

# Natural Hazard Mitigation Plan Bristol, Rhode Island

July 2016

**Horsley Witten Group**

*Sustainable Environmental Solutions*

55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)



Natural Hazard Mitigation Plan for the Town of Bristol, Rhode Island  
*A Multi-Hazard Mitigation Strategy*

**Acknowledgements**

Gina Raimondo - *Governor*

**RI Emergency Management Agency**

Peter Gaynor - *Director*

**Bristol Local Hazard Mitigation Committee:**

Antonio A. Teixeira - *Town Administrator*

Diane M. Williamson - *Director of Community Development*

Robert Martin - *Emergency Management Director/Fire Chief*

Walter Burke - *Director, Parks and Recreation Department*

Josue D. Canario - *Chief, Police Department*

Jose DaSilva - *Director, Water Pollution Control*

James Galuska - *Former Director, Department of Public Works*

Kevin McBride - *Director, Department of Public Works*

Edward M. Tanner - *Principal Planner*

Gregg Marsili - *Harbormaster*

Jess Stimson - *State Hazard Mitigation officer*

Seraphine DaPonte - *Citizen/Member at Large*

---

Geographic Information Systems Maps: Craig Pereira, Horsley Witten Group, Inc.

## **Additional Acknowledgements**

This project was made possible by the commitment of the Bristol Local Hazard Mitigation Committee and leadership and support from the Bristol Town Administrator and Town Council. This commitment, leadership, and support will result in better preservation and enhancement of the quality of life, property, and resources of the Town of Bristol.

### **Bristol Town Administrator**

Antonio A. Teixeira

### **Bristol Town Council**

Nathan T. Calouro, Chairman  
Timothy E. Sweeney, Vice Chairman  
Halsey C. Herreshoff, Member  
Mary A. Parella, Member  
Edward P. Stuart, Jr., Member

### **State Assistance**

The project has moved forward thanks to the support and resources provided by the Rhode Island Emergency Management Agency with special acknowledgement to Jess Stimson, State Hazard Mitigation Officer.

### **Authors**

Town of Bristol Local Hazard Mitigation Committee  
Town of Bristol Director of Community Development  
Horsley Witten Group, Inc.

State of Rhode Island and Providence Plantations  
Town of Bristol

Town Council

# Resolution

Resolved:

To adopt the Hazard Mitigation Plan 2016, as written.

*I hereby certify that at its regular meeting held on September 28, 2016 being duly noticed and with a quorum present and voting the foregoing was unanimously approved.*



Louis P. Cirillo, CMC, Council Clerk



# Table of Contents

<u>SECTION 1.0 - INTRODUCTION</u> .....	1
1.1 What Hazard Mitigation Can Do for Bristol.....	1
1.2 Bristol’s Mission statement .....	3
1.3 Goals .....	3
1.4 Planning Process.....	4
1.5 Environmental Setting.....	14
1.6 Brief History.....	15
1.7 History of Disaster Declarations .....	15
1.8 Recent Disaster Declarations.....	16
1.8.1 Tropical Storm Irene – FEMA 4027 .....	16
1.8.2 Hurricane Sandy – FEMA 4089 .....	17
1.8.3 Severe Winter Storm/Snowstorm – FEMA 4107.....	18
1.8.4 Severe Winter Storm/Snowstorm – FEMA 4212 .....	18
<u>SECTION 2.0 - RISK ASSESSMENT</u> .....	20
2.1 Introduction.....	20
2.2 Hazard Identification .....	20
2.3 Hazard Profiles .....	21
2.3.1 Wind-Related Hazards .....	27
2.3.2 Flood-Related Hazards.....	33
2.3.3 Winter-Related Hazards.....	50
2.3.4 Geologic-Related Hazards .....	52
2.3.5 Drought/Extreme Heat-Related Hazards.....	55
2.3.6 Wildfires .....	57

2.4 Vulnerability .....	58
2.4.1 Development Trends.....	59
2.4.2 Economic Vulnerability .....	60
2.4.3 Social Vulnerability .....	64
2.4.4 Environmental Vulnerability .....	66
2.5 FEMA Disaster Grant Assistance.....	67
<u>SECTION 3.0 –CAPABILITY ASSESSMENT</u> .....	68
3.1 Introduction.....	68
3.2 Planning and Regulatory Capabilities.....	68
3.3 Administrative and Technical Capabilities.....	72
3.4 Financial Capabilities .....	75
3.5 National Flood Insurance Program.....	74
3.6 Community Rating System.....	77
3.7 Existing Protection Matrix.....	78
<u>SECTION 4.0 – MITIGATION STRATEGY</u> .....	85
4.1 Introduction .....	85
4.2 Mitigation Activities.....	85
4.3 Mitigation Action Plan.....	85
<u>SECTION 5.0 – PLAN IMPLEMENTATION AND MAINTENANCE</u> .....	99
5.1 Implementation, Evaluation and Revision of Plan.....	99
5.2 Continued Public Involvement.....	100
<u>REFERENCES</u> .....	
<u>APPENDICES</u> .....	

**Appendix A: Maps**

Appendix B: Public Information/Outreach and Local Plan Adoption

Appendix C: Model Lease Agreement for Commercial Uses in the Flood Zone

Appendix D: Photos and Historical Information

#### LIST OF FIGURES

2-1 Greenhouse Effect.....	40
2-2 Long-Term Trends of Sea level Rise .....	46
2-3 RI Wildland Urban Fire Interface Zones .....	57

#### LIST OF TABLES

1-1 2010 Plan Report Card.....	7
2-1 Risk Assessment Matrix 2015 Update .....	23
2-2 Hazard Index.....	25
2-3 Wind-Related Hazard Events.....	27
2-4 Saffir-Simpson Hurricane Wind Scale.....	29
2-5 Enhanced Fujita Scale.....	30
2-6 Flood-Related Hazard Events .....	33
2-7 Winter-Related Hazard Events .....	50
2-8 Geologic-Related Hazard Events.....	53
2-9 Modified Mercalli Intensity Scale .....	54
2-10 Richter Scale.....	54
2-11 Drought-Related Hazard Events .....	56
2-12 Wildfire-Related Hazard Events.....	58
2-13 Vulnerability Matrix.....	59
2-14 Summary of NFIP Activity in Bristol.....	61

2-15 Total Vulnerability FEMA Flood Zones Summary, Bristol, RI .....62  
2-16 Total Vulnerability Sea Level Rise Summary, Bristol, RI ..... 61  
3-1 Actions for Continued Compliance with NFIP .....76  
3-2 Existing Protection Matrix, Bristol, RI .....79

LIST OF MAPS

- A-1 Location Map
- A-2 Risks Map
- A-3 Critical Facilities
- A-4 Flood Risks with Repetitive Loss Areas
- A-5 Sea Level Rise

## Section 1 Introduction

### 1.1 What Hazard Mitigation Can Do for Bristol

Bristol has an *Emergency Response Plan*, so hasn't the Town already mitigated hazards? - A common question that arises when the topic of "Hazard Mitigation" is introduced at a community-wide scale. While hazard mitigation is by no means a new concept to Bristol, this plan is intended for a wide audience of residents, business people, governing boards, and agency officials; so the text shall make a brief distinction between emergency response and hazard mitigation.

We plan for *emergency response* in order to react efficiently during a hazardous event, such as a hurricane, flood, or blizzard.

Conversely, we pursue *hazard mitigation* in order to decrease the demand for emergency response and to protect community resources that even the best response could not safeguard.

In answering the call of past emergencies, we as a town have learned about where we are vulnerable and when we are unable to defy risk and still react with success. These lessons are combined with technical knowledge of our landscape, as well as ocean and weather patterns, to create scenarios – or plausible stories – of disastrous outcomes. Hazard mitigation is the effort to intervene in those storylines of mayhem and calm the tenor of unwanted suspense.

---

In pursuit of a unified effort by a well-informed and conversant public, the terms "Disaster Resistance" and "Hazard Resilience" also warrant clarification.

*Disaster resistance* is the general avoidance of massive and unwelcome impacts, including deaths and material losses, as well as the social and economic havoc that tends to accompany it.

Disaster resistance is the central goal of hazard mitigation.

*Hazard resilience* is the ability of an at-risk structure or municipal system to confront and withstand the brunt of a hazard. Improved resilience, achieved through retrofitting and code enforcement, is *one method* of increasing disaster resistance.

There are several approaches to disaster resistance, but common threads persist; each requires money, time commitments, and a degree of openness to change. So, what is our incentive? Why should we dedicate resources to hazard mitigation and moreover, why should we question some of our decisions and habits?

The following list *does not* imply a likelihood of risk with reference to Bristol, but instead, sets forth the types of damages and expenses endured time and again by communities facing hazards similar to our own.

## Losses Associated with Inaction

### Initial Damages

- ✓ Casualties including residents, tourists, rescue personnel, pets, and livestock
- ✓ Infrastructure damage and prolonged interruption of utility services
- ✓ Temporary and permanent business closings
- ✓ Damage to invaluable historic structures
- ✓ Loss of vital government records and documents
- ✓ Loss of personal property including items of irreplaceable sentiment

### Expenses and After-Effects

- ✓ Emergency response costs, such as triage supplies
- ✓ Facility and infrastructure repairs
- ✓ Debris and contamination cleanup
- ✓ Depreciated real estate values
- ✓ Lost wages and sales tax revenue
- ✓ Reluctance of new business starts
- ✓ Permanent environmental damage via secondary “technological” hazards
- ✓ Home rebuilding costs and homeowner relocation costs

While prevention of unwanted outcomes is sufficiently compelling, it is also nice to know that some mitigation activities can produce benefits for the community that are felt immediately or that are related to other social, economic, and environmental goals. Proponents often champion hazard mitigation in light of “simultaneous gains”, as opportunities for multi-objective expenditures and fiscal prudence.

## Gains Associated with Mitigation Activities

### Foremost Benefits

- ✓ Defense of human life and health
- ✓ Protection of municipal (tax-payer) investments
- ✓ Stability of local economy

## Furthering Other Community Goals in Unison

- ✓ Conservation of natural lands and enhanced recreational opportunities
- ✓ Reduced government overhead for response and recovery personnel/equipment
- ✓ Incorporation of more durable, higher efficiency, or “best of breed” technologies
- ✓ Attraction and retention of businesses through hazard-safe facilities
- ✓ Appreciation of land values via market capitalization of hazard resilience
- ✓ Compliance with Americans with Disabilities Act
- ✓ Historic preservation
- ✓ Brownfields development
- ✓ Urban beautification

The Town of Bristol, with the assistance of the Horsley Witten Group, Inc. developed this update to the Natural Hazards Mitigation Plan with funds provided through a Hazard Mitigation Assistance Grant from the Rhode Island Emergency Management Agency (RIEMA). The Bristol Local Hazard Mitigation Committee (LHMC) from the 2010 plan was again, re-energized and re-organized to provide a broad spectrum of local knowledge and experience to complete this 2016 Update.

### **1.2 Bristol’s Mission Statement**

The purpose of the Bristol Hazard Mitigation Plan is to preserve and enhance the quality of life, property, and resources for the residents of Bristol by:

- Identifying areas at risk from natural hazards; and,
- Implementing priority hazard mitigation actions in order to protect the Town’s residents, built environment, historic, cultural, economic and natural resources

### **1.3 Goals**

The goals of the Bristol Hazard Mitigation Plan are to:

1. Protect the public health, safety and welfare;
2. Reduce property damages caused by hazard impact;
3. Minimize social dislocation and distress;
4. Reduce economic losses and minimize disruption to local businesses;
5. Protect the ongoing operations of critical facilities;
6. Reduce the dependence and need for disaster assistance funding after disasters;
7. Expedite recovery disaster mitigation efforts during the recovery phase; and,

8. Provide an ongoing forum for the education and awareness of natural hazard mitigation issues, programs, policies, and projects.

## **1.4 Planning Process**

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from the Federal Emergency Management Agency (FEMA) in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an institutional awareness and involvement in hazard mitigation as part of daily activities.

In April 2012, the Town submitted a Pre-Disaster Mitigation grant application to the RIEMA for funds to update the local Town of Bristol Natural Hazards Mitigation Plan. FEMA obligated funds to support the grant application and the Town contracted with the Horsley Witten Group, Inc. to facilitate the update.

Members of the Bristol LHMC include:

- Antonio A. Teixeira – Town Administrator
- Diane M. Williamson – Director, Community Development
- Jose DaSilva – Director, Water Pollution Control
- James Galuska – Former Director, Department of Public Works
- Kevin McBride – Director, Department of Public Works
- Robert Martin – Fire Chief/Emergency Management Director
- Walter Burke – Director, Parks and Recreation Department
- Edward M. Tanner – Principal Planner
- Gregg Marsili – Harbormaster
- Jess Stimson – State Hazard Mitigation Officer (RIEMA)
- Seraphine DaPonte – Member at Large

The Horsley Witten Group, Inc. conducted a series of meetings from July 2014 through May 2015 with the appointed Bristol LHMC, municipal officials, the community, and representatives of the RIEMA. All meetings were held in an open public forum and in accordance with R.I.G.L. 42-46-2(a) in complying with the requirements of the Federal Disaster Mitigation Act of 2000 (DMA 2000).

A Kickoff Meeting was conducted on August 14, 2014 to review the project scope and revised schedule, discuss project coordination (data collection, municipal coordination and public outreach), review proposed revisions to the Update's mitigation measures layout (utilization of hazard mitigation categories) and identification of risks content (to include climate change and sea level rise), and coordinate the agenda and logistics for the first Public Workshop. The meeting Agenda, Revised Schedule and Sign-In Sheet are included in Appendix B.

A Project webpage was designed and hosted on the Town's municipal website to announce the project, inform and engage the community before, during and after plan development, and to serve as a repository of project documents, presentations, and summaries. A PDF of the Project webpage layout is included in Appendix B.

A series of Municipal Interviews (in-person, telephone and email correspondence) were conducted early in the Update process for the development of the 2010 Plan Report Card (Table 1-1), identification of accomplishments since the 2010 Plan, and preliminary identification of mitigation measures for consideration in the Update. Meeting Memorandums of the Municipal Interviews are included in Appendix B.

#### In-Person Interviews:

Diane Williamson – Director, Community Development  
Edward Tanner – Principal Planner  
Jose DaSilva – Director, Water Pollution Control  
James Galuska – Director, Department of Public Works  
Antonio A. Teixeira – Town Administrator  
Robert Martin – Fire Chief/Emergency Management Director  
Gregg Marsili – Harbormaster  
Walter Burke – Director, Parks and recreation Department  
Seraphine DaPonte – Member at Large  
Cortney Lancaster – Deputy EMA Director

The project coordinated with Jessica Stimson, State Hazard Mitigation Officer, and Samantha Richer, NFIP Planner/CRS Coordinator regarding NFIP program coordination and repetitive flood loss properties.

The project consultant also staffed a booth at the Town's annual Harbor Festival in August of 2014. Here, residents were able to provide input regarding 'local knowledge' of hazards within the community by marking up town-wide maps, while also learning about the Town's various vulnerabilities and capabilities surrounding natural hazards.

The first Public Workshop was held on September 24, 2014 at the Burnside Building. Announcements were posted on the project webpage, emailed to Bristol Municipal Boards, Commissions and interested citizens, and was featured in the Bristol Phoenix (online at Eastbayri.com), copies included in Appendix B. The presentation included an overview of the project, a review of the 2010 Risk Assessment Matrix Report Card, and preliminary revisions to the update (based on personal interviews with municipal officials, boards, and commissions). Participants were provided the opportunity to comment and also mark up town-wide maps with specific issues at identified locations. The Workshop agenda, PowerPoint Presentation and Sign-In Sheet are included in Appendix B.

The Bristol LHMC met on April 2, 2015 to review the revised project schedule, draft updated GIS mapping, Hazard Index, finalize the 2010 Plan Report Card (Table 1-1 below), and discuss Preliminary Mitigation Actions. At this meeting, it was decided to develop an online survey to

solicit additional feedback from the general public regarding hazard mitigation knowledge, planning and preparation. A complete set of meeting materials is included in Appendix B.

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2016 Status</i>
Utilize School curriculum to educate students and their parents about hazard risks.	Town-wide	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Increase safety and institutional awareness, Protection of property	H and P	Ongoing, move to capability assessment
Educational Program for residents of flood zones and nearby downstream neighborhoods	Town-wide	Public and Private	Flooding: coastal and interior	Uninformed general public, Public and Private property damage	Increase safety and institutional awareness of hazards, Protection of property through flood policies	H and P	Ongoing, move to capability assessment
Ensure emergency personnel can access people/property within wooded areas	Mt Hope Farm area	Public and Private	Fire	Blocked emergency access within wooded areas	Established fire lanes, Protection of life and property	H and P	Ongoing - carry forward continue to implement and maintain
Disseminate information on mitigation techniques/hazard insurance	Town-wide	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Uninformed general public, Public and Private property damage	Increase safety and institutional awareness, Protection of property	H and P	Ongoing - carry forward continue to implement and maintain
Make residents aware of emergency plan	Town-wide	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters, Fire	Uninformed general public	Increase safety and institutional awareness, accelerated evacuation	H and P	Ongoing - carry forward continue to implement and maintain

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2016 Status</i>
Public Information, Outreach and Signage	FEMA Flood zones	Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Uninformed general public	Increase safety and institutional awareness, accelerated evacuation	H and P	Ongoing - carry forward continue to implement and maintain
Designate alternative evacuation route for Poppasquash area through Colt State Park	Poppasquash area	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Evacuation disruption	Increase safety and institutional awareness, accelerated evacuation	H and P	Completed
Adopt a 'no on-street parking' ordinance that goes into effect with a hurricane warning	Town-wide	Public	Hurricanes	Maintain roads as passable	Protection of secure evacuation and emergency vehicle access	H and P	Remove - Declaration of emergency situation by EMA Director supersedes this
Develop a Debris Management Plan	Town-wide	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Maintain roads as passable, potential hazardous material	Accelerated recovery, continued access townwide	H and P	Ongoing - carry forward, continue to implement
Offer a Business Hazard Resilience Audit	Businesses Townwide	Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters, Fire	Private property damage	Protection of property	H and P	Remove - not considered a viable option...utilize FEMA publications
Prepare an 'After the Storm' Permitting plan for rebuilding	Town-wide	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Protection of property	H and P	Ongoing - carry forward continue to implement

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2016 Status</i>
Explore location (s) for new and/or additional storm shelter (s)	150 Franklin Court, Quinta Gamelin Comm. Center	Public	All	Risk to public health and safety	Protection of public health and safety	H and P	Ongoing - carry forward
Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds	Tanyard Brook and Silver Creek Watersheds	Public and Private	Flooding	Public and Private property damage	Protection of Public/Private property, accelerated drainage/infiltration	H and P	Ongoing - carry forward continue to implement and maintain
Prohibit new basement utilities or require installation of grinder pump	Town-wide	Public and Private	Flooding	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - carry forward continue to implement and maintain
Eliminate flood risk to repetitive flood loss properties	Town-wide	Public	Flooding	Public property damage	Protection of Public property	H and P	Ongoing - carry forward continue to implement and maintain
Acquire properties that are within the coastal flood zones	Coastal Areas	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - carry forward continue to implement and maintain
Retrofit public buildings especially the Everready Fire Station and DPW buildings	Coastal Areas	Public and Private	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Protection of Public/Private property	H and P	Delete - no longer warranted

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2016 Status</i>
Continue implementation of Silver Creek Watershed Study	Silver Creek Watershed	Public and Private	Flooding	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - Completed incrementally... conduct an updated review to prioritize projects
Repair the seawall along Poppasquash Road and restore culverts under road at Mill Pond/Mill Gut Pond	Poppasquash area	Public and Private	Flooding	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - carry forward continue to implement and maintain (culvert remediation)
Reline or replace sewer lines where necessary	Town-wide	Public and Private	Flooding	Groundwater entering system, then increasing wastewater flows in excess of design of system	Reduce infiltration, prevent sewer surcharges, overflows, blockages, and backups	H and P	Ongoing - carry forward continue to implement and maintain
Eliminate illegal connections of private sump pumps to sanitary sewer system	Town-wide	Private	Flooding, Hurricanes, nor'easters	Illegally connected sump pumps overwhelm the treatment facility, pump stations and system overall	Reduce manhole overflows, sewer backups, and unsanitary conditions	H and P	Ongoing, move to capability assessment
Upgrade the Mt. Hope Pump Station by installing Overflow Bypass	Mt. Hope Pump Station/surrounding residential area	Public and Private	Flooding	heavier than designed for wastewater flows overwhelm facilities	Reduce manhole overflows, sewer backups, and unsanitary conditions	H and P	Ongoing - carry forward continue to implement and maintain

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk</i> <i>H- Historical</i> <i>P- Potential</i>	<i>2016 Status</i>
Install overflow bypass at the Wastewater Treatment Plant	Mt. Hope Pump Station/ surrounding residential area	Public and Private	Flooding	Heavier than designed for wastewater flows overwhelm facilities	Reduce manhole overflows/sewer backups, and divert flows to be pumped independently	H and P	Ongoing - continue drainage improvements affecting the WWTF
Install overflow bypass upstream of the Silver Creek Pump Station	Silver Creek Pump Station/ surrounding residential area	Public and Private	Flooding	Heavier than designed for wastewater flows overwhelm facilities	Reduce manhole overflows/sewer backups, and divert flows to be pumped independently to force main (Wood St.)	H and P	Ongoing - study and identify alternatives for mitigation action
Concrete/earthen berm to protect Wastewater Treatment Plant above base flood elevation	Wastewater Treatment Plant	Public	Flooding	Flooding of facility during periods of heavy rain	Protection of infrastructure	H and P	Ongoing - carry forward continue to implement and maintain
Priority Cleaning Plan for sewer lines	Town-wide	Public and Private		Identification of problems early on	Protection/ maintenance of infrastructure	H and P	Completed - carry forward and modify to state, "return to problem areas"

Table 1-1  
2010 Plan Report Card (2016 Update), Bristol, Rhode Island

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk</i> <i>H- Historical</i> <i>P- Potential</i>	<i>2016 Status</i>
Continue to implement the Tanyard Brook Watershed Study	Silver Creek Watershed	Public and Private	Flooding	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - incrementally... conduct an updated review to prioritize projects
Bury Electrical wires and other suspended cables	Town-wide	Public and Private	Hurricanes, nor'easters	Interrupted utility services	Maintained utility services	H and P	Not Completed - carry forward in case a funding opportunity arises
Reinforce wire-to-pole connections	Town-wide, but particularly Hope Street	Public and Private	Hurricanes, nor'easters	Interrupted utility services	Maintained utility services	H and P	Ongoing - carry forward and continue to implement
Inspect and repair the seawall along Independence Park and Walley Beach, as necessary	Independence Park, Walley Beach	Public	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Protection of Public/Private property	H and P	Ongoing - carry forward and continue to implement... add Armory Building downtown

A second Public Workshop was held on May 11, 2015 at the Burnside Building. Announcements were posted on the project webpage, emailed to Bristol Municipal Boards, Commissions and interested citizens, and was featured in the Bristol Phoenix (online at Eastbayri.com), copies included in Appendix B. The presentation included an overview of the project, a report of the project status, a review of the updated mapping, and the preliminary mitigation actions for consideration. Participants were provided the opportunity to comment during an open dialogue session following the presentation. The Workshop agenda, PowerPoint Presentation and Sign-In Sheet are included in Appendix B.

The Bristol LHMC met one last time on May 14, 2015 to conduct the benefit cost review. The project consultant reviewed the draft 2016 Mitigation Actions (Table 4-1) which identified those actions: Ongoing – initially addressed but requires ongoing maintenance/attention, therefore, carried forward from the 2010 plan; Not addressed/partially addressed - revised from the 2010 plan; and, New - completely new action items. The Bristol LHMC completed the cost benefit review to prioritize/rank the action items, assigned time frames and responsible parties, and agreed on the proposed methodology/schedule for plan maintenance and update (based on FEMA requirements). A complete set of meeting materials is included in Appendix B. The Bristol Town Council will adopt through resolution, the *Natural Hazard Mitigation Plan Bristol, Rhode Island* following ‘Approved Pending Adoption’ status from FEMA.

#### Online Survey

The Town coordinated with local church groups to advertise the survey link in their weekly bulletins, featured it in the Bristol Phoenix (online at Eastbayri.com) advertisement for Public Workshop #2, and also announced it at Public Workshop #2, copies included in Appendix B. The survey was open beginning April 15, 2015 and closed on June 17, 2015 and included a total of thirteen responses. A brief summary of responses collected is included below. The full Survey Summary is included in Appendix B.

- Most residents/businesses have experienced flood, winter, and wind-related hazard events in the past 20 years
- Almost half (46.15%) of residents and business owners feel they are adequately prepared to deal with a natural hazard event, with most getting their information from personal experience (84.62%) and/or local news/social media (53.85%)
- Most respondents are ‘Very Concerned’ with flood-related hazards (61.54%), followed by winter and wind-related hazards (both at 16.67%)
- 38.46% of respondents are not sure if their property is located in/near a FEMA – designated floodplain
- More than half (61.54%) of respondents are interested in making their home, business or neighborhood more resilient, with 69.23% willing to spend their own money to do so
- The top three choices to reduce damage/destruction of natural hazards in Bristol include:
  - Retrofit public infrastructure, such as elevating roadways and improving drainage systems (76.92%)
  - Work to improve utility resilience: electric; communications; water/wastewater facilities (76.92%)
  - Install/improve protective structures such as flood walls/sea walls (69.23%)

With this information, the project consultant prepared the draft Natural Hazards Mitigation Plan which was available for public comment September 2015 through October 2015 (online, on the Town's website and hard copies available at the Town Hall), and then presented the final draft to the Bristol Planning Board on September 8, 2015 and to the Bristol Town Council on September 9, 2015. The draft was then submitted to RIEMA for review/consideration.

This Update was also forwarded to the neighboring Town of Warren (Caroline Wells – Community Development Director) and Roger Williams University (Peter Wilbur – Vice President) in Bristol, with no comments returned. It is the intention of the Bristol LHMC that the Natural Hazards Mitigation Plan be an available and pertinent source of information to a wide variety of individuals and interests. The Update also has a specific and pragmatic function. By identifying and prioritizing local mitigation needs, the Plan has already served, and will continue to serve, as a basis for amendments to local policies and regulations.

As the Town of Bristol Natural Hazards Mitigation Plan is implemented, additional regulations and steering documents may be subject to compliance. Likewise, the routines of some government departments and related agencies may be adjusted to reflect the aspirations of the plan. On relevant matters, the plan update can serve as a budgetary and administrative guide to decision-making entities, such as the Town Administrator and Town Council.

For Bristol, like most towns, costly mitigation projects are an impracticable luxury in the absence of external funding. Thus, the preparation of this Update is closely tied to the pursuit of financial assistance. The Hazard Mitigation Grant Program, or 'The 404 Program', of the FEMA is the primary vehicle. Based on State priorities and available funds, the Rhode Island State Hazard Mitigation Committee (SHMC) will conduct preliminary eligibility review of projects submitted by Bristol for funding, and will serve as a grant manager for projects ultimately approved by FEMA. Projects commonly receiving funds include:

- Acquisition and relocation or repetitively damaged structures,
- Retrofitting of vulnerable structures,
- Construction of minor flood controls, and
- Development of an official hazard mitigation plan.

State authorities will incorporate information compiled in this document into the State Hazard Mitigation Plan, to strengthen the statewide knowledge and idea-base for mitigation planning. A well-prepared and locally adopted plan can demonstrate understanding and commitment, two important variables when vying for limited, high-demand resources.

## **1.5 Environmental Setting**

Bristol is situated on 10.1 square miles (26 km<sup>2</sup>) of a peninsula (the smaller sub-peninsula on the west is called Poppasquash), with Narragansett Bay on its west and Mount Hope Bay on its east. According to the United States Census Bureau, the town has a total area of 20.6 square miles (53.4 km<sup>2</sup>), of which, 10.1 square miles (26.2 km<sup>2</sup>) of it is land and 10.5 square miles (27.2

km<sup>2</sup>) of it (50.99%) is water. Bristol's harbor is home to over 800 boat moorings (Map A-1 Location Map).<sup>1</sup>

## 1.6 Brief History

Bristol is a town in the historic county seat of Bristol County, Rhode Island, United States. Bristol, a deepwater seaport, is named after Bristol, England. Major industries include boat building (and related marine industries), manufacturing and tourism. The town's school system is united with neighboring Warren, Rhode Island. Prominent ethnic minorities include Portuguese-Americans, mostly Azorean, and Italian-Americans.

The first battle of King Philip's War took place here in 1675; although Philip was eventually defeated, a variant of his Indian name, Metacomet, is now the shortened name of a main road in Bristol: Metacom Avenue (RI Route 136). King Philip made nearby Mount Hope (Montaup) his base of operations. "King Philip's Chair", a rocky ledge on the mountain, was a lookout site for enemy ships on Mount Hope Bay. After that war concluded, the town was settled in 1680 as part of Plymouth Colony. It was named after Bristol, England and was sold for £1100 to four Boston investors by the names of Byfield, Walley, Oliver, and Burton. It remained a part of Massachusetts until the British Crown transferred it to the Rhode Island Colony in 1747.

Bristol has the oldest continuously celebrated Independence Day festivities in the United States. The first mention of the celebration comes from July 1777, when a British officer noted sounds coming from across Narragansett Bay, but tradition suggests that the first observance was held on July 4, 1785. Until 1854, Bristol was one of the five state capitals of Rhode Island. Bristol is home to Roger Williams University, named for Rhode Island founder Roger Williams.

The southerly terminus of the East Bay Bike Path is located at Independence Park on Bristol Harbor. The Bike path continues north to India Point Park in Providence, Rhode Island. Constructed on a former railroad right of way, some of the best views of Narragansett Bay can be seen along this magnificent corridor. This path is a valued commodity to Bristol; it allows bikers, roller skaters and walkers to enjoy the area. The Bristol-based Herreshoff Manufacturing Company built five consecutive America's Cup Defenders between 1893 and 1920. The Colt Estate, now known as Colt Park, was home to Samuel P. Colt, founder of the United States Rubber Company and nephew the man of the same name famous for the invention of the revolver. Colt Park lies on magnificently manicured gardens abutting the West Passage of Narragansett Bay, and is popular for its unparalleled views of the waterfront and spectacular sunsets.<sup>2</sup>

## 1.7 History of Disaster Declarations

Since 1953, FEMA Region 1 (the New England States) has endured more than 150 federal emergency and disaster declarations. The following information gives an overview of the most

---

<sup>1</sup> Town of Bristol, RI website, <http://bristolri.us/DocumentCenter/View/301>

<sup>2</sup> Id.

significant past Federal Emergency and Disaster Declarations for Rhode Island (and in particular Bristol County, and including Bristol):

Hurricane Carol	August 1954
Hurricane Edna	September 1954
Hurricane Diane and Flood	August 1955
Hurricane Donna	December 1960
Blizzard 1978	February 1978
Hurricane Gloria	September 1985
Hurricane Bob	August 1991
January Blizzard	January 1996
Snowstorm	December 2003
Snowstorm	January 2005
Hurricane Katrina	August 2005
Severe Storm/Floods	December 2008
Severe Storms/Flooding	March 2010
Tropical Storm Irene	August 2011
Hurricane Sandy	October 2012
Severe Winter Storm/Snowstorm	February 2013
Severe Winter Storm	January 2015

## **1.8 Recent Disaster Declarations**

The communities of Bristol County (including Bristol) have experienced significant losses during several recent storms that have warranted the Federal Emergency Management Agency (FEMA) to declare these storms as disasters.

The following are descriptions of each of the recent storms (since the 2010 Plan) that have been declared as disasters by FEMA and which have affected the Town of Bristol.

### **1.8.1 Tropical Storm Irene – August 2011 (FEMA-4027)**

Hurricane Irene formed east of the Caribbean Island of Dominica, part of the Lesser Antilles region, on the afternoon of August 20, 2011. Irene moved through the Caribbean and up the east coast of the United States making landfall twice. She first made landfall as a Category 1 Hurricane near Cape Lookout, North Carolina around 7:30 am on August 27th, then moved offshore again during the evening. She then made a 2nd landfall, again as a Category 1 Hurricane at 5:40 am on August 28th near Little Egg Inlet in New Jersey. She moved over New York City and then into southeastern New York State and Connecticut as a Tropical Storm a few hours later. By the end of the evening of the 28th, Irene was crossing the U.S./Canada border having produced significant amounts of rain, storm surge, inland and coastal flooding, and wind damage across southern New England and much of the east coast of the United States.

In Southern New England, the storm surge experienced along the coast was generally in the two to four foot range with a high of 4.78 feet at Fox Point in Providence, Rhode Island. Despite the relatively low wind speeds, sustained winds over a 6 to 12 hour long duration resulted in

widespread tree damage and resulted in power outages to roughly half a million customers throughout the state. Some of these customers did not get their power back until the Friday following the storm (some five days later). During the passage of Tropical Storm Irene, the winds resulted in \$0.19M in property damages.

The collective effects of Tropical Storm Irene on August 28th, resulted in 1 fatality, 0 injuries, and \$127.3M in property damage in the following counties: Barnstable, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester (all in MA), Hartford, Tolland, and Windham (all in CT), Cheshire and Hillsborough (all in NH), and Bristol, Providence, Kent, Washington, and Newport (all in RI).<sup>3</sup>

### **1.8.2 Hurricane Sandy – October 2012 (FEMA-4089)**

Hurricane Sandy made landfall in New Jersey on Monday, October 29, 2012. Its enormous dimensions (tropical force winds spanned almost 900 miles) created widespread devastation and affected approximately 300,000 Rhode Island residents, or 28% of the State's population. Fortunately, there were no fatalities. Mandatory local evacuations were ordered in eight communities. Approximately 122,000 homes and businesses lost electricity as a result of the storm. An estimated 40,000 remained without power for two or more days.

The highest concentration of damages resulting from Hurricane Sandy and its storm surge were located in the southern coastal communities of Newport and Washington Counties (Towns of Westerly, New Shoreham, Charlestown, South Kingstown, Narragansett, and the City of Newport). The majority of the damages in these areas occurred from storm surge and wind damage. The storm surge destroyed houses and businesses, damaged pilings and deck supports, blew out walls on lower levels, and moved significant amounts of sand and debris into homes, businesses, streets, and adjacent coastal ponds. Septic systems were damaged and underground septic tanks were exposed, creating potential hazardous material exposure. Wind damage left downed trees and branches on homes, businesses, utility lines, and roadways. The National Guard restricted entry to the community of Misquamicut (located in the Town of Westerly) due to the devastation.

In addition to severe impacts to homes and businesses, public buildings, roads, bridges, and related infrastructure experienced extensive impacts. Applications for FEMA Public Assistance indicate over \$7.7 million in losses to public property. Large scale disruptions of normal community functions and services resulted. Hurricane Sandy's storm surge, damage, and debris closed local and State roads along the coast for varying lengths of time. Sections of Atlantic Avenue in Westerly, Corn Neck Road in New Shoreham, Surfside Avenue in Charlestown and Sachuest Point Road in Middletown was inaccessible by vehicle. The State's ports were temporarily closed and ferry service to New Shoreham was cancelled for several days.

The U.S. Fish and Wildlife Refuge at Sachuest Point remained closed for over six months after Hurricane Sandy swept Rhode Island. Sections of Newport's famous Cliff Walk and Narragansett's seawall was damaged. In Washington County, Charlestown, Narragansett, New

---

<sup>3</sup> National Climatic data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

Shoreham, South Kingstown, and Westerly suffered extensive beach erosion. Beaches had to be restored in order to ensure the viability of the tourism, hospitality, and fishery industries. Public facilities, beaches, and parks in both counties had to be restored to attract the visitors that support these local industries.<sup>4</sup>

### **1.8.3 Sever Winter Storm/Snowstorm – February 2013 (FEMA-4107)**

A major disaster declaration (DR - 4107) was declared on March 22, 2013 due to a severe winter storm and snowstorm in Bristol, Kent, Newport, Providence and Washington counties. The total Public Assistance cost estimate in Rhode Island was \$7,057,671.

Reports indicated that this storm stretched from New Jersey to Maine and into Canada. More than two feet of snow fell in Rhode Island from Friday night to Saturday morning. National Grid estimated more than 180,000 customers lost power. By Saturday night, 129,000 customers in Rhode Island remained without power.<sup>5</sup>

### **1.8.4 Sever Winter Storm/Snowstorm – January 2015 (FEMA-4212)**

An historic winter storm brought heavy snow to southern New England with blizzard conditions to much of Rhode Island and eastern Massachusetts, beginning during the day on Monday, January 26, 2015 and lasting into the early morning hours of Tuesday, January 27th. The highest snowfall totals, averaging two to three feet, extended from extreme northeast Connecticut and northwest Rhode Island into much of central and northeast Massachusetts, including greater Boston. Much of southeast Massachusetts and the rest of Rhode Island received one to two feet of snow. Totals dropped off dramatically west of the Connecticut River Valley where totals of 4 to 8 inches were observed.

The storm was well-forecast, with Blizzard Watches and Winter Storm Watches issued 2 days before the snow began. Low pressure tracked northeast from the Carolinas and strengthened rapidly as it slowly passed southeast of Nantucket on Monday evening, January 26. All of the precipitation fell as snow with this storm. At its peak, snowfall rates of 2 to 3 inches per hour were common. In Rhode Island, blizzard conditions were officially reported in Westerly (5 hours), Newport (4 hours), and at T.F. Green State Airport in Warwick (3 hours).

Daily snowfall records were set for January 27th in Boston (22.1 inches, previous record 8.8 inches in 2011), Worcester (31.9 inches, previous record 11.0 inches in 2011), and Providence (16.0 inches, previous record 6.7 inches in 2011). In Providence, the total of 19.1 inches was the fourth highest on record (dating back to 1904), while in Boston the total of 24.6 inches was the sixth highest on record (dating back to 1872).

The Blizzard of January 2015 produced very strong winds late Monday into Tuesday near the Massachusetts and Rhode Island coasts where gusts of 50 to 65 mph were common.

---

<sup>4</sup> *State of Rhode Island Action Plan – Hurricane Sandy Disaster*, Rhode Island office of Housing and Community Development, June 2013/Revised July 2013.

<sup>5</sup> *Rhode Island 2014 Hazard Mitigation Plan Update*, Rhode Island Emergency Management Agency.

The Governor of Rhode Island declared a statewide travel ban beginning at midnight on January 27th and continuing through 8 pm. The few cars/drivers who did not obey the travel ban became stuck. A RI Department of Transportation vehicle flipped over during the storm as well.<sup>6</sup>

---

<sup>6</sup> National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

## Section 2 Risk Assessment

### 2.1 Introduction

Identifying potential hazards is the first step in any effort to reduce community vulnerability. The subsequent identification of the risk and vulnerability for a community are the primary factors in determining how best to allocate finite resources to address what mitigation might take place. The FEMA document titled Plan Review Guide, dated October 1, 2011 was used in developing this strategy plan as a basic template to identify the various natural hazard types. The hazard identification and analysis involves all of those hazards that potentially threaten the Town of Bristol.

By collecting and analyzing information for each potential hazard that may affect Bristol, several determinations have been made:

- Which hazards merit special attention
- What actions might be taken to reduce the impact(s) of those hazards
- What resources are likely to be needed

### 2.2 Hazard Identification

The Bristol LHMC evaluated each of the hazard types that may affect Bristol, with the addition of Climate Change and Sea Level Rise (new to this 2016 update), and similarly to those identified in the 2010 plan. For the purposes of the 2016 update, and for consistency with the State Hazard Mitigation Plan, the Bristol LHMC decided to organize natural hazards into the following categories and listed in order of frequency and impact, beginning at the top of the list with the most frequently occurring natural hazards:

- Wind-Related Hazards
- Flood-Related Hazards
- Winter-Related Hazards
- Geologic-Related Hazards
- Extreme Heat
- Drought
- Wildfire

The Horsley Witten Group, Inc. updated available town-wide Geographical Information Systems (GIS) mapping with Hurricane Tracks/Surge Inundation data (Map A-2 Risks), with Critical Facilities (Map A-3 Critical Facilities), with flood zone delineations identified on the Flood Insurance Rate Maps (FIRM) from the FEMA (Map A-4 Flood Risks with Repetitive Loss Areas), and with impacts from projected rises in sea level (Map A-5 Sea Level Rise).

## 2.3 Hazard Profiles: Location, History and Probability of Future Occurrence

In assessing the hazards to a community, both the risk and the vulnerability must be taken into account. A hazard is the actual event that poses the danger to the community, (e.g. the hurricane, tornado, earthquake, etc. that threatens the Town). The term “risk” refers to the predicted impact that a hazard would have on people, services, specific facilities and structures in the community. The term “vulnerability” refers to the characteristics of the society or environment affected by the event that resulted in the costs from damages (Heinz Center Report, 1999, p. 105). The vulnerability of an area refers to its susceptibility to a hazard. The areas of the town affected by extreme natural events are identified by the hazard risk assessment. In determining the risk and vulnerability of the town, the likelihood, frequency and magnitude of damage from identified hazards are assessed.

In developing an updated Risk Assessment, Bristol defined the risks that the town could face and followed up with an assessment of the vulnerability of the at-risk areas, and the implications of experiencing natural disasters (e.g., loss of life, damage to the natural environment, property damage, and economic losses). Risk assessment is the determination of the likelihood of adverse impacts associated with specific natural hazards, and vulnerability assessment is concerned with the qualitative or quantitative examination of the exposure of some societal component (i.e. economy, environment). The result of this process was the preparation of a Risk Assessment Matrix (Table 2.1 Risk Assessment Matrix 2016 Update) that lists the vulnerable areas and the primary effects from an event on these areas. The matrix was then used to establish mitigation benefits and develop mitigation strategies (Section 4.3).

### Hazard Index

The Bristol LHMC delineated additional areas of both coastal and inland flooding not identified on the FEMA mapping but collectively understood to be flood prone areas. Additionally, the LHMC evaluated each of the flood, winter, wind, fire and geologic-related hazards and collectively determined the likelihood of occurrence, locations affected, and potential impacts of each. This information was used to establish a Hazard Index (HI) value (HI=1 being lowest impact and HI=10 being highest impact) for each of the types of natural hazards and is presented in Table 2-2. The highest hazard index values were assigned to those natural hazards that were deemed to have the highest level of impact to the community. These hazards include wind related hazards such as hurricanes (HI=8) and flood related hazards such as heavy rain/urban flooding and coastal flooding/storm surge (HI=7, for both).

The Hazard Index for this 2016 Update utilizes language used in the FEMA State and Local Mitigation Planning How-to-Guide Series for frequency and severity categorization:

#### Criteria for Frequency Categorization:

- Very low frequency:* events that occur less frequently than once in 1,000 years (less than 0.1% per year).
- Low frequency:* events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

- Medium frequency:* events that occur from once in 10 years to once in 100 years (1% to 10% per year).
- High frequency:* events that occur more frequently than once in 10 years (greater than 10% per year).

The criteria used for severity categorization, based on past hazard events includes:

*Criteria for Severity Categorization (based on past hazard events):*

- Minor:* Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.
- Serious:* Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.
- Extensive:* Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.
- Catastrophic:* Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

Table 2-1  
2016 Risk Assessment Matrix, Bristol, Rhode Island

<i>Ranking</i>	<i>Vulnerable Area</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problems/Effects</i>	<i>Mitigation Benefits</i>	<i>Risk H-Historical P- Potential</i>
1	Coastal Flooding of Property	Areas in A and V flood zones and along critical roads: Hope St. at Silver Creek; Poppasquash Rd.	Public and private State Roads	Hurricane, Nor' easter, Flooding with wave/wind action, Heavy rain	risk to property/lives, Evacuation hindered, Limited access, Business Interruption	Improved public safety, Reduced damage to structures/public and private costs of cleanup	H and P
2	Bridges Subject to Flooding and Washout	Mill Gut Pond, Mill Pond, Town Bridge at Silver Creek	Public - State	Hurricane, Nor' easter, Flooding with wave/wind action, Heavy rain	Evacuation hindered, limited access/egress, property/lives at risk, Business interruption	Public safety, Maintain evacuation routes	H and P
3	Local Roads Subject to Flooding	Conduits under these roads: Chestnut, Gooding, Tupelo, Terrace and Elmwood, St. Mary's Cemetery	Public - Town and State	Hurricane, Nor' easter, Flooding with wave/wind action, Heavy rain	Loss/damage of property and lives, hindered evacuation, Business interruption	Public safety, Maintain evacuation routes, Reduced cleanup costs	H and P
4	Wastewater Treatment Facilities	Plant Avenue	Public - Town	Flood, Hurricane, Nor' easter, Heavy rain	Facility inoperable/disruption of services, Public health/safety concerns, Potential pollution to waterways	Limits health/pollution risks, Continuity of services	H and P
5	Sewer Pump Stations	Silver Creek, Mt. Hope, Ferry Rd., Plant Avenue, Kickemuit	Public - Town	Flood, Hurricane, Nor' easter, Heavy rain	Facility inoperable/disruption of services, Public health/safety concerns, Potential pollution to waterways	Limits health/pollution risks, Continuity of services	H and P
6	Sanitary Sewer Lines	Hope St., Shore Rd., Brookwood Dr., Everette Dr., Harrison St., Viking Dr., King Philip Rd., Wilcox Rd., and all roads along bike path	Public - Town	Flood, Hurricane, Nor' easter, Heavy rain	Safety/health issues from sewers backing up into dwellings, Potential pollution to waterways	Limits health/pollution risks, Continuity of services	H and P
7	Tree Damage	Town-wide	Public and Private	Hurricane, Wind, Ice, Snow, Nor' easter, Blizzard	Tree damage causes downed power lines/safety issues, Lack of power and communication, Loss of heat (no power), Disposal of debris after event, Limited access	Improved public safety, Lower cost/time for recovery, Maintain provision of services, maintain access	H and P
8	Inland Flood Areas	Silver Creek and Tanyard Brook watersheds	Public and Private	Hurricane, Flood, Nor' easter, Heavy rain	Flooding (various locations)	Reduced property damage	H and P

Table 2-1  
2016 Risk Assessment Matrix, Bristol, Rhode Island

<i>Ranking</i>	<i>Vulnerable Area</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problems/Effects</i>	<i>Mitigation Benefits</i>	<i>Risk H-Historical P- Potential</i>
9	Sea Walls (various locations)	Independence Park, Walley Beach, Armory Building, Prudence Island Ferry Dock	Public and Private	Hurricane, Flood, Nor' easter, Flood with wave action	Loss of property, Threat to storm protection infrastructure	Reduced property loss, Public safety	H and P
10	Emergency Shelters	Franklin Court, Quinta-Gamelin Community Center (proposed)	Public and Private	Flood, Hurricane, Nor' easter, Blizzard, Ice	Current shelter is not an approved 'all-hazards' shelter	Improved public safety	P
11	Residential Homes	Town-wide	Private	Earthquake, Hurricane, Nor' easter, Flood, Billzard	Economic/Social hardship, Property damage	Public safety, Reduced property damage, Reduced economic/social damage	H and P
12	Dam	State Street Reservoir	Public	Hurricane, Flood	Property damage downstream, Economic hardship	Reduced property damage, Reduced economic impacts	P
13	Nursing Homes, Elderly Housing, and Medical Center	Silver Creek Nursing Home (Elder care 1 and 2), Franklin Court Assisted Living, Bristol County Medical Center	Private	Hurricane, Flood, Nor' easter, Blizzard, Heavy Rain	Loss/Damage of property and lives, hindered evacuation, Interruption of services	Public safety, Expedited evacuation	H and P
14	Historic Buildings	Waterfront national Register District	Public and Private	Hurricane, Nor' easter, Flood, Earthquake	Economic/Social hardship, loss of cultural resources	Reduced economic/social damage, Reduced cultural resources loss	H and P
15	Access Points within Wooded Areas	Mt. Hope	Public and Private	Fire	Loss/Damage of property/lives, Economic/Social hardship	Access to fire source, Reduced property damage, Reduced economic impacts	P

Table 2 - 2 Hazard Index Bristol, Rhode Island

Natural Hazard	Frequency (i.e. Very Low, Low, Medium, High)	Location (i.e. small/local, medium/regional, large/multiple communities)	Severity (i.e. minor, serious, extensive, catastrophic)	Hazrd Index (i.e. ranked by combining frequency and severity; 10 - high, 1 - low)
<b>Flood-Related Hazards</b>				
- Riverine	Very Low	Small/Local	Minor	2
- Flash Flooding	High	Medium/Regional	Minor	5
- Inland/Urban Flooding/Heavy Rain	High	Medium/Regional	Extensive	7
- Coastal Flooding/Storm Surge	High	Small/Local	Extensive	7
- Coastal Erosion	High	Small/Local	Minor	5
- Climate Change/Sea Level Rise	Medium	Large/Multiple	Serious	5
- Dam Failures	Very Low	Small/Local	Minor	2
<b>Winter-Related Hazards</b>				
- Snow/Nor' easter	High	Large/Multiple	Minor	5
- Blizzard	Medium	Large/Multiple	Serious	5
- Ice	Medium	Large/Multiple	Minor	4
- Extreme Cold	Very Low	Large/Multiple	Serious	3
<b>Wind-Related Hazards</b>				
- Hurricanes	High	Large/Multiple	Catastrophic	8
- Tornadoes	Medium	Local	Minor	4
- High Winds	High	Large/Multiple	Serious	6
- Lightning/Thunderstorms	Medium	Local	Minor	4
- Hail	Medium	Local	Minor	4
<b>Geologic-Related Hazards</b>				
- Earthquakes	High	Medium/Regional	Minor	5
<b>Drought</b>				
- Drought	Low	Medium/Regional	Minor	2
<b>Extreme Heat</b>				
- Extreme Heat	Low	Large/Multiple	Serious	3
<b>Wildfire</b>				
- Wildfire	Low	Small/Local	Minor	2

For the purposes of this 2016 update, based on the Hazard Index, the Bristol LHMC determined that the Town is most at risk to the following hazards (and has advanced the assessment of the vulnerability of the at-risk areas, and the implications of experiencing these natural disasters):

- ✓ Coastal Flooding/Storm Surge
- ✓ Inland/Urban Flooding and Heavy Rain
- ✓ Coastal Erosion
- ✓ Climate Change/Sea Level Rise
- ✓ Riverine
- ✓ Flash Flooding
- ✓ Dam Failure
- ✓ Hurricanes
- ✓ Tornadoes
- ✓ High Winds
- ✓ Heavy Snow/Blizzards
- ✓ Ice Storms
- ✓ Earthquakes
- ✓ Drought

The Bristol LHMC formed the consensus that wind related hazards, particularly hurricanes, and flood related hazards, particularly inland/urban flooding and coastal flooding/storm surge, are the major causes of risk to the community.

It should be noted that the above hazards are not a complete listing of hazards that may impact Bristol. The LHMC agreed that this listing accurately represents those hazards that impact Bristol most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. The following hazards will not be addressed in this 2016 Update:

- Avalanche
- Expansive Soils
- Land Subsidence
- Landslides
- Volcanoes
- Tsunamis

These hazards were considered and discussed during several meetings of the LHMC, who determined these hazards would not be considered for the following reasons:

- Lack of frequency in which they occur;
- The minimal probability of their occurrence; and/or

- The lack of resources to devote any amount of time to further research the likelihood or potential occurrence or impact.

The hazard-specific tables that follow after each section represent the various significant natural hazard events that have occurred in and around the Town of Bristol, utilizing NOAA’s National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

### 2.3.1 Wind-Related Hazards

Wind is the movement of air caused by a difference in pressure from one place to another. Local wind systems are created by the immediate geographic features in a given area, such as mountains, valleys, or large bodies of water. Wind effects can include blowing debris, interruptions in elevated power and communications utilities, and intensification of the effects of other hazards related to winter weather and severe storms.

Based on historical tornado and hurricane data, FEMA has produced a map that depicts maximum wind speeds for design of safe rooms. Rhode Island is included in Wind Zone II (160 MPH). Rhode Island is also within the Hurricane - Susceptible Region. Rhode Island wind events can produce damage often associated with thunderstorms or tornadoes. In some instances, these events have been associated with weakening tropical weather systems, including downgraded tropical and sub-tropical storm systems<sup>7</sup>.

Table 2-3 below represents the various significant wind-related hazard events that have occurred in and around the Town of Bristol over time, utilizing NOAA’s National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

*Table 2-3 Significant Wind-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
<i>Hurricanes</i>			
	9/21/1938	115 mph	\$100 million in damages; 262 deaths
	9/14/1944	95 mph	\$2 million in damages
	8/31/1954	Carol; 110 mph	\$90 million in damages; 19 deaths
	9/11/1954	Edna; 75 mph	\$100,000 in damages
	8/19/1955	Diane; 75 mph	\$170 million in damages
	12/12/1960	Donna; 75 mph:	\$2.4 million in damages
	9/27/1985	Gloria; 90 mph	\$19.8 million in damages; 1 death
	8/19/1991	Bob; 75 mph	\$115 million in damages
	8/28/2011	Irene; 62 mph	\$10,000 in damages
	10/29/2012	Sandy; 60 mph	

<sup>7</sup> Rhode Island 2014 Hazard Mitigation Plan Update, Rhode Island Emergency Management Agency..

Hazard Type	Date	Level/Description	Damages
<i>Tornadoes</i>			
	9/14/1972	F0	
	1991		Bristol Point/Poppasquash Point
<i>Strong Winds</i>			
	1/19/1996	73 mph	Scattered power outages; rain/snow melt led to street flooding
	1/27/1996	64 mph	
	1/25/1996	81 mph	Snapped utility poles/trees; multiple roofs damaged
	5/21/1996	58 mph	
	1/3/1999	73 mph	Small branches down
	12/17/2000	58 mph	Downed trees/wires; ferry cancellations
	3/8/2005	59 mph	\$150,000 property damages
	2/25/2011	60 mph	
	12/27/2011	64 mph	\$5,000 in damages
	12/21/2012	64 mph	
	12/27/2012	60 mph	
	1/31/2013	63 mph	
	9/13/2013	Microburst	\$50,000 in damages
	11/1/2013	52 mph	Downed Trees; \$5,000 in damages
	11/27/2013	52 mph	Downed Trees; \$5,000 in damages
	10/22/2014	52 mph	\$2,000 in damages
<i>Lightning/Thunderstorm</i>			
	7/25/1999	Thunderstorm; 58 mph	Large branches down
	8/2/2006	64 mph	\$10,000 in damages
	6/24/2008	Lightning/ Thunderstorms	Hail and damaging winds; man strung by lightning
	8/5/2009		\$20,000 in damages
<i>Hail</i>			
	6/22/1997	Hail; 81 mph	Swamped boats; tree damage; power outages; small fires (lightning)

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

### Hurricanes

Hurricanes are defined as a large circulating windstorm covering hundreds of miles that forms over warm ocean water. To be officially classified as a hurricane, the wind speeds must exceed seventy-four (74) miles per hour. In the northern hemisphere winds circulate in a counter clockwise direction. A great dome of water as much as fifty miles in diameter (called the “storm surge”) is pushed ahead of the storm by its winds. In some coastal locations, this can result in

tides twenty (20) feet higher than usual. Occasionally, storm surge is responsible for damage to property and potential deaths.

The winds that accompany hurricanes have the potential to cause serious damage. Downed power lines leave residents without electricity, and can impede business for days. Fallen trees can damage buildings and block roadways. Unsecured building components including gutters, screened enclosures, roof coverings, shingles, car ports, porch coverings, overhangs, siding, decking, windows, walls, gables can be blown off structures and carried by the wind to cause damage in other places. Wind driven rain often causes water damage in roof and wall envelopes.

*Measuring the Intensity of a Hurricane*

Hurricane damages come from wind, rain, tornadoes, floods/storm surge, and the effects of very low air pressure. The Saffir-Simpson Hurricane Wind Scale (SSHWS) intensity category system was developed in the 1970's to characterize a hurricane's destructive potential by indicating wind speeds and range of damage, see Table 2-4 below. The SSHWS category system measures sustained wind speed, central pressure, storm surge height, and coastal damage potential within five intensity categories.

**Table 2-4 Saffir-Simpson Hurricane Wind Scale**

Scale No. (Category)	Wind (mph)	Potential Damage
1	74 - 95	Minimal: Damage is primarily to shrubbery and trees, mobile homes, and some signs. No real damage is done to structures.
2	96 - 110	Moderate: Some trees topple, some roof coverings are damaged, and major damage is done to mobile homes.
3	111 - 130	Extensive: large trees topple, some structural damage is done to roofs, mobile homes are destroyed, and structural damage is done to small homes and utility buildings.
4	131 - 155	Extreme: Extensive damage is done to roofs, windows and doors; roof systems on small buildings completely fail; and some curtain walls fail.
5	> 155	Catastrophic: Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, and entire buildings could fail.
Additional Classifications		
Tropical Storm      39 - 73		
Tropical Depression < 38		

Source: NOAA.

The National Weather Service (NWS) will issue a hurricane warning when sustained winds of 74 mph or higher are reached and expected within a coastal area within 24 hours. On average, there are approximately 10 named tropical storms along the east coast of the U.S. each year, six of which are likely to develop into hurricanes, with only two or three likely to reach category 3 on the SSHWS. The SSHWS has undergone a minor modification for 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in

advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph.

Since 1865, Bristol has experienced seventy-one hurricanes of varying magnitude (Map A-2 Risks). In 1985, Hurricane Gloria left the town without power for three days. Along with the interruption of school and business activity, the roof of the Defiance Fire Station was destroyed. The most recent significant hurricanes impacting the Town of Bristol include Tropical Storms Irene and Sandy in August 2011 and October 2012, respectively. There is a concern that ‘new’ residents to this area haven’t experienced a hurricane and therefore do not fully comprehend the risks associated with this type of natural hazard.

### Tornadoes/Strong Wind Events

Tornadoes are violently rotating columns of air in contact with and extending between a cloud and the surface of the earth. Generally, winds in most tornadoes are 100 mph or less, but can exceed 250 mph in the most violent and least frequent tornadoes. Several conditions are required for the development of tornadoes and associated thunderstorm clouds, including abundant low level moisture to contribute to the development of a thunderstorm, along with a trigger/cold front to lift the moist air. Tornadoes usually form in areas where strong winds are turning in a clockwise direction and can be in the traditional funnel shape, or in a slender rope-like form. They typically begin in a supercell (severe thunderstorm), primarily in the month of May.

#### *Measuring the Intensity of a Tornado*

Typically, tornadoes are categorized by frequency values from historic data and area impacted based on the length and width of the damage path. Tornado damage severity is measured by the Fujita Tornado Scale, where wind speed is estimated from the amount of damage. As of February 1, 2007, the National Weather Service began rating tornadoes using the Enhanced Fujita-scale (Table 2-5). The Enhanced Fujita scale is more complicated than the original F-scale, allowing for more precise assessments of tornado severity.

*Table 2-5 Enhanced Fujita Scale*

Fujita Scale			Derived		Operational EF Scale	
F Number	Fastest ¼ mile (mph)	3-second gust (mph)	EF Number	3-second gust (mph)	EF Number	3-second gust (mph)
0	40 - 72	45 - 78	0	65 - 85	0	65 - 85
1	73 - 112	79 - 117	1	86 - 109	1	86 - 110
2	113 - 157	118 - 161	2	110 - 137	2	111 - 135
3	158 - 207	162 - 209	3	138 - 167	3	136 - 165
4	208 - 260	210 - 261	4	168 - 199	4	166 - 200
5	261 - 318	262 - 317	5	200 - 234	5	Over 200

Source: NOAA.

Electrical utilities and communications infrastructure are vulnerable to tornadoes. Damage to power lines or communication towers has the potential to cause power and communication outages for residents, businesses and critical facilities. In addition to lost revenues, downed power lines present a threat to personal safety. Further, downed wires and lightning strikes have been known to spark fires. A structure's tornado vulnerability is based in large part on building construction and standards. In general, mobile homes and wood-framed structures are more vulnerable to damage in a tornado than steel framed structures. Other factors, such as location, condition and maintenance of trees also plays a significant role in determining vulnerability.

The risk of tornado is considered minimal; however, a tornado did touch-down in Bristol in 1991 and followed a path cross Bristol Point and Poppasquash Point. The majority of the damage was a result of downed trees.

### Lightning/Thunderstorms

Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur any time of the day and in all months of the year, but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. Thunderstorms affect a smaller area compared with winter storms or hurricanes, but they can be dangerous and destructive for a number of reasons. Storms can form in less than 30 minutes, giving very little warning; they have the potential to produce lightning, hail, tornadoes, powerful straight-line winds, and heavy rains that produce flash flooding.

All thunderstorms produce lightning, and therefore all thunderstorms are dangerous. Lightning often strikes outside of areas where it is raining, and may occur as far as 10 miles away from rainfall. It can strike from any part of the storm, and may even strike after the storm has seemed to pass. Hundreds of people across the nation are injured annually by lightning, most commonly when they are moving to a safe place but have waited too long to seek shelter.<sup>8</sup> The Town of Bristol can be uniformly affected by lightning and thunderstorms, dependent upon the time of day, existing/incoming weather conditions, and time of year.

Building construction, location, and nearby trees or other tall structures will have a large impact on how vulnerable an individual facility is to a lightning strike. A rough estimate of a structure's likelihood of being struck by lightning can be calculated using the structure's ground surface area, height, and striking distance between the downward-moving tip of the stepped leader (negatively charged channel jumping from cloud to earth) and the object. In general, buildings are more likely to be struck by lightning if they are located on high ground or if they have tall protrusions such as steeples or poles which the stepped leader can jump to. Electrical and communications utilities are also vulnerable to direct lightning strikes. Damage to these lines has the potential to cause power and communications outages for businesses, residencies, and critical facilities. Based on the limited frequency and severity of

---

<sup>8</sup> *Rhode Island 2014 Hazard Mitigation Plan Update*, Rhode Island Emergency Management Agency.

lightning/thunderstorm events over time, as reported by the National Climatic Data Center and indicated in Table 2-3, the risk of lightning/thunderstorms is considered minimal in Bristol.

### Hail

Hail is formed in towering cumulonimbus clouds (thunderheads) when strong updrafts carry water droplets to a height at which they freeze. Eventually, these ice particles become too heavy for the updraft to hold up, and they fall to the ground at speeds of up to 120 MPH. Hail falls along paths called swaths, which can vary from a few square acres to up to 10 miles wide and 100 miles long. Hail larger than ¾ inch in diameter can do great damage to both property and crops, and some storms produce hail over two (2) inches in diameter.<sup>9</sup> The Town of Bristol can be uniformly affected by hail, dependent upon the existing/incoming weather conditions, and time of year.

Structure vulnerability to hail is determined mainly by construction and exposure. Metal siding and roofing is better able to stand up to the damages of a hailstorm than many other materials, although it may also be damaged by denting. Exposed windows and vehicles are also susceptible to damage. Crops are extremely susceptible to hailstorm damage, as even the smallest hail stones can rip apart unsheltered vegetation. Based on the limited frequency and severity of hail events over time, as reported by the National Climatic Data Center and indicated in Table 2-3, the risk of hail is considered minimal in Bristol.

Since the 2010 plan, there have been two significant hurricane events and nine strong wind events impacting Bristol/Bristol County, see Map A-2 Risks.

### **Property at Risk from Wind-Related Events in Bristol**

Wind events are quite normal in New England and happen regularly each year. Since Bristol is a peninsula, the entire Town is equally susceptible to wind-related events. In the winter months, the Town of Bristol is susceptible to high winds from nor'easters and winter storms (both high frequency). Spring and summer seasons usually bring a number of severe thunderstorms to the region (medium frequency). During the late summer and fall seasons, the area is at risk from a hurricane or tropical event (high frequency). Fortunately, Bristol has not received the brunt of a hurricane since Hurricane Bob in August 1991. Since the 2010 plan, the Town has experienced approximately 11 significant high-wind events.

### **Probability of Future Occurrence of Wind-Related Hazards in Bristol**

Bristol, as with the entire coast of Rhode Island, is particularly vulnerable to hurricanes given its geographic location as a coastal peninsula. As previously stated, wind events are quite normal in New England, as evidenced throughout the year. Given the increase in frequency and severity of high wind events realized over the last several years, and considering the presence of isolated microburst (September 13, 2013), high-wind hazards will continue to impact the Town to varying degrees

---

<sup>9</sup> *Ibid*

### 2.3.2 Flood-Related Hazards

Flooding is the accumulation of water within a water body and the overflow of excess water onto adjacent floodplain lands (FEMA, Multi Hazard Identification and Risk Assessment, 1997). The floodplain is the land adjoining the river/stream channel, ocean or other watercourse or water body that is susceptible to flooding.

Flooding results from: large-scale weather systems generating prolonged rainfall; on-shore winds; locally intense thunderstorms; dam failures; or significant snow melt. Floods are capable of undermining buildings and bridges, eroding shorelines and stream banks, uprooting trees, washing out access roads, and causing loss of life and injuries. Also, flash floods (characterized by rapid onset and high velocity waters) carry large amounts of debris that further exacerbate conditions.

