Rhode Island

2014 Hazard Mitigation Plan

Update

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Adopted by the Governor, State of Rhode Island
April 4, 2014

Approved by Region I, Federal Emergency Management Agency
March 28, 2014

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Adoption and Assurances

44 Code of Federal Regulations (CFR) Requirement

Adoption by the State

Requirement §201.4(c)(6): The plan must be formally adopted by the State prior to submittal to [FEMA] for final review and approval.

Requirement §201.4(c)(7): The plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d).

The Rhode Island State Hazard Mitigation Plan was approved by FEMA and adopted by the State in April 2005, April 2008, and in April 2011. This 2014 plan update was developed during the time period of February 2013 and November 2013 in accordance with federal regulations and adopted on April 4, 2014 by Governor Lincoln D. Chafee.

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State of Rhode Island and Providence Plantations
State House, Room 224
Providence, Rhode Island 02903
401-222-2080

Lincoln D. Chafee
Governor

April 4, 2014

Paul Ford, Acting Regional Administrator
FEMA Region 1
99 High Street, 6th Floor
Boston, MA 02110

Re: Rhode Island State Hazard Mitigation Plan Adoption

Dear Mr. Ford:

Please find enclosed, for your review and formal approval, the Rhode Island Hazard Mitigation Plan 2014 Update. Through this letter, as Governor, I hereby adopt this plan on behalf of the State of Rhode Island. The Update is consistent with the mission of our state hazard mitigation program and has been prepared pursuant to the Disaster Mitigation Act (DMA) of 2000.

This Update was led by the Rhode Island Emergency Management Agency and representatives from the State Interagency Hazard Mitigation Committee. The coordinated effort represents a commitment by numerous state agencies, public and private stakeholders and local governments involved in pre-disaster mitigation, emergency response efforts, and post-disaster recovery following a major natural disaster. The plan is a comprehensive document describing the assessed risks associated with natural disasters in Rhode Island and the existing mitigation measures our state has taken, and is planning to undertake, in the future to minimize the damage and disruption caused by these natural disasters. The adoption of the plan authorizes the State to implement the strategies outlined in this Update.

The Update is in full compliance with the planning requirements of the DMA 2000 and the Final Rule, Title 44 of the Code of Federal Regulations (CFR), parts 201 and 206, thus keeping the State of Rhode Island qualified to receive funding under all FEMA disaster assistance and hazard

Paul Ford, Acting Regional Administrator
April 4, 2014
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mitigation programs. Please accept our assurances that the State of Rhode Island will comply with all applicable Federal statutes and regulations in effect with respect to the periods in which it receives grant funding, in compliance with 44 CFR 13.11(c). Furthermore, the State of Rhode Island will amend its plan whenever necessary to reflect changes in State and Federal laws and statutes as required in 44 CFR 13.11(d).

In closing, the implementation of the Rhode Island Hazard Mitigation Plan 2014 Update will further complement our State's existing mitigation programs and encourage resiliency to natural hazards and climate change.

Sincerely,

Lincoln D. Chafee
Governor

enclosure

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

Lincoln D. Chafee, Governor
State of Rhode Island
State House, Room 224
82 Smith Street
Providence, RI 02903

Dear Governor Chafee:

Thank you for the opportunity to review the Rhode Island 2014 Hazard Mitigation Plan Update. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I has evaluated the plan for compliance with 44 C.F.R. Pt. 201. The plan satisfactorily meets all of the mandatory requirements set forth by the regulations.

FEMA approval and the State of Rhode Island's adoption of the Standard State Mitigation Plan confirms the continued availability within your State of non-emergency Stafford Act funding (Pre-Disaster Mitigation planning and project grants, Hazard Mitigation Grant Program planning and project grants, Fire Management Assistance, and Public Assistance categories C-G).

It is important to recognize that all requests for future funding through these programs will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities or projects are not automatically approved for FEMA funding under any of the programs listed above.

The Rhode Island 2014 Hazard Mitigation Plan Update must be reviewed, revised as appropriate, and resubmitted to FEMA for approval **within three years of the plan approval date of March 28, 2014**. We encourage the State to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Lincoln D. Chafee
Page 2

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting this superior strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Marilyn Hilliard at (617) 956-7536.

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF:mh

cc: Jamia McDonald, Executive Director, RIEMA
Jessica Stimson, Rhode Island State Hazard Mitigation Officer
Michelle Burnett, Rhode Island NFIP Coordinator

Enclosure

Executive Summary

Plan Purpose

The purpose of the Rhode Island SHMP (hereinafter referred to as "Plan") is to provide comprehensive guidance for hazard mitigation in the State of Rhode Island. Rhode Island has experienced its share of natural disasters in recent years with four (4) federal disaster declarations, in as many years, starting in 2010. This Plan serves the people of Rhode Island by providing the impetus for making homes, businesses and communities more resilient to the impacts of hurricanes, floods, tornadoes, earthquakes, winter storms, wildfires and other natural hazards. In response to these multiple events, hazard mitigation actions are designed and implemented to reduce or eliminate long-term risk from hazards and their effects. The Plan also provides the people of the State with information regarding the overall capabilities of the State and local governments to reduce or eliminate threats and vulnerabilities.

Hazard Mitigation Planning in Rhode Island

Rhode Island completed its initial Plan in April 2005, followed by updates in 2008 and 2011. This Plan update was guided by the RIEMA and representatives from the State Interagency Hazard Mitigation Committee (SIHMC). Future iterations of this Plan will seek to attract additional stakeholders in order to increase participation in hazard mitigation efforts statewide.

Plan Format

The State Hazard Mitigation Plan is divided up into seven (7) Sections followed by Appendices	
Section 1	Introduces the reader to the plan.
Section 2	Provides the reader with an overview of the planning process, including stakeholders who participated in the process and key planning steps.
Section 3	Presents the reader with the hazard identification and risk assessment that includes hazard descriptions, an assessment of the geographic extent of hazards, and hazard specific loss estimates for State facilities.
Section 4	Provides the reader with a capability assessment of the State, including resources and assistance that can be used for mitigation activities.
Section 5	Offers the reader information on local mitigation plans, and local programs to implement mitigation projects.
Section 6	Highlights the hazard mitigation goals, objectives and recommended actions and initiatives for State government that will reduce injury and damage from natural hazards for the reader.
Section 7	Outlines the implementation of the Plan and processes for updating the Plan for the reader.

Scope of the Plan

The Plan addresses all natural hazards which pose significant risks to Rhode Island. Each hazard has been assessed using the same methodology, and information including the historical significance, vulnerability, exposure and potential losses, as available, for all hazards identified in the Plan. The following types of hazards are analyzed and discussed in the Plan:

Wind Related Hazards	Winter Related Hazards	Flood Related Hazards	Geologic Related Hazards	Additional Hazards
Storm Surge	Snow	Riverine Flooding	Earthquakes	Wildfire
Hurricanes	Ice	Flash Flooding		Drought
Tornadoes	Extreme Cold	Urban Flooding		Extreme Heat
High Winds		Coastal Flooding		
		Climate Change and Sea Level Rise		
		Coastal Erosion		
		Dam Breach		

Additional information about these hazards, the potential impacts to the State and critical facilities can be found in Section 3. Hazards identified in specific communities, including local municipalities and Counties can be found in Section 5.

The Mitigation Strategy for the State is driven by the following vision statement and goals developed by the SIHMC.

Vision Statement	Rhode Island is resilient to natural hazards and climate change.
Goal 1	Rhode Island has the capacity to promote and implement projects, programs, plans, policies, and legislative actions to reduce vulnerability to natural hazards, in particular for properties with repetitive and severe repetitive losses due to flooding.
Goal 2	Statewide coordination with organizations, agencies, and stakeholders.
Goal 3	Local communities address natural hazards and long-term risk reduction in local decision making and planning.
Goal 4	The public understands, supports, and acknowledges the need for hazard mitigation.
Goal 5	The built environment and infrastructure are resilient to the impacts of natural hazards.

Mitigation Actions

Review Appendix 6: *Mitigation Strategy* for a matrix of mitigation actions and activities that will be implemented by the State of Rhode Island and it's communities to increase resiliency against all hazards. The implementation timelines for these activities are divided into short, medium and long-term time periods. These different time period provide an implementation timeline for the State to prioritize projects, activities and funding for mitigation.

Section 1: **Introduction**

The purpose of the Rhode Island SHMP (hereinafter referred to as "Plan") is to provide comprehensive guidance for hazard mitigation in the State of Rhode Island. This Plan has been developed to help serve the people of Rhode Island by providing the impetus for making our homes, businesses, and communities as safe as possible against the impacts of hurricanes, floods, tornadoes, earthquakes, winter storms, wildfires and other natural hazards. It contains a wealth of geographic and demographic information, along with a thorough assessment of the natural hazards faced throughout the state. It also addresses the overall capability of State and local governments to reduce or eliminate the vulnerability of our communities to these natural hazards.

This Plan identifies an overall hazard mitigation vision, goals, objectives and recommended actions and initiatives for state government that will reduce injury and damage from natural hazards. Most importantly, the Plan outlines a coordinated "Mitigation Strategy" adopted by the Rhode Island SIHMC, which includes long-term goals, short-term objectives and the assignment of specific, measurable tasks or actions. Therefore, this Plan is designed to be (1) informative, (2) strategic and (3) functional in nature. Through routine monitoring and updating, this Plan will remain the guide for the SIHMC to follow in accomplishing its vision of a safe and sustainable future for Rhode Island.

Mitigation actions help safeguard personal and public safety. Retrofitting bridges, for example, can help keep them from being washed out, which means they will be available to fire trucks and ambulances in the event of a storm. Installing hurricane clips and fasteners can reduce personal and real property losses for individuals and reduce the need for public assistance in the event of a hurricane. Increasing coastal setbacks reduce the risk of deaths and property losses from tsunamis and storm surge. Increased setbacks also reduce the risk of property losses from coastal erosion.

Another important benefit of hazard mitigation is that money spent today on preventative measures can significantly reduce the impact of disasters in the future, including the cost of emergency response and post-disaster cleanup.

Funding for this Plan was provided to RIEMA through a Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP) sub-grant (FEMA-DR-1894). The areas of focus for the updated 2014 Plan include:

- Update the existing Plan to the standards contained within Section 322 of Disaster Mitigation Act of 2000 (DMA 2000) for a standard state mitigation plan;
- Expand and modify the previous HIRA section of the Plan, including the addition of analysis using state owned and critical facility data and updated vulnerability methodology;

- Expand the Capabilities Assessment to include state agencies and additional stakeholders involved with hazard mitigation and the addition of numerous new initiatives;
- Expand the discussion on potential impacts due to climate change with regards to natural hazard mitigation in applicable hazard risk assessment sections;
- Inclusion of updated information within all chapters of the Plan and Plan reformatting;
- Reassessment of the goals, objectives, and activities presented in the 2011 Plan; and
- Increase State agency and other stakeholder participation.

1.1 Federal Authorities

In October 2000, the United State Congress recognized that the Nation as a whole was ill-prepared to handle the risks and damages associated with natural hazards by adopting DMA 2000 (Public Law (PL) 106-390). The law amended the existing 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), defining language for 44 CFR Section 201.4. DMA 2000 reinforced the importance of mitigation planning, emphasizing planning before disasters occur. It set an initial standard for a SHMP. The standard was further defined by FEMA on February 26, 2002. FEMA published an Interim Rule that modified §201 and §206 in the Federal Register; the Final Rule was published in October 2009. The Guidance and Standard Plan Crosswalk were revised on November 4, 2006 and further updated to include requirements for 90-10 Federal funding for the Severe Repetitive Loss (SRL) and Flood Mitigation Assistance (FMA) grant programs in January 2009.

Mitigation planning is specifically addressed at the State and local levels under the Stafford Act, Section 322 (42 USC 5165). Adherence to the requirements and criteria set forth in Section 322 of the Act qualifies Rhode Island to utilize disaster-related assistance, including Categories C through G of the PA Program, an essential component of disaster recovery. In addition, the State will remain eligible for Hazard Mitigation Assistance (HMA) program funds: HMGP, FMA and Pre-disaster Mitigation Program (PDM) grants. The state also participates in the Community Assistance Program – State Support Services Element (CAP-SSSE) program and the Cooperating Technical partners (CTP).

Since 2005, Rhode Island has been eligible to receive non-emergency Stafford Act assistance and Federal mitigation pre-disaster assistance by maintaining an approved Standard SHMP compliant with 44 CFR §201.4 and related FEMA mitigation planning guidance. The 2014 Rhode Island SHMP Update is a standard plan meeting the requirements for a Standard State Plan detailed in Interim Rule 44 CRF 201.4, published by FEMA February 28, 2004 and revised November 2, 2006.

Appendix 1: *Introduction* includes descriptions of the Federal regulations that have an impact on mitigation and mitigation planning in the United States.

1.2 Mitigation Planning in Rhode Island

Rhode Island completed its initial standard SHMP document, meeting the requirements of 44 CFR § 201.4, in April 2005, followed by an updated plan in the spring of 2008 and 2011. The first plan focused on the creation of plans for localities and was developed under the authority of RIEMA. The Executive Director of RIEMA is authorized to adopt the SHMP.

The 2014 Rhode Island SHMP represents the fourth update of this Plan. The preparation of the update was overseen by RIEMA and features a revised vulnerability analysis, comprehensive compilation of mitigation actions and status into one centralized document, and mitigation tracking methodology. The plan also includes a robust Repetitive Loss (RL) and SRL property analysis and strategy which will result in a reduced cost share for grants awarded under the FMA programs for mitigation of FEMA-listed SRL properties.

1.2.1 Organization of the 2014 Plan Update

Each section of the 2014 Plan begins with a brief introduction followed by relevant information, tables, and maps, which fulfill regulation requirements. The main sections of the plan follow primary requirements of the hazard mitigation planning law and are as follows:

Acknowledgements identifies parties that were involved in developing and updating the plan.

Adoption and Assurances identifies the formal adoption of the plan.

Executive Summary provides a high level overview of the plan.

Section 1: Introduction describes the background and authorities governing the update of the plan.

Section 2. Planning Process describes the update of the plan, activities and work of the RIEMA, SIHMC, stakeholders invited to participate in the process, the primary consultant, Hagerty Consulting, and sub-contractor, Dewberry. The plan participants, planning process, planning products and relevance to other related plans or state functions is described.

Section 3. Hazard Identification and Risk Assessment has three primary components. A description of Rhode Island is provided that includes: Identification, Risk Assessment and Vulnerability Analysis with the impacts of climate change discussed where appropriate. Natural hazards affecting the state are identified, including:

1. Descriptions and histories of hazards;
2. Assessment of geographic extent and risk of hazards; and
3. Hazard specific loss estimation for state facilities, where appropriate.

During the early formation of the 2014 plan update process it was decided to focus only on natural hazards. These were condensed into fewer categories, based on SIHMC feedback, to enable use of best available data. A new vulnerability assessment was initiated in February 2013 with the objective of gathering and incorporating, where usable, data from local and regional plan HIRAs. The current municipal plans were analyzed and hazard rankings were captured. These were used in the state plan hazard ranking formula. Hazard information from the local plans was archived using a newly developed tracking spreadsheet. This tracker will be maintained by RIEMA as local plans are updated to facilitate the 2017 Rhode Island SHMP plan revision.

The new plan HIRA and associated vulnerability analysis now provides a more comprehensive look at natural hazards challenging Rhode Island's people, property, critical facilities, and natural resources. Where data allowed, hazards were ranked comparatively on a county basis using algorithm-based evaluation methods using parameters such as population, population projections, building permit, hazard occurrence, probability, and local hazard mitigation plan scores. Where data was insufficient to provide a formula-based analysis a detailed hazard description is provided, the hazard is characterized geographically to the extent practicable. Data gaps are listed as mitigation actions to continue to develop analytical data sets for the hazards which require a more analytical analysis.

Section 4. State Capability Assessment combines the previous Capability Assessment and ongoing Mitigation Programs into one section. This section significantly expands on the capabilities and initiatives for State, Federal, non-state and local programs have in terms of mitigation planning. There is also emphasis on programs available for technical assistance and funding of mitigation actions.

Section 5. Local Mitigation Plan Incorporation describes a comprehensive process to engage all Rhode Island communities in hazard mitigation planning. It summarizes the status of plans in Rhode Island, projects that have been implemented or funded by FEMA grant programs, and the process by which the State of Rhode Island provides financial and technical assistance for local planning, as well as its review and approval process. A summary of vulnerability identified from rolling up the local plans is provided in this section and Appendix 5: *Local Plan Integration* in the form of the Local Mitigation Tracker Tool. Details on vulnerability data derived from the local plans is discussed in Section 6.

Section 6. Plan Update presents the mitigation goals, objectives, strategies and associated actions identified to reduce the risk from hazards across the state. The section presents the program actions with complete rankings for importance to reduce exposure to hazards, along with an analysis of their feasibility using the Social, Technical, Administrative, Political, Legal, Economic and Environmental (STAPLEE) criteria. The table of identified actions further includes project leads, cost estimates and other information. A complete listing of evaluated 2011 actions is also presented. The

evaluation includes the status of the 2011 actions with explanations on progress. Many actions that were determined to be ongoing capabilities or standard operating activities were moved to Section 7. Emphasis was placed on diversifying the actions to meet changing vulnerabilities and on expanding the entities involved in “owning” actions to a more diverse range of state agencies and others. A plan to address Repetitive and SRL properties is included in Section 6 HIRA with related strategies included in this section.

Section 7. Plan Maintenance outlines implementation of the plan and development of the anticipated 2017 plan revision. Processes used to maintain and update data and information contained in the hazard identification and vulnerability assessment are described, as are implementation progress review and reporting techniques. This section has been expanded to detail progress reviews and to provide a detailed schedule for monitoring maintenance, implementation and revision.

Appendices may be found immediately following the plan. These provide detailed listings and agendas from each plan update meeting that was held, new MS Excel tracking tools, results from the surveys and other outreach, and other relevant documents supporting the plan or its production.

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Section 2: **Planning Process**

44 CFR Requirement
Planning Process **Requirement §201.4(b):** An effective planning process is essential in developing and maintaining a good plan.

Federal regulations require that planning process participants represent a cross-section of relevant State and Federal agencies as well as organizations. The Rhode Island 2014 Plan Update meets this requirement through the engagement of the SIHMC. A diverse group of stakeholders invited initially provided a representative cross-section of State and Federal agencies as well as other organizations detailed below. The SIHMC remained active throughout the planning process by providing data and expertise and making decisions. RIEMA staff contributed expertise in natural resources, weather forecasting, data and Geographical Information Systems (GIS) development, hydrology, emergency services, transportation, health, public safety, and higher education. Appendix 2: *Planning Process* includes the SIHMC members, participation and roles throughout the 2014 Plan Update.

The Rhode Island SHMP was approved by FEMA and adopted by the State in April 2005, 2008, and 2011. This 2014 plan update was developed during the period of February and November 2013 in accordance with federal regulations. For the 2014 update, each chapter was reviewed and reinvigorated to highlight progress since the 2011 plan adoption. Many portions of the plan were reorganized and combined. All of the sections were re-formatted, new data integrated into the risk assessment, and the overall plan was re-organized to better meet the needs of the state. Mitigation measures, actions taken as well as other weather related information included in local hazard mitigation plans have been incorporated in multiple sections of this update.

The importance of mitigation planning is the process itself. It involves the collaboration of groups, individuals, perceptions, perspectives and priorities. By including these planning process results in meaningful mitigation strategies that effectively reduce the impact of hazards. This section details the process for the 2014 Update. The process spanned nearly a year prior to plan adoption. It included meetings between representatives of various Federal, State, and local agencies, and organizations. The update process also involved the review of existing programs, plans, policies, statutes, and historical hazard data. The planning team reviewed this information in the early stages of plan development and remained supportive throughout the planning process in order to better inform decisions on potential mitigation actions.

To facilitate statewide collaboration, the update process engaged the SIHMC, which was established in 2003 for the initial plan creation. The SIHMC includes representatives from a wide array of State agencies, departments, and offices, whose participation is an important part

of the planning process. Contributions from each of these agencies, departments, and offices not only ensures that a wide variety of perspectives and interests are represented in the plan, but also allows for mitigation actions to be developed, adopted, and enacted by agencies with a wide variety of skill sets and resources. This ensures that the many resources available throughout Rhode Island are fully used. Documentation of each meeting can be found in Appendix 2: *Planning Process*.

Many of the planning activities were completed concurrently throughout the spring and summer of 2013. Datasets from RIGIS, RIEMA, SIHMC and national open sources were gathered and databases to support GIS mapping were developed. Continued development of an inventory of state and critical facilities, analysis of the recorded history of damage impacts due to natural hazards and synthesis of GIS layers for hazards led to the prediction of probability for incurred damages to facilities from identified natural hazards.

Funding assistance for the preparation and printing of this plan was provided by FEMA through a HMA grant and was prepared in accordance with appropriate regulations and guidance provided by FEMA. It was completed with planning assistance and support by the hazard mitigation and floodplain management program staff at the RIEMA, and Hagerty Consulting with Dewberry as sub-consultants. Additional technical assistance throughout plan development and plan review was provided by FEMA Region I staff.

2.1 2014 Plan Update

From 2011 through 2013 the committee did not meet on a regular basis. Significant changes were made to the 2011 SHMP. Each section of the plan outlines the changes that were made. The 2014 plan section organization has been maintained to some degree with an overhaul of all of the sections. The following sections were considered a priority and have been drastically changed: HIRA, Capabilities Assessment, Local Plan Integration, Mitigation Strategy and Implementation. SIHMC members participated in several in-person and virtual meetings throughout the plan update process, most actively during February 2013 through December 2013.

A major addition to the 2013 update process was the development of the Threat and Hazard Identification and Risk Assessment (THIRA). In March 2011, the Administration released Presidential Policy Directive 8 (PPD-8). The Directive established the framework for the National Preparedness Goal, which was then outlined in more detail by the DHS in September 2011. PPD-8 “describes the Nation’s approach to preparing for threats and hazards that pose the greatest risk to the security of the United States.”[1] While the addition of the THIRA does not directly impact the development of the mitigation plan, it did create the need for additional meetings and hazard assessments in order to comply with PPD-8. The THIRA was developed in compliance with applicable Federal guidance (Comprehensive Preparedness Guide – 201 (CPG-201)).

[1] Department of Homeland Security. *National Preparedness Goal: First Edition.* September 2011.

2.1.1 Coordination Among Agencies

44 CFR Requirement
Coordination Among Agencies **Requirement §201.4(b):** The [State] mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and…

The involvement of a large array of stakeholders during the planning process was considered a vital element to the success of the plan. Stakeholders provided critical input to each step in the plan update process. They shared inventories of past events, facilities, database layers identifying risk to structures from various hazards, and participated in the revision of the 2011 mitigation goals and complete revision of the 2014 Mitigation Strategy.

State, federal, and non-profit agencies participated actively in the 2014 plan update process highlighting coordination amongst stakeholders. Representatives from each of these agencies reviewed the 2011 plan and contributed reflective changes in programs and policies since 2011.

Public involvement in the planning process was also very important to the update. Inclusion of representatives from local government, businesses and nonprofit organizations, and the public is an important part of the process. Their input provides realistic perspectives of how they are impacted by various hazards, as well as how the actions developed by Rhode Island impact them.

As part of the 2014 plan update, representatives attended two (2) in-person meetings, numerous conference calls and WebEx meetings, provided facilities data, submitted hazard mitigation actions, ranked activities, supported and hosted outreach activities, and reviewed the plan draft. In addition, support of the SIHMC will determine continued data and information required for the THIRA concurrent to this effort. Specific information regarding these meetings can be found in Appendix 2: *Planning Process*.

The primary group responsible for oversight of the plan is RIEMA and the SIHMC. RIEMA oversees the SIHMC, which was established to identify current hazard mitigation needs, to review project applications and set priorities, and to update previous recommendations. During the 2014 plan update, representatives from RIEMA and FEMA Region I met following the plan kick-off meeting and multiple conference calls to discuss the proposed approach to completing the plan update. RIEMA and sub-consultant Hagerty and Dewberry were primarily responsible for providing input and data, plan writing, assessment, review, and planning coordination

The SIHMC provided guidance and assisted with development and subsequent updates of the SHMP, including review of previous hazard mitigation planning initiatives and development of the Mitigation Strategy and Action Plan. The advantage of this group is that it provides a cross-disciplinary forum in which to discuss the myriad of statewide hazard mitigation issues. The

SIHMC also provides expertise and perspective to the planning process, including State and local emergency management initiatives throughout Rhode Island, natural hazards, land-use planning, building codes, transportation, State owned/operated facilities, critical facilities, utilities, State agency capability assessment analyses and public/private infrastructure.

Throughout the planning process the SIHMC were asked if additional stakeholders should be added to the committee. The SIHMC are the key technical advisors on mitigation program matters. From 2011 through 2013 the committee did not meet on a regular basis. One of the mitigation actions in this plan update includes expanding the SIHMC membership and establishing a standing committee which continually maintains and implements the Rhode Island SHMP.

It should be noted that the 2014 plan update includes significant participation from State Agencies, Federal Partners, Private Utilities, and non-governmental organizations. This effort to engage a broad spectrum of stakeholders will be key in the continued implementation of this plan. Appendix 2: *Planning Process* includes a complete listing of the participants in the 2014 plan update. RIEMA has discussed strategies to engage additional partners in the SIHMC.

The information in this section has been reviewed and revised by the SIHMC as well as subject-matter experts and the general public. The SIHMC has approved the information presented in this section and feel it represents the planning process completed for the 2014 update. SIHMC, subject-matter experts, and citizens who provided additional data and information are listed in Appendix 2: *Planning Process* along with their role in the plan update.

2.1.2 Plan Update Meeting Schedule

44 CFR Requirement
Documentation of the Planning Process **Requirement §201.4(c)(1):** [The State plan must include a] description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.

The 2014 SHMP update included two (2) in-person meetings and five (5) WebEx virtual interactive meeting during February 2013 and October 2013. The meeting topics included:

1. Project Kick-off meeting: February 7, 2013
2. WebEx#1 on Climate Change: February 26, 2013
3. WebEx#2 on Wind & Water, Facilities and Vulnerable Populations: March 26, 2013
4. WebEx#3 Geologic Hazards, Drought, Capabilities Assessment, and Public Outreach: May 1, 2013
5. HIRA Results and Mitigation Strategy meeting: June 21, 2013

6. WebEx#4 Mitigation Strategy review and Prioritization Methods: July 12, 2013
7. WebEx#5 Draft Plan Review: October 14, 2013

Stakeholders participated in all of these meetings, with 18 people involved in the kick-off meeting, and 19 attending the HIRA results and Mitigation Strategy meeting during this nine (9) month planning process. The virtual WebEx meetings provided a forum for discussion on hazard identification and assessment methods for a variety of hazards, and the refinement and development of the plan goals and strategies. Please refer to Appendix 2: *Planning Process* for documentation (Agenda, Minutes, and Presentations) on all of the meetings. The following subsection is a synopsis of the planning process meetings:

2.1.2.1 Project Kick-off Meeting

The SIHMC was reconvened on February 7, 2013 for the update kick-off meeting. Prior to this meeting a formal invitation went out to all stakeholders via email and hardcopy mailing which explained the need to reconvene the group and begin to re-engage them in the review process for the anticipated update. Committee members were provided a copy of the 2011 plan update.

On February 7, 2013, the first plan update meeting with the SIHMC was hosted by the RIEMA and conducted at the Radisson Hotel in Warwick. At the kick-off meeting, the requirements of Section 322 of the 2000 Stafford Act were presented along with the project schedule, schedule of meetings, proposed HIRA methodologies and a review of the 2011 plan goals and objectives. Data collection needs were presented and participants were provided with worksheets designed to collect information on available data, capabilities, new initiatives and potential projects and actions. Previously identified hazards were discussed in consideration of disaster activity since the last plan and all natural hazards were reprioritized and grouped into categories.

The meeting established ground rules for the plan update process, identified key players and points of contacts, identified priorities, and defined desired outcomes.

2.1.2.2 WebEx Working Sessions

Seven (7) virtual meetings were held during the February 2013 to October 2013 time period. The main concept of the interactive virtual meetings was to provide an open forum to discuss

reports and data that should be reviewed for inclusion in the 2014 SHMP. The virtual location allowed for council members to be actively engaged in the update without having to invest in travel and time away from work for in-person meetings.

Discussions during these meetings enabled true interagency cooperation and interaction. Many studies and results were discussed and used in the HIRA and Capabilities Assessment. During WebEx#4 the council members were presented with several options for mitigation strategy prioritization and, as a group, decided on the online survey to reach a wider audience (Section 6).

Appendix 2: *Planning Process* has a complete catalog of meeting minutes and presentations from these sessions. While each meeting varied, the general format that was followed included:

1. SHMP update progress to date
2. New reports or data available (specific to the hazard of interest for that meeting)
3. Vulnerability analysis options

2.1.2.3 HIRA Review and Mitigation Strategy Workshop Meeting

A full day working session was conducted on June 21, 2013 with the SIHMC. The first half of the session focused on the final results of the public survey, capability assessment, and results of the HIRA. A significant amount of discussion centered on the ranking of hazards and the methodology used for the ranking. Many stakeholders were concerned that limitations on National Climatologic Data Center (NCDC) data used in the ranking skewed the results. Time was spent analyzing the algorithm used for the ranking and changes were made to adjust the results. A full discussion of the ranking is included in Section 3.

Several SIHMC subject matter experts provided critical input into the HIRA, particularly related to drought, flooding, SLR, coastal erosion, and climate change that was integrated into this update.

In the afternoon, a brainstorming session was held to finalize and adjust actions developed during the prior meeting and in the month in between. Review of the disposition of actions identified in the 2011 plan was conducted, and new actions further developed in light of the HIRA and Capability Assessment results. Following these presentations, the goals, objectives and actions were reviewed and were redrafted to better characterize Rhode Island. A vision statement was developed, new to the 2014 plan. Additional information on the changes to the Mitigation Strategy is located in Section 6.

2.1.2.4 Capabilities Assessment

Section 4 of the plan was completely overhauled to better represent Rhode Island hazard mitigation capabilities. Individual agency profiles were developed using information in the 2011 SHMP and research. The completed profiles were shared with SIHMC members and agency

contacts for review and modification. Updates to Agency Profiles were completed by the agency representative and characterized their agency's role in mitigation planning.

The May 1, 2013 WebEx presented preliminary findings of the capabilities assessment. The Capabilities Assessment Matrix was reviewed during this WebEx and the SIHMC provided feedback on additional capabilities that should be included. The matrix was also distributed to the committee in an email on May 6, 2013, with comments/edits to the matrix to be received by May 14, 2013. Based on the comments that were received, agency specific profiles were prepared and then sent out to individual committee members within that agency for review. These individual emails were sent out on May 24th and a follow-up email was sent on June 24th. Agencies were given until July 3, 2014 to provide comments on their specific profiles. Comments were incorporated into each agency's profile and completed to the best of their ability; however, gaps can be found in some profiles due to unavailable information. Those agencies that were unable to provide a complete profile will have the opportunity to revise and update their profiles during the 3rd quarter meetings of the SIHMC.

2.1.2.5 Draft Plan Review

The plan was reviewed by the SIHMC via a WebEx and then distributed to the SIHMC and public for review on October 15, 2013. As part of distribution, the plan was also posted to the RIEMA website for public comment. A link to the plan was also sent to stakeholders and the SIHMC on December 2nd, 2013. On December 13th and 17th a subgroup of the SIHMC met to discuss the disposition of all comments received prior to submittal to FEMA Region I for review. These working sessions were conducted to review changes to the 2013 updated hazard mitigation plan, receive comments from the SIHMC.

Comments on the draft plan were received from the following individuals and entities and incorporated into the plan:

- Janet Freedman – Rhode Island Coastal Resources Management Council (CRMC)
- Pam Rubinoff – RI Sea Grant and Coastal Resources Center (CRC)
- Chelsea Siefert – RI Department of Administration (DOA) Division of Planning
- Thomas Kogut – RI Division of Public Utilities and Carriers (DPUC)
- David Vallee - NWS
- Laura Sullivan – RI DOA Office of Housing and Community Development
- Jessica Stimson – RIEMA
- Robert Sturdal – RIEMA
- Alysia Mihalakos – RI DOA
- Nick Larmore – RI DOA
- Mike Cullen – NewportReady.org

- Henry Walker – EPA Office of Research & Development Atlantic Ecology Division
- Dave Aucoin – Narragansett Bay Commission

2.2 Public Outreach

Public participation for the update of the Plan was primarily enabled through participation in an internet-based survey and posting of the Draft 2014 SHMP Update to RIEMA's webpage. Emails were also sent out to multiple stakeholder distribution lists on September 24th, October 7th and 10th, December 4th and 11th.

2.2.1 Public Hazard Mitigation Plan Survey

The online survey consisted of 15 questions and was available from June 6th through July 2nd, 2013. The SIHMC distributed hyperlinks to the survey via emails to their agencies, and community representatives in June and again as the survey closure date neared in July. Links to the 2011 SHMP were also included for additional reference. A total of 70 people participated in the survey; complete results, by respondent, are available in Appendix 2: *Planning Process*.

The survey recorded the type of organization the respondent was presenting. Local government (35.4%) and state government (23.1%), and private business represented the majority of organizations participating in the survey. A small number of responses was collected from non-profit organizations, public community members, and Community Based Organizations (COBs). Seven people (10.8%) noted that they were from "other" organizations including nursing facility, neighboring State EMA, health care provider, community health center, Federal government, and Federally Qualified health center. None of the respondents indicated they were affiliated with an educational institution, utility, or professional associations.

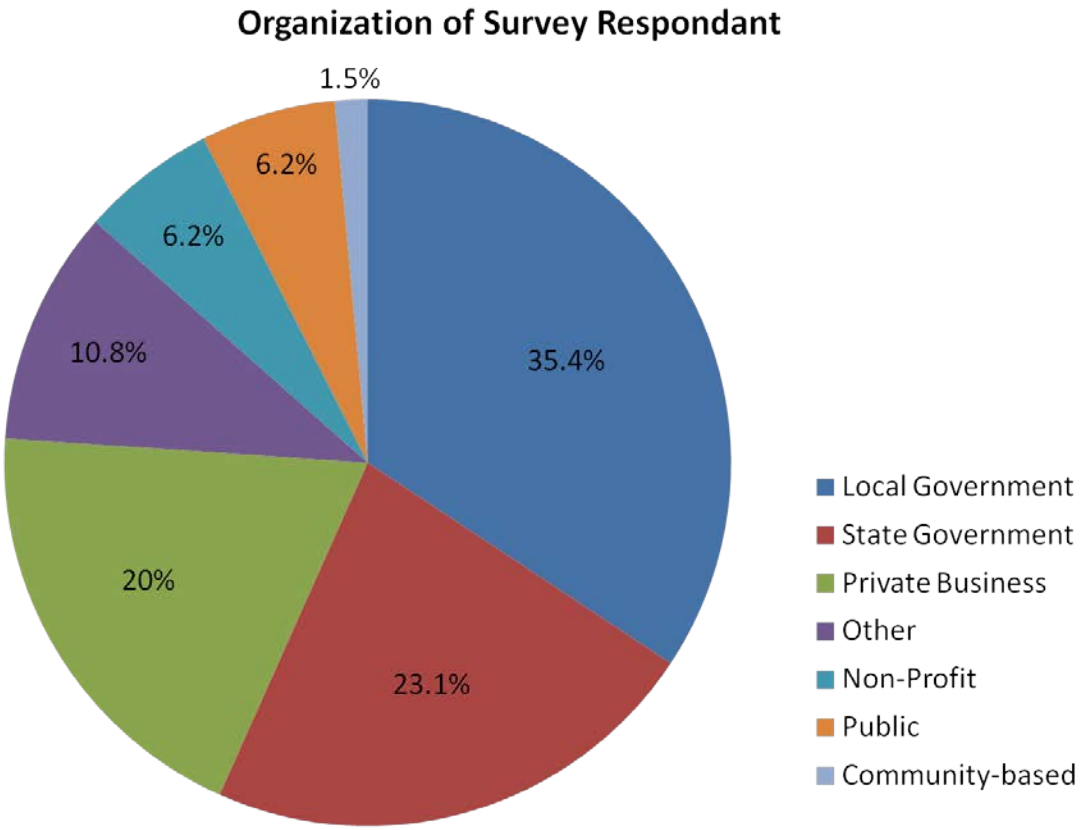


Figure 1: Public Survey Responses by Organization Type

With regard to plan awareness, the majority (69.7%) of responders were familiar with the RI SHMP approved in April 2011 and 30.3% were not familiar with the SHMP. For local hazard mitigation plans, the responses were split almost evenly of those who were aware that their community had a plan. The overwhelming majority of respondents were interested in receiving correspondence from RIEMA on the SHMP update and local information; these respondents were included in the email distribution of the 2014 SHMP update.

Respondents were asked to rate 22 hazards on a scale of one (1) (low threat) to three (3) (high threat) indicating the level of threat each presents to the responder's home or the functions of his or her organization. Responses for natural hazard are included in Table 1. The hazards that ranked as a **High Threat** for the majority of the responses include hurricanes, blizzards, Nor'easters, heavy snow, and ice storms.

Responses reflect the spatial characteristic of each hazard as well as their frequencies and intensities. For example, the threat reported for flooding was evenly split between low, medium, and high. This is presumably because only some of the housing stock and people are located in areas of flood risk. However, the threats were primarily reported as medium to high for

hurricanes and winter storms, which can impact large areas more frequently. The low threats reported for earthquakes, wildfires, landslides, sinkholes/subsidence, and tsunamis are influenced by low frequencies and/or low geographic effects.

Responses for other hazards included: human pandemic outbreaks, hazardous materials transport, acts of terror, transportation accidents, chemical spill, cyber threats, mass casualty/mass fatality incidents, chemical/biological/nuclear terrorist attack.

Table 1. Public survey natural hazard perceived threat.

Hazard	Low Threat	Medium Threat	High Threat
Riverine Flooding	27.9 % (17)	36.1% (22)	26.2% (16)
Coastal Flooding	21.3% (13)	27.9% (17)	27.9% (17)
Flash Flooding	28.8 % (17)	**47.5% (28)**	18.6% (11)
Storm Surge	26.7% (16)	26.7% (16)	28.3% (17)
Coastal Erosion and Shoreline Change	38.3% (23)	20% (12)	15% (9)
Climate Change and SLR	30.5% (18)	33.9% (20)	18.6% (11)
Urban/Stormwater Flooding	31.7% (19)	**45% (27)**	16.7% (10)
Dam Breach	45% (27)	35% (21)	8.3% (5)
Hurricanes	6.7% (4)	31.7% (19)	**60% (36)**
Tornadoes	**56.7% (34)**	21.7% (13)	15% (9)
Thunderstorms/Wind Storms	21.7% (13)	**45% (27)**	31.7% (19)
Hail	**55.9% (33)**	33.9% (20)	8.5% (5)
Lightning	43.3% (26)	33.3% (20)	21.7% (13)
Heavy Snow	8.3% (5)	**46.7% (28)**	**43.3% (26)**
Ice Storms	16.7% (10)	38.3% (23)	**43.3% (26)**
Blizzards	10% (6)	38.3% (23)	**50% (30)**
Extreme Cold	20% (12)	**58.3% (35)**	20% (12)
Nor'easters	6.8% (4)	44.1% (26)	**47.5% (28)**
Drought	**61.7% (37)**	25% (15)	6.7% (4)
Earthquake	**66.7% (38)**	14% (8)	15.8% (9)
Wildfire (including conflagration)	**68.3% (41)**	13.3% (8)	8.3% (5)
Extreme Heat	37.9% (22)	37.9% (22)	22.4% (13)

Recent weather events result in a keen awareness of natural hazards. Participants were asked what recent events, if any, improved their awareness of natural hazards. The majority of responses included Superstorm Sandy (October 2012), Severe Snowstorm (February 2013), Hurricane/Tropical Storm Irene (August 2011), Flooding (March 2010), Snowstorms (January 2011), and the Virginia Earthquake (August 2011). Other events include Hurricane Bob, rain events, and the Motiva Port thunderstorm (July 2007).

Primary concerns regarding natural hazards focused on:

- Loss of power and utilities
- Damage to property
- Accommodating access and functional needs

- Inability to return to work
- Providing sheltering
- Lack of food and water following an incident
- Conducting debris removal
- Other: hazard mitigation planning, long-term recovery (housing, public facilities/infrastructure, economic recovery needs), medication and supply deliveries following an incident, safety of retirement, assisted living, and nursing home residents, vegetative debris clearing and eradication, monitoring insurer solvency and consumer protection during natural hazards, competition for limited resources (generators, debris reduction, forestry services, etc.), damage to public infrastructure, water quality and contamination issues.

2.2.1.1 Survey Summary

Several important messages were provided by the survey responders. Hazards identified through this survey are in line with the hazards addressed in the SHMP update and local plans. Respondents noted a need to address wind and snow damage to electrical lines that results in power outages, and manage flood risk. Participants highlighted a need for continued communication, workshops on post-storm response and preparedness, technical and financial assistance.

Appendix 2: *Planning Process* includes the survey results for each of the participants. General comments and recommendations were also provided and include:

- Unify the state plan with the local community plans including sharing mapping and databases.
- Abbreviate/shorten the SHMP. It is too large.
- The Blackstone River is not called out in the plan as being a potential hazard. It impacts the state's bike path, bridges that go over the river, historic areas, etc.
- Cut back on any more rules and regulations from Department of Emergency Management (DEM) and allow us to clean waste and debris from streams and waterways.
- Additional organizations to include:
    - Jonah Center
    - Chestnut Terrace Nursing and Rehab Center
    - RI Public Works Association
    - RI Health Center Association
    - Briarcliffe Manor
    - Cranston Fire Department
    - East Providence Area Chamber of Commerce
    - Rhode Island Consulting Engineers
    - Construction Industries of Rhode Island

2.2.2 Public Draft Plan Review

Beginning on December 2nd, 2013, hyperlinks to the draft plan were provided on RIEMA's webpage, inviting public comment on the draft. SIHMC members and the general public reviewed and commented on the draft plan during the period of October 7th through December 13th, 2013.

2.3 Local Hazard Mitigation Plan Integration

To ensure complimentary planning efforts, and in compliance with the Interim Final Rule, this update of the SHMP includes the integration of data from the local hazard mitigation plans for the communities in Rhode Island to the extent possible. RIEMA provided all local plans (approved, under review, and expired) and several supplemental local comprehensive plans for inclusion in the plan update.

Specifically, the following components of the local hazard mitigation plans were surveyed:

- Hazard identification terminology
- Vulnerability and Risk assessment methodologies
- Types of mitigation actions
- Mitigation actions completed since the 2011 Plan Update

This information was collected, catalogued and incorporated throughout this SHMP. Section 5 includes a complete summary of the local plan review. Where data limitations exist or inconsistencies in methodologies were observed, those were noted. For example, as noted in Section 3, attempts to utilize the local hazard mitigation plan vulnerability and loss estimates were limited for this Plan Update due to variability in the level of detail and results of the vulnerability assessments in the local HMPs. The 2014 Mitigation Strategy identifies actions to increase local plan incorporation and consistency in future plan updates. The tabular data collected during this survey can be found in Appendix 5: *Local Plan Integration*.

A Local Plan upload tool was developed for the assessment of the plans. This tool is intended to provide RIEMA staff with a means of continuing to track local plans as they are updated and mitigation actions are completed. The populated tool is located in Appendix 5: *Local Plan Integration*.

Section 3: Hazard Identification and Risk Assessment

The purpose of this section is to provide a statewide overview of how various natural hazards impact the State of Rhode Island. In this section natural hazards will be ranked in order of priority based on the frequency of occurrence and area of impact affected.

A natural hazard is defined as “an event or physical condition that has 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.” A natural hazard can also be exacerbated by societal behavior and practice, such as building in a floodplain, along a sea cliff or an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

In order to fulfill the planning guidelines outlined in DMA 2000, this SHMP focuses only on the risk assessment, analysis and recommendations for natural hazards mitigation, and does not consider man-made hazards (i.e., structural fires, hazardous materials or terrorism). Sections of this SHMP, such as critical infrastructure maps, may be utilized to develop other long-term mitigation strategies for man-made hazards.

Rhode Island has experienced its share of natural disasters. Hurricanes and related coastal flooding, winter storms and riverine flooding affect Rhode Island on a recurring basis. Rhode Island's vulnerability to hurricanes is rated as high.21 communities in the State have exposed coastal areas that are vulnerable to a hurricane storm surge, particularly the associated wave actions and wind hazards. Much of the coastline on the Atlantic Ocean consists of barrier beaches that are open to the full force of destructive hurricane waves. Other damages associated with hurricanes include inland flooding, coastal erosion and tornadoes. The most serious inland flood threats occur when the eye of the hurricane passes just to the west of Rhode Island at a time of high tide. This type of flooding poses an additional health risk as it involves the overflow of storm-sewer systems and is usually caused by inadequate drainage following heavy rain, rapid snow melt or an extreme storm surge up Narragansett Bay.

Identifying the risk and vulnerability for a community is the primary factor in determining how to allocate finite resources to determine what mitigation actions are feasible and appropriate. The hazard analysis involves identifying all of the hazards that potentially threaten Rhode Island, and then analyzing them individually to determine the degree of threat that is posed by each natural hazard. Addressing risk and vulnerability through hazard mitigation measures will reduce societal, economic and environmental exposure to natural hazards impacts.

For multi-hazard identification, all hazards that may potentially impact the State should be identified, including both natural hazards and cascading emergencies - situations when one

hazard triggers others sequentially. For example, severe flooding that damaged buildings storing hazardous, water-reactive chemicals could result in critical contamination problems that would dramatically escalate the type and magnitude of events. Dam failures may occur as a result of an earthquake creating a dangerous flash flooding scenario for communities located in dam inundation areas.

3.1 2014 Plan Update

The HIRA consolidates, updates, and streamlines content from the 2011 plan update. In 2011 the chapter content was restructured to address a broad range of emerging hazards, vulnerabilities, and risk issues. Significant changes to the HIRA include:

- Availability of facilities data for spatial analysis;
- Use of a new, GIS-based ranking methodology that assesses hazard risk by jurisdiction;
- New analysis for all major hazards;
- Development of annualized loss by jurisdiction; and
- Review and inclusion of local risk assessments, land use planning, and development.

The 2014 update includes a revised hazard ranking methodology that incorporates local hazard mitigation plan rankings, land use and geographic areas of impact. Each hazard section includes revised ranking maps that factor in local plan ranking and updated historical events. Hazard event maps were condensed into multi-panel maps for comparison. In addition, hazard profiles were freshened, and new analyses were performed using updated NCDC Storm Events data as well as other data sources to capture hazard events that have occurred since 2011.

The information in this section has been reviewed and revised by the SIHMC as well as subject-matter experts. The SIHMC has approved the information presented in this section and feel it represents the risk and vulnerability in Rhode Island. SIMHC members and subject-matter experts who provided additional data and information are listed in Appendix 2: *Planning Process* along with their role in the plan update.

3.2 Rhode Island Planning Area

According to the 2010 U.S. Census, the State of Rhode Island has a population of 1,052,567 people. U.S. Census population estimates as of July 2012 show a 0.2% drop in population, totaling 1,050,292 people. Table 2 shows the population estimates by county. Municipalities located within each county are also shown in this table. Table summarizes the April 2013 report by the Rhode Island Statewide Planning Program, Rhode Island Population Projections 2010-2040, projects that the state will see population decline between 2010 and 2015, growth through 2035, and subsequently population decline thereafter.[2] Table 3 and Figure 2, taken from the report indicated above, provides a summary of population projections from 2015 through 2040.

[2] http://www.planning.ri.gov/documents/tp/tp162.pdf

According to the 2010 U.S. Census, there are a total of 413,600 households in the State of Rhode Island and there are a total of 463,388 housing units, of which 49,788 (11%) are vacant. U.S. Census 2012 population estimates show a total of 462,564 housing units, a decrease of 824 housing units. The U.S. Census describes the following methodology that is used for estimating total housing units: "use building permits, estimate of non-permitted construction, mobile home shipments, and estimates of housing loss to estimate change in the housing stock".[3]

There are 39 cities and towns within Rhode Island, each with their own governing body (Table 2). Rhode Island municipalities are governed by a Town or City Council, with the chief executive officer being either an elected Mayor or an appointed Town Administrator or Manager.

[3] http://www.census.gov/popest/methodology/2012-hu-meth.pdf

Table 2. Population Estimates by County and Municipality. Source: U.S. Census.

County	Municipality	Total Population April 1, 2010	Total Population July 1, 2012
	Rhode Island	**1,052,567**	**1,050,292**
Bristol	**County Total**	**49,875**	**49,144**
	Barrington	16,310	
	Bristol	22,954	
	Warren	10,611	
Kent	**County Total**	**166,158**	**164,843**
	Coventry	35,014	
	East Greenwich	13,146	
	Warwick	82,672	
	West Greenwich	6,135	
	West Warwick	29,191	
Newport	**County Total**	**82,888**	**82,036**
	Jamestown	5,405	
	Little Compton	3,492	
	Middletown	16,150	
	Newport	24,672	
	Portsmouth	17,389	
	Tiverton	15,780	
Providence	**County Total**	**626,661**	**628,323**
	Burrillville	15,955	
	Central Falls	19,376	
	Cranston	80,387	
	Cumberland	33,506	
	East Providence	47,037	
	Foster	4,606	
	Glocester	9,746	
	Johnston	28,769	
	Lincoln	21,105	
	North Providence	32,078	
	North Smithfield	11,967	
	Pawtucket	71,148	
	Providence	178,036	
	Scituate	10,329	
	Smithfield	21,430	
	Woonsocket	41,186	
Washington	**County Total**	**126,979**	**125,946**
	Charlestown	7,827	
	Exeter	6,425	
	Hopkinton	8,188	
	Narragansett	15,868	

County	Municipality	Total Population April 1, 2010	Total Population July 1, 2012
	New Shoreham (Block Island)	1,051	
	North Kingstown	26,486	
	Richmond	7,708	
	South Kingstown	30,639	
	Westerly	22,787	

Table 3. Summary of Rhode Island Population Projections, 2015-2040. Source: RI Planning.

Rhode Island	Total 2010	Projection					
		2015	2020	2025	2030	2035	2040
Population	1,052,567	1,046,327	1,049,177	1,061,796	1,070,677	1,073,799	1,070,104
Births over previous five (5) years*	60,436	57,825	56,470	56,015	55,848	54,751	52,518
Deaths over previous five (5) years*	48,100	50,722	49,464	50,191	53,592	58,492	63,053
Net migration over previous five (5) years*	-24,088	-13,346	-4,156	6,795	6,904	6,864	6,840

3.2.1 Land Use and Development

In Rhode Island, land use and development decisions are made at the local level. Depending on the decision being made, applications for development are heard in public meetings before the Planning Board or Commission, Zoning Board and/or Town or City Council. In most municipalities, the members of the Planning Board or Commission and Zoning Board are appointed by the chief executive officer of the municipality, except in Charlestown, where the Planning Board is elected by residents. Prior experience and/or knowledge relative to planning and development is usually considered when appointments are made, but is not a requirement.

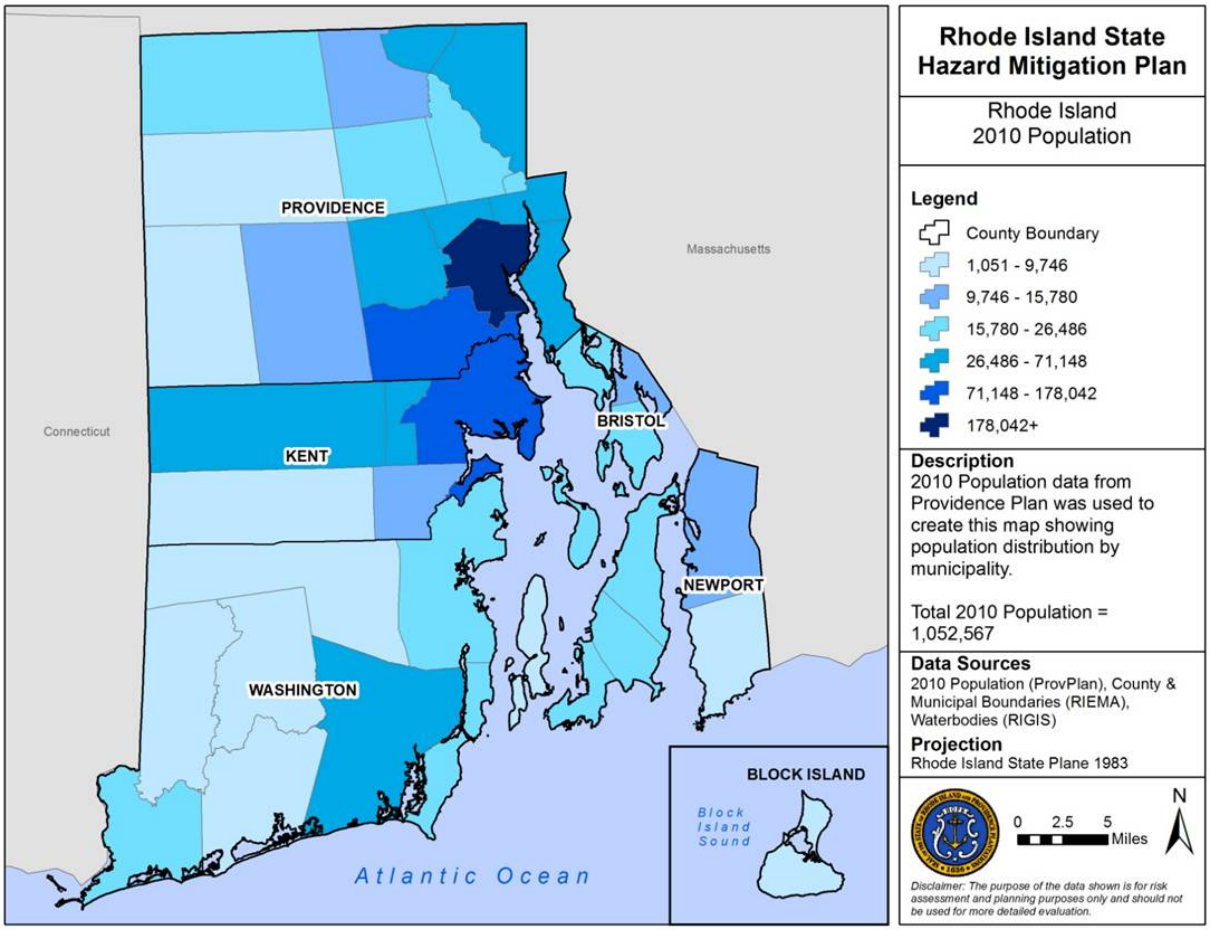


Figure 2. U.S. 2010 Census population distribution by census tract.

Depending on the scale and location of development, applications for development projects may also be reviewed by State Agencies prior to approval, including:

- Coastal Resources Management Council (applications within the coastal zone)
- Department of Environmental Management (all applications that may impact freshwater water wetlands, environmental habitats, applications requiring/modifying septic systems)
- Rhode Island Building Commission (RIBC) (in instances when a variance to the State Building Code is being sought)

Although development has continued throughout the last decade, the pace of development slowed dramatically during years 2007-2011. This most likely was caused by the economic downturn which not only affected Rhode Island, but affected the United States as a whole. Building permit counts are an industry accepted measure of growth. Appendix 3: *Hazard Identification & Risk Assessment* includes the 2011 and 2012 annual new privately-owned residential building permits throughout the state. The following towns show the highest number of building permits for the year 2011: Town of Westerly, Town of Cumberland, and Town of

South Kingstown. Total building permits in 2011 across the state is 588, with a total of 654 individual units. 2012 shows similar jurisdictions with the most building permits issued: Town of South Kingstown, Town of Cumberland, and City of Warwick. The towns of Westerly and North Kingstown follow. Total building permits in 2012 across the state is 639, with a total of 675 individual units. As data becomes available from the Division of Planning, future plan updates will be able to include an analysis changes with commercial and industrial development as well as key changes that could affect economic losses such as to major employers, transportation districts, and ports.

Land Use 2025: Rhode Island's Land Use Polices and Plan provides the vision for how Rhode Island will grow through the year 2025. Land Use 2025 describes a vision for Rhode Island as "a unique and special place, retaining its distinctive landscape, history, traditions, and natural beauty, while growing to meets its residents' needs for a thriving economy and vibrant place to live."[4] The main theme of Land Use 2025 is to target growth within areas already serviced by public services and facilities, indicated by an Urban Services Boundary, and in smaller, more rural growth centers, as shown in Figure 3. This plan will use seven percent of the state's land area with an emphasis on new housing at higher densities and greater use of public transit. The plan limits impacts on natural resources, especially in the Western portion of the state.

[4] Rhode Island Division of Planning. 2006. Land Use 2025: Rhode Island State Land Use Policies and Plan Executive Summary. M. Allard Cox (ed.), Rhode Island Sea Grant, Narragansett, R.I. 16 pp.

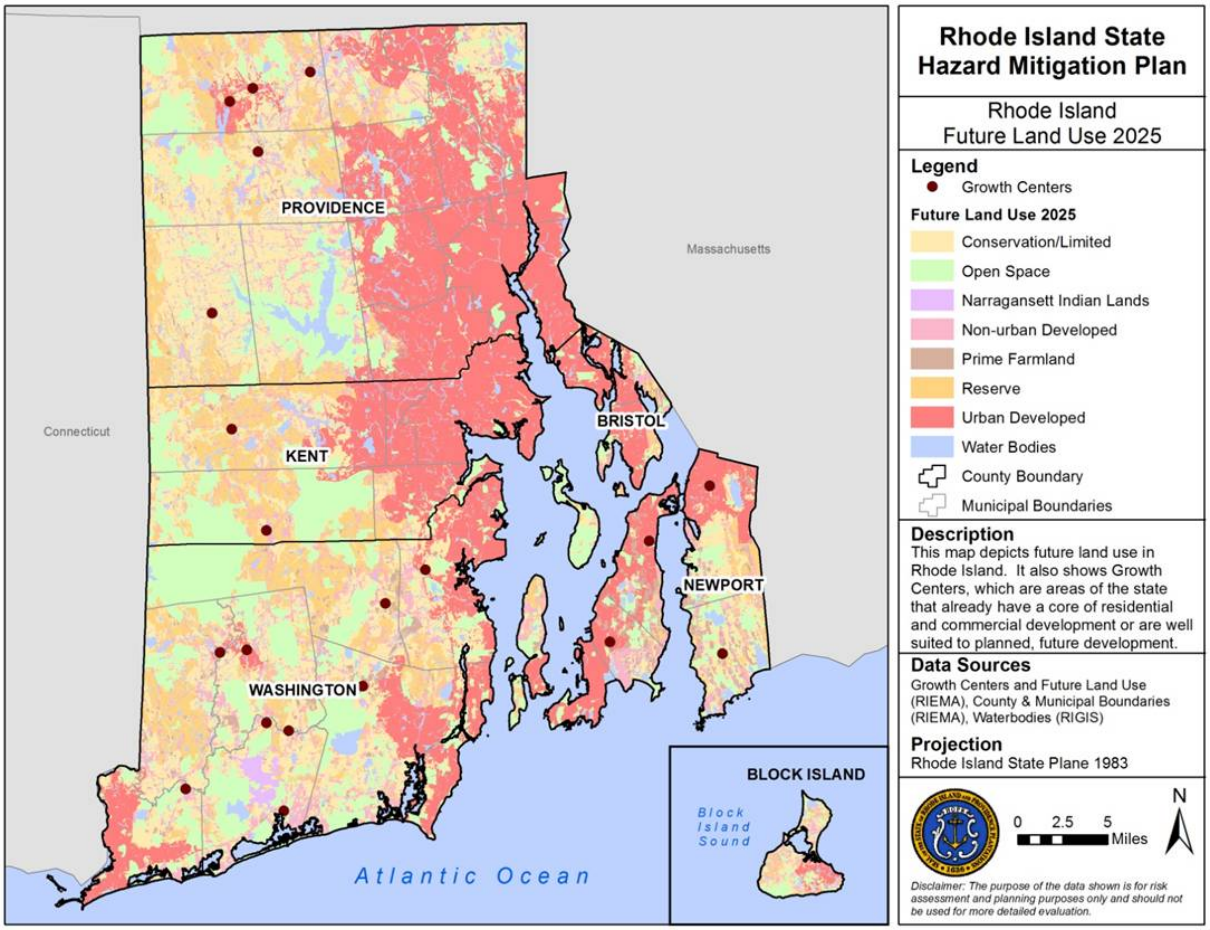


Figure 3. Future land use 2025.

3.3 Hazard Identification

In order to fulfill the planning guidelines outlined in the DMA 2000, this SHMP addresses only on natural hazards, and does not consider man-made hazards (i.e., structural fires, hazardous materials, chemical spills, and weapons of mass destruction).

At the kick-off meeting for the 2014 plan update, the decision was made by the SIHMC to merge several hazard categories together and focus on natural hazards. The THIRA focuses on human caused activities, scenarios, and target capabilities for Rhode Island.

For the purposes of the Rhode Island SHMP's risk assessment, natural hazards have been grouped into the following categories and are listed in order of frequency and impact, starting at the top of the list with the most frequently occurring natural hazards. Based on SIHMC approval and a thorough review of the Federally Declared Disasters, NCDC data, previous versions of this plan, and local plan rankings, the following hazards will be discussed and analyzed in this report:

Wind Related Hazards	Winter Related Hazards	Flood Related Hazards	Geologic Related Hazards	Additional Hazards
Storm Surge	Snow	Riverine Flooding	Earthquakes	Wildfire
Hurricanes	Ice	Flash Flooding		Drought
Tornadoes	Extreme Cold	Urban Flooding		Extreme Heat
High Winds		Coastal Flooding		
		Climate Change and SLR		
		Coastal Erosion		
		Dam Breach		

Wildfire and extreme heat were added to the vulnerability assessment for the 2014 plan update.

It should be noted that the above hazards are not a complete listing of hazards that may impact Rhode Island. The SIHMC agreed that this listing accurately represents those hazards that impact Rhode Island 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 the SHMP:

- Avalanche
- Expansive soils
- Hail
- Land Subsidence
- Landslides
- Volcanoes
- Tsunamis

These hazards were considered and discussed during several meetings of the SIHMC, 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.

3.3.1 Disaster History

Historically, hurricanes and winter weather related events have caused the most damage to the State and its citizens. Recent disasters have focused the attention of Rhode Island's citizens and government officials on the resultant human, economic, and environmental impacts. The State of Rhode Island has had 18 declared disasters since 1954. The most recent declaration occurred in March 2013 due to a Severe Winter Storm and Snowstorm. Table 4 shows how many federally declared disasters and emergencies have occurred from 1954 to September 2013.

These disasters had significant impacts as Rhode Island, and its residents were forced to bear the majority of the costs of clean up and restoration of services. Disasters impact the State through death and injury; loss of residences, property, and possessions; lost wages and business revenue; and the immeasurable psychological and sociological costs to disaster victims and their families. In considering the economic costs of disasters, it is important to recognize that small- to medium-sized businesses, which provide the majority of the jobs in an average community, are at high risk for failure after a disaster.

3.3.1.1 Federal Declared Disasters

Local and State governments share the responsibility for protecting their citizens and for helping them recover when a disaster strikes. In some cases, a disaster is beyond the capabilities of State and local government to respond. In 1988, the Stafford Act was enacted to support State and local governments and their citizens when disasters overwhelm them and exhaust their resources. This law, as amended, established a process for requesting and obtaining a Presidential Disaster Declaration, defines the type and scope of assistance available from the Federal Government, and sets the conditions for obtaining that assistance.[5]

An important source for identifying hazards that can affect the State is the record of Federal disaster declarations. According to FEMA, since 1954 there have been18 major disaster declarations for Rhode Island. Table 4 has been updated to include events since the 2011 plan and expanded to include the incident period of the declared event. Appendix 3 *Hazard Identification & Risk Assessment* includes the process by which Federal disasters and emergencies are declared.

A brief summary of selected declared disasters since the 2011 plan is highlighted below:

DR-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 PA 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.[6] National Grid estimated more than 180,000 customers lost power. By Saturday night, 129,000 customers in Rhode Island remained without power: “Nearly all of Bristol County and most of Newport County were in the dark, as were many homes in communities along the southern coast and surrounding Providence.”[7]

DR-4089 (Emergency Declaration 3355) Hurricane Sandy swept through the region in October 2012 leaving significant damage all along the coast. Beaches along Westerly, including

[5] *A Guide to the Disaster Declaration Process and Federal Disaster Assistance*. FEMA March 4, 2008.
[6] http://abcnews.go.com/US/blizzard-2013-fierce-storm-drops-feet-snow-northeast/story?id=18443349
[7] http://www.boston.com/news/weather/2013/02/09/digs-out-after-snow-storm-widespread-outages/bxLHC925PCC8kdZLGfUmuI/story.html

Misquamicut, were devastated and almost unrecognizable.[8] More than 122,000 people lost power.[9]

In a FEMA report released June 2013, it is estimated that more than $39.4 million in support from four federal disaster relief programs is helping RI recover from this disaster, a majority of which is from the National Flood Insurance Program (NFIP) ($31.1 million). In addition to NFIP claim payments, federal aid includes:

- "Public Assistance: more than $5.3 million in grants for state and local agencies and some private nonprofits;
- Individual Assistance (IA): more than $423,000 in grants paid directly to eligible individuals and families to meet basic needs for housing and cover other essential disaster-related expenses;
- US Small Business Administration (SBA): more than $2.6 million in low-interest disaster recovery loans to Rhode Island homeowners, renters and business owners of all sizes."

DR-4027 (Emergency Declaration 3334) Tropical Storm Irene hit Rhode Island on August 27, 2011 and was declared a Major Disaster on September 3, 2011. A preliminary damage assessment report from FEMA brings the total PA cost to $9,260,898.

Reports estimated that Irene knocked down trees and power lines, leaving up to half of Rhode Island residents without power.[10] Gusts of wind up to 71 MPH were reported, and storm surge in Narragansett Bay caused some coastal damage. However, the majority of damage was caused by wind.

Emergency Declaration 3311 in March 2010, the State of Rhode Island encountered the worst flooding in its recorded history on a number of the State's largest rivers, including, but not limited to the Pawtuxet, Pawcatuck and Woonsocket. The incredible amount of precipitation in February and March 2010, along with saturated soils, high water tables, lack of leaf cover and limited pervious surfaces all contributed to the disastrous flooding during March.

The hardest hit areas in the state included Warwick, West Warwick, Coventry and Cranston, which are located around the Pawtuxet River, and Westerly, which is located along the Main Stem Pawcatuck River. The United States Geological Survey (USGS) river gauge at Pawtuxet River at Cranston hit Record Flood Stage at 14.98 feet on March 15, 2010 and was then quickly superseded by another Record Flood Stage on March 31, 2010 of 20.79 feet. Prior to these two back to back Record Flood Stages, the highest recorded level of the Pawtuxet River at Cranston was 14.5 feet on June 7, 1982.

[8] http://www.masslive.com/news/index.ssf/2012/10/hurricane_sandy_leaves_beaches.html
[9] http://www.cbsnews.com/8301-201_162-57544801/a-state-by-state-look-at-superstorms-effects/
[10] http://usatoday30.usatoday.com/weather/storms/hurricanes/story/2011-08-28/Irene-pounds-Rhode-Island-155000-without-power/50162892/1

For the March 2010 events, PA grants totaled $17,043,832 and IA totaled $37,033,311. Following the disaster and in looking forward towards building sustainable communities, the Rhode Island Mitigation Planning Workshop, "Planning: Moving Toward Greater Resiliency" was held on June 18, 2010 at the Coastal Institute, Narragansett, Rhode Island. The hazard mitigation planning workshop was sponsored by RIEMA and supported by FEMA and the University of Rhode Island (URI) Coastal Institute. Approximately 70 community representatives came from 32 of Rhode Island's 39 communities. Nine (9) Federal agencies and two (2) State agencies also sent representatives to the event.

Table 4. Federally Declared Disasters and Emergencies in Rhode Island 1954 – 2013. Note: Total assistance values not inflated.

Disaster Number	Declaration Date	Description	Individual Assistance Total	Public Assistance Total
4107	3/22/2013	Severe Winter Storm and Snowstorm	N/A	$7,057,671
4089	11/3/2012	Hurricane Sandy	$421,341	$6,519,140
3355 (DR4089)	10/29/2012			
4027	09/03/2011	Tropical Storm Irene Hurricane Irene	N/A	$9,260,898
3334 (DR4027)	8/27/2011			
3311 (DR1894)	03/30/2010	Severe Storms and Flooding	N/A	N/A
1894	03/29/2010	Severe Storms and Flooding	$37,033,311	$17,043,832
1704	05/25/2007	Severe Storms and Island/Coastal Flooding	N/A	$605,080
3255	09/19/2005	Hurricane Katrina Evacuation	N/A	$1,110,010
3203	02/17/2005	Snow	N/A	$6,273,609
3182	03/27/2003	Snowstorm	N/A	$2,002,984
3123	11/19/1996	Major water main break	N/A	N/A
1091	01/24/1996	Blizzard	N/A	N/A
3102	03/16/1993	Blizzards, High Winds and Record Snowfall	N/A	N/A
3094	09/16/1992	Water Contamination	N/A	N/A
913	08/26/1991	Hurricane Bob	N/A	N/A
748	10/15/1985	Hurricane Gloria	N/A	N/A
548	02/16/1978	Snow, Ice	N/A	N/A
3058	02/07/1978	Blizzards and Snowstorms	N/A	N/A
39	08/20/1955	Hurricane, Flood	N/A	N/A
23	09/02/1954	Hurricanes	N/A	N/A

3.3.1.2 National Climatic Data Center (NCDC)

NCDC Storm Data is published by the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, and was used for this update. The storm events database contains information on storms and weather phenomena that have caused loss of life, injuries, significant property damage, and/or disruption to commerce. Efforts are made to collect the best available information, but because of time and resource constraints, information may be unverified by the National Weather Service (NWS). The NWS does not guarantee the accuracy or validity of the information. Although the historical records in the database often vary widely in their level of detail, the NWS does have a set of guidelines for use in the preparation of event descriptions that were followed in preparation of this hazard analysis.[11] Appendix 3 *Hazard Identification & Risk Assessment* includes NCDC details and processing information for the 2014 plan update.

Most of the events in NCDC are not associated with a Federal Emergency or Disaster. If the event did occur at the same time as an event that was later determined to be a Federal Emergency or Disaster, it is included with the NCDC data even if it occurred in a county not included with the Federal declaration. Appendix 3: *Hazard Identification and Risk Assessment, National Climatic Data Center Data Processing* includes the total number of NCDC events, by county. High wind events make up more than 38.3 percent of the events for the jurisdictions, followed by flooding (25.6 percent) and winter storm (12.1 percent).

Table 5 and Table 6 show the total damages and annualized damages for each jurisdiction and hazard type. Three-quarters of the past damages and estimated further losses is related to flooding. These estimates are believed to be an underrepresentation of the actual losses experienced due to both hazards as losses from events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database. This is especially true with hurricanes. When available, these values have been supplemented in each of the hazard specific sections with information available from SIHMC members and state agencies.

[11] National Weather Service Instruction 10-1605. Operations and Services Performance: Storm Data Preparation Guide. August 17, 2007. Available at: http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf

Table 5. NCDC total damages (2012 dollars)

County Name	Flood	Hurricane	Wind	Hail	Lightning	Tornado	Winter Storm	Total
Years of Record	**1993-2012**	**1993 - 2012**	**1956- 2012**	**1956 - 2012**	**1956 - 2012**	**1950 - 2012**	**1993 - 2012**	
Bristol	$7,814,091	$10,207	$1,346,641	$0	$92,928	$47,987	$209,937	**$9,560,521**
Kent	$29,063,309	$66,345	$3,100,402	$0	$679,425	$439,160	$7,340,679	**$40,689,321**
Newport	$6,776,626	$20,414	$1,540,188	$0	$84,081	$0	$497,214	**$8,918,523**
Providence	$33,365,719	$95,518	$4,530,261	$21,327	$1,472,740	$6,747,369	$7,749,765	**$54,021,430**
Washington	$33,525,907	$15,310	$2,675,225	$0	$43,296	$50,000	$364,375	**$36,674,113**
Statewide	**$110,545,653**	**$207,794**	**$13,192,717**	**$21,327**	**$2,372,470**	**$7,284,516**	**$16,161,970**	**$149,863,909**

Table 6. NCDC annualized total damages (2012 dollars)

County Name	Flood	Hurricane	Wind	Hail	Lightning	Tornado	Winter Storm	Total
Years of Record	**1993-2012**	**1993 - 2012**	**1956- 2012**	**1956 - 2012**	**1956 - 2012**	**1950 - 2012**	**1993 - 2012**	
Bristol	$390,705	$510	$22,824	$0	$1,575	$762	$10,497	**$426,873**
Kent	$1,453,165	$3,317	$52,549	$0	$11,516	$6,971	$367,034	**$1,894,552**
Newport	$338,831	$1,021	$26,105	$0	$1,425	$0	$24,861	**$392,243**
Providence	$1,668,286	$4,776	$76,784	$361	$24,962	$107,101	$387,488	**$2,269,758**
Washington	$1,676,295	$766	$45,343	$0	$734	$794	$18,219	**$1,742,150**
Statewide	**$5,527,283**	**$10,390**	**$223,605**	**$361**	**$40,211**	**$115,627**	**$808,098**	**$6,725,576**

3.4 Risk Assessment

The HIRA provides a factual basis for developing mitigation strategies and for prioritizing those jurisdictions that are most threatened and vulnerable to natural hazards. This section details the risk assessment process and the methods used to rank hazard risk. Results from this process and accompanying methods will be presented in hazard-specific sections that follow.

Based on review of the Federally Declared Disasters, NCDC data, previous versions of this plan, and local plan rankings, the hazards shown below are discussed and analyzed in the following hazard specific sections.

Wind Related Hazards	Winter Related Hazards	Flood Related Hazards	Geologic Related Hazards	Additional Hazards
Storm Surge	Snow	Riverine Flooding	Earthquakes	Wildfire
Hurricanes	Ice	Flash Flooding		Drought
Tornadoes	Extreme Cold	Urban Flooding		Extreme Heat
High Winds		Coastal Flooding		
		Climate Change and Sea Level Rise		
		Coastal Erosion		
		Dam Breach		

It should be noted that the above hazards are not a complete listing of hazards that may impact Rhode Island. The SIHMC agreed that this listing accurately represents those hazards that impact Rhode Island annually and has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

3.4.1 Ranking Methodology

In this section the methodology of scoring vulnerability for the profiled hazards will be explained as it relates to each hazard. The discussion of the methodology is critical to understanding how and why natural hazards are prioritized differently in Rhode Island. It is also critical to understand how the hazards' impacts have been scored because each hazard utilizes a different scoring system based upon the various scales of intensity, frequency and magnitude of the event.

Many of the hazards assessed in this plan did not have quantifiable probability or impact data, so a semi-quantitative ranking system was used instead to compare all of the hazards of interest. This system allows for greater flexibility and more room for expert judgment.

Based on input from the SIHMC, a standardized methodology was developed to compare different hazards' risk on a county basis. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. These include:

- Historical occurrence;
- Vulnerability of population in the hazard area;
- Historical impact, in terms of human lives and property; and
- How the Local plans ranked the hazards.

Eight (8) ranking parameters were used to come up with jurisdiction based hazard rankings for the hazards identified by the SIHMC. Each parameter was rated on a scale of one (1) through four (4) with those rated one (1) considered low risk and those rated at four (4) considered high risk. Population vulnerability, density and building permits were each weighted at 0.5 relative to all of the other parameters. Geographic extent and local plan ranking were each weighted at 1.5 relative to all the other parameters. These scores were summed at a county level for each hazard separately, allowing for easy comparison between counties for each hazard type. A summation of all the scores for all hazards in each county provides an overall, "all-hazards" risk prioritization. Below is an overview of the parameters that were used in ranking the hazards.

- Population Vulnerability and Population Density (weight 0.5)
- Building Permits Count (weight 0.5)
- Annualized Events (weight 1)
- Deaths & Injuries (weight 1)
- Annualized Property Damage (weight 1)
- Local Plan Hazard Rankings (weight 1)
- Geographic Extent of Hazard (weight 1.5)

3.4.1.1 Population Vulnerability and Density

Population vulnerability and density are important factors in risk assignment. A hazard event that occurs in a highly populated area generally has a much higher impact as compared to an event that takes place in a very rural, unpopulated area. Two (2) population parameters were used to account for counties with high populations and counties with densely populated areas. Each of these parameters was given a weight of 0.5 in an effort to avoid biasing the overall ranking with population data.

Population vulnerability was calculated as the percent of the total population of Rhode Island present in each county. The 2010 U.S. Census population for each county was divided by the total population for the state and multiplied by 100; a value between one and four was assigned based on a geometric interval. By ranking counties this way, those counties with significantly larger populations have effectively been given extra weight.

Population density was based on the population per square mile for each county. The 2010 U.S. Census population for each county was divided by the total area (sq. mi.) for the county; a value between one (1) and four (4) was assigned based on geometric intervals. By ranking jurisdictions this way, those counties with densely populated areas have effectively been given extra weight.

3.4.1.2 Building Permits/Land Use and Development

Building permit data for 2012 highlights areas with new privately-owned residential building permits throughout the state. This parameter was added based on feedback by the SIHMC members to address future vulnerability and risk.

3.4.1.3 Annualized Events and Probability of Future Events

While each hazard may not have a comprehensive database of past historical events, the record of historical occurrences is still an important factor in determining where hazards are likely to occur in the future. Annualizing the NCDC storm events data yields a rough estimate of the number of times a jurisdiction might experience a similar hazard event in any given year. To accomplish this, the total number of events in the NCDC database, for each specific hazard in each jurisdiction, was divided by the total years of record for that hazard to calculate an 'annualized events' value.

Table 7 shows the classifications used for establishing the probability of future events in Rhode Island. Events with a 500-year recurrence interval were given a classification of low for probability of future events and hazards with greater than 5 events in a year are classified as a high probability of occurrence. When applicable, NCDC event totals have been supplemented with additional sources. The hazard specific sections further detail the probability of future events for the counties and State as a whole.

Table 7. Annualized Events and qualitative ranking.

Return Interval	Probability of Future Event
<0.002 events/year	Low
0.002 – 1 event/year	Medium-Low
1 – 5 events/year	Medium-High
>5 events/year	High

3.4.1.4 Deaths and Injuries

Deaths and injuries are also important factors to evaluate when determining hazard ranking. Using NCDC past deaths and injuries were totaled for each hazard. Ranking was established by assigned a four (4) to jurisdictions with at least one (1) injury or death. Hazards having no reported deaths or injuries were assigned a ranking of one (1).

3.4.1.5 Property Damage

Property damage was also analyzed in order to give each jurisdiction a score of one (1) to four (4) based on natural breaks in the data. This data was obtained from the NCDC storm events database, inflated into 2012 dollars and annualized according to the period of record for each event category. The rating scales used for this parameter are provided in the ranking spreadsheet in Appendix 3 *Hazard Identification & Risk Assessment*. The NCDC database did not include crop damages and therefore not included in this analysis. Supplemental data, such as Hazards US Multi-Hazard (Hazus-MH), has been used when hazard specific data was available. See the individual hazard sections for additional details.

3.4.1.6 Local Mitigation Plan Ranking

Local plans were reviewed for ranking methodology, loss estimates and risk to facilities. Based on feedback from the kick-off meeting, Local Plan Ranking was given a 1.5 weighting relative to the other parameters, as local input was deemed to be critically important to the overall state ranking.

3.4.1.7 Geographic Extent

Some of the hazards have defined geography where there is a greater likelihood of the hazard occurring in the future. To be able to include this in the ranking system, each hazard has been assigned individual scores based on the available hazard data. Geographic extent was given a 1.5 weighting relative to the other parameters, as geographic extent was deemed to be critically important. Data sources for geographic extent are shown in Table 8. The rating scales used for this parameter are provided in the ranking spreadsheet in Appendix 3 *Hazard Identification & Risk Assessment*.

Table 8. Sources for Geographic Extent.

Hazard	Source
Wind Related Hazards	NOAA NCDC Storm Events (1950-2012) NWS Number of hurricanes to pass within 50 miles of RI(1851 – 2013) NOAA-NHC SLOSH Model ASCE Minimum Design Loads for Buildings and Other Structure
Winter Related Hazards	NWS Weather station data average annual snowfall
Flood Related Hazards	NOAA NCDC Storm Events (1993-2012) FEMA Digital Flood Insurance Rate Map (DFIRM) NOAA-NHC SLOSH Model Number of NPDP/NID high or significant dams
Wildfire	NOAA NCDC Storm Events (2001-2006) Percent land areas within Wildland Urban Interface zones (interface or intermix)
Earthquake	FEMA HAZUS-MH MR5 Earthquake Model Peak Ground Acceleration (PGA) USGS (1568-2012)
Dam Failure	NID Number of High or Significant Dams per jurisdiction
Drought	NOAA NCDC Storm Events (1995-2012) Extent assumed to be uniform

3.4.2 Composite Hazard Ranking

To determine overall risk, the scores for each of the parameters were added together (weighting applied as described previously) for each hazard to estimate the total county risk due to that hazard. The overall or total hazard score for the state was determined by calculating the average hazard risk for each of the counties and using natural breaks to assign the ranking. Appendix 3 *Hazard Identification & Risk Assessment* includes the ranking spreadsheet and supporting data sources.

3.4.2.1 Limitations of Ranking

The NWS does not guarantee the accuracy or validity of the information used for weather-related hazards. Although the historical records in the database often vary widely in their level of detail, the NWS does have a set of guidelines for use in the preparation of event descriptions which were followed in preparation of this hazard analysis.[12]

As previously described, NCDC is not a complete data source. It was chosen for use in ranking because of its standardized collection of many of the hazards that impact Rhode Island. Unfortunately, the data set is somewhat lacking in terms of hurricanes and geological hazards. As a result, the ranking can only characterize the current form of the

[12] National Water Service Instruction 10-1605. Operations and Services Performance: Storm Data Preparation Guide. August 17, 2007. Available at: http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf

data. Future plan updates and mitigation actions should assess the availability of other data sources to be sure that the parameters are still valid for ranking of the hazards.

3.5 Vulnerability Analysis

Vulnerability includes all populations and assets (environmental, economic and critical facilities) that may be at risk from the natural hazards. Vulnerability analysis measures the level of assets, populations, or resources within a given region, city or town. The vulnerability is a function of the built environment, local economy, demographics, and environmental uses of a given region. In considering Rhode Island's vulnerability to natural hazards, four major groups were used in the 2011 update and reaffirmed in the 2014 plan update: Critical Facilities; Populations at Risk; Environmental Resources/Threats and Economic Values.

It should be noted that the vulnerability analysis was limited based on the spatial data available. Several large projects are being completed concurrent to this update and as a result were not available for analysis. Zoning and land use information is currently being collected/compiled by Division of Planning. This data, once available, will assist in the ability to assess changes in development for jurisdictions in hazard prone areas using up to date and accurate data.

RIEMA is currently pursuing funding to develop a statewide parcel dataset. As discussed throughout this plan, the existing data has not been favorable for a statewide detailed economic or structural loss assessment. Each community maintains their own municipal parcel data and, typically, this data is not organized similarly across boundaries. This limitation has made it difficult to successfully model loss estimations between communities, counties or even statewide. Development of the parcel dataset will allow both State and local partners to run analyses and output a realistic estimation of loss following a specific scenario. The data developed as part of this initiative will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

3.5.1 Facility Analysis

The damage to and destruction of the built environment, particularly in the critical lifeline sectors (Communications, Emergency Services, Energy, Healthcare and Public Health, Transportation, Water) represents enormous economic, social, and general functional costs to a community, while also impeding emergency response and recovery activities.

More and more people live in the areas most vulnerable to hurricanes, within 50 miles of the Gulf of Mexico or the Atlantic Ocean. It is here where, for many coastal states, tremendous amounts of valuable infrastructure exist, especially transportation lifelines. A nonfunctional road can have major implications for a community: general loss of

productivity; disruption of physical access preventing residents from getting to work or other daily activities, prevention of emergency vehicles from reaching their destinations, with the associated health and safety implications and the potential access difficulties causing the disruption of important lifeline supplies such as food and other deliveries to the community.

Damaged or destroyed utility lines and facilities - including electricity, computer and satellite links, gas sewer, and water services - can cripple a region after a disaster. Power lines are often badly damaged or destroyed resulting in the loss of power for days, weeks or even months. This is particularly critical considering modern societies' dependence on electricity. In addition to basic modern households appliances being affected, public water supplies, water treatment and sewage facilities can also be impacted. Electric pumps cannot pump drinking water into an area without power, and even if they could, the water delivery system could be breached in several areas. The loss of even elevated water tanks also results in a lack of safe drinking water. Even disaster victims who do get water may have to boil it to eliminate waterborne pathogens introduced to the supply in breached areas.

The analysis of State and critical facility vulnerability for the 2014 update was completed using three major sources of facility data supplied by RIEMA Mitigation and Infrastructure & Protection:

(1) Critical Infrastructure and Key Resources (CIKR) uses the Department of Homeland Security (DHS) definition which includes banking & finance, chemical facilities, commercial facilities, communications, dams, defense, emergency services, energy & utilities, government facilities, healthcare facilities, information technology, postal and shipping, transportation infrastructure, and drinking & wastewater facilities. Concurrent to this planning effort, RIEMA staff are completing assessments on all CIKR within the state.

(2) Critical Facilities include facilities that may not be owned or operated by Rhode Island but are critical to its citizens. This includes research & academic facilities, dams, fire stations, hospitals, shelters, law enforcement, libraries, marinas, schools, and government facilities.

(3) State-Owned Facilities include facilities that are owned, operated, and maintained by Rhode Island and do not fall within the CIKR defined categories. Additional information on these facilities is currently being collected concurrent to this update.

Many of the buildings in the Rhode Island are critical to disaster preparedness and response, although not all critical facilities are state-owned. For example, many privately owned buildings and structures (hospitals, power plants, certain industrial facilities, etc.) are critical to societal function, especially during emergencies and disasters. Thus, critical

facilities data collection extended to a broader array of critical facilities than would be available by only using state-owned facilities. However, as shown in the Mitigation Strategy, development of a robust critical infrastructure database will be an ongoing effort to support implementation of the National Infrastructure Protection Plan (NIPP) and sector specific plans.**Table** 9 breaks down the dataset and the asset type for the facilities included in this update. The majority of the facilities fall within the critical facility dataset. Figure 4 shows the distribution of facilities across the state. As shown on the map, three critical facilities (hurricane shelters) are located within Massachusetts. The Overall Hazard Composite section at the end of the HIRA provides a summary, by hazard, of the vulnerabilities for the facilities. Facilities within Providence County represent over 53 percent of the facilities analyzed, with the majority within the City of Providence and are state-owned facilities.

Although not a complete representation of all the possible types of facilities, this dataset is a good representation of facility locations in Rhode Island. The data from these various sources was combined together in a unified database for analysis and ease of distribution to localities. The database contains over 2,487 facilities. The available data only contains the general location of each of the facilities, with no attribute information such as building value, sprinkler systems, etc. is available. In addition, facilities are represented only as geographic points, and so the full spatial extent of larger facilities is not considered.

It should be noted that the Department of Health (HEALTH) is currently working with RIEMA to develop a comprehensive list and mapping of facilities (for example, hospitals) in Rhode Island.

Table 9. Facilities included in vulnerability assessment. Source: RIEMA.

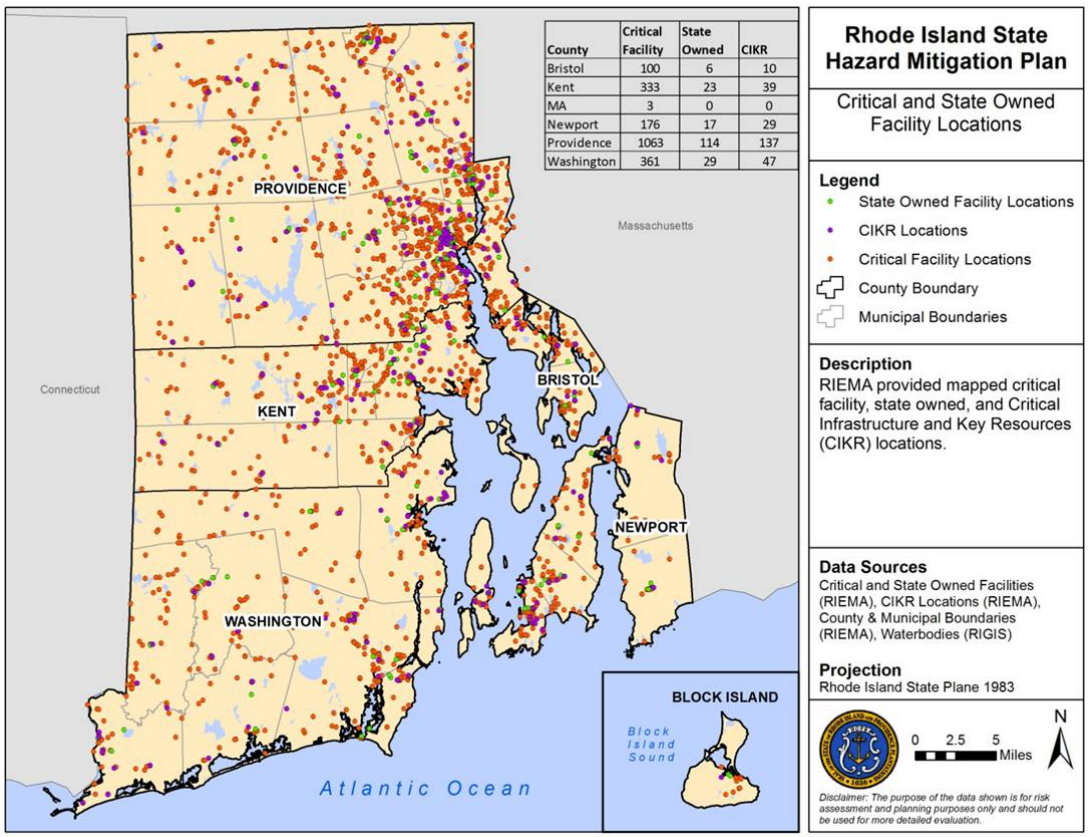
Dataset	Asset Type	Bristol	Kent	Newport	Providence	Washington	Total
Critical Infrastructure and Key Resources (CIKR)	Banking and Finance				1		1
	Chemical		7		9	1	17
	Commercial - Public Assembly				4		4
	Commercial Facilities - Lodging and Resort Facilities				1		1
	Communications		2		3	1	6
	Dam		1		3		4
	Defense Industrial Base			1		1	2
	Emergency Services	6	18	14	57	27	122
	Energy : Electricity				1		1

Dataset	Asset Type	Bristol	Kent	Newport	Providence	Washington	Total
	Energy : Oil and Natural Gas			1	6		7
	Government Facilities	4	7	8	26	9	54
	Government Facilities - Military Bases			1			1
	Healthcare and Public Health		1	1	13	2	17
	Information Technology				4		4
	Nuclear Reactors, Materials, and Water					1	1
	Postal and Shipping		1		1		2
	Transportation - Aviation		1		1	1	3
	Transportation - Maritime			1	1	1	3
	Transportation - Rail Systems / Mass Transit		1		1	3	5
	Transportation - Road Systems / Maritime			2	2		4
	Water - Drinking Water and Wastewater				3		3
Critical Facility	College	3	2	2	11	2	20
	Correctional Institute	3	5	7	30	11	56
	Dam	6	94	20	301	119	540
	EMS Company	7	20	11	55	18	111
	Fire Station	12	26	12	77	37	164
	Hospital	0	1	1	13	2	17
	Hurricane Shelter	14	24	14	71	20	146
	Law Enforcement	3	7	9	41	18	78
	Library	6	13	10	62	16	107
	Marina	9	20	18	9	22	78
	School	34	116	65	375	87	677
	Town Hall	3	5	6	16	9	39
State Facility	State Facility	6	23	17	114	29	189
Total		**116**	**395**	**222**	**1,314**	**437**	**2,487**

Each individual hazard sections include analysis results in the risk assessment section for the defined facilities. When hazard data was available, facilities were intersected with hazard specific data to determine the building's risk zone. The analysis methodology is described in full detail in these sections; tables are used to represent the number of

facilities in each risk category. ***Potential dollar loss and/or exposed building value of State and critical facilities were not completed due to lack of building-specific details.*** Hazus-MH analysis for hurricane and earthquake provide some details for losses and is available in the hazard specific sections and Appendix 3 *Hazard Identification & Risk Assessment*. As previously discussed, RIEMA is currently pursing funding opportunities to create a statewide parcel dataset that would become the foundation for creating meaningful vulnerability exposure and loss estimates.

As a result of Presidential Preparedness Directive 21 released in February 2013, a review and revision of the NIPP is being made. Pending the release of the revised NIPP, changes will be reflected in the 2017 SHMP.



County	Critical Facility	State Owned	CIKR
Bristol	100	6	10
Kent	333	23	39
MA	3	0	0
Newport	176	17	29
Providence	1063	114	137
Washington	361	29	47

Figure 4. State-owned and critical facilities.

3.6 Hazard Profiles

The following subsections present a description of each type of natural hazard Rhode Island may expect to experience, as determined by the SIHMC members. The information presented in this section has been expanded upon and have been reorganized since 2011 for ease of review for the reader. Reorganization of information of general information, past history, future risk and vulnerability has been placed for each natural hazard under

the respective natural hazard sub-category. Facilities data, new in the 2014 plan update, has been included in the vulnerability analysis as applicable. Hazard profiles include:

Wind Related Hazards	Winter Related Hazards	Flood Related Hazards	Geologic Related Hazards	Additional Hazards
Storm Surge Section 3.6.1.1	Snow Section 3.6.5.3	Riverine Flooding Section 3.6.7.1.1	Earthquakes Section 3.6.12	Wildfire Section 3.6.11
Hurricanes Section 3.6.2	Ice Section 3.6.5.2	Flash Flooding Section 3.6.7.1.2		Drought and Extreme Heat Section 3.6.13
Tornadoes Section 3.6.3	Extreme Cold Section 3.6.5.3.3	Urban Flooding Section 3.6.7.1.3		
High Winds Section 3.6.4		Coastal Flooding Section 3.6.7.1.4		
		Climate Change and SLR Section 3.6.8		
		Coastal Erosion Section 3.6.9		
		Dam Breach Section 3.6.10		

Wildfire, extreme heat and climate change/SLR have been added as new sections in the 2014 HIRA.

Climate change is both a present threat and an onsetting hazard. It acts as an amplifier of existing natural hazards.[13] Extreme weather events have become more frequent during the past half-century, and this trend is projected to continue.[14] Climate change is expected to have a significant impact on communities, including those in Rhode Island. For instance, more frequent intense precipitation events may translate into more frequent flash flooding episodes. The National Climate Assessment and Development Committee has documented average temperature across the United States has increased 1.5°F since 1895 with the majority of the increase since 1980. Weather events have and will continue to become more intense, frequent, and will result in health and livelihood related impacts such as water supply, agriculture, transpiration and energy. The impact of dynamic storm events include but are not limited to more frequent and intense heat waves, increases in ocean and freshwater temperatures, frost-free-days, heavy downpours, floods, sea level

[13] ***The Copenhagen Diagnosis****, 2009: Updating the World on the Latest Climate Science.* I. Allison, N.L. Bindoff, R.A. Bindschadler, P.M. Cox, N. de Noblet, M.H. England, J.E. Francis, N. Gruber, A.M. Haywood, D.J. Karoly, G. Kaser, C. Le Quéré, T.M. Lenton, M.E. Mann, B.I. McNeil, A.J. Pitman, S. Rahmstorf, E. Rignot, H.J. Schellnhuber, S.H. Schneider, S.C. Sherwood, R.C.J. Somerville, K. Steffen, E.J. Steig, M. Visbeck, A.J. Weaver. The University of New South Wales Climate Change Research Centre (CCRC), Sydney, Australia, 60pp.http://www.copenhagendiagnosis.com/

[14] IPCC, 2012 - Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (Eds.) Available from Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 8RU ENGLAND, 582 pp.

rising, droughts and wildfires.[15] Climate change and SLR has been added as a new section in the 2014 HIRA.

In August 2013, Rhode Island established a working group to meet and coordinate SLR and Climate Change Assessments across state agencies. This working group is currently working on details on how to coordinate efforts, as well as in-depth discussions of static versus dynamic modeling of SLR and inundation risk. Many members of this working group are active participants on the SIHMC and will be key in the implementation, maintenance, and update of this plan over the next three (3) to five (5) years.

3.6.1 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 as shown in Figure 5.

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. This section examines the risks associated with damaging wind events with emphasis on hurricanes, tornadoes, and thunderstorms.

