Pequabuck River Flooding Study and Flood Mitigation Plan

The City of Bristol and Towns of Plainville and Plymouth, CT

Raymond Rogozinski and Maged Aboelata
The City of Bristol and Towns of Plainville and Plymouth have combined resources to develop a watershed-based approach to flood mitigation through regional cooperation.

- Automated and geo-referenced GIS
- Regional and site specific flood mitigation measures
- Site specific mapping for buildings in floodplain
- Selection of priority mitigation projects
Outline

– Purpose and Scope
– Study Area
– Stakeholders and Outreach Efforts
– Study Plan and Implementation
– Mitigation Projects Selection Process
– Example of Mitigation Projects Analysis
– Conclusion
Purpose & Scope

– Identify the existing flood risk along the Pequabuck River

– Identify 10 priority flood mitigation projects that will be focused on reducing economic losses and supporting future economic development.
Study Area

Total Watershed area: 57.8 sq. mi
Plymouth 8%
Bristol 44%
Plainville 12%
Stakeholders and Outreach Efforts

• **Technical Advisory Group**
  - Mark DeVoe, Plainville, Director of Planning
  - John Bossi, Plainville, Town Engineer
  - Charlie Wiegert, Plymouth, Director of Public Works
  - Margus Laan, Plymouth, Director of Planning
  - Justin Malley, Bristol, Director of Economic Development
  - Dawn Ledger, Bristol, Grant Administrator

• **Representative Key Business Owners**

• **Briefings and Presentations**

  • Validate accuracy of revised H&H analyses
  • Identify potential flood mitigation alternatives
  • Involve community, elected officials, and local business
Study Funding Sources

– Local
  • Bristol, Plainville, and Plymouth ($50,000)

– US Department of Commerce
  • Economic Development Administration (EDA) ($200,000)
Study Plan

Part 1: Flooding
- Data Collection
- H&H Analysis
- Identify potential future flooding
- Identify flooding causes
- Mapping

Part 2: Mitigation
- Project identification
- Project prioritization
- Project screening
- Project selection
Hydrologic Analysis

- 57.8 square miles watershed area
  - Plymouth 6.8 mi², Bristol 25.4 mi², Plainville 6.8 mi²
  - 5 sub-basins
  - Existing land use
  - Soil type and imperviousness
  - Historical flood conditions

- Updated frequency analysis
Hydrologic Analysis

– Potential Future Flooding
  • Future Development of the watershed
    o Changes in imperviousness scenarios
  • Impact of climate change
    o % increase in observed heavy rains (top 1%)
Hydraulic Analysis

- HEC-RAS 4.1
  - 18.5 miles
  - Surveyed cross-sections
  - Geo-referenced
  - LiDAR data
  - 53 stream crossings
  - Referenced to FEMA Effective Models
Model Validation

– High Water Marks
  • Max. difference 0.76 ft
Primary Causes of Flooding

- Inadequate channel conveyance capacity
- Inadequate stream crossing capacity (bridges and culverts)
- Channel obstructions (dams and weirs)
- Development in the floodplain
Primary Causes of Flooding

– Inadequate channel conveyance capacity
Primary Causes of Flooding

– Inadequate stream crossing capacity (bridges and culverts)
Primary Causes of Flooding

- Development in the floodplain
New flood frequency study was performed including Hurricane Irene flood discharge
- Irene \(\approx\) 100-year flood

Latest USACE computer models were used to calculate the flood elevations
- GIS-based modeling for rapid future updates
- Included field surveys of typical channel sections and stream crossings
- Includes sediment removal at 2 bridges

The latest topography was used to map the 100-year floodplain
- Digital mapping linked to the model
- Includes elevation surveys of several buildings for better definition of floodplain

- August 19, 1955 (Connie and Donna) \(Q= 11,700\text{cfs} \approx 200\text{-yr.}\)
- 10-28-11 \(Q=10,000\text{cfs} \approx 100\text{-yr.}\)
- 09-16-99 \(Q= 6,630\text{cfs} \approx 50\text{-yr.}\)
- 06-05-82 \(Q=4,990\text{cfs} \approx 25\text{ yr.}\)
- 10-15-05 \(Q= 4,320\text{cfs} \approx 10\text{-yr.}\)
Updating the FEMA Flood Risk Mapping

- New 100-year discharge approximately 10% higher than FEMA
- 2011 flood simulated in models and compared to High Water Marks, verified as defendable
- Acreage in the 100-year floodplain (Bristol)
  - New 100-year mapping - 251 acres
  - Current FEMA FIRMs - 257 acres
- Buildings identified in the 100-year floodplain
  - New 100-year mapping - 260 buildings
  - Current FEMA FIRMs - 233 buildings
Updating the FEMA Flood Risk Mapping

