67900.00	1139.79	1166.50		1167.20	0.001345	7.60	13018.63	1449.02	0.29
R1	R1	14420	100 yr	MMI Existing	67900.00	1139.79	1167.64		1168.20	0.001032	6.89	14728.29	1535.69	0.25
R1	R1	14267	100 yr	Alt. MC-A	67900.00	1139.73	1165.56		1166.87	0.002163	10.10	11765.09	1338.81	0.38
R1	R1	14267	100 yr	MMI Existing	67900.00	1139.73	1166.53		1167.89	0.002028	10.07	8171.56	1361.41	0.37
R1	R1	14113	100 yr	Alt. MC-A	67900.00	1139.67	1165.40		1166.58	0.001407	9.26	11979.46	1356.41	0.36
R1	R1	14113	100 yr	MMI Existing	67900.00	1139.67	1166.01		1167.59	0.001629	10.16	7030.58	1365.77	0.39
R1	R1	13963	100 yr	Alt. MC-A	67900.00	1139.62	1165.27		1166.36	0.001394	9.18	11921.50	1361.78	0.35
R1	R1	13963	100 yr	MMI Existing	67900.00	1139.62	1165.39		1167.29	0.002020	11.10	6371.38	1363.52	0.43
R1	R1	13809	100 yr	Alt. MC-A	67900.00	1138.90	1164.62		1166.11	0.001514	10.45	11378.81	1403.73	0.40
R1	R1	13809	100 yr	MMI Existing	67900.00	1138.90	1165.13		1167.01	0.001680	11.18	6825.46	1407.92	0.42
R1	R1	13655	100 yr	Alt. MC-A	67900.00	1138.90	1161.64	1157.71	1165.54	0.003778	16.12	5862.65	1039.46	0.66
R1	R1	13655	100 yr	MMI Existing	67900.00	1138.90	1162.71		1166.47	0.003297	15.64	4501.17	1191.97	0.62
R1	R1	13501	100 yr	Alt. MC-A	67900.00	1138.72	1162.27		1164.55	0.002926	13.13	9778.41	1399.91	0.52
R1	R1	13501	100 yr	MMI Existing	67900.00	1138.72	1162.71	1157.17	1165.74	0.003393	14.34	5784.24	1415.87	0.56
R1	R1	13350	100 yr	Alt. MC-A	67900.00	1139.00	1162.37		1163.97	0.002386	11.41	11919.25	1467.38	0.46
R1	R1	13350	100 yr	MMI Existing	67900.00	1139.00	1162.61	1157.03	1165.09	0.003118	13.15	6379.99	1470.72	0.53
R1	R1	13201	100 yr	Alt. MC-A	67900.00	1138.86	1161.76		1163.55	0.003222	11.68	10562.66	1425.49	0.49
R1	R1	13201	100 yr	MMI Existing	67900.00	1138.86	1162.90		1164.38	0.002481	10.69	10071.41	1456.54	0.44
R1	R1	13050 Prattsville Cen	100 yr	Alt. MC-A	67900.00	1138.51	1161.49		1163.10	0.002107	11.40	11006.32	1369.24	0.46
R1	R1	13050 Prattsville Cen	100 yr	MMI Existing	67900.00	1138.51	1162.73		1164.02	0.001601	10.36	12711.59	1378.85	0.41
R1	R1	12899	100 yr	Alt. MC-A	67900.00	1138.64	1161.19		1162.81	0.001830	11.12	10790.66	1135.24	0.45
R1	R1	12899	100 yr	MMI Existing	67900.00	1138.64	1162.38	1154.43	1163.78	0.001471	10.38	10263.45	1188.61	0.41
R1	R1	12747	100 yr	Alt. MC-A	67900.00	1138.34	1160.90		1162.51	0.002221	11.10	9523.23	1206.85	0.44
R1	R1	12747	100 yr	MMI Existing	67900.00	1138.34	1162.12	1153.86	1163.54	0.001804	10.42	9110.51	1281.47	0.40
R1	R1	12594 FEMA D	100 yr	Alt. MC-A	67900.00	1136.78	1160.40		1162.19	0.001878	11.71	9168.31	1161.35	0.46
R1	R1	12594 FEMA D	100 yr	MMI Existing	67900.00	1136.78	1161.84		1163.30	0.001430	10.70	10870.22	1200.35	0.41
R1	R1	12519	100 yr	Alt. MC-A	67900.00	1137.95	1160.25		1162.03	0.002210	11.42	8780.53	1097.37	0.46
R1	R1	12519	100 yr	MMI Existing	67900.00	1137.95	1161.65	1153.15	1163.17	0.001727	10.59	8818.31	1169.01	0.41
R1	R1	12370	100 yr	Alt. MC-A	67900.00	1137.12	1160.00		1161.67	0.002284	11.05	9131.11	1101.92	0.44
R1	R1	12370	100 yr	MMI Existing	67900.00	1137.12	1161.44	1152.80	1162.90	0.001806	10.31	8666.69	1127.66	0.40
R1	R1	12218	100 yr	Alt. MC-A	67900.00	1136.40	1159.77		1161.36	0.001940	10.94	9300.59	1075.13	0.43
R1	R1	12218	100 yr	MMI Existing	67900.00	1136.40	1161.28	1152.40	1162.65	0.001511	10.14	9088.26	1143.97	0.39
R1	R1	12067	100 yr	Alt. MC-A	67900.00	1134.88	1158.30		1160.91	0.003057	13.85	7081.75	901.31	0.56
R1	R1	12067	100 yr	MMI Existing	67900.00	1134.88	1160.24	1152.65	1162.32	0.002162	12.41	7481.36	1043.74	0.47
R1	R1	11915	100 yr	Alt. MC-A	67900.00	1135.37	1158.61		1160.26	0.002019	10.39	7910.29	922.84	0.41

HEC-RAS Locations: User Defined Profile: 100 yr (Continued)

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	11915	100 yr	MMI Existing	67900.00	1135.37	1160.47	1149.91	1161.84	0.001492	9.49	7830.41	971.70	0.36
R1	R1	11763	100 yr	Alt. MC-A	67900.00	1134.04	1157.95		1159.89	0.002448	11.36	7771.29	946.70	0.45
R1	R1	11763	100 yr	MMI Existing	67900.00	1134.04	1159.99	1149.80	1161.58	0.001762	10.28	7472.83	994.94	0.39
R1	R1	11611	100 yr	Alt. MC-A	67900.00	1133.43	1157.19		1159.44	0.003129	12.38	7564.12	932.45	0.50
R1	R1	11611	100 yr	MMI Existing	67900.00	1133.43	1159.25	1150.27	1161.23	0.002341	11.46	6703.40	1024.73	0.44
R1	R1	11460	100 yr	Alt. MC-A	67900.00	1132.95	1156.79		1158.89	0.003690	12.36	7642.99	983.29	0.51
R1	R1	11460	100 yr	MMI Existing	67900.00	1132.95	1158.19	1150.55	1160.74	0.003659	12.92	5597.61	1041.60	0.51
R1	R1	11309	100 yr	Alt. MC-A	67900.00	1133.08	1154.67	1150.90	1158.12	0.004962	15.52	6016.10	948.96	0.63
R1	R1	11309	100 yr	MMI Existing	67900.00	1133.08	1156.72	1150.64	1160.08	0.003961	14.87	4993.92	1042.10	0.58
R1	R1	11154	100 yr	Alt. MC-A	67900.00	1132.32	1153.79	1150.96	1157.28	0.006036	15.47	6193.56	975.26	0.67
R1	R1	11154	100 yr	MMI Existing	67900.00	1132.32	1156.33	1150.21	1159.36	0.004134	14.07	5134.27	1046.23	0.56
R1	R1	11000	100 yr	Alt. MC-A	67900.00	1132.37	1152.43	1150.71	1156.34	0.005895	16.29	5524.79	806.76	0.71
R1	R1	11000	100 yr	MMI Existing	67900.00	1132.37	1155.92	1149.72	1158.74	0.003213	13.68	5798.39	1028.10	0.54
R1	R1	10643	100 yr	Alt. MC-A	67900.00	1130.67	1153.16		1154.73	0.001521	10.35	8841.15	1098.01	0.43
R1	R1	10643	100 yr	MMI Existing	67900.00	1130.67	1156.53	1145.41	1157.72	0.000898	8.90	8574.46	1190.25	0.34
R1	R1	10430	100 yr	Alt. MC-A	67900.00	1126.70	1152.07		1154.27	0.002417	12.08	7352.74	986.91	0.53
R1	R1	10430	100 yr	MMI Existing	67900.00	1126.70	1155.89	1145.51	1157.45	0.001294	10.05	6927.31	1238.16	0.40
R1	R1	10328	100 yr	Alt. MC-A	67900.00	1127.67	1152.24		1153.86	0.002300	10.64	8455.95	1024.04	0.45
R1	R1	10328	100 yr	MMI Existing	67900.00	1127.67	1153.19	1145.00	1155.04	0.002255	10.93	6289.92	1078.76	0.45
R1	R1	10116	100 yr	Alt. MC-A	67900.00	1128.04	1151.71	1145.24	1153.39	0.002094	10.77	9588.60	1286.84	0.47
R1	R1	10116	100 yr	MMI Existing	67900.00	1128.04	1152.88	1145.22	1154.56	0.001817	10.49	6942.30	1486.30	0.44
R1	R1	9804	100 yr	Alt. MC-A	67900.00	1128.52	1147.98	1146.27	1152.12	0.005230	16.76	6106.92	1206.62	0.76
R1	R1	9804	100 yr	MMI Existing	67900.00	1128.52	1150.27	1146.02	1153.62	0.003430	14.91	5294.69	1515.63	0.63
R1	R1	9654	100 yr	Alt. MC-A	67900.00	1127.73	1148.43	1146.65	1150.95	0.003838	13.57	7472.34	1329.66	0.62
R1	R1	9654	100 yr	MMI Existing	67900.00	1127.73	1150.14	1145.38	1152.95	0.003342	13.61	5840.34	1397.54	0.59
R1	R1	9504 FEMA C	100 yr	Alt. MC-A	67900.00	1127.70	1148.56		1150.23	0.002662	11.54	8679.70	1407.91	0.52
R1	R1	9504 FEMA C	100 yr	MMI Existing	67900.00	1127.70	1149.69	1145.17	1152.43	0.003294	13.46	6020.01	1468.62	0.59
R1	R1	9438	100 yr	Alt. MC-A	67900.00	1128.55	1148.73		1149.95	0.002064	10.07	9934.16	1499.80	0.47
R1	R1	9438	100 yr	MMI Existing	67900.00	1128.55	1149.69	1145.07	1152.13	0.002996	12.66	6361.30	1553.01	0.57
R1	R1	9284	100 yr	Alt. MC-A	67900.00	1126.68	1148.60		1149.59	0.002074	9.03	10765.98	1589.03	0.43
R1	R1	9284	100 yr	MMI Existing	67900.00	1126.68	1149.61	1144.51	1151.51	0.002907	11.21	7307.78	1644.84	0.51
R1	R1	9134	100 yr	Alt. MC-A	67900.00	1127.12	1148.43		1149.26	0.001825	8.42	11908.24	1727.38	0.39
R1	R1	9134	100 yr	MMI Existing	67900.00	1127.12	1149.20	1143.98	1151.10	0.002611	11.31	7929.20	1771.87	0.51

HEC-RAS Model Output Summary Table

Alternative 3: Channel Deepening and Widening (MC-E)

HEC-RAS River: R1 Reach: R1 Profile: 100 yr

Reach	River Sta	Profile	Plan	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)	
R1	55440	100 yr	MMI Existing	50630.00	1309.47	1334.36	1324.31	1335.63	0.001842	9.04	5779.67	407.53	0.36
R1	55440	100 yr	Alt. MC-E	50630.00	1309.47	1334.36	1324.31	1335.63	0.001842	9.04	5779.67	407.53	0.36
R1	55292	100 yr	MMI Existing	50630.00	1308.75	1333.68	1324.88	1335.32	0.001800	10.32	5168.39	622.52	0.40
R1	55292	100 yr	Alt. MC-E	50630.00	1308.75	1333.68	1324.88	1335.32	0.001800	10.32	5168.39	622.52	0.40
R1	55252 Rte 42 Bridge			Bridge									
R1	55213	100 yr	MMI Existing	50630.00	1308.61	1327.40	1325.18	1332.45	0.005501	18.05	2805.21	226.96	0.80
R1	55213	100 yr	Alt. MC-E	50630.00	1308.61	1327.40	1325.18	1332.45	0.005501	18.05	2805.21	226.96	0.80
R1	55069	100 yr	MMI Existing	50630.00	1308.47	1327.68		1331.03	0.007349	14.71	3516.05	329.37	0.71
R1	55069	100 yr	Alt. MC-E	50630.00	1308.47	1327.68		1331.03	0.007349	14.71	3516.05	329.37	0.71
R1	55025	100 yr	MMI Existing	50630.00	1308.06	1327.46		1330.69	0.005935	14.58	3759.96	391.17	0.67
R1	55025	100 yr	Alt. MC-E	50630.00	1308.06	1327.46		1330.69	0.005935	14.58	3759.96	391.17	0.67
R1	54874	100 yr	MMI Existing	50630.00	1304.58	1326.82		1329.74	0.005594	14.03	3918.89	338.06	0.63
R1	54874	100 yr	Alt. MC-E	50630.00	1304.58	1326.82		1329.74	0.005594	14.03	3918.89	338.06	0.63
R1	54724	100 yr	MMI Existing	50630.00	1302.85	1325.46	1322.93	1328.84	0.005855	15.08	3873.30	445.41	0.69
R1	54724	100 yr	Alt. MC-E	50630.00	1302.85	1325.46	1322.93	1328.84	0.005855	15.08	3873.30	445.41	0.69
R1	54570	100 yr	MMI Existing	50630.00	1299.62	1325.22		1327.81	0.004540	13.68	4505.73	585.42	0.61
R1	54570	100 yr	Alt. MC-E	50630.00	1299.62	1325.22		1327.81	0.004540	13.68	4505.73	585.42	0.61
R1	54417	100 yr	MMI Existing	50630.00	1300.33	1324.70		1327.03	0.004679	12.90	5363.77	831.91	0.59
R1	54417	100 yr	Alt. MC-E	50630.00	1300.33	1324.70		1327.03	0.004679	12.90	5363.77	831.91	0.59
R1	54267	100 yr	MMI Existing	50630.00	1301.15	1324.19		1326.37	0.003470	12.84	6240.67	883.61	0.64
R1	54267	100 yr	Alt. MC-E	50630.00	1301.15	1324.19		1326.37	0.003470	12.84	6240.67	883.61	0.64
R1	54117	100 yr	MMI Existing	50630.00	1300.11	1324.52		1325.71	0.001812	9.76	8218.72	1103.52	0.46
R1	54117	100 yr	Alt. MC-E	50630.00	1300.11	1324.52		1325.71	0.001812	9.76	8218.72	1103.52	0.46
R1	53964	100 yr	MMI Existing	50630.00	1299.46	1323.51		1325.33	0.002135	11.68	7896.82	945.95	0.53
R1	53964	100 yr	Alt. MC-E	50630.00	1299.46	1323.51		1325.33	0.002135	11.68	7896.82	945.95	0.53
R1	53815	100 yr	MMI Existing	50630.00	1299.52	1323.48		1324.83	0.002706	10.60	7695.93	836.38	0.48
R1	53815	100 yr	Alt. MC-E	50630.00	1299.52	1323.48		1324.83	0.002706	10.60	7695.93	836.38	0.48
R1	53666	100 yr	MMI Existing	50630.00	1299.16	1322.92		1324.47	0.001946	11.10	6959.57	709.43	0.51
R1	53666	100 yr	Alt. MC-E	50630.00	1299.16	1322.92		1324.47	0.001946	11.10	6959.57	709.43	0.51
R1	53511	100 yr	MMI Existing	50630.00	1299.23	1321.89		1324.05	0.002709	12.45	6106.11	716.78	0.58
R1	53511	100 yr	Alt. MC-E	50630.00	1299.23	1321.89		1324.05	0.002709	12.45	6106.11	716.78	0.58
R1	53357	100 yr	MMI Existing	50630.00	1296.73	1321.69		1323.40	0.004243	11.53	6040.78	669.17	0.52
R1	53357	100 yr	Alt. MC-E	50630.00	1296.73	1321.69		1323.40	0.004243	11.53	6040.78	669.17	0.52
R1	53205	100 yr	MMI Existing	50630.00	1296.84	1320.91		1322.84	0.003034	12.20	6008.06	654.32	0.56
R1	53205	100 yr	Alt. MC-E	50630.00	1296.84	1320.91		1322.84	0.003034	12.20	6008.06	654.32	0.56
R1	53051	100 yr	MMI Existing	50630.00	1296.42	1320.18		1322.31	0.003640	13.08	5760.46	661.90	0.60
R1	53051	100 yr	Alt. MC-E	50630.00	1296.42	1320.18		1322.31	0.003640	13.08	5760.46	661.90	0.60
R1	52898	100 yr	MMI Existing	50630.00	1296.15	1319.87	1317.29	1321.61	0.004113	12.33	6166.52	731.59	0.54
R1	52898	100 yr	Alt. MC-E	50630.00	1296.15	1319.87	1317.29	1321.61	0.004113	12.33	6166.52	731.59	0.54
R1	52747	100 yr	MMI Existing	50630.00	1295.10	1319.93	1315.66	1321.00	0.002060	9.41	7324.97	781.97	0.44
R1	52747	100 yr	Alt. MC-E	50630.00	1295.10	1319.93	1315.66	1321.00	0.002060	9.41	7324.97	781.97	0.44
R1	52598	100 yr	MMI Existing	50630.00	1294.06	1319.54		1320.67	0.002340	9.75	7919.40	828.68	0.46
R1	52598	100 yr	Alt. MC-E	50630.00	1294.06	1319.54		1320.67	0.002340	9.75	7919.40	828.68	0.46
R1	52452	100 yr	MMI Existing	50630.00	1293.00	1319.12		1320.31	0.003198	10.29	7889.15	854.15	0.47
R1	52452	100 yr	Alt. MC-E	50630.00	1293.00	1319.12		1320.31	0.003198	10.29	7889.15	854.15	0.47
R1	52298	100 yr	MMI Existing	50630.00	1292.05	1318.58		1319.77	0.003830	10.97	9172.62	972.86	0.48
R1	52298	100 yr	Alt. MC-E	50630.00	1292.05	1318.58		1319.77	0.003830	10.97	9172.62	972.86	0.48
R1	52148	100 yr	MMI Existing	50630.00	1291.02	1318.31		1319.24	0.002595	10.31	10394.67	1089.38	0.42
R1	52148	100 yr	Alt. MC-E	50630.00	1291.02	1318.31		1319.24	0.002595	10.31	10394.67	1089.38	0.42
R1	51995	100 yr	MMI Existing	50630.00	1289.75	1318.33		1318.89	0.001759	8.26	11250.89	1113.29	0.34
R1	51995	100 yr	Alt. MC-E	50630.00	1289.75	1318.33		1318.89	0.001759	8.26	11250.89	1113.29	0.34
R1	51843	100 yr	MMI Existing	50630.00	1288.62	1318.25		1318.70	0.001250	7.32	12015.12	1221.25	0.30
R1	51843	100 yr	Alt. MC-E	50630.00	1288.62	1318.25		1318.70	0.001250	7.32	12015.12	1221.25	0.30
R1	51689	100 yr	MMI Existing	50630.00	1287.44	1317.65		1318.47	0.002077	9.64	11473.64	1262.25	0.39
R1	51689	100 yr	Alt. MC-E	50630.00	1287.44	1317.65		1318.47	0.002077	9.64	11473.64	1262.25	0.39
R1	51612 West Kill	100 yr	MMI Existing	50630.00	1286.84	1317.63		1318.33	0.001310	8.20	12415.75	1329.65	0.35
R1	51612 West Kill	100 yr	Alt. MC-E	50630.00	1286.84	1317.63		1318.33	0.001310	8.20	12415.75	1329.65	0.35
R1	51418	100 yr	MMI Existing	50630.00	1287.27	1317.38		1318.07	0.001878	8.52	11454.10	1206.36	0.36
R1	51418	100 yr	Alt. MC-E	50630.00	1287.27	1317.38		1318.07	0.001878	8.52	11454.10	1206.36	0.36