[15] National Climate Assessment and Development Advisory Committee (NCADAC) January 2013 Draft Climate Assessment Report. http://ncadac.globalchange.gov/

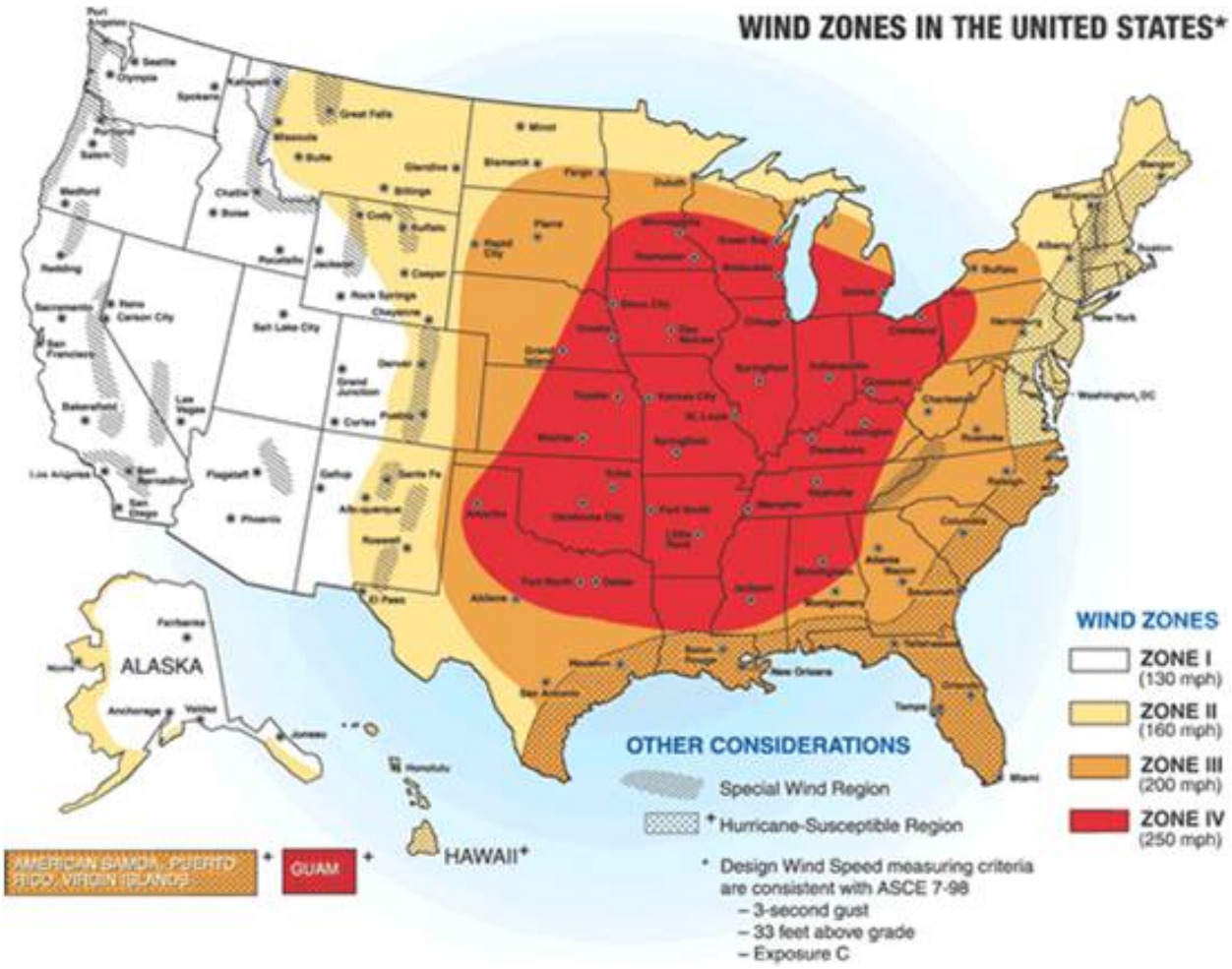


Figure 5. FEMA Safe Room Design Wind Speed Zones for the United States

3.6.2 Hurricanes

Coastal hazards take many forms ranging from storm systems like tropical storms, hurricanes and Nor'easters that can cause storm surge inundation, heavy precipitation that may lead to flash flooding, and exacerbation of shoreline erosion to longer term hazards such as SLR. The focus for much of this section is coastal storms. Discussion and limited analysis for shoreline erosion, SLR and climate changes are included in the flood-related hazard section.

3.6.2.1 Description

Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as "cyclones" due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds,

heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage.

There are three categories of tropical cyclones:

1. Tropical Depression: maximum sustained surface wind speed is less than 39 mph.
2. Tropical Storm: maximum sustained surface wind speed from 39-73 MPH.
3. Hurricane: maximum sustained surface wind speed exceeds 73 MPH.

Once a tropical cyclone no longer has tropical characteristics it is then classified as an extratropical system.

Most Atlantic tropical cyclones begin as atmospheric “easterly waves” that propagate off the coast of Africa and cross the tropical North Atlantic and Caribbean Sea. When a storm starts to move toward the north, it begins to leave the area where the easterly trade winds prevail, and enters the temperate latitudes where the westerly winds dominate. This produces the eastward curving pattern of most tropical storms that pass through the Mid-Atlantic region. When the westerly steering winds are strong, it is easier to predict where a hurricane will go. When the steering winds become weak, the storm follows an erratic path that makes forecasting very difficult.

Howling winds associated with Nor’easters also have the potential to produce significant storm surge, similar to that of a Category One hurricane. In addition, these types of storms can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall.

Hurricanes are categorized according to the Saffir/Simpson scale with ratings determined by wind speed and central barometric pressure. Hurricane categories range from one (1) through five (5), with Category 5 being the strongest (winds greater than 155 MPH). A hurricane watch is issued when hurricane conditions could occur within the next 36 hours. A hurricane warning indicates that sustained winds of at least 74 MPH are expected within24 hours or less.

3.6.2.1.1 Storm Surge

Storm surge is the abnormal rise in water level caused by the wind and pressure forces of a hurricane or nor’easter. Nationally, storm surge flooding has caused billions of dollars in damage and hundreds of deaths. Given today's ever increasing population densities in coastal communities, the need for information about the potential for flooding from storm surge has become even more important. Storm surge heights in Rhode Island range from a few feet higher than normal tides during nor’easters to more than 10 feet during hurricanes. The breaking wave height is related to water depth so that as water depth over a given surface increases with storm surge, larger waves can be generated.

There are a number of factors which contribute to the generation of storm surge, but the fundamental forcing mechanism is wind and the resultant frictional stress it imposes on the water surface. Winds blowing over a water surface generate horizontal surface currents flowing in the general direction of the wind. These surface currents in turn create subsurface currents which, depending on the intensity and forward speed of the hurricane or nor'easter, may extend from one to several hundred feet below the surface. If these currents are in the onshore direction, water begins to pile up as it is impeded by the shoaling continental shelf causing the water surface to rise. This "dome of water" will increase shoreward until it reaches a maximum height at the shoreline or at some distance inland. The most conducive bathymetry for the formation of large storm surges is a wide gently sloping continental shelf.

3.6.2.1.2 Hurricane Storm Surge

The magnitude of storm surge within a coastal basin is governed by both the meteorological parameters of the hurricane and the physical characteristics of the basin. The meteorological aspects include:

- Hurricane size - measured by the radius of maximum winds (Measured from the center of the hurricane to the location of the highest wind speeds within the storm. This radius may vary from as little as four (4) miles to as much as 50 miles);
- Hurricane intensity - measured by sea level pressure and maximum surface wind speeds at the storm center;
- Hurricane path, or forward track of the storm; and
- Hurricane forward speed.

The counterclockwise rotation of the hurricane's wind field in combination with the forward motion of the hurricane typically causes the highest surge levels to occur to the right of the hurricane's forward track. This phenomenon has been observed in regions where the shoreline is typical straight, not fragmented by large inlets and bays, and when a hurricane travels generally perpendicular to the shore. In Rhode Island, the increased wind stress from the rotational wind field has a large effect on the level of surge. The contribution to surge generation from the forward motion of the storm can be greater than the contribution made by an increase in hurricane intensity.

The Rhode Island shoreline faces south, so storms passing to the west raise the highest storm surges for Rhode Island. In addition, Narragansett Bay funnels the surge northward where decreasing surface area amplifies the surge height (Boothroyd 2008). The 1938 Hurricane made landfall west of Rhode Island as a Category 3 hurricane with a forward speed in excess of 50 miles per hour. Because the center of the storm made landfall in Connecticut, the Rhode Island shoreline experienced the highest storm surge levels.

The reduction of atmospheric pressure within the storm system results in another surge-producing phenomenon known as the "inverted barometer" effect. Within the region of low

pressure the water level will rise at/the approximate rate of 13.2" per inch of mercury drop. This can account for a rise of one (1) to two (2) feet near the center of the hurricane. This effect is considered to be a more important factor in the open ocean where there is no depth related restrictions to water flow.

3.6.2.1.3 Nor'easter Storm Surge

An extra-tropical coastal storm, known as a nor'easter, is typically a large, counter-clockwise wind circulation around a low pressure center. The storm radius is often as large as 1,000 miles, and the horizontal storm speed is about 25 miles per hour, traveling up the eastern United States coast. Sustained wind speeds of 1040 MPH are common during a nor'easter, with short term wind speeds gusting up to 70 MPH. Unlike hurricanes and tropical storms, nor'easters can sit off shore, wreaking damage for days. Nor'easters are a common winter occurrence in New England and repeatedly result in flooding, various degrees of wave and erosion-induced damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs. The erosion of coastal features commonly results in greater potential for damage to shoreline development from future storms.

Nor'easters cause varying amounts of coastal erosion depending on the intensity and the duration of the storm; the tidal phase at the time of the storm (neap or spring tide); the path of the storm; and the time interval between storms (Boothroyd 2008). Back to back storms do not allow time for the beaches and dunes to recover sand that has been transported offshore.

Damages resulting from nor'easters are often due to coastal erosion and undermining the structures that were previously behind the dunes or on the top of coastal bluffs. Damages to a house that topples off an embankment are usually much more costly than damages resulting from localized areas of flooding

3.6.2.2 Location

The entire State is vulnerable to hurricanes and tropical storms, depending on the storm's track. The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model is used to evaluate the potential impact of storm surge. Emergency managers use data from SLOSH to identify at-risk populations and determine evacuation areas. Storm surges also affect tidal rivers and creeks, potentially increasing evacuation areas. Figure 6 indicates the potential inland extent of storm surge as a function of hurricane category. It is readily apparent from this figure that Rhode Island has significant vulnerability to storm surge. This is particularly true of portions of the Bristol and Washington. Community specific inundation maps can be found in Appendix 3 *Hazard Identification & Risk Assessment*. The inundation data was derived by the United States Army Corps of Engineers (USACE) by overlaying the hurricane surge water surface elevations from SLOSH model results on

top of ground elevations from FEMA Light Detection and Radar (LiDAR) data to show which areas would be flooded by hurricane storm surge.

Figure 7 highlights areas especially those on floodplains, are also at risk for flooding and wind damage. Low-lying coastal areas in close proximity to the shore, sounds or estuaries are exposed to the threat of flooding from wind events and storm surge.

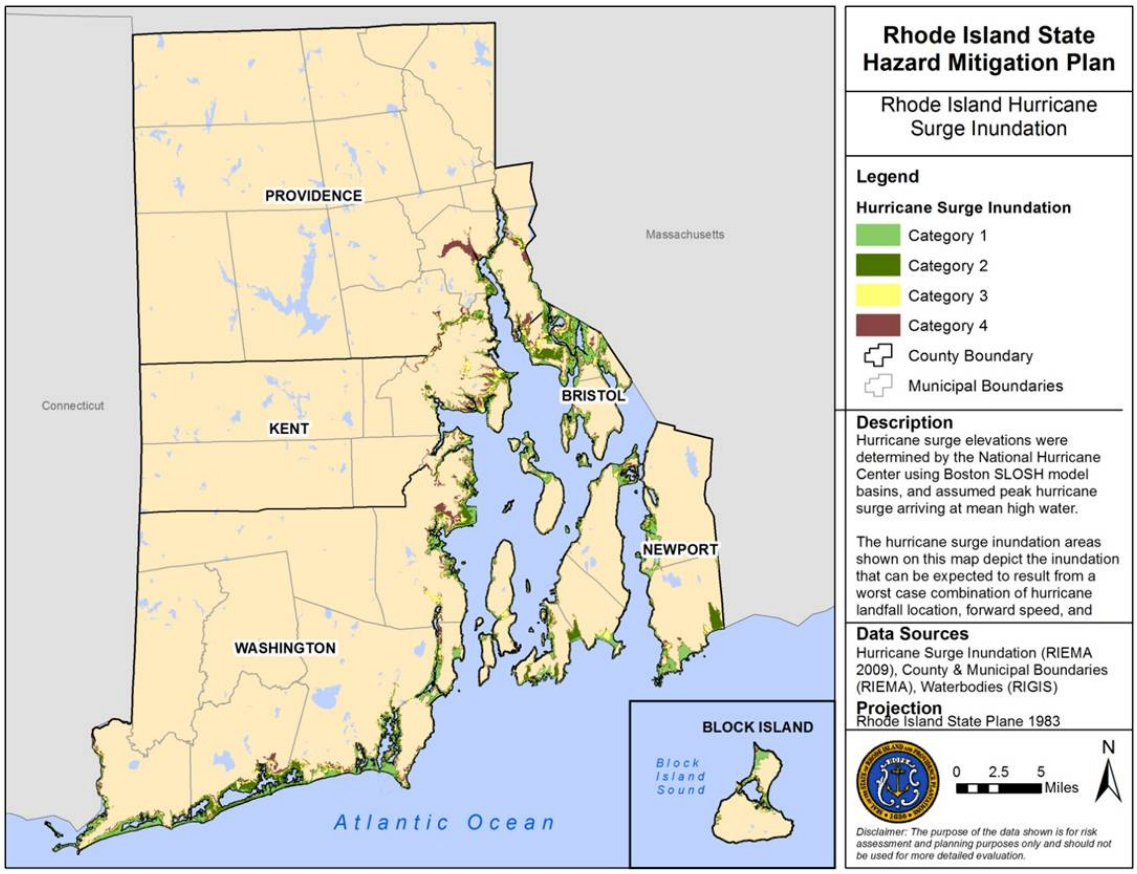


Figure 6. Storm surge inundation based on hurricane category.

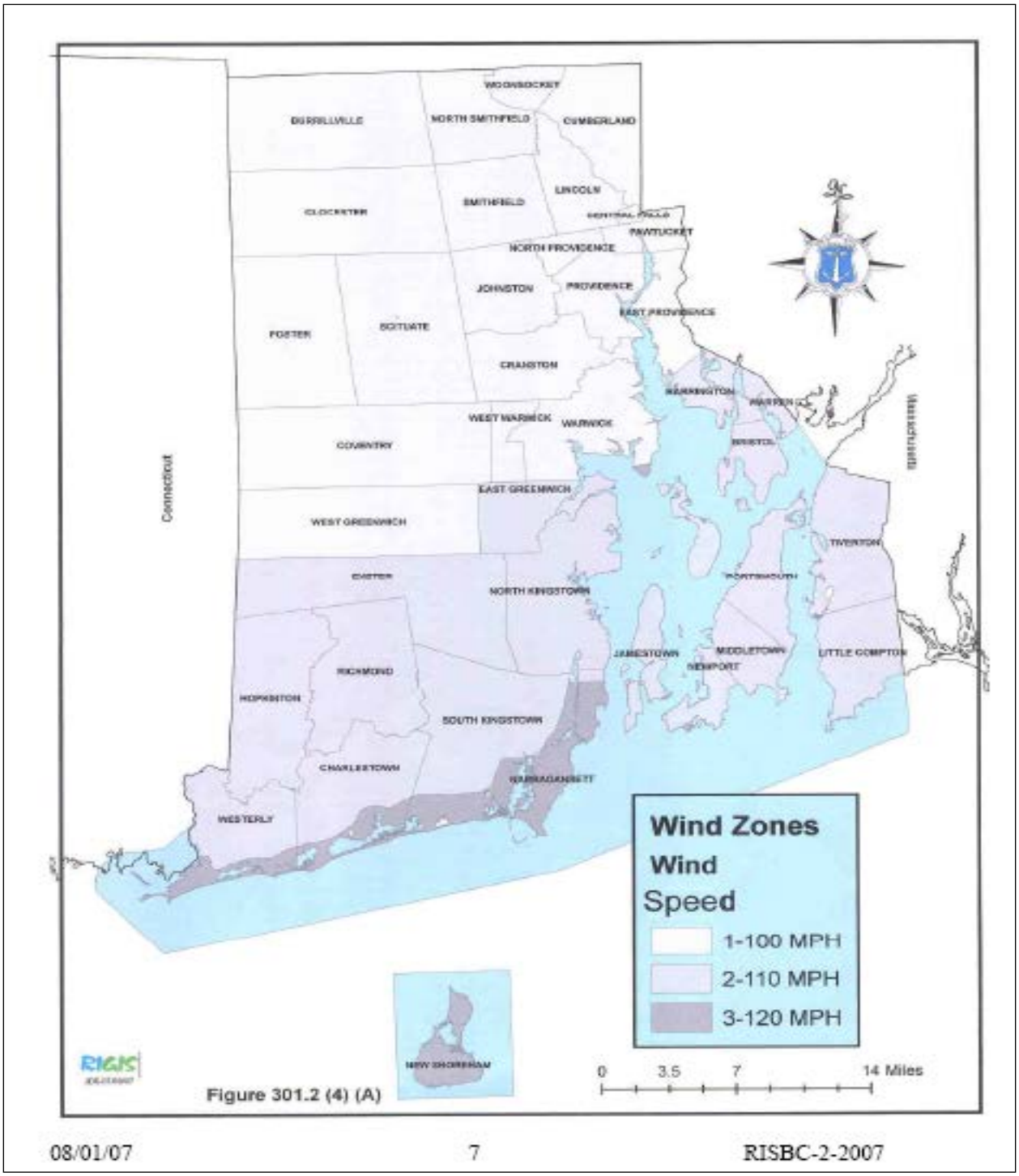


Figure 7. Rhode Island Wind Speed Zones

3.6.2.3 Extent (Impact and Vulnerability)

Hurricanes are classified by their damage potential according to a scale developed in the 1970s by Robert Simpson and Herbert Saffir, and updated slightly by the National Hurricane Center in 2012. The scale is designed to give public officials and the general public usable information on the magnitude of a storm. It gives an indication of the potential flooding and wind damages associated with each hurricane category. The scale rates the intensity and effects of hurricanes based on wind speed and barometric pressure measurements as shown in Table 10.

Table 10. Saffir/Simpson Scale of Hurricane Intensity. Source: NWS NCDC.

Wind Speed	Typical Effects
Category One Hurricane – Weak	
74-95 MPH (64-82kt)	Minimal Damage: Damage is primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage occurs in building structures. Some damage is done to poorly constructed signs.
Category Two Hurricane – Moderate	
96-110 MPH (83-95kt)	Moderate Damage: Considerable damage is done to shrubbery and tree foliage, some trees are blown down. Major structural damage occurs to exposed mobile homes. Extensive damage occurs to poorly constructed signs. Some damage is done to roofing materials, windows, and doors; no major damage occurs to the building integrity of structures.
Category Three Hurricane – Strong	
111-130 MPH (96-113kt)	Extensive damage: Foliage torn from trees and shrubbery; large trees blown down. Practically all poorly constructed signs are blown down. Some damage to roofing materials of buildings occurs, with some window and door damage. Some structural damage occurs to small buildings, residences and utility buildings. Mobile homes are destroyed. There is a minor amount of failure of curtain walls (in framed buildings).
Category Four Hurricane - Very Strong	
131-155 MPH (114-135kt)	Extreme Damage: Shrubs and trees are blown down; all signs are down. Extensive roofing material and window and door damage occurs. Complete failure of roofs on many small residences occurs, and there is complete destruction of mobile homes. Some curtain walls experience failure.
Category Five Hurricane – Devastating	
Greater than 155 MPH (135kt)	Catastrophic Damage: Shrubs and trees are blown down; all signs are down. Considerable damage to roofs of buildings. Very severe and extensive window and door damage occurs. Complete failure of roof structures occurs on many residences and industrial buildings, and extensive shattering of glass in windows and doors occurs. Some complete buildings fail. Small buildings are overturned or blown away. Complete destruction of mobile homes occurs.

3.6.2.4 Previous Occurrences and Probability of Future Events

Rhode Island has experienced tropical depressions and tropical storms as well as hurricanes ranging from Category 1 to Category 3. Hurricanes are rare but devastating events in Rhode Island. Hurricane wind damages can be costly but storm surge is by far the most destructive force acting on the Rhode Island coast. The highest storm surges recorded at the Newport tide gauge were 9.45' and 6.76' above MHHW during the Great September Hurricane of 1938 and Hurricane Carol, August 1954, respectively. By comparison, the Providence gauge recorded surges of 12.66' and 9.96' above MHHW respectively.

The comparison of hurricanes to nor'easters reveals that the duration of high surge and winds in a hurricane is 6-12 hours while a nor'easter's duration can be from 12 hours to 3 days. The amount of damage resulting from a strong hurricane is often more severe than a nor'easter, but historically, Rhode Island has suffered more damage from nor'easters because of the greater frequency in which they occur.

USACE and NWS records indicate 37 hurricane tracks have passed within 50 miles for Rhode Island since 1851 (Figure 9).

Table 11 highlights hurricanes and tropical storms that have resulted in significant damages and injuries and deaths in Rhode Island. Damages from Hurricane Carol in the Town of Westerly are pictured in Figure 8.

Hurricane Irene in 2011 and Hurricane Sandy in October 2012 are the most recent events to hit the state. Table 12 is a summary of Sandy claims and losses paid from the Rhode Island Department of Banking and Insurance.

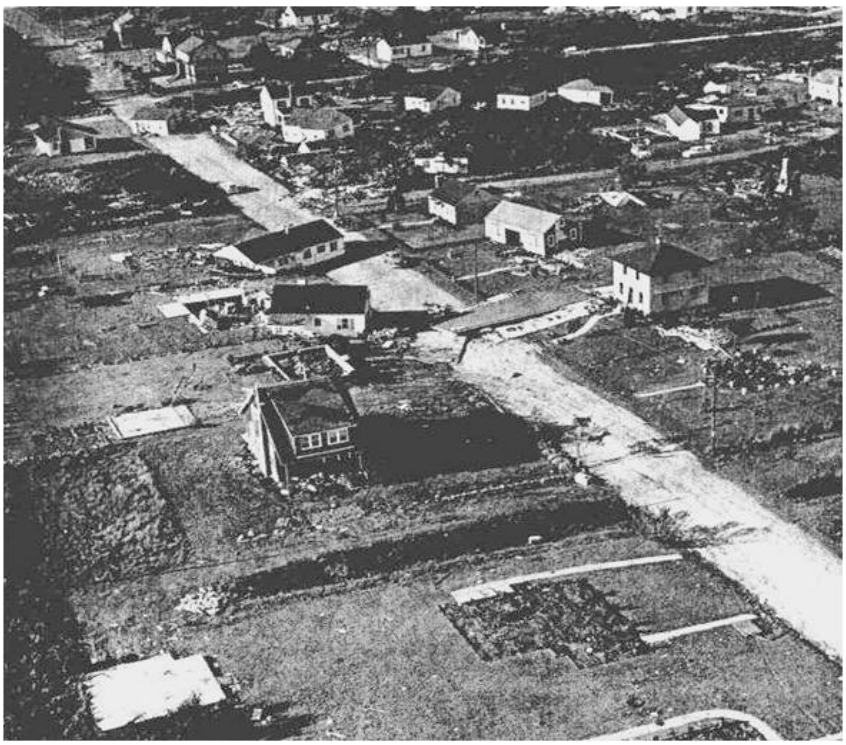


Figure 8. Hurricane Carol damages in Westerly. Source: RI National Gaury (9/1954)

Table 11. Rhode Island Historic Hurricanes.

Hurricane	Date	Description
1938	September 21, 1938	The hurricane of September 21, 1938 brought major devastation to the State, with 262 persons losing their lives and damage estimated at $100 million. Another major hurricane occurred on September 14, 1944; no lives were lost, but property damage was over $2 million. The coastal area from Westerly to Little Compton experienced the heaviest damage, but there was no tidal wave, since the storm hit at ebb tide. Sustained winds of 95 MPH recorded; damage estimated at $100 million; 262 fatalities. Tide 15 feet above mean sea level (at USGS gage in Westerly). Virtually all the State was without power. Ten percent of electric customers still without power 12 days after hurricane.
1944	September 14, 1944	Affected Rhode Island and southeastern Massachusetts; $2 million property damage, no loss of life.

Hurricane	Date	Description
Carol	August 31, 1954	On August 31, 1954, Hurricane Carol swept into Rhode Island with little warning. The result was 19 deaths and $200 million in property damage. The storm center passed to the west of Providence and came at high tide. The central area of Providence was flooded to a depth of 13 feet, and 3,500 cars were inundated in the downtown areas. Hurricane Edna occurred 12 days after Carol, with heavy rain and major river flooding. There were 19 fatalities in New England, $200 million property damage and 13' flooding. In Providence, wind speed of 90 MPH, with 115 MPH gusts; nearly 3,800 homes destroyed. Tide 12.2 feet above mean seal level (at USGS gage in Westerly). Most of State without power. Four days after storm, approximately 50% had power restored; 90% after seven days.
Edna	September 11, 1954	Heavy rain and major flooding in the Blackstone River Valley.
Diane	August 17-20, 1955	In 1955, remnants of the August Hurricane Diane swept over Rhode Island, but its wind velocities were far below hurricane force because of its long inland trip over North Carolina, Virginia, and Pennsylvania. Damage to power lines was high, and at one time 82% of Rhode Island's homes were without electricity. Ample warning permitted people to return home from school and work early, and as a result, only two lives were lost. Property damage amounted to $170 million, most resulting from torrential rains which caused serious river flooding. Heavy rain; Blackstone River crests 15' above normal; $170 million in property damage. Heavy rain and 6' tidal surge; $5 million in property damage; 82% of electric customers lose power.
Donna	September 12, 1960	Heavy rain and major flooding in the Blackstone River Valley.
Esther	September 21, 1961	Heavy shore damage at Sakonnet Point in Little Compton and Misquamicut in Westerly.
Gloria	September 27, 1985	Two fatalities in New England; property damage estimated at $19.8 million; 8,596 of electric customers lose power an estimated 23,700 people evacuated.
Bob	August 18, 1991	Southern New England damage at $1.5 billion; 60% of residents across Southeastern New England lost power; 6'-10' storm surge in Narragansett Bay; Two (2) unconfirmed tornadoes in Rhode Island. There were 18 fatalities in Southern New England, although none in Rhode Island.

Hurricane	Date	Description
Irene	August 27, 2011	Preliminary damage assessment report from FEMA brings the total Public Assistance cost to $9,260,898. Irene knocked down trees and power lines, leaving up to half of Rhode Island residents without power. Gusts of wind up to 71 MPH were reported, and storm surge in Narragansett Bay caused some coastal damage. However, the majority of damage was caused by wind. 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. The highest sustained windspeed was 54 knots (62 MPH) at the Physical Oceanographic Real Time System station at Conimicut Light in Narragansett Bay, RI.
Sandy	October 29, 2012	Hurricane Sandy swept through the region in October 2012 leaving significant damage all along the coast. Beaches along Westerly, including Misquamicut, were devastated and almost unrecognizable. More than 122,000 people lost power. It is estimated that more than $39.4 million in support from four federal disaster relief programs is helping RI recover from this disaster, a majority of which is from the NFIP ($31.1 million).

Table 12. Hurricane Sandy – Summary of claims and losses paid. Source: RI Department of Banking and Insurance, As of February 2013.

Claim Type	Claims Reported	Claims Closed With Payment	Claim Closed Without Payment	Paid Loss	Case Incurred Loss	Percent Closed
Residential Property	7,645	5,635	1,328	$23,072,602.02	$27,814,073.21	91.08
Commercial Property	627	321	166	$5,830,534.63	$11,536,035.89	77.67
Personal Auto	688	559	75	$2,780,841.38	$2,706,766.00	92.15
Commercial Auto	27	19	2	$121,378.32	$127,737.72	77.78
Business Interruption	65	33	15	$2,280,008.90	$2,484,052.12	73.85
Flood	607	219	93	$6,314,575.25	$10,735,065.62	51.40
All Other Lines	207	119	50	$1,241,818.20	$2,045,364.64	81.64
Total	**9,866**	**6,905**	**1,729**	**$41,641,758.70**	**$57,449,095.20**	**87.51**

Based on historical frequency of occurrence, Rhode Island may experience a hurricane every four years, or 22.8 percent annually which can be related to a Medium-Low probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 12 includes the probability of future events by county. Long-term global climate models under Intergovernmental Panel on Climate Change (IPCC) warming scenarios indicate that it is

possible that hurricanes will become more intense, with stronger winds and heavier precipitation through the 21st century.

Nor'easters are a primary concern for Rhode Island residents; not only because of the damage potential in any given storm, but because there is a frequent rate of recurrence. Nor'easters have an average frequency of one (1) or two (2) per year, with a storm surge equal to or greater than two (2) feet.

3.6.2.5 Vulnerability & Risk Assessment

Rhode Island, as with other New England states, is particularly vulnerable to hurricanes. One reason is due to the geography of southern New England in relation to the Atlantic seaboard. Historically, most hurricanes which have struck the New England region re-curved northward on tracks which paralleled the eastern seaboard maintaining a slight north-northeast track direction. The fact that the States of Connecticut, Rhode Island, and Massachusetts geographically project easterly into the Atlantic and have southern exposed shorelines place them in direct line of any storm which tracks in this manner. Therefore, even though New England is a relatively far distance from the tropics, its susceptibility to hurricane strikes can statistically be greater than other states closer to the tropics.

Another explanation giving evidence to New England's unique vulnerability to hurricanes is the fact that hurricanes which eventually strike the region undergo significant increases in forward speed. Historically, it can be shown that hurricanes tend to lose their strength and accelerate in a forward motion after pasting the outer banks of Cape Hatteras, North Carolina. The increase in forward speed that usually occurs simultaneously as the hurricane weakens with further northward movement can often compensate for any discounting in hurricane intensity. Surge flooding, wave effects, and wind speeds accompanying a faster moving, weaker hurricane may exceed conditions caused by more intense hurricanes. This means that for some locations, depending on the meteorology of the storm, the affects from a Category 2 hurricane traveling at 60 MPH might be worse than that from a Category 4 hurricane moving at 20 MPH.

Table 13 summarizes the NCDC hurricane events since 1993. These estimates are believed to be an underrepresentation of the actual losses experienced due to hazards as losses from events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database and as a result have been supplemented with Hazus-MH analysis.

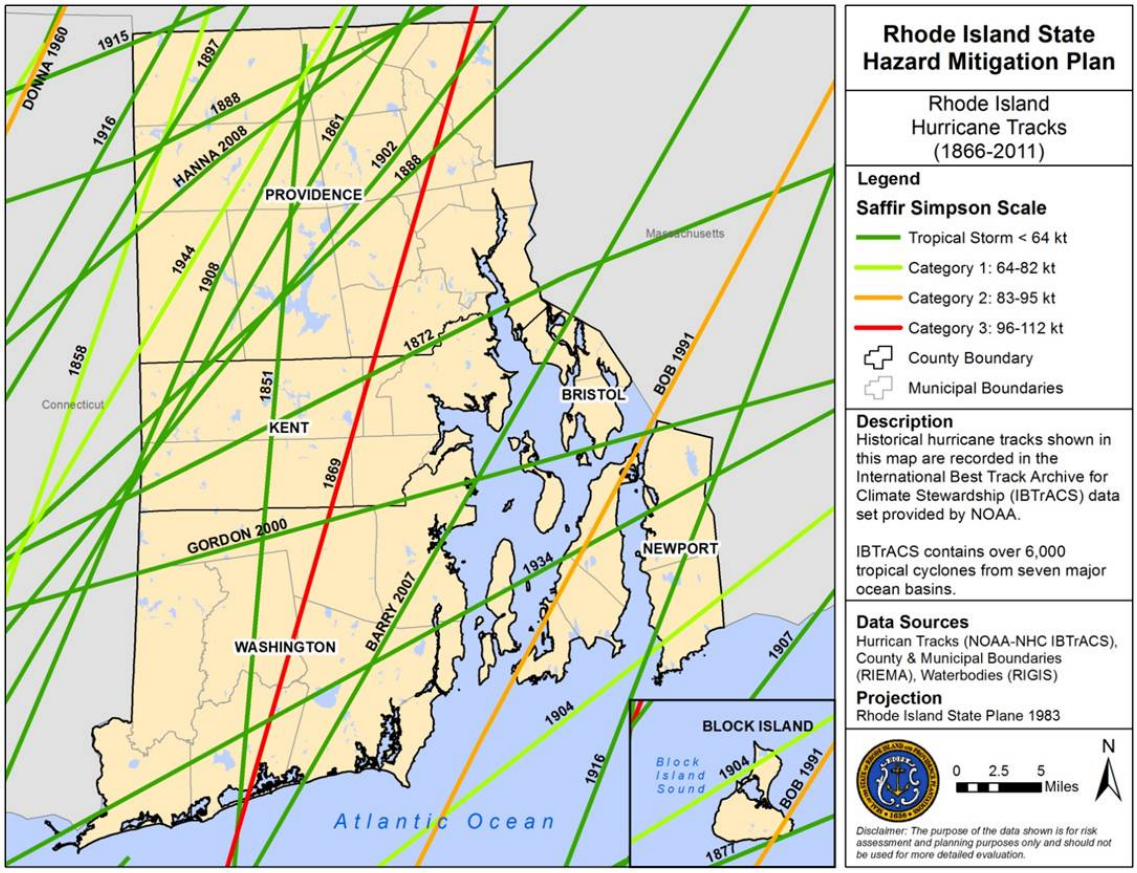


Figure 9. Hurricane tracts within 50 miles of Rhode Island (1866 – 2012). Source: NOAA NHC.

Table 13. NCDC hurricane events and damages.

County Name	Number of Events	Total Damages	Annualized Damages
Years of Record	1993 – 2012		
Bristol	2	$10,207	$510
Kent	2	$66,345	$3,317
Newport	2	$20,414	$1,021
Providence	3	$95,518	$4,776
Washington	2	$15,310	$766
Statewide	**11**	**$207,794**	**$10,390**

There are primarily three components of statewide vulnerability from the impact of a hurricane: storm surge (coastal flooding); ability to evacuate in a timely manner; and shelter capacity. Storm surge has the potential to create a very serious problem in many Rhode Island coastal communities because in most cases the waters will rise to extremely high levels and cover roads and bridges completely with water. These roads are hurricane evacuation routes and the only way out of danger.

The vulnerability of Rhode Island to hurricane surges is further increased by the presence of Narragansett Bay. The Bay's configuration can exhibit a funneling phenomenon on tidal surges as they flood the East and West Passages and the Sakonnet River. Ocean waters entering these inlets become more restricted causing higher flood levels with continued movement into the upper reaches of the Bay. The funneled ocean waters along the shores of the Bay's northern most points tend to result in higher storm surge elevations causing a greater amount of coastal and tidal riverine flooding. The northern reaches of Narragansett Bay are the most urbanized and densely developed areas in the State. Table 14 summaries the facilities located within the hurricane storm surge categories. It should be noted that the vulnerability is cumulative and facilities located within a Category 4 event are also vulnerable to categories one through three as well.

Table 14. Facilities located within hurricane storm surge categories.

County	Dataset	Asset Type	Category 1	Category 2	Category 3	Category 4
Bristol	CIKR	Emergency Services			3	1
	Critical Facility	Correctional Institute			1	1
		Dam		2		
		EMS Company				3
		Fire Station	1	1	2	3
		Hurricane Shelter		2	4	1
		Law Enforcement			1	1
		Marina	2	5	1	
		School	2	4	3	4
	State Facility	State Facility	1		1	
Kent	CIKR	Emergency Services				2
	Critical Facility	Correctional Institute				1
		Dam		1	1	1
		EMS Company				1

County	Dataset	Asset Type	Category 1	Category 2	Category 3	Category 4
		Fire Station				1
		Hurricane Shelter				1
		Law Enforcement				1
		Marina	7	4	1	
		School			1	4
	State Facility	State Owned			1	1
Newport	CIKR	Emergency Services				2
		Transportation - Maritime				1
		Transportation - Road Systems / Maritime				1
	Critical Facility	Dam	1	3	2	
		EMS Company	1			
		Fire Station	1			
		Hospital				1
		Library		1		
		Marina	3	5	1	1
		School		1	1	1
	State Facility	State Owned	1	1	1	
Providence	CIKR	Banking and Finance				1
		Chemical		1		
		Commercial - Public Assembly				2
		Commercial Facilities - Lodging and Resort Facilities				1
		Communications				1
		Dam				1
		Emergency Services				1
		Energy : Electricity				1
		Energy : Oil and Natural Gas		2	2	
		Government Facilities	1			1
		Healthcare and Public Health				2
		Transportation - Maritime			1	
	Critical Facility	College				2

County	Dataset	Asset Type	Category 1	Category 2	Category 3	Category 4
		Correctional Institute				2
		Dam	1		2	6
		EMS Company				2
		Fire Station				3
		Hospital				1
		Law Enforcement				4
		Library				4
		Marina	1	3	2	1
		School				6
		Town Hall				2
	State Facility	State Owned				29
Washington	CIKR	Defense Industrial Base			1	
		Emergency Services		3		2
		Transportation - Aviation		1		
	Critical Facility	Correctional Institute				1
		Dam	1	2	5	3
		EMS Company		1	1	1
		Fire Station		1	1	3
		Law Enforcement		1		1
		Library				2
		Marina	10	3	1	
		School	1			4
		Town Hall		1	1	
	State Facility	State Owned	1	1	1	4

Electrical utilities and communications as well as transportation infrastructure are vulnerable to significant coastal events. 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 vulnerability to significant coastal event hazards is based in large part on building construction and standards and its location in relation to potential storm surge inundation zones. In general, mobile homes and wood-framed structures are more vulnerable to damage from wind during significant coastal events than steel framed structures. Other factors, such as location, condition and maintenance of trees also plays a significant role in determining vulnerability.

Human vulnerability is based on the availability, reception and understanding of early warnings of coastal hazard events (i.e., Hurricane Watches and Warnings issued by the NWS) as well as access to substantial shelter and a means and desire to evacuate if so ordered. In some cases, despite having access to technology (computer, radio, television, outdoor sirens, etc.) that allows for the reception of a warning, language differences are sometimes a barrier to individuals understanding them. Once warned of an impending significant coastal hazard event, seeking shelter in a substantial indoor structure, that is wind resistant and outside of storm surge zones, is recommended as the best protection against bodily harm.

The Northeast States Emergency Consortium (NESEC) completed several default hurricane Hazus-MH runs for RIEMA in December 2012 and include the 1938 hurricane, Hurricane Carol, Hurricane Donna, and Hurricane Irene (Figure 10). Results are shown in comparison with annualized loss in Table 15 . Individual county totals were not provided with the NESEC summary results. The 1938 hurricane simulation estimates over $2.3 trillion in total direct economic loss, with 3,800 displaced households and 1,000 people requiring short-term sheltering. Appendix 3*:Hazard Identification & Risk Assessment* includes the summary reports from NESEC.

Annualized loss estimates were also generated using Hazus-MH for the 2014 plan update to determine potential losses due to winds associated with tropical storm and hurricanes (Figure 11and Table 15). Total damages (adjusted for inflation) on an annualized basis exceeds $134 million statewide. Providence County is estimated to experience $63.8 million in hurricane related damages, the loss and vulnerability is equally spread among the municipalities in the County. Kent County also has a relatively uniform distribution of vulnerability and loss among municipalities, with Warwick experiencing the highest risk and loss in the County. Bristol County municipalities are all likely to experience $1 million in losses, by census block. As shown in Figure 11, shorelines communities such as South Kingstown and Narragansett in Washington County and Middletown and Jamestown in Newport are extremely vulnerable to hurricanes and have multiple census blocks with annualized losses estimated over $1.5 million. Appendix 3*: Hazard Identification & Risk Assessment* provides background information regarding Hazus-MH runs and also includes potential loss estimates. RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

Table 15. Hazus-MH simulation losses.
Values computed in current dollars using 2010 US Census data.

County	1938 Unnamed Hurricane	Hurricane Carol (1954)	Hurricane Donna (1960)	Hurricane Irene (2011)	Annualized Loss
Bristol	**$2,326 Million**	**$1,697 Million**	**$902 Million**	$1,947,728	$8,061,612
Kent				$5,358,576	$22,045,205
Newport				$1,722,993	$16,431,209
Providence				$15,732,279	$63,868,323
Washington				$6,422,545	$23,711,460
Total				**$31,184,122**	$134,117,809

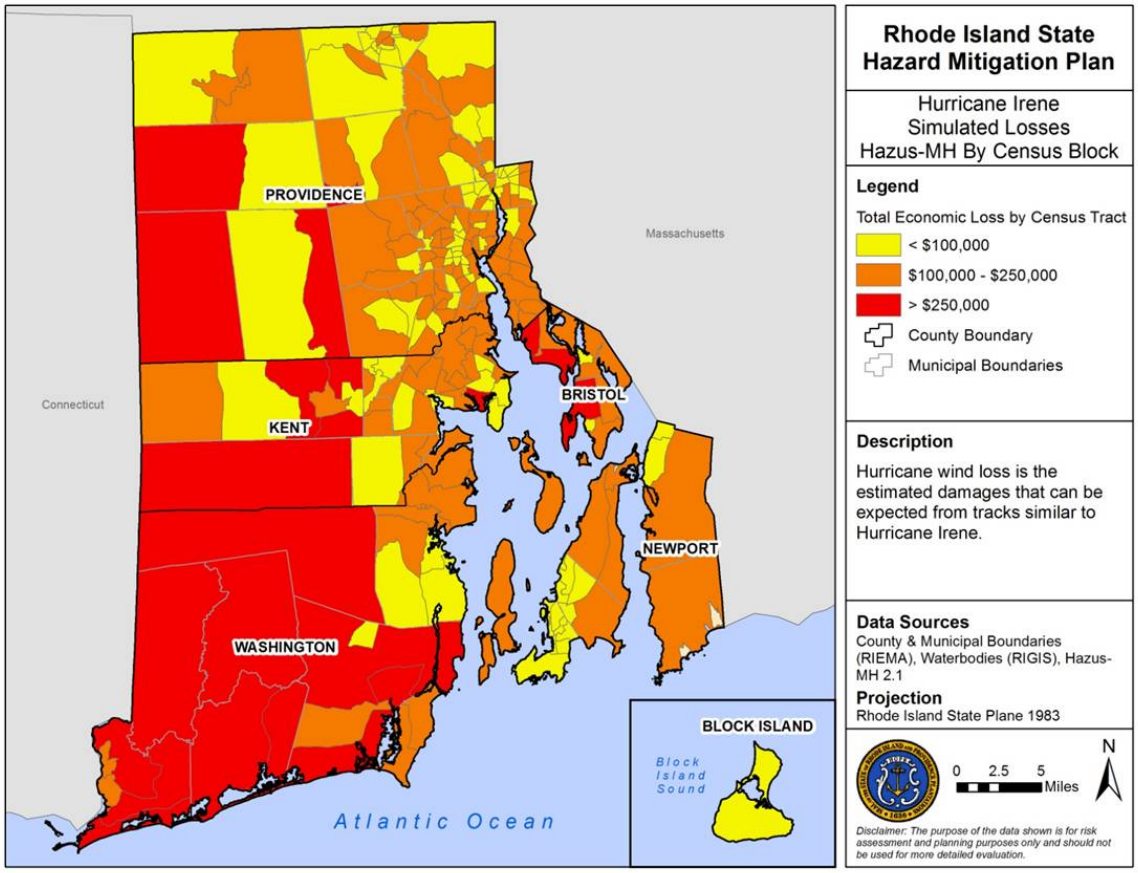


Figure 10. Hurricane Irene simulated Hazus-MH loss estimates.

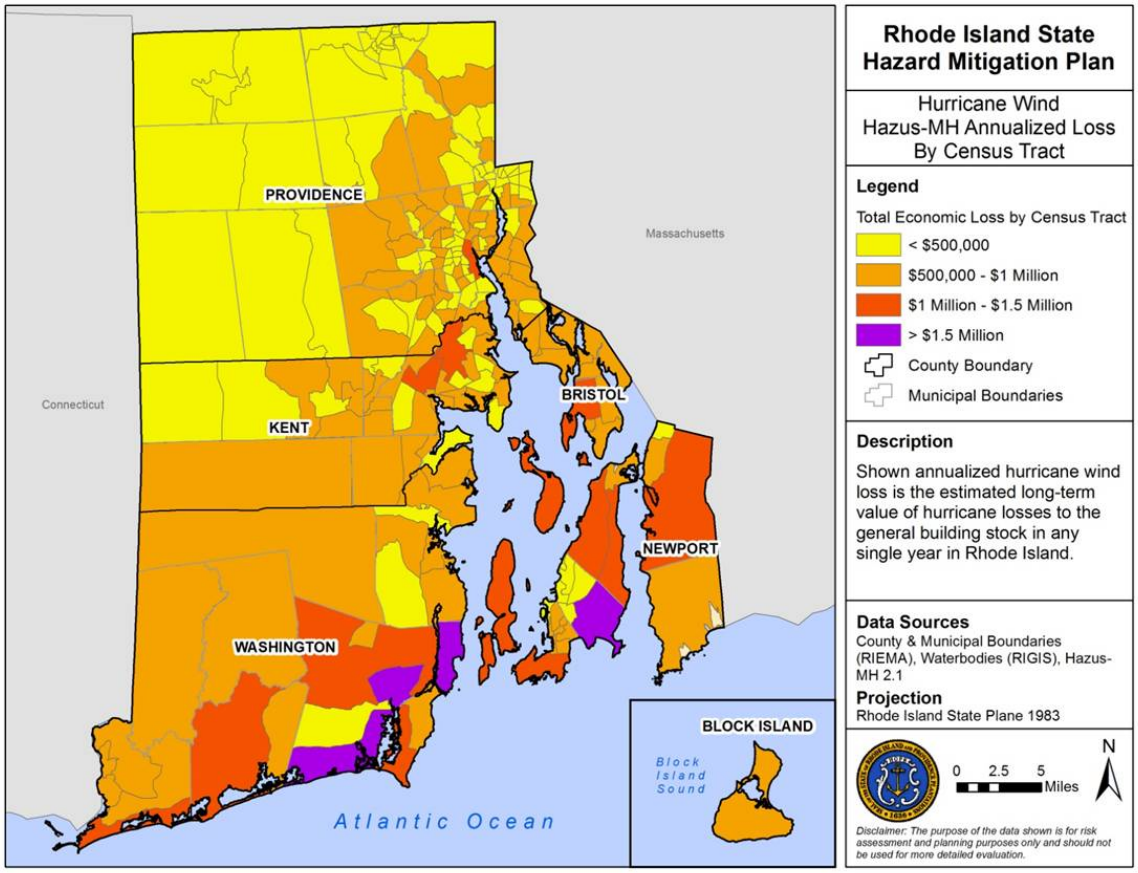


Figure 11. Hazus-MH annualized loss estimates by census tract.

3.6.2.5.1 Hazard Ranking

Quantitative risk assessment, to the degree possible, has been completed for hurricane using the methodology described in the Hazard Analysis and Ranking methodology section. Annualized events have been supplemented with NOAA National Hurricane Center (NHC) data using hurricane tracks within 50 miles of Rhode Island. Geographic extent is based on USACE 100-year wind speeds (Figure 6 and Figure 7). Figure 12 depicts the hurricane hazard ranking for Rhode Island. Based on the ranking parameters and extent of historical events and damages, the entire state is vulnerable to hurricane and coastal hazards, as also shown in the local plans.

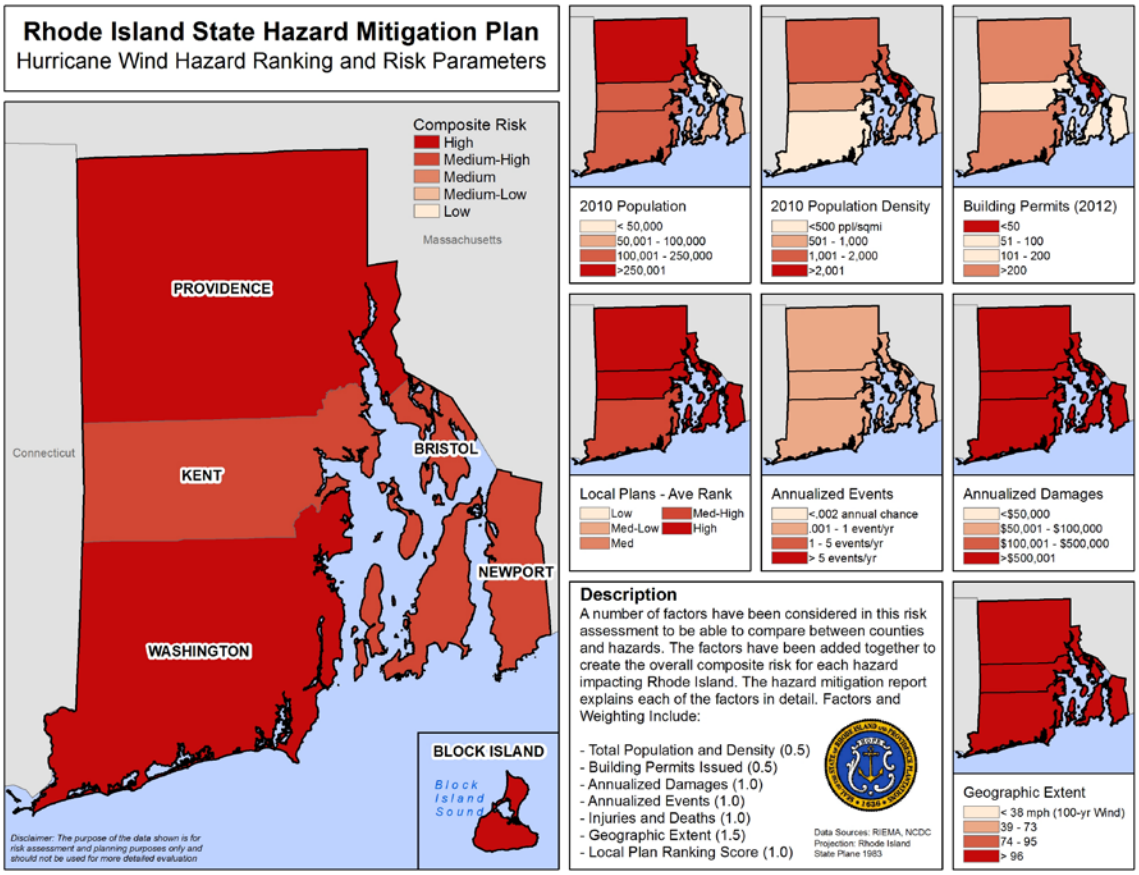


Figure 12. Hurricane wind NCDC relative ranking.

3.6.3 Tornadoes

3.6.3.1 Description

A tornado is a violently rotating column of air in contact with and extending between a cloud and the surface of the earth. Winds in most tornadoes are 100 MPH or less, but in the most violent, and least frequent tornadoes, wind speeds can exceed 250 MPH. Tornadoes, typically track along the ground for a few miles or less and are less than 100 yards wide, though some can remain in contact with the earth for well over fifty miles and exceed one (1) mile in width.

Several conditions are required for the development of tornadoes and the thunderstorm clouds with which most tornadoes are associated. Abundant low level moisture is necessary to contribute to the development of a thunderstorm, and a "trigger" (perhaps a cold front or other low level zone of converging winds) is needed to lift the moist air aloft. Once the air begins to rise and becomes saturated, it will continue rising to great heights

and produce a thunderstorm cloud, if the atmosphere is unstable. An unstable atmosphere is one where the temperature decreases rapidly with height.

Finally, tornadoes usually form in areas where winds at all levels of the atmosphere are not only strong, but also turning with height in a clockwise, or veering, direction.

Tornadoes can appear as a traditional funnel shape, or in a slender rope-like form. Some have a churning, smoky look to them, and others contain "multiple vortices" – small, individual tornadoes rotating around a common center. Others may be nearly invisible, with only swirling dust or debris at ground level as the only indication of the tornado's presence.

A tornado begins in a severe thunderstorm called a supercell. A supercell can last longer than a regular thunderstorm. The wind coming into the storm starts to swirl and forms a funnel. The air in the funnel spins faster and faster and creates a very low pressure area which sucks more air (and possibly objects) into it. The severe thunderstorms which produce tornadoes form where cold dry polar air meets warm moist tropical air. This is most common in a section of the United States called Tornado Alley.

Tornadoes can form any time during the year, but most form in May. The more north you go, the later the peak tornado season is. This is because it takes longer to warm the northern parts of the plains so tornadoes form later. Most tornadoes spin cyclonically but a few spin anti-cyclonically. Because there are records of anti-cyclonic tornadoes, scientists don't think that the Coriolis Effect causes the rotations.

The Fujita scale, introduced in 1971 by Dr. Ted Fujita, provided a way to characterize tornadoes based on the damage they produced and relating that damage to the fastest quarter-mile wind at the height of a damaged structure. An Enhanced Fujita scale became operational in 2007 and improves upon the original scale by including more damage indicators, taking into account construction quality and variability, and providing a more definitive correlation between damage and wind speed (Table 16).

Table 16. Fujita Scale and Enhanced Fujita Scale.

Fujita Scale			Enhanced Fujita Scale	
F Number	Fastest 1/4-mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165

Fujita Scale			Enhanced Fujita Scale	
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

The Storm Prediction Center issues tornado and severe thunderstorm watches. A tornado watch defines an area shaped like a parallelogram, where tornadoes and other kinds of severe weather are possible in the next several hours. A tornado watch does not indicate an imminent tornado; rather, a tornado watch is an advisory for citizens to be alert and prepared to go to safe shelter if tornadoes do develop or if a tornado warning is issued.

Local NWS offices are responsible for issuing tornado warnings. Tornado warnings indicate that a tornado has been spotted, or that Doppler radar detects a thunderstorm circulation capable of spawning a tornado.

Nationally, the tornado season lasts from March to August, with peak tornado activity normally occurring in April, May, and June. The highest concentrations of tornadoes have been in the Central U.S. and portions of the Gulf Coast states.

3.6.3.2 Location

Rhode Island does not fall into Tornado Alley; however, tornadoes do occur. While tornadoes do not occur frequently, they may occur anytime and anywhere in Rhode Island (and the rest of New England). This situation may be more dangerous than states in Tornado Alley because Rhode Island residents do not expect severe tornadoes and are ill-prepared to respond to a tornado strike.

Tornadoes are considered to be low frequency, high-impact events. All areas of Rhode Island face nearly uniform susceptibility to tornadoes.

3.6.3.3 Extent (Impact and Vulnerability)

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.

Human vulnerability is based on the availability, reception and understanding of early warnings of tornadoes (i.e. Tornado Warning issued by the NWS) and access to substantial shelter. In some cases, despite having access to technology (computer, radio, television, outdoor sirens, etc.) that allows for the reception of a warning, language differences are sometimes a barrier to full understanding of the risk. Once warned of an impending tornado hazard, seeking shelter indoors on the lowest floor of a substantial building away from windows is recommended as the best protection against bodily harm. Table 17 provides a breakdown of injuries and fatalities by county that are the result of tornadoes between 1950 and December 2012.

3.6.3.4 Previous Occurrences, Disasters, and Probability of Future Events

Table 17 was derived from the NOAA NCDC. Rhode Island has had 20 tornadoes since 1950 with property damages amounting to $7.28 million. No fatalities were incurred, however there were 20 injuries reported. Figure 13 shows the locations of tornadoes in and around Rhode Island. The F-2 in Providence County that resulted in over $5.2 million in damages is shown on the southeastern portion of the county.

Table 17. NCDC Historic Tornadoes (1950 – 2012).

Event Date	County	Length	Width	F-Scale	Fatalities	Injuries	Property Damages (2012 dollars)
9/14/1972	Bristol	2	33	0	0	0	$0
8/26/1985	Providence	1	100	1	0	0	$0
8/7/1986	Providence	0.5	100	1	0	0	$523,707
8/7/1986	Providence	4	1000	2	0	20	$5,237,067
8/8/1986	Providence	6	1000	1	0	0	$523,707
9/23/1989	Providence	0.2	40	0	0	3	$462,889
10/18/1990	Kent	4.5	73	1	0	0	$439,160
8/13/1994	Kent	0.5	50	0	0	0	$0
8/4/1995	Washington	0	0		0	0	$0
7/13/1996	Washington	0	0		0	0	$0
8/29/1997	Newport	0	0		0	0	$0
8/6/1997	Newport	0	0		0	0	$0
8/20/1997	Kent	0	0		0	0	$0
8/20/1997	Providence	0	0		0	0	$0
8/20/1997	Providence	0	0		0	0	$0

Event Date	County	Length	Width	F-Scale	Fatalities	Injuries	Property Damages (2012 dollars)
8/20/1997	Providence	0	0		0	0	$0
8/16/2000	Providence	0.2	15	0	0	0	$0
8/7/2004	Kent	0	0		0	0	$0
7/23/2008	Bristol	3	40	1	0	0	$47,987
8/10/2012	Washington	4	20	0	0	0	$50,000

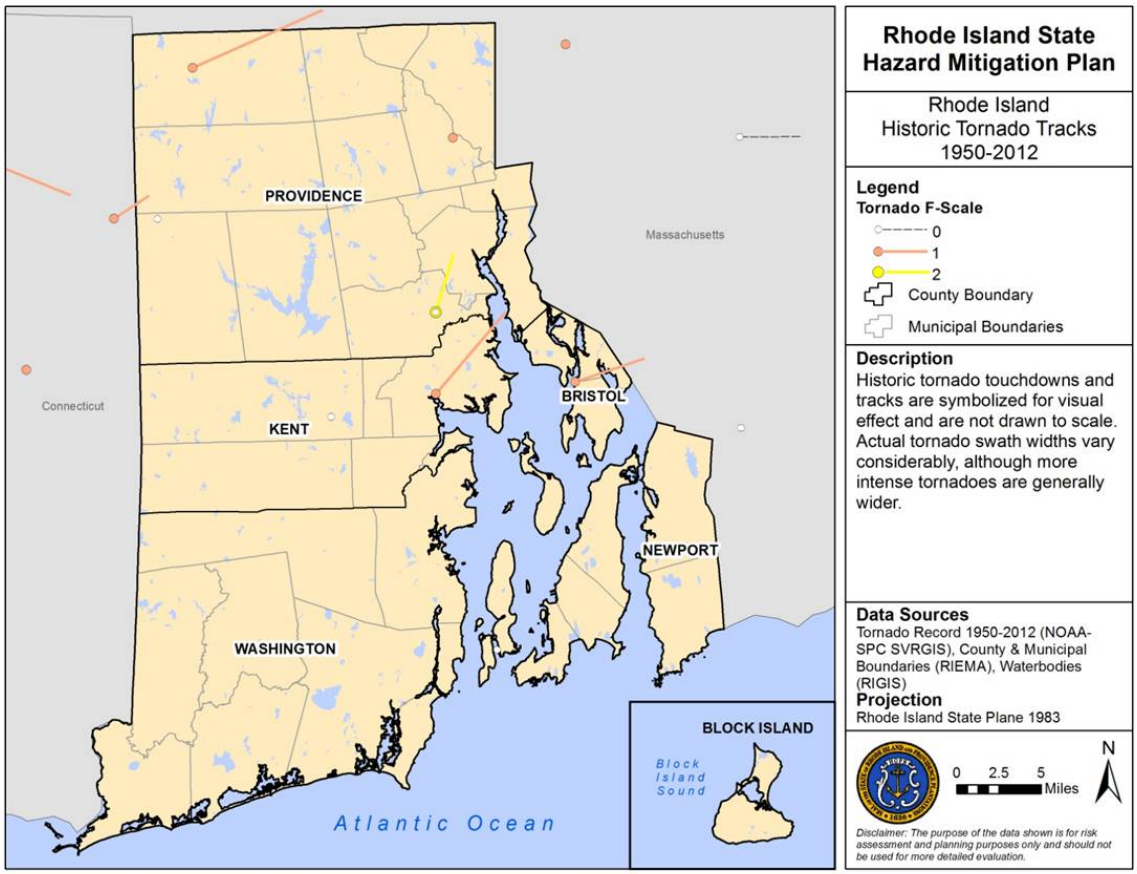


Figure 13. Tornado touchdowns and tracks (1950 – 2012). Source: NOAA NWS NCDC.

Incidence of tornadoes in Rhode Island is relatively infrequent, particularly when compared to states in the Plains and Midwest that can average hundreds of occurrences annually. Tornadoes have occurred in Rhode Island in the past and will likely occur in the future.

Based on historical frequency of occurrence using NCDC data, a reasonable determination of probability of future tornado events can be made. Although relatively infrequent, tornadoes have had significant impacts on Rhode Island in the past and are likely to impact the state in the future. An examination of NCDC data suggests that on an annual basis, approximately 0.03 to 0.14 tornadoes occur in any particular Rhode Island county. As a whole. Rhode Island may experience a tornado every three (3) years, or 31.7 percent annually which can be related to a Medium-Low probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 14 includes the probability of future events by county.

A tornado may happen anywhere in Rhode Island given the right climatic conditions. Based on past events, as depicted in the above map, it appears that the areas at greatest risk for touchdowns run from north-western to north-eastern northern Rhode Island.

3.6.3.5 Vulnerability & Risk Assessment

Tornadoes are high-impact, low-probability hazards whose effect is dependent on its intensity and the vulnerability of development in its path. Tornado vulnerability is based on building construction and standards, the availability of shelters or safe rooms, and advanced warning capabilities. Even well-constructed buildings are vulnerable to the effects of a stronger (generally EF-2 or higher) tornado. Due to the relatively low incidence and risk for tornado, traditional “Tornado Alley” mitigation methods such as tornado safe rooms may not be economically feasible in Rhode Island to appear in the NCDC database.

Table 18 summarizes the NCDC storm events from 1950 to present. Twenty tornadoes have touched down in Rhode Island, with almost half impacting Providence County. Burrillville, Lincoln, Glocester, and Cranston have experienced past tornado events and are considered to be vulnerable to future events and damages. The majority of the damages ($6.7 million) has occurred within these municipalities and is estimated to experience $107,101 in damages on any given year due to tornadoes. Warren and Bristol within Bristol County and Warwick in Kent County have experienced past events and are vulnerable to future tornado events and damages. It should be noted that the entire state population is considered uniformly vulnerable to tornadoes. The type and age of construction plays a role in vulnerability of facilities to tornadoes. In general, concrete, brick and steel-framed structures tend to fare better in tornadoes than older, wood-framed structures.

As evidence in property loss figures (Table 18) obtained from NCDC, tornadoes have the potential to be very destructive. The NCDC estimates are believed to be an underrepresentation of the actual losses experienced due to hazards as losses from

events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database.

Table 18. Tornado NCDC storm events.

County Name	Number of Events	Total Damages	Annualized Damages
Years of Record	1950- 2012		
Bristol	2	$47,987	$762
Kent	4	$439,160	$6,971
Newport	2	$0	$0
Providence	9	$6,747,369	$107,101
Washington	3	$50,000	$794
Statewide	**20**	**$7,284,516**	**$115,627**

A high tornado ranking has been determined for Providence County based on the Hazard Assessment and Ranking Methodology previously discussed. There are approximately 2,487 facilities located within Rhode Island that are equally at risk and vulnerable to tornadoes. Building and contents value were not available for the facilities and as a result, no loss estimation was calculated for tornadoes. It should be noted that the majority of facilities do not have redundant power sources and may not even be wired to accept a generator. RIEMA is currently updating the facilities information with building value and generator information. Future state mitigation plan updates should consider closer examination of critical facilities risk by looking at construction type of facilities in jurisdictions considered to be at higher risk of tornadoes.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

3.6.3.5.1 Hazard Ranking

Quantitative risk assessment, to the degree possible, has been completed for tornadoes using the methodology described in the Hazard Analysis and Ranking methodology section. Geographic extent is represented by the number of tornado touchdowns per square mile. Based on the available data, Providence County has been determined to have a high tornado ranking followed by Kent and Bristol counties. Figure 14 depicts the tornado hazard ranking for Rhode Island.

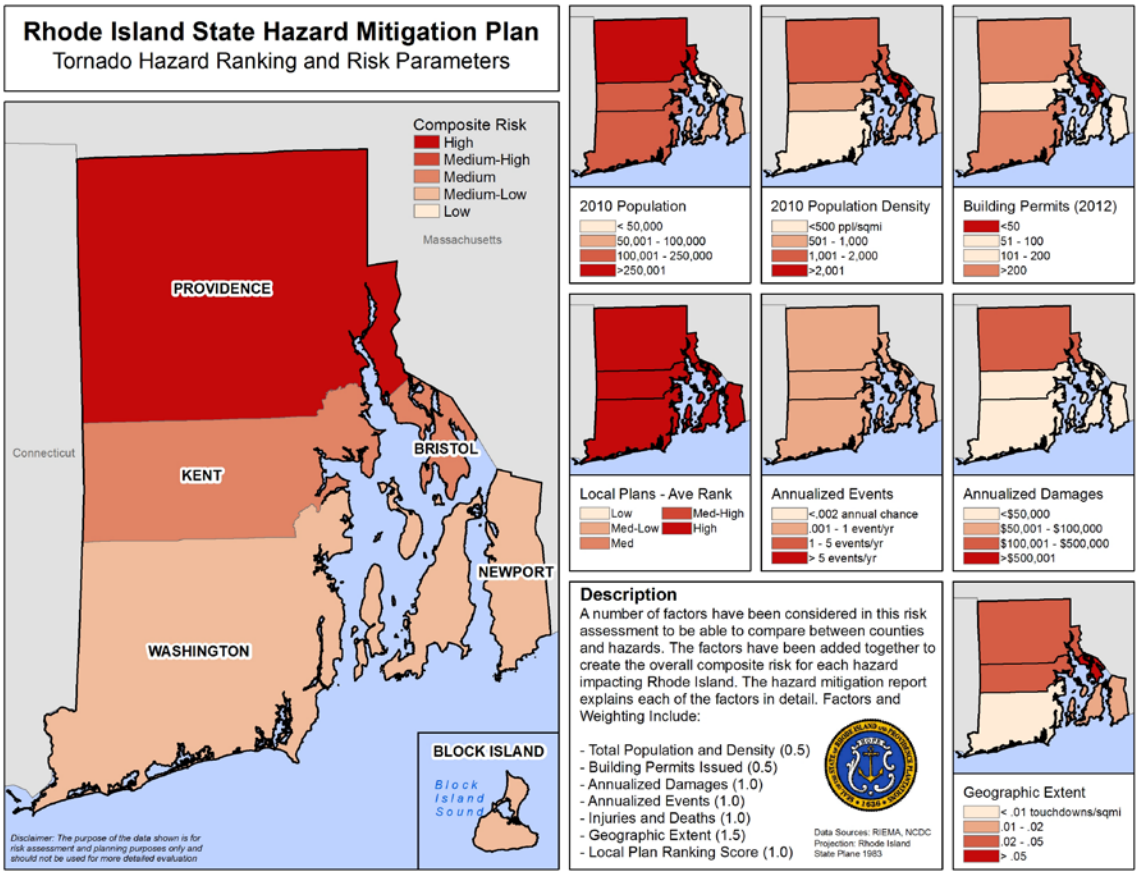


Figure 14. Tornado NCDC relative ranking.

3.6.4 High Wind and Thunderstorms

3.6.4.1 Description

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. The NWS classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 MPH or greater, or a tornado. About 10 percent of the estimated 100,000 annual thunderstorms that occur nationwide are considered severe.[16] 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.

[16] National Oceanic and Atmospheric Administration, http://www.nws.noaa.gov/om/severeweather/resources/ttl6-10.pdf.

Wind is the motion of air past a given point caused by a difference in pressure from one place to another. Severe wind poses a threat to Rhode Island in many forms, including that produced by severe thunderstorms and tropical weather systems. The effects can include blowing debris, interruptions in elevated power and communications utilities and intensified effects of winter weather. Harm to people and animals as well as damage to property and infrastructure may be the result. Two (2) basic types of damaging wind events other than tropical systems affect Rhode Island: synoptic-scale winds and thunderstorm winds. Synoptic-scale winds are high winds that occur typically with cold frontal passages or Nor'easters. When thunderstorm winds exceed 58 MPH, the thunderstorm is considered severe and a warning is issued. "Downbursts" cause the high winds in a thunderstorm. Downburst winds result from the sudden descent of cool or cold air toward the ground. As the air hits the ground, it spreads outward, creating high winds. Unlike tornadoes, downburst winds move in a straight line, without rotation. The term "microburst" refers to a small downburst with damaging winds up to 168 MPH and less than 2.5 miles in length. The term "macroburst" refers to a large downburst that can extend greater than 2.5 miles with winds up to 134 MPH and can last five (5) to 30 minutes.

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. Lightning strike victims often suffer long-term effects such as memory loss, sleep disorders, weakness and fatigue, chronic pain, depression and muscle spasms. Lightning has the potential to start both house fires and wildfires. Lightning causes an average of 55-60 fatalities, 400 injuries, and over $1 billion in insured losses annually nationwide.

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.[17] 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. Hail causes about $1 billion in damages annually in the U.S.

3.6.4.2 Location

All areas of Rhode Island are vulnerable to severe thunderstorms and winds, especially those along the Atlantic coast in Washington and Newport counties, and those areas

[17] University Corporation for Atmospheric Research, http://www.ucar.edu/communications/factsheets/Hail.html.

located on Narragansett Bay. Figure 7 highlights the three wind speed zones in Rhode Island.

3.6.4.3 Extent (Impact and Vulnerability)

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.[18] 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.

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.

Human vulnerability is largely determined by the availability and reception of early warnings for the approach of severe storms, and by the availability of nearby shelter. Individuals who immediately seek shelter in a sturdy building or metal-roofed vehicle are much safer than those who remain outdoors. Early warnings of severe storms are also vital for aircraft flying through the area.

3.6.4.4 Previous Occurrences and Probability of Future Events

Rhode Island is not known for experiencing the same frequency of severe thunderstorms as the Midwest and Southeast, but the state has observed a number of very destructive wind, hail and lightning events over the years. The NCDC has recorded 151 significant (those causing injury, fatalities, and/or damage) lightning and hail events and 344 high wind events; and these events have caused more than $15.5 million in total damages. One (1) death as a result of lightning was recorded on August 11, 2004 in Washington County. Eleven additional injuries have been recorded since 1956 due to lightning. Some of the most significant wind and lightning events in the state's history are listed in Table 19. Hail and wind events are shown in Figure 15.

[18] Hasbrouck, P.E. *Determining the Probability of Lightning Striking a Facility*, National Lightning Safety Institute, http://lightningsafety.com/nlsi_lhm/prbshort.html (April 2004).

Table 19. Significant NCDC hail, lightning, and wind events.

Date	HIRA Type	County	Property Damage (Inflated to 2012 dollars)
12/23/1994	Wind	Statewide	$7,746,053
8/5/1994	Lightning	Providence	$774,605
8/24/1996	Wind	Washington	$1,097,481
6/22/1997	Lightning	Kent	$357,621
6/17/2001	Lightning	Providence	$194,460
8/21/2004	Wind	Providence	$607,710
10/28/2006	Wind	Kent	$170,828
6/9/2011	Wind	Providence	$255,173
6/25/2012	Lightning	Providence	$150,000

Since strong winds occur during a variety of meteorological events such as thunderstorms, it is difficult to determine the probability of future occurrences with any degree of accuracy. Historically, wind events have occurred throughout the state as shown in Figure 15, with Providence and Kent counties experiencing the greatest number of events.

Based on historical frequency of occurrence using NCDC data, a reasonable determination of probability of future severe wind events can be made. An examination of NCDC data suggests that on an annual basis, approximately one (1) to four (4) wind events occur in any particular Rhode Island county. As a whole, Rhode Island may experience upwards of 12 events per year which can be related to a High probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 16 includes the probability of future events by county.

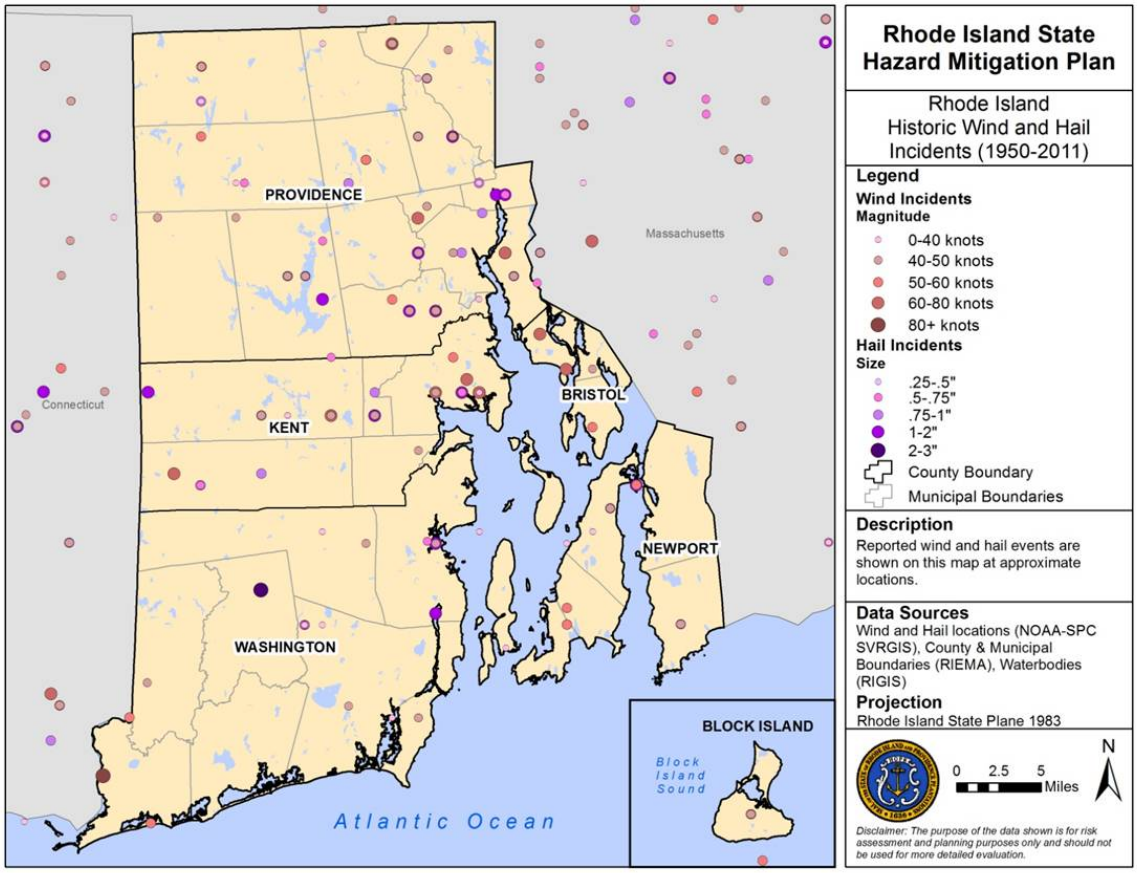


Figure 15. Rhode Island Historic Wind and Hail Incidents (1950-2011)

3.6.4.5 Vulnerability & Risk Assessment

The impact of wind can be measured in financial terms as well as fatalities and injuries. An examination of NCDC data shows that wind contributed to at least 20 injuries. Wind vulnerability is based in large part on building construction and standards. Other factors, such as location, condition, and maintenance of trees also plays a significant role in determining vulnerability.

As seen in Table 20, property damages between 1956 and 2012, wind, lightning and hail events can be very costly. Annualized damages range from $22,824 in Bristol County to $76,784 in Providence County. Within Providence County, Scituate and Pawtucket have experienced multiple hail and wind events of increased size and magnitude, followed by Cranston and Providence. Richmond in Washington County is vulnerable to large hail events and may see $45,343 in annualized damages due to wind related events. As previously described, the NCDC loss estimates are only available at the county level and are believed to be an underrepresentation of the actual losses experienced due to

hazards as losses from events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database; this is especially true with crop damages.

Table 20. Severe wind NCDC events.

County	Number of Events	Total Damages	Annualized Damages
Years of Record	1956- 2012		
Bristol	75	$1,346,641	$22,824
Kent	178	$3,100,402	$52,549
Newport	111	$1,540,188	$26,105
Providence	223	$4,530,261	$76,784
Washington	115	$2,675,225	$45,343
Statewide	344	$13,192,717	$223,605

All facilities within Rhode Island are considered evenly vulnerable to thunderstorms. The location and construction of a facility plays a role in how it will be affected by lightning and hail incidents. If a structure is located on a hilltop, is tall or has other tall structures around it, or has large exposed windows, it may be damaged during a storm. Communications and power supplies may be compromised during thunderstorms, and some critical facilities might not be equipped with a backup power source. As the facilities datasets are expanded to include construction and value information, analysis to thunderstorms should be reconsidered.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

3.6.4.5.1 Hazard Ranking

Based on the available data, Providence County has been determined to have a high thunderstorm ranking followed by Newport County. This ranking was accomplished using the methodology previously detailed. Figure 21 the thunderstorm hazard ranking for Rhode Island. Population data, building permits, past events and local plan rankings factored into Providence and Newport counties having a slightly higher risk than the rest of the state.

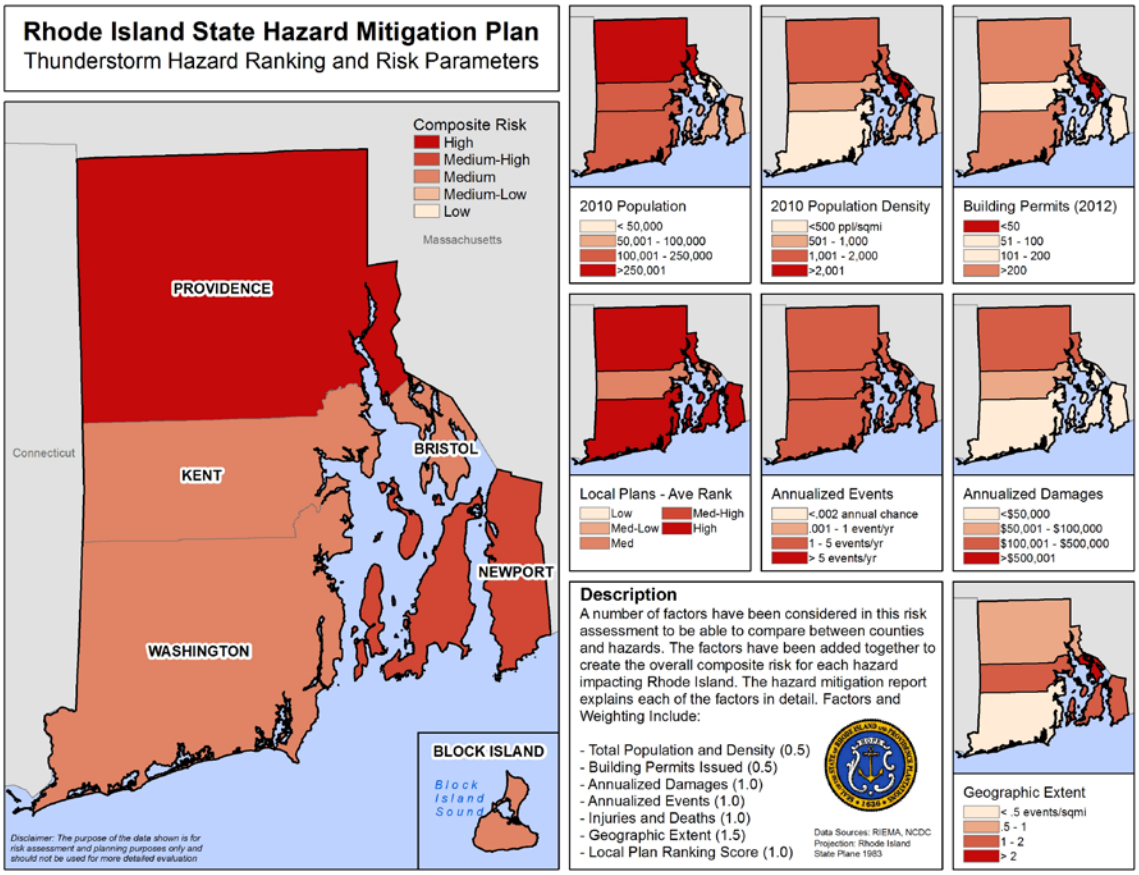


Figure 16. Thunderstorm NCDC hazard ranking.

3.6.5 Winter Related Hazards

3.6.5.1 Description

Winter weather includes heavy snows, ice, and extreme cold and can affect the entire State. A heavy snow is generally defined as having more than eight (8) inches of accumulation in less than 24 hours. Heavy snow can bring a community to a standstill by inhibiting transportation, knocking down trees and utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant and surpass annual municipal salt and snow removal budgets, often before the end of the season. A winter storm warning is issued when snowfall is expected to accumulate more than four (4) inches in 12 hours and/or a quarter inch or more of freezing rain accumulation.

The term “ice storm” is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain, which is rain that becomes super-cooled and freezes upon impact with cold

surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. If extreme cold conditions are combined with low/no snow cover, the cold can better penetrate downward through the ground and potentially create problems for underground infrastructure as well. When utilities are affected and heaters do not work, water and sewer pipes can freeze and even rupture.

Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold can lead to hypothermia and frostbite, which are both serious medical conditions. What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Rhode Island, extreme cold usually involves temperatures below zero degrees Fahrenheit.

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five (5) degrees below zero (0), even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.

3.6.5.2 Location

Average annual snowfall based on extrapolation of weather station snow climatology data is shown in Figure 17. Although somewhat more variable in terms of distribution, northwest portions of Providence and Kent counties see these heavy snowfall events with greater frequency (roughly five (5) -six (6) events years) compared to Bristol, Newport, and Washington that tend to have less than two (2) significant events per year.

Heavy snow can affect the entire State of Rhode Island but the highest amounts occur in the northern and northwestern areas of the State as shown in Figure 17.

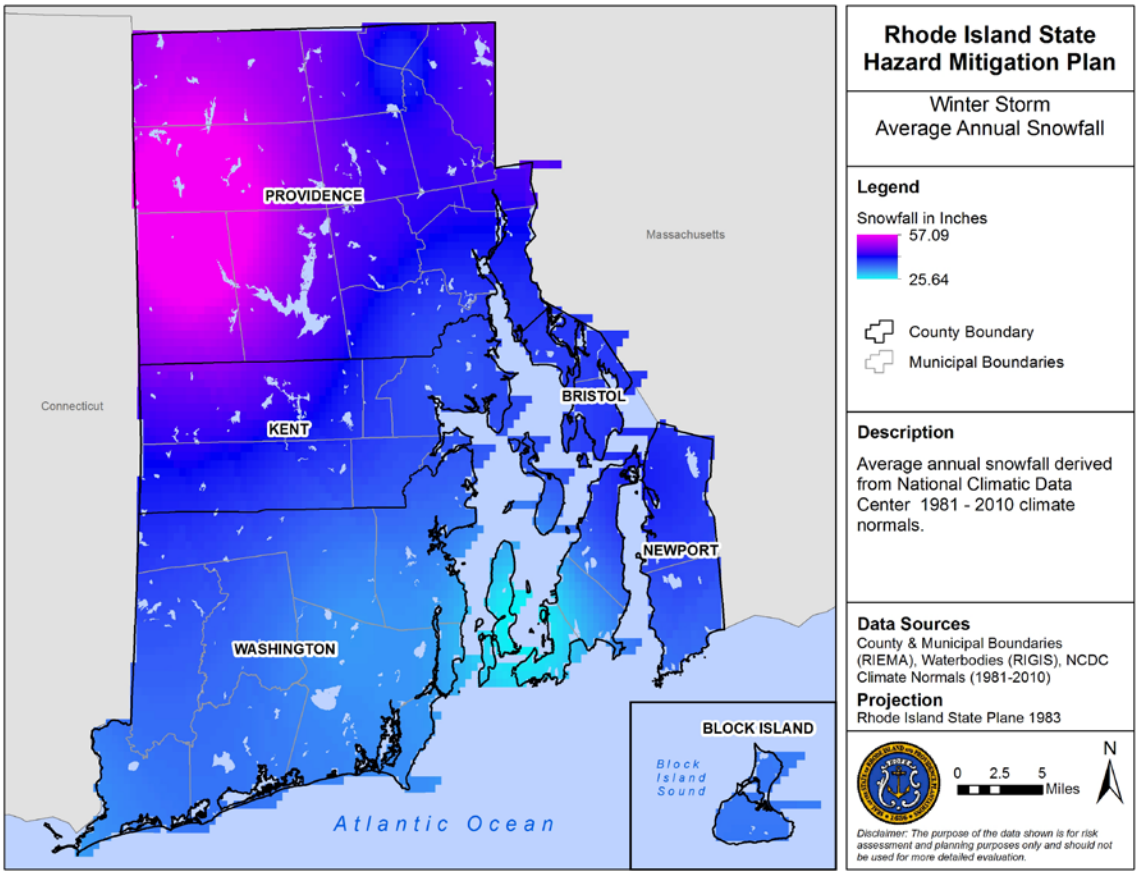


Figure 17. Rhode Island Winter Storm Average Annual Snowfall

3.6.5.3 Extent (Impact and Vulnerability)

The impact of a winter storm is primarily measured in terms of the financial costs associated with preparing for, responding to, and recovering from the event. Modeling the relationship between actual financial impact and winter storm magnitude is difficult. The NCDC data set provides estimates of property damage from many of the significant events in the period of record that begins 1993. Though the data is not necessarily complete or entirely consistent in its reporting from event to event, it provides a basis for meaningful initial analysis.

3.6.5.3.1 Snow

Heavy snow can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. A quick thaw after a heavy snow can cause substantial flooding, especially along small streams and in urban areas. The cost of snow removal, repairing damages, and the

loss of business caused by power outages can have severe economic impacts on cities and towns. Injuries and deaths related to heavy snow usually occur as a result of vehicle accidents. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

3.6.5.3.2 Ice Storms

Ice storms can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power and communication system outages, personal injury and death. Moreover, they can hinder the delivery of emergency services needed in response to these catastrophes and endanger the responders. Ice storms accompanied by wind gusts cause the most damage.

The greatest threat from ice storms is to essential utility and transportation systems, also known as lifelines. It coats power and communications lines, trees, highways, bridges and other paved surfaces. Ice-weighted wires, antennae, and structures holding them can break and collapse. Downed trees and limbs can also damage lines and block transportation routes. Both pedestrians and automobiles are at risk.

3.6.5.3.3 Extreme cold

The greatest danger from extreme cold is to people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold. Infants and elderly people are most susceptible. Certain medications, medical conditions or the consumption of alcohol can also make people more susceptible to the cold. House fires and carbon monoxide poisoning are also possible as people use supplemental heating devices.

3.6.5.4 Previous Occurrences, Disasters, and Probability of Future Events

In Rhode Island there is no single database or repository of consistent, detailed descriptions of the types of ongoing “normal” winter hazards that occur. Detailed information only exists for the unusual events which cause an exceptional amount of hardship (i.e. snow and ice removal), threats to public safety, and major damage to public and private property, such as the Blizzard of 1978, the 1991 Halloween Storm, the 2003 President’s Day Storm, and the 2005 Blizzard.

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. Reports indicated that this storm stretched from New Jersey to Maine and into Canada. More than two (2) 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: “Nearly all of Bristol

County and most of Newport County were in the dark, as were many homes in communities along the southern coast and surrounding Providence."

According to the NCDC there have been 109 winter weather related events in Rhode Island between 1993 and 2012. Table 21 further breaks out the number of events by county and damages recorded. The NCDC estimates are believed to be an underrepresentation of the actual losses experienced due to hazards as losses from events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database.

Winter weather events in Rhode Island can be described as unpredictable. Days of frigid, arctic air and below freezing temperatures may be followed by days of mild temperatures in the 40s or 50s. Snowfall and rainfall vary; however, Rhode Island residents can expect to experience several nor'easters, which usually bring coastal erosion and a possibility for blizzard conditions or heavy rainstorms dependent on the temperature.

Based on past history and climatic conditions, there is a great probability that winter hazards will continue to occur and impact RI. Winter-related hazards affect the entire State to varying degrees. Using NCDC data, a reasonable determination of probability of future winter storm events can be made. Winter storms have had significant impacts on Rhode Island in the past and are likely to impact the State in the future. An examination of NCDC data suggests that on an annual basis, approximately two (2) to six (6) winter weather events of some significance occur in any particular county (Table 21) which can be related to a Medium-High to High probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 18 includes the probability of future events by county.

Table 21. NCDC winter weather storm events. Source: NWS NCDC 1993-2012.

County	Number of Events	Annualized Events	Total Damages	Annualized Damages
Years of Record	1956- 2012			
Bristol	38	1.9	$209,937	$10,497
Kent	111	5.55	$7,340,679	$367,034
Newport	36	1.8	$497,214	$24,861
Providence	139	6.95	$7,749,765	$387,488
Washington	43	2.15	$364,375	$18,219
Statewide	**109**	**5.45**	**$16,161,970**	**$808,098**

3.6.5.5 Vulnerability & Risk Assessment

In general, the northwestern areas of Rhode Island experience winter weather of significance with greater frequency than the rest of the state. Electrical utilities and communications as well as transportation infrastructure are vulnerable to damages from winter storms. 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 have been known to spark fires. Respondents to the 2014 plan update public survey noted that the Oak Hill neighborhood in the City of Pawtucket Providence County have difficulties with snow removal during and after heavy snows and blizzards.

Based on NCDC data, Rhode Island can expect approximately six (6) events and damages upward of $808,098 annually in winter weather related damages (Table 21). This estimated loss does not take into account snow removal costs. Providence County will likely see annual snowfall totals over 57inches; impacts and vulnerability are greatest in western Glocester and northern Foster communities. Burrillville and Scituate also have an elevated risk and associated damages. The majority of the $387,488 in annualized damages for Providence will be located within these four municipalities.

The current facilities dataset does not contain attribute information to accurately quantify facility vulnerability due to winter weather. Facility data necessary for vulnerability assessment would include, but not limited to, roof type, building construction type, building and contents values, and use. For example, type of roof would help to determine whether or not it is a flat roof and therefore more susceptible to heavy snow loads). To address the vulnerability of infrastructure to the impacts of ice storms, it would be important to complete an inventory of utility lines as they are very susceptible to breakage when ice forms on the lines, and this of course results in power failure. It would also be important to describe this potential impact in terms of the direct impact (such as a power failure) on Rhode Island's economy. RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

Transportation structures are at great risk from winter storms. In addition, building construction type, particularly roof span and construction methods, support the capacity of a building to withstand severe stress weights from snow. Finally, State and critical facilities often do not have redundant power sources and are not even wired to accept a generator for auxiliary heat.Winter storms, ice storms and extreme cold can adversely affect people, some more than others. Infants and those persons 65 years of age or more are especially vulnerable. General observations by NOAA indicate that in winter deaths related to exposure to cold: 50% were over 60 years old, over 75% were male and about 20% occur in the home. Of winter deaths related to ice and snow: about 70% occur in automobiles,

25% of the people were caught out in the storm and the majority was males over 40 years old (heart attacks from snow shoveling).

Human vulnerability is based on the availability, reception and understanding of advanced warnings of impending significant winter weather events (i.e. Winter Storm Watches and Warnings issued by the NWS) and heeding the advice of local officials. In some cases, despite having access to technology (computer, radio, television, etc.) that allows for the reception of a watch or warning, language differences are sometimes a barrier to individuals understanding and responding to them.

3.6.5.5.1 Hazard Ranking

Based on the available data, Providence and Kent counties have been determined to have a high winter storm ranking. (Figure 18) Local plan rankings further support the ranking designation. This ranking was accomplished using the methodology described in the Hazard Analysis and Ranking Methodology section.

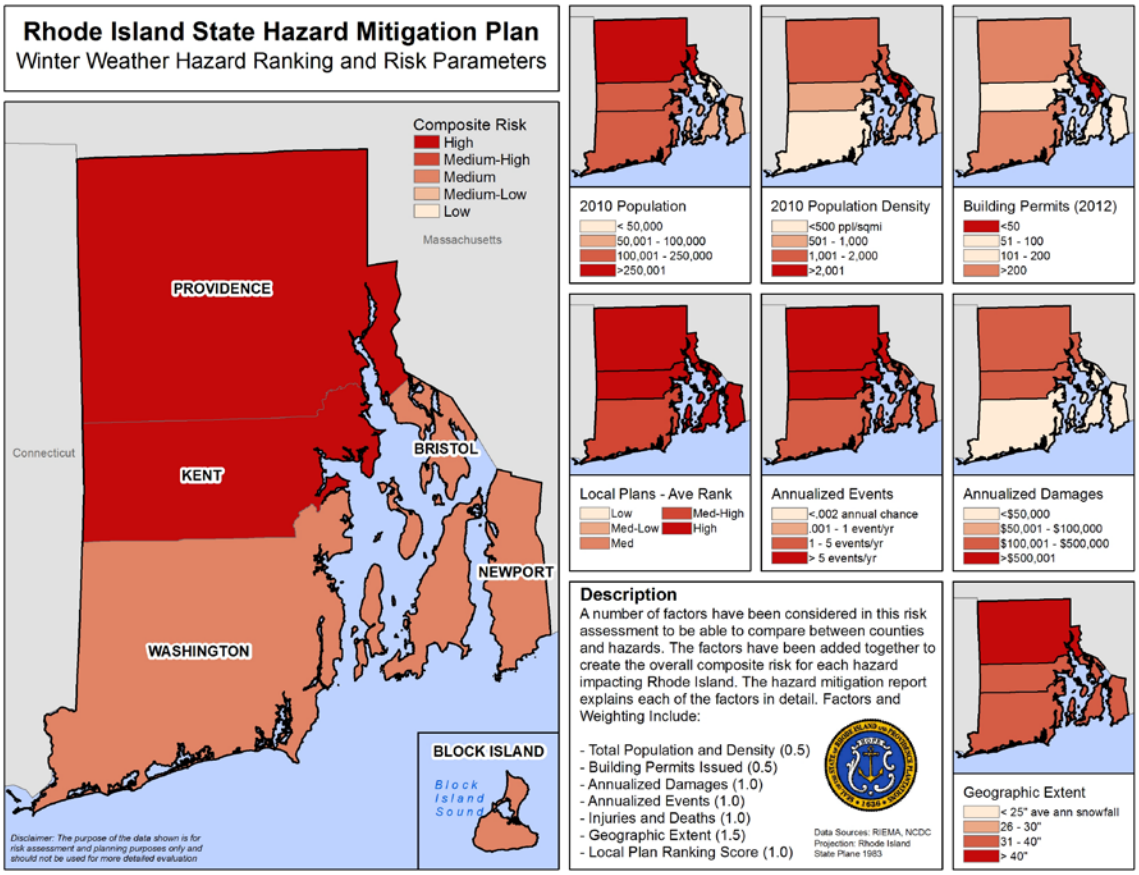


Figure 18. NCDC winter weather hazard ranking.

3.6.6 Flood Related Hazards

The 2014 plan update consolidates several sections into one section to fully detail the vulnerability and risk due to flood related hazards. This section includes descriptions, locations, extents, historical occurrences, probability of future events and vulnerabilities for flooding related to riverine, flash, urban/stormwater, and coastal. In addition to the flooding types previously discussed, storm surge, SLR, coastal erosion and dam breach are also profiled in detail within this section as flood-related hazards.

Flooding is a localized hazard that is generally the result of excessive precipitation. Flooding is the most commonly occurring natural hazard, due to the widespread geographical distribution of river valleys and coastal areas, and the attraction of human settlements to these areas. Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss.

3.6.7 Flood

3.6.7.1 Description

A flood, which can be slow or fast rising but generally develops over a period of days, is defined by the NFIP as:

- A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from: overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or a mudflow; or
- The collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

By their very nature, floodplains are the low, flat, periodically flooded lands adjacent to rivers, lakes and oceans and subject to geo-morphic (land-shaping) and hydrologic (water flow) processes. It is only during and after major flood events that the connections between a river and its floodplain become more apparent. These areas form a complex physical and biological system that not only supports a variety of natural resources but also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater. When a river is divorced from its floodplain with levees and other flood control structures then natural benefits are either lost, altered, or significantly reduced.

3.6.7.1.1 Riverine Flooding

Riverine flooding is a function of precipitation levels (both rain and snow) and water runoff volumes within the stream or river. Riverine flooding is defined as the periodic occurrence of over bank flows of rivers or streams resulting in partial or complete inundation of the adjacent floodplain. The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude to an equal or larger flood. Flood magnitude increases with increasing recurrence interval. When land next to or within the floodplain is developed, these cyclical floods can become costly and dangerous events.