Under the National Flood Insurance Program (NFIP), FEMA is required to develop flood risk data for use in both insurance rating and floodplain management. FEMA develops this data through Flood Insurance Studies (FIS). Detailed analyses are used to generate flood risk data only for developed or developing areas of communities. For undeveloped areas FEMA uses approximate analyses to generate flood risk data. Flood hazard areas are identified in the FEMA Flood Insurance Rate Maps (FIRMs). Flood hazard areas are divided into zones (V, X, AO, etc.) depending on the severity and type of flood threat. These zones are those areas subject to inundation (shallow or deep) by a flood (and/or velocity wave action) that has a 1 percent chance of occurring during any given year.

Floodplains in Bristol include ‘AE’, ‘VE’, and ‘X’ Zones. ‘AE’ Zones are areas that would be inundated by the 100-year flood. The 100-year flood is a regulatory standard used by federal agencies and most states to administer floodplain management programs and is also used by the NFIP as the basis for insurance requirements nationwide. ‘VE’ Zones are velocity zones that are subject to breaking wave action where waves greater than 2.9 feet are forecasted during a 100-year flood or storm surge. ‘X’ Zones are areas that would be inundated by the 500-year flood. Approximately 40% of the Town is located within a flood plain, including the 500-year flood areas Map A-2 ‘Risks’ (Appendix A) depicts the FEMA flood zones.

Table 2-6 below represents the various significant flood-related hazard events that have occurred in and around the Town of Bristol over time, utilizing NOAA’s National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

*Table 2-6 Significant Flood-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
<i>Riverine Flooding</i>			
	2/13/2008	2 to 4"	Backyards with 6" of water; small stream and minor river flooding; strong winds at coast
<i>Flash Flooding</i>			

	9/5/2012	3 to 4"	Numerous roads closed; Woodlawn Ave. washed out; \$10,000 in damages
	3/30/2014	3 to 5"	Several roads/commercial businesses closed; Mt. Hope bridge closed
<i>Heavy Rain/Inland and Urban Flooding</i>			
	9/15/2002	2.15" associated with Trop. Storm Hanna	Minor flooding due to poor drainage
	3/28/2005	3 to 4"	Significant street flooding due to poor drainage; \$50,000 in damages
	6/7/2006	2 to 4"	Widespread flooding; \$5,000
	3/2/2007	2 to 3"	Several roads in Bristol closed; widespread urban/small stream flooding; \$5,000 in damages
	12/12/2008	3 to 5"	Silver Creek overflowed banks; Route 114 and others closed; \$3,000 in damages
	3/30/2010	14.72 to 16.67"	Residential/commercial flooding; road closures
	6/7/2013	2 to 5"	Several roads closed
	9/3/2013		Several roads closed
<i>Coastal Flooding/Storm Surge</i>			
	10/28/2006	2 to 4"	Moderate coastal flooding Smith St. in Bristol covered with 2 feet of water; \$2,000 in damages
	3/8/2008	2 to 3"	Coastal flooding with water lapping over seawall
	8/28/2011	3.2 to 4.78" storm surge	
	10/29/2012	Coastal flooding at high tide caused 30-foot section of seawall to collapse/undermining of Poppasquash Rd.	\$220,000 in damages
<i>Coastal Erosion</i>			
	7/13/1996	74 mph	Minor coastal flooding/beach erosion; urban street flooding
	1/10/1997	Storm tidal surge	Basement/road flooding

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

### Riverine/Flash Flooding

Riverine or inland flooding often occurs after heavy rain, particularly in areas of the state with high water tables. These areas are also particularly susceptible to flash flooding caused by rapid runoff occurring after heavy precipitation events, and in combination with spring snowmelt. Frozen ground conditions can also contribute to low rainfall infiltration and high runoff events that sometimes result in river flooding.

Flood magnitude increases with increasing recurrence interval. The Town of Bristol can be uniformly affected by riverine/flash flooding events, dependent upon the location (amount of impervious surfaces within the area), existing/incoming weather conditions, and time of year (frozen ground conditions exacerbate flooding) Based on the increased frequency and severity of flash flooding events (two significant events) which caused numerous business, road and bridge closures since the last plan update, as reported by the National Climatic Data Center and indicated in Table 2-6, the Town is considered at high risk for future flash flooding events.

#### Heavy Rain/Inland and Urban Flooding

Bristol's geology includes large areas of bedrock and/or high groundwater. As a result, there are areas of poor drainage that become flooded even with heavy rain storms. Many of Bristol's local roads become flooded during a heavy rain storm impacting residents in these neighborhoods and causing property damage.

The State of Rhode Island experienced heavy rain fall and documented hurricane-force winds during storms that affected the State between the dates of March 12, 2010 through March 31, 2010. The most affected areas were Kent County, which received up to 3.68 inches, Providence County, which received up to 5.71 inches, and Washington County which received 5.55 inches of rain over that time frame. The monthly rain total in Providence Rhode Island was at 16.32 inches, making March the City's all-time wettest month on record.

The Pawtuxet River went into major flood stage on the evening of March 14, 2010, and hit historic flood levels (14.98 feet) on March 15, 2010, flooding communities across Kent and Providence Counties. Most of the damage in Bristol County was from rainfall, water runoff, and wind damage. The Town of Bristol has two rain gauges that were collecting rain fall data during March 2010 – the gauge located at the Silver Creek Pumping Station reported 16.67 inches of rain and the gauge located at the Mount Hope Pumping Station reported 14.72 inches of rain during this period. On April 2, 2010, the FEMA major disaster declaration for the State of Rhode Island was amended to include Bristol County.

Other flood hazards not found on the FIRM are ones that involve stormwater related issues. Thunderstorms, winter storms, coastal storms and nor'easters, and hurricanes all contribute to interior flood related hazards due to the large amounts of precipitation associated with them. Development has exacerbated the magnitude and frequency of urban flooding by increasing impervious surfaces, also increasing the rate of drainage collection, reducing the carrying capacity of the land, and often overwhelming sewer system infrastructure.

#### *Tanyard Brook*

The properties in the southern watershed of the Tanyard Brook experience flooding problems during major rainstorms combined with high tides with the most recent event occurring in summer/late summer of 2013. Previous to 2013, significant flooding occurred during the March 2010 storms. Following the March 2010 storms, a study completed by the FEMA Joint Field Office in Rhode Island demonstrated that the area of the Tanyard Brook experienced more claims and higher requests for individual assistance than most other areas in Town (in addition to the Silver Creek area).

Following the historic March 2010 floods, the Town was able to secure just over \$4 million in grants from the US Economic Development Agency Special Appropriates and the US HUD Community Development Block Grant- Disaster Recovery Program (CDBG-DR) to complete Phase 1 of the Tanyard Brook Culvert Improvement project (Tanyard Brook Watershed Study originally commissioned by the Town in 2002). The project extended from the outfall at Walker's Cove north to Garfield Avenue and included installation of a tide gate at the outfall with an enlarged culvert. This was a long anticipated project by the Town and will mitigate flooding in the Tanyard Brook watershed which includes a low – moderate income residential neighborhood and many businesses.

In 2010, the Town approved a bond referendum that included \$3 million dollars for drainage projects. The engineering and design for Phase 2 (last phase) of this culvert improvement project is currently underway. The Town continues to seek grant funds to match this bond money for completing Phase 2 of the Tanyard Brook Culvert Improvement project.



*Tanyard Brook Watershed pre- (left photo) and post-construction (right photo) improvements.*

#### *Silver Creek*

The area of Hope Street where the Silver Creek discharges into Bristol Harbor frequently floods during heavy rain storm events, particularly when combined with high tides. This area combined with the Tanyard Brook area, have traditionally experienced the highest damages from flooding throughout the Town.

Just prior to the March 2010 floods, the Town slip-lined the existing drainage pipe that extended from the High School property on the north side of Chestnut Street through St. Mary's cemetery and to the outlet structure on the south side of the cemetery. The March 2010 floods sent so much water into this drainage system that the outlet structure "blew out" and caused



*Silver Creek Watershed discharges to Bristol Harbor.*

significant erosion at the outfall. The Town was able to secure a grant (\$25, 000) from NRCS to re-grade the area and stabilize the banks with rip rap which replaced the destroyed outlet structure.

The Town also received another CDBG-DR grant in the amount of \$41,359 to fix the spillway on the pond to the north side of Chestnut Street which was impacted from the March 2010 flooding. The result of the flooding caused the dam at the spillway to be compromised such that water was finding its way around the dam and causing erosion to the embankment and the continuous flow of water since the dam wasn't holding anything back. For this project, the Town partnered with the engineers at the NRCS who completed the design of the repair at no charge to the Town. With the CDBG-DR grant, the spillway was repaired in 2014.



*Hope St. flooding March 30, 2014 at Silver Creek.*



*Silver Creek Watershed pre- (left photo) and post-construction (right photo) improvements.*

In 2013, the Town received a \$400,000 grant from the RIDEM for drainage improvements to the fields at Mt. Hope High School. This grant was matched with an additional \$400,000 from the Town and the School District and is currently out to bid. Silver Creek flows through the high school property and beneath portions of the school building; and athletic fields and impervious surfaces drain directly to the waterway.

### Coastal Flooding/Storm Surge

Coastal storm surge is typically defined as the abnormal rise in water level caused by the wind and pressure forces of a hurricane and/or nor'easter. Many of the current hazard risks in the Town of Bristol are associated with flooding, especially in coastal areas where the 100-year floodplain encroaches inland. Bristol experiences significant coastal flooding several times per year due to coastal storm surges resulting mainly from winter storms and nor'easters.

Additionally, several interior locations experience flooding due to inadequate drainage during significant storm events. In particular, storm surge associated with a high tide back in 2012, caused a 30-foot section of seawall to collapse, further undermining Poppasquash Road (Table 2-6).

### Coastal Erosion/Shoreline Change

Coastal erosion is another hazard that occurs during large coastal storm events and through natural processes. Shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human interaction, and other factors that move sand and material within a coastal shoreline system.

Bristol is somewhat susceptible to coastal erosion resulting from storm events and natural erosion. The area of most concern is along Poppasquash Road where the seawall is in a state of disrepair. The coastal erosion is exacerbated by the blocked culverts under the roadway which cause the road to flood during significant storm events and is undermining the pavement. This area is an evacuation route for the Poppasquash Road peninsula of approximately 100 dwellings and a dozen businesses.



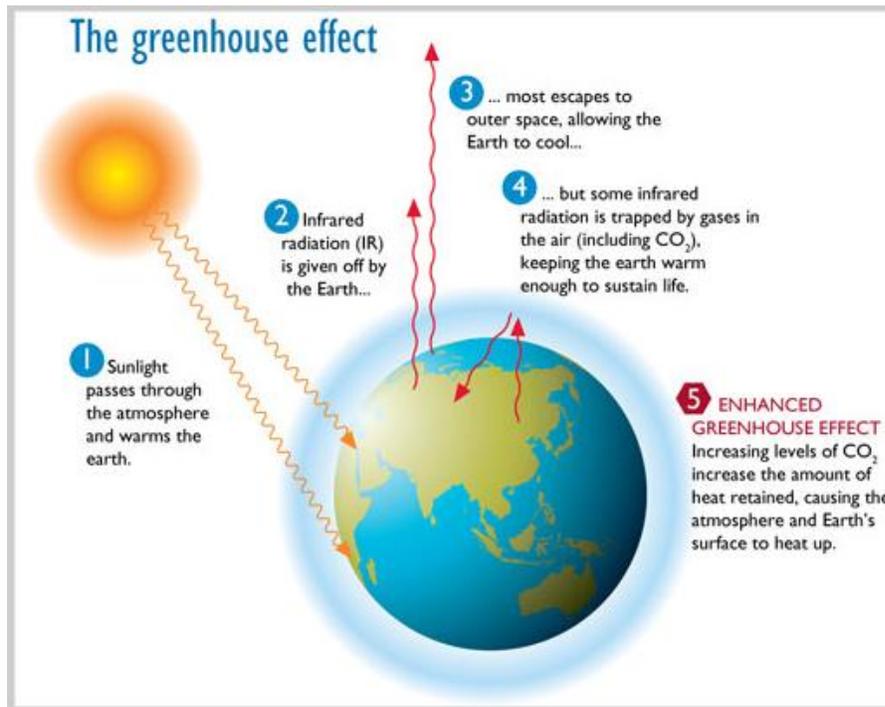
*Flooding on Poppasquash Rd. December 19, 2010, at high tide.*

### Climate Change

The Environmental Protection Agency (EPA) indicates there is recent, strong evidence that most of the warming of the Earth's surface temperature over the past 50 years is a direct result of human behavior (Figure 2-1).

Human activities have been contributing to natural background levels of greenhouse gases since the Industrial Revolution. The primary source of emissions is the burning of fossil fuels for energy. Although increases in the atmosphere's heat-trapping ability can be predicted, resulting impacts on climate are more uncertain. By 2100, Rhode Island could see a temperature increase by about 4 degrees F (with a range of 1-8 degrees F) in the winter and spring and by about 5 degrees F (with a range of 2-10 degrees F) in the summer and fall.

Figure 2-1 Greenhouse Effect



Source: [www.landlearnsw.org.au](http://www.landlearnsw.org.au)

Increased temperatures and frequency of heat waves could also impact the number of heat-related illnesses and deaths in Rhode Island. The same high temperatures could also result in an increase in ground-level ozone (a major component of smog). Ground-level ozone facilitates respiratory illnesses such as asthma and respiratory inflammation, as well as reducing general lung functioning. The very same warming and climate increases could also expand the habitat and infectivity of disease-carrying insects, increasing the potential for malaria, Eastern Equine Encephalitis and Lyme Disease. The Town of Bristol can be uniformly affected by the impacts of climate change.

### Sea Level Rise

The Intergovernmental Panel on Climate Change (IPCC) continues to better understand the science and implications of climate change and sea level rise. Rising sea levels, as a direct result of warmer temperatures and glacial ice melt, threaten low-lying coastal areas through coastal flooding, coastal erosion, wetland inundation and saltwater intrusion. Recent projections of sea level rise by the end of the century range from 20 to 55 inches. Localized land subsidence, also on the rise, also contributes to accelerated impacts of sea level rise. Standard management approaches to address these issues include:

- Coastal armoring
- Rolling easements
- Setbacks
- Re-nourishment
- Post-storm reconstruction policies

### Dam Failure

A dam is any artificial barrier with the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or water control. Dam failure can be a catastrophic type of failure characterized by the sudden, immediate, and uncontrolled release of impounded water, or the likelihood of such an uncontrolled release with secondary impacts to downstream structures within the inundation zone.

The State Street Reservoir is a Town-owned pond (or impoundment) that functions as a storm water detention basin located at the headwater of the Tanyard Brook. This historic mill pond has a dam and weir structure which is controlled by the Department of Public Works. This dam is inspected regularly and there is little chance of any dam failure. Prior to a storm event the weir is lowered to allow the reservoir to empty and then the weir is raised to allow maximum stormwater storage capacity. This impoundment is shallow and heavily silted in and in need of dredging. **Should there be a dam breach at this structure, the immediate areas surrounding the structure, as well as properties located downstream (within the inundation zone) of the structure are most vulnerable.**

Since the 2010 plan, there have been six significant flood-related events impacting Bristol by way of flash floods (two events/\$10 K in damages/numerous road/business closures), heavy rain/inland and urban floods (two events/numerous road/business closures), and coastal floods/storm surge (two events/\$220k in damages), see Map A-4 Flood Risks with Repetitive Loss Areas and Map A-5 Sea Level Rise.



*WWTF submerged pumps March 30, 2014.*

### **Property at Risk from Flood-Related Hazards in Bristol**

Flooding in Bristol is primarily associated with coastal areas (high frequency) as a result of storm surge and inland areas due to stormwater collection deficiencies (particularly in the Tanyard Brook and Silver Creek watersheds). The Bristol Waterfront National Register District (along Bristol Harbor) continues to be at risk, particularly when considering the identified accelerated rates of sea level rise for Rhode Island (medium frequency). This irregular pattern of at-risk areas also impacts many Town and State-owned roadways, which also serve as primary evacuation routes for residents, businesses and tourists in Bristol. Projections for sea level rise may lead to the permanent inundation of some roads in Bristol, and Rhode Island overall. As a peninsula, both temporary and permanent breaks in the transportation network place significant impacts on access, evacuation and life safety.

## Critical Facilities

Critical facilities are those public or private facilities that possess added value to the community and deserve additional consideration when determining mitigation strategies to protect these resources from natural hazard risks.

A list of critical facilities provided by the Town was reviewed and approved with minor modifications by the Bristol LHMC. Forty-three critical facilities have been identified and are presented in Map A-3 Critical Facilities. Only a portion of the Town's critical facilities are located in high hazard areas, however, many of these facilities such as emergency shelters and nursing homes are still critical in ensuring the health and safety of the entire community during a natural disaster.

## Coastal and Inland Flood Hazard Areas

### *FEMA Flood Zones*

Coastal and inland flooding caused by major rainstorms combined with high tides/storm surge has been determined as possessing the second highest risk of natural disaster to the community. As a peninsula with water on three sides, Bristol flood zones include 'AE', 'VE', and 'X' Zones. HW performed a Vulnerability Analysis that considered those areas in Town impacted by the various flood zones according to land use type, critical facilities, and critical infrastructure. A full Economic Analysis of the impacts based on flood zones follows later in this section (Table 14).

### **VE/Velocity Zone**

The VE zone or 'velocity zone' is subject to breaking wave action where waves greater than 2.9 feet are forecasted during a 100-year flood or storm surge. Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by the VE flood zone:

#### Parcels affected: (501 Parcels Total)

- Public: 32 (includes 'Municipal' and 'School')
- Residential: 273 (includes One Family Residence, Two to Five Family Residence, Apartments, Estate, Residential Buildings on Leased Land, Residential Condominium, Time-Shared Condominium – Deeded, Mobile Home)
- Commercial: 18 (includes Commercial I, Commercial II, Commercial Condominium, Commercial Building on Leased Land)
- Mixed Use: 5 (Combination)
- Industrial: 2 (Industrial, Industrial Buildings on Leased land, Industrial Condominium)
- Vacant: 54 (Residential, Commercial and Industrial Vacant Land, Farm Forest and Open Space)
- State: 13 (State)
- Farm/Open Space: 13 (Farm, Vote of City)
- Seasonal/Beach: 10 (Seasonal and Beach Property)
- Federal: 6 (Federal)
- Other: 75 (Other Improved Land, Church, Ex-Charter)

Critical Facilities affected:

- Mt. Hope Bridge (Ferry Road)
- Tanyard Brook Crossing
- Bristol Fire Department (193 Thames Street)
- Sea Wall at Poppasquash Road
- Mill Pond Bridge

Critical Infrastructure affected:

- Hope Street
  - (intersection of Hope St./Ferry Rd. northwest to Walley St...also serves as a section of the primary evacuation route)
  - (Burton St. northwest to Summer St.)
- Thames Street
  - (Constitution St. to just north of State St.)
  - (north of Bradford St. to the intersection with Washington St., then continuing north onto Hope St. to Poppasquash Rd.)
- Coggeshall Farm Road (Colt Rd. through to Colt Drive...also serves as a section of the primary evacuation route)
- Colt Drive (north along Asylum Rd.)
- Brookwood Road (in its entirety)
- Surf Drive (Beach Rd. to just north of Cliff Drive)
- Wood Street (intersection of Hope St. north to Woodlawn Ave... also serves as a section of the primary evacuation route)

**AE/100-Year Flood Zone**

The AE zone or 100-year flood zone (has a 1% chance of flooding occurring each year) is a regulatory standard used by federal agencies and most states to administer floodplain management programs and is also used by the NFIP as the basis for insurance requirements nationwide. Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by the AE flood zone:

Parcels affected: (1,073 Parcels Total)

- Public: 149
- Residential: 560
- Commercial: 28
- Mixed Use: 11
- Industrial: 2
- Vacant: 169
- State: 30
- Farm/Open Space: 5
- Seasonal/Beach: 38
- Federal: 4
- Other: 77

Critical Facilities affected:

- Bristol Fire Department (193 Thames Street)
- Sea Wall at Poppasquash Road
- Mill Pond Bridge
- Guiteras School
- Silver Creek Manor
- Roger Williams University
- DPW Facility
- Mt. Hope Pump Station
- Silver Creek Pump Station
- Constitution Pump Station
- Ferry Road Pump Station

Critical Infrastructure affected:

- Hope Street
  - (intersection of Hope St./Ferry Rd. northwest to Walley St...also serves as a section of the primary evacuation route)
  - (Burton St. northwest to Summer St.)
- Thames Street
  - (Constitution St. to just north of State St.)
  - (north of Bradford St. to the intersection with Washington St., then continuing north onto Hope St. to Poppasquash Rd.)
- Poppasquash Road (south to Reliance Dr... also serves as a section of the primary evacuation route)
- Coggeshall Farm Road (Colt Rd. through to Colt Drive...also serves as a section of the primary evacuation route)
- Colt Drive (north along Asylum Rd. and mid-way through the Park... 2<sup>nd</sup> segment also serves as a section of the primary evacuation route)
- Slocum Street (Bristol Town Line south to Butterworth Ave.)
- Riverview Avenue (Butterworth Ave. to Franca Dr.)
- Everette Street (Franca Dr. south to terminus)
- Smith Street (Water St. to several inland segments)
- Wilcox lane (in its entirety)
- Harrison Street (in its entirety)
- Wood Street
  - (intersection of Hope St. north to Woodlawn Ave... also serves as a section of the primary evacuation route)
  - (bisecting through residential areas north at Garfield St., Collins St., Cole St., Charles St., Richmond St., Prospect St., Catherine St., and Mt. Hope Ave.)
  - (Ferry St. north)
- Washington Street (Hope St. to High St. to intersection with Bayview Ave.)
- Monroe Avenue (north from Washington St. to Perry St.)

- Jones Street( in its entirety)
- Chestnut Street (at Benjamin Church Manor intersection)
- Gooding Avenue (multiple segments)
- East Bay Bike Path

### **X/500-Year Flood Zone**

The X zone or 500-year flood zone is a flood that has a 0.2% chance of occurring each year. Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by the X flood zone:

#### Parcels affected: (572 Parcels Total)

- Public: 13
- Residential: 371
- Commercial: 16
- Mixed Use: 14
- Industrial: 1
- Vacant: 79
- State: 18
- Farm/Open Space: 15
- Seasonal/Beach: 9
- Federal: 1
- Other: 35

#### Critical Facilities affected:

- Ferry Road Pump Station
- Constitution Pump Station

#### Critical Infrastructure affected:

- Brookwood Road (at intersections of Curtis Rd., Fales Rd., Fenmore St., Melrose Rd.)
- Harborview Avenue (southern segment)
- Church Cove Road (cul de sac area)
- Harrison Street (multiple segments)
- Sherman Avenue/Spruce Lane/San Miguel Drive/Fatima Drive/Franca Drive (terminus only)
- Bay Street (one segment)
- High Street (one segment)
- Washington Street (one segment)
- Perry Street (one segment)
- Monroe Avenue (one segment)
- Wood Street (one segment...also serves as a section of the primary evacuation route)
- Doran Avenue (one segment)

- Paull Street (Hillside Rd. and Sheffield Ave. intersection)
- Hope Street
  - at Poppasquash Rd. intersection...also serves as a section of the primary evacuation route
  - at Oliver St. intersection
  - Pleasant St. to Walley St. intersection
- Reliance Drive (one segment)
- Colt Drive (multiple segments...also serves as a section of the primary evacuation route)
- Valley Road (one segment)
- Poppasquash Road (Bristol Marine area... also serves as a section of the primary evacuation route)
- Thames Street (majority)
- Ferry Road (at Fairview Dr. intersection)
- East Bay Bike Path

#### *Sea Level Rise*

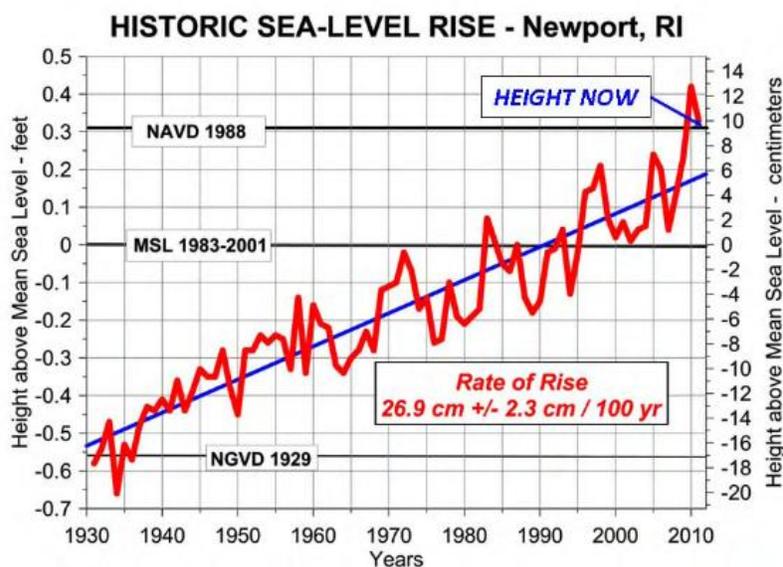
Over the last 100 years, sea levels have risen 0.56 feet globally, with the average rate of rise during the years between 1961 and 2003 at 0.071 inches per year, and between 1993 and 2003 that rate nearly doubled to 0.12 inches per year.<sup>10</sup> Although the rate of sea level rise is accelerating, it is not expected to be globally uniform, with some areas more substantially inundated than others. Given the size and geography of Bristol (as a peninsula), it is expected that all coastal areas, as well as the Silver Creek watershed are vulnerable to the impacts of sea level rise.

In Rhode Island, the Coastal Resources Management Council (CRMC) acknowledges that sea level rise is ongoing, noting the accelerated rate of rise as the primary concern for coastal areas around the state. CRMC has thus integrated climate change and sea level rise scenarios into its programs to better prepare communities to become more resilient in light of these new, evolving conditions. As recorded at the Newport Tide Gage, sea level has risen 8.5 inches since 1931 (Figure 2-2).

---

<sup>10</sup> IPCC. (2007). *Climate Change 2007: The Physical Science Basis. Summary for Policymakers. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Geneva, Switzerland: UNEP.

Figure 2-2 Long-Term Trends of Sea Level Rise, Newport Tide Gage Since 1931



Source: adapted from: [http://tidesandcurrents.noaa.gov/sltrends/sltrends\\_station.shtml?stnid=8452660%20Newport,%20RI](http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660%20Newport,%20RI)

CRMC’s policy, for planning and management purposes, is to accommodate a base rate of expected 3 - 5 foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities. This 3 - 5 foot base rate is considered narrow and low, recognizing that as research and new scientific evidence comes forward, CRMC will periodically revisit this policy.

HW performed a Vulnerability Analysis that considered those areas in Town with the potential for future impacts across the range of projected sea level rise scenarios for Rhode Island (1, 3, 5-foot), according to land use type, critical facilities, and critical infrastructure. HW utilized data sets resulting from a "modified bathtub" coastal inundation analyses conducted by the NOAA Coastal Services Center and the RI Division of Planning, available at: <http://www.edc.uri.edu/rigis/data/data.aspx?ISO=planningCadastre>, and depicted in Map A-5 Sea Level Rise. A full Economic Analysis of the impacts based on the range sea level rise projections follows later in this section (Table 2-15).

Complementing the Vulnerability Analysis, HW also utilized *Technical Paper 164 - Vulnerability of Transportation Assets to Sea Level Rise* (Rhode Island Statewide Planning Program, Division of Planning – Department of Administration, January 2015). Using a GIS-based methodology, this study analyzes transportation assets under state jurisdiction (including Roadways, Rail, RIPTA, Passenger Intermodal Hubs, Ports and Harbors, Bridges, Bicycle Infrastructure) at risk under 1, 3, and 5-foot scenarios across the state. The study also notes that the East Bay communities of Barrington, Bristol, and Warren, in particular, have significant transportation infrastructure vulnerable to sea level rise. The study is intended to be a resource for the state and affected communities to incorporate sea level rise data into informed decision-making regarding

spending, planning, goal setting, communication and capacity building, and for additional analysis.

### **1-Foot Rise Scenario**

Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by a projected 1-foot rise in sea level:

#### Parcels affected: (357 Parcels Total)

- Public: 21 (includes ‘Municipal’ and ‘School’)
- Residential: 181 (includes One Family Residence, Two to Five Family Residence, Apartments, Estate, Residential Buildings on Leased Land, Residential Condominium, Time-Shared Condominium – Deeded, Mobile Home)
- Commercial: 7 (includes Commercial I, Commercial II, Commercial Condominium, Commercial Building on Leased Land)
- Mixed Use: 0 (Combination)
- Industrial: 1 (Industrial, Industrial Buildings on Leased land, Industrial Condominium)
- Vacant: 52 (Residential, Commercial and Industrial Vacant Land, Farm Forest and Open Space)
- State: 13 (State)
- Farm/Open Space: 13 (Farm, Vote of City)
- Seasonal/Beach: 12 (Seasonal and Beach Property)
- Federal: 2 (Federal)
- Other: 53 (Other Improved Land, Church, Ex-Charter)

#### Critical Facilities affected:

- Mt. Hope Bridge
- Silver Creek Bridge
- Silver Creek Manor
- Mill Pond Bridge

#### Critical Infrastructure affected:

- Hope Street (multiple segments)
- Colt Drive (north along Asylum Rd.)
- Poppasquash Road (multiple segments)
- Hope/Washington RIPTA stop
- Prudence Island Ferry Terminal
- USCG Bristol
- East Bay Bike Path (multiple segments)

### **3-Foot Rise Scenario**

Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by a projected 3-foot rise in sea level:

Parcels affected: (471 Parcels Total)

- Public: 31 (includes ‘Municipal’ and ‘School’)
- Residential: 251 (includes One Family Residence, Two to Five Family Residence, Apartments, Estate, Residential Buildings on Leased Land, Residential Condominium, Time-Shared Condominium – Deeded, Mobile Home)
- Commercial: 10 (includes Commercial I, Commercial II, Commercial Condominium, Commercial Building on Leased Land)
- Mixed Use: 1 (Combination)
- Industrial: 1 (Industrial, Industrial Buildings on Leased land, Industrial Condominium)
- Vacant: 63 (Residential, Commercial and Industrial Vacant Land, Farm Forest and Open Space)
- State: 15 (State)
- Farm/Open Space: 13 (Farm, Vote of City)
- Seasonal/Beach: 21 (Seasonal and Beach Property)
- Federal: 2 (Federal)
- Other: 63 (Other Improved Land, Church, Ex-Charter)

Critical Facilities affected:

- Mt. Hope Bridge
- Silver Creek Bridge
- Silver Creek Manor
- Mill Pond Bridge
- Town Bridge

Critical Infrastructure affected:

- Hope Street (multiple segments)
- Washington St./Hope St./Thames St. intersection
- Colt Drive (north along Asylum Rd.)
- Thames St. (at High St. intersection)
- Poppasquash Road (multiple segments)
- Smith Street
- Hope/Washington RIPTA stop
- Prudence Island Ferry Terminal
- USCG Bristol
- East Bay Bike Path (multiple segments)

**5-Foot Rise Scenario**

Below is a breakdown of the number of parcels (by land use type), critical facilities, and critical infrastructure impacted by a projected 5-foot rise in sea level:

Parcels affected: (592 Parcels Total)

- Public: 38 (includes ‘Municipal’ and ‘School’)

- Residential: 315 (includes One Family Residence, Two to Five Family Residence, Apartments, Estate, Residential Buildings on Leased Land, Residential Condominium, Time-Shared Condominium – Deeded, Mobile Home)
- Commercial: 16 (includes Commercial I, Commercial II, Commercial Condominium, Commercial Building on Leased Land)
- Mixed Use: 6 (Combination)
- Industrial: 1 (Industrial, Industrial Buildings on Leased land, Industrial Condominium)
- Vacant: 85 (Residential, Commercial and Industrial Vacant Land, Farm Forest and Open Space)
- State: 18 (State)
- Farm/Open Space: 14 (Farm, Vote of City)
- Seasonal/Beach: 26 (Seasonal and Beach Property)
- Federal: 4 (Federal)
- Other: 69 (Other Improved Land, Church, Ex-Charter)

Critical Facilities affected:

- Mt. Hope Bridge
- Silver Creek Bridge
- Silver Creek Manor
- Mill Pond Bridge
- Town Bridge
- Bristol Fire Department (193 Thames St.)
- Tanyard Brook Crossing
- Silver Creek Pump Station

Critical Infrastructure affected:

- Hope Street (multiple segments)
- Washington St./Hope St./Thames St. intersection
- Colt Drive (north along Asylum Rd.)
- Coggeshall Farm Road (multiple segments)
- Thames St. (majority of Historic Downtown)
- Poppasquash Road (majority)
- Smith Street
- Perry Street/Monroe Avenue intersection
- Swift's Point/Harrison Street intersection
- Everette Street (between Spruce Lane and Sherman Ave.)
- Hope/Washington RIPTA stop
- Prudence Island Ferry Terminal
- USCG Bristol
- East Bay Bike Path (multiple segments)

## Probability of Future Occurrence of Flood-Related Hazards in Bristol

As new development and urbanization continues, increasing impervious surfaces, increasing the rate of drainage collection, and reducing the carrying capacity of the land, it is likely interior flooding and stormwater runoff events will also increase on a more frequent basis with even lower storm events. Until the Town completes the planned improvements within the Tanyard Brook and Silver Creek watersheds, and other projects in town, Bristol will likely continue to 'band-aid' these identified areas. Most evident in predictions of future flooding occurrences are the impacts due to rising sea levels and climate change. Considering the continuation of urbanization, increases in significant rain events (and timing of events - saturated ground levels), it should be expected that the coastal waters will continue to surge, at increasingly higher and likely historic flood levels/stages, and further exacerbating the rate of coastal erosion.

### 2.3.3 Winter-Related Hazards

Winter weather events can include heavy snows, ice, and extreme cold and can affect the entire Town of Bristol. Heavy snow can bring the community to a standstill by inhibiting mobility (transportation networks, pedestrian travel), knocking down trees and utility lines, and cause structural collapses in older buildings. Ice buildup can down utility lines and communication towers. The impacts of both events can cause indirect issues such as freezing/rupturing pipes from lack of heat, while also changing the ground's frost level, creating problems for underground infrastructure.

Table 2-7 below represents the various significant winter-related hazard events that have occurred in and around the Town of Bristol over time, utilizing NOAA's National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

*Table 2-7 Significant Winter-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
<i>Snow</i>			
	1/7/1994	over 7'	Roof collapse
	1/7/1996	1' to 2' (Blizzard of 96)	School and commercial closings; transportation interruption
	2/2/1996	6 to 8"	Transportation difficulties
	3/2/1996	6 to 11"	Numerous automobile accidents
	4/9/1996	up to 7"	Downed trees/lines; power outages
	1/11/1997	4 to 7"	Numerous automobile accidents
	3/31/1997	1 foot; 60 - 70 mph winds	Widespread power outages; transportation difficulties
	4/1/1997	near blizzard conditions	\$700,000 in damages snow removal/power restoration
	2/25/1999		
	3/15/1999	7 to 12"	Transportation difficulties; school/commercial closings

Hazard Type	Date	Level/Description	Damages
	2/18/2000	3 to 5"	Treacherous driving
	1/20/2001	up to 8"	Minor accidents
	12/5/2002	7" average	
	12/5/2003	10 to 20"	Major transportation disruption
	2/25/2005	8"	
	1/22/2005	21" ; 60 mph	Major winter storm; near blizzard conditions
	3/1/2005	6"	
	2/12/2006	9 to 14"	Blizzard-like conditions; \$70,000 in damages
	12/13/2007	12"	Major transportation disruption
	12/19/2008	10 to 11"	
	12/19/2009	8 to 21"	
	12/26/2010	6 to 10"	
	1/12/2011	7"	
	1/26/2011	9 to 10"	
	1/19/2012	3"	
	1/21/2012	9 to 10"	
	2/17/2013	3 to 4"	
	3/7/2013	6 to 7"	
	1/2/2014	6 to 9"	
	1/21/2014	6"	
	2/5/2014	6"	
	2/15/2014	6 to 8"	
<i>Blizzard</i>			
	2/8/2013	2 to 2.5 feet	Blizzard conditions
	1/25/2015	1.5 to 2 feet	Blizzard conditions
<i>Ice</i>			
	1/8/1994	1" thick, Interstate I-95	\$50,000 damage in RI; highway accidents; prolonged power loss
	1/31/1997	freezing rain	Numerous automobile accidents; 1 death

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

### Blizzards/Heavy Snow/Nor'easters

Winter storms often include natural hazards such as extreme winds, coastal erosion and flooding. Utility and power lines can break from the weight of snow or ice coupled with strong winds. This could put residents at risk of losing heat, electricity, and water (if using well water). Snow melting poses problems as well such as road flooding in low lying areas.

Although somewhat variable in distribution, northwest portions of Providence and Kent counties see heavier snowfall events with greater frequency compared to Bristol, Newport and Washington. Heavy snow affects the entire State, but the highest amounts occur in the northern and northwestern areas of the State. Typically, the impact and vulnerability of winter weather is measured in terms of the financial costs associated with preparing for, responding to, and recovering from the event. The Town uniformly continues to experience heavy snow and winter storms with greater frequency and severity, as reported by the National Climatic Data Center and indicated in Table 2-7. Near blizzard conditions experienced in late January 2015 has been the most significant snow event in Rhode Island since the February 2013 snow event, followed by the Blizzard of 1978. The Town is considered at high risk for heavy snow/winter storms.

### Ice Storms

Ice storms result from the accumulation of freezing rain, or rain that becomes super-cooled and freezes upon impact with cold surfaces. Most commonly, freezing rain occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. The Town of Bristol is uniformly susceptible to the impacts of ice storms.

Infrastructure (utility lines/power outages, roads, and bridges) are at great risk from ice storms. Based on the limited frequency and severity of ice storm events over time, as reported by the National Climatic Data Center and indicated in Table 2-7 (only two events), Bristol is considered to be at low risk of any future ice storm events.

### Extreme Cold

Extreme cold events often accompany winter storms, may be left in their wake, or occur without any associated storm activity, and can lead to hypothermia and frostbite. Extreme cold temperatures vary dependent on the normal climate of the region, however, Bristol can expected to be uniformly affected. For Rhode Island, extreme cold typically means temperatures below zero degrees Fahrenheit.

Extreme cold can adversely affect people - some more than others, infants and residents 65 years of age or more are especially vulnerable. Based on the limited frequency and severity of extreme cold events over time, as reported by the National Climatic Data Center and indicated in Table 2-7, Bristol is considered at low risk to extreme cold.

Since the 2010 plan, there have been 13 significant winter-related events impacting Bristol/Bristol County by way of heavy snow/blizzards (11 events).

### **Property at Risk from Winter-Related Hazards in Bristol**

New England experiences winter storms in more extreme ways than most of the rest of the country. The Town of Bristol receives between 36 inches to 72 inches of snow per year (high frequency), with a typically average snowfall around 42 inches. The most dangerous hazard associated with winter storms, as it concerns Bristol, is the possibility of citizens losing power due to downed trees and utility lines (loss of heat, electricity and water). Flooding caused by storm surge or blizzard conditions (medium frequency) where snow fall is too rapid to be cleared efficiently may cause the closure of Poppasquash Road, stranding residents and

businesses. Other minor hazards include flooding during snow melt and treacherous roadways due to ice (medium frequency) and snow.

### Probability of Future Occurrence of Winter-Related Events in Bristol

According to past history and climatic conditions, and the inability to predict extreme snow and temperature (very low frequency) events, it is likely that winter-related hazards (heavy snow) will continue to impact the Town to varying degrees.

### 2.3.4 Geologic-Related Hazards

For this Update, geologic-related events include earthquakes. Table 2-8 below represents the various significant geologic-related hazard events that have occurred in and around the Town of Bristol over time, utilizing NOAA’s National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

*Table 2-8 Significant Geologic-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
<i>Earthquakes</i>			
	1996		
	3/6/2002		

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

#### Earthquakes

An earthquake is the sudden release of strain energy in the Earth’s crust, resulting in energy waves that radiate outward from the earthquake source. The point on the Earth’s surface directly above the focus is called the earthquake epicenter. The severity of earthquake effects is dependent upon: magnitude of energy released; proximity to the epicenter; depth to the epicenter; duration; geologic characteristics; and, type of ground motion.

When earthquakes occur, much of the damage is a result of structures falling under the stress created by the ground movement. Another significant effect is damage to the public and private infrastructure (i.e. water service, communication lines, drainage system). Because earthquakes are highly localized it is difficult to assign regional boundaries that share the same relative degree of risk.

#### *Measuring the Intensity of an Earthquake*

An earthquake’s severity can be expressed in terms of intensity and magnitude. Intensity is defined by the observed effects of groundshaking on people, buildings, and the natural environment, which varies dependent upon the location of the observer with respect to the epicenter. Currently in the U.S., the Modified Mercalli (MMI) Intensity Scale is used to evaluate the effects of earthquakes – specifically, it describes how strongly an earthquake was felt at a particular location, Table 2-9 below. Magnitude is defined by the amount of seismic energy released at the hypocenter of the earthquake, based on the amplitude of the earthquake

waves recorded on seismographs (using the Richter Magnitude Scale, Table 2-10). Another measure of the relative strength of an earthquake is the expanse of area the shaking is noticed.

*Table 2-9 Modified Mercalli Intensity Scale*

Mercalli Intensity	Description
I	Felt by very few people, barely noticeable.
II	Felt by few people, especially on upper floors.
III	Noticeable indoors, especially on upper floors, but may not be recognized as an earthquake.
IV	Felt by many indoors, few outdoors. May feel like passing truck.
V	Felt by almost everyone, people have trouble standing. Small objects move, trees and poles may shake.
VI	Felt by everyone, people have trouble standing. Heavy furniture can move, plaster can fall off walls. Chimneys may be slightly damaged.
Mercalli Intensity	Description
VII	People have difficulty standing. Drivers feel cars shaking. Some furniture breaks. Loose bricks fall from buildings. Damage is slight to moderate in well-built buildings; considerable in poorly built buildings.
VIII	Buildings suffer slight damage if well-built; severe damage if poorly built. Some walls collapse.
IX	Considerable damage to specially built structures; buildings shift off their foundations. The ground cracks. Landslides may occur.
X	Most buildings and their foundations are destroyed. Some bridges are destroyed. Dams are seriously damaged. Large landslides occur. Water is thrown on the banks of canals, rivers, lakes. The ground cracks in large areas.
XI	Most buildings collapse. Some bridges are destroyed. Large cracks appear in the ground. Underground pipelines are destroyed.
XII	Almost everything is destroyed. Objects are thrown into the air. The ground moves in waves or ripples. Large amounts of rock may move.

Source: USGS, 2012.

*Table 2-10 Richter Magnitude Scale*

Richter Magnitude	Earthquake Effects
2.5 or less	Not felt or felt mildly near the epicenter, but can be recorded by seismographs
2.5 to 5.4	Often felt, but only causes minor damage
5.5 to 6.0	Slight damage to buildings and other structures
6.1 to 6.9	May cause a lot of damage in very populated areas
7.0 to 7.9	Major earthquake; serious damage
8.0 or greater	Great earthquake; can totally destroy communities near the epicenter

Source: USGS, 2012.

These need to be further evaluated, but for the present the area of potential earthquake damage appears to be essentially along the harbor front according to resident expert Dr. Patrick J. Barosh. A minor earthquake occurred in Bristol in 1996 and there was no damage reported. On March 6, 2002 another minor earthquake was felt in the southern part of Bristol. The faults in this area are shallower and less powerful than those in other parts of the country. Bristol is a seismic source zone VII according to the ‘Map of New England and adjacent areas showing seismic source zones and their maximum expected epicentral intensity’ (modified from Krinitzsky, 1986 and revised by Barosh, 1999) which is used by the U.S. Army Corps of Engineers.

Since the 2010 plan, there have been no significant geologic-related events impacting Bristol/Bristol County.

#### **Property at Risk from Geologic-Related Hazards in Bristol**

Bristol recently has been found to have some of the youngest exposed fault zones in New England exposed on the east side of Mount Hope and a zone of seismic activity is emerging from Swansea to Sakonnet. In addition, buildings that are most at risk from earthquakes are the old masonry buildings and older, large wooden structures scattered throughout the Town.

#### **Probability of Future Occurrence of Geologic-Related Hazards in Bristol**

New England is not considered to be a hot spot for earthquakes, especially when compared to the western United States. However, given the discovery of the youngest exposed fault zones, Bristol can likely expect shallower and less powerful earthquakes from time to time (high frequency).

### **2.3.5 Drought/Extreme Heat**

Drought is a temporary irregularity characterized by long durations of below normal precipitation. Drought occurs in virtually all climatic zones yet varies significantly from one region to another, due to its relationship to normal precipitation in that specific region. Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.

Drought can be defined or grouped by the following:

- Meteorological drought is a measure of departure of precipitation from normal, defined solely on the degree of dryness.
- Agricultural drought links various characteristics of meteorological (or hydrological) drought to agricultural impacts with a focus on precipitation shortages, differences between actual and potential evapo-transpiration, soil water deficits, reduced groundwater or reservoir levels, etc.
- Hydrological drought is associated with the effects of precipitation (including snowfall) shortfalls on surface or subsurface water supply and when water supplies are below normal.
- Socioeconomic drought is associated with the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought.

The Town of Bristol can expect to be uniformly affected by drought conditions. Table 2-II below represents the significant drought-related hazard events that have occurred in and around the Town of Bristol over time, utilizing NOAA's National Climatic Data Center (<http://www.ncdc.noaa.gov/>). All events are county wide (Bristol County), unless otherwise noted.

*Table 2-II Significant Drought-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
<i>Drought</i>			
	4/12/2012	half the normal precipitation reported	

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

Since the 2010 plan, there has been one significant drought-related event (2012) impacting Bristol/Bristol County which lasted 12 days causing rivers and streams to run at record low levels during the spring run-off season. The main impact was periods of very high fire danger.

#### Property at Risk from Drought-Related Hazards in Bristol

Past drought events in RI have affected the entire state. Summer dry spells, during which crops and lawns may require irrigation, are fairly common. Farmers can lose livestock or crops or pay substantially more to produce a year's crop. Water suppliers may lose income if they impose restrictions or face increased costs for developing alternate water supplies. In addition, Rhode Island relies heavily on tourism. Use restrictions on water dependent uses at beach communities, and restrictions on fishing and canoeing in rivers or on golf courses could reduce the appeal to visitors causing reduced revenues from tourism.<sup>11</sup>

#### Probability of Future Occurrence of Drought-Related Hazards in Bristol

Very few drought events have occurred in Bristol County. The most recent event in 2012 occurred without the need for any drought declaration due to the above normal precipitation which followed. For this update, Bristol is considered at low risk to future droughts.

<sup>11</sup> *Rhode Island 2014 Hazard Mitigation Plan Update*, Rhode Island Emergency Management Agency.

### 2.3.6 Wildfires

Wildfires are defined as any non-structure fire that occurs in the vegetative wildland, including grass, shrub, leaf litter/debris, and forested tree fuels. Most susceptible to the hazard are pitch pine, scrub oak, and oak forests – the most flammable vegetative fuels. Small wildfires are common throughout the State, especially when drought or near-drought conditions warrant, the potential for spreading wildfires is real. The State's Wildland Urban Interface (WUI) – the area where structures and human development meet and intermingle with undeveloped wildland, creates an environment in which fire can move readily between structural and vegetative fuels. The State's WUI includes the Intermix WUI – areas where housing and vegetation intermingle<sup>12</sup>, mapped in red as shown below (Figure 2 - 3) as part of the State's Hazard Mitigation Plan. Intermix WUI areas identified in Bristol include woodland portions of the Town, particularly, the southern portion of Poppasquash, the Mt. Hope Farm area, and the Town's open space land holdings north of the municipal golf course/Tupelo Street (including the recently-acquired Perry Farm).

*Figure 2- 3 RI Wildland Urban Interface Zones*



Source: SILVIS LAB 2010, Rhode Island 2014 Hazard Mitigation Plan Update, Rhode Island Emergency Management Agency.

The impact and vulnerability to wildfire is influenced by a variety of factors, such as land cover conditions, weather and the effectiveness of land management techniques. Suburban neighborhoods located at the WUI are very vulnerable to wildfire. Individual buildings may be more or less vulnerable to damage from wildfire based on factors such as the clear distance around the structure, and the structure's construction materials.

In April 2012 there was a significant brush fire that burned approximately six acres of woodlands on Poppasquash Point just south of Colt State Park. This fire brought to light the lack of water pressure and lack of fire hydrants in the area to fight this type of fire in an area of town with much wild vegetation interspersed with low density residential development.

---

<sup>12</sup> Radeloff, V.C., R.B. Hammer, S.I. Stewart, J.S. Fried, S.S. Holcomb, and J.F. McKeefry. 2005. The Wildland Urban Interface in the United states. *Ecological Applications* 15:799-805.

*Table 2-12 Significant Wildfire-Related Events, Bristol County*

Hazard Type	Date	Level/Description	Damages
Wildfires			
	4/2012		

Source: NOAA National Climatic Data Center, [www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

Since the 2010 plan, there has been one significant wildfire-related event (2012) impacting Bristol/Bristol County.

#### Property at Risk from Wildfire-Related Hazards in Bristol

Although Bristol is considered to be low risk for wildfires, wooded areas such as Mt. Hope (Metacom Avenue to the coast), the southern half of Poppasquash, and the Town's open space/conservation land holdings north of Tupelo Street should be monitored as the area is most susceptible to spreading fires due to lightning, compounded by limited vehicular access.

#### Probability of Future Occurrence of Fire Hazard in Bristol

In the future, the possibility of more frequent short-term drought associated with a changing climate could result in more frequent occurrence of wildfire, however, very few wildfire events have occurred in Bristol County. For this update, Bristol is considered at low risk to future wildfires.

## 2.4 Vulnerability

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. After identifying types and areas of risk, a vulnerability analysis can help to determine the gaps in the community. This section examines the vulnerability of the built environment, such as structures, utilities, roads, and bridges, as well as social and environmental vulnerability. A vulnerability analysis also estimates the number of people exposed to hazards, including elderly populations and concentrated populations. This also includes such things as whether the shelter capacity is sufficient for the affected population, and whether businesses are likely to face temporary closure due to natural disasters. Historical damages are often good indicators for current exposure and potential damage.

A vulnerability chart was developed based on the identification and profile of the natural hazards that have occurred throughout Bristol over time, as presented earlier in Section 2.3. Below, Table 2-13 Vulnerability Matrix 2016 Update describes the expected frequency of occurrence, and the potential severity of the damage resulting from each individual hazard evaluated for this update. Coordination with the State Plan was also a consideration in the development of the updated Vulnerability Matrix.

*Table 2 - 13 Vulnerability Matrix 2016 Update*

Hazard	Frequency	Severity
Flood-Related Hazards	Medium	Serious/Extensive
Winter-Related Hazards	Low/Medium	Minor/Serious
Wind-Related Hazards	Medium/High	Serious/Extensive
Geologic-Related Hazards	High	Minor
Drought-Related Hazards	Low	Minor
Extreme Heat-Related Hazards	Low	Serious
Wildfire-Related Hazards	Low	Minor

### 2.4.1 Development Trends

Since the 2010 plan, (the date of the last approved plan), Bristol’s vulnerability to natural disasters has not significantly changed. In fact, new developments are in compliance with the updated State building codes and storm water standards.

#### Residential Development Trends

As of the 2010 census, Bristol has a population of 22,954 with 8,511 residential dwellings and a total of 9,015 housing units. The number of households increased 2.3% over the 2000 census. The Town issued approximately 15 building permits per year for new residential construction over the past five years. The majority of building permits issued have been for single-family dwellings. Population increased 2.1% between 2000 and 2010, while the number of households increased 2.3%. The off-campus student population of Roger Williams University also contributes to the number of households. Of the total residential units, 62.7% are renter occupied units and 30% are renter occupied. The majority of housing units in Bristol (62.1%) are single-unit detached (i.e. a typical single-family home); however, there are a number of 2 family and multi-family structures.

#### Commercial and Industrial Development Trends

Buildings in town can be categorized as follows: 70% residential; 20% commercial; and 10% industrial. Bristol has a historic waterfront downtown comprised of mixed use commercial and residential buildings.

In the past decade, new commercial development has been constructed on vacant land in Bristol or occurred through redevelopment, reuse or additions to existing commercial buildings. The newest additions include Bank 5, Dunkin Donuts, and Riley Kitchen & Bath on Metacom Avenue. A large downtown redevelopment project, the former Belvedere Hotel is being redeveloped into mixed-use condominiums. First begun in 2008, this project is currently in design for phase III, including a large mixed-use building at Thames and State Streets. In addition, industrial facilities for boat building and related industries have been developed in the East Bay Industrial Park and along nearby Tupelo Street, including the Tupelo Cove.

### Roger Williams University Development

Roger Williams University has continued to expand on their campus at Ferry Road and Metacom Avenue under the Educational Institutional Master Plan process. Recent improvements include a new sailing center and waterfront facilities. It is noted that the University's vision for the campus is to keep it pedestrian oriented with walkways and green space through the center of campus keeping parking lots on the north and south edges.

### Natural, Historic and Cultural Development Trends

The Town's commitment to open space preservation has led to the preservation of nearly 100 acres of land over the last five years. Preservation of the Fales Farm and Pagano Farm properties by conservation easement preserves 53 acres of active farm land located east of Metacom Avenue. These properties are important, not only for the open space, but also for the agricultural and cultural significance of these properties. Approximately 40 acres of woodlands and meadow open space property acquired by the Town in the north-central portion of town expands the Perry Farm Conservation Area to nearly 100 acres of preserved public open.

In 2006, and again in 2013, the Town passed a bond referendum to acquire and preserve open space parcels. The Town also established an Open Space Committee to develop an open space plan and a system to prioritize the properties being considered which includes a rank for amount of flood prevention achieved. Consistent with the goals for preservation, the Town rezoned a number of significant public open space parcels from either business or residential zones to the Open Space zone.

### Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. The Town is presently assessing the feasibility of a Stormwater Management Utility District which will consider the development of 'criteria' relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions. The Town recently completed the retrofit of the Town Beach parking lot (Clean Water Severe Repetitive Flood Loss loan/RIDEM 319 grant) with the Guiteras School property and the Bristol Police Department site as the next scheduled retrofits.

## **2.4.2 Economic Vulnerability**

### NFIP-Insured Property Damage

As seen in Table 2-14, FEMA estimated that the value of property insured by the NFIP in Bristol is over \$140 million as of September 1, 2014 (RI State Floodplain Coordinator). There are now twelve residential properties that have experienced repetitive loss damages. According to the State Floodplain Coordinator and since the 2010 plan, there have been several repetitive loss claims totaling just over \$285,000 in payments, town-wide.

*Table 2-14 Summary of National Flood Insurance Program Activity in Bristol, RI*

Total Policies	Coverage Value	Policies in V-Zone*	Policies in A-Zone*	Claims Since 1978
542	\$140,120,900	83	294	137

Source: FEMA, NFIP, Loss Statistics from January 1, 1978 through September 1, 2014.

\*V-zone refers to the velocity zone, where waves greater than 2.9 feet are feasible during a 100-year flood. A-zone refers to other areas within the 100-year flood zone with less than 2.9-foot waves (FEMA, 1997).

The majority of the NFIP insured properties are located along the coast, along with several interior low-lying commercial and residential areas vulnerable to flooding from stormwater collection deficiencies.

### Impacts of FEMA Flood Zones

As the second highest risk to the community, HW performed an analysis to estimate the total land and building values within the coastal and inland flooding areas. The number and types of residential, commercial, industrial, and publicly-owned structures are described earlier in Section 2.3.2 and quantified in Table 2-14 Total Vulnerability FEMA Flood Zones Summary, Bristol, RI. All flood zone data presented is based on the FEMA Flood Insurance Rate Maps (FIRMs) as revised through 2014.

There are approximately 1,204 residential structures located within the coastal and inland flood hazard areas. There are also approximately 62 commercial properties and 194 publicly-owned properties including both natural and recreational assets such as area beaches and critical infrastructure including several bridges (Mt. Hope and Mill Pond), four wastewater pumping stations (Mt. Hope, Silver Creek, Constitution, and Ferry Road), Two schools (Roger Williams University and Guiteras School), a fire station (193 Thames Street), and the sea wall along Poppasquash Road.

### Impacts of Sea Level Rise

Concerns for the accelerated rate sea level rise in Rhode Island, and impacts for coastal areas, HW performed a second analysis to estimate the total land and building values across the range of projected sea level rise scenarios for Rhode Island. The number and types of residential, commercial, industrial, and publicly-owned structures are described earlier in Section 2.3.2 and quantified in Table 2-15 Total Vulnerability Sea Level Rise Summary, Bristol, RI. All sea level rise scenario projections presented is based on a "modified bathtub" coastal inundation analyses conducted by the NOAA Coastal Services Center and the RI Division of Planning, available at: <http://www.edc.uri.edu/rigis/data/data.aspx?ISO=planningCadastre>, and depicted in Map A-5 Sea Level Rise.

There are approximately 747 residential structures located within the range of projected sea level rise scenarios. There are also approximately 33 commercial properties and 90 publicly-owned properties including both natural and recreational assets such as the East Bay Bike Path and critical infrastructure including several bridges (Mt. Hope, Mill Pond, and Silver Creek), several wastewater pumping stations, the Prudence Island Ferry Terminal and U.S. Coast Guard, Bristol - Aids to Navigation Team (ANT).

Table 2-15 Total Vulnerability FEMA Flood Zone Summary Bristol, RI

Land Use	No. of Parcels Impacted	Approximate Land Value	Approximate Building Value	Approximate "Other" Value	Approximate Total Value
<b>0.2% Annual Chance</b>					
Public	13	\$4,100,679	\$3,564,500	\$576,300	\$8,241,479
Residential	371	\$83,892,600	\$78,615,100	\$1,720,700	\$164,228,400
Commercial	16	\$4,362,100	\$7,174,000	\$690,200	\$12,226,300
Mixed Use	14	\$2,835,900	\$3,210,600	\$22,400	\$6,068,900
Industrial	1	\$132,200	\$307,100	\$0	\$439,300
Vacant	79	\$11,277,310	\$456,800	\$329,600	\$12,063,710
State	18	\$26,824,440	\$2,702,800	\$303,600	\$29,830,840
Farm/Open Space	15	\$7,827,188	\$2,890,500	\$213,100	\$10,930,788
Seasonal/Beach	9	\$1,208,600	\$494,100	\$900	\$1,703,600
Federal	1	\$280,800	\$0	\$0	\$280,800
Other	35	\$22,808,227	\$23,346,000	\$447,800	\$46,602,027
<b>Total</b>	<b>572</b>	<b>\$165,550,044</b>	<b>\$122,761,500</b>	<b>\$4,304,600</b>	<b>\$292,616,144</b>
<b>1% Annual Chance</b>					
Public	149	\$9,140,924	\$16,193,900	\$6,864,400	\$32,199,224
Residential	560	\$135,246,800	\$106,882,000	\$3,007,700	\$245,136,500
Commercial	28	\$8,095,600	\$23,360,000	\$888,100	\$32,343,700
Mixed Use	11	\$2,326,600	\$2,150,100	\$13,100	\$4,489,800
Industrial	2	\$802,800	\$4,255,100	\$0	\$5,057,900
Vacant	169	\$24,153,227	\$363,000	\$415,300	\$24,931,527
State	30	\$37,946,932	\$5,364,200	\$608,200	\$43,919,332
Farm/Open Space	5	\$2,009,189	\$1,682,800	\$145,200	\$3,837,189
Seasonal/Beach	38	\$9,418,100	\$2,194,900	\$100,000	\$11,713,000
Federal	4	\$1,675,600	\$493,300	\$1,800	\$2,170,700
Other	77	\$1,902,500	\$2,550,300	\$252,700	\$4,705,500
<b>Total</b>	<b>1073</b>	<b>\$232,718,272</b>	<b>\$165,489,600</b>	<b>\$12,296,500</b>	<b>\$410,504,372</b>
<b>VE Zone</b>					
Public	32	\$3,299,100	\$2,515,500	\$673,800	\$6,488,400
Residential	273	\$2,718,500	\$2,989,900	\$323,200	\$6,031,600
Commercial	18	\$9,868,100	\$26,278,800	\$488,000	\$36,634,900
Mixed Use	5	\$1,322,900	\$1,021,000	\$13,100	\$2,357,000
Industrial	2	\$1,341,200	\$7,896,000	\$0	\$9,237,200
Vacant	54	\$25,716,748	\$206,600	\$249,700	\$26,173,048
State	13	\$20,263,340	\$12,919,100	\$499,200	\$33,681,640
Farm/Open Space	13	\$6,983,485	\$2,219,900	\$157,400	\$9,360,785
Seasonal/Beach	10	\$3,285,200	\$651,600	\$62,100	\$3,998,900
Federal	6	\$2,607,700	\$493,300	\$1,800	\$3,102,800
Other	75	\$41,645,527	\$135,941,700	\$906,500	\$178,493,727
<b>Total</b>	<b>501</b>	<b>\$119,051,800</b>	<b>\$193,133,400</b>	<b>\$3,374,800</b>	<b>\$315,560,000</b>

Source: Bristol Tax Assessor CAMA data, Rhode Island Property Tax Use Code (2003)

*Table 2-16 Total Vulnerability Sea Level Rise Summary Bristol, RI*

Land Use	No. of Parcels Impacted	Approximate Land Value	Approximate Building Value	Approximate "Other" Value	Approximate Total Value
<b>1-Foot SLR</b>					
Public	21	\$5,747,410	\$2,859,700	\$2,045,100	\$10,652,210
Residential	181	\$137,904,600	\$67,211,400	\$2,588,900	\$207,704,900
Commercial	7	\$4,900,800	\$14,748,000	\$374,000	\$20,022,800
Mixed Use	0	\$0	\$0	\$0	\$0
Industrial	1	\$670,600	\$3,948,000	\$0	\$4,618,600
Vacant	52	\$19,598,248	\$206,600	\$29,600	\$19,834,448
State	13	\$20,779,040	\$12,959,000	\$495,200	\$34,233,240
Farm/Open Space	13	\$4,344,685	\$1,619,600	\$61,500	\$6,025,785
Seasonal/Beach	12	\$4,184,000	\$644,700	\$63,100	\$4,891,800
Federal	2	\$932,100	\$0	\$0	\$932,100
Other	53	\$35,413,927	\$128,129,600	\$735,200	\$164,278,727
<b>Total</b>	<b>355</b>	<b>\$234,475,410</b>	<b>\$232,326,600</b>	<b>\$6,392,600</b>	<b>\$473,194,610</b>
<b>3-Foot SLR</b>					
Public	31	\$6,472,962	\$3,276,500	\$2,057,200	\$11,806,662
Residential	251	\$168,644,000	\$84,196,400	\$3,463,900	\$256,304,300
Commercial	10	\$5,784,800	\$15,254,600	\$409,200	\$21,448,600
Mixed Use	1	\$286,300	\$182,700	\$11,600	\$480,600
Industrial	1	\$670,600	\$3,948,000	\$0	\$4,618,600
Vacant	63	\$20,321,048	\$206,600	\$43,000	\$20,570,648
State	15	\$21,536,940	\$12,959,000	\$496,600	\$34,992,540
Farm/Open Space	13	\$4,344,685	\$1,619,600	\$61,500	\$6,025,785
Seasonal/Beach	21	\$6,293,300	\$1,267,400	\$63,700	\$7,624,400
Federal	2	\$932,100	\$0	\$0	\$932,100
Other	63	\$36,806,727	\$128,129,600	\$893,700	\$165,830,027
<b>Total</b>	<b>471</b>	<b>\$272,093,462</b>	<b>\$251,040,400</b>	<b>\$7,500,400</b>	<b>\$530,634,262</b>
<b>5-Foot SLR</b>					
Public	38	\$6,996,431	\$3,371,600	\$2,123,100	\$12,491,131
Residential	315	\$183,693,900	\$93,936,900	\$3,531,300	\$281,162,100
Commercial	16	\$7,507,700	\$17,702,200	\$488,000	\$25,697,900
Mixed Use	6	\$1,445,800	\$1,176,200	\$13,100	\$2,635,100
Industrial	1	\$670,600	\$3,948,000	\$0	\$4,618,600
Vacant	85	\$24,190,348	\$206,600	\$276,400	\$24,673,348
State	18	\$22,667,240	\$12,959,000	\$496,600	\$36,122,840
Farm/Open Space	14	\$7,429,385	\$2,890,500	\$165,500	\$10,485,385
Seasonal/Beach	26	\$7,115,900	\$1,573,300	\$70,000	\$8,759,200
Federal	4	\$1,766,600	\$493,300	\$1,800	\$2,261,700
Other	69	\$37,760,327	\$130,142,900	\$928,700	\$168,831,927
<b>Total</b>	<b>592</b>	<b>\$301,244,231</b>	<b>\$268,400,500</b>	<b>\$8,094,500</b>	<b>\$577,739,231</b>

Source: Bristol Tax Assessor CAMA data, Rhode Island Property Tax Use Code (2003)

### Impacts of Business Interruption

Notwithstanding the obvious costs of commercial property damage, the impacts of potential business interruption from a natural disaster in Bristol cannot be under estimated. Business closures result in a reduction of revenues to proprietors and a loss of wages to employees. In addition, State and local tax revenues can be significantly reduced. In addition to the costs of commercial property damage, the impacts from potential business interruption following a disaster in Bristol could have long-lasting effects on the local economy, quality of life, and sense of place that has been maintained and revered for generations.