Reach	River Sta	Profile	Plan	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)	
R1	51267	100 yr	MMI Existing	50630.00	1288.79	1317.10	1311.89	1317.84	0.001984	8.56	10831.96	1112.66	0.35
R1	51267	100 yr	Alt. MC-E	50630.00	1288.79	1317.10	1311.89	1317.84	0.001984	8.56	10831.96	1112.66	0.35
R1	51116	100 yr	MMI Existing	50630.00	1289.81	1313.19	1312.46	1317.09	0.005707	17.25	6139.90	823.93	0.73
R1	51116	100 yr	Alt. MC-E	50630.00	1289.81	1313.19	1312.46	1317.09	0.005707	17.25	6139.90	823.93	0.73
R1	50967	100 yr	MMI Existing	50630.00	1290.46	1312.84	1311.06	1316.17	0.004864	15.62	5808.10	750.28	0.70
R1	50967	100 yr	Alt. MC-E	50630.00	1290.46	1312.84	1311.06	1316.17	0.004864	15.62	5808.10	750.28	0.70
R1	50816	100 yr	MMI Existing	50630.00	1291.25	1313.54		1315.10	0.002934	10.86	7221.79	920.73	0.49
R1	50816	100 yr	Alt. MC-E	50630.00	1291.25	1313.54		1315.10	0.002934	10.86	7221.79	920.73	0.49
R1	50665	100 yr	MMI Existing	50630.00	1290.76	1313.35		1314.58	0.002743	9.92	7055.76	905.00	0.45
R1	50665	100 yr	Alt. MC-E	50630.00	1290.76	1313.35		1314.58	0.002743	9.92	7055.76	905.00	0.45
R1	50512	100 yr	MMI Existing	50630.00	1290.58	1312.43		1314.13	0.002526	11.18	6833.32	835.47	0.50
R1	50512	100 yr	Alt. MC-E	50630.00	1290.58	1312.43		1314.13	0.002526	11.18	6833.32	835.47	0.50
R1	50342	100 yr	MMI Existing	50630.00	1292.28	1312.27		1313.63	0.002379	10.09	7846.79	967.96	0.48
R1	50342	100 yr	Alt. MC-E	50630.00	1292.28	1312.27		1313.63	0.002379	10.09	7846.79	967.96	0.48
R1	50171	100 yr	MMI Existing	50630.00	1291.16	1312.14	1307.62	1313.21	0.001739	8.93	8334.78	937.69	0.43
R1	50171	100 yr	Alt. MC-E	50630.00	1291.16	1312.14	1307.62	1313.21	0.001739	8.93	8334.78	937.69	0.43
R1	50007	100 yr	MMI Existing	50630.00	1290.19	1311.98	1306.54	1312.90	0.001530	8.18	9422.04	1032.45	0.39
R1	50007	100 yr	Alt. MC-E	50630.00	1290.19	1311.98	1306.54	1312.90	0.001530	8.18	9422.04	1032.45	0.39
R1	49886	100 yr	MMI Existing	50630.00	1290.26	1311.83	1306.17	1312.72	0.001463	8.04	9720.10	969.19	0.38
R1	49886	100 yr	Alt. MC-E	50630.00	1290.26	1311.83	1306.17	1312.72	0.001463	8.04	9720.10	969.19	0.38
R1	49785	100 yr	MMI Existing	50630.00	1289.85	1311.57	1306.59	1312.55	0.001805	8.58	8728.72	970.77	0.41
R1	49785	100 yr	Alt. MC-E	50630.00	1289.85	1311.57	1306.59	1312.55	0.001805	8.58	8728.72	970.77	0.41
R1	49669	100 yr	MMI Existing	50630.00	1292.53	1311.21	1306.27	1312.34	0.001849	9.27	8709.84	937.07	0.43
R1	49669	100 yr	Alt. MC-E	50630.00	1292.53	1311.21	1306.27	1312.34	0.001849	9.27	8709.84	937.07	0.43
R1	49516	100 yr	MMI Existing	50630.00	1291.78	1311.12	1306.00	1311.99	0.001846	8.68	9269.37	917.06	0.39
R1	49516	100 yr	Alt. MC-E	50630.00	1291.78	1311.12	1306.00	1311.99	0.001846	8.68	9269.37	917.06	0.39
R1	49350	100 yr	MMI Existing	50630.00	1290.53	1310.13		1311.57	0.003639	11.51	8532.13	827.58	0.51
R1	49350	100 yr	Alt. MC-E	50630.00	1290.53	1310.13		1311.57	0.003639	11.51	8532.13	827.58	0.51
R1	49239	100 yr	MMI Existing	50630.00	1289.26	1310.15		1311.15	0.002394	10.08	9077.16	830.70	0.44
R1	49239	100 yr	Alt. MC-E	50630.00	1289.26	1310.15		1311.15	0.002394	10.08	9077.16	830.70	0.44
R1	49088	100 yr	MMI Existing	50630.00	1287.91	1309.19		1310.74	0.004185	11.86	8285.56	817.81	0.54
R1	49088	100 yr	Alt. MC-E	50630.00	1287.91	1309.19		1310.74	0.004185	11.86	8285.56	817.81	0.54
R1	48939	100 yr	MMI Existing	50630.00	1287.04	1305.42	1305.42	1309.64	0.010781	18.07	5330.63	712.48	0.87
R1	48939	100 yr	Alt. MC-E	50630.00	1287.04	1305.42	1305.42	1309.64	0.010781	18.07	5330.63	712.48	0.87
R1	48792	100 yr	MMI Existing	50630.00	1285.64	1304.24	1302.78	1307.32	0.008674	15.12	5330.13	636.17	0.73
R1	48792	100 yr	Alt. MC-E	50630.00	1285.64	1304.24	1302.78	1307.32	0.008674	15.12	5330.13	636.17	0.73
R1	48645	100 yr	MMI Existing	50630.00	1284.28	1304.35		1306.56	0.001912	12.39	6126.79	609.59	0.58
R1	48645	100 yr	Alt. MC-E	50630.00	1284.28	1304.35		1306.56	0.001912	12.39	6126.79	609.59	0.58
R1	48490	100 yr	MMI Existing	50630.00	1282.69	1303.68		1306.12	0.003955	13.64	5879.09	496.42	0.59
R1	48490	100 yr	Alt. MC-E	50630.00	1282.69	1303.68		1306.12	0.003955	13.64	5879.09	496.42	0.59
R1	48345	100 yr	MMI Existing	50630.00	1281.58	1303.29		1305.63	0.002705	12.99	5600.62	444.38	0.55
R1	48345	100 yr	Alt. MC-E	50630.00	1281.58	1303.29		1305.63	0.002705	12.99	5600.62	444.38	0.55
R1	48191	100 yr	MMI Existing	50630.00	1280.10	1302.49		1305.08	0.004609	14.03	5220.59	400.92	0.57
R1	48191	100 yr	Alt. MC-E	50630.00	1280.10	1302.49		1305.08	0.004609	14.03	5220.59	400.92	0.57
R1	48038	100 yr	MMI Existing	50630.00	1278.49	1302.95		1304.21	0.002174	9.94	6341.39	430.73	0.40
R1	48038	100 yr	Alt. MC-E	50630.00	1278.49	1302.95		1304.21	0.002174	9.94	6341.39	430.73	0.40
R1	47968	100 yr	MMI Existing	50630.00	1277.96	1302.40		1304.01	0.002660	11.03	6069.52	428.08	0.44
R1	47968	100 yr	Alt. MC-E	50630.00	1277.96	1302.40		1304.01	0.002660	11.03	6069.52	428.08	0.44
R1	47826	100 yr	MMI Existing	50630.00	1277.39	1301.83		1303.58	0.003305	11.34	5919.52	416.01	0.46
R1	47826	100 yr	Alt. MC-E	50630.00	1277.39	1301.83		1303.58	0.003305	11.34	5919.52	416.01	0.46
R1	47672	100 yr	MMI Existing	50630.00	1276.67	1301.64		1303.07	0.002209	10.18	6589.02	438.10	0.41
R1	47672	100 yr	Alt. MC-E	50630.00	1276.67	1301.64		1303.07	0.002209	10.18	6589.02	438.10	0.41
R1	47521	100 yr	MMI Existing	50630.00	1275.78	1300.45		1302.61	0.003155	12.68	5849.95	426.23	0.50
R1	47521	100 yr	Alt. MC-E	50630.00	1275.78	1300.45		1302.61	0.003155	12.68	5849.95	426.23	0.50
R1	47368	100 yr	MMI Existing	50630.00	1274.43	1299.74		1302.07	0.003620	13.01	5493.35	389.31	0.52
R1	47368	100 yr	Alt. MC-E	50630.00	1274.43	1299.74		1302.07	0.003620	13.01	5493.35	389.31	0.52
R1	47219	100 yr	MMI Existing	50630.00	1273.37	1296.10	1294.82	1301.03	0.009220	18.56	3457.04	358.69	0.80
R1	47219	100 yr	Alt. MC-E	50630.00	1273.37	1296.10	1294.82	1301.03	0.009220	18.56	3457.04	358.69	0.80

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	47070	100 yr	MMI Existing	50630.00	1272.79	1293.12	1292.72	1299.60	0.008097	20.92	3144.34	285.66	0.90
R1	47070	100 yr	Alt. MC-E	50630.00	1272.79	1293.12	1292.72	1299.60	0.008097	20.92	3144.34	285.66	0.90
R1	46921	100 yr	MMI Existing	50630.00	1272.37	1294.45	1290.31	1297.65	0.005226	14.87	4263.12	373.09	0.62
R1	46921	100 yr	Alt. MC-E	50630.00	1272.37	1294.45	1290.31	1297.65	0.005226	14.87	4263.12	373.09	0.62
R1	46768	100 yr	MMI Existing	50630.00	1271.96	1294.75	1288.62	1296.64	0.003312	11.07	4835.29	457.21	0.49
R1	46768	100 yr	Alt. MC-E	50630.00	1271.96	1294.75	1288.62	1296.64	0.003312	11.07	4835.29	457.21	0.49
R1	46616	100 yr	MMI Existing	50630.00	1271.29	1294.25		1296.11	0.003609	10.98	4834.07	523.93	0.51
R1	46616	100 yr	Alt. MC-E	50630.00	1271.29	1294.25		1296.11	0.003609	10.98	4834.07	523.93	0.51
R1	46463	100 yr	MMI Existing	50630.00	1270.55	1292.44		1295.37	0.004733	14.11	4455.94	354.25	0.61
R1	46463	100 yr	Alt. MC-E	50630.00	1270.55	1292.44		1295.37	0.004733	14.11	4455.94	354.25	0.61
R1	46315	100 yr	MMI Existing	50630.00	1269.97	1292.07		1294.74	0.003096	13.20	4288.61	337.83	0.56
R1	46315	100 yr	Alt. MC-E	50630.00	1269.97	1292.07		1294.74	0.003096	13.20	4288.61	337.83	0.56
R1	46166	100 yr	MMI Existing	50630.00	1269.01	1291.76		1294.21	0.003106	12.62	4236.17	299.23	0.53
R1	46166	100 yr	Alt. MC-E	50630.00	1269.01	1291.76		1294.21	0.003106	12.62	4236.17	299.23	0.53
R1	46018	100 yr	MMI Existing	50630.00	1268.01	1291.10		1293.70	0.003699	12.96	3995.22	252.86	0.55
R1	46018	100 yr	Alt. MC-E	50630.00	1268.01	1291.10		1293.70	0.003699	12.96	3995.22	252.86	0.55
R1	45900	100 yr	MMI Existing	50630.00	1267.54	1290.58		1293.24	0.003910	13.14	4084.50	344.56	0.57
R1	45900	100 yr	Alt. MC-E	50630.00	1267.54	1290.58		1293.24	0.003910	13.14	4084.50	344.56	0.57
R1	45753	100 yr	MMI Existing	50630.00	1266.81	1287.98		1292.31	0.007393	16.70	3077.47	249.65	0.77
R1	45753	100 yr	Alt. MC-E	50630.00	1266.81	1287.98		1292.31	0.007393	16.70	3077.47	249.65	0.77
R1	45599	100 yr	MMI Existing	50630.00	1265.97	1286.92	1283.99	1291.30	0.005816	16.82	3244.68	289.97	0.74
R1	45599	100 yr	Alt. MC-E	50630.00	1265.97	1286.92	1283.99	1291.30	0.005816	16.82	3244.68	289.97	0.74
R1	45449	100 yr	MMI Existing	50630.00	1265.22	1287.27		1290.11	0.004107	13.55	3898.39	293.35	0.59
R1	45449	100 yr	Alt. MC-E	50630.00	1265.22	1287.27		1290.11	0.004107	13.55	3898.39	293.35	0.59
R1	45297	100 yr	MMI Existing	50630.00	1264.52	1286.87		1289.51	0.003058	13.08	3964.72	243.21	0.55
R1	45297	100 yr	Alt. MC-E	50630.00	1264.52	1286.87		1289.51	0.003058	13.08	3964.72	243.21	0.55
R1	45146	100 yr	MMI Existing	50630.00	1263.76	1285.86		1288.94	0.004110	14.10	3652.93	222.96	0.59
R1	45146	100 yr	Alt. MC-E	50630.00	1263.76	1285.86		1288.94	0.004110	14.10	3652.93	222.96	0.59
R1	44994	100 yr	MMI Existing	50630.00	1262.84	1285.33		1288.36	0.003386	14.08	3923.08	254.47	0.58
R1	44994	100 yr	Alt. MC-E	50630.00	1262.84	1285.33		1288.36	0.003386	14.08	3923.08	254.47	0.58
R1	44841	100 yr	MMI Existing	50630.00	1262.03	1285.12		1287.72	0.003282	12.96	3979.34	238.68	0.54
R1	44841	100 yr	Alt. MC-E	50630.00	1262.03	1285.12		1287.72	0.003282	12.96	3979.34	238.68	0.54
R1	44690	100 yr	MMI Existing	50630.00	1261.29	1283.65		1287.12	0.003588	15.27	3492.43	220.29	0.61
R1	44690	100 yr	Alt. MC-E	50630.00	1261.29	1283.65		1287.12	0.003588	15.27	3492.43	220.29	0.61
R1	44542	100 yr	MMI Existing	50630.00	1260.61	1283.18		1286.53	0.003814	14.75	3566.47	243.65	0.62
R1	44542	100 yr	Alt. MC-E	50630.00	1260.61	1283.18		1286.53	0.003814	14.75	3566.47	243.65	0.62
R1	44390	100 yr	MMI Existing	50630.00	1259.59	1283.16		1285.73	0.003651	12.88	3980.96	225.42	0.52
R1	44390	100 yr	Alt. MC-E	50630.00	1259.59	1283.16		1285.73	0.003651	12.88	3980.96	225.42	0.52
R1	44252	100 yr	MMI Existing	50630.00	1258.61	1282.52		1285.27	0.002869	13.33	3935.05	226.35	0.52
R1	44252	100 yr	Alt. MC-E	50630.00	1258.61	1282.52		1285.27	0.002869	13.33	3935.05	226.35	0.52
R1	44102	100 yr	MMI Existing	50630.00	1258.22	1281.71		1284.79	0.003071	14.18	3780.91	239.87	0.57
R1	44102	100 yr	Alt. MC-E	50630.00	1258.22	1281.71		1284.79	0.003071	14.18	3780.91	239.87	0.57
R1	43950	100 yr	MMI Existing	50630.00	1258.10	1281.64		1284.25	0.002266	13.10	4181.19	245.38	0.52
R1	43950	100 yr	Alt. MC-E	50630.00	1258.10	1281.64		1284.25	0.002266	13.10	4181.19	245.38	0.52
R1	43798	100 yr	MMI Existing	50630.00	1257.77	1281.17		1283.88	0.002441	13.23	3876.21	212.69	0.53
R1	43798	100 yr	Alt. MC-E	50630.00	1257.77	1281.17		1283.88	0.002441	13.23	3876.21	212.69	0.53
R1	43648	100 yr	MMI Existing	50630.00	1257.26	1280.30		1283.43	0.003061	14.24	3684.99	260.49	0.56
R1	43648	100 yr	Alt. MC-E	50630.00	1257.26	1280.30		1283.43	0.003061	14.24	3684.99	260.49	0.56
R1	43501	100 yr	MMI Existing	50630.00	1256.87	1279.41		1282.86	0.004384	14.97	3512.08	222.23	0.61
R1	43501	100 yr	Alt. MC-E	50630.00	1256.87	1279.41		1282.86	0.004384	14.97	3512.08	222.23	0.61
R1	43348	100 yr	MMI Existing	50630.00	1256.16	1278.50		1282.18	0.004308	15.52	3556.58	238.07	0.63
R1	43348	100 yr	Alt. MC-E	50630.00	1256.16	1278.50		1282.18	0.004308	15.52	3556.58	238.07	0.63
R1	43198	100 yr	MMI Existing	50630.00	1255.64	1278.62		1281.31	0.003373	13.19	3911.15	226.59	0.53
R1	43198	100 yr	Alt. MC-E	50630.00	1255.64	1278.62		1281.31	0.003373	13.19	3911.15	226.59	0.53
R1	43050	100 yr	MMI Existing	50630.00	1255.14	1278.22		1280.78	0.003231	12.94	4069.91	275.02	0.53
R1	43050	100 yr	Alt. MC-E	50630.00	1255.14	1278.22		1280.78	0.003231	12.94	4069.91	275.02	0.53
R1	42909	100 yr	MMI Existing	50630.00	1254.15	1277.51		1280.32	0.002961	13.51	3917.47	249.99	0.55
R1	42909	100 yr	Alt. MC-E	50630.00	1254.15	1277.51		1280.32	0.002961	13.51	3917.47	249.99	0.55
R1	42756	100 yr	MMI Existing	50630.00	1253.99	1275.98		1279.75	0.003354	15.66	3419.86	210.74	0.63

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	42756	100 yr	Alt. MC-E	50630.00	1253.99	1275.98		1279.75	0.003354	15.66	3419.86	210.74	0.63
R1	42607	100 yr	MMI Existing	50630.00	1252.75	1275.56		1279.13	0.004203	15.16	3388.24	196.68	0.61
R1	42607	100 yr	Alt. MC-E	50630.00	1252.75	1275.56		1279.13	0.004203	15.16	3388.24	196.68	0.61
R1	42460	100 yr	MMI Existing	50630.00	1252.64	1273.25		1278.29	0.005249	18.07	2857.78	171.86	0.75
R1	42460	100 yr	Alt. MC-E	50630.00	1252.64	1273.25		1278.29	0.005249	18.07	2857.78	171.86	0.75
R1	42312	100 yr	MMI Existing	50630.00	1252.01	1273.00		1277.23	0.005845	16.54	3111.16	205.06	0.71
R1	42312	100 yr	Alt. MC-E	50630.00	1252.01	1273.00		1277.23	0.005845	16.54	3111.16	205.06	0.71
R1	42165	100 yr	MMI Existing	50630.00	1251.51	1271.68		1276.22	0.007730	17.13	3015.93	221.02	0.77
R1	42165	100 yr	Alt. MC-E	50630.00	1251.51	1271.68		1276.22	0.007730	17.13	3015.93	221.02	0.77
R1	42016	100 yr	MMI Existing	50630.00	1250.70	1272.16		1274.90	0.003783	13.49	4345.26	375.34	0.56
R1	42016	100 yr	Alt. MC-E	50630.00	1250.70	1272.16		1274.90	0.003783	13.49	4345.26	375.34	0.56
R1	41866	100 yr	MMI Existing	50630.00	1250.14	1271.95		1274.24	0.003218	12.19	4332.13	302.53	0.52
R1	41866	100 yr	Alt. MC-E	50630.00	1250.14	1271.95		1274.24	0.003218	12.19	4332.13	302.53	0.52
R1	41777	100 yr	MMI Existing	50630.00	1249.70	1271.43	1265.78	1273.92	0.003423	12.77	4383.57	319.92	0.54
R1	41777	100 yr	Alt. MC-E	50630.00	1249.70	1271.43	1265.78	1273.92	0.003423	12.77	4383.57	319.92	0.54
R1	41675	100 yr	MMI Existing	50630.00	1239.96	1269.70	1263.97	1273.41	0.004281	15.50	3365.87	189.26	0.61
R1	41675	100 yr	Alt. MC-E	50630.00	1239.96	1269.70	1263.97	1273.41	0.004281	15.50	3365.87	189.26	0.61
R1	41622			Bridge									
R1	41571	100 yr	MMI Existing	50630.00	1240.20	1268.59	1262.61	1272.21	0.003709	15.33	3444.82	190.74	0.59
R1	41571	100 yr	Alt. MC-E	50630.00	1240.20	1268.59	1262.61	1272.21	0.003709	15.33	3444.82	190.74	0.59
R1	41469	100 yr	MMI Existing	50630.00	1241.55	1268.04		1271.77	0.004683	15.58	3370.90	199.65	0.63
R1	41469	100 yr	Alt. MC-E	50630.00	1241.55	1268.04		1271.77	0.004683	15.58	3370.90	199.65	0.63
R1	41338	100 yr	MMI Existing	50630.00	1241.68	1267.92		1271.03	0.003732	14.20	3640.36	222.61	0.59
R1	41338	100 yr	Alt. MC-E	50630.00	1241.68	1267.92		1271.03	0.003732	14.20	3640.36	222.61	0.59
R1	41185	100 yr	MMI Existing	50630.00	1241.96	1267.82		1270.33	0.003142	12.72	4001.44	251.93	0.55
R1	41185	100 yr	Alt. MC-E	50630.00	1241.96	1267.82		1270.33	0.003142	12.72	4001.44	251.93	0.55
R1	41031	100 yr	MMI Existing	50630.00	1242.20	1267.06		1269.74	0.004473	13.14	3887.48	270.38	0.59
R1	41031	100 yr	Alt. MC-E	50630.00	1242.20	1267.06		1269.74	0.004473	13.14	3887.48	270.38	0.59
R1	40882	100 yr	MMI Existing	50630.00	1242.27	1267.22		1268.97	0.002504	10.64	4922.21	347.11	0.46
R1	40882	100 yr	Alt. MC-E	50630.00	1242.27	1267.22		1268.97	0.002504	10.64	4922.21	347.11	0.46
R1	40734	100 yr	MMI Existing	50630.00	1242.72	1267.03		1268.60	0.001841	10.23	5191.37	389.06	0.44
R1	40734	100 yr	Alt. MC-E	50630.00	1242.72	1267.03		1268.60	0.001841	10.23	5191.37	389.06	0.44
R1	40584	100 yr	MMI Existing	50630.00	1242.50	1265.88		1268.15	0.003772	12.79	5270.93	470.24	0.54
R1	40584	100 yr	Alt. MC-E	50630.00	1242.50	1265.88		1268.15	0.003772	12.79	5270.93	470.24	0.54
R1	40436	100 yr	MMI Existing	50630.00	1243.04	1265.77		1267.52	0.002501	11.66	5606.68	478.17	0.49
R1	40436	100 yr	Alt. MC-E	50630.00	1243.04	1265.77		1267.52	0.002501	11.66	5606.68	478.17	0.49
R1	40286	100 yr	MMI Existing	50630.00	1243.34	1265.55	1260.82	1267.13	0.002228	11.27	5919.37	622.47	0.49
R1	40286	100 yr	Alt. MC-E	50630.00	1243.34	1265.55	1260.82	1267.13	0.002228	11.27	5919.37	622.47	0.49
R1	40135	100 yr	MMI Existing	50630.00	1242.00	1265.51	1258.88	1266.64	0.002620	8.59	6143.92	696.12	0.40
R1	40135	100 yr	Alt. MC-E	50630.00	1242.00	1265.51	1258.88	1266.64	0.002620	8.59	6143.92	696.12	0.40
R1	39982	100 yr	MMI Existing	50630.00	1240.12	1265.07	1258.93	1266.29	0.001878	8.94	6273.99	918.76	0.42
R1	39982	100 yr	Alt. MC-E	50630.00	1240.12	1265.07	1258.93	1266.29	0.001878	8.94	6273.99	918.76	0.42
R1	39831	100 yr	MMI Existing	50630.00	1240.62	1264.99	1258.41	1265.95	0.001582	7.86	6533.37	914.46	0.38
R1	39831	100 yr	Alt. MC-E	50630.00	1240.62	1264.99	1258.41	1265.95	0.001582	7.86	6533.37	914.46	0.38
R1	39680	100 yr	MMI Existing	50630.00	1240.67	1264.52	1258.29	1265.65	0.002218	8.81	6311.47	912.41	0.40
R1	39680	100 yr	Alt. MC-E	50630.00	1240.67	1264.52	1258.29	1265.65	0.002218	8.81	6311.47	912.41	0.40
R1	39531	100 yr	MMI Existing	50630.00	1240.36	1264.20	1257.68	1265.34	0.001925	8.93	6562.46	921.80	0.39
R1	39531	100 yr	Alt. MC-E	50630.00	1240.36	1264.20	1257.68	1265.34	0.001925	8.93	6562.46	921.80	0.39
R1	39478	100 yr	MMI Existing	50630.00	1243.31	1264.16	1258.39	1265.20	0.001843	8.71	6463.24	903.87	0.39
R1	39478	100 yr	Alt. MC-E	50630.00	1243.31	1264.16	1258.39	1265.20	0.001843	8.71	6463.24	903.87	0.39
R1	39329	100 yr	MMI Existing	50630.00	1242.72	1263.73	1257.83	1264.92	0.001870	9.25	6484.51	836.41	0.42
R1	39329	100 yr	Alt. MC-E	50630.00	1242.72	1263.73	1257.83	1264.92	0.001870	9.25	6484.51	836.41	0.42
R1	39176	100 yr	MMI Existing	50630.00	1241.74	1263.06	1257.17	1264.55	0.002787	10.09	6326.14	793.95	0.45
R1	39176	100 yr	Alt. MC-E	50630.00	1241.74	1263.06	1257.17	1264.55	0.002787	10.09	6326.14	793.95	0.45
R1	39022	100 yr	MMI Existing	50630.00	1239.88	1262.70	1256.40	1264.07	0.003012	9.81	6291.67	727.86	0.43
R1	39022	100 yr	Alt. MC-E	50630.00	1239.88	1262.70	1256.40	1264.07	0.003012	9.81	6291.67	727.86	0.43
R1	38871	100 yr	MMI Existing	50630.00	1239.59	1261.96	1256.21	1263.57	0.003101	10.54	5881.69	637.88	0.46
R1	38871	100 yr	Alt. MC-E	50630.00	1239.59	1261.96	1256.21	1263.57	0.003101	10.54	5881.69	637.88	0.46