3.6.7.1.2 Flash Flooding

A flash flood is the fastest-moving type of flood. It happens when heavy rain collect in a stream or gully, turning the normally calm area into an instant rushing current. Any flood involves water rising and overflowing its normal path. A flash flood is a specific type of flood that appears and moves quickly across the land, with little warning making it very dangerous.

Flash floods are the result of heavy rainfall concentrated over one area. Most flash flooding is caused by slow-moving thunderstorms, thunderstorms that repeatedly move over the same area, or heavy rains from hurricanes and tropical storms. Dam failures can create the most damaging flash flood events. When a dam or levee breaks, a large quantity of water is suddenly let loose downstream, destroying anything in its path.

Flash flood waters move at very fast speeds. They have the power to move boulders, tear out trees, destroy buildings, and obliterate bridges. Walls of water can reach heights of 10’ to 20’, and generally carry a huge amount of debris with them. The best response to any signs of flash flooding is to move immediately and quickly to higher ground.

3.6.7.1.3 Urban/Stormwater Flooding

Urban flooding occurs where there has been development within stream floodplains. This is partly a result of the use of waterways for transportation purposes in earlier times. Sites adjacent to rivers and coastal inlets provided convenient places to ship and receive commodities. Floodways and wetlands which are the natural storage basins for flood waters were filled to accommodate development. The price of this accessibility to the rivers was increased flooding of the ensuing urban areas. Urbanization increases the magnitude and frequency of floods by increasing impermeable surfaces, increasing the speed of drainage collection, reducing the carrying capacity of the land and, occasionally, overwhelming sewer systems. The most common result from these areas flooding is due to poor or insufficient storm water drainage, high groundwater levels, and high percentage of impervious surfaces which prevent groundwater recharge. More often than not, when heavy rains occur, Rhode Island’s aging sewer systems (or combined sewer overflows –

CSOs) are overrun and this results in raw sewage flowing into Narragansett Bay, often creating Bay closures to shell fishing and swimming.

3.6.7.1.4 Coastal Flooding

Coastal flooding is typically a result of storm surge and wind-driven waves, which erode the coastline. These conditions are produced by hurricanes (tropical storms) during the summer and fall, and nor'easters and other large coastal storms (extra-tropical storms) during the fall, winter, and spring. Storm surges may overrun barrier islands and push sea water up coastal rivers and inlets, blocking the downstream flow of inland runoff. Thousands of acres of crops and forest lands may be inundated by both saltwater and freshwater. Escape routes, particularly from barrier islands, may be cut off quickly, stranding residents in flooded areas and hampering rescue efforts

3.6.7.2 Location

All Rhode Island communities are subject to flooding. The State's 39 communities have areas identified as "flood prone" by the FEMA, and all have elected to participate in the NFIP in order to make federally-subsidized flood insurance available to their residents. Figure 19 shows the flood hazard areas within the state. Table 22 summarizes the total area within each of the flood hazard area types. Washington County has over 40 percent of the state floodplains, followed by Providence with 31 percent.

Table 22. FEMA SFHA area within jurisdictions by flood zone.

County	Zone A (sq mi)	Zone AE (sq mi)	Zone AO (sq mi)	Zone AH (sq mi)	Zone V (sq mi)	Zone VE (sq mi)	500-year (sq mi)
Bristol	0.08	4.17	-	-	-	1.54	2.39
Kent	7.65	6.32	0.01	-	-	0.98	2.98
Newport	1.83	6.36	0.03	-	0.08	6.04	2.82
Providence	25.22	13.76	0.02	0.04	-	0.83	7.12
Washington	30.43	15.70	0.04	0.04	-	7.90	6.79
Total	**65.21**	**46.31**	**0.1**	**0.08**	**0.08**	**17.29**	**22.1**

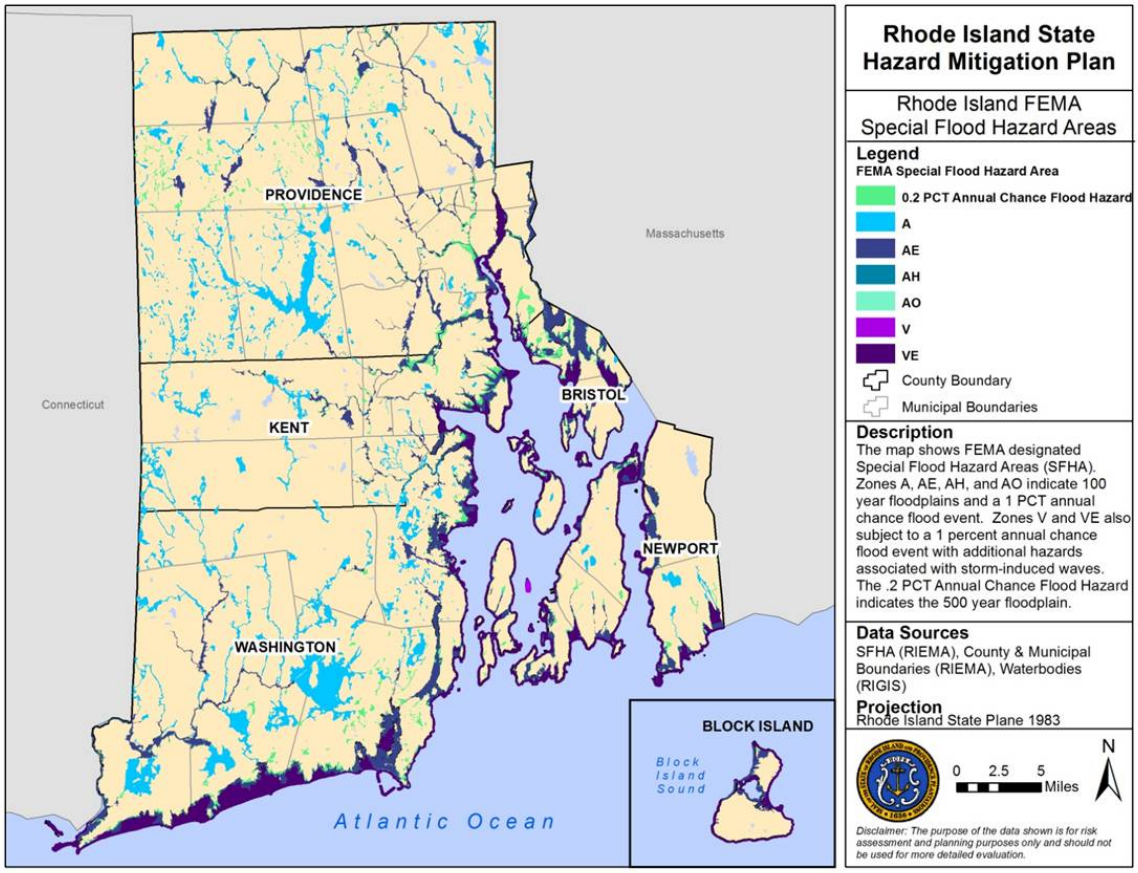


Figure 19. FEMA Special Flood Hazard Area (SFHA) zones within Rhode Island.

3.6.7.2.1 Riverine Flooding

Riverine flooding in Rhode Island may be associated with hurricanes, the aftermath of winter storms, spring snow melts combined with heavy rains or take place independently of major storm activity. The Blackstone River basin and the Pawtuxet River watershed of Narragansett Bay Drainage Basin have had long histories of flooding, with records dating as far back as 1818. The Providence River is very shallow, but flooding has not occurred. It was recently dredged by the United States Army Corps of Engineers (USACE). Cumberland is subject to repetitive flooding of commercial property (manufacturing and wholesale); however, the Town doesn't have many RL structures because most of the properties do not carry flood insurance.

Specific areas prone to riverine and urban flooding include:

- Pawtuxet River - The Pawtuxet River runs through the communities of Coventry, West Warwick, Cranston and Warwick. Due to its shallow depths from sediment buildup, increased development, lack of pervious surface, and other localized

drainage issues, frequent flooding occurs. The Pawtuxet River experienced the most significant flooding in recorded history during the March 2010 floods. Flood levels hit historic levels, with a record of 20.79 ft on March 29, 2010.

- Pawcatuck River - The Pawcatuck River and tributaries run west to east through the southern reaches of the State including portions of Westerly, Richmond and North Kingstown. There is limited development in these areas; however, during significant flood events flooding damages do occur.
- Woonasquatucket River - The Woonasquatucket River runs from Smithfield to Providence. The areas surrounding this river are densely populated and developed with a combination of mixed use lots of residential and commercial properties.
- Natick Area - Natick is an area located within the Town of West Warwick. This area is relatively flat and has a combination of mixed use structures including commercial, industrial, and residential. Natick was hit incredibly hard during the March 2010 floods. NFIP Staff assisted with building inspections, technical support and site visits after the flood receded.
- East Providence - There are a number of low lying areas in East Providence that routinely get flooded, including Riverside and Marsh Street off Waterman Avenue. Marsh Street and the surrounding area is directly adjacent to freshwater wetlands which fill up and create a “bathtub” effect during significant rain events.

3.6.7.2.2 Flash Flooding

Rhode Island experienced flash flooding first hand during the flooding in March 2010. The communities that were hit the hardest by flash floods were Cranston, Warwick, West Warwick, Westerly and Coventry. Inland areas are most at risk from flash flooding caused by intense rainfall over short periods of time.

3.6.7.2.3 Urban/Stormwater Flooding

Rhode Island’s stormwater infrastructure is undersized for today’s storms by 25% to 30% (UNH Stormwater Center). Recent research examining impacts of climate change on rainfall depths showed a 28-60% increase in Q25-Q100 (Northeast Regional Climate Center, UNH Stormwater Center).

Urban flooding in Rhode Island (or stormwater flooding) is a very common problem. Large amounts of impervious surfaces in urban areas increase runoff amounts and decrease the lag time between the onset of rainfall and stream flooding. Manmade channels may also constrict stream flow and increase flow velocities. Currently, there is no State map or database providing locations of repeated urban flooding.

3.6.7.2.4 Coastal Flooding

Zones V and VE in Figure 19 indicate areas subject to a 1% annual chance flood event with additional hazards associated with storm-induced waves. Beavertail Road at Mackerel Cove, Matunuck Beach Road and Arnolds Neck Road are examples of coastal flood prone access routes. Additionally, specific areas vulnerable to coastal flooding were identified by the public and committee members through the Public Survey that was discussed in Section 2. Areas vulnerable areas to coastal flooding included Nausauket, Oakland Beach, Buttonwoods, and Conimicut in Warwick County, the Port of Providence area in Providence County, the Newport Harbor Area, Narragansett Bay, the Bristol Harbor, and New Shoreham (Block Island). Detailed Responses to the Public Survey are available in Appendix 2: Planning Process.

3.6.7.3 Extent (Impact and Vulnerability)

Populations and property are extremely vulnerable to flooding. Homes and business may suffer damage and be susceptible to collapse due to heavy flooding. Floodwaters can carry chemicals, sewage, and toxins from roads, factories, and farms; therefore any property affected by the flood may be contaminated with hazardous materials. Debris from vegetation and man-made structures may also be hazardous following a flood. In addition, floods may threaten water supplies and water quality and initiate power outages.

The flood hazard varies by location and type of flooding. Coastal areas are most at risk from flooding caused by hurricanes, tropical storms and nor'easters. Low-lying coastal areas in close proximity to the shore, sounds or estuaries are exposed to the threat of flooding from storm surge and wind-driven waves, as well as from intense rainfall. Areas bordering rivers may also be affected by large discharges caused by heavy rainfall over upstream areas. Inland areas are most at risk from flash flooding caused by intense rainfall over short periods of time. Stream flow tends to increase rapidly. Large amounts of impervious surfaces in urban areas increase runoff amounts and decrease the lag time between the onset of rainfall and stream flooding. Manmade channels may also constrict stream flow and increase flow velocities.

More intense rainfall, the result of climate change, is likely to increase peak flooding, particularly in urban environments in the future. The magnitude of this increase is dependent on the level and rate of greenhouse gas emissions through the end of the century.

3.6.7.4 Previous Occurrences and Probability of Future Events

Flooding is the most prevalent and frequent natural hazard that impacts the state. Though there is no distinct flood season in Rhode Island and major river flooding can occur in any

month of the year, NOAA has studied a number of past floods from the 1990's to 2000[19] and has noted three (3) times of the year of particular importance with regard for the potential of flood activity to occur:

- Late winter/spring melt;
- Late summer/early fall; and
- Early winter.

According to FEMA's disaster declaration database, 11 disasters Rhode Island has experienced 11 disasters, nine (9) of the disasters were related to severe flooding and hurricanes. Flood events have caused significant damage and impact to Rhode Island; several historic events are further described:

- August 1955 - caused record flooding along the main rivers in the Blackstone River Basin in Rhode Island and Massachusetts, and the Thames River Basin (predominantly in Connecticut), resulted from torrential rainfall accompanying Hurricane Diane. Damages from the 1955 flood were estimated at approximately $28 million for the State, with the Woonsocket area hardest hit in Rhode Island. Except for a small local protection project at Blackstone, Massachusetts, there were no federal flood control projects in operation at the time of the flood. Subsequently two projects in Rhode Island - for Upper and Lower Woonsocket - and two in Massachusetts, were constructed for Blackstone River Basin flood protection. The Army Corp of Engineers estimates that these projects prevented about $8 million in damages in the flood of March 1968.
- March 1968 – prior to the 2010 floods, constituted as the record flood for the State. The March 1968 flood resulted from heavy rainfall that followed a period of sustained snowmelt which had caused stream flows to be much above normal.
- January 1979 – Flooding in the Belmont Park section in Warwick occurred when a combination of above-normal temperatures and rainfall caused the Pawtuxet River to overflow its banks, inundating about 30 acres of land in the Belmont Park area, a residential section built in and adjacent to a flood hazard area. Flooding had worsened with increased upstream development. To prevent repeated flooding, some 60 homes were purchased and demolished. Currently, frequent flooding of the Pawtuxet River in the Natick Flats section between Warwick and West Warwick has occasioned investigation of potential flood control measures by the USACE.
- March 2010 - Rhode Island encountered the worst flooding in its recorded history on a number of the State's largest rivers, including, but not limited to the Pawtuxet, Pawcatuck and Woonasquatucket. The incredible amount of precipitation in February and March 2010, along with saturated soils, high water tables, lack of

[19] Source: NOAA, *A river and Flash Flood Climatology of Southern New England: Results From 1994-2000*, website: http://www.erh.noaa.gov/box/flood%20climatology.htm.

leaf cover and limited pervious surfaces all contributed to the disastrous flooding during March. The hardest hit areas in the state included Warwick, West Warwick, Coventry and Cranston, which are located around the Pawtuxet River, and Westerly, which is located along the Main Stem Pawcatuck River. The USGS river gage at Pawtuxet River at Cranston hit Record Flood Stage at 14.98' on March 15, 2010 and was then quickly superseded by another Record Flood Stage on March 31, 2010 of 20.79'. Prior to these two (2) back to back Record Flood Stages, the highest recorded level of the Pawtuxet River at Cranston was 14.5' on June 7, 1982.

- Hurricane Sandy swept through the region in October 2012 leaving significant damage all along the coast. Beaches along Westerly, including Misquamicut, were devastated and almost unrecognizable.[20] More than 122,000 people lost power.[21] In a FEMA report released June 2013, it is estimated that more than $39.4 million in support from four federal disaster relief programs is helping Rhode Island recover from this disaster, a majority of which is from the NFIP ($31.1 million). In addition to NFIP claim payments, federal aid includes:
    - "Public Assistance: more than $5.3 million in grants for state and local agencies and some private nonprofits;
    - Individual Assistance: more than $423,000 in grants paid directly to eligible individuals and families to meet basic needs for housing and cover other essential disaster-related expenses;
    - US SBA: more than $2.6 million in low-interest disaster recovery loans to Rhode Island homeowners, renters and business owners of all sizes."

During the past 30 years, the Federal Government has shifted focus from flood "control" to flood "management." The primary impetus for this shift is continuing flood losses experienced during the latter half of the 20th Century and the first decade of the present century. The goal of flood management is to prevent loss of life and damage to public and private property by reducing the effects of flood damage and forming effective plans for recovery and rehabilitation. The change from flood control to flood management resulted in revisions and improvements to Federal policies. One major impetus was flood hazard mapping. The development of SFHA maps was the first comprehensive attempt to identify flood hazard risk in the Nation's floodplains.

This effort began in 1968, with the passage of the NFIP Act by Congress. The program's intent is to reduce future damage and to provide protection for property owners from potential losses. Flood insurance is made available in communities participating in the NFIP. Policyholders pay premiums that are based on the level of flood risk at an identified location in the community. To accurately identify the risk, FEMA produces Flood Insurance Rate Maps (FIRMs) that show areas subject to flooding. The flood risk

[20] http://www.masslive.com/news/index.ssf/2012/10/hurricane_sandy_leaves_beaches.html
[21] http://www.cbsnews.com/8301-201_162-57544801/a-state-by-state-look-at-superstorms-effects/

information presented on the FIRMs is based on historic, hydrologic, and hydraulic data, as well as open-space conditions, flood-control works, and development.

A 100-year flood is not a flood that occurs every 100 years. In fact, the 100-year flood has a 26-percent chance of occurring during a 30-year period, the typical length of many mortgages. The 100-year flood is a regulatory standard used by Federal agencies, States, and NFIP-participating communities to administer and enforce floodplain management programs. The 100-year flood is also used by the NFIP as the basis for insurance requirements nationwide.[22] The main recurrence intervals used on the FIRMS are shown in Table 23. In those FEMA SFHAs or velocity zones (V-Zones) where there are armored shorelines, or any other manmade structures impeding the beaches' natural process of sediment transport, there is a greater likelihood of coastal flooding as the beaches erode and can no longer protect these areas from flooding.

Table 23. Annual probability based on flood recurrence intervals.

Flood Recurrence Interval	Annual Change of Occurrence
10-yr	10.0%
50-yr	2.0%
100-yr	1.0%
500-yr	0.2%

Flooding is often a result of the occurrence of other natural hazards such as hurricanes and tropical storm systems, winter and coastal storms, ice jams, dam failures, and severe precipitation events. SLR and the increased intensity of frequency of storm surge due to climate change also contribute to the impacts of flooding. Rhode Island has historically experienced all these other natural hazards at one time or another and can expect to experience them in the future. According to NCDC records, there have been a total of 313 flood events in Rhode Island from January 1993 to December 2012 (Table 24).

These events resulted in a total of $110.5 million in estimated property damages (in adjusted dollars) according to NCDC records. Rhode Island can expect between two (2) to six (6) flood events per year which can be related to a Medium-High to High probability of occurrence. Providence County has experienced the most flood events in the state and is predicted to continue to experience upward of six (6) events per year. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 14 includes the probability of future events by county.

[22] National Flood Insurance Program (www.fema.gov)

Table 24. NCDC flood events (1993 -2012).

County	Number of Events	Annualized Events	Property Damages	Annualized Damages
Bristol	39	1.95	$7,814,091	$390,705
Kent	70	3.5	$29,063,309	$1,453,165
Newport	40	2	$6,776,626	$338,831
Providence	113	5.65	$33,365,719	$1,668,286
Washington	51	2.55	$33,525,907	$1,676,295

3.6.7.5 Vulnerability & Risk Assessment

All areas of Rhode Island continue to be vulnerable to flooding and the impacts associated with this natural hazard. Rhode Island is a water-rich state, in that it has many rivers, streams and brooks flowing within and between its boundaries and other states. Past land use patterns and the continued use of structures within areas vulnerable to flooding will continue to promote future risk and vulnerability of flood impacts to structures and people. Local land use regulations and ordinances have done much to curb unregulated development within flood hazard areas. However, Rhode Island is one of the older states in the nation with limited land resources. This places a high value on all property within the state. This limitation of land availability and high property values will continue to encourage the reuse of land and structures in areas vulnerable to flooding.

3.6.7.5.1 National Flood Insurance Program (NFIP)

Floodplain management begins at the community level with operation of a community program of corrective and preventative measures for reducing flood damage. These measures take a variety of forms; for inclusion in the NFIP, communities adopt their flood hazards maps and the community Flood Insurance Study (FIS). In addition, a FEMA-compliant floodplain management ordinance that regulates activity in the floodplain is adopted and enforced.

A community's agreement to adopt and enforce floodplain management ordinances, including regulation of new construction in the SFHA, is a requirement for making flood insurance available to home and business owners. Currently more than 24,624 communities nationwide voluntarily adopt and enforce local floodplain management ordinances that provide flood loss reduction building standards for new and existing development. To address the threat of flood damage, many communities and residents participate in the NFIP. Homeowner insurance policies do not cover damage from flood. As of July 31, 2013, all 39 communities in Rhode Island were participating in the NFIP. Data on active NFIP policies was obtained from FEMA's BureauNet database and is summarized below. Table 25 shows the NFIP flood policy and claim information by participating municipality. There are 16,123 policies in-force for Rhode Island NFIP communities. Rhode Islanders pay nearly $21.7 million annually in premiums for $3.9

billion in coverage. Since January 1, 1978 there have been 6,363 total losses of more than $116.9 million. Six municipalities have more than 1,000 insurance policies in-force. The average claim payment on active policies has been $18,376. City of Warwick (Kent County) and Town of Narragansett (Washington County) accounts for nearly 22 percent of the policies in-force and coverage. It should be noted that the information presented here does not take into account any of the uninsured losses caused by flooding.

Table 25. NFIP policies and claims paid in Rhode Island as of July 31, 2013. Source: FEMA BureauNet.

County	Municipality	Number of Polices In-Force	Coverage Total $	Annual Premium	Number of Claims	Claim Total Value	Average Claim Value $
Bristol	Barrington, Town of	1,058	$293,975,100	$1,445,523	421	$1,546,326	$3,673
	Bristol, Town of	619	$138,955,500	$877,963	189	$1,397,949	$7,397
	Warren, Town of	464	$86,213,400	$587,957	132	$1,217,785	$9,226
Kent	Coventry, Town of	153	$37,869,800	$130,501	72	$1,281,242	$17,795
	East Greenwich, Town of	224	$55,912,700	$260,825	83	$490,410	$5,909
	Warwick, City of	1,871	$425,922,900	$2,748,837	847	$10,881,676	$12,847
	West Greenwich, Town of	12	$2,882,900	$4,685	2	$10,427	$5,214
	West Warwick, Town of	179	$35,147,600	$210,753	155	$6,013,078	$38,794
Newport	Jamestown, Town of	218	$62,611,600	$199,430	58	$231,690	$3,995
	Little Compton, Town of	155	$43,892,300	$192,103	32	$309,488	$9,672
	Middletown, Town of	186	$50,933,700	$238,410	47	$264,501	$5,628
	Newport, City of	1,427	$330,168,400	$2,231,345	285	$7,015,074	$24,614
	Portsmouth, Town of	858	$190,201,600	$1,447,543	200	$735,152	$3,676
	Tiverton, Town of	172	$42,976,700	$267,143	88	$471,939	$5,363
Providence	Burrillville, Town of	55	$14,240,500	$49,889	17	$117,975	$6,940
	Central Falls, City of	55	$6,350,000	$46,400	28	$438,404	$15,657
	Cranston, City of	603	$146,146,400	$856,313	481	$14,975,648	$31,134
	Cumberland, Town of	62	$17,503,900	$89,701	46	$2,633,481	$57,250
	East Providence, City of	333	$88,881,400	$380,385	115	$985,326	$8,568
	Foster, Town of	11	$3,326,000	$9,430	3	$35,025	$11,675

County	Municipality	Number of Polices In-Force	Coverage Total $	Annual Premium	Number of Claims	Claim Total Value	Average Claim Value $
	Glocester, Town of	34	$8,649,700	$21,622	8	$17,682	$2,210
	Johnston, Town of	72	$20,486,900	$69,735	78	$3,784,588	$48,520
	Lincoln, Town of	252	$63,425,800	$78,392	58	$1,823,747	$31,444
	North Providence, Town of	255	$54,622,000	$280,719	126	$1,130,527	$8,972
	North Smithfield, Town of	40	$11,114,700	$49,002	13	$267,145	$20,550
	Pawtucket, City of	101	$27,380,300	$85,809	35	$1,528,641	$43,675
	Providence, City of	471	$132,054,100	$605,931	329	$10,384,107	$31,563
	Scituate, Town of	28	$6,313,500	$12,971	30	$527,115	$17,571
	Smithfield, Town of	160	$29,872,000	$92,907	29	$321,776	$11,096
	Woonsocket, City of	136	$30,574,000	$77,937	7	$67,361	$9,623
Washington	Charlestown, Town of	816	$218,836,000	$1,286,161	248	$2,718,954	$10,964
	Exeter, Town of	22	$4,914,400	$11,529	8	$45,408	$5,676
	Hopkinton, Town of	28	$6,684,300	$17,829	15	$152,242	$10,149
	Narragansett, Town of	1,605	$425,034,500	$1,630,941	472	$7,916,839	$16,773
	New Shoreham, Town of	100	$28,858,100	$197,967	17	$346,760	$20,398
	North Kingstown, Town of	911	$233,039,100	$1,187,297	279	$1,571,630	$5,633
	Richmond, Town of	36	$10,534,600	$36,420	29	$1,655,017	$57,070
	South Kingstown, Town of	1,095	$261,221,100	$1,390,705	422	$6,205,236	$14,704
	Westerly, Town of	1,246	$308,531,500	$2,249,286	859	$25,408,299	$29,579
Total		**16,123**	**$3,956,259,000**	**$21,658,296**	**6,363**	**$116,925,670**	**$18,376**

The Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (Public Law 108-264) revised the existing FMA Program by creating a Pilot Program at $40 million per year to mitigate RL properties. The act was signed into law by President George W. Bush on June 30, 2004.

The FEMA HMA RL and SRL programs provide funds for local governments to address the most egregious flood-prone properties with the most flood insurance claims. The program features a reduced non-federal match (from 25 percent to 10 percent) with an approved mitigation plan that specifies the state's strategy to reduce the number of RL and SRL properties. The amendment authorizes scheduled increases in flood insurance premium rates to actuarial rates for SRL property owners who refuse a formal and complete mitigation grant offer through the SRL grant program to mitigate an SRL structure.

Many flood insured properties have had more than one claim. A property that is currently insured for which two or more NFIP losses (occurring more than 10 days apart) of at least $1,000 each have been paid within any 10-year period since 1978 is defined as a "repetitive loss property" by the NFIP program.

Residential SRL properties are single family structures consisting of one (1) to four (4) residences that have flood insurance which have incurred flood related damages on four (4) or more separate occasions with the amount of each claim exceeding $5,000 and the cumulative amount of the total claims paid exceeding $20,000; or cumulative amount of the claims exceeds the value of the property, when at least two separate claim payments have been made. In either case, at least two (2) losses must have occurred within a 10-year time span; claims must be more than 10 days apart.

Residential SRL properties have received priority for mitigation funding through the Bunning-Bereuter-Blumenauer Reform Act (Public Law 108-264). The primary goal of the SRL Program has been to reduce excessive flood claim payments and reliance on the National Flood Insurance Fund (NFIF) for flood relief when mitigation is an option. Residential SRL properties are single-family structures consisting of one (1) to four (4) residences that have flood insurance that have:

- Incurred flood related damages on four (4) or more separate occasions with the amount of each claim exceeding $5,000 and the cumulative amount of the total claims paid exceeding $20,000; or
- Cumulative amount of the claims exceeds the value of the property, when at least two (2) separate claim payments have been made.
- At least two (2) losses must have occurred within a 10-year time span; claims must be more than 10 days apart.

There are currently 431 non-mitigated RL properties in Rhode Island. Table 26 includes the number of non-mitigated RL structures, number of losses and claims paid on those losses. The City of Cranston (Providence County) accounts for 17.6% of the non-mitigated RL properties, followed by the Town of Westerly (Washington County), and City of Warwick (Kent County).

Table 26. Non-mitigated repetitive loss properties as of October 2013.

County	Municipality	Total RL Properties	Total Non-Mitigated RL Properties
Bristol	Barrington, Town of	14	12
	Bristol, Town of	10	10
	Warren, Town of	8	8
Kent	Coventry, Town of	6	6
	East Greenwich, Town of	6	6
	Warwick, City of	56	44
	West Greenwich, Town of	0	0
	West Warwick, Town of	21	20
Newport	Jamestown, Town of	1	1
	Little Compton, Town of	0	0
	Middletown, Town of	2	2
	Newport, City of	19	18
	Portsmouth, Town of	6	6
	Tiverton, Town of	3	3
Providence	Burrillville, Town of	2	2
	Central Falls, City of	5	5
	Cranston, City of	77	76
	Cumberland, Town of	4	4
	East Providence, City of	15	15
	Foster, Town of	0	0
	Glocester, Town of	0	0
	Johnston, Town of	13	13
	Lincoln, Town of	7	6
	North Providence, Town of	20	19
	North Smithfield, Town of	2	2
	Pawtucket, City of	4	4
	Providence, City of	29	26
	Scituate, Town of	5	3
	Smithfield, Town of	1	0
	Woonsocket, City of	1	1
Washington	Charlestown, Town of	13	10

County	Municipality	Total RL Properties	Total Non-Mitigated RL Properties
	Exeter, Town of	0	0
	Hopkinton, Town of	0	0
	Narragansett, Town of	20	20
	New Shoreham, Town of	0	0
	North Kingstown, Town of	13	13
	Richmond, Town of	2	1
	South Kingstown, Town of	24	24
	Westerly, Town of	52	51
	Total	**461**	**431**

The Community Rating System (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 (3) goals: the reduction of flood losses, facilitating accurate insurance rating and 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. Currently, five (5) communities participate in the CRS and receive flood insurance premium discounts. These communities are shown in Table 27.

Table 27. CRS eligible community status as of May 2013.

County	Municipality	CRS Entry Date	Current Effective Date	Current Class	% Discount for SFHA	% Discount for Non-SFHA
Bristol	Town of Bristol	5/1/13	5/1/13	8	10	5
Newport	Town of Middletown	10/1/91	4/1/00	8	10	5
Washington	Town of Narragansett	10/1/92	10/1/07	8	10	5
Washington	Town of North Kingstown	10/1/93	10/1/93	9	5	5
Washington	Town of Westerly	5/1/13	5/1/13	8	10	5

3.6.7.5.2 Hazus-MH and Average Annualized Loss

As part of FEMA Risk MAP, Hazus-MH Average Annualized Loss (AAL) data was made available for the 2014 plan update. This was created using default Level 1 study using Hazus-MH MR4 software for the continental US. This is the first attempt by FEMA to model risk for both riverine and coastal areas. Outputs from the study include information on total building exposure, total losses, and the loss ratio between these value (what

percent of structures and their content were damaged). Model runs were completed for both individual return period events and then combining into an AAL value.

Flood hazard is defined by a relationship between depth of flooding and the annual chance of inundation to that depth. Loss estimation for this Hazus-MH module is based on specific input data. The type of data shown below includes information on the local economy that is used in estimating losses. Table 28 displays the economic loss categories used to calculate annualized losses by Hazus-MH.

Table 28. HAZUS direct economic loss categories and descriptions.

Category Name	Description of Data Input into Model	Hazus Output
Building	Cost per sq ft to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in $ per sq ft	Loss of building inventory as contents related to business activities
Relocation	Rental costs per month per sq ft by occupancy	Relocation expenses (for businesses and institutions)
Income	Income in $ per sq ft per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq ft by occupancy	Loss of rental income to building owners
Wage	Wages in $ per sq ft per month by occupancy	Employee wage loss as described in income loss

Table 29 summarizes the total estimated potential losses from Hazus-MH for five (5) return-periods as well as an estimated annual loss; $387 million for Rhode Island. The majority of the annualized losses in Rhode Island are within Providence County.

Table 29. FEMA Hazus-MH AAL estimates.

County	0.2% Annual Chance (500-yr)	0.5% Annual Chance (200-yr)	1% Annual Chance (100-yr)	2% Annual Chance (50-yr)	10% Annual Chance (10-yr)	Average Annualized Loss
Bristol	$418,500,000	$286,190,000	$253,198,000	$123,625,000	$62,238,000	$11,166,000
Kent	$883,388,000	$680,531,000	$617,231,000	$556,596,000	$297,663,000	$42,801,000
Newport	$814,598,000	$632,077,000	$577,796,000	$459,482,000	$290,177,000	$38,722,000
Providence	$4,802,273,000	$3,879,335,000	$3,456,994,000	$2,943,049,000	$1,689,662,000	$238,038,000
Washington	$1,151,686,000	$909,984,000	$823,764,000	$700,237,000	$417,019,000	$56,903,000
Total	**$8,070,445,000**	**$6,388,117,000**	**$5,728,983,000**	**$4,782,989,000**	**$2,756,759,000**	**$387,630,000**

In addition, the FEMA Mapping Task Force provided Hurricane Sandy surge depth grids for coastal counties based on post-Sandy surveyed High Water Marks (HWM). Hazus-MH flood model was run for this plan update; $647.9 million in total damages and an additional $14 million in direct output losses (Table 30 and Figure 20). Appendix 3: *Hazard Identification & Risk Assessment* includes additional analysis and related information.

Table 30. Hurricane Sandy Hazus-MH analysis with high water marks. Shown in thousands of dollars.

County	Building Loss	Contents Loss	Inventory Loss	Relocation	Income Loss	Rental Loss	Wage Loss	Direct Outputs
Bristol	$32,788	$73,387	$4,366	$99	$257	$20	$641	$3,211
Kent	$38,133	$42,044	$651	$50	$135	$16	$127	$570
Newport	$47,725	$68,949	$1,427	$48	$257	$59	$412	$841
Providence	$31,922	$66,286	$2,095	$63	$207	$26	$347	$750
Washington	$109,421	$122,078	$2,242	$193	$292	$48	$1,134	$1,934
Total	$259,989	$372,744	$10,781	$453	$1,148	$169	$2,661	$7,306

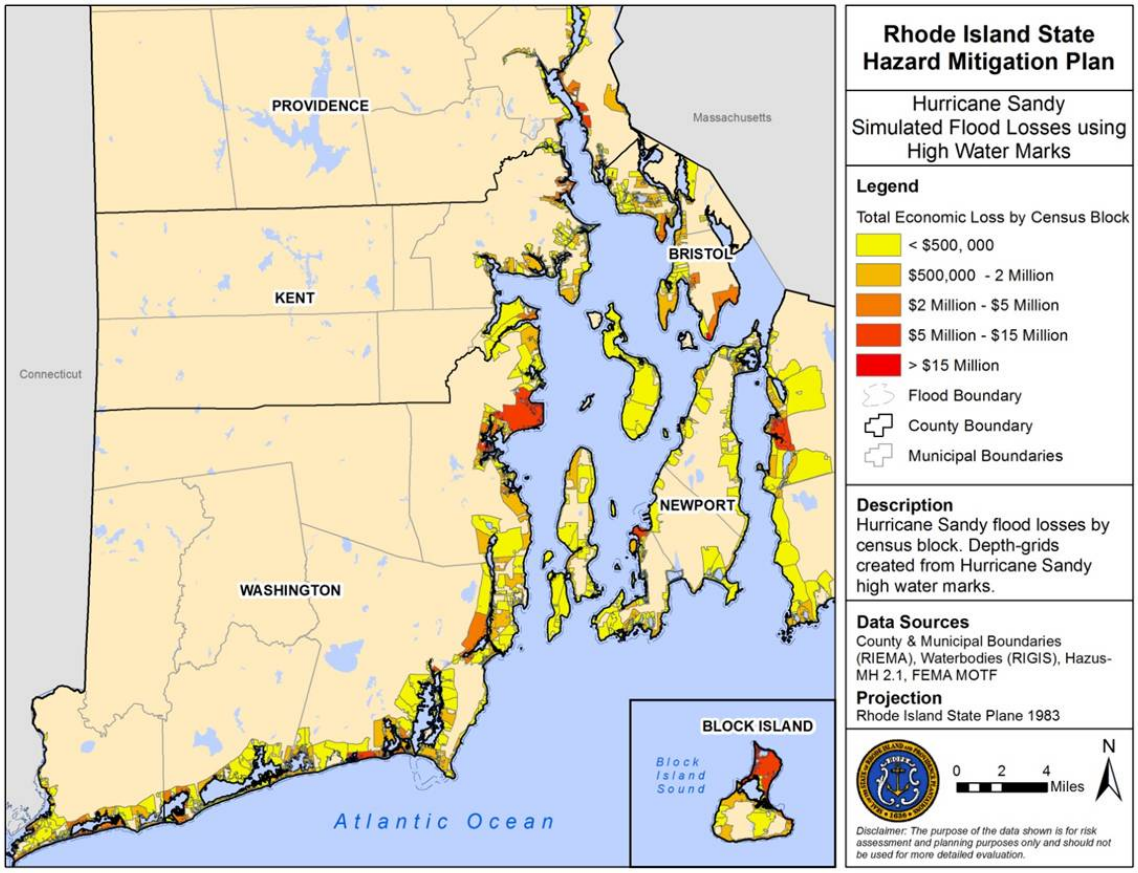


Figure 20. Hazus-MH Hurricane Sandy simulated losses due to flooding.

In order to determine the number of critical facilities within FEMA's SFHA, the facility points were intersected with the SFHL layer. This analysis, depicted in Table 31 shows 512 facilities located with a SFHA with 263 located within Providence County. Table 32 summarizes the facilities located within the mapped floodplain by asset type and flood zone.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to supplement the current loss estimates by municipality for hazards with known geographic extents.

Table 31. Number of facilities located within FEMA effective SFHA.

County	500-year	A	AE	AH	VE
Bristol	10	0	13	0	3
Kent	6	21	47	0	5
Newport	5	3	23	0	11
Providence	77	87	92	2	5

County	500-year	A	AE	AH	VE
Washington	17	35	45	0	5
Total	115	146	220	2	29

Table 32. Number of facilities located within SFHA by asset type.

County	Dataset	Asset Type	500-year	Zone A	Zone AE	Zone AH	Zone VE
Bristol	Critical Facility	Dam			4		
		Fire Station	1				1
		Hurricane Shelter	3		1		
		Marina	4		3		2
		School	2		4		
	State Facility	State Owned			1		
Kent	CIKR	Emergency Services			1		
	Critical Facility	Dam	1	18	26		
		EMS Company	1	1	1		
		Fire Station	1	2	1		
		Marina			14		5
		School	1		3		
	State Facility	State Owned	2		1		
Newport	CIKR	Emergency Services	1		1		
		Transportation - Maritime			1		
		Transportation - Road Systems / Maritime			1		
	Critical Facility	Dam	1	3	7		2
		EMS Company			1		
		Fire Station			1		
		Hospital			1		
		Law Enforcement	1				
		Library			1		
		Marina	1		6		9
		School	1		1		
	State Facility	State Owned			2		
Providence	CIKR	Chemical			1		
		Commercial - Public Assembly	1		1		
		Emergency Services	2				

County	Dataset	Asset Type	500-year	Zone A	Zone AE	Zone AH	Zone VE
		Energy : Electricity	1				
		Energy : Oil and Natural Gas	1		2		
		Government Facilities	1				1
		Transportation - Maritime	1				
		Water - Drinking Water and Wastewater		1			
	Critical Facility	College	1				
		Correctional Institute	2				
		Dam	19	84	78		
		EMS Company			1		
		Fire Station	1		1		
		Hurricane Shelter				1	
		Law Enforcement	3				
		Library	3				
		Marina	2		2		4
		School	14		4	1	
		State Facility	23	2	2		
		State Owned	23	2	2		
		Town Hall	2				
Washington	CIKR	Defense Industrial Base	1				
		Emergency Services		1	3		
		Transportation - Aviation					1
	Critical Facility	Correctional Institute	1				
		Dam	4	33	22		
		EMS Company	2		1		
		Fire Station	1		2		
		Law Enforcement	2				
		Library	1				
		Marina			13		4
		School	1		1		
		Town Hall	2				
	State Facility	State Owned	2	1	3		

3.6.7.5.3 Hazard Ranking

Quantitative risk assessment, to the degree possible, has been completed for flood using the methodology described in the Hazard Analysis and Ranking methodology section. Scores for each jurisdiction were calculated based on population, building permits, average score from local plan rankings, and measures of historical impact including injuries and deaths, property damage, and the number of reported events. Annualized damages have been supplemented with NFIP claim information spanning 33 years of record. Geographic extent is represented by the percent floodplain area within each jurisdiction (Figure 21).

The composite flood hazard rank shows Washington as high risk, followed by Providence, Newport and Bristol as medium-high risk. Rhode Island will continue to be at risk for flood events due to the geographic location along the Northeast Atlantic seaboard, abundance of waterways, and future projections by climate change models and studies that project an increase in more intense precipitation events punctuated by periods of drought conditions.[23]

Published climate change studies discuss an increase in extreme precipitation frequency, and an actual change in precipitation types and intensity throughout the next century. Tools developed by Cornell University, Northeast Regional Climate Center and Natural Resource Conservation Service include interactive data for extreme precipitation and frequency estimates. Using these tools, the southwest and eastern parts of the state have a slightly lower estimate for precipitation extremes, relative to Rhode Island.[24]

[23] M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds)
[24] Cornell Extreme Precipitation in New York and New England. Version 1.12 Joint project between Northeast Regional Climate Center (NRCC) and Natural Resource Conservation Service (NRCS) http://precip.eas.cornell.edu/ Assessed 8/26/2013.

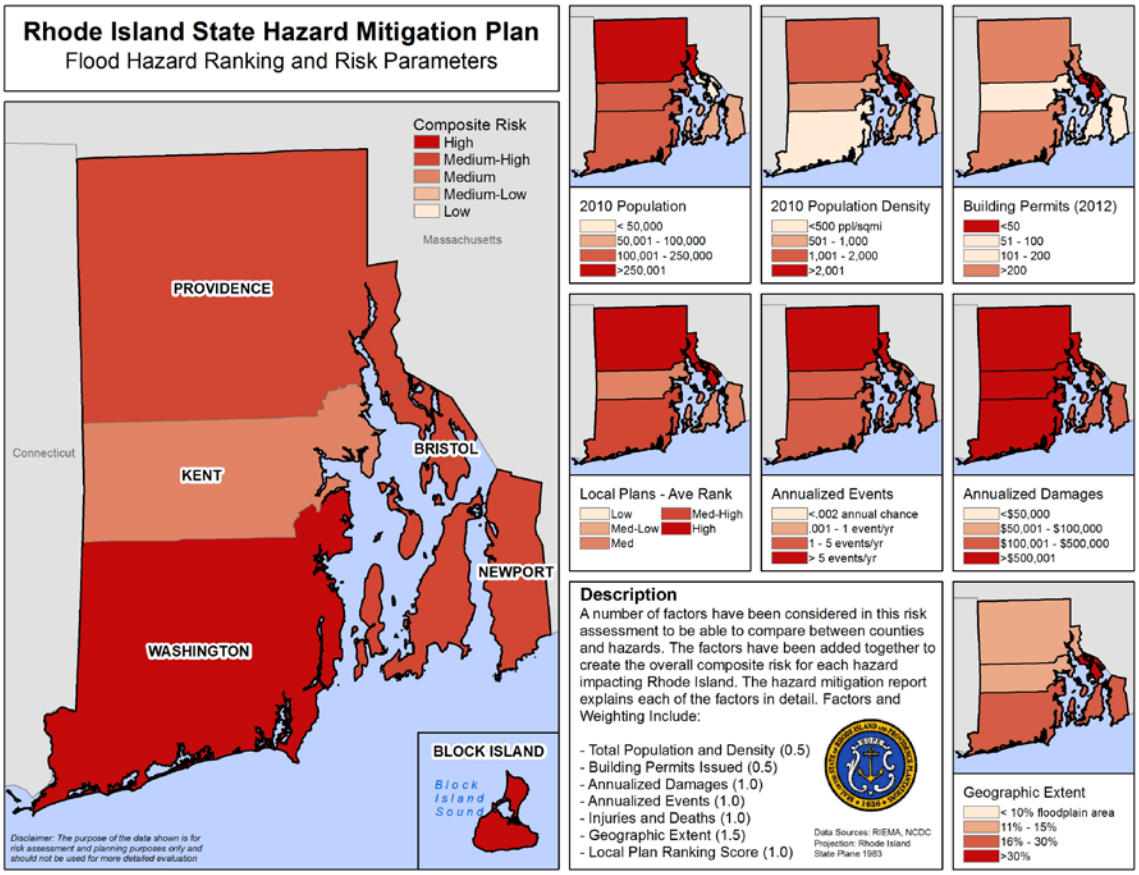


Figure 21. Flood-related hazard ranking by municipality.

3.6.8 Climate Change and Sea Level Rise

Descriptions of climate change and Sea Level Rise (SLR) were included in the 2011 SHMP. The 2014 update expands on these descriptions with reports and studies furnished by members of the steering committee. Analysis of critical and state facilities within SLR scenarios has been completed to identify areas of risk within jurisdictions in Rhode Island. The SLR simulated inundation surfaces used in this analysis are from June 2011, and were based on existing elevation data; new inundation surfaces, based on the 2011 LiDAR elevation data, have been developed by the URI, and were not available at the time of the analysis. These are for planning purposes only, and should be used with caution, as they are "bath tub" approach, have not been ground truthed and do not include considerations for surge and wave runup.

As mentioned in the Planning Process Section, 18 steering committee members met via WebEx on February 26, 2013 to discuss data and reports used in the 2011 plan and new sources to be integrated into the 2014 SHMP. The Capabilities Assessment Section of this report further identifies agencies and groups with current and ongoing studies related to climate change and SLR. It should also be noted that local Comprehensive Plans are

now required to consider SLR and guidance is being developed on how to integrate natural hazards.

During the final stages of the update for this plan, the first meeting to coordinate SLR and Climate Change Assessments across State agencies was held on August 21, 2013. The main purpose of the meeting was to discuss SLR and climate change assessment projects currently being conducted by various state agencies and other groups. This newly formed group will convene and coordinate studies within Rhode Island (see Table 33); several steering committee members participated in both of these efforts and will continue to inform the SIHMC of new data and analysis when it is available. Coordination will include:

- RI Shoreline Change (Beach) SAMP mapping
- High resolution data under development
- Pilot projects form North Kingstown and Newport
- RI Transportation Assets and Planning
- URI Transportation Vulnerability Pilot Project
- SLR affecting Marsh Model (SLAMM) study to predict future tidal salt marsh habitat
- SafeWater for Rhode Island's Future – SLR Assessment findings
- URI Onsite Wastewater Treatment Systems in a Changing Climate study
- NOAA new mapping tools and techniques for visualizing SLR and coastal flooding impacts under development

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Table 33. Climate Change and SLR Project Summary Matrix

Question	North Kingstown/ Newport	COCA SLAMM	Shoreline Change SAMP	RI Transportation Assets and Planning: Statewide Planning	URI transportation vulnerability pilot project: URI Marine Affairs	Dept of Health- SafeWater Rhode Island	Onsite Wastewater Treatment Systems in a Changing Climate- URI	**NOAA** Coastal Services Center **(CSC) SLR and Coastal Flooding Impacts Viewer**
1. What is the purpose or long-term application of your project's SLR mapping?	Compile the best available elevation and coastal bathymetry data and build a seamless coastal terrain model (CTM). The CTM will be used as the foundation data for other's inundation and coastal modeling work.	The project will map projected salt marsh responses to SLR scenarios and locate opportunities for salt migration. This information will help in the development of coastal wetland adaptation strategies, including conservation, restoration and CZM policies.	Provide CRMC with sound, quantified geologic info for planning. The result of this activity will be a listing of those critical concern areas most at risk of erosion and inundation. The research team will also work with hydrogeologists to examine the impact of SLR on saltwater intrusion into coastal groundwater resources, and how inundation from storm surge may impact groundwater.	This project will develop a transportation perspective for all Rhode Island roads, rail segments, infrastructure, etc and create a map atlas for the whole state showing inundation zones. It will also conduct vulnerability and risk assessments for a subset of transportation infrastructure.	This project will model SLR plus erosion, wave runup, and storm surge for a few specific road segments in North and South Kingstown. Will these additional, dynamic factors provide different data from the static bathtub models?	Conducting environmental impact assessments, including SLR, temperature, precipitation, and storm surge, on the state's drinking water facilities, and to develop strategies to address these changes. The project also hopes to conduct extensive outreach and education around the state to manage and communicate the problems.	OWTS are used by 31% of people in RI, and will be affected by SLR. This project aims to quantify those impacts and start examining the potential for alternative OWTA treatment systems	Developing a complete SLR viewer for the whole United States, Pacific Islands, and Caribbean to help address coastal management issues related to SLR
2. What are the SLR or storm surge scenarios you are mapping?	MHHW plus 1', 3', 5' MHHW plus 1' with 3' surge Hurricane of '38 which approximates the 100yr flood.	1ft, 3ft and 5ft SLR	1, 1.5, 3, 5 ftSLR. Storm surge inundation from a significant hurricane at present (10.2 ft above MHHW), and after SLR (13.1-16.2 ft above MHHW), will also be depicted. Maps will also be created for different time horizons 2030, 2050, 2075 and 2100	1 ,3, 5 ft SLR	Undecided at this time	3 time scenarios: 2022, 2052, and 2084	Modeling 1 ft SLR and 7 degree F soil temperature increase	1-6 foot SLR scenarios, plus additional features that include SLAMM, social and economic vulnerability assessments, and flood frequency tabs
3. What are your data inputs?	USGS 2011 terrestrial LiDAR (statewide); 2010 USACE coastal bathymetry; multiple bathymetry sounding datasets. The 2007 USACE coastal bathymetry data may also be included ** Note: the latest topo/bathy terrain we are working with uses a single source for all of the terrestrial elevation data (USGS 2011 LiDAR). The NK project (and the state-wide surfaces) used a mix of LiDAR data of varying quality and years. This was always meant as an interim data set while we waited for the 2011 USGS stuff to be delivered.	2011 Lidar DEM (USGS) 2010 NWI (National Wetland Inventory) USACE tide data (coastal ponds) NOAA tide gauge data	Historical vertical air photos and orthos; LiDAR coverages, beach profiles, 40 years of on the ground and aerial field photos by our geologists. Other imagery.	Transportation Assets from various sources: roads, RIPTA, airport, etc. Bridge data from DOT and NOAA charts. 2011 LiDAR from USGS. Digital elevation models from URI's EDC. Vdatum from NOAA.	Narragansett Bay- known wave fetches Choosing model storm for wind direction speed, and duration Wave runup FEMA decision tree- shoreline slope, material, etc. High resolution LiDAR data Historic observed high water line	Literature review of climate change patterns for the NorthEast and RI, impacts to water facilities, and best-practice adaptation strategies. DEMS from USGS Land Use Land Cover from NLCD Point Sources from Dept. of Environmental Management Weather data from EPA Erosion rates from CRMC Flood maps from FEMA, etc	Carrying out 16 month experiments for current conditions under three drainfield types, and 16 months under "climate change" scenario	Best terrain NED LiDAR Mass Points and breaklines, hydroconnectivity (NOAA was provided new RI LiDAR dataset)

Question	North Kingstown/ Newport	COCA SLAMM	Shoreline Change SAMP	RI Transportation Assets and Planning: Statewide Planning	URI transportation vulnerability pilot project: URI Marine Affairs	Dept of Health- SafeWater Rhode Island	Onsite Wastewater Treatment Systems in a Changing Climate- URI	NOAA Coastal Services Center (CSC) SLR and Coastal Flooding Impacts Viewer
4. Describe the methods being used in your project(s):	All elevation/bathymetry points were processed using the ESRI ArcGIS Terrain model. Any datum conversions required for older sounding datasets was accomplished using the NOAA VDatum conversion tools. Bilinear interpolation was used to convert discrete values into a final continuous surface. NK inundation surfaces were all static, single source values commonly referred to as "bathtub" modeling.	SLAMM 6.1: "SLAMM simulates the dominant processes involved in wetland conversions and shoreline modifications during long-term SLR. A complex decision tree incorporating geometric and qualitative relationships is used to represent transfers among coastal classes. Each site is divided into cells of equal area; each cell has an elevation, slope, and aspect."	Once the extent of inundation is determined, the number and type of structures and infrastructure in these regions can be analyzed by state and municipal agencies. Shoreline change rates, based on the results from this study, will be used to project the migration of the barriers and erosion of the headlands. While inundation models using LiDAR have been undertaken in many coastal regions including Rhode Island (i.e. Knowles, 2010; NOAA-CSC, 2012), these took a 'bathtub' approach to inundation, and do not account for changes to coastal geomorphology. This task will account for projected erosion of the coastal headlands and migration of barrier spits to create a more accurate inundation assessment especially in areas with coastal barriers and lagoons.	This project will use a modified bathtub model with Vdatum surface through a partnership with NOAA. Vdatum takes elevation and calibrates it to Mean Higher High Water. The project will also utilize the Federal Highway Administration's vulnerability assessment framework which can be found at : http://www.fhwa.dot.gov/environment/climate_change/adaptation/resources_and_publications/vulnerability_assessment_framework/ in order to develop indicators of sensitivity and adaptive capacity.	Conducting meetings with town councils to identify vulnerable roads. Have not yet chosen a model/models to use.	Survey of water utilities to collect data on current and future concerns, planning tools and horizons, and methods to address planning uncertainties. Consultation with RI government partners and drinkwater facilities Using global climate models for climate change scenarios: CGCM3, GFDL, CCSM3, HadCM3, etc	See above	Using the modified bathtub approach to map scenarios, plus adding other layers including more dynamic MHHW and Vdatum
5. What is the output (e.g. maps, online viewer, etc.)	Final output was the inundation surfaces in GIS format, the NK map atlas, and quantitative measures indicating possible financial/infrastructure for the town of N. Kingstown.	Map atlas, likely online viewer or at least a map server.		A statewide vulnerability map, municipal map books, vulnerability and risk profiles for selected assets. Final report: adaptation strategies with case studies.	Final output: more detailed, higher resolution studies for a subset of roads in NK and SK, to see if additional detail changes previously predicted SLR scenarios.	Wind speed and storm surge outputs for each scenario. Riverine and coastal flood risk maps for impacted utilities. Adaptation options for drinkwater facilities.	Identify which water quality functions are most impaired, which drainfield type is impacted the most. Develop a mechanistic understanding of drainfield functions and how they are impaired.	A public awareness building tool
6. Link to project information	http://seagrant.gso.uri.edu/climate/slr_tools.html#nk	http://seagrant.gso.uri.edu/climate/habitat.html#slamm	http://www.beachsamp.org			http://www.health.ri.gov/materialbyothers/SafeWaterRIReport.pdf	http://www.uri.edu/ce/wq/OWT/	http://csc.noaa.gov/digitalcoast/tools/slrviewer

3.6.8.1 Description

Sea level is the sea level related to the level of the continental crust. Relative sea level changes can thus be caused by absolute changes of the sea level and/or by absolute movements of the continental crust. SLR presents a hazard that should be considered in long-term land use, development, and critical infrastructure planning. Rhode Island has large exposure to the potential impacts of SLR, with approximately 400 miles of shoreline, 21 coastal communities, and significant areas of low elevation.[25] Climate change, including the continued increase in global temperature, is projected to result in an acceleration of observed rates of SLR. Projections in global increases in sea level by 2100 due to climate change range from one (1) to two (2) feet[26] up to 6.6 feet.[27]

Although SLR is a gradual process, impacts may be experienced in the short term. Some examples include increased frequency of low-level inundation, exacerbated flood elevations during storm events, increased rates of coastal erosion, and increased saltwater intrusion into groundwater.

The Sentinel Monitoring for Climate Change in Long Island Sound Program is a multidisciplinary scientific approach to provide early warning of climate change impacts to Long Island Sound ecosystems, species and processes to facilitate appropriate and timely management decisions and adaptation responses.[28] It has been such a successful collaborative project that Sentinel Monitoring is being scaled up for the entire Northeast and Gulf of Maine region through the joint Ecosystem Heath Committee of Northeast Regional Ocean Council (NROC) and Northeast Regional Association of Coastal and Ocean Observing Systems (NERACOOS). With a scaled up Sentinel Monitoring program, Rhode Island and regional efforts can be leveraged to support key monitoring for discernible climate signals and impacts, as well as inform adaptation strategies to keep our ocean and coastal resources as healthy as possible. Data from this effort will be available on their data clearinghouse and will contain SLR data and trends.

Heat waves, coastal flooding due to SLR, marine transgression, and river flooding due to more extreme precipitation event will pose a growing challenge to Rhode Island. This will increase the vulnerability of the region's residents, especially those already disadvantaged. While several municipalities have already begun to incorporate the risk of climate change, implementation of adaption measures is still at early stages.[29] Since Rhode Island is a "home rule" state and nearly all land use decision are made at the municipal level, planning and implementation of actions to reduce the impacts of SLR and climate change in general must happen at the local level.

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[25] NOAA Office of Science and Technology webpage. New England summary of communities. July 2013.
[26] IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E.Hanson, Eds., Cambridge University Press, Cambridge, UK, 976pp.
[27] Pfeffer, W.T. et al, 2008: Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise. Science 321, 1340.
[28]Sentinel Monitoring for Climate Change in Long Island Sound Program http://longislandsoundstudy.net/research-monitoring/sentinel-monitoring/
[29] Global Change. Assess the US Climate. National Climate Assessment (NSA) Draft report Chapter 16 for the Northeast. V11 Jan 2013.

3.6.8.2 Location

In the northeastern United States, signs of the planet's changing climate have become increasingly apparent. Over the past 30 years, average winter temperatures in the region have risen 3.8º F.[30] The Northeast has experienced the largest increase in extreme precipitation events in the country. New England as a whole has experienced a 61% increase in such storm events over the past 59 years, while Rhode Island in particular has witnessed an 88% rise over the same period.[31]

Additionally, data from the Newport tide gauge (1930-2006) suggests a relative rate of SLR equal to 10.2" (± 0.75") over the last century in Rhode Island, with the last 19 years (1989-2007) showing an even higher average rate of SLR: approximately 0.157" per year.[32] If this linear trend continues, Newport's sea level in 2100 will be 15" higher than today. However, most model predictions are non-linear; these models anticipate sea levels to be approximately 1.6' to 4.6' higher by 2100. Higher sea levels will mean that coastal flood zones will move inland, encroaching on areas that currently are not in high risk flood zones.[33] A one (1) foot SLR is possible in the next 25 years, five (5) feet or higher rise by 2100 is no longer considered the worst case scenario.[34]

The Rhode Island Sea Grant (RISG) College Program working with numerous state, institutional, and federal partners compiled SLR inundation scenarios that represent conditions under average conditions at high tide as measured from the Newport, RI tide gauge using tide data collected between 1983 and 2001 (National Tidal Datum Epoch). However, tide levels can vary by more than a foot above or below average conditions due to gravitational forces from the alignment of the earth, the moon, and the sun. In addition, water levels at high tide become increasingly higher as you travel north through Narragansett Bay. Mean Higher High Water (MHHW) at the Providence tide gauge is about seven (7) inches higher than at the Newport tide gauge. Newport tide data are a reasonable representation of tides in North Kingstown, the site of one of the pilot communities. The inundation zones do not include wave heights or consider obstructions to water flow such as dikes and culverts. It should be noted that the data is intended for planning purposes only and not to be used as regulatory or jurisdictional capacity. The following bullets explain the five (5) SLR inundation scenarios for Rhode Island that have been utilized for this plan update vulnerability assessment:

- Mean Higher High Water (MHHW) – MHHW is the mean elevation of the higher of the two (2) daily high tides over a nineteen year period, in comparison to the mean high water (MHW), which is the average elevation of all high tides over the same period. MHHW is the chosen baseline for the RI SLR study since it reflects a realistic average tidal elevation that communities will experience regularly.
    - MHW = average of all high tides over 19-year tidal epoch
    - MHHW = average of the highest daily tide over a 19-year tidal epoch

[30] Union of Concerned Scientists, 2006
[31] Madsen and Figdor, 2007
[32] National Oceanic and Atmospheric Administration (NOAA1, 2007
[33] CRMC Metro Bay SAMP, 2009
[34] Veemer and Rahmstorf, 2009; USACE, 2009

- MHHW Plus One (1) foot SLR – Historically, sea level has already risen about 11 inches in the past 100 years. A rise of nine (9) inches has been noted at North Kingstown based on data since 1930 when the Newport tide gauge was installed. With accelerated SLR already being observed in RI, models show that global sea levels are likely to rise one foot in the next 20 to 50 years. MHHW Plus one (1) foot SLR scenario depict:
    - Areas inundated at mean high tide levels with one (1) foot of SLR, or
    - Areas inundated at spring high tide today.
- MHHW Plus One (1) foot SLR and three (3) foot Storm Surge – Extra-tropical storms, often referred to as Nor'easters, typically have storm surges of three feet above the predicted tide height as experienced in RI. MHHW Plus one (1) foot SLR and three (3) foot Storm Surge scenario depict:
    - Areas inundated during extra-tropical storms with a one (1) foot SLR, or
    - Areas inundated during extra-tropical storms that strike at spring tide today.
- MHHW Plus Five (5) foot SLR – Models show that global sea levels may rise as much as five (5) feet by 2100. MHHW Plus Five (5) foot SLR scenario depicts:
    - Areas inundated at mean high tide at 2100 or beyond, or
    - Areas inundated during extra-tropical storms that strike at spring high tide with a one (1) foot SLR.
- Hurricane 1938 Surge Height – This inundation surface estimates flood elevations of the 1938 hurricane, as recorded at the Newport tide gauge. Elevations do not include wave heights or run-up. It should be noted that inundation levels were higher in the upper Bay coastal communities as the storm surge traveled north into Narragansett Bay.

There are several models that project accelerated rates of SLR. Table 34 shows that the differences in planning horizons depending on the scenario and the specific scientific study.

Table 34. Sea level change studies

Study Name	1 foot SLR	3 foot SLR	5 foot SLR	Hurricane 1938 surge height
Vermeer and Rahmstorf, 2009	20 – 40 years	60 – 90+ years	80 – 90+ years	One percent change of occurrence every year
USACE Circular No. 1165-2-211, 2009	20 – 60 years	60 – 110+ years	90 – 110+ years	

Each of Rhode Island's 21 coastal communities are subject to impacts from SLR. Table 35 summarizes, in square miles, the inundation of each of the counties in Rhode Island. Washington and Newport counties represent the largest portion of inundation areas within the state. Figure 22 shows the extent of SLR in each of the scenarios.

Table 35. SLR scenarios shown in square miles of inundation area.

County	Hurricane 1938	Mean Higher High Water (MHHW)	+1' SLR	+3' SLR	+1 SLR and 3' Surge	+5' SRL
Bristol	2.67	0.68	0.55	1.07	0.56	0.66
Kent	1.23	0.30	0.23	0.37	0.20	0.24
Newport	3.51	2.10	1.43	1.97	0.91	0.82
Providence	1.31	0.29	0.16	0.23	0.11	0.17
Washington	6.03	5.10	1.42	2.64	1.37	1.42
Total	**14.75**	**8.47**	**3.79**	**6.28**	**3.15**	**3.31**

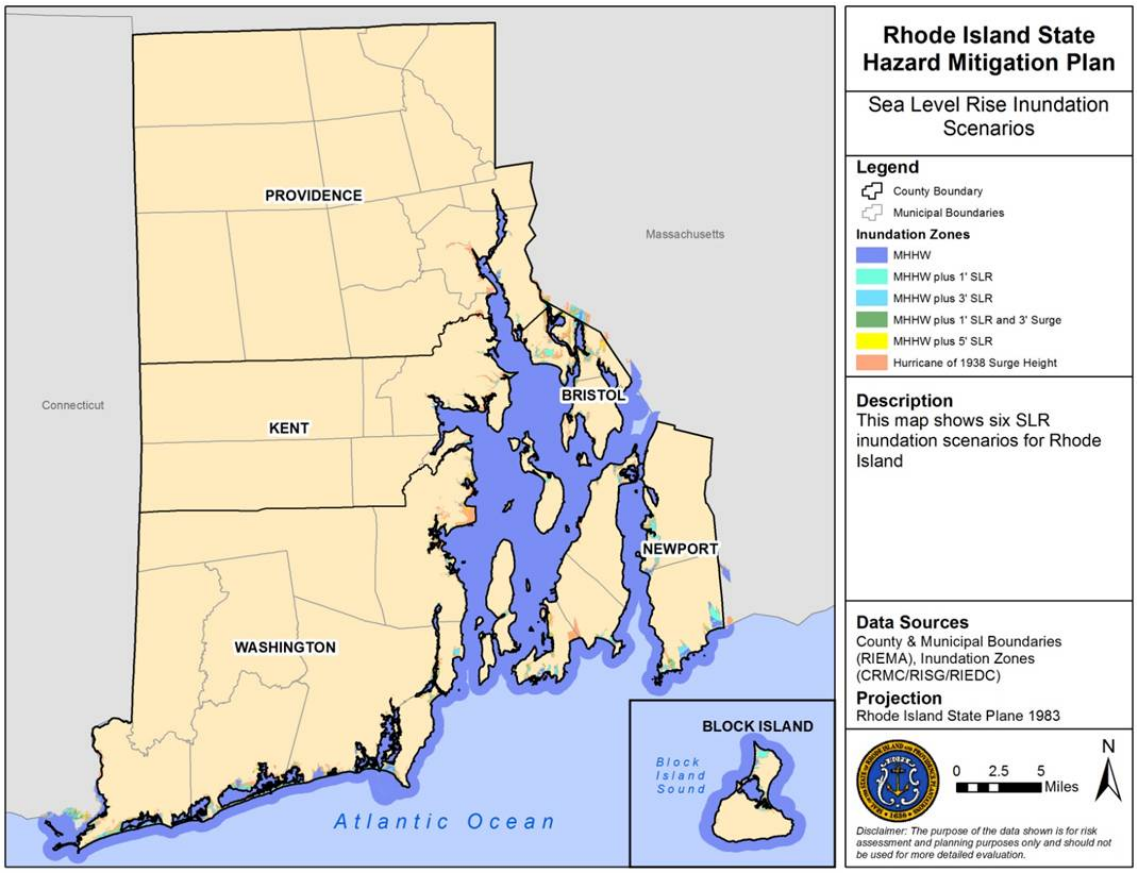

Figure 22. SLR inundation scenarios.

3.6.8.3 Extent (Impact and Vulnerability)

The most recent findings of the Intergovernmental Panel on Climate Change clearly demonstrate the global air and ocean temperatures are rising due to recent anthropogenic forcing. As global temperatures continue to increase, thermal expansion of seawater and accelerated melting of glacial ice leads to an increase in the total volume of global ocean waters. Over the last 100 years, sea levels have risen 6.7" globally. By 2100, greenhouse gas

concentrations are predicted to reach levels greater than or equal to those observed during the last interglacial period when sea levels were between 13.1' and 19.7' higher than present levels.[35] Moreover, it has been reported that the occurrence of severe storm events is increasing almost everywhere in the contiguous United States.[36] Climate change may increase both the frequency and the severity of these events. Finally, as sea temperatures increase, the associated changes in species composition and ecosystem dynamics will alter our estuaries, fisheries and wetlands, with the potential to increase the presence of invasive species.[37]

Due to the timescales associated with climate processes and feedbacks, anthropogenic warming and SLR will continue for centuries regardless of steps taken to curb greenhouse gas emissions.[38]

Extreme weather events have become more frequent over the past 40 to 50 years and this trend is projected to continue[39]. Rising sea levels, coupled with potentially higher hurricane wind speeds, rainfall intensity, and storm surges are expected to have a significant impact on coastal communities. More intense heat waves may mean more heat-related illnesses, droughts and wildfires. As climate science evolves and improves, future updates to this plan might consider including climate change as a parameter in the ranking or scoring of natural hazards.

Climate change will result in wide scale systematic changes in the terrestrial and marine environments. Future increases in relative sea level will displace coastal populations, threaten infrastructure, intensify coastal flooding and ultimately lead to the loss of recreation areas, public space, and coastal wetlands. Coastal infrastructure will become increasingly susceptible to complications from rising sea levels, as the upward trend continues. Residential and commercial structures, roads, and bridges will be more prone to flooding. SLR will also reduce the effectiveness and integrity of existing seawalls and revetments, designed for historically lower water levels. Higher sea levels will result in changes in surface water and groundwater characteristics. Salt intrusion into aquifers will contaminate drinking water supplies and higher water tables will compromise wastewater treatment systems in the coastal zone.

Future increase in relative sea level will increase the extent of flood damage over time. Lower elevations will become increasingly susceptible to flooding as storm surge reaches further inland due to both SLR in concert with a probable increase in the frequency and intensity of storms predicted from climate change. As a result, more coastal lands will be susceptible to erosion. Barriers if unimpeded by development will tend to over wash and move landward. Increased frontal erosion and retreat of the barriers will cause Rhode Island's south shore to migrate continuously landward with rising sea levels.

[35] Overpeck, et al., 2006
[36] Madsen and Figdor, 2007
[37] CRMC Metro Bay SAMP, 2009
[38] IPCC, 2007
[39] Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

3.6.8.4 Previous Occurrences and Probability of Future Events

Sea level in Rhode Island has increased by an average of one (1) inch per decade since 1930. Over the past half century, sea levels in the Northeast have been increasing three (3) to four (4) times faster than the global average rate, resulting in a six (6) inch rise between 1970 and 2012. With accelerating rates, sea level is project to increase by three (3) to five (5) feet above 1990 levels in Rhode Island by 2100, with a potential for one (1) foot of SLR by 2050.[40] This is the policy for CRMC, three (3) to five (5) feet by 2100.

SLR presents a hazard that should be considered in long-term land use, development, and critical infrastructure planning. Rhode Island has large exposure to the potential impacts of SLR, with over 400 miles of shoreline and significant areas of low elevation. Climate change, including the continued increase in global temperature, is projected to result in an acceleration of observed rates of SLR. Projections in global increases in sea level by 2100 due to climate change range from one (1) to two (2) feet[41] up to 6.6 feet[42].

It is difficult to assign quantitative probabilities to projections of sea level increases. Climate planning is being completed in an adaptive approach to allow for best available science to be continually updated. No widely accepted method is currently available for probabilistic projections at the regional or local level. Multiple scenarios allows for experts and decision makers to consider multiple future conditions and develop responses based on the information that may reduce future impacts and vulnerabilities.[43]

The scenarios shown in Table 36 are based on four (4) estimates of global SLR that reflect different degrees of ocean warming and ice sheet loss ranging from 0.2 meters (8 inches) to 2.0 meters (6.6 feet) by 2100. These scenarios provide a set of plausible trajectories of global mean SLR for use in assessing vulnerability, impacts, and adaptation strategies. None of the scenarios should be used in isolation, and experts and coastal managers should factor in locally and regionally specific information on climatic, physical, ecological, and biological processes and on the culture and economy of coastal communities.[44]

Table 36. Global SLR scenarios. * Using mean sea level in 1992 as a starting point.

Scenario	SLR by 2100 (meters)*	SLR by 2100 (feet)*
Highest	2.0	6.6
Intermediate-High	1.2	3.9
Intermediate-Low	0.5	1.6
Lowest	0.2	0.7

[40] Sea Level Rise in Rhode Island. Trends and Impacts Fact Sheet. http://seagrant.gso.uri.edu/z_downloads/climate_SLR_factsheet2013.pdf
[41] IPCC, 2007: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E.Hanson, Eds., Cambridge University Press, Cambridge, UK, 976pp.
[42] Pfeffer, W.T. et al, 2008: Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise. Science 321, 1340.
[43] Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, et all 2012. Global Sea Level Rise Scenarios for the US National Climate Assessment. NOAA Tech Memo OAR CPO-1. 37 pp.
[44] Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, et all. 2012. Global Sea Level Rise Scenarios for the US National Climate Assessment. NOAA Tech Memo OAR CPO-1. 37 pp.

3.6.8.5 Vulnerability & Risk Assessment

SLR vulnerability is restricted to the coastal communities and shoreline in Rhode Island. Washington County has the largest inundation area with potential vulnerability and losses in North Kingstown, Narragansett, South Kingstown, Charlestown, and Westerly. All municipalities within Newport County are vulnerable to inundation and losses; these include Jamestown, Newport, Middletown, Portsmouth, Tiverton, and Little Compton. Barrington, Warren, and Bristol within Bristol County are also vulnerable, with the entire extent of Barrington and Warren at elevated risk due to the elevation of the community in relation to the potential inundation.

Exposure and risk to the six (6) inundation scenarios were evaluated by intersecting the CRMC SLR hazard layers with the Rhode Island critical and state-owned facility geospatial data. Exposure values to each scenario could not be completed due to the lack of economic attributes available for the facilities. Occurrence of a higher range scenario would accumulate risk in a step-wise fashion on top of a lower range scenario. Risk to state-owned and critical facilities was evaluated for each SLR risk class by facility category. Exposed state-owned and critical facilities were tabulated by county. Facilities data did not have building contents or exposure value and as a result, this analysis does not include total exposure or monetary loss estimates.

Table 37 and Appendix 3: *Hazard Identification & Risk Assessment* show the number of facilities in each inundation zone by county. Two (2) state facilities, Welfare in Newport County and Block Island Facility in Washington County intersected with the MHHW plus five (5) feet SLR scenario. 12 critical facilities intersected with the MHHW plus five (5) feet SLR scenario and include:

- Striper Marina (Bristol County)
- Angel's Marina (Kent County)
- Pawtuxet Reservoir Lower Dam (Kent County)
- Christie's Restaurant (Newport County)
- Newport Yacht Club, Harbour Court (Newport County)
- Newport Fire Department Station 1 (Newport County)
- Old Harbor Marina (Providence County)
- Rhode Island Yacht Club (Providence County)
- Avondale Boatyard Inc.(Washington County)
- Kenport Marina.(Washington County)
- Wickford Yacht Club.(Washington County)

Seventeen state facilities, 33 critical facilities and 11 CIKR facilities are located within the Hurricane 1938 flood level. The CIKR facilities include several unnamed facilities, Dominion Energy, Johnson & Wale University Harborside Campus, Quonset State Airport, and Univar.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update t**o include**

comprehensive loss estimates by municipality for hazards with known geographic extents.

Table 37. Facilities within SLR inundation scenarios.

County	Hurricane 1938 Flood Level	Mean Higher High Water (MHHW)	MHHW Plus 1' SLR	MHHW Plus 3' SLR	MHHW Plus 1' SLR & 3' Storm Surge	MHHW Plus 5' SLR
Bristol	6	2	1	3	2	1
Kent	5	5	2	3	3	2
Newport	10	4	1	3	1	5
Providence	25	1	0	2	0	2
Washington	15	4	1	3	3	4
Total	**61**	**16**	**5**	**14**	**9**	**14**

3.6.9 Coastal Erosion

3.6.9.1 Description

Coastal zones are dynamic areas that are constantly undergoing change in response to a multitude of factors, including SLR, wave and current patterns, hurricanes, coastal flooding and human influences. High winds and associated marine flooding from storm events such as hurricanes, nor'easters, flooding and SLR, all increase the risk exposure along developed coastal lands. Storm impacts and long-term erosion threatens developed areas with potential loss of life and billions of dollars in property damage. In addition to the natural processes that cause erosion, human alterations are affecting erosion rates.

Erosion has been wearing away bluffs and moving beaches and barriers along the U.S. coastal and Great Lakes shores from the powers of flooding, storm surge, rising sea levels, and high surf. As shorelines retreat inland, waterfront homes, public infrastructure such as roads, bridges, wastewater treatment facilities, and stormwater drainage systems, eventually become severely damaged. The Heinz Center report on the "Evaluation of Erosion Hazards" predicts that over the next 60 years erosion may claim one (1) out of four (4) houses within 500 feet of the U.S. shoreline. Most of the damage will occur in low-lying areas – areas also subject to the highest risk of flooding. Additional damage will also occur along coastal bluffs as waves reach higher on the shoreline and erode the toe of the bluff and gravity takes its course.

The beaches, barrier spits and coastal bluffs of Rhode Island are vital economic, environmental, and cultural resources. A healthy, wide sandy beach provides protection against the effects of storm surge, coastal flooding, and high surf impacts. The beach and barrier environment provides habitat for marine and terrestrial organisms with beach dependent life stages and is home to species of indigenous and endemic Rhode Island plants. Beaches, barrier spits and coastal bluffs are also the basis for the tourism industry, exceeding by a factor of three all other industries combined when providing direct income to the State.

The south shore of Rhode Island is a headland/barrier system that extends for approximately 25 miles from Watch Hill to Point Judith. Rhode Island's headlands formed 16,000 to 20,000 years ago with the disintegration of the Laurentide Ice Sheet, which once covered this landscape. The silt, sand, gravel and boulders that had been entrained in the ice were either deposited in place as the ice melted or were jetted out from the glacier in meltwater rivers. Most of the glacial headlands are eroding. The sediment that erodes from the headlands is transported by waves and currents to form beaches and barrier spits.

Rhode Island's beaches and barriers serve as natural protective buffers between the ocean and the land. During storm events, a beach is able to modify its slope and overall morphology to dissipate the waves. The beach profile is flattened, and the waves coming inshore shoal further out offshore, thus minimizing further erosion. Beaches recover when sand is moved back onto the shore by fair weather waves, and then is blown inland to reestablish the frontal dunes. The final stage of recovery of the beach and dunes occurs when vegetation grows back over these new dunes. Hence, the narrowing of healthy beaches in response to a high wave event is often a temporary condition.

Barriers are strips of sediment that extend parallel to the shoreline and enclose a tidal water body or salt marsh. The barriers are more recent features than the headlands. Storm induced erosion of the headlands, coupled with SLR and longshore sediment transport all factor into the formation of the barriers. Rhode Island's south shore barrier spits are miles in length and several hundred feet wide. They typically have a beach, a foredune zone and a back barrier flat. Barriers are landforms in motion. During storms, sand eroded from the seaward-facing side of the barrier is carried toward the back of the barrier through surge channels. In severe storms, inlets can form, cutting through the barrier. Over time, these processes cause the barrier spit to move landward.

3.6.9.2 Location

The CRMC has adopted shoreline change maps, showing changes from Narragansett to Little Compton inclusive of Narragansett Bay and its islands (Figure 23). These maps are supplemental to those incorporated into the RI Coastal Resources Management Program for the south coast between Watch Hill and Narragansett Pier. The purpose of these maps is to delineate shoreline rates of change that will be applied to pertinent sections of the Council's regulatory programs to address issues including setbacks of activities from coastal features. These shoreline change maps detail erosion rates for the shoreline, and are further detailed into shoreline segments for each map. In total there are 150 such maps. A map for New Shoreham has not yet been developed, however, setbacks and erosion rates for New Shoreham shall be assessed on a case-by-case basis. These are currently being updated by the CRMC.[45]

The headlands and barriers of the south shore from Watch Hill in Westerly to Point Judith in Narragansett are generally eroding at a higher rate than other shorelines along the Rhode Island coast due to their exposure to ocean forces and geologic setting and composition.

[45] http://www.crmc.state.ri.us/maps/maps_shorechange.html

Matunuck, South Kingstown Erosion Map

Figure 23. Example of community specific erosion maps.

3.6.9.3 Extent (Impact and Vulnerability)

The vulnerability of many of Rhode Island's beaches and shoreline areas to coastal erosion and flooding tends to dramatically increase as manmade structures are allowed to be built along the shoreline thus impeding the natural, dynamic system of the beach. Coastal armoring and the construction of jetties and groins may save the beach or one private property owner, but it severely impacts sediment deposits from occurring down shore of the structure, thus accelerating erosion activity and hindering property owners in these locations.

For example, sediment impoundment accompanies coastal armoring. Sands that would normally be released into coastal waters during high wave events and with seasonal profile fluctuations are trapped behind walls and revetments and prevented from adding to the beach sediment budget. One wall may have minimal impact, but along the Rhode Island coastline numerous armoring combine to reduce sand availability to nearly zero. Natural coastal erosion does not damage beaches that have access to a robust sediment budget. Beaches on chronically eroding coasts that are not armored remain healthy even during shoreline retreat because sands are released from eroding coastal lands that nourish the adjoining beach. However, armoring traps those sands and a sediment deficiency develops, such that the beach does not withstand wave stresses and begins to narrow with time. Chronic beach erosion and

beach loss eventually results. Many beaches eventually disappear simply because they are starved of sand.

Experimental, short-term erosion control methods have been proposed for use throughout the state to combat coastal erosion until longer-term solutions, such as the landward retreat of residential and commercial structures can be implemented. The CRMC is also developing a Shoreline Change Special Area Management Plan (SAMP), which will provide a long-term plan for coastal cities and towns to plan for and be more resilient to natural processes like erosion, SLR, and flooding.

3.6.9.4 Previous Occurrences and Probability of Future Events

Fifty percent of Rhode Island's shoreline sediments are susceptible to erosion and a significant portion of the State's shoreline is eroding. Erosion rates are calculated by comparing the shoreline location from historic aerial photographs to the most recent shoreline position. Sections of the south shore barriers have average annual erosion rates of more than two (2) to three (3) feet per year (Figure 24). Significant erosion also occurs during storms. The shoreline typically erodes tens of feet in a single storm, followed by some accretion. Erosion poses a significant threat to property owners, the public and the State's natural resources. Probability of future coastal erosion can be related to a Medium-High to High probability of occurrence based on the relationship to other hazard events such as hurricane probabilities. Table 7 provides the annualized events qualitative ranking used for determining probability of future events.

Over shorter periods of time, waves and storm events are the primary cause of changes in shoreline conditions. SLR is one of the long term causes of shoreline erosion (see SLR section for a full description of that hazard). SLR contributes to erosion by influencing and worsening on-going coastal processes, making coastal areas ever more vulnerable to extreme events. As SLRs, storm surges and waves will extend further inland, flooding homes, businesses and roadways. In some areas of the Northeast, storm surges associated with future hurricanes could be two (2) to four (4) feet higher than present conditions. The potentially large effect of SLR on erosion rates must therefore be considered.

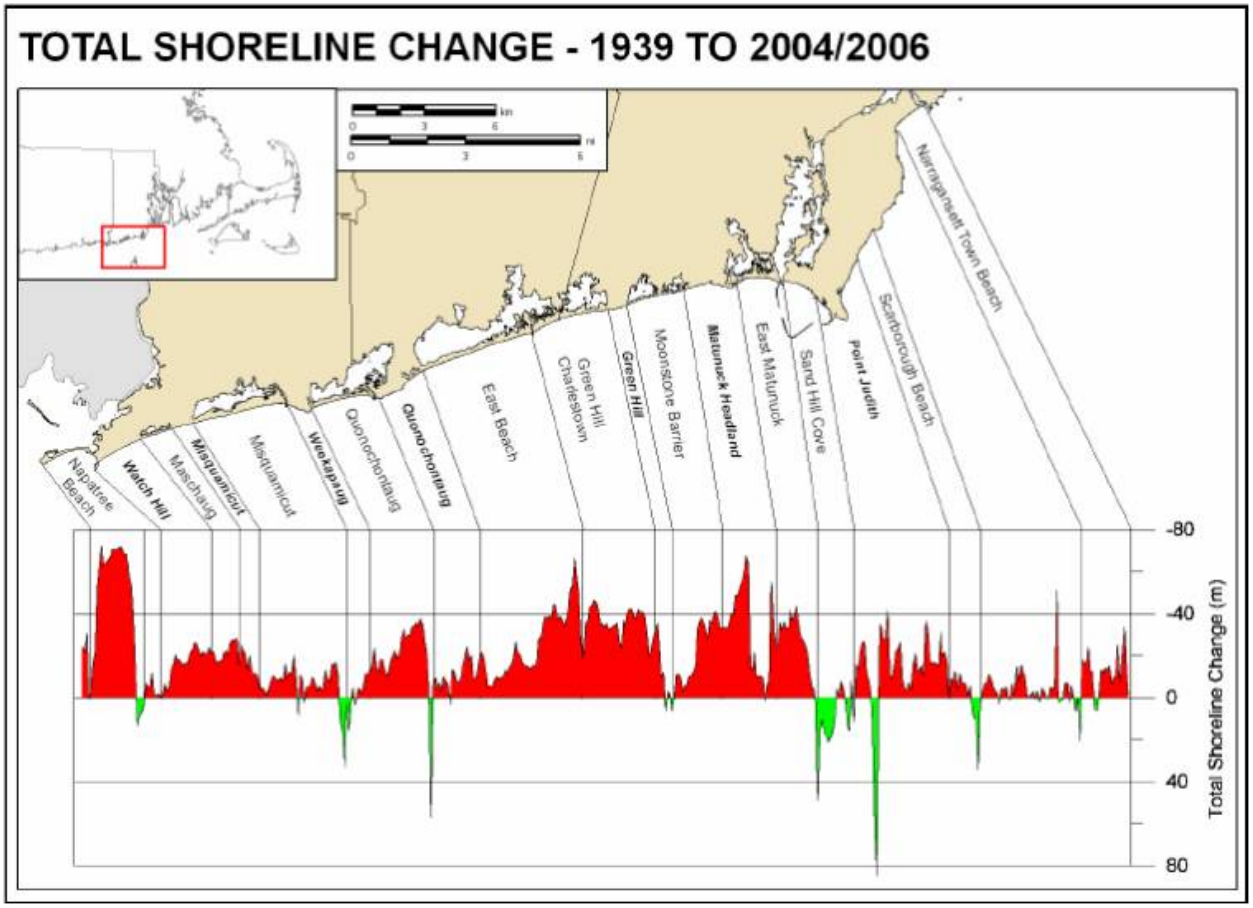

Figure 24. Coastal erosion shoreline change (1939 – 2006).

3.6.9.5 Vulnerability & Risk Assessment

New development along coastal areas in Rhode Island is regulated by CRMC and municipalities. One regulation requires a Coastal Buffer Zone, or a "land area adjacent to a Shoreline (Coastal) Feature that is, or will be, vegetated with native shoreline species and which acts as a natural transition zone between the coast and adjacent upland development," on property within 200 feet of the inland edge of a coastal feature. The benefits of the Coastal Buffer Zone include protection of water quality, protection of coastal habitat, protection of scenic and aesthetic quality, erosion control, and flood control.

The CRMC also maintains regulations for barrier spits and islands located on the state's south shore. New development is prohibited on undeveloped and moderately developed barriers except where the primary purpose of the project is restoration, protection or improvement of the feature as a natural habitat for plants and wildlife. The construction of new buildings is prohibited on developed barriers on which only roads, utility lines, and other forms of public infrastructure were present as of 1985. In addition, all residential construction should be setback a minimum of fifty feet. Results of this regulation have decreased vulnerability and potential losses due to shoreline erosion in Rhode Island.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

3.6.10 Dam Breach

3.6.10.1 Description

Dam failures can result from natural events, human-induced events, or a combination of the two (2). Failures due to natural events such as prolonged periods of rainfall and flooding can result in overtopping, which is the most common cause of dam failure. Overtopping occurs when a dam's spillway capacity is exceeded and portions of the dam which are not designed to convey flow begin to pass water, erode away, and ultimately fail. Other causes of dam failure include design flaws, foundation failure, internal soil erosion, inadequate maintenance, or misoperation. Complete failure occurs if internal erosion or overtopping results in a complete structural breach, releasing a high-velocity wall of debris-laden water that rushes downstream, damaging or destroying everything in its path. An additional hazard concern is the cascading effect of one dam failure causing multiple dam failures downstream due to the sudden release of flow.

While dam failures that occur during flood events compound an already tenuous situation and are certainly problematic, the dam failures that occur on dry days are the most dangerous. These "dry day" dam failures typically occur without warning, and downstream property owners and others in the vicinity are more vulnerable to being unexpectedly caught in life threatening situations than failures during predicted flood events.

Dams are classified by size and hazard ratings. The size classification provides a relative description of small, medium, or large, based on the storage capacity and height of the impounded water. The hazard classification relates to the probable consequences of failure or misoperation of the dam; however, it does not relate to the current condition or the likelihood of failure of the dam. The hazard classifications are defined in the Rhode Island Dam Safety Regulations as follows:

- High Hazard – means a dam where failure or misoperation will result in a probable loss of human life.
- Significant Hazard – means a dam where failure or misoperation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities, or impact other concerns detrimental to the public's health, safety, or welfare.

Low Hazard – means a dam where failure or misoperation results in no probable loss of human life and low economic losses. Intense storms may produce a flood in a few hours or even minutes for upstream locations. Flash floods occur within six (6) hours of the beginning of heavy rainfall, and dam failure may occur within hours of the first signs of breaching. Other failures and breaches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

3.6.10.2 Location

In 2012, there were 96 high hazard dams (14.4% of all dams), 81 significant hazard dams (12.1% of all dams), 490 low hazard dams (73.4% of all dams), and one (1) dam not hazard classified (.1% of all dams), for a total inventory of 666 dams (Table 38 and Figure 25). This is a slight change from the 2010 SHMP, which documented 97 high hazard dams, 83 significant hazard dams, and 491 low hazard dams, with a total active inventory of 671 dams.

One of the DEM responsibilities in the Dam Safety Program is to inspect and identify unsafe dams and take appropriate action to return the dams to safe condition. An unsafe dam is a high or significant hazard dam whose condition is such that an unreasonable risk of failure exists. In 2012, the DEM worked on addressing 37 unsafe dams and by the end of the year, six (6) dams were removed from the list. Unsafe dams are listed in Table 40.

Table 38. DEM Dam Inventory.

County	High	Significant	Low	Total # Dams
Bristol	2	7	15	24
Kent	12	10	111	133
Newport	7	3	11	21
Providence	56	40	235	331
Washington	19	21	117	157
Total	96	81	489	666

3.6.10.3 Extent (Impact and Vulnerability)

Dams have been an important part of Rhode Island's water infrastructure for centuries. In addition to the historic economic benefits provided by dams, they are used for flood control, water supply, power generation, recreation, and for mitigating the impact of increased runoff typically caused by land use changes associated with property development. Today there are over 666 dams in Rhode Island which because of their size and location pose a potential hazard to downstream properties.

Two (2) factors influence the severity of a dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream. The potential severity of a dam failure may be classified for each dam according to its "hazard potential," meaning the probable impact that would occur if the structure failed in terms of loss of human life and economic loss or environmental damage. RI DEM classifies dam based solely on the types of impacts expected if a dam were to fail—they are not related to the adequacy or structural integrity of the dams themselves.

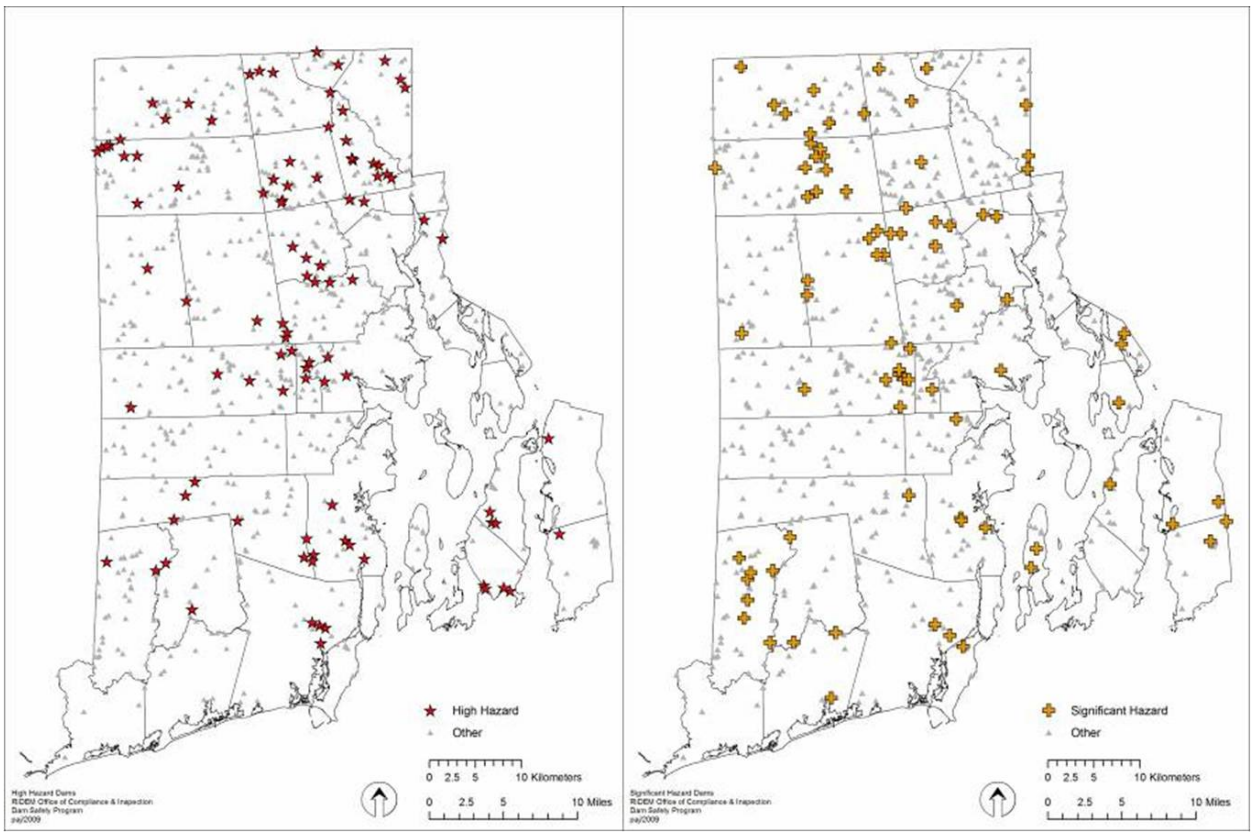

Figure 25. High and significant dams in Rhode Island. Source: DEM.

3.6.10.4 Previous Occurrences, Disasters, and Probability of Future Events

Rhode Island has experienced many dam failures, mainly resulting from major flood events. Historically, however, the consequences of dam failures have not been well documented. Descriptions of previous dam failure events provided in this section are based on data available from the National Performance of Dams Program (NPDP) at Stanford University, the Association of State Dam Safety Officials, and NCDC.

Over 111 dam incidents have been recorded in Rhode Island, of which seven (7) resulted in dam failure. The most recent documented event was in May 2002 at Sweet's Mill dam in the Town of Glocester, Providence County.

Table 39: National Performance of Dams Program Rhode Island Reported Dam Incidents.

Incident Date	Dam Name	Incident Type
8/25/1889	Spring Lake Dam	Piping
3/11/1901	Randall's Pond (Lower)	Inflow Flood - Hydrologic Event
1991	Burton Pond Dam	Concrete Deterioration
1991	Unnamed Dam (RIS00003)	Not Known
2/18/1998	Peace Dale Pond Dam	Inflow Flood - Hydrologic Event
8/6/2000	Mill Pond	Embankment Erosion
5/8/2002	Sweet's Mill	Biological Attack (i.e., bush, tree growth);Embankment Erosion

While generally considered an unlikely occurrence, the potential for dam failure in Rhode Island is a significant concern given the large number of dams across the state and the fact there have been dam failure events in the past. The probability of future occurrence or annualized events shown in Figure 26 illustrates a Medium-High to High probability of occurrence across the state. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. The probability of future dam failure events is not easily measured, but correlates to some extent with the probability of future major flood events coupled with preventative measures, including the routine inspection, maintenance, repair, and proper operation of dams by their owners, and as regulated by Rhode Island dam safety.

The Dam Safety Section is tasked with monitoring the routine inspection and maintenance of those dams that present the greatest risk or are in need of structural repair. State regulations require that over 600 dams in Rhode Island must be inspected annually, with priority placed on those dams which pose the greatest potential threat to downstream persons and properties. Other structures are inspected as time and funding permit, and upon notification of potentially significant deficiencies or emergency conditions. Dam owners are responsible for complying with maintenance and repair requirements and developing Emergency Action Plans (EAPs), which are required for high and significant hazard dams.

Dams which receive construction permits for repair and/or reconstruction are designed to pass at least the 100-year rainfall event with one foot of freeboard (a factor of safety against overtopping). The most critical and hazardous dams are required to meet a spillway design standard much higher than passing the runoff from a 100-year rainfall event. Although not all of the dams have been shown to be able to withstand the 100-year rainfall event, most of the dams meet this standard due to original design requirements or recent spillway upgrades. For the most part if smaller rainfall events (e.g., 10-year and 25-year events) occur more frequently there will be little impact on the ability of the dams to operate safely.

As more and more state-owned and privately owned dams are repaired, the number of dams that will not meet the State minimum requirements for spillway design diminishes. However, the average age of all the dams continues to increase and thus the State must remain vigilant in administering its dam safety regulations and related programs.

3.6.10.5 Vulnerability & Risk Assessment

The DEM does maintain dam inundation data and maps; however, they wish to keep these materials for State use only. As a result, dam inundation mapping with critical and state facilities was not possible for this plan update. The State may consider conducting internal analysis between dam inundation layers and critical and state facilities and reporting on the numbers of facilities within the dam inundation zone for future SHMP updates. Table 40 summarizes the unsafe dams in Rhode Island. A summary of each of these dams and the reason they were deemed unsafe can be found in the Rhode Island 2012 Annual Report to the Governor on the Activities of the Dam Safety Program, prepared by the Office of Compliance and Inspection within the DEM.