### 2.4.3 Social Vulnerability

A critical step in assessing risk and vulnerability of Bristol to natural hazards is to identify the links between the potential destructive impacts to the built and natural environments and that relationship to the social structure. The social assets/potential losses continue to be key components of the community and include the closure of institutions, loss of vital services (communication and transportation systems), and disruption in the movement of goods and services, and emotional strain from financial and physical losses.

The vulnerability of a community obviously includes the potential for direct damage to residential, commercial and industrial property, as well as, schools, government and critical facilities. However, it also includes the potential for disruption of communication and transportation following disasters. Any disruption to the infrastructure, such as a loss of electric power or break in gas lines, can interrupt businesses and cause stress to affected families. This is especially the case where residents are forced to evacuate their homes and become subject to shortages of basic supplies.

### Public Infrastructure and Emergency Life Lines

There are several public buildings/structures located in the flood plain. In addition to potential structural damage, the access roads for these buildings could also flood during a storm. There are also several high-risk bridges that have utilities running underneath them which have been flooded or washed out in prior hurricanes.

- Wastewater Treatment Plant on Plant Avenue is in the floodplain of the Tanyard Brook and is also in an area of poor drainage. If this building becomes inoperable, there are public health issues and potential pollution to adjacent waterways. In addition to the main treatment plant, there are five sewer pump stations located in flood plains, with the same public health and potential pollution issues if these facilities become inoperable.
- Town Bridge (Route 114) at Silver Creek, which has been flooded in the past, now carries water and sewer lines that service the northwest portion of Bristol. The residents of Bristol, and all the commercial businesses in that area, are vulnerable to destruction of this bridge and the water and sewer lines that run underneath it. Breaks in the sewer line would not only leave residents without sewage disposal, but would also result in raw sewage discharge into Silver Creek. This section of Route 114 was closed during the March 2010 storm event.
- The Bridges at Mill Gut Pond and Mill Pond are also susceptible to flooding. There are utility lines underneath these bridges that serve some of the homes on Poppasquash.

- Tanyard Brook runs under Hope Street (Route 114) and Wood Street, these are major roads with water and sewer lines. This section of Route 114 was closed during the March 2010 storm event.

### Historical and Cultural Resource Areas

Another component of the social vulnerability includes the long-standing 'sense of place' or cultural traditions associated with the Town of Bristol as a recreational boating/tourist community. Much of the Bristol Waterfront National Register District in downtown Bristol is located within the flood zone. A significant hurricane, with flooding, would impact many of the historic properties in this area. It is important to balance mitigation in a manner that is consistent with historical preservation policies and laws.

### Evacuation/Population at Risk

Bristol is shaped like a lobster claw and as such has two peninsulas that are surrounded by water on three sides. One of the peninsulas, the Poppasquash area of Bristol, has two egress roads, both of which are located in the velocity flood zone and are at risk for flooding and storm surge. While the structures in the Poppasquash area may not be subject to flooding, the residents are at risk since their evacuation may be impeded (the mapped Emergency Evacuation Route is identified on Map A-3 Critical Facilities). Those residents who remain in their homes are also at risk since emergency vehicles may not be able to reach them if the roads are washed out.

The use of mass care facilities during an emergency is dependent on a variety of circumstances. These include warning time, public awareness of the hazard, the level of encouragement from public officials and the availability of shelters. The Community Room at the Franklin Court Assisted Living Facility serves as the Town's primary shelter. The recently-acquired Quinta-Gamelin Community Center has been proposed as a secondary/alternate shelter, however, the site remains in need of a kitchen and retrofit for Americans with Disabilities Act (ADA) access.

Shelter use is not easily predicted because each emergency situation has different variables such as the length of the warning period, official encouragement of the evacuation, public awareness of the location and availability of shelter, and the severity of the approaching hazard. Shelter use may be higher in the winter, such as an ice storm, since homes would be without heat. Historically, shelter use has not been high since residents seek safety at the homes of friends or family or hotels/motels. Traditionally, there are large numbers of residents who would not use the shelters because they would not leave their pets. In 2014 the Town completed construction of a new animal shelter facility located off Minturn Farm Road. This facility has space to accommodate many pets during a natural disaster/evacuation, and may result in more residents evacuating their homes or using shelters when needed as they will not need to worry about leaving their pets behind.

The Silver Creek Manor nursing home is located in the floodplain, and thus, they have an agreement with the State to shelter their residents at the Veteran's Home on Metacom Avenue. Residents of Elder Care 1, Elder Care 2, and the Assisted Living at Franklin Court do not need to evacuate to the shelter since each of these facilities have their own generators to run necessary equipment if the electricity is out.

Hurricane evacuation notices should be released eight hours before the predicted landfall of a storm. This gives residents plenty of time to seek alternative places to stay rather than riding out the storm in public shelters, minimizing the shelter demand and opening spaces for those really in need.

In addition to mass care facilities, also identified on Map A-3 Critical Facilities, are the Health/Medical Facilities within the Town, including:

- Police Station
- Fire Station (s)
- Metacom Manor Health Center

Also identified as Critical Facilities are the Special Populations – Bristol Elderly, Special Needs/Disabled and Youth living independently or in group situations within the Town, including:

- Veteran's Home
- Sea Side Nursery School
- Storyland Preschool
- Our Lady of Mt. Carmel School
- Rockwell School
- Mt. Hope High School
- Colt Andrews School
- Reynolds School
- Byfield School
- Guiteras School
- Franklin Court Assisted Living
- Benjamin Church Manor
- Silver Creek Manor
- Bristol Senior Center

#### **2.4.4 Environmental Vulnerability**

Hurricanes, earthquakes, nor'easters, floods or any weather related hazard event will have particular impacts on the natural and built environment. Differences in storm size, speed of movement, wind speeds, storm surge heights, timing with respect to tides and landfall location relative to vulnerable resources makes for high variability in impacts and related costs.

When the natural environment is impacted there are both direct and indirect costs. Impacts of severe weather events to the natural environment include both direct (loss of habitat and salinization of land/ groundwater) and indirect costs (widespread inland damage to built environment, threats to ecosystems/ species, and contamination of potable water supply).

## 2.5 FEMA Disaster Grant Assistance

FEMA has provided the Town of Bristol with approximately \$244,650 in grant assistance in recent years for the following five disasters:

- Disaster Number: DR 1894  
Main Items for Funding Provided for:
  - Back-Flow Prevention Program (\$145,913)
- Disaster Number: DR 1894  
Main Items for Funding Provided for:
  - Flood Awareness Signage Program (\$18,750)
- Pre-Disaster Mitigation 2012  
Main Items for Funding Provided for:
  - Hazard Mitigation Plan Update (\$25,612.50)
- Pre-Disaster Mitigation 2013  
Main Items for Funding Provided for:
  - Elevating Utilities in the Downtown Naval Reserve Armory (\$54,375)
- Pre-Disaster Mitigation 2014  
Main Items for Funding Provided for:
  - Generator at Quinta Gamelin Community Center (\$66,750)

## Section 3 Capability Assessment

### 3.1 Introduction

The Capabilities Assessment section has been restructured to better document local, state, and federal department, agency and program capabilities in terms of pre- and post-disaster activities. It has been organized into three (3) main sections: Planning and Regulatory capabilities, Administrative and Technical capabilities, and Financial capabilities to better define the programs, policies, and funding opportunities each department or agency is implementing to reduce risk and work towards implementing hazard mitigation programs targeted at increased resiliency.

The Town of Bristol implements several hazard mitigation policies and procedures, current state laws, executive orders, and regulations to promote the safety of its residents and minimize risk to community assets. This section presents a brief description of each of the primary mitigation programs currently in place.

### 3.2 Planning and Regulatory Capabilities

#### Comprehensive Plan 2014

The Comprehensive Plan is a planning document that outlines goals, policies, issues and actions to provide a framework for growth within the Town. In 2014, the Town adopted an updated Comprehensive Plan, which includes many of the mitigation actions included in the 2010 Hazard Mitigation Plan, still relevant for this 2015 Update. Moving forward, the Town will integrate new mitigation actions from this 2015 Update into the next update of the Comprehensive Plan.

#### Land Use Element

- Action Item LU8 – Continue to protect the Silver Creek and Tanyard Brook Watersheds.
- Action Item LU9 – Implement the Silver Creek Watershed Drainage Study and the Recommended Tanyard Brook improvements.

#### Homes and Neighborhoods Element

- Goal 3/Policy C – The Town will pursue federal and/or state funds to purchase flood prone properties.
- Action Item H&N30 – Stress that residential and other development in any flood zone continue to be compliant with FEMA regulations, CRMC, DEM regulations and any Bristol Town flood hazard zone regulations.

#### Economic Development Element

- Action Item ED31 – In conjunction with the recommendations of the Town’s Hazard Mitigation Plan, consider public monies to assist in financing the demolition of some parts of the buildings along the waterfront that would make public access more feasible and reduce obstruction and bulk along the waterfront.

### Services and Facilities Element

- Action item SF6 – Move forward with the recommended for the Tanyard Brook and State Street Reservoir. Seek Federal and State grants to augment funding of this project to supplement the bond.

### Open Space, Conservation, and recreation Element

- Action Item OSCRII – Require Best Management Practices (BMPs) to preserve wetlands, flood plains, and other environmentally sensitive areas.

### Natural, Historical, and Cultural Element

- Action item NHC8 – Use federal, State, and local programs to purchase properties that are subject to frequent flood or storm damage.

### Open Space Plan 2008

The Open Space Plan is another planning document intended to advise the Town Council on open space preservation and acquisition efforts, act as a resource for other agencies with open space concerns, and advise the Planning Board on elements of the Comprehensive Plan. In June 2008, the Town adopted an updated Open Space Plan, which includes direct support for several mitigation actions included in the 2010 Hazard Mitigation Plan, still relevant for this 2015 Update:

### Flood Protection Services

As a public service (free of charge), the Building Official and/or the Director of Community Development provide residents and businesses owners (upon request) with the following information regarding flood protection:

- Whether a property appears to be in or out of the Special Flood Hazard Area (SFHA) as shown on the current FIRM of the Town.
- Additional flood insurance data for a site, such as the FIRM zone and the base flood elevation or depth, if shown on the FIRM.
- The Town has a handout on the flood insurance purchase requirement that can help people who need a mortgage or loan for a property in the SFHA.
- The Town has copies of completed FEMA Elevation Certificates for buildings built in the floodplain since 2004; and, for some buildings completed prior to that, as well.

### Flood Hazard Development Permit - Development Standards

In compliance with the requirements of the National Flood Insurance Act of 1968, the Town Council established a Flood Hazard Development Permit System and Review Procedures for development activities in the designated flood hazard areas of the Town. This system requires a Flood Hazard Permit prior to applying for a building permit in the areas of special flood hazard as identified by FEMA in the FIRM for the Town of Bristol. It also references Division 2 of Article IX of the Bristol Town Code of Ordinances, Sections 28-301 through 28-310 which includes additional floodplain management measures to ensure public safety; minimize hazards to persons and property from flooding; to protect watercourses from encroachment and to maintain capability of floodplains to retain and carry off floodwaters.

### Subdivision and Development Review Regulations, Amended 2009

The Town's Subdivision and Development Review Regulations provide for additional protections in the form of Environmental Impact Statements (EISs) for subdivisions and development projects. Article 6.6 Impact Statements - In accordance with R.I.G.L. 45-23-60(3), in order to make a positive finding that there will be no significant negative environmental impacts, the Planning Board may require that an environmental impact statement be prepared by the applicant of any subdivision or development project. Section A Environmental Impact Statement - (3) An EIS required under this section shall be prepared by a qualified professional(s) and shall include research and documentation describing and assessing short and long-term cumulative environmental impacts, which may include but not be limited to impacts upon: (b) Flooding and drainage.

Also, under Appendix F *Design and Construction Standards*, B(2)cii, to facilitate functional and attractive development, minimize adverse impacts, and to ensure that a project will be an asset to the community, the Regulations state: The following specific areas shall be preserved as undeveloped open space or lot area, to the extent consistent with the reasonable utilization of land; and in accordance with the applicable State or Town regulations: Undeveloped lands in the flood plain, especially velocity flood plain, as defined in Article XII of the Zoning Ordinance.

### Chapter 29 Soil Erosion, Runoff and Sediment Control Ordinance

The Town of Bristol has adopted regulations that provide detailed requirements for the submission of a soil erosion, runoff and sediment control plan for land disturbance of any existing vegetation, grades, or contours of land. This ordinance was adopted out of the findings that excessive quantities of soil are eroding from certain areas undergoing development for nonagricultural uses, such as storage/filling, housing developments, commercial construction, industrial areas, recreational facilities, and roads, as a direct result of poorly planned and implemented site grading and surface water runoff controls. These types of developments are required to submit a plan prepared by a professional engineer for approval and are subject to inspections during construction.

### Revised Phase II Stormwater Management Program Plan – September 2008

The Environmental Protection Agency's (EPA) Storm Water Phase II Final Rule is an effort to preserve, protect, and improve the Nation's water resources from polluted storm water runoff. The Rule determined there are six Minimum Control Measures which need to be addressed for the Phase II National Pollutant Discharge Elimination System (NPDES) by implementing Best Management Practices (BMPs) appropriate for Bristol's community, including:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

The Town acting through the Department of Public Works continues to utilize a variety of BMPs, identified by the EPA, to minimize pollutant loads into the local waterways and water bodies.

### Rhode Island Climate Change Commission November 2012 Report

The Rhode Island Climate Change Commission, recognizing there is a lot of change coming with impacts to the State's natural resources and infrastructure, worked with a range of stakeholders from Rhode Island's public and private sectors, including environmental researchers and advocacy representatives and State and local housing organizations, and released its November 2012 report. The Report is a summary of the risks of climate change to the state, including points of weakness in infrastructure – critical for State and local officials to make thoughtful and informed policy decisions.

### Rhode Island Sea Grant Fact Sheets/Climate Change Science Summary

Rhode Island Sea Grant, collaborating with scientists from the University of Rhode Island and other institutions, continue to better understand the science and policy implications of climate change. Recognized as a leader within the State, and region overall, RI Sea Grant provides assistance to decision makers at both the State and local level regarding vulnerability and risk reduction. Specifically, RI Sea Grant has developed fact sheets to highlight impacts to the built environment, public health and welfare, and natural resources which include: *Precipitation and Storms in Rhode Island: Trends and Impacts*; and *Sea Level Rise in Rhode Island: Trends and Impacts*. RI Sea Grant has also developed the climate change science summary: *Climate Change: Rhode Island's Coasts*, while also gathering additional climate data by conducting two municipal projects in North Kingstown and Newport.

### Adapting to Climate Change: A Planning Guide for State Coastal Managers, National Oceanographic and Atmospheric Administration (NOAA)

Federal resources such as the National Oceanographic and Atmospheric Administration (NOAA) Office of Ocean and Coastal Resource Management and the United States Geological Survey (USGS) continue to provide guidance on adaptation planning for states. In particular, NOAA's *Adapting to Climate Change: A Planning Guide for State Coastal Managers* is a valuable resource relative to the proximity of infrastructure adjacent to Rhode Island's coast.

### Storm Preparedness and Hazard Mitigation Plan, Bristol Harbormaster's Office

The individual boater is one of the primary harbor and shoreline users. As such, they warrant special attention. The Storm Preparedness and Hazard Mitigation Plan developed by the Harbormaster's Office in May of 2004 include some basic steps to be taken before a storm strikes. The primary goal for the plan is to prevent the loss of life and property by:

- Properly preparing for storm events;
- Having a completed and enforceable response and recovery plan;
- Working in cooperation with harbor and shoreline users to ensure that a coordinated approach is applied to hazard mitigation;
- Integrating harbor hazard mitigation activities with other, ongoing, local hazard mitigation programs; and

- Identifying and completing long term actions to redirect, interact with or avoid the hazard.

### Harbor Management Plan 2011

The Harbor Management Plan is a document which presents the community's goals, objectives and recommendations for guiding public and private use of the land and water of its harbor areas, and establishes an implementation program to achieve the desired outcomes. The plan is designed to be useful to the Town in determining their priorities for the management of the harbor, matching their goals with the vision of the harbor, and for obtaining funding for harbor programs and infrastructure improvements.

Bristol waters are utilized for a variety of purposes such as recreation, tourism, fishing, and commercial activities. Based on harbor issues and needs presented within the Plan, the following list of proposed Capital Improvements includes:

- State Street Dock
  - Sea wall repair
  - Improvements to parking area
  - Harbor walk
  - Pedestrian amenities
- State Street Boat Ramp
  - Transient slips and dredging (State Street North)
- Independence Park
  - Boat ramp
  - Improvements to parking area
  - Harbor walk
  - Pedestrian amenities
  - Dinghy rack
- Church Street Dock Extension
  - Docks
  - Transient slips
  - Dinghy dock
- Rights-of-way and neighborhood boat ramps
  - Clearing
  - Dinghy docks (Constitution Street)
  - Signage
  - Parking

### 3.3 Administrative and Technical Capabilities

#### Citizens Emergency Response Team (CERT)

The CERT program educates citizens about disaster preparedness for hazards that may affect there are and trains them in basic disaster response skills such as fire safety, light search and rescue, team organization and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others following an event when

professional responders are not immediately available to help, or by taking a more active role in emergency preparedness projects in the community.

### Coordination with Local Business Community

The Town has coordinated with the local business community during the preparation of this 2015 Update. The Bristol County Medical Center was provided a copy of the draft plan and offered an opportunity to comment. The Thames Street Landing development on Thames Street is located within the 100-year flood plain and velocity flood plain. They have provided a copy of their lease agreement and hazard mitigation strategy to use as a model for other local businesses in the Bristol downtown (See Appendix C). As a condition of the Town's approval for the project, the developers have agreed that the ground floor stores will not be leased to any businesses that would sell large objects such as appliances. These items would be difficult to get out of the store prior to the storm and would become projectiles during a flood event. The lease agreement provides a storage area, located out of the floodplain, for each of the stores.

Additionally, there is an arrangement with a local moving company to assist the store owners with transporting their goods to a safe and secure location until the storm event is over. This helps to reduce the amount of property lost and also allows the store owners to reopen their businesses quickly following an event.

### Coordination with Neighboring Municipalities

The Town of Bristol coordinates with the Town of Warren as evidenced by the former agreement with Warren to use the Kickemuit Middle School as a storm shelter. The Town will continue to coordinate with Warren on natural hazard mitigation planning, specifically evacuation plans.

### Coordination with Roger Williams University

The Town of Bristol regularly coordinates with Roger Williams University, as a primary stakeholder and population at-risk in Town. The Town will continue to coordinate with the University regarding future development plans and natural hazard mitigation planning.

### Municipal Administration and Staff

The Bristol Town Council, Planning Board, Bristol Local Hazard Mitigation Committee, and municipal officials all work well together to develop, implement and update policies and plans to promote the safety of its residents and minimize risk to the community.

The Building Official and Director of Community Development are educated on the current NFIP policies and ordinances, both are Certified Floodplain Managers (CFM). The Zoning Official/Planner works to prioritize the retrofit of paved parking areas with property owners within the Tanyard Brook and Silver Creek Watersheds. The Town received a grant through RIEMA for the design and installation of signage on Town-owned properties in the downtown and along roadways identified as critical flooding areas to alert residents and tourists or potential flood hazards. The Town also has a *Hurricane Disaster Information* pamphlet, developed in 2014 that includes information on hurricane season/past events, disaster supply kits, safety tips, shelter/emergency contacts and R.I. Special Needs Emergency Information registration.

Working in conjunction with FEMA, Save Bristol Harbor and the School Department currently perform water quality monitoring with Mt. Hope High School marine science students within Bristol Harbor and Silver Creek. This curriculum could be amended to include information on the risks of natural hazards along the shoreline with presentations in classrooms on a yearly basis by local and State Officials.

The Department of Water Pollution Control continues to work to reduce illegal connections of private sump pumps and floor drains that exacerbate heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being distributed. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations.

### **SafeWater RI: Ensuring Safe Water for Rhode Island's Future**

To help address the implications of climate change to drinking water utilities, the Rhode Island Department of Health, Office of Drinking Water Quality launched *SafeWater RI: Ensuring Safe Water for Rhode Island's Future*. The objective is to assess changing conditions including, temperature, precipitation patterns, sea level rise and storm surge and their potential impacts to drinking water infrastructure in Rhode Island. The project includes a desktop literature review of the following issues: the state of knowledge regarding climate change trends for the Northeast and specifically Rhode Island; potential climate change impacts of drinking water utilities; and, best practices used in adaptation strategies for drinking water utilities.

### **Coastal Resource Management Council's (CRMC) Section 145 Climate Change and Sea Level Rise Policy**

The CRMC has worked to implement climate change by adopting its Climate Change and Sea Level Rise policy as part of Section 145 through its Rhode Island Coastal Resources Management Plan, to prepare the State in its adaptation efforts and assist with coastal resiliency. As stated within Section 145, scientific observations and modeling indicate the State of Rhode Island can expect an increase in sea level rise of between three and five feet by the end of the century. The coastal monitoring work of Dr. Jon Boothroyd, coastal geologist at URI, has helped to provide the science needed to plan for future changes in the coastline and address coastal erosion. In addition to participating on several of the Climate Change Commission subcommittees, CRMC also adopted Shoreline Change maps in 2007, and has been working to develop the forthcoming Shoreline Change (Beach) SAMP – which focuses on obtaining the scientific data and information necessary to support policy decisions around coastal erosion and inundation events.

### **Rhode Island Coastal Property Guide: What Coastal Property Owners, Renters, Builders and Buyers Should Know About Rhode Island's Shoreline**

The University of Rhode Island Coastal Resources Center/Rhode Island Sea Grant compiled this guidance document for the Rhode Island Coastal Resources Council as a product of the Shoreline Change Special Area Management Plan, or Beach SAMP. It refers the reader to various

regulations and policies adopted by federal and state regulatory agencies and encourages the reader to review the specific regulation and policies.

### StormSmart Coasts Rhode Island

A web resource, the StormSmart Coasts Network is dedicated to helping decision makers in coastal communities address the challenges of storms, flooding, sea level rise, and climate change by providing a place to find and share the best resilience-related resources available, and provides tools for collaboration.

## 3.4 Financial Capabilities

### Federal/State Grant Opportunities

The Town, across all municipal departments, considers and pursues all applicable federal, state and local grant opportunities to assist in implementing hazard mitigation programs, such as FEMA, Housing and Urban Development (HUD) Community Development Block Grant (CDBG) Program, United States Department of Agriculture – Natural Resources Conservation Service (NRCS), U.S. Economic Development Administration (EDA), and Rhode Island Department of Environmental Management (RIDEM) opportunities.

FEMA Hazard Mitigation Assistance (HMA) Guidance, Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM) Program, Flood Mitigation Assistance (FMA) Program - Over the past several years, FEMA has provided the Town of Bristol with approximately \$244,650 in grant assistance from various projects (see Section 2.5 for additional details).

HUD CDBG Program - a flexible program that provides communities with resources to address a wide range of unique community development needs, particularly the Disaster Recovery Assistance Program which provides grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.

USDA NRCS – provides Conservation Technical Assistance, Financial Assistance, and Conservation Innovation Grant programs.

EDA - empowers distressed communities to revitalize, expand, and upgrade their physical infrastructure to attract new industry, encourage business expansion, diversify local economies, and generate or retain long-term, private sector jobs and investment.

RIDEM – provide up to 50% matching funds to municipalities, land trusts and non-profit land conservation organizations to preserve valuable open space in Rhode Island.

### Local/Capital Improvement Plan (CIP)

The Town regularly plans and budgets for both short- and long-term capital improvement projects through its CIP. The updated list of projects includes:

- Guiteras School Stormwater Improvements - \$90,000
- Prudence Ferry Dock Repairs - \$200,000

- Police Station Drainage Improvements - \$100,000
- Tanyard Brook Phase II - \$4,000,000
- Independence Park Master Plan - \$1,500,000

### Stormwater Management District

The Town of Bristol is currently evaluating the Town’s stormwater management issues and considering the development of an appropriate funding mechanism to support those needs in the form of a stormwater management district.

### 3.5 National Flood Insurance Program

Bristol implements and enforces the state building code and is fully participates in the NFIP. Bristol has supported natural resource management and protection which is articulated in the *Comprehensive Community Plan* and the *Open Space Plan*. Bristol has been active in protecting valuable natural open space, which can help minimize flood damage and has acquired flood plain and wetlands in the Tanyard Brook watershed and elsewhere. The Town has also adopted and incorporated the requirements from FEMA regarding development in the flood plain into the Zoning Ordinance and has updated the Subdivision and Development Review Regulations to address drainage and properties in the flood plain. The Building Official and Director of Community Development are educated on the current NFIP policies and ordinances; and both are Certified Floodplain Managers (CFM). Bristol understands that participation in the NFIP is an essential step in mitigation flood damage and is working to consistently enforce NFIP compliant policies in order to continue its participation in this program. FEMA has also developed new floodplain mapping for the Town which was finalized in July 2014. Along with the new flood plain mapping, the Town has adopted a companion Flood Zone Ordinance Update which was also adopted in July 2014.

Table 3-1 Actions for Continued Compliance with NFIP below lists those actions that the Town has done and will continue to do and those actions that will be done within the next five years for continued compliance with the NFIP. The “To Be Done actions” listed in the table that follows are listed in order of priority.

*Table 3-1 Actions for Continued Compliance with NFIP*

Actions (Listed in order of priority)	Done/Ongoing	To be Done
Join the NFIP.	X	
Participate in NFIP training by State and/or FEMA. Bristol is also a member of the RI Flood Mitigation Association and attends the annual conference.	X	
Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event.	X	
Address NFIP monitoring and compliance activities.	X	
Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in the community.	X	
Participate in the CRS.	X	

Actions (Listed in order of priority)	Done/Ongoing	To be Done
Prepare, distribute, or make available NFIP, insurance and building code explanatory pamphlets or booklets.	X	
Identify and become knowledgeable on non-compliant structures in the community.		X
Identify and become knowledgeable of submit to rate structures.		X
Identify cause of submit to rate structure and analyze how to prevent non-compliant structures in the future.		X
Inspect foundations at time of completion before framing to determine if lowest floor is at or above BFE.	X	
Require use of elevation certificates.	X	
Report any changes in the Special Flood hazard Area to FEMA within 180 days of change.		X
Identify and keep track of LOMA/LOMR in the community.	X	
Gain familiarity with community's Flood Insurance Rate Maps.	X	
Address repetitive loss structures.	X	

Source: Town of Bristol Community Development Department

### 3.6 Community Rating System (CRS)

CRS is a voluntary program that recognizes and encourages a community's efforts that exceed the NFIP minimum requirements for floodplain management. The CRS program emphasizes three goals:

- the reduction of flood losses
- facilitating accurate insurance rating
- promoting the awareness of flood insurance

By participating in the CRS program, communities can earn a 5-45% discount for flood insurance premiums based upon the activities that reduce the risk of flooding within the community.

In May 2013, the Town was entered into the Community Rating System (CRS) Program of the FEMA as a Class 8. The discount is currently 10% for all property owners in Town who purchase flood insurance. The Building Official and the Director of Community Development both became Certified Floodplain Managers (CFM) in 2013. The adoption of the Flood Zone Mapping and Ordinance allows the Town to continue to participate in the NFIP which means that all property owners in Town continue to be eligible to purchase flood insurance for their property.

CRS Goals/Actions for the Hazard Mitigation Plan update include:

- Continue participation in the CRS program
- Update the application and community efforts to the Town's classification, and in turn, increase the discount available from the CRS program
- Continue to participate in the NFIP
- Continue to maintain CFM accreditation for municipal staff who review flood hazard permits and development in the coastal/flood area

### **3.7 Existing Protection Matrix**

A summary of the main identified existing and future protection measures presented above are summarized on Table 3-2. These measures constitute the baseline protection that was further evaluated by the Bristol LHMC to determine gaps in Bristol's protection from natural disasters. Goal statements and specific actions were then developed to mitigate the identified gaps in the existing protection. These identified protection measures facilitate the Town of Bristol to implement various hazard mitigation programs, and ultimately making the community more resilient.

Table 3-2 Existing Protection Matrix, Bristol, Rhode Island

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<b>Planning and Regulatory</b>				
<b>Comprehensive Plan 2009</b>				
	The 2009 Plan includes many of the mitigation actions included in the 2010 Hazard Mitigation Plan, still relevant for this 2015 Update. Moving forward, the Town will integrate new mitigation actions from this 2015 Update in the next Comprehensive Plan Update.	Townwide	Effectiveness: Very Good Enforcement: Managed by Town Council and Town Administrator	Update concurrently with Hazard Mitigation Plan
<b>Open Space Plan 2008</b>				
	The 2008 Plan includes some of the mitigation actions regarding open space preservation and acquisition included in the 2010 Hazard Mitigation Plan, still relevant for this 2015 Update. Moving forward, the Town will integrate new mitigation actions from this 2015 Update in the next Open Space Plan Update.	Townwide	Effectiveness: Very Good Enforcement: Managed by Conservation Commission, Town Council, and Town Administrator	Update concurrently with Hazard Mitigation Plan
<b>Flood Protection Services</b>				
	As requested, the Building Official and/or Director of Community Development provide residents and business owners with information regarding properties located within the Special Flood Hazard area, flood insurance/Flood Insurance rate Maps (DFIRMs), and elevation certificates.	Properties located within Special Flood Hazard areas	Effectiveness: Very Good Enforcement: Managed by Building Inspector and/or Director of Community Development	Continue to Enforce
<b>Flood Hazard Development Permit/Development Standards</b>				
	A Flood Hazard Permit is required prior to Building permit application for properties located within Special Flood Hazard area identified on FEMA DFIRM.	Properties located within Special Flood Hazard areas	Effectiveness: Good Enforcement: Managed by Building Inspector and/or Director of Community Development	Continue to Enforce

Table 3-2 Existing Protection Matrix, Bristol, Rhode Island

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<b>Subdivision and Development Review Regulations</b>				
	Provide for additional protections by way of Environmental Impact Statements (EISs) by assessing short and long-term cumulative environmental impacts including flooding and drainage. Also regulates development in the flood plain, specifically within the velocity flood zone.	Townwide, specifically, coastal areas	Effectiveness: Good Enforcement: Planning Board, Building Inspector, and Director of Community Development	Continue to Enforce
<b>Chapter 29 Soil Erosion, Runoff and Sediment Control</b>				
	Regulations that require detailed data for the submission of a soil erosion, runoff and sediment control plan for land disturbance of any existing vegetation, grades, or contours of land.	Townwide	Effectiveness: Good Enforcement: Planning Board, Building Inspector, and Director of Community Development	Continue to Enforce
<b>Revised Phase II Stormwater Management Plan</b>				
	Utilizes Best Management Practices (BMPs) to address the six minimum control measures regarding NPDES program to minimize pollutant loads in local water ways/water bodies.	Townwide	Effectiveness: Very Good Enforcement: Managed by Department of Public Works	Continue to Enforce
<b>R.I. Climate Change Commission</b>				
	Commission has released its summary report of the risks of climate change to the state, including points of weakness in infrastructure.	Coastal and inland areas subject to inundation	Effectiveness: Good Enforcement: Across municipal officials/departments	Continue to Utilize
<b>R.I. Sea Grant Fact Sheets/Climate Change Science Summary</b>				
	Highlights impacts to the built environment, public health and welfare, and natural resources.	Coastal and inland areas subject to inundation	Effectiveness: Good Enforcement: Across municipal officials/departments	Continue to Utilize

Table 3-2 Existing Protection Matrix, Bristol, Rhode Island

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<b>Adapting to Climate Change: A Planning Guide for State Coastal Managers, NOAA</b>				
	Highlights guidance on adaptation planning to the built environment, public health and welfare, and natural resources.	Coastal and inland areas subject to inundation	Effectiveness: Good Enforcement: Across municipal officials/departments	Continue to Utilize
<b>Storm Preparedness and Hazard Mitigation Plan</b>				
	Bristol Harbormaster's Office developed this plan which includes basic steps to protect life and property on the water before a storm event strikes.	Waterfront/harbor areas	Effectiveness: Very Good Enforcement: Harbormaster	Continue to Utilize
<b>Harbor Management Plan</b>				
	Document which presents the community's goals and objectives for guiding public and private use of the land and water of its harbor areas, and establishes an implementation program to achieve the desired outcomes.	Waterfront/harbor areas	Effectiveness: Very Good Enforcement: Harbormaster	Continue to Enforce
<b>Administrative and Technical</b>				
<b>Citizens Emergency Response Team (CERT)</b>				
	Responds to all types of emergency situations (excluding medical, law enforcement) in Bristol.	Town of Bristol	Effectiveness: Very Good Enforcement: Managed by EMA Director and Town Administrator	Continue to Operate
<b>Coordination with Local Business Community</b>				
	Town regularly coordinates with local business community to provide basic lease agreements for businesses locating within the floodplain regarding merchandise sold/stored, and with a local moving company to relocate merchandise outside of the floodplain prior to an event.	Historic Downtown Waterfront District	Effectiveness: Very Good Enforcement: Department of Community Planning	Continue to Utilize

Table 3-2 Existing Protection Matrix, Bristol, Rhode Island

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<b>Coordination with Neighboring Municipalities</b>				
	Coordination to identify applicable efficiencies (resource-sharing, Mutual Aid agreements, evacuation plans).	Regional context	Effectiveness: Very Good Enforcement: EMA Director, Town Admin.	Maintain
<b>Coordination with Roger Williams University</b>				
	Coordination to understand future development plans, evacuation of at-risk population.	Roger Williams University	Effectiveness: Good Enforcement: Town Admin., Town Council	Maintain
<b>Municipal Administration and Staff</b>				
	Municipal officials, staff, Boards, and Commissions all work together to develop, implement and update policies and plans to promote the safety of residents and minimize risk to the community.	Townwide	Effectiveness: Very Good Enforcement: Town Administrator, Town Council, Municipal Staff	Maintain
<b>SafeWater RI: Ensuring Safe Water for Rhode Island's Future</b>				
	Assesses changing conditions such as temperature, precipitation patterns, sea level rise/storm surge and potential impacts to drinking water infrastructure.	Townwide	Effectiveness: Good Enforcement: Town Administrator	Continue to Utilize
<b>CRMC's Section 145 Climate Change and Sea Level Rise Policy</b>				
	CRMC implements climate change by adopting its Climate Change and Sea Level Rise policy as part of Section 145 to prepare the State in its adaptation efforts and assist with coastal resiliency.	Coastal areas	Effectiveness: Very Good Enforcement: Town Administrator, Planning Board, Director of Community Development	Continue to Implement
<b>R.I. Coastal Property Guide</b>				
	Refers the reader to various regulations and policies adopted by federal and state regulatory agencies and encourages the reader to review the specific regulation and policies.	Coastal areas	Effectiveness: Very Good Enforcement: Town Administrator, Planning Board, Director of Community Development	Continue to Utilize

Table 3-2 Existing Protection Matrix, Bristol, Rhode Island

Existing Protection	Description	Area Covered	Effectiveness and/or Enforcement	Improvements or Changes Needed
<b>StormSmart Coasts R.I.</b>				
	A web resource dedicated to helping decision makers in coastal communities address the challenges of storms, flooding, sea level rise, and climate change by providing a place to find and share the best resilience-related resources available.	Coastal areas	Effectiveness: Very Good Enforcement: Town Administrator, Planning Board, Director of Community Development	Continue to Utilize
<b>Financial</b>				
<b>Federal Funding Opportunities</b>				
	FEMA 2013 Hazard Mitigation Guidance, HMA Guidance, FEMA requirements regarding HMGP, PDM and FMA grants. <a href="http://www.fema.gov/media-library/assets/documents/33634?id=7851">http://www.fema.gov/media-library/assets/documents/33634?id=7851</a>	Townwide		Continue to utilize
	USDA, Natural Resources Conservation Service (NRCS) Conservation Technical Assistance: <a href="http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta">http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta</a> Financial Assistance: <a href="http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/">http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/</a> Conservation Innovation Grant Programs: <a href="http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs">http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs</a>	Townwide		Continue to utilize
	HUD CDBG Disaster Recovery Assistance: <a href="http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/drsi">http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/drsi</a>	Low-income areas.		Continue to utilize
<b>State Funding Opportunities</b>				
	R.I. State Hazard Mitigation Officer (SHMO) and State Mitigation Planners	Townwide		Continue to utilize
	2014 Rhode Island State Hazard Mitigation Plan	Townwide		Continue to utilize

*Table 3-2 Existing Protection Matrix, Bristol, Rhode Island*

<i>Existing Protection</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
<b>Local Funding Opportunities</b>				
	Bristol Capital Improvement Program	Townwide		Continue to utilize
	Stormwater Management District	Townwide		Continue to evaluate

## Section 4 Mitigation Strategy

### 4.1 Introduction

Removing and precluding development from hazardous areas is the best method of mitigation. However, this cannot be the sole focus of hazard mitigation in Bristol. The Town's character and functionality require a level of intimacy with the areas of greatest risk – hurricanes, heavy rain/urban flooding and coastal flooding/storm surge. The opportunity for preclusion has passed, as the Town is nearing buildout, and over 40 percent of the population currently resides in a floodplain (including homes in the 500-year floodplain). Furthermore, two of the most prevalent hazards, windstorms and snowstorms, are not easily delineated on the map. Consequently, Bristol's approach to mitigation is primarily comprised of:

- Informing citizens and business owners how to protect themselves, their property, and their livelihood (and providing resources for doing so whenever possible);
- Reinforcing and upgrading the Town's built environment and municipal systems;
- Incorporating hazard resilience into the provisions for land redevelopment, with special emphasis on post-disaster recovery and rebuilding; and,
- To the extent feasible, removing repetitively damaged structures from floodplains.

### 4.2 Mitigation Activities

In completing the risk and vulnerability analyses, the LHMC considered projects and actions that would reduce Bristol's vulnerability to the identified hazards. The updated 2016 Risk Assessment Matrix (Table 2-1) is the basis for the mitigation actions presented in Section 4.3.

### 4.3 Mitigation Action Plan

The LHMC considered the goals of this plan and re-prioritized the matrix and the associated actions based on historical damage, safety of the population, property protection and consistency with town-wide goals and objectives. After the 'Priority Score' for each mitigation action, the '2010 Plan Score' has been included to reflect any changes in the prioritization of actions for this 2016 Update by the LHMC. Issues and objectives were aligned to public health risks, evacuation and mass care considerations, disruption of essential services and potential economic losses to the town.

The LHMC determined that the identified objectives could be met by considering actions aligned to the following Mitigation Categories:

- Public Education and Awareness
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Planning and Prevention

The LHMC has worked to set goals and objectives that are bounded by a time frame and are compatible and consistent with state hazard mitigation goals. Upon submittal of this plan to RIEMA, the State Hazard Mitigation Committee (SHMC) is expected to review and approve these goals and objectives to ensure consistency with the statewide goals and objectives. The time frames used for this strategy are as follows:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

The following actions use the Risk Assessment Matrix (Table 2-1) to identify areas at risk, offer mitigation strategies and consider benefits. Each action offers a discussion of the project and if applicable, includes the options considered. Multiple actions associated with a vulnerable area reflect town priorities and are simply prioritized high, medium or low. If known, the actions include cost estimations and assign responsible parties to lead the efforts to complete the action. The cost ranges used for this strategy are as follows:

- Staff Time – municipal personnel time
- Minimal – less than \$5,000
- Moderate – more than \$5,000, but less than \$25,000
- Significant – over \$25,000

Other relevant departments/agencies that can offer support to the project are also listed. Finally, possible finance options are offered. **Once the 2016 Update receives FEMA’s ‘Approved Pending Adoption’, the mitigation strategy will be put into motion.**

### Evaluation/Selection of Mitigation Actions

After reviewing the Town’s identified risks and vulnerabilities to natural hazards, the input/feedback from the public workshop and recommendations from the Town, and the local Capability Assessment, the LHMC selected mitigation actions to incorporate into the 2016 Update.

### Prioritization of Actions

Due to budgetary constraints and other limitations, it is often impossible to implement all mitigation actions. The LHMC needed to select the most cost-effective actions for implementation first to use resources efficiently and develop a realistic approach toward mitigation risks. The Disaster Mitigation Act 2000 (DMA) supports this principle of cost-effectiveness by requiring action plans to follow a prioritization process that emphasizes benefits over costs. DMA 2000 states:

*“The mitigation strategy section shall include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.”*

### Part 1: Review Benefits and Costs

As part of the planning process, the LHMC utilized Review Tools 1, 2, and 3 associated with each action identified.

### Part 2 Prioritize Actions – Qualitative Method, Relative Score

The LHMC utilized Method B: Prioritization using STAPLEE and Relative Scores (see Appendix B – May 14, 2015 Bristol LHMC).

#### **STAPLEE Criteria**

1. **Social:** Is the action compatible with present and future local community needs and values?
2. **Technical:** Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
3. **Administrative:** Does the community have the administrative capacity to implement the action?
4. **Political:** Is there strong public support to implement and maintain the action?
5. **Legal:** Does the community have the legal authority to implement the action?
6. **Economic:** Is the action cost-effective?
7. **Environmental:** Does the action impact environmental resources, and is the impact positive, negative, or neutral?

### Part 3 Documentation of the Process

The Worksheets have been included in the Update, see Appendix B, to emphasize that a Benefit-Cost Review was employed when prioritizing actions.

Each of the mitigation actions were scored against each of the STAPLEE criteria outlined above with a numerical score. These numbers were then totaled and developed into an overall priority score. The ranking of the Priority Score is a guideline for when the Town should begin acting on the identified strategies, or actions.

The STAPLEE Method includes a cost-benefit review as part of the Mitigation Actions prioritization process. A more detailed cost-benefit analysis will be done, at the time of application, for those proposed Mitigation Actions that the Town applies for funding under the Pre-Disaster Grant Program and Hazard Mitigation Grant Program.

## **PUBLIC EDUCATION AND AWARENESS**

### **Action #1**

*Make residents aware of Emergency Response Plan*

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation.



Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new 'Code Red' program to receive alerts via phone, email, text, etc.

- Action Type: Planning, Pre-Disaster
- Priority Score: 22 (2010 Plan: 21)
- Lead: EMA Director
- Supporting: Town Administrator
- Time Frame: Short Term
- Financing Options: Town Budget
- Cost Estimate: Staff Time
- Benefit: Increased safety/institutional awareness of hazards, accelerated evacuation
- Vulnerable Area: Nursing Homes, elderly housing, and medical center

#### **Action #2**

##### *Designate Alternative Evacuation Route for the Poppasquash Area through Colt State Park*

The Town should seek an agreement from Rhode Island Department of Environmental Management for use of the service road from Poppasquash Road through Colt State Park as a designated evacuation route. This road is located to the west of the former Pearson house and is important for evacuation since it does not cross any waterbodies. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

- Action Type: Planning, Pre-Disaster
- Priority Score: 20 (2010 Plan: 15)
- Lead: Town Administrator
- Supporting: EMA Director, Colt State Park Director/RIDEM
- Time Frame: Medium Term
- Financing Options: Town Budget
- Cost Estimate: Staff Time
- Benefit: Increased safety/institutional awareness of hazards (including for tourists), accelerated evacuation, uninterrupted access for emergency vehicles/responders

- Vulnerable Area: Bridges subject to flooding and washout

### Action #3

#### Implement Mitigation Incentive Program

The Building Official will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual*, (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, *R.I. Coastal Properties Guide*, and other FEMA publications, as applicable.

In addition, the Town will promote and support enforcement of the latest policy revisions relative to climate change and sea level rise and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of Technical Bulletins), grant/loan sources, and insurance options.

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost-sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

- Action Type: Planning, Pre-Disaster
- Priority Score: 24 (2010 Plan: 19)
- Lead: Building Official
- Supporting: EMA Director, Director of Community Development, Downtown Bristol Merchant's Association, Chamber of Commerce
- Time Frame: Short Term
- Financing Options: Municipal Personnel Time
- Cost Estimate: Staff Time
- Benefit: Institutional awareness of hazards for contractors/homeowners, increased property protection
- Vulnerable Area: Coastal flooding of property

## **PROPERTY PROTECTION**

### Action #4

#### Prepare an "After the Storm Recovery" Plan for the Community

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consideration should be given to a 'Regional' approach.

Additional items for consideration as part of the Plan's development include the completion of *Community Assessments* and a *Recovery and Reconstruction Ordinance*. The Bristol Emergency Management Task Force/Certified Floodplain Manager (s) to develop a formalized protocol to complete Community Assessments after an event regarding the shutoff/reconnection of utilities, damage assessments/documentation and Certificate of Occupancy re-instatements. The Town to coordinate with CRMC and Statewide Planning to review the permitting process, develop and adopt an ordinance to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. Formalize the existing process, and also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.

- Action Type: Planning, Pre/Post-Disaster
- Priority Score: 21 (2010 Plan: New Action)
- Lead: Town Administrator
- Supporting: Building Inspector, EMA Director, Director of Community Development
- Time Frame: Medium Term
- Financing Options: Town Budget
- Cost Estimate: Minimal
- Benefit: Increased property protection, accelerated recovery, reduced losses/improved resiliency, community support of tax base
- Vulnerable Area: Residential homes

#### **Action #5**

##### *Acquire properties in the Special Flood Hazard and Repetitive Flood Loss Areas*

Bristol now includes 12 severe repetitive flood loss properties as well as properties subject to periodic flooding within the Tanyard Brook and Silver Creek watershed area. The Town will work with private homeowners in these areas and FEMA to identify an acquisition project (s), obtain approval by the State and FEMA, and seek funding to purchase the property. By purchasing these residential properties, the Town is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The buildings are either demolished or relocated, and the land is then restricted to open space, recreation, or wetlands in perpetuity.

- Action Type: Mitigation, Pre-Disaster/Post-Disaster
- Priority Score: 10 (2010 Plan: New Action)
- Lead: Director of Community Development
- Supporting: Town Council, Building Inspector, Town Administrator, Bristol Open Space Committee, Bristol Land Trust
- Time Frame: Long Term
- Financing Options: Town Budget, State/FEMA/Open Space grants
- Cost Estimate: Significant

- Benefit: Reduced losses/improved resiliency, satisfies other community objectives of additional open space, parks/recreation sites and/or scenic areas
- Vulnerable Area: Coastal flooding of property, Residential homes

#### **Action #6**

##### Preserve vacant open space within the coastal flood zones.

The Open Space Plan identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Conservation Commission as part of the Open Space Plan implementation, will seek to acquire parcels in risk areas as they become available for acquisition.

- Action Type: Mitigation, Pre-Disaster/Post-Disaster
- Priority Score: 10 (2010 Plan: 18)
- Lead: Director of Community Development
- Supporting: Town Council, Building Inspector, Town Administrator, Bristol Conservation Commission, Bristol Land Trust
- Time Frame: Long Term
- Financing Options: Town Budget, State/FEMA/Open Space grants
- Cost Estimate: Significant
- Benefit: Reduced losses/improved resiliency, satisfies other community objectives of additional open space, parks/recreation sites and/or scenic areas
- Vulnerable Area: Coastal flooding of property

#### **Action #7**

##### Develop a stand-alone Environmental and Historic Preservation Plan.

An Environmental and Historic Preservation Plan (EHP) will identify and mitigate potential loss to historic resources associated with natural disasters, primarily threats to sea level rise, subsidence and flooding, particularly in the Bristol Waterfront National Register District. By assessing the significance of cultural resources within the 100-year floodplain boundary and risk from flooding associated with those resources, planning for their preservation will enable the Town to better protect the architectural integrity of the downtown. As a first step, the Town will conduct a comprehensive vulnerability analysis of historic structures to include elevations and vulnerabilities within the first 5 years. The plan should articulate the potential re-use/rehabilitation/relocation potential for historic structures and at-risk properties within the floodplain.

In the past two years, the Town has acquired two properties in the downtown historic district along the west side of Thames Street, and is working with the state to study potential re-use/rehabilitation concepts. The Town now owns all properties from the State Street Dock to the Robin Rug building.

- Action Type: Planning, Pre-Disaster
- Priority Score: 19 (2010 Plan: New Action)
- Lead: Director of Community Development
- Supporting: Town Council, Town Administrator, Bristol Historic District Commission, Bristol Conservation Commission
- Time Frame: Medium Term
- Financing Options: Town Budget, State/FEMA/Certified Local Government (CLG) grants
- Cost Estimate: Moderate
- Benefit: Provides the balance necessary between historic preservation and mitigation, and serves as a resource for the Bristol Waterfront National Register District
- Vulnerable Area: Historic buildings

### Action #8

#### Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 10 (2010 Plan: 11)
- Lead: Town Administrator
- Supporting: Planning Board, National Grid
- Time Frame: Long Term
- Financing Options: FEMA grants
- Cost Estimate: Significant
- Benefit: Continuity of services, increased protection of property and life from downed utility lines, improved view corridors/vistas.
- Vulnerable Area: Tree Damage

### Action #9

#### Reinforce wire-to-pole connections

While Action #11 above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with “Hendrick’s Spacer Cables.” These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 7 (2010 Plan: 12)
- Lead: Town Administrator

- Supporting: National Grid
- Time Frame: Medium Term
- Financing Options: FEMA grants
- Cost Estimate: Moderate
- Benefit: Continuity of services, increased protection of property and life from downed utility lines
- Vulnerable Area: Tree damage

## **NATURAL RESOURCE PROTECTION**

### **Action #10**

#### Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. The Town is presently assessing the feasibility of a Stormwater Management Utility District which will consider the development of ‘criteria’ relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions. The Town recently completed the retrofit of the Town Beach parking lot (Clean Water Severe Repetitive Flood Loss loan/RIDEM 319 grant) with the Guiteras School property and the Bristol Police Department site as the next scheduled retrofits.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 20 (2010 Plan: 19)
- Lead: Department of Public Works
- Supporting: Town Council, Department of Community Development
- Time Frame: Short Term
- Financing Options: Town Budget, FEMA grants, private funds
- Cost Estimate: Moderate
- Benefit: Reduced flow/loading to the WWTF, increased infiltration onsite, increased property protection
- Vulnerable Area: Local roads subject to flooding, Inland flood areas

### **Action #11**

#### Develop Shoreline Management Plan

Develop a management plan for Bristol’s coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. As a first step, the Town will develop and prioritize a functional ‘retrofit program’ for dead-end streets that taper off into the water. Consideration should be given to a ‘Regional’ approach.

- Action Type: Planning, Pre-Disaster
- Priority Score: 23 (2010 Plan: New Action)
- Lead: Director of Community Development
- Supporting: Town Council, Town Administrator
- Time Frame: Medium Term
- Financing Options: Town Budget, State/FEMA grants
- Cost Estimate: Staff Time
- Benefit: Increased property/environmental resources protection, reduced losses/increased resiliency
- Vulnerable Area: Local roads subject to flooding

## **STRUCTURAL PROJECTS**

### **Action #12**

#### Public Information, Outreach – Signage

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 21 (2010 Plan: 21)
- Lead: Town Administrator
- Supporting: EMA Director
- Time Frame: Medium Term
- Financing Options: Town Budget
- Cost Estimate: Staff Time
- Benefit: Increased safety/institutional awareness of hazards (including for tourists), accelerated evacuation, uninterrupted access for emergency vehicles/responders
- Vulnerable Area: Local roads subject to flooding

### **Action #13**

#### Upgrade sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. The Town continues work currently underway in the Tanyard Brook area. The Downtown area has been completed (Franklin St. to the south/business area), while the Tanyard Brook area is currently underway (pilot program).

Due to the regulating agencies (RI DEM and EPA), the Town must project and plan for the future some ten to twenty years forward. The Town's operating permit is often the driving force dependent upon how stringent the parameters are. The Town has completed a pilot program to remove sump pump discharges in the eastern Annawamscutt Avenue area at the cost of \$1 million dollars, and is currently awaiting the collection of flow data from several rain events to determine the cost effectiveness of this project. The primary purpose for the project was EPA's mandate to reduce the amount of Inflow and Infiltration (I&I) experienced with storm events. Once the data has been collected and analyzed, the results will determine if the Town continues forward with similar projects, or if the EPA will request the construction of underground storage bypass areas.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 18 (2010 Plan: 16)
- Lead: Department of Water Pollution Control/Compost Facilities
- Supporting: Town Administrator, Town Council
- Time Frame: Medium Term
- Financing Options: Town Budget, State/FEMA grants, Impact fees
- Cost Estimate: \$3,000,000
- Benefit: Continuity of services, protection of infrastructure, reduced potential for pollutant loadings/environmental impacts, prevention of sewer surcharges/overflows/backups
- Vulnerable Area: Sanitary sewer lines

#### **Action #14**

##### Conduct drainage improvements at the Wastewater Treatment Facility

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result will also improve drainage along Fairview Drive.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 18 (2010 Plan: New Action)
- Lead: Department of Water Pollution Control/Compost Facilities
- Supporting: Town Administrator, Town Council
- Time Frame: Medium Term
- Financing Options: Town Budget, State/FEMA grants
- Cost Estimate: Significant
- Benefit: Continuity of services, protection of infrastructure, reduced potential for pollutant loadings/environmental impacts
- Vulnerable Area: Wastewater Treatment Facilities, Sewer pump stations

### Action #15

#### Inspect and secure the seawall along downtown coastal commercial facilities, as necessary

The stability of the seawall at Independence Park, Walley Beach, the Armory Building, and Prudence Island Ferry Dock should be evaluated. Retrofits should be made to withstand a 20-to 50-year storm, in addition to the impacts of projected sea level rise.

- Action Type: Mitigation, Pre/Post-Disaster
- Priority Score: 16 (2010 Plan: 17)
- Lead: Department of Public Works
- Supporting: R.I. Department of Transportation
- Time Frame: Long Term
- Financing Options: Town Budget, State/FEMA grants, RIDOT funding
- Cost Estimate: Significant
- Benefit: Increased property/recreational resources protection, reduced losses/increased resiliency
- Vulnerable Area: Sea walls

## EMERGENCY SERVICES

### Action #16

#### Establish fire lanes in the Mt. Hope area

Ensure emergency personnel can access people and property within the wooded areas of the Mt. Hope area.

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 24 (2010 Plan: New Action)
- Lead: EMA Director/Fire Chief
- Supporting: Town Administrator , Town Council, Property Owners
- Time Frame: Short Term
- Financing Options: Town Budget
- Cost Estimate: Staff Time
- Benefit: Increased protection of property and life, uninterrupted access
- Vulnerable Area: Access points within wooded areas

### Action #17

#### Upgrade the Quinta Gamelin Community Center to be shelter compliant

The Quinta-Gamelin Community Center has been proposed as a secondary shelter (outstanding needs include a functional kitchen and ADA access throughout the building).

- Action Type: Mitigation, Pre-Disaster
- Priority Score: 22 (2010 Plan: 21)

- Lead: EMA Director
- Supporting: Town Council, Town Administrator, Fire Chief, Police Chief
- Time Frame: Short Term
- Financing Options: Town Budget and FEMA grants
- Cost Estimate: Moderate
- Benefit: Secondary shelter location, protection of public health and safety
- Vulnerable Area: Emergency shelters

## **PLANNING AND PREVENTION**

### **Action #18**

#### Promote installation of a check valve/backflow preventer

Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town has adopted an ordinance which requires either sewer service connection at two-feet above lowest floor elevation (as per Plumbing Code) or requires installation of a check valve or backflow preventer between the building and the sewer collection system (applies to all building spaces constructed below the grade of the street).

- Action Type: Planning, Pre-Disaster
- Priority Score: 26 (2010 Plan: 19)
- Lead: Department of Water Pollution Control
- Supporting: Town Council, Department of Community Development
- Time Frame: Medium Term
- Financing Options: Town Budget and FEMA grants
- Cost Estimate: Minimal
- Benefit: Protection of property, uninterrupted services
- Vulnerable Area: Wastewater Treatment Facilities

### **Action #19**

#### Expand the implementation of the Backflow Retrofit Program

In 2011, the Town of Bristol received a \$145,913 grant from the FEMA Hazard Mitigation Grant Program (HMGP) for a sewage back-flow prevention project. The project was the first of its kind to be awarded in the State. The funds were used to retrofit existing properties that experienced sewage backups as a result of the flooding from the March 2010 floods. Under this grant the Town was able to help 38 property owners retrofit their existing sewer connections with internal or external check valves to prevent future sewage backups.

- Action Type: Planning, Pre-Disaster
- Priority Score: 23 (2010 Plan: New Action)
- Lead: Department of Water Pollution Control
- Supporting: Town Council, Department of Community Development

- Time Frame: Short Term
- Financing Options: Town Budget and FEMA grants
- Cost Estimate: Significant
- Benefit: Protection of property/infrastructure, uninterrupted services
- Vulnerable Area: Wastewater Treatment Facilities

## Section 5 Plan Implementation and Maintenance

### 5.1 Implementation, Evaluation, and Revision of Plan

“The success of the hazard mitigation plan is measured by the degree to which actions are accomplished. Without the implementation and maintenance of the plan, the previous components have merely been an effort in research void of any practical application.” — Tennessee Emergency Management Agency

#### Implementation

The LHMC realized that assigning a time frame to each recommended mitigation action is important so that activities can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide inputs to a project plan used for tracking the progress of all activities. Once the 2016 Update receives FEMA’s ‘Approved Pending Adoption’, the mitigation strategy will be put into motion and the Town Council will adopt the Plan (within one year of FEMA’s approval). It is recognized that progress on plan implementation may vary dependent upon available funding and capacity of staff to complete assigned tasks.

#### Evaluation

The LHMC will meet annually to review the status of the mitigation actions. Within two months of this meeting, a status report will be given to the Planning Board and Town Council. Progress will be reviewed annually at advertised public hearings held by the Bristol Planning Board. It is advantageous the annual review be conducted prior to the Town’s annual budget process so any locally funded projects can be considered in the budget process.

#### Revision

As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities, and resubmitted for approval within 5 years in order to continue to be eligible for mitigation project grant funding. In order to ensure that the Plan remains current, the LHMC, which consists of representatives from the Planning Department, EMA, Public Works, Zoning and Code Enforcement, Water/Sewer Department, Fire Department, and Police Department, will meet annually. The Plan will also be evaluated and updated after a disaster, or as funding opportunities arise for the actions and projects identified in the plan. Any updates will be reviewed and submitted to RIEMA upon local approval to ensure that the state hazard mitigation strategy remains current.

The Town of Bristol Hazard Mitigation Plan will be incorporated into the Town’s Comprehensive Emergency Management Plan (CEMP) for consistency and Capital Improvement Plan (CIP) for potential funding of projects, as appendices.

## 5.2 Continued Public Involvement

The Town of Bristol will continue public involvement in the plan maintenance process by:

- The approved/adopted plan will be posted on the Town's web site.
- The annual meeting of the LHMC to review the implementation of the Plan will be posted/advertised as a public meeting as per Town guidelines.
- The LHMC will include the public in the preparation of the five-year Update using the same public participation process as in the development of this Update.

## *References*

## Federal/National Resources

Local Mitigation Plan Review Guide  
FEMA  
October 1, 2011

## State Resources

*Rhode Island 2014 Hazard Mitigation Plan Update*  
Rhode Island Emergency Management Agency

*Rhode Island Climate Change Commission Report*  
November 2012

*Precipitation and Storms in Rhode Island: Trends and Impacts*  
*Sea Level Rise in Rhode Island: Trends and Impacts*  
*Climate Change: Rhode Island's Coasts*  
Rhode Island Sea Grant/URI Coastal Resources Center  
2012

*Adapting to Climate Change: A Planning Guide for State Coastal Managers*  
NOAA  
2010

*SafeWater RI: Ensuring Safe Water for Rhode Island's Future*  
Rhode Island Department of Health  
May 2012

*The State of Rhode Island Coastal Resources Management Program – Section 145 Climate Change and Sea Level Rise*  
1978 As Amended

*Rhode Island Coastal Property Guide: What Coastal Property Owners, Renters, Builders and Buyers Should Know About Rhode Island's Shoreline*  
Rhode Island Sea Grant/URI Coastal Resources Center  
2014

*StormSmart Coasts Rhode Island*  
StormSmart Coasts Network  
<http://ri.stormsmart.org/page/28/>

## Local/Regional Resources

*Town of Bristol Comprehensive Plan*  
2009

*Open Space Plan of the Town of Bristol, RI*  
Bristol Open Space Committee  
2008

*Town of Bristol, R.I. Subdivision and Development Review Regulations*  
Town of Bristol  
September 8, 2009 Amended

*Flood Hazard Development Standards/Permit – Article IX, Division 2 (Sections 28-301 through 28-310)*  
Town of Bristol  
June 25, 2014

*Revised Phase II Stormwater Management Program Plan*  
Town of Bristol  
September 2008 Revised

*Storm Preparedness and Hazard Mitigation Plan*  
Bristol Harbormaster's Office  
May 2004

*Harbor Management Plan*  
Bristol Harbormaster's Office  
2005

Appendix A – Maps

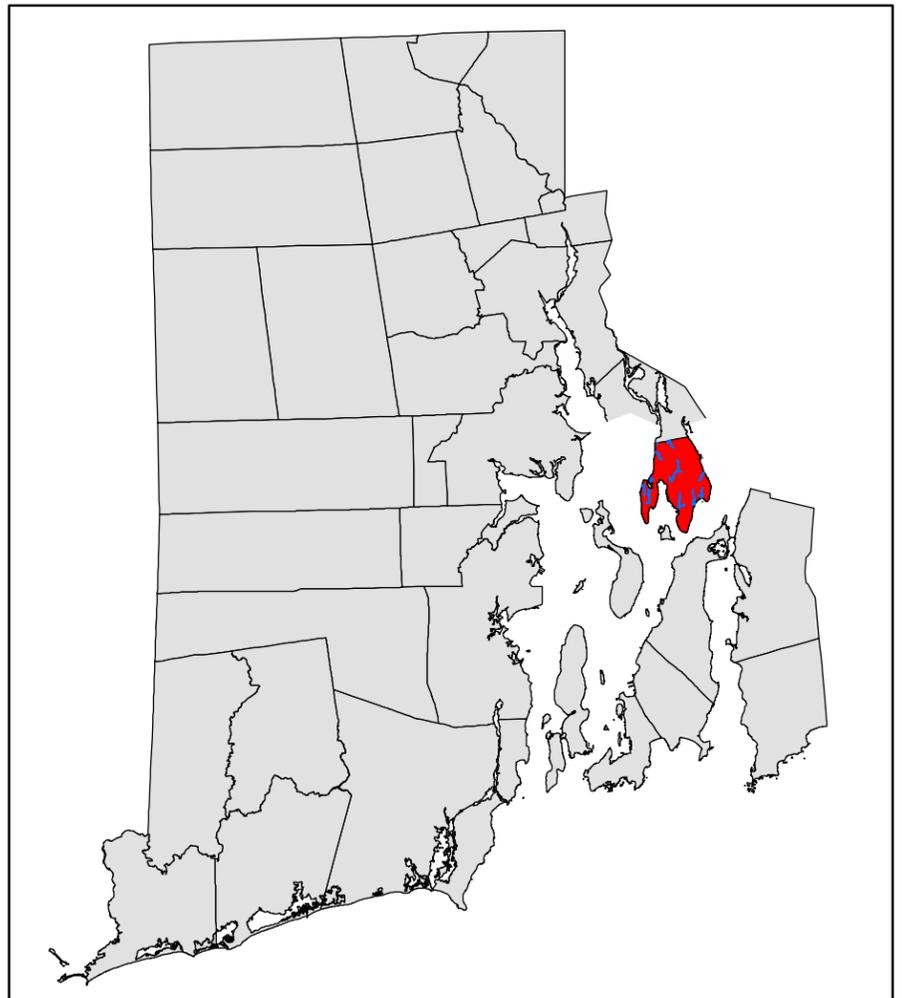
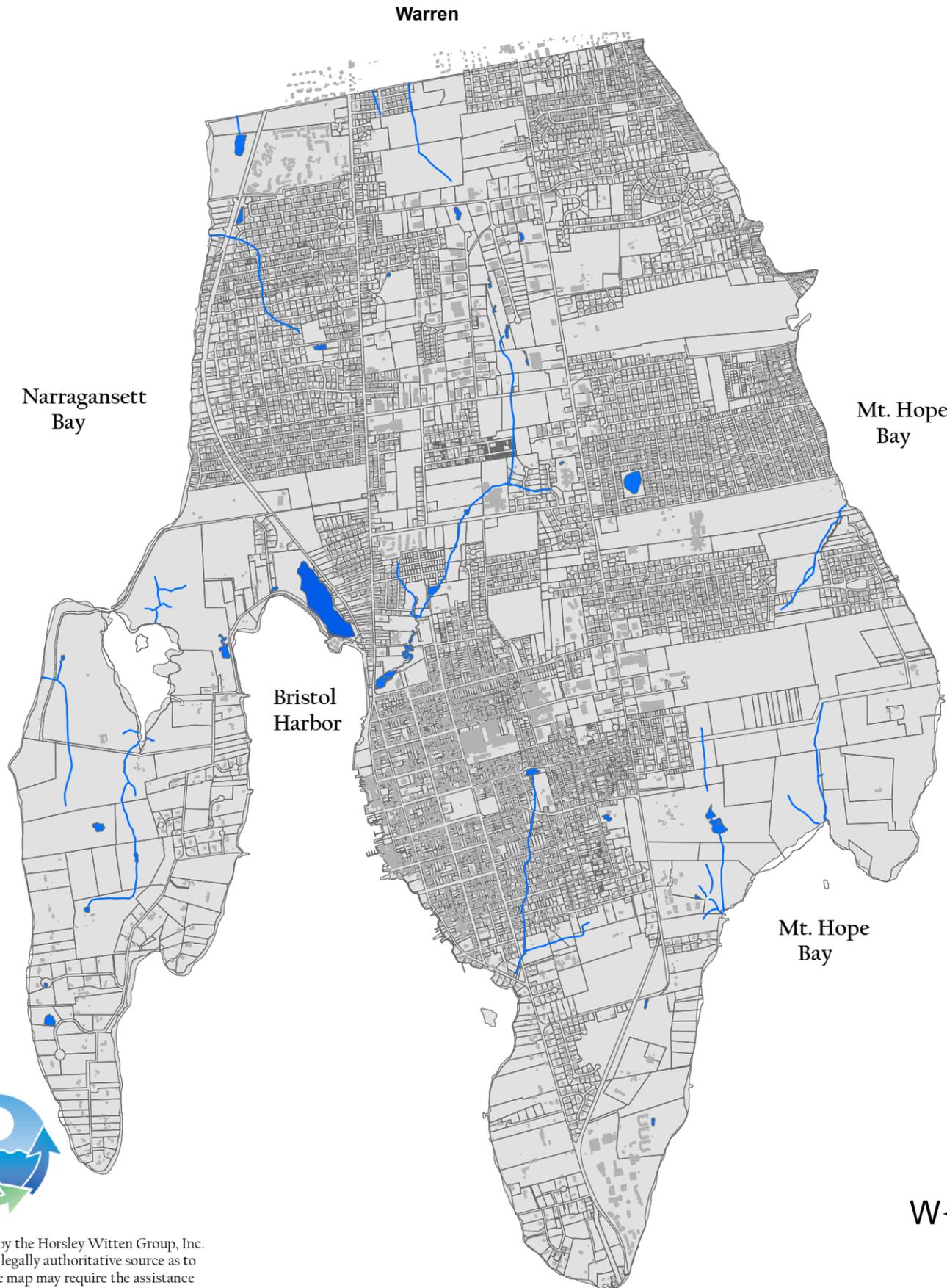
*Location Map (A-1)*

*Risks (A-2)*

*Critical Facilities (A-3)*

*Flood Risks with Repetitive Loss Areas (A-4)*

*Sea Level Rise (A-5)*

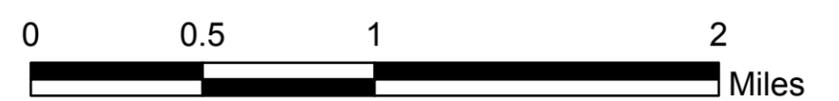
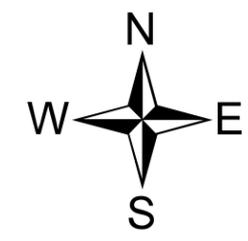


May 1, 2015  
 Data Sources:  
 RIGIS,  
 Bristol Municipal Database,  
 RIEMA,  
 NOAA-NHC IBTrACS.