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	38721	100 yr	MMI Existing	50630.00	1239.03	1261.55	1255.48	1263.15	0.002565	10.37	5674.51	514.39	0.46
R1	38721	100 yr	Alt. MC-E	50630.00	1239.03	1261.55	1255.48	1263.15	0.002565	10.37	5674.51	514.39	0.46
R1	38567	100 yr	MMI Existing	50630.00	1238.05	1261.04		1262.68	0.003466	10.66	5749.77	498.90	0.46
R1	38567	100 yr	Alt. MC-E	50630.00	1238.05	1261.04		1262.68	0.003466	10.66	5749.77	498.90	0.46
R1	38416	100 yr	MMI Existing	50630.00	1237.19	1259.23		1262.05	0.003736	15.20	5121.55	426.19	0.62
R1	38416	100 yr	Alt. MC-E	50630.00	1237.19	1259.23		1262.05	0.003736	15.20	5121.55	426.19	0.62
R1	38266	100 yr	MMI Existing	50630.00	1236.42	1256.16	1254.65	1261.02	0.009180	19.55	3847.23	346.59	0.85
R1	38266	100 yr	Alt. MC-E	50630.00	1236.42	1256.16	1254.65	1261.02	0.009180	19.55	3847.23	346.59	0.85
R1	38114	100 yr	MMI Existing	50630.00	1235.60	1256.83		1259.36	0.004623	13.35	4907.47	486.38	0.58
R1	38114	100 yr	Alt. MC-E	50630.00	1235.60	1256.83		1259.36	0.004623	13.35	4907.47	486.38	0.58
R1	37962	100 yr	MMI Existing	50630.00	1234.77	1255.51		1258.59	0.004930	15.02	4651.16	467.75	0.64
R1	37962	100 yr	Alt. MC-E	50630.00	1234.77	1255.51		1258.59	0.004930	15.02	4651.16	467.75	0.64
R1	37808	100 yr	MMI Existing	50630.00	1234.02	1254.86		1257.86	0.004335	14.59	4713.51	433.38	0.61
R1	37808	100 yr	Alt. MC-E	50630.00	1234.02	1254.86		1257.86	0.004335	14.59	4713.51	433.38	0.61
R1	37734	100 yr	MMI Existing	50630.00	1233.71	1254.65		1257.52	0.003528	14.43	4766.37	456.69	0.59
R1	37734	100 yr	Alt. MC-E	50630.00	1233.71	1254.65		1257.52	0.003528	14.43	4766.37	456.69	0.59
R1	37583	100 yr	MMI Existing	50630.00	1232.70	1254.91		1256.73	0.002716	11.18	5327.94	510.16	0.47
R1	37583	100 yr	Alt. MC-E	50630.00	1232.70	1254.91		1256.73	0.002716	11.18	5327.94	510.16	0.47
R1	37433	100 yr	MMI Existing	50630.00	1231.88	1254.01		1256.24	0.003330	12.38	4997.65	512.72	0.51
R1	37433	100 yr	Alt. MC-E	50630.00	1231.88	1254.01		1256.24	0.003330	12.38	4997.65	512.72	0.51
R1	37286	100 yr	MMI Existing	50630.00	1231.68	1254.16		1255.70	0.001630	10.40	6106.75	629.25	0.42
R1	37286	100 yr	Alt. MC-E	50630.00	1231.68	1254.16		1255.70	0.001630	10.40	6106.75	629.25	0.42
R1	37133	100 yr	MMI Existing	50630.00	1231.06	1253.03		1255.31	0.002740	12.44	4937.21	536.67	0.52
R1	37133	100 yr	Alt. MC-E	50630.00	1231.06	1253.03		1255.31	0.002740	12.44	4937.21	536.67	0.52
R1	36985	100 yr	MMI Existing	50630.00	1231.32	1251.90		1254.79	0.003646	13.90	4457.77	447.82	0.58
R1	36985	100 yr	Alt. MC-E	50630.00	1231.32	1251.90		1254.79	0.003646	13.90	4457.77	447.82	0.58
R1	36878	100 yr	MMI Existing	50630.00	1231.26	1251.73		1254.25	0.004420	12.87	4496.95	496.81	0.55
R1	36878	100 yr	Alt. MC-E	50630.00	1231.26	1251.73		1254.25	0.004420	12.87	4496.95	496.81	0.55
R1	36728	100 yr	MMI Existing	50630.00	1228.80	1248.24	1246.78	1253.11	0.008731	17.89	3252.34	391.39	0.83
R1	36728	100 yr	Alt. MC-E	50630.00	1228.80	1248.24	1246.78	1253.11	0.008731	17.89	3252.34	391.39	0.83
R1	36577	100 yr	MMI Existing	50630.00	1227.99	1247.34	1245.15	1251.71	0.007529	17.00	3337.48	376.00	0.76
R1	36577	100 yr	Alt. MC-E	50630.00	1227.99	1247.34	1245.15	1251.71	0.007529	17.00	3337.48	376.00	0.76
R1	36426	100 yr	MMI Existing	50630.00	1226.42	1245.42	1244.09	1250.78	0.004295	18.79	3019.86	278.58	0.86
R1	36426	100 yr	Alt. MC-E	50630.00	1226.42	1245.42	1244.09	1250.78	0.004295	18.79	3019.86	278.58	0.86
R1	36272	100 yr	MMI Existing	50630.00	1227.05	1245.11	1243.64	1249.64	0.008381	17.40	3157.53	356.57	0.80
R1	36272	100 yr	Alt. MC-E	50630.00	1227.05	1245.11	1243.64	1249.64	0.008381	17.40	3157.53	356.57	0.80
R1	36123	100 yr	MMI Existing	50630.00	1225.82	1244.97	1241.58	1248.09	0.006918	14.32	3696.79	356.70	0.66
R1	36123	100 yr	Alt. MC-E	50630.00	1225.82	1244.97	1241.58	1248.09	0.006918	14.32	3696.79	356.70	0.66
R1	35970	100 yr	MMI Existing	50630.00	1223.81	1243.18		1247.00	0.006411	15.82	3362.97	309.51	0.72
R1	35970	100 yr	Alt. MC-E	50630.00	1223.81	1243.18		1247.00	0.006411	15.82	3362.97	309.51	0.72
R1	35821	100 yr	MMI Existing	50630.00	1223.66	1243.14	1239.24	1246.02	0.003573	13.65	3774.28	429.51	0.63
R1	35821	100 yr	Alt. MC-E	50630.00	1223.66	1243.14	1239.24	1246.02	0.003573	13.65	3774.28	429.51	0.63
R1	35665	100 yr	MMI Existing	50630.00	1222.60	1242.04		1245.37	0.004366	14.67	3599.13	372.04	0.66
R1	35665	100 yr	Alt. MC-E	50630.00	1222.60	1242.04		1245.37	0.004366	14.67	3599.13	372.04	0.66
R1	35513	100 yr	MMI Existing	50630.00	1221.37	1241.59	1237.39	1244.61	0.004381	14.01	3779.64	372.43	0.62
R1	35513	100 yr	Alt. MC-E	50630.00	1221.37	1241.59	1237.39	1244.61	0.004381	14.01	3779.64	372.43	0.62
R1	35360	100 yr	MMI Existing	50630.00	1220.00	1240.94		1244.01	0.003592	14.16	3904.06	360.47	0.61
R1	35360	100 yr	Alt. MC-E	50630.00	1220.00	1240.94		1244.01	0.003592	14.16	3904.06	360.47	0.61
R1	35209	100 yr	MMI Existing	50630.00	1218.98	1239.54		1243.26	0.005802	15.80	3833.98	361.38	0.67
R1	35209	100 yr	Alt. MC-E	50630.00	1218.98	1239.54		1243.26	0.005802	15.80	3833.98	361.38	0.67
R1	35054	100 yr	MMI Existing	50630.00	1217.80	1237.85	1235.70	1242.09	0.009247	16.70	3393.04	368.42	0.77
R1	35054	100 yr	Alt. MC-E	50630.00	1217.80	1237.85	1235.70	1242.09	0.009247	16.70	3393.04	368.42	0.77
R1	34900	100 yr	MMI Existing	50630.00	1216.90	1235.21	1234.46	1240.31	0.013397	18.22	2982.25	334.79	0.87
R1	34900	100 yr	Alt. MC-E	50630.00	1216.90	1235.21	1234.46	1240.31	0.013397	18.22	2982.25	334.79	0.87
R1	34750	100 yr	MMI Existing	50630.00	1215.45	1234.95	1231.80	1238.20	0.008297	14.52	3677.06	416.37	0.68
R1	34750	100 yr	Alt. MC-E	50630.00	1215.45	1234.95	1231.80	1238.20	0.008297	14.52	3677.06	416.37	0.68
R1	34598	100 yr	MMI Existing	50630.00	1213.09	1233.63		1237.07	0.006454	14.98	3663.22	397.80	0.67
R1	34598	100 yr	Alt. MC-E	50630.00	1213.09	1233.63		1237.07	0.006454	14.98	3663.22	397.80	0.67
R1	34446	100 yr	MMI Existing	50630.00	1213.31	1232.85		1236.17	0.005077	14.69	3747.09	358.66	0.64

Reach	River Sta	Profile	Plan	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)	
R1	34446	100 yr	Alt. MC-E	50630.00	1213.31	1232.85		1236.17	0.005077	14.69	3747.09	358.66	0.64
R1	34299	100 yr	MMI Existing	50630.00	1211.97	1232.42		1235.37	0.004303	13.80	3766.88	264.82	0.60
R1	34299	100 yr	Alt. MC-E	50630.00	1211.97	1232.42		1235.37	0.004303	13.80	3766.88	264.82	0.60
R1	34150	100 yr	MMI Existing	50630.00	1209.97	1232.32		1234.72	0.002544	12.51	4260.98	263.70	0.52
R1	34150	100 yr	Alt. MC-E	50630.00	1209.97	1232.32		1234.72	0.002544	12.51	4260.98	263.70	0.52
R1	34002	100 yr	MMI Existing	50630.00	1209.86	1231.55		1234.28	0.003024	13.28	3904.35	234.34	0.55
R1	34002	100 yr	Alt. MC-E	50630.00	1209.86	1231.55		1234.28	0.003024	13.28	3904.35	234.34	0.55
R1	33872	100 yr	MMI Existing	50630.00	1208.88	1231.38		1233.86	0.002333	12.75	4212.67	263.67	0.52
R1	33872	100 yr	Alt. MC-E	50630.00	1208.88	1231.38		1233.86	0.002333	12.75	4212.67	263.67	0.52
R1	33723	100 yr	MMI Existing	50630.00	1208.35	1230.91		1233.45	0.003219	12.81	4029.56	239.17	0.53
R1	33723	100 yr	Alt. MC-E	50630.00	1208.35	1230.91		1233.45	0.003219	12.81	4029.56	239.17	0.53
R1	33574	100 yr	MMI Existing	50630.00	1207.80	1230.50		1232.97	0.002940	12.66	4096.71	230.43	0.51
R1	33574	100 yr	Alt. MC-E	50630.00	1207.80	1230.50		1232.97	0.002940	12.66	4096.71	230.43	0.51
R1	33420	100 yr	MMI Existing	50630.00	1207.29	1229.94		1232.53	0.002762	12.94	4067.28	240.68	0.52
R1	33420	100 yr	Alt. MC-E	50630.00	1207.29	1229.94		1232.53	0.002762	12.94	4067.28	240.68	0.52
R1	33271	100 yr	MMI Existing	50630.00	1206.80	1229.84		1232.04	0.002267	11.92	4357.05	271.90	0.49
R1	33271	100 yr	Alt. MC-E	50630.00	1206.80	1229.84		1232.04	0.002267	11.92	4357.05	271.90	0.49
R1	33118	100 yr	MMI Existing	50630.00	1206.30	1228.77		1231.57	0.003174	13.56	4090.36	261.85	0.55
R1	33118	100 yr	Alt. MC-E	50630.00	1206.30	1228.77		1231.57	0.003174	13.56	4090.36	261.85	0.55
R1	32966	100 yr	MMI Existing	50630.00	1205.78	1228.17		1231.04	0.003695	13.70	3957.02	251.74	0.57
R1	32966	100 yr	Alt. MC-E	50630.00	1205.78	1228.17		1231.04	0.003695	13.70	3957.02	251.74	0.57
R1	32817	100 yr	MMI Existing	50630.00	1205.30	1228.20		1230.34	0.002844	11.77	4398.29	262.58	0.49
R1	32817	100 yr	Alt. MC-E	50630.00	1205.30	1228.20		1230.34	0.002844	11.77	4398.29	262.58	0.49
R1	32664	100 yr	MMI Existing	50630.00	1204.83	1227.81		1229.97	0.002141	11.83	4562.07	299.19	0.48
R1	32664	100 yr	Alt. MC-E	50630.00	1204.83	1227.81		1229.97	0.002141	11.83	4562.07	299.19	0.48
R1	32515	100 yr	MMI Existing	50630.00	1204.31	1227.09		1229.56	0.003007	12.61	4098.18	231.15	0.51
R1	32515	100 yr	Alt. MC-E	50630.00	1204.31	1227.09		1229.56	0.003007	12.61	4098.18	231.15	0.51
R1	32363	100 yr	MMI Existing	50630.00	1203.79	1225.99		1228.90	0.005565	13.72	3745.48	227.95	0.57
R1	32363	100 yr	Alt. MC-E	50630.00	1203.79	1225.99		1228.90	0.005565	13.72	3745.48	227.95	0.57
R1	32213	100 yr	MMI Existing	50630.00	1203.29	1225.61		1228.18	0.003193	12.89	4019.45	257.69	0.53
R1	32213	100 yr	Alt. MC-E	50630.00	1203.29	1225.61		1228.18	0.003193	12.89	4019.45	257.69	0.53
R1	32062	100 yr	MMI Existing	50630.00	1202.80	1224.37		1227.52	0.005251	14.32	3730.43	259.28	0.60
R1	32062	100 yr	Alt. MC-E	50630.00	1202.80	1224.37		1227.52	0.005251	14.32	3730.43	259.28	0.60
R1	31910	100 yr	MMI Existing	50630.00	1202.26	1224.22		1226.58	0.004071	12.36	4198.97	284.89	0.53
R1	31910	100 yr	Alt. MC-E	50630.00	1202.26	1224.22		1226.58	0.004071	12.36	4198.97	284.89	0.53
R1	31759	100 yr	MMI Existing	50630.00	1201.72	1223.59		1225.97	0.003971	12.44	4207.28	292.71	0.54
R1	31759	100 yr	Alt. MC-E	50630.00	1201.72	1223.59		1225.97	0.003971	12.44	4207.28	292.71	0.54
R1	31609	100 yr	MMI Existing	50630.00	1201.24	1222.72		1225.34	0.004190	13.02	3986.49	272.08	0.57
R1	31609	100 yr	Alt. MC-E	50630.00	1201.24	1222.72		1225.34	0.004190	13.02	3986.49	272.08	0.57
R1	31458	100 yr	MMI Existing	50630.00	1200.71	1222.17		1224.88	0.002267	13.32	4192.65	312.19	0.57
R1	31458	100 yr	Alt. MC-E	50630.00	1200.71	1222.17		1224.88	0.002267	13.32	4192.65	312.19	0.57
R1	31304	100 yr	MMI Existing	50630.00	1200.15	1222.10		1224.47	0.001747	12.42	4364.16	334.55	0.54
R1	31304	100 yr	Alt. MC-E	50630.00	1200.15	1222.10		1224.47	0.001747	12.42	4364.16	334.55	0.54
R1	31151	100 yr	MMI Existing	50630.00	1199.63	1221.95		1224.06	0.002792	11.71	4727.74	542.85	0.51
R1	31151	100 yr	Alt. MC-E	50630.00	1199.63	1221.95		1224.06	0.002792	11.71	4727.74	542.85	0.51
R1	31000	100 yr	MMI Existing	50630.00	1199.14	1221.87		1223.63	0.001685	10.74	5450.48	577.73	0.49
R1	31000	100 yr	Alt. MC-E	50630.00	1199.14	1221.87		1223.63	0.001685	10.74	5450.48	577.73	0.49
R1	30849	100 yr	MMI Existing	50630.00	1198.62	1222.02		1223.28	0.001072	9.06	6403.26	868.25	0.41
R1	30849	100 yr	Alt. MC-E	50630.00	1198.62	1222.02		1223.28	0.001072	9.06	6403.26	868.25	0.41
R1	30696	100 yr	MMI Existing	52000.00	1198.00	1221.93		1223.00	0.002147	8.56	7220.86	962.66	0.39
R1	30696	100 yr	Alt. MC-E	52000.00	1198.00	1221.93		1223.00	0.002147	8.56	7220.86	962.66	0.39
R1	30543	100 yr	MMI Existing	52000.00	1197.51	1221.50	1214.95	1222.63	0.002716	8.72	7487.12	1162.81	0.40
R1	30543	100 yr	Alt. MC-E	52000.00	1197.51	1221.50	1214.95	1222.63	0.002716	8.72	7487.12	1162.81	0.40
R1	30392	100 yr	MMI Existing	52000.00	1196.91	1220.86	1215.35	1222.16	0.003275	9.41	7110.67	1186.74	0.45
R1	30392	100 yr	Alt. MC-E	52000.00	1196.91	1220.86	1215.35	1222.16	0.003275	9.41	7110.67	1186.74	0.45
R1	30243	100 yr	MMI Existing	52000.00	1196.22	1220.38	1213.64	1221.79	0.001893	10.27	8069.93	1263.66	0.42
R1	30243	100 yr	Alt. MC-E	52000.00	1196.22	1220.38	1213.64	1221.79	0.001893	10.27	8069.93	1263.66	0.42
R1	30089	100 yr	MMI Existing	52000.00	1195.43	1220.27	1212.19	1221.41	0.002033	9.08	8346.17	1226.30	0.38
R1	30089	100 yr	Alt. MC-E	52000.00	1195.43	1220.27	1212.19	1221.41	0.002033	9.08	8346.17	1226.30	0.38