Dam inspections may also reflect dam vulnerability. High hazard dam inspections are required to be performed every two (2) year and significant hazard dams every five (5) years. Low hazard dams are inspected every five (5) years. A visual inspection is performed whenever the DEM has cause to believe that an unsafe dam exists. In addition, a high or significant hazard dam is visually inspected upon request by any person who has cause to believe that an unsafe dam exists.

By requirement, 21 high hazard dams and 25 significant hazard dams were inspected in 2012. In addition, the DEM received an inspection request for the Middle Dam, a significant hazard dam located in Coventry. The reason given for inspection was that the water level in the pond was lower than usual. However, an inspection revealed that water was flowing from the pond through the spillway pipes at the dam and since the pond level was high enough to flow through the spillway, it was at its normal level and the complaint was unfounded. Three dams in Cranston and Johnson in Providence County are classified as High hazard dams with poor embankment, spillway and low level outlet and, as a result have a high vulnerability and potential loss estimate. No potential losses or specific vulnerabilities could be estimated due to the lack of inundation mapping available.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

Table 40. RI Department of Environmental Management (DEM) Unsafe Dams.

County	Town	Dam Name	Hazard Class	Embankment	Spillway	Low Level Outlet
Kent	Coventry	Pearce	H	Fair to Poor	Fair to Poor	Poor
		Middle	S	Poor	Poor	Poor
Newport	Tiverton	Creamer	H	Fair to Poor	Good	Not Present
Providence	Burrillville	Mapleville	H	Fair to Poor	Fair to Poor	Poor
		Gilleran	L	Fair	Fair	Poor
		Sucker	S	Fair to Poor	Fair to Poor	Poor
	Cranston	Curran Upper	H	Poor	Poor	Poor
		Curran Lower	H	Poor	Poor	Poor

County	Town	Dam Name	Hazard Class	Embankment	Spillway	Low Level Outlet
		Clarke's Upper	H	Poor	Poor	Poor
	Glocester	Hawkins	H	Poor	Poor	Poor
		Bowdish Lower	H	Fair to Poor	Poor	Unknown
	Johnston	Oak Swamp	H	Fair to Poor	Fair to Poor	Not Present
		Almy	H	Poor	Poor	Poor
		Simmons Upper	H	Poor	Poor	Poor
		Simmons Lower	H	Poor	Poor	Poor
	Lincoln	Butterfly	H	Fair to Poor	Fair to Poor	Poor
		Bleachery	H	Fair	Fair	Poor
		Limerock	H	Poor	Fair	Poor
		Handy Upper	H	Poor	Fair	Not Present
		Bridlewood	H	Fair	Fair	Not Present
	North Smithfield	Slatersville Middle	H	Fair	Fair	Poor
		Todd's	S	Poor	Fair to Poor	Poor
	Providence	Canada Upper	S	Fair to Poor	Fair to Poor	Poor
	Smithfield	Sprague Upper	H	Poor	Good	Poor
		Sprague Lower	H	Poor	Fair to Poor	Poor
		Georgiaville	H	Poor	Good to Poor	Unknown
		Stillwater	S	Poor	Fair	Poor
Washington	Exeter	Slocum	H	Good to Poor	Good to Fair	Poor
		Metcalf	H	Fair to Poor	Fair	Poor
	Hopkinton	Wincheck	S	Fair to Poor	Fair to Poor	Poor
		Blue	S	Breached	Fair	Poor
		Harris	S	Fair to Poor	Fair	Not Present
		Langworthy	S	Fair to Poor	Good	Not Present
	North Kingstown	Rodman Mill	H	Poor	Fair	Poor
		Slocum Upper	H	Poor	Fair to Poor	Unknown
	North Providence	Wenscott	H	Fair	Fair	Poor
	South Kingstown	Wakefield	H	Fair to Poor	Fair	Poor

3.6.10.5.1 Hazard Ranking

Quantitative risk assessment, to the degree possible, has been completed for dam breach using the methodology described in the Hazard Analysis and Ranking methodology section. Annualized events, damages, and deaths/injuries have been supplemented with the NPDP data covering 135 years of record. Geographic extent is represented by the number of high or significant dams per jurisdiction. Providence County has a higher risk due to dam failure based on number of dams in the county and previous events resulting in deaths and injuries (Figure 26).

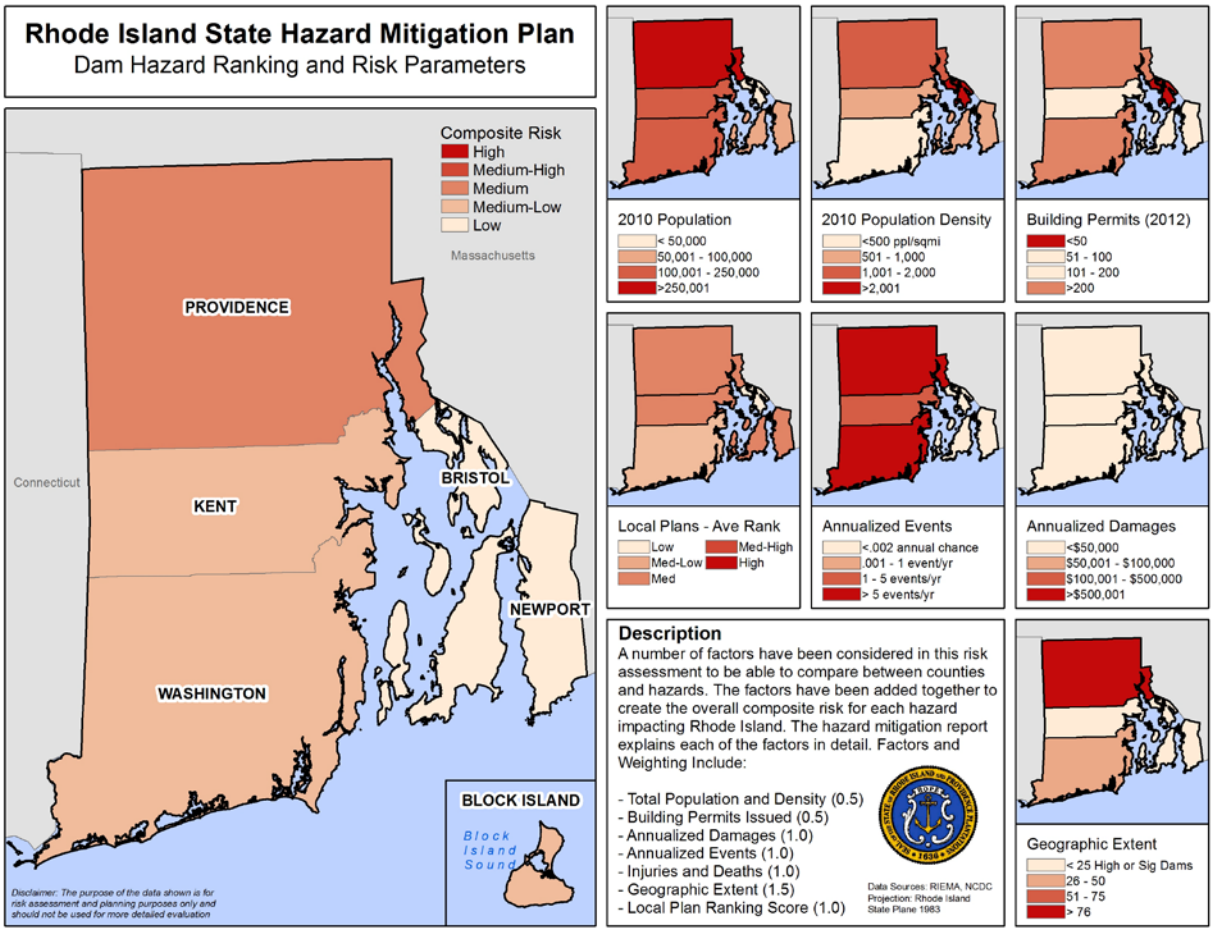

Figure 26. NCDC dam breach hazard ranking.

3.6.11 Wildfire

3.6.11.1 Description

Wildfires are fueled by natural cover, including native and non-native species of trees, brush and grasses, and crops along with weather conditions and topography. While available fuel, topography, and weather provide the conditions that allow wildfires to spread, most wildfires are caused by people through criminal or accidental misuse of fire.

Wildfires pose serious threats to human safety and property in rural and suburban areas. They can destroy crops, timber resources, recreation areas, and habitat for wildlife. Wildfires are commonly perceived as hazards in the western part of the country; however, wildfires are a growing problem in the wildland/urban interface of the eastern United States, including Rhode Island.

Wildfires are dependent upon the quantity and quality of available fuels. Fuel quantity is the mass per unit area. Fuel quality is determined by a number of factors, including fuel density, chemistry, and arrangement. Arrangement influences the availability of oxygen. Another important aspect of fuel quality is the total surface exposed to heat and air. Fuels with large area-to-volume ratios, such as grasses, leaves, bark and twigs, are easily ignited when dry.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In Rhode Island, common factors leading to large fires include short-term drought, humidity below 20%, and fuel type.

Various natural and human agents can be responsible for igniting wildfires. Natural agents include lightning, sparks generated by rocks rolling down a slope, friction produced by branches rubbing together in the wind, and spontaneous combustion.

Human-caused wildfires are typically worse than those caused by natural agents. Arson and accidental fires usually start along roads, trails, streams, or at dwellings that are generally on lower slopes or bottoms of hills and valleys. Nurtured by updrafts, these fires can spread quickly uphill. Arson fires are often set deliberately at times when factors such as wind, temperature, and dryness contribute to the fires' spread.

3.6.11.2 Location

Small wildfires are common throughout the State. When drought or near-drought conditions warrant, the potential for spreading wildfires is real. Forests cover more than half of Rhode Island's land area and the State's woodlands are increasingly being developed. Figure 27 portrays the State's Wildland Urban Interface (WUI), the area where structures and human development meet and intermingle with undeveloped wildland, creating an environment in which

fire can move readily between structural and vegetative fuels. Intermix WUI are areas where housing and vegetation intermingle (48% Rhode Island land area); interface WUI are areas with housing in the vicinity of contiguous wildland vegetation (9% Rhode Island land area).[46]

Table 41. Wildland Urban Interface area by county and zone.

County	Intermix Area (Sq Mi)	Interface Area (Sq Mi)	Total Area (Sq Mi)
Bristol	2.85	0	24.72
Kent	78.85	8.49	173.96
Newport	41.02	8.27	107.49
Providence	213.48	34.57	429.95
Washington	185.77	41.13	341.86
Total	521.97	92.46	1077.98

3.6.11.3 Extent (Impact and Vulnerability)

Vulnerability to wildfire is influenced by a variety of factors, such as land cover conditions, weather, and the effectiveness of land management techniques. Highly urbanized areas are less vulnerable to wildfire, but 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. Wildfire primarily impacts timber and forest ecosystems, although the threat to nearby buildings is always present.

The accurate prediction of the potential risk of a wildland fire and the forewarning of dangerous wildland fire conditions can help reduce the incidence and seriousness of wildland fires. It can also provide firefighters the critical time needed for important preparation and readiness for wildfire suppression, as well as assist decision makers in the appropriate uses and activities for the public at large during times of extreme fire danger to aid in the prevention efforts.

[46] 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.

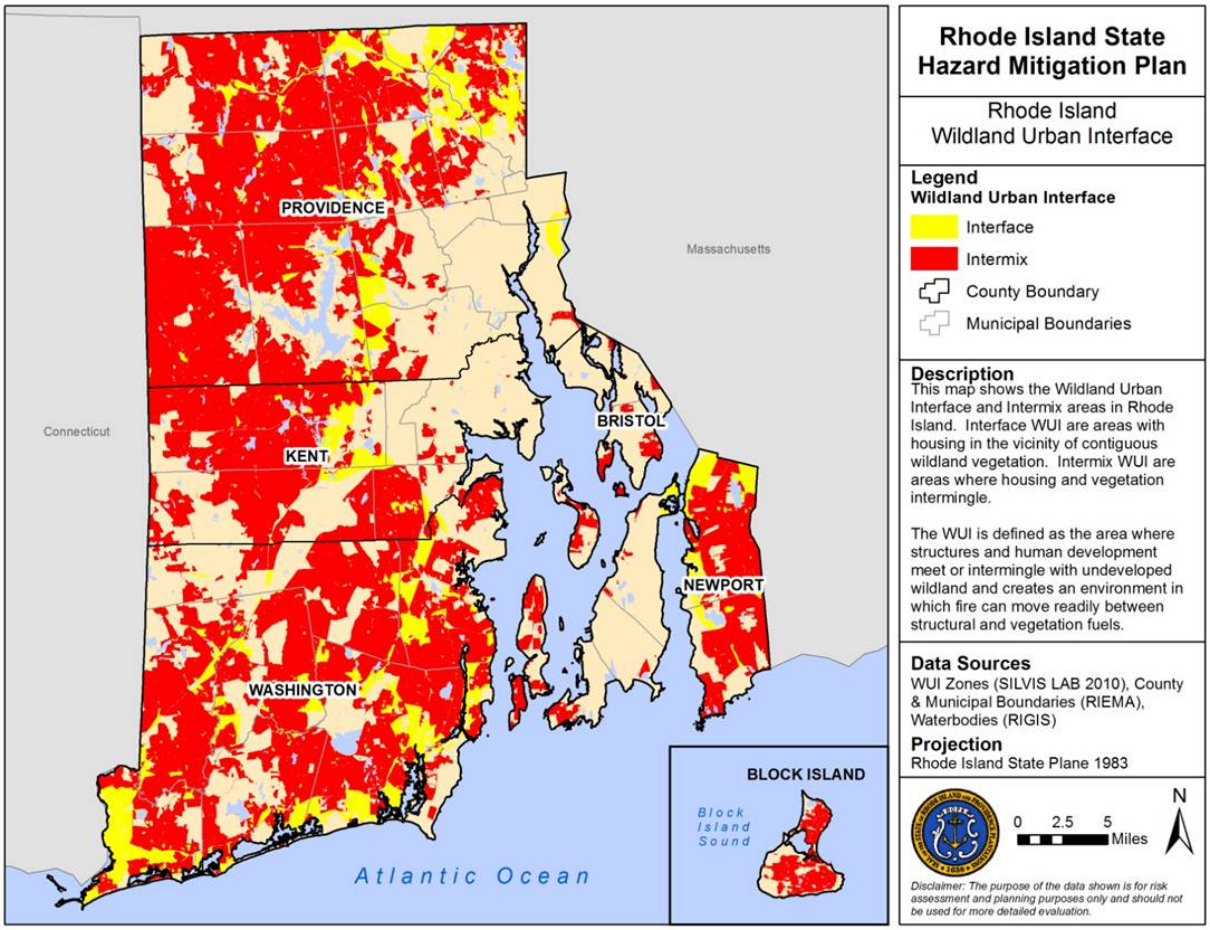

Figure 27. Wildland Urban Interface (WUI) zones.

3.6.11.4 Previous Occurrences and Probability of Future Event

The largest fire was the Coventry Fire, occurring from April 30th to May 2nd 1942 in which 18,000 acres were burned. The most intense fire was the Wood River Fire on May 2, 1951, in which 7,400 acres burned. The worst year for fires was 1930, when 37,400 acres burned. Figure 28 outlines areas burned during these periods.

Figure 29 highlights the five (5) year average, in Rhode Island, for wildfires. Early spring and fall appear to be peak wildand fire seasons. While dated, this information was the best available provided for the 2014 plan update by the Rhode Island Division of Forest Environment. As members of the SIHMC, Division of Forestry will be in contact with RIEMA during plan implementation and maintenance to discuss data needs and collection for the plan update.

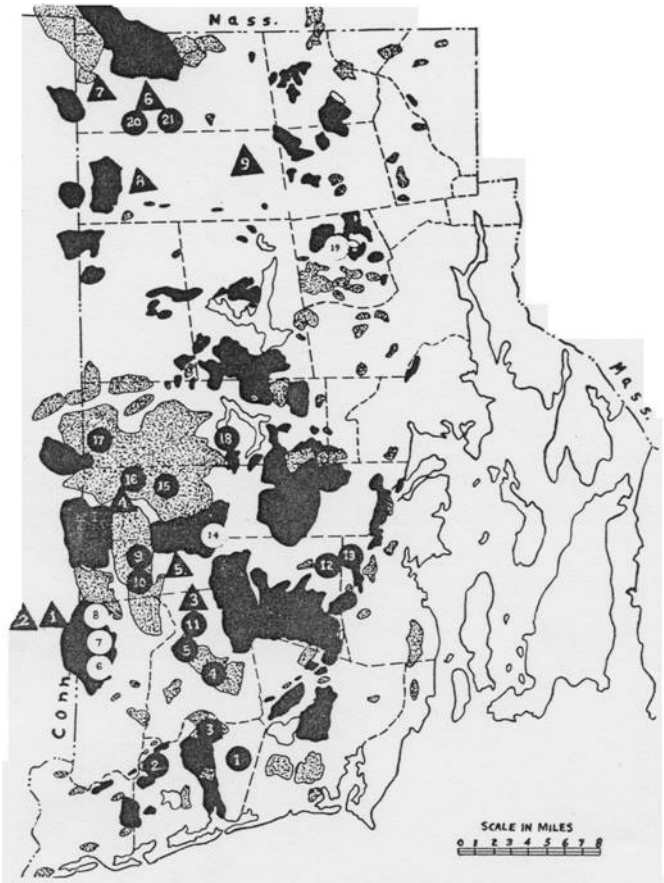

FIG. 1. Rhode Island woodland burned in the period from 1930 to 1940 (solid black area) and from 1940 to 1955 (dotted area). Circles indicate locations of plots in burned stands; triangles indicate locations of plots in unburned stands.

Figure 28. Wildfire occurrence during 1930 through 1955.

Drought conditions and other natural disasters increase the probability of wildfires by producing fuel in both urban and rural settings. Using historical NCDC records, it can be estimated that Rhode Island will experience one (1) wildland type or natural vegetation fire event every 10 years or a 10 percent occurrence annually, which can be related to a Low probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 30 includes the probability of future events by county.

In the future, the possibility of more frequent short-term drought associated with a changing climate could result in more frequent occurrence of wildfire.

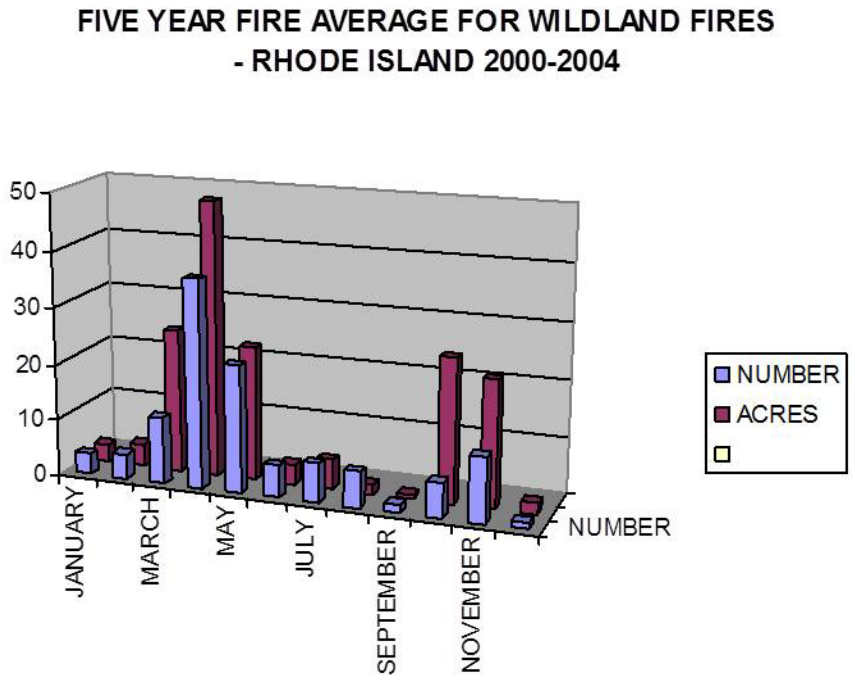

Figure 29. Five year average for wildland fire. RI Department of Forestry (DOF).

3.6.11.5 Vulnerability & Risk Assessment

Portions of Rhode Island are within wildfire risk areas, as shown in Figure 27. An estimated 614 are within areas of extreme wildfire risk, and 1,259,329 acres are within high wildfire risk. Table 41 lists the area totals for counties at risk of wildfire and the percent of total county area at risk. As shown, Providence County has the highest amount of WUI area and has experienced several large wildfires since the 1930s. Foster, Scituate, Glocester, and Burrillville are almost entirely WUI intermix. Smithfield and North Smithfield have large swaths of intermix and interface surrounding populated areas. Coventry and East Greenwich in Kent County also includes a majority of WUI intermix with interface areas in populated portions of the community. Washington County communities all appear to be equally vulnerable to wildfire, with WUI risk zones throughout all communities. Little Compton and Tiverton, in Newport County have a high wildfire risk due to intermix and interface areas. Lack of historical damage data prevents the ability to produce comprehensive and meaningful loss estimates for wildfire.

Table 42 summarizes the types of facilities and WUI zones that the facility is within. Providence has the highest number of facilities within the High Density Interface zone. No information was available for facilities, such as sprinkler systems, building construction, building age and value. As additional facility attributes are available, more in-depth analysis will be able to be completed. Appendix 3: *Hazard Identification & Risk Assessment* includes additional details on the facility names and addresses within each of the hazard zones.

RIEMA is currently pursuing funding to develop parcel datasets as well as assessment values for critical facilities. These initiatives will allow for the 2017 plan update to include comprehensive loss estimates by municipality for hazards with known geographic extents.

Table 42. Facilities located within WUI zones.

County	Facility Type	Asset Type	High Density Interface	Medium Density Interface	Medium Density Intermix	Low Density Interface	Low Density Intermix	Total
Bristol	Critical Facility	Library			1			1
Kent	CIKR	Emergency Services		3			1	4
		Government Facilities		1				1
		Postal and Shipping		1				1
	Critical Facility	Dam	1	3	4		14	22
		EMS Company		5			3	8
		Fire Station		4	1		3	8
		Hurricane Shelter		2			2	4
		Library		1			3	4
		School		8	4	2	5	19
		Town Hall		1				1
	State Facility	State Owned		1	1	1	1	4
Newport	CIKR	Emergency Services	1	1			2	4
		Government Facilities					1	1
	Critical Facility	Correctional Institute					2	2
		EMS Company	1				3	4
		Fire Station	1		1		3	5
		Hurricane Shelter					3	3
		Law Enforcement					2	2
		Library					3	3
		Marina	1	3				4
		School		1	2	1	6	10
		Town Hall		1			1	2
	State Facility	State Owned					3	3
Providence	CIKR	Chemical		1	1			2
		Commercial - Public Assembly					1	1
		Communications				1		1
		Dam					1	1

County	Facility Type	Asset Type	High Density Interface	Medium Density Interface	Medium Density Intermix	Low Density Interface	Low Density Intermix	Total
		Emergency Services	2	10	7	3	6	28
		Government Facilities		2	2		2	6
		Information Technology				1		1
		Transportation - Aviation					1	1
	Critical Facility	College					2	2
		Correctional Institute		3	4	1		8
		Dam	1	12	39	1	44	97
		EMS Company	2	6	4		4	16
		Fire Station	5	11	4	1	5	26
		Hospital					2	2
		Hurricane Shelter	1	6	3	1	6	17
		Law Enforcement		3	4	2		9
		Library		8	1		4	13
		School	6	37	15	2	15	75
		Town Hall		4	1	1		6
	State Facility	State Facility	1	3	4	3	7	18
		State Owned	1	3	4	3	7	18
Washington	CIKR	Communications					1	1
		Emergency Services		5	5	1	2	13
		Government Facilities		3			1	4
		Healthcare and Public Health		2				2
		Transportation - Rail Systems / Mass Transit		1	1			2
	Critical Facility	College		1				1
		Correctional Institute		1	3	2	2	8
		Dam		9	14	4	24	51
		EMS Company	1	3	4	2	2	12
		Fire Station	1	11	7	2	5	26
		Hospital		2				2
		Hurricane Shelter		8	4		3	15

County	Facility Type	Asset Type	High Density Interface	Medium Density Interface	Medium Density Intermix	Low Density Interface	Low Density Intermix	Total
		Law Enforcement		1	3	2	4	10
		Library		6	4		2	12
		Marina	1	5	2			8
		School	3	28	16	2	15	64
		Town Hall		3	1			4
	State Facility	State Owned	1	3	5	3	2	14

3.6.11.5.1 Hazard Ranking

Based on the available data for hazard ranking, Rhode Island falls within the low and medium-low risk for wildfire (Figure 30). Local plan ranking indicated that Kent County had an elevated wildfire risk. This ranking was accomplished using the methodology described in the Hazard Analysis and Ranking Methodology section.

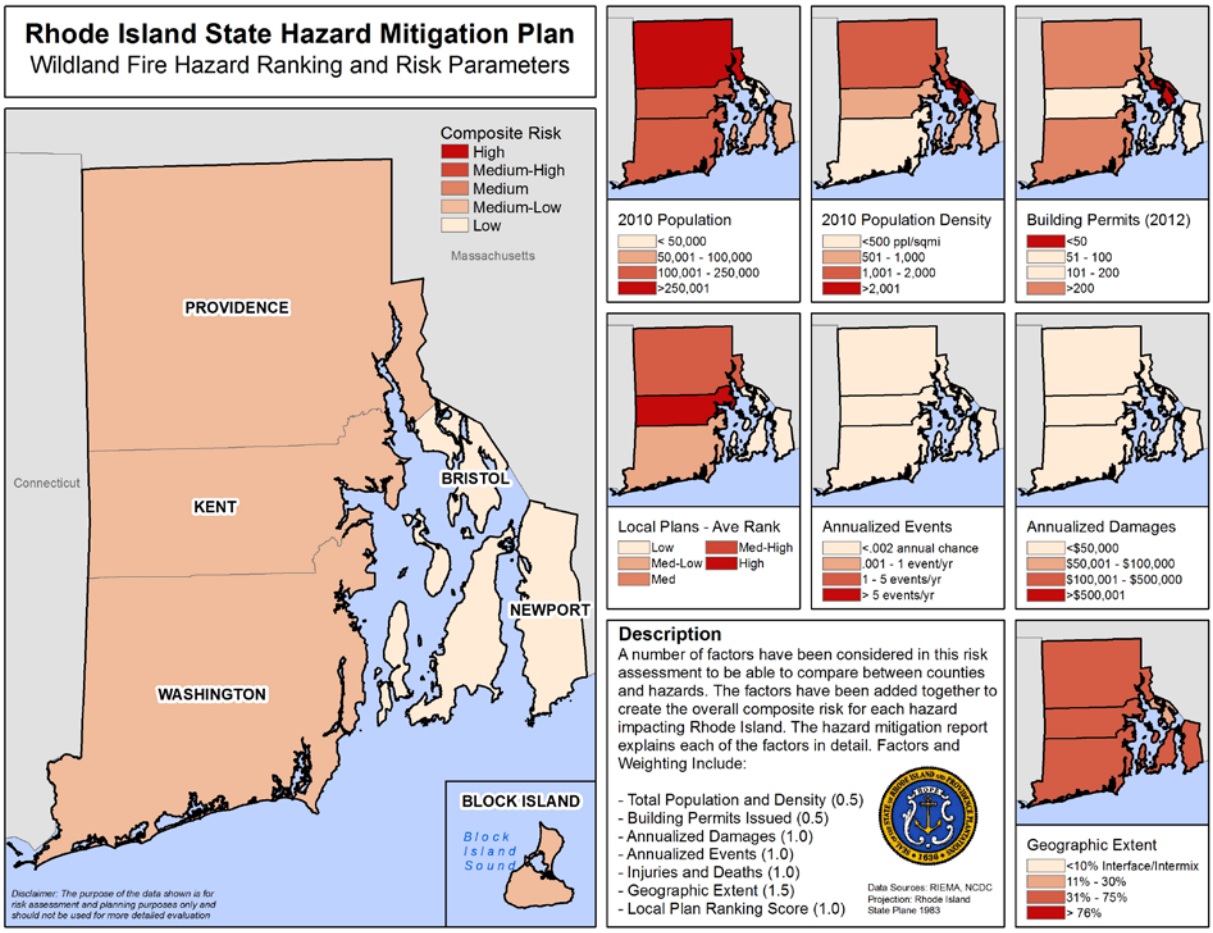

Figure 30. NCDC wildfire hazard ranking.

3.6.12 Geologic Related Hazards - Earthquakes

3.6.12.1 Description

An earthquake is caused by a sudden displacement within the earth. Strong and destructive earthquakes usually result from the rupturing or breaking of great masses of rocks far beneath the surface of the earth. The ultimate cause of these deep ruptures has not been established. All earthquakes produce both vertical and horizontal ground shaking. This ground movement begins at the focus or hypocenter, deep in the earth, and spreads in all directions. The felt motion is the result of several kinds of seismic vibrations. The primary, or P, waves are compressional. The secondary, or S, waves have a shear motion. These body waves radiate outward from the fault to the ground surfaces where they cause ground shaking.

The fast moving P waves are the first waves to cause the vibrations of a building. The S waves arrive next and may cause a structure to vibrate from side to side. Rayleight and Love waves (surface waves), which arrive last, cause low-frequency vibrations and are more likely than P and S waves to cause tall buildings to vibrate. Surface waves decline less rapidly than body

waves, so as the distance from the fault increases, tall buildings located at relatively great distances from the epicenter can be damaged.

Geologists have found that earthquakes tend to reoccur along faults, which reflect zones of weakness in the Earth's crust. *A fault* is a fracture in the Earth's crust along which two (2) blocks of the crust have slipped with respect to each other. Faults are divided into three main groups, depending on how they move. *Normal faults* occur in response to pulling or tension; the overlying block moves down the dip of the fault plane. *Thrust (reverse) faults* occur in response to squeezing or compression; the overlying block moves up the dip of the fault plane. *Strike-slip (lateral) faults* occur in response to either type of stress; the blocks move horizontally past one another. Most faulting along spreading zones is normal, along subduction zones is thrust, and along transform faults is strike-slip. Even if a fault zone has recently experienced an earthquake there is no guarantee that all the stress has been relieved.

The *focal depth* of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the *focus).* Earthquakes with focal depths from the surface to about 70 kilometers (43.5miles) are classified as shallow. Earthquakes with focal depths from 70 to 300 kilometers (43.5 to 186 miles) are classified as intermediate. The focus of deep earthquakes may reach depths of more than 700 kilometers (435 miles). The focuses of most earthquakes are concentrated in the crust and upper mantle. The depth to the center of the Earth's core is about 6,370 kilometers (3,960 miles), so even the deepest earthquakes originate in relatively shallow parts of the Earth's interior. The *epicenter* of an earthquake is the point on the Earth's surface directly above the focus. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

Earthquakes beneath the ocean floor sometimes generate immense sea waves or tsunamis. These waves travel across the ocean at speeds as great as 960 kilometers per hour (597 miles per hour) and may be 15 meters (49 feet) high or higher by the time they reach the shore.

Liquefaction, which happens when loosely packed, water-logged sediments lose their strength in response to strong shaking, causes major damage during earthquakes.

3.6.12.2 Location

Rhode Island is located in the North Atlantic tectonic plate and is in a region of historically low seismicity. Only three (3) or four (4) earthquakes of Modified Mercalli Intensity Scale (MMI) V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake of magnitude 4.6 on the Richter scale. Other past earthquakes centered in Narragansett Bay. Because of this low seismic level there is a general perception that the State has very little risk of sustaining any earthquake induced damage. However, areas geographically close to Rhode Island have had moderate seismic activity historically. For example the area off Cape Ann, Massachusetts has had several MMI VIII or greater events within the past 300 years. An earthquake of that location and intensity has the possibility to cause damage to structures in Rhode Island not designed to withstand seismic loadings.

In addition, an examination of the regional geology of Rhode Island yielded the potential for amplification of ground motions in significant areas in the State. Most of the region is generally characterized by till plains. Till is generally composed of unsorted rocks of varying sizes and is considered to be a stable geological formation not susceptible to amplification. However, the area around Narragansett Bay is characterized by outwash deposits. These deposits are

typically sorted sand and gravel under dynamic loading, they tend to amplify the intensity of the bedrock motion so that the surface intensity is greater than that of the bedrock. This phenomenon has been known to cause extensive damage to structures. The City of Providence is located at the head of Narragansett Bay, is within the outwash region, and is therefore in the zone of potential amplification. In this region of outwash deposits, the bedrock intensity will be increased by one intensity level to account for the possibility of amplification. The region identified as Charlestown and Block Island Moraine will be increased by a 0.5 intensity level.

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent peak ground acceleration (%PGA), over a specified period of years. The severity of earthquakes is site specific, and is influenced by proximity to the earthquake epicenter and soil type, among other factors. Average PGA, for the 1000-year return period, has been used in the hazard ranking as the geographic extent parameter (Figure 31). The average PGA values for the state would result in no felt shaking or potential damage. Although California is widely known for its seismic activity, earthquakes, mostly with a magnitude of < 3.0, occur in a large frequency within the Northeast United States.[47] In fact, the Northeast States Emergency Consortium notes that from 1538 to 1989 1,215 earthquakes occurred in New England.[48]

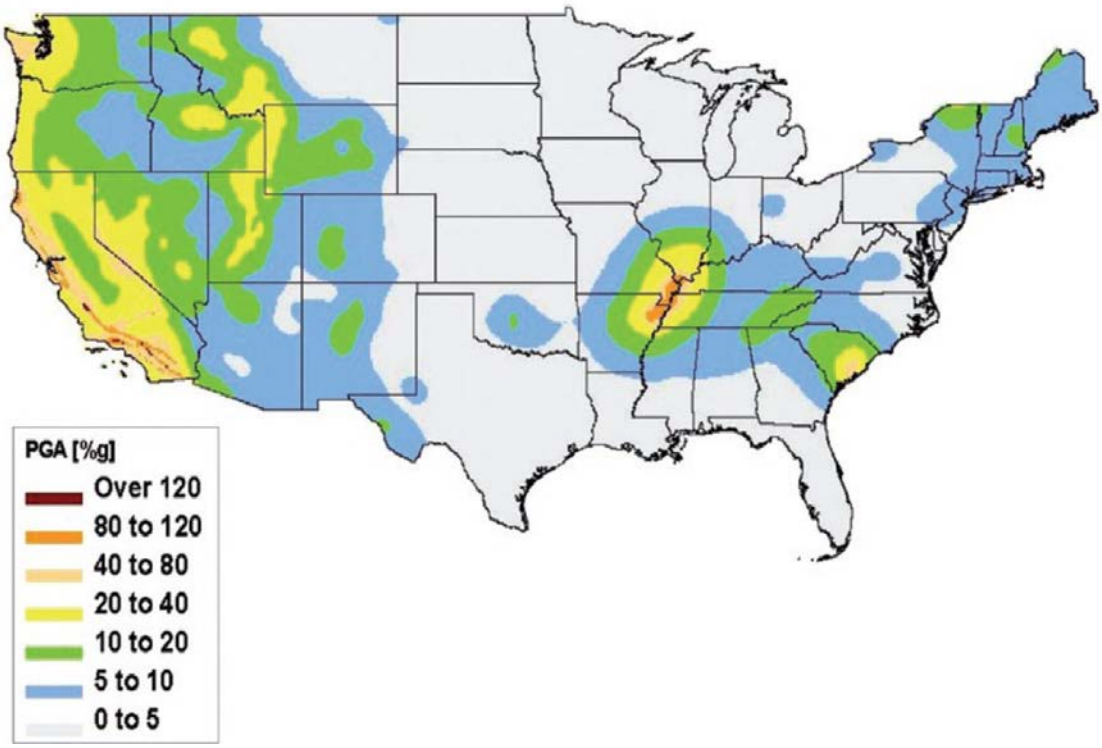

Figure 31. USGS seismic hazard map for the 1,000 year return period. Source: USGS and FEMA.

[47]S*Why Does the Earth Quake in New England,* written by Alan L. Kafka and located on Boston College's Weston Observatory website

[48] NESEC website: www.nesec.org/hazards/earthquakes.cfm

3.6.12.3 Extent (Impact and Vulnerability)

The severity of an earthquake can be expressed in terms of both *intensity* and *magnitude. Intensity* is based on the observed effects of ground shaking on people, buildings, and natural features. It varies from place to place within the disturbed region depending on the location of the observer with respect to the earthquake epicenter. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the MMI Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects. *Magnitude* is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments which have a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value. The magnitudes of seismic waves are recorded on instruments called seismographs, using the Richter Magnitude Scale. The Richter scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frightens the wildlife. Large magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

Earthquakes with magnitude of 2.0 or less are usually called micro earthquakes. They are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of 4.5 or greater are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one (1) earthquake of such size occurs somewhere in the world each year. Although the Richter scale has no upper limit, the largest known shocks have had magnitudes in the 8.8 to 8.9 range. Recently, another scale called the moment magnitude scale has been devised for more precise study of great earthquakes. Only a couple earthquakes of MMI Scale V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake of magnitude 4.6 on the Richter scale.

Impacts from earthquakes can be severe and cause significant damage. Ground shaking can lead to the collapse of buildings and bridges and disruption of gas and electric lines, phone service, and other critical utilities. Death, injuries, and extensive property damage are possible vulnerabilities from earthquakes. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failure.

Earthquakes can cause flooding due to the tilting of the valley floor; dam failure and seiches in lakes and reservoirs. Flooding can also result from the disruption of the rivers and streams. Water tanks, pipelines and aqueducts may be ruptured or canal and streams altered by ground shaking surface faulting, ground tilting and land sliding.

Earthquake-caused fires are generally the result of broken natural gas lines. These types of fires were very evident in the 1906 and 1989 San Francisco earthquakes. As many as 25,000 people could be displaced from their homes as a result of these fires. Other types of fires may include oil refineries, electrical, gasoline stations and chemical spills. Earthquakes may also result in a hazardous materials spill.

Despite the low probability of a high impact earthquake, physical characteristics in Rhode Island may increase earthquake vulnerability:

1. **Hard Rock**: Due to the geological makeup of New England's base rock, seismic energy is conducted on a greater scale (four (4)-10 times that of an equivalent Richter magnitude earthquake in California)

2. **Soft Soil**: Many coastal regions of New England are made up of soft soils. These soils can magnify an earthquake as much as two times.

3. **Structures**: The New England region, being one (1) of the first settled areas of the United States, has an abundance of older, unreinforced masonry structures that are inherently brittle and very vulnerable to seismic forces.

4. **Low Public Awareness of Vulnerability**: Little public recognition of earthquake threat, and no established system of educating or informing the public of the threat or how to prepare for or respond during an earthquake. Therefore, higher losses will occur here than in other regions of the country.

Table 43. Richter Magnitude Scale and the Modified Mercalli Intensity Scale

Richter Magnitude Scale	Modified Mercalli Intensity Scale
1.0 to 3.0	I
3.0 to 3.9	II to III
4.0 to 4.9	IV to V
5.0 to 5.9	VI to VII
6.0 to 6.9	VII to IX
7.0 and Higher	VIII or Higher
Defined Modified Mercalli Intensity Scale Rating	
I	Not felt except by a very few under especially favorable conditions
II	Felt only by a few persons at rest, especially on upper floors of buildings
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck.
IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

3.6.12.4 Previous Occurrences, Disasters, and Probability of Future Events

The USGS National Earthquake Information Center maintains a national database of significant earthquake epicenters from 1568-2010. USGS defines significant earthquakes as those that caused deaths, property damage, or geological effects, or that were experienced by populations in the epicentral area.[49] The Weston maintains the history of earthquakes in Northeast. Past earthquakes which occurred in and near Rhode Island are presented in Figure 32. The list was compiled from several northeast earthquake catalog files. Several recent events include:

[49] United States Geological Survey, http://www.nationalatlas.gov/mld/quksigx.html (June 2013).

New England has had a history of earthquakes including those recorded by the first settlers, and by the Plymouth Pilgrims in 1630. Over 34 earthquakes have been recorded in or near Rhode Island between 1568 and 2012. Since the 2011 plan, there have been two (2) earthquakes in Rhode Island with magnitude of less than one (1) on the Richter scale. Several earthquakes are highlighted below.

- Only three (3) shocks (intensity V or greater on the MMI Scale) have centered in Rhode Island, although several earthquakes in New England and the St. Lawrence Valley have been felt in the State, including the 1638 Trois-Rivieres Earthquake, near Quebec.
- A February 27, 1883, earthquake that was centered in RI was felt from New London, Connecticut to Fall River, Massachusetts. Within Rhode Island, it was felt (MMI V) from Bristol to Block Island.
- A large area, estimated at over 5,000,000 square kilometers of eastern Canada and the United States (south to Virginia and west to the Mississippi River) was affected by a magnitude 7 shock on February 28, 1925. The epicenter was in the St. Lawrence River region; minor damage was confined to a narrow belt on both sides of the River. Intensity effects were felt on Block Island and at Providence; intensity IV, at Charlestown.
- The major submarine earthquake (magnitude 7.2) in the vicinity of the Grand Banks of Newfoundland on November 18, 1929, was felt throughout the New England states. Moderate vibrations were felt on Block Island and at Chepachet, Newport, Providence, and Westerly.
- Another widely felt earthquake occurred on November 1, 1935, near Timiskaming, Quebec, Canada. Measured at magnitude 6.25, the shock was felt (MM IIV) on Block Island and at Providence and Woonsocket. The total area affected was about 2,500,000 square kilometers of Canada and the United States.
- The strong earthquakes centered near Lake Ossipee, New Hampshire on December 20 and 24, 1940, caused some damage in the epicenter area and effects were felt in Newport, Rhode Island. Additional reports included intensity IV effects in Central Falls, Pascoag, Providence, and Woonsocket, and intensity I-III effects in Kingston, New Shoreham, and Wakefield.
- Minor intensities were also reported from a September 4, 1944, shock in the, Massena, NY and Cornwall, Ontario area. Kingston, Lonsdale, Providence, Wakefield, and Woonsocket reported intensity I-III. In addition, a magnitude 4.5 earthquake on October 16, 1963, near the coast of Massachusetts caused some cracked plaster (MMI V) at Chepachet, Rhode Island.
- A small earthquake was felt in the Narragansett Bay region on December 7, 1965 with a MMI V. Both windows and doors were reported to be shaking slightly. Moreover, some fourteen months later another small earthquake (MMI V) was felt in the Lower Bay area
- A magnitude 5.2 earthquake in western Maine on June 14, 1973, caused some damage in the epicenter region and was reported felt over an area of 250,000 square kilometers of New England and Quebec. The intensities in Rhode Island were IV at Charlestown and I-III at Bristol, East Providence, Harmony, and Providence.
- The last earthquake in Rhode Island with a magnitude of 4.0 or greater was near North Kingstown on June 10, 1951 with a magnitude of 4.6.

Earthquake events do occur in the state, though of much less intensity than elsewhere in the region or on the west coast. Additionally earthquake events are more likely to be felt as a result of an earthquake that occurs in the surrounding region rather than originating within Rhode Island.

Seismologists and geologists agree that earthquakes are impossible to predict with any degree of accuracy. Rhode Island is located in an area of "moderate" seismicity and "high" risk. Seismic risk applies to the seismic hazard, location demographics, and regional economics to the vulnerabilities of the structure or lifeline on the site. Seismologists have estimated that there is about a 50% probability of a very damaging magnitude 5.0 earthquake occurring anywhere in New England, in a 50-year period. Using the hazard ranking criteria, probability of future occurrence has been related to a Medium-Low probability of occurrence based on previous occurrences of earthquakes in Rhode Island. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 34 includes the probability of future events by county.

Table 44. Rhode Island Historic Earthquakes. Source: USGS and Weston Observatory,

Year	Month	Magnitude	Epicenter Location
1766	August	Unknown	Newport (Near Middletown)
1849	February	Unknown	RI
1849	March	Unknown	Newport
1876	September	Unknown	Newport
1883	February	Unknown	Newport
1888	January	Unknown	Fall River, MA
1925	November	Unknown	Fall River, MA
1925	December	Unknown	Wareham/Taunton, MA
1926	January	Unknown	Voluntown, CT
1940	January	Unknown	Block Island
1948	May	Unknown	Westerly
1949	April	Unknown	N Kingstown
1951	June	4.6	Kingstown RI
1956	September	Unknown	Swansea, MA
1962	August	Unknown	East Greenwich
1965	December	2.6	Warwick
1967	February	3	Narragansett Bay
1974	October	2.5	West Warwick
1976	March	1.8	Portsmouth
1976	March	2.9	Portsmouth
1976	March	2.7	New Bedford, MA
1978	September	2.8	RI Sound
1978	April	1.7	Block Island Sound
1978	October	1.9	South of Dartmouth, MA
1981	April	2.7	Portsmouth

Year	Month	Magnitude	Epicenter Location
1982	November	1.8	West of Providence
1983	February	2.2	NW of Newport
1983	February	1.8	SW of New Bedford, MA
1989	May	Unknown	Island Park
2000	June	Unknown	East Greenwich
2005	November	Unknown	Newport
2003	November	Unknown	Near North and South Kingstown
2007	November	Unknown	West of Warwick, RI
2011	August	0.9	Near South Kingstown, RI
2012	December	1.0	Near Exeter, RI

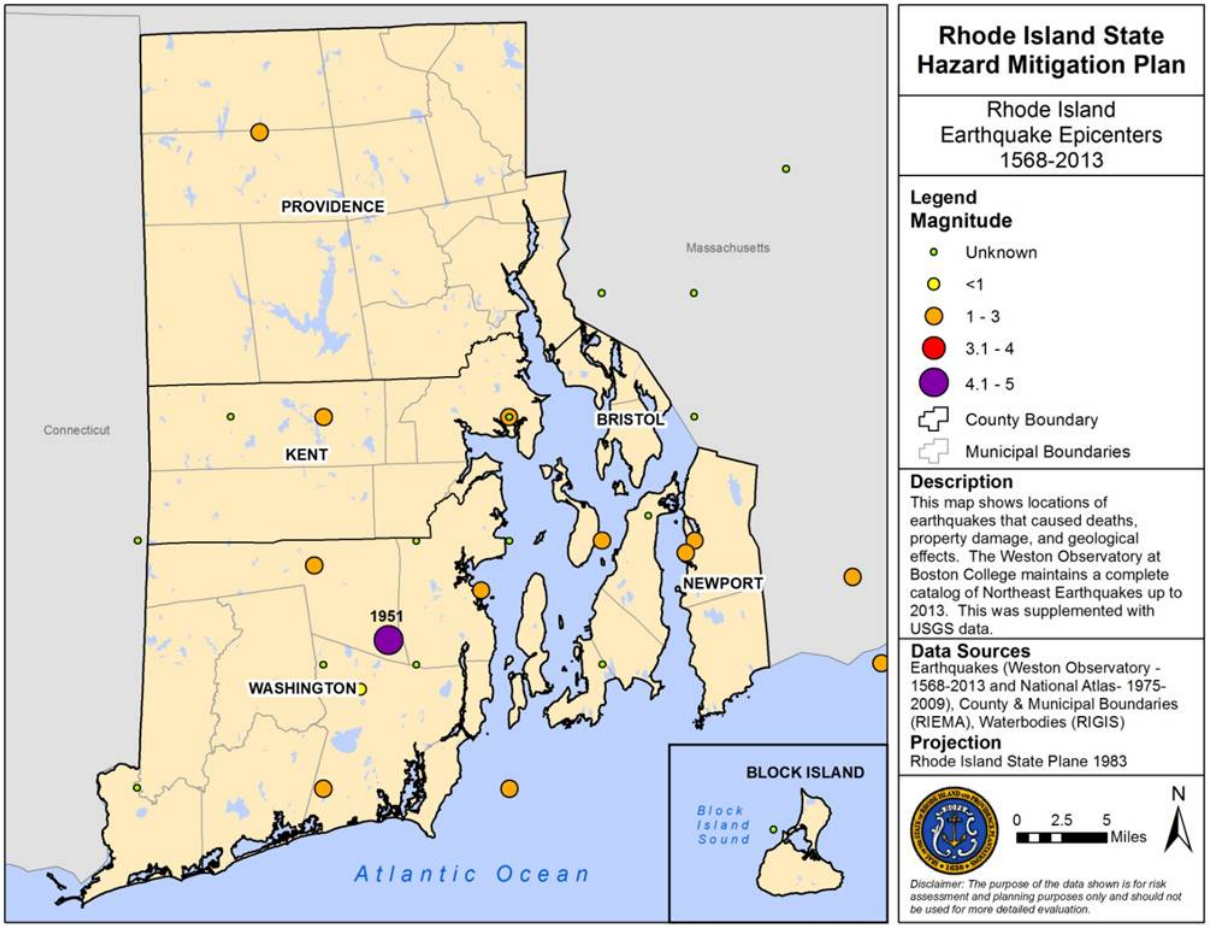

Figure 32. Earthquake epicenters near Rhode Island (1568 – 2013). Source: Weston earthquake center.

3.6.12.5 Vulnerability & Risk Assessment

An earthquake risk assessment is difficult because it is challenging to monetize the potential damages accurately. FEMA has developed a software suite, HAZUS-MH, for estimating potential losses to natural disasters. The HAZUS-MH earthquake model was utilized to estimate damages and losses to buildings, lifelines, and essential facilities from deterministic (scenario-based) and probabilistic earthquakes. Estimates for the annualized losses as well as estimates based on two historical scenarios of have been developed and will be discussed below.

Recent earthquakes worldwide depict a pattern of steadily increasing damages and losses that are due to significant growth in earthquake-prone urban areas and vulnerability of older building stock, including buildings constructed within the past 20 years. In April 2008, FEMA released an update to the 2000 report that conducted a nationwide evaluation of earthquake losses in the United States: *Hazus-MH Estimated Annualized Earthquake Losses for the United States.*[50] FEMA's evaluation ranked Rhode Island 42nd in the Nation for Annualized Earthquake Loss Ratio (AELR) ($2.7 million) and 34th for Annualized Earthquake Losses (AEL) ($36/million $). As of the 2013 plan update, this study is still valid.

The evaluation considers two measures of losses:

- AEL in any single year; and
- AELR, which is a measure of seismic risk in relation to the value of the building inventory. The ratio is considered a more accurate picture of seismic risk and makes it easier to compare between regions.

In addition to the AELR and AEL studies, the NESEC completed several default scenarios for RIEMA in December 2012. These include the 1755 Cape Ann with a magnitude 6.5 and the 1951 North Kingstown with a magnitude 5.0. The Hazus quick assessments are available in Appendix 3: *Hazard Identification & Risk Assessment* of this report. A summary of these events are included in Table 45. As shown in the table, the 1951 earthquake in North Kingstown would result in $1.3 trillion if the event happened in current times. All facilities are expected to maintain functionality during and following an earthquake, based on Hazus-MH historic simulations.

Table 45. Historic Hazus-MH earthquake scenario results. Source: NESEC.

Hazus-MH Damage Category	1755 Cape Ann (6.5 magnitude)	1951 North Kingstown (5.0 magnitude)
Buildings Moderately Damaged	3,883	7,913
Building Damaged Beyond Repair	21	100
Tons of Debris	117,000 (69% brick & wood)	210,000 (57% brick & wood)
Total Economic Loss	$507.95 Million	$1,326.28 Million
Utility System Loss	$14 Million	$184.24 Million

[50] *HAZUS-MH Estimated Annualized Earthquake Losses for the United States* FEMA 366, 2008

Hazus-MH probabilistic scenario for annualized loss was completed for the 2014 plan update. Table 46 presents the total estimated losses that may result from the earthquake scenario created for this plan, as estimated by FEMA's Hazus-MH software. Though the projected economic impacts resulting from these simulations may appear low, the results do indicate that attention does need to be given to potential economic impacts as a result of earthquakes. The areas of increased economic loss are in Providence, Kent, and Washington counties, most likely due to the higher building stock values and populations in those areas. Municipalities with census tracks of >$25,000 in annualized earthquake losses:

- Providence County (Lincoln, Providence, Cranston)
- Kent County (Warwick)
- Washington (South Kingston)

Table 46. Hazus-MH earthquake annualized loss.

County	Annualized Economic Loss
Bristol	$103,699
Kent	$366,463
Newport	$183,329
Providence	$1,499,951
Washington	$277,191

Currently, the Rhode Island Building Code follows the Building Official & Code Administration (BOCA) code which has very basic earthquake provisions. Thus, an even moderate earthquake could cause severe damage to aged structures and unreinforced masonry buildings. In addition, these codes are only for new structures and do not take into account past structures like the "classic mill building". So, although New England is considered to have a moderate seismic risk, in general it has a high seismic vulnerability because of the built environment.

In addition to the physical characteristics of the soil and built environment, one of the most critical factors of vulnerability is low public awareness. In Rhode Island, there is little public recognition of earthquake threat, and no established system of educating or informing the public of the threat or how to prepare for or respond during an earthquake. Therefore, higher losses will occur than in other regions of the country.

Although Rhode Island has not suffered a major quake in modern times, seismicity is occurring and any strong earthquake, in the northeast region, may affect the area to some degree. Inherent risks to life and property are: the increase in population since the Cape Ann earthquake (magnitude 6.25) of 1755, buildings which were built prior to seismic building code regulation, older infrastructure which is vulnerable to any ground shaking, and any construction in "filled areas" which would be victim to liquefaction.

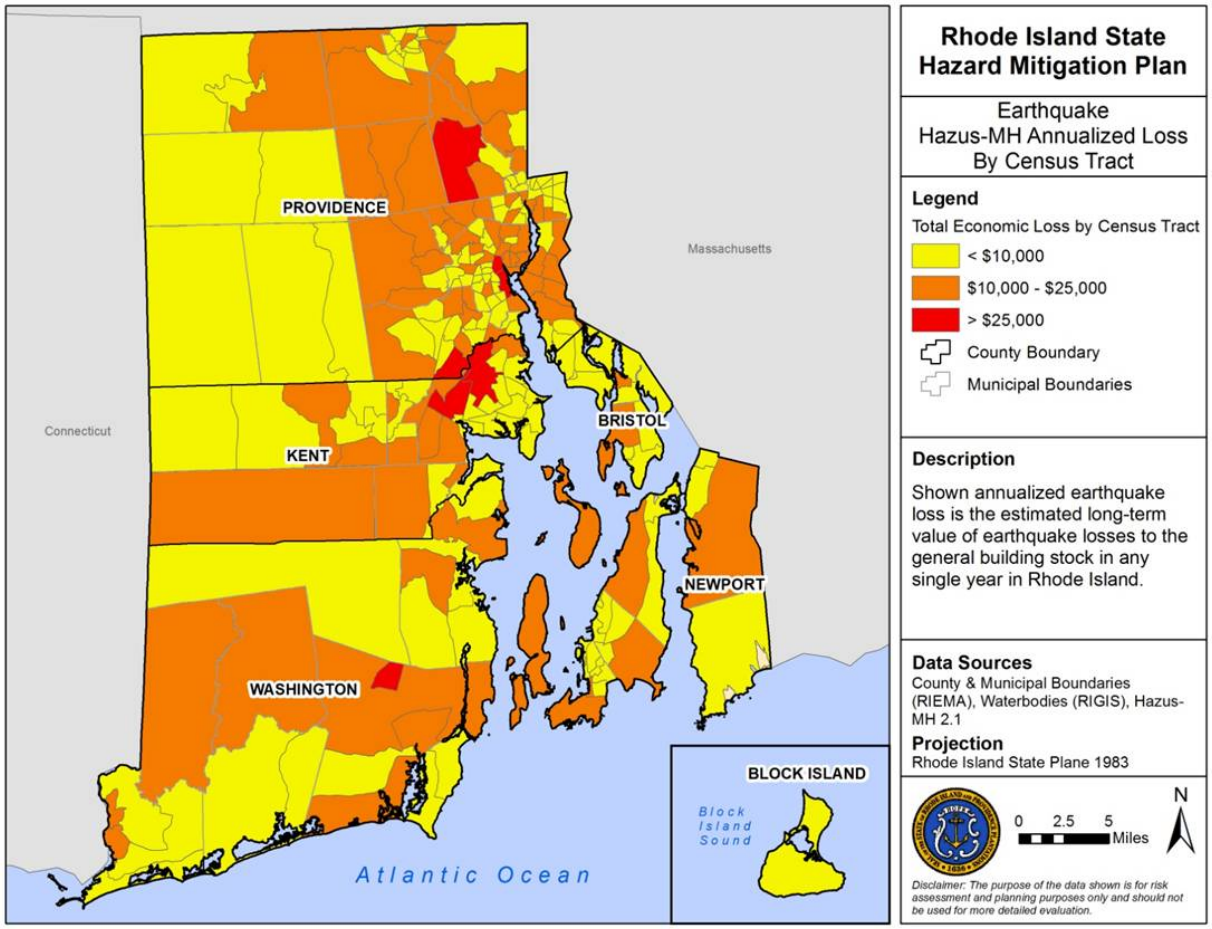

Figure 33. Earthquake annualized loss by census tract. Source: Hazus-MH.

3.6.12.5.1 Hazard Ranking

Quantitative risk assessment, to the degree possible, has been completed for earthquake using the methodology described in the Hazard Analysis and Ranking methodology section. Scores for each jurisdiction were calculated based on population, building permits, average score from local plan rankings, and measures of historical impact including injuries and deaths, property damage, and the number of reported events. Annualized events, dating back to 1568, have been supplemented with data provided by the USGS. Geographic extent is represented by the average 1000-year PGA. The composite earthquake rank shows all of Rhode Island in the medium-low and low categories relative to the other hazards addressed in this plan (Figure 34).

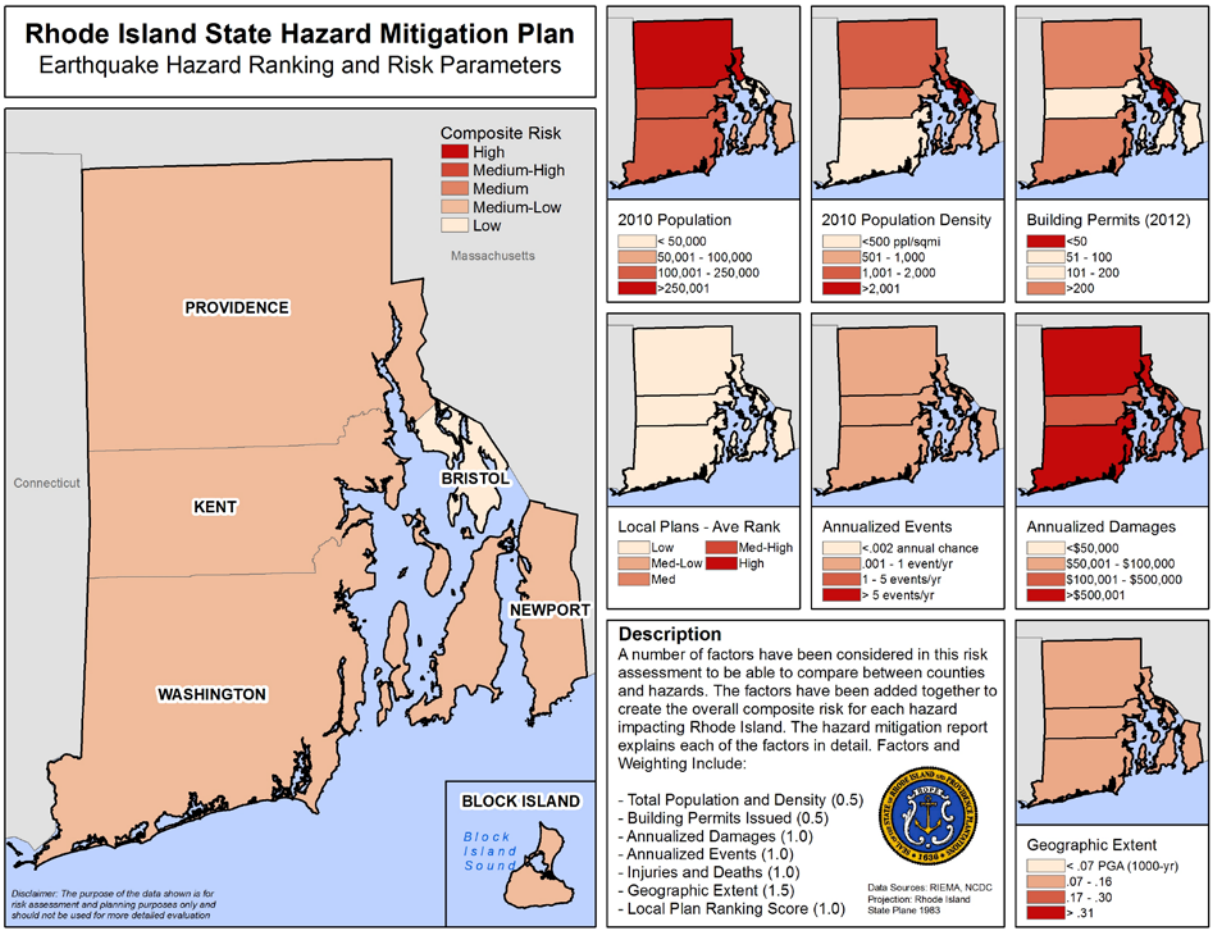

Figure 34. NCDC earthquake hazard ranking.

3.6.13 Drought and Extreme Heat

3.6.13.1 Description

Drought is characterized as a continuous period of time in which rainfall is significantly below the norm for a particular area. The American Meteorology Society defines drought as a period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance. Drought differs from other natural hazards in that it is not something that occurs suddenly. Rather, a drought evolves over months or even years and, while causing very little structural damage, can have profound economic, environmental, and social impacts.

Four methods are used to define the severity of drought: meteorological, hydrological, agricultural, and socioeconomic. Meteorological drought refers to a reduction in the normal rainfall for a given geographic area. This needs to be area-specific, as the average rainfall can vary greatly in different areas. Hydrological drought is based on the amount of surface and groundwater relative to normal levels. Agricultural drought deals with the amount of moisture in soils available for plants. The last, socioeconomic drought, measures the impact that any or all of the first three have on people and businesses.

Characteristics and impacts of drought differ in many ways, so it is difficult to quantify drought. An existing index called the Palmer Drought Severity Index (PDSI) 51 (Table 47) that used temperature and precipitation levels to determine dryness, measuring a departure from the normal rainfall in a given area. The PDSI uses temperature and precipitation levels to determine dryness. The advantage of the PDSI is that it is standardized to local climate, so it can be applied to any part of the country to demonstrate relative drought or rainfall conditions. A monthly PDSI value below -2.0 indicates moderate drought, and a value below -3.0 indicates severe drought.

Table 47.Palmer Drought Severity Index.

Severity	Index Value
Extreme Drought	-4 or less
Severe Drought	-4 to -3
Moderate Drought	-3 to –2
Mild Drought	-2 to –1
Incipient Dry Spell	-1 to –0.5

Rhode Island, as with most states within the United States, use both the PDSI and the Crop Moisture Index (CMI) as indices for a drought occurrence.[52] The CMI (a derivative of the PDSI) provide information on the short-term or current status of purely agricultural drought or moisture surplus. The PDSI is most effective for determining long-term drought conditions, while the CMI is effective at helping determine short-term droughts.

Drought levels are measured using several major hydrologic indices; precipitation, groundwater, and surface water are evaluated in terms of departure from normal. Normal is defined as the statistical average of the data for the period of record. It is important to note that time of year may influence the process considerably. In the fall and winter months, the CMI and PDI may react slowly but decline rapidly once the spring “green-up” occurs. The lag between surface water levels and groundwater levels could similarly skew the relative importance and number of indicators that are critical to determining the level of drought. In the final two stages, groundwater and reservoir data particular to the supplier will be used in conjunction with statewide data to determine drought levels.

1. **Palmer Drought Index (PDI)**: is an index that reflects soil moisture and weather conditions, including temperature. It is compiled by the NWS and the NCDC.

2. **CMI:** is an index that reflects short-term soil moisture conditions, particularly as it pertains to agriculture. The agricultural sector is usually the first to be affected because of its heavy dependence on stored soil water, which can be rapidly depleted in extended dry periods.

3. **Precipitation:** data is collected by the NWS at eight (8) data points and reported by county. A drought phase determination is based on conditions relative to normal in three (3), six (6), and 12-month intervals.

[51] NOAA Drought Information Center, http://www.drought.noaa.gov/palmer.html (February 2012)
[52] Sources: NOAA Climate Prediction Center and National Drought Mitigation Center websites.

4. **Groundwater Levels:** are monitored by the USGS from 38 observation wells. A drought phase determination is based on the number of months groundwater levels are below normal (lowest 25% of period of record). Local water suppliers also monitor public wells in order to make seasonal water availability comparisons.

5. **Stream Flow:** conditions are monitored by the USGS from 21 near-real-time stations with 30 or more years of record. A drought phase determination is based on the number of months that stream flow levels are below normal compared to historical trend data.

6. **Surface Water Reservoir Levels:** data is typically reported by water suppliers, relative to normal conditions or percent "full". A drought phase determination considers historic monthly averages of small, medium, and large index reservoirs.

The RI Drought Steering Committee assigns drought levels, for the seven (7) designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the PDI as well as local supply indices such as static groundwater levels and reservoir levels (Table 48). The Normal, Advisory, and Watch levels are issued statewide. The Warning and Emergency levels are issued on a regional basis and consider local conditions, source of water supply, and water storage capacity issues.

3.6.13.2 Location

Current drought conditions in Rhode Island and the Nation are tracked by the U.S. Drought Monitor, a partnership between the University of Nebraska-Lincoln, as well as various Federal and State agencies and other experts. Graphic and text summaries of current and projected drought conditions are updated on a weekly basis and are available through the Drought Monitor website (http://droughtmonitor.unl.edu).

Past drought events in RI have affected the entire state. Southern Rhode Island relies on extensive groundwater aquifers for water supply, while much of the rest of the State relies on surface water reservoirs for water supply.

Table 48. Drought indices and phases.

Drought Indices and Phases						
Drought Level	PDI	CMI	Precipitation	Ground Water	Stream Flow	Surface Water Reservoirs
Normal	-1.0 to -1.99	0.0 to -1.0 Slightly dry	1 month below normal	1 month below normal	2 consec. months below normal	Reservoir levels at or near normal for the time of year
Advisory	-2.0 to 3.99	-1.0 to -1.9 Abnormally dry	2 month cumulative below 65% of normal	At least 2 out of 3 months below normal	3 consec. months below normal	Small index Reservoirs below normal
Watch	-3.0 to 3.99	-2.0 to -2.9 Excessively dry	1 of the following criteria met: 3 month cum. <65% or 6 months cum <70% or 12 months cum. <70%	4-5 consecutive moths below normal	At least 4 out of 5 consec. months below normal	Medium index Reservoir normal
Warning	-4.0 and below	>-2.9 Severely dry	2 out 3 of the above criteria met: 3 months cum. <65% **and** 6 months cum <65% **and** 12 months cum. <65% **or** 3 months cum. <65% **and** 12 months cum <65%	6-7 consecutive months below normal	At least 6 out of l7 consec. months below normal	Large index reservoir below normal
Emergency	-4.0 and below	>-2.9 Severely dry	Same criteria as Warning and Previous month was Warning Emergency	7 months below normal observation wells recording monthly record lows	>7 months below normal	Cont. of previous month's conditions
NOTES: PDI and CMI are short-term indicators. Local triggers will also be considered in assessing drought, such as water storage capacity and other water supply system management considerations, particularly in the later phases of drought.						

3.6.13.3 Extent (Impact and Vulnerability)

According to the NWS, the State receives, on average, between 39 inches (on Block Island) to 54 inches of rain (in Foster) annually. In contrast, the average annual precipitation for the United States is 29.53 inches. Even though the State receives more rain annually than the average for the United States, Rhode Island does experience extended periods of dry weather. Summer dry spells, during which crops and lawns may require irrigation, are fairly common. Thus, droughts, while not frequent, do occur.

Economic impacts can result from a drought itself or, more indirectly, through conservation measures implemented because of a drought. 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. Economic impacts to industries can include loss of production due to use restrictions or increased costs for

alternate water supplies (e.g., for cooling). 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 State's appeal to visitors causing reduced revenues from tourism.

According to the Rhode Island DOA Division of Planning, *Rhode Island Water 2030 (2012),* 92% of the State's resident population is served public water by 28 major water suppliers and 458 small public systems. The remaining population is served by private wells; the total amount of persons on private wells varies by each region with the highest percent (nearly 30%) in the Southern Region. The quantities of water used by the small systems and private well is estimated as there is no reporting system to record this type of water use. Much of the public drinking water in the central and southern parts of the state comes from wells relying on groundwater aquifers, and that surface water sources supply the majority of water supply for the other regions of the State. Some of the surface water supplies in the north and east come from out of the State as well.[53]

According to the Rhode Island Department of Environmental Management's Section 305(b) *State of the State's Waters Report (2006),* the primary use of water in Rhode Island by the general population is for domestic uses, sanitation and drinking water. Domestic water use includes water for normal household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets and watering lawns and gardens. There are 647 public wells in Rhode Island according to the Rhode Island Department of Health (HEALTH), Division of Drinking Water Quality (DWQ), 170 of these wells are community wells, which serve residential populations of 25 persons or more. The remaining 477 wells are non-community wells that supply places such as schools and businesses. It is estimated that there are an additional 127,000 people served by an on-site water supply source.

Prior to the creation of the *Rhode Island Drought Management Plan (2002),* there was no mechanism for coordinating responses to drought by water suppliers throughout the State because of the decentralized nature of water suppliers and the variability of water supply sources.

In 2002, the Water Allocation Program Advisory Committee was launched to develop a water allocation program for the state and in 2004/2005 an Implementation Team identified water resources and developed a pilot study for the Lower Blackstone River basin. Although these committees have been established, Rhode Island has not formally developed a systematic regulatory procedure for the allocation of water on a statewide or regional basis. Water allocation is currently based on riparian rights, traditional usage, and *ad hoc* permit approvals. Each water supplier imposes use restrictions when necessary based on the limitations of their system. Generally this has worked because water supply has traditionally exceeded demand throughout most of the State's history. However, when drought conditions occur, shortages develop which may affect water suppliers and individual wells (private or community) differently because of regional hydrology, water demand, differing water supply sources, and infrastructure. For example, southern Rhode Island relies on extensive groundwater aquifers for water supply, while much of the rest of the State relies on surface water reservoirs for water supply.

[53] Rhode Island Water 2030. RIDOA Division of Planning. 6/14/2012.

3.6.13.4 Previous Occurrence and Probability of Future Events

Considering just the PDSI, severe droughts have occurred periodically in Rhode Island; periods of two (2) or more months of severe or extreme drought were documented in 1911, 1925, 1930, 1943-1944, 1947, 1949-1950, 1957, 1965-1967 and 1985. The lowest PDSI was April 1966 with an index of -4.60.[54]

For the major historical drought events, the NWS noted that the precipitation during the preceding fall and winter months was below normal to much below normal which is typically defined as 90% and 75% less than levels through the spring and led to the most severe drought episodes, including the 1965-67 long-term droughts (Table 49). The 1965-67 drought episodes lasted for three (3) summers and included long periods of below normal precipitation through the winter, spring, and summer months. This drought period serves as the classic model of a long-term drought in Rhode Island. Though short-term droughts, such as 1999, may not pose a significant impact for the State's public water systems; no water system will be immune to periods of long-term drought. Extended droughts, though not common, require statewide monitoring of climactic conditions.

Table 49. Rhode Island historical droughts and locations of impacts.

Date	Area Affected	Remarks
1930-31	Statewide	Estimated stream flow about 70% of normal
1941-45	Statewide. Particularly severe in the Pawtuxet and Blackstone Rivers	Estimated stream flow about 70% of normal
1949-50	Statewide	Estimated stream flow about 70% of normal
1963-67	Statewide	Water restrictions and well replacements common
1980-81	Statewide. Groundwater deficient in eastern part of State	Considerable crop damage in 1980
1987-88	Southern part of State	Crop damage, $25 million

In addition to the events above, two (2) drought events have been documented by NCDC since 1993, both in the Spring/Summer of 2012, impacting each county during this time. The U.S. Drought Monitor declared a severe drought across Rhode Island. A meteorological drought was documented by precipitation that had been approximately one half of normal from January 2012 through April 2012. Rivers and streams were most affected as most ran at record low levels during the spring run-off season. No southern New England state issued drought declarations as reservoirs were at normal levels, due to above normal precipitation falling between August 2011 and November 2011. The main impact of the meteorological drought was periods of very high fire danger. In addition, small pond levels were reduced. While soil moisture was well below normal, this drought occurred prior to the beginning of the growing season. Thus, no agricultural impacts were noted. From January 1 through April 15, precipitation levels were six (6) to eight (8) inches below normal across Rhode Island.

[54] Source of historic data for droughts consisting of a two or more month period of severe or extreme drought is: http://www.nrcc.cornell.edu/drought/RI_drought_periods.html.

Annual average PDSI values have been recorded for Rhode Island since 1895.[55] Historically, Rhode Island has ranged from near-normal moisture conditions to moderate and severe droughts throughout the past century (Figure 35). Using the hazard ranking criteria, drought has a Low probability of occurrence. Table 7 provides the annualized events qualitative ranking used for determining probability of future events. Hazard ranking shown in Figure 37 includes the probability of future events by county.

A noticeable trend in the PDSI is the lowering frequency of moderate to severe droughts (PDSI at or below -1.0) since the late 1960s. This corresponds very closely to a similar trend in the annual rainfall at Providence, RI (Figure 36), which shows the majority of dry years (those experiencing less than 36 inches of rainfall) have all occurred prior to 1970. Note also the majority of very wet years (those experiencing greater than 54 inches of rainfall) most have occurred since 1970.

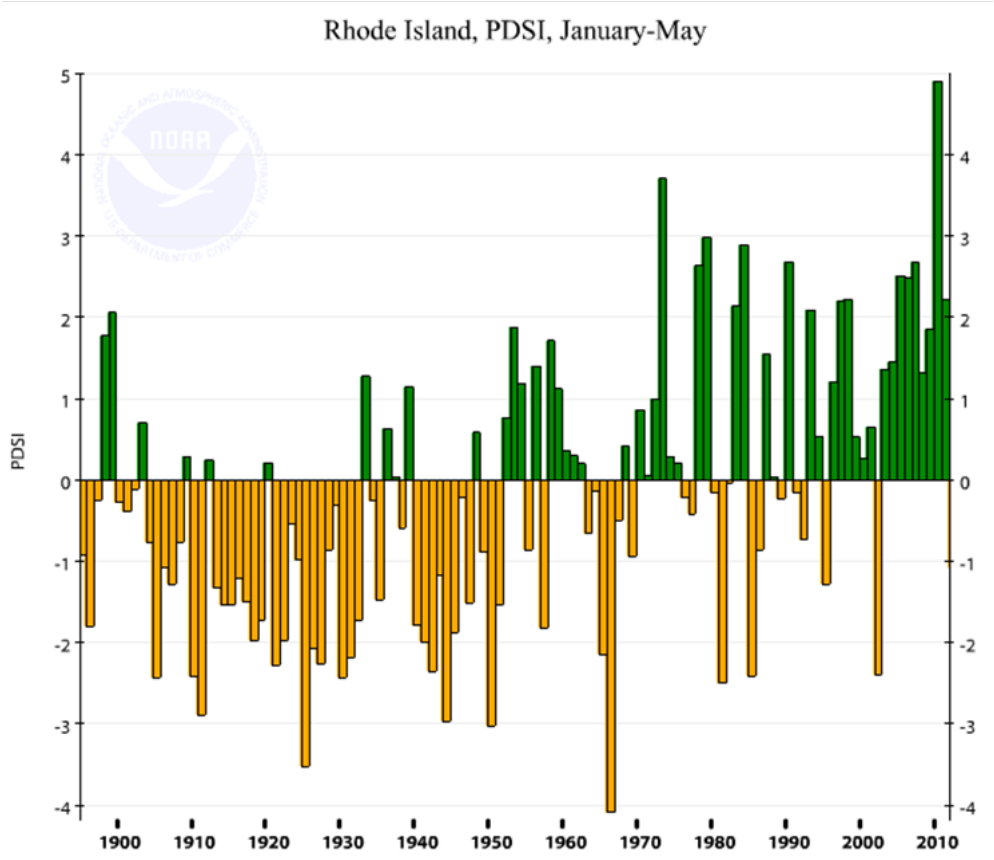

Figure 35. Average annual Palmer Drought Severity Index for Rhode Island (1895 – 2012).

[55] NOAA NCDC, http://www.ncdc.noaa.gov/temp-and-precip/time-series/index.php?parameter=pdsi&month=5&year=2012&filter=ytd&state=37&div=0 (June 2013)

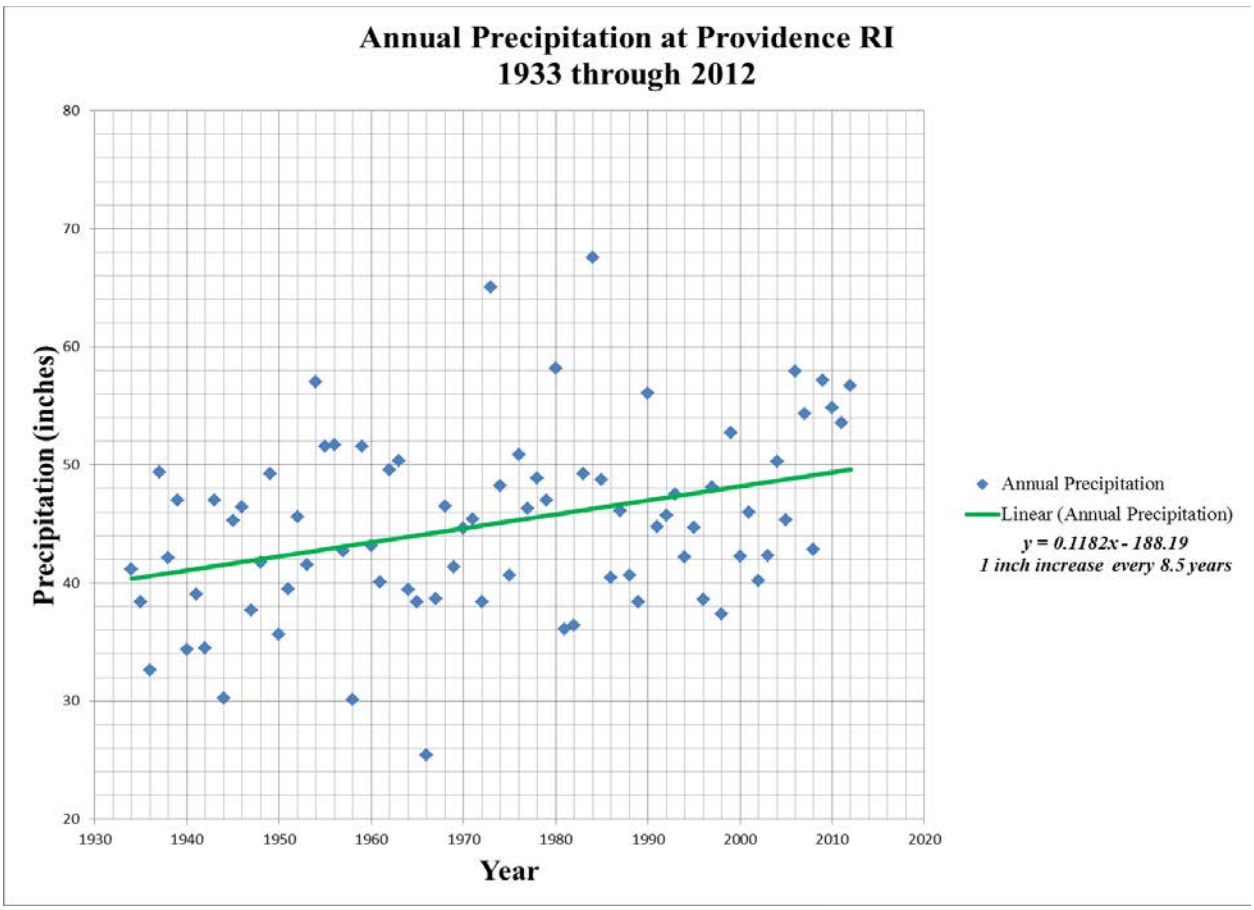

Figure 36. Annual Precipitation at Providence, RI (1933 – 2012).

Extended periods of dry weather with significant negative impacts on crops, livestock, and people have occurred in the past and should be expected to occur into the future. Since drought is highly unpredictable and may be very localized, assessing probability of its occurrence is difficult. Calculation of annualized drought or extreme heat risk as a function of probability and impact has not been performed for this analysis. Quantifying drought in terms of historical frequency also proves to be a difficult task because of the variations in drought definition and the very limited and curtailed historical reports.

Other factors may also contribute to the degree of droughts and their impacts on Rhode Island. These include projections of humidity levels (decrease), hotter temperatures and increased heat wave occurrences, transpiration rates, increased water demands by the general population, and industry sectors. A review of the limited amount of data available suggests that a drought will occur about every 10 years in Rhode Island.

Recent climate change studies[56] have indicated that although precipitation is projected to increase throughout this century, it will be in the form of short duration, intense, and less frequent events. In addition it is projected by the Northeast Climate Impact Assessment Group

[56] Information derived from two recent studies: *Confronting Climate Change in the Northeast*, by the Northeast Climate Impact Assessment Group, July 2007, and *Climate Risk Information*, by the New York City Panel on Climate Change, 2/17/09.

(NECIA) and the New York Panel on Climate Change (NPCC) that most of this increased precipitation may occur during colder times of the year (i.e., winter in the form of snow or ice). Furthermore, it is projected that the frequency and intensity of both long-term and short-term droughts throughout the Northeast, will increase throughout the century with the impacts beginning to occur with a greater degree of frequency beginning in the mid-century (2050s).

3.6.13.5 Vulnerability & Risk Assessment

The entire state is susceptible and vulnerable to the occurrence of a drought event. The vulnerability of the State to drought is increasing as water use and land use change. People tend to assume that plentiful water is the norm for Rhode Island, when, in fact, occasional droughts of at least moderate intensity and duration have occurred in the State. Impacts from droughts can be moderated through mitigation planning and preparedness. Because droughts are a normal part of any climate, it is important to have a plan in place providing for response actions.

Rhode Island is highly vulnerable to a drought occurrence, whether short- or long-term in duration. Impacts will be costly in both social and economic terms. The responsibility for drought planning lies with the Rhode Island Water Resources Board. It is recommended that future updates of the *Rhode Island Drought Management Plan* include:

- Assessment of vulnerability aspects (social and economic) of the state;
- Identification of primary and secondary impacts which may arise from a drought (both long-term and short-term droughts), including underlying issues which may increase the state's or a particular sector's vulnerability to a drought;
- Inclusion of risk assessment and recommendation work performed by the Governors Steering Committee on Climate Change; and
- Proposed mitigation measures and implementation of educational outreach, which may be performed to reduce the impacts from both short-term and long-term droughts.

Even though there is some minor variation throughout the state in terms of areas potentially more prone to experience drought conditions, it is assumed that the drought hazard would impact buildings in a fairly uniform and negligible manner. It is assumed therefore that state-owned and critical facility buildings would sustain very minor, if any, direct physical damage from exposure to drought conditions.

Economic impacts from a drought event may affect both elderly populations and families with children under 18 years of age. In addition, if current economic data are also taken into consideration at the time of a long-term drought (i.e., unemployment figures), the economic and social impacts from such an event could be significant for Rhode Island. It is assumed that the drought hazard would impact the general population in a fairly uniform and negligible manner related to estimated damages.

A drought will produce different impacts in Rhode Island depending on the extent and geographic location of the drought (e.g., affecting a local area or region, or occurring statewide). The *Rhode Island Water 2030* plan details the anticipated demands versus the available water to 2030. The water data within the plans includes the system's safe yields, total volume of water consumed, the available water to the systems and anticipated future demands were used.

Based on this analysis, four (4) suppliers are predicted to have a deficit of current available water and seven (7) are predicted to be close to source capacity.

In highly developed areas drought impacts tend to be dominated by economic losses and possible potable water shortages and potential health threats. In less densely populated areas of the state, the impacts from the occurrence of a drought are equally as high a threat. They include:

- Increased potential of brush and forest fire occurrences. Potential loss of natural resources in addition to the impacts to people living within or near heavily forested areas, who are at a higher risk for the impacts which can come from fires. Safe access/evacuation routes from the affected area, loss of personal belongings and economic losses, potential physical injury, and/or loss of life;
- Potential threat to levels and quality of municipal public water supplies, and impacts to small community and private potable water wells; and
- Reduction of available fresh water resources of existing wells, including increased threat of well contamination (bacterial or chemical) and increased need to drill deeper wells to adequately provide fresh water resources for the resident population and natural resource and agriculture management.

3.6.13.5.1 Hazard Ranking

The county drought hazard rank is based on NCDC Storm Events data parameters supplemented with data for the hazard area. Geographic extent for drought is considered uniform across the state and given a Medium rank. Scores for a given county were calculated based on population and measures of historical impact including property damage, crop damage and the number of reported events. As shown in Figure 37, Providence County has an increased vulnerability in terms of total drought hazard risk. The remaining counties are shown as having a Low risk ranking.

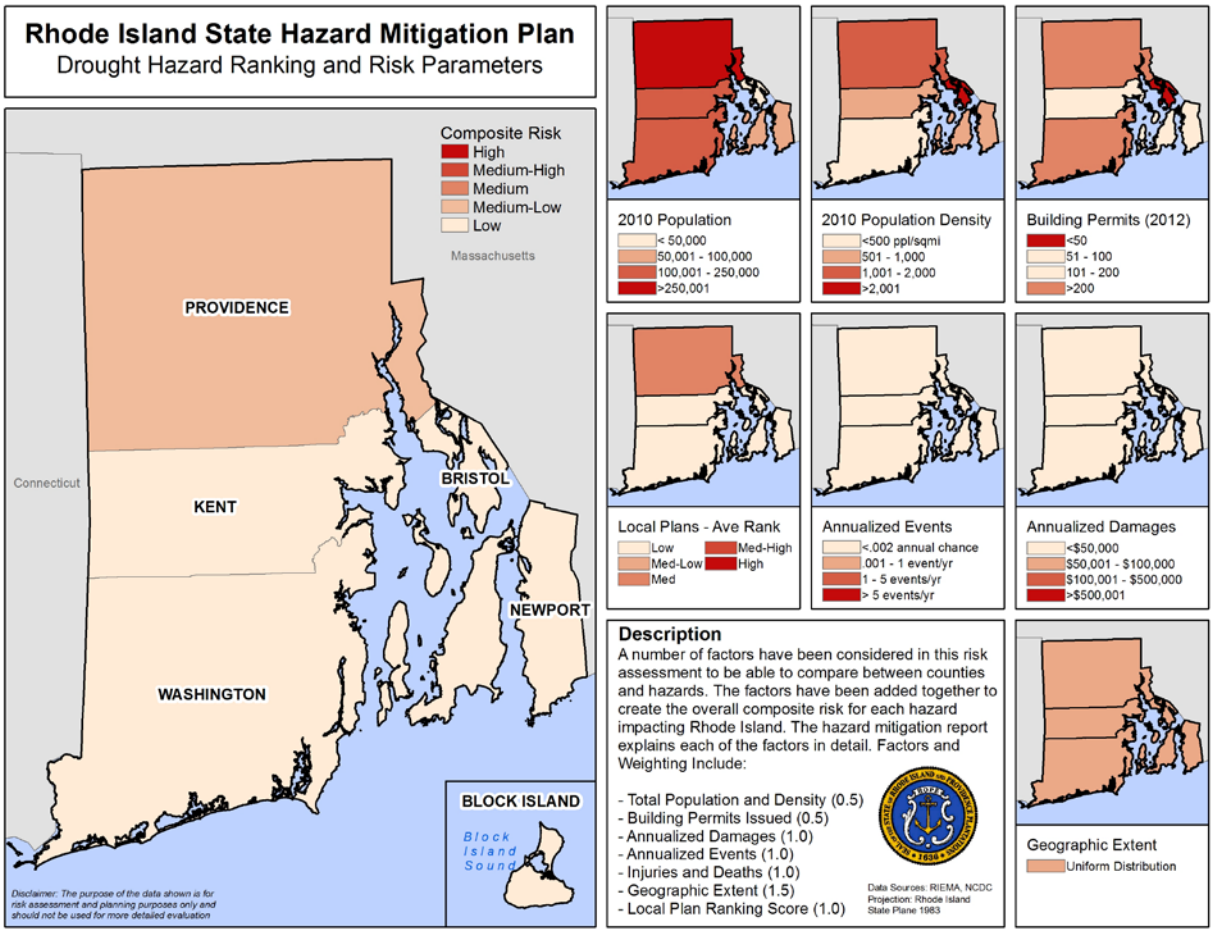

Figure 37. Drought NCDC relative ranking.

3.7 Overall Hazard Results and Summary

3.7.1 Composite Risk Ranking

Composite risk for each county was determined by adding the scores for population vulnerability, population density, building permits, annualized events, property damage, local plan rankings, geographic extent, and injuries and deaths together for each hazard. Table 51 includes a summary of each of the parameters and scores assigned. Modifications to the ranking parameters based on committee feedback was taken into account and resulted in several changes to the overall hazard ranking were made for the statewide ranking and have been noted in the individual hazard sections of this chapter. Section 3.4.1 describes the ranking parameters that were used for this analysis.

Combined scores represent the effects of hazards on the vulnerability of a given region. The combined scores are useful results for policymaking and risk mitigation, as they indicate the key hazard/vulnerability combinations that exist in a region. Combined risk scores are calculated for each community and can then be aggregated to measure overall scores for the State or other combinations of sub-regions by summation.

It should be noted that the significance of the scores is relative in nature. A given score does not correspond to a dollar loss level or other direct measure of risk. Instead, the risk scores are intended to provide a framework for understanding the aggregate distribution of hazard and vulnerability combinations across the State. Table 51 is the culmination of the hazard scores broken down by hazard. It should be noted that the results are relative to Rhode Island and should not be used to compare risk and vulnerability of the state to other geographic locations.

Section 5 describes the local plan ranking and Appendix 5: *Local Plan Integration* includes the summary of local plan review. As discussed, the local plan ranking compares agreeably to the new ranking that was developed for this report. Hazards that were considered low or negligible were included as textual descriptions in the major hazard sections.

As stated before, this analysis is only representative of the NCDC data that was used. It is known that the time period of this data is small in comparison to the known historical events. The data does not fully represent geological hazards but in the absence of better data, NCDC was used to represent risk. Efforts were made to contact representatives for the geological hazards to determine if databases were available for past events.

Table 50. Composite risk ranking parameters.

County	Background			Winter Weather					Flood					Hurricane				
	PM	PV	PP	EV	PD	ID	GE	LP	EV	PD	ID	GE	LP	EV	PD	ID	GE	LP
Bristol	L	L	H	MH	L	L	MH	H	MH	MH	L	H	H	ML	H	L	H	H
Kent	MH	MH	ML	H	MH	H	MH	H	MH	H	L	ML	MH	ML	H	L	H	H
Newport	MH	ML	ML	MH	L	L	MH	H	MH	MH	H	MH	MH	ML	H	L	H	H
Providence	H	H	MH	H	MH	L	H	H	H	H	L	ML	H	ML	H	L	H	H
Washington	H	MH	L	MH	L	L	MH	H	MH	H	H	MH	H	ML	H	H	H	H
County	**Background**			**Thunderstorm**					**Tornado**					**Wildfire**				
	PM	PV	PP	*EV*	*PD*	*ID*	*GE*	*LP*	*EV*	*PD*	*ID*	*GE*	*LP*	*EV*	*PD*	*ID*	*GE*	*LP*
Bristol	L	L	H	MH	L	H	H	MH	ML	L	L	H	H	L	L	L	ML	L
Kent	MH	MH	ML	MH	ML	H	MH	MH	ML	L	L	MH	H	L	L	L	MH	H
Newport	MH	ML	ML	MH	L	H	MH	H	ML	L	L	ML	H	L	L	L	MH	L
Providence	H	H	MH	MH	MH	H	ML	H	ML	MH	H	MH	H	L	L	L	MH	MH
Washington	H	MH	L	MH	L	H	L	H	ML	L	L	L	H	L	L	L	MH	ML
County	**Background**			**Dam or Levee**					**Drought**					**Earthquake**				
	PM	PV	PP	*EV*	*PD*	*ID*	*GE*	*LP*	*EV*	*PD*	*ID*	*GE*	*LP*	*EV*	*PD*	*ID*	*GE*	*LP*
Bristol	L	L	H	L	L	L	L	L	L	L	L	ML	L	ML	MH	L	ML	L
Kent	MH	MH	ML	MH	L	L	L	MH	L	L	L	ML	L	ML	MH	L	ML	L
Newport	MH	ML	ML	L	L	L	L	MH	L	L	L	ML	L	ML	MH	L	ML	L
Providence	H	H	MH	H	L	L	H	MH	L	L	L	ML	MH	ML	H	L	ML	L
Washington	H	MH	L	H	L	L	ML	ML	L	L	L	ML	L	ML	H	L	ML	L

TABLE KEY:

BP: Building Permits

PSqMi: 2010 Population per square mile

P2025: 2025 Population projections (% changes from 2010)

Hazard specific default data : NCDC (unless noted below)

EV: Annualized events (Probability of Future Events)

Hurricane tracks from NOAA NHC tracks within 50 miles of Connecticut

Wildfire data from CT DOF

Dam data from NPDP

Earthquake data from CT State Geologist

PD: Annualized property damages

Flood property damages from NFIP claims paid

Hurricane property damages replaced with committee knowledge

Wildfire data from CT DOF

Dam data from NPDP

ID: Total injuries and deaths

Dam data from NPDP

GE: Geographic extents (hazard specific)

LP: Local plan average for county

Table 51. NCDC hazard ranking composite results.

County	Municipality	Winter Weather	Flood	Hurricane	Thunderstorm Winds	Tornado	Wildfire	Dam Failure	Drought	Earthquake
Bristol	Barrington	Med	Med-High	Med-High	Med	Med	Low	Low	Low	Low
	Bristol	Med	Med-High	Med-High	Med	Med	Low	Low	Low	Low
	Warren	Med	Med-High	Med-High	Med	Med	Low	Low	Low	Low
Kent	Coventry	High	Med	Med-High	Med	Med	Med-Low	Med-Low	Low	Med-Low
	East Greenwich	High	Med	Med-High	Med	Med	Med-Low	Med-Low	Low	Med-Low
	Warwick	High	Med	Med-High	Med	Med	Med-Low	Med-Low	Low	Med-Low
	West Greenwich	High	Med	Med-High	Med	Med	Med-Low	Med-Low	Low	Med-Low
	West Warwick	High	Med	Med-High	Med	Med	Med-Low	Med-Low	Low	Med-Low
Newport	Jamestown	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
	Little Compton	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
	Middletown	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
	Newport	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
	Portsmouth	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
	Tiverton	Med	Med-High	Med-High	Med-High	Med-Low	Low	Low	Low	Med-Low
Providence	Burrillville	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Central Falls	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Cranston	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Cumberland	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	East Providence	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low

County	Municipality	Winter Weather	Flood	Hurricane	Thunderstorm Winds	Tornado	Wildfire	Dam Failure	Drought	Earthquake
	Foster	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Glocester	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Johnston	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Lincoln	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	North Providence	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	North Smithfield	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Pawtucket	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Providence	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Scituate	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Smithfield	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
	Woonsocket	High	Med-High	High	High	High	Med-Low	Med	Med-Low	Med-Low
Washington	Charlestown	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	Exeter	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	Hopkinton	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	Narragansett	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	New Shoreham (Block Island)	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	North Kingstown	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	Richmond	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	South Kingstown	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low
	Westerly	Med	High	High	Med	Med-Low	Med-Low	Med-Low	Low	Med-Low

3.7.2 Facilities

As discussed in the hazard specific sections, facilities were intersected with known hazard zones/boundaries. The totals of the facilities within these zones are summarized within the sections. A complete listing of facility analysis is available in Appendix 3: *Hazard Identification & Risk Assessment*. In an effort to highlight the facilities exposed to multiple hazards, Appendix 3: *Hazard Identification & Risk Assessment* summarizes the facilities that are located within at least two (2) hazard zones. Eight (8) facilities are located within four (4) hazard areas: hurricane surge zone, SLR scenario, flood zone, and wildfire interface zone. These include facilities within Washington and Newport counties:

- **Washington County**
  - State Facilities: Block Island Facility
  - Critical Facilities
    - Westerly Fire Department Station 2 (Fire Station)
    - Ocean House (Marina)
    - Ocean House (Marina in Washington County)
    - Billington Cove (Marina in Washington County)
    - Frank Hall Boatyard (Marina in Washington County)
    - Avondale Boatyard Inc. (Marina in Washington County)
- **Newport County**
  - Critical Facility
    - Tiverton Yacht Club (Marina)
    - Brewer's Sakonnet (Marina)

3.7.3 Loss Estimation

The local hazard mitigation plans were reviewed to determine if the local plan loss estimates could be summarized to create statewide loss estimates. During the review it was noticed that some plans did not include complete loss estimates and others were highly variable in the methodology used to compute loss. A summary of the local plan loss estimates is provided in Section 5. It was decided that the variability in the local loss estimates would limit the ability to integrate them into statewide vulnerability and loss estimate. Ideally, future revisions to the local plans will include a template for loss estimation that will allow the next revision of the state plan to be a representation of all of the local plans.