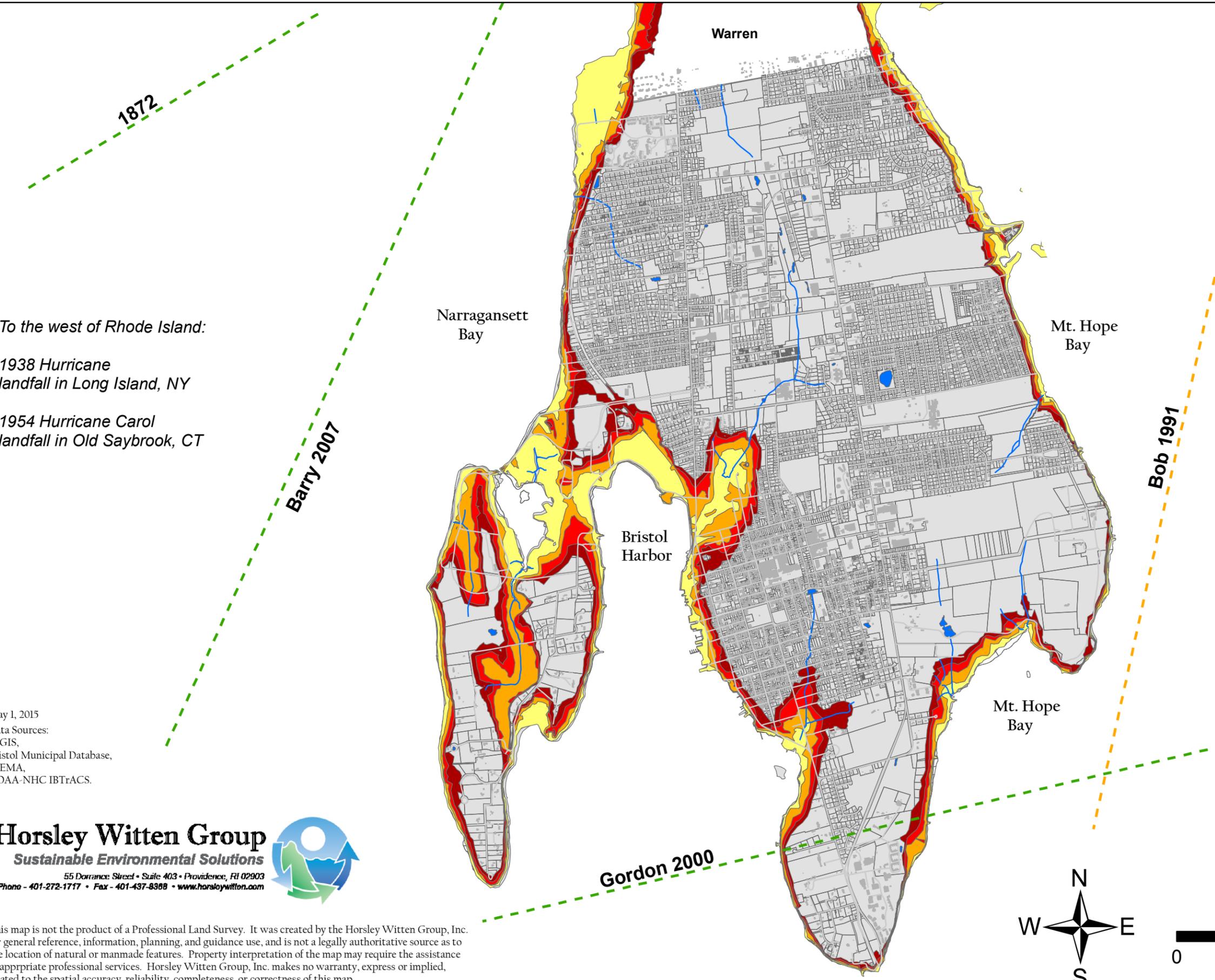
**Horsley Witten Group**  
*Sustainable Environmental Solutions*

55 Dorrance Street • Suite 403 • Providence, RI 02903  
 Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)

This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.



# Map A - 1 Location Map



**LEGEND**

- Buildings
- Rivers/Streams
- Lakes/Ponds
  
- Hurricane Tracks**
- Tropical Storm: < 64 kt.
- Category 1: 64-82 kt.
- Category 2: 83-95 kt.
  
- Hurricane Surge Inundation**
- Category 1
- Category 2
- Category 3
- Category 4

To the west of Rhode Island:  
 1938 Hurricane  
 landfall in Long Island, NY  
 1954 Hurricane Carol  
 landfall in Old Saybrook, CT

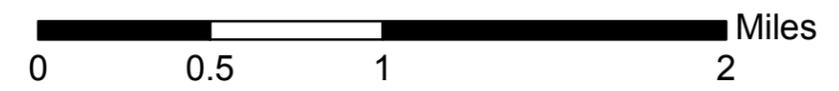
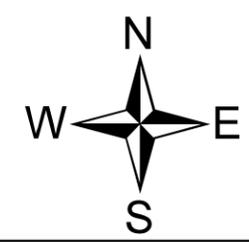
May 1, 2015  
 Data Sources:  
 RIGIS,  
 Bristol Municipal Database,  
 RIEMA,  
 NOAA-NHC IBTrACS.

**Horsley Witten Group**  
 Sustainable Environmental Solutions  
 55 Dorrance Street • Suite 403 • Providence, RI 02903  
 Phone - 401-272-1717 • Fax - 401-437-8388 • www.horsleywitten.com



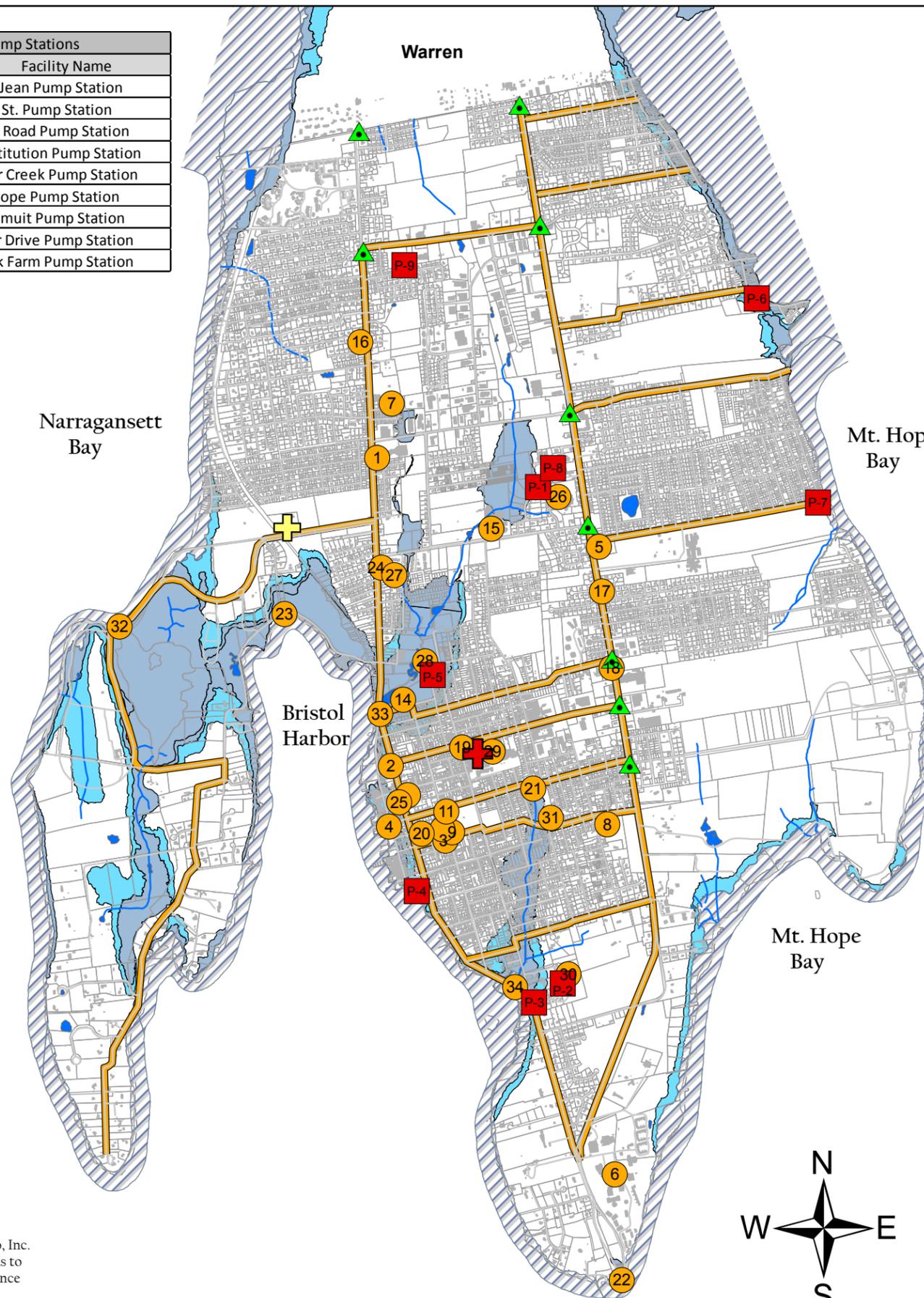
This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.

# Map A - 2 Risks



Critical Facilities	
Site ID	Facility Name
1	Bristol Fire Department (400 Hope St.)
2	Bristol Fire Department (Franklin/High St.)
3	Bristol Fire Department (Church St.)
4	Bristol Fire Department (193 Thames St.)
5	Bristol Fire Department/EOC (482 Metacom Avenue)
6	Roger Williams University
7	Sea Side Nursery School and Kindergarten
8	Stoney Lane Preschool
9	Byfield School
10	Reynolds School
11	Our Lady of Mt. Carmel School
12	Colt Andrews School
14	Guiteras School
15	Mt. Hope High School
16	Rockwell School
17	Veteran's Home
18	Bristol Police Department
19	DCYF Frame
20	Bristol Town Hall
21	State St. Pond Dam
22	Mt. Hope Bridge
23	Sea Wall at Poppasquash Rd.
24	Bristol Senior Center
25	Rogers Free Library
26	Metacom Manor Health Center
27	Benjamin Church Manor
28	Silver Creek Manor
29	Franklin Court Assisted Living
30	Wastewater Treatment Facility
31	Bristol DPW Facility
32	Mill Pond Bridge
33	Town Bridge
34	Tanyard Brook Crossing

Pump Stations	
Site ID	Facility Name
P-1	Leila Jean Pump Station
P-2	Main St. Pump Station
P-3	Ferry Road Pump Station
P-4	Constitution Pump Station
P-5	Silver Creek Pump Station
P-6	Mt. Hope Pump Station
P-7	Kickemuit Pump Station
P-8	Peter Drive Pump Station
P-9	Brook Farm Pump Station



**LEGEND**

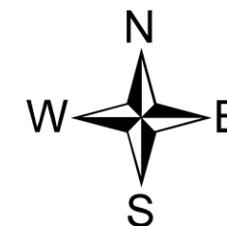
- Critical Facilities
- Pump Stations
- Emergency Evacuation Route
- FEMA Flood Zones
  - AE (100-Year)
  - VE (100-Year)
  - X500 (500-Year)
- Buildings
- Rivers/Streams
- Lakes/Ponds
- Red Cross Shelter
- Red Cross Shelter (Proposed)
- Traffic Control Point

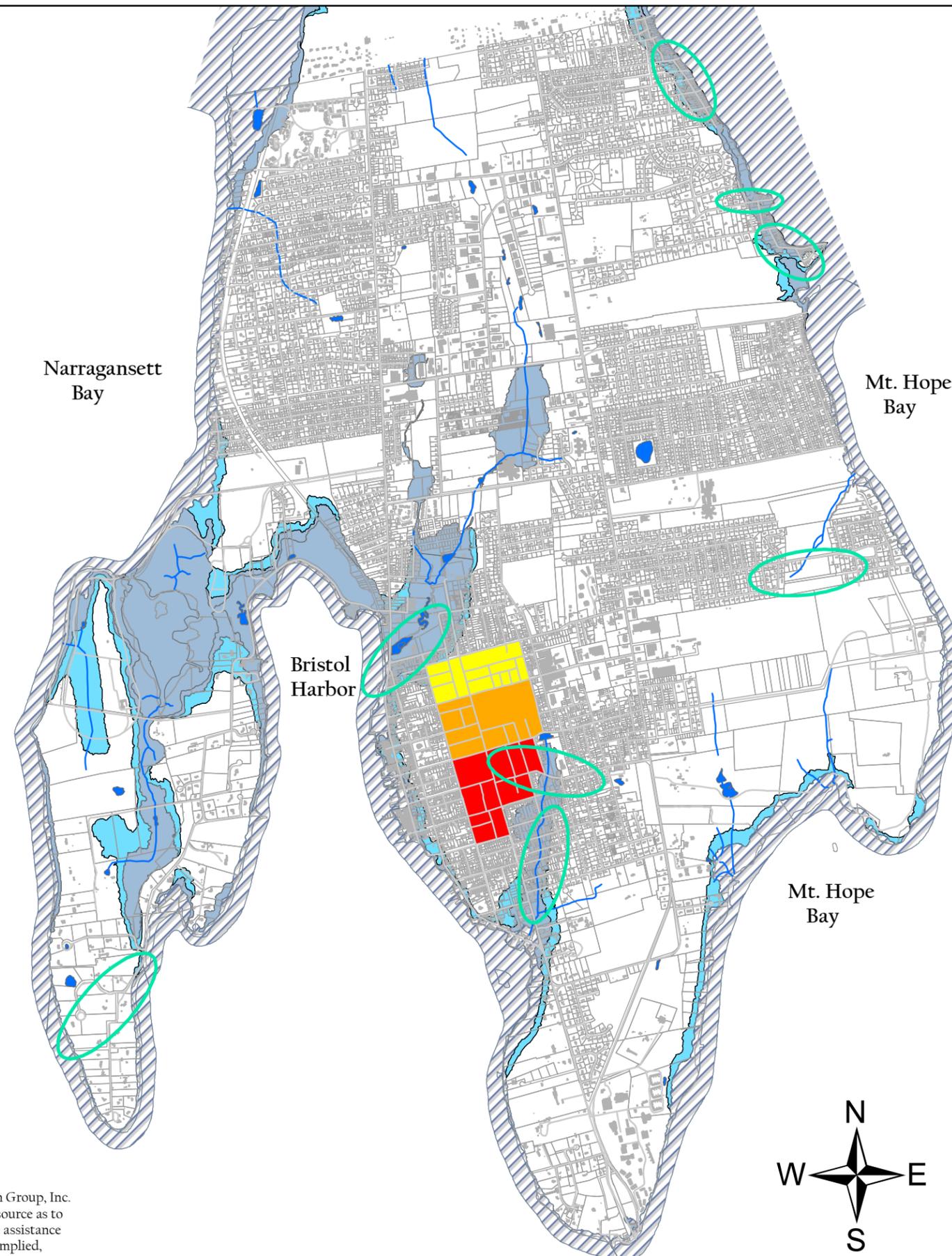
# Map A-3 Critical Facilities

May 1, 2015  
 Data Sources:  
 RIGIS,  
 Bristol Municipal Database,  
 Bristol Police Department



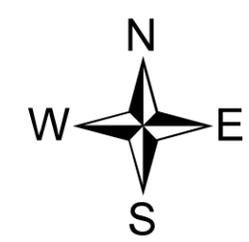
This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.





- LEGEND**
- Repetitive Loss Area (12/2014)
  - FEMA Flood Zones
    - AE (100-Year)
    - VE (100-Year)
    - X500 (500-Year)
  - Buildings
  - Rivers/Streams
  - Lakes/Ponds
  - LOW-MODERATE CENSUS TRACTS
    - Census Tract 307/Block Group 1
    - Census Tract 307/Block Group 2
    - Census Tract 307/Block Group 3

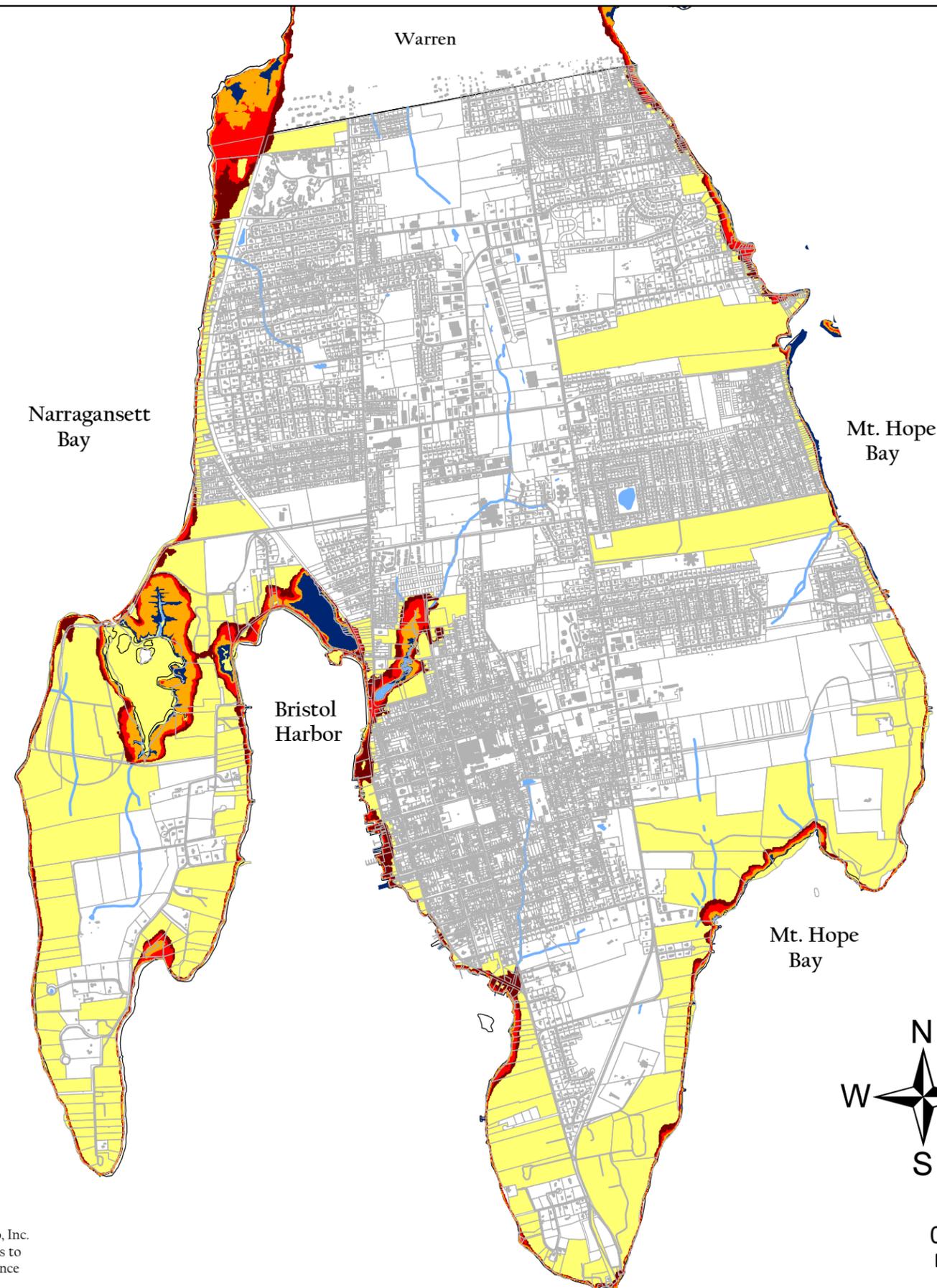
# Map A-4 Flood Risks with Repetitive Loss Areas



October 26, 2015  
Data Sources:  
RIGIS,  
Bristol Municipal Database

**Horsley Witten Group**  
Sustainable Environmental Solutions  
55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com

This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.



**LEGEND**

-  Average Daily High Tide - (Mean Higher High Water - MHHW)
- Potential Sea Level Rise Scenarios*
-  1 Foot
-  3 Feet
-  5 Feet
-  Parcels that Intersect with Potential Sea Level Rise Scenarios
-  Parcels
-  Rivers/Streams
-  Lakes/Ponds
-  Buildings

May 27, 2015

Data Sources:  
RIGIS, State of Rhode Island, and the University of Rhode Island  
Bristol Municipal Database

**Horsley Witten Group**  
*Sustainable Environmental Solutions*

55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)



This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.



# Map A - 5

## Sea Level Rise



Appendix B – Public Information and Outreach

*Project Kickoff/Local hazard Mitigation Committee: August 14, 2014*

*Project Webpage*

*Public Workshop #1: September 24, 2014*

*Local Hazard Mitigation Committee Meeting: April 2, 2015*

*Public Workshop #2: May 11, 2015*

*On-Line Survey*

*Local Hazard Mitigation Committee: May 14, 2015*

*Project Kickoff/Local hazard Mitigation Committee: August 14, 2014*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
August 14, 2014 2 PM

### **Agenda**

1. Introductions
2. Overview of Scope and Revised Schedule
3. Project Coordination
  - a. Data Collection
    - i. Report Card of Existing Plan
  - b. Municipal Coordination
    - i. Date for municipal interviews
  - c. Public Outreach
    - i. Press Release
    - ii. Project Webpage
    - iii. Bristol Harbor Festival (August 30, 2014)
4. Agenda/Logistics for Public Workshop (week of September 22, 2014)

**Bristol Hazard Mitigation Plan Update  
Revised Schedule (July 30, 2014)**

<b>Task 1: Build the Planning Team/Update and Document Planning Process</b>	July 27 - August 15, 2014
<b>Meeting #1 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Project Webpage (Municipal Website) - Report Card (Implementation of Existing Plan) - Data Collection	week of August 10, 2014
<b>Task 2: Identify Changes to the Plan</b> - Complete Report Card (Implementation of Existing Plan)	August 18 - September 26, 2014
<b>Coordination with Town Departments/Personnel</b> <b>Bristol Harbor Festival Outreach</b> <b>Public Workshop</b>	August 18 - August 29, 2014 August 30, 2014 week of September 22, 2014
<b>Task 3: Improve Risk Assessment</b> - Hazard Identification - Hazard Event Profile	Sept. 29 - October 10 2014
<b>Task 4: GIS Mapping</b> - Development of Risk/Critical Facilities/Evacuation Route Mapping	October 13 - October 17, 2014
<b>Task 5: Hazard Vulnerability Assessment</b> - Risk Assessment/Loss Estimation	October 20 - November 7, 2014
<b>Task 6: Develop Goals and Objectives</b> <b>Meeting #2 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Mitigation Recommendations - Review Goals and Objectives	November 10 - Nov. 28, 2014 week of November 17, 2014
<b>Task 7: Analyze Existing/Research New Strategies</b> - Plans, Policies and Problems Examination - Identification of Resources	December 1 - Dec. 12, 2014
<b>Task 8: Develop Comprehensive Range of Actions and Projects</b> <b>Meeting #3 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Refine Goals and Objectives - Cost Benefit Review/Prioritization	Dec. 15, 2014 - January 9, 2015 week of January 5, 2015
<b>Task 9: Update Plan Maintenance/Implementation</b> - Mitigation Action Plan	January 12 - January 23, 2015
<b>Task 10: Review, Revision, Approval and Adoption of Plan</b> <b>Public Comment Period</b> <b>Town Council Public Hearing</b> <b>Final Deliverable to RIEMA</b>	January 26 - March 13, 2015 January 26 - February 20, 2015 week of March 2, 2015 <b>March 13, 2015</b>



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 8/15/2014  
**Re:** Local Hazard Mitigation Committee Kickoff Meeting (No. 1)

---

**In attendance:**

Diane Williamson, Director of Community Development  
Ed Tanner, Principal Planner  
Jose DaSilva, Director – Water Pollution Control  
Bob Martin, Fire Chief  
Jim Galuska, Director – DPW  
Walter Burke, Director – Parks and Recreation  
Craig Pereira, Project Consultant

A meeting was held on August 14, 2014 at Bristol Town Hall to kickoff the Hazard Mitigation Plan Update project. The following items were discussed:

- Craig Pereira reviewed the revised schedule (attached) which maintains the project completion date of March, 2015, but accelerates the up-front items to make up for the several weeks lost.
- Mr. Pereira proposed several modifications to the general layout of the plan Update, including:
  - Hazard Index: the current plan does not have a Hazard Index Matrix... we will need to develop one for the Update. Mr. Pereira presented an example to the Committee from another project.
  - Identified Hazards: the Committee agreed to incorporate Sea Level Rise and Climate Change into the Update.
  - Chapter 2 Risk Assessment/Profiling Hazards: the Committee agreed to expand this section to report on identified hazards individually with a comprehensive discussion of location, history and probability of future occurrence.
  - Chapter 3 Mitigation Action Plan: the Committee agreed to utilizing FEMA's 'categorization' of measures, including:
    - Planning and Prevention
    - Property Protection
    - Natural Resource Protection
    - Structural Projects
    - Emergency Services
    - Public Education and Awareness
- Mr. Pereira presented a draft template for the project webpage to be posted on the Town's website as a public engagement piece for the duration of the project (attached).
- Ms. Williamson stated that we'll have a booth at the upcoming Harbor Festival to initiate interest in the project and to hopefully solicit foot traffic to the Public Workshop. It was suggested to have some FEMA brochures available (Fire Chief has hurricane brochures), a map that folks can mark up with 'local knowledge' of hazard areas (i.e. localized flooding, etc.). Jim Galuska mentioned that the Town is looking into establishing a 'Code Red'

notification System. Ms. Williamson stated that she'll check to see if we can use the booth to have folks sign-up for inclusion on this registry.

- Mr. Pereira presented the concept of a 'Report Card' of the 2010 plan. Essentially, the Committee needs to thoroughly review the Mitigation Action Plan presented in the 2010 plan, and determined what has been achieved (responsible party/date/funding mechanism), what was not achieved and should be carried forward (or eliminated), and what was achieved by should be considered on-going, and be carried forward. This will be the primary focus of the Public Workshop to highlight the efforts the community has made towards sustained resilience (but will also inform the updated Mitigation Action Plan. The Committee went through each mitigation action and briefly reported on the status of each. A more comprehensive review will take place during the municipal interviews.
- Mr. Pereira discussed the upcoming municipal coordination/interviews to be conducted August 18 – 29, 2014. Ms. Williamson will see if there is a municipal list serve we can access for coordination. Mr. Pereira will send an email out to department chairs requesting they select a timeslot to meet at Town Hall...the primary discussion topic will be the Report Card, however, other related comments are also welcome.
- Ms. Williamson stated that we should include recent discussions regarding the new animal shelter/sheltering in place opportunity for pet owners into the Update.
- Mr. Pereira requested a point of contact for Roger Williams University, as the university is a major stakeholder in the town. Peter Wilbur was mentioned, although maybe just as a conduit to someone in the Public Safety Dept. Ms. Williamson/Mr. Galuska stated that we should also reach out to Wenley Ferguson with Save the Bay as a resource, as well as Mt. Hope Farm, Blithewald Gardens, and Colt State Park.
- Mr. Pereira will utilize RIGIS data sets to update the existing mapping required for the Update, and coordinate with Ed Tanner for any additional data.
- Ms. Williamson suggested we mention the Historic District and process for a stand-alone plan, as the Town recently acquired two historic properties.
- Chief Martin stated that emergency access for Poppasquash has been achieved through Colt State Park, however, there is a locked gate at Coggeshall Farm.
- It was mentioned that a portion of the sea wall along Poppasquash Road was repaired, however, further along (where there is no sea wall) floods periodically and creates a public safety hazard.
- Mr. DaSilva stated that he received several grants for generators, and for check valves/backflow preventers. He also asked about investigating the feasibility of the Wood St. extension.

Follow-up Action Items:

- Ms. Williamson will coordinate a booth at the Bristol Harbor Festival on August 30, 2014 to announce the kickoff of the project...Mr. Pereira will participate and develop a flyer for distribution advertising the Public Workshop . Ms. Williamson will coordinate with town personnel if we should be soliciting names/numbers for the Code Red registry.
- Ms. Williamson will develop a press release announcing the booth at the Bristol Harbor Festival, and the Public Workshop, tentatively scheduled for August 30, 2014.
- Ms. Williamson will coordinate the logistics for the Public Workshop. Tentative date is September 24, 2014. 6-7 pm informal drop-in session (for those who can't make the meeting). 7-9 pm formal presentation/mark up maps. Mr. Pereira to request Jess Stimson (RIEMA) speaks at the workshop.
- Ms. Williamson will provide current NFIP and repetitive flood loss data.
- Ms. Williamson will provide the 2010 Plan in native format.



## Craig Pereira

---

**From:** Diane M Williamson [dianew@bristolri.us]  
**Sent:** Wednesday, July 30, 2014 12:39 PM  
**To:** 'Antonio Teixeira'; 'James Galuska'; jdsumpman@yahoo.com; 'Chief Josue D. Canario'; bobmartin@bristolri.us; 'Walter Burke'; seraphin@dapontes.com; 'Ed Tanner'; 'Gregg Marsili'  
**Cc:** 'Stimson, Jessica (EMA)'; Craig Pereira  
**Subject:** Update to Town's Natural Hazard Mitigation Plan  
**Attachments:** Natural Hazard Mitigation Plan of the Town of Bristol.pdf; Agenda Project Kickoff Meeting.pdf  
**Importance:** High

Hello All! I am pleased to let you know that we are starting the 5-year update to the Town's Natural Hazard Mitigation Plan as required by the State. This plan is an important document and has allowed the Town to receive several FEMA Grants. As your input is very valuable and needed for the success of this plan update, I am asking all of you (or your designee) to participate as members of the Local Hazard Mitigation Committee. The Town has also received a grant for the hiring of a consultant to work with us on the update and we have engaged the services of Craig Perreira from Horsely Witten. We are scheduling a kick-off meeting on August 14, 2104 at 2:00 p.m. in the 2<sup>nd</sup> floor conference room at 9 Court Street to start the process and I would like to invite all of you to attend. Please let me know if you are available and/or if you will be appointing a designee. A copy of the current plan and a meeting agenda are attached for your information.

Looking forward to working with all of you on this project!!

Diane M. Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
(401) 253-7000 ext. 126  
(401) 396-5466 Fax

*Project Webpage*



FEMA defines hazard mitigation as:

*A series of actions and policies designed to reduce and/or eliminate the impacts of naturally occurring disasters on people and property.*

## About the Natural Hazard Mitigation Plan Update

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

This Plan Update will replace the existing June 2010 Natural Hazard Mitigation Plan as a standalone document. The approach for this Update is premised on four primary methods, all geared towards meeting the requirements of the DMA 2000 Public Law 106-390, October 10, 2000:

- Planning Process—Outreach and Stakeholder Coordination
- Risk Assessment—Identifying Hazards and Estimating Losses
- Mitigation Strategy— Identifying Mitigation Actions and Implementation Strategies
- Plan Maintenance—Implementation, Evaluation and Revision/Update

**Stay tuned for more information on how to get involved!**

## Contacts

Diane Williamson—Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

*Public Workshop #1: September 24, 2014*



# **PUBLIC WORKSHOP**

September 24, 2014 6:00 PM to 8:30 PM

Burnside Building

2nd Floor Conference Room

400 Hope Street Bristol, RI

## **6:00 PM—7:00 PM Informal Drop-In Session**

Short on time? Stop by during the Drop-In Session to get/give information.

## **7:00 PM Formal Presentation**

Looking for more information? Attend the Formal Presentation to learn what the Town has accomplished and hear more about planning for the future.

### **About the Natural Hazard Mitigation Plan Update**

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

### **Contacts**

Diane Williamson—Director of Community Development

Town of Bristol

10 Court Street

Bristol, RI 02809

[dianew@bristolri.us](mailto:dianew@bristolri.us)

Phone: (401) 253-7000 Ext. 126

# Bristol seeks public's help to minimize disaster impacts

Featured News   Government   News   September 15, 2014

---



Rain water sweeps across Chestnut Street and rushes through St. Mary's cemetery eroding the earth at the foot of head stones and washing away flowers and flags in this eastbayri.com file photo.

As Bristol begins to update its five-year Natural Hazard Mitigation Plan, the Community Development department is seeking the public's help to identify areas most affected by storms to prioritize trouble spots and work to lessen those impacts.

While the mitigation plan is vital to the health and welfare of the community, it is also a necessary requirement to secure grant funds from FEMA to help pay for mitigation projects. After massive flooding in March 2010, residents in priority areas benefited by the town's backflow prevention program that assisted residents who had experienced sewer back-ups. Bristol's director of community planning, Diane Williamson, said that as a result of the plan, 32 households received retrofitting to prevent sewage from backing up into their homes should a similar flood occur.

Once the Hazard Mitigation Plan is updated, the town will be able to identify additional trouble areas that need attention. Some solutions, said Ms. Williamson, include the purchase of generators for sewer pump stations and signage to make people aware of areas of potential flooding. To accomplish the plan, the community development department will host a public workshop during which residents can provide additional information that will help develop the plan.

“We need information they might have for their areas. There might be mitigation actions we haven’t thought of,” Ms. Williamson said. “We haven’t had a coastal flood in quite a while. People lose the thought that it could happen.”

The public workshop will be held on Wednesday, Sept. 24 at in the Burnside Building, 400 Hope St. Residents will learn about the hazard mitigation process and share information from prior storms between 6 and 7 p.m. The main workshop will begin at 7, with representatives from the Rhode Island Emergency Management Agency and the town of Bristol discussing the hazard mitigation planning process.

## Town of Bristol, RI Natural Hazard Mitigation Plan June 2010- Update

Public Workshop  
September 24, 2014  
7:00 pm  
Burnside Building



## Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.



## Bristol Local Hazard Mitigation Committee

- Diane Williamson, Director of Community Planning
- Antonio A. Teixeira, Town Administrator
- Robert Martin, Fire Chief/Emergency Management Director
- Josue Canario, Police Chief
- Ed Tanner, Principal Planner
- James Galuska, Director Department of Public Works
- Jose DaSilva, Director of Water Pollution Control
- Walter Burke, Director of Parks and Recreation
- Greg Marsili, Harbormaster
- Seraphine DaPonte, Member at Large
- Jess Stimson, State Hazard Mitigation Officer
- Craig Pereira, Consultant – Horsley Witten Group



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



## Assess Risks... Risk and Vulnerability Assessment

### *Natural Hazard:*

"Any event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, and agricultural loss, damage to the environment, interruption of business, or other types of harm and/or loss".



## Hazards Affecting Bristol (2010 Plan)

- Flood Related
  - Coastal Storms...approximately 40% of the Town is located within a floodplain, including 'AE', 'VE' and 'X' zones.
  - Inland Floods...large areas of bedrock and/or high groundwater in Bristol results in areas of poor drainage, flooding many roads in Bristol during periods of heavy rain.
  - Coastal Erosion...area of most concern is along Poppasquash Road along the sea wall. This is an evacuation route for the Poppasquash Road peninsula of approximately 100 dwellings and several businesses.
  - Dam Failure...although there is little chance of failure, the State Street Reservoir is a Town-owned stormwater detention basin at the headwater of the Tanyard Brook controlled by the Bristol DPW.
- Winter Related
  - Severe Winter Storms... Heavy snow and winter storms continue to increase in frequency and severity. Power outages are a primary concern.



## Hazards Affecting Bristol (2010 Plan)

- Wind Related
  - Hurricanes...since 1865, Bristol has experienced seventy-one hurricanes of varying magnitude.
  - Tornadoes...the risk of tornado is minimal, yet real. A tornado touched down in Bristol in 1991.
  - High Winds...strong winds can create debris problems including downed power lines.
- Geologic Related
  - Earthquakes...two minor earthquakes occurred in Bristol in 1996 and again in 2002.
- Fire Related
  - Wildfires...not considered a high risk in Bristol.
  - Drought...Town is susceptible, although minimal risk.

Hazards affecting Bristol will be updated to include climate change and sea level rise.



## Hazard Index (2015 Update)

The Local Hazard Mitigation Committee (LHMC) will be evaluating each of the hazards affecting Bristol to establish a **Hazard Index** – the natural hazards posing the most risk to the community, based on historical frequency and severity. To date, the top three hazards include:

- Hurricanes
- Inland/Urban Flooding/Heavy Rain
- Coastal Flooding/Storm Surge



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Economic Assets**
  - Businesses/major employers
  - Tourist destinations
- **Social Assets**
  - Vulnerable populations
  - Cultural locations
- **Natural Resources**
  - Lifeline and utility systems
  - Wetlands
  - Conservation and recreation lands



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Essential Buildings and Critical Facilities**
  - Municipal buildings
  - Hazardous facilities
  - Roadways



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



## Establish Goals... Mitigation Strategy

- **Review Existing Hazard Mitigation Activities:**
  - Coordination with local business community
  - Coordination with neighboring communities
  - Coordination with Roger Williams University
  - Bristol Comprehensive Plan, 2009
  - Bristol Open Space Plan, 2008
  - Bristol Flood Protection Services
  - Flood Hazard Development Permit/Standards
  - Subdivision and Development Review Regulations



## Establish Goals... Mitigation Strategy

### Review Existing Hazard Mitigation Activities:

- Chapter 29 Soil Erosion, Runoff and Sediment Control Ordinance
- Revised Phase II Stormwater Management Program Plan, 2008
- *SafeWater RI*: Ensuring Safe Water for RI's Future
- CRMC's Section 145 Climate Change and Sea Level Rise Policy
- RI Climate Change Commission
- Storm Preparedness and Hazard Mitigation Plan

Horsley Witten Group



## Establish Goals... Mitigation Goal

*"Reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters"*

Horsley Witten Group



## Establish Goals... Mitigation Measures

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness

\* Proposed approach to reconfigure the format/layout of the updated plan.

Horsley Witten Group



## Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan

Horsley Witten Group



## Identify Projects/Actions... Identification of Mitigation Actions

Mitigation actions to be developed based on review of the Town's identified risks and vulnerabilities to natural hazards.

Each action incorporates a brief description of the intended action, who the responsible parties are, a proposed time frame for completion and potential funding sources.

Horsley Witten Group



## Identify Projects/Actions... Prioritization of Actions

- Social
- Technical
- Administrative
- Political
- Legal
- Economic
- Environmental

Horsley Witten Group



## Identify Projects/Actions... Implementation

- Town Capability
- Plan Adoption/Incorporation into Existing Plans



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- **Update/Maintain Plan**



## Update/Maintain Plan...

- Maintain periodically, recommended annually
- Update every 5 years per DMA 2000



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

1. *Utilize School Curriculum to educate students and their parents about hazard risks.*  
Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State officials...*Ongoing, carry forward.* High School students work with Save Bristol Harbor and the Town monitoring outfalls in Silver Creek Watershed collect data for sampling program (RIDEM stormwater requirements). 5<sup>th</sup> graders have a storm drain marking program (Save the Bay).
2. *Educational program for residents of flood zones and nearby downstream neighborhoods.*  
Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e. Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not so obvious...*Ongoing.* Town received RIEMA grant for downtown signage program. Currently in design phase of signage, once approved, will be installed downtown and along roadways in critical flooding areas (Hope St. at Silver Creek, Chestnut St., and Poppasquash Road).



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

3. *Ensure emergency personnel can access people and property within wooded areas.*  
Work with property owners to establish fire lanes in the Mt. Hope area which is the largest wooded area in Town... *Completed, carry forward/on-going.* Fire lanes established from Babbit to Haffenreffer to Mt. Hope Farm. Mt. Hope Farm performs maintenance on Brown University property. Fire Chief currently assembling a brush rig for use.
4. *Disseminate information on mitigation techniques and hazard insurance*  
Distribute literature related to mitigation techniques including the literature from the Institute of Business and Home Safety; retrofit methodology, grant/loan sources, and insurance option... *Ongoing, carry forward.*
5. *Make residents aware of Emergency Response Plan*  
Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households...*Ongoing, carry forward.* Town is moving forward to include a 'CodeReady' system for sending critical communications.



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

6. *Public Information, Outreach – Signage*  
Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area...*Part of Action #2*
7. *Designate alternative evacuation route for the Poppasquash area through Colt State Park.*  
The Town should seek and agreement from RIDEM for use of the service road from Poppasquash Road through Colt State Park as a designated evacuation route. This road is located to the west of the former Pearson house and is important for evacuation since it does not cross any waterbodies. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted... *Completed, through Colt State Park...doesn't go far enough though, carry forward.* There is an additional inland opportunity for an alternate route along lower Poppasquash Rd. on state-owned land, and a second opportunity along a new ROW water line along Poppasquash.



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 8. Adopt a 'no on-street parking' ordinance that goes into effect with a hurricane warning

This ordinance would identify streets where on-street parking would be prohibited in the event of a hurricane similar to the parking ban currently used during snowstorms... **Not completed, suggested to delete...declaration of an emergency situation by EMA Director supersedes this need.**

#### 9. Develop a debris management plan

Fallen debris and tree limbs resulting from thunderstorms, ice storms, and windstorms become fuel for fires in the wooded areas. Prompt removal and clean up of the wooded areas decrease this potential. A comprehensive debris management program will minimize potential impacts... **Not completed, carry forward. Town has an 'informal' process in place, consider formalizing.**

#### 10. Offer a business hazard resilience audit

Town would hire a specialist or train the Building Inspector to identify vulnerabilities and appoint a point of contact for offering personalized mitigation advice and distributing useful literature including notice to property owners about the importance of maintaining the building's systems; and the retrofit of basement utilities, if feasible... **Not completed, suggested to delete. Town to continue to utilize FEMA publications.**

Horsley Witten Group



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 11. Prepare an 'After the Storm Permitting' plan for rebuilding

Review the permitting process and prepare a plan to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. The plan should outline a triage procedure for the rush of proposals and requests... **Ongoing, carry forward, but formalize existing process. Also need to consider continuing current policy of waiving permit fees to repair storm-damaged properties.**

#### 12. Explore location (s) for new and/or additional storm shelter (s)

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered... **Not completed, carry forward. Quinta Gamelin Community Center is a potential alternate...needs a generator and kitchen.**

#### 13. Retrofit of paved parking areas within the Tanyard Brook and Silver Creek watersheds

There may be opportunities to include drainage and/or Low impact development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. A permit process should be implemented to require that resurfacing and expansion of parking lots in the Tanyard Brook and Silver Creek watersheds are reviewed by the Department of Public Works... **Ongoing, carry forward. Town recently completed Town Beach parking lot, and Police Station is the next scheduled project.**

Horsley Witten Group



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 14. Prohibit new basement utilities or require installation of a grinder pump

Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town should adopt an ordinance to prohibit new basement utilities or require installation of a grinder pump between the building and the sewer collection system. This ordinance should apply to all building spaces constructed below the grade of the street... **Completed, carry forward/ongoing. Ordinance completed, requires sewer service connections 2-feet above lowest floor elevation (as per Plumbing Code). Town received FEMA grant to retrofit existing utilities with backflow preventer valves.**

### CAPITAL PROJECTS

#### 15. Eliminate flood risk to repetitive loss properties

The three properties in Bristol that have been repetitively damaged from floods should be retrofitted. The Building Official should determine the appropriate actions to mitigate flood risk to repetitive loss structures... **Not completed, carry forward. Consider providing homeowners with engineering assistance.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 16. Acquire properties that are within the coastal flood zones

The Open Space Plan identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives. The Town will seek to acquire parcels in risk areas... **Ongoing, carry forward. Town acquired 2 properties in Historic District, and studying potential reuse/rehabilitation ideas for sites.**

#### 17. Retrofit public buildings especially the Everready Fire Station and the Department of Public Works (DPW) buildings.

Refer to FEMA guide 'Floodproofing non-residential structures' to retrofit the fire station and DPW buildings, including raising outlets above base flood elevation. Continue agreement with gasoline stations to fuel vehicles when the Town's fueling station at the DPW facility is impacted from flooding... **Not completed, suggested to look closer at this. Fire Chief relocates equipment during storm event, and DPW is not in the floodplain.**

#### 18. Continue implementation of the Silver Creek Watershed Study

Implementation of the Silver Creek Watershed Study has begun with the restoration of the Silver Creek Salt Marsh including removing the restrictions from the outfall. The Town needs to continue implementing the recommendations including sediment removal in the salt marsh, providing more upstream detention, and upgrade to the spillway on the north side of Chestnut Street at the high school... **Ongoing, carry forward. Update plan, re-prioritize projects to be shovel-ready when funding opportunities arise.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 19. Repair the seawall along Poppasquash Road, restore the culverts under this road at Mill Pond and Mill Gut Pond and repave the road

Implement the findings and recommendations of the Poppasquash Road and pedestrian and Bicycle Facility Study which includes recommendations to repair the stone wall and restore the culverts. Repaving of the roadway is also needed to maintain this evacuation route... **Ongoing, carry forward. March 2010, DOT repaired the sea wall in 3 locations and completed repaving.**

#### 20. Reline or replace sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, and damaged sewer pipes, in excess of 75 years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups... **Ongoing, carry forward. Downtown completed...Franklin St. to the south/business area. Tanyard Brook area is currently underway (Pilot Program).**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 21. Eliminate illegal connections of private sump pumps to the sanitary sewer system

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences. Partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being drafted. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations... **Completed, suggested to delete...difficult to enforce.**

#### 22. Upgrade the Mt. Hope Pump Station by installing overflow bypass

During rain storms excess flows to the Mt. Hope Pump Station are greater than the design of the station resulting in manhole overflows to Mt. Hope Bay and sewer backups into residences. Replacing existing pumps with new design and more efficient pumps will reduce the possibility of manhole overflows and sewer backups... **Ongoing, carry forward. Town completed \$1.4 million in upgrades (new pumps and generator, underground storage tank removed)...EPA indicated this was not enough.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 23. Install an overflow bypass at the Wastewater Treatment Plant

During periods of heavy rains, wastewater flows into the Wastewater Treatment Plant is greater than the design of the plant resulting in manhole overflows to Bristol harbor and sewer backups to residences. The installation of an overflow bypass station will allow the excess flows to be diverted to this bypass structure and pump independently... **Review...EPA rejected this plan due to limited applicability at pump station.**

#### 24. Install an overflow bypass upstream of the Silver Creek Station

During periods of heavy rains wastewater flow to this station is greater than the design of the station resulting in manhole overflows to Bristol Harbor and sewer backups to residences, nursing homes, and businesses. The installation of an overflow bypass station will allow the excess flows to be diverted to this bypass structure and pump independently with its own force main to the Wood St. sewer line, reducing backups... **Review...EPA rejected this plan, as pump station already has more water than it can handle.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 25. Concrete earthen berm to protect Wastewater Treatment Plant above base flood elevation

This wall would serve as a dam to keep the flood waters out of the Wastewater Treatment Plant... **Ongoing, carry forward. BETA is currently doing a study. Consider adding in provision for a gravel road for elevated access.**

#### 26. Priority cleaning plan for sewer lines

Over the next five years, beginning in 2009, all sewer lines must be cleaned and camera inspected... **Completed. Consider modifying to state, "Return to problem areas."**

#### 27. Continue implementation of the Tanyard Brook Watershed Study

The recommendation of Beta Group, the Town's consultant for this study, is to install a new culvert, I install a tide gate at the outfall, and, expand the capacity of the State St. Reservoir. The current culvert is under capacity and higher than the adjacent grade at some areas. This creates serious local flooding during rain events. The new culvert has been designed in accordance with the recommendations of the study and Phase 1 of the project has recently received permits from RIDEM and RICRMC... **Ongoing, carry forward. Phase I completed (June 2014), Phase II at 50% design.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 28. Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, and along Poppasquash Rd., the above ground utilities should be placed underground. Although not financially feasible at this time, it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event... **Not completed, carry forward.**

#### 29. Reinforce wire-to-pole connections

While Action 28 above is a long-term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope St. should be secured to the poles with 'Hendrick's Spacer Cables', which make the wires more durable, improve the reliability of service customers; and protect the health of the street trees, making them less susceptible to storms... **Ongoing, carry forward.**

#### 30. Inspect and repair the seawall along Independence Park and Wally Beach as necessary

Stability of the seawall should be evaluated. Repairs and regular maintenance should be made when necessary to enable it to withstand a 20 to 50-year storm. ... **Ongoing, carry forward. Consider adding in Armory Building and Prudence Island Ferry Dock.**

Horsley Witten Group



## Project Schedule

Draft Update available for public comment – **February 2015**

Draft Update to RIEMA – **March 2015**

Horsley Witten Group



## Contact Us...

If you have general questions and/or comments about the Hazard Mitigation Plan Update, please contact:

Diane Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

Thank You!



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 10/3/2014  
**Re:** Public Workshop September 24, 2014

---

A Public Workshop was held on September 24, 2014 at Bristol Town Hall to kickoff the Hazard Mitigation Plan Update project to the community. Eight (8) members of the community and several municipal officials were in attendance. The following comments were provided by those in attendance:

- On several occasions, during rain events raw sewerage is flowing down Fairview Drive...this is unacceptable. Is the Town aware of this issue and what is the Town going to do about it?
  - Response: On several occasions, during periods of extreme precipitation, the wastewater treatment facility has experienced flooding/overflow. As mentioned in tonight's presentation on the Report Card of 2010 mitigation measures, the Town is aware of the issues surrounding this, completed several projects in an attempt to remedy this issue, and due to the comprehensive scope of the issue, has since determined a new approach is needed to address this.
- Who within the Town can we contact to discuss these sorts of issues? You should state that right in the plan Update.
  - Each mitigation action in the existing plan, as well as the proposed plan, identifies (will identify) the primary and secondary 'Responsible Party'... which represents the municipal official/department residents should reach out to for more information.
- I live in the Charles Street area which periodically floods. Is the Town working to remedy this problem?
  - It is anticipated that Phase II of the Tanyard Brook project will remedy this.
- During recent emergency events, getting accurate, updated information has been difficult. Is it possible to consider establishing strategically-located information stations where residents can go to get informed?
  - The Town is currently developing a 'CodeReady' communication system as part of a more comprehensive approach of 'Civic Ready'. The Town will be soliciting residents and business owners to join this voluntary registry to receive updated communications regarding emergency resources, evacuation notices and weather updates. Perhaps these 'stations' could be established and facilitated/staffed through the Town's expanding Community Emergency Response Team (CERT).
- At times, Route 136 floods, which is also part of the Town's evacuation route. Is the Town doing anything to improve these conditions to maintain this as a viable evacuation route?
  - The Town will coordinate with RIDOT to identify potential partnerships for mitigation along this route, as this is a State road.
- During the last flood event, the Fire Department was performing pump-outs for residents, which was extremely timely and helpful. Is this an established policy throughout the Tow?
  - The Fire Department works to help private residents with pump outs on an as needed basis, when they have additional capacity to do so.



*Local Hazard Mitigation Committee Meeting: April 2, 2015*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
April 2, 2015 10 AM

### **Agenda**

1. Revised Schedule
2. Draft Mapping
3. Hazard Index
4. 2009 Plan Report Card
5. Preliminary Mitigation Actions
6. Next Steps

**Bristol Hazard Mitigation Plan Update  
Revised Schedule (April 2, 2015)**

<b>Task 1: Build the Planning Team/Update and Document Planning Process</b>	July 27 - August 15, 2014
<b>Meeting #1 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Project Webpage (Municipal Website) - Report Card (Implementation of Existing Plan) - Data Collection	week of August 10, 2014
<b>Task 2: Identify Changes to the Plan</b> - Complete Report Card (Implementation of Existing Plan)	August 18 - September 26, 2014
<b>Coordination with Town Departments/Personnel</b> <b>Bristol Harbor Festival Outreach</b> <b>Public Workshop</b>	August 18 - August 29, 2014 August 30, 2014 week of September 22, 2014
<b>Task 3: Improve Risk Assessment</b> - Hazard Identification - Hazard Event Profile	Sept. 29 - October 10 2014
<b>Task 4: GIS Mapping</b> - Development of Risk/Critical Facilities/Evacuation Route Mapping	October 13 - October 17, 2014
<b>Task 5: Hazard Vulnerability Assessment</b> - Risk Assessment/Loss Estimation	October 20 - November 7, 2014
<b>Task 6: Develop Goals and Objectives</b>	April 2, 2015
<b>Meeting #2 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Preliminary Mitigation Recommendations - Review Goals and Objectives	April 2, 2015
<b>Task 7: Analyze Existing/Research New Strategies</b> - Plans, Policies and Problems Examination - Identification of Resources	March 30, 2015 - April 3, 2015
<b>Task 8: Develop Comprehensive Range of Actions and Projects</b>	April 6, 2015 - April 27, 2015
<b>Meeting #3 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Refine Goals and Objectives - Cost Benefit Review/Prioritization	week of April 27, 2015
<b>Task 9: Update Plan Maintenance/Implementation</b> - Mitigation Action Plan	April 6, 2015 - April 27, 2015
<b>Task 10: Review, Revision, Approval and Adoption of Plan</b>	May 4, 2015 - May 22, 2015
<b>Public Comment Period</b> <b>Town Council Public Hearing</b> <b>Final Deliverable to RIEMA</b>	May 4, 2015 - May 18, 2015 week of May 18, 2015 <b>May 22, 2015</b>



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 4/8/2015  
**Re:** Local Hazard Mitigation Committee Kickoff Meeting (No. 2)

---

**In attendance:**

Diane Williamson, Director of Community Development  
Ed Tanner, Principal Planner  
Craig Pereira, Project Consultant

A meeting was held on April 2, 2015 at Bristol Town Hall to for the Hazard Mitigation Plan Update project. The following items were discussed:

- Craig Pereira reviewed the revised schedule (attached) which changes the project completion date, with anticipated draft submission to RIEMA for June 1, 2015. In an effort to bolster public participation throughout the planning process, a second public workshop will be scheduled for early May.
- Mr. Pereira reviewed the three draft updated maps (attached)
  - Figure A-1 Risks:
    - Request to also show on the map, the two historical hurricane tracks ('38 and '54).
    - Request to remove the flood zones since they are already on the other maps, and to verify the zone in the center of the Town.
  - Figure A-2 Critical Facilities:
    - Request to break –out pump stations separately from facilities in the table.
    - Request to show Quinta-Gamelin as proposed shelter.
    - List source and verify traffic control points (Police/Fire).
    - Request to identify hidden facility east of Thames St. (adjacent to Church St.)
  - Figure A-3 Flood Risks with Repetitive Loss Areas:
    - Request to add Low/Mod. Areas from Census Tract Data to facilitate eligibility for funding, as available.
    - Request to add the date for the Repetitive Loss area locations.
- Mr. Pereira reviewed the draft Hazard Index. The Index is new and required for the Update.
  - Request to include notation regarding development based on FEMA's criteria (will also be inserted into the Update).
- Mr. Pereira reviewed the 'Report Card' of the 2010 plan based on completion of municipal interviews (attached). General acceptance on the Report Card, with several revisions and outstanding items to be discussed individually.
  - Request to keep in Action 21...BETA Group is mapping this, change text to read study/identify alternative. Reference Annawamscutt area pilot study (installation of pipes for sump pump connections).
  - Mr. Pereira to follow up with Jose regarding Action 23, and 24.

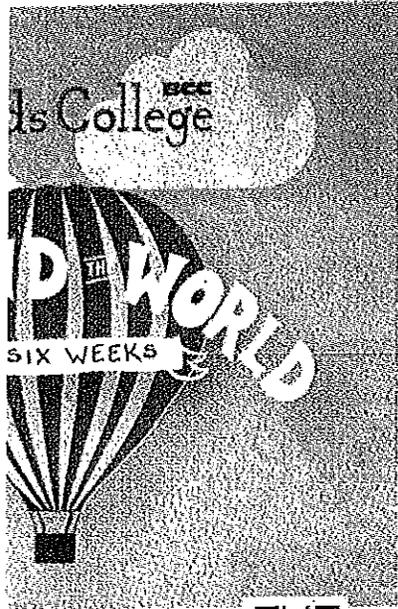
- Mr. Pereira reviewed the preliminary Mitigation Actions, which includes items from existing plan to be carried over into Update (attached).
  - Action 2: add in accomplishments (from Diane)
  - Action 5: add in information on how residents can sign up, from Diane)
  - Action 7: add in information on inland route
  - Action 7: add in consideration of a regional plan
  - Action 11: formalize existing process by ordinance
  - Action 12: add in Quinta Gamelin Community Center as potential future shelter
  - Action 13: reference consideration of Stormwater Utility Management Plan...add new action that considers development of the permit process with three sections: retrofit of existing, new/expansion of parking for commercial, and the residential piece.
  - Action 15: add in information on CRS outreach (from Diane)
  - Action 21: keep, rework statement (Report Card section above)
  - Actions 22, 23, and 24: coordinate with Jose
  - Action 30: study is on hold
  - New Action – secondary point of access/egress at Water Pollution Control Facility: reference Fairview sump pumps/need for in-street drainage and dovetail to new action
  - New Action – develop overwash/sand/rubble removal plan: add to Debris Management Plan Action 9
  - New Action – Develop Shoreline Management Plan: add in piece regarding opportunity at dead end streets to water (cul-de-sacs)
  - New Action – Recovery and Reconstruction Ordinance: rework
  - New Action: Tourist Evacuation and Shelter: add in marinas
  - New Action: Elderly/Special Needs Residents: change to ‘Social Services’ responsibility

Follow up:

- Mr. Pereira will follow up with specific departments regarding data/input needed.
- Committee to work towards finishing draft actions/Update.
- Next Committee meeting to be held end of April for prioritization and ranking of actions.



*Public Workshop #2: May 11, 2015*



**COURSES**  
 July 6 - 31  
 Monday - Friday  
 August 3 - 14  
 Monday - Friday  
 Drop-off at 8:30 a.m., pick up at 4 p.m.  
 BCC Fall River Campus  
 777 Elsbree Street, Fall River, MA 02720  
 BristolCC.edu/KidsCollege  
 508.678.2811, ext. 2264  
**BCC**  
 BRISTOL COMMUNITY COLLEGE

nts, people, etc.  
 case at eastbayri.com

# Bristol Public Works director ousted

The town of Bristol is looking to hire a new Department of Public Works director, after Town Administrator Tony Teixeira decided not to renew the contract of current DPW Director James Galuska.

Mr. Galuska's three-year contract expired in October 2014 after being hired by former Town Administrator Diane Mederos.

"When it comes to engineering, Jim did bring quite a few skills into this job," Mr. Teixeira said.

But he cited "a little bit of difference" as to how the department should operate as part of the reason he opted to not renew Mr. Galuska's employment with the town.

Mr. Galuska declined to comment.

The town is currently seeking applicants with 5 to 10 years of municipal/public works experience in addition to previous management experience, preferably with a civil engineering degree.

Under the fiscal year 2015-2016 budget, Mr.



James Galuska

Galuska was to receive a salary of \$104,000 plus benefits to oversee the department's operations and \$2.9 million budget.

## Bristol asks residents to help update town's hazard mitigation plan

The town of Bristol is updating its Natural Hazard Mitigation Plan, a document that was last reviewed in 2010, and is asking the public for help.

The plan identifies risk areas, estimates losses in natural disasters and lays out a strategy to mitigate the damage. Having such a plan in place gives the town a better chance to get funding for projects that reduce the

risk of injury or damage to property from future natural disasters like flooding and hurricanes.

To make the plan as comprehensive as possible to address the needs of the town, the Community Development department is asking residents to complete an on-line survey. A 10-minute questionnaire is set up at [www.surveymonkey.com/s/bristolhazardmitigationplanupdate](http://www.surveymonkey.com/s/bristolhazardmitigationplanupdate).

The information will help planners coordinate activities and identify projects for the town. The survey responses are anonymous.

In addition to the on-line survey, a public workshop is scheduled for Monday, May 11 at 7 p.m. in the Burnside building. For more information, contact the Bristol Planning Department at 401-253-7000.

# TOM'S MARKET

*Fresh. Local. Exceptional.*

**TIVERTON**

492 Main Road

Tiverton, RI

401-816-0862

Mon-Sat 8-8 • Sun 8-7

## KITCHEN

Tom's Own  
Clam Cakes

**6/\$3.99**



## DELI

Kretschmar  
**Lo-Sodium Ham**

**\$2.99** lb. *WOW!*



CUSTOM CUT BEEF MEATS

- Land o' Lakes Cheese  
Italian Blend . . . \$5<sup>99</sup> lb.
- Boar's Head Regular &  
Low Salt  
Bologna . . . . . \$4<sup>99</sup> lb.
- Boar's Head Vermont  
Cheddar . . . . . \$5<sup>99</sup> lb.
- Kretschmar Bacon Crusted  
Turkey . . . . . \$5<sup>99</sup> lb.
- Tom's Own Rare & Juicy  
Roast Beef . . . . . \$8<sup>99</sup> lb.