Comparison of new 100-year floodplain to FEMA 100-yr
Updating the FEMA Flood Risk Mapping

Letter of Map Revision (LOMR)

- Coordination is underway with FEMA Region I and HQ, USGS, and DEEP, to process a LOMR
  - The 3 communities will be requesting a waiver of FEMA review processing fees
- Submission in August 2015 with approval by late 2015 or early 2016
- FEMA will perform a physical map revision of the FIRMs when funds become available - well after 2016
- Until the LOMR is issued, the new maps can be used for floodplain regulation while the current FEMA maps for flood insurance

- Submit LOMR • November 2015
- LOMR Issued • Late 2015, Early 2016
- Physical Map Revision • Post 2016 when funding is authorized
## Potential Flood Mitigation Actions

<table>
<thead>
<tr>
<th>Structural measures</th>
<th>Nonstructural</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increasing channel capacity</td>
<td>• Elevation of buildings</td>
</tr>
<tr>
<td>• Enlarging stream crossing openings</td>
<td>• Relocation of building</td>
</tr>
<tr>
<td>• Removing constrictions</td>
<td>• Acquisition of buildings</td>
</tr>
<tr>
<td>• Removing sediment</td>
<td>• Wet and Dry Floodproofing</td>
</tr>
<tr>
<td>• Removing obstructions</td>
<td>• Small site specific berms and floodwalls</td>
</tr>
<tr>
<td>• Increasing floodplain overbank storage</td>
<td>• Flood warning and emergency preparedness</td>
</tr>
<tr>
<td>• Flood retarding measures</td>
<td>• Land use regulations</td>
</tr>
<tr>
<td>• Levees and floodwall systems</td>
<td></td>
</tr>
</tbody>
</table>
Setting Project Priorities

– Factors for consideration (not in order):
  • Constructability
  • Public acceptance
  • Effectiveness in reducing flooding
  • Economic development potential
  • Relative cost
  • Funding and financing
Project Funding Sources

– Enterprise Fund

– Federal Grants and Funding

– FEMA Hazard Mitigation Assistance Grants
  • Hazard Mitigation Grant Program (HMGP)
  • Pre-Disaster Mitigation (PDM)
  • Flood Mitigation Assistance (FMA)

– Community Development Block Grants

– HUD Economic Development Authority (EDA) Grants

– HUD 203 (K) Loans

– USDA, Natural Resources Conservation Service Emergency Watershed Protection (EWP) Program

– Connecticut Funding for Flood Mitigation

– Connecticut Transportation Funding

– Private-Public Partnerships

– Environmental Grants
Potential Mitigation Actions for Screening

– Selected actions based on Stakeholders and Outreach efforts:
  • Channel modifications to increase capacity
  • Construction of upstream flood reduction dams
  • Enlargement of existing bridges and culverts
  • Construction of berms, levees, and floodwalls
  • Sediment removal
  • Purchase and demolition of existing structures

– First path project identification resulted in 55 projects
# Top Mitigation Projects

<table>
<thead>
<tr>
<th>ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLV 1</td>
<td>Acquisition of Flood Prone Properties – Assist with Development of Letters of Map Amendment (LOMA) Applications</td>
</tr>
<tr>
<td>PLV 2</td>
<td>Flood Proofing of Commercial/Industrial Buildings</td>
</tr>
<tr>
<td>PLV 3</td>
<td>Sediment Removal at Railroad Bridge West of Neal Court</td>
</tr>
<tr>
<td>BRI 1</td>
<td>Enroll the City of Bristol in the FEMA Community Rating System</td>
</tr>
<tr>
<td>BRI 2</td>
<td>Community-wide Flood Proofing Program</td>
</tr>
<tr>
<td>BRI 3</td>
<td>Increase Height of Wingwalls and Headwall at the Entrance to the Twin Box Culvert (Pequabuck River Culvert)</td>
</tr>
<tr>
<td>BRI 4</td>
<td>Pequabuck River Flood Warning System</td>
</tr>
<tr>
<td>PLY 1</td>
<td>Increase Capacity of Secondary Driveway Bridge Serving Plymouth Village Apartments</td>
</tr>
<tr>
<td>PLY 2</td>
<td>Removal of Building at 150 Main Street and Channel Improvements</td>
</tr>
</tbody>
</table>
Example of Mitigation Project Analysis

– Project BRI 3- Increase Height of Wingwalls and Headwall at the Entrance to the Twin Box Culvert (Pequabuck River Culvert)

<table>
<thead>
<tr>
<th>Photo No.</th>
<th>Date</th>
<th>Direction Photo Taken</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>08/28/11</td>
<td>Looking westerly from Riverview Apartments parking lot.</td>
<td>View of Pequabuck River on 8-28-11 at Pequabuck River Culvert inlet adjacent to River View Apartments near School St, downstream of West St. Photo taken by Jose Luis Torres.</td>
</tr>
</tbody>
</table>
7.6 Project BRI 3 - Increase Height of Wingwalls and Headwall at the Entrance to the Twin Box Culvert (Pequabuck River Culvert)

Location:
The project is located at the entrance to the Pequabuck River twin Box Culvert to the rear of 171 Laurel Street (River View Apartments). The location is shown in Figure BRI 3A.