Rough estimates of annualized losses can be generated based on the NCDC Storm Events database, which documents the damage costs associated with the various hazards. Supplemental annualized loss values for flood, hurricane winds, wildfire and earthquake have also been derived from the other sources as described in each individual

hazard section. NCDC did not include any historical information about damages due to drought and this is not included in the loss estimates.

Table 52 summarizes the annualized loss values derived from NCDC and supplemental sources. As shown, the Hazus-MH derived loss estimates are exponential compared to the NCDC annualized losses based on past recorded events. The information used was also used as parameters in the hazard ranking. The hazard specific sections include information regarding the annualized loss by county, where available. The ranking and risk parameter maps show the annualized damages as established using NCDC data. The hazards that used an established method other than sole use of NCDC loss data for calculating annualized loss are explained in detail in those sections.

3.7.4 Effect of Changes in Development on Loss Estimates

The majority of development in Rhode Island is regulated and occurring outside of the known/mapped hazard areas (for example, FEMA floodplains). The effect of this change would be positive and result in a decrease in the estimated losses of facilities and infrastructure. Most of the local hazard mitigation plans include a general overview of land uses and development trends. Each local hazard mitigation plan was reviewed for information on local trends.

Local hazard mitigation plans lacked detailed information about land use and future development planning. Generalized information about land use planning has been made at the State level but really should be evaluated locally. Land use planning, completed at local level, can reduce risk to the population and infrastructure by addressing the hazards that impact the jurisdiction. It is necessary for this to be done at the jurisdictional level since this is where planning, regulation, and taxation occur. Rhode Island mitigation staff will be coordinating with localities to ensure that future revisions of their local plans will be standardized and will have the ability to be uploaded and used in the next revision of the statewide hazard analysis.

3.7.5 Limitations of Ranking

The NCDC data, as previously described, is not a complete data source. It was chosen for use in ranking because of its standardized collection of many of the hazards that impact Rhode Island. Unfortunately, the data set is lacking in terms of geological hazards. As a result, the ranking can only characterize the current form of the data. Future plan updates and mitigation actions should assess the availability of other data sources ensure the parameters are still valid for ranking the hazards.

The NWS does not guarantee the accuracy or validity of the information used for weather-related hazards. Although the historical records in the database often vary widely in their level of detail, the NWS does have a set of guidelines for use in the preparation of event descriptions.[57]

[57] National Weather Service Instruction 10-1605. Operations and Services Performance: Storm Data Preparation Guide. August 17, 2007. http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf

Table 52. Annualized Loss Estimation from NCDC and Supplemental Sources.

County	Flood (NCDC)	Flood (Hazus-MH)	Flood (Irene Scenario Hazus-MH)	Hurricane (Hazus-MH)	Winter Weather (NCDC)	Thunderstorms	Tornado	Earthquake (Hazus-MH)
Bristol	$390,705	$11,166,000.0	$1,947,728	$8,061,612	$10,497	$24,399	$762	$103,699
Kent	$1,453,165	$42,801,000.0	$5,358,576	$22,045,205	$367,034	$64,065	$6,971	$366,463
Newport	$338,831	$38,722,000.0	$1,722,993	$16,431,209	$24,861	$27,530	$0	$183,329
Providence	$1,668,286	$238,038,000.0	$15,732,279	$63,868,323	$387,488	$102,107	$107,101	$1,499,951
Washington	$1,676,295	$56,903,000.0	$6,422,545	$23,711,460	$18,219	$46,077	$794	$2,771,914
Total	**$5,527,283**	**$387,630,000**	**$31,184,121**	**$134,117,809**	**$808,098**	**$264,178**	**$115,627**	**$4,925,356**

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Section 4: State Capability Assessment

44 CFR Requirement
State Capability Assessment **Requirement §201.4(c)(3)(ii):** [The State mitigation strategy shall include a] discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and] a discussion of State funding capabilities for hazard mitigation projects …

A number of different Rhode Island State agencies and offices have incorporated hazard mitigation objectives into their organizational missions. Descriptions of each agency's hazard mitigation-related functions, including their enabling legislation, and examples of the agency's current hazard mitigation measures are summarized in this section.

4.1 2014 Plan Update

The 2014 Rhode Island SHMP Capabilities Assessment section has significantly changed since 2011. This section has been restructured to better document agency and program capabilities in terms of pre- and post-disaster activities. The State Capability Assessment section is now organized into three (3) main sections: a capabilities summary matrix, agency specific profiles, and agency checklists. The summary matrix documents the programs, policies, and funding opportunities each state agency is implementing to reduce risk. The agency specific profiles provide further detail on these programs, policies, and funding opportunities. The agency checklists summarize each agencies pre- and post- disaster capabilities as well as funding, staffing, and technical assistance capabilities. In addition, the checklist documents if that agency regulates development in hazard areas.

Statewide hazard mitigation capabilities documented in the 2011 plan were reviewed for relevance. Those programs, policies, and funding capabilities that were no longer applicable to hazard mitigation or were outdated were removed from the plan and Section 2 on the Planning Process, a WebEx with the SIHMC was held on May 1, 2013 to present the preliminary findings of the capabilities assessment. The Capabilities Assessment Matrix, shown in Table 53, was reviewed during this WebEx and the Committee provided feedback on additional capabilities that should be included. The matrix was also distributed to the committee via email. Based on the comments that were received, agency specific profiles were prepared and then sent out to individual committee members within that agency for review.

Comments were incorporated into each agency's profile and completed to the best of their ability; however, gaps can be found in some profiles due to unavailable information. Those agencies that were unable to provide a complete profile will have the opportunity to revise and update their profiles during quarterly meetings of the SIHMC.

Noteworthy Statewide capabilities that have changed since 2011 include:

- State LiDAR data
- Water Resources Board Strategic Plan
- CDBG-DR funding post Hurricane Sandy
- State of Rhode Island THIRA
- Shoreline Change (Beach) SAMP
- SafeWater RI
- Energy Assurance Plan
- National Grid Gas and Electric Infrastructure Safety and Reliability plans
- National Grid Community Liaison program
- USACE Reconnaissance level reports for Wonnasquatucket, Pawtuxet, and Pawcatuck watersheds

The following section further details the capabilities of agencies with programs and policies related to hazard mitigation. Each agency specific profile includes new capabilities since the 2011 plan. The information in this section has been reviewed and revised by the SIHMC and members of the highlighted agencies and offices. The SIHMC has approved the information presented in this section and feel it represents the hazard mitigation capabilities of Rhode Island. SIMHC members and agency contacts who provided additional data and information are listed in Appendix 2: *Planning Process* along with their role in the plan update.

4.2 Pre- and Post-Disaster Management Policies, Programs, and Capabilities

This section presents a summary of the State's hazard mitigation capability including a description and analysis of State laws, regulations, policies, and programs organized by the agency responsible. A general description and analysis of the effectiveness of local mitigation policies and programs can be found in Section 5.

Table 53 lists the plans, programs, policies, and funding opportunities that support risk reduction activities, encourage mitigation measures, and increase community resiliency at the state level. This matrix includes current State laws, Executive Orders, regulations, policies and programs as well as related federal programs that currently support hazard mitigation throughout the State. These items are discussed in more detail under the agency descriptions in the sections below. Each SIHMC and agency identified in the capability assessment was provided with the capabilities matrix and profiles to review.

Each agency's hazard mitigation effectiveness, which includes accomplishments such as funding of mitigation projects, risk reduction activities, public education/outreach, and other ways the agency has contributed to increasing state-wide resiliency, is documented in the agency descriptions. New state policies, programs, and funding resources available within or to the agency and changes to hazard management capabilities since 2011 are also noted.

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Table 53. Current Plans, Programs, Policies, and Funding Opportunities that Support Risk Reduction, Community Resiliency, and Mitigation Activities.

Agency	Plan/Program	Policy	Funding
Federal Emergency Management Agency			See RIEMA profile
National Grid	Electric Infrastructure, Safety, and Reliability Plan (includes status of flood mitigation projects) Enhanced Hazard Tree Mitigation Program Regular inspections and maintenance Storm warnings and safety/power notifications		
National Weather Service	HURREVAC/SLOSH training Severe Weather Spotter training Flood event summaries and studies River and dam break modeling		
RI Coastal Resources Management Council	State Coastal Plan SLAMM: North Kingstown (other phases to follow) Special Area Management Plans (Ocean, Shoreline, MetroBay, Greenwich Bay, Aquidneck Island, Salt Pond, Providence Harbor, Narrow River, Pawcatuck River Estuary and Little Narragansett Bay) Coastal Zone Buffer Program Stormwater Design and Installation Standards Manual RI Coastal and Estuarine Land Conservation Plan	Wetland Preservation Dune Preservation Barrier Island and Spits Planning Policy Climate Change and SLR	Coastal and Estuary Habitat Restoration Program and Trust Fund
RI Department of Environmental Management	Governor's Task Force on Dam Safety and Maintenance Dam Safety Program Division of Forestry (tree warden, fire mitigation) Office of Water Resources (wastewater and stormwater management, drought monitoring) Emergency Response Plan (hazardous materials/oil spills, hurricane, prescribed fire burn, securing state parks, beaches, and forests)	Dam EPA Regulation	
RI Department of Health	Center for Emergency Preparedness and Response (CEPR) SafeWater RI Long-term Care Mutual Aid Plan		PHEP grant Hospital Preparedness Program
RI Department of Transportation	-Hurricane Evacuation Routes -Highway safety campaigns -Stormwater management planning -Infrastructure vulnerability assessments		

Agency	Plan/Program	Policy	Funding
RI Department of Administration (Division of Planning)	State Guide Plan Element 110: General Goals and Policies Element 121: Land Use 2025 Element 211: Economic Development Policies and Plan Element 152: Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan Element 155: A Greener Path: Greenspace and Greenways for RI's Future Element 162: River Policy and Classification Plan Element 611: Transportation 2035 Element 721: RI Water 2030 Element 781: RI Energy Plan Element 161: Forest Resources Management Plan Element 423: RI Five Year Strategic Housing Plan Element 421: State Housing Plan Element : Comprehensive Conservation and Management Plan for Narragansett Bay	Comprehensive Planning Regulation and Land Use Act (RIGL 45-22.2) Rhode Island Zoning Enabling Act (45-24) Rhode Island Land Development and Subdivision Review Enabling Act (45-23) Social Equity Report	Elements 211 and 423 are currently being updated through a HUD Sustainable Communities grant Element 661 is currently being updated
RI Emergency Management Agency	National Flood Insurance Program FEMA RiskMAP Community Assistance Program (CAP) RI Flood Awareness Task Force Debris Management Plan Railway Vulnerability Plan Emergency Operations Plan RI Business Operations Center Infrastructure Protection Program Protected Critical Infrastructure Information Program Automated Critical Asset Management System State Emergency Operations Center State Hazard Mitigation Program Threat and Hazard Identification and Risk Assessment (THIRA) Homeland Security Information Network		HMGP PDM FMA SRL
RI Historical Preservation and Heritage Commission		SHPO/RIEMA Disaster Recovery MOU	
RI Office of Energy Resources	Energy Assurance Plan RI State Energy Plan		
RI Office of Housing and Community Development (Division of Planning)	Disaster Housing Task Force (DHFT) Housing Resources Commission CDBG-DR Action plans		CDBG Program/Grants – including CDBG-DR funds

Agency	Plan/Program	Policy	Funding
RI Public Utilities Commission and Division of Public Utilities and Carriers	Infrastructure, Safety, and Reliability dockets for National Grid Gas and Electric (include flood mitigation projects and vegetation management) Major storm event damage summaries		
RI Rivers Council	Cultural Heritage and Land Management Plan for the Blackstone River Valley RI Rivers Policy and Classification Plan Establishment of Riparian and Shoreline Buffers and the Taxation of Property included in Buffers report		Grants for projects proposed by state designated local watershed councils
RI Sea Grant College Program and URI Coastal Resources Center	Ongoing research/vulnerability assessments for coastal hazards and SLR Technical assistance to decision makers at the state and local level Climate change adaptation planning Special Area Management Plan (SAMP)		Research grants
RI Water Resources Board (Division of Planning)	Strategic Plan Water Supply System Management Plan program Drought Steering Committee	Water Use and Efficiency Act	Water Quality Protection Surcharge Corporate Water Quality Protection Surcharge
Scientific Support for Environmental Emergency Response	Environmental disaster response and recovery		
State Building Code Commission	Building Code Standards Committee Rebuilding After a Storm	State Building Code	
The Providence Plan	Data and maps pertaining to population and housing		
United States Army Corp of Engineers	Dam breach failure analysis SLR analysis Flood Control Projects Habitat Restoration Floodplain Management Services Planning Assistance to States Wetland Identification and Restoration Estuary Protection Inspections of infrastructure		Floodplain Management Services Planning Assistance to States
United States Department of Agriculture Natural Resources Conservation Service	Emergency Watershed Program (EWP) Watershed and Flood Prevention Program		EWP Federal Watershed Operations funding assistance

Agency	Plan/Program	Policy	Funding
United States Geological Survey	Real-time river flood stage monitoring and warning systems Stream gauges Coastal storm tide data collection Post-storm/flood data analysis		
University of Rhode Island Environmental Data Center	GIS/Mapping services Technical support Grant application services		

Table 54 summarizes the capabilities captured in each agency Capability Checklist presented in the subsections below. This table highlights the capabilities of the state as it pertains to hazard mitigation and helps identify gaps where risk reduction capabilities can be improved upon in the future. In an effort to sufficiently evaluate the capabilities of each stakeholder's agency or organization, a weighting system was implemented to determine their relative rank for how effective the capability of the agency is at achieving the goals and implementing mitigation. Each of the basic capabilities were reviewed and given a numerical value to demonstrate the ability of each activity to support mitigation efforts.

Capabilities with the greatest mitigation related benefit were ranked the highest. These include pre and post-disaster capabilities and received a weighting of two (2). Other important but lesser valued capabilities include both the funding and technical assistance resources available were weighted with a value on one and a half (1.5). An agency or organization's ability to regulate development in hazard prone areas and staffing resources were weighted with a value of one (1).

Once assessments were completed, agencies with an overall capability total of none (9), having all capabilities to complete hazard mitigation activities, were given a high capability ranking. Assessment totals between 7 and 8 were given a medium capability ranking. Neutral capabilities were given for agencies with total ranking scores between five (5) and six (6).

As this planning process continues and evolves, the SIHMC will review the current agencies and expand upon capabilities, as they are presented, that help mitigate hazards identified in the risk assessment.

Table 54. Rhode Island mitigation capabilities matrix.

Agency	Pre-Disaster Capabilities	Post-Disaster Capabilities	Regulates Development in Hazard Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	Pre-Disaster Capabilities	Post-Disaster Capabilities	Regulates Development in Hazard Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	Overall Capacity Score	**Capability Ranking**
					Weighting		*2*	*2*	*1*	*1.5*	*1*	*1.5*		
Federal Emergency Management Agency	X	X	X	X	X	X	2	2	1	1.5	1	1.5	9	High
RI Department of Health	X	X	X	X	X	X	2	2	1	1.5	1	1.5	9	High
RI Department of Transportation	X	X	X	X	X	X	2	2	1	1.5	1	1.5	9	High
RI Emergency Management Agency	X	X	X	X	X	X	2	2	1	1.5	1	1.5	9	High
RI Rivers Council	X	X		X	X	X	2	2	0	1.5	1	1.5	8	Medium
RI Water Resources Board	X	X	X	X		X	2	2	1	1.5	0	1.5	8	Medium
United States Department of Agriculture Natural Resources Conservation Service	X	X	X	X		X	2	2	1	1.5	0	1.5	8	Medium
RI Coastal Resources Management Council	X	X	X		X	X	2	2	1	0	1	1.5	7.5	Medium
RI Office of Energy Resources	X	X	X		X	X	2	2	1	0	1	1.5	7.5	Medium
RI Office of Housing and Community Development	X	X		X		X	2	2	0	1.5	0	1.5	7	Medium
RI Sea Grant College Program and URI Coastal Resources Center	X		X	X	X	X	2	0	1	1.5	1	1.5	7	Medium
United States Army Corp of Engineers	X	X		X		X	2	2	0	1.5	0	1.5	7	Medium
National Grid	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral
National Weather Service	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral

Agency	Pre-Disaster Capabilities	Post-Disaster Capabilities	Regulates Development in Hazard Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	Pre-Disaster Capabilities	Post-Disaster Capabilities	Regulates Development in Hazard Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	Overall Capacity Score	**Capability Ranking**
					Weighting		*2*	*2*	*1*	*1.5*	*1*	*1.5*		
RI Department of Environmental Management	X	X	X			X	2	2	1	0	0	1.5	6.5	Neutral
RI Division of Planning	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral
Scientific Support for Environmental Emergency Response	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral
United States Geological Survey	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral
University of Rhode Island Environmental Data Center	X	X			X	X	2	2	0	0	1	1.5	6.5	Neutral
RI Historical Preservation and Heritage Commission	X	X				X	2	2	0	0	0	1.5	5.5	Neutral
The Providence Plan	X	X				X	2	2	0	0	0	1.5	5.5	Neutral
RI Public Utilities Commission and Division of Public Utilities and Carriers	X	X			X		2	2	0	0	1	0	5	Neutral
State Building Code Commission	X	X	X				2	2	1	0	0	0	5	Neutral

4.2.1 Agency Specific Profiles

The following section includes each of the Agency profile capability assessments completed for the 2014 Plan update. The agency description also includes a capability checklist, summarizing the agency capabilities that support hazard mitigation. FEMA Region I graciously provided feedback and insight during the development of the agency profile and capability checklist. Each contributing Agency received a pre-populated profile, based on information presented in the 2011 SHMP to review and edit, as well as the template shown in Figure 38. Agency profile contacts are shown in Appendix 4: *Capability Assessment*; the majority of the contacts are also members of the SIHMC.

Agency Name

Description of agency
(Summary of agency mission and description of programs and policies that support risk reduction activities)

Funding capabilities
(Summary of operating budget, grant programs available to complete structural projects or outreach activities, investments in risk reduction or mitigation activities)

Staffing resources
(Summary of total staff within agency; identification of available staff to support risk reduction or mitigation activities)

Technical assistance
(Description of expertise with technical programs such as GIS, engineering models, etc. Any qualified/committed personnel for preparing project grant applications? Does the agency provide technical support to the public or other state agencies?)

Capability Checklist	
Pre-Disaster Capabilities?	• Name of program/plan/policy
Post-Disaster Capabilities?	• Name of program/plan/policy
Regulates Development in Hazard Prone Areas?	Yes/No
Funding Capabilities?	Yes/No
Staffing Resources?	Yes/No
Technical Assistance?	Yes/No
Participant in implementing the SHMP mitigation strategy?	Yes
Date of Assessment	May 7, 2013

Hazard mitigation effectiveness
(State accomplishments such as funding of mitigation projects, risk reduction activities, public education/outreach, etc. What has the agency contributed or achieved with regard to increasing state-wide resiliency? Does the agency have the authority to regulate impact to or development in hazard prone areas?)

New capabilities since 2011
(State new policies, programs, funding resources available within or to the agency since 2011)

Figure 38. Capability Assessment Agency Profile Worksheet.

4.2.1.1 Federal Emergency Management Agency (FEMA)

Quick Look Capabilities Assessment:	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	See RIEMA	See RIEMA	✓	✓	✓	✓	✓ Carried out through RIEMA

4.2.1.1.1 Description of agency

FEMA works in partnership with RIEMA to prepare for, respond to, and recover from disasters. Many federal mitigation funding opportunities, policies, and programs are administered by FEMA and carried out at the State level by RIEMA.

4.2.1.1.2 Funding capabilities

The Grants Management Division at FEMA Region I provides support for the management of all disaster, non-disaster, and preparedness grants issued by FEMA. RIEMA's profile above includes information on the FEMA grants that RIEMA uses to fund mitigation projects.

4.2.1.1.3 Staffing resources

FEMA Region I has a Mitigation Division with staff able to assist with floodplain management and insurance, HMGP, and hazard mitigation planning.

4.2.1.1.4 Technical assistance

FEMA Region I offers technical assistance to Rhode Island on matters pertaining to floodplain management and insurance, HMGP, and state and local hazard mitigation planning.

4.2.1.1.5 Hazard mitigation effectiveness

FEMA works with RIEMA to increase opportunities to minimize future damage to public and private property from natural hazard events. See the RIEMA profile for more information.

4.2.1.1.6 New capabilities since 2011

See RIEMA profile.

4.2.1.2 National Grid

Quick Look Capabilities Assessment: June 5, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Maintain lists of contact information for critical facilities (CFs), life support customers (LSCs) and local officials Proactive outreach to CFs and LSCs in areas that are expected to be impacted Advance Notification to EMA, School superintendents, police and fire, town officials, RIEMA, PUC, and governors assistants prior to a storm	Municipal Conference Call Dedicated Municipal Phone Lines RIEMA EOC Liaison			✓	✓	✓

4.2.1.2.1 Description of agency

National Grid strives to deliver safe and reliable energy to 487,000 electric and 250, 000 gas customers throughout Rhode Island.

4.2.1.2.2 Funding capabilities

National Grid is an international electricity and gas company and one of the largest investor-owned energy companies in the world. Funding is made available for pre- and post- disaster assistance.

4.2.1.2.3 Staffing resources

National Grid has a core staff of operations and support personnel staffed in Rhode Island on a normal full time basis. This staff is capable of handling day to day operations and small scale emergencies on a standalone basis. During emergency events which require additional support, the company has the ability to allocate additional operations and support resources from Massachusetts and New York service territory. Additionally the company maintains relationships with utilities and contractors from across the U.S. in order to obtain additional support and operations resources on an as needed basis.

4.2.1.2.4 Technical assistance

The Company maintains lists of contact persons for emergency events, with names, titles, addresses, phone/cell numbers, emails and other pertinent data as appropriate for:

- Local elected, local appointed, state and local public safety officials and emergency management and response personnel.

- Contact persons for facilities which are jointly considered critical to both the community and the Company. These facilities are typically engaged in providing services essential to the health and safety of the community, and where the loss of electrical service would interrupt vital services to the public (e.g., hospitals, nursing homes, key municipal facilities, and sewage treatment plants).

On “Blue Sky” days, the Company’s Community & Customer Manager is the primary liaison between the Company and each municipality, and is established to develop relationships between the Company and municipal officials to better respond to the community needs during a restoration effort. During major events and extended restoration efforts, additional employees who are trained as Community Liaisons are deployed to supplement the Community and Customer Manager. The Community Liaison will contact the assigned Emergency Management Director or local Incident Commander of the individual community as the forecasts becomes more certain. This role is in addition to the Customer & Community Manager and the Municipal Call Center. When directed, Community Liaisons will report to the municipality’s Incident Commander and will provide assistance in the prioritization of work and communication of municipal priorities to ensure public safety and to facilitate the restoration of electric service to the assigned community. Each community liaison has access to feeder maps or maps outlining municipal substations and distribution networks and up-to-date customer outage information. In addition, the liaison will have all the key contact, facility, and other municipal information to facilitate communications. The community liaison shall utilize the maps and outage reports to respond to inquiries from state and local officials and relevant regulatory agencies. The company has provided feeder maps and town specific restoration information to local points of contact as well.

The Company may establish a Municipal Call Center with a dedicated telephone number(s) for responding to local governmental authority inquiries during major events. The telephone number will only be provided to authorized municipal officials, for their official use only, prior to activation of the dedicated line. If a municipality is concerned over the loss of electrical service to facilities that provide vital services to the public, e.g. key municipal facilities, sewage treatment plants, etc., they should communicate this concern to the Company via this dedicated line or their community liaison. If this dedicated line or community liaison has not been activated, the municipality should make contact with the Company via their assigned Customer and Community Manager.

During an emergency event, the Company provides a representative to the RIEMA EOC to provide Emergency Support Function (ESF) 12 support as well as facilitate communications between the Company and other response agencies. The RIEMA liaison will:

- Liaise with state EMA during the emergency.
- Provide outage information on a regular basis.
- Support ESF 12.
- Assist with the coordination of additional of requests of other responding agencies as required.

4.2.1.2.5 Hazard mitigation effectiveness

The Company sends text and email message notifications out to customers during major storms and provides safety tips. Storm recovery information on power restoration and steps customers can take to recover from an outage or from property damage are also provided.

The Company reaches out to United Way's 2-1-1 system, to craft messages for people looking for information and assistance. In addition, a website which provides live electrical outage information and estimated restoration times on a 24 hour basis.

A list of print and broadcast media contact information is maintained and may uses various means to disseminate information to the press, including news releases, news conferences and teleconferences, interviews, etc.

4.2.1.2.6 New capabilities since 2011

Since Hurricane Irene, National Grid has expanded the Community Liaison program to directly communicate with the towns and their Emergency Management Agencies (EMA). They coordinate the town's priorities and provide updates to town officials on our progress.

Upon request during major events the company may allocate dedicated resources (strike force teams) to assist state police, RI DOT, National Guard, and local DPW teams to assist with removal of electrical hazards in order to clear roads and facilitate other public safety activities.

4.2.1.3 National Weather Service (NWS)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	HURREVAC/ SLOSH Training Evacuation Planning General hazardous weather education	Decision making tools			✓ As it relates to public education and outreach or Decision Support Services	✓	✓

4.2.1.3.1 Description of agency

The National Weather Service provides life-saving forecast and warning services to the region as well as detailed event-driven decision support services.

The NWS offers HURREVAC/SLOSH training for help in evacuation planning. Training is also available on Hydrologic Services and Tools, Severe Weather Spotter Training and All-Weather Hazards training. Monthly summaries of flood events (E-5 Reports) are available from Weather Forecast Office (WFO) in Taunton while all hazardous weather event summaries are available through the Storm Data publications.

RI has many NWS-trained weather spotters feeding "ground truth" observations directly into NWS Taunton as part of the NWS SkyWarn program. Such observations can trigger warnings to be issued by NWS.

4.2.1.3.2 Funding capabilities

The NWS does not currently offer funding opportunities for hazard mitigation.

4.2.1.3.3 Staffing resources

The NWS WFO in Taunton leads local outreach and education efforts, including the Warning Coordination Meteorologist and Senior Service Hydrologist. The Northeast River Forecast Center provides river and dam break modeling expertise and conducts outreach with partners on a regional basis, led by the Service Coordination Hydrologist.

4.2.1.3.4 Technical assistance

NWS provides technical support in the form of Decision Support Services on an event-driven basis in support of ongoing hydrometeorological events.

4.2.1.3.5 Hazard mitigation effectiveness

The NWS has helped to raise situational awareness for a host of hydrometeorological hazards through training and public outreach and education programs, attendance at workshops and conferences, as well as conducting Spotter Training classes. One specific example is the use of HURREVAC, which allows local EMS Directors and personnel to plan and forecast evacuations and to identify potential resource needs and areas at greatest risk.

4.2.1.3.6 New capabilities since 2011

The NWS provides Decision Support Services through the provision of weather briefings and supporting briefing materials, short range ensemble river forecast services, and has greatly enhanced its routine interactions with partners and the general public through the use of social media tools such as NWSChat, Facebook, and Twitter.

4.2.1.4 Rhode Island Coastal Resources Management Council (CRMC)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	State Coastal Plan Sea Level Rise Studies Coastal Flooding Studies Development Regulation	Recovery after storm events Emergency Permitting - Section 180	✓		✓	✓	✓

4.2.1.4.1 Description of agency

The CRMC plans for and manages the coastal resources of the State.

Within the State Coastal Plan, there are numerous policies and programs for the protection of coastal and tidal wetlands. CRMC has statutory authority to restrict the alteration of coastal wetlands in order to preserve them. They also implement regulations requiring setbacks and to prohibit construction on beaches, in dunes, and on barrier spits that are identified as undeveloped or moderately-developed. The preservation of wetlands from development and destruction will provide for the natural and beneficial use of wetlands as related to flood retention and natural buffers from coastal storms.

4.2.1.4.2 Funding capabilities

The CRMC receives federal and state funds for its annual operational costs, most of which supports its staff.

4.2.1.4.3 Staffing resources

CRMC employs 28 staff members including coastal policy analysts, a coastal geologist, and a marine resources specialist who are assigned to analyze climate change and SLR issues, shoreline change, beneficial re-use of sediment, and wetlands restoration.

4.2.1.4.4 Technical assistance

Technical support is provided to other state agencies.

4.2.1.4.5 Hazard mitigation effectiveness

CRMC has several ongoing partnerships to reduce risks from coastal hazards and for public education and outreach. Some specific projects include:

- Partnering with URI and RISGto develop a Shoreline ChangeSAMP.

- Partnering with RISG and The Nature Conservancy to examine SLR impacts to coastal wetlands throughout Rhode Island.
- Working with Federal, state and local agencies for post-hurricane Sandy recovery.
- Partnering with statewide and local planners, URI, GIS coordinators, and Sea Grant to develop tools for determining vulnerability to future coastal flooding scenarios.
- Partnering with the RIEMA, the State Building Commission, and Sea Grant to develop regulations for adaptation to SLR for new and substantially improved buildings within the coastal zone.
- Developing regulations for beneficial reuse of dredged sediment for beach and dune restoration.
- Developing "living shoreline" regulations for alternatives to structural shoreline protection.

In addition, CRMC staff give numerous presentations to professional groups and the general public on coastal hazards, climate change and other topics.

4.2.1.4.6 New capabilities since 2011

The CRMC has initiated a new Shoreline Change (Beach) SAMP to assess flood inundation and SLR scenarios and shoreline erosion to better inform planning efforts and decision-making to enhance community resilience. The CRMC and partners received a federal grant to evaluate SLR impacts to coastal wetlands and plan for future preservation.

4.2.1.5 Rhode Island Department of Environmental Management (RI DEM)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Dam Safety Program Fire Mitigation Public Education and Outreach Tree Maintenance/ Removal Drought Monitoring Water Quality Monitoring RCRA Facility Monitoring	Emergency Response Plan Post Emergency HazMat Cleanups Chemical and Air Sampling	✓	Unavailable	Unavailable	✓	✓

4.2.1.5.1 Description of agency

The RI DEM is committed to preserving the quality of RI's environment, maintaining the health and safety of its residents, and protecting natural systems. The department enforces law to protect the environment. Specific program areas and plans pertain to risk reduction and hazard mitigation. DEM has an Emergency Response Plan that includes sections on how to respond to hazardous material and oil spills, a hurricane plan for closing the Port of Galilee and Newport and for securing state parks, beaches, and forests, and a prescribed fire plan.

Office of Compliance and Inspection - Dam Safety Program - All dams and reservoirs are to be inspected at regular intervals. Regular inspection schedules are critical to assessing safety of dams, especially in the densely developed and populated areas in close proximity to the spillway. Through a regular assessment and inspection program, an accurate inventory of unsafe/safe dams is created. This inventory provides a basis for prioritizing dam repair and maintenance. In addition, plans for construction or alteration of dams and reservoirs must be approved by DEM.

Office of Compliance and Inspection - Hazardous Waste - This program investigates citizen complaints and referrals from DEM divisions and offices relating to facilities storing hazardous waste and performs compliance monitoring of hazardous waste generators. The program is critical in preventing chemical waste from being released into the environment.

Office of Compliance and Inspection – Underground Storage Tanks - This program investigates citizen complaints and referrals from DEM divisions and offices relating to

underground storage tanks and performs compliance monitoring of underground storage tanks.

Dam Safety Program. The division's Dam Safety Section is the nucleus within the State for inspecting and evaluating the structural stability and maintenance of all dams and dikes, both privately and publicly owned. Dam owners are notified owners of any deficiencies and must seek corrective action as necessary.

Division of Forest Environment - The Division of Forestry manages 40,000 acres of State owned rural forestland. The division performs the following fire mitigation capabilities:

- coordination of statewide forest fire protection plan
- forest fire protection on State owned lands
- assist rural volunteer fire departments
- development of forest fire and wildlife management plans for private landowners
- risk assessments of fires in wild land areas, State forests, parks, and rural areas
- management of suppression resources and coordination with local, state, and federal entities

The Division promotes public education and outreach on environmental conservation. The Tree Warden can be found within the Division of Forestry and is in charge of tree removal and pruning if a tree constitutes an immediate hazard to the public.

Office of Water Resources (OWR) - OWR implements a variety of programs aimed at the protection of the quality of the State's surface waters, groundwater and wetlands. OWR's programs play a pivotal role in controlling wastewater discharges, promoting non-point source pollution abatement, setting standards for wastewater and stormwater management, and preventing alterations to wetlands. In addition to the Water Resources Board, the Office of Water Resources also holds State drought information.

Office of Emergency Response (OER) – (OER) is Rhode Island's first line of defense in protecting public health, safety, and welfare in an environmental emergency. Like police and fire fighters, DEM's emergency responders are prepared to handle incidents of great variety - everything from a spill of a few gallons to a whole tanker-full of petroleum, from a single abandoned drum to biological and chemical weapons. Highly trained first responders are on-call 24-hours a day, seven (7) days a week to secure the incident and to minimize the risk to the public and the environment. The office responds to over 700 complaints each year and the work load includes overseeing the Aboveground Storage Tank program that has requirements for all petroleum tanks greater than 500 gallons.

4.2.1.5.2 Funding capabilities

Detailed information on funding capabilities for mitigation activities were not provided at this time.

4.2.1.5.3 Staffing resources

Detailed information on staffing resources available for mitigation activities were not provided at this time.

4.2.1.5.4 Technical assistance

Within the Division of Planning and Development, DEM uses GIS technology to create, manipulate and analyze spatial data that help achieve their mission of preserving the quality of Rhode Island's environment. This section works closely with other divisions of DEM to provide high quality GIS services necessary to forward the mission of the Department.

4.2.1.5.5 Hazard mitigation effectiveness

The OER provides outreach to local schools and universities to assist with the proper storage and disposal school chemicals.

The Division of Agriculture provides outreach and funding for the disposal of farm chemicals for RI farmers.

DEM has worked with local building officials to establish more resilient building codes and designs (i.e. septic systems, underground storage tanks and above ground storage tanks).

4.2.1.5.6 New capabilities since 2011

Detailed information on new capabilities since 2011 were not provided at this time.

4.2.1.6 Rhode Island Department of Health (HEALTH)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Emergency Preparedness SafeWater RI	Emergency Response	✓	✓	✓	✓	✓

4.2.1.6.1 Description of agency

The mission of the Rhode Island Department of Health (HEALTH) is to prevent disease and to protect and promote health and safety of the people of Rhode Island. Many of the programs administered by HEALTH routinely serve to prevent and mitigate the spread of morbidity and mortality within the State. These programs include:

- Division of Environmental Health Services and Regulation
  - Office of Drinking Water Quality
  - Office of Food Protection
  - Office of Facilities Regulation
  - Beach Monitoring Program
  - Radiological Health Program
  - Division of Emergency Medical Services
- Division of Community, Family Health, and Equity
  - Healthy Homes and Environment Team
    - Healthy Communities Initiative
    - Climate Change Program
    - Healthy Homes and Childhood Lead Poisoning Program
    - Healthy Schools Program
    - Asbestos Control Program
    - Radon Control Program
    - Lead Training and Compliance
    - Occupational Safety and Health Administration (OSHA Consultation Program
  - Preventive Services and Community Practice Team
    - Immunization Program
- State Health Laboratories
  - Environmental Sciences
  - Biological Sciences
- Division of Infectious Disease and Epidemiology
  - Tuberculosis Control Program

  - Office of HIV/AIDS and Viral Hepatitis
  - Acute Infectious Disease Program
- CEPR
  - Healthcare System Preparedness Program
  - Medical Emergency Distribution System Program
  - Internal Planning Program

HEALTH maintains the CEPR whose mission centers on public health and healthcare emergency preparedness and response. During emergencies, CEPR is tasked with facilitating the Department's response, and with the coordination between private, local, state, and federal partners to further the State's overall response. When not responding to emergencies, the Center is routinely engaged with both internal and external partners in activities to prepare for and mitigate against threats to the public's health and the healthcare system.

HEALTH maintains an ongoing pursuit of public water supply resiliency within the State. The following bullets outline programs that support this pursuit:

- The Drinking Water Incident Response Plan – The 2004 DWQ emergency plan is being updated by a consultant hired by the Office of DWQ with the goal of aligning the plan with the framework of HEALTH's EOP. The document is targeted for completion by the end of 2013. The project includes tabletop exercises.
- Small System Emergency Preparedness Planning – DWQ grant to URI to assist small systems using professional training and tools for development and implementation of vulnerability assessments, emergency preparedness plans, and communication and public notification strategies.
- RIWARN – continue to be a member of the RIWARN steering committee.
- Hired a staff person to further develop and implement the Office's Emergency Preparedness and Security.
- Ongoing program development to achieve better communication with all Public Water Systems (PWSs) before, during, and after emergency events.

4.2.1.6.2 Funding capabilities

Funding for public health and healthcare emergency preparedness and response activities has decreased dramatically over the past several years. Rhode Island was awarded $4.4 million from the Centers for Disease Control (CDC) and Prevention's Public Health Emergency Preparedness (PHEP) grant for the current grant year (ending June 30, 2014) and was also awarded $1.5 million from the HHS the Hospital Preparedness Program grant.

HEALTH is >80% federally funded. With regard to preparedness grants, grants are prepared with key administrators who manage the fiscal and administrative requirements (annual grant cycle including application, budget development, progress and budget tracking, contracts, reporting, performance measures, carry forward/no cost extension

requests, and closeout); meanwhile, program staff complete the project plans and narratives and their implementation internally and with external partners.

4.2.1.6.3 Staffing resources

- Total staff within the agency: ~430
- CEPR staff: 13
- Total HEALTH staff fully or partially funded by PHEP (outside of CEPR): 43 (16.97 FTEs total)

4.2.1.6.4 Technical assistance

HEALTH employs a GIS Data Manager, and both the Beach Monitoring Program and Office of DWQ have staff who also use GIS regularly. These resources are often called upon for emergency preparedness and response support, especially in preparing for and responding to natural disasters.

HEALTH staff who are funded with preparedness dollars develop, test, and revise plans to respond to emergencies; train physicians, nurses, and front-line staff to watch for unusual disease presentations; develop plans and train laboratories to test for these agents/diseases; set up and maintain emergency communications networks; and teach the public what to expect during emergencies and what they can do to prepare for them.

CEPR maintains contracts with all hospitals and health centers, the Hospital Association of Rhode Island, the Rhode Island Health Center Association, and the Rhode Island Department of Behavioral Healthcare, Developmental Disabilities, and Hospitals to continue to improve preparedness and response capabilities in the public health and healthcare sector. Because there are no local health departments in Rhode Island, HEALTH maintains contracts with all 39 municipalities to ensure the capability of each of the municipalities to mass dispense and/or vaccinate all people within Rhode Island in an expedited timeframe during a public health emergency. HEALTH also maintains a contract with the Rhode Island Disaster Medical Assistance Team/Medical Reserve Corps (DMAT/MRC) to continue to build and maintain a medical supply and equipment cache, which is intended to be used to establish a field hospital and/or other types of medical support in response to a large-scale disaster or planned event. A second contract with DMAT/MRC ensures the continued building and training of its pool of volunteer health professionals.

4.2.1.6.5 Hazard mitigation effectiveness

Through numerous emergency responses, HEALTH has tested and evaluated the mitigation actions for healthcare facilities, drinking water system, food establishments, and the public and has developed ongoing recommendations for additional mitigation actions. Some of these activities include improving systems that provide warning and emergency communications and providing additional training to first responders. Data collected about

storm-related health impacts are driving projects related to climate change to mitigate the impacts of heat and cold weather on individuals who are most vulnerable to their effects.

Ongoing quality improvement activities to support the activities of the following areas ensure that mitigation activities are constantly being improved in the following areas:

The Healthy Homes and Environment Team as it conducts lead screening, surveillance, and monitoring; lead training for the building trades, and lead compliance and enforcement. The program has developed a Healthy Homes in Healthy Communities Strategic Plan 2012-2017.

The OSHA Consultation Program as it provides safety and health consultation services to promote the safety and health of Rhode Island's working men and women in small to medium size private businesses (less than 250 employees) by identifying hazards and ensuring their timely abatement. This program has increased the number of companies in its Safety and Health Achievement Recognition Program (SHARP) to 12 employers recently.

The Office of Food Protection as it certifies food managers, inspects food establishments; investigates illness complaints and disease outbreaks; and inspects, review plans for, and licenses food establishments including schools.

The Office of DWQ as it approves and inspects water sources and treatment; monitors public DWQ; conducts outreach and training; and certifies operators.

The Beach Monitoring Program as it monitors water quality at beach and bathing areas.

Since 2007, CEPR has partnered with multiple entities throughout the State to create a voluntary registry for individuals with disabilities, chronic conditions, and other special medical needs called the Rhode Island Special Needs Emergency Registry (RISNER). RISNER allows the state and local responders to see not only where people who might need special assistance during an emergency reside through a GIS system, but also what their self-identified needs are. Enrollment in RISNER does not guarantee assistance, but allows first responders to better plan for, prepare for, and respond to the needs of the community. Outreach workers promote registration of citizens through community fairs/events, doctors' offices, public housing facilities, home health care agencies, and durable medical equipment suppliers. RIEMA assists in the enrollment process; CEPR continually updates the data and coordinates outreach to municipal users, community organizations, and the general public. Access is provided to local emergency managers, so that they can log in to RISNER before and/or during an event to access information about individuals within their respective municipalities who have registered, providing local emergency management and responders a greater degree of situational awareness. Some of the best practices employed by locals in the past several storms have been well

visits to enrollees; swapping out of enrollees' oxygen containers; providing transportation assistance to shelters; and charging of their medical device batteries.

The next planned upgrade to RISNER includes the addition of an automated emergency notification system to contact enrollees by phone and email.

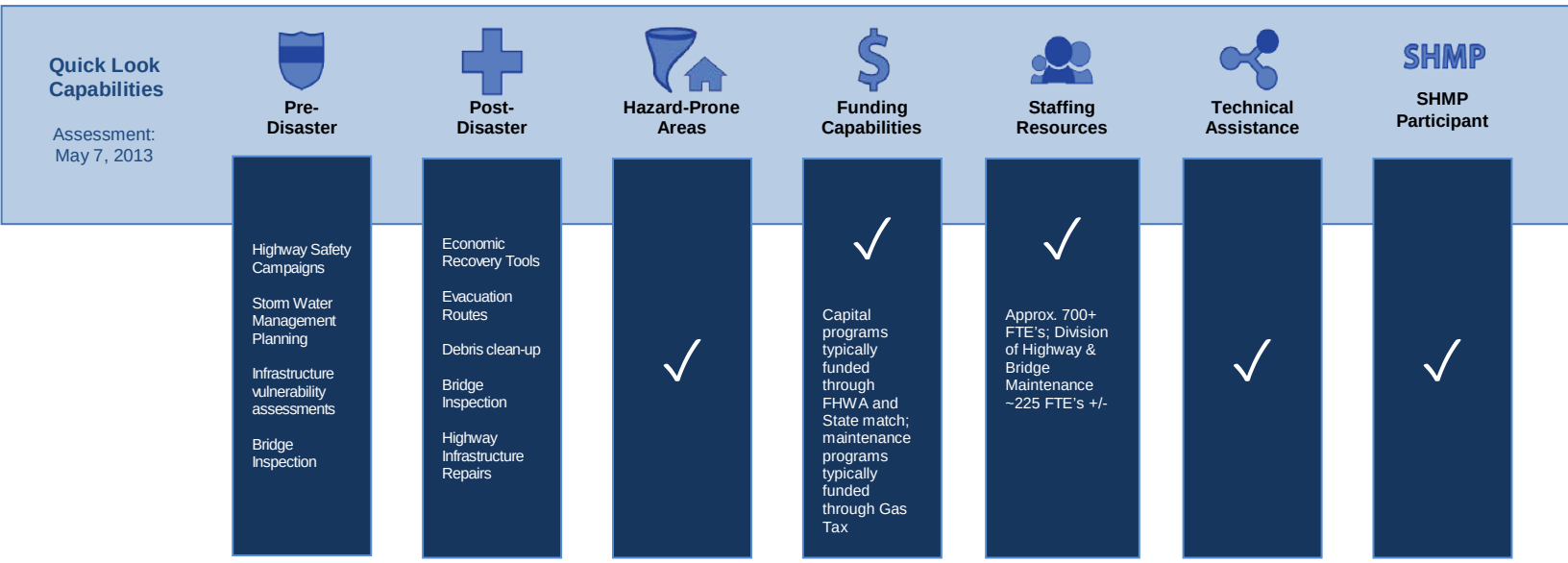
4.2.1.6.6 New capabilities since 2011

The RI HEALTH launched a project in 2012 to address challenges posed by changing environmental conditions. In the study, called the SafeWater RI project, global climate models that simulate future temperature and precipitation conditions were used to predict water supplies, extreme flood events and economic impacts. Data were analyzed for eight scenarios for three time horizons (2022, 2052, and 2084) for a total of 24 scenarios, each of which represents different temperature and precipitation amounts and patterns.

Each Rhode Island water utility was ranked for vulnerability for each of the following five hazards: drought, sea-level rise, coastal flooding, riverine flooding, and hurricane storm surge. A list of the most vulnerable facilities that were identified by this study can be found in the HIRA section of this plan. On the basis of the risks and vulnerabilities identified in the SafeWater RI study, draft adaptation strategies and a framework for implementing those strategies in an effort to meet key goals according to Rhode Island's drinking water state-guide plan are being developed.

HEALTH is presently developing a long-term care mutual aid plan (LTC-MAP) with assistance from Russell Phillips & Associates, which will serve to enhance both preparedness and coordination within the long-term care community. These facilities are particularly vulnerable when power outages and/or generator failures occur, given that the individuals they serve require intensive services and are particularly sensitive to temperature extremes. Each facility has access to a customized web-based data collection system that includes facility information on types of residents that can be cared for at the site, as well as specific information on transportation vehicles owned by the facility, contact information, supplies / equipment, vendors, and staffing, to assist in the coordination of evacuation of long-term care facilities within the state. This system can be linked to the LTC-MAPs in MA and CT, also allowing for greater regional capability when nursing home evacuation is required. In 2013, two (2) tabletop exercises and two (2) functional exercises were conducted with the nursing homes to test the system. By June of 2014, all assisted living facilities will be added to the system and multiple exercises to include them will be conducted.

4.2.1.7 Rhode Island Department of Transportation (DOT)



4.2.1.7.1 Description of agency

The mission of RI DOT is to provide, maintain, and secure a safe intermodal transportation network that increases mobility opportunities for the movement of people and goods with the goals of enabling economic development and improving quality of life. RIDOT provides several programs that are designed to protect residents, the environment, and increase economic growth. Examples include:

- Highway safety campaigns
- Storm Water Management Planning
- Economic Recovery Tools

4.2.1.7.2 Funding capabilities

RIDOT receives $399.8 million dollars a year, $248 million from Federal, $49 million from State bonds, and $91.8 million from the State Gas Tax. The Division of Highway & Bridge Maintenance receives approximately $41 million per year from the State Gas Tax and the remainder of the Gas Tax pays debt services and provides funding to RIPTA. Roughly $10 million per year goes to Winter Operations.

In response/recovery to federally declared disasters, capital repairs along the Federal Aid System of Highways are eligible for funding through FHWA.

4.2.1.7.3 Staffing resources

The Department is allotted 772 FTE's, comprising four (4) major divisions: Highway & Bridge Maintenance, Transportation Development, Planning & Finance, and Administrative Services. The Division of Maintenance serves as the main operations

group and has approximately 225 FTE's amongst seven maintenance Districts and Headquarters in Warwick.

4.2.1.7.4 Technical assistance

The DOT has the following technical programs available to provide assistance:

- Engineering – bridge/structural inspections and assessments, hydraulics, geotechnical, transportation, electrical, etc.
- GIS/Mapping
- Equipment – certified mechanics/technicians
- Environmental
- Historical

4.2.1.7.5 Hazard mitigation effectiveness

The RIDOT conducted the first ever collaboration among cities and towns and the State to develop a comprehensive approach to creating statewide evacuation routes. RIEMA provided the RIDOT with local evacuation routes for hurricanes. The RIDOT digitized these routes and put them up on the RIEMA website. This benefits communities in knowing where their evacuation routes are and where abutting communities are directing evacuees. Critical resource needs were also inventoried through collaboration with towns, State Police, and the RIDOT.

RIDOT is currently working on Phase II of the emergency evacuation routes.

All roads in the State except rural minor collectors and local roads and streets are eligible for federal highway aid, and must adhere to federal design regulations. These include standards for the location and hydraulic design of roads and bridges that encroach on floodplains. It is the stated policy of the Federal Highway Act (FHA) to "prevent uneconomic, hazardous or incompatible use and development" of floodplains. RIDOT conducts hydraulic analyses for all new and rebuilt roadways over water bodies, including emergency construction when feasible. While there is no set rule, it is DOT policy to build bridges to the 100-year flood standard wherever appropriate from an engineering standpoint.

4.2.1.7.6 New capabilities since 2011

RIDOT is conducting a preliminary study to determine which infrastructure throughout the state is potentially vulnerable to SLR. Information from the SHMP may be considered for incorporation into the study and data obtained through the vulnerable infrastructure study will be incorporated into the next update of the SHMP.

4.2.1.8 Rhode Island Division of Planning

Quick Look Capabilities Assessment: May 31, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Comprehensive Planning State Guide Plan Technical assistance to municipalities on assessing vulnerabilities and risks	Comprehensive Planning State Guide Plan			✓	✓	✓

4.2.1.8.1 Description of agency

The RI Statewide Planning Program is tasked with preparing, adopting, and amending strategic plans for the physical, economic, and social development of the state (RIGL 42-11-10 (b) (1)), also known as the State Guide Plan, and overseeing the local comprehensive planning process, which is governed by the Rhode Island CPR and Land Use Act (RIGL 45-22.2). Local comprehensive plans are used to direct community land use decisions and capital improvement funding strategies. The RI Statewide Planning Program offers both staffing and planning capabilities that can be used to implement hazard mitigation strategies.

The State Guide Plan is Rhode Island's centralized and integrated long-range planning document. The State Guide Plan is a collection of plans that have been adopted over many years, comprising many separately published elements covering a range of topics. The State Guide Plan is developed by the RI Statewide Planning Program, in conjunction with other state agencies, and has four main functions: it sets long-range policy (generally 20 years), provides a means to evaluate and coordinate projects or proposals of state importance, sets standards for local comprehensive plans, and serves as a general background information source on various topics. Many of the goals, objectives, policies and strategies set forth in the State Guide Plan recommend that the state and municipalities prepare for and respond to natural hazards and climate change impacts. The specific elements of the State Guide Plan that have the most relevance to hazard mitigation are described in more detail below.

In 2011, amendments to the RI Comprehensive Planning Regulation and Land Use Act were enacted that require municipalities to include goals, policies, and actions related to natural hazards within their comprehensive plans by June 1, 2016. Incorporating natural hazards and climate change impacts into the framework of the local comprehensive plan requires communities to consider the impacts of these items relative to land use, transportation, infrastructure and other important community decisions. Additionally, the RI

Statewide Planning Program is currently developing guidance for municipalities on how best to incorporate natural hazards and climate change into municipal comprehensive plans, including recommendations on how to assess impacts and determine appropriate strategies.

State Guide Plan Element 121: Land Use 2025. The purpose of this plan element is to guide future land use, conservation, and development. One major concept defined in this element is sustaining the urban-rural distinction within the state through the identification of an Urban Services Boundary and municipally-designated growth centers, based upon land capability and suitability analysis, which demonstrates the capacity of the area to accommodate future growth. The element directs the State and communities to concentrate growth inside the Urban Services Boundary and within locally-designated growth centers in rural areas. Areas of Special Concern, which include areas under high development pressure, are also discussed in this element. Understanding land use trends and knowing the locations of areas with high development pressures are crucial to hazard mitigation since the impacts from natural hazards are more severe in areas with greater development densities.

In addition, Element 121 recognizes and protects open space and mandates that urban and community development should be undertaken in such a way as to upgrade or maintain open space in the state. Statewide guidelines concerning the protection of wetlands, floodways, and coastal areas help preserve the natural and beneficial uses of floodplains for storm water retention and buffers from coastal storm events. Specifically, Land Use Policy 10 of Land Use 2025 calls for the state to “Guide development in a manner that will prevent encroachment on floodways, dunes, barrier beaches, coastal and freshwater wetlands, and other natural features that provide protection from storms, flooding, and sea-level rise.” (Note: other elements of the Plan protect open space, which is beneficial for natural hazard mitigation techniques. These elements include: 152, 155, and 162).

State Guide Plan Element 423: RI Five Year Strategic Housing Plan. The Strategic Housing Plan element describes recent development trends and housing and population projections within the State. It designates that communities should avoid locating affordable housing on sites that have poor topography or are located in critical environmental areas, such as floodplains. The element also suggests that while increased density may be suitable in some areas of the state, communities should ensure that increasing density will not create other serious impacts such as increased run-off, flooding, and water quality degradation.

State Guide Plan Element 611: Transportation 2035. Adopted in 2012, this plan addresses Rhode Island’s transportation needs over the next twenty plus years. The plan addresses how transportation projects can be conducted in relation to, among other aspects, water quality, flooding, and SLR. To ensure water quality and reduce flooding,

RIDOT conducts drainage improvement projects on roadways, encourages runoff prevention from transportation construction through education, inspection, and maintenance, and has concentrated on using “best management” practices for erosion, sediment, and runoff control planning. In an effort to understand the effects of SLR on transportation infrastructure, the plan encourages the identification of infrastructure lying within SLR inundation zones and categorized as to their future status as a means of creating future adaptation strategies. In addition, the transportation element documents significant and high hazard dams that are within 1,000 feet of a roadway to assess roadways vulnerable to dam failure. The plan states that future analysis should screen the condition of the dam as well as the importance of the roadway and should identify diversionary routes given a dam failure event.

One goal of the plan is to “Develop transportation and communication systems that serve Rhode Islanders and the region in the event of natural disasters, accidents, and acts of terrorism in a manner that minimizes injury, loss of life, and disruption to the economy; facilitates evacuation of people; and allows emergency response and recovery activities to occur.” Objectives and policies that support this goal in addition to ways to measure performance of these objectives and policies to reach the goal are found in this plan element.

State Guide Plan Element 721: RI Water 2030. The RI Water 2030 State Guide Element consolidates five previous State Guide Plan Elements which examined issues that directly affect the availability of, demand for, and management and protection of drinking water, as well as the operation and maintenance of water systems to meet or exceed public health and safety standards, sustain growth and development, and improve the overall quality of life in Rhode Island. The consolidated plan identifies the previously adopted goals, policies, and recommended actions that are based on strategies deemed essential to maintaining existing and protecting future water supplies. In conjunction with Land Use 2025, this element of the state plan is intended to advance the effectiveness of public and private stewardship of the state’s water supply resources.

In addition to including information on Drought Mitigation and Response, the plan includes a table listing natural and human-caused hazards and their potential water related consequences, such as service disruption, system contamination, damage to infrastructure, and loss of revenue.

4.2.1.8.2 Funding capabilities

Currently, the RI Statewide Planning Program has no direct funds available to assist in hazard mitigation activities, but the comprehensive planning and technical assistance provided by this program is available to greatly improve development of integrated mitigation strategies across the state.

4.2.1.8.3 Staffing resources

The RI Statewide Planning Program currently includes a staff of 23, split into five (5) units: Transportation, Land Use, Consistency and Local Planning Assistance, Sustainable Communities, and Data Center. Staff from each unit is available to provide technical assistance related to planning for natural hazards and climate change.

4.2.1.8.4 Technical resources

The RI Statewide Planning Program provides technical planning, GIS, and community engagement assistance to municipalities, state agencies, and non-governmental organizations as requested.

4.2.1.8.5 Hazard mitigation effectiveness

The RI Statewide Planning Program has just begun to address resiliency and planning for natural hazards and climate change impacts and therefore cannot assess effectiveness at this time.

4.2.1.8.6 New capabilities since 2011

Rhode Map RI: Building a Better Rhode Island is currently underway within the RI Statewide Planning Program and will have implications for hazard mitigation and resiliency. Funded by the US Department of Housing and Urban Development's (HUD) Sustainable Communities program, Rhode Map RI will 1) produce new economic development and housing State Guide Plan elements, 2) assist municipalities in determining where local growth centers may be appropriate, and 3) incorporate equity into this and future planning processes. This plan is expected to be completed in 2015. Results of the Rhode Map RI effort will be incorporated into the next SHMP update.

The RI Statewide Planning Program, in conjunction with the RI DOT, is in the final stages of releasing LiDAR data. This data will be extremely useful in assisting the state and municipalities in preparing for natural hazards and climate change impacts as it will provide exact elevations from which to plan risk reduction measures for flood events. This data is expected to be available for general use by the end of 2013.

The program is currently managing a project to identify specific bridges, roads, rail segments, airports and other intermodal facilities that will be exposed to specific SLR scenarios. The project will use new LiDAR data generated through the support of the USGS. The first stage of the project will produce a map atlas of impacted transportation facilities. The second stage will pilot vulnerability and risk assessment methodology for a selected subgroup of assets. The project will culminate in a report that includes adaptation strategies for transportation assets and case studies.

4.2.1.9 Rhode Island Emergency Management Agency (RIEMA)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	RiskMAP NFIP RIBEOC PCII ACAMS	SRL FMA HMGP PDM SEOC	✓	✓	✓	✓	✓

4.2.1.9.1 Description of agency

The mission of RIEMA is to protect life and property in the event of a disaster or crisis situation through an emergency management program of mitigation, preparedness, response, and recovery. Numerous hazard mitigation and disaster preparedness and recovery programs and policies are administered by RIEMA.

Critical Facilities and Infrastructure Management

The RIEMA Infrastructure Protection Program enhances critical infrastructure protection on a state wide basis across the mission areas of prevention, protection, response, recovery, and mitigation. The program, developed in December of 2010, supports the intent of Homeland Security Presidential Directive 8 “National Preparedness Goal” as well as the recent Presidential Preparedness Directive 21 “Critical Infrastructure Security and Resiliency”. The program may be extremely useful in supporting agency goals and objectives when deciding where to invest resources and grant allocations to enhance asset protection and resiliency.

To support the program, RIEMA is an accredited DHS agency for the Protected Critical Infrastructure Information program. The Protected Critical Infrastructure Information (PCII) Program is an information-protection program that enhances voluntary information sharing between infrastructure owners and operators and the government. PCII protections mean that homeland security partners can be confident that sharing their sensitive security information with the government will not expose sensitive or proprietary data. DHS and other Federal, State, tribal, and local analysts use PCII to:

- Analyze and secure critical infrastructure and protected systems,
- Identify vulnerabilities and develop risk assessments, and
- Enhance recovery preparedness measures.

In addition, RIEMA maintains access to the DHS Automated Critical Asset Management System (ACAMS) to provide a secure, online database as a management and analysis platform that allows for the collection and management of critical infrastructure asset data.

State Emergency Operations Center (SEOC)

RIEMA's SEOC provides a central location from which all state government at any level can provide interagency coordination and executive decision-making in support of any regional incident or local response. This is done by: Information Collection and Evaluation, Executive Decision-Making, Priority Setting, Management, Coordination and Tracking of Resources, and Interoperable Communication Facilitation to support any overall response efforts. RIEMA's SEOC operates under the guidance of the National Response Framework (NRF) and National Incident Management System (NIMS). This is done by using the Incident Command System (ICS) and 15 predetermined ESFs.

Rhode Island Statewide Communications Network (RISCON)

The RISCON system serves public safety agencies at the local, state, military, and federal levels. There are approximately 9,200 radios in the system, some of which are used heavily during incidents and planned events to coordinate agencies from across the state and country. There are 29 radio sites spread throughout RI, linked by microwave. Seven (7) sites have no generator, the others have a combination of diesel and propane generators. RISP, RI DEM, and the City of Providence are the largest users of the system.

NFIP

Each of Rhode Island's 39 municipalities and one (1) Tribal nation are members of the NFIP. The program participants maintain and enforce floodplain regulations conforming to NFIP requirements as part of their zoning ordinance or as a standalone ordinance. These regulations can involve regulation of development within a designated floodway area, restrictions on activities which involve alteration of watercourses or sand dunes, and criteria for the location of mobile homes. In addition, some communities also impose special zoning regulations governing accessory structures, storage of buoyant or hazardous materials, and set-backs for new/substantially improved and/or damaged structures within flood hazard zones. The NFIP affords homeowners, renters or business owners the opportunity to purchase flood insurance if their community agrees to enact and enforce regulations that meet or exceed FEMA's floodplain requirements.

Risk MAP

Map Modernization for RI was completed in 2010 and is now included in a new FEMA initiative called Risk MAP (Mapping, Assessment and Planning). Flood Insurance Rate Maps (FIRMs) and the accompanying FIS data are used in the administration of the minimum requirements of NFIP. Rhode Island cities and towns are dependent upon the

flood hazard information contained in the FIRMs and FISs for review of proposed development. As part of the NFIP, the federal government provides FIRMs to communities that agree to regulate development in high risk flood areas. The maps identifying the flood prone areas would then form the basis for the federally backed flood insurance rates. Risk MAP is designed to help increase the purchase of flood insurance and increase the public's awareness of flood prone structures and potential mitigation measures.

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 and 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.

The State of Rhode Island currently has five (5) communities participating in CRS. The State anticipates that the total enrollment of communities will double by the end of the 2014 due to the overwhelming interest in the program and the recent changes of BW-12. As of October 1, 2013, 49 communities within Region One (1) participate in CRS. The participating Rhode Island communities and the premium reduction they receive are below:

Community	Entrance Date	Class	Discount (%)
Bristol	5/1/2013	8	10
Middletown	4/1/2000	8	10
Narragansett	10/1/2007	8	10
North Kingstown	10/1/1993	9	5
Westerly	5/1/2013	8	10

4.2.1.9.2 Funding capabilities

RIEMA administers the following grant programs supporting risk reduction and mitigation activities for state and local agencies:

Pre-Disaster:

- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Severe Repetitive Loss (SRL)

Post-Disaster:

- Hazard Mitigation Grant Program (HMGP)

4.2.1.9.3 Staffing resources

The agency staff is currently 39 employees across all sections and departments.

4.2.1.9.4 Technical assistance

RIEMA technical assistance related to hazard mitigation is provide through:

- GIS Technical assistance (local and state levels)
- Floodplain Management assistance
- Local Hazard Mitigation Planning assistance
- Mitigation project oversight and assistance

The SEOC can assist the Local Emergency Operation Centers (EOCs) or Local Incident Commanders by:

- Creating a Common Operating Picture from Informative Collection,
- Evaluating information for Executive Policy Decision Making,
- Creating static plans and priority setting,
- Managing, coordinating and tracking resources,
- Provide Interoperable Communications Support; and
- Manage Public Information.

The majority of the above goals can be accomplished using the system WebEOC. WebEOC is the original web-enabled crisis information management system that provides secure real-time information sharing to help managers make sound decisions quickly. WebEOC allows for up-to-date situational awareness throughout the State and 15 ESFs, as well as various State agencies that may not be physically present in the SEOC.

4.2.1.9.5 *Hazard mitigation effectiveness*

FEMA's HMA grant programs for the State of Rhode Island are administered by RIEMA. The programs are designed to provide funding for eligible mitigation activities that protect life, property and the environment from future disaster damages. Mitigation supports actions that are long-term, cost-effective and environmentally sound. HMA funding opportunities enable eligible sub-applicants to implement mitigation actions pre and post-disaster.

The following are mitigation grants RIEMA is currently coordinating:

PDM. PDM provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster. The goal of the PDM program is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from actual disaster declarations. Funding is available on an annual basis (as available).

Award Year	Period of Performance	Number of Sub-Grantees	Activity Types	Total Federal Award	Status
PDM 2010	9/10/2010-9/9/2014	16	Hazard Mitigation Plans	$226,102.71	Open
PDM 2011	9/16/2011-9/16/2014	1	Hazard Mitigation Plan	$28, 056.72	Open
PDM 2012	9/12/2012-9/11/2015	3	Hazard Mitigation Plans & Residential Acquisition	$243,302.25	Open

Hazard Mitigation Grant Program (HMGP). The HMGP assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement plans or projects in accordance with State, Tribal, and local priorities.

Declared Disaster	Event	Number of Sub-Grantees	Activity Types	Total Federal Share (To Date)	Status
HMGP DR - 1894	March 2010 Floods	13	• Acquisitions • Backflow valves • Drainage • Outreach initiative • Structure Relocation	$2,749,934.50	Open
HMGP DR-4027	TS Irene	10	• Backflow valves • Hazard Mitigation Plans	$145,667.00	Open

SRL. The SRL program was designed to reduce flood damages to residential properties that had experienced SRLs under flood insurance coverage. The program provides funds that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the NFIP. Funding is available on an annual basis (as available).

Award Year	Period of Performance	Number of Sub-Grantees	Activity Type	Total Federal Award	Status
SRL 2012	9/24/2012 – 9/23/2016	1	Residential Elevation	$45,052.20	Open

4.2.1.9.6 New capabilities since 2011

At the direction of FEMA, each state was tasked to produce a THIRA to support the National Preparedness Goals and PPD-8. The five (5)-step THIRA development process

outlined in CPG 201 identifies the worst case, most probable threats and hazards facing a jurisdiction, gives those threats and hazards context, examines the core capabilities against the threats and hazards, and sets anticipated capability targets to address the threats and hazards. The fifth and final step in the THIRA process cycle, is to apply the results towards emergency and strategic planning initiatives, inform future grant justifications, and provide guidance for the planning of training and exercises.

The 2012 THIRA was the initial development year. Successive years will reflect an ongoing process, and incorporate changes in threats and hazards as appropriate. Most importantly, future THIRAs are intended to serve as justifications for competitive grant funding requests. The annual submission deadline is December 31st. The THIRA also serves as a foundation for the annual State Preparedness Report where the State is required to analyze progress towards achieving each of the target capabilities.

RIEMA implemented a Homeland Security Information Network (HSIN) “Community of Interest” to provide secure-information sharing specific to Rhode Island stakeholders. DHS provides the capability to Federal, State, local, and private sector partners to share sensitive but unclassified information. HSIN operates on a MS SharePoint 2010 design and is fully funded by DHS to enhance the core capability of Intelligence and Information Sharing. RIEMA had previously managed a HSIN portal however it was dormant for several years and deactivated due to inactivity. In 2012, DHS completed a server migration to enhance HSIN functionality and developed a Community of Interest for each state and territory.

RIEMA sponsors and administers the HSIN-RI Community of Interest and provides site access to the Rhode Island Fusion Center to share Law Enforcement Sensitive information and collect suspicious activity reports (SARs). The Cyber Disruption Team will also utilize the capability to provide alerts and information to private sector partners relevant to cyber threats. The capabilities of HSIN include secure instant messaging, online collaboration for project management, web conferencing, document libraries, and a shared master calendar.

4.2.1.10 Rhode Island Historical Preservation and Heritage Commission

4.2.1.10.1 Description of agency

The Commission identifies and protects historic and prehistoric sites, buildings, and districts in the State. RI's historic buildings are an important resource and are major attractions for the State's billion dollar tourism industry. The Commission identifies and protects historic and prehistoric sites, buildings, and districts by nominating significant properties to the National Register of Historic Places (NHRP) and the State Register; administering grants, loans, and tax credits for rehabilitation of historic buildings; reviewing federal and State projects that affect cultural resources; and regulating archaeological exploration on State land and under State territorial waters. The Commission also develops and carries out programs to document, support, and celebrate the ethnic and cultural heritage of Rhode Island's people.

In the event of destruction and damage resulting from a natural disaster, a Memorandum of Understanding (MOU) is established in which RIEMA would defer to the State Historic Preservation Office (SHPO) policies when repairing historic structures and other structures. The MOU provides a mechanism whereby damaged buildings will be repaired utilizing mitigation measures while also following the guidance as set out in the State Historic Preservation regulations.

4.2.1.10.2 Funding capabilities

Detailed information on funding capabilities for mitigation activities was not provided at this time.

4.2.1.10.3 Staffing resources

Detailed information on staffing resources for mitigation activities was not provided at this time.

4.2.1.10.4 Technical assistance

The SHPO provides assistance when repairing and mitigating historic structures following a disaster. The SHPO also reviews approximately State and federal projects to identify and avoid harmful effects to historic resources.

4.2.1.10.5 Hazard mitigation effectiveness

The MOU was tested during the March 2010 floods, where numerous historic structures were affected. Structures can be retrofitted utilizing mitigation measures while also preserving the historic integrity of these very unique resources.

4.2.1.10.6 New capabilities since 2011

Detailed information on new mitigation capabilities since 2011 were not provided at this time.

4.2.1.11 Rhode Island Office of Energy Resources

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Energy Assurance Plan RI State Energy Plan	Staffing during storm events	✓		✓	✓	✓

4.2.1.11.1 Description of agency

The mission of the OER is to help RI achieve a reliable, cost-effective, and sustainable energy future. They work closely with private and public stakeholders to increase the security of the State's energy supply, reduce energy costs, and improve environmental quality. The OER recommends and implements smart energy policies to help reduce RI's dependency on out-of-state fuels.

OER maintains an Energy Assurance Plan and RI State Energy Plan, each are discussed in further detail below.

4.2.1.11.2 Funding capabilities

The OER operating budget is secured through federal funding from the Department of Energy; the Regional Greenhouse Gas Initiative Program; and by RI gas and electric ratepayers through a System Benefit Charge Program. The OER operating budget is used for staffing and activities associated with planning, management and evaluation of energy efficiency programs, renewable energy programs, system reliability, and least-cost procurement. The OER also manages regulatory proceedings, contested cases, and other actions pertaining to the purposes, powers and duties of the Office as laid out in legislation.

4.2.1.11.3 Staffing resources

The OER has seven (7) staff members. Two (2) staff members are responsible for energy assurance planning and preparation. One staff member serves as the primary contact during storm or emergency related events, while another is designated as the secondary point of contact.

4.2.1.11.4 Technical assistance

The OER provides support to the distillate fuel terminals in Providence and Tiverton during emergency related events. The OER communicates and assists the fuel terminals in getting any matters resolved with the electric distribution company. The OER also

works in coordination and provides necessary support to other state agencies, including the DPUC and the RIEMA.

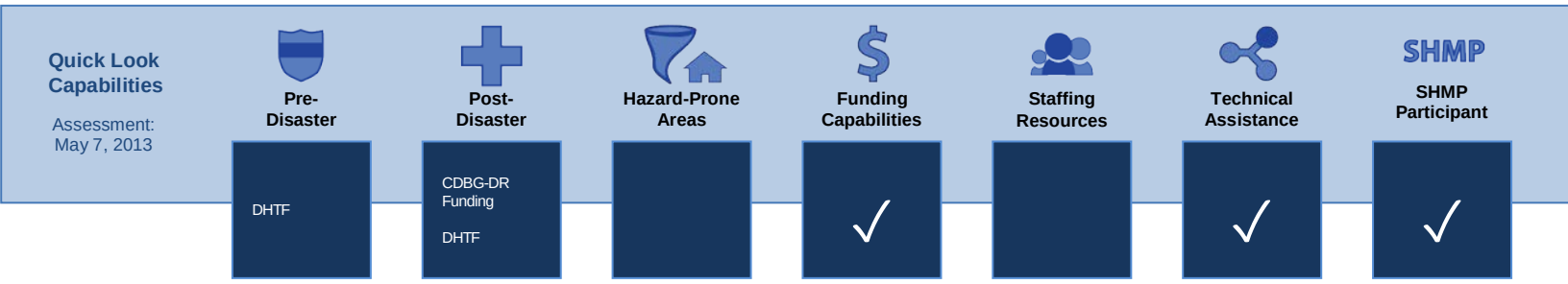
4.2.1.11.5 Hazard mitigation effectiveness

Adopted in June 2012, the Energy Assurance Plan provides the State with guidance to prepare for, monitor, and mitigate energy deficiencies and disruptions. It focuses on electricity, natural gas, and petroleum. The information in this plan expedites the State's response process by laying out key information that is necessary to address the safety, health, and economic viability of its constituents. Critical infrastructure is outlined in this plan and there is a complete vulnerability and risk assessment section, which incorporates information from the 2011 hazard mitigation plan.

4.2.1.11.6 New capabilities since 2011

The OER was restructured and secured long-term funds for staffing in the FY2013 State Budget passed by the Governor and General Assembly in June 2012. The OER is currently undertaking the development of an update to the RI State Energy Plan. The last RI State Energy Plan was completed in August 2002. A completed update is expected by March 2014 and will include a more comprehensive vision for providing secure, cost-effective and sustainable energy services across all sectors including residential, municipal, and industrial.

4.2.1.12 Rhode Island Office of Housing and Community Development



4.2.1.12.1 Description of agency

OHCD coordinates housing functions and selected community development activities of State agencies. The primary purpose of the office is to promote decent, safe, and affordable housing opportunities; create a suitable living environment; and expand economic opportunities, principally for low-and moderate-income Rhode Islanders. This Office provides financial and operational support for all housing programs administered by the Housing Resources Commission. The Office works with communities to achieve their affordable housing goals. They assist the Planning staff in review of Local Comprehensive Plan Updates for consistency with State Affordable Housing Elements. They have partnered with RIEMA to create the Disaster Housing Task Force (DHTF) to address housing issues following a disaster.

4.2.1.12.2 Funding capabilities

CDBG-DR funds may be used to restore public facilities and infrastructure, rehabilitate or replace housing, acquire property, promote economic revitalization, and support hazard mitigation planning. CDBG-DR funds are intended to support long-term recovery from a specific natural disaster and may not be applied to recovery activities associated with other disasters.

Annual CDBG Program funds may also be used for certain eligible hazard mitigation and disaster recovery activities.

4.2.1.12.3 Staffing resources

OHCD staff support the Housing Resources Commission, and administer housing, homelessness, emergency shelter, lead safe housing, and community development funds. One (1) staff person is assigned to disaster recovery and addresses hazard mitigation issues in the context of disaster recovery.

4.2.1.12.4 Technical assistance

OHCD prepares CDBG-DR Action Plans after funds are allocated to the State by the U.S.HUD. Staff provides technical assistance to municipalities on federal regulations and the CDBG program.

4.2.1.12.5 Hazard mitigation effectiveness

Specific activities were funded through CDBG-DR (2010 Floods grant) using a competitive grant application process open to all RI municipalities in 2011 and 2012. Funded activities include:

- River Wall Repair/Improvements in Pawtucket
- Stormwater Infrastructure Repair/Improvements in Bristol, East Providence, Johnston, West Warwick, and Westerly
- Debris Removal in Richmond
- Life/Safety Infrastructure Improvements in Richmond, West Warwick, and Westerly
- Residential Rehabilitation/Reconstruction in Narragansett, Richmond, and Westerly
- Acquisition and Clearance of Floodplain Properties in Cranston and Cumberland
- Flood Mitigation Planning Studies in Cumberland and Johnston

Many of these activities are underway or substantially complete; however, some are undergoing environmental reviews.

4.2.1.12.6 New capabilities since 2011

On February 6, 2013, HUD announced an allocation of $3,240,000 in Hurricane Sandy CDBG-DR funds for Rhode Island. Previously, the State of Rhode Island received $8,935,237 in federal CDBG-DR funding to address the impacts of the March 2010 floods. Only Newport and Washington Counties are eligible for Hurricane Sandy CDBG-DR funding. 80 percent is reserved for Washington County, designated a “most impacted and distressed county.”

4.2.1.13 Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Electric Infrastructure, Safety, and Reliability Plan Gas Infrastructure, Safety, and Reliability Plan	Separate Commission and Division post-event reporting requirements to assess response and cost			✓		✓

4.2.1.13.1 Description of agency

The Commission and Division execute laws relating to public utilities and carriers which govern the conduct and rates of public utilities. The commission maintains statutorily mandated annual gas and electric Infrastructure, Safety and Reliability (ISR) dockets for National Grid Gas and Electric. Projects, like flood mitigation work at substations, are taken up in those proceedings. The status of flood mitigation projects undertaken and planned by National Grid are detailed in the company's 2014 Electric Infrastructure, Safety, and Reliability Plan. The Electric ISR also includes provisions for vegetation management and inspection and maintenance programs. The Gas ISR provides for ongoing leak prone pipe replacement as well as other reliability such as the extension of high pressure service, which is less prone to flood water incursion.

Summaries from major storm events, such as the 2010 flooding event (March 30-April 1), Hurricanes Sandy, and Irene, provide a description of the storm along with a summary of the extent of damage to National Grid's system, including the number and length of outages. Supplemental reports detailing restoration costs caused by the storm are also available. Information obtained from these reports has been incorporated into the HIRA and vulnerability assessment of this 2014 RI SHMP.

4.2.1.13.2 Funding capabilities

The Commission and Division review and annually approve National Grid's ISR plans, which are funded by ratepayers.

4.2.1.13.3 Staffing resources

The three (3)-member Commission has a staff of eight (8). The Division has a staff of 36.

Division staff review the annual ISR filings. This review includes Division Engineering staff (two (2)) and the Division's Gas Engineer (one (1)). Additionally, accounting and legal staff review this annual filing.

The Commission is the final authority for approving the ISR plan and its funding through utility rates.

4.2.1.13.4 Technical assistance

The Commission and Division do not currently offer technical assistance to the public or other state agencies regarding hazard mitigation.

4.2.1.13.5 Hazard mitigation effectiveness

For electric service:

- National Grid is engaged in a flood mitigation program at several substation locations.
- The Company is engaged in an Enhanced Hazard Tree Mitigation Program in addition to its cycle pruning programs.
- Inspection and maintenance program methodologies have been incorporated into annual ISR filings.

For gas service:

- From 2007 to 2012, 8.4% of the state's leak-prone gas mains have been replaced, with projections for 50 to 60 additional miles a year of pipe replacement from 2013 onward.
- The company is relocating 8,500 indoor high pressure service meters to outdoor location, a process expected to be completed in 2014.
- As part of a 15 year program, 80,000 low pressure gas service lines are being replaced.
- All 250 "farm taps" (pressure reduction regulators) deemed to be a risk have been removed in 2011-2012.

4.2.1.13.6 New capabilities since 2011

This agency was not part of the 2011 SHMP. Representatives of the Commission and Division have been included in the SIHMC.

The first National Grid Gas and Electric Infrastructure, Safety and Reliability Plans became effective in April 2011.

4.2.1.14 Rhode Island Rivers Council

Quick Look Capabilities Assessment: May 29, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Promote the protection of riparian and shoreline buffers	Support flood mitigation		✓ Small support grants for state designated local watershed councils	✓ Through affiliated agencies	✓	✓

4.2.1.14.1 Description of agency

The RI General Assembly created the RI Rivers Council in 1991 to coordinate efforts to improve the quality of the state's rivers and their watersheds. The RI Rivers Council authorizes local watershed councils with state designation for five year terms that provide local watershed councils legal standing to represent water bodies in their watersheds before state and local government agencies and also to be eligible for an annual grant from the Rivers Council. State designated local watershed councils/associations include:

- Blackstone River Watershed Council / Friends of the Blackstone
- Buckeye Brook Coalition
- Friends of the Moshassuck
- Kickemuit River Council
- Narrow River Preservation Association
- Pawtuxet River Authority & Watershed Council
- Salt Ponds Coalition
- Wood-Pawcatuck Watershed Association
- Woonasquatucket River Watershed Council

The RI Rivers Council also advocates that Congress establish the Blackstone River National Historical Park as a permanent unit within the National Park System and that Congress designate the Wood-Pawcatuck river system to be part of the National Wild and Scenic Rivers System.

4.2.1.14.2 Funding capabilities

The RI Rivers Council receives an annual legislative grant from the RI General Assembly and conducts an annual grant round for projects proposed by state designated local watershed councils. As of 2013, nine (9) local watershed councils are state designated.

4.2.1.14.3 Staffing resources

The RI Rivers Council is an "associated function" of the RI Water Resources Board, which provides staff assistance to the Rivers Council. Also, two (2) state agencies, the RI DOA and the RI Department of Environmental Management, have voting member representatives on the Rivers Council. These representatives provide staff assistance in addition to RI Water Resources Board staff.

4.2.1.14.4 Technical assistance

The RI Rivers Council is author of the RI Rivers Policy and Classification Plan, as amended May 2004, Report Number 92, State Guide Plan Element 162. The plan utilizes US Hydrologic Unit Code (HUC) Levels 10 and 12 mapping. In 2005, the RI Rivers Council provided the RI General Assembly a report entitled *Establishment of Riparian and Shoreline Buffers and the Taxation of Property Included in Buffers.* The RI Rivers Council pays attention to RI Dam Inventory assessments of State's 670 dams conducted by the RI Department of Environmental Management.

4.2.1.14.5 Hazard mitigation effectiveness

The RI Rivers Council has worked to strengthen the capacity and capability of local watershed councils and associations. The RI Rivers Council has been supportive of efforts by the state designated Pawtuxet River Authority and Watershed Council in mitigation efforts resulting from the RI Flood of March/April 2010. The RI Rivers Council also participated on the intergovernmental agency review team for the TF Green Airport Improvements Program Environmental Impact Statement effort from approximately 2007 to 2011.

4.2.1.14.6 New capabilities since 2011

In 2011 and 2012, the RI Rivers Council participated in the RI Renewable Energy Siting Partnership in regard to the hydropower element of the state energy plan. The RI Rivers Council considers the merits of dam removal projects, hydropower projects and the like on a case by case basis.

4.2.1.15 Rhode Island Sea Grant College Program and University of Rhode Island Coastal Resources Center (RISG/CRC)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Ongoing research on coastal development and hazards and sea level rise RI Flood Awareness Task Force	Unavailable	✓	✓	✓	✓	✓

4.2.1.15.1 Description of agency

The RISG/CRC conducts research, training, and public outreach on priority issues of importance to coastal communities and the marine environment with the goal of providing the best available information to decision makers and the public. The program is a partnership between RISG, which is a NOAA funded program, and CRC, which is a center within the URI, with links to network of 30 Sea Grant university programs nationwide. It supports research on issues such as resilient coastal development, healthy coastal ecosystems, and safe and sustainable seafood. The program has done extensive research on SLR and coastal hazards in RI. They are part of several interagency work groups and have a history of working with communities and businesses to minimize impacts of coastal and riverine flooding. RISG/CRC works closely with various state agencies, including the CRMC, with a specific focus on the development of coastal policy and SAMPs.

4.2.1.15.2 Funding capabilities

RISG/CRC receives core funding from NOAA to conduct outreach activities, all other funding for the organization is supported through federal, state, or private foundation grants. RISG competitively awards research grants on a biannual basis to support priority themes.

4.2.1.15.3 Staffing resources

RISG/CRC has a total of eight (8) team members working on projects within Rhode Island. A portion of this team works primarily on hazard mitigation planning, SLR and climate change related issues.

4.2.1.15.4 Technical assistance

RISG/CRC provides assistance to decision makers at the state and local levels to better understand the science and policy implications of SLR and climate change. Information and tools developed by this organization assist stakeholders in identifying vulnerabilities and developing actions to reduce risk. Staff regularly partner with university researchers, faculty, and students to advance development of knowledge in natural and social sciences.

4.2.1.15.5 Hazard mitigation effectiveness

RISG/CRC worked with RIEMA in the 1990s to develop the first pilot community hazard mitigation plans. Today RISG/CRC is working with communities to pilot climate adaptation planning and incorporate this information into hazard mitigation plans and local comprehensive plans. Linking planning and policy, the team has facilitated the development of SAMP with CRMC, which integrate coastal hazards into state policy and permitting. These efforts include the Metro Bay SAMP and Shoreline Change (BEACH), SAMP. RISG funded research over the years has provided a foundation for policy development (CRMC SLR policy) and is a means to understand coastal processes (erosion mapping). In addition, maps depicting SLR have been developed for communities. RISG/CRC has a series of fact sheets and summary reports for stakeholders and decision makers on the science, issues, and actions related to flooding, SLR and other climate related risks.

4.2.1.15.6 New capabilities since 2011

This agency was not part of the 2011 Hazard Mitigation Plan. Based on their technical assistance with regard to SLR and climate change, this agency has become members of the SIHMC.

4.2.1.16 Rhode Island Water Resources Board

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Water Supply System Management Drought Steering Committee Emergency Interconnection Program Water Facilities Assistance Program[58]	Water Facilities Assistance Program	✓	✓		✓	✓

4.2.1.16.1 Description of agency

The Water Resources Board (WRB) regulates the proper development, protection, conservation, and use of the state's water resources[58] and manages the withdrawals and use of the waters of the state[59], while providing for economic development and protection of the environment. The WRB implements capital projects that result from their plans and studies, including the 2012 Strategic Plan[60], managing the Water Supply System Management Plan program (WSSMP)[61]. These programs help strengthen water resources and supply in the state and prepare the state for emergency drought conditions, the ongoing effects of climate change, and the future water supply needs based on growth and water availability. Statewide strategic planning and risk evaluation assist in identifying risk, capacity, and mitigation and response strategies. Allocation research supports mitigation efforts and future allocation programs will consider the potential impacts of climate and hydrologic variability. They also administer the Drought Steering Committee, which assigns drought stages, engages in public communication, and coordinates with suppliers. One (1) policy that the WRB oversees is the Water Use and Efficiency Act, which was passed to assure reasonable, needed, and adequate water supplies through managing demand, reinvesting in water supply infrastructure and water supply resources, and protecting and preserving the health and ecological function of the water resources in the state.

[58] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-15/46-15-1.HTM
[59] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-15.7/46-15.7-1.HTM
[60] http://www.wrb.ri.gov/policy_statutes_planning/WRB_StrategicPlan_031612.pdf
[61] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-15.3/46-15.3-5.1.HTM

4.2.1.16.2 Funding capabilities

The WRB administers two (2) separate funds, the WRB's Water Quality Protection Surcharge ($4.2 million/year)[62], and the WRB Corporate's Water Quality Protection Surcharge ($1 million/year)[63]. These surcharges are collected by major water suppliers and deposited by the WRB for water resource and water supply programs and administrative expenses.

4.2.1.16.3 Staffing resources

The WRB staff were reduced from six (6) to three (3) FTE's in 2011 and the board is prioritizing work in order to keep up with their statutory responsibilities. The remaining WRB staff are highly qualified.

4.2.1.16.4 Technical resources

The Board provides technical guidance for municipalities and water suppliers to align land management programs with water resource programs.

4.2.1.16.5 Hazard mitigation effectiveness

Early warning of drought conditions allows for reductions in water use and preserving storage and groundwater levels. A thorough understanding of the hydrology, water use, and projected demand is a necessary first step to assessing risk and mitigating impacts of drought emergencies. Several models are publicly available and could assist in developing planning scenarios and identifying solutions.

The WRB regulates development in hazard prone areas through the WSSMP and Statewide Planning Program's Community Comprehensive Planning Program (CCP). Both documents reference each other and must be integrated in regard to water availability.

4.2.1.16.6 New capabilities since 2011

The WRB Strategic Plan was completed in March of 2012. This plan outlines both short and long range statewide initiatives that address goals for development, protection, conservation, and use of the water resources of the State. Deficiencies in policies, programs, and projects that require action from the WRB were identified during the creation of the Strategic Plan and these deficiencies were turned into initiatives. For each initiative, a project description and overview, key milestones, desired outcomes, current status, key challenges/needs, and both short and long term actions are addressed.

[62] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-15.3/46-15.3-10.HTM
[63] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-15.3/46-15.3-9.HTM

4.2.1.17 Scientific Support for Environmental Emergency Response (SSEER)

Quick Look Capabilities Assessment: May 29, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Use of SSEER to plan response and research and to test protocols	SSEER			✓	✓	✓

4.2.1.17.1 Description of agency

An MOU was established between the URI Coastal Institute and the Rhode Island Department of Environmental Management to sustain an administrative process for SSEER. The process enables state agencies to deploy university resources to assess, reduce, and remediate threats to public health and safety and the environment of RI. The agreement helps the state be ready to engage rapid, incident-specific support from university staff and facilities.

4.2.1.17.2 Funding capabilities

SSEER does not have direct funding to support hazard mitigation at this time.

4.2.1.17.3 Staffing resources

Staffing resources within SSEER include professors in hydrology and biology, fisheries, oceanography, watershed experts, and GIS professionals. A full list of staffing support can be found here: http://www.ci.uri.edu/Projects/SSEER/Docs/Roster_July2012.html

4.2.1.17.4 Technical assistance

SSEER staff include GIS professionals with mapping, analysis, and GPS skills.

4.2.1.17.5 Hazard mitigation effectiveness

SSEER accomplishments in hazard mitigation and emergency preparedness include:

- Development of standard procedures for NRDA following an oil spill
- Conducting annual exercises and training opportunities

4.2.1.17.6 New capabilities since 2011

There are no new policies, programs, or funding resources available from SSEER. The MOU is effective from June 2010 to June 2015 with the possibility of being extended.

4.2.1.18 State Building Code Commission

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	State Building Code	Rebuilding After a Storm	✓	Unavailable	Unavailable	Unavailable	✓

4.2.1.18.1 Description of agency

Rhode Island administers a State Building Code through the Building Code Commission. The Building Code is implemented statewide and enforced through the building official in each municipality. The Code consists of uniform regulations to control construction, reconstruction, repair, removal, demolition, and inspection of all buildings. The NFIP standards, wind, and snow loads are all an integral part of the State Building Code, ensuring that all new construction and substantial improvements meet national flood resistant standards through consistent statewide application of the NFIP minimum criteria. Communities have enacted stricter standards under their local floodplain ordinances. Seismic design standards are advisory.

The Building Commission distributes a brochure entitled Rebuilding After a Storm. This brochure, sponsored by the RI Flood Awareness and Climate Change Taskforce, includes a checklist of the types of items residents should have available in their homes to prepare for hurricanes and nor'easters. It also outlines the process property owners should take if their homes have been damaged after a storm event and special procedures if their home is located in a CRMC or if they have a septic system. New structures or those that are being rebuilt and are within a CRMC jurisdiction require a CRMC permit. Existing structures that have been physically destroyed fifty percent or more by coastal storms must meet all current regulations when being rebuilt. In some cases, these structures may not be permitted to be rebuilt if located on undeveloped or moderately developed barriers. New or substantially improved residential or commercial buildings located within the SFHAs are also required to conform to state and local requirements.

4.2.1.18.2 Funding capabilities

Detailed information on funding capabilities for mitigation activities were not provided at this time.

4.2.1.18.3 Staffing resources

Detailed information on staffing resources available for mitigation activities were not provided at this time.

4.2.1.18.4 Technical assistance

Detailed information on technical assistance was not provided at this time.

4.2.1.18.5 Hazard mitigation effectiveness

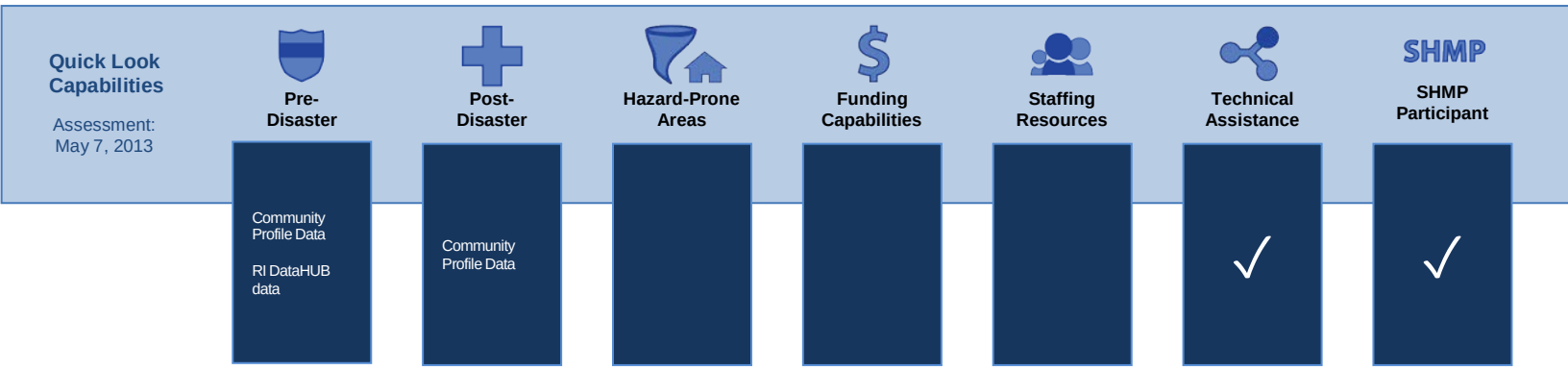
The effective date of the original implementation of the Rhode Island State Building Code was July 1, 1977, following adoption of the concept of uniform regulations to control construction, reconstruction, repair, removal, demolition, and inspection of all buildings in the State. The Rhode Island Building Code incorporates provisions of International Code Council, Inc (ICC) the basic national building code, with changes and additions as adopted by the State of Rhode Island Building Code Standards Committee. ICC consists of model building regulations for the protection of public health, safety and welfare. The chief executive of each city and town is required to appoint a Building Official to administer the building code; two or more communities may join in the appointment of a building official. The Code stipulates that the building official review all permits for construction in flood hazard areas to ascertain that all required federal, State, and local permits have been obtained

The Building code has been effective in addressing structural issues as they relate to potential damage and safety issues in regard to natural disasters. The Building Commission has also been very proactive in minimizing the granting of variances to the NFIP criteria.

4.2.1.18.6 New capabilities since 2011

Detailed information on new capabilities since 2011 was not provided at this time.

4.2.1.19 The Providence Plan (ProvPlan)



4.2.1.19.1 Description of agency

ProvPlan maintains the largest data warehouse in RI. They develop tools that help people access this data. Community profiles provide data on demographics, economic development, health, education, housing, the environment, transportation, and public safety.

4.2.1.19.2 Funding capabilities

ProvPlan does not have direct funds for mitigation activities at this time.

4.2.1.19.3 Staffing resources

ProvPlan does not have staffing resources available for mitigation activities at this time.

4.2.1.19.4 Technical assistance

ProvPlan staff have experience with GIS, lead screening data, and housing data. ProvPlan provides technical assistance to the public as well as state agencies.

4.2.1.19.5 Hazard mitigation effectiveness

ProvPlan launched a healthy housing mapper for Providence, healthy housing data collection, and has provided public trainings relating to both the mapper and data.

4.2.1.19.6 New capabilities since 2011

ProvPlan does not have any new capabilities relating to hazard mitigation.

4.2.1.20 United States Army Corps of Engineers (USACE)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	Flood Control Projects Habitat Restoration Program Infrastructure Inspections Public Awareness and Outreach	Disaster Response		✓	Unavailable	✓	✓

4.2.1.20.1 Description of agency

In the past USACE has assisted the State and it's communities by conducting investigations related to dam breach failure analysis, public awareness and outreach related to potential flooding, wetland restoration opportunities, and the effects of SLR.

Flood Control Projects, built by the USACE, such as dams, groins, breakwaters, hurricane barriers and seawalls, protect many municipalities in Rhode Island from riverine and tidal flooding.

The Habitat Restoration Program helps to repair the original condition of the natural area which, in the case of a coastal wetland, restores it back to its natural and beneficial use and helps to control flooding and acts as a natural buffer prior to the onset of coastal storms.

4.2.1.20.2 Funding capabilities

Floodplain Management Services (FPMS) funding is requested annually and can be used to investigate flooding or floodplain related issues. Studies are 100% federally funded.

Planning Assistance to States (PAS) studies can address any water resource related problem and are cost shared on a 50/50 basis.

4.2.1.20.3 Staffing resources

Detailed information on staffing resources for mitigation activities was not provided at this time.

4.2.1.20.4 Technical assistance

USACE can provide technical assistance to the state and communities on flooding or any other water resource related problem through either its FPMS or the PAS programs. USACE assists the state and local governments in conducting annual inspections of flood protection infrastructure.

4.2.1.20.5 Hazard mitigation effectiveness

Flood Control Projects have prevented flood damages in major Rhode Island urban areas estimated at saving millions of dollars.

The Habitat Restoration Program has been very beneficial to RI because the Army Corps and the CRMC have been working together on one of the largest habitat restoration programs in the south county coastal lagoons in order to repair decades of damage to this environmentally fragile area. The negative result of using hard structures is that they require continual maintenance, which is a challenge to state and local governments. There may be future opportunities to work with USACE on floodplain management planning initiatives such as inundation mapping for high hazard dams.

4.2.1.20.6 New capabilities since 2011

In 2011, USACE began flood risk management investigations in the Blackstone, Woonasquatucket, Pawtuxet, and Pawcatuck watersheds. The USACE completed Reconnaissance level reports for the Wonnasquatucket, Pawtuxet, and Pawcatuck watersheds in 2012. It was determined that there is a federal interest in pursuing cost-shared feasibility studies for flood risk management in all three of these watersheds. The feasibility studies are cost shared 50/50. The USACE is currently waiting to hear from the federal sponsor on the status of non-federal funding that will be needed to begin these efforts.