**Barilla Pasta**

Excludes Lasagna, Shells,  
Plus & Gluten Free

**5/\$5**

## GROCERY

- 16 oz. All Varieties  
Ken's Dressing. . . 2/\$4
- Post Great Grains  
Cereal . . . . . \$2<sup>99</sup>
- Nature Valley or Fiber One  
Granola Bars . . . 2/\$5
- Pepperidge Farms  
Swirl Breads . . . \$3<sup>29</sup>



**FRESH PRODUCE**

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Public Workshop #2**

Burnside Building 2<sup>nd</sup> Floor Conference Room  
May 11, 2015 7 PM

### **Agenda**

1. Opening Remarks – Diane Williamson, Director of Community Development
2. Accomplishments to date: Overview, Why Hazard Mitigation Planning in Bristol, 2010 Report Card – Craig Pereira, Project Manager, Horsley Witten Group
3. Preliminary Mitigation Actions
4. Questions/Comments
5. Next Steps

## Town of Bristol, RI Natural Hazard Mitigation Plan June 2010- Update

Public Workshop  
May 11, 2015  
7:00 pm  
Burnside Building



## Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.



## Bristol Local Hazard Mitigation Committee

- Diane Williamson, Director of Community Planning
- Antonio A. Teixeira, Town Administrator
- Robert Martin, Fire Chief/Emergency Management Director
- Josue Canario, Police Chief
- Ed Tanner, Principal Planner
- James Galuska, Director Department of Public Works
- Jose DaSilva, Director of Water Pollution Control
- Walter Burke, Director of Parks and Recreation
- Greg Marsili, Harbormaster
- Seraphine DaPonte, Member at Large
- Jess Stimson, State Hazard Mitigation Officer
- Craig Pereira, Consultant – Horsley Witten Group



## Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan



## What we have accomplished...

- Harbor Festival (August 2014)
- Municipal Interviews (Fall 2014/Winter 2015)
- Public Workshop (September 24, 2014)
- Bristol Local Mitigation Committee Meetings
- 2010 Plan 'Report Card'
- Survey (Spring 2015)



## Improved Risk Assessment

- Hazard Identification
- Hazard Event profile



## Confirmation of ... Hazards Affecting Bristol (2010 Plan)

- Flood Related
  - Coastal Storms...approximately 40% of the Town is located within a floodplain, including 'AE', 'VE' and 'X' zones.
  - Inland Floods...large areas of bedrock and/or high groundwater in Bristol results in areas of poor drainage, flooding many roads in Bristol during periods of heavy rain.
  - Coastal Erosion...area of most concern is along Poppasquash Road along the sea wall. This is an evacuation route for the Poppasquash Road peninsula of approximately 100 dwellings and several businesses.
  - Dam Failure...although there is little chance of failure, the State Street Reservoir is a Town-owned stormwater detention basin at the headwater of the Tanyard Brook controlled by the Bristol DPW.
- Winter Related
  - Severe Winter Storms... Heavy snow and winter storms continue to increase in frequency and severity. Power outages are a primary concern.



## Confirmation of ... Hazards Affecting Bristol (2010 Plan)

- Wind Related
  - Hurricanes...since 1865, Bristol has experienced seventy-one hurricanes of varying magnitude.
  - Tornadoes...the risk of tornado is minimal, yet real. A tornado touched down in Bristol in 1991.
  - High Winds...strong winds can create debris problems including downed power lines.
- Geologic Related
  - Earthquakes...two minor earthquakes occurred in Bristol in 1996 and again in 2002.
- Fire Related
  - Wildfires...not considered a high risk in Bristol.
  - Drought...Town is susceptible, although minimal risk.



## Additional Considerations for ... Hazards Affecting Bristol (2015 Plan)

- Climate Change
  - The Environmental Protection Agency (EPA) indicates there is recent, strong evidence that most of the warming of the Earth's surface temperature over the past 50 years is a direct result of human behavior.
  - By 2100, Rhode Island could see a temperature increase by about 4 degrees F (with a range of 1-8 degrees F) in the winter and spring and by about 5 degrees F (with a range of 2-10 degrees F) in the summer and fall.
  - Increased temperatures and frequency of heat waves could also impact the number of heat-related illnesses and deaths in Rhode Island, increasing ground-level ozone, a major component of smog (facilitating respiratory illnesses such as asthma and respiratory inflammation, as well as reducing general lung functioning.)
  - The very same warming and climate increases could also expand the habitat and infectivity of disease-carrying insects, increasing the potential for malaria, Eastern Equine Encephalitis and Lyme Disease.



## Additional Considerations for ... Hazards Affecting Bristol (2015 Plan)

- Sea Level Rise
  - The Intergovernmental Panel on Climate Change (IPCC) continues to better understand the science and implications of climate change and sea level rise.
  - Rising sea levels, as a direct result of warmer temperatures and glacial ice melt, threaten low-lying coastal areas through coastal flooding, coastal erosion, wetland inundation and saltwater intrusion. Recent projections of sea level rise by the end of the century range from 20 to 55 inches.
  - Localized land subsidence, also on the rise, also contributes to accelerated impacts of sea level rise.



## Hazard Index (2015 Update)... based on historical frequency and severity

### Criteria for Frequency Categorization:

*Very low frequency:* events that occur less frequently than once in 1,000 years (less than 0.1% per year).

*Low frequency:* events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

*Medium frequency:* events that occur from once in 10 years to once in 100 years (1% to 10% per year).

*High frequency:* events that occur more frequently than once in 10 years (greater than 10% per year).



## Hazard Index (2015 Update)... based on historical frequency and severity

### Criteria for Severity Categorization (based on past hazard events):

*Minor:* Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.

*Serious:* Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.

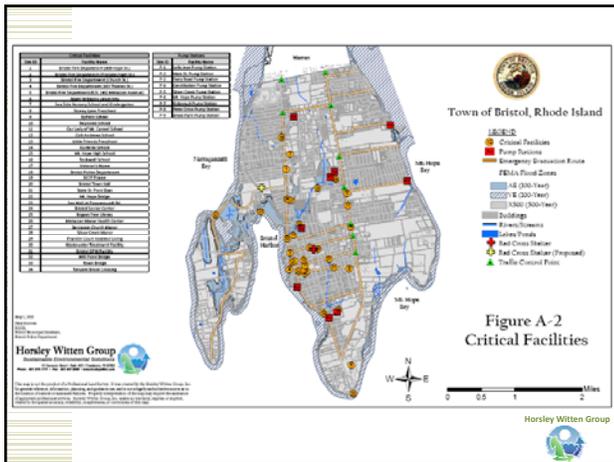
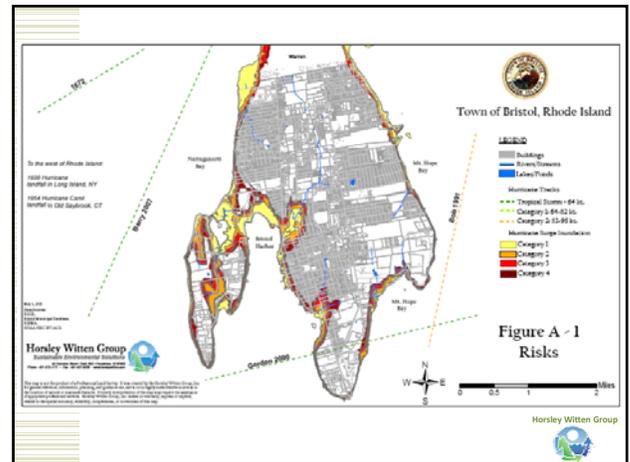
*Extensive:* Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.

*Catastrophic:* Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

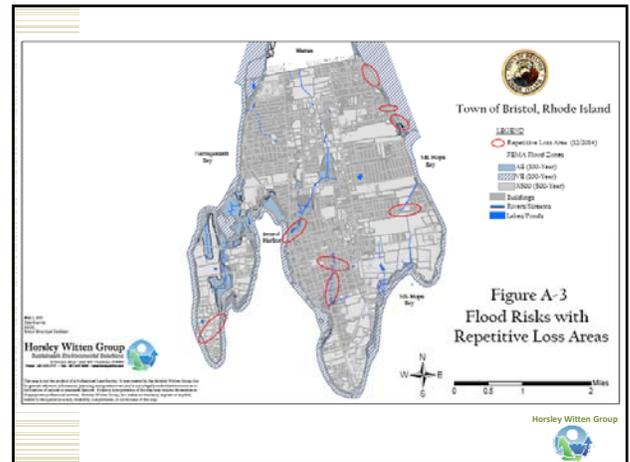


Natural Hazard	Frequency (i.e. Very Low, Low, Medium, High)	Location (i.e. local/small, medium/regional, large/multiple communities)	Severity (i.e. minor, serious, extensive, catastrophic)	Hazard Index (i.e. ranked by combining frequency and severity; 10 = high, 1 = low)
<b>Flood-Related Hazards</b>				
- Riverine	Very Low	Small/Local	Minor	2
- Flash Flooding	High	Medium/Regional	Minor	5
- Inland/Urban Flooding/Heavy Rain	High	Medium/Regional	Extensive	7
- Coastal Flooding/Storm Surge	High	Small/Local	Extensive	7
- Coastal Erosion	High	Small/Local	Minor	5
- Climate Change/Sea Level Rise	Medium	Large/Multiple	Serious	5
- Dam Failures	Very Low	Small/Local	Minor	2
<b>Winter-Related Hazards</b>				
- Snow	High	Large/Multiple	Minor	5
- Ice	Medium	Large/Multiple	Minor	4
- Extreme Cold	Very Low	Large/Multiple	Serious	3
<b>Wind-Related Hazards</b>				
- Hurricanes	High	Large/Multiple	Catastrophic	8
- Tornadoes	Medium	Local	Minor	4
- High Winds	High	Large/Multiple	Serious	6
- Lightning/Thunderstorms	Medium	Local	Minor	4
- Hail	Medium	Local	Minor	4
<b>Geologic-Related Hazards</b>				
- Earthquakes	High	Medium/Regional	Minor	5
<b>Fire-Related Hazards</b>				
- Drought	Low	Medium/Regional	Minor	2
- Extreme Heat	Low	Large/Multiple	Serious	3

Horsley Witten Group



Horsley Witten Group



## Hazard Vulnerability Assessment

- Evacuation
  - Bristol has two peninsulas surrounded by water on three sides
  - The risk from flooding and storm surge may impede evacuation out of the area, as well as emergency vehicles into the area for those residents who choose to stay.
- Economic and Social Vulnerability
  - At-risk populations continue to increase as new development occurs in vulnerable areas.
  - Although the Town has adopted Flood Zoning and enforces the RI Building Code, most of the development in at-risk areas occurred before these regulations.
  - The historic downtown is particularly vulnerable

Horsley Witten Group

## Hazard Vulnerability Assessment

- Historical and Cultural Resource Areas
  - Much of the Bristol Waterfront National Register District in downtown is located within the flood zone.
  - Balancing mitigation in a way that is consistent with historical preservation policies is important.
- Shelters
  - The Community Room at Franklin Court serves as the only American Red Cross Approved shelter.
  - The Quinta-Gamelin building is proposed as the secondary shelter, requiring several upgrades first.

Horsley Witten Group

## Hazard Vulnerability Assessment

### • Public Infrastructure and Emergency Lifelines

- The Wastewater Treatment Plant on Plant St. is within the flood plain of the Tanyard Brook and area of poor drainage, in addition to five sewer pump stations located in floodplains.
- Several high risk bridges that carry utilities underneath them have flooded or washed out in prior hurricanes (Town Bridge – Route 114, Bridges at Mill Gut Pond/Mill Pond, and Tanyard Brook runs under Hope St./Route 114.)

### • Repetitive Loss Structures

- According to the information provided by RIEMA, there are 12 repetitive loss structures in Bristol.
- Repetitive loss properties are those for which two or more losses of at least \$1,000 each have been paid under the NFIP within any 10-year period since 1978.



## Develop Goals and Objectives Mitigation Goal...

*“Reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters”*



## Develop Goals and Objectives Mitigation Objectives...

- *Informing citizens and business owners how to protect themselves, their property, and their livelihood (and providing resources for doing so whenever possible)*
- *Reinforcing and upgrading the Town’s built environment and municipal systems*
- *Incorporating hazard resilience into the provisions for land redevelopment, with special emphasis on post-disaster recovery and rebuilding*
- *To the extent feasible, removing repetitively damaged structures from floodplains.*



## Analyze Existing/Research New Strategies

- Coordination with local business community
- Coordination with neighboring communities
- Coordination with Roger Williams University
- Bristol Comprehensive Plan, 2009
- Bristol Open Space Plan, 2008
- Bristol Flood Protection Services
- Flood Hazard Development Permit/Standards
- Subdivision and Development Review Regulations



## Analyze Existing/Research New Strategies

- Chapter 29 Soil Erosion, Runoff and Sediment Control Ordinance
- Revised Phase II Stormwater Management Program Plan, 2008
- *SafeWater RI: Ensuring Safe Water for RI’s Future*
- CRMC’s Section 145 Climate Change and Sea Level Rise Policy
- RI Climate Change Commission
- Storm Preparedness and Hazard Mitigation Plan



## Develop Comprehensive Range of Actions/Projects

- Public Education and Awareness
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Utilize school curriculum to educate students and their parents about hazard risks

Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State Officials.

#### Educational program for residents of flood zones and nearby downstream neighborhoods

Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not as obvious.



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Make residents aware of Emergency Response Plan

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new "Civic Ready" program to receive alerts via phone, email, text, etc..

#### Public Information, Outreach – Signage

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Designate Alternative Evacuation Route for the Poppasquash Area

The Town should seek an agreement from the State of Rhode Island for the feasibility of an additional inland opportunity for an alternate route along lower Poppasquash Rd. on state owned land, as well as a second opportunity along a new right-of-way for water lines along Poppasquash. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

#### Public Information, Outreach and Incentive Program

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, RI Coastal Properties Guide, and other FEMA publications, as applicable



## Preliminary Mitigation Measures

### Property Protection

#### Disseminate information on mitigation techniques and hazard insurance.

Distribute literature related to mitigation techniques including the literature from the Institute of Business and Home Safety; retrofit methodology, grant/loan sources, and insurance options.

#### Prepare an "After-the-Storm Permitting" Plan for rebuilding

Review the permitting process and prepare a plan to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. The plan should outline a triage procedure for the rush of proposals and requests. Formalize the existing process, also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.



## Preliminary Mitigation Measures

### Property Protection

#### Eliminate flood risk to repetitive loss properties.

Consider public/private partnership with consulting engineer/NFIP to assist repetitive loss properties owners to identify appropriate flood mitigation retrofit projects.

#### Acquire properties that are within the coastal flood zones.

The *Open Space Plan* identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Open Space Committee as part of the *Open Space Plan* implementation, will seek to acquire parcels in risk areas as they become available for acquisition.



## Preliminary Mitigation Measures

### Property Protection

#### Develop a stand-alone Environmental and Historic Preservation Plan for at-risk properties within the flood zone (incorporate the potential re-use/rehabilitation/relocation potential for historic structures).

#### Construct concrete/earthen berm for improved access and protection at the Wastewater Treat Plant, above base flood elevation

This wall would serve as a dam to keep the flood waters out of the WWTF, while also providing a secondary means of access/egress above the base flood elevation.



## Preliminary Mitigation Measures

### Property Protection

#### Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

#### Reinforce wire-to-pole connections

While the action above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with "Hendrick's Spacer Cables". These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

Horsley Witten Group



## Preliminary Mitigation Measures

### Natural Resources Protection

#### Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds.

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. A permit process should be developed to evaluate 'credits' when considering three approaches: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions.

#### Continue implementation of the Silver Creek Watershed Study.

Identify what has been accomplished, and re-prioritize what still needs to be done (perform update of the Study).

Horsley Witten Group



## Preliminary Mitigation Measures

### Natural Resources Protection

#### Continue implementation of the Tanyard Brook Watershed Study

Identify what has been accomplished (Phase I, Phase II at 50% design), and re-prioritize what still needs to be done (perform update of the Study).

#### Develop Shoreline Management Plan

Develop a management plan for Bristol's coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. Consider development of "retrofit program" for dead-end streets, also consider a "Regional" approach to this management plan.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Restore the culverts under Poppasquash Road at Mill Pond and Mill Gut Pond

Implement the findings and recommendations of the *Poppasquash Road and Pedestrian and Bicycle Facility Study* which includes recommendations to restore the culverts.

#### Reline or replace sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. Continue work that is underway Tanyard Brook area Pilot Program.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Upgrade the Mt. Hope Pump Station by Installing Overflow Bypass

During rainstorms excess flows to the Mount Hope Pump Station are greater than the design of the station resulting in manhole overflows to Mount Hope Bay and sewer backups into residences. Replacing existing pumps with new design and more efficient pumps will reduce the possibility of manhole overflows and sewer backups.

#### Continue Drainage Improvements at the Wastewater Treatment Plant

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result, will also improve drainage along Fairview Drive.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Install an Overflow Bypass up stream of the Silver Creek Pump Station

During periods of heavy rains wastewater flow to this station is greater than the design of the station resulting in manhole overflows to Bristol Harbor and sewer backups to residences, nursing homes, and businesses. The installation of an Overflow Bypass Station will allow the excess flows be diverted to this bypass structure and pumped independently with its own force main to the Wood Street sewer line. This should reduce manhole overflows and backups.

#### Inspect and repair the seawall along Independence Park and Walley Beach as necessary

Stability of the seawall should be evaluated. Repairs and regular maintenance should be made when necessary to enable it to withstand a 20 to 50-year storm.

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Ensure emergency personnel can access people and property within wooded areas

Continue to work with property owners to establish fire lanes in the Mount Hope Area which is the largest wooded area in Town.

#### Explore location(s) for new and/or additional storm shelter(s)

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered. The Quinta-Gamelin Community Center has been proposed as a secondary shelter (needs include a kitchen and generator).

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Implement "mobile information stations" (dependent upon event/severity/location) throughout the community.

The Town will set up mobile information stations to residents throughout the community (possibility through CERT team).

#### Tourist Evacuation and Shelter

Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. The Town will distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, marinas and other facilities and events hosting tourists.

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Elderly and Special Needs Residents

The Police Dept/Social Services Dept. will continue to update/maintain a list of elderly and special needs residents living independently in the Town, and coordinate with the Police Department. The list will be divided by evacuation area and susceptibility to hazards, in the event an evacuation is necessary.

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Develop a debris management program

Fallen debris and tree limbs resulting from thunderstorms, ice storms, and windstorms become fuel for fires in the wooded areas. Prompt removal and clean up of the wooded areas decrease this potential. A comprehensive debris management program will minimize potential impacts. Consider a "Regional" approach to this plan

#### Prohibit new basement utilities or require installation of a grinder pump.

Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town has adopted an ordinance which requires either sewer service connection at 2 feet above lowest floor elevation (as per Plumbing Code) or require installation of a check valve or backflow preventer between the building and the sewer collection system (applies to all building spaces constructed below the grade of the street.)

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Continue to pursue/implement Backflow Retrofit Program through FEMA grant funding (as available).

#### Eliminate illegal connections of private sump pumps to the sanitary sewer system

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences. Partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being distributed. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations.

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Priority Cleaning Plan for Sewer Lines

Over the next five years, return to identified "problem areas" and clean/camera inspect sewer lines.

#### Recovery and Reconstruction Ordinance

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consider a "Regional" approach to this plan.

#### Coordinate Evacuation Plans with Neighboring Municipalities

The Police Department will work with neighboring communities to coordinate evacuation plans.

Horsley Witten Group



## Preliminary Mitigation Measures

Additions??



## Next Steps...

- Refine/Confirm Mitigation Measures
- Cost Benefit Review/Prioritization



## Update Plan Maintenance/Implementation

- Maintain periodically, recommended annually
- Update every 5 years per DMA 2000



## Review, Revision, Approval and Adoption of Plan

- Public Comment
- Public Hearing
- RIEMA Submission



## Contact Us...

If you have general questions and/or comments about the Hazard Mitigation Plan Update, please contact:

Diane Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

**Thank You!**



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 8/25/2015  
**Re:** Public Workshop May 11, 2015

---

A second Public Workshop was held on May 11, 2015 at Bristol Town Hall to update the Hazard Mitigation Plan Update project to the community. Seven (7) members of the community and several municipal officials were in attendance. The following comments were provided by those in attendance:

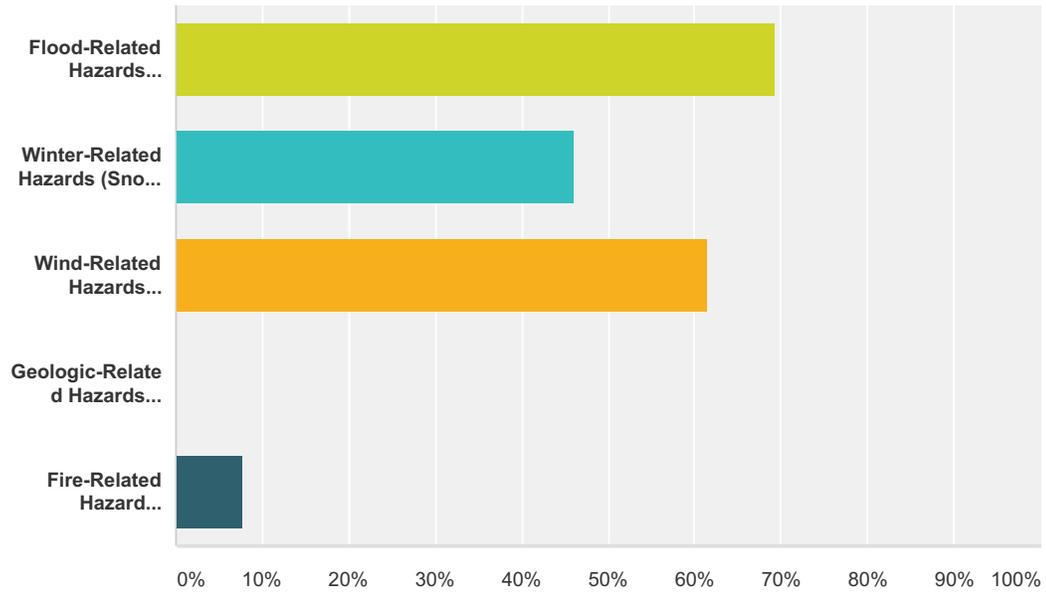
- There are areas of flooding that also correlate with the Town's Emergency Evacuation Route such as near the Sip n' Dip and Lobster Pot Restaurant. When these areas flood, the road (Hope St.) is closed and evacuation is stalled). Isn't there something the Town can do to remediate this problem long-term, such as temporary bridges? We need to be able to assemble the necessary information to develop a strong, comprehensive application for this.
  - Response: Perhaps the Vulnerability Assessment and mapping for the impacts of 1, 3, and 5 foot projections for sea level rise could be a starting point, looking at not just structures (residential and commercial buildings), but also infrastructure and life lines.



*On-Line Survey*

**Q1 Which of the following hazard events have you or has anyone in your household and/or business experienced in the past 20 years within the Town of Bristol? (Check all that apply)**

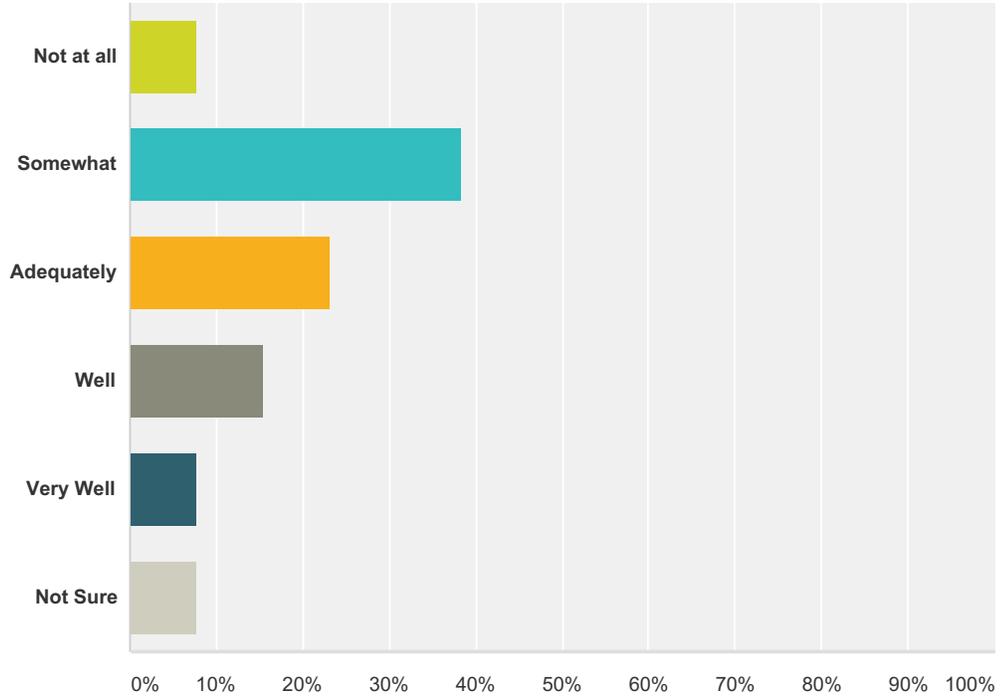
Answered: 13 Skipped: 0



Answer Choices	Responses
Flood-Related Hazards (Riverine/Flash Flooding, Inland/Urban Flooding, Coastal Flooding/Storm Surge, Coastal Erosion, Climate Change/Sea Level Rise)	69.23% 9
Winter-Related Hazards (Snow, Ice, Extreme Cold)	46.15% 6
Wind-Related Hazards (Hurricanes, Tornadoes, High Winds, Lightning/Thunderstorms, Hail)	61.54% 8
Geologic-Related Hazards (Earthquakes)	0.00% 0
Fire-Related Hazard (Drought, Extreme Heat)	7.69% 1
<b>Total Respondents: 13</b>	

## Q2 How prepared is your household and/or business to deal with a natural hazard event?

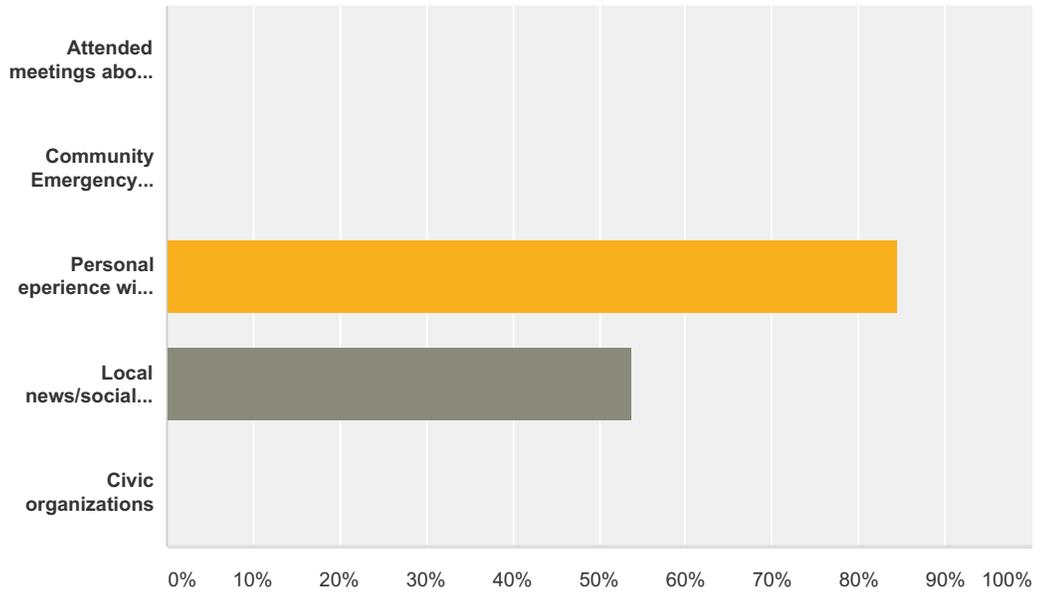
Answered: 13 Skipped: 0



Answer Choices	Responses
Not at all	7.69% 1
Somewhat	38.46% 5
Adequately	23.08% 3
Well	15.38% 2
Very Well	7.69% 1
Not Sure	7.69% 1
<b>Total</b>	<b>13</b>

**Q3 Which of the following have provided you with useful information to help you prepare for a hazard event? (Check all that apply)**

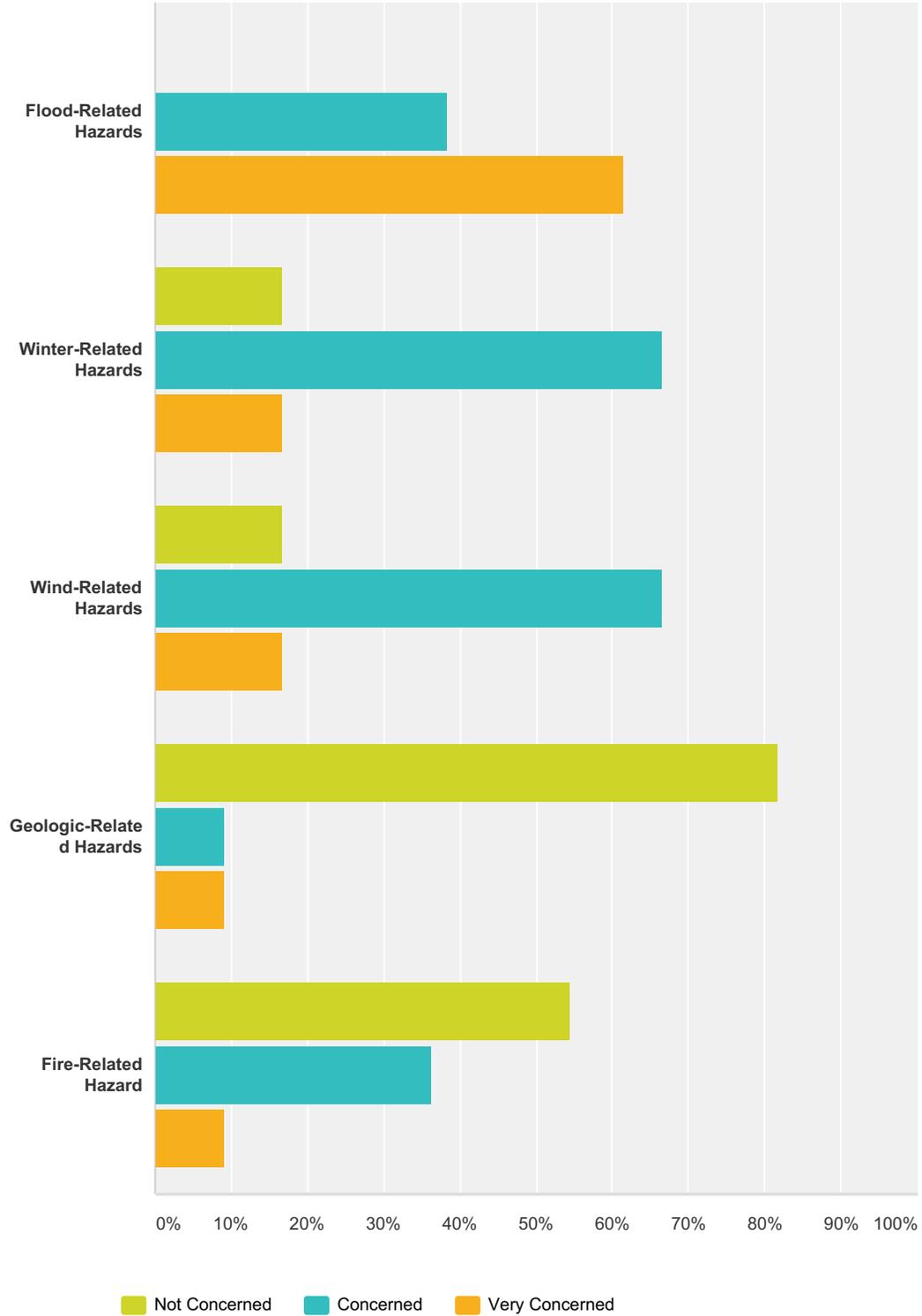
Answered: 13 Skipped: 0



Answer Choices	Responses
Attended meetings about disaster preparedness	0.00% 0
Community Emergency Response Training (CERT)	0.00% 0
Personal experience with one or more natural hazards/disasters	84.62% 11
Local news/social media	53.85% 7
Civic organizations	0.00% 0
<b>Total Respondents: 13</b>	

**Q4 How concerned are you about the following hazards in the Town of Bristol?  
(Check one response for each hazard)**

Answered: 13 Skipped: 0



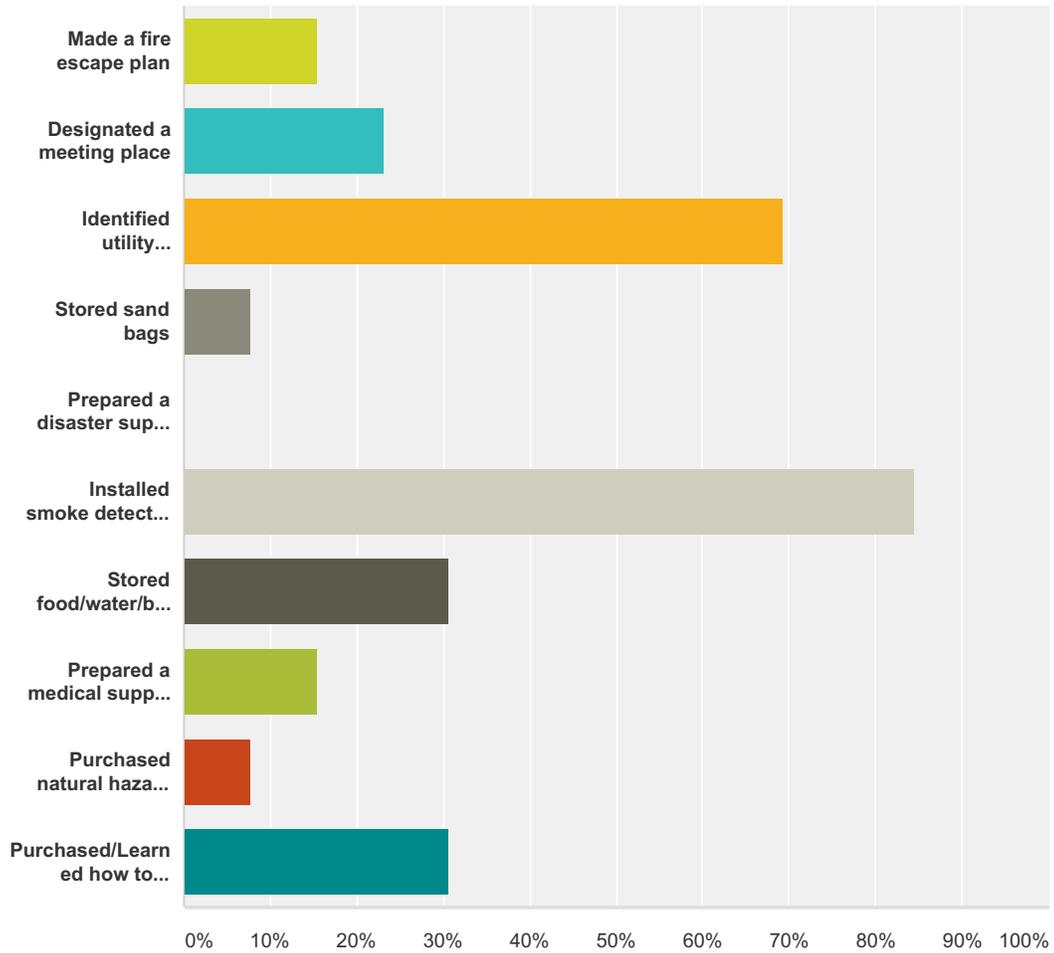
	Not Concerned	Concerned	Very Concerned	Total
--	---------------	-----------	----------------	-------

## Bristol Hazard Mitigation Plan Update

Flood-Related Hazards	<b>0.00%</b> 0	<b>38.46%</b> 5	<b>61.54%</b> 8	13
Winter-Related Hazards	<b>16.67%</b> 2	<b>66.67%</b> 8	<b>16.67%</b> 2	12
Wind-Related Hazards	<b>16.67%</b> 2	<b>66.67%</b> 8	<b>16.67%</b> 2	12
Geologic-Related Hazards	<b>81.82%</b> 9	<b>9.09%</b> 1	<b>9.09%</b> 1	11
Fire-Related Hazard	<b>54.55%</b> 6	<b>36.36%</b> 4	<b>9.09%</b> 1	11

**Q5 Which of the following steps has your household and/or business taken to prepare for a hazard event? (Check all that apply)**

Answered: 13 Skipped: 0



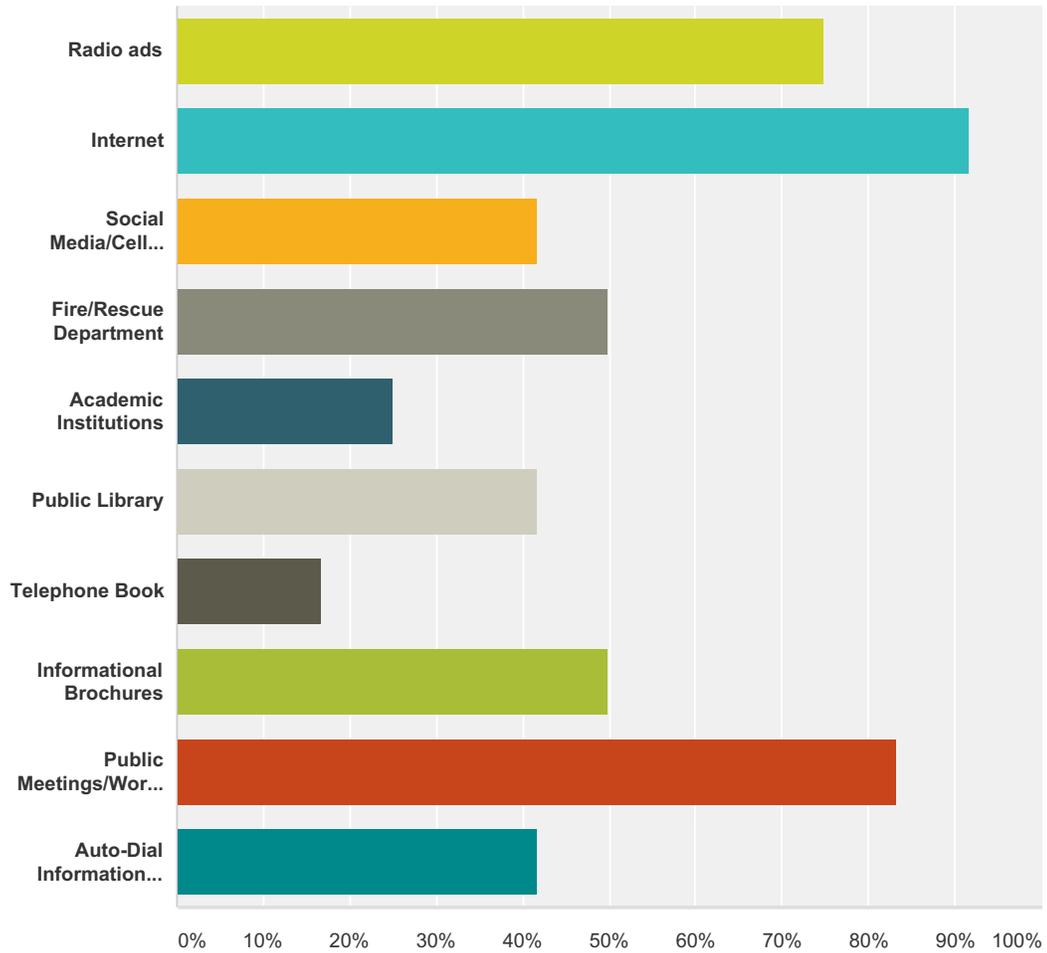
Answer Choices	Responses
Made a fire escape plan	15.38% 2
Designated a meeting place	23.08% 3
Identified utility shut-offs	69.23% 9
Stored sand bags	7.69% 1
Prepared a disaster supply kit	0.00% 0
Installed smoke detectors on each level of the house	84.62% 11
Stored food/water/batteries	30.77% 4
Prepared a medical supply kit	15.38% 2

## Bristol Hazard Mitigation Plan Update

Purchased natural hazard insurance	7.69%	1
Purchased/Learned how to program a NOAA Weather Radio	30.77%	4
<b>Total Respondents: 13</b>		

**Q6 Which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)**

Answered: 12 Skipped: 1



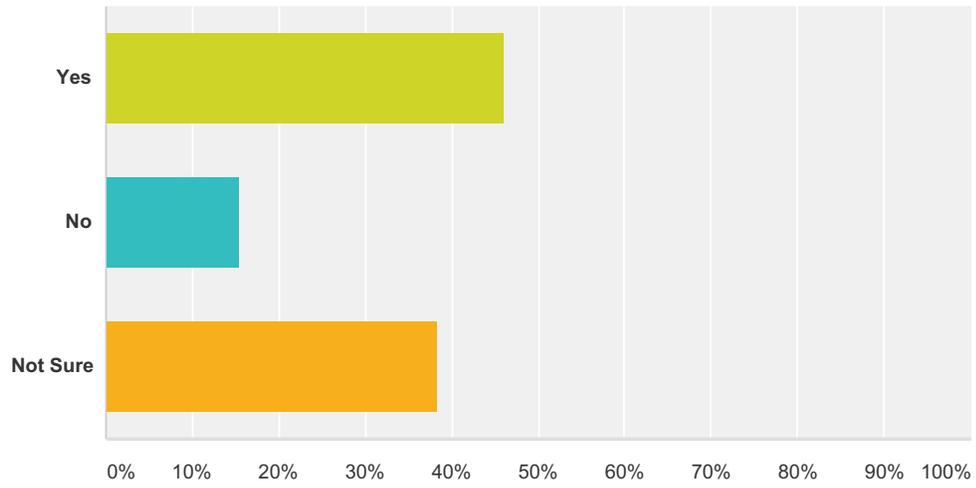
Answer Choices	Responses
Radio ads	75.00% 9
Internet	91.67% 11
Social Media/Cell phone apps.	41.67% 5
Fire/Rescue Department	50.00% 6
Academic Institutions	25.00% 3
Public Library	41.67% 5
Telephone Book	16.67% 2
Informational Brochures	50.00% 6

## Bristol Hazard Mitigation Plan Update

Public Meetings/Workshops	83.33%	10
Auto-Dial Information (Code Ready)	41.67%	5
<b>Total Respondents: 12</b>		

**Q7 Is your property located in or near a FEMA designated floodplain?**

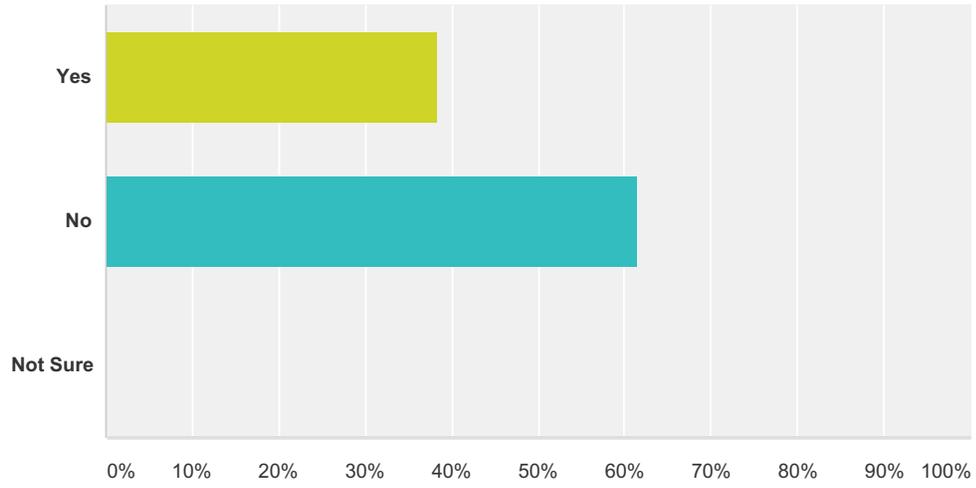
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	46.15% 6
No	15.38% 2
Not Sure	38.46% 5
<b>Total</b>	<b>13</b>

### Q8 Do you have flood insurance?

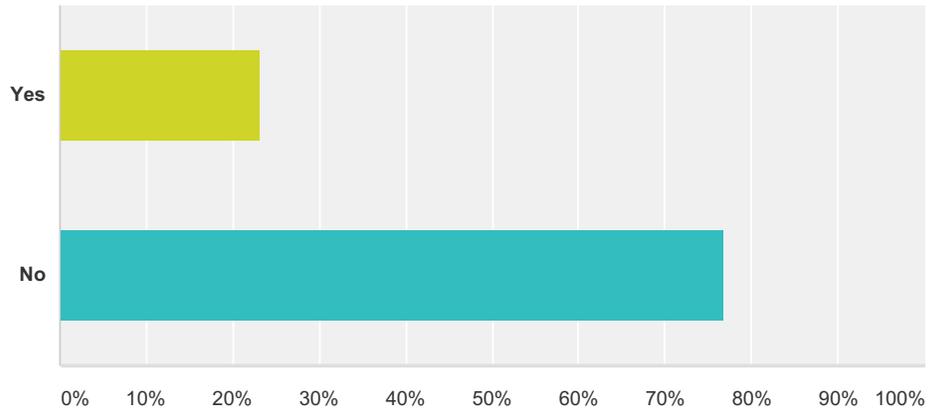
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	38.46% 5
No	61.54% 8
Not Sure	0.00% 0
<b>Total</b>	<b>13</b>

**Q9 Do you have any special access or functional needs within your household and/or business that would require early warning or specialized response during disasters?**

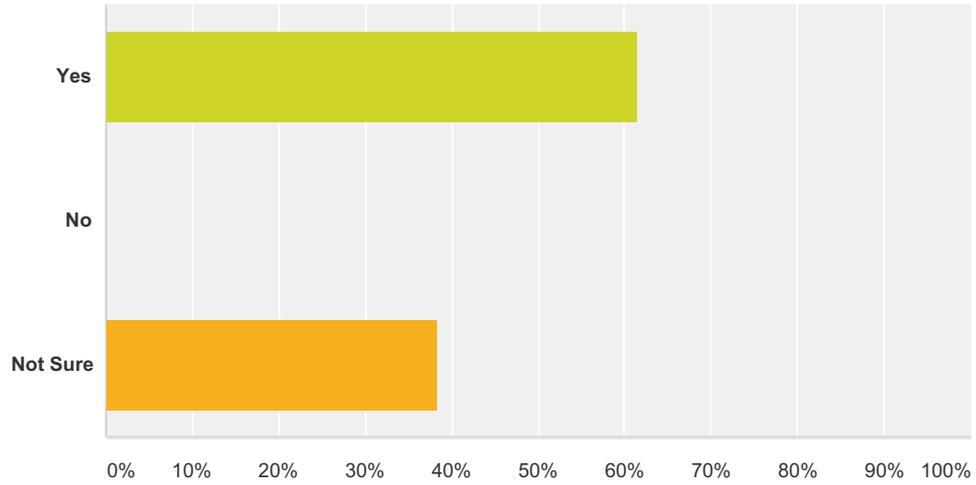
Answered: 13 Skipped: 0



Answer Choices	Responses	
Yes	23.08%	3
No	76.92%	10
<b>Total</b>		<b>13</b>

**Q10 Are you interested in making your home, business or neighborhood more resistant to hazards?**

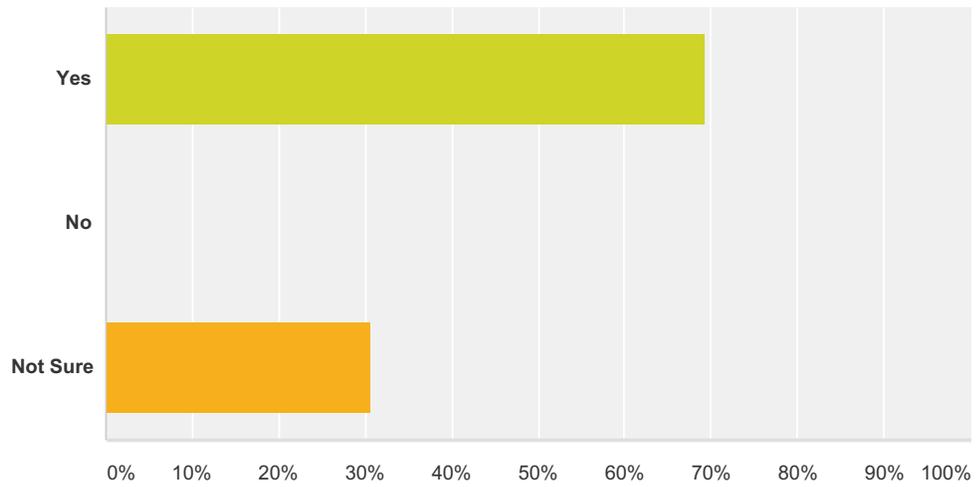
Answered: 13 Skipped: 0



Answer Choices	Responses	Count
Yes	61.54%	8
No	0.00%	0
Not Sure	38.46%	5
<b>Total</b>		<b>13</b>

**Q11 Would you be willing to spend your own money on your current home and/or business to help protect it from impacts of potential future natural disasters within the community? Examples could include: Elevating a flood-prone home; Elevating utilities in flood-prone basements; Strengthening your roof, siding, doors, or windows to withstand high winds; Removing trees/low branches.**

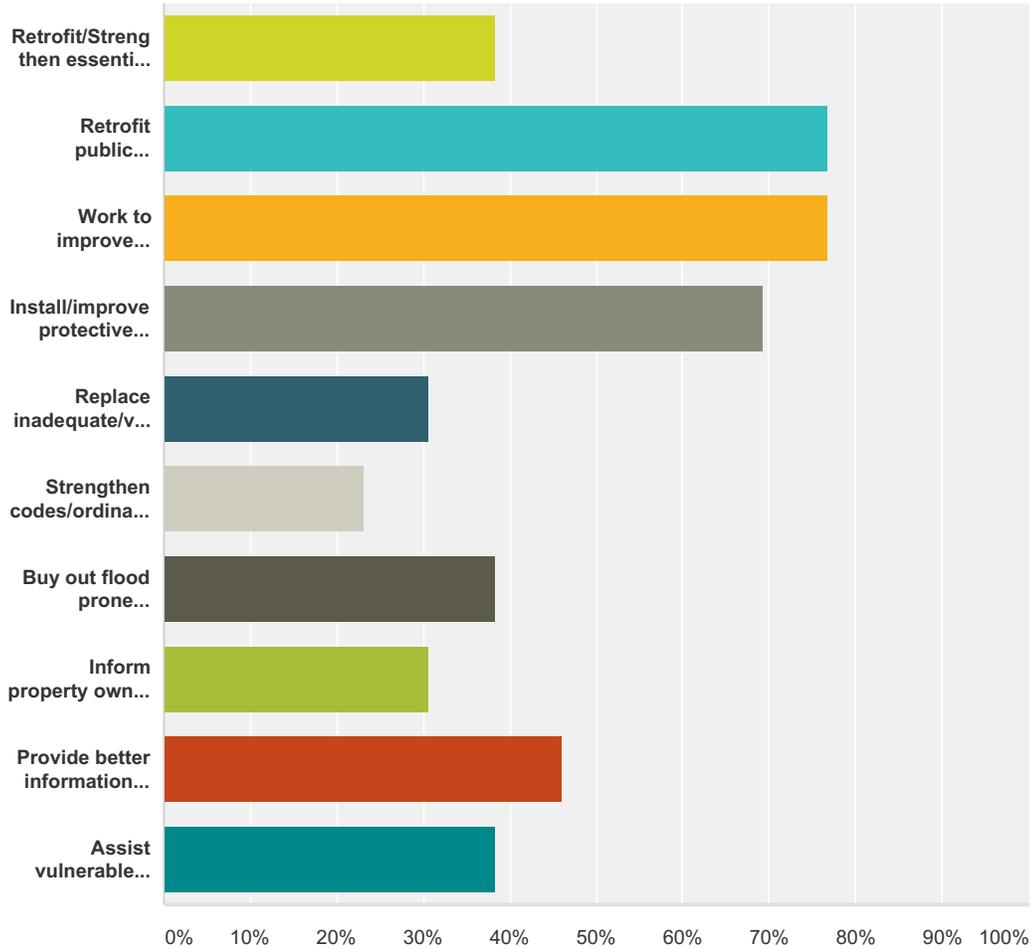
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	69.23% 9
No	0.00% 0
Not Sure	30.77% 4
<b>Total</b>	<b>13</b>

**Q12 What types of projects do you believe local, county, state or federal government agencies could be doing to reduce the damage and disruption of natural disasters in Bristol? (Select your top three choices)**

Answered: 13 Skipped: 0



Answer Choices	Responses
Retrofit/Strengthen essential public facilities such as police, fire/emergency, schools,	38.46% 5
Retrofit public infrastructure, such as elevating roadways and improving drainage systems	76.92% 10
Work to improve utilities resiliency (electric, communications, water/wastewater facilities)	76.92% 10
Install/improve protective structures (floodwalls/sea walls)	69.23% 9
Replace inadequate/vulnerable bridges and causeways	30.77% 4
Strengthen codes/ordinances to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	23.08% 3
Buy out flood prone properties and maintain as open space	38.46% 5

## Bristol Hazard Mitigation Plan Update

Inform property owners of ways they can reduce the damage caused by natural events	30.77%	4
Provide better information about hazard risks and high hazard areas	46.15%	6
Assist vulnerable property owners with securing funding to make their properties more resilient	38.46%	5
<b>Total Respondents: 13</b>		

# Bristol Hazard Mitigation Plan Update

## Q13 Additional comments?

Answered: 5 Skipped: 8

#	Responses	Date
1	Rock barriers from Lobster Pot area to Blithewold.	5/11/2015 2:42 PM
2	I am a civil engineer experienced with disaster mitigation. Call George Tamaro, 53 Shore Road- 253-3474 if I can be of help in your planning.	5/10/2015 7:43 PM
3	None.	5/10/2015 12:08 PM
4	Stream that runs across elbow and waterman always floods. There should be better drainage in the stream and a catch basin near Lugent.	5/8/2015 1:49 PM
5	Fire Dept. is very helpful with pumping out flooded basements, but would be better if basement did not flood in the first place. Redesign the Tanyard Brook!!	5/8/2015 12:12 PM

*Local Hazard Mitigation Committee: May 14, 2015*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
May 14, 2015 9 AM

### **Agenda**

1. Mapping
2. Benefit Cost Analysis Review
3. Next Steps

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Utilize school curriculum to educate students and their parents about hazard risks*

Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State Officials.

Diane...

- accomplishments to date
- information on Save Bristol Harbor (Marine Sciences Program)

Benefits

- ...increased safety, institutional awareness of hazards
- ...protection of property

Costs

- ...minimal
- ...staff time for classroom presentations
- ...printing costs for brochures

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	0	0
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Educational program for residents of flood zones and nearby downstream neighborhoods*

Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not as obvious.

The Town has a *Hurricane Disaster Information* pamphlet, developed in 2014 that includes information on hurricane season/past events, disaster supply kits, safety tips, shelter/emergency contacts and RI Special Needs Emergency Information registration.

The Town also received a grant through RIEMA for the design and installation of signage on Town-owned properties in the downtown and along roadways identified as critical flooding areas to alert residents and tourists of potential flood hazards.

Benefits

- ...increased safety, institutional awareness of hazards
- ...protection of property through increased flood policies

Costs

- ...minimal
- ...staff time
- ...printing costs for maps/literature

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	11
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Make residents aware of Emergency Response Plan*

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed through actions such as: the implementation of ‘mobile Information stations’ (dependent upon event/severity/location) throughout the community; the distribution of evacuation and sheltering to hotels, bed and breakfast establishments; seasonal rental real estate agencies; marinas; and events hosting tourists. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new ‘Civic Ready’ program to receive alerts via phone, email, text, etc..

Benefits

- ...increased safety and institutional awareness
- ...accelerated evacuation
- ...Civic Ready program already planned to roll out

Costs

- ...minimal
- ...staff time for mailings
- ...printing costs for brochures

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Public Information, Outreach – Signage*

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Cortney...

- More from her meeting on 5/15/15
- Consideration of EMAP (RIEMA)

Benefits

- ...increased safety and institutional awareness
- ...accelerated evacuation

Costs

- ...minimal
- ...staff time
- ...printing costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	12
Total Score	21	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2      favorable 1  
 not applicable 0      not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Designate Alternative Evacuation Route for the Poppasquash Area*

The Town will work towards a shared agreement with the State of RI (DEM) to assess the feasibility an additional inland opportunity for an alternate route along lower Poppasquash Rd., as well as a second opportunity along a new right-of-way for water lines along Poppasquash. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Benefits

- ...increased safety and institutional awareness (including tourists)
- ...accelerated evacuation
- ...uninterrupted access for emergency vehicles/responders

Costs

- ...minimal
- ...staff time for coordination/mapping
- ...printing costs for literature

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	-1
Sub-total of cost/benefit	9	11
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2    favorable 1  
 not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Public Information, Outreach and Incentive Program*

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, *RI Coastal Properties Guide*, and other FEMA publications, as applicable.

In addition, the Town will promote and support enforcement of the latest policy revisions relative to climate change and sea level rise and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of Technical Bulletins), grant/loan sources, and insurance options.

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

Benefits

...institutional awareness of risks for contractors/homeowners

...increased property protection

Costs

...minimal

...staff time to place order through FEMA's library

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	12	12
Total Score	24	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

*Action: Prepare an "After-the-Storm Recovery" Plan for the community*

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consider a 'Regional' approach to this plan.

*Community Assessments*

The Bristol Emergency Management Task Force/Certified Floodplain Manager (s) to develop a formalized protocol to complete Community Assessments after an event regarding the shutoff/reconnection of utilities, damage assessments/documentation and Certificate of Occupancy re-instatements.

*Recovery and Reconstruction Ordinance*

The Town to coordinate with CRMC to review the permitting process, develop and adopt an ordinance to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. Formalize the existing process, also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.

Benefits

- ...increased property protection, resiliency/reduced losses
- ...homeowner supported by community
- ...accelerated recovery

Costs

- ...minimal
- ...staff time to develop the protocol and ordinance

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	12
Total Score	21	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Acquire properties in Special Flood Hazard and repetitive flood loss areas* Bristol now includes 12 severe repetitive flood loss properties as well as properties subject to periodic flooding within the Tanyard Brook and Silver Creek watershed area. The Town will work with private homeowners in these areas and FEMA to identify an acquisition project (s), obtain approval by the state and FEMA, and seek funding to purchase the property. By purchasing these residential properties, the Town is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The land is then restricted to open space, recreation or wetlands in perpetuity.

Benefits

...increased resiliency/reduced losses

...would satisfy other community objectives of additional open space, parks/recreation sites, and/or scenic areas

Costs

...could be substantial, dependent upon location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	-1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	1	9
Total Score	10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Acquire properties that are within flood zones*

The *Open Space Plan* identifies areas for acquisition that would not only remove properties from flood-prone areas, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Open Space Committee as part of the *Open Space Plan* implementation, will seek to acquire parcels in risk areas as they become available for acquisition.

Benefits

...increased resiliency/reduced losses

...would satisfy other community objectives of additional open space, parks/recreation sites, and/or scenic areas

Costs

...could be substantial, dependent upon location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	-1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	1	9
Total Score	10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Develop a stand-alone Environmental and Historic Preservation Plan*

An Environmental and Historic Preservation Plan (EHP) will identify and mitigate potential loss to historic resources associated with natural disasters, primarily threats to sea-level rise, subsidence, and flooding, particularly in the historic waterfront district. By assessing the significance of cultural resources within the 100 year flood plain boundary and risk from flooding associated with those resources, planning for their preservation will enable the Town to better protect the architectural integrity of the downtown. The plan should articulate the potential re-use/rehabilitation/relocation potential for historic structures/at-risk properties within the flood zone.

In the past two years, the Town has acquired two properties in the downtown historic district along the west side of Thames St., and is working with the state to study potential re-use/rehabilitation concepts. The Town now owns all properties from the State St. Dock to the Robin Rug building.

Benefits

- ...would provide the balance necessary between historic preservation and mitigation
- ...a resource for the Bristol Waterfront National Register District

Costs

- ...minimal
- ...staff time to develop Plan

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	10
Total Score	19	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Bury electrical wires and other suspended cables*

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

Benefits

- ...continuity of services
- ...protection of property and life safety from downed utility lines
- ...improved view corridors/vistas

Costs

...could be substantial dependent upon the scale of the project

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	-1	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	-1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	-1
<b>Political:</b> Is there strong public support to implement and maintain the action?	-1	-1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	-1
<b>Economic:</b> Is the action cost-effective?	-1	-1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	-1	0
Sub-total of cost/benefit	-7	-3
Total Score	-10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2      favorable 1  
 not applicable 0      not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: Reinforce wire-to-pole connections

While the action above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with “Hendrick’s Spacer Cables”. These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

Benefits

...continuity of services

...protection of property and life safety from downed utility lines

Costs

...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	-1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	1	6
Total Score	7	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Natural Resources Protection**

Action: *Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds.*

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. The Town is presently assessing the feasibility of a Stormwater Management Utility District which will consider the development of 'criteria' relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions.

Benefits

...reduced flow/loading to the WWTF

...increased infiltration onsite

...property protection

Costs

...dependent upon site/location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	8	12
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Natural Resources Protection**

Action: *Develop Shoreline Management Plan*

Develop a management plan for Bristol’s coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. As an example, the Town could consider development of a functional ‘retrofit program’ for dead-end streets that taper-off into the water. Town to consider a ‘Regional’ approach to this management plan.

Benefits

- ...increased property/environmental resources protection
- ...increased resiliency/reduced losses

Costs

- ...minimal (especially if regional approach is utilized)
- ...staff time to develop the Plan

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	10	13
Total Score	23	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
 not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Reline or replace sewer lines where necessary*

A recent *Sewer System Evaluation Study* has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. Continue work that is underway in the Tanyard Brook area.

Jose...

- information on Annawamscutt area pilot project

- EPA mandate (cured in place)

Benefits

...protection of infrastructure

...continuity of services

...reduced potential for pollutant loadings/environmental impacts

...prevent sewer surcharges/overflows/backups

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	0
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	-1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	2	2
Sub-total of cost/benefit	7	11
Total Score	18	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Continue Drainage Improvements at the Wastewater Treatment Plant*

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result, will also improve drainage along Fairview Drive.

Benefits

- ...protection of infrastructure
- ...continuity of services
- ...reduced potential for pollutant loadings/environmental impacts

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	-1
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	8	10
Total Score	18	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
 not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Inspect and retrofit the seawall along Independence Park and Walley Beach, the Armory building downtown and the Prudence Island Ferry Dock*

Stability of the seawall, Armory building, and Ferry Dock should be evaluated. Retrofits should be made to withstand a 20 to 50-year storm, in addition to the impacts of projected sea level rise.

Benefits

...increased property/recreational resources protection

...increased resiliency/reduced losses

Costs

...could be substantial dependent upon results of evaluation

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	-1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	5	11
Total Score	16	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Emergency Services**

Action: *Work with property owners to establish fire lanes in the Mount Hope Area*

Ensure emergency personnel can access people and property within the wooded areas of the Mount Hope area.

Benefits

...protection of life and property

...uninterrupted access

Costs

...minimal

...staff time to maintain/clear access roads

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	10	14
Total Score	24	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Emergency Services**

Action: *Explore location(s) for new and/or additional storm shelter(s)*

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered. The Quinta-Gamelin Community Center has been proposed as a secondary shelter (outstanding needs include a functional kitchen and ADA access throughout the building).

Benefits

- ...secondary shelter space
- ...protection of public health and safety

Costs

- ...minimal
- ...staffing/training

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Planning and Prevention**

Action: *Continue to evaluate new basement utilities or require installation of a check valve/backflow preventor*  
 Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town has adopted an ordinance which requires either sewer service connection at 2 feet above lowest floor elevation (as per Plumbing Code) or require installation of a check valve or backflow preventer between the building and the sewer collection system (applies to all building spaces constructed below the grade of the street.)

Benefits

- ...protection of property
- ...uninterrupted services

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	12	14
Total Score	26	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2    favorable 1  
 not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Planning and Prevention**

Action: *Expand the implementation of the Backflow Retrofit Program to both residential and commercial properties through FEMA grant funding (as available).*

Benefits

- ...protection of property
- ...uninterrupted services

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	10	13
Total Score	23	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
 not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

**Planning and Prevention**

Action: *Reduce illegal connections of private sump pumps and floor drains to the sanitary sewer system through educational programs*

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences, partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being distributed. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations.