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	29940	100 yr	MMI Existing	52000.00	1194.85	1220.01	1212.36	1221.12	0.001936	8.94	7841.44	1061.36	0.38
R1	29940	100 yr	Alt. MC-E	52000.00	1194.85	1220.01	1212.36	1221.12	0.001936	8.94	7841.44	1061.36	0.38
R1	29787	100 yr	MMI Existing	52000.00	1193.99	1219.79	1211.77	1220.82	0.001690	8.78	8044.98	1089.53	0.36
R1	29787	100 yr	Alt. MC-E	52000.00	1193.99	1219.79	1211.77	1220.82	0.001690	8.78	8044.98	1089.53	0.36
R1	29718	100 yr	MMI Existing	52000.00	1193.84	1219.78	1210.67	1220.67	0.001543	8.22	8809.44	1084.74	0.32
R1	29718	100 yr	Alt. MC-E	52000.00	1193.84	1219.78	1210.67	1220.67	0.001543	8.22	8809.44	1084.74	0.32
R1	29569	100 yr	MMI Existing	52000.00	1192.02	1218.86		1220.35	0.002418	10.27	6993.80	681.73	0.41
R1	29569	100 yr	Alt. MC-E	52000.00	1192.02	1218.86		1220.35	0.002418	10.27	6993.80	681.73	0.41
R1	29452	100 yr	MMI Existing	52000.00	1189.73	1217.50		1219.92	0.003719	12.74	4986.35	532.75	0.51
R1	29452	100 yr	Alt. MC-E	52000.00	1189.73	1217.50		1219.92	0.003719	12.74	4986.35	532.75	0.51
R1	29303	100 yr	MMI Existing	52000.00	1190.09	1216.10		1219.26	0.004367	14.27	3818.21	403.88	0.61
R1	29303	100 yr	Alt. MC-E	52000.00	1190.09	1216.10		1219.26	0.004367	14.27	3818.21	403.88	0.61
R1	29148	100 yr	MMI Existing	52000.00	1190.52	1215.79		1218.59	0.003050	13.51	4279.54	423.86	0.54
R1	29148	100 yr	Alt. MC-E	52000.00	1190.52	1215.79		1218.59	0.003050	13.51	4279.54	423.86	0.54
R1	29001	100 yr	MMI Existing	52000.00	1190.47	1215.23		1218.07	0.004158	13.65	4155.85	392.98	0.57
R1	29001	100 yr	Alt. MC-E	52000.00	1190.47	1215.23		1218.07	0.004158	13.65	4155.85	392.98	0.57
R1	28850	100 yr	MMI Existing	52000.00	1190.07	1214.74		1217.52	0.003058	13.41	4017.78	291.49	0.55
R1	28850	100 yr	Alt. MC-E	52000.00	1190.07	1214.74		1217.52	0.003058	13.41	4017.78	291.49	0.55
R1	28698	100 yr	MMI Existing	52000.00	1190.48	1213.50		1216.95	0.003559	14.93	3566.63	204.73	0.60
R1	28698	100 yr	Alt. MC-E	52000.00	1190.48	1213.50		1216.95	0.003559	14.93	3566.63	204.73	0.60
R1	28544	100 yr	MMI Existing	52000.00	1190.60	1211.82		1216.23	0.004620	16.89	3160.71	197.63	0.70
R1	28544	100 yr	Alt. MC-E	52000.00	1190.60	1211.82		1216.23	0.004620	16.89	3160.71	197.63	0.70
R1	28393	100 yr	MMI Existing	52000.00	1190.90	1209.11	1207.98	1215.09	0.009963	19.65	2725.07	223.13	0.89
R1	28393	100 yr	Alt. MC-E	52000.00	1190.90	1209.11	1207.98	1215.09	0.009963	19.65	2725.07	223.13	0.89
R1	28202	100 yr	MMI Existing	52000.00	1191.73	1210.04		1213.11	0.003791	14.26	4091.38	432.15	0.64
R1	28202	100 yr	Alt. MC-E	52000.00	1191.73	1210.04		1213.11	0.003791	14.26	4091.38	432.15	0.64
R1	28053	100 yr	MMI Existing	52000.00	1191.44	1207.93	1207.02	1212.22	0.007424	16.73	3443.38	404.09	0.81
R1	28053	100 yr	Alt. MC-E	52000.00	1191.44	1207.93	1207.02	1212.22	0.007424	16.73	3443.38	404.09	0.81
R1	27899	100 yr	MMI Existing	52000.00	1191.02	1207.48		1211.04	0.005280	15.43	3772.88	397.16	0.75
R1	27899	100 yr	Alt. MC-E	52000.00	1191.02	1207.48		1211.04	0.005280	15.43	3772.88	397.16	0.75
R1	27749	100 yr	MMI Existing	52000.00	1190.28	1206.61	1204.82	1210.21	0.005724	15.36	3818.55	397.45	0.76
R1	27749	100 yr	Alt. MC-E	52000.00	1190.28	1206.61	1204.82	1210.21	0.005724	15.36	3818.55	397.45	0.76
R1	27596	100 yr	MMI Existing	52000.00	1189.39	1206.07		1209.22	0.005484	14.27	3791.73	382.49	0.72
R1	27596	100 yr	Alt. MC-E	52000.00	1189.39	1206.07		1209.22	0.005484	14.27	3791.73	382.49	0.72
R1	27442	100 yr	MMI Existing	52000.00	1188.53	1205.99		1208.23	0.004030	12.24	5001.56	575.54	0.62
R1	27442	100 yr	Alt. MC-E	52000.00	1188.53	1205.99		1208.23	0.004030	12.24	5001.56	575.54	0.62
R1	27289	100 yr	MMI Existing	52000.00	1187.60	1205.69		1207.43	0.004553	10.98	6130.42	761.35	0.55
R1	27289	100 yr	Alt. MC-E	52000.00	1187.60	1205.69		1207.43	0.004553	10.98	6130.42	761.35	0.55
R1	27136	100 yr	MMI Existing	52000.00	1186.71	1205.38		1206.78	0.002874	9.84	6918.66	843.63	0.48
R1	27136	100 yr	Alt. MC-E	52000.00	1186.71	1205.38		1206.78	0.002874	9.84	6918.66	843.63	0.48
R1	26985	100 yr	MMI Existing	52000.00	1185.76	1205.22		1206.34	0.002040	8.87	8049.32	912.83	0.42
R1	26985	100 yr	Alt. MC-E	52000.00	1185.76	1205.22		1206.34	0.002040	8.87	8049.32	912.83	0.42
R1	26831	100 yr	MMI Existing	52000.00	1184.77	1204.96		1205.98	0.002295	8.78	7986.18	852.11	0.40
R1	26831	100 yr	Alt. MC-E	52000.00	1184.77	1204.96		1205.98	0.002295	8.78	7986.18	852.11	0.40
R1	26634	100 yr	MMI Existing	52000.00	1183.42	1204.49		1205.63	0.001367	8.96	7328.52	899.78	0.42
R1	26634	100 yr	Alt. MC-E	52000.00	1183.42	1204.49		1205.63	0.001367	8.96	7328.52	899.78	0.42
R1	26484	100 yr	MMI Existing	52000.00	1182.29	1203.34		1205.27	0.003423	12.19	6178.84	921.29	0.52
R1	26484	100 yr	Alt. MC-E	52000.00	1182.29	1203.34		1205.27	0.003423	12.19	6178.84	921.29	0.52
R1	26334	100 yr	MMI Existing	52000.00	1181.92	1202.70		1204.73	0.003972	12.50	5911.77	911.84	0.55
R1	26334	100 yr	Alt. MC-E	52000.00	1181.92	1202.70		1204.73	0.003972	12.50	5911.77	911.84	0.55
R1	26183	100 yr	MMI Existing	52000.00	1181.34	1201.56	1200.76	1204.01	0.005490	13.43	5139.76	893.21	0.60
R1	26183	100 yr	Alt. MC-E	52000.00	1181.34	1201.56	1200.76	1204.01	0.005490	13.43	5139.76	893.21	0.60
R1	26032	100 yr	MMI Existing	52000.00	1181.05	1200.97		1203.10	0.005296	12.62	5506.54	930.71	0.57
R1	26032	100 yr	Alt. MC-E	52000.00	1181.05	1200.97		1203.10	0.005296	12.62	5506.54	930.71	0.57
R1	25879	100 yr	MMI Existing	52000.00	1180.88	1199.87	1197.40	1202.27	0.005496	13.14	5231.98	928.03	0.59
R1	25879	100 yr	Alt. MC-E	52000.00	1180.88	1199.87	1197.40	1202.27	0.005496	13.14	5231.98	928.03	0.59
R1	25730	100 yr	MMI Existing	52000.00	1180.49	1199.56		1201.37	0.004377	11.38	5733.36	841.51	0.53
R1	25730	100 yr	Alt. MC-E	52000.00	1180.49	1199.56		1201.37	0.004377	11.38	5733.36	841.51	0.53

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	25578	100 yr	MMI Existing	52000.00	1179.85	1197.91	1195.17	1200.49	0.006658	13.57	4929.87	788.56	0.63
R1	25578	100 yr	Alt. MC-E	52000.00	1179.85	1197.91	1195.17	1200.49	0.006658	13.57	4929.87	788.56	0.63
R1	25432	100 yr	MMI Existing	52000.00	1179.39	1198.07		1199.49	0.003502	10.10	6506.25	985.80	0.49
R1	25432	100 yr	Alt. MC-E	52000.00	1179.39	1198.07		1199.49	0.003502	10.10	6506.25	985.80	0.49
R1	25286	100 yr	MMI Existing	52000.00	1179.05	1197.91		1198.92	0.002715	8.61	7728.23	1181.67	0.42
R1	25286	100 yr	Alt. MC-E	52000.00	1179.05	1197.91		1198.92	0.002715	8.61	7728.23	1181.67	0.42
R1	25133	100 yr	MMI Existing	52000.00	1178.55	1197.05		1198.43	0.003349	10.11	7583.50	1287.12	0.48
R1	25133	100 yr	Alt. MC-E	52000.00	1178.55	1197.05		1198.43	0.003349	10.11	7583.50	1287.12	0.48
R1	24979	100 yr	MMI Existing	52000.00	1176.86	1196.34		1197.88	0.003864	10.55	7263.42	1322.46	0.50
R1	24979	100 yr	Alt. MC-E	52000.00	1176.86	1196.34		1197.88	0.003864	10.55	7263.42	1322.46	0.50
R1	24829	100 yr	MMI Existing	52000.00	1176.90	1195.70		1197.19	0.005247	10.26	7222.26	1403.47	0.53
R1	24829	100 yr	Alt. MC-E	52000.00	1176.90	1195.70		1197.19	0.005247	10.26	7222.26	1403.47	0.53
R1	24662	100 yr	MMI Existing	52000.00	1176.89	1195.13		1196.32	0.004315	9.41	8076.27	1601.65	0.52
R1	24662	100 yr	Alt. MC-E	52000.00	1176.89	1195.13		1196.32	0.004315	9.41	8076.27	1601.65	0.52
R1	24543	100 yr	MMI Existing	52000.00	1176.52	1195.07		1195.81	0.002634	8.07	9281.74	1799.54	0.40
R1	24543	100 yr	Alt. MC-E	52000.00	1176.52	1195.07		1195.81	0.002634	8.07	9281.74	1799.54	0.40
R1	24391	100 yr	MMI Existing	52000.00	1176.03	1194.44	1191.71	1195.35	0.003830	8.66	8734.89	1923.62	0.44
R1	24391	100 yr	Alt. MC-E	52000.00	1176.03	1194.44	1191.71	1195.35	0.003830	8.66	8734.89	1923.62	0.44
R1	24242	100 yr	MMI Existing	52000.00	1175.43	1193.92	1191.50	1194.82	0.003902	8.99	8845.02	1957.85	0.43
R1	24242	100 yr	Alt. MC-E	52000.00	1175.43	1193.92	1191.50	1194.82	0.003902	8.99	8845.02	1957.85	0.43
R1	24091	100 yr	MMI Existing	52000.00	1173.84	1193.20	1190.17	1194.24	0.004624	9.47	9169.33	1962.89	0.46
R1	24091	100 yr	Alt. MC-E	52000.00	1173.84	1193.20	1190.17	1194.24	0.004624	9.47	9169.33	1962.89	0.46
R1	23939	100 yr	MMI Existing	52000.00	1171.03	1192.86	1188.24	1193.65	0.003062	8.08	10096.42	1885.04	0.38
R1	23939	100 yr	Alt. MC-E	52000.00	1171.03	1192.86	1188.24	1193.65	0.003062	8.08	10096.42	1885.04	0.38
R1	23789	100 yr	MMI Existing	52000.00	1172.39	1192.33	1189.16	1193.21	0.004047	8.60	9549.36	1896.05	0.42
R1	23789	100 yr	Alt. MC-E	52000.00	1172.39	1192.33	1189.16	1193.21	0.004047	8.60	9549.36	1896.05	0.42
R1	23638	100 yr	MMI Existing	52000.00	1171.07	1189.89	1187.47	1192.33	0.007127	13.41	6681.19	1494.94	0.61
R1	23638	100 yr	Alt. MC-E	52000.00	1171.07	1189.89	1187.47	1192.33	0.007127	13.41	6681.19	1494.94	0.61
R1	23484	100 yr	MMI Existing	52000.00	1171.52	1190.40		1191.20	0.002941	8.05	8886.78	1821.75	0.42
R1	23484	100 yr	Alt. MC-E	52000.00	1171.52	1190.40		1191.20	0.002941	8.05	8886.78	1821.75	0.42
R1	23329	100 yr	MMI Existing	52000.00	1171.53	1189.96		1190.79	0.002839	8.13	8902.14	1730.00	0.40
R1	23329	100 yr	Alt. MC-E	52000.00	1171.53	1189.96		1190.79	0.002839	8.13	8902.14	1730.00	0.40
R1	23178	100 yr	MMI Existing	52000.00	1170.97	1189.11		1190.28	0.004193	10.22	8266.60	1711.94	0.48
R1	23178	100 yr	Alt. MC-E	52000.00	1170.97	1189.11		1190.28	0.004194	10.22	8265.76	1711.89	0.48
R1	23029	100 yr	MMI Existing	52000.00	1170.13	1188.96		1189.67	0.002834	8.21	9463.64	1690.67	0.39
R1	23029	100 yr	Alt. MC-E	52000.00	1170.13	1188.96		1189.67	0.002835	8.21	9462.81	1690.66	0.39
R1	22880	100 yr	MMI Existing	52000.00	1169.26	1188.49		1189.27	0.002652	8.49	9201.68	1553.40	0.39
R1	22880	100 yr	Alt. MC-E	52000.00	1169.26	1188.49		1189.27	0.002652	8.49	9200.92	1553.39	0.39
R1	22708	100 yr	MMI Existing	52000.00	1167.84	1188.08		1188.86	0.002504	8.72	8668.38	1415.87	0.37
R1	22708	100 yr	Alt. MC-E	52000.00	1167.84	1188.08		1188.86	0.002505	8.72	8667.69	1415.87	0.37
R1	22558	100 yr	MMI Existing	52000.00	1165.66	1187.31		1188.42	0.002908	10.12	8063.43	1328.53	0.43
R1	22558	100 yr	Alt. MC-E	52000.00	1165.66	1187.31		1188.42	0.002909	10.12	8062.46	1328.53	0.43
R1	22409	100 yr	MMI Existing	52000.00	1165.49	1186.99		1187.95	0.002324	9.10	8470.54	1327.56	0.40
R1	22409	100 yr	Alt. MC-E	52000.00	1165.49	1186.99		1187.95	0.002325	9.10	8469.24	1327.55	0.40
R1	22259	100 yr	MMI Existing	52000.00	1165.98	1186.08		1187.54	0.002622	10.68	8240.34	1357.30	0.46
R1	22259	100 yr	Alt. MC-E	52000.00	1165.98	1186.08		1187.54	0.002623	10.68	8238.52	1357.30	0.46
R1	22109	100 yr	MMI Existing	52000.00	1165.26	1185.71		1187.10	0.002556	10.55	8058.46	1154.95	0.45
R1	22109	100 yr	Alt. MC-E	52000.00	1165.26	1185.71		1187.10	0.002557	10.55	8056.76	1154.90	0.45
R1	21957	100 yr	MMI Existing	52000.00	1165.34	1185.51		1186.70	0.001897	9.70	8392.34	1106.70	0.41
R1	21957	100 yr	Alt. MC-E	52000.00	1165.34	1185.51		1186.70	0.001898	9.70	8390.58	1106.69	0.41
R1	21803	100 yr	MMI Existing	52000.00	1165.11	1185.36		1186.31	0.001910	8.86	9001.91	1129.30	0.39
R1	21803	100 yr	Alt. MC-E	52000.00	1165.11	1185.36		1186.31	0.001911	8.86	9000.12	1129.30	0.39
R1	21653	100 yr	MMI Existing	52000.00	1165.18	1184.58		1185.94	0.002411	10.24	8848.66	1139.09	0.45
R1	21653	100 yr	Alt. MC-E	52000.00	1165.18	1184.58		1185.94	0.002413	10.24	8846.30	1139.07	0.45
R1	21498	100 yr	MMI Existing	52000.00	1164.85	1184.56		1185.44	0.002102	8.39	9391.30	1117.83	0.38
R1	21498	100 yr	Alt. MC-E	52000.00	1164.85	1184.56		1185.44	0.002104	8.39	9388.84	1117.82	0.38
R1	21345	100 yr	MMI Existing	52000.00	1164.33	1184.37		1185.13	0.001572	7.98	9317.58	1045.56	0.35
R1	21345	100 yr	Alt. MC-E	52000.00	1164.33	1184.36		1185.13	0.001573	7.98	9315.03	1045.54	0.35
R1	21192	100 yr	MMI Existing	52000.00	1163.74	1184.11		1184.89	0.001755	8.16	9049.28	987.51	0.36