The Blackstone flood risk management feasibility study is currently ongoing (as of July 2013). The focus area for that study is the Berkeley Industrial Park located in Cumberland.

4.2.1.21 United States Department of Agriculture - Natural Resource Conservation Service (NRCS)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	EWP Watershed and Flood Prevention Operations Program	EWP	✓	✓	Unavailable	✓	✓

4.2.1.21.1 Description of agency

The NRCS is a federal agency that works with the people of RI to improve and protect their soil, water, and other natural resources. Private landowners have worked with NRCS specialists to prevent soils erosion, improve water quality, and promote sustainable agriculture. NRCS employees include soil conservationists and scientists, engineers, geologists, and resource planners. These experts help develop conservation plans, create and restore wetlands and other natural ecosystems as well as provide advice on stormwater remediation and watershed planning.

The objective of the Emergency Watershed Protection Program (EWP) is to undertake emergency measures, including the purchase of floodplain easements for runoff retardation and soil erosion prevention, in order to safeguard lives and property from floods, drought, and erosion within watersheds when fire, flood, or any other natural occurrence is causing or has caused a sudden impairment of the watershed. This allows for immediate action to be taken to stabilize storm damages in watersheds following a federal declared natural disaster.

Through the Watershed and Flood Prevention Operations Program, NRCS provides technical and financial assistance to States, local governments and Tribes to plan and implement watershed project plans for the purpose of:

- watershed protection
- flood mitigation
- water quality improvement
- soil erosion reduction
- rural, municipal and industrial water supply
- irrigation
- water management
- sediment control
- fish and wildlife enhancement

- wetlands and wetland function creation and restoration
- groundwater recharge
- wetland and floodplain conservation easements

Project sponsors provide assistance in installing land treatment measures when watershed project plans are approved.

4.2.1.21.2 Funding capabilities

NRCS may bear up to 75% of the construction cost of emergency measures under the EWP. The remaining 25% must come from local sources and can be in the form of cash or in-kind services. Funding is subject to congressional approval.

Sponsoring local organizations can request that watershed project plans be authorized for Federal Watershed Operations funding assistance. Plans involving Federal contributions in excess of $5,000,000 for contribution, or construction of any single structure having a capacity in excess of 2,500 acres, require congressional approval. Some plans may be authorized for Federal funding by the Chief of NRCS. Funds that may be available for watershed projects are subject to the following:

- Annual congressional appropriations
- State and national resource priorities
- Acquisition of land and water right permits
- Local funding established for specific project measures
- Completion of structural, agronomic, and vegetative designs for project measures
- NRCS and the project sponsor approval of an Operation and Maintenance Agreement involving the measures to be installed

4.2.1.21.3 Staffing resources

Detailed information on staffing resources for mitigation activities was not provided at this time.

4.2.1.21.4 Technical assistance

NRCS experts help develop local conservation plans, create and restore wetlands and other natural ecosystems as well as provide advice on stormwater remediation and watershed planning.

4.2.1.21.5 Hazard mitigation effectiveness

The EWP program has been extremely effective in working with communities that have stormwater/urban flooding problems. The program offers best practices in developing

watershed management programs and ideas on how to redevelop watershed hydrology and hydraulics, enabling these communities to have new FIRMs developed.

Through the Watershed and Flood Prevention Operations Program, Pocasset Watershed in Johnston and Cranston received funding to address flooding in the Pocasset River which resulted in repetitive damage to homes and businesses. A floodplain management study, including a detailed hydrology and hydraulics analysis, was completed. This study provides more precise data on the hydraulic deficiencies that cause flooding within the watershed. New FIRMs for the area have been developed but not yet adopted.

4.2.1.21.6 New capabilities since 2011

Communities affected by the flood of 2010 received technical and financial assistance to repair soil erosion and stabilize stream banks that threatened infrastructure and the safety of critical commercial and residential properties. Debris removal was also conducted as part of this program.

4.2.1.22 United States Geological Survey (USGS)

Quick Look Capabilities Assessment: May 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	River flood stage monitoring Warning systems	Documentation of riverine and coastal flooding. Elevations and extent of riverine and coastal flooding, stream discharges (if applicable), and annual exceedance probabilities of floods			✓ If the work is funded	✓	✓

4.2.1.22.1 Description of agency

The USGS researches the processes that control or trigger natural hazards and manages real-time river flood stage monitoring and warning systems. The USGS also collects additional coastal storm tide data during tropical storm/hurricane events. Following riverine and coastal flooding, post-storm data is collected documenting the elevation and extent of flooding, and annual exceedance probabilities of the floods. This information is displayed on the web and published in a report.

4.2.1.22.2 Funding capabilities

The USGS does not supply funds to other agencies, unless it is to provide matching dollars to a USGS study done in cooperation with another Federal, State, or local government agency.

4.2.1.22.3 Staffing resources

USGS staff are available to work on funded data collection activities and studies.

4.2.1.22.4 Technical assistance

USGS maintains and operates stream gages in cooperation with other Federal, State, and local government agencies. The USGS also works on other water resources studies in cooperation with other Federal, State, and local government agencies. These activities must be funded work.

4.2.1.22.5 Hazard mitigation effectiveness

Real-time flood stage monitoring is critical for the operation of flood response plans, and to provide additional lead time to downriver communities for response purposes. The USGS stream gage program is critical for RI in order to address riverine flooding. The

State continues to partner with USGS and is seeking ways in which to develop a statewide system of real-time river flood warning and monitoring systems. In addition, the USGS conducts studies and other documentation of the elevations and extent of major flood events, and the annual exceedance probabilities of these flood events.

USGS also provides data collection on coastal storm-tide elevations from tropical storms and hurricane or other major coastal event. This can be displayed on the web and in other publications.

4.2.1.22.6 New capabilities since 2011

The USGS does not have new policies, programs, or funding resources available for hazard mitigation since 2011.

4.2.1.23 University of Rhode Island Environmental Data Center (URI EDC)

Quick Look Capabilities Assessment: June 7, 2013	Pre-Disaster	Post-Disaster	Hazard-Prone Areas	Funding Capabilities	Staffing Resources	Technical Assistance	SHMP Participant
	All aspects of effective and efficient acquisition, management, and distribution of geospatial data. Online web mapping application development and hosting.	All aspects related to effective and efficient acquisition, management, and distribution of geospatial data. Online web mapping application development and hosting. On-demand, on-site and off-site geospatial technologies support.			✓	✓	✓

4.2.1.23.1 Description of agency

The URI EDC offers a wide range of professional geospatial technology services that are available on a contractual basis to partners, including RI state and municipal governments. Services include production of risk and vulnerability maps for RI municipalities that highlight local hazard and critical facility locations. Such information educates communities on vulnerable areas, and helps inform how and where to allocate and prioritize the resources necessary to minimize the damages from natural hazards. The URI EDC is available to provide mapping capabilities for the SHMP, and is also available to work with RIEMA on other geospatial data development and analyses that support hazard mitigation vulnerability assessment initiatives.

4.2.1.23.2 Funding capabilities

The URI EDC is a professional services provider, and does not have direct funds for mitigation activities at this time.

4.2.1.23.3 Staffing resources

The URI EDC is staffed by six (6) to eight (8) full-time grant-funded professionals, as well as hosts a dynamic group of graduate and undergraduate student research assistants.

4.2.1.23.4 Technical assistance

All aspects of geospatial technology support for the analysis and mapping of risks and vulnerabilities in RI. The URI EDC has a very successful record of grant applications, and

is potentially available to support the preparation of mutual grant applications with partners.

Technical support is provided on a contractual basis to a wide range of partners representing the federal, state, municipal, non-profit sectors.

4.2.1.23.5 Hazard mitigation effectiveness

In its role as the public distributor for data by the Rhode Island Geographic Information System (RIGIS) consortium, the URI EDC maintains the primary source for geospatial data in RI for supporting local hazard and mitigation efforts, including mapping. Hazard and risk mapping provides a critical spatial component to hazard mitigation and is critical to improving the effectiveness of mitigation programs and the broader understanding of RI risks and vulnerabilities.

4.2.1.23.6 New capabilities since 2011

The URI EDC has continued to enhance the most robust platform for online web mapping application development currently available in Rhode Island. The vast majority of the underlying server-based map, image, locator, and geoprocessing services developed and hosted by the URI EDC are available for use by the general public.

4.2.1.24 State Higher Education Mitigation Capabilities

Higher education institutions in Rhode Island are themselves communities in many ways, and they can draw on important lessons from the efforts of counties and municipalities to reduce disaster risks. Higher education institutions are engaged in and skilled at planning exercises for a wide range of issues. The addition or improvement of campus-based hazard mitigation planning will yield substantial benefits. Moreover, steps taken to become more disaster-resistant can complement the long-term sustainability of the campus and improve the overall quality of life.

The State of Rhode Island has three (3) public institutions of higher education (Table 55):

- The University of Rhode Island,
- Rhode Island College, and
- The Community College of Rhode Island

All of these are administered by the Rhode Island Board of Governors for Higher Education. The largest, URI, has approximately 15,000 residents and commuting students spread over four campus locations. Rhode Island College has an approximate enrollment of 9,000 commuting and resident students located in Providence. The Community College of Rhode Island has over 16,000 commuting students at six locations across the State.

Table 55. University and College Locations

School	Campus Location
University of Rhode Island	Kingston Campus, Route 138 Kingston, RI 02881
	W. Alton Jones Campus, 401 Victory Highway, West Greenwich, RI
	Narragansett Bay Campus 215 South Ferry Road Narragansett, RI 02882
	URI Providence Campus 80 Washington Street Providence, RI 02903
Rhode Island College	600 Mount Pleasant Avenue, Providence, RI 02908-1991
Community College of Rhode Island	Knight Campus 400 East Avenue Warwick, RI 02886-1807
	Flanagan Campus 1762 Louisquisset Pike Lincoln, RI 02865-4585
	Liston Campus One Hilton Street Providence, RI 02905
	Newport County Campus One John H. Chafee Blvd. Newport, RI,02840
	CCRI Downcity 80 Washington Street Providence, RI, 02903-1803
	Westerly Middle School 10 Sandy Hill Road Westerly RI 02891

4.3 Funding Capabilities and Funding Programs

44 CFR Requirement

Funding Sources: §201.4(c)(3)(iv)

Requirement §201.4(c)(3)(iv): [The State mitigation strategy shall include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.

As highlighted in the agency profiles and Table 54, less than half of the agencies have funding capabilities related to hazard mitigation. This is a current gap identified in the SHMP. RIEMA and SIHMC will further investigate this gap and identify additional sources that can be used to implement mitigation activities; this investigation will take place during the 2nd and 4th Quarter meetings of the SIHMC (See Section 7).

4.3.1 Federal Funding Sources

Over the last 20 years, the federal government has been the primary source of funds to support risk reduction through a range of grant programs. The availability of federal funding depends upon Congress' ongoing appropriations process. The United States HSS are managing partners of a comprehensive web site that tracks available funding from all federal agencies at www.grants.gov. The following provides an overview of the major federal hazard mitigation related funding programs.

Table 55 provides description of programs that are the primary sources of federal funding for hazard mitigation projects and activities in Rhode Island. These sources have been referenced in the previous section agency profiles and additional details provided in this section for the most frequently used sources. Appendix 4: *Capability Assessment* includes detailed program descriptions and includes the *FEMA Funding Sources* guide.

Table 56. Federal Funding Programs.

Program	Type of Assistance	Availability	Funding Sources
National Flood Insurance Program (NFIP)	Pre-Disaster Insurance	Any time (pre- and post disaster)	NFIP
Flood Mitigation Assistance Program (FMAP)	Cost share grants for pre-disaster planning and projects	Annual pre-disaster grant program	Federal share (up to 100%), non-federal share (local government or other organization)
Hazard Mitigation Grant Program (HMGP)	Post-disaster cost share grants	Post disaster grant program	75% federal share, 25% non-federal share (local government or other organization)

Program	Type of Assistance	Availability	Funding Sources
Pre-Disaster Mitigation Program (PDM)	National, competitive grant program for multiple hazard mitigation projects and "all hazards" plans	Annual pre-disaster grant program	75% federal share, 25% non-federal share (local government or other organization)
Public Assistance Program (Section 406 Mitigation)	Post-disaster aid to state, tribal and local governments	Post-disaster	Federal share (minimum of 75%, up to 100%), non-federal share (local government or other organization)
Community Development Block Grant – Disaster Recovery Funding (CDBG-DR)	Post-disaster aid to state, tribal and local governments	Post-disaster	US Department of Housing and Urban Development
Volunteer Fire Assistance Grants (VFA)	Pre-disaster Grants	Pre-disaster	USDA Forest Service
Assistance to Firefighters Grants Program - Fire Prevention & Safety Grants	Pre-disaster Grants	Pre-disaster	FEMA

FEMA, which is part of the DHS, administers two (2) major programs related to hazard mitigation: the NFIP and the HMA Program. FEMA also administers the PA Program which funds mitigation as part of long-term response and recovery efforts and two (2) grant programs providing assistance to volunteer and community fire-fighting departments and organizations. All of these programs are managed for the State and its constituent jurisdictions by RIEMA. In addition, the US HUD CDBG funds can be used to support mitigation activities at the community level under certain conditions.

4.3.2 State Funding Sources

At this point in time, there are no State sources of funding for hazard mitigation; all non-federal cost sharing requirements (usually 25 percent of the total project costs) are the responsibility of the jurisdiction applying for funding. The State does, however, provide resources in terms of staffing and in-kind match to federal dollars intended for mitigation planning and projects.

The State currently employs a State Floodplain Coordinator, State Hazard Mitigation Officer (SHMO), Risk MAP Coordinator, HMA Program Coordinator, and a Community Rating System Coordinator. These positions are all federally funded through FEMA and are housed at RIEMA. Other State agencies offer additional staffing capabilities with a variety of expertise and resources, and are requested for coordination as needed.

4.4 Summary of Current Programs Supporting Hazard Mitigation

Every agency included in the Capabilities Assessment has pre-disaster capabilities within their organization and the majority, with the exception of the RI Sea Grant College Program and URI Coastal Resources Center, has post-disaster capabilities.

Technical assistance has been noted for 21 of the 23 profiles, with limited capabilities for the State Building Code Commission and RI Public Utilities Commission and DPUC. Approximately half of the agency profiles indicate they have capabilities to regulate development in hazard prone areas, funding capabilities or have adequate staffing resources.

Table 54 summarizes the capabilities captured in each agency Capability Checklist presented in the subsection above. This table highlights the capabilities of the state as it pertains to hazard mitigation and helps identify gaps where risk reduction capabilities can be improved upon in the future. Future updates to this plan should review the current agencies and expand upon capabilities, as they are presented, that help mitigate the hazards identified in the risk assessment.

4.4.1 Program Integration - Incorporation of Research and Plans

44 CFR Requirement
Program Integration **Requirement §201.4(b):** [The State mitigation planning process should] be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.

4.4.1.1 Incorporated in 2014

Table 57 highlights plans/studies/data that were provided by state agencies and organizations and were used to inform the 2014 Plan update.

Strategies and actions from prior editions of the plan may have been continued several times and denoted as “ongoing”. These actions are conducted on a regular basis and have been accounted for in the state capabilities. Appendix 4: *Capabiity Assessment* includes the actions that have been removed from the current actions and added to the state capabilities.

Table 57. Provided resources for the 2014 HMP update.

Plan/Study Title	Agency/Agencies
Preliminary Statewide Digital Elevation and Bathymetry Data Tool for SLR Planning	CRMC/RI Sea Grant College Program and URI Coastal Resources Center
Shoreline Change and Erosion Data	Coastal Resources Management Council
SafeWater RI	RI Department of Health
Energy Assurance Plan	RI Office of Energy Resources
Demographic Data	The Providence Plan
Land Use and Future Population Data	Division of Planning
Storm Event Summaries (2010 Floods, Irene, Sandy)	RI Public Utilities Commission and DPUC/National Grid
Magnitude of Flood Flows for Selected Annual Exceedance Probabilities in Rhode Island through 2010	USGS
State Guide Element 721: RI Water 2030	Division of Planning
2012 Annual Report to the Governor on the Activities of the Dam Safety Program	Department of Environmental Management

4.4.2 "Ongoing" Mitigation Actions converted to State Capabilities

The 2014 update of Rhode Island's SHMP recognizes that some strategies and actions from prior editions of the plan may have been continued several times and denoted as "ongoing". These actions are conducted on a regular basis and should be considered state capabilities.

Table 58 summarizes the ongoing and continued actions from the 2011 mitigation plan that are capabilities for Rhode Island. RIEMA has been noted as the responsible agency for the majority of the mitigation actions identified in the 2011 SHMP.

Table 58. 2011 mitigation actions converted into ongoing state capabilities.

2011 Action #	Action
1.1.8	Encourage State agency and local government officials involved in floodplain management, community planning, building inspection, emergency services, or enforcement of land use planning to take the FEMA Independent Study courses relating to flooding, flood mitigation, and floodplain management.
1.1.9	Ensure that hazard mitigation is recognized in any state-level programs that targets “smart-growth” or sustainable development practices.
1.2.5	Allow staff members and local EMA directors and NFIP coordinators to travel and attend relevant conferences, workshops, and professional meetings.
2.1.2	Provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities.
2.2.1	Provide floodplain management resources to local government such as: an updated Local Administrator’s Handbook; quick guide for floodplain management; updated segments of floodplain management on the EMA website; a guidebook for local public officials with recommendations for incorporating higher regulatory standards into local flood damage prevention ordinances to enhance local capability to manage floodplain development.
2.2.2	Improve compliance with the NFIP through better understanding by local officials of the NFIP criteria and therefore fewer variance approvals.
3.2.2	Agree to address relevant hazards and the risks they pose in any state-level land use decision, including plans for State-owned property development. The State will also encourage adoption of local land use plans that incorporate hazards into decision-making.
3.3.2	Continue to support existing statewide mitigation planning initiatives including the Community Assistance Program – State Support Element (CAP-SSE), the National Flood Insurance Program (NFIP), and the FEMA Mapping and Modernization Program.

4.4.2.1 To be Incorporated in 2017 Update

Several agencies are currently working on or have plans to begin initiatives that support hazard mitigation activities. These initiatives, shown in Table 59, should be reviewed during the SIHMC 2nd Quarter meeting(s) on Mitigation Strategy Progress & Research Initiatives. Discussion should include the method in which the research and plans will be incorporated into the plan update.

The 2014 SHMP acknowledges that there are numerous studies being conducted across the State relating to SLR and flooding. To coordinate these efforts, a group has been formed to discuss the various vulnerability assessments and SLR/storm surge mapping being done throughout the State.

Table 59. Plans and studies currently underway. Results to be integrated into the 2017 SHMP.

Plan/Study Title	Agency/Agencies
Climate Change and Health	RI Department of Health
Ocean/Beach and Shoreline Change Special Area Management plans (SAMP)	Coastal Resources Management Council/RI Sea Grant College Program and URI CRC
Regulations for adaptation to SLR for new and substantially improved buildings within the coastal zone	Coastal Resources Management Council/RIEMA/State Building Commission
Rhode Map RI: Building a Better Rhode Island *Expected Completion: 2015*	Division of Planning
RI State Energy Plan *Expected Completion: March 2014*	Office of Energy Resources
SafeWater RI – to expand to include Wastewater Treatment facilities	RI Department of Health/RI Department of Environmental Management
Sea Level Affecting Marshes Model (SLAMM)	Coastal Resources Management Council/RI Sea Grant College Program and URI Coastal Resources Center
SLR and Wetlands study	Coastal Resources Management Council/RI Sea Grant College Program and URI Coastal Resources Center/USGS
SLR Study	Coastal Resources Management Council/RI Sea Grant College Program and URI Coastal Resources Center
Statewide LiDAR data *Expected Completion: End of 2013/2014*	Division of Planning/RI Department of Transportation
Vulnerability of transportation infrastructure to SLR	RI Department of Transportation/RI Division of Planning

Section 5: Local Hazard Mitigation Plan Coordination

44 CFR Requirement

Local Plan Integration §201.4(c)(4)(ii)

Requirement §201.4(c)(4)(ii): [The section on the Coordination of Local Mitigation Planning must include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.

The RIEMA continually works to foster the development of the State and local hazard mitigation plans. The development of these plans will ensure that hazard mitigation principles become incorporated into the routine activities and day-to-day decision-making of local governments, ultimately decreasing the current and future vulnerability of our communities to all hazards. The initial phase of this initiative began following Hurricane Bob in 1991 with the award of HMGP funds. Under a partnership with the URI's CRC, a hazard mitigation program was conceived in addition to an outreach program to Rhode Island's communities with the objective of reducing losses from natural disasters.

Much of the work in hazard mitigation and sustainable development must be carried out at the local level. It is at the local level where land use decisions are made, growth and development take place, and where the impacts of natural hazards are most direct. RIEMA has always supported local self-sufficiency and reliance, providing assistance to communities where it is needed, but allowing local initiative to take the lead. As noted within this SHMP, a major goal of RIEMA is to build and support such local capacity and commitment to mitigation planning.

5.1 2014 Plan Update

As local hazard mitigation plans are completed, they are typically reviewed by RIEMA within 90 days of being submitted. In addition to the FEMA review tool, RIEMA will document local areas of hazard risks and vulnerability, mitigation actions, programs, policies and projects for inclusion in SHMP updates. As part of the 2014 plan update, these results were collected and compiled into the Local Hazard Mitigation Plan Tracker (Appendix 5: *Local Plan Integration*).

Section 7 details the process in which local plans will be monitored and included in the SHMP update. As part of implementation, local plan status will be discussed during the 3rd Quarter meeting of the SIHMC. At this Quarterly meeting, tentative workshop locations and meeting leads. SIHMC members will assist RIEMA in the organization and facilitation of the meetings. The focus of the workshops will be to solicit input from local communities and stakeholders and to ensure that the local interests and issues have been accurately represented in the SHMP.

The information in this section has been reviewed and revised by the SIHMC as well as the general public. The SIHMC has approved the information presented in this section and feel it represents the information presented in the local hazard mitigation plans.

5.2 Status of Local Hazard Mitigation Plans

Eighteen municipalities in Rhode Island have approved plans and one municipality Approved Pending Adoption (APA). Fifteen localities have expired plans and six municipalities have no plan. RIEMA is currently working with localities to update the local mitigation plans that have expired or do not have a plan in place. Appendix 5: *Local Plan Integration* includes the current status of local hazard mitigation plans in Rhode Island.

5.2.1 Local Hazard Mitigation Plan Incorporation into 2014 SHMP

For the 2014 SHMP update, 34 local mitigation plans, regardless of expiration, were reviewed and catalogued in the Local Mitigation Tracker Tool (Appendix 5: *Local Plan Integration*). Main categories of this tool include:

- Catalog of local hazard mitigation plan: municipality, plan date, FEMA approval date, expiration date, and relevant notes.
- Hazard identification: what hazards were discussed in plan, how the hazards were rated, location in plan, and location of loss estimation.
- Capabilities: identifies the capability of the locality via programs, plans, policies noted in the plan.
- Development trends: summarizes the areas within the community that are experiencing growth and development.
- Goals: types of goals identified by the locality.
- Mitigation actions: identified and completed actions in each of the localities.
- Funding sources: types of funding that localities have utilized for completed projects and sources for their current actions.
- Losses: estimates for losses by hazard type.

5.2.1.1 Local Hazard Identification and Risk Assessment

As part of a program of improving the integration of local hazard mitigation plans into the State's Plan, local HIRA formation has been incorporated into the 2014 plan update.

Table 60 provides a statewide average summary of the hazards identified in local plans and prioritized by the state. It should be noted that this table is a combination of all the individual hazards identified in local plans and combined based on the state hazard identification naming convention. For example, Winter Weather includes winter storm, severe winter storm, snow, ice,

and ice storms. RIEMA is currently working with localities to standardize the hazard identification naming convention used in plan updates.

Table 60. Statewide summary of local plan hazard ranking.

Hazard	Rank
Thunderstorms	High
Winter Weather	High
Hurricanes	Medium-High
Flood	Medium-High
Tornadoes	Medium
Dam Failure	Medium
Wildfires / Forest Fire / Structural Fire / Conflagration	Medium-Low
Earthquake / Geologic	Low
Drought	Low
Extreme Heat	Low
Coastal Erosion	Low

Local hazard mitigation plans identify and address a number of hazards that may not have been addressed in the State plan. For example, approximately half of the local plans addressed hail/hailstorms as a potential hazard, however most plans ranked this hazard as low, in the State plan hail/hailstorms has been combined into the Wind-related hazards.

Appendix 5: *Local Plan Integration* includes the hazards, prioritizations, and how they were rated, if applicable, in the local plans. The system used to rank the hazard is show in the table, such as High, Medium, and Low. If the plan did not assign a rank but included the plan in the risk assessment, this is denoted with an “X” in the table.

All of the prevalent hazards identified in the local hazard mitigation plans are addressed in the SHMP, either using the same hazard terminology or using comparable hazard terminology. Some hazards identified in local hazard mitigation plans are not directly addressed in the Plan Update. Generally, these hazards appear in a small number of local municipal plans. There are three (3) basic reasons why the Plan Update does not directly address mitigation for these hazards.

- These hazards may have profiles that lead to similar mitigation measures as hazards that are addressed directly by the Plan Update;
- These hazards may be sufficiently addressed by another State or federal agency or (local) entity; or
- These hazards may have been deemed by the SIHMC to not be among the most serious threats to the State.

Very few local plans included man-made hazards such as Communicable Diseases, HazMat Events, and Pandemic that are not included in the state plan. Appendix 5: *Local Plan Integration* includes a full-detail of the plans reviewed for all hazards.

5.3 Local Capability Assessment

44 CFR Requirement

Local Capability Assessment: §201.4(c)(3)(ii)

Requirement §201.4(c)(3)(ii): [The State mitigation strategy shall include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.

A local EMA, headed by a director, exists in each city and town in the State. The Emergency Management Director (EMD) is primarily responsible for local response and recovery, in addition to overseeing updates and implementation of the local hazard mitigation strategy. The powers and duties of these agencies within their respective jurisdictions are similar to those of the State agency. Local agencies may act jointly with other such agencies. The chief executive officer of each city and town has powers and duties with respect to disaster preparedness within their city or town similar to those of the governor on the State level, not inconsistent with other provisions of law. During a local or State disaster, the head of the local government or the director of the local EMA is to activate a local EOC, with direct communication link to the State center. Each Rhode Island municipality has an Evacuation Annex as part of its local Emergency Operations Plan (EOP). . The Evacuation Annex includes a map of coastal areas (if any) threatened by a hurricane storm surge and wave action flooding. The map shows areas to be evacuated, routes of travel, and shelters.

Local municipalities have primary authority over land use and development in Rhode Island. With regard to hazard mitigation, local government has the primary role in developing policy, making all land use decisions, establishing annual capital budgets, and implementing hazard mitigation and floodplain management activities. Appendix 5: *Local Plan Integration* includes an overview of the local departments and/or organizations that have a responsibility in overseeing and/or implementing the local hazard mitigation projects, programs and policies within each community.

Each community has unique programs, policies and organizations relating to hazard mitigation. The local hazard mitigation plans have been reviewed for this plan update and Appendix 5: *Local Plan Integration* provides an overview of those capabilities identified in the local plans. As shown, many communities have a comprehensive plan, which can be utilized to implement hazard mitigation techniques throughout the community. In addition, every Rhode Island community participates in the NFIP, which means that communities adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding.

It should be noted that the capabilities shown in Appendix 5: *Local Plan Integration* are solely based on the information in the local hazard mitigation plans and may not be a complete representation of all capabilities, at the local level, related to mitigation. RIEMA is currently working with communities undergoing updates to ensure local capabilities are captured. An example of the range of capabilities presented can be seen in the documentation of local, State, and International Building Codes (IBC), only ten of the 39 localities indicated building code standards within their jurisdiction.

Local plans list many response activities as capabilities; such as, tree trimming and generators. Appendix 5: *Local Plan Integration* includes a complete listing of the capabilities catalogued for each local hazard mitigation plan in Rhode Island.

5.3.1.1 Local Plan Mitigation Strategy

The HIRA portions of mitigation plans was used by local planning committees to formulate and determine mitigation goals and strategies that would address vulnerabilities faced by local communities in Rhode Island.

As previously discussed, information related to the identification of mitigation project types in local hazard mitigation plans was also included in the plan review. The analysis of the types of mitigation goals and activities provides a baseline assessment of local hazard mitigation priorities. It also demonstrates the recognition among local communities that an effective mitigation strategy is comprised of a wide array of activities and actions, and provides areas of opportunity to strengthen local mitigation strategies.

All mitigation measures described in the local hazard mitigation plans were reviewed and analyzed in order to identify any trends and issues related to these proposed hazard mitigation measures. Dependent on future funding, Rhode Island will provide the participating communities with technical assistance as needed for the identification and implementation of cost effective hazard mitigation measures.

During the local hazard mitigation plan review process, it became apparent that certain items within the plans weren't consistent amongst communities. For example, weather terminology and descriptions varied significantly between plans. In order to create consistent terminology and other descriptive issues within the local plans, REIMA has created a format and terminology of the State Plan to serve as an example for Local Hazard Mitigation Plans to follow and utilize when updating their plan (see Appendix 5: Local Plan Integration for Local Hazard Mitigation template).

5.3.1.1.1 Mitigation Goals

Mitigation goals in the local hazard mitigation plans appear to have a general trend of protecting people, property and infrastructure. Five (5) main goal concepts have been summarized from the local plans:

1. Protect and reduce loss to present and future structures or property from all hazards
2. Protect the public and reduce injury and protect lives from all hazards
3. Protect critical infrastructure (includes dams, roads, utilities, essential services)
4. Public Education and increase public understanding and support for hazard mitigation
5. Protect cultural, historical, natural, and economical environments

5.3.1.1.2 Mitigation Actions

A large majority of local plans included similar mitigation actions and categories of actions. Below lists the most popular mitigation actions and number of communities that proposed each action:

- Provide public outreach/education/incentives (27 local plans)
- Infrastructure improvements (bypass sewer main, bridges, water, other utilities) (25 local plans)
- Implement/continue tree trimming program (20 local plans)
- Building/code/zoning improvements or enforcement (19 local plans)
- Assess dams/address dam safety issues (17 local plans)
- Acquire lands/repetitive loss structures in hazard prone areas of the community (16 local plans)

RIEMA and the SIHMC strongly believe that mitigation is most successfully achieved when implemented at the local level. As part of the SHMP update process, RIEMA conducted a survey of local hazard mitigation plans, to determine what mitigation actions had been completed since the last SHMP update in 2011, and how those completed actions further the established goals of the SHMP and hazard mitigation programs. This section provides information on those actions that have been implemented since 2011.

Appendix 5: Local Plan Integration includes the jurisdictions that have not reported any completed actions since the 2011 SHMP. In many cases, the plans for these communities are in the process of being updated. It is likely that mitigation actions have in fact been implemented and relevant information will be included in the local plan updates and future updates of the SHMP.

5.3.1.1.3 Compliance with the NFIP

All 39 of Rhode Island's cities and towns and one (1) Tribal nation participate and are compliant with the NFIP. The NFIP minimum building and construction criteria and floodplain ordinances are implemented through the local NFIP Coordinators. Each local planning board's responsibilities for NFIP enforcement are part of its larger duty to review and regulate the subdivision of land in the community.

The NFIP criteria pertaining to subdivisions require that they be reasonably safe from flooding and that subdivision developers furnish flood data for subdivision proposals above a certain size. Under the State Building Code and local zoning ordinances, applicants who are denied permits for floodplain development can generally apply to the Local Building or Zoning Appeals Board for variances to the floodplains management criteria. The Appeals Board may grant variances on a case-by-case basis provided they comply with the variance guidelines established by the NFIP. *The National Flood Insurance Program Handbook for Rhode Island Communities,* produced by the Office of State Planning, cautions:

> "In granting variances, however, the Appeals Boards must be aware that they are reducing the effectiveness of the NFIP's floodplain management requirements and likely exposing floodplain development to greater flood risks. Beyond the specific land use regulations required for participation in the NFIP, communities have broad discretion to guide development in a manner that will protect the health and safety of their residents and reduce the dangers of floods."

5.3.2 Local Hazard Mitigation Plan Funding and Assistance

44 CFR Requirement

Local Funding and Technical Assistance §201.4(c)(4)(i)

Requirement §201.4(c)(4)(i): [The section on the Coordination of Local Mitigation Planning must include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

Prioritizing Local Assistance §201.4(c)(4)(iii)

Requirement §201.4(c)(4)(iii): [The section on the Coordination of Local Mitigation Planning must include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures.

Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.

As part of Rhode Island's statewide planning strategy to meet the multiple hazard mitigation planning goal of DMA 2000, 13 communities have received funding through the Pre-Disaster Mitigation Grant Program to complete local hazard mitigation plans and nine (9) have received HMGP4027 awards. These plans identified specific local hazard mitigation strategies and specific mitigation measures, such as non-structural measures and projects that addressed natural hazard risks within their community.

Appendix 5: *Local Plan Integration* provides a detailed description of the process by which RIEMA prioritizes local assistance, project eligibility, technical assistance, and how local hazard mitigation plans are tracked and monitored.

Section 6: State Hazard Mitigation Strategy

44 CFR Requirement
Mitigation Strategy **Requirement §201.4(c)(3):** [To be effective the plan must include a] Mitigation Strategy that provides the State's blueprint for reducing the losses identified in the risk assessment.

Rhode Island continues to aggressively implement a widely-recognized, comprehensive strategy that goes beyond that of solely reducing hazard vulnerability, but also incorporates complementary goals that can address multiple state and local needs and lead to safer, more sustainable communities. This mitigation strategy directly addresses the prioritized hazards from the HIRA.

Rather than focus on short-term solutions to inevitably long-term problems, the following mitigation strategy emphasizes the need to ensure communities become better able to withstand hazards while at the same time improving their residents' overall quality of life. By avoiding unnecessary exposure to known hazard risks, communities will save lives, reduce property damages and minimize the social, economic and environmental disruptions that commonly follow hazard events. This SHMP addresses the needs of current residents and also considers the needs of future generations. The focus on an integrated, future-oriented approach will result in communities that are less vulnerable and more sustainable. Therefore, the principles and spirit of community sustainability have been carefully and deliberately integrated throughout this SHMP.

6.1 2014 Plan Update

The Rhode Island SHMP mitigation strategy has been modified since the 2011 plan update. During the 2014 planning process, the SIHMC convened several times in-person (February 7, 2013, May 1, 2013, June 21, 2013, and July 12, 2013) and via WebEx conference calls to discuss the mitigation strategy. The planning process section of this plan further details these meetings. During the June 21, 2013 committee meeting, the SIHMC determined that the 2011 Mitigation Strategy was not comprehensive and developed a State Vision, five (5) goals, and multiple objectives to meet the goals.

The 2014 plan update includes 14 new objectives, and 34 new actions that were developed as a blueprint for risk reduction, following strategic planning ideals. Concepts from the 2011 mitigation strategy were integrated into the update. For example, mitigation actions contained within the 2011 plan were reviewed and duplicate actions were consolidated or deleted. The mitigation goals outline the overall desired outcomes, while the mitigation actions detail specific

projects to be executed. Accomplishing the goals depends on successful implementation of supporting actions.

The following terms were utilized when developing the 2014 mitigation strategy:

> ***Vision:*** *Long-term view for the Rhode Island*
>
> ***Goal:*** *desired outcome that provides direction and purpose.*
>
> ***Objective:*** *Supports the achievement of a defined goal. Should be Specific, Measureable, Achievable, Realistic, and Time-Oriented (SMART).*
>
> ***Action:*** *Potential specific approaches (or actions) to achieve the objectives and attain the goals. Includes identified responsible parties, timeframes, and potential funding sources.*

Appendix 6: *Mitigation Strategy* includes the final mitigation strategies and a full status update on the 2011 mitigation actions as provided by participating hazard mitigation committee members.

A number of different Rhode Island State agencies and offices have incorporated hazard mitigation objectives into their organizational missions. Descriptions of each agency's hazard mitigation-related functions, including their enabling legislation, and examples of the agency's current hazard mitigation measures can be found as individual agency profiles in the State Capability Assessment section.

Ongoing mitigation actions were removed from the mitigation strategy and integrated within the capabilities assessment for the various agencies and programs.

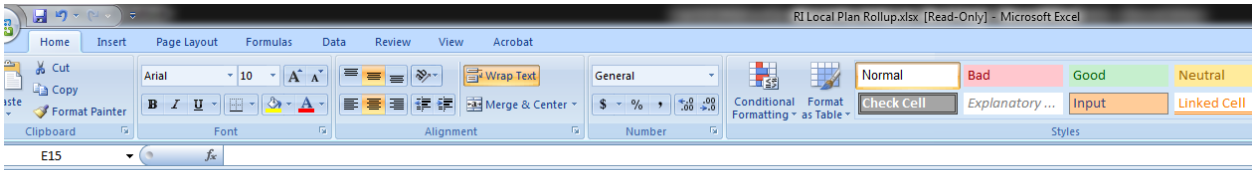
The information in this section has been reviewed, revised and prioritized by the SIHMC. The SIHMC has approved the information presented in this section and feel the mitigation strategy presented provides the blueprint for reducing losses identified in the risk assessment. Rhode Island. SIMHC members and subject-matter experts who provided additional data and information are listed in Appendix 2: *Planning Process* along with their role in the plan update.

6.2 Local Hazard Mitigation Plan Integration

As discussed in Section 5, status of local hazard mitigation plans (HMPs) can be found in the local HMP tracker in Appendix 5. The tracker was used to capture information from the local plans for integration into the 2014 update. It details, when applicable, hazard identification, rankings, loss estimation, capabilities, development trends, goals, mitigation strategies, and applicable funding sources. The local hazard rankings were used as one of the ranking factors for the State HIRA, while the other mitigation related capabilities and mitigation strategies were used to inform this section. Several summary screen captures of this data may be found in the local vulnerability analysis in Sections 4 and 5. The tool has also been provided to RIEMA in

digital format. This tool will also be used for local plan tracking as plans are updated and local mitigation actions are implemented. A screenshot of the tool is shown in Figure 39.

Much of the work in hazard mitigation and sustainable development must be carried out at the local level. It is at the local level where land use decisions are made, growth and development take place, and the impacts of natural hazards are most direct. The RIEMA has always supported local sufficiency and reliance, providing assistance to communities where it is needed, but allowing local initiative to take the lead. As noted within this SHMP, a major goal of this Plan is to support local capacity and commitment to hazard mitigation practices.



Completed Mitigation Actions	Town of Burrillville Comprehensive Plan	Town of Charlestown	Town of Coventry	East Greenwich	Foster	Glocester	Town of Johnson	Lincoln	Town of Middletown	Town of Narragansett	Town of Barrington	Town of Bristol
Assess / study the impact of hazards		X				H			X			X
Assess dams / address dam safety issues			X	X		M		X	X			
Building / code / zoning improvements or enforcement			X						**X**	X	X	X
Close Water Main during Storms												
Develop debris management plan / manage debris				X					X	X	X	X
Develop evacuation plans / shelter plans										X		X
Develop plans, polices, regulations and procedures related to mitigation										X		X
Establish or develop priorities for repairs / post-disaster restoration					H			X				
Explore other means of communication during power failure						**H**						
Identify and secure funding		X	X	X	H	H						
Implement / continue tree trimming program				X		H		X	X	X	X	
Implement or continue natural hazard planning								X				
Implement post-disaster improvements		X								X	X	
Improve communication / collaboration with agencies (local, State, Federal, private sector)			X		X			X				X
Enhance capabilities (mapping, firefighting)		**X**									**X**	
Incorporate hazard mitigation into project / land development review		X									X	
Infrastructure improvements (bypass sewer main, bridges, water, other utilities)				X		H		X	X	X	X	X
Inspect / grade / manage culverts				X	M				X			X
Insure Continued Safety of Navigation in the Ponds		**X**										
Investigate repeater for Fire Department at Stanley Bostich.				**X**								
Join Community Rating System (CRS) / National Flood Insurance program								**X**				
Maintain snow removal programs				X					X			
Make priority repair plans / priority repairs (roads, sewage)					H							X
Natural resource management / planning for natural resource management / natural resource		X	X		X				X	X	X	
Participate in NFIP's Community Rating System												
Private property improvements (including access to private property and incentive programs)									X			X
Provide public outreach / education / incentives		X	X	X	X	H		X		X	X	X
Provide training or education to personnel			X	X								

Figure 39. Local HMP tracker tool screenshot.

6.3 2014 Rhode Island Vision, Goals, and Objectives

44 CFR Requirement

Hazard Mitigation Goals: §201.4(c)(3)(i)

Requirement §201.4(c)(3)(i): [The State mitigation strategy shall include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses.

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

The State of Rhode Island's overall mitigation strategy is to minimize the loss of life, property, cultural and environmental resources from natural disasters in addition to developing better programs to educate the public in issues related to hazard mitigation and strengthening communication within RIEMA, and with other State agencies, local officials and any appropriate and potential partners in mitigation.

The following subsection details the 2014 Vision, Goals, and Objectives that reflect the State's commitment to enhancing resilience to natural disasters by minimizing potential impact. The vision, goals, and objectives were agreed upon by the entire committee. Mitigation actions have been developed using the HIRA and input from SIHMC members. All actions support the vision for the state and multiple goals and objectives.

6.3.1 Vision Statement

Rhode Island is resilient to natural hazards and climate change.

6.3.2 Goals and Objectives

Goal 1: Rhode Island has the capacity to promote and implement projects, programs, plans, policies, and legislative actions to reduce vulnerability to natural hazards, in particular for properties with repetitive and SRLs due to flooding.

Objective 1.1 Maintain and implement a SHMP that fosters innovation, advances public support, and gains long-term commitments for action from all stakeholders.

Objective 1.2 Increase the capacity of, and diversify the representation of SIHMC.

Objective 1.3 Increase the capability of Rhode Islanders to address natural hazards in their daily lives and work.

Goal 2: Statewide coordination with organizations, agencies, and stakeholders.

Objective 2.1 Leverage resources and expertise and capitalize on opportunities that will further hazard mitigation efforts.

Objective 2.2 Institutionalize hazard mitigation into the activities of all stakeholders.

Objective 2.3 Increase communications and stream line policies, procedures, and operations to eliminate conflicts and duplication of effort.

Goal 3: Local communities address natural hazards and long-term risk reduction in local decision making and planning.

Objective 3.1 Aid in the development and implementation of LHMP.

Objective 3.2 Improve the quality of Comprehensive Plans in addressing natural hazards.

Objective 3.3 Increase the capabilities of local decision makers in hazard mitigation.

Goal 4: The public understands, supports, and acknowledges the need for hazard mitigation.

Objective 4.1 Identify and educate the public about hazard specific issues.

Objective 4.2 Engage the private sector in hazard mitigation initiatives.

Objective 4.3 Increase public and private sector coordination.

Goal 5: The built environment and infrastructure are resilient to the impacts of natural hazards.

Objective 5.1 Implement measurable actions to reduce vulnerability.

Objective 5.2 Increase and measure losses avoided as a result of mitigation actions.

6.4 Development of 2014 Mitigation Actions

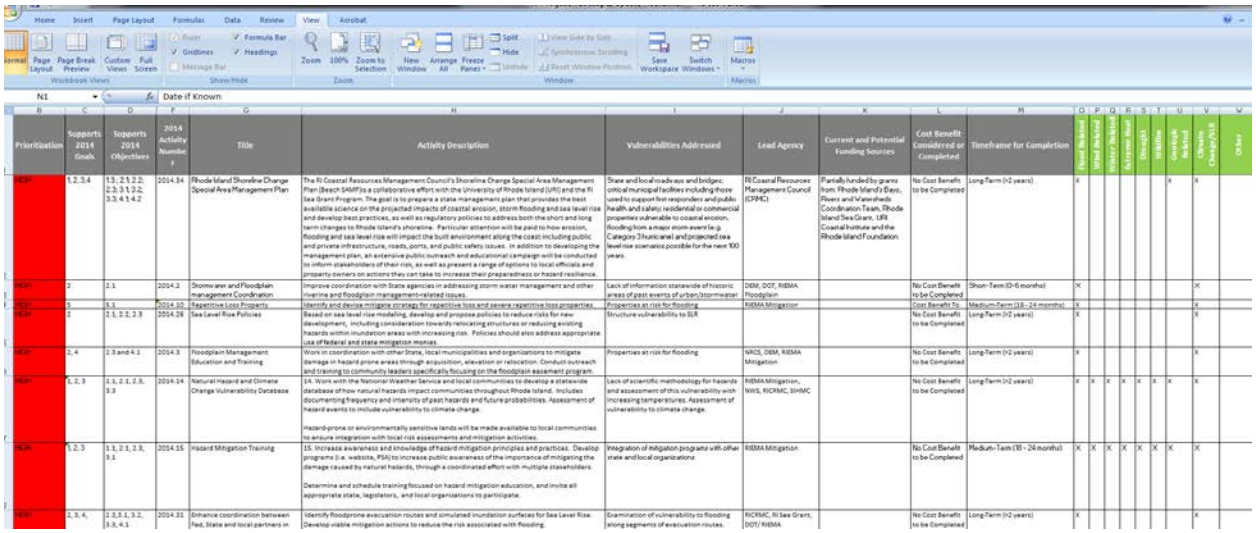
44 CFR Requirement

Mitigation Actions: §201.4(c)(3)(iii)

Requirement §201.4(c)(3)(iii): [State plans shall include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

As discussed in the planning process section the SIHMC members met in-person February 7, 2013 and June 21, 2013 to review and update the SHMP mitigation strategy. In preparation for the June in-person meeting, the 2011 mitigation strategy was again reviewed during a virtual WebEx SIHMC meeting on May 1, 2013. The hazard mitigation committee used a matrix to evaluate the 2011 actions and document new mitigation actions for this 2014 plan update. Figure 40 is a screenshot of the mitigation action tracker developed as part of the plan update. This tool captured previous plan action reporting, ongoing actions (migrated into Capabilities Assessment), definitions, relevant goals and objectives, and the 2014 prioritized actions.



Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit Considered or Completed	Timeframe for Completion	Other
HIGH	1, 2, 3, 4	1.3 , 2.1, 2.2, 2.3; 3.1, 3.2, 3.3; 4.1, 4.2	2014.34	Rhode Island Shoreline Change Special Area Management Plan	The RI Coastal Resources Management Council's Shoreline Change Special Area Management Plan (Beach SAMP) is a collaborative effort with the University of Rhode Island (URI) and the RI Sea Grant Program. The goal is to prepare a state management plan that provides the best available science on the projected impacts of coastal erosion, storm flooding and sea level rise and develop best practices, as well as regulatory policies to address both the short and long term changes to Rhode Island's shoreline. Particular attention will be paid to how erosion, flooding and sea level rise will impact the built environment along the coast including public and private infrastructure, roads, ports, and public safety issues. In addition to developing the management plan, an extensive public outreach and educational campaign will be conducted to inform stakeholders of their risk, as well as present a range of options to local officials and property owners on actions they can take to increase their preparedness or hazard resilience.	State and local roadways and bridges; critical municipal facilities including those used to support first responders and public health and safety; residential or commercial properties vulnerable to coastal erosion, flooding from a major storm event (e.g. Category 3 hurricane) and projected sea level rise scenarios possible for the next 100 years.	RI Coastal Resources Management Council (CRMC)	Partially funded by grants from Rhode Island's Bays, Rivers and Watersheds Coordination Team, Rhode Island Sea Grant, URI Coastal Institute and the Rhode Island Foundation	No Cost Benefit to be Completed	Long-Term (>2 years)	
HIGH	2	2.1	2014.2	Stormwater and Floodplain management Coordination	Improve coordination with State agencies in addressing storm water management and other riverine and floodplain management-related issues.	Lack of information statewide of historic areas of past events of urban/stormwater	DEM, DOT, RIEMA Floodplain		No Cost Benefit to be Completed	Short-Term (0-6 months)	
HIGH	5	5.1	2014.10	Repetitive Loss Property	Identify and devise mitigate strategy for repetitive loss and severe repetitive loss properties.	Properties at risk for flooding	RIEMA Mitigation		Cost Benefit To	Medium-Term (18 - 24 months)	
HIGH	3	2.1, 2.2, 2.3	2014.28	Sea Level Rise Policies	Based on sea level rise modelling, develop and propose policies to reduce risks for new development, including consideration towards relocating structures or reducing existing hazards within inundation areas with increasing risk. Policies should also address appropriate use of federal and state mitigation monies.	Structure vulnerability to SLR			No Cost Benefit to be Completed	Long-Term (>2 years)	
HIGH	2, 4	2.3 and 4.1	2014.3	Floodplain Management Education and Training	Work in coordination with other State, local municipalities and organizations to mitigate damage in hazard prone areas through acquisition, elevation or relocation. Conduct outreach and training to community leaders specifically focusing on the floodplain easement program.	Properties at risk for flooding	NRCS, DEM, RIEMA Mitigation		No Cost Benefit to be Completed	Long-Term (>2 years)	
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.3	2014.14	Natural Hazard and Climate Change Vulnerability Database	14. Work with the National Weather Service and local communities to develop a statewide database of how natural hazards impact communities throughout Rhode Island. Includes documenting frequency and intensity of past hazards and future probabilities. Assessment of hazard events to include vulnerability to climate change. Hazard-prone or environmentally sensitive lands will be made available to local communities to ensure integration with local risk assessments and mitigation activities.	Lack of scientific methodology for hazards and assessment of this vulnerability with increasing temperatures. Assessment of vulnerability to climate change.	RIEMA Mitigation, NWS, RICRMC, SIHMC		No Cost Benefit to be Completed	Long-Term (>2 years)	
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.1	2014.15	Hazard Mitigation Training	15. Increase awareness and knowledge of hazard mitigation principles and practices. Develop programs (i.e. website, PSAs) to increase public awareness of the importance of mitigating the damage caused by natural hazards, through a coordinated effort with multiple stakeholders. Determine and schedule training focused on hazard mitigation education, and invite all appropriate state, legislators, and local organizations to participate.	Integration of mitigation programs with other state and local organizations	RIEMA Mitigation		No Cost Benefit to be Completed	Medium-Term (18 - 24 months)	
HIGH	2, 3, 4,	2.3, 3.1, 3.2, 3.3, 4.1	2014.31	Enhance coordination between Fed, State and local partners in	Identify floodprone evacuation routes and simulated inundation surfaces for Sea Level Rise. Develop viable mitigation actions to reduce the risk associated with flooding.	Examination of vulnerability to flooding along segments of evacuation routes.	RICRMC, RI Sea Grant, DOT/ RIEMA		No Cost Benefit to be Completed	Long-Term (>2 years)	

Figure 40. Mitigation action tracker. See Appendix 6 for complete workbook.

The June 21, 2013 HIRA results meeting set the stage to review and update the mitigation strategy goal, objectives and actions. The strategy was further discussed and developed within the context of the vulnerability assessment. During the development of the goals and objectives, potential mitigation actions that fell within specific objectives were also brainstormed during this meeting and followed up on during the mitigation action development meetings and correspondence in July.

SIHMC members met via virtual WebEx meeting on July 12, 2013 to discuss mitigation action development, prioritization criteria and options for action prioritization. During this meeting, action development was discussed by reviewing the mitigation action tracker and worksheet (Figure 41). Several changes were made to the worksheet based on SIHMC and FEMA Region I insight to better align with the CFR mitigation strategy requirements. The mitigation action tracker includes all the fields from the mitigation action worksheet. The committee decided to prioritize mitigation actions through an online survey.

Rhode Island State Hazard Mitigation Plan 2014 Update

Mitigation Activity Worksheet
(Instructions on Second Page)

Please submit completed worksheets to Rachael Herman at rherman@dewberry.com with a copy to Jess Stimson at jessica.r.stimson.nfg@mail.mil . Worksheets should be submitted by Friday, July 26th.

Name/Title of Activity	
☐ Expands on 2011 Activity # _____	☐ This is a new Activity for 2014
Supports Objective #(s):	
Activity Description	
Lead Agency	
Current & Potential Funding Sources *(if applicable)*	☐ Cost Benefit considered/ completed
Timeframe for Completion ☐ Date known __/__/__	☐ Short-term (0 – 6 months) ☐ Medium-term (18 – 24 months) ☐ Long-term (> 2 years)
Hazard(s) to be Addressed	☐ Flood related ☐ Extreme Heat ☐ Geologic-related ☐ Wind related ☐ Drought ☐ Climate Change/ SLR ☐ Winter related ☐ Wild Fire ☐ OTHER:_____
Vulnerabilities Addressed	
Point of Contact *(Name, phone, email)*	
Notes	

Rhode Island State Hazard Mitigation Plan 2014 Update

Worksheet Instructions

Supports Objective # Identify the specific objective the activity is intended to help achieve (i.e., "2.1"), as provided in separate handout. This may include multiple objectives, if applicable.

Activity Description: Describe the mitigation activity, and please be as specific as possible. In order to meet FEMA requirements, proposed activities must include specific *risk reduction* measures and not be focused on emergency preparedness or response activities. See separate worksheet for applicable mitigation activities.

Lead Agency: Identify the lead department and division/office with primary responsibility for implementation of the activity. Please be as specific as possible. It is also acceptable to list secondary agencies that may provide implementation support.

Estimated Cost (if applicable): Provide a general estimate of the anticipated total costs required to complete the activity. In addition to dollar estimates, it is acceptable to include "staff time" or "in-kind resources," or simply "N/A" for those actions not requiring direct funding assistance. See additional worksheet for funding sources.

Current and Potential Funding Sources (if applicable): Identify potential funding sources, including any known Federal, State or non-governmental funding sources. Identify if benefit-cost reviews will be used to determine cost effectiveness of projects.

Timeframe for Completion: Target timeline (duration) or specific completion date (month/year) for the proposed activity. It is acceptable to include "ongoing/continuous" for those actions already underway and/or to be continued with no end date.

Hazard(s) to be Addressed: Identify the natural hazard group the activity is designed to mitigate against. This may include multiple or all natural hazards. Proposed activities should be focused on mitigating the highest risk hazards for the state.

Flood Related	**Wind Related**	**Geologic Related**
Riverine	Hurricanes	Earthquake
Coastal	Tornadoes	Landslide/Fluvial Erosion
Flash	Thunderstorms/Wind Storms	Expansive Soils
Storm Surge	Hail & Lightning	Subsidence
Urban/Stormwater	**Winter Related**	**Extreme Heat**
Dam Breach	Heavy Snow & Blizzards	**Drought**
Shoreline Change (Accretion & Coastal Erosion/Landslide)	Ice Storms	**Wildfire**
	Nor'easters	**Climate Change and Sea Level Rise**
	Extreme Cold	

Vulnerabilities Addressed: Similar to hazards to be addressed, identify vulnerabilities that this action will address. This can be completed through a statement of what the problem/gap currently is.

Point of Contact: Provide you name, phone number, and email address so that we may contact you for any required follow-up information.

Notes: Provide any additional comments or information as needed.

Figure 41. Mitigation action worksheet. See Appendix 6 for complete action worksheets.

SIHMC members coordinated (via email) to identify new mitigation actions for achieving the new 2014 goals and objectives. They used several tools and resources. Members were asked to expand upon on the current and newly identified actions. As shown in Figure 41, the committee used Mitigation Activity Worksheets to capture details and implementation approaches for each of the proposed actions. Two (2) additional FEMA resources on Mitigation Funding and Mitigation Ideas were provided and used to identify appropriate actions. These documents are included in Appendix 2: *Planning Process* as part of the planning process documentation.

The 2011 plan included 56 actions; three (3) of these actions were completed, five (5) were in-progress, six (6) were not started, 24 were cancelled and 18 were considered ongoing from

2011 and have been added to capabilities for Rhode Island (see Capability Assessment). This 2014 plan update includes 34 actions; 10 actions from the 2011 plan were carried forward with modifications of combining several similar actions together into a more comprehensive strategy. As mentioned above, the committee collaboratively discussed and developed new mitigation actions via WebEx and email.

The complete list of 2014 actions is available in Table 61 and Appendix 6: *Mitigation Strategy.* The SIHMC will use the tracker in Appendix 6 to track their progress on mitigation actions at the quarterly SIHMC meetings. A complete review of the mitigation actions will take place at least twice a year as a committee.

6.4.1 Mitigation Action Prioritization

Based on consensus of the committee during the July 2013 WebEx, an online survey (Figure 42) was created to assist committee members in prioritizing mitigation actions. The complete survey template and raw prioritization results are available in Appendix 6: *Mitigation Strategy*.

Mitigation actions were evaluated using the STAPLEE criterion suggested in FEMA's Hazard Mitigation Planning How-to-Guide Series (Figure 43). The STAPLEE criteria addresses feasibility, cost-effectiveness, and environmental considerations, among other factors. This process varied somewhat from the 2011 Plan Update, where each action was scored based on RIEMA staffing levels, financial resources, cost-effectiveness, environmental soundness, technical feasibility, and timeline. One of the main goals of the 2014 update was to expand on how the agencies (state, non-profits, and private) participating in the mitigation plan can support the identified actions.

For the 2014 plan update, the SIHMC reviewed the STAPLEE criterion and considered the potential impacts of the proposed action on the identified criteria. Each action was then ranked as high, medium, or low, based on this qualitative assessment. Table 61 provides a summary of the hazard mitigation activities that received a High prioritization score. This is a subset of the action information, see Appendix 6: *Mitigation Strategy* for the complete description of the actions. These actions were revised and developed by the SIHMC to achieve the above goals and objectives and to assist in reducing impacts from natural hazards which may impact the State. These include those activities which the State, including offices cutting across multiple departments and agencies, may implement as part of their ongoing work programs and contingent on available resources and/or funding, if applicable. All actions, including the Medium and Low ranked mitigation actions are available in the Mitigation Action Tracker in Appendix 6: *Mitigation Strategy*.

2013 Rhode Island Mitigation Action Prioritization

1. Please enter your contact information so we may track who has responded to this survey and follow up with you if we have any specific questions.

Name (first and last)

Agency

Email Address

Phone Number

2. Using the STAPLE/E criteria, please rate each mitigation action as to how effective it will be in reducing long-term risk and vulnerability to natural hazards in Rhode Island.

	Minimal	Moderate	High	N/A
1. Encourage professional development and certification through outside continuing education programs (e.g. CEM certification, CFM certification, EMAP program accreditation, HAZUS certifications). Create master list of personnel with current licenses and certifications.				
2. Improve coordination with State agencies in addressing storm water management and other riverine and floodplain management-related issues.				
3. Integrate the findings of the Threat and Hazard Identification and Risk Assessment into the RI Hazard Mitigation Plan. Ensure the THIRA is updated on a yearly basis in accordance with FEMA guidance.				
4. Integrate natural hazards section into comprehensive planning guidance and provide workshops to disseminate guidance.				
5. Enhance coordination between National Grid and Public Utility capabilities and State initiatives				
6. Develop a standardized methodology for local hazard mitigation plan creation and updates. Local mitigation plan review will include focused on how to develop "best practices" and common practices that should be regionalized.				
7. Increase CRS participation through education and outreach as a means for local communities to soften the likely increase in many flood insurance policy rates resulting				

Figure 42. Mitigation action prioritization survey screenshot. See Appendix 6 for complete survey.

S Social	• Is the proposed action socially acceptable to the community(s)? • Are there equity issues involved that would mean that one segment of a community is treated unfairly? • Will the action cause social disruption?
T Technical	• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other community(s) goals?
A Administrative	• Can the community(s) implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
P Political	• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
L Legal	• Is the community(s) authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? • Are there legal side effects? Could the activity be construed as a taking? • Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action? • Will the community(s) be liable for action or lack of action? • Will the activity be challenged?
E Environmental	• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?
E Economic	• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the community(s)? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other community goals, such as capital improvements or economic development? • What benefits will the action provide?

Figure 43. STAPLEE Review and Selection Criteria

Table 61. 2014 Rhode Island Mitigation Strategy for High prioritization Actions. See Appendix 6 for a complete listing of actions.

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency*
HIGH	1 2 3 4	1.3 2.1 2.2 2.3 3.1 3.2 3.3 4.1 4.2	2014.34	Rhode Island Shoreline Change Special Area Management Plan	The RI Coastal Resources Management Council's Shoreline Change (Beach) SAMP is a collaborative effort with the URI and the RI Sea Grant Program. The goal is to prepare a state management plan that provides the best available science on the projected impacts of coastal erosion, storm flooding and SLR and develop best practices, as well as regulatory policies to address both the short and long term changes to Rhode Island's shoreline. Particular attention will be paid to how erosion, flooding and SLR will impact the built environment along the coast including public and private infrastructure, roads, ports, and public safety issues. In addition to developing the management plan, an extensive public outreach and educational campaign will be conducted to inform stakeholders of their risk, as well as present a range of options to local officials and property owners on actions they can take to increase their preparedness or hazard resilience.	State and local roadways and bridges; critical municipal facilities including those used to support first responders and public health and safety; residential or commercial properties vulnerable to coastal erosion, flooding from a major storm event (e.g. Category 3 hurricane) and projected SLR scenarios possible for the next 100 years.	CRMC
HIGH	2	2.1	2014.2	Stormwater and Floodplain management Coordination	Improve coordination with State agencies in addressing storm water management and other riverine and floodplain management-related issues.	Lack of information statewide of historic areas of past events of urban/stormwater flooding.	DEM, DOT, RIEMA Floodplain Management
HIGH	5	5.1	2014.10	Repetitive Loss Property Mitigation	Identify and devise mitigate strategy for repetitive loss and severe repetitive loss properties.	Properties at risk for flooding	RIEMA Mitigation
HIGH	2	2.1 2.2 2.3	2014.26	SLR Policies	Based on SLR modeling, develop and propose policies to reduce risks for new development, including consideration towards relocating structures or reducing existing hazards within inundation areas with increasing risk. Policies should also address appropriate use of federal and state mitigation monies.	Structure vulnerability to SLR	CRMC
HIGH	2 4	2.3 4.1	2014.3	Floodplain Management Education and Training	Work in coordination with other State, local municipalities and organizations to mitigate damage in hazard prone areas through acquisition, elevation or relocation. Conduct outreach and training to community leaders specifically focusing on the floodplain easement program.	Properties at risk for flooding	NRCS, DEM, RIEMA Mitigation
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.3	2014.14	Natural Hazard and Climate Change Vulnerability Database	Work with the National Weather Service and local communities to develop a statewide database of how natural hazards impact communities throughout Rhode Island. Includes documenting frequency and intensity of past hazards and future probabilities. Assessment of hazard events to include vulnerability to climate change. Hazard-prone or environmentally sensitive lands will be made available to local communities to ensure integration with local risk assessments and mitigation activities.	Lack of scientific methodology for hazards and assessment of this vulnerability with increasing temperatures. Assessment of vulnerability to climate change.	RIEMA Mitigation, NWS,CRMC, SIHMC
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.1	2014.15	Hazard Mitigation Training	Increase awareness and knowledge of hazard mitigation principles and practices. Develop programs (i.e. website, PSA) to increase public awareness of the importance of mitigating the damage caused by natural hazards, through a coordinated effort with multiple stakeholders. Determine and schedule training focused on hazard mitigation education, and invite all appropriate state, legislators, and local organizations to participate.	Integration of mitigation programs with other state and local organizations	RIEMA Mitigation

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency*
HIGH	2, 3, 4,	2.3, 3.1, 3.2, 3.3, 4.1	2014.31	Enhance coordination between Fed, State and local partners in regards to evacuation routes, zones and planning.	Identify floodprone evacuation routes and simulated inundation surfaces for SLR. Develop viable mitigation actions to reduce the risk associated with flooding. Develop evacuation protocol training and disseminate to local communities.	Examination of vulnerability to flooding along segments of evacuation routes. Potential for prioritization of road improvement projects.	CRMC, RI Sea Grant, DOT, RIEMA Mitigation, RI State Police
HIGH	2	2.2	2014.3	THIRA & HMP Integration	Integrate the findings of the Threat and Hazard Identification and Risk Assessment into the RI Hazard Mitigation Plan. Ensure the THIRA is updated on a yearly basis in accordance with FEMA guidance.	THIRA and HIRA updates not aligned	RIEMA Operations, SIHMC
HIGH	1, 2	1.1, 1.2, 2.3, 3.1	2014.11	State Interagency Hazard Mitigation Committee	Add members to the SIHMC that will represent Federal, State and local agencies and additional relevant stakeholders from both non-profit and the private sector. Establish a regular meeting schedule for the SIHMC occur quarterly. Invite State and local officials to hazard mitigation workshops, meetings and all other relevant functions in which they can learn more about hazard mitigation programs, polices and projects. Members of the State Interagency Hazard Mitigation Committee identify other planning initiatives that may relate to hazard mitigation and reach out to those committees to attend a meeting and discuss this action. Adhere or modify the method and schedule for monitoring, evaluating and updating the mitigation plan set forth in the 2013 plan update. Update and maintain 2013 Mitigation Action Tracker spreadsheet. Incorporate and integrate reports for vulnerabilities and capabilities assessments that are currently underway into 2017 plan update	Determine if more frequent meetings are required to accomplish mitigation actions, and develop smaller committees as appropriate. Concurrent analysis and reports not available for plan update	RIEMA Mitigation, SIHMC

*Agency Name:

- CRMC: Coastal Resources Management Council
- DEM: Department of Environmental Management
- DOT: Department of Transportation
- RIEMA: Rhode Island Emergency Management Agency
- NRCS: Natural Resource Conservation Service
- NWS: National Weather Service
- SIHMC: State Interagency Hazard Mitigation Committee

6.5 Implementing Mitigation Actions

Shortsighted development patterns, along with a misunderstanding of how the natural environment functions to provide protection from natural hazards, have contributed to community vulnerability to natural hazards. Implementing the precepts and practices of hazard mitigation can help ensure that such communities do not increase their vulnerability by continuing inappropriate land uses, and by encouraging the acquisition, relocation or retrofitting of existing vulnerable structures along with the protection of valuable natural resources.

Through experience, communities can develop strategies to face the significant challenges that accompany post-disaster redevelopment and learn to balance the driving need for rapid recovery with implementing long-term hazard mitigation. In the immediate aftermath of a disaster, the necessity to meet basic needs and resettle displaced populations often overshadows the more abstract, longer-term sustainability considerations. Once full-scale reconstruction is initiated, it is difficult to modify projects in progress to meet sustainability objectives. This phenomenon highlights the need for pre-disaster mitigation planning that incorporates principles of sustainable development within the context of reconstruction. If a disaster should strike, this plan will guide communities to rebuild stronger than before, incorporating the tenets of hazard mitigation.

Much of the work in hazard mitigation and sustainable development must be carried out at the local level. It is at the local level where land use decisions are made, growth and development take place, and the impacts of natural hazards are most direct. RIEMA has always supported local sufficiency and reliance, providing assistance to communities where it is needed, but allowing local initiative to take the lead. As noted within this SHMP, a major goal of this plan is to support local capacity and commitment to hazard mitigation practices.

All of the mitigation activities listed in Table 61 have been deemed feasible with respect to their implementation or performance on a state or local level. Appendix 6: *Mitigation Strategy* includes a mitigation ranking and action tracker for each of the strategies identified in Table 61. Each of the potential activities can be implemented independently of other proposed activities. In addition, each activity will support the improvement of an increasingly effective and comprehensive plan. However, the implementation of any of the proposed activities listed is completely dependent upon availability of resources both monetary and other (e.g., staff, technical, supplies, etc.). This dependence on available resources will be a significant factor regarding their implementation and performance over the next three (3) to five (5) years. A complete current listing of potential funding sources is included as Appendix 4: *Capability Assessment.* Further feasibility analysis of individual activities will be performed prior to the implementation and performance of any activity. Similarly, the implementation of any proposed activity is contingent on confirmation that it satisfies the aforementioned STAPLEE evaluation criteria at the time of the proposed performance or implementation. This ensures the activity still has the necessary social, technical, administrative, political, legal, economic, and environmental support required even if conditions have changed since plan adoption.

Climate change and adaptation techniques are an area of continued concern for which hazard mitigation strategies and activities must be linked. This will be accomplished through future coordination and plan integration across multiple state agencies, as deemed appropriate, and as identified and included in this plan as outlined in multiple actions in Table 61.

6.5.1 Mitigation Action Progress (2005 -2013)

Mitigation actions from the 2011 SHMP were reviewed and an assessment of progress made in implementing each action has been completed. Several tables in Appendix 6: *Mitigation Strategy* have been created based on the status of each item relative to this 2014 update of the plan. Progress has been tracked using the following definitions:

- **Completed** –indicates that the action was discrete and completed during the period from 2011 and 2013. These actions are not included in the 2014 mitigation strategy. As appropriate, actions have been integrated in the Capabilities Assessment (Section 4).
- **Not Started and Work-in-Progress** –includes actions that are to be continued in the plan update and the 2014 updated action number is provided.
- **Cancelled** – action has been removed from consideration due to lack of resources or not contributing to the 2014 mitigation strategy.
- **Ongoing** – indicates that progress was made in implementing this action and/or that the action represents an on-going continuing activity by RIEMA and/or other State agencies and partners in the implementation of the plan. Activities that are considered ongoing have been moved to the Capabilities Assessment (Section 4). A listing of ongoing actions is shown in Appendix 6: *Mitigation Strategy* and integrated into the Capabilities Assessment.

6.6 Repetitive and Severe Repetitive Loss Mitigation Strategies

44 CFR Requirement

Repetitive Loss Mitigation Strategy

Requirement §201.4(c)(3)(v): A State may request the reduced cost share authorized under §79.4(c)(2) of this chapter for the FMA and SRL programs, if it has an approved State Mitigation Plan … that also identifies specific actions the State has taken to reduce the number of RL properties (which must include SRL properties), and specifies how the State intends to reduce the number of such RL properties.

Coordination with Repetitive Loss Jurisdictions

Requirement §201.4(c)(3(v): In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with SRL properties take actions to reduce the number of these properties, including the development of local mitigation plans.

Addressing the State's non-mitigated combined 431 RL and SRL structures will require the combined efforts of agencies and organizations beyond the hazard mitigation program staff housed at RIEMA.

Achieving and working through this revised strategy will require the state to continue to reach out to others, making this a joint effort. RIEMA will continue to seek assistance to implement this strategy through close cooperation with its public and private sector partners. Rhode Island's approach to targeting mitigation of SRL and RL is multi-tiered. Some activities must be coordinated and directed at the State level, while others require the support of the local governments that serve as HMA project sponsors.

In acknowledgement of the importance of mitigating RL and SRL structures, several mitigation strategies have been developed to specifically address RL and SRL properties. These include:

- Annually perform data synthesis and update of BureauNet databases in coordination with FEMA Region I; provide RL and SRL datasets to local governments for use in their RL and SRL targeting efforts.
- Initiate contact with each local government with listed SRL property through a letter and follow-up communication to promote HMA grant programs to mitigate listed SRL and RL properties.
- Encourage communities to notify each listed SRL property owner with a letter promoting mitigation at no cost to the property owner through HMA grant programs.
- Prioritize mitigation activities for HMA funds to RL and SRL properties for acquisition and demolition projects in targeted communities.

A number of mitigation projects targeting RL and SRL are currently underway and the State will continue to advocate to target these types of properties moving forward. RIEMA staff will

continue to manage the datasets with the tools created for the 2014 Plan Update in the following manner:

- Maintain access to the BureauNet NFIP database of RL and SRL properties.
- Align RL property data and SRL property data with validated FEMA NFIP RL and SRL property data, annually.
- Use Greatest Savings to the Fund data and amplified BCA module environmental benefits to inventory to further demonstrate the cost effectiveness of mitigation projects.
- Review potential acquisition projects to determine if new BCA module accelerated environmental benefits will enable these structures to be eligible for HMA grants.
- Continue to complete FEMA Form AW-501 for each mitigated property and provide it to FEMA through the current FEMA database or submittal to Region I upon project close-out.
- Ensure that the latitude and longitude of each property is gathered during project close-out as well as during the sponsoring community's three-year mitigation compliance inspection for completed properties.

Creating a competitive FEMA HMA grant application can be challenging for local officials. Local government-to-local government mentoring can be highly effective; RIEMA and FEMA will help to facilitate this process and match experienced grant participants with those that have not participated in HMA programs. In addition to mentoring local governments, the data analysis performed for the HIRA in the 2014 Plan Update will be provided to localities to assist in targeting mitigation opportunities. This will be done by:

- Providing State direction that each jurisdictional plan must include the targeting and mitigation of SRL and RL structures in the mitigation strategies section of every local (§322) mitigation plan with SRL or RL properties.
- Examining the FEMA RL and SRL data sets to seek candidate properties that could potentially be mitigated through the FEMA HMA funding programs or any other available funding sources on an annual basis, or more frequently as required by disaster experience or available staffing resources. Include targeting of SRL and RL structures for mitigation in the mitigation strategies section of every §322 plan with SRL or RL properties.
- Develop and conduct education efforts that increase residential and business owners' knowledge and awareness of mitigation grants by conducting various outreach activities. Target these activities to SRL property owners.
- Subsequent to the distribution of a RL and SRL letter, RIEMA staff will meet with municipalities if requested for follow up.

For the purposes of this plan, "mitigation of high-hazard structures" is considered to be an alteration of a floodprone property or its immediate surroundings (such as a minor drainage project) that reduces or eliminates the risk from flooding. FEMA's HMA grant programs: HMGP, PDM and (FMA continue a focus on mitigating RL and SRL buildings, as are some HUD CDBG-

DR and other State, local, and privately funded efforts. RIEMA will use these available programs, which are addressed in great detail in Appendix 4:*Capability Assessment*, to fund mitigation of SRL and RL structures.

6.7 Monitoring the Mitigation Strategy

44 CFR Requirement

Monitoring Progress of Mitigation Activities

Requirement §201.4(c)(5)(ii): [The Standard State Plan Maintenance Process must include a] system for monitoring implementation of mitigation measures and project closeouts. Requirement §201.4(c)(5)(iii): [The Standard State Plan Maintenance Process must include a] system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.

The RIEMA mitigation staff, with assistance from the SIHMC during the 2nd and 4th Quarterly meetings, will maintain a Mitigation Strategy spreadsheet that has been developed in accordance with this plan. It is anticipated that major aspects of this task during the three- year cycle following plan approval will include:

- Continued development of protocol for local data input.
- Inclusion of local §322 plan databases from local HIRAs, Capability Assessments, and local priority mitigation strategies.
- Expansion of State hazard historical data.
- Refinement of facility inventories.
- Continued expansion of databases to target critical facilities" to enhance Continuity of Operations Plans (COOPs) and human-caused vulnerability assessment.

RIEMA is currently working with FEMA and local mitigation planners to develop a local hazard mitigation plan template with standardized terms and methodology. As local plans are updated, their HIRA information will be uploaded into the local plan tracker tool at the time the local plan is reviewed so that local vulnerability as characterized in local plans is continually updated. This iterative process of updating the local plan data base to reflect annual accomplishment of mitigation actions and plan update HIRA data will facilitate a much easier local plan upload process for the next update of the SHMP.

6.7.1 Progress of Goals and Mitigation Actions/Projects since 2010

The 2014 Rhode Island SMHP Update provides guidance for hazard mitigation within Rhode Island. Its vision is supported by five goals, 14 supporting objectives and 34 targeted mitigation strategies that will reduce or prevent injury from natural hazards to citizens, reduce damage to property and maintain operation of critical state and local facilities. The actions that support the objectives organized within the five goal groups were submitted by Rhode Island state agencies,

colleges and universities along with federal agency cooperators and related non-governmental organizations. These strategies and projects were determined during the June 21, 2013 meeting of the SIHMC.

As SHMPs must be revised three (3) years after FEMA approval, RI agencies that initiated a strategy or project were asked to report on the progress and accomplishments of each strategy and project during spring of 2013. They were also asked to evaluate the relevance of goals, objectives, strategies and projects that were not accomplished due to inadequate funding or other barriers. This discussion continued at the March, 2013 SIHMC meeting and during sub-committee calls.

As previously described, many of the projects that were identified in previous versions of the Rhode Island plan were completed. However, due to funding constraints, additional strategies have not yet been initiated or completed. The 2014 mitigation strategies were wholly informed by the vastly improved Vulnerability Analysis and renewed priorities of the State. The continued relevance of current goals, objectives, and strategies and projects will be evaluated during the development of the next plan revision. Agencies will continue to integrate mitigation activities with their planning efforts.

Detailed descriptions of project closeout, program closeout, and reporting are included in Appendix 6: *Mitigation Strategy*.

Section 7: Plan Maintenance Process

44 CFR Requirement
Monitoring, Evaluating, and Updating the Plan **Requirement §201.4(c)(5)(i):** [The Standard State Plan Maintenance Process must include an] established method and schedule for monitoring, evaluating, and updating the plan.

The SHMP is a living document which will be reviewed, updated and adopted by State officials and submitted to FEMA for approval every three (3) years. As outlined in the Mitigation Strategy (Section 6), the plan will be revised more frequently as local plans are completed and if conditions under which the plan was developed change, such as a major disaster or a new or revised State policy. Also, as documented in the Capabilities Assessment (Section 4), there are many state planning documents that are being revised or written during the time that this plan was being updated. The information in these planning documents will be reviewed and incorporated into the next plan update as necessary.

This section describes the process through which this plan will be monitored, evaluated, and updated. Federal hazard mitigation planning regulations (44 CFR 201.4) require the State plan to be reviewed, revised and submitted for approval to the Regional Administrator of FEMA every three years. The regulations require a plan maintenance process that includes:

- An established method and schedule for monitoring, evaluating and updating the plan;
- A system for monitoring implementation of mitigation measures and project closeouts;
- And a system for reviewing progress on achieving goals as well as activities and projects identified in the Mitigation Strategy.

7.1 2014 Plan Update

The SIHMC, first convened during 2005, was composed of representatives from mostly State and Federal agencies. The committee was expanded for the 2014 Plan Update to include additional State and Federal agencies as well as public and private utilities and non-governmental agencies, such as the Climate Change subgroup that was established in September 2013.

The 2014 plan update presents a new and obtainable plan maintenance process that actively engages the SIHMC and local stakeholders. A well-defined schedule and process provides the foundation for successful mitigation practices and the 2017 SHMP update.

The information in this section has been reviewed and revised by the SIHMC. The SIHMC has approved the information presented in this section and feel it represents the process by which the 2014 SHMP will be monitored and evaluated during the update cycle.

7.1.1 2010 Plan Evaluation

Review of implementation of the 2010 plan, during the update process, revealed significant gaps in implementation of the plan. Presidentially declared disasters, and disaster activity in general, during the 2010 plan horizon, exceeded disaster activity experienced during any previous plan cycle. This combined with a complete reorganization of State government and a down economy presented challenges toward implementation of the plan. However, along with those challenges came many enhancements to Rhode Island's capabilities and programs, as outlined in Section 4.

Prior to initiation of the 2014 plan update process, little evaluation of the plan was conducted and no SIHMC meetings were held on a scheduled basis. Although the 2010 plan identified a schedule for plan maintenance, monitoring and updating, it lacked a process for regular evaluation, particularly criteria for measuring progress and success and for identifying corrective measures for filling gaps in plan implementation success. The SIHMC agreed that resources were limited during the last plan update and its implementation and made adjustments for that gap by applying for a grant and hiring professional consulting assistance for the update. The 2014 update outlines a specific schedule and evaluation criteria that will assist in making this a living document for Rhode Island.

7.2 Parties Responsible for Plan Monitoring and Maintenance

RIEMA is responsible for developing and maintaining the SHMP. Additional participants in the plan maintenance process include representatives of local jurisdictions whose hazard mitigation plans were used in the development of the multi-jurisdictional plans, or who developed a "stand alone" local plan and representatives from the SIHMC.

The SIHMC will facilitate the review and revision of the SHMP every three (3) years. The review and revision will be an ongoing process. This process will incorporate all of the revisions made during the annual plan review, especially new data obtained from the local hazard mitigation plans. As these plans are completed, the new information relative to HIRA will be incorporated into the formal three year update.

Rhode Island will seek to expand participation in the mitigation planning process through expansion of the committee to represent municipal planners, other State agencies and non-governmental organizations (see Mitigation Strategy Section 6). This expansion will focus on implementation of this plan update as well as to inform the next plan update.

The SIHMC will meet quarterly to share information and to review implementation of the mitigation actions identified in this plan.

7.3 Plan Implementation, Monitoring, Evaluating, and Updating

The SHMP was significantly expanded and enhanced to support development of the plan in consideration of the changes in disaster related activity throughout the state, local mitigation plan development and statewide capabilities. The RIEMA mitigation program staff and SIHMC, in consultation with key state agencies, federal partners and organizations will direct implementation of the plan. RIEMA serves as the lead coordinating agency for emergency management in Rhode Island, and thus will lead the mitigation planning effort, including plan maintenance. The RIEMA will track projects identified this SHMP and local plans through the Mitigation Trackers developed for the 2014 plan update.

7.3.1 Plan Monitoring Procedures, Schedule, and Evaluation for 2014 through 2017

The planning process timeline (Table 62) will be revised continually in the coming years to ensure that the 2017 plan revision can be prepared and submitted to FEMA within the required three (3)-year time period. Special attention will continue to be focused on ensuring that businesses and special interest groups are included and have an input into the plan revision.

Plan updates will continue to emphasize the expanded vulnerability assessment of the database of local and State facilities and the redevelopment of strategies for the intended purpose of continued proactive assistance to the most vulnerable citizens and assets of Rhode Island. State or federal legislative, regulatory or rule changes or additions that occur during the period following approval of the 2014 plan will be integrated into the 2017 update. Should a specific plan element or section require revision or amendment prior to the subsequent plan revision due to State or Federal legislation or policy change, RIEMA staff will meet with all appropriate stakeholders and propose the change or addendum to FEMA as quickly as is practicable.

The monitoring, maintenance and implementation approach outlined above will be conducted in accordance with the schedule in Table 62. The quarterly schedule will allow the RIEMA and SIHMC time to collect data from ongoing research and local hazard mitigation plans, review information, and include relevant information as necessary.

The plan maintenance schedule will act as the framework to ensure that the 2017 plan revision can be prepared and submitted to FEMA within the established time period. Funding sources for the update process will be investigated and secured six (6) months prior to the schedule start of the process to allow for ample data collection and interagency coordination. As highlighted above and in the table, the SIHMC will meet quarterly to discuss plan implementation, changes in the plan, and progress on strategies and projects. The SIHMC meeting will also be used as a forum to discuss changes to the update process, committee members, what works well, what should be changed, and to assess the system (FEMA state plan cross-walk) used to evaluate the plan.

7.3.1.1 Quarterly Progress Meetings

The subsections below provide additional information on the plan monitoring procedures. The purpose of the quarterly progress meetings is to reconvene the SIHMC and to discuss status of proposed projects, current studies or conditions that may affect hazard mitigation planning and implementation in Rhode Island without overwhelming the members of the committee and allowing ample time for members to reach out to their agencies and organizations for information and feedback.

Attention will continue to be focused on ensuring that businesses and special interest groups are included and have an input into the plan revision. This will include inviting the Blackstone River Watershed Council (BRWC), Partners of the Kickemuit River Council, Narragansett Bay watershed Council to participate in the planning process and plan updates. RIEMA will also reach out to and coordinate with neighboring states to ensure integration and collaboration on mitigation related projects and programs impacting the shared geographic area. Should a specific plan element or section require revision or amendment prior to the subsequent plan revision due to state or federal legislation or policy change, RIEMA staff will meet with all appropriate stakeholders and propose the change or addendum to FEMA as quickly as is practicable.

RIEMA will be the main point of contact for the quarterly meetings and will maintain attendance, meeting minutes, and will update the Mitigation Tracker and Local Plan tools to truly make this a living document. Evaluation criteria have been summarized in Table 62. The SIHMC will use the State Hazard Mitigation cross-walk as the main evaluation tool to update the plan and guide the quarterly meetings.

Figure 44. Plan update schedule and topics.

7.3.1.1.1 1st Quarter Meeting: Annual Progress Evaluation

The 1st quarter meeting will be used to set the stage for the remaining quarterly meetings for the year, review overall progress and chances to the plan and establish agenda items for the 2nd, 3rd, and 4th quarter meetings. This meeting will also be used to refine the Planning Process and timeline for upcoming year and 2017 plan update.

The SHMP will be reviewed annually to reflect significant policy changes that took place during the preceding year and to report on the progress made on funded and implemented hazard mitigation projects statewide. The 1st Quarterly meeting (2014) will be used to discuss FEMA cross-walk comments and how/if the comments should be addressed throughout the year and in the 2017 SHMP update.

Overall implementation will be monitored to identify any problems or obstacles (financial, technical, political and legal), and develop recommendations to overcome them. In addition, the SIHMC roster will be reviewed the council will identify additional people who should be included in the SIHMC and recommend ways to increase participation by State agencies and local jurisdictions in the hazard mitigation planning process.

The January 2017 Annual Progress Evaluation meeting will focus on the FEMA review and comments of the 2017 SHMP.

7.3.1.1.2 2nd Quarter Meeting: Mitigation Strategy and Research Initiatives

The purpose of the Mitigation Strategy and Research Initiatives meeting is to gauge the progress of mitigation activities and evaluate any changed conditions or priorities that may affect hazard mitigation planning and implementation in Rhode Island. A status of each of the mitigation actions will be presented, discussed, and documented in the Mitigation Action Tracker tool (Appendix 6: *Mitigation Strategy*).

The second portion of this meeting will be focused on discussing current research and program/policy initiatives that should be included, or updated, in the SHMP. The policies, programs, and plans in the Capabilities Assessment (Section 4) will be used to launch discussion. The tables at the end of Section 4 will be updated and maintained in an effort not to lose sight of initiatives discussed.

7.3.1.1.3 3rd Quarter Meeting: Vulnerability Assessment Updates

The Vulnerability Assessment meeting will review the HIRA (Section 3) and will discuss hazards and analysis that should be updated or revised. The information obtained during the 2nd Quarterly meeting will assist and help to focus the areas that should be discussed. Facilities data will need to be a priority during the July 2014 meeting.

The SIHMC will decide how this review will be handled. Council members may want to tackle only specific hazards. For example, in July 2014 flood-related hazards may be the focus and winter weather and drought in 2015. It will be important to engage subject-matter experts in this meeting.

The agenda for the July 2016 meeting will focus on the review and comments for the 2017 SHMP update.

7.3.1.1.4 4th Quarter Meeting: Mitigation Strategy, Capabilities, and Local Plan Status

The main focus of the 4th quarter meeting will be to review the mitigation strategies (full discussion during the 3rd quarter meeting) and refine or develop additional actions that reflect the Vulnerability Assessment (3rd Quarter meeting) findings.

Each represented stakeholder will use this time to comment on the agency profiles. SIHMC will recommend any necessary revisions to reflect changes in federal and State policies, priorities, programs and funding, and incorporating new information following major disaster events.

As plan reviews are completed, RIEMA will populate the Local Plan tracker. During this meeting, a summary of the local plans hazards, capabilities, and actions these plans will be presented. SIHMC will be involved with the monitoring of effectiveness of funded, local mitigation projects.

The 4th quarter meeting may include multiple agenda items depending on how many local plans have been approved during the previous year.

In October 2016, the 4th Quarter meeting will also include final comment of the 2017 SHMP and submission to FEMA.

7.3.1.1.5 Post Disaster Review

After each Presidential disaster declaration and in coordination with FEMA, the SIHMC will assist in documenting the effects of the disaster. Meetings will be scheduled by RIEMA to share disaster related data and to determine the areas in need of mitigation to reduce future risk. This will allow for the development of hazard mitigation recommendations to FEMA during the disaster operation as well as to update the Mitigation Strategy as needed. The post-disaster review may coincide with the already established SIHMC quarterly meetings and the agenda items can be altered to reflect recent events.

This has been successful practice in the past. Following the March 2010 floods (DR-1894), the SIHMC was convened, and a Workshop Planning Team was created to identify the direct actions and preparatory actions the State of Rhode Island and the 39 municipalities within the five declared counties (Kent, Washington, Providence, Newport and Bristol) took to mitigate and respond to the effects of the March flooding. Topics discussed included:

- Planning
- Communications
- Emergency Operations Center Management
- Critical Resource Distribution
- Volunteer and Donations Management
- Environmental Health
- Citizen Evacuation
- Urban Search and Rescue
- Mass Care
- Restoration of Lifelines
- Economic and Community Recovery

Some of the major strengths identified during the Workshop included the coordination and cooperation among federal, State and local agencies, the use of internet and media outlets to provide information, and the State's expedited process to declare a State of Emergency. As a result of the State's capabilities, the federal disaster declaration was quickly received, and FEMA was able to coordinate the response in a timely manner. A number of primary areas for improvement were also identified including increasing statewide training in ICS, NIMS, NRF, and WebEOC® will aid the State in preparing for future incidents.

Table 62. Schedule for Plan Maintenance and Revision (January 2014 – April 2017).

Quarterly Meeting	Task	Evaluation Criteria	Responsibility	Time Frame
1: Annual Progress Evaluation	• Refine Planning Process and timeline for upcoming year and 2017 plan update • Assess SIHMC members and involvement and discuss expanding and increase participation. • Review entire SHMP: identify problems/obstacles (financial, technical, political, and legal) and develop recommendations. • Review current regulatory requirements for plan revision • ***Review Progress from FEMA on 2017 SHMP Comments (January 2017)***	Review CFR and State Crosswalk Email SIHMC list and expand based on agency feedback Review 2014 SHMP FEMA crosswalk	SIHMC (RIEMA lead)	January 2014 January 2015 January 2016 January 2017
2: Mitigation Strategy and Research Initiatives	• Evaluate progress on strategies and projects • Review 2014 Mitigation Goals and Strategies and update as appropriate • Discuss research initiatives or special project group findings (i.e. climate change) • ***Progress from FEMA on 2017 SHMP Approval (April2017 only)***	Distribute mitigation actions and progress tracking excel spreadsheet to SIHMC a week prior to 2nd quarter meeting. Report on progress of high mitigation actions and obstacles preventing mitigation actions from starting. Evaluate effectiveness against current mitigation Goals and Objectives. Does the goal help to achieve the purpose of the plan?	RIEMA Mitigation Staff Project sponsors SIMHC	April 2014 April 2015 April 2016 April 2017

Quarterly Meeting	Task	Evaluation Criteria	Responsibility	Time Frame
3: Vulnerability Assessment Updates	• Initiate review and revision of HIRA and Vulnerability Analysis • Work to update facilities information • Use available tools and resources to apply vulnerability analysis to manmade hazard mitigation where cross-program relationships exist • Draft Review (July 2016)	Evaluate facilities included in 2014 analysis. Is this listing accurate? Review hazard data and analysis completed. Is the analysis representative of current risk? Consider impacts and losses reduced through mitigation. Have local plans been completed? Review local risk assessments. Evaluate changes in development. Have there been significant population changes, planned development, new building codes since 2014?	RIEMA Mitigation Staff Geospatial Information System (GIS) database Commodity flow studies Local sample Hazmat Terrorism Consequence Management Plans State Agency COOP Plans	July 2014 July 2015 July 2016

Quarterly Meeting	Task	Evaluation Criteria	Responsibility	Time Frame
4: Mitigation Strategy, Capabilities, and Local Plan Status	• Evaluate progress on strategies and projects • Evaluate Agency Profiles for Capabilities Assessment • Review Local Plan Updates • Review and expand, based on HIRA, mitigation actions • Submit new Revised All-Hazard Mitigation Plan to FEMA (October 2016)	Review current vision, goals and objectives. Are goals consistent with risk assessment findings? Have modifications been made to the system to track the initiation, status and completion of actions? Report on RL actions and changes to funding. Review assigned responsibility for monitoring and evaluating actions and project closeout. Have RI pre and post disaster policies, programs, and regulations changed? SIHMC review each agency profile. Has local jurisdiction funding programs changed?	RIEMA Mitigation Staff Project sponsors SIMHC State Emergency Coordinator RIEMA Mitigation Staff SIHMC	October 2014 October 2015 October 2016
Post-Disaster	• Review of SHMP to address areas where the plan should be refocused due to the impact of the disaster(s).	Evaluate mitigation actions and strategy to reassess vulnerability and priorities.	SIHMC	As Needed

7.4 2014 SHMP Conclusion

The 2014 SHMP provides guidance for hazard mitigation activities within the State and has undergone a full revision using the best available data and subject-matter experts for the required update. This plan fulfills the standard state mitigation planning requirements (44 CFR § 201.4). The SIHMC is committed to a long-term strategy for reducing risks to natural hazards, as shown in the mitigation strategy set forth in this plan. Mitigation actions will reduce risk from natural hazards to citizens, state facilities, and critical facilities. Capabilities of agencies and programs within the state will allow for collaboration, integration of concurrent planning initiatives and progress on mitigation actions through to the 2017 plan update.

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Appendix 1: Introduction

Key Terms and Acronyms

100-Year Flood (also called the Base Flood). The flood having a one percent chance of being equaled or exceeded in magnitude in any given year. Contrary to popular belief, it is not a flood occurring once every 100 years.

AAL. Average Annualized Loss.

ACAMS. Automated Critical Asset Management System.

AEL. Annualized Earthquake Losses.

AELR. Annualized Earthquake Loss Ratio.

AFG. Assistance to Firefighters Grants.

All-hazards Approach. Integrated hazard mitigation strategy that incorporates planning for and consideration of all potential natural and manmade hazard threats.

APA. Approved Pending Adoption.

ASFPM. Association of State Floodplain Managers.

Flood. The flood having a one percent chance of being equaled or exceeded in magnitude in any given year. (Also known as the 100-year flood). This is the flooding event that is used to calculate flood risk for the National Flood Insurance Program (NFIP) and the Federal Emergency Management Agency (FEMA).

Base Flood Elevation. The height (above mean sea level) that flood waters will reach at a given location in the event of the base (100-year) flooding event.

BOCA. Building Official & Code Administration.

CAP. Community Assistance Program.

CAP-SSE. Community Assistance Program Support Services Element.

CAP-SSSE. Community Assistance Program – State Support Services Element

CAZ. Coastal A Zone (CAZ) is a term that is used to draw a distinction between coastal and inland A Zones, and to highlight similarities between V Zones and A Zones in coastal areas. In a Coastal A Zone, the principal source of flooding will be astronomical tides, storm surges, seiches or tsunamis, not riverine flooding. During base flood conditions the potential for breaking wave heights between 1.5 feet and 3.0 ft will exist.

CBO. Community Based Organizations.

CCP. Community Comprehensive Planning Program.

CDBG. Community Development Block Grant.

CDBG-DR. Community Development Block Grant – Disaster Recovery

CDC. Centers for Disease Control.

CEPR. Center for Emergency Preparedness and Response.

CFAA. Cooperative Forestry Assistance Act.

CFP. Cooperative Fire Protection.

CFR. Code of Federal Regulations.

CIKR. Critical Infrastructure and Key Resources.

CMI. Crop Moisture Index.

Contour. A line of equal ground elevation on a topographic map.

COOP. Continuity of Operations Plan.

CPD. The Office of Community Planning and Development

CPG. Comprehensive Preparedness Guide.

CRC. Coastal Resources Center.

Critical Facility. Facilities that are vital to the health and welfare of the population and that are especially important following disasters. Critical facilities include, but are not limited to, shelters, police and fire and hospitals.

CRMC. Rhode Island Coastal Resources Management Council

CRS. Community Rating System a National Flood Insurance Program that provides incentives for NFIP-member communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of NFIP policyholders in these communities are reduced.

CSC. Coastal Services Center, part of NOAA, located in Charleston, SC.

CT. Connecticut.

CTM. Coastal Terrain Model

CTP. Cooperating Technical Partners.

DBR. Department of Business Regulation.

DEM. Department of Environmental Management.

DFIRM. Digital Flood Insurance Rate Map.

DHTF. Disaster Housing Task Force.

DHS. Department of Homeland Security.

DMA 2000. Disaster Mitigation Act of 2000.

DMAT. Disaster Medical Assistance Team.

DPUC. Division of Public Utilities and Carriers.

DOA. Department of Administration.

DOF. Department of Forestry.

DOH. Department of Health.

DOT. Department of Transportation

DWQ. Drinking Water Quality.

EAP. Emergency Action Plan.

EAS. Emergency Alert System.

Earthquake. A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the earth's tectonic plates.

EDC. University of Rhode Island Environmental Data Center.

EMA. Emergency Management Agency.

EMD. Emergency Management Director.

Enhanced Fujita Tornado Scale. An update to the original F-scale by a team of meteorologists and wind engineers that was implemented in the US on February, 1, 2007.

EOC. Emergency Operations Center.

EOP. Emergency Operations Plan.

EPA. Environmental Protection Agency.

ESF. Emergency Support Function.

EWP. Emergency Watershed Protection Program.

FEMA. Federal Emergency Management Agency.

FHA. Federal Highway Act.