Benefits

- ...protection of infrastructure
- ...continuity of services
- ...reduced potential for pollutant loadings/environmental impacts
- ...prevent sewer surcharges/overflows/backups

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	1
<b>Economic:</b> Is the action cost-effective?	1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	3	9
Total Score	11	
<b>Priority</b>		

Definition of Rating Scale: 2=very beneficial 1=favorable  
 0=not applicable 1=not favorable

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

**Planning and Prevention**

Action: *Coordinate Evacuation Plans with Neighboring Municipalities*

The Police Department will work with neighboring communities to coordinate evacuation plans.

Courtney...

- More from her meeting on 5/15/15

Benefits

- ...accelerated evacuation
- ...protection of life safety

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	11	11
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: 2=very beneficial 1=favorable  
 0=not applicable 1=not favorable



**Appendix C – Model Lease Agreement for Commercial Uses in the Floodzone**

# Emergency Evacuation Plan

## Thames Street Landing

251-267 Thames St.  
Bristol, RI 02809

Upon confirmation from the Town of Bristol Emergency Official that a storm with the threat of flood is approaching, the businesses on the ground floor in the Flood plain at Thames Street Landing will be told to move their goods to the storage room in the hotel building at the third floor. This command will be issued by the manager of Miles Ave. Property Co., LLC, or in the absence of that person, the manager, of the Bristol Harbor Inn, or assistant manager of the Bristol Harbor Inn.

The evacuation shall occur six hours before the onset of the actual high water flood occurrence. An alternate is for the tenant to remove all belongings from the tenants leased space and move those belongings in a truck or other vehicle to a location above the 18 foot flood plain.

Miles Ave. Property has procured the services of East Bay Movers for another option for tenants. Upon notification of the approach of a flooding condition, in addition to 1) Moving goods to the top Floor of the Inn, 2) removing goods from the site, the tenant may contract with East Bay Movers for space in the moving van, and when the van is full, it will move to the parking lot East of Thames Street, which is above the 18 foot flood level.

Space in the third floor will be designated by Miles Ave. personnel by retail location for short term storage of goods until the flood condition has passed. Goods taken to the third floor of the Inn will be stored to the left and right of the elevator, and East along the North wall of the "E" building, and West, past the mechanical room, along the south wall of the "F" building. Assignment of space will be made by the person that has contacted the tenant, or designate.

It is the responsibility of the tenant to provide the resources to timely move materials to the safe locations established for a flood condition. Miles Ave. is obligated to the Town of Bristol to provide the space, and terms of the tenant lease dictate that this action shall be taken.

COOV

1.14 First Month's Rent. The first month's rent per Exhibit A shall be due upon signing of this lease.

1.15 Flood Disclosure. The Lessor hereby discloses to Lessee that the premises are located on the Bristol Harbor in a high velocity flood zone and that the Lessee shall be required to take certain action during a severe storm or hurricane in order to prevent loss, damage, or injury, to people or property. Lessor shall not be required to give notice to, or inform lessee of severe storm or hurricane weather forecasts. The Lessor reserves the right to establish, from time to time, reasonable rules and regulations in regards to the action Lessee shall be required to take in the event of a severe storm or hurricane.

(  ) The demised Unit does include additional storage space above the flood level in the building or on site in a different building, for the purpose of storing merchandise and equipment during a severe storm or hurricane.

## ARTICLE 2. TAXES

2.1 Lessor's and Lessee's Obligation. Lessor shall pay all base year real estate taxes, assessments and other governmental charges that would become a lien on the demised premises if not paid when due.

2.2 Lessee's Taxes. Lessee shall pay when due all taxes, assessments and other governmental charges levied on the personal property or business of Lessee located on the demised premises. Lessee shall pay to lessor increases over base year real estate taxes. Lessee shall pay to Lessor a pro rata share of any increase in real estate taxes above the amount of such taxes levied upon the Thames Street Landing complex of which the premises, forms a part for the Tax Base Year (as used in this provision "Tax Base Year" shall be deemed to mean the first tax year following the commencement of the

taking of possession of the demised premises by Lessee shall be conclusive evidence that the demised premises were in satisfactory condition at the time such possession was so taken, except for buildout punchlist items. Excepting article 1.3.

1.10 Use of Premises. The demised premises shall be used for the purpose of retail sales of Jewelry & Clothing and related and for no other purpose. Lessee shall restrict its use to such purposes, and shall not use or permit the use of the premises for any other purpose without the written consent of Lessor. Such consent will not unreasonably be withheld if Lessee's proposed purpose does not significantly affect other tenants of Thames Street Landing.

In accordance with the Bristol Zoning Board of Review approval for the premises, the following uses for the building in which the demised Unit is located is prohibited: The sale or storage of stoves, refrigerators, heavy appliances, or similar items which may become a projectile during a severe storm or hurricane is prohibited on the demised Unit.

1.11 Quiet Enjoyment. Lessee on paying the base rent and any additional rent herein specified and observing Lessee's agreements hereof shall and may peaceably and quietly have, hold and enjoy the demised premises during the Term of this Lease.

1.12 Parking. Lessor shall provide parking, which shall be shared in common by all of the tenants and customers on the premises. Lessee agrees not to unreasonably interfere with the use of said parking facilities by the other tenants within reason. Lessor shall establish, from time to time, rules and regulations for the use of the parking facilities by all of the tenants on the premises. Employees of all Lessees of Thames Street Landing will not be allowed to park in the main on-site parking lot.

1.13 Security Deposit. Lessee shall pay one (1) month's rent to lessor as a security deposit upon signing of this lease.

## Appendix D – Photos and Historical Information

# HURRICANE AND FLOOD PICTORIAL RECORD

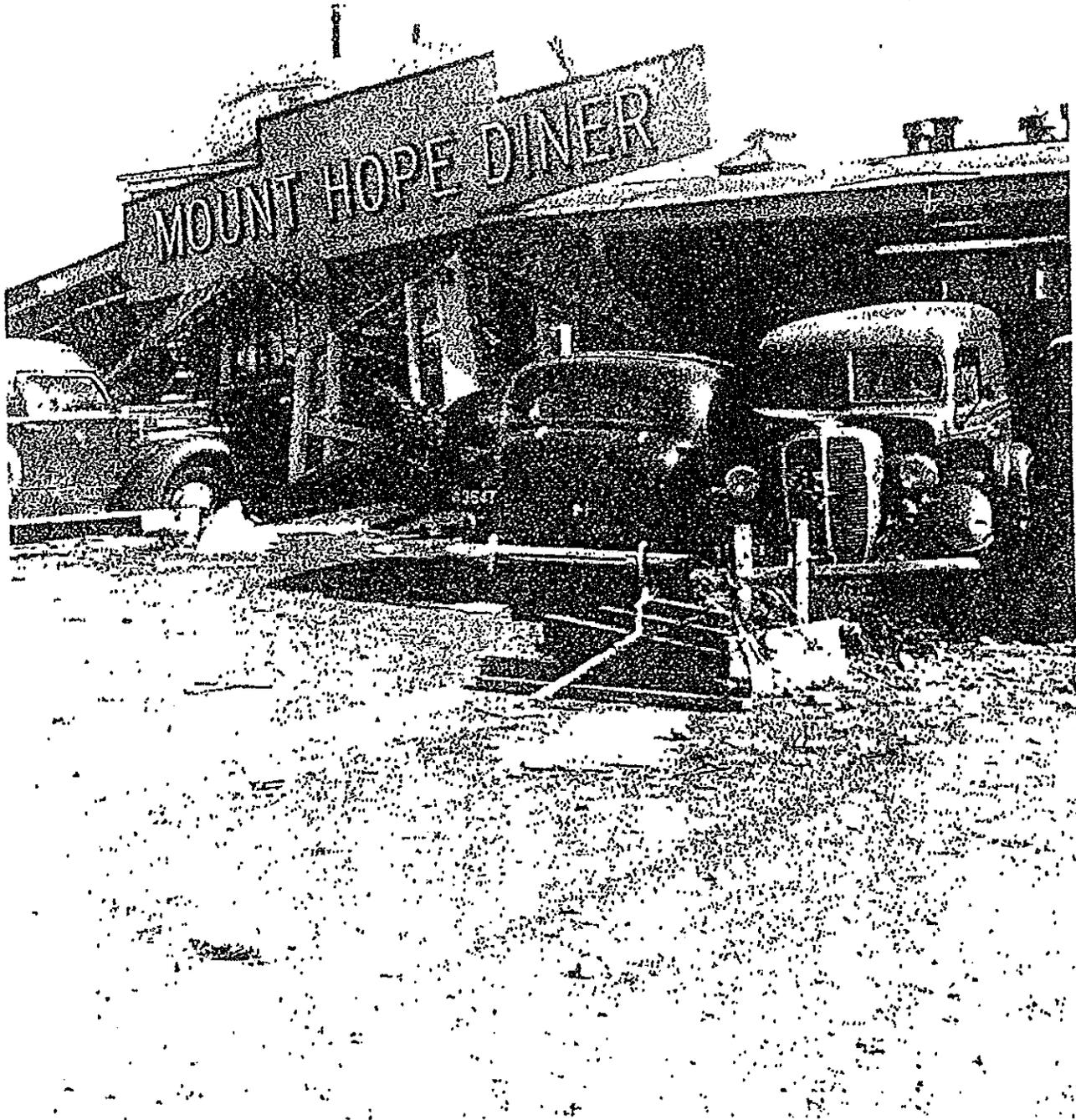


Rockwell Park at the foot of Church Street, as a  
flood survivor forces his way to a place of safety.

SEPTEMBER 21, 1938

at

BRISTOL, R. I.



The completely ruined diner which was only recently renovated.  
This building was almost completely covered by the flooding tides.



Travel in and out of Bristol along Hope Street was impossible for two days, because of such piles of debris and destruction near Poppasquash Road.



What once was a three story residence on Hope Street. The entire first floor and corner was completely carried away by the force of the swirling currents.

The historic town of Bristol was struck by a tropical hurricane, on the afternoon of September 21, 1938. Although the town was very fortunate in not having any loss of life, the destruction of property was estimated at many hundred thousands of dollars. The waters surrounding Bristol rose to an average height of 18 feet above low tide level, carrying with it many waterfront buildings and boats. When the waters receded tons of debris was deposited along the town's main thoroughfares, boats of all kinds were found on front lawns and in vacant lots.

Two of the town's largest industries, Collins and Aikman Corporation and Herreshoff Manufacturing Company, as well as many of the smaller business places suffered heavy losses. Many homes were damaged by fallen trees, the roots were pulled from the ground by the wind which is estimated to have attained a velocity exceeding 100 miles an hour.

The citizens of Bristol, who, for a time were without water, electricity and gas showed splendid spirit, cooperation and courage. The individuals and utilities are also to be congratulated on their excellent work in returning Bristol to normalcy.

These pictures which are reproduced here are without any retouching, provide a pictorial record of this great disaster.

Photographs by Newman and Ryono

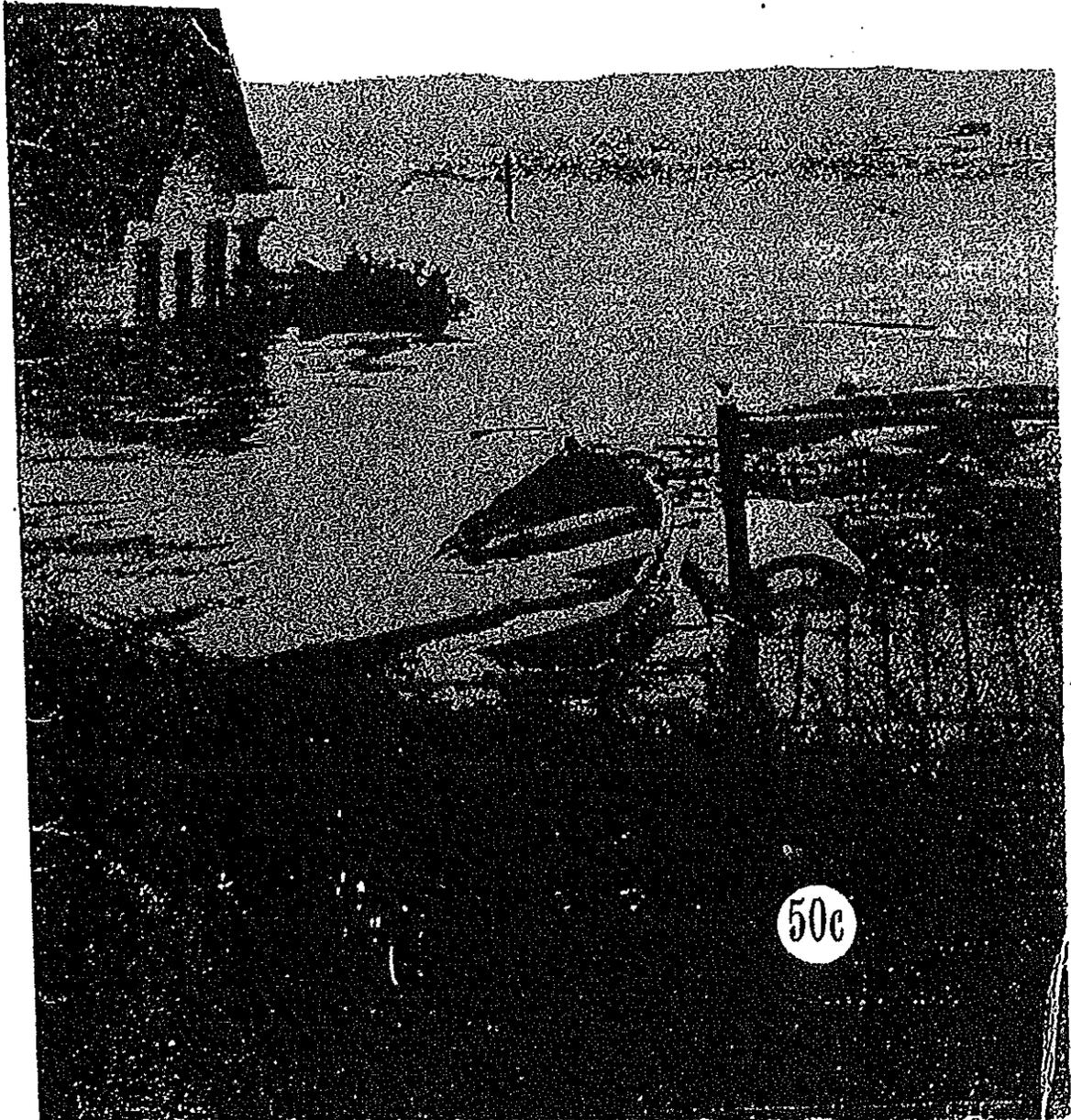


Cumberland Farms Site  
Looking North on Hope Street from Berretto's Service Station  
December 4, 1990 Storm

# *Hurricane Carol*

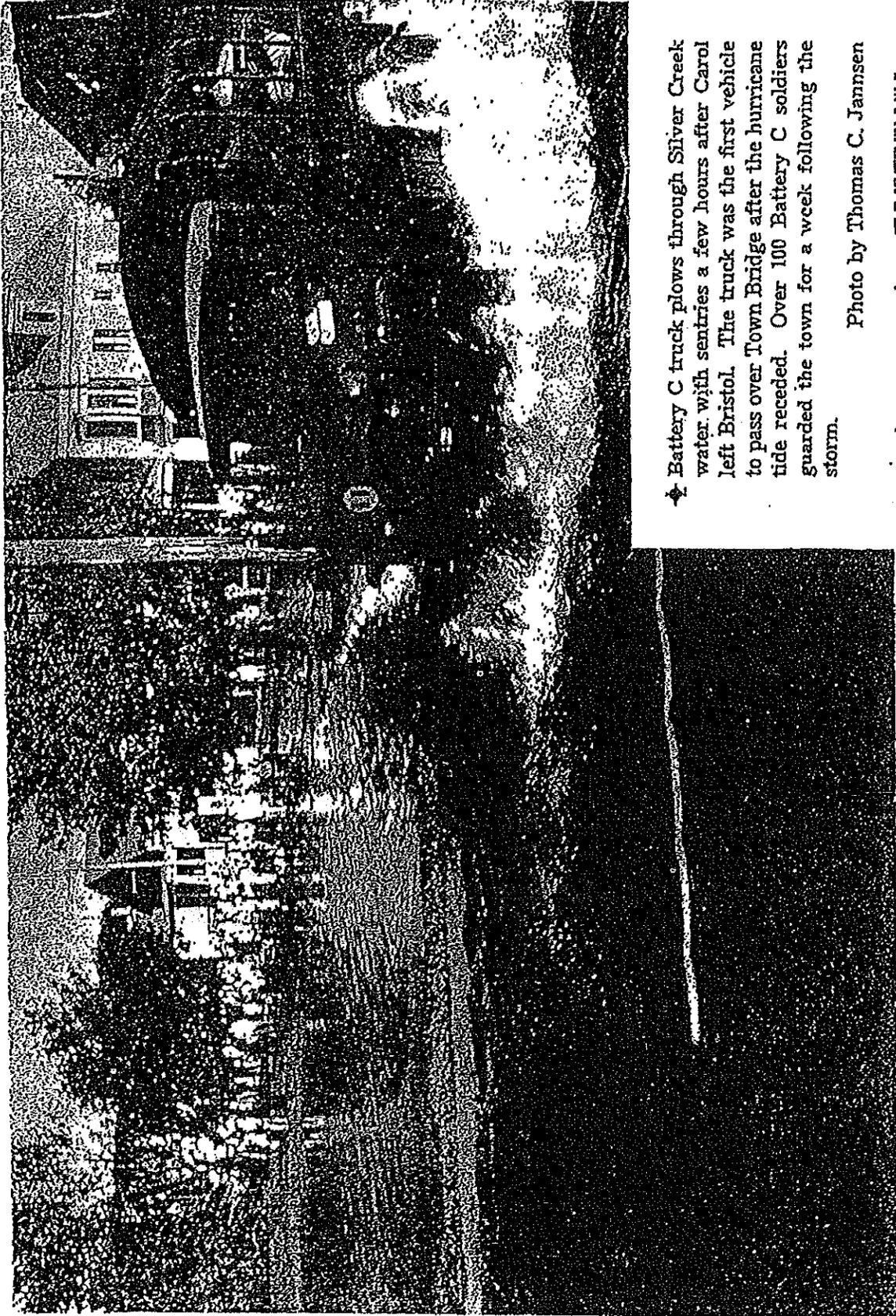
In Bristol, R. I.

*August 31, 1954*



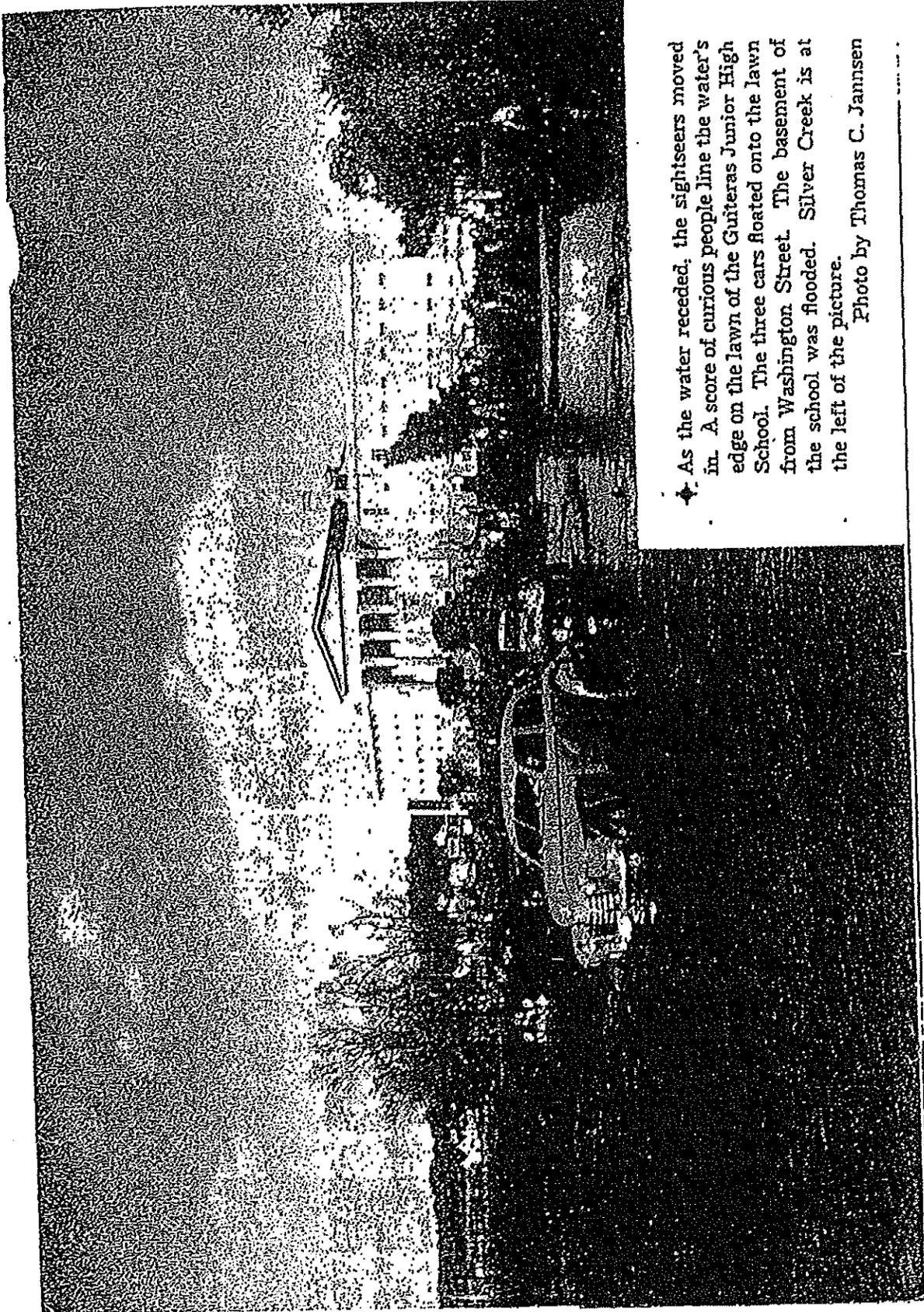
50c

This pictorial account  
of Hurricane Carol  
in Bristol, R. I.  
was compiled, edited  
and printed by the staff  
of the



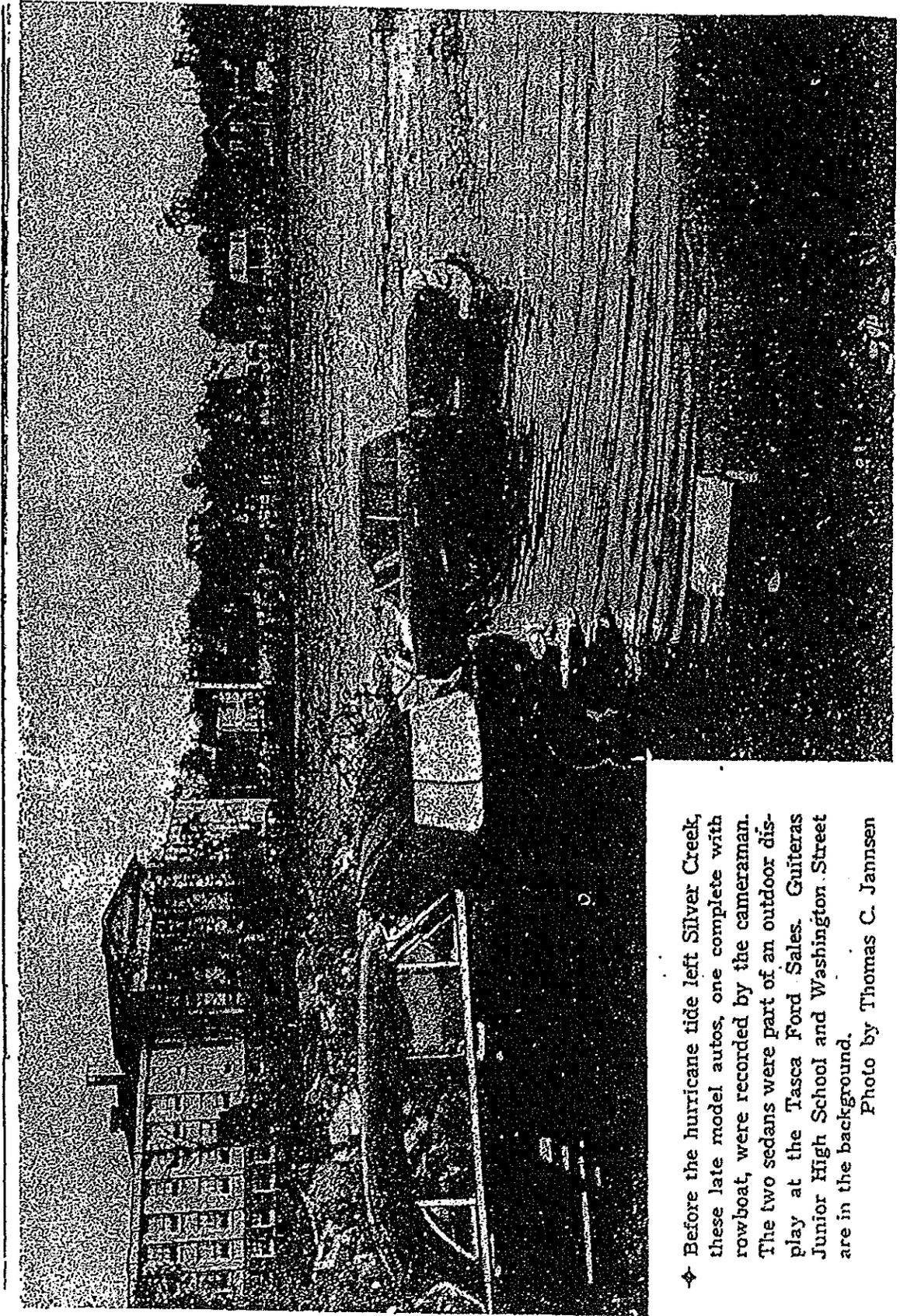
◆ Battery C truck plows through Silver Creek water, with sentries a few hours after Carol left Bristol. The truck was the first vehicle to pass over Town Bridge after the hurricane tide receded. Over 100 Battery C soldiers guarded the town for a week following the storm.

Photo by Thomas C. Jannsen



◆ As the water receded, the sightseers moved in. A score of curious people line the water's edge on the lawn of the Guiteras Junior High School. The three cars floated onto the lawn from Washington Street. The basement of the school was flooded. Silver Creek is at the left of the picture.

Photo by Thomas C. Jannsen



◆ Before the hurricane tide left Silver Creek, these late model autos, one complete with rowboat, were recorded by the cameraman. The two sedans were part of an outdoor display at the Tasca Ford Sales. Guiteras Junior High School and Washington Street are in the background.

Photo by Thomas C. Jannsen

## *References*

## Federal/National Resources

Local Mitigation Plan Review Guide  
FEMA  
October 1, 2011

## State Resources

*Rhode Island 2014 Hazard Mitigation Plan Update*  
Rhode Island Emergency Management Agency

*Rhode Island Climate Change Commission Report*  
November 2012

*Precipitation and Storms in Rhode Island: Trends and Impacts*  
*Sea Level Rise in Rhode Island: Trends and Impacts*  
*Climate Change: Rhode Island's Coasts*  
Rhode Island Sea Grant/URI Coastal Resources Center  
2012

*Adapting to Climate Change: A Planning Guide for State Coastal Managers*  
NOAA  
2010

*SafeWater RI: Ensuring Safe Water for Rhode Island's Future*  
Rhode Island Department of Health  
May 2012

*The State of Rhode Island Coastal Resources Management Program – Section 145 Climate Change and Sea Level Rise*  
1978 As Amended

*Rhode Island Coastal Property Guide: What Coastal Property Owners, Renters, Builders and Buyers Should Know About Rhode Island's Shoreline*  
Rhode Island Sea Grant/URI Coastal Resources Center  
2014

*StormSmart Coasts Rhode Island*  
StormSmart Coasts Network  
<http://ri.stormsmart.org/page/28/>

## Local/Regional Resources

*Town of Bristol Comprehensive Plan*  
2009

*Open Space Plan of the Town of Bristol, RI*  
Bristol Open Space Committee  
2008

*Town of Bristol, R.I. Subdivision and Development Review Regulations*  
Town of Bristol  
September 8, 2009 Amended

*Flood Hazard Development Standards/Permit – Article IX, Division 2 (Sections 28-301 through 28-310)*  
Town of Bristol  
June 25, 2014

*Revised Phase II Stormwater Management Program Plan*  
Town of Bristol  
September 2008 Revised

*Storm Preparedness and Hazard Mitigation Plan*  
Bristol Harbormaster's Office  
May 2004

*Harbor Management Plan*  
Bristol Harbormaster's Office  
2005



Appendix A – Maps

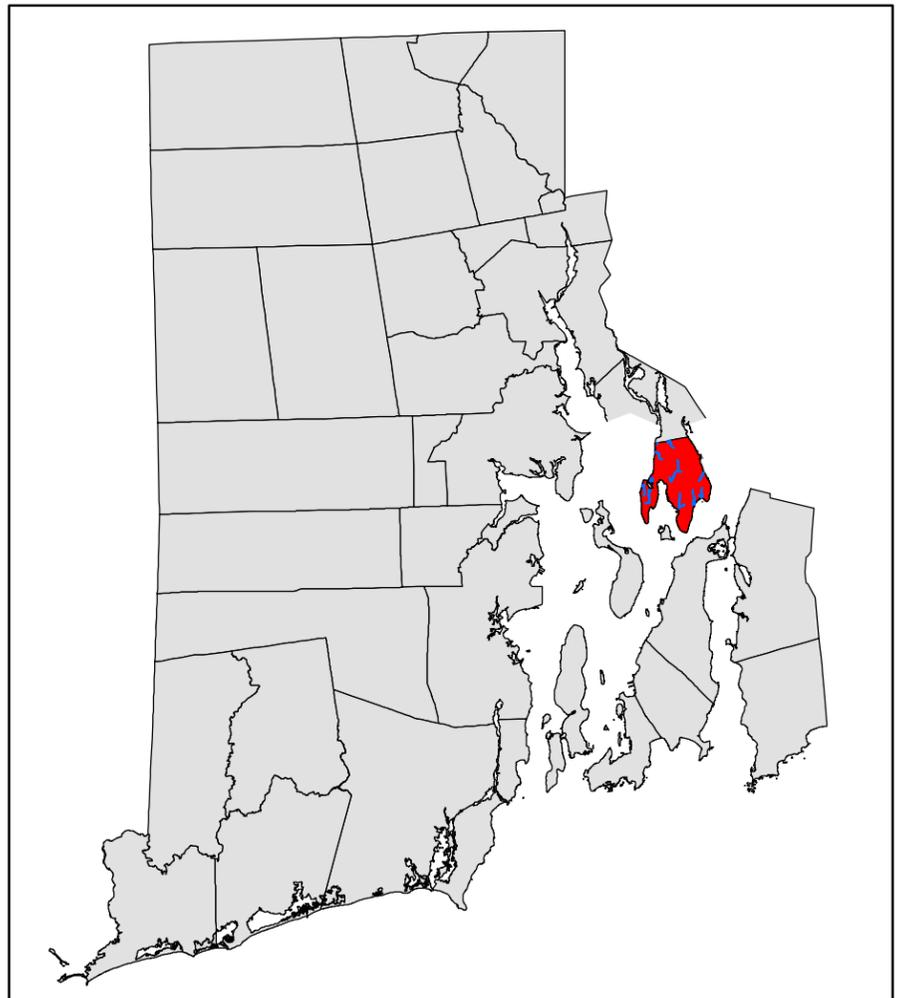
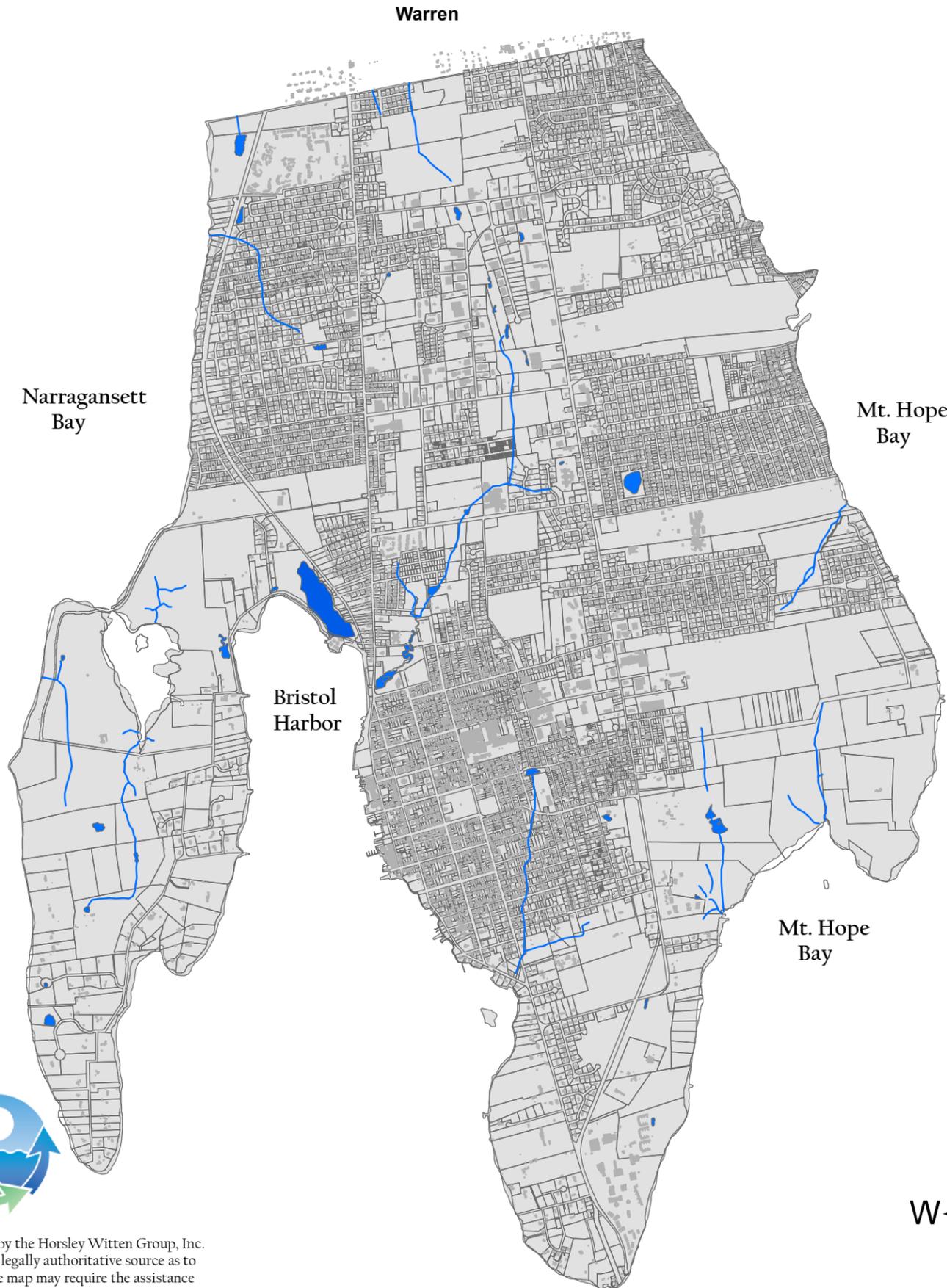
*Location Map (A-1)*

*Risks (A-2)*

*Critical Facilities (A-3)*

*Flood Risks with Repetitive Loss Areas (A-4)*

*Sea Level Rise (A-5)*

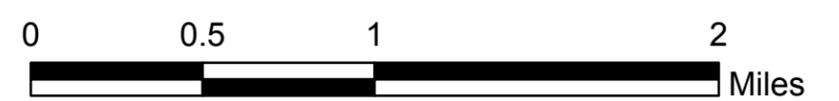
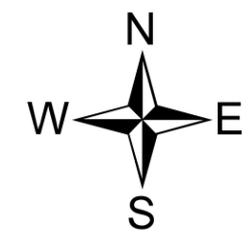


May 1, 2015  
 Data Sources:  
 RIGIS,  
 Bristol Municipal Database,  
 RIEMA,  
 NOAA-NHC IBTrACS.

**Horsley Witten Group**  
*Sustainable Environmental Solutions*

55 Dorrance Street • Suite 403 • Providence, RI 02903  
 Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)

This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.



# Map A - 1 Location Map



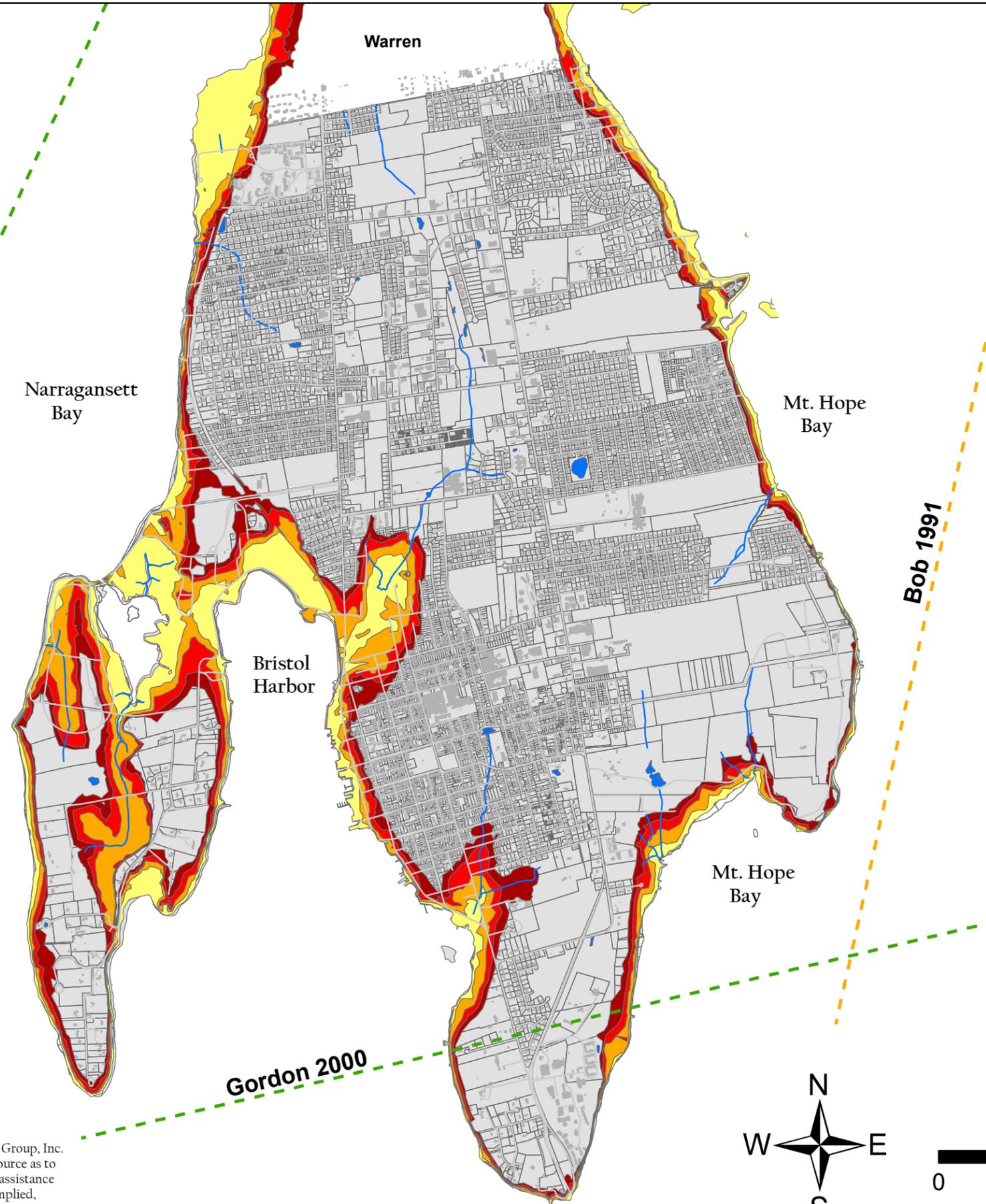
1872

To the west of Rhode Island:

1938 Hurricane  
landfall in Long Island, NY

1954 Hurricane Carol  
landfall in Old Saybrook, CT

Barry 2007



**LEGEND**

- Buildings
- Rivers/Streams
- Lakes/Ponds

**Hurricane Tracks**

- Tropical Storm: < 64 kt.
- Category 1: 64-82 kt.
- Category 2: 83-95 kt.

**Hurricane Surge Inundation**

- Category 1
- Category 2
- Category 3
- Category 4

May 1, 2015  
Data Sources:  
RIGIS,  
Bristol Municipal Database,  
RIEMA,  
NOAA-NHC IBTrACS.

**Horsley Witten Group**  
Sustainable Environmental Solutions

55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8388 • www.horsleywitten.com

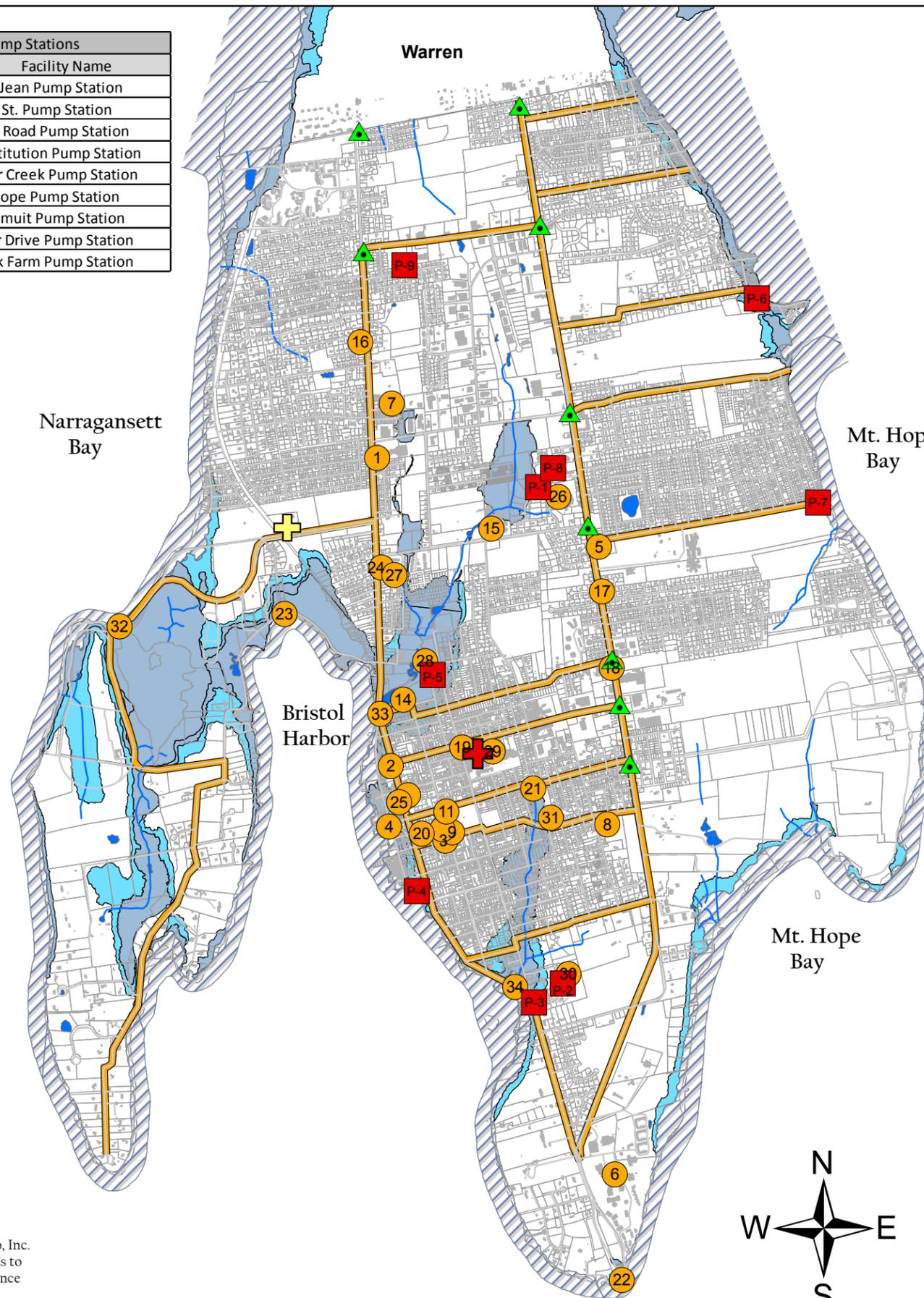
This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.

# Map A - 2 Risks

0 0.5 1 2 Miles

Critical Facilities	
Site ID	Facility Name
1	Bristol Fire Department (400 Hope St.)
2	Bristol Fire Department (Franklin/High St.)
3	Bristol Fire Department (Church St.)
4	Bristol Fire Department (193 Thames St.)
5	Bristol Fire Department/EOC (482 Metacom Avenue)
6	Roger Williams University
7	Sea Side Nursery School and Kindergarten
8	Stoney Lane Preschool
9	Byfield School
10	Reynolds School
11	Our Lady of Mt. Carmel School
12	Colt Andrews School
14	Guiteras School
15	Mt. Hope High School
16	Rockwell School
17	Veteran's Home
18	Bristol Police Department
19	DCYF Frame
20	Bristol Town Hall
21	State St. Pond Dam
22	Mt. Hope Bridge
23	Sea Wall at Poppasquash Rd.
24	Bristol Senior Center
25	Rogers Free Library
26	Metacom Manor Health Center
27	Benjamin Church Manor
28	Silver Creek Manor
29	Franklin Court Assisted Living
30	Wastewater Treatment Facility
31	Bristol DPW Facility
32	Mill Pond Bridge
33	Town Bridge
34	Tanyard Brook Crossing

Pump Stations	
Site ID	Facility Name
P-1	Leila Jean Pump Station
P-2	Main St. Pump Station
P-3	Ferry Road Pump Station
P-4	Constitution Pump Station
P-5	Silver Creek Pump Station
P-6	Mt. Hope Pump Station
P-7	Kickemuit Pump Station
P-8	Peter Drive Pump Station
P-9	Brook Farm Pump Station



**LEGEND**

- Critical Facilities
- Pump Stations
- Emergency Evacuation Route
- FEMA Flood Zones
- AE (100-Year)
- VE (100-Year)
- X500 (500-Year)
- Buildings
- Rivers/Streams
- Lakes/Ponds
- Red Cross Shelter
- Red Cross Shelter (Proposed)
- Traffic Control Point

# Map A-3 Critical Facilities

May 1, 2015

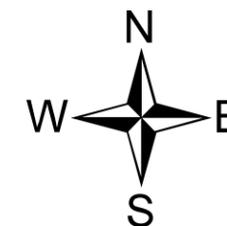
Data Sources:  
RIGIS,  
Bristol Municipal Database,  
Bristol Police Department

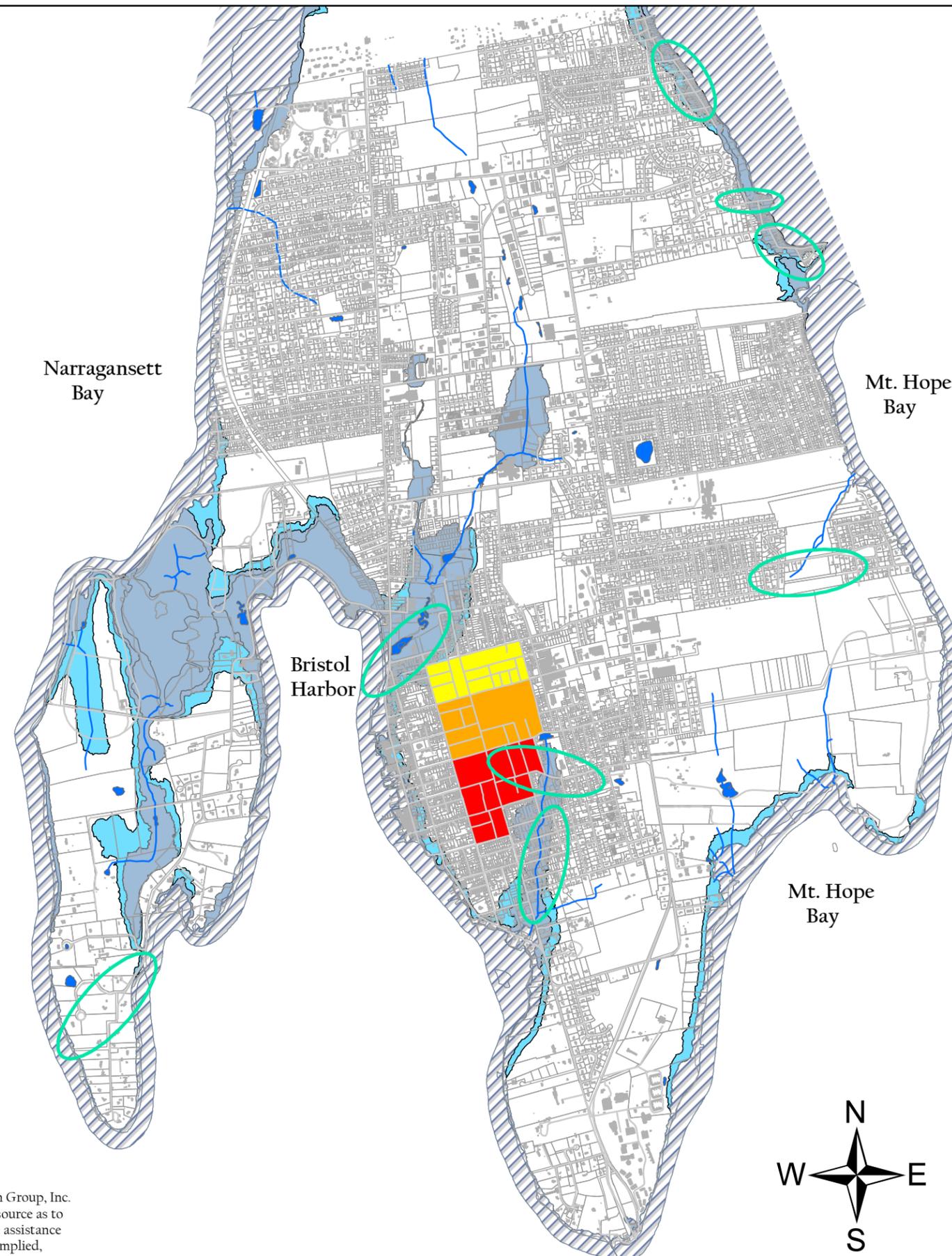
**Horsley Witten Group**  
Sustainable Environmental Solutions



55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com

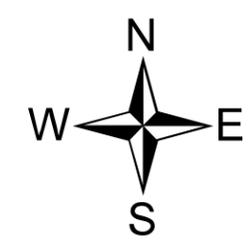
This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.





- LEGEND**
- Repetitive Loss Area (12/2014)
  - FEMA Flood Zones
    - AE (100-Year)
    - VE (100-Year)
    - X500 (500-Year)
  - Buildings
  - Rivers/Streams
  - Lakes/Ponds
  - LOW-MODERATE CENSUS TRACTS
    - Census Tract 307/Block Group 1
    - Census Tract 307/Block Group 2
    - Census Tract 307/Block Group 3

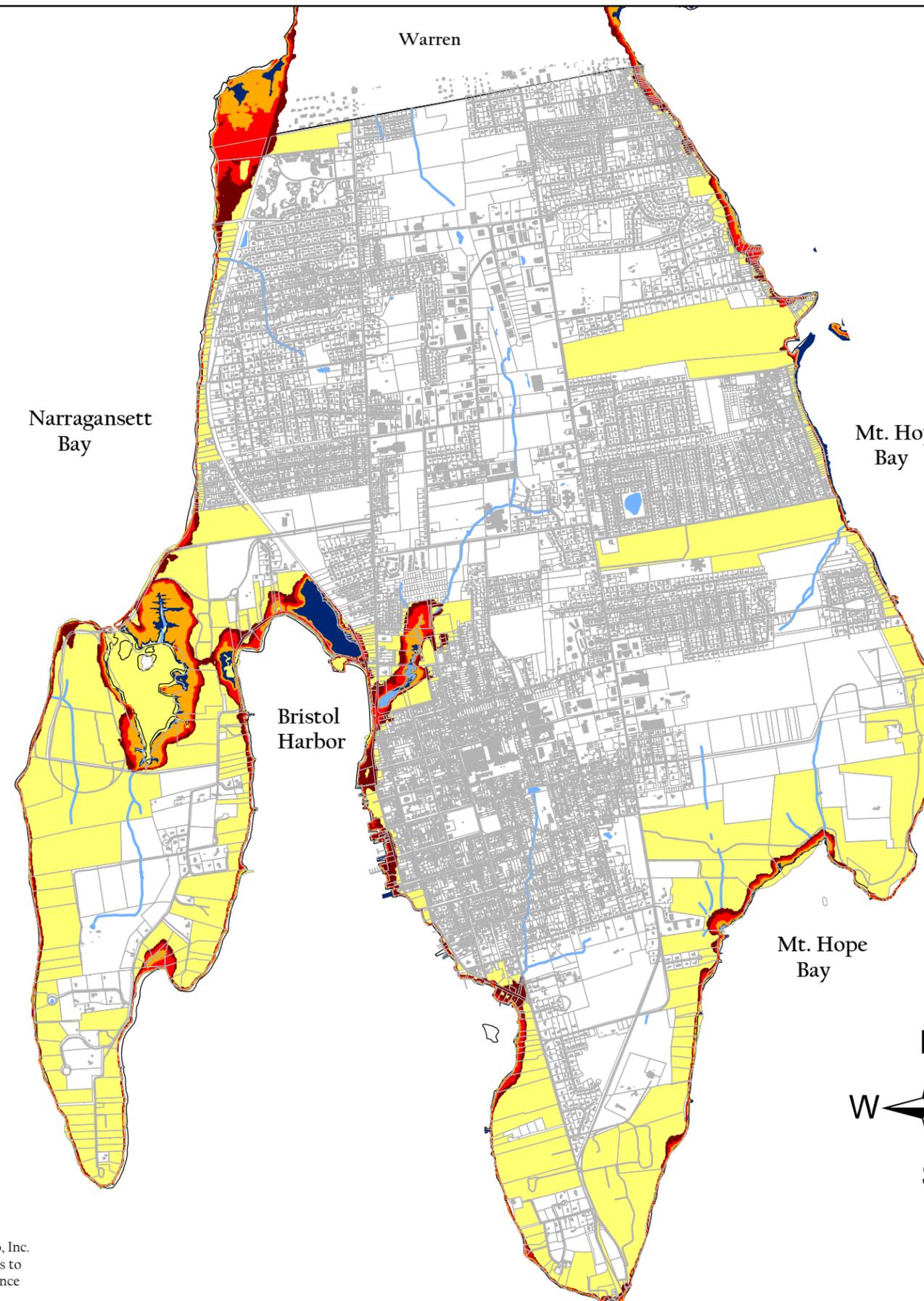
# Map A-4 Flood Risks with Repetitive Loss Areas



October 26, 2015  
Data Sources:  
RIGIS,  
Bristol Municipal Database

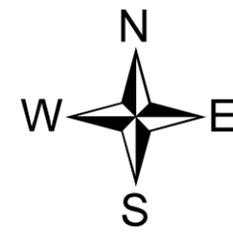
**Horsley Witten Group**  
Sustainable Environmental Solutions  
55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com

This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.

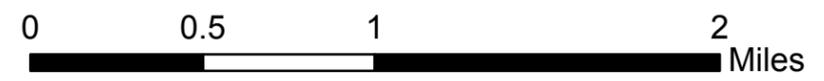


**LEGEND**

-  Average Daily High Tide - (Mean Higher High Water - MHHW)
- Potential Sea Level Rise Scenarios*
-  1 Foot
-  3 Feet
-  5 Feet
-  Parcels that Intersect with Potential Sea Level Rise Scenarios
-  Parcels
-  Rivers/Streams
-  Lakes/Ponds
-  Buildings



# Map A - 5 Sea Level Rise



May 27, 2015

Data Sources:  
RIGIS, State of Rhode Island, and the University of Rhode Island  
Bristol Municipal Database

**Horsley Witten Group**  
Sustainable Environmental Solutions



55 Dorrance Street • Suite 403 • Providence, RI 02903  
Phone - 401-272-1717 • Fax - 401-437-8368 • www.horsleywitten.com

This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.

Appendix B – Public Information and Outreach

*Project Kickoff/Local hazard Mitigation Committee: August 14, 2014*

*Project Webpage*

*Public Workshop #1: September 24, 2014*

*Local Hazard Mitigation Committee Meeting: April 2, 2015*

*Public Workshop #2: May 11, 2015*

*On-Line Survey*

*Local Hazard Mitigation Committee: May 14, 2015*

*Project Kickoff/Local hazard Mitigation Committee: August 14, 2014*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
August 14, 2014 2 PM

### **Agenda**

1. Introductions
2. Overview of Scope and Revised Schedule
3. Project Coordination
  - a. Data Collection
    - i. Report Card of Existing Plan
  - b. Municipal Coordination
    - i. Date for municipal interviews
  - c. Public Outreach
    - i. Press Release
    - ii. Project Webpage
    - iii. Bristol Harbor Festival (August 30, 2014)
4. Agenda/Logistics for Public Workshop (week of September 22, 2014)

**Bristol Hazard Mitigation Plan Update  
Revised Schedule (July 30, 2014)**

<b>Task 1: Build the Planning Team/Update and Document Planning Process</b>	July 27 - August 15, 2014
<b>Meeting #1 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Project Webpage (Municipal Website) - Report Card (Implementation of Existing Plan) - Data Collection	week of August 10, 2014
<b>Task 2: Identify Changes to the Plan</b> - Complete Report Card (Implementation of Existing Plan)	August 18 - September 26, 2014
<b>Coordination with Town Departments/Personnel</b> <b>Bristol Harbor Festival Outreach</b> <b>Public Workshop</b>	August 18 - August 29, 2014 August 30, 2014 week of September 22, 2014
<b>Task 3: Improve Risk Assessment</b> - Hazard Identification - Hazard Event Profile	Sept. 29 - October 10 2014
<b>Task 4: GIS Mapping</b> - Development of Risk/Critical Facilities/Evacuation Route Mapping	October 13 - October 17, 2014
<b>Task 5: Hazard Vulnerability Assessment</b> - Risk Assessment/Loss Estimation	October 20 - November 7, 2014
<b>Task 6: Develop Goals and Objectives</b> <b>Meeting #2 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Mitigation Recommendations - Review Goals and Objectives	November 10 - Nov. 28, 2014 week of November 17, 2014
<b>Task 7: Analyze Existing/Research New Strategies</b> - Plans, Policies and Problems Examination - Identification of Resources	December 1 - Dec. 12, 2014
<b>Task 8: Develop Comprehensive Range of Actions and Projects</b> <b>Meeting #3 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Refine Goals and Objectives - Cost Benefit Review/Prioritization	Dec. 15, 2014 - January 9, 2015 week of January 5, 2015
<b>Task 9: Update Plan Maintenance/Implementation</b> - Mitigation Action Plan	January 12 - January 23, 2015
<b>Task 10: Review, Revision, Approval and Adoption of Plan</b> <b>Public Comment Period</b> <b>Town Council Public Hearing</b> <b>Final Deliverable to RIEMA</b>	January 26 - March 13, 2015 January 26 - February 20, 2015 week of March 2, 2015 <b>March 13, 2015</b>



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 8/15/2014  
**Re:** Local Hazard Mitigation Committee Kickoff Meeting (No. 1)

---

**In attendance:**

Diane Williamson, Director of Community Development  
Ed Tanner, Principal Planner  
Jose DaSilva, Director – Water Pollution Control  
Bob Martin, Fire Chief  
Jim Galuska, Director – DPW  
Walter Burke, Director – Parks and Recreation  
Craig Pereira, Project Consultant

A meeting was held on August 14, 2014 at Bristol Town Hall to kickoff the Hazard Mitigation Plan Update project. The following items were discussed:

- Craig Pereira reviewed the revised schedule (attached) which maintains the project completion date of March, 2015, but accelerates the up-front items to make up for the several weeks lost.
- Mr. Pereira proposed several modifications to the general layout of the plan Update, including:
  - Hazard Index: the current plan does not have a Hazard Index Matrix... we will need to develop one for the Update. Mr. Pereira presented an example to the Committee from another project.
  - Identified Hazards: the Committee agreed to incorporate Sea Level Rise and Climate Change into the Update.
  - Chapter 2 Risk Assessment/Profiling Hazards: the Committee agreed to expand this section to report on identified hazards individually with a comprehensive discussion of location, history and probability of future occurrence.
  - Chapter 3 Mitigation Action Plan: the Committee agreed to utilizing FEMA's 'categorization' of measures, including:
    - Planning and Prevention
    - Property Protection
    - Natural Resource Protection
    - Structural Projects
    - Emergency Services
    - Public Education and Awareness
- Mr. Pereira presented a draft template for the project webpage to be posted on the Town's website as a public engagement piece for the duration of the project (attached).
- Ms. Williamson stated that we'll have a booth at the upcoming Harbor Festival to initiate interest in the project and to hopefully solicit foot traffic to the Public Workshop. It was suggested to have some FEMA brochures available (Fire Chief has hurricane brochures), a map that folks can mark up with 'local knowledge' of hazard areas (i.e. localized flooding, etc.). Jim Galuska mentioned that the Town is looking into establishing a 'Code Red'

notification System. Ms. Williamson stated that she'll check to see if we can use the booth to have folks sign-up for inclusion on this registry.

- Mr. Pereira presented the concept of a 'Report Card' of the 2010 plan. Essentially, the Committee needs to thoroughly review the Mitigation Action Plan presented in the 2010 plan, and determined what has been achieved (responsible party/date/funding mechanism), what was not achieved and should be carried forward (or eliminated), and what was achieved by should be considered on-going, and be carried forward. This will be the primary focus of the Public Workshop to highlight the efforts the community has made towards sustained resilience (but will also inform the updated Mitigation Action Plan. The Committee went through each mitigation action and briefly reported on the status of each. A more comprehensive review will take place during the municipal interviews.
- Mr. Pereira discussed the upcoming municipal coordination/interviews to be conducted August 18 – 29, 2014. Ms. Williamson will see if there is a municipal list serve we can access for coordination. Mr. Pereira will send an email out to department chairs requesting they select a timeslot to meet at Town Hall...the primary discussion topic will be the Report Card, however, other related comments are also welcome.
- Ms. Williamson stated that we should include recent discussions regarding the new animal shelter/sheltering in place opportunity for pet owners into the Update.
- Mr. Pereira requested a point of contact for Roger Williams University, as the university is a major stakeholder in the town. Peter Wilbur was mentioned, although maybe just as a conduit to someone in the Public Safety Dept. Ms. Williamson/Mr. Galuska stated that we should also reach out to Wenley Ferguson with Save the Bay as a resource, as well as Mt. Hope Farm, Blithewald Gardens, and Colt State Park.
- Mr. Pereira will utilize RIGIS data sets to update the existing mapping required for the Update, and coordinate with Ed Tanner for any additional data.
- Ms. Williamson suggested we mention the Historic District and process for a stand-alone plan, as the Town recently acquired two historic properties.
- Chief Martin stated that emergency access for Poppasquash has been achieved through Colt State Park, however, there is a locked gate at Coggeshall Farm.
- It was mentioned that a portion of the sea wall along Poppasquash Road was repaired, however, further along (where there is no sea wall) floods periodically and creates a public safety hazard.
- Mr. DaSilva stated that he received several grants for generators, and for check valves/backflow preventers. He also asked about investigating the feasibility of the Wood St. extension.

#### Follow-up Action Items:

- Ms. Williamson will coordinate a booth at the Bristol Harbor Festival on August 30, 2014 to announce the kickoff of the project...Mr. Pereira will participate and develop a flyer for distribution advertising the Public Workshop . Ms. Williamson will coordinate with town personnel if we should be soliciting names/numbers for the Code Red registry.
- Ms. Williamson will develop a press release announcing the booth at the Bristol Harbor Festival, and the Public Workshop, tentatively scheduled for August 30, 2014.
- Ms. Williamson will coordinate the logistics for the Public Workshop. Tentative date is September 24, 2014. 6-7 pm informal drop-in session (for those who can't make the meeting). 7-9 pm formal presentation/mark up maps. Mr. Pereira to request Jess Stimson (RIEMA) speaks at the workshop.
- Ms. Williamson will provide current NFIP and repetitive flood loss data.
- Ms. Williamson will provide the 2010 Plan in native format.