Reach	River Sta	Profile	Plan	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)	
R1	21192	100 yr	Alt. MC-E	52000.00	1163.74	1184.11		1184.89	0.001757	8.16	9046.62	987.50	0.36
R1	21040	100 yr	MMI Existing	52000.00	1163.07	1183.76		1184.63	0.001844	8.08	8875.04	956.04	0.37
R1	21040	100 yr	Alt. MC-E	52000.00	1163.07	1183.75		1184.63	0.001845	8.08	8872.12	956.03	0.37
R1	20892	100 yr	MMI Existing	52000.00	1162.41	1183.69		1184.38	0.001143	7.07	9889.69	970.30	0.31
R1	20892	100 yr	Alt. MC-E	52000.00	1162.41	1183.69		1184.38	0.001144	7.08	9886.61	970.28	0.31
R1	20740	100 yr	MMI Existing	52000.00	1161.81	1183.63		1184.14	0.001155	6.35	9974.05	931.51	0.27
R1	20740	100 yr	Alt. MC-E	52000.00	1161.81	1183.62		1184.14	0.001156	6.35	9971.09	931.48	0.27
R1	20590	100 yr	MMI Existing	52000.00	1161.10	1183.44		1183.97	0.001175	6.35	10217.18	971.30	0.27
R1	20590	100 yr	Alt. MC-E	52000.00	1161.10	1183.44		1183.96	0.001176	6.35	10213.86	971.26	0.27
R1	20438	100 yr	MMI Existing	52000.00	1160.17	1183.02		1183.73	0.001620	8.17	10313.69	1066.70	0.34
R1	20438	100 yr	Alt. MC-E	52000.00	1160.17	1183.01		1183.72	0.001622	8.18	10309.53	1066.67	0.34
R1	20286	100 yr	MMI Existing	52000.00	1160.18	1181.71		1183.31	0.003001	11.46	7855.56	1028.50	0.49
R1	20286	100 yr	Alt. MC-E	52000.00	1160.18	1181.70		1183.30	0.003007	11.47	7848.65	1028.45	0.49
R1	20135	100 yr	MMI Existing	52000.00	1159.55	1181.33		1182.79	0.002790	11.18	8107.25	1000.67	0.48
R1	20135	100 yr	Alt. MC-E	52000.00	1159.55	1181.32		1182.78	0.002797	11.19	8099.56	1000.64	0.48
R1	19984	100 yr	MMI Existing	52000.00	1159.13	1181.23		1182.29	0.002286	9.52	8848.79	996.27	0.42
R1	19984	100 yr	Alt. MC-E	52000.00	1159.13	1181.23		1182.28	0.002291	9.53	8841.13	996.20	0.42
R1	19834	100 yr	MMI Existing	52000.00	1158.51	1181.32		1181.86	0.001301	6.53	9612.21	970.40	0.29
R1	19834	100 yr	Alt. MC-E	52000.00	1158.51	1181.32		1181.86	0.001304	6.54	9604.87	970.36	0.29
R1	19682	100 yr	MMI Existing	52000.00	1157.85	1181.18		1181.68	0.001188	6.30	10018.04	960.18	0.27
R1	19682	100 yr	Alt. MC-E	52000.00	1157.85	1181.18		1181.67	0.001190	6.30	10010.54	960.15	0.27
R1	19532	100 yr	MMI Existing	52000.00	1157.53	1180.81	1173.56	1181.48	0.001176	7.19	8689.40	1027.83	0.31
R1	19532	100 yr	Alt. MC-E	52000.00	1157.53	1180.81	1173.56	1181.47	0.001179	7.19	8684.10	1027.76	0.31
R1	19382	100 yr	MMI Existing	52000.00	1157.09	1180.09	1171.92	1181.25	0.001324	8.96	7839.59	1083.14	0.37
R1	19382	100 yr	Alt. MC-E	52000.00	1157.09	1180.09	1171.92	1181.24	0.001327	8.97	7834.63	1082.56	0.37
R1	19227	100 yr	MMI Existing	52000.00	1156.64	1180.26	1170.09	1180.97	0.000694	7.34	11828.92	1218.11	0.29
R1	19227	100 yr	Alt. MC-E	52000.00	1156.64	1180.25	1170.09	1180.96	0.000695	7.35	11822.45	1217.99	0.29
R1	19077	100 yr	MMI Existing	52000.00	1153.74	1180.19	1167.93	1180.84	0.000713	6.81	10347.19	1236.89	0.26
R1	19077	100 yr	Alt. MC-E	52000.00	1153.74	1180.18	1167.93	1180.84	0.000714	6.82	10341.06	1236.84	0.26
R1	18923 Batavia Kill	100 yr	MMI Existing	67900.00	1151.83	1178.06	1172.23	1180.47	0.002801	13.03	7674.86	1154.07	0.51
R1	18923 Batavia Kill	100 yr	Alt. MC-E	67900.00	1151.83	1178.04	1172.23	1180.46	0.002808	13.04	7667.13	1153.99	0.52
R1	18773	100 yr	MMI Existing	67900.00	1152.16	1177.80	1171.88	1179.97	0.002997	12.15	7165.70	1145.78	0.50
R1	18773	100 yr	Alt. MC-E	67900.00	1152.16	1177.79	1171.88	1179.96	0.003006	12.16	7157.99	1145.64	0.50
R1	18618	100 yr	MMI Existing	67900.00	1153.18	1176.78	1171.72	1179.47	0.002939	13.63	6439.11	1133.60	0.55
R1	18618	100 yr	Alt. MC-E	67900.00	1153.18	1176.76	1171.72	1179.46	0.002950	13.65	6429.53	1133.36	0.55
R1	18468 FEMA F	100 yr	MMI Existing	67900.00	1152.57	1177.27	1171.50	1178.76	0.001607	10.48	7202.03	1146.40	0.41
R1	18468 FEMA F	100 yr	Alt. MC-E	67900.00	1152.57	1177.25	1171.50	1178.74	0.001613	10.49	7192.98	1145.83	0.41
R1	18324	100 yr	MMI Existing	67900.00	1152.06	1176.24	1170.27	1178.39	0.002324	12.47	6156.89	994.54	0.47
R1	18324	100 yr	Alt. MC-E	67900.00	1152.06	1176.22	1170.27	1178.37	0.002335	12.49	6147.85	994.01	0.47
R1	18174	100 yr	MMI Existing	67900.00	1152.50	1176.28	1170.92	1177.91	0.002295	10.75	6912.21	1085.50	0.44
R1	18174	100 yr	Alt. MC-E	67900.00	1152.50	1176.25	1170.92	1177.89	0.002307	10.77	6899.91	1080.61	0.44
R1	18019	100 yr	MMI Existing	67900.00	1152.04	1175.78	1169.75	1177.49	0.002974	10.74	6991.74	1240.43	0.47
R1	18019	100 yr	Alt. MC-E	67900.00	1152.04	1175.76	1169.75	1177.47	0.002991	10.76	6977.89	1239.69	0.47
R1	17866	100 yr	MMI Existing	67900.00	1152.19	1175.40	1169.29	1177.10	0.002018	10.84	7216.75	1165.17	0.46
R1	17866	100 yr	Alt. MC-E	67900.00	1152.19	1175.37	1169.29	1177.08	0.002030	10.86	7200.15	1165.00	0.46
R1	17717	100 yr	MMI Existing	67900.00	1151.77	1175.15	1168.85	1176.83	0.001678	10.81	7076.49	1190.57	0.45
R1	17717	100 yr	Alt. MC-E	67900.00	1151.77	1175.12	1168.85	1176.81	0.001690	10.83	7058.56	1190.31	0.45
R1	17563	100 yr	MMI Existing	67900.00	1151.60	1174.56	1168.52	1176.50	0.002567	11.80	7071.51	1191.89	0.48
R1	17563	100 yr	Alt. MC-E	67900.00	1151.60	1174.52	1168.52	1176.47	0.002587	11.83	7050.67	1191.61	0.48
R1	17412	100 yr	MMI Existing	67900.00	1151.49	1174.58	1167.93	1175.99	0.002223	10.07	8071.16	1232.52	0.41
R1	17412	100 yr	Alt. MC-E	67900.00	1151.49	1174.54	1167.93	1175.96	0.002243	10.11	8041.83	1231.99	0.42
R1	17261	100 yr	MMI Existing	67900.00	1151.05	1174.34	1168.30	1175.58	0.002452	9.48	8410.68	1226.16	0.39
R1	17261	100 yr	Alt. MC-E	67900.00	1151.05	1174.30	1168.30	1175.54	0.002478	9.51	8378.68	1225.65	0.40
R1	17107	100 yr	MMI Existing	67900.00	1150.76	1174.02	1166.84	1175.22	0.002120	9.32	9170.11	1408.23	0.38
R1	17107	100 yr	Alt. MC-E	67900.00	1150.76	1173.98	1166.84	1175.19	0.002143	9.36	9130.52	1407.62	0.38
R1	16955	100 yr	MMI Existing	67900.00	1150.30	1174.00		1174.66	0.001953	7.24	12379.63	1118.54	0.29
R1	16955	100 yr	Alt. MC-E	67900.00	1150.30	1173.96		1174.62	0.001974	7.27	12326.94	1118.33	0.29
R1	16802	100 yr	MMI Existing	67900.00	1149.95	1173.46		1174.43	0.001070	8.39	13194.66	1244.78	0.34
R1	16802	100 yr	Alt. MC-E	67900.00	1149.95	1173.41		1174.39	0.001081	8.42	13129.93	1244.58	0.34

Reach	River Sta	Profile	Plan	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)	
R1	16650	100 yr	MMI Existing	67900.00	1149.64	1173.11		1174.24	0.001386	9.55	13763.13	1306.94	0.38
R1	16650	100 yr	Alt. MC-E	67900.00	1149.64	1173.05		1174.19	0.001404	9.60	13687.52	1306.63	0.38
R1	16496	100 yr	MMI Existing	67900.00	1147.40	1172.92		1174.01	0.001611	9.68	13373.51	1219.67	0.37
R1	16496	100 yr	Alt. MC-E	67900.00	1147.40	1172.86		1173.96	0.001630	9.72	13300.13	1219.24	0.37
R1	16344	100 yr	MMI Existing	67900.00	1147.29	1172.71		1173.74	0.001714	8.70	12065.68	1001.99	0.34
R1	16253	100 yr	MMI Existing	67900.00	1148.34	1172.36		1173.57	0.001592	9.71	10884.87	923.74	0.38
R1	16253	100 yr	Alt. MC-E	67900.00	1148.34	1172.35		1173.56	0.001597	9.72	10870.33	923.62	0.38
R1	16101	100 yr	MMI Existing	67900.00	1147.17	1172.19		1173.35	0.001627	9.68	10095.75	898.50	0.38
R1	16101	100 yr	Alt. MC-E	67900.00	1147.17	1172.17		1173.34	0.001633	9.69	10080.84	898.22	0.38
R1	15953	100 yr	MMI Existing	67900.00	1148.05	1170.75		1172.94	0.003170	13.31	8963.35	815.50	0.52
R1	15953	100 yr	Alt. MC-E	67900.00	1148.05	1170.72	1166.50	1172.93	0.003187	13.33	8943.54	814.92	0.52
R1	15801	100 yr	MMI Existing	67900.00	1147.82	1168.64	1167.24	1172.25	0.005021	17.19	7562.15	771.54	0.70
R1	15801	100 yr	Alt. MC-E	67900.00	1147.82	1167.18	1167.18	1172.01	0.007192	19.49	6447.06	757.50	0.83
R1	15650	100 yr	MMI Existing	67900.00	1146.74	1170.04		1171.18	0.001386	9.78	9446.14	828.00	0.37
R1	15650	100 yr	Alt. MC-E	67900.00	1146.74	1169.10	1162.91	1170.46	0.001723	10.58	8675.17	812.33	0.41
R1	15495	100 yr	MMI Existing	67900.00	1147.26	1169.38		1170.73	0.014371	5.49	8417.17	844.90	0.22
R1	15495	100 yr	Alt. MC-E	67900.00	1147.26	1168.08		1169.86	0.021633	6.43	7346.48	798.55	0.26
R1	15331 Fish Block Weir	100 yr	MMI Existing	67900.00	1147.62	1168.71		1170.17	0.001851	10.91	8629.53	962.84	0.44
R1	15331 Fish Block Weir	100 yr	Alt. MC-E	67900.00	1147.62	1166.82		1168.94	0.002969	12.88	6900.77	849.95	0.55
R1	15214	100 yr	MMI Existing	67900.00	1147.55	1168.57		1169.86	0.002567	9.95	8578.41	1083.87	0.43
R1	15214	100 yr	Alt. MC-E	67900.00	1147.55	1165.18	1164.10	1168.31	0.007580	14.66	5311.41	839.46	0.71
R1	15211	100 yr	MMI Existing	67900.00	1146.37	1168.54		1169.85	0.002405	9.97	8559.78	1079.59	0.43
R1	15211	100 yr	Alt. MC-E	67900.00	1146.37	1164.00	1164.00	1168.18	0.010299	16.62	4416.84	699.64	0.85
R1	15208	100 yr	MMI Existing	67900.00	1145.38	1168.56		1169.83	0.002314	9.84	8658.80	1073.88	0.42
R1	15208	100 yr	Alt. MC-E	67900.00	1145.38	1162.58	1163.36	1168.02	0.014923	18.78	3702.72	440.02	1.00
R1	15090 FEMA E	100 yr	MMI Existing	67900.00	1141.62	1168.46		1169.51	0.002035	8.88	10210.41	1154.27	0.35
R1	15090 FEMA E	100 yr	Alt. MC-E	67900.00	1141.62	1158.01	1159.38	1165.45	0.028230	21.90	3100.64	298.72	1.20
R1	15027	100 yr	MMI Existing	67900.00	1139.85	1168.35		1169.39	0.001557	8.81	10314.61	1024.01	0.34
R1	15027	100 yr	Alt. MC-E	67900.00	1140.00	1160.55	1150.84	1161.78	0.001215	8.91	7661.94	483.60	0.37
R1	14877	100 yr	MMI Existing	67900.00	1139.90	1167.92		1169.13	0.001968	9.35	10198.47	1322.02	0.36
R1	14877	100 yr	Alt. MC-E	67900.00	1139.08	1160.30		1161.59	0.001292	9.09	7600.10	500.26	0.38
R1	14726	100 yr	MMI Existing	67900.00	1139.87	1167.63		1168.85	0.001834	9.45	9882.02	1385.62	0.36
R1	14726	100 yr	Alt. MC-E	67900.00	1138.72	1160.23		1161.36	0.001067	8.55	8266.06	595.83	0.35
R1	14573	100 yr	MMI Existing	67900.00	1139.80	1167.35		1168.59	0.001585	10.01	10243.98	1427.71	0.37
R1	14573	100 yr	Alt. MC-E	67900.00	1138.29	1160.07		1161.20	0.001057	8.57	8598.66	749.64	0.34
R1	14420	100 yr	MMI Existing	67900.00	1139.79	1167.64		1168.20	0.001032	6.89	14728.29	1535.69	0.25
R1	14420	100 yr	Alt. MC-E	67900.00	1138.02	1159.98		1161.02	0.000985	8.31	9405.08	880.51	0.33
R1	14267	100 yr	MMI Existing	67900.00	1139.73	1166.53		1167.89	0.002028	10.07	8171.56	1361.41	0.37
R1	14267	100 yr	Alt. MC-E	67900.00	1137.37	1159.82		1160.87	0.000976	8.35	9351.02	813.18	0.33
R1	14113	100 yr	MMI Existing	67900.00	1139.67	1166.01		1167.59	0.001629	10.16	7030.58	1365.77	0.39
R1	14113	100 yr	Alt. MC-E	67900.00	1137.29	1158.65		1160.57	0.002194	11.22	6717.13	848.25	0.49
R1	13963	100 yr	MMI Existing	67900.00	1139.62	1165.39		1167.29	0.002020	11.10	6371.38	1363.52	0.43
R1	13963	100 yr	Alt. MC-E	67900.00	1136.69	1158.92		1160.11	0.001219	8.77	8254.04	767.44	0.37
R1	13809	100 yr	MMI Existing	67900.00	1138.90	1165.13		1167.01	0.001680	11.18	6825.46	1407.92	0.42
R1	13809	100 yr	Alt. MC-E	67900.00	1136.14	1158.00		1159.82	0.001794	10.82	6472.42	612.94	0.44
R1	13655	100 yr	MMI Existing	67900.00	1138.90	1162.71		1166.47	0.003297	15.64	4501.17	1191.97	0.62
R1	13655	100 yr	Alt. MC-E	67900.00	1135.70	1157.17		1159.45	0.002410	12.14	5646.48	408.28	0.51
R1	13501	100 yr	MMI Existing	67900.00	1138.72	1162.71	1157.17	1165.74	0.003393	14.34	5784.24	1415.87	0.56
R1	13501	100 yr	Alt. MC-E	67900.00	1135.60	1157.73		1158.87	0.001097	8.87	10155.33	904.22	0.35
R1	13350	100 yr	MMI Existing	67900.00	1139.00	1162.61	1157.03	1165.09	0.003118	13.15	6379.99	1470.72	0.53
R1	13350	100 yr	Alt. MC-E	67900.00	1134.90	1157.92		1158.61	0.000667	6.78	11662.94	890.07	0.27
R1	13201	100 yr	MMI Existing	67900.00	1138.86	1162.90		1164.38	0.002481	10.69	10071.41	1456.54	0.44
R1	13201	100 yr	Alt. MC-E	67900.00	1134.71	1157.60		1158.48	0.000824	7.61	10083.67	789.38	0.31
R1	13050 Prattsville Cen	100 yr	MMI Existing	67900.00	1138.51	1162.73		1164.02	0.001601	10.36	12711.59	1378.85	0.41
R1	13050 Prattsville Cen	100 yr	Alt. MC-E	67900.00	1134.42	1157.47		1158.36	0.000773	7.74	10838.78	773.03	0.30
R1	12899	100 yr	MMI Existing	67900.00	1138.64	1162.38	1154.43	1163.78	0.001471	10.38	10263.45	1188.61	0.41
R1	12899	100 yr	Alt. MC-E	67900.00	1133.94	1157.29		1158.23	0.000857	7.86	10039.92	674.77	0.31
R1	12747	100 yr	MMI Existing	67900.00	1138.34	1162.12	1153.86	1163.54	0.001804	10.42	9110.51	1281.47	0.40

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	12747	100 yr	Alt. MC-E	67900.00	1134.05	1157.28		1158.08	0.000600	7.18	9559.97	566.75	0.28
R1	12594 FEMA D	100 yr	MMI Existing	67900.00	1136.78	1161.84		1163.30	0.001430	10.70	10870.22	1200.35	0.41
R1	12594 FEMA D	100 yr	Alt. MC-E	67900.00	1133.65	1156.80		1157.94	0.000931	8.67	8691.09	505.87	0.33
R1	12519	100 yr	MMI Existing	67900.00	1137.95	1161.65	1153.15	1163.17	0.001727	10.59	8818.31	1169.01	0.41
R1	12519	100 yr	Alt. MC-E	67900.00	1133.45	1156.49		1157.84	0.001122	9.50	8063.81	446.14	0.36
R1	12370	100 yr	MMI Existing	67900.00	1137.12	1161.44	1152.80	1162.90	0.001806	10.31	8666.69	1127.66	0.40
R1	12370	100 yr	Alt. MC-E	67900.00	1133.00	1156.67		1157.56	0.000808	7.57	9014.24	485.92	0.30
R1	12218	100 yr	MMI Existing	67900.00	1136.40	1161.28	1152.40	1162.65	0.001511	10.14	9088.26	1143.97	0.39
R1	12218	100 yr	Alt. MC-E	67900.00	1132.50	1156.59		1157.43	0.000732	7.36	9329.78	498.18	0.29
R1	12067	100 yr	MMI Existing	67900.00	1134.88	1160.24	1152.65	1162.32	0.002162	12.41	7481.36	1043.74	0.47
R1	12067	100 yr	Alt. MC-E	67900.00	1132.20	1155.58		1157.20	0.001446	10.41	7302.92	413.48	0.41
R1	11915	100 yr	MMI Existing	67900.00	1135.37	1160.47	1149.91	1161.84	0.001492	9.49	7830.41	971.70	0.36
R1	11915	100 yr	Alt. MC-E	67900.00	1132.00	1155.62		1156.91	0.001170	9.11	7501.87	486.21	0.36
R1	11763	100 yr	MMI Existing	67900.00	1134.04	1159.99	1149.80	1161.58	0.001762	10.28	7472.83	994.94	0.39
R1	11763	100 yr	Alt. MC-E	67900.00	1131.50	1155.57		1156.69	0.000962	8.51	8286.14	801.45	0.33
R1	11611	100 yr	MMI Existing	67900.00	1133.43	1159.25	1150.27	1161.23	0.002341	11.46	6703.40	1024.73	0.44
R1	11611	100 yr	Alt. MC-E	67900.00	1131.00	1155.16		1156.51	0.001139	9.36	8177.46	880.46	0.36
R1	11460	100 yr	MMI Existing	67900.00	1132.95	1158.19	1150.55	1160.74	0.003659	12.92	5597.61	1041.60	0.51
R1	11460	100 yr	Alt. MC-E	67900.00	1130.00	1155.23		1156.28	0.000844	8.34	9521.79	924.67	0.31
R1	11309	100 yr	MMI Existing	67900.00	1133.08	1156.72	1150.64	1160.08	0.003961	14.87	4993.92	1042.10	0.58
R1	11309	100 yr	Alt. MC-E	67900.00	1130.00	1154.92		1156.12	0.001002	8.98	9167.37	987.76	0.34
R1	11154	100 yr	MMI Existing	67900.00	1132.32	1156.33	1150.21	1159.36	0.004134	14.07	5134.27	1046.23	0.56
R1	11154	100 yr	Alt. MC-E	67900.00	1130.00	1154.75		1155.97	0.001017	9.00	9791.72	1007.62	0.34
R1	11000	100 yr	MMI Existing	67900.00	1132.37	1155.92	1149.72	1158.74	0.003213	13.68	5798.39	1028.10	0.54
R1	11000	100 yr	Alt. MC-E	67900.00	1129.00	1154.70		1155.79	0.000890	8.57	10312.99	1035.44	0.32
R1	10643	100 yr	MMI Existing	67900.00	1130.67	1156.53	1145.41	1157.72	0.000898	8.90	8574.46	1190.25	0.34
R1	10643	100 yr	Alt. MC-E	67900.00	1129.14	1154.60		1155.11	0.002715	5.68	11965.61	1119.86	0.31
R1	10430	100 yr	MMI Existing	67900.00	1126.70	1155.89	1145.51	1157.45	0.001294	10.05	6927.31	1238.16	0.40
R1	10430	100 yr	Alt. MC-E	67900.00	1127.37	1154.12	1138.74	1154.75	0.001081	6.52	13157.34	1103.00	0.24
R1	10379 Rte 23 Bridge			Bridge									
R1	10328	100 yr	MMI Existing	67900.00	1127.67	1153.19	1145.00	1155.04	0.002255	10.93	6289.92	1078.76	0.45
R1	10328	100 yr	Alt. MC-E	67900.00	1127.78	1152.47		1153.97	0.002028	10.24	8836.67	1042.20	0.43
R1	10116	100 yr	MMI Existing	67900.00	1128.04	1152.88	1145.22	1154.56	0.001817	10.49	6942.30	1486.30	0.44
R1	10116	100 yr	Alt. MC-E	67900.00	1128.04	1151.40	1145.22	1153.44	0.002478	11.56	6172.38	1246.83	0.50
R1	9804	100 yr	MMI Existing	67900.00	1128.52	1150.27	1146.02	1153.62	0.003430	14.91	5294.69	1515.63	0.63
R1	9804	100 yr	Alt. MC-E	67900.00	1128.52	1148.63	1146.27	1152.24	0.004391	15.80	6927.37	1299.63	0.70
R1	9654	100 yr	MMI Existing	67900.00	1127.73	1150.14	1145.38	1152.95	0.003342	13.61	5840.34	1397.54	0.59
R1	9654	100 yr	Alt. MC-E	67900.00	1127.73	1149.14		1151.23	0.003088	12.55	8416.57	1356.77	0.56
R1	9504 FEMA C	100 yr	MMI Existing	67900.00	1127.70	1149.69	1145.17	1152.43	0.003294	13.46	6020.01	1468.62	0.59
R1	9504 FEMA C	100 yr	Alt. MC-E	67900.00	1127.70	1149.27		1150.64	0.002115	10.60	9693.23	1450.36	0.47
R1	9438	100 yr	MMI Existing	67900.00	1128.55	1149.69	1145.07	1152.13	0.002996	12.66	6361.30	1553.01	0.57
R1	9438	100 yr	Alt. MC-E	67900.00	1128.55	1149.40		1150.42	0.001653	9.29	10956.19	1538.32	0.42
R1	9284	100 yr	MMI Existing	67900.00	1126.68	1149.61	1144.51	1151.51	0.002907	11.21	7307.78	1644.84	0.51
R1	9284	100 yr	Alt. MC-E	67900.00	1126.68	1149.32		1150.13	0.001623	8.26	11920.52	1629.09	0.38
R1	9134	100 yr	MMI Existing	67900.00	1127.12	1149.20	1143.98	1151.10	0.002611	11.31	7929.20	1771.87	0.51
R1	9134	100 yr	Alt. MC-E	67900.00	1127.12	1149.10		1149.91	0.001429	8.33	12989.30	1764.93	0.38
R1	8984	100 yr	MMI Existing	67900.00	1127.17	1148.24	1144.30	1150.59	0.003607	12.67	7297.66	1788.85	0.59
R1	8984	100 yr	Alt. MC-E	67900.00	1127.17	1148.42		1149.61	0.002203	9.99	12389.18	1799.71	0.46
R1	8833	100 yr	MMI Existing	67900.00	1126.68	1147.88	1143.53	1150.09	0.002591	12.29	8201.03	1785.64	0.55
R1	8833	100 yr	Alt. MC-E	67900.00	1126.68	1148.29		1149.28	0.001411	9.23	14633.33	1787.54	0.41
R1	8683	100 yr	MMI Existing	67900.00	1125.34	1147.43	1143.71	1149.67	0.003005	12.45	8476.03	1740.20	0.57
R1	8683	100 yr	Alt. MC-E	67900.00	1125.34	1148.03		1149.05	0.001620	9.39	15132.68	1747.03	0.42
R1	8532	100 yr	MMI Existing	67900.00	1126.46	1147.19	1143.30	1149.14	0.002804	11.75	9779.99	1760.70	0.54
R1	8532	100 yr	Alt. MC-E	67900.00	1126.46	1147.73		1148.79	0.001719	9.43	15300.92	1766.82	0.43
R1	8382	100 yr	MMI Existing	67900.00	1126.28	1147.47		1148.49	0.002199	9.16	15726.32	1756.95	0.42
R1	8382	100 yr	Alt. MC-E	67900.00	1126.28	1147.47		1148.49	0.002199	9.16	15726.32	1756.95	0.42
R1	8231	100 yr	MMI Existing	67900.00	1126.68	1147.12		1148.15	0.002311	9.08	15589.37	1683.59	0.42
R1	8231	100 yr	Alt. MC-E	67900.00	1126.68	1147.12		1148.15	0.002311	9.08	15589.37	1683.59	0.42