FHWA. Federal Highway Administration.

FIRM. Flood Insurance Rate Map. The insurance and floodplain management map issued by FEMA that identifies areas of 100-year flood hazard in a community. In some areas, the map also shows base flood elevations and 500-year floodplain boundaries and occasionally, regulatory floodway boundaries.

FIS. Flood Insurance Study. Engineering study performed by FEMA to identify flood hazard areas, flood insurance risk zones, and other flood data in a community.

Flash Flood. A flash flood is a specific type of flood that appears and moves quickly across the land with little warning, making it very dangerous. A flash flood is the fastest-moving type of flood. It happens when heavy rain collect in a stream or gully, turning the normally calm area into an instant rushing current.

Flood. A general and temporary condition of partial or complete inundation of normally dry land areas from: (1) the overflow of inland or tidal waters; (2) the unusual and rapid accumulation of runoff of surface water from any source.

Flood Depth. Height of the floodwater surface above the ground surface.

Flood Elevation. Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.

Flood Fringe. That portion of the 100-year floodplain outside the floodway in which total encroachment is permissible.

Floodplain. Any land area susceptible to inundation by floodwaters from any source.

Floodproofing. Any combination of structural and non-structural additions, changes or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Floodway. The channel of a river or watercourse and the adjacent land areas that must be reserved in order to discharge the 100-year flood without cumulatively increasing the water surface elevation more than one foot.

FMA. Flood Mitigation Assistance.

FMAP. Flood Mitigation Assistance Program.

FMO. Fire Marshall's Office.

FP&S. Fire Prevention and Safety Grants.

FPMS. Floodplain Management Services.

FTE. Full-time employee.

Fujita Scale of Tornado Intensity. An intensity scale which rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 rating indicates light damage such as broken tree limbs or signs, while an F5 rating indicates incredible damage was sustained.

Geographic Information System (GIS). A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Hazard. A source of potential danger or adverse conditions. Hazards included in this plan are natural in origin and include: floods, droughts, high winds, winter storms; hurricanes; tornadoes; dam failures and coastal erosion. These events are hazards when they have the potential to harm people or property.

Hazard Identification. The process of identifying hazards that threaten an area.

Hazard Mitigation. Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Profile. A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent.

Hazards U.S. (HAZUS). A GIS-based software program that is a nationally standardized earthquake, flood, and hurricane wind loss estimation tool developed by FEMA.

Hazus-MH. Hazards US Multi-Hazard.

HEALTH. Rhode Island Department of Health.

HHS. Department of Health and Human Services.

HIRA. Hazard Identification and Risk Assessment.

HMA. Hazard Mitigation Assistance.

HMGP. Hazard Mitigation Grant Program.

HSIN. Homeland Security Information Network.

HUC. Hydrologic Unit Code.

HUD. Department of Housing and Urban Development.

Hurricane. An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles-per-hour or more and blow in a large spiral around a relatively calm center or “eye.” Hurricanes develop over the North Atlantic

Ocean, northeast Pacific Ocean, or the South Pacific Ocean east of 160 degrees longitude. Hurricane circulation is counter-clockwise in the northern hemisphere and clockwise in the southern hemisphere.

HWM. High Water Marks.

Hydrology. The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.

IA. Individual Assistance.

IBC. International Building Code.

ICC. International Code Council, Inc.

ICS. Incident Command System.

IHP. Individual and Households Program.

IPCC. Intergovernmental Panel on Climate Change.

Intensity. A measure of the effects of a hazard event at a particular place.

ISR. Infrastructure, Safety and Reliability.

LHMC. Local Hazard Mitigation Committee.

LiDAR. Light Detection and Radar.

Liquefaction. The phenomenon that occurs when ground shaking causes loose soils (such as till and outwash) to lose strength and act like a viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Lowest Floor. Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.

Magnitude. A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard is usually determined using technical measures specific to a hazard.

MHHW. Mean Higher High Water.

Mitigation. The process of reducing the severity of the impact of natural hazards through planning. Each hazard requires a specific type of mitigation. In some cases, we can use engineering solutions (such as an earthquake -resistant building) to at least temporarily reduce the impact of a natural hazard. In other cases, the only form of mitigation that is guaranteed to be successful is to limit or not allow human activities where the hazard occurs (such as in floodplains).

Mitigation Plan. A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the state and includes a description of actions to minimize future vulnerability to natural hazards.

MMI. Modified Mercalli Intensity.

MOU. Memorandum of Understanding.

MRC. Medical Reserve Corps.

National Grid. The State's dominant electric utility and sole natural gas service provider.

Natural Disaster. A natural hazard event, such as a flood or tornado, which results in widespread destruction of property or caused injury and/or death.

Natural Hazard. An unexpected or uncontrollable natural event of unusual magnitude that threatens the activities of people or people themselves.

NCDC. National Climatic Data Center.

NECIA. Northeast Climate Impact Assessment Group.

NEHRP. National Earthquake Hazards Reduction Program.

NERACOOS. Northeast Regional Association of Coastal and Ocean Observing Systems.

NESEC. New England States Emergency Consortium.

NFIF. National Flood Insurance Fund.

NFIP. National Flood Insurance Program.

NFR. National Response Framework.

NHC. National Hurricane Center.

NHRP. National Register of Historic Places.

NIPP. National Infrastructure Protection Plan.

NIMS. National Incident Management System.

NOAA. National Oceanic and Atmospheric Administration.

Nor'easter. An extra-tropical cyclone producing gale-force winds and precipitation in the form of heavy snow.

NPCC. New York Panel on Climate Change.

NPDP. National Performance of Dams Program.

NRCS. Natural Resources Conservation Service.

NROC. Northeast Regional Ocean Council.

NWI. National Wetland Inventory.

NWS. National Weather Service.

OER. Office of Emergency Response.

OHCD. Office of Housing and Community Development

OSHA. Occupational Safety and Health Administration

OWR. Office of Water Resources

PA. Public Assistance.

PAC. Public Assistance Coordinator.

PAS. Planning Assistance to States.

PCII. Protected Critical Infrastructure Information.

PDA. Preliminary Damage Assessment.

PDI. Palmer Drought Index,

PDM. Pre-Disaster Mitigation Program. Authorized by Section 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 USC, as amended by 102 of the Disaster Mitigation Act Mitigation Fund to assist States and local governments (to include Indian Tribal governments) in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program.

PDSI. Palmer Drought Severity Index.

PGA. Peak Ground Acceleration.

PHEP. Public Health Emergency Preparedness.

ProvPlan. The Providence Plan.

PUC. Public Utilities Commission.

PWS. Public Water System. A system that provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year

RFC. Repetitive Flood Claims . The Repetitive Flood Claims (RFC) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al).

RL. Repetitive Loss. A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000.00 each have been paid within any 10-year period of time since 1978.

RI. Rhode Island.

RIBC. Rhode Island Building Commission.

RIEMA. Rhode Island Emergency Management Agency.

RIGIS. Rhode Island Geographic Information System.

RISCON. Rhode Island Statewide Communications Network.

RISG. Rhode Island Sea Grant.

Risk. The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It can also be expressed in terms of potential monetary losses associated with the intensity of the hazard.

RISNER. Rhode Island Special Needs Emergency Registry.

Riverine. Of or produced by a river.

SAMP. Special Area Management Plan.

SAR. Suspicious Activity Report.

SBA. Small Business Administration.

Scour. Removal of soil or fill material by the flow of floodwaters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

SEOC. State Emergency Operations Center.

SHARP. Safety and Health Achievement Recognition Program.

SHMO. State Hazard Mitigation Officer. The representative of state government who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

SHMP. State Hazard Mitigation Plan Update

SHPO. State Historic Preservation Office.

SIHMC. State Interagency Hazard Mitigation Council. Representatives of state agencies, non-profits, and who the primary point of contact for the Rhode Island Hazard Mitigation Plan

SLAMM. Sea Level Rise affecting Marsh Model.

SLOSH. Sea, Lake, Overland Surges from Hurricane is a computerized model run by the National Hurricane Center to estimate storm surge heights and winds resulting from historical, hypothetical or predicted hurricanes by taking into account pressure, size, forward speed, track and winds.

SLR. Sea Level Rise.

SMART. Specific, Measureable, Achievable, Realistic, and Time-Oriented.

Special Flood Hazard Area (SFHA). The shaded area on the Flood Hazard Boundary Map (FHBM) or Flood Insurance Rate Map (FIRM) which identifies an area that has a one percent chance of being flooded in any given year (100-year floodplain). The FIRM identifies these shaded areas as FIRM Zones A, AO, AH, A1-A30, AE, A99, V, V1-30, and VE.

SRF. State Revolving Fund.

SRL. Severe Repetitive Loss. The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss (SRL) structures insured under the National Flood Insurance Program (NFIP).

SSEER. Scientific Support for Environmental Emergency Response.

Stafford Act. The Robert T. Stafford Disaster Relief and Emergency Act, P.L. 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, P.L. 23-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

STAPLEE. Social, Technical, Administrative, Political, Legal, Economic and Environmental Criteria.

Storm Surge. A rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface

Substantial Damage. Damage of any origin sustained by an obstruction whereby the cost of restoring the obstruction to its before-damage condition would equal or exceed 50 percent of the market value of the obstruction before the damage occurred.

Substantial Improvement. Any reconstruction, rehabilitation, addition, or other improvement of an obstruction, the cost of which equal or exceed 50 percent of the market value of the obstruction before "start of construction" of the improvement. This includes obstructions which have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either (1) any project for improvement of a structure or other obstruction to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or (2) any alteration of a "historic structure," provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Technological Disaster. A disaster that results from a technological or man-made hazard event

Technological Hazard. A hazard that originates in accidental or intentional human activity (oil spill, chemical spill, building fires, terrorism, etc.)

THIRA. Threat and Hazard Identification and Risk Assessment.

Topographic Map. A map which shows natural features and indicates the physical shape of the land using contour lines. These maps may also include manmade features.

Tornado. A violently rotating column of air extending ground-ward

Tropical Cyclone. A generic term for a cyclonic, low pressure system over tropical or sub-tropical waters

Tropical Storm. A tropical cyclone with maximum sustained winds greater than 39 miles per hour and less than 74 miles per hour.

URI. University of Rhode Island.

USACE. United States Army Corps of Engineers

USDA. United States Department of Agriculture.

USGS. United States Geological Survey.

VFA. Volunteer Fire Assistance Grants

Vulnerability. Describes how exposed or susceptible to damage an asset is. Vulnerability depends upon an asset’s construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another.

WFO. Weather Forecast Office.

Wildfire. An uncontrollable fire spreading through vegetative fuels, exposing and possibly consuming structures.

WRB. Water Resources Board.

WSSMP. Water Supply System Management Plan program.

WUI. Wildland Urban Interface.

ZONE A (UNNUMBERED). Special Flood Hazard Areas subject to inundation from the 100-year flood. Because detailed hydraulic analyses have not been performed, no base flood elevations or depths are shown. Mandatory flood insurance purchase requirements apply.

ZONE AE and A1-30. Special Flood Hazard Areas subject to inundation by the 100-Year flood determined in a Flood Insurance Study by detailed methods. Base flood elevations are shown within these zones. Mandatory flood insurance purchase requirements apply. (Zone AE is used on new and revised maps in place of Zones A1-30.)

ZONE AH. Special Flood Hazard Areas subject to inundation by 100-year shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base flood elevations derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements apply.

ZONE AO. Special Flood Hazard Areas subject to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. Mandatory flood insurance purchase requirements apply.

ZONE X. Areas that have been identified in the community flood insurance study as areas of moderate or minimal flooding from a principal source in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Flood insurance is available in participating communities but is not required by regulation in these zones.

Disaster Mitigation Act of 2000 and Implementing Regulations

The intent of DMA 2000 was to facilitate cooperation between State and local authorities. It encourages and rewards local and State disaster planning in advance of disasters in order to promote sustainability of communities and services as a strategy to improve disaster resistance. This enhanced pre-disaster planning effort is intended to support State and local governments' efforts to articulate accurate, targeted, and prioritized needs for hazard mitigation that will reduce exposure to natural hazards. This effort is intended to support timely funding allocation to encourage effective risk reduction strategies and projects.

FEMA prepared an Interim Final Rule, published in the Federal Register on February 26, 2002 within 44 CFR Parts 201 and 206 that establishes planning and funding criteria for states. The Final Rule was published in October, 2009. The Guidance and Standard Plan Crosswalk were revised November 4, 2006 and was further updated to include requirements for 90%-10% Federal funding for the SRL and FMAP in January, 2009. The completed Crosswalk for the *2014 Rhode Island Hazard Mitigation Plan Update* is located in Appendix 1.

44 CFR Part 201

44 CFR § 201.1 et seq. was promulgated by the FEMA on February 26, 2002 in order to implement DMA 2000. The interim final rule was amended several times to address standard and enhanced state plans during 2007. Revised guidance for local plans was released July 1, 2008 with a major revision slated for September 2013. In addition, guidance for the FMAP (44 CFR § 201.4 et seq.) requires amendment of state plans per a new crosswalk for these programs issued on January 14, 2008. The rule addresses state mitigation planning, and specifically in 44 CFR § 201.3 (c) identifies the states' mitigation planning responsibilities, which include:

1. Prepare and submit to FEMA a Standard Hazard Mitigation Plan following criteria established in 44 CFR § 201.4 as a condition of receiving Stafford Act assistance (except emergency assistance).

2. For consideration for 20 percent HMGP funding, prepare and submit an Enhanced State Mitigation Plan in accordance with 44 CFR § 201.5, which must be reviewed and updated, if necessary, every three years from the date of the approval of the previous plan.

3. Review and if necessary, update the Standard State Mitigation Plan by November 1, 2004, and every three years from the date of approval of the previous plan in order to continue program eligibility.

4. Make available the use of up to the seven percent of HMGP funding for planning in accordance with 44 CFR § 206.434. *See* 44 CFR § 201.3 (c).

44 CFR § 201.4, Standard State Mitigation Plans, lists the required elements of SHMPs. Under 44 CFR § 201.4 (a), by November 1, 2004 states must have an approved Standard SHMP that meets the requirements of the regulation to receive Stafford Act assistance.

The planning process, detailed by 44 CFR § 201.4 (b), must include coordination with other state agencies, appropriate Federal agencies and interested groups. Guidance for state standard and enhanced plans and local and multi-jurisdictional plans has been updated several times to incorporate changes from the Katrina Reform Act, Unified Hazard Mitigation Assistance Grant Programs and "lessons learned" through the first cycle of state and local mitigation planning. Current state standard plan guidance and the state plan cross walk were used to inform the *2014 Rhode Island State Hazard Mitigation Plan Update.*

44 § 201.4 (c), Plan content, identifies the following elements that must be included in a SHMP:

1. A description of the planning process used to develop the plan;

2. Risk assessments that provide the factual basis for activities proposed in the strategy portion of the mitigation plan;

3. A Mitigation Strategy that provides the state's blueprint for reducing losses identified in the risk assessment;

4. A section describing Coordination of Local Mitigation Planning;

5. A Plan Maintenance Process, including a method and schedule for monitoring, evaluating and revising the plan; a system for monitoring implementation of mitigation strategies and projects; and a system for reviewing progress in achieving goals, objectives and strategies as well as project implementation;

6. A Plan Adoption Process for formal adoption by the State prior to submittal to FEMA for final review and approval; and

7. Assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to grant funding periods, in compliance with 44 CFR 13.11(c). The state must amend its plan whenever needed to reflect changes in state or federal laws and statutes as required by 44 CFR 13.11 (d).

8. Revisions to plans per guidance issued January 14, 2008 must include a program strategy for state eligibility for 90 percent federal funding for the SRL Program for FY 2008 and the FMAP for FY2009. Plan revisions must in compliance with 44 CFR 201.4.

44 CFR Part 206

On February 26, 2002, FEMA also changed 44 CFR Part 206 in order to implement DMA 2000 (See 67 Federal Register 8844 [February 26, 2002]). Changes to 44 CFR Part 206 authorize HMGP funds for planning activities and increase the amount of HMGP funds available to states that develop an Enhanced Mitigation Plan. FEMA amended Part 206 in 2006 following the passage of the Katrina Reform Act which restored HMGP funding to 15 percent of eligible disaster recovery costs for states with approved Standard Mitigation Plans.

44 CFR Part 400

(a) As a condition of the receipt of any disaster assistance under the Stafford Act, the applicant shall carry out any repair or construction to be financed with the disaster assistance in accordance with applicable standards of safety, decency, and sanitation and in conformity with applicable codes, specifications and standards.

(b) Applicable codes, specifications, and standards shall include any disaster resistant building code that meets the minimum requirements of the NFIP as well as being substantially equivalent to the recommended provisions of the National Earthquake Hazards Reduction Program (NEHRP). In addition, the applicant shall comply with any requirements necessary in regards to Executive Order 11988, Floodplain Management, Executive Order 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction, and any other applicable Executive orders.

(c) In situations where there are no locally applicable standards of safety, decency and sanitation, or where there are no applicable local codes, specifications and standards governing repair or construction activities, or where the Regional Administrator determines that otherwise applicable codes, specifications, and standards are inadequate, then the Regional Administrator may, after consultation with appropriate State and local officials, require the use of nationally applicable codes, specifications, and standards, as well as safe land use and construction practices in the course of repair or construction activities.

(d) The mitigation planning process that is mandated by section 322 of the Stafford Act and 44 CFR part 201 can assist State and local governments in determining where codes, specifications, and standards are inadequate, and may need to be upgraded.

Post-2010 Federal Policy Updates

Biggert-Water Flood Insurance Reform and Modernization Act of 2012

On July 6, 2012, the Biggert-Waters Flood Insurance Reform and Modernization Act of 2012 (BW12), was signed into law. It represents significant changes to fundamental operation and management of the NFIP. Many policyholders will see revised flood insurance rates that more accurately reflect the actuarial rate, or true flood risk, of their insured property. These measures were inserted into the law to help financially stabilize the NFIP. Furthermore, these provisions change how FIRM updates impact policyholders through increased premiums resulting from more accurate predictions of risk. The legislation also consolidates three HMA programs funded through the NFIP: the RFC, FMA, and SRL programs.

Sandy Recovery Improvement Act of 2013

On January 29, President Obama signed the Sandy Recovery Improvement Act of 2013. The Act sets out certain reconstruction and grant administrative standards that apply to the States that received the Sandy Presidential Declaration of Disaster. Some implications of the Act could be seen in general revised FEMA HMA Guidance released in July 2013 and other Federal recovery funds.

The Federal Hurricane Sandy Rebuilding Task Force has also announced that all Sandy-related rebuilding projects funded by the supplemental spending bill must meet a single uniform flood risk reduction standard. The standard is informed by the best science and practices, including assessments taken following Hurricane Sandy. It brings the Federal standard into alignment with many existing State and local standards and takes into account the increased risks in the Sandy-affected region caused by extreme weather events, SLR, and other impacts of climate change. The standard applies to the rebuilding of structures that were substantially damaged during the storm and will be repaired or rebuilt with Federal funding. As a result, the new standard will require owners of residential, commercial, or infrastructure projects who are applying for Federal dollars to plan for increased flood risk by elevating or otherwise flood proofing to one (1) foot above the elevation recommended by the most recent available Federal flood guidance. Again, these new program requirements applied to the Sandy-impacted region could eventually extend to these programs nationwide.

Requirements derived from the Sandy Recovery Act do not retroactively affect Federal aid that was previously given to property owners and communities in Sandy-impacted areas. Insurance rates under the NFIP are not impacted. Moving forward, the Federal standard applies to substantial rebuilding projects (i.e., when damage exceeds 50 percent of the value of the structure) that will rely on Federal funding.

The specific steps required for these types of structures include:

- Elevating. The standard would require elevating the lowest floor of a structure1 foot higher than the most recent flood risk guidance provided by FEMA; and/or
- Flood proofing. In situations where elevation is not possible, the standard will require that structures be prepared for flooding that is one (1) foot higher than the most recent flood risk guidance provided by FEMA. Examples of this approach include relocating or sealing boilers or other utilities that are situated below the standard elevation.

These additional steps are intended to protect communities from future risk and to protect taxpayer investments over the long term. The programs which received funding in the supplemental bill and will be impacted by this standard include:

- HUD: Community Development Block Grant Disaster Recovery program
- Department of Health and Human Services (HHS): Construction and reconstruction projects funded by Social Services Block Grants and Head Start
- FEMA: HMGP and PA Program
- U.S. EPA: The State Revolving Fund (SRF) programs
- U.S. DOT: Federal Transit Administration's Emergency Relief Program, as well as some Federal Railroad Administration and Federal Highway Administration (FHWA) projects

Appendix 2: Planning Process

SIHMC Members

Information (agency, contact, and attendance) on the SIHMC members is shown in the table below.

Agency/Program	Contact Name	Title	Kickoff Meeting 2/7/2013	WebEx#1: Climate Change 2/26/2013	WebEx#2: Water & Wind 3/26/2013	WebEx#3: Geo Hazards, Capabilities, and Public 5/1/2013	HIRA & Action Meeting 6/21/2013	WebEx#4: Mitigation Strategies & Prioritization 7/12/2013	WebEx#5: Draft Plan review 10/14/2013
Coastal Resources Management Council (CRMC)	Grover J. Fugate	Executive Director		X	X				
	James Boyd	Coastal Policy Planner					X		
	Janet Freedman	Coastal Geologist	X	X	X			X	
Eastern Connecticut State University	Brian Oakley	Asst. Professor of Environmental Geoscience		X	X				
Federal Emergency Management Agency (FEMA)	Brigitte Ndikum-Nyada	Community Planner		X	X				
	De'an Bass	Disaster Recovery Coordinator	X	X	X				
	Donna Nelson	Hazard Mitigation Assistance Specialist	X						
	Marilyn Hilliard	Senior Planner/ Disaster Operations Coordinator			X				
	Nan Johnson	Community Planner	X	X	X	X	X	X	X
Housing and Community Development	Laura Sullivan	CDBG Disaster Recovery Manager	X						X
National Grid	Andrew Schneller	Manager of Emergency Planning					X		

Agency/Program	Contact Name	Title	Kickoff Meeting 2/7/2013	WebEx#1: Climate Change 2/26/2013	WebEx#2: Water & Wind 3/26/2013	WebEx#3: Geo Hazards, Capabilities, and Public 5/1/2013	HIRA & Action Meeting 6/21/2013	WebEx#4: Mitigation Strategies & Prioritization 7/12/2013	WebEx#5: Draft Plan review 10/14/2013
National Weather Service (NWS)	Alan Dunham	Meteorologist	X	X	X				
	David Vallee	Hydrologist-in-charge	X	X	X		X		
Natural Resource Conservation Service (NRCS)	Kevin Farmer	State Conservation Engineer			X				
	Alan Gillespie	Civil Engineer					X		
	R. Phou Vongkhamdy	State Conservationist			X				
Northeast States Emergency Consortium (NESEC)	Davis Acker	Executive Assistant	X	X	X				
	Edward Fratto	Executive Director	X	X	X				
Public Utilities Commission and Division of Public Utilities and Carriers	Thomas Kogut	Associate Administrator (CATV)/Chief of Information	X	X		X	X	X	X
Rhode Island Department of Environmental Management (DEM)	Bill Patenaude	Principal Engineer			X			X	
	Jim Ball	Emergency Response Coordinator		X	X				
Rhode Island DEM Emergency Response	John Leo	Emergency Responder					X		
Rhode Island Department of Administration (DOA)	Kevin Carvahlo	Risk Manager	X				X		
Rhode Island Department of Business Regulation (DBR)	Paula Pallozzi	Chief Property & Casualty Insurance Analyst	X						
Rhode Island Department of Health (HEALTH)	Alysia Mihalakos	Interim Chief	X			X			
	Julia Gold	Climate Change Program Manager					X		X

Agency/Program	Contact Name	Title	Kickoff Meeting 2/7/2013	WebEx#1: Climate Change 2/26/2013	WebEx#2: Water & Wind 3/26/2013	WebEx#3: Geo Hazards, Capabilities, and Public 5/1/2013	HIRA & Action Meeting 6/21/2013	WebEx#4: Mitigation Strategies & Prioritization 7/12/2013	WebEx#5: Draft Plan review 10/14/2013
	June Swallow	Drinking Water Quality Chief			X	X			
	Carlene Newman	Environmental Engineer					X	X	
Rhode Island Department of Transportation (DOT)	Arthur Bovis	Programming Services Officer					X		
	Joseph Baker	Highway & Bridge Maint. Administrator		X	X			X	
Rhode Island Division of Planning (DOP)	Chelsea Siefert	Principal Planner	X	X	X	X	X	X	X
	Shane White	RIGIS Coordinator					X		
Rhode Island Division of State Fire Marshal	Richard James	Chief Deputy	X						
Rhode Island Emergency Management Agency (RIEMA)	Armand Randolph	Public Information Officer	X		X	X			
	Bob Sturdahl	Critical Infrastructure Coordinator					X		
	Jess Stimson	State Hazard Mitigation Officer	X		X	X	X	X	X
	Michelle Burnett	Assistant Chief of Planning	X				X		
Rhode Island Insurance Division	Beth Vollucci	Insurance Rate Analyst		X	X				
Rhode Island Office of Lieutenant Governor	Valivd Ibarra	Senior Policy Analyst			X				
State Building Code Commission	Jack Leyden	State Building Commissioner	X						
University of Rhode Island CRC and the Rhode Island Sea Grant College Program	Michelle Carnevale	Project Manager		X	X				
	Pamela Rubinoff	Coastal Extension Specialist		X	X			X	
	Teresa Crean	Coastal Community Planner					X		
University of Rhode Island	Greg Bonynge	RI Geospatial Extension Specialist					X		

Agency/Program	Contact Name	Title	Kickoff Meeting 2/7/2013	WebEx#1: Climate Change 2/26/2013	WebEx#2: Water & Wind 3/26/2013	WebEx#3: Geo Hazards, Capabilities, and Public 5/1/2013	HIRA & Action Meeting 6/21/2013	WebEx#4: Mitigation Strategies & Prioritization 7/12/2013	WebEx#5: Draft Plan review 10/14/2013
Environmental Data Center									
University of Rhode Island Geosciences	Jon Boothroyd	Research Professor Emeritus		X	X		X		X

SIHMC Member Participation and Roles

The table below summarizes the stakeholder participation for the 2014 plan update. This listing includes many of the SIHMC members as well as additional stakeholders who provided input into the plan development.

Team Member	Agency	Role in 2014 Plan Update
Jessica Stimson Michelle Burnett Robert Sturdahl John Washburn Gilbert Woodside	RIEMA	• Oversaw Plan Update • Mitigation Action status • Local Plan Incorporation • State and critical facilities data • Statewide GIS data • Repetitive and Severe Repetitive Loss data • Critical and State Facilities data review and supplements
Chelsea Siefert	DOP	• Mitigation Goals and Objective revision • Capability Assessment • Plan review
David Vallee	NWS	• Capability Assessment • Subject-Matter expert and reviewer for HIRA • History of events • Drought data
Janet Freedman Pam Rubinoff Bill Patenaude	CRC CRMC DEM	• Capability Assessment • Subject-Matter expert and reviewer for HIRA (specifically SLR, Climate Change, and Coastal Erosion) • Climate Change and Seal Level Rise data
Nick Larmore Alysia Mihalakos Carlene Newman	HEALTH	• Capability Assessment • Subject-Matter expert (facilities) and reviewer for HIRA • Mitigation Action development
Ed Fratto	NESEC	• Hazus-MH summary reports
Kenneth Burke	RI Water Resources Board	• Capability Assessment
Laura Sullivan	DOA	• Capability Assessment
Guy Lefebvre	RI Rivers Council	• Capability Assessment
Rebecca Lee	ProvPlan	• Capability Assessment
Bruce Payton	RI DFE	• Wildfire data and section review
Craig Kampmier	Elmhurst Extended Care	• Capability Assessment • Public Survey Comments
Greg Bonynge	URI GIS	• Capability Assessment
Marion Gold Chris Kearns	Energy	• Capability Assessment

Team Member	Agency	Role in 2014 Plan Update
Byron Rupp	USACE	• Capability Assessment
Gardner Bent	USGS New England Water Science Center	• Capability Assessment
Joseph Baker	RIDOT	• Capability Assessment
Robert Schneller Thomas Kogut	National Grd Public Utilities	• Capability Assessment • Mitigation Action development
DBR		• Sandy insurance reports
FEMA		• NFIP data

Meeting Documentation

Project Kick-off meeting: February 7, 2013

Rhode Island State Hazard Mitigation Plan Update
Kick-Off Meeting Notes 2-7-2013

Agenda

February 7th, 2013 9:00 – 12:00 PM
Radisson 2081 Post Rd Warwick, RI 02886

Purpose: *Getting Organized, Jump-starting the Revision Process*

Description	Lead	Time
Welcome, Introductions and How We'll Communicate • Project Team • Expectations • Planning Process • Update Requirements • Improvements to 2011	Armand Randolph, RIEMA State Hazard Mitigation Officer Liam O'Keefe, Hagerty Scott Choquette, Dewberry	9:00 – 9:30

Updating the Hazard Identification & Risk Assessment
• Overview of HIRA Planning Process
• Hazard Analysis consistent with State Hazards
• New Hazards to Consider?
• Data Needs
  o Data discrepancies from previous plan, what can be improved?
  o Critical Facilities and Assets
  o Hazard Specific Data Sources
• Local Hazard Mitigation Plan Incorporation
• Review of Existing Ranking
	Rachael Herman, Dewberry	9:30 – 10:30
		
		Break – 10am

Evaluating 2011: • Mitigation Actions • Program Capacity • Planning Integration	Scott Choquette, Dewberry	10:45– 11:15
Wrap Up and Future Meetings • Project Schedule - Milestones • Next Mitigation Council Meeting • Overview of Action Items	FEMA Region I Rachael Herman, Dewberry	11:15– 12:00

Attendees: RI State Hazard Mitigation Committee; RIEMA; FEMA Region I; Hagerty & Dewberry

Attachments:
1. Meeting Notes (following page)
2. RI Kickoff presentation (pdf as separate document attached to email)

Rhode Island State Hazard Mitigation Plan Update
Kick-Off Meeting Notes 2-7-2013

Attendees:

- Alysia Mihalakos (Health)
- Alan Dunham (NWS)
- Kevin Carvalleo (State Administration)
- Jack Leyden (RIBCC)
  Richard James (RISFMO)
- David Vallee (NWS)
- Davis Acker (NESEC)
- Thomas Kogut (DPUC)
- Nan Johnson (FEMA R1)
- Janet Freedman (CRMC)
- Jess Stimson (RIEMA)
- Michele Burnett (RIEMA)
- Chelsea Siefert (Division of Planning)
- Laura Sullivan (Office of Housing)
- De'an Bass (FEMA CRTF)
- Paula Pallozzi (DBR)
- Donna Nelson (FEMA R1)
- Armand Randolph (RIEMA)
- Liam O'Keefe (Hagerty)
- Scott Choquette (Dewberry)
- Janna Newman (Dewberry)
- Rachael Herman (Dewberry)

I. Armand welcomed everyone to the kick-off meeting and introduced the Hagerty/Dewberry team that has been contracted to update the RI hazard mitigation Plan.

II. Scott walked the committee through the update process and expectations of the steering committee.

III. Rachael led a discussion about improvements that can be made to the current mitigation plan.

- Additional Stakeholders to include:
  - Department of Environmental Management – particularly Wastewater group who have data from March 2010 storm
  - URI Sea Grant – Theresa Creane – have study on sea level rise and may have information on contact for maritime development plan (fishing/shellfishing)
  - Manufacturing company in Cumberland, RI that is susceptible to a great deal of riverine flooding
  - EDC – RI Economic Development Corporation

- The committee discussed other Plans/Studies to include/review for the HIRA and Capability Assessment. Data and reports should be sent to Rachael and Janna for inclusion. Janna will be conducting the Capability Assessment in the coming weeks and will follow-up with agencies as needed.
  - Sea Level Rise Study - from RIDOT
  - Sea Level Rise Study - from Sea Grant
  - Wetland Migration Plan – from CRMC

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- Beach Management Plan – from CRMC
- Housing and Development Plan – from Housing contact
- Climate Change and Health Plan – from Health contact
- USGS March 2010 Storm study and data
- Information about substations and utilities post 2010 storm, post Irene, and post Sandy from utilities contact
- Railway vulnerability study in RI – from Armand Randolph
- Energy Assurance Plan from Office of Energy Resources
- Sustainable Communities Plan
- Economic Development Plan
- Urban Flooding Study conducted by NWS for Southern New England

IV. Rachael led a discussion about improvements that can be made to the current mitigation plan.

- Data needed for HIRA update:
  - State Facility Data (Jess Stimson and Thomas Kogut): includes state facility values, insurance claims, and the flood zones that facilities are located in.
  - Land Use/Future Land Use/Population Projection data. RI Division of Planning has this. Email Chelsea for information.

- Changes to hazard classification:
  - Shoreline Change Data: CRMC – Janet Freedman
  - Include flash flood in Water Related hazards (remove as separate section)
  - Change Flood Related hazards to Water Related hazards
    - March 2010 event was not flash flooding but was riverine flooding
  - Include landslide in coastal erosion profile
  - State that coastal erosion and dam breach don't have to occur strictly as a result of a flood but that they risk is increased by flooding events
  - Add WUI/Wildfire
  - Add extreme heat?
  - Include landslide in erosion discussion

- Changes to HIRA:
  - Vulnerabilities of utilities, infrastructure, transportation, ports, major employers
  - Increase capacity to plan for climate change (coordination)

V. Mitigation Goals were reviewed by Scott and the steering committee. Discussions on goals, objectives, and actions will continue over the next several months as the HIRA is completed. The next in-person meeting (April/May) will focus on Mitigation Strategies.

Rhode Island State Hazard Mitigation Plan Update
Kick-Off Meeting Notes 2-7-2013

- Goal 1: Enhance the State of Rhode Island's capacity to promote and implement projects, programs, policies, and legislative actions to minimize losses due to natural hazards.
    - The second part of Goal 1 was suggested to become an action: Properties with repetitive and severe repetitive losses due to flooding.
    - Strategy 1.1 should be expanded to include post-disaster
- Goal 2: Build and support statewide and local capacity and commitment to continuously becoming less vulnerable to natural hazards.
    - Should include an element of increased collaboration with state agencies.
- Updates to Mitigation Actions from Previous Plan: HWM data from March 2010 storm is currently being added to DFIRMs

VI. FEMA Region I provided some comments to keep in mind while updating the mitigation plan:

- Stakeholder involvement: especially outside of State government agencies to bring additional perspectives, solutions, and resources to the process .
- Planning process: identifying a communication network to discuss, analyze, evaluate with those involved in the process including those wanting to be involved.
- Try to update and improve the changes in development and how this changes risk
- How will the State access more funding? What other grants are available for RI? What other ways can this be supported (ie. adopting new state statutes)?
    - Review: NY and NJ are looking into additional strategies and resources to bring land use solutions and to support the local communities.
- Include secondary/cascading hazards in HIRA. This will be addressed through the HIRA sub-committee conference calls.

Additional Notes:

- Providence EMA Code Red is holding 2 workshops for business resiliency
- Social coordinator for RIEMA may have ideas for public outreach

FTP Site:

Email or call Rachael (rherman@dewberry.com or phone 585.429.7448) once files are posted. Files are automatically deleted every 5 days.

ftp.dewberry.com
username - RhodeIslandHMPupdate
password - 7X4TUY (case sensitive)

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HAGERTY
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Rhode Island State Hazard Mitigation Plan Update 2014

February 7th, 2013

Presented by:
Rachael Herman, CFM
Scott Choquette, CFM

Meeting Agenda

- Welcome & Introductions
- Hazard Mitigation Planning Process
  - Plan Update Requirements & Data Availability
  - Ranking Methodology, Risk & Vulnerability
  - Evaluating 2011 Mitigation Actions, Program Capacity, Planning Integration, Public Outreach
- Wrap Up and Future Meetings

Project Team

- Rhode Island Hazard Mitigation Steering Committee: aka "the decision makers"
- RIEMA
- FEMA Region I
- Hagerty-Dewberry Team
  - Liam O' Keefe – Project Manager
  - Carrie Speranza/Corinne Bartshire – HMP Project Managers
  - Scott Choquette – Subject Matter Expert/Mitigation Strategies
  - Rachael Herman – Deputy PM/ Technical Lead
  - Janna Newman – Lead Planner
  - Katie Freeman – HIRA and Capability Assessment

Hazard Mitigation Plan Update Process

- Data Collection & 2011 Plan Evaluation
- Hazard Identification & Risk Assessment
- Mitigation Goals, Strategies, and Projects (progress, revisions and additions)
- Project Scoping
- Capability Assessment & Plan Maintenance
- Public Outreach
- Draft Plan Submittal and Review
- Plan Adoption
- Plan Submission to REIMA & FEMA

Planning Process

It's Your Plan!

We are here to:

- ✓ Facilitate the process
- ✓ Lend technical expertise & consultation
- ✓ Do the heavy lifting

You need to:

- ➢ Participate and contribute hazard information
- ➢ Make the final decisions
- ➢ Ensure a feasible plan that meets your needs

Plan Update Requirements

- Must be updated every 3 years
  - Adopted & Approved: April 8, 2011
  - April 2008
  - April 2005
- Re-assess Hazard Identification and Risk Assessment (HIRA)
  - Consider changes to hazards and vulnerability of people and assets
  - Address hazard events that have occurred since the last plan

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Plan Update Requirements

- Incorporate local planning efforts with RI State Plan
  - Burrillville, Central Falls, Charlestown, East Greenwich, Exeter, Lincoln, Little Compton, Narragansett, New Shoreham, North Kingstown, North Smithfield, Providence, Warren, Warwick, West Warwick and Woonsocket.
- Report on progress with mitigation strategy to-date and discuss adjustments
- Address weaknesses identified in previous plan review

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Improvements: *Discussion with SHMC*

- *What do you like about current State plan?*
- *Are there other efforts currently going on that we should be aware of?*
- *Have the necessary people/departments been asked to participate?*
- *How can this plan help your agency?*
- *What would you like changed in this revision?*

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Hazard Identification & Risk Assessment

- **Purpose:** Provides a factual basis for prioritizing hazard mitigation activities
- **Major components:**
  - Identify and profile natural hazards affecting the state
  - Describe vulnerability to jurisdictions and estimate losses
  - Describe vulnerability to state owned/operated facilities and critical facilities, and estimate losses
  - Incorporate findings of local plans

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Data Discrepancies: *Discussion with SHMC*

- *What can be improved?*
- *HIRA to inform mitigation projects/activities*
- *Does your locality/agency have new data sources that have been created since the 2011 plan revision?*
- *What types of data would you like to see in the revision?*

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Data Needs: *Building & Critical Facilities*

- State Owned or Operated Facilities (Geospatial, addresses, types)
  - Building Specific (year, materials, value…)
  - Infrastructure
- Critical/Essential Facilities
  - Shelters, Police, Fire Dept, Hospitals
  - Local Facilities with Building Specific Parameters
  - Hazus-MH default Data

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Data Sources & Needs

- Demographics
  - 2010 Census Data
  - American Community Survey
- Hazard Data
  - Federally Declared Disasters (TS Irene & Hurricane Sandy)
  - Flood Related: FEMA FIRMs, FEMA Rep Loss, NCDC, SLOSH & Hazus-MH
  - Wind Related: Hazus-MH,NCDC & SVRGIS
  - Winter Related: NCDC and NWS station data
  - Drought: PDSI, water supply/shortage reports
  - Geologic Related: RI Geological Survey, USGS, National Atlas
- Land Use
  - State & Local Planning Efforts (population changes and/or shifts, changes in land use activities)
  - National Land Cover Data (NLCD)
  - RIGIS

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Historical Disaster Databases

- List of Federally Declared Disasters from FEMA
  - Jurisdictions declared
  - Nature of disaster
  - Type(s) of assistance provided
- NWS / National Climatic Data Center (NCDC) Storm Events Database
  - Area Impacted
  - Damages
  - Description of event
- ***Other Data Sources??***

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Local Plan Integration

- Survey of Plans
  - Hazard Identification terminology
  - Vulnerability and Risk Assessment methodologies
  - Types of Mitigation Actions
- Incorporate ranking and loss estimates into State vulnerability

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Local Plan Integration

- Identified 51 hazards
- Majority fall under the broad hazard categories in State plan

Table 4-21
Hazards Identified in Local Hazard Mitigation Plans

Hazard Identified	Frequency	Hazard Identified	Frequency
Drought	1	Nor'easter - Snowstorm	1
Coastal Erosion	4	Nor'easter - Snowstorm and Ice	1
Coastal Erosion and Sea Level Rise	1	Severe Weather (winter, Nor'easter, high winds)	3
Coastal Storms	2	Severe Weather (winter)	1
Conflagration (wildland fire or fire)	3	Severe Winter Storm	5
Dam Failure	1	Severe Winter Storm, (Nor'easter)	1
Drought	5	Snow and Ice (Severe Winter Storm)	1
Earthquake	24	Snow - Snowstorm	1
Ice Rapids, Fire and Dam Failure	1	Storm Surge	2
Ice Rapids and Forest Fire	1	Tropical(Hurricane) Storm	3
Fire	1	Tornado and Wind Storm	1
Forest Fire	1	Thunderstorm	3
Flood - Flooding	11	Thunderstorm and Lightning	1
Riverine Flood	1	Thunderstorm and Tornado	1
Flooding and Dam Failure	1	Tornado	11
Hailstorm	13	Tropical Cyclone	3
Hazardous Materials Event	3	Tsunami	1
Heat Wave	1	Urban Fire	4
Heavy Rain / Flood	9	Urban/Wildland Interface Fire	1
Hurricane	24	Wildfire	3
Hurricane and Coastal Flooding	1	Wind (hurricane, Nor'easter, tornado)	1
Hurricane and Coastal Storm	2	Windstorm	11
Inland Flood	1	Windstorm and Tornado	1
Lightning	12	Winter Storm	1
Nor'easter	2	Winter Weather	1
Nor'easter and Winter Storm	1		

Source: Analysis of local hazard mitigation plans.

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Hazard Prioritization

Listed in order of frequency and impact, starting with the most frequently occurring:

1. Flood-related hazards (riverine, coastal, flash, surge, erosion, climate change/sea level rise, hurricanes, nor'easters, urban/stormwater, dam breach)
2. Wind-related hazards (hurricanes and tornadoes)
3. Winter-related hazards (heavy snow, ice storms, extreme cold)
4. Drought
5. Flash Floods
6. Geologic-related hazards

Does the prioritization need to be modified for the update?

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Hazards Not Addressed

Due to lack of frequency, minimal probability, lack of resources for likelihood or potential occurrence or impact

1. Volcanoes
2. Tsunamis
3. Landslides
4. Land Subsidence
5. Avalanche
6. Expansive Soils
7. Extreme Heat
8. Hail
9. Wildfire

Should any of these hazards be included in the 2013 update?

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Flood Related Hazards

- Riverine
  - 9 events since plan update $70K
- Coastal Flooding
  - Flood prone access routes: Beavertail Rd, Matunuck Beach Rd, and Arnolds Neck Road
  - Superstorm/Hurricane Sandy (12/29/2012)
- Flash
  - March 2010: Cranston, Warwick, West Warwick, Westerly, Coventry
  - 7 events since 2011 plan update $80K
- Storm Surge (Hurricanes, Nor'easters)
- Coastal Erosion
  - Coastal Resources Management Council shoreline change maps
- Climate Change and Sea Level Rise
  - 1' SLR in 25 years and 5' SLE by 2100

Mitigation Action 2.1.12:
Incorporating March 2010
high water mark data into FIRMs

19

Flood Related Hazards

- Hurricanes
  - Record Storm Surge: 1938 Hurricane and Hurricane Carol 1954
- Nor'easters
  - 1-2 times per year with 2' storm surge
  - Coastal erosion
- Urban Flooding/ Storm Water Runoff
  - Aging sewer systems
  - Undersized stormwater infrastructure

Mitigation Action 3.1.3:
Urban flood probability

20

Flood Related Hazards

- Dam Breech
  - 671 Dams
    - 97 High, 83 Significant, and 491 Low Hazard
  - Department of Environmental Management (DEM)
    - Enforcing dam safety program
    - Dam Safety Regulations 12/20/2007
    - Request for inspection
    - 2008: Dam owner contact and registration
  - Inundation Mapping and Inventory
    - FEMA National Dam Safety grants
    - Emergency Action Plans (EAP)

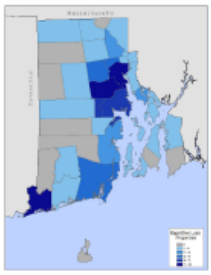
Mitigation Action 3.3.3:
History of Dam Failures
Potential Dam Failure
Inundation Maps
Dam Inventory

21

Severe Repetitive Loss

Figure 4.32:
Severe Repetitive Loss

Figure 4.31:
Repetitive Loss Properties



22

Wind-Related Hazards

- Hurricanes
  - 30 hurricanes
    - 9/21/1938: 262 deaths & $100 million in damages
    - 9/31/1954: 19 deaths $200 million in damages
  - ACOE SLOSH maps (9/2009)
    - 21 coastal communities
  - Probability: 6% annually
- Tornadoes
  - 10 tornadoes 1972 – 2010 $3.5 million property damage, 23 injuries
  - Block Island August 2012 $50K

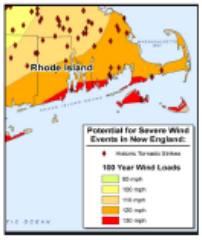
Mitigation Action 3.1.6:
Tornado Probability

23

Wind-Related Hazards

Figure 4.35
Hurricane Activity

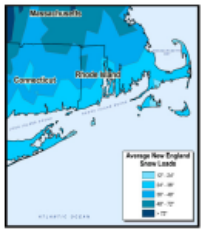
Figure 4.34
Tornado Strikes



24

Winter-Related Hazards

- Historical Events
  - 1978, 1991 Halloween Storm, 2003 Presidents Day Storm, 2005 Blizzard
  - 19 snow & ice events 2008 – 2010
  - 14 events since last plan update
- Heavy Snow
- Ice Storms
- Extreme Cold
- Probability : >1 snowfall event/yr

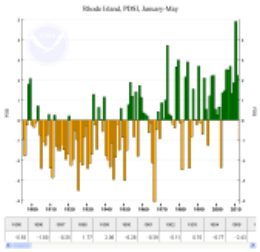


Mitigation Action 3.1.4: Winter Probability

25

Drought

- Historically about 1 drought every 11 years
- April & May 2012
- Water Allocation



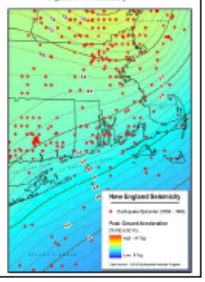
Mitigation Action 3.1.5: Drought Probability

26

Geologic-Related Hazards

- Earthquake
  - 1776-2007: 38 earthquakes
  - 6/10/1951: Kingston, RI magnitude 4.6
  - Moderate seismicity and high risk

Figure 4.40 Seismicity



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Vulnerability Assessment

- NOAA Coastal Services Center (NOAA CSC)
  - Community Vulnerability Assessment Tool
    1. Hazard Score = Frequency Score * Area Impact Score * Intensity Score
    2. Vulnerability Score
    3. Combined Score (risk + vulnerability)
- Risk Scores
  - Frequency Score – events per year
  - Area Impact Score – how much area impacted
    - Relative Area - % of subregion
    - Absolute Area – sq mi impacted

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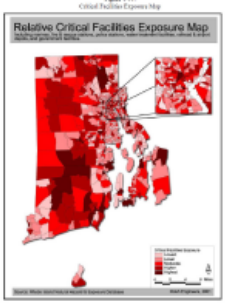
Scoring Vulnerability

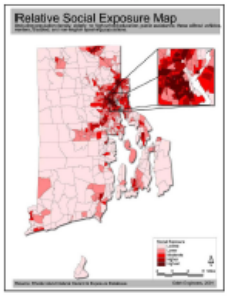
1. Critical Facilities
2. Populations at Risk
3. Enviro. Resources/Threats
4. Economic Values



30

Social Vulnerability

- Population Density
- Non-White
- Family below poverty level
- Over 65 years old
- Disabled Adults
- No high school education
- Public Assistance
- No Vehicle
- Rental Units
- Non-English Speaking



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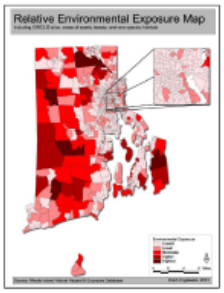
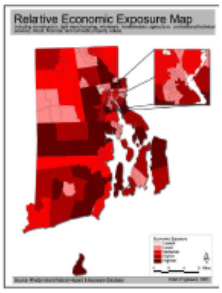
Environmental Resources

- CERCLA Sites
- Rare Species
- Scenic Vistas



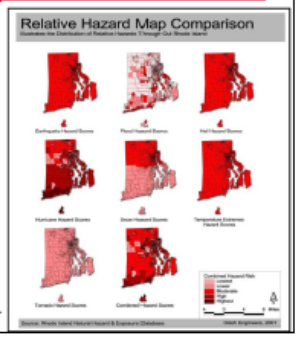
Economic Values

- Construction
- Manufacturing
- Wholesale
- Hotels/Motels
- Agriculture
- Professional/Tech Srvs
- Retail
- Financial
- Domestic



Combined Vulnerability

Combined Score =
Hazard Score x
Vulnerability Score



Supplemental Ranking Parameters

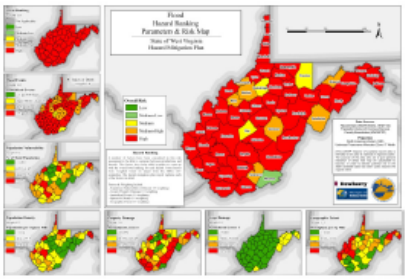
- **"Semi-Quantitative" Scoring System**
  - Actual Data Values grouped in categories 1-4 based on statistics
- **Data with normalization (inflation …)**
  - Limitations with probability & impact data
- **Parameters Used:**
  - **Population Vulnerability (weight 0.5)**
  - **Population Density (weight 0.5)**
  - **Annualized Events (weight 1)**
  - **Deaths & Injuries (weight 1)**
  - **Annualized Property Damage (weight 1)**
  - **Annualized Crop Damage (weight 1)**
  - **Regional Plan Hazard Rankings (weight 1)**
  - **Geographic Extent of Hazard (weight 1)**

Vulnerability Analysis and Loss Estimation

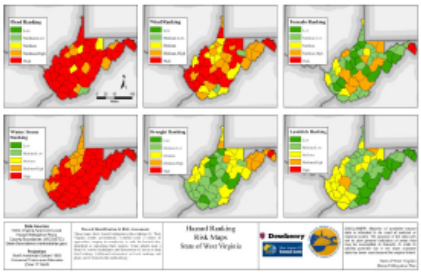
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate ….

- Annualized loss to be based on:
  - NCDC Storm Events and other local, State and Federal data (NFIP claims
  - Hazus
- Building Specific Analysis
  - Critical and State Facilities – Data Dependent
- Development Trends
  - Specific areas in high risk?
- Address vulnerabilities through mitigation actions

Example Hazard Specific Ranking



Example Ranking Comparison



Building Culture

Data Transfer to Dewberry

- Historical Data
- Hazard Specific Data (i.e. Dam Inundation)
- Facility (State and/or Critical)
- Insurance Claims
- Local Hazard Mitigation Plans
- Data used in previous plan and/or other planning efforts

Rachael Herman
(585) 429-7448
rherman@dewberry.com

Secure FTP site has been established for this project

Recap of HIRA Next Steps…

- Data Collection for Hazards & Critical Facilities (On-going)
- Collection of Development and Land Use planning documents
- Inclusion of disasters/events since 2011 plan
- Update Hazard & Vulnerability Analysis
  - Update/Apply Ranking Methodology based on HMSC Decisions & Available Data
  - Update Loss Estimations
- Map generation & Report writing

HIRA → Inform → Mitigation Strategies

Reduce societal, economic, and environmental exposure to natural hazard impacts

2011 Mitigation Goals

- **Goal 1:** Enhance the Rhode Island Emergency Agency's capacity to promote and implement projects, programs, policies and legislative action to minimize losses due to natural hazards, in particular for properties with repetitive and severe repetitive losses due to flooding
- **Goal 2:** Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.
- **Goal 3:** Improve coordination and communication with other relevant organizations, agencies and stakeholders.
- **Goal 4:** Increase public understanding, support and demand for hazard mitigation.

Objectives and Actions

- Divided into groups by Goal and Strategy:
  - 4 Goals, 10 Strategies
    - 56 Mitigation Actions
- Will need to provide updates to all actions!
  - RIEMA
  - Responsible Agencies
  - Complete narratives on updates, not just "completed" "deferred" "cancelled"

Planning Integration

- Discusses the State's support to the locals in developing local hazard mitigation plans and also regional hazard mitigation plans.
  - Provide an update on training conducted for locals, by the state
  - Discuss technical assistance
  - Update adoption dates
- Discuss funding availability to local jurisdictions in developing their mitigation plans.
- Discuss state support of local mitigation projects.

Outreach

- Steering Committee HIRA focus groups & WebEx
  - Contacts for Capability Assessment
- Social media updates
  - What works well?
- Plan link on RIEMA website requesting review and feedback

Wrap Up & Future Meetings

- Project Schedule
  - Data and Report Collection
  - HIRA Draft Review
  - Capability Assessment
- Next Committee Meeting
  - HIRA & Mitigation Strategies: April
  - Mitigation Strategies: May

Planning Process

WebEx#1 on Climate Change: February 26, 2013

Rhode Island State Hazard Mitigation Plan Update
WebEx #1: Climate Change and Sea Level Rise Meeting Notes 2-26-2013

Purpose:

To provide an open forum to discuss reports and data related to climate change and sea level rise that should be reviewed for inclusion in the 2014 RI Hazard Mitigation Plan Update. WebEx format:

1. 2011 RI Hazard Mitigation Plan
2. New reports or data available
3. Vulnerability analysis options

Attendees:

- Joseph Baker (DOT)
- Alan Dunham (NWS)
- David Vallee (NWS)
- Davis Acker (NESEC)
- Nan Johnson (FEMA R1)
- Janet Freedman (CRMC)
- Chelsea Siefert (Division of Planning)
- De'an Bass (FEMA CRTF)
- Pamela Rubinoff (URI Sea Grant)
- Michelle Carnevale (URI Sea Grant)
- Beth Vollucci (RI Insurance Division)
- Bridgitt (FEMA)
- Brian Oakley (Eastern CT State)
- John Boothroyd (URI Geosciences)
- Grover J. Fugate (CRMC)
- Marilyn
- Jim Ball (RI DEM)
- Valivd Ibarra
- Janna Newman (Dewberry)
- Rachael Herman (Dewberry)

Attachments:

WebEx1-ClimateChange.pdf

Meeting Notes:

1. Reports and data from the current 2011 plan were discussed. This includes a brief discussion of coastal erosion and climate change narrative. This section will be expanded for the 2014 plan based on available data and input from the steering committee.
2. New reports and data were discussed in detail. A summary of the reports/data is available in the table below. Agency Contacts will provide Rachael with reports and data. ***Ftp instructions are provided at the end of the meeting notes.***
3. Vulnerability analysis options will be dependant of the data provided by steering committee members. GIS data is needed for projected sea level rise scenarios. Analysis with this data will include overlaying the inundation zones with state and critical facilities to determine which ones are at risk. Similar analysis is being completed by the studies noted in the table below but will most likely not be available by the time the update is completed.

Rhode Island State Hazard Mitigation Plan Update
WebEx #1: Climate Change and Sea Level Rise Meeting Notes 2-26-2013

Agency/Group	Contact	Report/Data Title	Brief Report Summary	Date Completed	GIS Data Available	Plan/Data Provided
DOT	Joe Baker		GIS group within DOT is working on vulnerability assessment.	Summer/Fall 2013	*Follow-up needed to determine*	
DOT	Steve Cutham					
DOH DEM Wastewater Treatment Group	June Swallow Bill Patenaude	SafeWater RI initiative	Sea level rise affects drinking water, wastewater, etc. This will have tables that show facilities and dollar amts affected. It is about to expand to include the Wastewater Treatment group at DEM.			
DOH	June Swallow Pamela Rubinoff		HAZUS training for water quality and infrastructure in spring/summer from DOH?			
Division of Planning	Chelsea Siefert		DOP is evaluating DOT infrastructure in a new planning effort			
DOH Division of Planning	Bob Vanderslice Chelsea Siefert		DOH started another plan this past November on Climate Change and Health funded through CDC			
DEM Bay Waters and Coordination Team	Ames Cole	Climate Change Commission Report	Local climate change report			
Climate Change Task Force			Task force is still active. URI Sea Grant has up to date information for this.			
Natural Resources Task Force			Still active.			
RI Sea Grant	Michelle Carnevale		SLR study GIS data is ongoing	Summer/Fall 2013		

Rhode Island State Hazard Mitigation Plan Update
WebEx #1: Climate Change and Sea Level Rise Meeting Notes 2-26-2013

Agency/Group	Contact	Report/Data Title	Brief Report Summary	Date Completed	GIS Data Available	Plan/Data Provided
RI Sea Grant	Jim Boyd	Sea Level Affecting March Model (SLAMM)	SLAMM Changes in land use to SLR. Multiple phase project 1. South Shore and Block Island 2. Bay 3. East Bay Already completed for North Kingstown.	First set of maps in summer/Fall 2013	Yes	
RI Sea Grant		Simulated Inundation Surfaces	GIS data for 3-5' SLR by 2100	June 2011	Yes	Online
CRMC-SAMP	Grover Fugate		Major state wide planning effort on sea level rise, inundation modeling, erosion, barrier roll back, bluff response, and storm surge at the state level. 3-4 year project broken into phases: first product is an update of the erosion maps for RI – coming out this summer. Also will look at critical erosion areas (high, medium, low risk) for municipalities. Will include SLR (how effect septic systems and critical infrastructure) and inundation. Will include planning scenarios on how to deal with it.			
	Grover Fugate	Shoreline Special Management Plan	Update of erosion maps started in January 2012	Summer 2013		
CRMC	Janet Freedman		Shoreline change GIS data is available		Yes	
CRMC	Janet Freedman		Earlier LIDAR study data available from URI environmental data center.		Yes (?)	
CRMC	Janet Freedman		Block Island transportation vulnerabilities			
CRMC	Janet Freedman		Shoreline change GIS data		Yes	
RI DEM Office of Emergency Response	Thomas Kogut James Ball		Firsthand knowledge of vulnerabilities and some potential mitigation issues related to shoreline fuel terminals.			
National Grid	Thomas Kogut		Thomas has reached out to National Grid to see if they would designate a contact for the mitigation plan update.			

Rhode Island State Hazard Mitigation Plan Update
WebEx #1: Climate Change and Sea Level Rise Meeting Notes 2-26-2013

Agency/Group	Contact	Report/Data Title	Brief Report Summary	Date Completed	GIS Data Available	Plan/Data Provided
Office of Energy Resources	Chris Kearns Thomas Kogut	Energy Assurance Plan	Guidance to prepare for, monitor, and mitigate energy deficiencies and disruptions.	June 29, 2012		Yes
DOP	Chelsea Siefert	Local Comprehensive Plans	Local Comp Plans now have to consider sea level rise. Guidance is being developed for comp plans for how to integrate natural hazards.			

FTP Instructions:

Email or call Rachael once files are posted (rherman@dewberry.com or phone 585.429.7448)
Files are automatically deleted every 5 days.

ftp.dewberry.com
username - RhodeIslandHMPupdate
password - 7X4TUY (case sensitive)

In Internet Explorer: "View" *View in Windows Explorer*

Rhode Island
HIRA Sub-Committee

WebEx#1: Climate Change and Sea Level Rise

WebEx#2: Flood and Wind Related (3/12/2013)
WebEx#3: Drought, Wildfire & Geologic-Related (TBD in March)
WebEx#4: Ranking Methods & Vulnerability Analysis (TBD in April)

1. Current RI Hazard Mitigation Plan

- Coastal Erosion
  - Coastal Resources Management Council
    - **Shoreline Change maps**
- **Climate Change**
  - **Intergovernmental Panel on Climate Change (2007)**
  - **Newport Tide Gauge (1930-2006) SLR = 10.2"**

1. Current RI Hazard Mitigation Plan

- **Climate Change**
  - **CRMC Climate Change Policy (2007)**
    - **Policy to accommodate 3 to 5' rise in sea level by 2100 in siting, design and implementation of public and private coastal activities**
    - **Working with RI Sea Grant, URI Enviro Data Center, Statewide Planning, Town of North Kingstown and Nature Conservancy to identify most vulnerable slr and increased storm surge events. Status on this?**
- **RI Flood Awareness and Climate Change Taskforce**
  - **Storm Smart Coasts RI website to help build resilience to storms and floods, targeting communities and local officials**

2. New reports or data available

- Climate Change Commission/Task Force
  - Is this commission still active
- URI Sea Grant/Climate Change Collaborative
  - SLR Study (GIS data?)
- Rhode Island Coastal Resources Management Council
  - Shoreline Change Data and damage to properties in coastal zones (Janet Freedman)

2. New reports or data available

- DOT
  - Assessment of infrastructure to SLR
- DOH
  - Climate Change and Health plan
- RI Flood Awareness and Climate Change Taskforce
- RI GIS Website
- Land Use and SLR studies?
- Coastal Resources Management Council
  - Shoreline Change/Coastal Erosion GIS Data?

3. Vulnerability analysis options

- Studies completed that quantify risk
- SLR Inundation zones (GIS data) intersected with facilities to determine those at risk

WebEx#2 on Wind & Water, Facilities and Vulnerable Populations: March 26, 2013

Rhode Island State Hazard Mitigation Plan Update
WebEx #2: Water and Wind Meeting Notes 3-26-2013

Purpose:

To provide an open forum to discuss reports and data related to flood and wind hazards that should be reviewed for inclusion in the 2014 RI Hazard Mitigation Plan Update. WebEx format:

1. 2011 RI Hazard Mitigation Plan
2. New reports or data available
3. Vulnerability analysis options

Participants:

- Jess Stimson, Armand Randolph, and Michelle Burnett (RIEMA)
- Alan Dunham and David Vallee (NWS)
- Nan Johnson (FEMA Region 1)
- Janet Freedman (CRMC)
- Chelsea Siefert (Division of Planning)
- Beth Vollucci (RI Insurance Division)
- Jim Ball (RI DEM)
- Mike Catsos (NESEC)
- Kevin Farmer (USDA)
- Corinne Bartshire, Scott Choquette, Janna Newman (Dewberry)
- Katie Freeman (Haggerty)

Attachments: Presentation Slides - WebEx2-WaterandWind.pdf

Summary of Discussion Items:

HIRA Vulnerability Ranking Methodology

Armand and Jess have been looking into getting the editable data files. They will discuss their findings with Dewberry on Thursday, March 28.

Past Water Related Hazard Events to ensure inclusion in updated HIRA

- Sandy, Irene, Remnants of Tropical Storm Lee – Flash flooding, affected morning commute (**Dave Vallee** to provide more info)
- March event from NCDC was an accumulation of several events – 4 distinct floods (**Dave Vallee** – March 2010)
- **Jess** and **Dewberry** will review NCDC data to make sure it is comprehensive
- Coastal ErosionSouth Shore has increased – erosion rate maps are available showing from 1939 – 2004. These are being updated. The State knows where erosion is worst. (**Janet Freedman**)
- Check into flooding following large winter storms – **Nan Johnson**

1

Rhode Island State Hazard Mitigation Plan Update
WebEx #2: Water and Wind Meeting Notes 3-26-2013

Coastal Erosion Data – **Janet Freedman** – Maps show where areas are worse, up to 2004. Agrees with Chelsea that coastal erosion is not specific to one event but is a continuous process.

What other mapping is available?

- USACE Evacuation Maps – current, study underway, maps done – **Jess**
- Coastal remapping – FEMA Risk MAP Products
- DFIRMS and Preliminary DFIRMs
- Did/does flooding occur during Winter Storms? Westerly may have local information
- SLOSH
- HAZUS for Kent and Providence counties, maybe Bristol
- Incorporate Risk MAP products -Nan
  - Wave heights and changes since last firm – **Jess will upload all she has**

Facilities

- Is there a state layer with facilities/critical facilities – infrastructure?
  - **Jess** - has state defined critical facilities – does not match FEMA definition
  - Does not have building values in Jess' dataset but can be acquired
  - Relatively new dataset
  - **Jess and Armand will look at the data further and discuss with Dewberry. (*set up a follow up call)**
  - Nan – stressed in last review about getting input from other stakeholders – how will State determine what is critical? Key vulnerabilities – stakeholder's opinions must be in plan
  - Corinne – Are there specific facilities that the participating agencies have concerns with regarding risk to water and wind events?
    - David Vallee – pumping stations and wastewater treatment plants – what level of specificity?
    - Ports, tourism, industry – resiliency
    - Corinne – **public outreach** to gather stakeholder vulnerability interests (facilities, tourism, economic components)
    - Galilee – fishing industry, ferry service to Block Island, Newport, ports
    - Specific beaches that are of concern due to tourism
    - Rail service can be significantly impacted due to flood

Vulnerable populations

- Consider access and functional needs, young, elderly, etc.
- Migrant tourists
- **Jess** – have really good demographic data
- **Jim** – Dept of health has statistics on special needs

2

Rhode Island State Hazard Mitigation Plan Update
WebEx #2: Water and Wind Meeting Notes 3-26-2013

- As part of sustainable communities regional planning initiative, a social equity report was recently complete (focused on economic development and housing) – talks general demographic trends, income, etc. – **Chelsea**
- Nan – look at residents v. seasonal breakdown of how many of each, etc.
- Knowing where home heating oil storage tanks vs. gas is helpful as a responder – **Jim Ball**
- Concern with identifying jurisdictional boundaries in the field (i.e. USACE, US Coast Guard, State, Local lands) to identify eligibilities for recovery – Suggest adding a strategy to clarify / map these boundaries to be available when needed. - **Kevin**

Past Wind Related Hazard Events to ensure inclusion in updated HIRA

- Look at severe weather events in NCDC that are non thunderstorm related wind events
- Change date of hurricane (on slide) to 8/31/1954
- Motiva Fire July 18, 2006 - tree damage, problems with fueling, pier caught fire at port of providence
- Article about storm before Irene from Janet - http://www.providenceri.gov/mayor/trees-down-damage-to-homes-power-outages-in
- Few southeast wind events – but those are the ones that destroy the tree canopy and power lines – **Dave Vallee**

Current practices to reduce risk to Wind Related Hazards?

- National grid has a tree trimming plan - individual city tree wardens – DEM Forestry
- Nan – cell towers? Dave Vallee - In 1954 lost all phones for 8 hours statewide. Haven't experienced what could happen to the cell grid yet based on past storms.

Participant Comments

- Kevin – mention of agricultural flood – agricultural waste in flood event could end up at impacting downstream facilities. Wind could cause power disruption and force dairy farms to shut down and lose product. Ken Ayers with DOA could provide names of vulnerable facilities.
- Jim – First responders are always looking for more information on specific locations of hazardous or potentially hazardous situations. Involve Jim in the development of public outreach materials to incorporate any questioning that could benefit the first responders (i.e. location of Tier 2 facilities).
- Janet suggests outreach to let people know of where their household hazardous waste goes when they dispose of it. Jim says do not put it on the curb if severe weather is predicted.
- Nan – Suggest looking back at the RI THIRA for linkages. Thank you. This dialogue is important.

3

Dewberry

Rhode Island – HIRA SubCommittee

WebEx#1: Climate Change and Sea Level Rise (2/26/2013)
WebEx#2: Water and Wind Related (3/26/2013)
WebEx#3: Drought, Wildfire & Geologic-Related (TBD)
WebEx#4: Ranking Methods & Vulnerability Analysis (TBD)

Water Related Hazards

- Riverine
  - 9 events since plan update $70K
- Coastal Flooding
  - Flood prone access routes: Beavertail Rd, Matunuck Beach Rd, and Arnolds Neck Road
  - Superstorm/Hurricane Sandy (10/29/2012)
- Flash
  - March 2010: Cranston, Warwick, West Warwick, Westerly, Coventry
  - 7 events since 2011 plan update $80K
- Storm Surge (Hurricanes, Nor'easters)
- Coastal Erosion
  - Coastal Resources Management Council shoreline change maps
- Climate Change and Sea Level Rise
  - 1' SLR in 25 years and 5' SLE by 2100

2 | Flood and Wind HIRA SubCommittee March 26, 2013 Dewberry

Water Related Hazards (cont.)

- Hurricanes
  - Record Storm Surge: 1938 Hurricane and Hurricane Carol 1954
- Nor'easters
  - 1-2 times per year with 2' storm surge
  - Coastal erosion
- Urban Flooding/ Storm Water Runoff
  - Aging sewer systems
  - Undersized stormwater infrastructure
- Dam Breech
  - 671 Dams (97 High, 83 Significant, and 491 Low Hazard)
  - Department of Environmental Management (DEM)
    - Enforcing dam safety program
    - Dam Safety Regulations 12/20/2007
  - Inundation Mapping and Inventory
    - FEMA National Dam Safety grants
    - Emergency Action Plans (EAP)

3 | Flood and Wind HIRA SubCommittee March 26, 2013 Dewberry

Water Related Hazards (cont.)

Figure 4.32: Severe Repetitive Loss

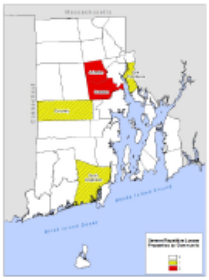
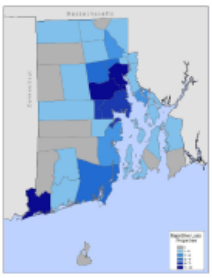


Figure 4.31: Repetitive Loss Properties



4 | Flood and Wind HIRA SubCommittee March 26, 2013 Dewberry

Available Water Related Hazard Data?

- Past Events
  - Declarations since March 2010?
  - Significant events to research?
- Mapping
  - Updated SLOSH mapping since 2009?
- Vulnerable Facilities Information
  - Update to condition of dams?
  - Update to Repetitive Loss Properties?
- Vulnerable Populations Information

5 | Flood and Wind HIRA SubCommittee March 26, 2013 Dewberry

Quantifying Water Related Hazard Risk

- Vulnerability
  - Hazard Score (frequency*area impact*intensity)
  - Critical Facilities
  - Populations at Risk
  - Environmental Resources
  - Economic Values

Look Up Tables / Spreadsheets / Mapping layers used by Odeh Engineers Available?

6 | Flood and Wind HIRA SubCommittee March 26, 2013 Dewberry

Wind Related Hazards

- Hurricanes
  - 30 hurricanes
    - 9/21/1938: 262 deaths & $100 million in damages
    - 9/31/1954: 19 deaths $200 million in damages
  - ACOE SLOSH maps (9/2009)
    - 21 coastal communities
  - Probability: 6% annually
- Tornadoes
  - 10 tornadoes 1972 – 2010 $3.5 million property damage, 23 injuries
  - Block Island August 2012 $50K

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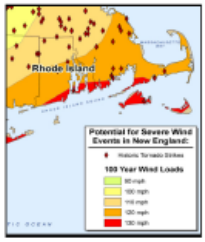
Wind Related Hazards (cont.)

Figure 4.35
Hurricane Activity

Figure 4.34
Tornado Strikes



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Available Wind Data?

- Past Events
  - Significant events since April 2011?
- Mapping
- Vulnerable Facilities Information
- Vulnerable Populations Information

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Quantifying Wind Risk

- Loss estimations by Jurisdiction collected?
- Vulnerability
  - Based on ASCE 7-98 Design Loads for Buildings...
- Facilities vulnerable to wind?
  - Located in A and V FEMA flood zones

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Contact and FTP Information

Rachael Herman
Dewberry
585.429.7448
rherman@dewberry.com

ftp.dewberry.com
username - RhodeIslandHMPupdate
password - 7X4TUY (case sensitive)

**Notify Rachael of files posted to FTP site

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WebEx#3 Geologic Hazards, Drought, Capabilities Assessment, and Public Outreach: May 1, 2013

Rhode Island State Hazard Mitigation Plan Update
WebEx #3: Drought, Wildfire & Geologic-Related Hazards, Capability Assessment, and Public Outreach

Purpose:

To provide an open forum to discuss reports and data that should be reviewed for inclusion in the 2014 RI Hazard Mitigation Plan Update. WebEx format:

1. 2013 RI Hazard Mitigation Plan Progress to Date
2. Drought, Wildfire, & Geologic-Related Hazards
    a. New reports or data available
    b. Vulnerability analysis options
3. Ranking Methodology
4. Capability Assessment
5. Public Outreach
    a. Online Survey

Attendees:

- Armand Randolph (RIEMA)
- Chelsea Siefert (RI Division of Planning)
- Alysia Mihalakos (Division of Health)
- Jessica Stimson (RIEMA)
- Thomas Kogut (RI Division of Public Utilities and Carriers)
- June Swallow (RI Division of Health)
- Nan Johnson (FEMA R1)
- Janna Newman (Dewberry)
- Katie Freeman (Hagerty)
- Scott Choquette (Dewberry)
- Rachael Herman (Dewberry)

Attachments:

WebEx3-Geo_CapAssess-PublicOutreach.pdf
RI_CapabilitiesMatrix_For2013Plan.doc

Meeting Notes:

1. Progress to date on the HIRA was discussed. Data collection has been completed. Local plan reviews will be completed next week for inclusion in the HIRA ranking. If you or your agency has additional reports or data that should be included in the HIRA, please follow-up with Rachael.
    a. Thomas Kogut has sent several utility reports for the most recent events.
    b. June Swallow will send modeling results for riverine and coastal SLR up to 2084.
    c. Water Resources board will be contacted to see if they have information on past events/water shortages/analysis completed.
    d. Extreme Heat hazard profile should distinguish between the two different kinds: daily temperature maximum and extended periods (heat wave). Chelsea will be

Rhode Island State Hazard Mitigation Plan Update
WebEx #3: Drought, Wildfire & Geologic-Related Hazards, Capability Assessment, and Public Outreach

in contact with Bob Vanderslice to provide additional information on this and the climate change and health report.

2. Ranking methodology has been modified for this plan update. The ranking formulas and data from past plans was not available to use. The 2013 methodology will include: population, annualized events, deaths/injuries, property and crop damage, local plan results, and geographic extent.
    a. The inclusion of changes in future development was discussed as a parameter to be added to the ranking. Chelsea Sieffert (Div of Planning) said that this data is not yet available for the state. Chelsea can work with the planning team to add/update future land use based on municipal permits.

3. Capabilities Assessment: Reviewed the layout of the capabilities matrix and section of the plan. Each agency was asked to review the plans, programs, policies, and funding sources in the table. The **BOLD** items reflect plans/programs/policies that further support mitigation and will be summarized in the Capabilities section of the update.
    a. Staffing resources, pre-post disaster, state laws, development, evaluation, ability to enforce/implement, political support, community buy-in, etc. will be further described in the narrative of the plans/policies/programs that further support mitigation.
    b. Discussion regarding what agencies should be included in the matrix. It was decided that only agencies that directly support or are involved in RI mitigation planning or add to the capability of the state should be included. If funding sources are administered by RI agencies, that agency profile will contain the funding opportunity (ie. RIEMA administers FEMA HMGP)
    c. Reviewed agencies in the current matrix to determine what agencies were missing. Changes to matrix:
        i. Add beach management plans
        ii. USACE hurricane evacuation study is currently underway. Evacuation zones will be complete this summer
        iii. Discussion of statewide adaption – this does not exist
        iv. Watershed Planning is under Dept of Environmental Management
        v. Add FEMA
        vi. Add "Rhode Island" before EMA
        vii. Dept of Planning, Office of Housing and Comm. Development, CDBG grants
    d. Agency review and comments on the matrix are due Tuesday **May 14th.**
        i. Email comments to Rachael: rherman@dewberry.com

Rhode Island State Hazard Mitigation Plan Update
WebEx #3: Drought, Wildfire & Geologic-Related Hazards, Capability Assessment, and Public Outreach

4. Hazard Mitigation Survey : http://www.surveymonkey.com/s/RISHMP
    a. Purpose of the survey is to provide the steering committee, stakeholders, non-profits, private industry, utilities, etc. and the general public an opportunity to participate and provide feedback in the mitigation plan update.
    b. No additional comments or questions were added to the survey.
    c. Armand will be distributing the survey: ***Please to pass along groups, emails, websites, or distribution lists that Armand should share this with.***
    d. Survey will close **June 1st** and results presented at the June 19th meeting.

FTP Instructions:

Email or call Rachael once files are posted (rherman@dewberry.com or phone 585.429.7448)
Files are automatically deleted every 5 days.

ftp.dewberry.com
username - RhodeIslandHMPupdate
password - 7X4TUY (case sensitive)

In Internet Explorer: "View" *View in Windows Explorer*

Next Meeting: Wednesday June 19th, 2013.

Armand will be sending out meeting invite as the date gets closer.

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Rhode Island – HIRA SubCommittee

WebEx#1: Climate Change and Sea Level Rise (2/26/2013)

WebEx#2: Water and Wind Related (3/26/2013)

WebEx#3: Drought, Wildfire & Geologic-Related, Capability Assessment Review and Public Outreach (5/1/2013)

Comm. Meeting: Ranking Methods & Vulnerability Analysis and Mitigation Strategies (TBD: Tentative 6/19/2013)

Progress to Date

- Data Collection
  - Hazard Specific Datasets
  - Facilities Data
  - NCDC Storm Events
  - Repetitive Loss
  - Hazus Analysis from NESEC
  - Storm Sandy Insurance Claims
- Local Plan Review & Upload
- Ranking Methodology Established
  - Analysis Underway
- Capabilities Assessment
- Public Outreach Survey

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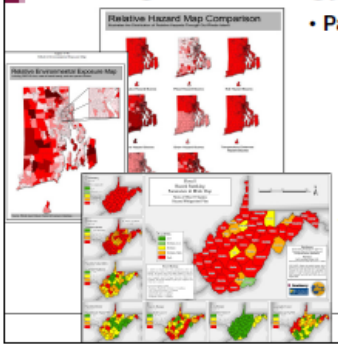
LHMP Template

- State Plan with align with guidance RIEMA is giving to local hazard mitigation plans
  - Document Template
    - Hazards Identified
    - Analysis

1. **Flood-related hazards**
   - Riverine
   - Coastal
   - Flash
   - Storm Surge
   - Coastal Erosion (with landslide) and Shoreline Change
   - Climate Change and Sea Level Rise
   - Urban/Stormwater
   - Dam Breach
2. **Wind-related hazards**
   - Hurricanes
   - Tornadoes
   - Thunderstorms/Wind Storms
   - Hail
   - Lightning
3. **Winter-related hazards**
   - Heavy Snow
   - Ice Storms
   - Blizzards
   - Extreme Cold
   - Nor'easters
4. **Drought**
5. **Earthquake**
6. **Wildfire**
   - Conflagration
7. **Extreme Heat**

Ranking Methodology



- **Parameters:**
  1. Population Vulnerability
  2. Population Density
  3. Annualized Events
  4. Deaths & Injuries
  5. Annualized Property Damage
  6. Annualized Crop Damage
  7. Regional Plan Hazard Rankings
  8. Geographic Extent of Hazard

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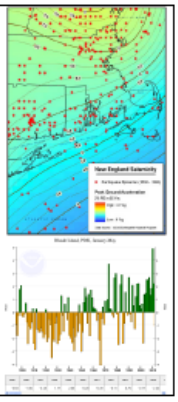
Hazards

- Earthquake
  - Hazus Analysis from NESEC
    - 1755 Cape Ann (6.5)
    - 1951 North Kingstown (5.0)
- Drought
  - Palmer Drought Severity Index
  - Information on Water Shortages or Allocation
- Extreme Heat (New in 2013)
- Wildfire (New in 2013)



Available Hazard Data?

- Past Events
  - Declarations since March 2010?
  - Significant events to research?
- Mapping & GIS Data
- Quantifying Risk
  - Vulnerable Facilities Information
  - Vulnerable Populations Information
  - Areas at Risk

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Capabilities Assessment

- Capabilities Matrix
  - Current Plans, Programs, Policies, and Funding Opportunities that Support Risk Reduction, Community Resiliency, and Mitigation Activities Policies/Plans
  - Preliminary Plans/Studies to be Incorporated into Next Plan Update
- Additional Agencies to be included
- **Next Step: Agency Capability Assessments**
  - **Review and Comments**

7 | HIRA Sub-Committee May 1, 2013 — Dewberry

Agencies

- **Department of Administration**
- **State Building Code Commission**
- **Climate Change Commission**
- **Department of Environmental Management**
- **University of Rhode Island Environmental Data Center**
- **Emergency Management Agency**
- **Coastal Resources Management Council**
- **State Historic Preservation Office**
- **RI Rivers Council**
- **Department of Transportation**
- **Department of Health**
- **Office of Energy Resources**
- **RI SeaGrant**
- **The Providence Plan**
- **RI NRCS**
- **RI Public Utilities Commission and Division of Public Utilities and Carriers**
- **Army Corp of Engineers**
- **NWS**
- **USGS**

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Example Agency Profile

Agency	Plan/Program	Policy	Funding
Department of Administration	-State Guide Plan • Element 110: General Goals and Policies • **Element 121: Land Use** • **Element 211: Economic Development and Policies** • **Element 723: Water Emergency Response Management Plan** • **Element 724: Drought Management Plan** • Element 152: Outdoor Recreation Plan • Element 155: IA Greener Path • Element 162: River Policy and Classification Plan	-Comprehensive Planning and Land Use Act	

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Capability Assessment Section

5.2.1 Department of Administration (DOA)

The DOA provides support to all RI departments and agencies for effective coordination and direction of state programs. The department also provides policy direction for executive leadership in a variety of financial and administrative matters and is responsible for the statewide implementation of policy decisions affecting the organization and delivery of services administered and supported by the State. Primary responsibilities include developing and administering the State budget, determining State purchases, maintenance of State facilities, and administration of the statewide planning program.

5.2.1.1 Division of Planning, Housing, and Community Development

The RI Division of Planning consists of three main components: the Statewide Planning Program, the Office of Housing and Community Development, and the Water Resources Board. This Division offers both staffing and planning capabilities that can be used to implement hazard mitigation strategies. One upcoming plan that is currently being conducted by the Planning Program is being funded by the US Department of Housing and Urban Development and is called the Regional Plan for Sustainable Development. The plan will define areas appropriate for growth and development and establish a Social Equity Advisory Committee to represent underserved populations in the state. This plan is not expected to be completed until 2015 and results will be incorporated into the next state plan update. The Statewide Planning Program also oversees state and local comprehensive planning, which is governed by the Rhode Island Comprehensive Planning and Land Use Act. Elements of the State Guide Plan that pertain to hazard mitigation are described in more detail below. In addition, as of 2011, local comprehensive plans must include a natural hazards element into their plan. Apart from the local hazard mitigation plans, the natural hazard element in local comprehensive plans provides the framework necessary to incorporate information detailed in the Hazard Identification and Risk Assessment detailed in Section X of this plan and to discuss mitigation projects at the local level that could reduce risk within the various municipalities.

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Public Outreach

- Survey: http://www.surveymonkey.com/s/RISHMP
  - Comments on content or format?
  - What do we do with this?
    - Press Release
    - Website Posting
    - Social Media
    - Email Distribution Lists
  - Draft language for distribution
  - Comments Due June 1st

2013 Rhode Island SHMP Survey

1. Please provide your contact information.

2. Please indicate who you are representing for the purp- respond to the survey more than once if you wish to resp in addition to yourself as a public resident.)

11 | HIRA Sub-Committee May 1, 2013 — Dewberry

Next Committee Meeting

- Tentative: June 19, 2013
- Topics:
  - Hazard Identification & Risk Assessment
    - Ranking Methodology
    - Vulnerabilities
  - Mitigation Strategies
    - Review of 2010 Goals, Objectives, and Actions
    - Development of new Actions based on HIRA results

12 | HIRA Sub-Committee May 1, 2013 — Dewberry

HIRA Results and Mitigation Strategy meeting: June 21, 2013

Rhode Island State Hazard Mitigation Plan Update
Stakeholder Meeting No. 2

Agenda

June 21st, 2013 9:00 – 3:00 PM
235 Promenade Street Room 300, Providence, RI.

Purpose: *Progress on the mitigation plan update: focus on mitigation goals, objective and action review.*

Description	Lead	Time

Welcome and Introductions
• Progress to Date
  ○ Planning Process Review
  ○ Progress to Date
	Jessica Stimson, RIEMA State Hazard Mitigation Planner	9:00 – 9:30

Local Plan Review, Public Outreach, and Capabilities Assessment • Local Plan Data and Information Capture • Public Outreach ○ http://www.surveymonkey.com/s/RISHMP • Agency Profiles	Rachael Herman, Dewberry Janna Newman, Dewberry	9:30 – 10:15

Hazard Identification and Risk Assessment
• Review of Hazard Identification
• Ranking Methodology
  ○ Historical Events
  ○ Critical & State Facilities
  ○ Local Plan Incorporation
	Rachael Herman, Dewberry	10:15 – 10:45

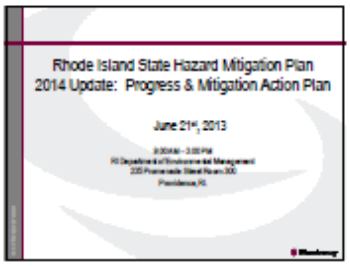
BREAK		10:45 – 11:00
Summary of Hazard Specific Analysis • Flood-related Hazards • Wind-related Hazards • Winter-related Hazards • Drought • Earthquake • Wildfire • Extreme Heat	Rachael Herman, Dewberry Janna Newman, Dewberry	11:00 – 12:00
LUNCH		12:00 – 1:00
Mitigation Action Plan • Goal and Objective review • Action status • New Mitigation Action Brainstorming	Scott Choquette, Dewberry	1:00 – 1:30
Small Group Discussions: Forming Mitigation Objectives and Actions	Rachael Herman Scott Choquette Janna Newman	1:30-2:30
Group Summaries		2:30-2:45
Wrap Up and Future Meetings	Scott Choquette, Dewberry	2:45 – 3:00

Rhode Island Hazard Mitigation Plan Update HIRA & Mitigation Strategy Development Meeting
June 21, 2013 Sign-in Sheet

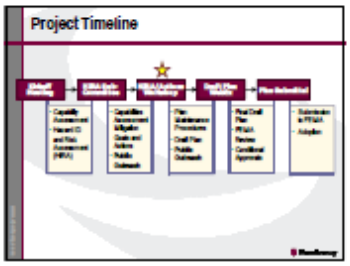
Name	Department/Organization	Phone	Email	Completed Review of Capability Assessment?
James Boyd	RICRMC	783-3370	JBOYD@CRMC.RI.GOV	Yes
SHANE WHITE	RI - DIVISION OF PLANNING	222-6483	SHANE.WHITE@DOA.RI.GOV	NO
GREG ISONTAGI	URI	874-2180	GREG@URI.EDU	YES
JON BOOTHROYD	URI - CRC	874-2265	JON.BOOTHROYD@URI.EDU	? [illegible]
John Leo	RI DEM Emergency Response	222-1360	john.leo@dem.ri.gov	?
Chelsea Siefert	RI Division of Planning	222-4721	chelsea.siefert@doa.ri.gov	✓
Julia Gold	DOH	222-7746	julia.gold@health.ri.gov	no
Kevin Carvalho	DOA	222-6429	Kevin.Carvalho@doa.ri.gov	NO
Arthur Bovis	RIDOT	401 734-4880	abovis@dot.ri.gov	
Ann Schneller	National Grid	781-907-2541	Robert.Schneller@nationalgridus.com	Yes
David R. VALLEE	NOAA / NWS	508-824-5116	david.vallee@noaa.gov	Yes
Carlene Newman	RIDOH / DWQ	401-222-3436	carlene.newman.health.ri.gov	no
THOMAS KOGUT	RI DPUC	401 780-2105	TKOGUT@RIPUC.STATE.RI.US	Yes
Michelle Burnett	RIEMA	462-7048	michelle.f.burnett.nfg@mail.mil	

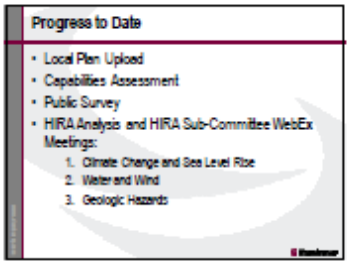
1

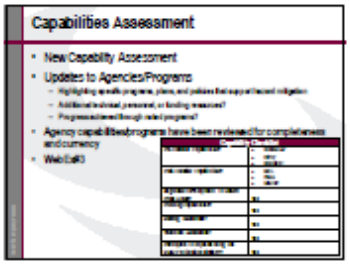
Name	Department/Organization	Phone	Email	Completed Review of Capability Assessment?
Teresa Crean	URI CRC / RISG	874 6626	tcrean@crc.uri.edu	no.
Bob Sturdahl	RIEMA	462 7127	robert.a.sturdahl.mil@mail.mil	NO
Nan Johnson	FEMA Reg 1	617-956-7672	nana.johnson@fema.dhs.gov	
[illegible]	RIEMA	462-7115		
ALAN GILLESPIE	USDA-NRCS	401 822-8812	ALAN.GILLESPIE@RI.USDA.GOV	NO

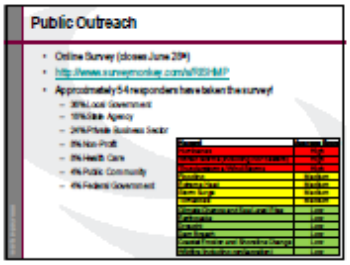

Rhode Island State Hazard Mitigation Plan
2014 Update: Progress & Mitigation Action Plan
June 21st, 2013

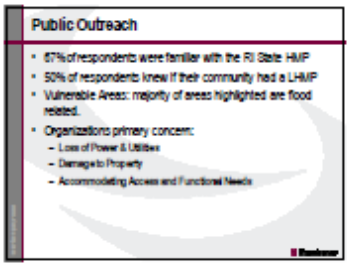
Meeting Agenda
Welcome & Introductions
Timeline for Review and Approval
Progress to Date
Capabilities Assessment & Public Outreach
Local Plan Upload
Hazard Identification & Risk Assessment
Mitigation Action Plan
Goals
Objectives
Project Development
Small Group Exercise
Wrap Up and Future Meetings

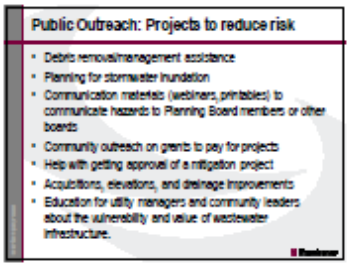

Project Timeline

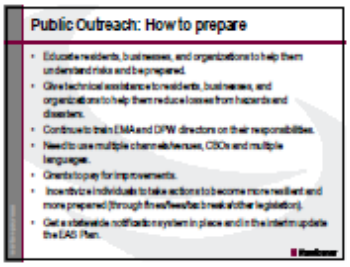

Progress to Date
Local Plan Upload
Capabilities Assessment
Public Survey
HIRA Analysis and HIRA Sub-Committee WebEx Meetings:
1. Climate Change and Sea Level Rise
2. Water and Wind
3. Geologic Hazards


Capabilities Assessment
New Capability Assessment
Updates to Agencies/Programs
Agency capabilities/programs have been reviewed for completeness and currency
WebEx#3

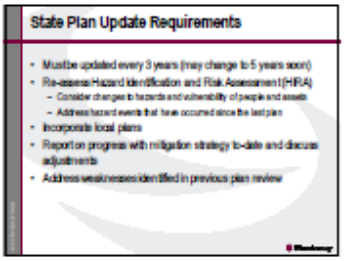

Public Outreach
Online Survey (closes June 20th)
Approximately 54 responders have taken the survey!

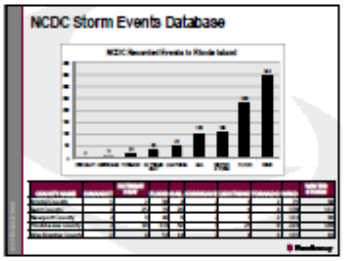

Public Outreach
67% of respondents were familiar with the RI State HMP
50% of respondents knew if their community had a LHMP
Vulnerable Areas: majority of areas highlighted are flood related.
Organizations primary concern:
Loss of Power & Utilities
Damage to Property
Accommodating Access and Functional Needs

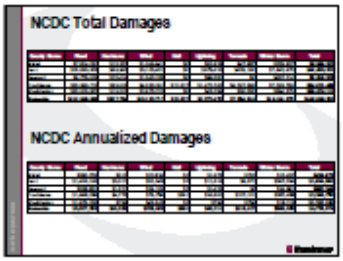

Public Outreach: Projects to reduce risk
Debris removal/management assistance
Planning for stormwater inundation
Communication materials (webinars, printables) to communicate hazards to Planning Board members or other boards
Community outreach on grants to pay for projects
Help with getting approval of a mitigation project
Acquisitions, elevations, and drainage improvements
Education for utility managers and community leaders about the vulnerability and value of wastewater infrastructure.

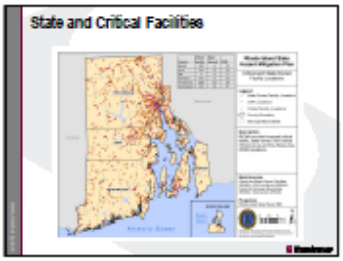

Public Outreach: How to prepare
Educate residents, businesses, and organizations to help them understand risks and be prepared.
Give technical assistance to residents, businesses, and organizations to help them reduce losses from hazards and disasters.
Continue to train EMA and DPW directors on their responsibilities.
Need to use multiple channels/venues, CBOs and multiple languages.
Grants to pay for improvements.
Incentivize individuals to take actions to become more resilient and more prepared (through fines/fees/tax breaks/other legislation).
Get a statewide notification system in place and in the interim update the EAS Plan.