## Craig Pereira

---

**From:** Diane M Williamson [dianew@bristolri.us]  
**Sent:** Wednesday, July 30, 2014 12:39 PM  
**To:** 'Antonio Teixeira'; 'James Galuska'; jdsumpman@yahoo.com; 'Chief Josue D. Canario'; bobmartin@bristolri.us; 'Walter Burke'; seraphin@dapontes.com; 'Ed Tanner'; 'Gregg Marsili'  
**Cc:** 'Stimson, Jessica (EMA)'; Craig Pereira  
**Subject:** Update to Town's Natural Hazard Mitigation Plan  
**Attachments:** Natural Hazard Mitigation Plan of the Town of Bristol.pdf; Agenda Project Kickoff Meeting.pdf  
**Importance:** High

Hello All! I am pleased to let you know that we are starting the 5-year update to the Town's Natural Hazard Mitigation Plan as required by the State. This plan is an important document and has allowed the Town to receive several FEMA Grants. As your input is very valuable and needed for the success of this plan update, I am asking all of you (or your designee) to participate as members of the Local Hazard Mitigation Committee. The Town has also received a grant for the hiring of a consultant to work with us on the update and we have engaged the services of Craig Perreira from Horsely Witten. We are scheduling a kick-off meeting on August 14, 2104 at 2:00 p.m. in the 2<sup>nd</sup> floor conference room at 9 Court Street to start the process and I would like to invite all of you to attend. Please let me know if you are available and/or if you will be appointing a designee. A copy of the current plan and a meeting agenda are attached for your information.

Looking forward to working with all of you on this project!!

Diane M. Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
(401) 253-7000 ext. 126  
(401) 396-5466 Fax

*Project Webpage*



FEMA defines hazard mitigation as:

*A series of actions and policies designed to reduce and/or eliminate the impacts of naturally occurring disasters on people and property.*

## **About the Natural Hazard Mitigation Plan Update**

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

This Plan Update will replace the existing June 2010 Natural Hazard Mitigation Plan as a standalone document. The approach for this Update is premised on four primary methods, all geared towards meeting the requirements of the DMA 2000 Public Law 106-390, October 10, 2000:

- Planning Process—Outreach and Stakeholder Coordination
- Risk Assessment—Identifying Hazards and Estimating Losses
- Mitigation Strategy— Identifying Mitigation Actions and Implementation Strategies
- Plan Maintenance—Implementation, Evaluation and Revision/Update

**Stay tuned for more information on how to get involved!**

## **Contacts**

Diane Williamson—Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

*Public Workshop #1: September 24, 2014*



# **PUBLIC WORKSHOP**

September 24, 2014 6:00 PM to 8:30 PM

Burnside Building

2nd Floor Conference Room

400 Hope Street Bristol, RI

## **6:00 PM—7:00 PM Informal Drop-In Session**

Short on time? Stop by during the Drop-In Session to get/give information.

## **7:00 PM Formal Presentation**

Looking for more information? Attend the Formal Presentation to learn what the Town has accomplished and hear more about planning for the future.

### **About the Natural Hazard Mitigation Plan Update**

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

### **Contacts**

Diane Williamson—Director of Community Development

Town of Bristol

10 Court Street

Bristol, RI 02809

[dianew@bristolri.us](mailto:dianew@bristolri.us)

Phone: (401) 253-7000 Ext. 126

# Bristol seeks public's help to minimize disaster impacts

Featured News   Government   News   September 15, 2014

---



Rain water sweeps across Chestnut Street and rushes through St. Mary's cemetery eroding the earth at the foot of head stones and washing away flowers and flags in this eastbayri.com file photo.

As Bristol begins to update its five-year Natural Hazard Mitigation Plan, the Community Development department is seeking the public's help to identify areas most affected by storms to prioritize trouble spots and work to lessen those impacts.

While the mitigation plan is vital to the health and welfare of the community, it is also a necessary requirement to secure grant funds from FEMA to help pay for mitigation projects. After massive flooding in March 2010, residents in priority areas benefited by the town's backflow prevention program that assisted residents who had experienced sewer back-ups. Bristol's director of community planning, Diane Williamson, said that as a result of the plan, 32 households received retrofitting to prevent sewage from backing up into their homes should a similar flood occur.

Once the Hazard Mitigation Plan is updated, the town will be able to identify additional trouble areas that need attention. Some solutions, said Ms. Williamson, include the purchase of generators for sewer pump stations and signage to make people aware of areas of potential flooding. To accomplish the plan, the community development department will host a public workshop during which residents can provide additional information that will help develop the plan.

“We need information they might have for their areas. There might be mitigation actions we haven’t thought of,” Ms. Williamson said. “We haven’t had a coastal flood in quite a while. People lose the thought that it could happen.”

The public workshop will be held on Wednesday, Sept. 24 at in the Burnside Building, 400 Hope St. Residents will learn about the hazard mitigation process and share information from prior storms between 6 and 7 p.m. The main workshop will begin at 7, with representatives from the Rhode Island Emergency Management Agency and the town of Bristol discussing the hazard mitigation planning process.

Town of Bristol, RI  
Natural Hazard Mitigation Plan  
June 2010- Update

Public Workshop  
September 24, 2014  
7:00 pm  
Burnside Building



Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.



Bristol Local Hazard Mitigation Committee

- Diane Williamson, Director of Community Planning
- Antonio A. Teixeira, Town Administrator
- Robert Martin, Fire Chief/Emergency Management Director
- Josue Canario, Police Chief
- Ed Tanner, Principal Planner
- James Galuska, Director Department of Public Works
- Jose DaSilva, Director of Water Pollution Control
- Walter Burke, Director of Parks and Recreation
- Greg Marsili, Harbormaster
- Seraphine DaPonte, Member at Large
- Jess Stimson, State Hazard Mitigation Officer
- Craig Pereira, Consultant – Horsley Witten Group



Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



Assess Risks...  
Risk and Vulnerability Assessment

**Natural Hazard:**

"Any event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, and agricultural loss, damage to the environment, interruption of business, or other types of harm and/or loss".



Hazards Affecting Bristol (2010 Plan)

- Flood Related
  - Coastal Storms...approximately 40% of the Town is located within a floodplain, including 'AE', 'VE' and 'X' zones.
  - Inland Floods...large areas of bedrock and/or high groundwater in Bristol results in areas of poor drainage, flooding many roads in Bristol during periods of heavy rain.
  - Coastal Erosion...area of most concern is along Poppasquash Road along the sea wall. This is an evacuation route for the Poppasquash Road peninsula of approximately 100 dwellings and several businesses.
  - Dam Failure...although there is little chance of failure, the State Street Reservoir is a Town-owned stormwater detention basin at the headwater of the Tanyard Brook controlled by the Bristol DPW.
- Winter Related
  - Severe Winter Storms... Heavy snow and winter storms continue to increase in frequency and severity. Power outages are a primary concern.



## Hazards Affecting Bristol (2010 Plan)

- Wind Related
  - Hurricanes...since 1865, Bristol has experienced seventy-one hurricanes of varying magnitude.
  - Tornadoes...the risk of tornado is minimal, yet real. A tornado touched down in Bristol in 1991.
  - High Winds...strong winds can create debris problems including downed power lines.
- Geologic Related
  - Earthquakes...two minor earthquakes occurred in Bristol in 1996 and again in 2002.
- Fire Related
  - Wildfires...not considered a high risk in Bristol.
  - Drought...Town is susceptible, although minimal risk.

Hazards affecting Bristol will be updated to include climate change and sea level rise.



## Hazard Index (2015 Update)

The Local Hazard Mitigation Committee (LHMC) will be evaluating each of the hazards affecting Bristol to establish a **Hazard Index** – the natural hazards posing the most risk to the community, based on historical frequency and severity. To date, the top three hazards include:

- Hurricanes
- Inland/Urban Flooding/Heavy Rain
- Coastal Flooding/Storm Surge



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Economic Assets**
  - Businesses/major employers
  - Tourist destinations
- **Social Assets**
  - Vulnerable populations
  - Cultural locations
- **Natural Resources**
  - Lifeline and utility systems
  - Wetlands
  - Conservation and recreation lands



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Essential Buildings and Critical Facilities**
  - Municipal buildings
  - Hazardous facilities
  - Roadways



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



## Establish Goals... Mitigation Strategy

- **Review Existing Hazard Mitigation Activities:**
  - Coordination with local business community
  - Coordination with neighboring communities
  - Coordination with Roger Williams University
  - Bristol Comprehensive Plan, 2009
  - Bristol Open Space Plan, 2008
  - Bristol Flood Protection Services
  - Flood Hazard Development Permit/Standards
  - Subdivision and Development Review Regulations



## Establish Goals... Mitigation Strategy

### Review Existing Hazard Mitigation Activities:

- Chapter 29 Soil Erosion, Runoff and Sediment Control Ordinance
- Revised Phase II Stormwater Management Program Plan, 2008
- *SafeWater RI*: Ensuring Safe Water for RI's Future
- CRMC's Section 145 Climate Change and Sea Level Rise Policy
- RI Climate Change Commission
- Storm Preparedness and Hazard Mitigation Plan



## Establish Goals... Mitigation Goal

*"Reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters"*



## Establish Goals... Mitigation Measures

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness

\* Proposed approach to reconfigure the format/layout of the updated plan.



## Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan



## Identify Projects/Actions... Identification of Mitigation Actions

Mitigation actions to be developed based on review of the Town's identified risks and vulnerabilities to natural hazards.

Each action incorporates a brief description of the intended action, who the responsible parties are, a proposed time frame for completion and potential funding sources.



## Identify Projects/Actions... Prioritization of Actions

- Social
- Technical
- Administrative
- Political
- Legal
- Economic
- Environmental



## Identify Projects/Actions... Implementation

- Town Capability
- Plan Adoption/Incorporation into Existing Plans



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- **Update/Maintain Plan**



## Update/Maintain Plan...

- Maintain periodically, recommended annually
- Update every 5 years per DMA 2000



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

1. *Utilize School Curriculum to educate students and their parents about hazard risks.*  
Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State officials...*Ongoing, carry forward.* High School students work with Save Bristol Harbor and the Town monitoring outfalls in Silver Creek Watershed collect data for sampling program (RIDEM stormwater requirements). 5<sup>th</sup> graders have a storm drain marking program (Save the Bay).
2. *Educational program for residents of flood zones and nearby downstream neighborhoods.*  
Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e. Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not so obvious...*Ongoing.* Town received RIEMA grant for downtown signage program. Currently in design phase of signage, once approved, will be installed downtown and along roadways in critical flooding areas (Hope St. at Silver Creek, Chestnut St., and Poppasquash Road).



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

3. *Ensure emergency personnel can access people and property within wooded areas.*  
Work with property owners to establish fire lanes in the Mt. Hope area which is the largest wooded area in Town... *Completed, carry forward/on-going.* Fire lanes established from Babbit to Haffenrefer to Mt. Hope Farm. Mt. Hope Farm performs maintenance on Brown University property. Fire Chief currently assembling a brush rig for use.
4. *Disseminate information on mitigation techniques and hazard insurance*  
Distribute literature related to mitigation techniques including the literature from the Institute of Business and Home Safety; retrofit methodology, grant/loan sources, and insurance option... *Ongoing, carry forward.*
5. *Make residents aware of Emergency Response Plan*  
Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households...*Ongoing, carry forward.* Town is moving forward to include a 'CodeReady' system for sending critical communications.



## 2010 Plan Report Card

### EDUCATIONAL ACTIONS

6. *Public Information, Outreach – Signage*  
Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area...*Part of Action #2*
7. *Designate alternative evacuation route for the Poppasquash area through Colt State Park.*  
The Town should seek and agreement from RIDEM for use of the service road from Poppasquash Road through Colt State Park as a designated evacuation route. This road is located to the west of the former Pearson house and is important for evacuation since it does not cross any waterbodies. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted... *Completed, through Colt State Park...doesn't go far enough though, carry forward.* There is an additional inland opportunity for an alternate route along lower Poppasquash Rd. on state-owned land, and a second opportunity along a new ROW water line along Poppasquash.



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 8. Adopt a 'no on-street parking' ordinance that goes into effect with a hurricane warning

This ordinance would identify streets where on-street parking would be prohibited in the event of a hurricane similar to the parking ban currently used during snowstorms... **Not completed, suggested to delete...** declaration of an emergency situation by EMA Director supersedes this need.

#### 9. Develop a debris management plan

Fallen debris and tree limbs resulting from thunderstorms, ice storms, and windstorms become fuel for fires in the wooded areas. Prompt removal and clean up of the wooded areas decrease this potential. A comprehensive debris management program will minimize potential impacts... **Not completed, carry forward. Town has an 'informal' process in place, consider formalizing.**

#### 10. Offer a business hazard resilience audit

Town would hire a specialist or train the Building Inspector to identify vulnerabilities and appoint a point of contact for offering personalized mitigation advice and distributing useful literature including notice to property owners about the importance of maintaining the building's systems; and the retrofit of basement utilities, if feasible... **Not completed, suggested to delete. Town to continue to utilize FEMA publications.**

Horsley Witten Group



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 11. Prepare an 'After the Storm Permitting' plan for rebuilding

Review the permitting process and prepare a plan to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. The plan should outline a triage procedure for the rush of proposals and requests... **Ongoing, carry forward, but formalize existing process. Also need to consider continuing current policy of waiving permit fees to repair storm-damaged properties.**

#### 12. Explore location (s) for new and/or additional storm shelter (s)

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered... **Not completed, carry forward. Quinta Gamelin Community Center is a potential alternate... needs a generator and kitchen.**

#### 13. Retrofit of paved parking areas within the Tanyard Brook and Silver Creek watersheds

There may be opportunities to include drainage and/or Low impact development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. A permit process should be implemented to require that resurfacing and expansion of parking lots in the Tanyard Brook and Silver Creek watersheds are reviewed by the Department of Public Works... **Ongoing, carry forward. Town recently completed Town Beach parking lot, and Police Station is the next scheduled project.**

Horsley Witten Group



## 2010 Plan Report Card

### PLANNING/COORDINATION

#### 14. Prohibit new basement utilities or require installation of a grinder pump

Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town should adopt an ordinance to prohibit new basement utilities or require installation of a grinder pump between the building and the sewer collection system. This ordinance should apply to all building spaces constructed below the grade of the street... **Completed, carry forward/ongoing. Ordinance completed, requires sewer service connections 2-feet above lowest floor elevation (as per Plumbing Code). Town received FEMA grant to retrofit existing utilities with backflow preventer valves.**

### CAPITAL PROJECTS

#### 15. Eliminate flood risk to repetitive loss properties

The three properties in Bristol that have been repetitively damaged from floods should be retrofitted. The Building Official should determine the appropriate actions to mitigate flood risk to repetitive loss structures... **Not completed, carry forward. Consider providing homeowners with engineering assistance.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 16. Acquire properties that are within the coastal flood zones

The Open Space Plan identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives. The Town will seek to acquire parcels in risk areas... **Ongoing, carry forward. Town acquired 2 properties in Historic District, and studying potential reuse/rehabilitation ideas for sites.**

#### 17. Retrofit public buildings especially the Everready Fire Station and the Department of Public Works (DPW) buildings.

Refer to FEMA guide 'Floodproofing non-residential structures' to retrofit the fire station and DPW buildings, including raising outlets above base flood elevation. Continue agreement with gasoline stations to fuel vehicles when the Town's fueling station at the DPW facility is impacted from flooding... **Not completed, suggested to look closer at this. Fire Chief relocates equipment during storm event, and DPW is not in the floodplain.**

#### 18. Continue implementation of the Silver Creek Watershed Study

Implementation of the Silver Creek Watershed Study has begun with the restoration of the Silver Creek Salt Marsh including removing the restrictions from the outfall. The Town needs to continue implementing the recommendations including sediment removal in the salt marsh, providing more upstream detention, and upgrade to the spillway on the north side of Chestnut Street at the high school... **Ongoing, carry forward. Update plan, re-prioritize projects to be shovel-ready when funding opportunities arise.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 19. Repair the seawall along Poppasquash Road, restore the culverts under this road at Mill Pond and Mill Gut Pond and repave the road

Implement the findings and recommendations of the Poppasquash Road and pedestrian and Bicycle Facility Study which includes recommendations to repair the stone wall and restore the culverts. Repaving of the roadway is also needed to maintain this evacuation route... **Ongoing, carry forward. March 2010, DOT repaired the sea wall in 3 locations and completed repaving.**

#### 20. Reline or replace sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, and damaged sewer pipes, in excess of 75 years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups... **Ongoing, carry forward. Downtown completed... Franklin St. to the south/business area. Tanyard Brook area is currently underway (Pilot Program).**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 21. Eliminate illegal connections of private sump pumps to the sanitary sewer system

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences. Partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being drafted. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations... **Completed, suggested to delete... difficult to enforce.**

#### 22. Upgrade the Mt. Hope Pump Station by installing overflow bypass

During rain storms excess flows to the Mt. Hope Pump Station are greater than the design of the station resulting in manhole overflows to Mt. Hope Bay and sewer backups into residences. Replacing existing pumps with new design and more efficient pumps will reduce the possibility of manhole overflows and sewer backups... **Ongoing, carry forward. Town completed \$1.4 million in upgrades (new pumps and generator, underground storage tank removed)... EPA indicated this was not enough.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 23. Install an overflow bypass at the Wastewater Treatment Plant

During periods of heavy rains, wastewater flows into the Wastewater Treatment Plant is greater than the design of the plant resulting in manhole overflows to Bristol harbor and sewer backups to residences. The installation of an overflow bypass station will allow the excess flows to be diverted to this bypass structure and pump independently... **Review...EPA rejected this plan due to limited applicability at pump station.**

#### 24. Install an overflow bypass upstream of the Silver Creek Station

During periods of heavy rains wastewater flow to this station is greater than the design of the station resulting in manhole overflows to Bristol Harbor and sewer backups to residences, nursing homes, and businesses. The installation of an overflow bypass station will allow the excess flows to be diverted to this bypass structure and pump independently with its own force main to the Wood St. sewer line, reducing backups... **Review...EPA rejected this plan, as pump station already has more water than it can handle.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 25. Concrete earthen berm to protect Wastewater Treatment Plant above base flood elevation

This wall would serve as a dam to keep the flood waters out of the Wastewater Treatment Plant... **Ongoing, carry forward. BETA is currently doing a study. Consider adding in provision for a gravel road for elevated access.**

#### 26. Priority cleaning plan for sewer lines

Over the next five years, beginning in 2009, all sewer lines must be cleaned and camera inspected... **Completed. Consider modifying to state, "Return to problem areas."**

#### 27. Continue implementation of the Tanyard Brook Watershed Study

The recommendation of Beta Group, the Town's consultant for this study, is to install a new culvert, I install a tide gate at the outfall, and, expand the capacity of the State St. Reservoir. The current culvert is under capacity and higher than the adjacent grade at some areas. This creates serious local flooding during rain events. The new culvert has been designed in accordance with the recommendations of the study and Phase 1 of the project has recently received permits from RIDEM and RICRMC... **Ongoing, carry forward. Phase I completed (June 2014), Phase II at 50% design.**

Horsley Witten Group



## 2010 Plan Report Card

### CAPITAL PROJECTS

#### 28. Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, and along Poppasquash Rd., the above ground utilities should be placed underground. Although not financially feasible at this time, it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event... **Not completed, carry forward.**

#### 29. Reinforce wire-to-pole connections

While Action 28 above is a long-term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope St. should be secured to the poles with 'Hendrick's Spacer Cables', which make the wires more durable, improve the reliability of service customers; and protect the health of the street trees, making them less susceptible to storms... **Ongoing, carry forward.**

#### 30. Inspect and repair the seawall along Independence Park and Wally Beach as necessary

Stability of the seawall should be evaluated. Repairs and regular maintenance should be made when necessary to enable it to withstand a 20 to 50-year storm. ... **Ongoing, carry forward. Consider adding in Armory Building and Prudence Island Ferry Dock.**

Horsley Witten Group



## Project Schedule

Draft Update available for public comment – **February 2015**

Draft Update to RIEMA – **March 2015**

Horsley Witten Group



## Contact Us...

If you have general questions and/or comments about the Hazard Mitigation Plan Update, please contact:

Diane Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

Thank You!



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 10/3/2014  
**Re:** Public Workshop September 24, 2014

---

A Public Workshop was held on September 24, 2014 at Bristol Town Hall to kickoff the Hazard Mitigation Plan Update project to the community. Eight (8) members of the community and several municipal officials were in attendance. The following comments were provided by those in attendance:

- On several occasions, during rain events raw sewerage is flowing down Fairview Drive...this is unacceptable. Is the Town aware of this issue and what is the Town going to do about it?
  - Response: On several occasions, during periods of extreme precipitation, the wastewater treatment facility has experienced flooding/overflow. As mentioned in tonight's presentation on the Report Card of 2010 mitigation measures, the Town is aware of the issues surrounding this, completed several projects in an attempt to remedy this issue, and due to the comprehensive scope of the issue, has since determined a new approach is needed to address this.
- Who within the Town can we contact to discuss these sorts of issues? You should state that right in the plan Update.
  - Each mitigation action in the existing plan, as well as the proposed plan, identifies (will identify) the primary and secondary 'Responsible Party'... which represents the municipal official/department residents should reach out to for more information.
- I live in the Charles Street area which periodically floods. Is the Town working to remedy this problem?
  - It is anticipated that Phase II of the Tanyard Brook project will remedy this.
- During recent emergency events, getting accurate, updated information has been difficult. Is it possible to consider establishing strategically-located information stations where residents can go to get informed?
  - The Town is currently developing a 'CodeReady' communication system as part of a more comprehensive approach of 'Civic Ready'. The Town will be soliciting residents and business owners to join this voluntary registry to receive updated communications regarding emergency resources, evacuation notices and weather updates. Perhaps these 'stations' could be established and facilitated/staffed through the Town's expanding Community Emergency Response Team (CERT).
- At times, Route 136 floods, which is also part of the Town's evacuation route. Is the Town doing anything to improve these conditions to maintain this as a viable evacuation route?
  - The Town will coordinate with RIDOT to identify potential partnerships for mitigation along this route, as this is a State road.
- During the last flood event, the Fire Department was performing pump-outs for residents, which was extremely timely and helpful. Is this an established policy throughout the Tow?
  - The Fire Department works to help private residents with pump outs on an as needed basis, when they have additional capacity to do so.



*Local Hazard Mitigation Committee Meeting: April 2, 2015*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
April 2, 2015 10 AM

### **Agenda**

1. Revised Schedule
2. Draft Mapping
3. Hazard Index
4. 2009 Plan Report Card
5. Preliminary Mitigation Actions
6. Next Steps

**Bristol Hazard Mitigation Plan Update  
Revised Schedule (April 2, 2015)**

<b>Task 1: Build the Planning Team/Update and Document Planning Process</b>	July 27 - August 15, 2014
<b>Meeting #1 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Project Webpage (Municipal Website) - Report Card (Implementation of Existing Plan) - Data Collection	week of August 10, 2014
<b>Task 2: Identify Changes to the Plan</b> - Complete Report Card (Implementation of Existing Plan)	August 18 - September 26, 2014
<b>Coordination with Town Departments/Personnel</b> <b>Bristol Harbor Festival Outreach</b> <b>Public Workshop</b>	August 18 - August 29, 2014 August 30, 2014 week of September 22, 2014
<b>Task 3: Improve Risk Assessment</b> - Hazard Identification - Hazard Event Profile	Sept. 29 - October 10 2014
<b>Task 4: GIS Mapping</b> - Development of Risk/Critical Facilities/Evacuation Route Mapping	October 13 - October 17, 2014
<b>Task 5: Hazard Vulnerability Assessment</b> - Risk Assessment/Loss Estimation	October 20 - November 7, 2014
<b>Task 6: Develop Goals and Objectives</b>	April 2, 2015
<b>Meeting #2 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Preliminary Mitigation Recommendations - Review Goals and Objectives	April 2, 2015
<b>Task 7: Analyze Existing/Research New Strategies</b> - Plans, Policies and Problems Examination - Identification of Resources	March 30, 2015 - April 3, 2015
<b>Task 8: Develop Comprehensive Range of Actions and Projects</b>	April 6, 2015 - April 27, 2015
<b>Meeting #3 - Bristol Hazard Mitigation Plan Committee (BHMPC)</b> - Refine Goals and Objectives - Cost Benefit Review/Prioritization	week of April 27, 2015
<b>Task 9: Update Plan Maintenance/Implementation</b> - Mitigation Action Plan	April 6, 2015 - April 27, 2015
<b>Task 10: Review, Revision, Approval and Adoption of Plan</b>	May 4, 2015 - May 22, 2015
<b>Public Comment Period</b> <b>Town Council Public Hearing</b> <b>Final Deliverable to RIEMA</b>	May 4, 2015 - May 18, 2015 week of May 18, 2015 <b>May 22, 2015</b>



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 4/8/2015  
**Re:** Local Hazard Mitigation Committee Kickoff Meeting (No. 2)

---

**In attendance:**

Diane Williamson, Director of Community Development  
Ed Tanner, Principal Planner  
Craig Pereira, Project Consultant

A meeting was held on April 2, 2015 at Bristol Town Hall to for the Hazard Mitigation Plan Update project. The following items were discussed:

- Craig Pereira reviewed the revised schedule (attached) which changes the project completion date, with anticipated draft submission to RIEMA for June 1, 2015. In an effort to bolster public participation throughout the planning process, a second public workshop will be scheduled for early May.
- Mr. Pereira reviewed the three draft updated maps (attached)
  - Figure A-1 Risks:
    - Request to also show on the map, the two historical hurricane tracks ('38 and '54).
    - Request to remove the flood zones since they are already on the other maps, and to verify the zone in the center of the Town.
  - Figure A-2 Critical Facilities:
    - Request to break –out pump stations separately from facilities in the table.
    - Request to show Quinta-Gamelin as proposed shelter.
    - List source and verify traffic control points (Police/Fire).
    - Request to identify hidden facility east of Thames St. (adjacent to Church St.)
  - Figure A-3 Flood Risks with Repetitive Loss Areas:
    - Request to add Low/Mod. Areas from Census Tract Data to facilitate eligibility for funding, as available.
    - Request to add the date for the Repetitive Loss area locations.
- Mr. Pereira reviewed the draft Hazard Index. The Index is new and required for the Update.
  - Request to include notation regarding development based on FEMA's criteria (will also be inserted into the Update).
- Mr. Pereira reviewed the 'Report Card' of the 2010 plan based on completion of municipal interviews (attached). General acceptance on the Report Card, with several revisions and outstanding items to be discussed individually.
  - Request to keep in Action 21...BETA Group is mapping this, change text to read study/identify alternative. Reference Annawamscutt area pilot study (installation of pipes for sump pump connections).
  - Mr. Pereira to follow up with Jose regarding Action 23, and 24.

- Mr. Pereira reviewed the preliminary Mitigation Actions, which includes items from existing plan to be carried over into Update (attached).
  - Action 2: add in accomplishments (from Diane)
  - Action 5: add in information on how residents can sign up, from Diane)
  - Action 7: add in information on inland route
  - Action 7: add in consideration of a regional plan
  - Action 11: formalize existing process by ordinance
  - Action 12: add in Quinta Gamelin Community Center as potential future shelter
  - Action 13: reference consideration of Stormwater Utility Management Plan...add new action that considers development of the permit process with three sections: retrofit of existing, new/expansion of parking for commercial, and the residential piece.
  - Action 15: add in information on CRS outreach (from Diane)
  - Action 21: keep, rework statement (Report Card section above)
  - Actions 22, 23, and 24: coordinate with Jose
  - Action 30: study is on hold
  - New Action – secondary point of access/egress at Water Pollution Control Facility: reference Fairview sump pumps/need for in-street drainage and dovetail to new action
  - New Action – develop overwash/sand/rubble removal plan: add to Debris Management Plan Action 9
  - New Action – Develop Shoreline Management Plan: add in piece regarding opportunity at dead end streets to water (cul-de-sacs)
  - New Action – Recovery and Reconstruction Ordinance: rework
  - New Action: Tourist Evacuation and Shelter: add in marinas
  - New Action: Elderly/Special Needs Residents: change to ‘Social Services’ responsibility

Follow up:

- Mr. Pereira will follow up with specific departments regarding data/input needed.
- Committee to work towards finishing draft actions/Update.
- Next Committee meeting to be held end of April for prioritization and ranking of actions.



*Public Workshop #2: May 11, 2015*

**BCC**  
Bristol College

**THE WORLD**  
SIX WEEKS

July 6 - 31  
Monday - Friday

August 3 - 14  
Monday - Friday

Drop-off at 8:30 a.m., pick up at 4 p.m.  
BCC Fall River Campus  
777 Elsbree Street, Fall River, MA 02720  
BristolCC.edu/KidsCollege  
508.678.2811, ext. 2264

**BCC**  
BRISTOL COMMUNITY COLLEGE

nts, people, etc.  
ase at eastbayri.com

# Bristol Public Works director ousted

The town of Bristol is looking to hire a new Department of Public Works director, after Town Administrator Tony Teixeira decided not to renew the contract of current DPW Director James Galuska.

Mr. Galuska's three-year contract expired in October 2014 after being hired by former Town Administrator Diane Mederos.

"When it comes to engineering, Jim did bring quite a few skills into this job," Mr. Teixeira said.

But he cited "a little bit of difference" as to how the department should operate as part of the reason he opted to not renew Mr. Galuska's employment with the town.

Mr. Galuska declined to comment.

The town is currently seeking applicants with 5 to 10 years of municipal/public works experience in addition to previous management experience, preferably with a civil engineering degree.

Under the fiscal year 2015-2016 budget, Mr.



James Galuska

Galuska was to receive a salary of \$104,000 plus benefits to oversee the department's operations and \$2.9 million budget.

## Bristol asks residents to help update town's hazard mitigation plan

The town of Bristol is updating its Natural Hazard Mitigation Plan, a document that was last reviewed in 2010, and is asking the public for help.

The plan identifies risk areas, estimates losses in natural disasters and lays out a strategy to mitigate the damage. Having such a plan in place gives the town a better chance to get funding for projects that reduce the

risk of injury or damage to property from future natural disasters like flooding and hurricanes.

To make the plan as comprehensive as possible to address the needs of the town, the Community Development department is asking residents to complete an on-line survey. A 10-minute questionnaire is set up at [www.surveymonkey.com/s/bristolhazardmitigationplanupdate](http://www.surveymonkey.com/s/bristolhazardmitigationplanupdate).

The information will help planners coordinate activities and identify projects for the town. The survey responses are anonymous.

In addition to the on-line survey, a public workshop is scheduled for Monday, May 11 at 7 p.m. in the Burnside building. For more information, contact the Bristol Planning Department at 401-253-7000.

# TOM'S MARKET

*Fresh. Local. Exceptional.*

**TIVERTON**

492 Main Road

Tiverton, RI

401-816-0862

Mon-Sat 8-8 • Sun 8-7

## KITCHEN

Tom's Own  
Clam Cakes

**6/\$3.99**

## DELI

Kretschmar  
Lo-Sodium Ham

**\$2.99** lb.



**WOW!**

- Land o' Lakes Cheese  
Italian Blend . . . \$5<sup>99</sup> lb.
- Boar's Head Regular &  
Low Salt  
Bologna . . . . . \$4<sup>99</sup> lb.
- Boar's Head Vermont  
Cheddar . . . . . \$5<sup>99</sup> lb.
- Kretschmar Bacon Crusted  
Turkey . . . . . \$5<sup>99</sup> lb.
- Tom's Own Rare & Juicy  
Roast Beef . . . . . \$8<sup>99</sup> lb.

**CUSTOM CUT SPECIAL MEATS**



**Barilla Pasta**

Excludes Lasagna, Shells,  
Plus & Gluten Free

**5/\$5**

## GROCERY

- 16 oz. All Varieties  
Ken's Dressing. . . 2/\$4
- Post Great Grains  
Cereal . . . . . \$2<sup>99</sup>
- Nature Valley or Fiber One  
Granola Bars . . . 2/\$5
- Pepperidge Farms  
Swirl Breads . . . \$3<sup>29</sup>

**FRESH PRODUCE**

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Public Workshop #2**

Burnside Building 2<sup>nd</sup> Floor Conference Room  
May 11, 2015 7 PM

### **Agenda**

1. Opening Remarks – Diane Williamson, Director of Community Development
2. Accomplishments to date: Overview, Why Hazard Mitigation Planning in Bristol, 2010 Report Card – Craig Pereira, Project Manager, Horsley Witten Group
3. Preliminary Mitigation Actions
4. Questions/Comments
5. Next Steps

## Town of Bristol, RI Natural Hazard Mitigation Plan June 2010- Update

Public Workshop  
May 11, 2015  
7:00 pm  
Burnside Building



## Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.



## Bristol Local Hazard Mitigation Committee

- Diane Williamson, Director of Community Planning
- Antonio A. Teixeira, Town Administrator
- Robert Martin, Fire Chief/Emergency Management Director
- Josue Canario, Police Chief
- Ed Tanner, Principal Planner
- James Galuska, Director Department of Public Works
- Jose DaSilva, Director of Water Pollution Control
- Walter Burke, Director of Parks and Recreation
- Greg Marsili, Harbormaster
- Seraphine DaPonte, Member at Large
- Jess Stimson, State Hazard Mitigation Officer
- Craig Pereira, Consultant – Horsley Witten Group



## Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan



## What we have accomplished...

- Harbor Festival (August 2014)
- Municipal Interviews (Fall 2014/Winter 2015)
- Public Workshop (September 24, 2014)
- Bristol Local Mitigation Committee Meetings
- 2010 Plan 'Report Card'
- Survey (Spring 2015)



## Improved Risk Assessment

- Hazard Identification
- Hazard Event profile



## Confirmation of ... Hazards Affecting Bristol (2010 Plan)

- Flood Related
  - Coastal Storms...approximately 40% of the Town is located within a floodplain, including 'AE', 'VE' and 'X' zones.
  - Inland Floods...large areas of bedrock and/or high groundwater in Bristol results in areas of poor drainage, flooding many roads in Bristol during periods of heavy rain.
  - Coastal Erosion...area of most concern is along Poppasquash Road along the sea wall. This is an evacuation route for the Poppasquash Road peninsula of approximately 100 dwellings and several businesses.
  - Dam Failure...although there is little chance of failure, the State Street Reservoir is a Town-owned stormwater detention basin at the headwater of the Tanyard Brook controlled by the Bristol DPW.
- Winter Related
  - Severe Winter Storms... Heavy snow and winter storms continue to increase in frequency and severity. Power outages are a primary concern.



## Confirmation of ... Hazards Affecting Bristol (2010 Plan)

- Wind Related
  - Hurricanes...since 1865, Bristol has experienced seventy-one hurricanes of varying magnitude.
  - Tornadoes...the risk of tornado is minimal, yet real. A tornado touched down in Bristol in 1991.
  - High Winds...strong winds can create debris problems including downed power lines.
- Geologic Related
  - Earthquakes...two minor earthquakes occurred in Bristol in 1996 and again in 2002.
- Fire Related
  - Wildfires...not considered a high risk in Bristol.
  - Drought...Town is susceptible, although minimal risk.



## Additional Considerations for ... Hazards Affecting Bristol (2015 Plan)

- Climate Change
  - The Environmental Protection Agency (EPA) indicates there is recent, strong evidence that most of the warming of the Earth's surface temperature over the past 50 years is a direct result of human behavior.
  - By 2100, Rhode Island could see a temperature increase by about 4 degrees F (with a range of 1-8 degrees F) in the winter and spring and by about 5 degrees F (with a range of 2-10 degrees F) in the summer and fall.
  - Increased temperatures and frequency of heat waves could also impact the number of heat-related illnesses and deaths in Rhode Island, increasing ground-level ozone, a major component of smog (facilitating respiratory illnesses such as asthma and respiratory inflammation, as well as reducing general lung functioning.)
  - The very same warming and climate increases could also expand the habitat and infectivity of disease-carrying insects, increasing the potential for malaria, Eastern Equine Encephalitis and Lyme Disease.



## Additional Considerations for ... Hazards Affecting Bristol (2015 Plan)

- Sea Level Rise
  - The Intergovernmental Panel on Climate Change (IPCC) continues to better understand the science and implications of climate change and sea level rise.
  - Rising sea levels, as a direct result of warmer temperatures and glacial ice melt, threaten low-lying coastal areas through coastal flooding, coastal erosion, wetland inundation and saltwater intrusion. Recent projections of sea level rise by the end of the century range from 20 to 55 inches.
  - Localized land subsidence, also on the rise, also contributes to accelerated impacts of sea level rise.



## Hazard Index (2015 Update)... based on historical frequency and severity

### Criteria for Frequency Categorization:

*Very low frequency:* events that occur less frequently than once in 1,000 years (less than 0.1% per year).

*Low frequency:* events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).

*Medium frequency:* events that occur from once in 10 years to once in 100 years (1% to 10% per year).

*High frequency:* events that occur more frequently than once in 10 years (greater than 10% per year).



## Hazard Index (2015 Update)... based on historical frequency and severity

### Criteria for Severity Categorization (based on past hazard events):

*Minor:* Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.

*Serious:* Scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.

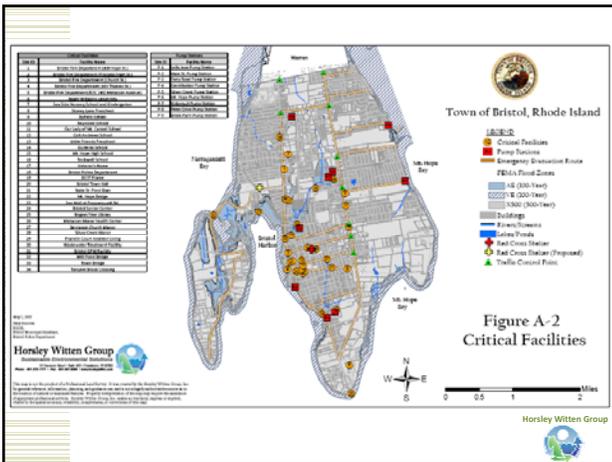
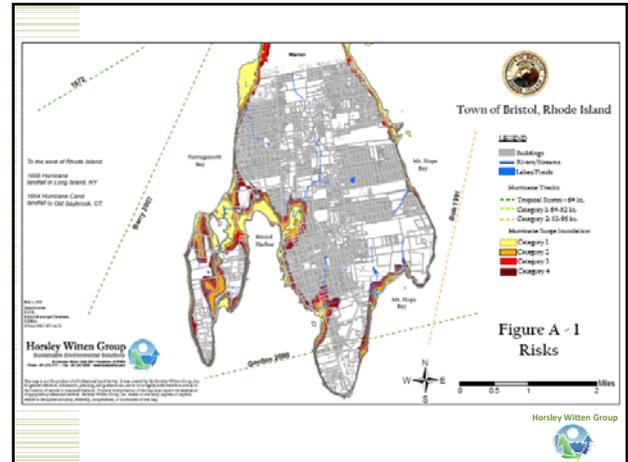
*Extensive:* Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.

*Catastrophic:* Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

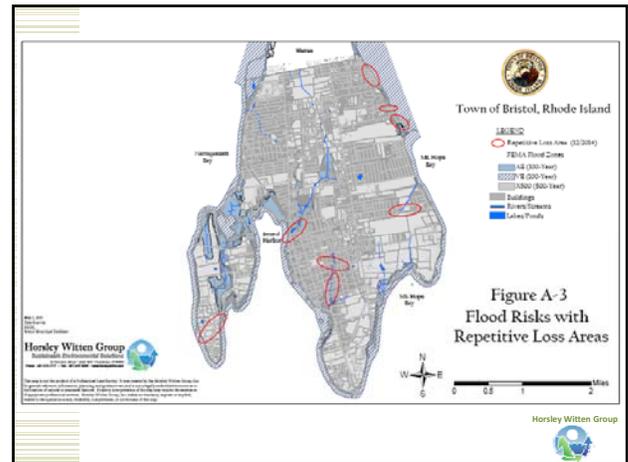


Natural Hazard	Frequency (i.e. Very Low, Low, Medium, High)	Location (i.e. local/small, medium/regional, large/multiple communities)	Severity (i.e. minor, serious, extensive, catastrophic)	Hazard Index (i.e. ranked by combining frequency and severity; 10 = high, 1 = low)
<b>Flood-Related Hazards</b>				
- Riverine	Very Low	Small/Local	Minor	2
- Flash Flooding	High	Medium/Regional	Minor	5
- Inland/Urban Flooding/Heavy Rain	High	Medium/Regional	Extensive	7
- Coastal Flooding/Storm Surge	High	Small/Local	Extensive	7
- Coastal Erosion	High	Small/Local	Minor	5
- Climate Change/Sea Level Rise	Medium	Large/Multiple	Serious	5
- Dam Failures	Very Low	Small/Local	Minor	2
<b>Winter-Related Hazards</b>				
- Snow	High	Large/Multiple	Minor	5
- Ice	Medium	Large/Multiple	Minor	4
- Extreme Cold	Very Low	Large/Multiple	Serious	3
<b>Wind-Related Hazards</b>				
- Hurricanes	High	Large/Multiple	Catastrophic	8
- Tornadoes	Medium	Local	Minor	4
- High Winds	High	Large/Multiple	Serious	6
- Lightning/Thunderstorms	Medium	Local	Minor	4
- Hail	Medium	Local	Minor	4
<b>Geologic-Related Hazards</b>				
- Earthquakes	High	Medium/Regional	Minor	5
<b>Fire-Related Hazards</b>				
- Drought	Low	Medium/Regional	Minor	2
- Extreme Heat	Low	Large/Multiple	Serious	3

Horsley Witten Group



Horsley Witten Group



## Hazard Vulnerability Assessment

- Evacuation
  - Bristol has two peninsulas surrounded by water on three sides
  - The risk from flooding and storm surge may impede evacuation out of the area, as well as emergency vehicles into the area for those residents who choose to stay.
- Economic and Social Vulnerability
  - At-risk populations continue to increase as new development occurs in vulnerable areas.
  - Although the Town has adopted Flood Zoning and enforces the RI Building Code, most of the development in at-risk areas occurred before these regulations.
  - The historic downtown is particularly vulnerable

Horsley Witten Group

## Hazard Vulnerability Assessment

- Historical and Cultural Resource Areas
  - Much of the Bristol Waterfront National Register District in downtown is located within the flood zone.
  - Balancing mitigation in a way that is consistent with historical preservation policies is important.
- Shelters
  - The Community Room at Franklin Court serves as the only American Red Cross Approved shelter.
  - The Quinta-Gamelin building is proposed as the secondary shelter, requiring several upgrades first.

Horsley Witten Group

## Hazard Vulnerability Assessment

### • Public Infrastructure and Emergency Lifelines

- The Wastewater Treatment Plant on Plant St. is within the flood plain of the Tanyard Brook and area of poor drainage, in addition to five sewer pump stations located in floodplains.
- Several high risk bridges that carry utilities underneath them have flooded or washed out in prior hurricanes (Town Bridge – Route 114, Bridges at Mill Gut Pond/Mill Pond, and Tanyard Brook runs under Hope St./Route 114.)

### • Repetitive Loss Structures

- According to the information provided by RIEMA, there are 12 repetitive loss structures in Bristol.
- Repetitive loss properties are those for which two or more losses of at least \$1,000 each have been paid under the NFIP within any 10-year period since 1978.



## Develop Goals and Objectives Mitigation Goal...

*“Reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters”*



## Develop Goals and Objectives Mitigation Objectives...

- *Informing citizens and business owners how to protect themselves, their property, and their livelihood (and providing resources for doing so whenever possible)*
- *Reinforcing and upgrading the Town’s built environment and municipal systems*
- *Incorporating hazard resilience into the provisions for land redevelopment, with special emphasis on post-disaster recovery and rebuilding*
- *To the extent feasible, removing repetitively damaged structures from floodplains.*



## Analyze Existing/Research New Strategies

- Coordination with local business community
- Coordination with neighboring communities
- Coordination with Roger Williams University
- Bristol Comprehensive Plan, 2009
- Bristol Open Space Plan, 2008
- Bristol Flood Protection Services
- Flood Hazard Development Permit/Standards
- Subdivision and Development Review Regulations



## Analyze Existing/Research New Strategies

- Chapter 29 Soil Erosion, Runoff and Sediment Control Ordinance
- Revised Phase II Stormwater Management Program Plan, 2008
- *SafeWater RI: Ensuring Safe Water for RI’s Future*
- CRMC’s Section 145 Climate Change and Sea Level Rise Policy
- RI Climate Change Commission
- Storm Preparedness and Hazard Mitigation Plan



## Develop Comprehensive Range of Actions/Projects

- Public Education and Awareness
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Utilize school curriculum to educate students and their parents about hazard risks

Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State Officials.

#### Educational program for residents of flood zones and nearby downstream neighborhoods

Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not as obvious.



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Make residents aware of Emergency Response Plan

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed. Hazardous locations and warning signs, along with critical phone numbers and evacuation routes, could be conveyed on a calendar, a refrigerator magnet, or some other item commonly displayed in households. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new "Civic Ready" program to receive alerts via phone, email, text, etc..

#### Public Information, Outreach – Signage

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.



## Preliminary Mitigation Measures

### Public Education and Awareness

#### Designate Alternative Evacuation Route for the Poppasquash Area

The Town should seek an agreement from the State of Rhode Island for the feasibility of an additional inland opportunity for an alternate route along lower Poppasquash Rd. on state owned land, as well as a second opportunity along a new right-of-way for water lines along Poppasquash. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

#### Public Information, Outreach and Incentive Program

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, RI Coastal Properties Guide, and other FEMA publications, as applicable



## Preliminary Mitigation Measures

### Property Protection

#### Disseminate information on mitigation techniques and hazard insurance

Distribute literature related to mitigation techniques including the literature from the Institute of Business and Home Safety; retrofit methodology, grant/loan sources, and insurance options.

#### Prepare an "After-the-Storm Permitting" Plan for rebuilding

Review the permitting process and prepare a plan to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. The plan should outline a triage procedure for the rush of proposals and requests. Formalize the existing process, also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.



## Preliminary Mitigation Measures

### Property Protection

#### Eliminate flood risk to repetitive loss properties.

Consider public/private partnership with consulting engineer/NFIP to assist repetitive loss properties owners to identify appropriate flood mitigation retrofit projects.

#### Acquire properties that are within the coastal flood zones.

The *Open Space Plan* identifies areas for acquisition that would not only remove properties from the flood zone, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Open Space Committee as part of the *Open Space Plan* implementation, will seek to acquire parcels in risk areas as they become available for acquisition.



## Preliminary Mitigation Measures

### Property Protection

#### Develop a stand-alone Environmental and Historic Preservation Plan for at-risk properties within the flood zone (incorporate the potential re-use/rehabilitation/relocation potential for historic structures).

#### Construct concrete/earthen berm for improved access and protection at the Wastewater Treat Plant, above base flood elevation

This wall would serve as a dam to keep the flood waters out of the WWTF, while also providing a secondary means of access/egress above the base flood elevation.



## Preliminary Mitigation Measures

### Property Protection

#### Bury electrical wires and other suspended cables

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

#### Reinforce wire-to-pole connections

While the action above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with "Hendrick's Spacer Cables". These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

Horsley Witten Group



## Preliminary Mitigation Measures

### Natural Resources Protection

#### Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds.

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. A permit process should be developed to evaluate 'credits' when considering three approaches: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions.

#### Continue implementation of the Silver Creek Watershed Study.

Identify what has been accomplished, and re-prioritize what still needs to be done (perform update of the Study).

Horsley Witten Group



## Preliminary Mitigation Measures

### Natural Resources Protection

#### Continue implementation of the Tanyard Brook Watershed Study

Identify what has been accomplished (Phase I, Phase II at 50% design), and re-prioritize what still needs to be done (perform update of the Study).

#### Develop Shoreline Management Plan

Develop a management plan for Bristol's coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. Consider development of "retrofit program" for dead-end streets, also consider a "Regional" approach to this management plan.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Restore the culverts under Poppasquash Road at Mill Pond and Mill Gut Pond

Implement the findings and recommendations of the *Poppasquash Road and Pedestrian and Bicycle Facility Study* which includes recommendations to restore the culverts.

#### Reline or replace sewer lines where necessary

A recent Sewer System Evaluation Study has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. Continue work that is underway Tanyard Brook area Pilot Program.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Upgrade the Mt. Hope Pump Station by Installing Overflow Bypass

During rainstorms excess flows to the Mount Hope Pump Station are greater than the design of the station resulting in manhole overflows to Mount Hope Bay and sewer backups into residences. Replacing existing pumps with new design and more efficient pumps will reduce the possibility of manhole overflows and sewer backups.

#### Continue Drainage Improvements at the Wastewater Treatment Plant

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result, will also improve drainage along Fairview Drive.

Horsley Witten Group



## Preliminary Mitigation Measures

### Structural Projects

#### Install an Overflow Bypass up stream of the Silver Creek Pump Station

During periods of heavy rains wastewater flow to this station is greater than the design of the station resulting in manhole overflows to Bristol Harbor and sewer backups to residences, nursing homes, and businesses. The installation of an Overflow Bypass Station will allow the excess flows be diverted to this bypass structure and pumped independently with its own force main to the Wood Street sewer line. This should reduce manhole overflows and backups.

#### Inspect and repair the seawall along Independence Park and Walley Beach as necessary

Stability of the seawall should be evaluated. Repairs and regular maintenance should be made when necessary to enable it to withstand a 20 to 50-year storm.

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Ensure emergency personnel can access people and property within wooded areas

Continue to work with property owners to establish fire lanes in the Mount Hope Area which is the largest wooded area in Town.

#### Explore location(s) for new and/or additional storm shelter(s)

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered. The Quinta-Gamelin Community Center has been proposed as a secondary shelter (needs include a kitchen and generator).

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Implement "mobile information stations" (dependent upon event/severity/location) throughout the community.

The Town will set up mobile information stations to residents throughout the community (possibility through CERT team).

#### Tourist Evacuation and Shelter

Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. The Town will distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, marinas and other facilities and events hosting tourists.

Horsley Witten Group



## Preliminary Mitigation Measures

### Emergency Services

#### Elderly and Special Needs Residents

The Police Dept/Social Services Dept. will continue to update/maintain a list of elderly and special needs residents living independently in the Town, and coordinate with the Police Department. The list will be divided by evacuation area and susceptibility to hazards, in the event an evacuation is necessary.

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Develop a debris management program

Fallen debris and tree limbs resulting from thunderstorms, ice storms, and windstorms become fuel for fires in the wooded areas. Prompt removal and clean up of the wooded areas decrease this potential. A comprehensive debris management program will minimize potential impacts. Consider a "Regional" approach to this plan

#### Prohibit new basement utilities or require installation of a grinder pump.

Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town has adopted an ordinance which requires either sewer service connection at 2 feet above lowest floor elevation (as per Plumbing Code) or require installation of a check valve or backflow preventer between the building and the sewer collection system (applies to all building spaces constructed below the grade of the street.)

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Continue to pursue/implement Backflow Retrofit Program through FEMA grant funding (as available).

#### Eliminate illegal connections of private sump pumps to the sanitary sewer system

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences. Partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being distributed. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations.

Horsley Witten Group



## Preliminary Mitigation Measures

### Planning and Prevention

#### Priority Cleaning Plan for Sewer Lines

Over the next five years, return to identified "problem areas" and clean/camera inspect sewer lines.

#### Recovery and Reconstruction Ordinance

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consider a "Regional" approach to this plan.

#### Coordinate Evacuation Plans with Neighboring Municipalities

The Police Department will work with neighboring communities to coordinate evacuation plans.

Horsley Witten Group



## Preliminary Mitigation Measures

Additions??



## Next Steps...

- Refine/Confirm Mitigation Measures
- Cost Benefit Review/Prioritization



## Update Plan Maintenance/Implementation

- Maintain periodically, recommended annually
- Update every 5 years per DMA 2000



## Review, Revision, Approval and Adoption of Plan

- Public Comment
- Public Hearing
- RIEMA Submission



## Contact Us...

If you have general questions and/or comments about the Hazard Mitigation Plan Update, please contact:

Diane Williamson, AICP, CFM  
Director of Community Development  
Town of Bristol  
10 Court Street  
Bristol, RI 02809  
[dianew@bristolri.us](mailto:dianew@bristolri.us)  
Phone: (401) 253-7000 Ext. 126

**Thank You!**



# Memorandum of Meeting

**To:** Diane Williamson, Local Hazard Mitigation Committee  
**CC:** Tom Noble  
**From:** Craig Pereira  
**Date:** 8/25/2015  
**Re:** Public Workshop May 11, 2015

---

A second Public Workshop was held on May 11, 2015 at Bristol Town Hall to update the Hazard Mitigation Plan Update project to the community. Seven (7) members of the community and several municipal officials were in attendance. The following comments were provided by those in attendance:

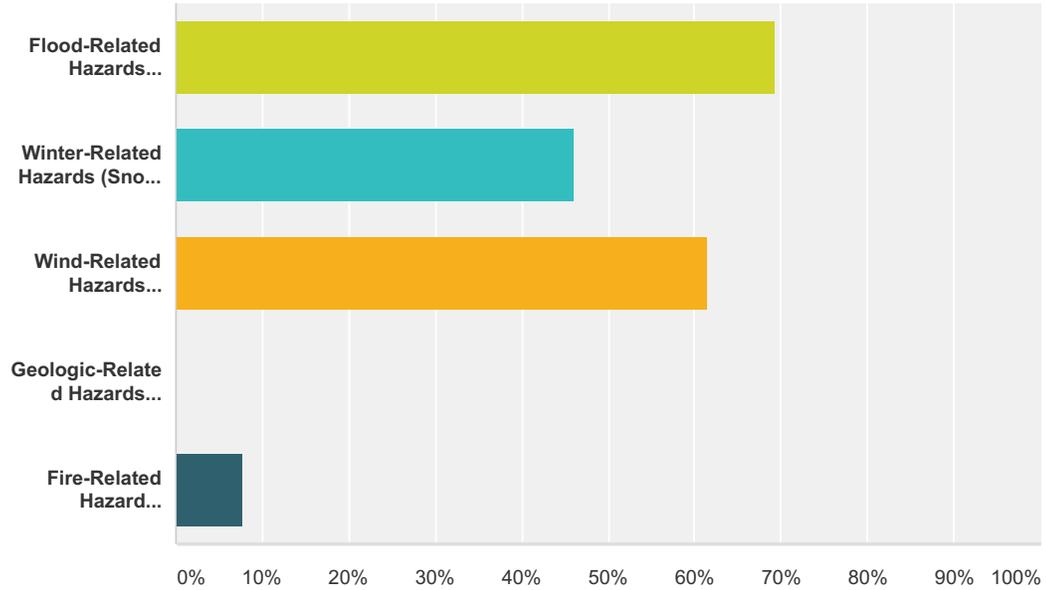
- There are areas of flooding that also correlate with the Town's Emergency Evacuation Route such as near the Sip n' Dip and Lobster Pot Restaurant. When these areas flood, the road (Hope St.) is closed and evacuation is stalled). Isn't there something the Town can do to remediate this problem long-term, such as temporary bridges? We need to be able to assemble the necessary information to develop a strong, comprehensive application for this.
  - Response: Perhaps the Vulnerability Assessment and mapping for the impacts of 1, 3, and 5 foot projections for sea level rise could be a starting point, looking at not just structures (residential and commercial buildings), but also infrastructure and life lines.



*On-Line Survey*

**Q1 Which of the following hazard events have you or has anyone in your household and/or business experienced in the past 20 years within the Town of Bristol? (Check all that apply)**

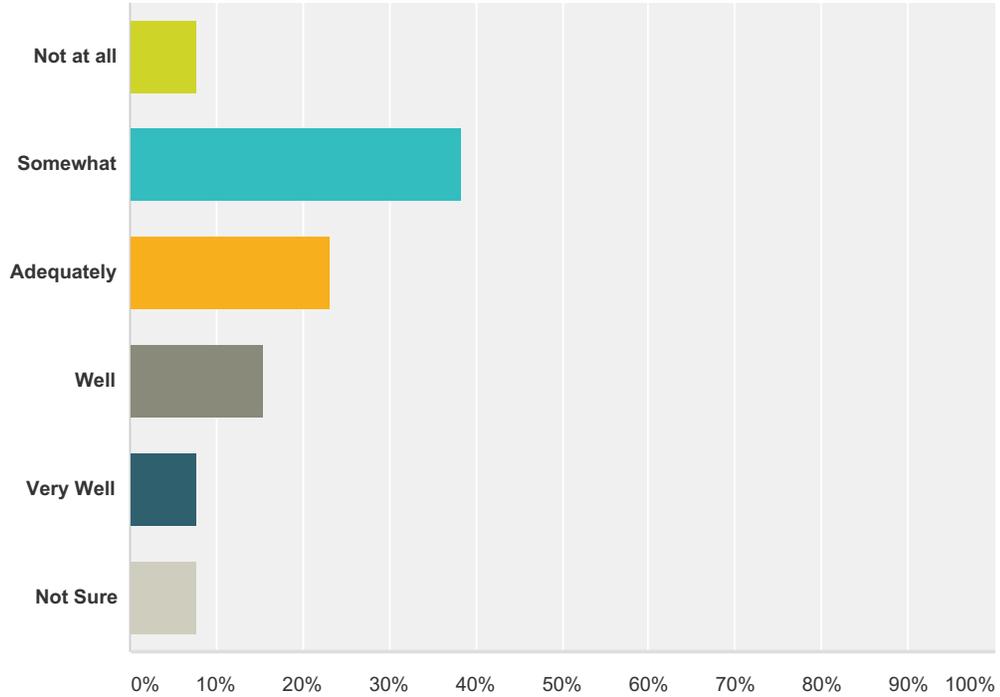
Answered: 13 Skipped: 0



Answer Choices	Responses
Flood-Related Hazards (Riverine/Flash Flooding, Inland/Urban Flooding, Coastal Flooding/Storm Surge, Coastal Erosion, Climate Change/Sea Level Rise)	69.23% 9
Winter-Related Hazards (Snow, Ice, Extreme Cold)	46.15% 6
Wind-Related Hazards (Hurricanes, Tornadoes, High Winds, Lightning/Thunderstorms, Hail)	61.54% 8
Geologic-Related Hazards (Earthquakes)	0.00% 0
Fire-Related Hazard (Drought, Extreme Heat)	7.69% 1
<b>Total Respondents: 13</b>	

## Q2 How prepared is your household and/or business to deal with a natural hazard event?

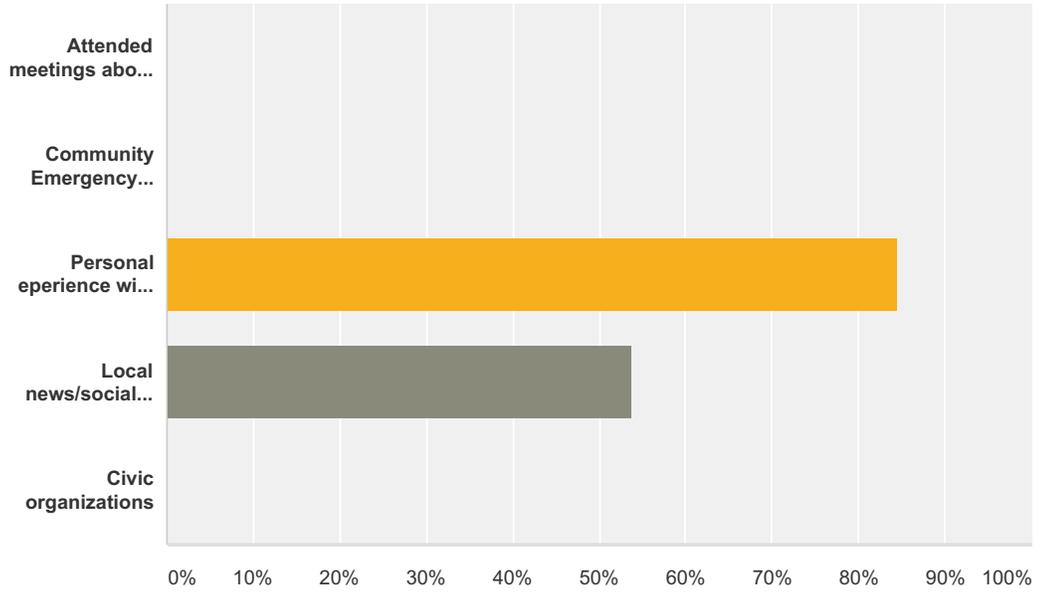
Answered: 13 Skipped: 0



Answer Choices	Responses
Not at all	7.69% 1
Somewhat	38.46% 5
Adequately	23.08% 3
Well	15.38% 2
Very Well	7.69% 1
Not Sure	7.69% 1
<b>Total</b>	<b>13</b>

**Q3 Which of the following have provided you with useful information to help you prepare for a hazard event? (Check all that apply)**

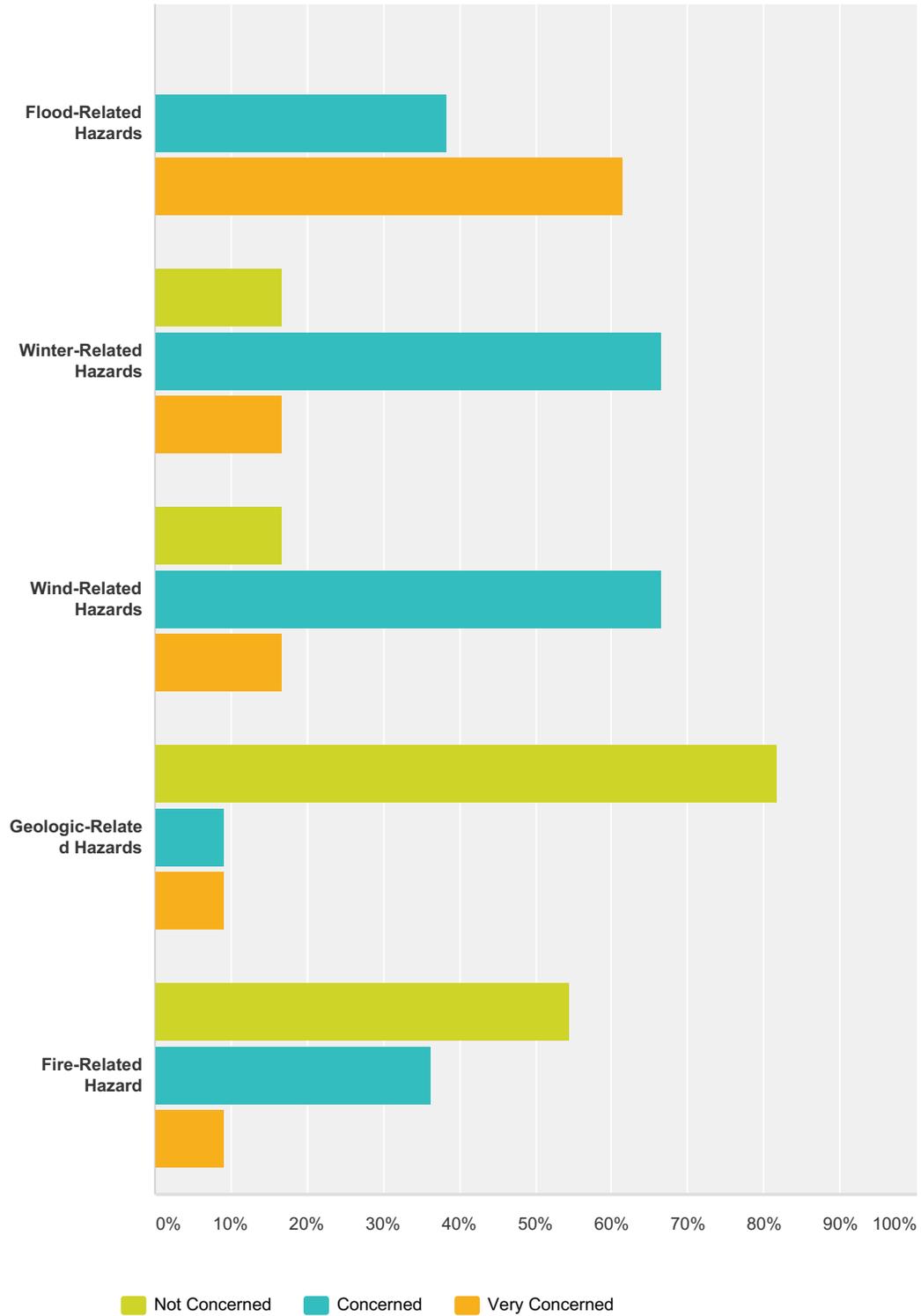
Answered: 13 Skipped: 0



Answer Choices	Responses
Attended meetings about disaster preparedness	0.00% 0
Community Emergency Response Training (CERT)	84.62% 11
Personal experience with one or more natural hazards/disasters	0.00% 0
Local news/social media	53.85% 7
Civic organizations	0.00% 0
<b>Total Respondents: 13</b>	