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	8076	100 yr	MMI Existing	67900.00	1125.69	1146.83		1147.84	0.001740	9.02	16450.87	1757.31	0.40
R1	8076	100 yr	Alt. MC-E	67900.00	1125.69	1146.83		1147.84	0.001740	9.02	16450.87	1757.31	0.40
R1	7923	100 yr	MMI Existing	67900.00	1125.65	1146.69		1147.58	0.001226	8.40	17419.76	1858.19	0.38
R1	7923	100 yr	Alt. MC-E	67900.00	1125.65	1146.69		1147.58	0.001226	8.40	17419.76	1858.19	0.38
R1	7769	100 yr	MMI Existing	67900.00	1125.17	1146.48		1147.41	0.001160	8.49	18018.92	1932.71	0.38
R1	7769	100 yr	Alt. MC-E	67900.00	1125.17	1146.48		1147.41	0.001160	8.49	18018.92	1932.71	0.38
R1	7614	100 yr	MMI Existing	67900.00	1123.90	1146.39		1147.19	0.001277	7.94	18529.80	1938.52	0.36
R1	7614	100 yr	Alt. MC-E	67900.00	1123.90	1146.39		1147.19	0.001277	7.94	18529.80	1938.52	0.36
R1	7460	100 yr	MMI Existing	67900.00	1124.53	1146.32		1146.96	0.001233	7.10	19039.46	1939.91	0.33
R1	7460	100 yr	Alt. MC-E	67900.00	1124.53	1146.32		1146.96	0.001233	7.10	19039.46	1939.91	0.33
R1	7306	100 yr	MMI Existing	67900.00	1123.67	1146.10		1146.79	0.001451	7.39	18449.00	1888.18	0.35
R1	7306	100 yr	Alt. MC-E	67900.00	1123.67	1146.10		1146.79	0.001451	7.39	18449.00	1888.18	0.35
R1	7152	100 yr	MMI Existing	67900.00	1121.77	1145.85		1146.60	0.001263	7.65	18372.39	1909.92	0.35
R1	7152	100 yr	Alt. MC-E	67900.00	1121.77	1145.85		1146.60	0.001263	7.65	18372.39	1909.92	0.35
R1	7001	100 yr	MMI Existing	67900.00	1122.26	1145.65		1146.44	0.001134	7.82	18666.52	1943.51	0.35
R1	7001	100 yr	Alt. MC-E	67900.00	1122.26	1145.65		1146.44	0.001134	7.82	18666.52	1943.51	0.35
R1	6846	100 yr	MMI Existing	67900.00	1121.94	1145.47		1146.28	0.001197	8.01	18892.25	1948.82	0.35
R1	6846	100 yr	Alt. MC-E	67900.00	1121.94	1145.47		1146.28	0.001197	8.01	18892.25	1948.82	0.35
R1	6695 FEMA B	100 yr	MMI Existing	67900.00	1121.18	1144.86		1146.06	0.001428	9.88	18015.44	1954.75	0.42
R1	6695 FEMA B	100 yr	Alt. MC-E	67900.00	1121.18	1144.86		1146.06	0.001428	9.88	18015.44	1954.75	0.42
R1	6587	100 yr	MMI Existing	67900.00	1120.91	1144.73		1145.87	0.001874	9.87	18067.10	1949.23	0.42
R1	6587	100 yr	Alt. MC-E	67900.00	1120.91	1144.73		1145.87	0.001874	9.87	18067.10	1949.23	0.42
R1	6436	100 yr	MMI Existing	67900.00	1121.57	1144.18		1145.60	0.001933	11.08	17036.18	1928.15	0.46
R1	6436	100 yr	Alt. MC-E	67900.00	1121.57	1144.18		1145.60	0.001933	11.08	17036.18	1928.15	0.46
R1	6283	100 yr	MMI Existing	67900.00	1122.01	1144.01		1145.33	0.001499	10.70	17927.71	1950.59	0.45
R1	6283	100 yr	Alt. MC-E	67900.00	1122.01	1144.01		1145.33	0.001499	10.70	17927.71	1950.59	0.45
R1	6131	100 yr	MMI Existing	67900.00	1121.13	1143.89		1145.09	0.001475	10.11	18839.12	1997.84	0.43
R1	6131	100 yr	Alt. MC-E	67900.00	1121.13	1143.89		1145.09	0.001475	10.11	18839.12	1997.84	0.43
R1	5980	100 yr	MMI Existing	67900.00	1122.20	1143.92		1144.81	0.001393	8.93	18762.65	2061.67	0.38
R1	5980	100 yr	Alt. MC-E	67900.00	1122.20	1143.92		1144.81	0.001393	8.93	18762.65	2061.67	0.38
R1	5825	100 yr	MMI Existing	67900.00	1121.44	1143.79		1144.59	0.001308	8.22	19553.52	2127.78	0.36
R1	5825	100 yr	Alt. MC-E	67900.00	1121.44	1143.79		1144.59	0.001308	8.22	19553.52	2127.78	0.36
R1	5670	100 yr	MMI Existing	67900.00	1123.05	1143.70		1144.38	0.001109	7.52	20802.48	2201.99	0.33
R1	5670	100 yr	Alt. MC-E	67900.00	1123.05	1143.70		1144.38	0.001109	7.52	20802.48	2201.99	0.33
R1	5516	100 yr	MMI Existing	67900.00	1123.01	1143.62		1144.20	0.000978	6.94	22475.88	2247.61	0.30
R1	5516	100 yr	Alt. MC-E	67900.00	1123.01	1143.62		1144.20	0.000978	6.94	22475.88	2247.61	0.30
R1	5362	100 yr	MMI Existing	67900.00	1122.74	1143.52		1144.07	0.000795	6.70	23395.35	2298.52	0.29
R1	5362	100 yr	Alt. MC-E	67900.00	1122.74	1143.52		1144.07	0.000795	6.70	23395.35	2298.52	0.29
R1	5208	100 yr	MMI Existing	67900.00	1121.82	1143.45		1143.92	0.000562	6.15	24120.45	2225.05	0.27
R1	5208	100 yr	Alt. MC-E	67900.00	1121.82	1143.45		1143.92	0.000562	6.15	24120.45	2225.05	0.27
R1	5148	100 yr	MMI Existing	67900.00	1122.36	1143.38		1143.87	0.000675	6.12	21103.96	2043.55	0.28
R1	5148	100 yr	Alt. MC-E	67900.00	1122.36	1143.38		1143.87	0.000675	6.12	21103.96	2043.55	0.28
R1	4994	100 yr	MMI Existing	67900.00	1121.38	1143.23		1143.73	0.001257	6.23	19789.36	2051.80	0.28
R1	4994	100 yr	Alt. MC-E	67900.00	1121.38	1143.23		1143.73	0.001257	6.23	19789.36	2051.80	0.28
R1	4841	100 yr	MMI Existing	67900.00	1121.34	1143.16		1143.58	0.000502	5.70	22954.11	1976.65	0.24
R1	4841	100 yr	Alt. MC-E	67900.00	1121.34	1143.16		1143.58	0.000502	5.70	22954.11	1976.65	0.24
R1	4686	100 yr	MMI Existing	67900.00	1120.43	1143.03		1143.49	0.000548	6.07	24026.71	2008.97	0.24
R1	4686	100 yr	Alt. MC-E	67900.00	1120.43	1143.03		1143.49	0.000548	6.07	24026.71	2008.97	0.24
R1	4532	100 yr	MMI Existing	67900.00	1120.17	1143.01		1143.39	0.000449	5.82	26086.89	2062.16	0.23
R1	4532	100 yr	Alt. MC-E	67900.00	1120.17	1143.01		1143.39	0.000449	5.82	26086.89	2062.16	0.23
R1	4377	100 yr	MMI Existing	67900.00	1119.86	1142.85		1143.31	0.000459	6.54	26606.73	2167.88	0.26
R1	4377	100 yr	Alt. MC-E	67900.00	1119.86	1142.85		1143.31	0.000459	6.54	26606.73	2167.88	0.26
R1	4226	100 yr	MMI Existing	67900.00	1119.42	1142.77		1143.24	0.000649	6.70	26916.49	2144.05	0.26
R1	4226	100 yr	Alt. MC-E	67900.00	1119.42	1142.77		1143.24	0.000649	6.70	26916.49	2144.05	0.26
R1	4076	100 yr	MMI Existing	67900.00	1118.00	1142.90		1143.09	0.000358	4.74	26949.48	2045.76	0.19
R1	4076	100 yr	Alt. MC-E	67900.00	1118.00	1142.90		1143.09	0.000358	4.74	26949.48	2045.76	0.19
R1	3925	100 yr	MMI Existing	67900.00	1118.65	1142.43		1142.98	0.000696	7.26	26018.08	1934.96	0.28
R1	3925	100 yr	Alt. MC-E	67900.00	1118.65	1142.43		1142.98	0.000696	7.26	26018.08	1934.96	0.28
R1	3773	100 yr	MMI Existing	67900.00	1118.74	1142.58		1142.81	0.000409	5.15	26782.81	1849.34	0.20

HEC-RAS River: R1 Reach: R1 Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	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)	
R1	3773	100 yr	Alt. MC-E	67900.00	1118.74	1142.58		1142.81	0.000409	5.15	26782.81	1849.34	0.20
R1	3620	100 yr	MMI Existing	67900.00	1118.27	1142.56		1142.73	0.000342	4.46	27316.70	1817.20	0.17
R1	3620	100 yr	Alt. MC-E	67900.00	1118.27	1142.56		1142.73	0.000342	4.46	27316.70	1817.20	0.17
R1	3467	100 yr	MMI Existing	67900.00	1117.73	1142.54		1142.68	0.000245	4.05	28157.74	1836.58	0.15
R1	3467	100 yr	Alt. MC-E	67900.00	1117.73	1142.54		1142.68	0.000245	4.05	28157.74	1836.58	0.15
R1	3315	100 yr	MMI Existing	67900.00	1117.04	1142.49		1142.64	0.000170	4.21	27959.24	1761.17	0.16
R1	3315	100 yr	Alt. MC-E	67900.00	1117.04	1142.49		1142.64	0.000170	4.21	27959.24	1761.17	0.16
R1	3166	100 yr	MMI Existing	67900.00	1116.12	1142.40		1142.60	0.000283	4.95	26763.40	1655.97	0.19
R1	3166	100 yr	Alt. MC-E	67900.00	1116.12	1142.40		1142.60	0.000283	4.95	26763.40	1655.97	0.19
R1	3015	100 yr	MMI Existing	67900.00	1115.96	1142.34		1142.55	0.000438	4.76	25353.60	1557.80	0.19
R1	3015	100 yr	Alt. MC-E	67900.00	1115.96	1142.34		1142.55	0.000438	4.76	25353.60	1557.80	0.19
R1	2861	100 yr	MMI Existing	67900.00	1115.42	1142.32		1142.49	0.000264	4.30	24605.25	1471.49	0.16
R1	2861	100 yr	Alt. MC-E	67900.00	1115.42	1142.32		1142.49	0.000264	4.30	24605.25	1471.49	0.16
R1	2702	100 yr	MMI Existing	67900.00	1114.90	1142.22		1142.45	0.000224	4.70	24756.49	1371.74	0.17
R1	2702	100 yr	Alt. MC-E	67900.00	1114.90	1142.22		1142.45	0.000224	4.70	24756.49	1371.74	0.17
R1	2387	100 yr	MMI Existing	67900.00	1116.39	1141.43		1142.26	0.000813	8.32	13136.74	821.66	0.31
R1	2387	100 yr	Alt. MC-E	67900.00	1116.39	1141.43		1142.26	0.000813	8.32	13136.74	821.66	0.31
R1	2234	100 yr	MMI Existing	67900.00	1116.19	1141.10		1142.12	0.001232	9.14	11580.79	741.77	0.35
R1	2234	100 yr	Alt. MC-E	67900.00	1116.19	1141.10		1142.12	0.001232	9.14	11580.79	741.77	0.35
R1	2083	100 yr	MMI Existing	67900.00	1116.27	1141.01		1141.92	0.001056	7.96	10179.75	574.50	0.31
R1	2083	100 yr	Alt. MC-E	67900.00	1116.27	1141.01		1141.92	0.001056	7.96	10179.75	574.50	0.31
R1	1929	100 yr	MMI Existing	67900.00	1116.71	1140.68		1141.76	0.000851	8.40	8630.43	476.19	0.32
R1	1929	100 yr	Alt. MC-E	67900.00	1116.71	1140.68		1141.76	0.000851	8.40	8630.43	476.19	0.32
R1	1774	100 yr	MMI Existing	67900.00	1116.72	1139.72		1141.53	0.001358	10.81	6652.57	380.06	0.42
R1	1774	100 yr	Alt. MC-E	67900.00	1116.72	1139.72		1141.53	0.001358	10.81	6652.57	380.06	0.42
R1	1619	100 yr	MMI Existing	67900.00	1116.29	1138.22		1141.14	0.002382	13.79	5346.76	308.76	0.54
R1	1619	100 yr	Alt. MC-E	67900.00	1116.29	1138.22		1141.14	0.002382	13.79	5346.76	308.76	0.54
R1	1465	100 yr	MMI Existing	67900.00	1116.22	1136.18		1140.50	0.004647	16.71	4160.51	272.54	0.73
R1	1465	100 yr	Alt. MC-E	67900.00	1116.22	1136.18		1140.50	0.004647	16.71	4160.51	272.54	0.73
R1	1311	100 yr	MMI Existing	67900.00	1117.65	1136.18		1139.65	0.003304	14.96	4555.39	269.19	0.63
R1	1311	100 yr	Alt. MC-E	67900.00	1117.65	1136.18		1139.65	0.003304	14.96	4555.39	269.19	0.63
R1	1156	100 yr	MMI Existing	67900.00	1116.30	1136.51		1138.94	0.002009	12.52	5458.89	309.73	0.52
R1	1156	100 yr	Alt. MC-E	67900.00	1116.30	1136.51		1138.94	0.002009	12.52	5458.89	309.73	0.52
R1	1006	100 yr	MMI Existing	67900.00	1115.93	1136.59		1138.55	0.001398	11.25	6054.32	316.39	0.45
R1	1006	100 yr	Alt. MC-E	67900.00	1115.93	1136.59		1138.55	0.001398	11.25	6054.32	316.39	0.45
R1	851	100 yr	MMI Existing	67900.00	1116.14	1135.18		1138.18	0.002101	13.92	4926.69	277.79	0.58
R1	851	100 yr	Alt. MC-E	67900.00	1116.14	1135.18		1138.18	0.002101	13.92	4926.69	277.79	0.58
R1	701	100 yr	MMI Existing	67900.00	1116.14	1133.55		1137.65	0.004118	16.33	4275.01	281.98	0.72
R1	701	100 yr	Alt. MC-E	67900.00	1116.14	1133.55		1137.65	0.004118	16.33	4275.05	281.98	0.72
R1	546	100 yr	MMI Existing	67900.00	1116.73	1132.99		1136.99	0.004010	16.25	4407.28	312.15	0.74
R1	546	100 yr	Alt. MC-E	67900.00	1116.73	1132.99		1136.99	0.004009	16.25	4407.36	312.15	0.74
R1	391	100 yr	MMI Existing	67900.00	1116.74	1133.79		1136.03	0.002052	12.02	5724.66	375.35	0.53
R1	391	100 yr	Alt. MC-E	67900.00	1116.74	1133.79		1136.03	0.002052	12.02	5724.80	375.35	0.53
R1	237	100 yr	MMI Existing	67900.00	1116.80	1133.86		1135.61	0.001540	10.64	6458.29	425.19	0.47
R1	237	100 yr	Alt. MC-E	67900.00	1116.80	1133.86		1135.61	0.001540	10.64	6458.39	425.20	0.47
R1	83	100 yr	MMI Existing	67900.00	1116.60	1133.64		1135.37	0.001483	10.57	6512.50	497.55	0.50
R1	83	100 yr	Alt. MC-E	67900.00	1116.60	1133.64		1135.37	0.001482	10.57	6512.69	497.56	0.50
R1	0 Reservoir	100 yr	MMI Existing	67900.00	1116.57	1130.77	1129.36	1134.88	0.010013	16.40	4648.60	534.37	0.82
R1	0 Reservoir	100 yr	Alt. MC-E	67900.00	1116.57	1130.77	1129.36	1134.88	0.010013	16.40	4648.60	534.37	0.82

HEC-RAS Model Output Summary Table

Alternative 4: Channel Deepening, Widening & Bridge Replacement (MC-F)