Project Description:
Proposed project consists of increasing the height of the headwall and wingwalls at the entrance to the Pequabuck River Culvert. Photographic documentation of the flood conditions during the August 28, 2011 flood (remnants of Tropical Storm Irene) show that the headwall for this culvert was overtopped. It is proposed to raise the elevation of the 225 feet long wall elements in the project area by 2.5 feet to contain a flood of similar magnitude. The project concept is shown on Figures BRI-3B and BRI-3C.

Benefit:
This improvement will provide a factor of safety against the potential for discharges associated with 100-year storm events combined with debris blockage from overtopping the culvert and flooding businesses along School Street and North Main Street. It will reduce the potential flooding to approximately 10 buildings (including 8 businesses) and will provide future capacity to contain the increases in discharges and water surfaces elevations associated with upstream land development and climate change.

Budget:
The estimated project cost for this project is $310,000.
Project BRI 3- Increase Height of Wingwalls and Headwall at the Entrance to the Twin Box Culvert (Pequabuck River Culvert)
Project BRI 3- Increase Height of Wingwalls and Headwall at the Entrance to the Twin Box Culvert (Pequabuck River Culvert)

MITIGATION PROJECTS
PHOTOGRAPHIC LOG

Client Name: City of Bristol, CT.

Project No.: 3-03882

Photo No. 1
Date: 11/14/13
Direction Photo Taken:
Looking Downstream:
Description:
View of Pequabuck River at Pequabuck River Culvert inlet adjacent to River View Apartments near School St, downstream of West St.

Photo No. 2
Date: 11/14/13
Direction Photo Taken:
Looking Downstream:
Description:
View of Pequabuck River at Pequabuck River Culvert inlet adjacent to River View Apartments near School St, downstream of West St.

Conceptual Design
Opinion of Probable Construction Cost Estimate
FOR THE CONSTRUCTION OF
Pequabuck River Flood Study
Flood Mitigation Project BRI 3
Increase Channel Wall Height - West Street to Pequabuck River Culvert

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Unit</th>
<th>Quantity</th>
<th>Unit Price</th>
<th>Cost</th>
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<tbody>
<tr>
<td></td>
<td>Clearing and Grubbing</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
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<tr>
<td></td>
<td>Remove Ornamental Fence</td>
<td>LF</td>
<td>225</td>
<td>$10</td>
<td>$2,250</td>
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<td></td>
<td>Excavation</td>
<td>CY</td>
<td>490</td>
<td>$25</td>
<td>$12,250</td>
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<tr>
<td></td>
<td>Concrete Retaining Wall</td>
<td>CY</td>
<td>175</td>
<td>$50</td>
<td>$8,750</td>
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<tr>
<td></td>
<td>Ornamental Railing</td>
<td>LF</td>
<td>225</td>
<td>$50</td>
<td>$11,250</td>
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<tr>
<td></td>
<td>Landscaping</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$25,000</td>
</tr>
</tbody>
</table>

Subtotal Construction: $161,009

General Requirements
- Mobilization and Demobilization (LS, 1, 5%)
- Maintenance and Protection of Traffic (LS, 1, 1%)
- Construction Staking (LS, 1, 1%)
- Incidents Construction (LS, 1, 10%)

Subtotal: General Requirements $30,009

Other Project Costs
- Engineering Design Services (T&M, 1, 10%)
- Engineering Services During Construction (T&M, 1, 10%)
- Permitting (T&M, 1, 1%)
- Topographic Survey (T&M, 1, 1%)

Subtotal: Other Project Costs $59,009

Subtotal: Construction, General Requirements and Other Project Costs $240,000

Contingency @ 30% $72,000

Total Project Cost: $312,000
Conclusion

The City of Bristol and Towns of Plainville and Plymouth have combined resources to develop a watershed-based approach to flood mitigation. Through regional cooperation the following has been accomplished:

– Watershed-based update of the flood risk modeling and mapping
– Use of automated GIS-based techniques to produce foundational geo-referenced products
– Through evaluation of regional and site specific structural and non structural flood mitigation measures
– Site specific mapping to identify specific buildings in the floodplain
– Selection of 10 priority projects that when implemented will reduce future economic losses
Questions, Comments?

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