**Q4 How concerned are you about the following hazards in the Town of Bristol?  
(Check one response for each hazard)**

Answered: 13 Skipped: 0



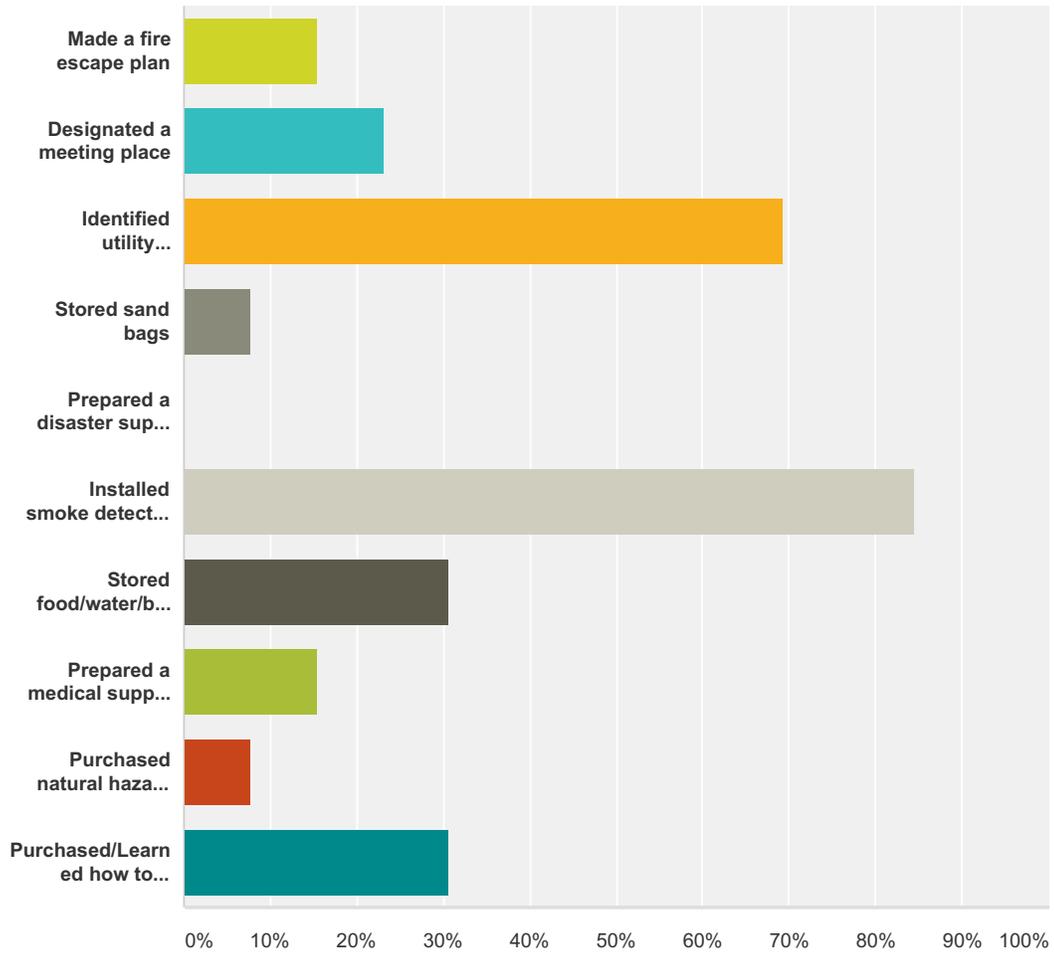
	Not Concerned	Concerned	Very Concerned	Total
--	---------------	-----------	----------------	-------

## Bristol Hazard Mitigation Plan Update

Flood-Related Hazards	<b>0.00%</b> 0	<b>38.46%</b> 5	<b>61.54%</b> 8	13
Winter-Related Hazards	<b>16.67%</b> 2	<b>66.67%</b> 8	<b>16.67%</b> 2	12
Wind-Related Hazards	<b>16.67%</b> 2	<b>66.67%</b> 8	<b>16.67%</b> 2	12
Geologic-Related Hazards	<b>81.82%</b> 9	<b>9.09%</b> 1	<b>9.09%</b> 1	11
Fire-Related Hazard	<b>54.55%</b> 6	<b>36.36%</b> 4	<b>9.09%</b> 1	11

**Q5 Which of the following steps has your household and/or business taken to prepare for a hazard event? (Check all that apply)**

Answered: 13 Skipped: 0



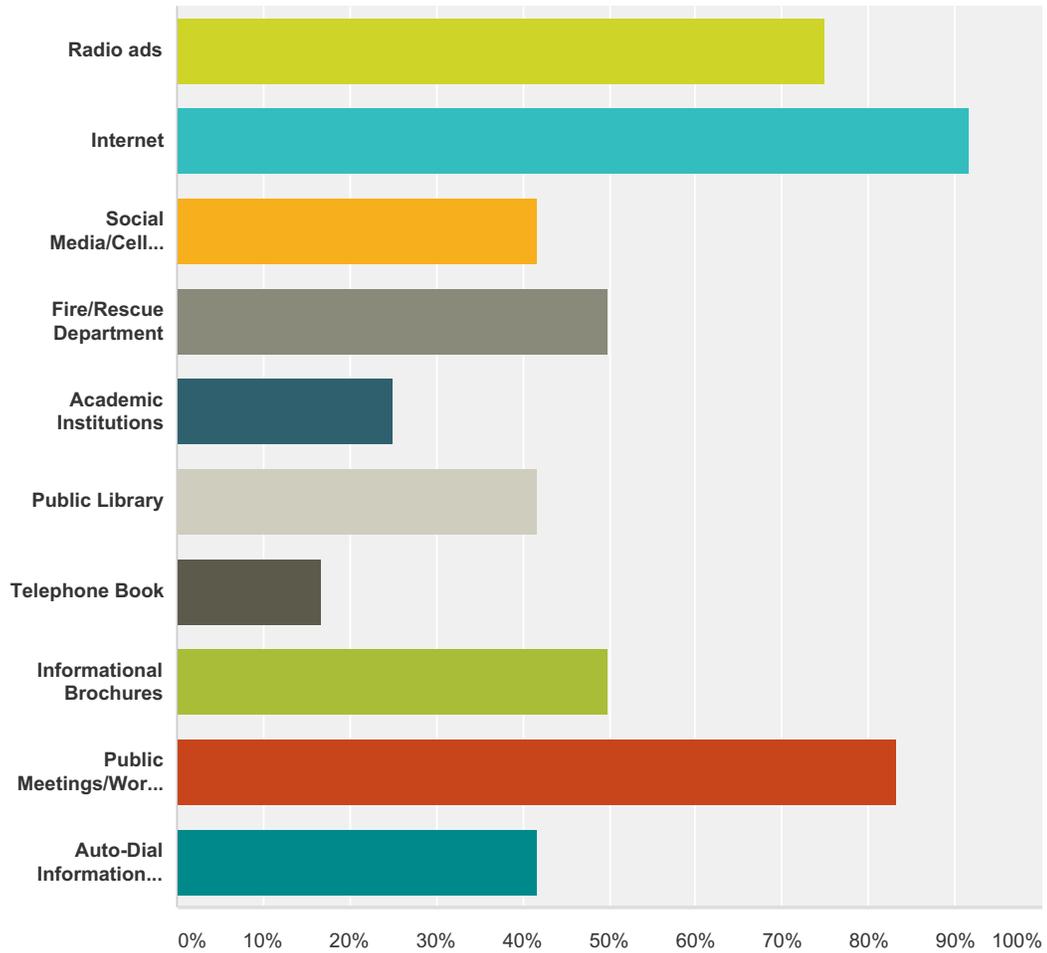
Answer Choices	Responses
Made a fire escape plan	15.38% 2
Designated a meeting place	23.08% 3
Identified utility shut-offs	69.23% 9
Stored sand bags	7.69% 1
Prepared a disaster supply kit	0.00% 0
Installed smoke detectors on each level of the house	84.62% 11
Stored food/water/batteries	30.77% 4
Prepared a medical supply kit	15.38% 2

## Bristol Hazard Mitigation Plan Update

Purchased natural hazard insurance	7.69%	1
Purchased/Learned how to program a NOAA Weather Radio	30.77%	4
<b>Total Respondents: 13</b>		

**Q6 Which of the following methods do you think are most effective for providing hazard and disaster information? (Check all that apply)**

Answered: 12 Skipped: 1



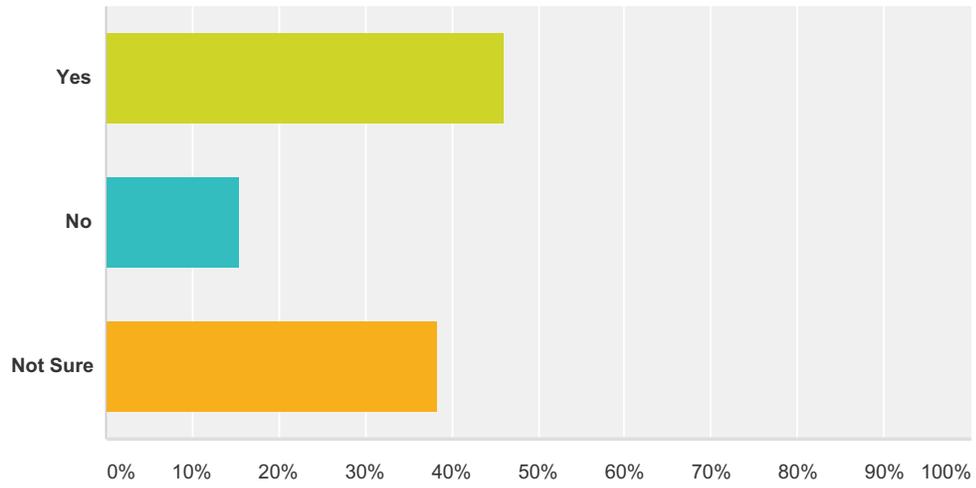
Answer Choices	Responses
Radio ads	75.00% 9
Internet	91.67% 11
Social Media/Cell phone apps.	41.67% 5
Fire/Rescue Department	50.00% 6
Academic Institutions	25.00% 3
Public Library	41.67% 5
Telephone Book	16.67% 2
Informational Brochures	50.00% 6

## Bristol Hazard Mitigation Plan Update

Public Meetings/Workshops	83.33%	10
Auto-Dial Information (Code Ready)	41.67%	5
<b>Total Respondents: 12</b>		

**Q7 Is your property located in or near a FEMA designated floodplain?**

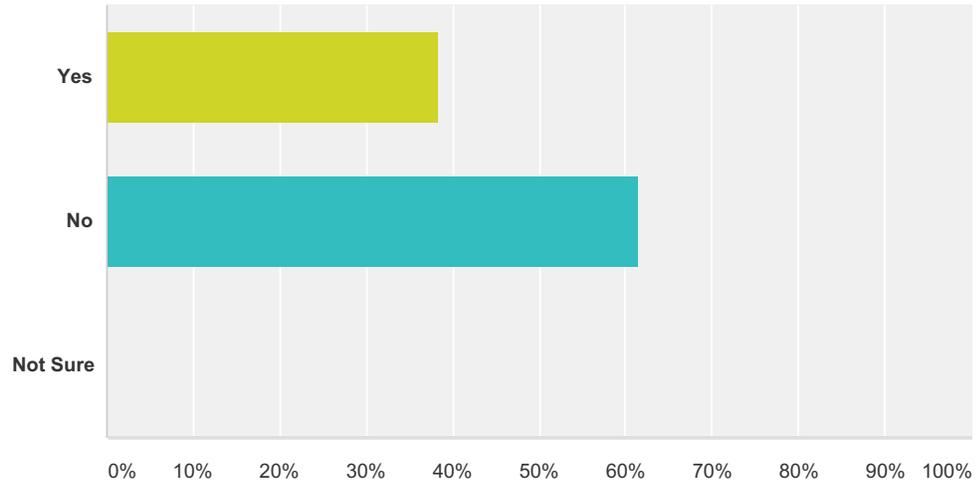
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	46.15% 6
No	15.38% 2
Not Sure	38.46% 5
<b>Total</b>	<b>13</b>

**Q8 Do you have flood insurance?**

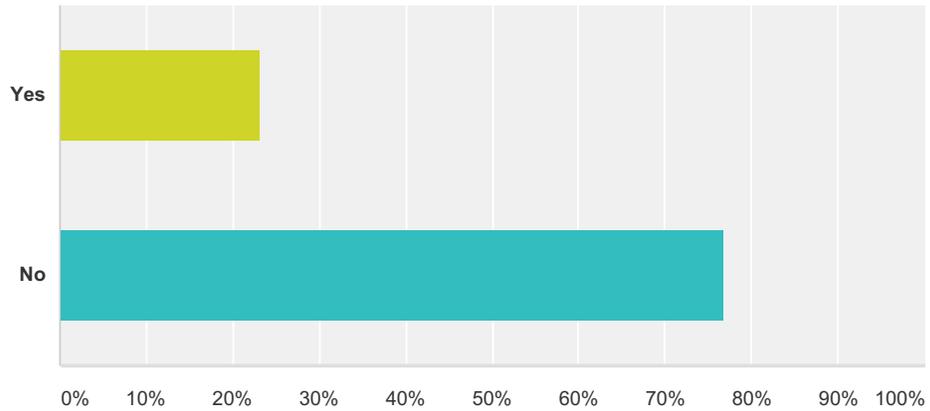
Answered: 13 Skipped: 0



Answer Choices	Responses	
Yes	38.46%	5
No	61.54%	8
Not Sure	0.00%	0
<b>Total</b>		<b>13</b>

**Q9 Do you have any special access or functional needs within your household and/or business that would require early warning or specialized response during disasters?**

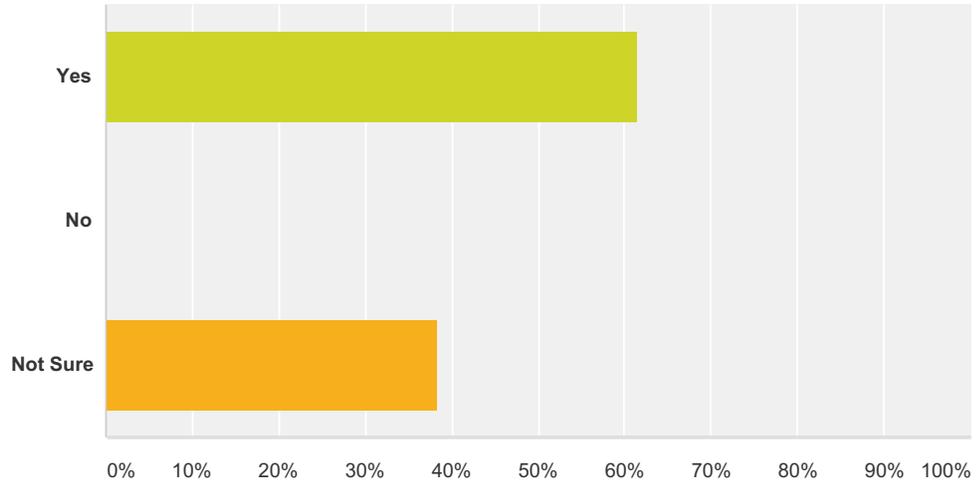
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	23.08% 3
No	76.92% 10
<b>Total</b>	<b>13</b>

**Q10 Are you interested in making your home, business or neighborhood more resistant to hazards?**

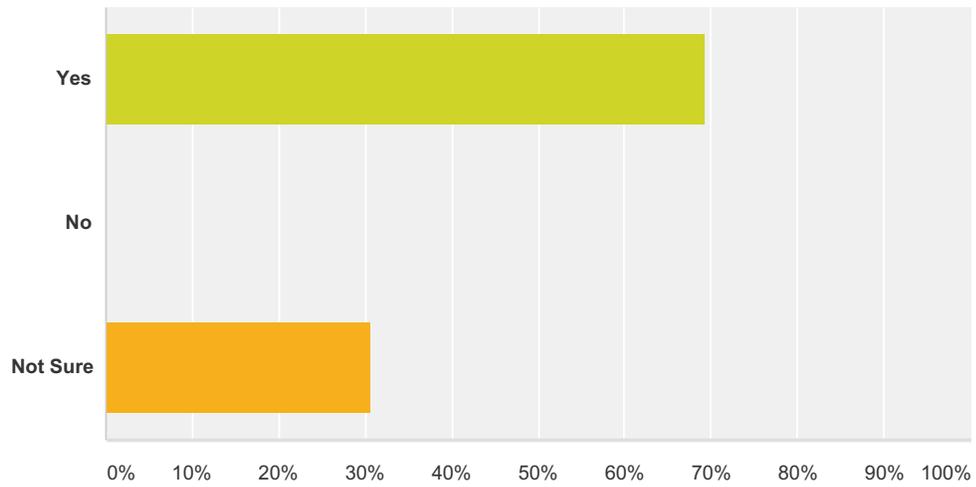
Answered: 13 Skipped: 0



Answer Choices	Responses	
Yes	61.54%	8
No	0.00%	0
Not Sure	38.46%	5
<b>Total</b>		<b>13</b>

**Q11 Would you be willing to spend your own money on your current home and/or business to help protect it from impacts of potential future natural disasters within the community? Examples could include: Elevating a flood-prone home; Elevating utilities in flood-prone basements; Strengthening your roof, siding, doors, or windows to withstand high winds; Removing trees/low branches.**

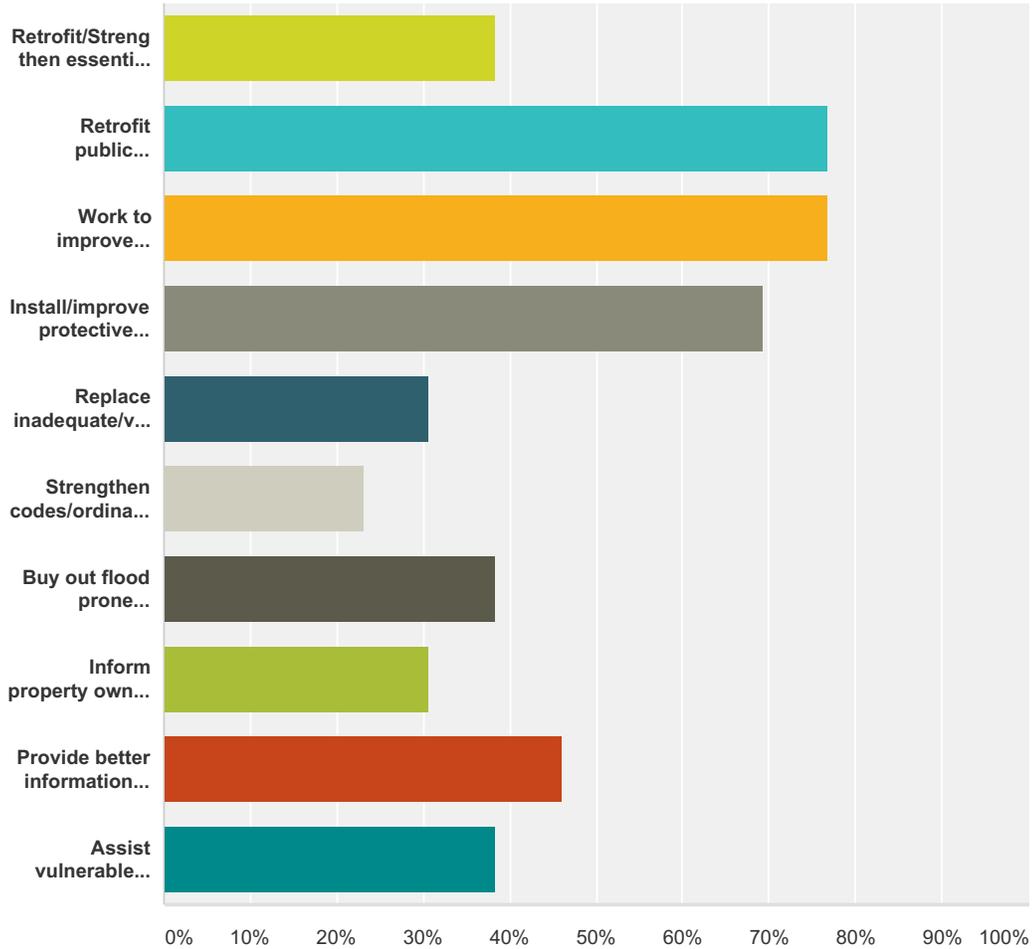
Answered: 13 Skipped: 0



Answer Choices	Responses
Yes	69.23% 9
No	0.00% 0
Not Sure	30.77% 4
<b>Total</b>	<b>13</b>

**Q12 What types of projects do you believe local, county, state or federal government agencies could be doing to reduce the damage and disruption of natural disasters in Bristol? (Select your top three choices)**

Answered: 13 Skipped: 0



Answer Choices	Responses
Retrofit/Strengthen essential public facilities such as police, fire/emergency, schools,	38.46% 5
Retrofit public infrastructure, such as elevating roadways and improving drainage systems	76.92% 10
Work to improve utilities resiliency (electric, communications, water/wastewater facilities)	76.92% 10
Install/improve protective structures (floodwalls/sea walls)	69.23% 9
Replace inadequate/vulnerable bridges and causeways	30.77% 4
Strengthen codes/ordinances to require higher hazard risk management standards and/or provide greater control over development in high hazard areas	23.08% 3
Buy out flood prone properties and maintain as open space	38.46% 5

## Bristol Hazard Mitigation Plan Update

Inform property owners of ways they can reduce the damage caused by natural events	30.77%	4
Provide better information about hazard risks and high hazard areas	46.15%	6
Assist vulnerable property owners with securing funding to make their properties more resilient	38.46%	5
<b>Total Respondents: 13</b>		

# Bristol Hazard Mitigation Plan Update

## Q13 Additional comments?

Answered: 5 Skipped: 8

#	Responses	Date
1	Rock barriers from Lobster Pot area to Blithewold.	5/11/2015 2:42 PM
2	I am a civil engineer experienced with disaster mitigation. Call George Tamaro, 53 Shore Road- 253-3474 if I can be of help in your planning.	5/10/2015 7:43 PM
3	None.	5/10/2015 12:08 PM
4	Stream that runs across elbow and waterman always floods. There should be better drainage in the stream and a catch basin near Lugent.	5/8/2015 1:49 PM
5	Fire Dept. is very helpful with pumping out flooded basements, but would be better if basement did not flood in the first place. Redesign the Tanyard Brook!!	5/8/2015 12:12 PM

*Local Hazard Mitigation Committee: May 14, 2015*

# Bristol Hazard Mitigation Plan Update

## **Local Hazard Mitigation Plan Committee Meeting**

Department of Community Development 2<sup>nd</sup> Floor Conference Room  
May 14, 2015 9 AM

### **Agenda**

1. Mapping
2. Benefit Cost Analysis Review
3. Next Steps

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Utilize school curriculum to educate students and their parents about hazard risks*

Working in conjunction with FEMA, develop brochures to distribute to the students. Work with the School Department to incorporate hazard risks and prevention into an appropriate school curriculum such as earth science. This could include a program with presentations in classrooms on a yearly basis by local and State Officials.

Diane...

- accomplishments to date
- information on Save Bristol Harbor (Marine Sciences Program)

Benefits

- ...increased safety, institutional awareness of hazards
- ...protection of property

Costs

- ...minimal
- ...staff time for classroom presentations
- ...printing costs for brochures

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	0	0
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Educational program for residents of flood zones and nearby downstream neighborhoods*

Since these properties are in a flood zone, public education and outreach should be ongoing. This would include distribution of maps and literature with information on the evacuation routes and emergency shelter. As part of the education, the Town could post indicators of historic flood levels. An example could be signage on some of the buildings downtown to illustrate how high past flood waters have been. Signage could also be posted on some of the major roadways (i.e Poppasquash Road) to indicate that the area is subject to flooding. This is especially important to include inland areas where the risk is not as obvious.

The Town has a *Hurricane Disaster Information* pamphlet, developed in 2014 that includes information on hurricane season/past events, disaster supply kits, safety tips, shelter/emergency contacts and RI Special Needs Emergency Information registration.

The Town also received a grant through RIEMA for the design and installation of signage on Town-owned properties in the downtown and along roadways identified as critical flooding areas to alert residents and tourists of potential flood hazards.

Benefits

- ...increased safety, institutional awareness of hazards
- ...protection of property through increased flood policies

Costs

- ...minimal
- ...staff time
- ...printing costs for maps/literature

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	11
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Make residents aware of Emergency Response Plan*

Steps should be taken to inform residents about which bridges and roads are subject to flooding, as well as about indicators to begin evacuation. Principles of the Emergency Response Plan that are pertinent to given neighborhoods or the population in general should be summarized and distributed through actions such as: the implementation of ‘mobile Information stations’ (dependent upon event/severity/location) throughout the community; the distribution of evacuation and sheltering to hotels, bed and breakfast establishments; seasonal rental real estate agencies; marinas; and events hosting tourists. Outreach to residents could also be in the form of an annual mailing prior to hurricane season to give information on property protection and preparedness. Public service messages in the newspaper, on the radio, or during public forums may be a sufficient alternative. Include information on how to register for new ‘Civic Ready’ program to receive alerts via phone, email, text, etc..

Benefits

- ...increased safety and institutional awareness
- ...accelerated evacuation
- ...Civic Ready program already planned to roll out

Costs

- ...minimal
- ...staff time for mailings
- ...printing costs for brochures

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Public Information, Outreach – Signage*

Post signs that indicate where major access routes are and areas where early evacuation is necessary. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Cortney...

- More from her meeting on 5/15/15
- Consideration of EMAP (RIEMA)

Benefits

- ...increased safety and institutional awareness
- ...accelerated evacuation

Costs

- ...minimal
- ...staff time
- ...printing costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	12
Total Score	21	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2    favorable 1  
 not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Designate Alternative Evacuation Route for the Poppasquash Area*

The Town will work towards a shared agreement with the State of RI (DEM) to assess the feasibility an additional inland opportunity for an alternate route along lower Poppasquash Rd., as well as a second opportunity along a new right-of-way for water lines along Poppasquash. Other roads in the Poppasquash area cross bridges at either Mill Gut or Mill Pond. Residents should be made aware of this route with signs posted. This is important not only for the residents but for the general public, including tourists, who may be visiting the area.

Benefits

- ...increased safety and institutional awareness (including tourists)
- ...accelerated evacuation
- ...uninterrupted access for emergency vehicles/responders

Costs

- ...minimal
- ...staff time for coordination/mapping
- ...printing costs for literature

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	-1
Sub-total of cost/benefit	9	11
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2    favorable 1  
 not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Public Education and Awareness**

Action: *Public Information, Outreach and Incentive Program*

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, *RI Coastal Properties Guide*, and other FEMA publications, as applicable.

In addition, the Town will promote and support enforcement of the latest policy revisions relative to climate change and sea level rise and distribute literature related to mitigation techniques including information from the Institute of Business and Home Safety, retrofit methodology (FEMA's library of Technical Bulletins), grant/loan sources, and insurance options.

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

Benefits

...institutional awareness of risks for contractors/homeowners

...increased property protection

Costs

...minimal

...staff time to place order through FEMA's library

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	12	12
Total Score	24	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

*Action: Prepare an "After-the-Storm Recovery" Plan for the community*

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger. Consider a 'Regional' approach to this plan.

*Community Assessments*

The Bristol Emergency Management Task Force/Certified Floodplain Manager (s) to develop a formalized protocol to complete Community Assessments after an event regarding the shutoff/reconnection of utilities, damage assessments/documentation and Certificate of Occupancy re-instatements.

*Recovery and Reconstruction Ordinance*

The Town to coordinate with CRMC to review the permitting process, develop and adopt an ordinance to streamline the process in the aftermath of a hazard impact including the process to allow homeowners to retrofit structures in order to reduce risk. Formalize the existing process, also maintain current policy to waive permit fees for building permits to repair storm-damaged properties.

Benefits

- ...increased property protection, resiliency/reduced losses
- ...homeowner supported by community
- ...accelerated recovery

Costs

- ...minimal
- ...staff time to develop the protocol and ordinance

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	12
Total Score	21	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Acquire properties in Special Flood Hazard and repetitive flood loss areas* Bristol now includes 12 severe repetitive flood loss properties as well as properties subject to periodic flooding within the Tanyard Brook and Silver Creek watershed area. The Town will work with private homeowners in these areas and FEMA to identify an acquisition project (s), obtain approval by the state and FEMA, and seek funding to purchase the property. By purchasing these residential properties, the Town is utilizing an effective program designed to move people and property away from high-risk areas to reduce disaster losses. The land is then restricted to open space, recreation or wetlands in perpetuity.

Benefits

...increased resiliency/reduced losses

...would satisfy other community objectives of additional open space, parks/recreation sites, and/or scenic areas

Costs

...could be substantial, dependent upon location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	-1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	1	9
Total Score	10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Acquire properties that are within flood zones*

The *Open Space Plan* identifies areas for acquisition that would not only remove properties from flood-prone areas, but would also satisfy other community objectives; such as, open space, parks and recreation sites; or, scenic areas. One of the best ways to prevent flood damage is to keep flood-prone areas undeveloped. The Town, working with the Open Space Committee as part of the *Open Space Plan* implementation, will seek to acquire parcels in risk areas as they become available for acquisition.

Benefits

...increased resiliency/reduced losses

...would satisfy other community objectives of additional open space, parks/recreation sites, and/or scenic areas

Costs

...could be substantial, dependent upon location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	-1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	1	9
Total Score	10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Develop a stand-alone Environmental and Historic Preservation Plan*

An Environmental and Historic Preservation Plan (EHP) will identify and mitigate potential loss to historic resources associated with natural disasters, primarily threats to sea-level rise, subsidence, and flooding, particularly in the historic waterfront district. By assessing the significance of cultural resources within the 100 year flood plain boundary and risk from flooding associated with those resources, planning for their preservation will enable the Town to better protect the architectural integrity of the downtown. The plan should articulate the potential re-use/rehabilitation/relocation potential for historic structures/at-risk properties within the flood zone.

In the past two years, the Town has acquired two properties in the downtown historic district along the west side of Thames St., and is working with the state to study potential re-use/rehabilitation concepts. The Town now owns all properties from the State St. Dock to the Robin Rug building.

Benefits

- ...would provide the balance necessary between historic preservation and mitigation
- ...a resource for the Bristol Waterfront National Register District

Costs

- ...minimal
- ...staff time to develop Plan

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	9	10
Total Score	19	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: *Bury electrical wires and other suspended cables*

Continue the requirements for subsurface utility lines in new subdivisions. On existing streets in the downtown, the above ground utilities should be placed underground. Although not financially feasible at this time; it should be considered in the future, especially if the Town is eligible for federal disaster assistance after a storm event.

Benefits

- ...continuity of services
- ...protection of property and life safety from downed utility lines
- ...improved view corridors/vistas

Costs

...could be substantial dependent upon the scale of the project

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	-1	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	-1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	-1
<b>Political:</b> Is there strong public support to implement and maintain the action?	-1	-1
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	-1
<b>Economic:</b> Is the action cost-effective?	-1	-1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	-1	0
Sub-total of cost/benefit	-7	-3
Total Score	-10	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Property Protection**

Action: Reinforce wire-to-pole connections

While the action above is a long term implementation item, in the short term, the wires on the poles in the downtown area, particularly along Hope Street, should be secured to the poles with “Hendrick’s Spacer Cables”. These spacer cables make the wires more durable, improve the reliability of service to customers; and protect the health of the street trees, making them less susceptible to storms.

Benefits

...continuity of services

...protection of property and life safety from downed utility lines

Costs

...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	-1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	1
<b>Economic:</b> Is the action cost-effective?	1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	1	6
Total Score	7	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Natural Resources Protection**

Action: *Retrofit of paved parking areas within the Tanyard Brook and Silver Creek Watersheds.*

There may be opportunities to include drainage and/or Low Impact Development techniques, such as infiltration strips and reduced pavement, in existing commercial and municipal parking lots that are being resurfaced. The Town is presently assessing the feasibility of a Stormwater Management Utility District which will consider the development of 'criteria' relative to incentive credits for stormwater improvements across three typologies: retrofit of existing paved surfaces (reductions); new/expansion of parking for commercial sites; and, residential conversions.

Benefits

...reduced flow/loading to the WWTF

...increased infiltration onsite

...property protection

Costs

...dependent upon site/location

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	8	12
Total Score	20	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Natural Resources Protection**

Action: *Develop Shoreline Management Plan*

Develop a management plan for Bristol’s coastal areas that includes the following objectives: improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects. As an example, the Town could consider development of a functional ‘retrofit program’ for dead-end streets that taper-off into the water. Town to consider a ‘Regional’ approach to this management plan.

Benefits

- ...increased property/environmental resources protection
- ...increased resiliency/reduced losses

Costs

- ...minimal (especially if regional approach is utilized)
- ...staff time to develop the Plan

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	1
Sub-total of cost/benefit	10	13
Total Score	23	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
 not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Reline or replace sewer lines where necessary*

A recent *Sewer System Evaluation Study* has found areas in town with old, cracked, damaged sewer pipes. The age of some pipes is in excess of 75+ years. The cracked, damaged pipes allow ground water to enter the sewer system increasing wastewater flows in excess of the design of the sewer system. By relining/replacing pipes will reduce infiltration, preventing sewer surcharges, overflows, blockages and backups. Continue work that is underway in the Tanyard Brook area.

Jose...

- information on Annawamscutt area pilot project

- EPA mandate (cured in place)

Benefits

...protection of infrastructure

...continuity of services

...reduced potential for pollutant loadings/environmental impacts

...prevent sewer surcharges/overflows/backups

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	0
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	-1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	2	2
Sub-total of cost/benefit	7	11
Total Score	18	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Continue Drainage Improvements at the Wastewater Treatment Plant*

Drainage improvements completed in 2012 (new drainage inlet structure connected to converted stormwater drain) has reduced overland flooding at the WWTF. Complementing this, the Town continues to replace Rotating Biological Contactors, elevating their drive motors 2.5 feet higher to ensure more reliable operation and treatment if flooding occurs. The Town is also moving forward to implement necessary drainage improvements (construction of a new drain line, concurrent with a sewer repair project) to keep the WWTF from flooding, which, as a result, will also improve drainage along Fairview Drive.

Benefits

- ...protection of infrastructure
- ...continuity of services
- ...reduced potential for pollutant loadings/environmental impacts

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	-1	-1
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	8	10
Total Score	18	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Structural Projects**

Action: *Inspect and retrofit the seawall along Independence Park and Walley Beach, the Armory building downtown and the Prudence Island Ferry Dock*

Stability of the seawall, Armory building, and Ferry Dock should be evaluated. Retrofits should be made to withstand a 20 to 50-year storm, in addition to the impacts of projected sea level rise.

Benefits

...increased property/recreational resources protection

...increased resiliency/reduced losses

Costs

...could be substantial dependent upon results of evaluation

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	-1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	5	11
Total Score	16	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Emergency Services**

Action: *Work with property owners to establish fire lanes in the Mount Hope Area*

Ensure emergency personnel can access people and property within the wooded areas of the Mount Hope area.

Benefits

...protection of life and property

...uninterrupted access

Costs

...minimal

...staff time to maintain/clear access roads

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	1	2
Sub-total of cost/benefit	10	14
Total Score	24	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Mitigation

**Emergency Services**

Action: *Explore location(s) for new and/or additional storm shelter(s)*

The Town is currently reviewing other buildings that may be more suitable for use as a hurricane and flooding storm shelter however these would likely need to be retrofitted for installation of portable power generators. The need for additional staffing for shelters should also be considered. The Quinta-Gamelin Community Center has been proposed as a secondary shelter (outstanding needs include a functional kitchen and ADA access throughout the building).

Benefits

- ...secondary shelter space
- ...protection of public health and safety

Costs

- ...minimal
- ...staffing/training

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	1	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	10	12
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale:    very beneficial 2    favorable 1  
    not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Planning and Prevention**

Action: *Continue to evaluate new basement utilities or require installation of a check valve/backflow preventor*  
 Much of the damage from the March 2010 storm event was due to basement utilities backing up, most notably the Bristol County Medical Center. The Town has adopted an ordinance which requires either sewer service connection at 2 feet above lowest floor elevation (as per Plumbing Code) or require installation of a check valve or backflow preventer between the building and the sewer collection system (applies to all building spaces constructed below the grade of the street.)

Benefits

- ...protection of property
- ...uninterrupted services

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	2	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	12	14
Total Score	26	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2    favorable 1  
 not applicable 0    not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

Action Type: Planning

**Planning and Prevention**

Action: *Expand the implementation of the Backflow Retrofit Program to both residential and commercial properties through FEMA grant funding (as available).*

Benefits

- ...protection of property
- ...uninterrupted services

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	2
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	10	13
Total Score	23	
<b>Priority</b>		

Definition of Rating Scale: very beneficial 2 favorable 1  
 not applicable 0 not favorable -1

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

**Planning and Prevention**

Action: *Reduce illegal connections of private sump pumps and floor drains to the sanitary sewer system through educational programs*

During heavy rain storms the treatment facility, pump stations and sewer system experience heavy wastewater flows in excess of the design of the sewer system causing manhole overflows and sewer backups into residences, partially caused by sump pumps connected illegally to the sanitary sewer system. A door to door inspection by an independent company has verified connections and the Town has created a GIS mapping of these locations. Notices to property owners to disconnect pumps, with possible solutions and consequences for failure to comply are currently being distributed. Plumbing inspectors can verify that no new connections are being made during construction. Eliminating and preventing such illegal connections would result in reduced manhole overflows, sewer backups and unhealthy situations.

Benefits

- ...protection of infrastructure
- ...continuity of services
- ...reduced potential for pollutant loadings/environmental impacts
- ...prevent sewer surcharges/overflows/backups

Costs

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	-1	1
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	-1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	1	1
<b>Legal:</b> Does the community have the legal authority to implement the action?	1	1
<b>Economic:</b> Is the action cost-effective?	1	1
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	2
Sub-total of cost/benefit	3	9
Total Score	11	
<b>Priority</b>		

Definition of Rating Scale: 2=very beneficial 1=favorable  
 0=not applicable 1=not favorable

**Part 1: Review Benefits and Costs**

*Review Tool 2: Benefits*

**Planning and Prevention**

Action: *Coordinate Evacuation Plans with Neighboring Municipalities*

The Police Department will work with neighboring communities to coordinate evacuation plans.

Courtney...

- More from her meeting on 5/15/15

Benefits

- ...accelerated evacuation
- ...protection of life safety

Costs

- ...minimal

**Part 2: Prioritize Actions - Quantitative Method**

*Method C Simple Score*

Criteria	Cost	Benefit
<b>Social:</b> Is the action compatible with present and future local community needs and values?	2	2
<b>Technical:</b> Is the action feasible with available local resources (or as supplement by outside resources as necessary)?	2	2
<b>Administrative:</b> Does the community have the administrative capacity to implement the action?	1	1
<b>Political:</b> Is there strong public support to implement and maintain the action?	2	2
<b>Legal:</b> Does the community have the legal authority to implement the action?	2	2
<b>Economic:</b> Is the action cost-effective?	2	2
<b>Environmental:</b> Does the action impact environmental resources, and is the impact positive, negative, or neutral?	0	0
Sub-total of cost/benefit	11	11
Total Score	22	
<b>Priority</b>		

Definition of Rating Scale: 2=very beneficial 1=favorable  
 0=not applicable 1=not favorable



**Appendix C – Model Lease Agreement for Commercial Uses in the Floodzone**

# Emergency Evacuation Plan

## Thames Street Landing

251-267 Thames St.  
Bristol, RI 02809

Upon confirmation from the Town of Bristol Emergency Official that a storm with the threat of flood is approaching, the businesses on the ground floor in the Flood plain at Thames Street Landing will be told to move their goods to the storage room in the hotel building at the third floor. This command will be issued by the manager of Miles Ave. Property Co., LLC, or in the absence of that person, the manager, of the Bristol Harbor Inn, or assistant manager of the Bristol Harbor Inn.

The evacuation shall occur six hours before the onset of the actual high water flood occurrence. An alternate is for the tenant to remove all belongings from the tenants leased space and move those belongings in a truck or other vehicle to a location above the 18 foot flood plain.

Miles Ave. Property has procured the services of East Bay Movers for another option for tenants. Upon notification of the approach of a flooding condition, in addition to 1) Moving goods to the top Floor of the Inn, 2) removing goods from the site, the tenant may contract with East Bay Movers for space in the moving van, and when the van is full, it will move to the parking lot East of Thames Street, which is above the 18 foot flood level.

Space in the third floor will be designated by Miles Ave. personnel by retail location for short term storage of goods until the flood condition has passed. Goods taken to the third floor of the Inn will be stored to the left and right of the elevator, and East along the North wall of the "E" building, and West, past the mechanical room, along the south wall of the "F" building. Assignment of space will be made by the person that has contacted the tenant, or designate.

It is the responsibility of the tenant to provide the resources to timely move materials to the safe locations established for a flood condition. Miles Ave. is obligated to the Town of Bristol to provide the space, and terms of the tenant lease dictate that this action shall be taken.

COPY

1.14 First Month's Rent. The first month's rent per Exhibit A shall be due upon signing of this lease.

1.15 Flood Disclosure. The Lessor hereby discloses to Lessee that the premises are located on the Bristol Harbor in a high velocity flood zone and that the Lessee shall be required to take certain action during a severe storm or hurricane in order to prevent loss, damage, or injury, to people or property. Lessor shall not be required to give notice to, or inform lessee of severe storm or hurricane weather forecasts. The Lessor reserves the right to establish, from time to time, reasonable rules and regulations in regards to the action Lessee shall be required to take in the event of a severe storm or hurricane.

( ✓ ) The demised Unit does include additional storage space above the flood level in the building or on site in a different building, for the purpose of storing merchandise and equipment during a severe storm or hurricane.

## ARTICLE 2. TAXES

2.1 Lessor's and Lessee's Obligation. Lessor shall pay all base year real estate taxes, assessments and other governmental charges that would become a lien on the demised premises if not paid when due.

2.2 Lessee's Taxes. Lessee shall pay when due all taxes, assessments and other governmental charges levied on the personal property or business of Lessee located on the demised premises. Lessee shall pay to lessor increases over base year real estate taxes. Lessee shall pay to Lessor a pro rata share of any increase in real estate taxes above the amount of such taxes levied upon the Thames Street Landing complex of which the premises, forms a part for the Tax Base Year (as used in this provision "Tax Base Year" shall be deemed to mean the first tax year following the commencement of the

taking of possession of the demised premises by Lessee shall be conclusive evidence that the demised premises were in satisfactory condition at the time such possession was so taken, except for buildout punchlist items. Excepting article 1.3.

1.10 Use of Premises. The demised premises shall be used for the purpose of retail sales of Jewelry & Clothing and related and for no other purpose. Lessee shall restrict its use to such purposes, and shall not use or permit the use of the premises for any other purpose without the written consent of Lessor. Such consent will not unreasonably be withheld if Lessee's proposed purpose does not significantly affect other tenants of Thames Street Landing.

In accordance with the Bristol Zoning Board of Review approval for the premises, the following uses for the building in which the demised Unit is located is prohibited: The sale or storage of stoves, refrigerators, heavy appliances, or similar items which may become a projectile during a severe storm or hurricane is prohibited on the demised Unit.

1.11 Quiet Enjoyment. Lessee on paying the base rent and any additional rent herein specified and observing Lessee's agreements hereof shall and may peaceably and quietly have, hold and enjoy the demised premises during the Term of this Lease.

1.12 Parking. Lessor shall provide parking, which shall be shared in common by all of the tenants and customers on the premises. Lessee agrees not to unreasonably interfere with the use of said parking facilities by the other tenants within reason. Lessor shall establish, from time to time, rules and regulations for the use of the parking facilities by all of the tenants on the premises. Employees of all Lessees of Thames Street Landing will not be allowed to park in the main on-site parking lot.

1.13 Security Deposit. Lessee shall pay one (1) month's rent to lessor as a security deposit upon signing of this lease.

## Appendix D – Photos and Historical Information

# HURRICANE AND FLOOD PICTORIAL RECORD

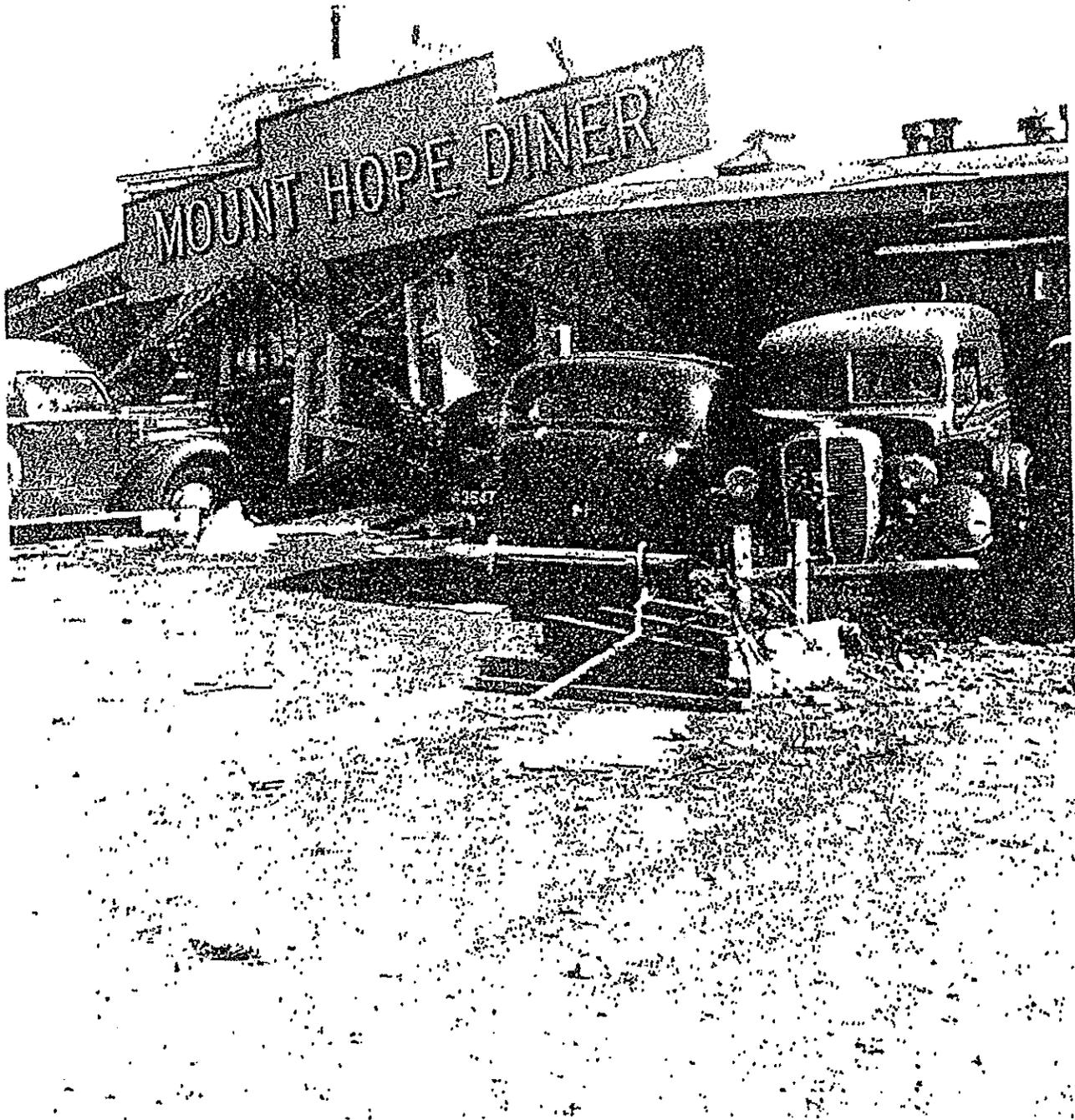


Rockwell Park at the foot of Church Street, as a  
flood survivor forces his way to a place of safety.

SEPTEMBER 21, 1938

at

BRISTOL, R. I.



The completely ruined diner which was only recently renovated.  
This building was almost completely covered by the flooding tides.



Travel in and out of Bristol along Hope Street was impossible for two days, because of such piles of debris and destruction near Poppasquash Road.



What once was a three story residence on Hope Street. The entire first floor and corner was completely carried away by the force of the swirling currents.

The historic town of Bristol was struck by a tropical hurricane, on the afternoon of September 21, 1938. Although the town was very fortunate in not having any loss of life, the destruction of property was estimated at many hundred thousands of dollars. The waters surrounding Bristol rose to an average height of 18 feet above low tide level, carrying with it many waterfront buildings and boats. When the waters receded tons of debris was deposited along the town's main thoroughfares, boats of all kinds were found on front lawns and in vacant lots.

Two of the town's largest industries, Collins and Aikman Corporation and Herreshoff Manufacturing Company, as well as many of the smaller business places suffered heavy losses. Many homes were damaged by fallen trees, the roots were pulled from the ground by the wind which is estimated to have attained a velocity exceeding 100 miles an hour.

The citizens of Bristol, who, for a time were without water, electricity and gas showed splendid spirit, cooperation and courage. The individuals and utilities are also to be congratulated on their excellent work in returning Bristol to normalcy.

These pictures which are reproduced here are without any retouching, provide a pictorial record of this great disaster.

Photographs by Newman and Ryono

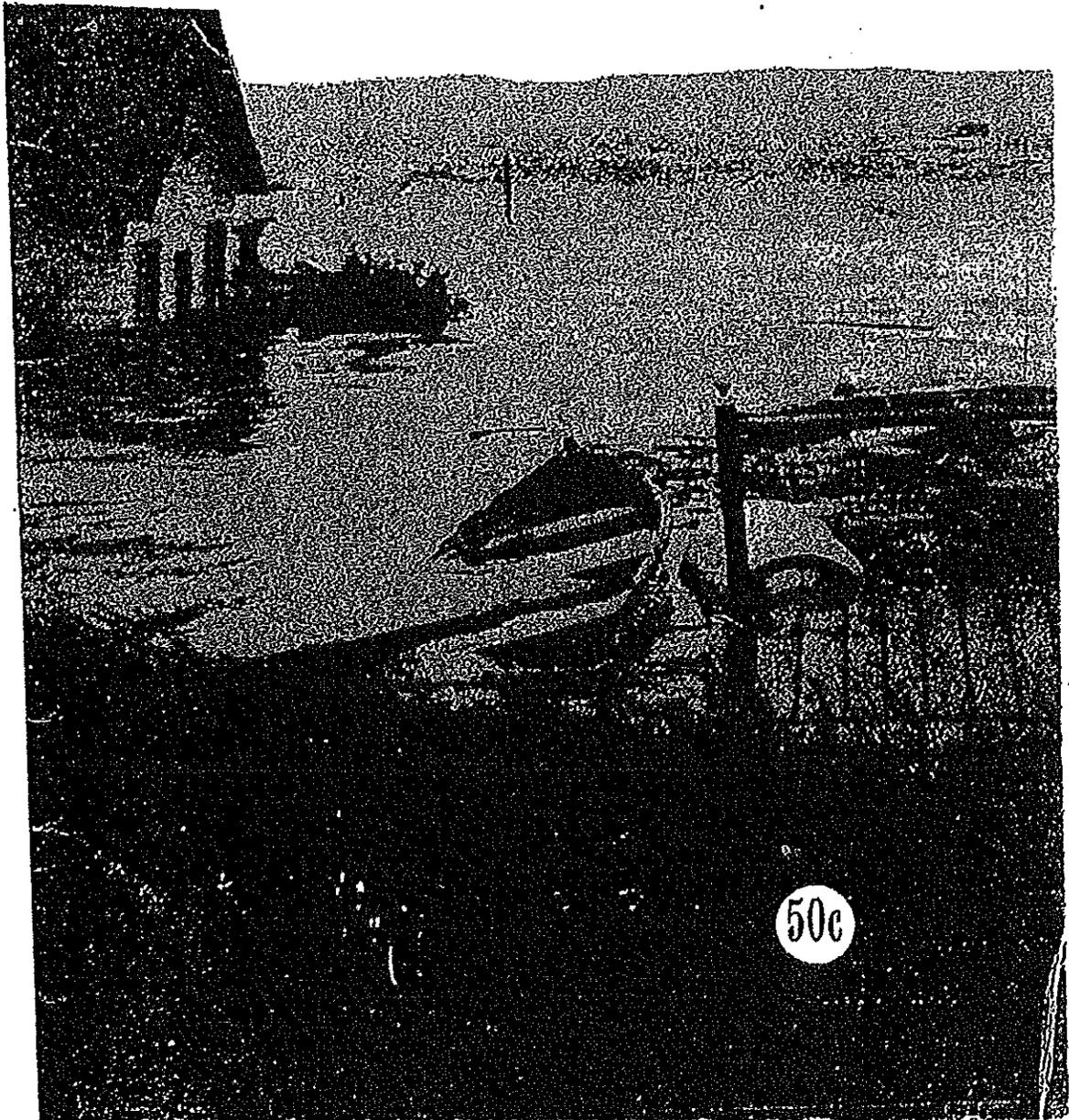


Cumberland Farms Site  
Looking North on Hope Street from Berretto's Service Station  
December 4, 1990 Storm

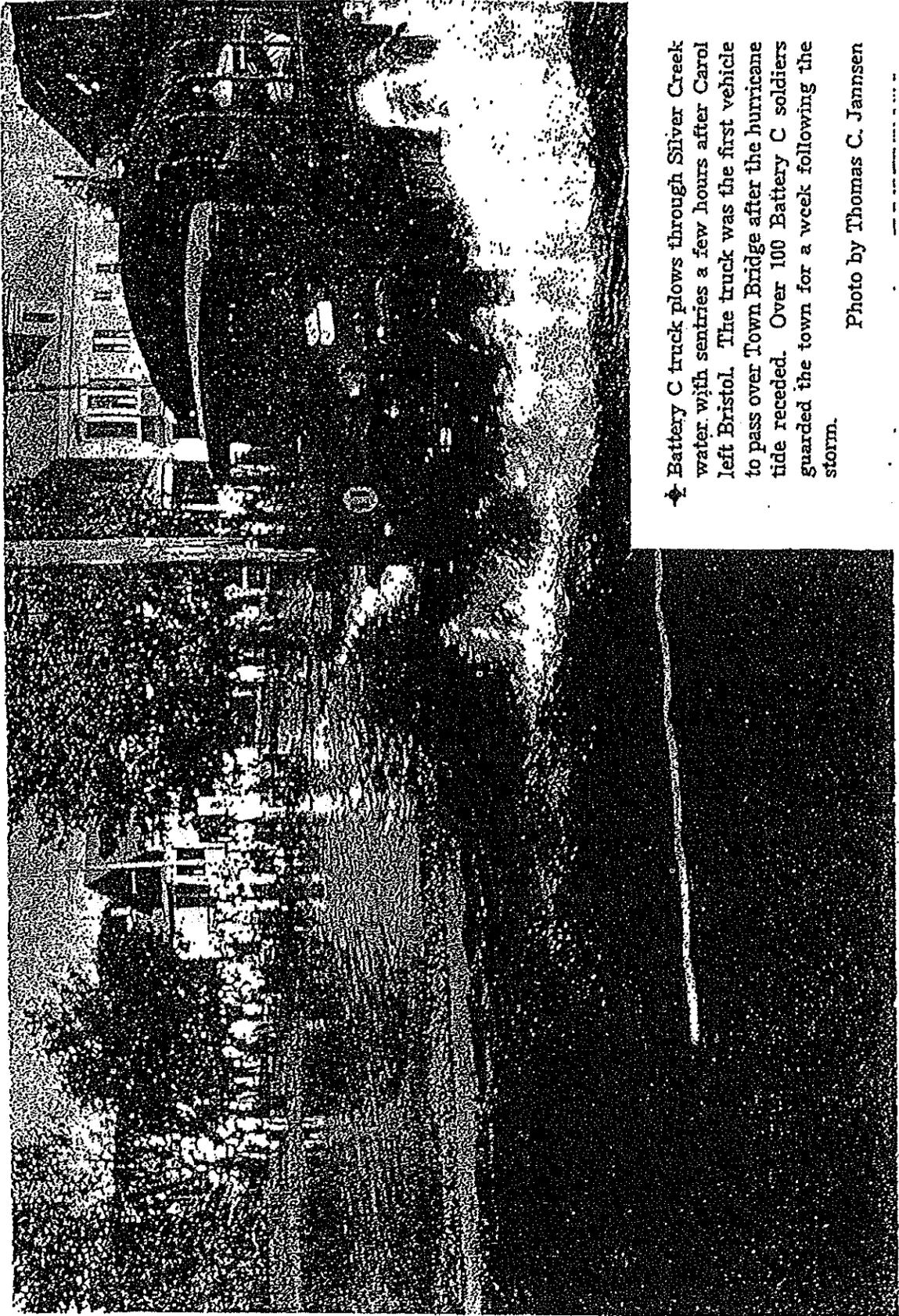
# *Hurricane Carol*

In Bristol, R. I.

*August 31, 1954*

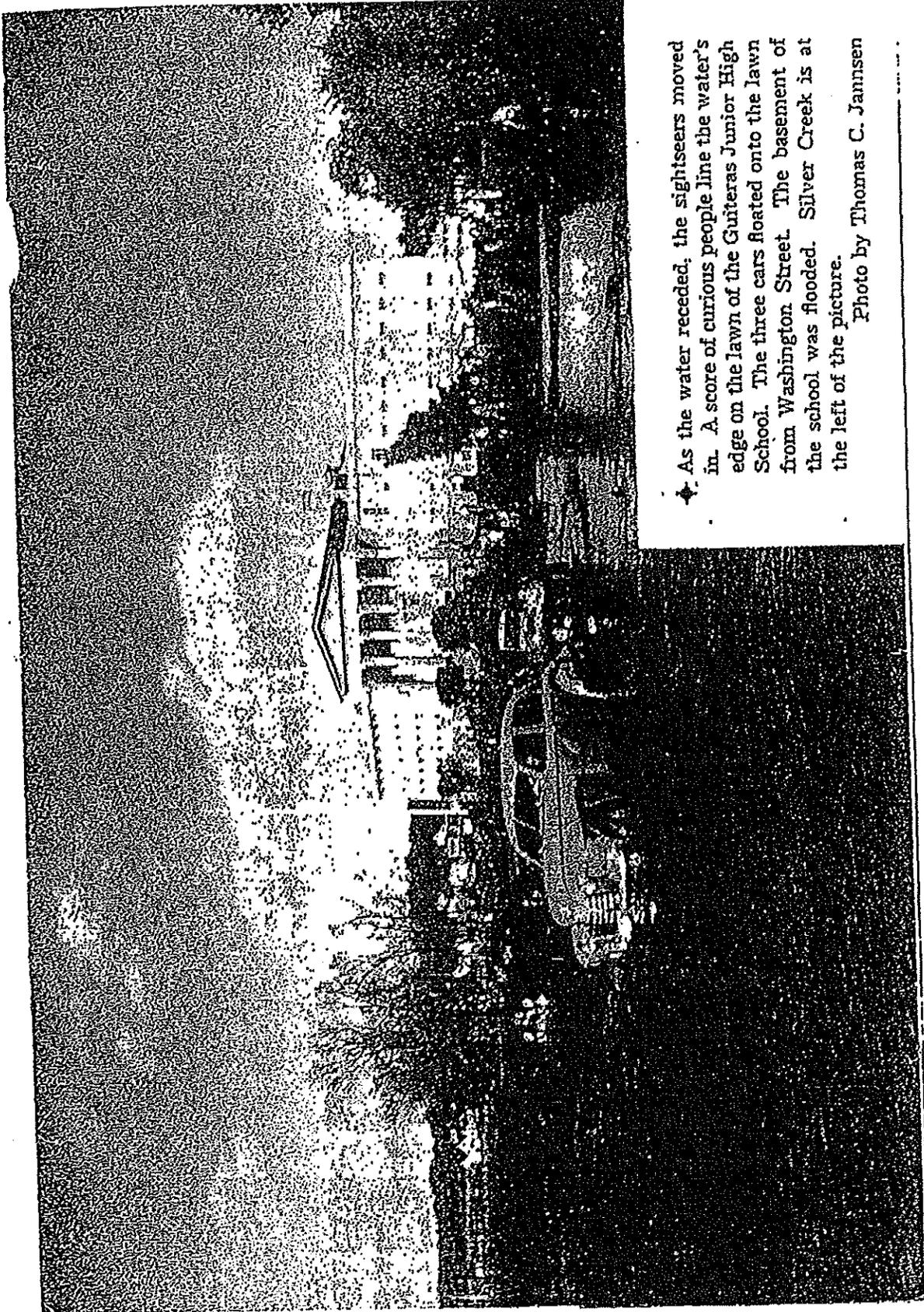


This pictorial account  
of Hurricane Carol  
in Bristol, R. I.  
was compiled, edited  
and printed by the staff  
of the



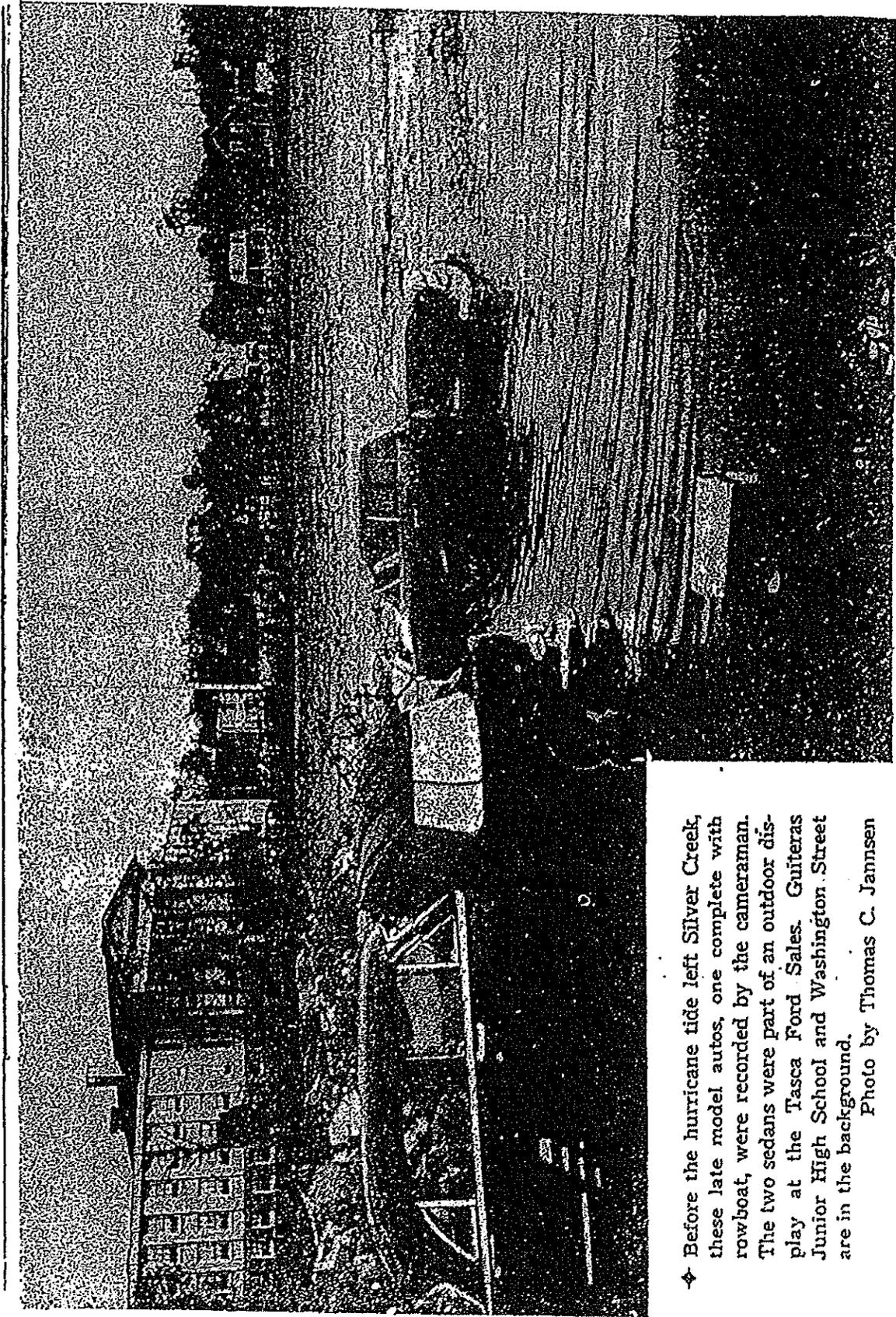
◆ Battery C truck plows through Silver Creek water, with sentries a few hours after Carol left Bristol. The truck was the first vehicle to pass over Town Bridge after the hurricane tide receded. Over 100 Battery C soldiers guarded the town for a week following the storm.

Photo by Thomas C. Jannsen



◆ As the water receded, the sightseers moved in. A score of curious people line the water's edge on the lawn of the Guiteras Junior High School. The three cars floated onto the lawn from Washington Street. The basement of the school was flooded. Silver Creek is at the left of the picture.

Photo by Thomas C. Jannsen



◆ Before the hurricane tide left Silver Creek, these late model autos, one complete with rowboat, were recorded by the cameraman. The two sedans were part of an outdoor display at the Tasca Ford Sales. Guiteras Junior High School and Washington Street are in the background.

Photo by Thomas C. Jannsen