HEC-RAS Locations: User Defined Profile: 100 yr

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	16101	100 yr	Alt. MC-F	67900.00	1147.17	1172.17		1173.34	0.001633	9.69	10080.84	898.22	0.38
R1	R1	16101	100 yr	MMI Existing	67900.00	1147.17	1172.19		1173.35	0.001627	9.68	10095.75	898.50	0.38
R1	R1	15953	100 yr	Alt. MC-F	67900.00	1148.05	1170.72	1166.50	1172.93	0.003187	13.33	8943.54	814.92	0.52
R1	R1	15953	100 yr	MMI Existing	67900.00	1148.05	1170.75		1172.94	0.003170	13.31	8963.35	815.50	0.52
R1	R1	15801	100 yr	Alt. MC-F	67900.00	1147.82	1167.18	1167.18	1172.01	0.007192	19.49	6447.06	757.50	0.83
R1	R1	15801	100 yr	MMI Existing	67900.00	1147.82	1168.64	1167.24	1172.25	0.005021	17.19	7562.15	771.54	0.70
R1	R1	15650	100 yr	Alt. MC-F	67900.00	1146.74	1169.10	1162.91	1170.46	0.001723	10.58	8675.17	812.33	0.41
R1	R1	15650	100 yr	MMI Existing	67900.00	1146.74	1170.04		1171.18	0.001386	9.78	9446.14	828.00	0.37
R1	R1	15495	100 yr	Alt. MC-F	67900.00	1147.26	1168.08		1169.86	0.021633	6.43	7346.48	798.55	0.26
R1	R1	15495	100 yr	MMI Existing	67900.00	1147.26	1169.38		1170.73	0.014371	5.49	8417.17	844.90	0.22
R1	R1	15331 Fish Block Weir	100 yr	Alt. MC-F	67900.00	1147.62	1166.82		1168.94	0.002969	12.88	6900.77	849.95	0.55
R1	R1	15331 Fish Block Weir	100 yr	MMI Existing	67900.00	1147.62	1168.71		1170.17	0.001851	10.91	8629.53	962.84	0.44
R1	R1	15214	100 yr	Alt. MC-F	67900.00	1147.55	1165.18	1164.10	1168.31	0.007580	14.66	5311.41	839.46	0.71
R1	R1	15214	100 yr	MMI Existing	67900.00	1147.55	1168.57		1169.86	0.002567	9.95	8578.41	1083.87	0.43
R1	R1	15211	100 yr	Alt. MC-F	67900.00	1146.37	1164.00	1164.00	1168.18	0.010299	16.62	4416.84	699.64	0.85
R1	R1	15211	100 yr	MMI Existing	67900.00	1146.37	1168.54		1169.85	0.002405	9.97	8559.78	1079.59	0.43
R1	R1	15208	100 yr	Alt. MC-F	67900.00	1145.38	1162.58	1163.36	1168.02	0.014923	18.78	3702.72	440.02	1.00
R1	R1	15208	100 yr	MMI Existing	67900.00	1145.38	1168.56		1169.83	0.002314	9.84	8658.80	1073.88	0.42
R1	R1	15090 FEMA E	100 yr	Alt. MC-F	67900.00	1141.62	1158.01	1159.38	1165.45	0.028230	21.90	3100.64	298.72	1.20
R1	R1	15090 FEMA E	100 yr	MMI Existing	67900.00	1141.62	1168.46		1169.51	0.002035	8.88	10210.41	1154.27	0.35
R1	R1	15027	100 yr	Alt. MC-F	67900.00	1140.00	1160.17	1150.84	1161.46	0.001300	9.09	7485.41	457.71	0.38
R1	R1	15027	100 yr	MMI Existing	67900.00	1139.85	1168.35		1169.39	0.001557	8.81	10314.61	1024.01	0.34
R1	R1	14877	100 yr	Alt. MC-F	67900.00	1139.08	1159.91		1161.25	0.001388	9.30	7402.46	489.86	0.39
R1	R1	14877	100 yr	MMI Existing	67900.00	1139.90	1167.92		1169.13	0.001968	9.35	10198.47	1322.02	0.36
R1	R1	14726	100 yr	Alt. MC-F	67900.00	1138.72	1159.83		1161.01	0.001149	8.75	8031.12	564.43	0.36
R1	R1	14726	100 yr	MMI Existing	67900.00	1139.87	1167.63		1168.85	0.001834	9.45	9882.02	1385.62	0.36
R1	R1	14573	100 yr	Alt. MC-F	67900.00	1138.29	1159.65		1160.83	0.001139	8.77	8290.76	697.42	0.36
R1	R1	14573	100 yr	MMI Existing	67900.00	1139.80	1167.35		1168.59	0.001585	10.01	10243.98	1427.71	0.37
R1	R1	14420	100 yr	Alt. MC-F	67900.00	1138.02	1159.54		1160.64	0.001072	8.54	9021.30	870.96	0.35
R1	R1	14420	100 yr	MMI Existing	67900.00	1139.79	1167.64		1168.20	0.001032	6.89	14728.29	1535.69	0.25
R1	R1	14267	100 yr	Alt. MC-F	67900.00	1137.37	1159.36		1160.48	0.001067	8.60	8981.54	808.87	0.35
R1	R1	14267	100 yr	MMI Existing	67900.00	1139.73	1166.53		1167.89	0.002028	10.07	8171.56	1361.41	0.37
R1	R1	14113	100 yr	Alt. MC-F	67900.00	1137.29	1158.02		1160.14	0.002535	11.75	6200.49	755.02	0.52
R1	R1	14113	100 yr	MMI Existing	67900.00	1139.67	1166.01		1167.59	0.001629	10.16	7030.58	1365.77	0.39
R1	R1	13963	100 yr	Alt. MC-F	67900.00	1136.69	1158.33		1159.61	0.001370	9.09	7827.04	690.07	0.39
R1	R1	13963	100 yr	MMI Existing	67900.00	1139.62	1165.39		1167.29	0.002020	11.10	6371.38	1363.52	0.43
R1	R1	13809	100 yr	Alt. MC-F	67900.00	1136.14	1157.32		1159.29	0.002039	11.25	6107.10	469.52	0.47
R1	R1	13809	100 yr	MMI Existing	67900.00	1138.90	1165.13		1167.01	0.001680	11.18	6825.46	1407.92	0.42
R1	R1	13655	100 yr	Alt. MC-F	67900.00	1135.70	1156.34		1158.87	0.002834	12.75	5340.84	337.12	0.55
R1	R1	13655	100 yr	MMI Existing	67900.00	1138.90	1162.71		1166.47	0.003297	15.64	4501.17	1191.97	0.62
R1	R1	13501	100 yr	Alt. MC-F	67900.00	1135.60	1156.94		1158.21	0.001283	9.34	9451.34	872.45	0.38
R1	R1	13501	100 yr	MMI Existing	67900.00	1138.72	1162.71	1157.17	1165.74	0.003393	14.34	5784.24	1415.87	0.56
R1	R1	13350	100 yr	Alt. MC-F	67900.00	1134.90	1157.15		1157.91	0.000774	7.10	10986.71	867.17	0.29
R1	R1	13350	100 yr	MMI Existing	67900.00	1139.00	1162.61	1157.03	1165.09	0.003118	13.15	6379.99	1470.72	0.53
R1	R1	13201	100 yr	Alt. MC-F	67900.00	1134.71	1156.79		1157.76	0.000961	7.99	9449.61	767.18	0.33
R1	R1	13201	100 yr	MMI Existing	67900.00	1138.86	1162.90		1164.38	0.002481	10.69	10071.41	1456.54	0.44
R1	R1	13050 Prattsville Cen	100 yr	Alt. MC-F	67900.00	1134.42	1156.65		1157.62	0.000895	8.10	10221.44	731.03	0.32
R1	R1	13050 Prattsville Cen	100 yr	MMI Existing	67900.00	1138.51	1162.73		1164.02	0.001601	10.36	12711.59	1378.85	0.41
R1	R1	12899	100 yr	Alt. MC-F	67900.00	1133.94	1156.44		1157.47	0.001000	8.24	9469.30	664.09	0.34
R1	R1	12899	100 yr	MMI Existing	67900.00	1138.64	1162.38	1154.43	1163.78	0.001471	10.38	10263.45	1188.61	0.41
R1	R1	12747	100 yr	Alt. MC-F	67900.00	1134.05	1156.43		1157.30	0.000696	7.51	9100.80	509.56	0.30
R1	R1	12747	100 yr	MMI Existing	67900.00	1138.34	1162.12	1153.86	1163.54	0.001804	10.42	9110.51	1281.47	0.40
R1	R1	12594 FEMA D	100 yr	Alt. MC-F	67900.00	1133.65	1155.85		1157.13	0.001108	9.18	8086.46	470.51	0.36
R1	R1	12594 FEMA D	100 yr	MMI Existing	67900.00	1136.78	1161.84		1163.30	0.001430	10.70	10870.22	1200.35	0.41
R1	R1	12519	100 yr	Alt. MC-F	67900.00	1133.45	1155.53		1157.02	0.001313	9.96	7644.37	433.48	0.39
R1	R1	12519	100 yr	MMI Existing	67900.00	1137.95	1161.65	1153.15	1163.17	0.001727	10.59	8818.31	1169.01	0.41
R1	R1	12370	100 yr	Alt. MC-F	67900.00	1133.00	1155.72		1156.70	0.000957	7.96	8554.54	477.38	0.33
R1	R1	12370	100 yr	MMI Existing	67900.00	1137.12	1161.44	1152.80	1162.90	0.001806	10.31	8666.69	1127.66	0.40
R1	R1	12218	100 yr	Alt. MC-F	67900.00	1132.50	1155.62		1156.54	0.000865	7.73	8852.43	486.62	0.31
R1	R1	12218	100 yr	MMI Existing	67900.00	1136.40	1161.28	1152.40	1162.65	0.001511	10.14	9088.26	1143.97	0.39
R1	R1	12067	100 yr	Alt. MC-F	67900.00	1132.20	1154.46		1156.28	0.001750	11.02	6847.15	402.14	0.44
R1	R1	12067	100 yr	MMI Existing	67900.00	1134.88	1160.24	1152.65	1162.32	0.002162	12.41	7481.36	1043.74	0.47
R1	R1	11915	100 yr	Alt. MC-F	67900.00	1132.00	1154.47		1155.93	0.001425	9.69	7030.60	392.92	0.40

HEC-RAS Locations: User Defined Profile: 100 yr (Continued)

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	11915	100 yr	MMI Existing	67900.00	1135.37	1160.47	1149.91	1161.84	0.001492	9.49	7830.41	971.70	0.36
R1	R1	11763	100 yr	Alt. MC-F	67900.00	1131.50	1154.41		1155.68	0.001162	9.03	7612.92	499.39	0.36
R1	R1	11763	100 yr	MMI Existing	67900.00	1134.04	1159.99	1149.80	1161.58	0.001762	10.28	7472.83	994.94	0.39
R1	R1	11611	100 yr	Alt. MC-F	67900.00	1131.00	1153.90		1155.45	0.001419	10.02	7147.22	626.54	0.40
R1	R1	11611	100 yr	MMI Existing	67900.00	1133.43	1159.25	1150.27	1161.23	0.002341	11.46	6703.40	1024.73	0.44
R1	R1	11460	100 yr	Alt. MC-F	67900.00	1130.00	1153.94		1155.17	0.001061	8.98	8370.01	851.24	0.35
R1	R1	11460	100 yr	MMI Existing	67900.00	1132.95	1158.19	1150.55	1160.74	0.003659	12.92	5597.61	1041.60	0.51
R1	R1	11309	100 yr	Alt. MC-F	67900.00	1130.00	1153.51		1154.97	0.001308	9.80	7811.55	907.87	0.38
R1	R1	11309	100 yr	MMI Existing	67900.00	1133.08	1156.72	1150.64	1160.08	0.003961	14.87	4993.92	1042.10	0.58
R1	R1	11154	100 yr	Alt. MC-F	67900.00	1130.00	1153.30		1154.77	0.001327	9.81	8353.73	976.26	0.39
R1	R1	11154	100 yr	MMI Existing	67900.00	1132.32	1156.33	1150.21	1159.36	0.004134	14.07	5134.27	1046.23	0.56
R1	R1	11000	100 yr	Alt. MC-F	67900.00	1129.00	1153.21		1154.54	0.001167	9.37	8793.52	978.32	0.37
R1	R1	11000	100 yr	MMI Existing	67900.00	1132.37	1155.92	1149.72	1158.74	0.003213	13.68	5798.39	1028.10	0.54
R1	R1	10643	100 yr	Alt. MC-F	67900.00	1129.14	1152.95		1153.64	0.004187	6.71	10132.02	1032.54	0.38
R1	R1	10643	100 yr	MMI Existing	67900.00	1130.67	1156.53	1145.41	1157.72	0.000898	8.90	8574.46	1190.25	0.34
R1	R1	10430	100 yr	Alt. MC-F	67900.00	1127.37	1152.40		1153.29	0.000821	7.67	10779.47	1078.18	0.30
R1	R1	10430	100 yr	MMI Existing	67900.00	1126.70	1155.89	1145.51	1157.45	0.001294	10.05	6927.31	1238.16	0.40
R1	R1	10328	100 yr	Alt. MC-F	67900.00	1127.44	1151.53		1153.11	0.001642	10.32	8374.09	994.43	0.43
R1	R1	10328	100 yr	MMI Existing	67900.00	1127.67	1153.19	1145.00	1155.04	0.002255	10.93	6289.92	1078.76	0.45
R1	R1	10116	100 yr	Alt. MC-F	67900.00	1127.99	1151.16		1152.75	0.001714	10.35	9476.48	1243.17	0.43
R1	R1	10116	100 yr	MMI Existing	67900.00	1128.04	1152.88	1145.22	1154.56	0.001817	10.49	6942.30	1486.30	0.44
R1	R1	9804	100 yr	Alt. MC-F	67900.00	1128.34	1149.16	1144.65	1151.90	0.003095	13.81	8035.97	1364.13	0.57
R1	R1	9804	100 yr	MMI Existing	67900.00	1128.52	1150.27	1146.02	1153.62	0.003430	14.91	5294.69	1515.63	0.63
R1	R1	9654	100 yr	Alt. MC-F	67900.00	1127.73	1149.14		1151.23	0.003088	12.55	8416.57	1356.77	0.56
R1	R1	9654	100 yr	MMI Existing	67900.00	1127.73	1150.14	1145.38	1152.95	0.003342	13.61	5840.34	1397.54	0.59
R1	R1	9504 FEMA C	100 yr	Alt. MC-F	67900.00	1127.70	1149.27		1150.64	0.002115	10.60	9693.23	1450.36	0.47
R1	R1	9504 FEMA C	100 yr	MMI Existing	67900.00	1127.70	1149.69	1145.17	1152.43	0.003294	13.46	6020.01	1468.62	0.59
R1	R1	9438	100 yr	Alt. MC-F	67900.00	1128.55	1149.40		1150.42	0.001653	9.29	10956.19	1538.32	0.42
R1	R1	9438	100 yr	MMI Existing	67900.00	1128.55	1149.69	1145.07	1152.13	0.002996	12.66	6361.30	1553.01	0.57
R1	R1	9284	100 yr	Alt. MC-F	67900.00	1126.68	1149.32		1150.13	0.001623	8.26	11920.52	1629.09	0.38
R1	R1	9284	100 yr	MMI Existing	67900.00	1126.68	1149.61	1144.51	1151.51	0.002907	11.21	7307.78	1644.84	0.51
R1	R1	9134	100 yr	Alt. MC-F	67900.00	1127.12	1149.10		1149.91	0.001429	8.33	12989.30	1764.93	0.38
R1	R1	9134	100 yr	MMI Existing	67900.00	1127.12	1149.20	1143.98	1151.10	0.002611	11.31	7929.20	1771.87	0.51

HEC-RAS Locations: User Defined Profile: 100 yr

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	16101	100 yr	Alt UC-A No Weir	67900.00	1147.17	1169.66		1171.44	0.002843	11.69	7920.55	825.58	0.49
R1	R1	16101	100 yr	MMI Existing	67900.00	1147.17	1172.19		1173.35	0.001627	9.68	10095.75	898.50	0.38
R1	R1	15953	100 yr	MMI Existing	67900.00	1148.05	1170.75		1172.94	0.003170	13.31	8963.35	815.50	0.52
R1	R1	15801	100 yr	MMI Existing	67900.00	1147.82	1168.64	1167.24	1172.25	0.005021	17.19	7562.15	771.54	0.70
R1	R1	15650	100 yr	MMI Existing	67900.00	1146.74	1170.04		1171.18	0.001386	9.78	9446.14	828.00	0.37
R1	R1	15495	100 yr	MMI Existing	67900.00	1147.26	1169.38		1170.73	0.014371	5.49	8417.17	844.90	0.22
R1	R1	15331 Fish Block Weir	100 yr	MMI Existing	67900.00	1147.62	1168.71		1170.17	0.001851	10.91	8629.53	962.84	0.44
R1	R1	15214	100 yr	MMI Existing	67900.00	1147.55	1168.57		1169.86	0.002567	9.95	8578.41	1083.87	0.43
R1	R1	15211	100 yr	MMI Existing	67900.00	1146.37	1168.54		1169.85	0.002405	9.97	8559.78	1079.59	0.43
R1	R1	15208	100 yr	Alt UC-A No Weir	67900.00	1142.41	1167.75		1169.13	0.002321	10.08	8268.85	1043.59	0.43
R1	R1	15208	100 yr	MMI Existing	67900.00	1145.38	1168.56		1169.83	0.002314	9.84	8658.80	1073.88	0.42
R1	R1	15090 FEMA E	100 yr	Alt UC-A No Weir	67900.00	1141.16	1167.58		1168.81	0.002399	9.43	9320.50	1082.78	0.38
R1	R1	15090 FEMA E	100 yr	MMI Existing	67900.00	1141.62	1168.46		1169.51	0.002035	8.88	10210.41	1154.27	0.35
R1	R1	15027	100 yr	Alt UC-A No Weir	67900.00	1139.85	1167.44		1168.67	0.001904	9.46	9422.88	959.39	0.37
R1	R1	15027	100 yr	MMI Existing	67900.00	1139.85	1168.35		1169.39	0.001557	8.81	10314.61	1024.01	0.34
R1	R1	14877	100 yr	Alt UC-A No Weir	67900.00	1139.90	1166.93		1168.35	0.002413	10.02	9309.88	1286.43	0.40
R1	R1	14877	100 yr	MMI Existing	67900.00	1139.90	1167.92		1169.13	0.001968	9.35	10198.47	1322.02	0.36
R1	R1	14726	100 yr	Alt UC-A No Weir	67900.00	1139.87	1166.57		1168.00	0.002261	10.14	8971.94	1361.51	0.40
R1	R1	14726	100 yr	MMI Existing	67900.00	1139.87	1167.63		1168.85	0.001834	9.45	9882.02	1385.62	0.36
R1	R1	14573	100 yr	Alt UC-A No Weir	67900.00	1139.80	1166.45		1167.64	0.001668	10.00	12162.53	1416.05	0.37
R1	R1	14573	100 yr	MMI Existing	67900.00	1139.80	1167.35		1168.59	0.001585	10.01	10243.98	1427.71	0.37
R1	R1	14420	100 yr	Alt UC-A No Weir	67900.00	1139.79	1166.58		1167.27	0.001321	7.55	13132.59	1463.98	0.28
R1	R1	14420	100 yr	MMI Existing	67900.00	1139.79	1167.64		1168.20	0.001032	6.89	14728.29	1535.69	0.25
R1	R1	14267	100 yr	Alt UC-A No Weir	67900.00	1139.73	1165.66		1166.94	0.002123	10.04	11890.40	1341.31	0.38
R1	R1	14267	100 yr	MMI Existing	67900.00	1139.73	1166.53		1167.89	0.002028	10.07	8171.56	1361.41	0.37
R1	R1	14113	100 yr	Alt UC-A No Weir	67900.00	1139.67	1165.50		1166.65	0.001378	9.19	12114.50	1358.30	0.35
R1	R1	14113	100 yr	MMI Existing	67900.00	1139.67	1166.01		1167.59	0.001629	10.16	7030.58	1365.77	0.39
R1	R1	13963	100 yr	Alt UC-A No Weir	67900.00	1139.62	1165.36		1166.45	0.001389	9.19	12034.80	1363.34	0.35
R1	R1	13963	100 yr	MMI Existing	67900.00	1139.62	1165.39		1167.29	0.002020	11.10	6371.38	1363.52	0.43
R1	R1	13809	100 yr	Alt UC-A No Weir	67900.00	1138.90	1164.75		1166.21	0.001472	10.35	11562.23	1404.82	0.39
R1	R1	13809	100 yr	MMI Existing	67900.00	1138.90	1165.13		1167.01	0.001680	11.18	6825.46	1407.92	0.42
R1	R1	13655	100 yr	Alt UC-A No Weir	67900.00	1138.90	1162.01	1157.71	1165.67	0.003485	15.69	6251.50	1085.62	0.64
R1	R1	13655	100 yr	MMI Existing	67900.00	1138.90	1162.71		1166.47	0.003297	15.64	4501.17	1191.97	0.62
R1	R1	13501	100 yr	Alt UC-A No Weir	67900.00	1138.72	1162.55		1164.77	0.002794	12.95	10169.53	1413.21	0.51
R1	R1	13501	100 yr	MMI Existing	67900.00	1138.72	1162.71	1157.17	1165.74	0.003393	14.34	5784.24	1415.87	0.56
R1	R1	13350	100 yr	Alt UC-A No Weir	67900.00	1139.00	1162.71		1164.20	0.002200	11.08	12409.39	1472.02	0.44
R1	R1	13350	100 yr	MMI Existing	67900.00	1139.00	1162.61	1157.03	1165.09	0.003118	13.15	6379.99	1470.72	0.53
R1	R1	13201	100 yr	Alt UC-A No Weir	67900.00	1138.86	1162.14		1163.81	0.002951	11.34	11100.91	1439.67	0.48
R1	R1	13201	100 yr	MMI Existing	67900.00	1138.86	1162.90		1164.38	0.002481	10.69	10071.41	1456.54	0.44
R1	R1	13050 Prattsville Cen	100 yr	Alt UC-A No Weir	67900.00	1138.51	1161.90		1163.40	0.001921	11.04	11567.72	1372.34	0.44
R1	R1	13050 Prattsville Cen	100 yr	MMI Existing	67900.00	1138.51	1162.73		1164.02	0.001601	10.36	12711.59	1378.85	0.41
R1	R1	12899	100 yr	Alt UC-A No Weir	67900.00	1138.64	1161.60		1163.12	0.001687	10.83	11257.82	1143.48	0.43
R1	R1	12899	100 yr	MMI Existing	67900.00	1138.64	1162.38	1154.43	1163.78	0.001471	10.38	10263.45	1188.61	0.41
R1	R1	12747	100 yr	Alt UC-A No Weir	67900.00	1138.34	1161.34		1162.85	0.002031	10.78	10064.31	1250.53	0.43
R1	R1	12747	100 yr	MMI Existing	67900.00	1138.34	1162.12	1153.86	1163.54	0.001804	10.42	9110.51	1281.47	0.40
R1	R1	12594 FEMA D	100 yr	Alt UC-A No Weir	67900.00	1136.78	1160.89		1162.56	0.001709	11.35	9739.95	1176.57	0.44
R1	R1	12594 FEMA D	100 yr	MMI Existing	67900.00	1136.78	1161.84		1163.30	0.001430	10.70	10870.22	1200.35	0.41
R1	R1	12519	100 yr	Alt UC-A No Weir	67900.00	1137.95	1160.76		1162.41	0.001998	11.05	9346.44	1135.16	0.44
R1	R1	12519	100 yr	MMI Existing	67900.00	1137.95	1161.65	1153.15	1163.17	0.001727	10.59	8818.31	1169.01	0.41
R1	R1	12370	100 yr	Alt UC-A No Weir	67900.00	1137.12	1160.54		1162.09	0.002056	10.68	9729.51	1118.95	0.42
R1	R1	12370	100 yr	MMI Existing	67900.00	1137.12	1161.44	1152.80	1162.90	0.001806	10.31	8666.69	1127.66	0.40
R1	R1	12218	100 yr	Alt UC-A No Weir	67900.00	1136.40	1160.33		1161.81	0.001742	10.56	9924.21	1122.64	0.41
R1	R1	12218	100 yr	MMI Existing	67900.00	1136.40	1161.28	1152.40	1162.65	0.001511	10.14	9088.26	1143.97	0.39
R1	R1	12067	100 yr	Alt UC-A No Weir	67900.00	1134.88	1159.09		1161.42	0.002617	13.16	7803.05	926.14	0.52
R1	R1	12067	100 yr	MMI Existing	67900.00	1134.88	1160.24	1152.65	1162.32	0.002162	12.41	7481.36	1043.74	0.47
R1	R1	11915	100 yr	Alt UC-A No Weir	67900.00	1135.37	1159.36		1160.85	0.001756	9.94	8601.53	932.95	0.39
R1	R1	11915	100 yr	MMI Existing	67900.00	1135.37	1160.47	1149.91	1161.84	0.001492	9.49	7830.41	971.70	0.36
R1	R1	11763	100 yr	Alt UC-A No Weir	67900.00	1134.04	1158.80		1160.54	0.002092	10.80	8584.62	964.92	0.42
R1	R1	11763	100 yr	MMI Existing	67900.00	1134.04	1159.99	1149.80	1161.58	0.001762	10.28	7472.83	994.94	0.39
R1	R1	11611	100 yr	Alt UC-A No Weir	67900.00	1133.43	1158.28		1160.18	0.002499	11.48	8600.45	977.14	0.45
R1	R1	11611	100 yr	MMI Existing	67900.00	1133.43	1159.25	1150.27	1161.23	0.002341	11.46	6703.40	1024.73	0.44
R1	R1	11460	100 yr	Alt UC-A No Weir	67900.00	1132.95	1158.10		1159.70	0.002681	11.03	8956.20	1035.84	0.44

HEC-RAS Locations: User Defined Profile: 100 yr (Continued)

River	Reach	River Sta	Profile	Plan	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)	
R1	R1	11460	100 yr	MMI Existing	67900.00	1132.95	1158.19	1150.55	1160.74	0.003659	12.92	5597.61	1041.60	0.51
R1	R1	11309	100 yr	Alt UC-A No Weir	67900.00	1133.08	1157.35		1159.28	0.002556	12.19	8732.06	1064.12	0.47
R1	R1	11309	100 yr	MMI Existing	67900.00	1133.08	1156.72	1150.64	1160.08	0.003961	14.87	4993.92	1042.10	0.58
R1	R1	11154	100 yr	Alt UC-A No Weir	67900.00	1132.32	1156.95		1158.88	0.002871	11.97	9431.99	1109.01	0.47
R1	R1	11154	100 yr	MMI Existing	67900.00	1132.32	1156.33	1150.21	1159.36	0.004134	14.07	5134.27	1046.23	0.56
R1	R1	11000	100 yr	Alt UC-A No Weir	67900.00	1132.37	1156.70		1158.47	0.002173	11.55	9740.42	1083.81	0.45
R1	R1	11000	100 yr	MMI Existing	67900.00	1132.37	1155.92	1149.72	1158.74	0.003213	13.68	5798.39	1028.10	0.54
R1	R1	10643	100 yr	Alt UC-A No Weir	67900.00	1130.67	1156.97		1157.84	0.000700	7.96	13197.17	1262.70	0.30
R1	R1	10643	100 yr	MMI Existing	67900.00	1130.67	1156.53	1145.41	1157.72	0.000898	8.90	8574.46	1190.25	0.34
R1	R1	10430	100 yr	Alt UC-A No Weir	67900.00	1126.70	1156.05	1145.51	1157.58	0.001261	9.97	6989.34	1295.31	0.39
R1	R1	10430	100 yr	MMI Existing	67900.00	1126.70	1155.89	1145.51	1157.45	0.001294	10.05	6927.31	1238.16	0.40
R1	R1	10379 Rte 23 Bridge			Bridge									
R1	R1	10328	100 yr	Alt UC-A No Weir	67900.00	1127.67	1151.89	1145.00	1154.04	0.002882	11.79	5786.05	1006.52	0.51
R1	R1	10328	100 yr	MMI Existing	67900.00	1127.67	1153.19	1145.00	1155.04	0.002255	10.93	6289.92	1078.76	0.45
R1	R1	10116	100 yr	Alt UC-A No Weir	67900.00	1128.04	1151.40		1153.44	0.002478	11.56	6172.38	1246.83	0.50
R1	R1	10116	100 yr	MMI Existing	67900.00	1128.04	1152.88	1145.22	1154.56	0.001817	10.49	6942.30	1486.30	0.44
R1	R1	9804	100 yr	Alt UC-A No Weir	67900.00	1128.52	1148.63	1146.27	1152.24	0.004391	15.80	6927.37	1299.63	0.70
R1	R1	9804	100 yr	MMI Existing	67900.00	1128.52	1150.27	1146.02	1153.62	0.003430	14.91	5294.69	1515.63	0.63
R1	R1	9654	100 yr	Alt UC-A No Weir	67900.00	1127.73	1149.14		1151.23	0.003088	12.55	8416.57	1356.77	0.56
R1	R1	9654	100 yr	MMI Existing	67900.00	1127.73	1150.14	1145.38	1152.95	0.003342	13.61	5840.34	1397.54	0.59
R1	R1	9504 FEMA C	100 yr	Alt UC-A No Weir	67900.00	1127.70	1149.27		1150.64	0.002115	10.60	9693.23	1450.36	0.47
R1	R1	9504 FEMA C	100 yr	MMI Existing	67900.00	1127.70	1149.69	1145.17	1152.43	0.003294	13.46	6020.01	1468.62	0.59
R1	R1	9438	100 yr	Alt UC-A No Weir	67900.00	1128.55	1149.40		1150.42	0.001653	9.29	10956.19	1538.32	0.42
R1	R1	9438	100 yr	MMI Existing	67900.00	1128.55	1149.69	1145.07	1152.13	0.002996	12.66	6361.30	1553.01	0.57
R1	R1	9284	100 yr	Alt UC-A No Weir	67900.00	1126.68	1149.32		1150.13	0.001623	8.26	11920.52	1629.09	0.38
R1	R1	9284	100 yr	MMI Existing	67900.00	1126.68	1149.61	1144.51	1151.51	0.002907	11.21	7307.78	1644.84	0.51
R1	R1	9134	100 yr	Alt UC-A No Weir	67900.00	1127.12	1149.10		1149.91	0.001429	8.33	12989.30	1764.93	0.38
R1	R1	9134	100 yr	MMI Existing	67900.00	1127.12	1149.20	1143.98	1151.10	0.002611	11.31	7929.20	1771.87	0.51

APPENDIX C
Field Assessment Summary

APPENDIX C

2013 Field Inventory of River, Floodplain and Structures

MMI conducted a field inventory of the river channel and floodplain multiple times since the flood in 2011. The most recent inspection in May 2013 included identifying low lying structures, characterizing bank and channel conditions, photographing channel reaches, identifying significant storm drainage discharge points, and observing existing land use and development patterns.

The northern bank of Schoharie Creek immediately upstream and downstream of the fish barrier weir is armored with riprap. A smaller section of riprap is located adjacent to the fish barrier weir on the southern bank of Schoharie Creek. The channel downstream of the weir consists of riffles and runs with a large gravel bar along the right bank. Flow becomes calm as Schoharie Creek approaches and passes under the Route 23 Bridge. Heavy riprap runs along the right bank starting across from the Prattsville Reformed Church to the Route 23 bridge. Two stormwater outfalls were observed; one outfall is located behind the auto shop across from Pine Street and one outfall is located across from Washington Street at the confluence of Schoharie Creek and Huntersfield Creek.

The upstream portion of Huntersfield Creek, along Washington Street, is confined by bedrock and characterized by a series of waterfalls approximately 10 feet in height. As Huntersfield Creek approaches the bridge under Route 23, the banks become shallower. A low berm runs along the right bank immediately upstream of the Route 23 bridge. It is not clear whether this berm existing prior to the flood of Irene. Stacked rock walls and riprap line the banks upstream of the bridge over Huntersfield Creek on Main Street. Concrete walls extend downstream from the bridge abutments and transition to riprap further downstream.

Data including parcel number, street address, assessed value, and property class was collected from the Greene County, New York online GIS mapping system for 162 properties located within the study area. A database organized by street address was created using parcel information from the online Greene County GIS map, notes collected during the field inventory, and floodway, 100-year flood zone, and 500-year flood zone mapping.

On May 2, 2013, MMI employees conducted a reconnaissance of the study area to collect data on flood-prone and flood-damaged structures to inform the Benefit Cost Analysis being prepared as part of the flood hazard mitigation assessment. Properties were inspected for evidence of flooding and damage, including missing siding, damaged foundations, and evidence of ongoing repairs. Additional information was collected regarding building type (basement, crawlspace, slab on grade, number of stories, garage, etc.), accessory structures, and location of utilities relative to basements and first floors. The field data collected was combined with parcel data from the Greene County online mapping system to create a database of properties within the study area by address.

The reconnaissance revealed that at least 34 structures had been demolished subsequent to the flooding caused by Irene, with 14 located in Moore's mobile home park, 19 located along Main Street (Route 23) and Route 7, and one on Washington Street. These 34 sites are now vacant lots.

Numerous homes appear to remain unoccupied, spanning the full length of Main Street from 14396 Main Street located near the weir on Schoharie Creek to the intersection with Route 7 and extending north to the driveway for the wastewater treatment plant. A handful of homes are marked with a red "X" or placard to indicate that they may not be occupied. The buildings on the Briggs Equipment site appear to remain mostly damaged.

During the reconnaissance, several residents were available to discuss the flooding caused by Irene. The owner of the home at 14474 Main Street reported that five feet of water (vertical) was present on the first floor during the flood, which later settled to the equivalent of three feet of mud. The mobile home at 14420 Main Street reportedly had a couple inches of water on the first floor. The main Briggs Equipment building had nine feet of water.

The flooding was described by the owners of the home at 5560 Washington Street. The limit of flooding was on the downhill side of their home. Homes next to them at 5566 Washington Street and across the street at 5561 Washington Street were flooded, while their home was not. This description provides a critical piece of evidence about the limit of flooding on the east side of Main Street.

Even when people were not available to provide information about flood depths, evidence was visible in the 2013 inventory. Mud is present in the window sills of the home at 14589 Main Street, approximately 2.5 to three feet above the ground surface. The siding on the Reformed Dutch Church appears to show a high water mark 6.5 feet above the ground surface.

Evidence of scour along foundations was observed at 14404 Main Street, 14452 Main Street, and 14607 Main Street (spanning nearly the full length of Main Street).

Signs of reconstruction are visible. At least two new homes have been constructed in the place of damaged homes (these are not included in the total of 33 mentioned above). These are (1) a ranch on Main Street in the vicinity of 14440 Main Street (actual address not listed) with a crawlspace and flood vents; and (2) a cape with walk-out basement on across the street from #14601 Main Street (this cape replaced the Victorian home that was tilted by floodwaters and later demolished).

The home located between 14480 and 14494 Main Street has been elevated. The O'Hara's gas station building has been replaced, and a number of sample mobile homes and log cabins on the Moore property have been replaced. New mobile home pads have been graded and prepared on the higher ground of the Moore's property. Evidence of new porches, siding, windows, and doors is visible throughout the areas that were flooded by Irene. Businesses such as Young's Agway, the Prattsville Diner, Joe's American grocery store, and Beth's Café are open, while others such as the old Country Hutt building are vacant. The Prattsville Plaza has been constructed post-Irene and appears to be ready for new occupants.

Some of the structures that are being repaired have taken a number of steps toward NFIP compliance, although this report cannot conclusively state whether compliance has been achieved. Several residential structures appear to have been elevated – with and without crawl spaces and flood vents. The basement of one structure was recently filled with gravel. However, many of the flood-damaged residential structures have been repaired without filling basements or elevating the first floor, and appear not to meet the NFIP requirement that new homes avoid basements in favor of crawlspaces.

Unlike residential homes, elevation of non-residential structures is not required when they are repaired, but typically some level of floodproofing is required instead. Floodproofing was not visible at any of the non-residential structures in Prattsville.

APPENDIX D
Sources of Funding

SOURCES OF FUNDING

Numerous potential funding sources may be available to the town of Prattsville as well as Greene County and its departments for the implementation of recommendations of this report. Each is discussed below.

Natural Resources Conservation Service (NRCS) Funding

The NRCS provides technical assistance to individual landowners, groups of landowners, communities, and soil and water conservation districts on land use and conservation planning, resource development, stormwater management, flood prevention, erosion control and sediment reduction, detailed soil surveys, watershed/river basin planning and recreation, and fish and wildlife management. Financial assistance is available to reduce flood damage in small watersheds and to improve water quality. Two major programs are described below.

Emergency Watershed Protection Program (EWP)

Through the EWP program, the U.S. Department of Agriculture’s NRCS can help communities address watershed impairments that pose imminent threats to lives and property. Most EWP work is for the protection of threatened infrastructure from continued stream erosion. NRCS may pay up to 75% of the construction costs of emergency measures. The remaining costs must come from local sources and can be made in cash or in-kind services. No work done prior to a project agreement can be included as in-kind services or part of the cost share. EWP projects must reduce threats to lives and property; be economically, environmentally, and socially defensible; be designed and implemented according to sound technical standards; and conserve natural resources.

Watersheds and Flood Prevention Operations

This program element contains two separate and distinct programs, “Watershed Operations” and “Small Watersheds.” The purpose of these programs is to cooperate with State and local agencies, Tribal governments, and other Federal agencies to prevent damages caused by erosion, floodwater, and sediment and to further the conservation, development, utilization, and disposal of water and the conservation and utilization of the land. The objectives of these programs are to assist local sponsors in assessing conditions in their watershed, developing solutions to their problems, and installing necessary measures to alleviate the problems. Measures may include land treatment and structural and nonstructural measures. Federal cost sharing for installation of the measures is available. The amount depends upon the purposes of the project.

FEMA Funding

Pre-Disaster Mitigation (PDM) Program

The Pre-Disaster Mitigation Program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through pre-disaster mitigation planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities.

The PDM program was one of the FEMA programs with the most potential fit to potential projects in Prattsville, with the other being HMGP (described below). After two years without support, Congress reauthorized the PDM program at a lower level of funding. It is possible that some of the projects could be funded if PDM is supported and if the projects meet FEMA’s requirement of cost effectiveness.

Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.

The HMGP is one of the FEMA programs with the greatest potential fit to potential projects in Prattsville. However, it is available only in the months subsequent to a federal disaster declaration in the State of New York. Because the State administers HMGP directly, application cycles will need to be closely monitored after disasters are declared in New York. It is possible that some of the projects could be funded if they meet FEMA’s requirement of cost effectiveness.

Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

One limitation of the FMA program is that it is generally used to provide mitigation for structures that are insured or located in SFHAs. Use of FMA in Prattsville would be contingent on demonstrating cost-effectiveness and the reduction of flood risks and flood insurance claims.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to the FMA program:

- The definitions of repetitive loss and severe repetitive loss properties have been modified;
- Cost-share requirements have changed to allow more Federal funds for properties with repetitive flood claims and severe repetitive loss properties; and
- There is no longer a limit on in-kind contributions for the non-Federal cost share

The NFIF provides the funding for the FMA program. The PDM and FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds.

One potentially important (yet still untested) change to the PDM, HMGP, and FMA programs is that "green open space and riparian area benefits can now be included in the project benefit cost ratio (BCR) once the project BCR reaches 0.75 or greater. The inclusion of environmental benefits in the project BCR is limited to acquisition-related activities." This may be an important consideration in Prattsville, where a number of properties may have a BCR of approximately 0.75 or greater, but not greater than 1.0, using the FIS and FIRM data in the Flood Module.

U.S. Army Corps of Engineers Funding

The U.S. Army Corps of Engineers provides 100% funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services Program (FPMS). Specific programs used by the Corps for mitigation are listed below.

Section 205 – Small Flood Damage Reduction Projects

This section of the 1948 Flood Control Act authorizes the Corps to study, design, and construct small flood control projects in partnership with non-Federal government agencies. Feasibility studies are 100% federally-funded up to $100,000, with additional costs shared equally. Costs for preparation of plans and construction are funded 65% with a 35% non-federal match. In certain cases, the non-Federal share for construction could be as high as 50%. The maximum federal expenditure for any project is $7 million.

Section 14 – Emergency Streambank and Shoreline Protection

This section of the 1946 Flood Control Act authorizes the Corps to construct emergency shoreline and streambank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and non-profit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $1.5 million.

Section 208 – Clearing and Snagging Projects

This section of the 1954 Flood Control Act authorizes the Corps to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $500,000.

Section 206 – Floodplain Management Services

This section of the 1960 Flood Control Act, as amended, authorizes the Corps to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, flood proofing, and inventories of flood prone structures. When funding is available, this work is 100% federally funded.

In addition, the Corps also provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and post-flood response. Corps assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, the Corps can loan or issue supplies and equipment once local sources are exhausted during emergencies.

U.S. Department of Housing and Urban Development Funding

The U.S. Department of Housing and Urban Development offers *Community Development Block Grants (CDBG)* to communities with populations greater than 50,000, who may contact HUD directly regarding CDBG. One program objective is to improve housing conditions for low and moderate income families. Projects can include acquiring flood prone homes or protecting them from flood damage. Funding is a 100% grant and can be used as a source of local matching funds for other funding programs such as HMGP. Funds can also be applied toward "blighted" conditions, which is often the post flood condition. A separate set of funds exists for conditions that create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminates police and fire access to the other side of the waterway. It is possible that recommendations of this plan regarding flood proofing or removal of structures could be matched with some of these grant programs.

NYCDEP Funding

NYCDEP administers the Stream Management Program for planning and projects that protect and restore stream stability and including flood hazard mitigation projects. The SMP is developing a Local Flood Hazard Mitigation Program (LFHMP) in response to Tropical Storms Irene and Lee. The LFHMP will direct flood hazard mitigation funds to communities through the Stream Management Program's "Stream Management Implementation Grant Program" and through the Catskill Watershed Corporation (see below). NYCDEP has developed the subject Local Flood Hazard Mitigation Analysis (LFHMA) to streamline the prioritization of funding for various flood mitigation projects in the Watershed communities. This is somewhat analogous to FEMA's requirement for hazard mitigation planning as a prerequisite for administering funds through its mitigation programs. Communities are invited to apply for funding to do an LFHMA through their local Stream Management Program and upon completion are eligible to apply for funding to implement projects recommended by the analysis. This program does not specifically require a match, but applicants are encouraged to leverage these funds with other funding sources such as those described herein.

Catskill Watershed Corporation Funding

The Catskill Watershed Corporation is a Local Development Corporation established to protect the water resources of the New York City Watershed West of the Hudson River; to preserve and strengthen communities located in the region; and to increase awareness and understanding of the importance of the NYC Water System. The Catskill Watershed Corporation administers a number of programs under this mission, such as:

- Septic Repair and Maintenance – Funds residential septic system repairs, replacements and maintenance.
- Stormwater Planning and Control – Funds planning, assessment, design and implementation of stormwater and erosion controls for existing conditions, as well as stormwater requirements for new construction.
- Education – Provides grants to schools and organizations.
- Community Wastewater Management – Funds a program to evaluate and build community-specific wastewater solutions which may include septic maintenance districts, community septic systems or wastewater treatment plants.
- Local Flood Hazard Mitigation Implementation Program – Funds projects that have been identified and evaluated through a Local Flood Hazard Mitigation Analyis (LFHMA).