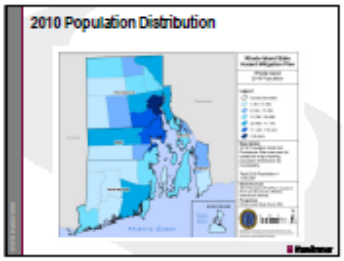
Hazard Identification & Risk Assessment
Purpose: Provides a factual basis for prioritizing hazard mitigation activities
Major components:

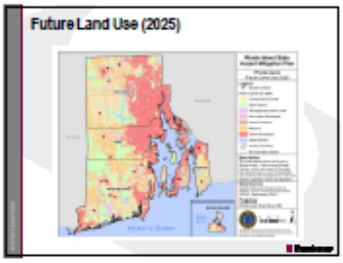

State Plan Update Requirements
Must be updated every 3 years (may change to 5 years soon)
Re-assess Hazard Identification and Risk Assessment (HIRA)
Consider changes to hazards and vulnerability of people and assets
Address hazard events that have occurred since the last plan
Incorporate local plans
Report on progress with mitigation strategy to-date and discuss adjustments
Address weaknesses identified in previous plan review

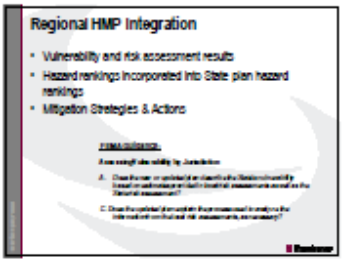

NCDC Storm Events Database

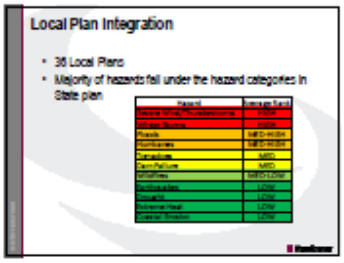

NCDC Total Damages
NCDC Annualized Damages


State and Critical Facilities


2010 Population Distribution

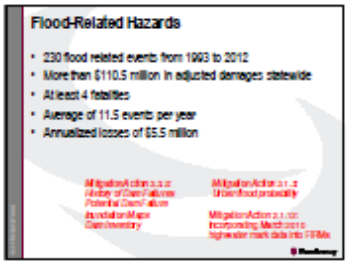

Future Land Use (2025)

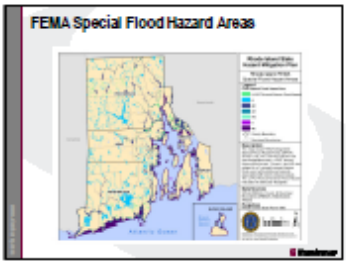

Regional HMP Integration
Vulnerability and risk assessment results
Hazard rankings incorporated into State plan hazard rankings
Mitigation Strategies & Actions

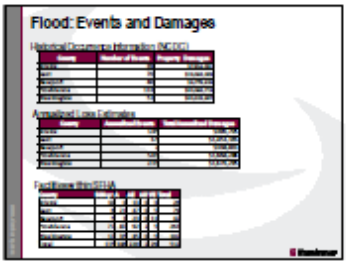

Local Plan Integration
36 Local Plans
Majority of hazards fall under the hazard categories in State plan

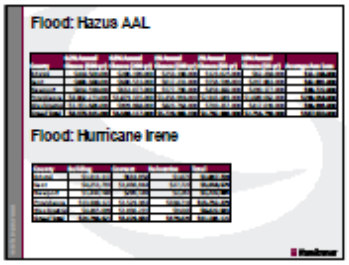
2014 Update
HAZARD VULNERABILITIES AND COMPOSITE RANKING MAPS

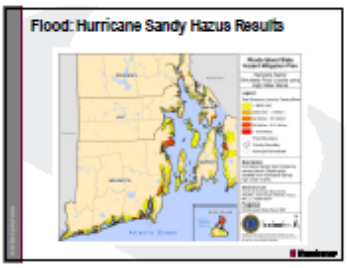
2013 Ranking Parameters
"Semi-Quantitative" Scoring System
Actual Data Values grouped in categories 1-4 based on statistics
Data with normalization (inflation ....)
Limitations with probability & impact data
Parameters Used:
Population Vulnerability and Population Density (weight 0.5)
Building Permits Count (weight 0.5)
Annualized Events (weight 1)
Deaths & Injuries (weight 1)
Annualized Property Damage (weight 1)
Local Plan Hazard Rankings (weight 1)
Geographic Extent of Hazard (weight 1.5)

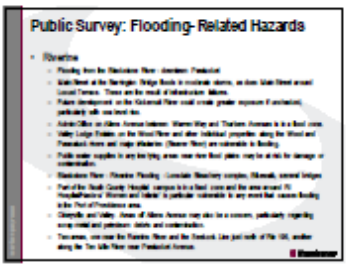

Flood-Related Hazards
230 flood related events from 1993 to 2012
More than $110.5 million in adjusted damages statewide
At least 4 fatalities
Average of 11.5 events per year
Annualized losses of $5.5 million

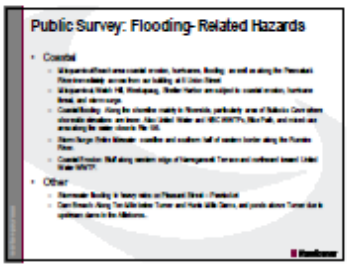

FEMA Special Flood Hazard Areas

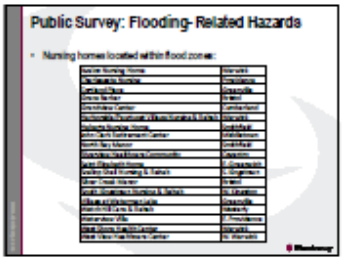

Flood: Events and Damages

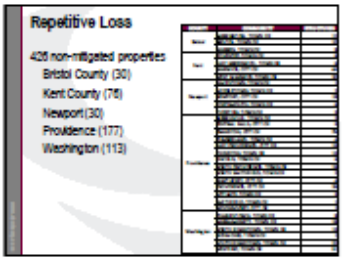

Flood: Hazus AAL
Flood: Hurricane Irene

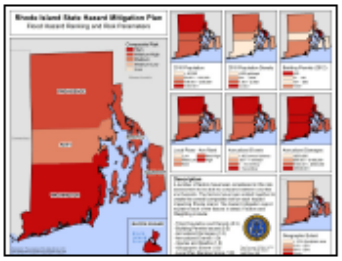

Flood: Hurricane Sandy Hazus Results

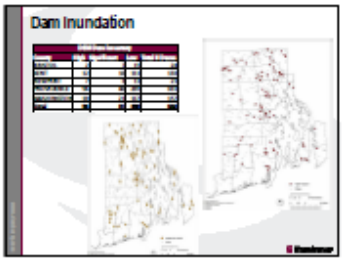

Public Survey: Flooding- Related Hazards
Riverine

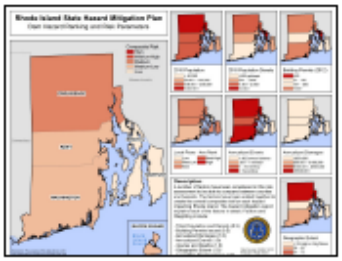

Public Survey: Flooding- Related Hazards
Coastal
Other

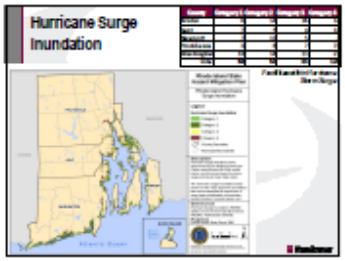

Public Survey: Flooding-Related Hazards
Nursing homes located within flood zones:

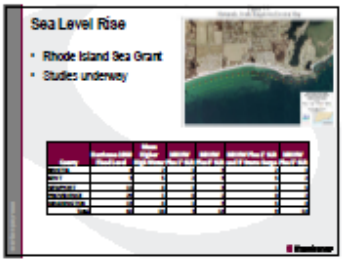

Repetitive Loss
426 non-mitigated properties
Bristol County (30)
Kent County (76)
Newport (30)
Providence (177)
Washington (113)

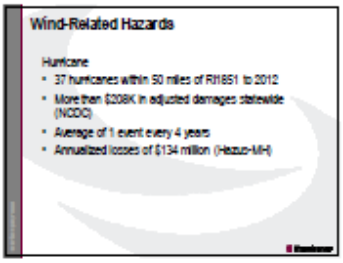


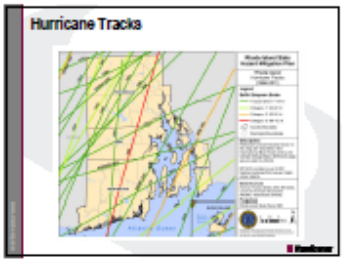

Dam Inundation

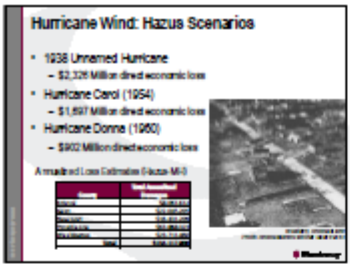


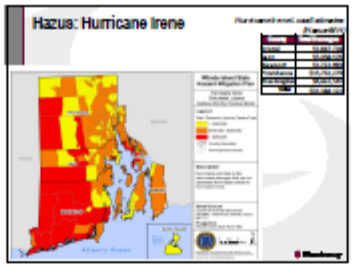

Hurricane Surge
Inundation

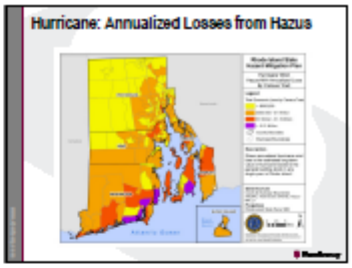

Sea Level Rise
Rhode Island Sea Grant
Studies underway

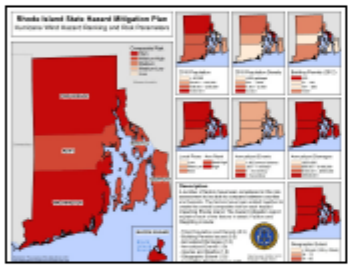

Wind-Related Hazards
Hurricane
37 hurricanes within 50 miles of RI1851 to 2012
More than $208K in adjusted damages statewide (NCDC)
Average of 1 event every 4 years
Annualized losses of $134 million (Hazus-MH)

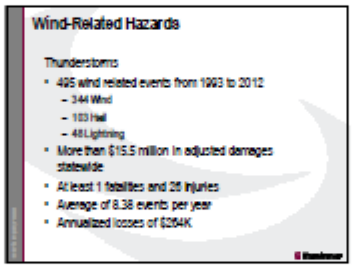

Hurricane Tracks

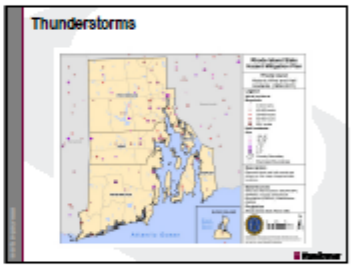

Hurricane Wind: Hazus Scenarios
1938 Unnamed Hurricane
$2,326 Million direct economic loss
Hurricane Carol (1954)
$1,597 Million direct economic loss
Hurricane Donna (1960)
$902 Million direct economic loss

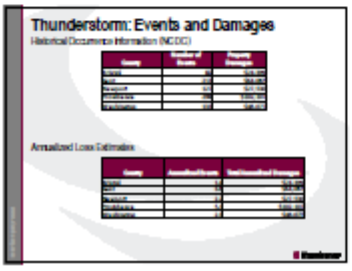

Hazus: Hurricane Irene

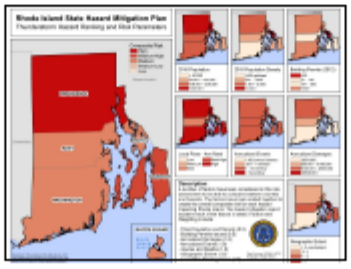

Hurricane: Annualized Losses from Hazus

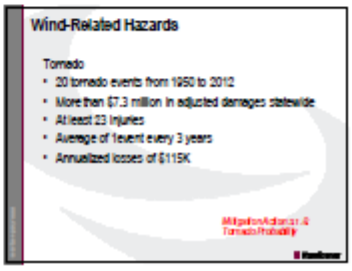


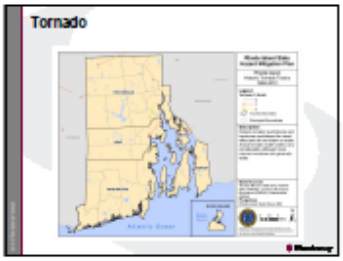

Wind-Related Hazards
Thunderstorms
495 wind related events from 1993 to 2012
344 Wind
103 Hail
48 Lightning
More than $15.5 million in adjusted damages statewide
At least 1 fatalities and 26 injuries
Average of 8.38 events per year
Annualized losses of $264K

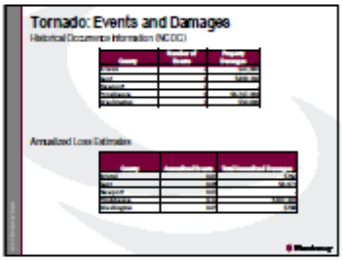

Thunderstorms

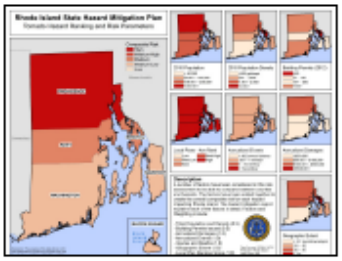

Thunderstorm: Events and Damages
Historical Occurrence Information (NCDC)
Annualized Loss Estimates



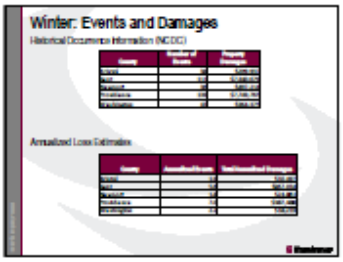

Wind-Related Hazards
Tornado
20 tornado events from 1950 to 2012
More than $7.3 million in adjusted damages statewide
At least 23 injuries
Average of 1 event every 3 years
Annualized losses of $115K

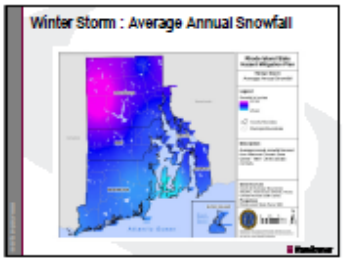

Tornado

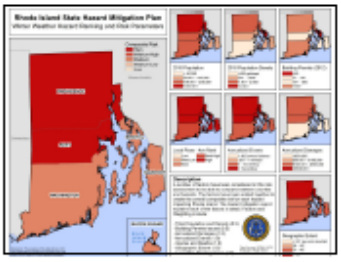

Tornado: Events and Damages
Historical Occurrence Information (NCDC)
County
Number of Events
Property Damages
Annualized Loss Estimates
County
Annualized Losses
Total Annualized Damages



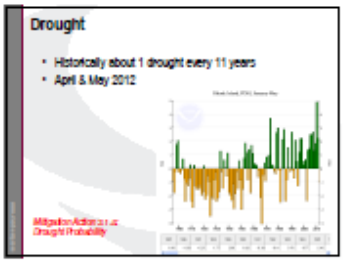
Winter Storm -Related Hazards
109 winter related events from 1993 to 2012
More than $16.1 million in adjusted damages statewide
At least 2 injuries
Average of 5.5 events per year
Annualized losses of $808 K
Mitigation Action 2.1.4: Winter Probability

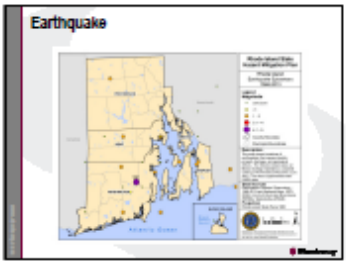

Winter: Events and Damages
Historical Occurrence Information (NCDC)
County
Number of Events
Property Damages
Annualized Loss Estimates
County
Annualized Losses
Total Annualized Damages

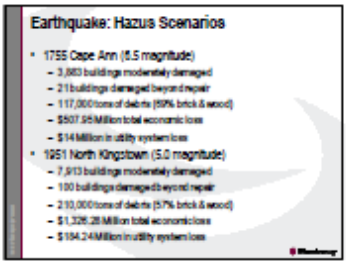

Winter Storm : Average Annual Snowfall

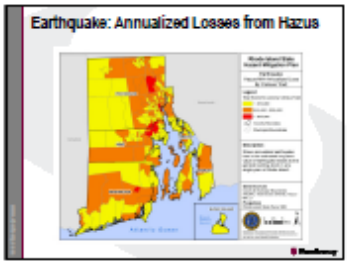


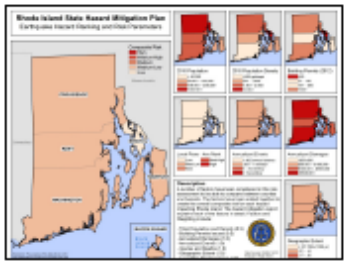
Public Survey: Winter-Related Hazards
Snow removal in the Oak Hill neighborhood from heavy snow, blizzards - Pawtucket

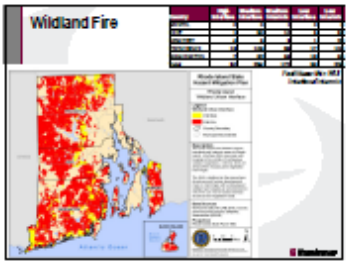

Drought
Historically about 1 drought every 11 years
April & May 2012
Mitigation Action 2.1.4: Drought Probability

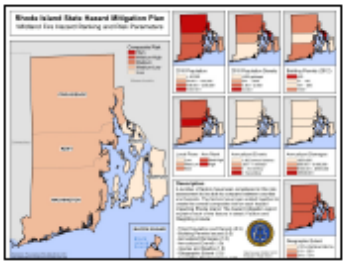

Earthquake

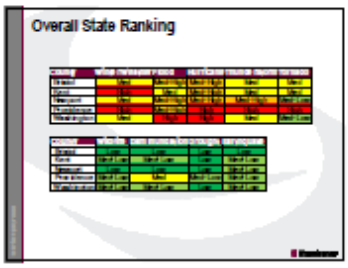

Earthquake: Hazus Scenarios
1755 Cape Ann (6.5 magnitude)
3,883 buildings moderately damaged
21 buildings damaged beyond repair
117,000 tons of debris (59% brick & wood)
$507.95 Million total economic loss
$14 Million in utility system loss
1951 North Kingstown (5.0 magnitude)
7,913 buildings moderately damaged
100 buildings damaged beyond repair
210,000 tons of debris (57% brick & wood)
$1,326.28 Million total economic loss
$184.24 Million in utility system loss


Earthquake: Annualized Losses from Hazus




Wildland Fire




Overall State Ranking

Using HIRA Results to Inform Strategies
Development & maintenance of spatial data for critical & state facilities
Hazard Specific GIS data development (i.e. Dam inundation areas)
Continue to mitigate RL & SRL properties
Climate Change & Sea Level Rise
Investigate properties within SLR scenarios

Goals, Objectives, and Actions
Divided into groups by Goal and Strategy:
4 Goals, 10 Strategies
56 Mitigation Actions
Updates provided on all 2011 Actions:
HIRA
Responsible Agencies
Must be updated or adjusted to reflect current conditions

2011 Mitigation Goals

Must be reaffirmed or updated based on current conditions

- Goal 1: Enhance the Rhode Island Emergency Agency's capacity to promote and implement projects, programs, policies and legislative action to minimize losses due to natural hazards, in particular for properties with repetitive and severe repetitive losses due to flooding
- Goal 2: Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.
- Goal 3: Improve coordination and communication with other relevant organizations, agencies and stakeholders.
- Goal 4: Increase public understanding, support and demand for hazard mitigation.

Mission: RI that is resilient to natural hazards and climate change.

1. Rhode Island has the capacity to promote and implement projects, programs, policies and legislative actions to reduce vulnerability to natural hazards.
2. Measurable actions are being taken to reduce vulnerability.
3. Local communities are addressing natural hazards and long-term risk reduction in local decision making and planning.
4. Statewide coordination with organizations, agencies, and stakeholders.
5. Public understands, supports, and acknowledges the need for hazard mitigation.

Goal 1

- 2011: Enhance the Rhode Island Emergency Agency's capacity to promote and implement projects, programs, policies and legislative action to minimize losses due to natural hazards, in particular for properties with repetitive and severe repetitive losses due to flooding
- 2014 Goal 1: RI that is resilient to natural hazards and climate change.

Goal 1 Strategies

- Strategy 1.1 Enhance the Rhode Island Emergency Agency's capacity to promote and implement projects, programs, policies and legislative action to minimize losses due to natural hazards, in particular for properties with repetitive and severe repetitive losses due to flooding r
- Strategy 1.2
- Strategy 1.3

Goal 2

- 2011: Build and support local capacity and commitment to continuously become less vulnerable to natural hazards.
- 2014: Build and support statewide and local capacity and commitment to continuously becoming less vulnerable to natural hazards.
  - Should include an element of increased collaboration with state agencies.

Goal 2 Strategies

- Strategy 2.1
- Strategy 2.2

Goal 3

- 2011: Improve coordination and communication with other relevant organizations, agencies and stakeholders.
- 2014: Improve coordination and communication with other relevant organizations, agencies and stakeholders.

Goal 3 Strategies

- Strategy 3.1
- Strategy 3.2
- Strategy 3.3

Goal 4

- 2011: Increase public understanding, support and demand for hazard mitigation.
- 2014: Increase public understanding, support and demand for hazard mitigation.

Goal 4 Strategies

- Strategy 4.1
- Strategy 4.2

2011 Mitigation Activities Progress Report

Local Plan: Main concepts presented in Goals

- Protect / reduce loss to present and future structures or property from all hazards
- Protect the public / reduce injury / protect lives from all hazards
- Protect critical infrastructure (includes dams, roads, utilities, essential services)
- Public Education / Increase public understanding and support for hazard mitigation
- Protect cultural, historical, natural, and economical environments

Local Plan: Identified Actions

- Provide public outreach / education / incentives
- Infrastructure improvements (bypass sewer main, bridges, water, other utilities)
- Implement / continue tree trimming programs
- Building / code / zoning improvements or enforcement
- Assess / study the impacts of hazards
- Assess dams / address dam safety issues
- Acquire lands / repetitive loss structures in hazard prone areas
- Develop debris management plan / manage debris

Local Plan: Main Funding Sources

- Local Funding / Resources (Dept budgets, general funds)
- FEMA/RIEMA
- RI Funds / Grants
- RI DOT
- RI DEM
- Private Funding (Partnerships, Fees)

Identifying NEW Mitigation Activities

Breakout Groups

- Identify specific mitigation activities to include for 2014-2017
- Activities should be:
  - Strategic – linked to HIRA findings and aligned with existing Goal-Objective-Strategy(s)
  - Actionable – specific enough to be implemented
  - Achievable – technically feasible, legal, affordable and cost-effective, and socially and politically acceptable
  - Measurable – progress can be evaluated over time
- Activity information will be captured by group facilitators

Identifying NEW Mitigation Activities

- Activity information includes:
  - Strategy #
  - Priority (H, M, L)
  - Activity Description
  - Lead Agency
  - Estimated Cost (if applicable)
  - Potential Funding Sources (if applicable)
  - Timeframe for Completion
  - Hazard(s) to be Addressed
  - Point of Contact (Name, phone, email)
  - Notes
- See handout, *Mitigation Action Worksheet*

Mitigation Brainstorming Exercise

- Focus Question: *What specific mitigation actions should the State be taking to make Rhode Island safer from natural hazards?*
- Guidelines:
  - Assemble into 3-4 breakout groups. Elect a group leader.
  - Spend 15 minutes discussing the mitigation resources or activities that your agency/organization provides (or could/should provide)
  - Spend 15 minutes discussing possible new mitigation actions or activities for the 2014 Plan Update (documented by group leader)
  - Focus on mitigation vs. preparedness/response activities

Prioritizing NEW Mitigation Activities

- Prioritize all final mitigation activities using established criteria (STAPLE-E factors):
  - Social
  - Technical
  - Administrative
  - Political
  - Legal
  - Economic
  - Environmental
- Each mitigation activity will be scored and assigned *High*, *Medium*, or *Low* priority

WebEx#4 Mitigation Strategy review and Prioritization Methods: July 12, 2013

Rhode Island State Hazard Mitigation Plan Update
WebEx #4: Mitigation Strategies Development and Prioritization
7/12/2013

Purpose:

To discuss and finalize the proposed vision statement, goals and objectives and to identify new mitigation activities to be included in the 2014 plan update.

WebEx format:

1. 2013 RI Hazard Mitigation Plan Progress to Date
2. Review of the Vision Statement, Goals, and Objectives
3. 2014 Action Development
4. Mitigation Activity Prioritization
    a. Online Survey

Attendees:

- Bill Patenaude (DEM)
- Janet Freedman (CRMC)
- Pam Rubinoff (CRC Sea Grant)
- Carlene Newman (RI DOH)
- Joe Baker (RIDOT)
- Chelsea Siefert (RI Division of Planning)
- Jessica Stimson (RIEMA)
- Thomas Kogut (RI Division of Public Utilities and Carriers)
- Nan Johnson (FEMA R1)
- Janna Newman (Dewberry)
- Rachael Herman (Dewberry)

Attachments:

WebEx4-Mitigation Actions and Prioritization.pdf

Meeting Notes:

1. Progress to date on the plan was discussed.
    a. The capabilities assessment is currently being reviewed by Jess Stimson.
    b. The HIRA analysis is complete and the plan sections are being finalized. Individual hazard sections are being reviewed by subject matter experts. David Vallee has reviewed the drought section. Janet Freedman and Pam Rubinoff would like to review the sea level rise information.
    c. Mitigation goals and objectives were completely revised during the June 21st meeting.
    d. Action development and prioritization is currently underway.

2. The vision statement, goals and objectives were reviewed and signed off on.

Rhode Island State Hazard Mitigation Plan Update
WebEx #4: Mitigation Strategies Development and Prioritization
7/12/2013

3. Action development was discussed by reviewing the mitigation strategies tracker spreadsheet and development word document. Several changes were made to the activity development word document and it was agreed that this should be sent out to the steering committee members along with the excel document so that the current actions could be expanded on by committee members.

4. Once the actions are finalized, prioritization will take place via Survey Monkey. Committee members will receive an email once this is ready for review and prioritization.

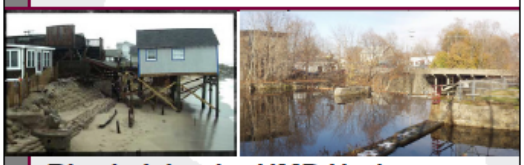
Next Steps:

1. ****Mitigation Action Development worksheets due 7/26/2013****
   - Send completed forms to Rachael Herman rherman@dewberry.com or Jess Stimsom jessica.r.stimson.nfg@mail.mil

2. Mitigation Action Prioritization via SurveyMonkey: email with details to be sent in August

3. Complete Draft for Review: August/September

Dewberry



Rhode Island – HMP Update

WebEx#1: Climate Change and Sea Level Rise (2/26/2013)
WebEx#2: Water and Wind Related (3/26/2013)
WebEx#3: Drought, Wildfire & Geologic-Related, Capability Assessment Review and Public Outreach (5/1/2013)
WebEx#4: Mitigation Strategies & Prioritization (7/12/2013)

Dewberry

Progress to Date

- HIRA Analysis Complete √
  - Hazard-specific reviews underway
- Capabilities Assessment Section Complete √
  - RIEMA internal review
- Mitigation Goals & Objectives Revised √
- Mitigation Actions Underway
  - 2011 Actions reported on
  - **2014 Actions under development**

Dewberry

2014 Vision Statement

Rhode Island is resilient to natural hazards and climate change.

Dewberry

Goal 1

Rhode Island has the capacity to promote and implement projects, programs, plans, policies, and legislative actions to reduce vulnerability to natural hazards.

1. Maintain and implement a SHMP that fosters innovation, advances public support, and gains long-term commitments for action from all stakeholders
2. Increase the capacity of, and diversify the representation of the State Interagency Hazard Mitigation Committee (IHMC)
3. Increase the capability of Rhode Islanders to address natural hazards in their daily lives and work

Dewberry

Goal 2

Statewide coordination with organizations, agencies, and stakeholders.

1. Leverage resources and expertise and capitalize on opportunities that will further hazard mitigation efforts
2. Institutionalize hazard mitigation into the activities of all stakeholders
3. Increase communication and stream line policies, procedures, and operations to eliminate conflicts and duplication of effort.

Dewberry

Goal 3

Local communities are addressing natural hazards and long-term risk reduction in local decision making and planning.

1. Aid in the development and implementation of LHMP.
2. Improve the quality of Comprehensive Plans in addressing natural hazards
3. Increase the capabilities of local decision makers in hazard mitigation

Dewberry

Goal 4

The Public understands, supports, and acknowledges the need for hazard mitigation.

1. Identify and educate the public about hazard specific issues
2. Engage the private sector in hazard mitigation initiatives
3. Increase public and private sector coordination

Goal 5

The built environment and infrastructure are resilient to the impacts of natural hazards

1. Implement measurable actions to reduce vulnerability
2. Increase and measure losses avoided as a result of mitigation actions

2014 Action Development

- See Mitigation Strategies Tracker spreadsheet
- See Mitigation Action Development word document

Local Plan: Identified Actions

- Provide public outreach / education / incentives
- Infrastructure improvements (bypass sewer main, bridges, water, other utilities)
- Implement / continue tree trimming programs
- Building / code / zoning improvements or enforcement
- Assess / study the impacts of hazards
- Assess dams / address dam safety issues
- Acquire lands / repetitive loss structures in hazard prone areas
- Develop debris management plan / manage debris

Identifying NEW Mitigation Activities

- Activity Information includes:
  - **Strategy #**
  - **Priority (H, M, L)**
  - **Activity Description**
  - **Lead Agency**
  - **Estimated Cost** *(if applicable)*
  - **Potential Funding Sources** *(if applicable)*
  - **Timeframe for Completion (short-term, long-term)**
  - **Hazard(s) to be Addressed**
  - **Point of Contact** *(Name, phone, email)*
  - **Notes**
- See handout, *Mitigation Action Worksheet*

Prioritizing NEW Mitigation Activities

- Prioritize all final mitigation activities using established criteria (STAPLE-E factors):
  - Social
  - Technical
  - Administrative
  - Political
  - Legal
  - Economic
  - Environmental
- Each mitigation activity will be scored and assigned *High*, *Medium*, or *Low* priority

WebEx#5 Draft Plan Review: October 14, 2013

Rhode Island State Hazard Mitigation Plan Update
WebEx #5: Draft Plan Review
10/15/2013

Purpose:

To discuss how steering committee should review and provide comments for the draft hazard mitigation plan.

WebEx format:

1. 2014 RI Hazard Mitigation Plan Progress to Date
2. Draft Plan Review
3. SIHMC Role in Review and Public Involvement
4. Plan Maintenance
5. Project Schedule for FEMA review and SIHMC future meetings

Attendees:

- Chelsea Siefert (RI Division of Planning)
- Jessica Stimson (RIEMA)
- Thomas Kogut (RI Division of Public Utilities and Carriers)
- Dave Aucoin (Narragansett Day Commission)
- Carrie (Narragansett Day Commission)
- Jim (Narragansett Day Commission)
- John Boothroyd (URI Geosciences)
- Laura Sullivan (RI Division of Planning)
- Joe Bucci (RI DOT)
- Julia Gold
- Steven Boudreau
- Nan Johnson (FEMA R1)
- Katie Freedman (Haggerty)
- Brock Long (Haggerty)
- Scott Choquette (Dewberry)
- Janna Newman (Dewberry)
- Rachael Herman (Dewberry)

Attachments:

WebEx5-Draft Plan review.pdf

Meeting Notes:

1. Progress to date on the plan was discussed.
    a. The draft plan was sent to steering committee members on 10/11/2013 to begin review prior to the WebEx call.
    b. Several committee members have sent comments regarding climate change, coastal erosion, mitigation actions, drought, and the plan maintenance schedule.

2. Draft Plan Review: each section of the plan was described. Committee members were asked to specifically review portions of Section 4 (Capabilities Assessment) and Section 6 (State Hazard Mitigation Strategy). Comments received by 10/25/2013 will be incorporated into the document posted to RIEMA and DOA websites.

Rhode Island State Hazard Mitigation Plan Update
WebEx #5: Draft Plan Review
10/15/2013

3. Public review: The draft plan will be posted to RIEMA and DOA websites on 10/28/2013 and will include comments received up until 10/25/2013. Committee members were asked to forward the plan link to other colleagues, agencies, planning groups, etc. Information on how/who the plan was sent to should be provided to Rachael and Jess to be included in the Planning Process. Public and steering committee members will have an opportunity to provide comments until 11/22/2013. Options discussed for involvement:
    a. Websites
    b. Facebook
    c. Twitter
    d. Newspaper/Television
    e. Listservs

    f. Executive Summary: It was discussed that an executive summary or a flyer should be provided in the email to other stakeholders/listservs. Haggerty is currently working on the summary and will work with Jess and Chelsea to finalize this.

4. Plan Maintenance: This section is new to the 2014 plan and includes a detailed process to evaluate and implement the RI SHMP through quarterly meetings.
    a. Nan mentioned that this section should also include the criteria by which the plan will be evaluated. Rachael and Jess will work together to make sure this is addressed.

Next Steps:

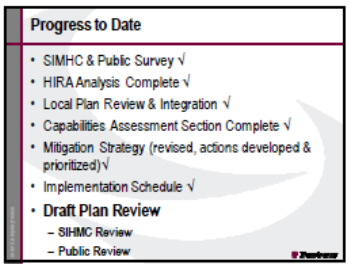
1. ****Comments on Draft RI SHMP due 10/25/2013****
    - Comments received by 10/25/2013 will be incorporated into the draft that will be posted for public review.
    - Send comments to Rachael Herman rherman@dewberry.com or Jess Stimsom jessica.r.stimson.nfg@mail.mil

2. Public review (RIEMA website, DOA website, listservs, industries/businesses) 10/28/2013 through 11/22/2013

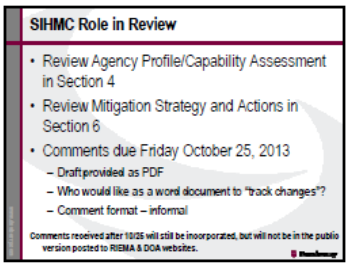
3. Complete Draft to FEMA: end of November/December

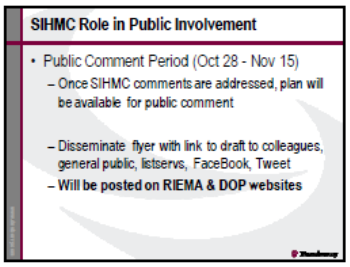
4. January 2014: First Quarterly meeting for SIHMC

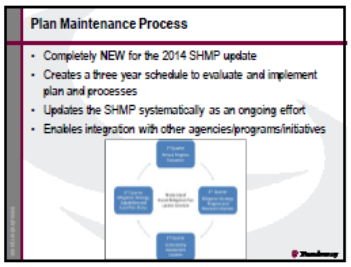
Dewberry
Rhode Island – HMP Update
WebEx#1: Climate Change and Sea Level Rise (2/26/2013)
WebEx#2: Water and Wind Related (3/26/2013)
WebEx#3: Drought, Wildfire & Geologic Related, Capability Assessment Review and Public Outreach (5/1/2013)
WebEx#4: Mitigation Strategies & Prioritization (7/12/2013)
WebEx#5: Draft Plan Review (10/15/2013)

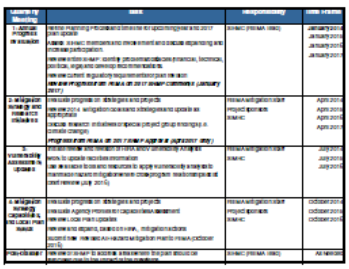

Progress to Date
• SIMHC & Public Survey √
• HIRA Analysis Complete √
• Local Plan Review & Integration √
• Capabilities Assessment Section Complete √
• Mitigation Strategy (revised, actions developed & prioritized) √
• Implementation Schedule √
• Draft Plan Review
– SIHMC Review
– Public Review

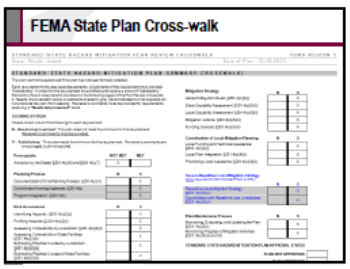
Draft Plan Review
• Section 1: Introduction
• Section 2: Planning Process
• Section 3: Hazard Identification & Risk Assessment
• Section 4: State Capability Assessment
• Section 5: Local Hazard Mitigation Plan Coordination
• Section 6: State Hazard Mitigation Strategy
• Section 7: Plan Maintenance Process

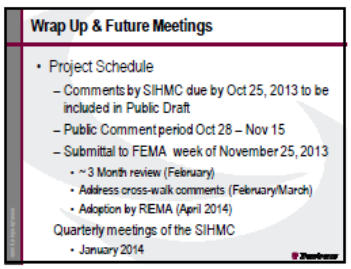

SIHMC Role in Review
• Review Agency Profile/Capability Assessment in Section 4
• Review Mitigation Strategy and Actions in Section 6
• Comments due Friday October 25, 2013
– Draft provided as PDF
– Who would like as a word document to "track changes"?
– Comment format – informal
Comments received after 10/25 will still be incorporated, but will not be in the public version posted to RIEMA & DOA websites.


SIHMC Role in Public Involvement
• Public Comment Period (Oct 28 - Nov 15)
– Once SIHMC comments are addressed, plan will be available for public comment
– Disseminate flyer with link to draft to colleagues, general public, listservs, FaceBook, Tweet
– Will be posted on RIEMA & DOP websites


Plan Maintenance Process
• Completely NEW for the 2014 SHMP update
• Creates a three year schedule to evaluate and implement plan and processes
• Updates the SHMP systematically as an ongoing effort
• Enables integration with other agencies/programs/initiatives




FEMA State Plan Cross-walk


Wrap Up & Future Meetings
• Project Schedule
– Comments by SIHMC due by Oct 25, 2013 to be included in Public Draft
– Public Comment period Oct 28 – Nov 15
– Submittal to FEMA week of November 25, 2013
• ~ 3 Month review (February)
• Address cross-walk comments (February/March)
• Adoption by RIEMA (April 2014)
Quarterly meetings of the SIHMC
• January 2014

Public Survey Detailed Responses

Specific areas vulnerable to identified hazards were asked to be identified. Of the 26 responses, 25 of these responses were related to flooding (riverine, coastal, dam breach, and urban/stormwater) and one (1) pertaining to winter storm. These responses are summarized by type of hazard below. The majority of the responses pertain to specific areas vulnerable to flood related hazards. These locations will be added to the Flood related hazard section in the HIRA for a more comprehensive geographic analysis.

Riverine

- Pawtuxet Watershed – including Pawtuxet and Pocasset Rivers and Meshanticut Brook
- V and AE flood zones
- Cranston has experienced major flooding events along rivers, especially Pontiac and Pocasset Rivers
- Areas with high rates of low/moderate income households in/near 100 year floodplains
- Higginson Avenue, Blackstone Falls High Street, CF Landing Broad Street
- Electric substations in flood prone areas
- Flooding from Blackstone River – downtown Pawtucket
- Pawcatuck River flooding
- Main Street at Barrington Bridge and Main Street near Locust Terrace – both areas flood in moderate storms
- Bridges, highways, and electrical systems
- Allens Avenue between Warren Way and Thurbers Avenue is in a flood zone
- Valley Lodge Estates on the Wood River
- Individual properties along the Wood, Pawcatuck, and Beaver rivers
- Public water supplies in low lying areas near river floodplains
- Lonsdale Bleachery complex to flooding
- South County Hospital Campus is in a flood zone
- Area around RI Hospital/Hasbro/Women and Infants' is particularly vulnerable to any event that causes flooding in the Port of Providence area
- Future development on the Kickemuit River could create greater exposure if unchecked
- Silver Creek
- All wastewater treatment infrastructure
- Olneyville and Valley subject to flooding
- Runnins River and Ten Mile River subject to flooding
- Nursing homes in flood zones:

Avalon Nursing Home	Warwick
Charlesgate Nursing	Providence
Cortland Place	Greenville
Grace Barker	Bristol
Grandview Center	Cumberland
Harborside/Pawtuxet Village Nursing	Warwick

& Rehab	
Heberts Nursing Home	Smithfield
John Clark Retirement Center	Middletown
North Bay Manor	Smithfield
Riverview Healthcare Community	Coventry
Saint Elizabeth Home	E. Greenwich
Scallop Shell Nursing & Rehab	S. Kingstown
Silver Creek Manor	Bristol
South Kingstown Nursing & Rehab	W. Kingston
Village at Waterman Lake	Greenville
Watch Hill Care & Rehab	Westerly
Waterview Villa	E. Providence
West Shore Health Center	Warwick
West View Healthcare Center	W. Warwick

Coastal Flooding

- Coastal flooding in Bullocks Cove, Riverside (Pawtucket)
- Low-lying beach communities in Warwick
- Coastal areas especially Charlestown Beach, East Beach, and West Beach areas
- Misquamicut Beach area vulnerable to coastal erosion, hurricanes, and flooding
- Watch Hill, Weekapaug, Shelter Harbor are all coastal areas subject to coastal erosion, hurricanes, and storm surge
- Entire tidewater coastline and southern half of eastern border along the Runnins River is vulnerable to storm surge
- Bluff along western edge of Narragansett Terrace and northward toward United Water WWTF is subject to coastal erosion

Other Flooding

- Dam breach along Ten Mile River below Turner and Hunts Mills dams
- Stormwater flooding during heavy rains on Pleasant Street in Pawtucket

Winter Storm

- Pawtucket snow removal from Oak Hill neighborhood

Participants were asked what the most important things that the State of Rhode Island can do to help communities prepare for a disaster and become more resilient; multiple selections were permitted. Reponses, in frequency of selection include:

- Educate residents, businesses, and organizations to help them understand risks and be prepared (83.9%)
- Give technical assistance to residents, businesses, and organizations to help them reduce losses from hazards and disasters (71.4%)

- Make it easier for residents, businesses, and organizations to take their own actions to become more resilient to disasters (57.1%)
- Improve warning and response systems (53.6%)
- Make it easier for communities to educate residents and give technical assistance as needed (48.2%)
- Additional responses include:
    - Clear messaging about risks, expectations, resources and resource limitations
    - Continue to train EMA and DPW directors on their responsibilities
    - Use multiple channels/venues, CBOs and multiple languages
    - Help Statewide Planning with what should be required in the Natural Hazard element that they required as of 2011 and that localities need to complete by 2016
    - Grants to pay for improvements
    - Incentivize individuals to take actions to become more resilient and prepared (through fines, fees, tax breaks, or other legislation)
    - Statewide notification system and update the EAS Plan

Over 74% of responses indicate that their organization has taken actions to reduce long-term vulnerability to natural hazards and one-third would like to learn more on increasing resiliency. Many organizations noted that they conduct outreach activities and provide funds for municipalities to conduct recover projects. Similarly, the majority of responses indicate that disaster plans and supply kits are maintained for their family, home, or business. One-third of the responses include maintenance of vegetation from overhead utility lines and measures taken to reduce snow build-up on roofs.

Participants were asked what projects would help them or their organization reduce risk of future damage from weather-related events. Choices were not provided; all responders were required to enter a response or skip the question. A total of 17 written responses were entered. These projects identified fall into categories of public outreach/technical assistance, flood management projects, and projects designed to maintain power during a hazard event. Many of these actions listed are response and preparedness. The Mitigation Strategy in this plan update includes a large educational component for mitigation activities verses preparedness and response. Written responses included:

- Putting more existing utilities underground
- Provide communities with detailed GIS mapping showing flood zones with street map, evacuation plans, mature tree cover, land uses, repetitive loss areas, etc.
- FEMA and NRCS grants to provide for flood mitigation
- Improved power outage contingency plans and response
- Continued communication and workshops on post-storm response and preparedness
- Continue with statutorily mandated gas and electric infrastructure dockets on an annual basis
- Planning for stormwater inundation
- Communication materials to communicate hazards to Planning Board members

- Statewide vegetation control program to increase the clear zone along major highways, freeways, and interstates to reduce the risk of trees falling and blocking travel lanes
- Debris management assistance
- Environmental analysis of power lines and trees
- Community outreach information
- Grants to pay for improvements
- Help with getting approval for a mitigation project
- Acquisitions, elevations, and drainage improvements
- Continue to acquire properties in floodprone areas
- Education for utility managers and community leaders about the vulnerability and value of wastewater infrastructure
- Improvement/replacement of Runnins River culvert along Warren Avenue at the Seekonk, MA line.
- Continuation of the Ten Mile River stream gage at Pawtucket Avenue
- Drainage improvements in chronic street flooding locations

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Appendix 3: Hazard Identification & Risk Assessment

Additional background information for the Rhode Island State profile is contained on the following pages.

U.S. Census Data

US Census 2011, 2012 Building Permit data*. Source: U.S. Census 2011, 2012.

County	Municipality	2011		2012	
		Buildings	Units	Buildings	Units
Bristol	Barrington	7	8	12	12
	Bristol	14	14	12	12
	Warren	0	0	3	3
Kent	Coventry	18	24	27	27
	East Greenwich	1	1	3	3
	Warwick	17	17	34	40
	West Greenwich	2	2	8	8
	West Warwick	6	6	11	12
Newport	Jamestown	19	19	12	16
	Little Compton	5	5	12	12
	Middletown	8	8	29	29
	Newport	12	12	10	11
	Portsmouth	17	17	20	22
	Tiverton	25	25	20	20
Providence	Burrillville	15	15	10	10
	Central Falls	0	0	1	1
	Cranston	27	27	28	28
	Cumberland	59	59	50	50
	East Providence	6	8	7	7
	Foster	3	3	4	4
	Glocester	N/A	N/A	N/A	N/A
	Johnston	14	14	13	13
	Lincoln	29	29	12	12
	North Providence	4	7	12	12
	North Smithfield	26	46	16	16
	Pawtucket	6	8	5	10
	Providence	11	14	4	4
	Scituate	13	13	7	7

County	Municipality	2011		2012	
		Buildings	Units	Buildings	Units
	Smithfield	15	15	9	9
	Woonsocket	3	3	2	2
Washington	Charlestown	24	24	18	18
	Exeter	27	45	15	23
	Hopkinton	N/A	N/A	11	11
	Narragansett	16	16	20	29
	New Shoreham (Block Island)	6	6	5	5
	North Kingstown	20	25	37	37
	Richmond	6	6	9	9
	South Kingstown	46	46	95	95
	Westerly	61	67	36	36

*This application provides construction statistics by permit-issuing place and by county on new privately-owned residential housing units authorized by building permits.

Federal Disaster Declaration Process

A Presidential Disaster Declaration is an action by the President to make U.S. federal funding available for emergency relief and reconstruction assistance. 64 The President can declare a disaster declaration for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President believes has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work.[65]

An Emergency Declaration can be declared for any occasion or instance when the President determines federal assistance is needed. Emergency Declarations supplement State and local efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. The total amount of assistance provided for a single emergency may not exceed $5 million. If this amount is exceeded, the President shall report to Congress.

Not all programs, however, are activated for every disaster. The determination of which programs are authorized is based the types of assistance specified in the governor's

[64] http://www.fema.gov/presidential-disaster-declarations
[65] http://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/recovery-directorate/disaster-declaration

request and on the needs identified during joint PDA and any subsequent PDAs. FEMA disaster assistance programs are as follows:

- **Individual Assistance** - Assistance to individuals and households;
- **Public Assistance** - Assistance to state and local governments and certain private nonprofit organizations for emergency work and the repair or replacement of disaster-damaged facilities; and
- **Hazard Mitigation Assistance** – Assistance to state and local governments and certain private nonprofit organizations for actions taken to prevent or reduce long term risk to life and property from natural hazards.

National Climatic Data Center (NCDC) Data Processing

NOAA's NCDC database provides information about events from 1951 to December 2012. Records for most weather events were reported starting in 1993, with the exception of tornado (reports date to 1950), thunderstorm winds (reports date to 1955), and hail (reports date to 1955).

For the purposes of this HIRA, the county in which the event occurred was of primary interest, and the NCDC has provided this data in two (2) methods:

County Name – Event listed as individual record for each county in which it occurred

Zone – Event listed by the zone or multiple zones, which contain multiple counties.

NCDC is known to have spotty recording of geological hazards (i.e., earthquake, landslide, karst). In the absence of better data it was decided to proceed with the records available in NCDC for these events. In all cases NCDC records for these events are significant under-representations of what has happened in Rhode Island's past. Efforts were made to contact the correct State representative for each hazard to see if better data sources of historical accounts were available. To date, comprehensive digital databases do not exist for these NCDC Normalizing Data

To accurately count the number of events occurring in a single county, the zonal data records were expanded into a set of individual city/county records, based on NCDC zone definitions. For example, if there were three political jurisdictions in a given zone, a record in the database for a winter storm covering that zone were replaced with three records for that storm, corresponding to each of the political jurisdictions. During this process, the damages, deaths, and injuries associated with a storm event in a certain zone were divided evenly among the political jurisdictions in that zone. Injuries and fatalities, once normalized, were combined into a single number. The amount of effort to properly assign the zonal events with damages, deaths and injuries was beyond the scope of this project.

NCDC Inflation Computation ("Normalizing")

Damages entered into the NCDC Storm Events database portray how much damage occurred in the year of the event. Due to inflation and the changing value of money, the values of damages incurred have been adjusted to 2012 dollars. This was accomplished using the U.S. Bureau of Labor Statistics annual Index of Consumer Prices. Each value was multiplied by the index for that year and subsequently divided by the index value in 2012, the target year. The year 2012 was chosen because it was the most recent full year available in the index values list.

NCDC Annualizing Data

After the data was normalized, inflation accounted for, and summary statistics calculated, the data was annualized so that results were comparable using a common system (i.e., ranking the hazards). The parameter or value of interest was divided by the length of record for each hazard. The annualized value should only be used to estimate what can be expected annually. Property and crop damage and events were annualized per county using this method and are available in each hazard section.

NCDC Events and Data Compilation

The NCDC Storm Events database uses very detailed event categories. The reported storm events were grouped into the major hazard types addressed by this plan. The table below shows the NCDC categories as reported in the database and the hazard categories used for the HIRA. Ranking methodologies in the next section explains how the NCDC data was used in ranking the hazards against each other. Several events did not have a county name or location associated with the record. As a result, these events were omitted from the analysis.

Assignment of NCDC Event Categories to Hazard Categories Addressed in the HIRA

HIRA Category	NCDC Categories Included in Database	
Drought	Drought	
Extreme Heat	Excessive Heat/Heat	Record Heat
Flood	Coastal Flood	Flood
	Coastal Flooding	Rip Currents
	Coastal Storm	Storm Surge/Tide
	Coastal Flood	Urban Flood
	Flash Flood	Urban/Sml Stream Fld
Hurricane	Hurricane	Tropical Storm
Thunderstorms	Hail	Thunderstorm Wind
	High Wind	Thunderstorm Winds
	High Winds	Tstm Wind
	Lightning	Tstm Wind/Hail

HIRA Category	NCDC Categories Included in Database	
	Strong Wind	Wind
	Strong Winds	Winds
Tornado	Funnel Cloud	Tornado
Winter Weather	Blizzard	Snow
	Freezing Rain	Snow Squalls
	Heavy Snow	Winter Storm
	Ice Storm	Winter Weather
	Wintery Mix	Winter Weather/Mix

NCDC Data Summary

Once the data was processed, individual totals for each hazard category could be summarized by County and statewide could be created. The table below summarizes each of the hazard categories by County.

NCDC storm events by county and HIRA category type.

County Name	Flood	Hurricane	Wind	Hail	Lightning	Tornado	Winter Storm
Years of Record	**1993-2012**	**1993 - 2012**	**1956-2012**	**1956 - 2012**	**1956 - 2012**	**1950 - 2012**	**1993 - 2012**
Bristol County	39	2	75	4	3	2	38
Kent County	70	2	178	26	9	4	111
Newport County	40	2	111	9	7	2	36
Providence County	113	3	223	50	25	9	139
Washington County	51	2	115	14	4	3	43

NCDC annualized storm events by county and HIRA category type.

County Name	Flood	Hurricane	Thunderstorm	Tornado	Winter Storm	Earthquake
Years of Record	**1993-2012**	**1993 - 2012**	**1956- 2012**	**1950 - 2012**	**1993 - 2012**	**1568 - 2012**
Bristol County	1.95	0.23	1.4	0.03	1.9	0.002
Kent County	3.5	0.23	3.6	0.06	5.55	0.014
Newport County	2	0.23	2.2	0.03	1.8	0.014
Providence County	5.65	0.23	5.1	0.14	6.95	0.002
Washington County	2.55	0.23	2.3	0.05	2.15	0.025

Facilities Analysis

As described in Section 3, infrastructure and facilities were intersected with hazards that have known geographic spatial extents. Infrastructure and facilities located within at least two (2) hazard zones are shown in the table below. All analysis is available through RIEMA mitigation.

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
BRISTOL	Critical Facility	Dam	WARREN RESERVOIR UPPER DAM	2		AE		
BRISTOL	Critical Facility	Dam	ECHO LAKE DAM	2	Plus3	AE		
BRISTOL	Critical Facility	Dam	WARREN RESERVOIR LOWER DAM		Plus3	AE		
BRISTOL	Critical Facility	Dam	RHODE ISLAND COUNTRY CLUB POND DAM		MHHW	AE		
BRISTOL	Critical Facility	Fire Station	WARREN FIRE DEPARTMENT - MECHANICS FIRE COMPANY STATION 2	3		500-yr		
BRISTOL	Critical Facility	Fire Station	HAMPDEN MEADOWS VOLUNTEER FIRE COMPANY	2	Hurricane38			
BRISTOL	Critical Facility	Fire Station	BRISTOL FIRE DEPARTMENT - EVEREADY STATION	1	Plus4	VE		
BRISTOL	Critical Facility	Hurricane Shelter	BARRINGTON MIDDLE	3		500-yr		
BRISTOL	Critical Facility	Hurricane Shelter	ST ALEXANDER CHURCH	2		500-yr		
BRISTOL	Critical Facility	Hurricane Shelter	BARRINGTON HIGH	2		500-yr		
BRISTOL	Critical Facility	Marina	Brewer's Cove Haven	3		500-yr		
BRISTOL	Critical Facility	Marina	Dyer Boats-Anchorage, Inc.	2		500-yr		
BRISTOL	Critical Facility	Marina	Speed's Marine Service	2	Hurricane38	500-yr		
BRISTOL	Critical Facility	Marina	Harbor Marine Corporation	2		500-yr		
BRISTOL	Critical Facility	Marina	Lavins' Marina	2	Hurricane38	VE		
BRISTOL	Critical Facility	Marina	Wharf Tavern	2	Hurricane38	VE		
BRISTOL	Critical Facility	Marina	Stanley's Boat Yard	1	Plus1	AE		
BRISTOL	Critical Facility	Marina	Striper Marina	1	Plus5	AE		
BRISTOL	Critical Facility	Marina	Barrington Yacht Club		MHHW	AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
BRISTOL	Critical Facility	School	Barrington Middle School	3		500-yr		
BRISTOL	Critical Facility	School	Barrington High School	2		500-yr		
BRISTOL	Critical Facility	School	Guiteras School	2	Hurricane38	AE		
BRISTOL	Critical Facility	School	Tot's Cooperative Nursery School	1	Plus3	AE		
BRISTOL	Critical Facility	School	Raggedy Ann Nursery	1	Plus4	AE		
BRISTOL	State Facility	State Owned	BARRINGTON POLICE	1	Hurricane38	AE		
KENT	Critical Facility	Dam	FRUIT OF THE LOOM DAM	4		AE	X	
KENT	Critical Facility	Dam	GORTON POND DAM	3		A		
KENT	Critical Facility	Dam	PAWTUXET RESERVOIR LOWER DAM	2	Plus5	AE	X	
KENT	Critical Facility	EMS Company	WARWICK FIRE DEPARTMENT STATION 4	4		500-yr		
KENT	Critical Facility	Fire Station	WARWICK FIRE DEPARTMENT STATION 4	4		500-yr		
KENT	Critical Facility	Marina	Little Rhody Boat Club - Private Club	3	Hurricane38	AE		
KENT	Critical Facility	Marina	Norton Shipyard & Marina	2	Hurricane38	AE		
KENT	Critical Facility	Marina	Winstead's Marina	2		AE		
KENT	Critical Facility	Marina	Pettis Marine Boat Yard	2	Hurricane38	VE		
KENT	Critical Facility	Marina	Angel's Marina	2	Plus5	VE		
KENT	Critical Facility	Marina	Breezy Point Marina, Inc.	1	Hurricane38	AE		
KENT	Critical Facility	Marina	Harbor Light Marina	1	Plus4	AE		
KENT	Critical Facility	Marina	C-Lark Marina	1	Plus4	AE		
KENT	Critical Facility	Marina	Carlson's Marina	1	Plus3	AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
KENT	Critical Facility	Marina	Harborside Lobstermania, Inc.	1	Plus1	AE		
KENT	Critical Facility	Marina	East Greenwich Yacht Club	1	Plus3	AE		
KENT	Critical Facility	Marina	Apponaug Harbor Marina	1	Plus3	VE		
KENT	Critical Facility	Marina	Warwick Cove Marina, Inc.		Plus4	AE		
KENT	Critical Facility	Marina	Greenwich Bay Marina		MHHW	AE		
KENT	Critical Facility	Marina	Marine Machinery Serv. Inc.		MHHW	AE		
KENT	Critical Facility	Marina	Nick's Dock		Plus1	AE		
KENT	Critical Facility	Marina	Wharf Marina Inc.		MHHW	AE		
KENT	Critical Facility	Marina	Ponaug Marina Inc.		MHHW	VE		
KENT	Critical Facility	Marina	Aqua Vista Marina & Boat Sales		MHHW	VE		
KENT	Critical Facility	School	Playschool of Warwick	4		500-yr		
KENT	Critical Facility	School	Warwick Montessori	3		AE		
KENT	State Facility	State Owned	R I MALL – DMV	4		AE	X	
KENT	State Facility	State Owned	WELFARE	3	Hurricane38	500-yr		
NEWPORT	CIKR	Emergency Services		4		500-yr		X
NEWPORT	CIKR	Emergency Services		4		AE		
NEWPORT	CIKR	Transportation - Maritime	Port of Newport Harbor	4		AE		
NEWPORT	CIKR	Transportation - Road Systems / Maritime		4		AE		
NEWPORT	Critical Facility	Dam	NELSON POND DAM	3		AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
NEWPORT	Critical Facility	Dam	GARDINER POND DAM	3		AE		
NEWPORT	Critical Facility	Dam	SHERER POND	2	Hurricane38	AE		
NEWPORT	Critical Facility	Dam	EASTON POND SOUTH DAM	2	Hurricane38	VE		
NEWPORT	Critical Facility	Dam	EASTON POND NORTH DAM	2	Hurricane38	VE		
NEWPORT	Critical Facility	Dam		1	Plus3	AE		
NEWPORT	Critical Facility	Dam	NONQUIT POND DAM		Hurricane38	AE		
NEWPORT	Critical Facility	EMS Company	NEWPORT FIRE DEPARTMENT STATION 1	1	Plus5	AE		
NEWPORT	Critical Facility	Fire Station	NEWPORT FIRE DEPARTMENT STATION 1	1	Plus5	AE		
NEWPORT	Critical Facility	Hospital	Naval Health Clinic New England, Newport	4		AE		
NEWPORT	Critical Facility	Library	U.S. Naval War College	2	Hurricane38	AE		
NEWPORT	Critical Facility	Marina	Newport On-Shore Marina	4		500-yr		
NEWPORT	Critical Facility	Marina	Stonebridge Marina	3		AE		X
NEWPORT	Critical Facility	Marina	Christie's Restaurant	2	Plus5	AE		
NEWPORT	Critical Facility	Marina	Tiverton Yacht Club	2	Hurricane38	AE		X
NEWPORT	Critical Facility	Marina	Brewer's Sakonnet Marina	2	Plus3	VE		X
NEWPORT	Critical Facility	Marina	New York Yacht Club, Harbour Court	2	Plus5	VE		
NEWPORT	Critical Facility	Marina	East Passage Yachting Center	2	Hurricane38	VE		
NEWPORT	Critical Facility	Marina	Inn on Long Wharf	1	Plus3	AE		
NEWPORT	Critical Facility	Marina	Newport Harbor Hotel & Marina	1	Hurricane38	AE		
NEWPORT	Critical Facility	Marina	Newport Yachting Center Marina	1	Plus4	VE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
NEWPORT	Critical Facility	Marina	Standish Boatyard		Plus1	AE		
NEWPORT	Critical Facility	Marina	Pirate Cove Marina, Inc.			VE		X
NEWPORT	Critical Facility	Marina	Goat Island Marina		MHHW	VE		
NEWPORT	Critical Facility	Marina	American Shipyard		MHHW	VE		
NEWPORT	Critical Facility	Marina	Little Harbor Marine		MHHW	VE		
NEWPORT	Critical Facility	Marina	Lighthouse Marina		MHHW	VE		
NEWPORT	Critical Facility	School	Fort Barton School @ Nonquit School	3		500-yr		
NEWPORT	Critical Facility	School	Naval War College	2	Hurricane38	AE		
NEWPORT	State Facility	State Owned	DCYF FRAME	2	Hurricane38	AE		
NEWPORT	State Facility	State Owned	WELFARE	1	Plus5	AE		
PROVIDENCE	CIKR	Chemical	Univar	2	Hurricane38	AE		
PROVIDENCE	CIKR	Commercial - Public Assembly		4	Hurricane38	500-yr		
PROVIDENCE	CIKR	Commercial - Public Assembly		4	Hurricane38	AE	X	
PROVIDENCE	CIKR	Emergency Services		4	Hurricane38	500-yr		
PROVIDENCE	CIKR	Energy : Electricity	Dominion Energy	4	Hurricane38	500-yr		
PROVIDENCE	CIKR	Energy : Oil and Natural Gas		3		500-yr		
PROVIDENCE	CIKR	Energy : Oil and Natural Gas		3	Hurricane38	AE		
PROVIDENCE	CIKR	Energy : Oil and Natural Gas		2	Hurricane38	AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
PROVIDENCE	CIKR	Energy : Oil and Natural Gas		2	Hurricane38			
PROVIDENCE	CIKR	Government Facilities		4		500-yr		
PROVIDENCE	CIKR	Government Facilities	Johnson & Wales University - Harborside Campus	1	Hurricane38	VE		
PROVIDENCE	CIKR	Transportation - Maritime		3		500-yr		
PROVIDENCE	Critical Facility	College	ALAN SHAWN FEINSTEIN COLLEGE OF CONTINUING EDUCATION	4		500-yr		
PROVIDENCE	Critical Facility	Correctional Institute	PAWTUCKET POLICE DEPARTMENT	4		500-yr		
PROVIDENCE	Critical Facility	Correctional Institute	UNITED STATES MARSHALS SERVICE - DISTRICT OF RHODE ISLAND	4		500-yr		
PROVIDENCE	Critical Facility	Dam	PARAGON POND DAM	4		500-yr		
PROVIDENCE	Critical Facility	Dam	RISING SUN POND DAM	4		AE	X	
PROVIDENCE	Critical Facility	Dam	CENTRAL FALLS DAM	4		AE	X	
PROVIDENCE	Critical Facility	Dam	PAWTUCKET UPPER DAM	4		AE	X	
PROVIDENCE	Critical Facility	Dam	PAWTUCKET LOWER DAM	4		AE	X	
PROVIDENCE	Critical Facility	Dam	BELLEFONTE POND DAM - BREACHED?	3		500-yr		
PROVIDENCE	Critical Facility	Dam	HUNTS MILL POND DAM - VERIFY	3		AE		
PROVIDENCE	Critical Facility	Dam	STANDARD OIL POND DAM - VERIFY	1	Plus3	AE		
PROVIDENCE	Critical Facility	Dam	OMEGA POND DAM		Plus3	500-yr		
PROVIDENCE	Critical Facility	Dam				AE		X
PROVIDENCE	Critical Facility	EMS Company	PROVIDENCE FIRE DEPARTMENT ENGINE COMPANY 14 LADDER COMPANY 6 RESCUE 6	4		AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
PROVIDENCE	Critical Facility	Fire Station	PAWTUCKET FIRE DEPARTMENT STATION 2	4		500-yr		
PROVIDENCE	Critical Facility	Fire Station	PROVIDENCE FIRE DEPARTMENT ENGINE COMPANY 14 LADDER COMPANY 6 RESCUE 6	4		AE		
PROVIDENCE	Critical Facility	Law Enforcement	UNITED STATES MARSHALS SERVICE - DISTRICT OF RHODE ISLAND	4		500-yr		
PROVIDENCE	Critical Facility	Law Enforcement	PROVIDENCE POLICE DEPARTMENT-DISTRICT 1	4	Hurricane38	500-yr		
PROVIDENCE	Critical Facility	Law Enforcement	PAWTUCKET POLICE DEPARTMENT	4		500-yr		
PROVIDENCE	Critical Facility	Library	Roger Williams Univ Education and Law	4		500-yr		
PROVIDENCE	Critical Facility	Library	University of RI College of Continuing Ed.	4		500-yr		
PROVIDENCE	Critical Facility	Marina	Old Harbor Marina	4	Plus5	500-yr		
PROVIDENCE	Critical Facility	Marina	Bullock Cove Marine, Inc.	3		VE		
PROVIDENCE	Critical Facility	Marina	Bullock's Cove Marina	3		VE		
PROVIDENCE	Critical Facility	Marina	Pawtuxet Cove Marina	2		500-yr		
PROVIDENCE	Critical Facility	Marina	East Providence Yacht Club	2	Hurricane38	AE		
PROVIDENCE	Critical Facility	Marina	Oyster House Marina	2		AE		
PROVIDENCE	Critical Facility	Marina	Rhode Island Yacht Club	1	Plus5	VE		
PROVIDENCE	Critical Facility	Marina	Edgewood Yacht Club		MHHW	VE		
PROVIDENCE	Critical Facility	School	East Providence Early Childhood Center	4		500-yr		
PROVIDENCE	Critical Facility	School	Alice M. Waddington School	4		500-yr		
PROVIDENCE	Critical Facility	School	Dr. Pat Feinstein Child Development Center	4	Hurricane38	500-yr		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
PROVIDENCE	Critical Facility	School	URI/Alan Shawn Feinstein College of Continuing Ed.	4		500-yr		
PROVIDENCE	Critical Facility	School	Paul Cuffee Charter School	4		500-yr		
PROVIDENCE	Critical Facility	School	Heritage Park Early Learning Center	4		AE		
PROVIDENCE	Critical Facility	Town Hall	Pawtucket City Hall	4		500-yr		
PROVIDENCE	Critical Facility	Town Hall	Providence City Hall	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	FAMILY SUPPORT	4		500-yr		
PROVIDENCE	State Facility	State Owned	RIEDC	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	CONVENTION CTR	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	DCYF FRAME	4		500-yr		
PROVIDENCE	State Facility	State Owned	DEM	4		500-yr		
PROVIDENCE	State Facility	State Owned	DLT	4		500-yr		
PROVIDENCE	State Facility	State Owned	PROVIDENCE POLICE	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	SEC STATE	4		500-yr		
PROVIDENCE	State Facility	State Owned	DCYF	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	FAMILY SUPPORT	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	JPTA SUPPORT	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	JUD SERV	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	SEC STATE	4		500-yr		
PROVIDENCE	State Facility	State Owned	TREASURY	4	Hurricane38	500-yr		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
PROVIDENCE	State Facility	State Owned	RETIREMENT	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	FAMILY SUPPORT	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	FAMILY SUPPORT	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	DEPT. EDUCATION	4		500-yr		
PROVIDENCE	State Facility	State Owned	JUD SERV	4	Hurricane38	500-yr		
PROVIDENCE	State Facility	State Owned	ELDERLY AFFAIRS	4		500-yr		
PROVIDENCE	State Facility	State Owned	OFF OF HIGHER EDUCATION	4		500-yr		
PROVIDENCE	State Facility	State Owned	PROVIDENCE POLICE	4		AE		
WASHINGTON	CIKR	Defense Industrial Base	General Dynamics Electric Boat, Quonset Point Division	3		500-yr		
WASHINGTON	CIKR	Emergency Services		4				X
WASHINGTON	CIKR	Emergency Services		2		AE		
WASHINGTON	CIKR	Emergency Services		2		AE		
WASHINGTON	CIKR	Emergency Services		2	Hurricane38	AE		
WASHINGTON	CIKR	Emergency Services				A		X
WASHINGTON	CIKR	Transportation - Aviation	Quonset State Airport	2	Hurricane38	VE		
WASHINGTON	Critical Facility	Correctional Institute	NARRAGANSETT POLICE DEPARTMENT	4		500-yr		
WASHINGTON	Critical Facility	Dam	KING TOM POND DAM	4		A		X
WASHINGTON	Critical Facility	Dam	POTTER HILL DAM	4		AE	X	
WASHINGTON	Critical Facility	Dam	HAMILTON RESERVOIR DAM	4		AE	X	

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
WASHINGTON	Critical Facility	Dam	WERTZ + VIALL POND DAM	3		500-yr		
WASHINGTON	Critical Facility	Dam	POTOWOMUT POND DAM	3		A		
WASHINGTON	Critical Facility	Dam	CARR POND DAM	3		AE	X	
WASHINGTON	Critical Facility	Dam	PEACE DALE POND DAM	3		AE	X	X
WASHINGTON	Critical Facility	Dam	TAYLOR POND DAM	3		AE	X	
WASHINGTON	Critical Facility	Dam	KENYON FARM POND DAM	2	Hurricane38	AE		
WASHINGTON	Critical Facility	Dam	WAKEFIELD POND DAM	2				X
WASHINGTON	Critical Facility	Dam	WESQUAGE POND DAM	1	Plus3	AE		
WASHINGTON	Critical Facility	EMS Company	NARRAGANSETT FIRE DEPARTMENT STATION 1	4		500-yr		
WASHINGTON	Critical Facility	EMS Company	GENERAL DYNAMICS ELECTRIC BOAT DIVISION-DOD	3		500-yr		
WASHINGTON	Critical Facility	EMS Company	QUONSET FIRE DEPARTMENT	2	Hurricane38	AE		
WASHINGTON	Critical Facility	Fire Station	NARRAGANSETT FIRE DEPARTMENT STATION 1	4		500-yr		
WASHINGTON	Critical Facility	Fire Station	CROSS MILLS FIRE DEPARTMENT STATION 2	4				X
WASHINGTON	Critical Facility	Fire Station	MISQUAMICUT FIRE DEPARTMENT	4				X
WASHINGTON	Critical Facility	Fire Station	WESTERLY FIRE DEPARTMENT STATION 2	3	Hurricane38	AE		X
WASHINGTON	Critical Facility	Fire Station	QUONSET FIRE DEPARTMENT	2	Hurricane38	AE		
WASHINGTON	Critical Facility	Law Enforcement	NARRAGANSETT POLICE DEPARTMENT	4		500-yr		
WASHINGTON	Critical Facility	Law Enforcement	RHODE ISLAND OFFICE OF THE STATE FIRE MARSHAL	2		500-yr		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
WASHINGTON	Critical Facility	Library	Narragansett Public Library	4		500-yr		
WASHINGTON	Critical Facility	Library	Westerly Public Library	4				X
WASHINGTON	Critical Facility	Marina	Pier 65 Marina	3				X
WASHINGTON	Critical Facility	Marina	Jim's Dock, Inc.	2	Hurricane38	AE		
WASHINGTON	Critical Facility	Marina	Ocean House Marina	2	Hurricane38	AE		X
WASHINGTON	Critical Facility	Marina	Allen's Harbor Yacht Club	2	Hurricane38	AE		
WASHINGTON	Critical Facility	Marina	Billington Cove Marina	1	Plus4	AE		X
WASHINGTON	Critical Facility	Marina	Avondale Boatyard Inc.	1	Plus5	AE		X
WASHINGTON	Critical Facility	Marina	Frank Hall Boatyard	1	Plus4	AE		X
WASHINGTON	Critical Facility	Marina	Brewer's Wickford Cove Marina	1	Plus3	AE		
WASHINGTON	Critical Facility	Marina	Wickford Shipyard	1	Hurricane38	AE		
WASHINGTON	Critical Facility	Marina	Ram Point Marina	1	Plus4	AE		
WASHINGTON	Critical Facility	Marina	Pleasant Street Wharf	1	Hurricane38	VE		
WASHINGTON	Critical Facility	Marina	Wickford Yacht Club	1	Plus5	VE		
WASHINGTON	Critical Facility	Marina	Rain-Bro Marina	1	Plus1	VE		
WASHINGTON	Critical Facility	Marina	Kenport Marina	1	Plus5	VE		
WASHINGTON	Critical Facility	Marina	Champlin's Marina		MHHW	AE		
WASHINGTON	Critical Facility	Marina	Point Judith Marina		MHHW	AE		
WASHINGTON	Critical Facility	Marina	Snug Harbor Marina		MHHW	AE		
WASHINGTON	Critical Facility	Marina	Point Judith Yacht Club		MHHW	AE		

COUNTY	Dataset	Asset Type	NAME	Hurricane Surge	SLR Scenario	Flood Zone	Floodway	Wildfire Zone
WASHINGTON	Critical Facility	School	KinderCare Learning Center	4		500-yr		
WASHINGTON	Critical Facility	School	Westerly Preschool Childhood Center	4				X
WASHINGTON	Critical Facility	School	Hamilton Elementary School	4				X
WASHINGTON	Critical Facility	School	St. Paul's Nursery School	1	Hurricane38	AE		
WASHINGTON	Critical Facility	Town Hall	New Shoreham Town Hall	3	Hurricane38	500-yr		
WASHINGTON	Critical Facility	Town Hall	North Kingstown Town Hall	2		500-yr		
WASHINGTON	State Facility	State Owned	NARRAGANSETT POLICE	4		500-yr		
WASHINGTON	State Facility	State Owned	BLOCK I SLAND FACILITY	4	Plus5	AE		X
WASHINGTON	State Facility	State Owned	DEM	3	Hurricane38	500-yr		
WASHINGTON	State Facility	State Owned	WESTERLY POLICE	2	Hurricane38	AE		
WASHINGTON	State Facility	State Owned	JRSLM COASTAL FISHRS	1	Plus3	AE		

Hazus-MH Summary Reports

Full page copies of the Hazus-MH reports are available through RIEMA.

Hurricane

Quick Assessment Report

June 19, 2013

Study Region : RI eq

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	1,078
Number of Census Tracts	233
Number of People in the Region	1,048,319

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ K)*
Residential	345,569	67,355,639
Commercial	22,664	16,206,664
Other	11,418	9,133,082
Total	379,651	92,695,385

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	259	16	0	0	275
20	1,577	115	9	0	1,701
50	24,523	3,095	118	52	27,788
100	60,908	13,472	1,023	695	76,098
200	101,155	35,152	4,927	3,468	144,702
500	128,549	69,919	15,588	10,523	224,578
1000	121,299	88,623	29,420	21,864	261,206

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	340	16	0	0	356
20	1,794	121	9	0	1,924
50	26,203	3,362	160	54	29,778
100	65,387	15,066	1,334	708	82,495
200	108,596	39,635	6,260	3,520	158,011
500	137,454	78,546	19,998	10,680	246,679
1000	129,327	98,577	36,803	22,162	286,869

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	871	236
100	3,557	952
200	11,113	2,886
500	34,144	8,986
1000	66,880	17,181

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		*Business Interruption*
ReturnPeriod	*Residential*	*Total*	*(Income) Losses*
10	5,017	5,017	25
20	98,447	102,993	3,499
50	669,509	725,506	64,458
100	1,757,455	2,024,307	249,965
200	4,421,490	5,355,227	727,081
500	10,151,134	12,943,288	1,868,552
1000	16,751,332	21,554,427	3,135,576
Annualized	96,416	118,804	15,314

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Earthquake

Hazus-MH: Earthquake Event Report

Region Name: RI eq

Earthquake Scenario: RI EQ Annualized

Print Date: June 19, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 379 thousand buildings in the region which have an aggregate total replacement value of 92,695 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 81% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 16 hospitals in the region with a total bed capacity of 3,181 beds. There are 521 schools, 78 fire stations, 63 police stations and 17 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 181 dams identified within the region. Of these, 14 of the dams are classified as 'high hazard'. The inventory also includes 330 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 25,101.00 (millions of dollars). This inventory includes over 1,223 kilometers of highways, 720 bridges, 21,562 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	720	13,171.20
	Segments	821	7,571.90
	Tunnels	0	0.00
		Subtotal	20,743.10
Railways	Bridges	16	1.80
	Facilities	3	8.00
	Segments	146	213.20
	Tunnels	0	0.00
		Subtotal	222.90
Light Rail	Bridges	0	0.00
	Facilities	2	5.30
	Segments	1	7.60
	Tunnels	0	0.00
		Subtotal	12.90
Bus	Facilities	13	16.00
		Subtotal	16.00
Ferry	Facilities	13	17.30
		Subtotal	17.30
Port	Facilities	22	43.90
		Subtotal	43.90
Airport	Facilities	7	74.60
	Runways	12	455.60
		Subtotal	530.10
		Total	21,586.30

Economic Loss

The total economic loss estimated for the earthquake is 2.43 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 2.43 (millions of dollars); 24 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 49 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.01	0.12	0.01	0.01	0.15
	Capital-Related	0.00	0.01	0.10	0.00	0.00	0.11
	Rental	0.01	0.05	0.06	0.00	0.00	0.13
	Relocation	0.04	0.04	0.09	0.01	0.03	0.21
	Subtotal	**0.05**	**0.11**	**0.37**	**0.02**	**0.04**	**0.59**
Capital Stock Losses							
	Structural	0.09	0.08	0.11	0.03	0.02	0.33
	Non_Structural	0.36	0.32	0.27	0.08	0.07	1.11
	Content	0.11	0.07	0.12	0.05	0.03	0.39
	Inventory	0.00	0.00	0.00	0.01	0.00	0.01
	Subtotal	**0.56**	**0.47**	**0.51**	**0.18**	**0.12**	**1.84**
	Total	**0.61**	**0.59**	**0.87**	**0.20**	**0.16**	**2.43**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	7,571.90	$0.00	0.00
	Bridges	13,171.16	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**20743.10**	**0.00**	
Railways	Segments	213.17	$0.00	0.00
	Bridges	1.77	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	7.99	$0.00	0.00
	Subtotal	**222.90**	**0.00**	
Light Rail	Segments	7.60	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	5.33	$0.00	0.00
	Subtotal	**12.90**	**0.00**	
Bus	Facilities	16.01	$0.00	0.00
	Subtotal	**16.00**	**0.00**	
Ferry	Facilities	17.30	$0.00	0.00
	Subtotal	**17.30**	**0.00**	
Port	Facilities	43.93	$0.00	0.00
	Subtotal	**43.90**	**0.00**	
Airport	Facilities	74.56	$0.00	0.00
	Runways	455.57	$0.00	0.00
	Subtotal	**530.10**	**0.00**	
	Total	**21586.30**	**0.00**	

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Appendix 4: Capability Assessment

Agency Contacts

Significant time and energy went into the compilation of the Agency/Program specific Capability Assessment profiles. Multiple people were involved in this initiative, Contacts for agency specific profiles are shown in the table below.

Agency	Contact for Capability Assessment Profile
Army Corp of Engineers	Byron Rupp , Chris Hatfield, Matt Walsh
Climate Change Commission	RIEMA, CRMC, SeaGrant
Coastal Resources Management Council	Janet Freedman, Grover J. Fugate
Division of Planning	Chelsea Siefert, Kevin Carvalleo
FEMA	Nan Johnson
Housing and Community Development	Laura Sullivan
NRCS	Kevin Farmer, Pooh Vongkhamdy
NWS	David Vallee, Alan Dunham
Public Utilities Commission and Division of Public Utilities and Carriers	Thomas Kogut
RI Department of Environmental Management	Jim Ball
RI Department of Health	June Swallow, Bob Vanderslice, Alysia Mihalakos
RI Department of Transportation	Joseph Baker, Paul Annarummo, Phillip Kydd
RI Emergency Management Agency	Jess Stimson, Michelle Burnett, Bob Sturdahl
RI Historical Preservation and Heritage Commission	Edward Sanderson
RI Office of Energy Resources	Marion Gold, Christopher Kearns
RI P RI Rivers Council	Guy Lefebvre
RI Sea Grant	Pamela Rubinoff, Michelle Carnevale
State Building Code Commission	Jack Leyden
The Providence Plan	Rebecca Lee
University of Rhode Island Environmental Data Center	Greg Bonynge
USGS	Gardner Bent
Water Resources Board	Kenneth Burke
SSEER	Judith Swift
National Grid	Andrew Schneller

Program Descriptions

Programs related to hazard mitigation are summarized in the following sections.

National Flood Insurance Program (NFIP)

NFIP, established by Congress in 1968, provides flood insurance to property owners in participating communities. This program is a direct agreement between the federal government and the local community that flood insurance will be available to residents in exchange for the community's compliance with minimum floodplain management requirements such as the adoption of a floodplain management or flood damage prevention ordinance. Since homeowners' insurance policies do not cover flooding, a community's participation in the NFIP is vital to protecting property in the floodplain and ensuring that federally backed mortgages and loans can be used to finance property and improvements within the SFHA.

Pursuant to the Flood Disaster Protection Act of 1973, many forms of federal financial assistance, including disaster assistance and federally-insured loans, related to structures located in the SFHA are contingent on the purchase of flood insurance. Such federal assistance includes not only direct aid from agencies, but also products and assistance from federally insured institutions.

In order for property owners to purchase flood insurance through the NFIP, their community must be participant in good standing in the NFIP. There is no requirement that the property be located within an identified SFHA. Instead, any property in the community can be insured through the NFIP as long as the community maintains its good participant standing.

Communities participating in the NFIP must:

- Adopt the FIRMs as an overlay regulatory district or through another enforceable measure;
- Require that all new construction or substantial improvement to existing structures in the SFHA will be compliant with the construction standards of the NFIP and the Rhode Island State Building Code; and
- Require additional design techniques to minimize flood damage for structures being built in high hazard areas, such as floodways or velocity zones (V zones).

In Rhode Island, the majority of the NFIP construction standards are contained in the Rhode Island State Building Code which is implemented at the local level by municipal building inspectors. All 39 cities and towns and one Tribal nation in Rhode Island are participants in the NFIP and all are in good standing.

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 and 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. Currently, five (5)

communities participate in the CRS and receive the following flood insurance premium discount:

Community	Entrance Date	Class	Discount (%)
Bristol	5/1/2013	8	10
Middletown	4/1/2000	8	10
Narragansett	10/1/2007	8	10
North Kingstown	10/1/1993	9	5
Westerly	5/1/2013	8	10

Hazard Mitigation Assistance Program

In an effort to streamline the grant application and management process, FEMA created the HMA program. This program created unified program guidance for three mitigation grant programs currently funded by FEMA:

- Flood Mitigation Assistance (FMA)
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)

The grant programs are managed by RIEMA Mitigation Staff. In addition, all programs except HMGP use FEMA's e-Grants system for application submission and review. RIEMA has a Rhode Island-specific HMGP application format which is consistent with FEMA required program elements.

The following describes the HMA programs in more detail.

Flood Mitigation Assistance Program (FMA)

Type of Assistance: Pre-disaster Cost-Share Grants

Funding Source: 75% federal share, 25% non-federal share (local government or other organization)

Authorized by the National Flood Insurance Reform Act of 1994, the FMAP provides funds in the form of a grant to assist States and communities in the implementation of measures that reduce or eliminate the long-term risk of damage to buildings and structures insured under the NFIP. Three types of grants are available to States and communities:

> **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grants.
>
> **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with two or more losses each with a claim of at least $1,000 within any ten-year period since 1978.

Management Cost Grants for the State to help administer the FMA program and activities. Up to ten percent (10%) of Project Grants may be awarded to states as Management Cost Grants

FEMA provides a federal share of up to 75% of the cost of the plan or project while communities and/or homeowners contribute a minimum of 25%. FMA is funded through an annual federal appropriation. Statutory limits exist on the amount of FMA funding a State may receive:

- The total amount of FMA funds provided during any five-year period shall not exceed $10 million to any State agency or $3.3 million to any community.
- The total amount of FMA funds provided to any State, including all communities located in the State, shall not exceed $20 million during any five-year period.
- Individual planning grants using FMA funds shall not exceed $150,000 to any Applicant or $50,000 to any sub-applicant. FMA funds only can be used for the flood hazard component of a hazard mitigation plan that meets the planning criteria outlined in 44 CFR Part 201.
- The total planning grants using FMA funds made in any fiscal year to any State and the communities located within the State shall not exceed $300,000.
- No more than 7.5 percent of FMA funds shall be used for planning in any fiscal year.
- A planning grant shall not be awarded to a State or community more than once every five years.
- FEMA may waive the above limits when a major flood-related disaster or emergency is declared pursuant to the Stafford Act.
- Applicants for FMA funding must submit their applications through the e-Grants system during the application window, as established by the *HMA Unified Guidance.*

Hazard Mitigation Grant Program (HMGP)

Type of Assistance: Post-disaster Cost-Share Grants

Funding Source: 75% federal (FEMA), 25% non-federal (local government or other organization)

Unlike the other HMA programs, HMGP is not a nationwide competitive program. Established pursuant to Section 404 of the Stafford Disaster Relief and Emergency Relief Act (PL 100-707), this program provides matching grants (75% Federal, 25% non-Federal) for FEMA-approved hazard mitigation projects following a Presidential Disaster Declaration.

The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Eligible state, local and tribal governments, as well as some non-profit organizations, may apply for the funding. Individual citizens are not eligible to apply, though communities may apply on their behalf.

HMGP is not funded annually. Available funding is derived from a formula based on the estimated aggregate grant funding under the Stafford Act assistance programs (PA, IA, and Disaster Unemployment Assistance). The State is allocated a percentage of the program funds expended by the federal government on each specific disaster recovery effort for 360 days after the date of the Presidential Declaration of Emergency. States with Standard Mitigation Plans, such as Rhode Island, are allocated the following:

- 15 % of the first $2,000,000,000 for HMGP
- 10% of the next $10,000,000,000 for HMGP
- 7.5% of any amount over $10,000,000,000 for HMGP
- For States with a Standard Mitigation Plan, the total allocation to the State for HMGP cannot exceed $35,333,000,000.
- The grants are specifically directed toward reducing future hazard losses, and can be used for projects protecting property and other resources against the damaging effects of floods, hurricanes, earthquakes, high winds, and other natural hazards. Rhode Island prioritizes its HMGP funds for non-structural hazard mitigation measures, such as:
- Acquisition and demolition of vulnerable structures followed by permanent deeding the land by the community for open space or recreational use.
- Relocating damaged or flood prone structures out of a high hazard area.
- Retrofitting properties to resist the damaging effects of natural hazards. Retrofitting can include wet or dry-flood proofing, elevation of the structure above flood level, elevation of utilities, or proper anchoring of the structure.

Pre-Disaster Mitigation Competitive Program

Type of Assistance: National, competitive grant program for multiple hazard mitigation projects and "all hazards" mitigation plans

Funding Source: 75% federal (FEMA) 25% non-federal (local government or other organization)

The PDM Program was authorized by §203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 US.C. Chapter 68, as amended by §1 02 of the Disaster Mitigation Act of 2000. Funding for the program is provided by annual appropriation through the National Pre-Disaster Mitigation Fund to assist states, local governments, Indian Tribal governments, territories, and universities in implementing cost effective hazard mitigation activities that complement a comprehensive mitigation program. All applicants must be participating and in good standing in the National Flood Insurance Program (NFIP) if they have been identified through the NFIP as having a SFHA.

44 CFR Part 201, *Hazard Mitigation Planning*, establishes criteria for State and local hazard mitigation planning authorized by §322 of the Stafford Act, as amended by §104 of the DMA 2000. After November 1, 2004, local governments and Indian Tribal governments applying for PDM funds through the State were required to have an approved local mitigation plan prior to receipt of mitigation project grants. States are also be required to have an approved Standard State mitigation plan in order to receive PDM funds for State or local mitigation projects. Therefore, the development and maintenance

of State and local hazard mitigation plans is critical to maintaining eligibility for future PDM funding. The program contingent on the federal budget and may not be available in future funding cycles.

Funding plans and projects reduces overall risks to people, property and infrastructure, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis and with nominal state set-aside annual allocations. PDM is a part of FEMA HMA Program, and is guided by the *HMA Unified Guidance* for the applicable fiscal year.

Sub-applicants (i.e., local governments, universities, etc.) submit their plan or project applications to the State (also called the Applicant) for review and prioritization through the e-Grants system during the application cycle. The State, in turn, submits the prioritized sub-applications to their FEMA Regional Office. Sub-applications will be initially reviewed by FEMA to ensure all minimum requirements are met for the PDM program. FEMA provides additional ranking points for all eligible mitigation planning and project sub-applications on the basis of predetermined, objective, quantitative factors to calculate a final National Ranking Score for each sub-application (Table below)

National Ranking Factors and Point Values
The priority given to the sub-application by the Applicant in their PDM grant application.
Assessment of frequency and severity of hazards.
Whether the Applicant has a FEMA-approved Enhanced State / Tribal Mitigation Plan by the application deadline.
Community mitigation factors such as Community Rating System class, Cooperating Technical Partner, participation as a FireWise Community, and adoption and enforcement of codes including the International Code Series and National fire Protection Association 5000 Code, as measured by the Building Code Effectiveness Grading Schedule.
The percent of the population benefitting, which equals the number of individuals directly benefiting divided by the community population.
Whether the project protects critical facilities.
Status of the local sub-applicant as a small and impoverished community.

Project and plan sub-applications that are selected for further review are sent for final review by the National Evaluation Panel. These are panels composed of representatives from FEMA, State, Territories, local governments, federally recognized Indian Tribal governments, and other Federal agencies who peer evaluate project and planning sub-applications on the basis of qualitative factors.

PDM, unlike other HMA programs, is a nationwide, competitive program. While there is no set limit on how much funding a single State or community may receive, there are restrictions in place, which are as follows:

- Up to $800,000 Federal share may be requested in a sub-application for a planning grant to develop a new hazard mitigation plan.
- Up to $400,000 Federal share may be requested in a sub-application for a planning grant to update a hazard mitigation plan.
- Up to $3 million Federal share may be requested in a sub-application to implement a mitigation project.

- The cumulative Federal award for sub-applications awarded during a single application cycle to any one Applicant shall not exceed 15 percent of the total appropriated PDM program funds for that application cycle. The amount of funding allocated for PDM fluctuates from year to year. \

Public Assistance Program (Section 406 Mitigation)

Type of Assistance: Post-disaster Cost-Share Grants

Funding Source: FEMA

The objective of the FEMA PA Grant Program is to provide assistance to State, Tribal and local governments, and certain types of Private Nonprofit organizations so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.

Through the PA Program, FEMA provides supplemental Federal disaster grant assistance for debris removal, emergency protective measures, and the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain Private Non-Profit (PNP) organizations. The PA Program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.

The Federal share of assistance is not less than 75% of the eligible cost for emergency measures and permanent restoration. The grantee (usually the State) determines how the non-Federal share (up to 25%) is split with the sub-grantees (eligible applicants).

After a natural or man-made event that causes extensive damage, FEMA coordinates with the State to implement the PA Grant Program. The funding process consists of the following steps:

1. Preliminary Damage Assessment (PDA)
2. Presidential Disaster Declaration
3. Applicants' Briefing by Grantee
4. Submission of Request for PA by Applicant
5. Kick-off Meeting with Public Assistance Coordinator (PAC)
6. Project Formulation and Cost Estimating
7. Project Review and Validation
8. Obligation of Federal Funds and Disbursement to Sub-grantees
9. Appeals and Closeout

The PA Program is administered through a coordinated effort between the FEMA, the State applicant (grantee), and the sub-applicants (sub-grantees).

The Robert T. Stafford Disaster Relief and Emergency Assistance Act gives FEMA the authority to fund the restoration of eligible facilities that have sustained damage due to a Presidentially declared disaster. Commonly called Section 406 Mitigation, this program

provides some mitigation funding to facilities damaged or destroyed by the present disaster.

Section 406 Mitigation provides discretionary authority to fund mitigation measures in conjunction with the repair of the disaster-damaged facilities. These opportunities usually present themselves during the repair efforts. The mitigation measures must be related to eligible disaster-related damages and must directly reduce the potential of future, similar disaster damages to the eligible facility. Normally, this work is performed on the parts of the facility that were actually damaged by the disaster. In some instances, an eligible mitigation measure may not be an integral part of the damaged facility.

There is no pre-set limit to the amount of Section 406 funds a community may receive. Section 406 Mitigation measures must be determined to be cost effective. Any one of the following means may be used to determine cost-effectiveness:

- Mitigation measures may amount to up to 15% of the total eligible cost of the eligible repair work on a particular project.
- Certain mitigation measures have been determined to be cost effective, as long as the mitigation measure does not exceed 100% of the eligible cost of the eligible repair work on the project.
- For measures that exceed the above costs, the Grantee or sub-grantee must demonstrate through an acceptable benefit/cost analysis methodology that the measure is cost effective.

Community Development Block Grant – Disaster Recovery Funding (CDBG-DR)

Type of Assistance: Pre-disaster aid to state and local governments

The US (HUD) provides flexible grants to help cities, counties, and States recover from Presidentially- declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. CDBG-DR is authorized under Title I of the Housing and Community Development Act of 1974, as amended. Program rules are published in the Federal Register pursuant to specific appropriation acts. The Office of Community Planning and Development (CPD) administers the program.

In response to disasters, Congress may appropriate additional funding for the CDBG program as disaster recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG-DR assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources. CDBG-DR grants often supplement disaster programs of the FEMA, the SBA, and the USACE.

HUD generally awards noncompetitive, nonrecurring CDBG-DR grants by a formula that considers disaster recovery needs unmet by other federal disaster assistance programs. CDBG-DR funds are made available to states, units of general local governments, Trial Nationals, and insular areas designated by the President as disaster areas. These communities must have significant unmet recovery needs and the capacity to carry out a disaster recovery program (usually these are governments that already receive CDBG

allocations). At times, supplemental appropriations restrict funding solely to States rather than the local cities and/or counties.

CDBG-DR grants primarily benefit residents, governments and businesses in communities impacted by a Presidential Declaration of Disaster. Generally, grantees must use at least half of CDBG-DR funds for activities that principally benefit low-and moderate-income persons. Grantees may use CDBG-DR funds for recovery efforts involving housing, economic development, infrastructure and prevention of further damage to affected areas, if such use does not duplicate funding available from the FEMA , the SBA, the USACE or other federal agencies or programs.

Examples of eligible activities include:

- Buying damaged properties in a floodplain and relocating residents to safer areas;
- Relocation payments for people and businesses displaced by the disaster;
- Debris removal not covered by FEMA;
- Rehabilitation of homes and buildings damaged by the disaster;
- Buying, constructing, or rehabilitating public facilities such as streets, neighborhood centers, and water, sewer and drainage systems;
- Code enforcement;
- Homeownership activities such as down payment assistance, interest rate subsidies and loan guarantees for disaster victims;
- Public services (generally limited to no more than 15 percent of the grant);
- Helping businesses retain or create jobs in disaster impacted areas; and
- Planning and administration costs (limited to no more than 20 percent of the grant).
- Eligible activities must meet at least one of three program national objectives:
- Benefit persons of low and moderate income, or
- Aid in the prevention or elimination of slums or blight, or
- Support to urgent community development needs if existing conditions pose a serious and immediate threat to the health and welfare of the community and other financial resources are not available.

HUD notifies eligible state and local governments that they must then develop and submit an Action Plan for Disaster Recovery before receiving CDBG-DR grants. The Action Plan must describe the needs, strategies, and projected uses of the CDBG-DR funds.

Volunteer Fire Assistance Grants (VFA)

Type of Assistance: Pre-disaster Grants

Funding Source: USDA Forest Service

The VFA Program was originally authorized in Title IV of Public Law 92-419, "The Rural Development Act of 1972." The Act authorized up to $7,000,000 to organize, train, and equip local fire forces to prevent, control and suppress fires in rural areas. In FY-75 the first appropriation of $3.5 million was provided for financial, technical, and other assistance to the State Foresters to carry out this Program. Title IV was later repealed by

the Cooperative Forestry Assistance Act (CFAA) of 1978 (Public Law 95-313). Section 7 of the CFAA became the authority which authorized the Cooperative Fire protection (CFP) programs.

The CFAA was amended by the Forest Stewardship Act of 1990, better known as the "1990 Farm Bill." This Act moved the CFP programs to Section 10 of the CFAA, so the authority for the VFA Program is now contained in Section 10(b)3 of the CFAA. This change did not alter the original language of the CFAA with respect to VFA.

VFA provides funds for fire equipment, training, and initial fire department organization to fire departments serving small communities under 10,000 in population. Congressionally-appropriated VFA funds are provided to State forestry agencies through the USDA Forest Service. The State forestry agencies pass this money on to needful fire departments within their states. A fire department may buy equipment, pay for training or training materials, or cover the cost of department incorporation, as long as the funds are matched. VFA funds are granted on a 50/50 matching basis. In other words, the department must match the dollars, dollar for dollar, in money, time, or equipment. Most grants are $5,000 or less. Actual amounts depend on the VFA funding allocated to the particular State, which in turn depends on Congressional action.

This strategy will contribute to the overall mitigation strategy of improving training and communications relative to hazard mitigation issues.

Assistance to Firefighters Grants Program – Fire Prevention and Safety Grants (FP&S)

Type of Assistance: Pre-Disaster Grants

Managing Agencies: Local or community organizations, including fire departments, state, regional and national organizations

The primary goal of the Assistance to Firefighters Grants (AFG) is to meet the firefighting and emergency response needs of fire departments and nonaffiliated emergency medical service organizations. Since 2001, AFG has helped firefighters and other first responders to obtain critically needed equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards.

The FP&S Grants are part of the AFG, and are under the purview of the Grant Programs Directorate in the FEMA. FP&S Grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and reduce injury and prevent death. In 2005, Congress reauthorized funding for FP&S and expanded the eligible uses of funds to include Firefighter Safety Research and Development. This federal grant program awards grants to national, regional, State, departments (private or public) that are recognized for their experience and expertise in fire prevention or safety programs and activities. Projects under the *Fire Prevention and Safety Activity* are designed to lessen the number of deaths and injuries from fire-related hazards to a high-risk group of people. This risk must be determined and documented through an objective, reasoned approach, or risk assessment.

Appendix 5: Local Plan Integration

Status of Local Plans and Updates

The following sections address local hazard identification, vulnerability, and potential losses based on estimates provided in local risk assessment. For the 2014 plan update, the results processed from the local plan reviews were used in the statewide hazard ranking. Results of this ranking are located in each of the hazard-specific sections and summarized in the Overall Composite Results at the end of the HIRA.

COMMUNITY	AWARD	PLAN STATUS	EXPIRATION DATE
Barrington		Approved	11/23/2015
Bristol	PDM 2012	Approved	9/30/2015
Burrillville	PDM 2010	Expired	4/12/2010
Central Falls		Expired	8/15/2010
Charlestown	PDM 2010	Expired	4/15/2010
Coventry		Approved	12/3/2015
Cranston	HMGP 4027	Approved	11/23/2015
Cumberland		Approved	11/14/2016
East Greenwich	PDM 2010	Approved	5/10/2016
East Providence		Approved	5/10/2016
Exeter	PDM 2010	Expired	7/11/2010
Foster		Expired	6/29/2010
Glocester	HMGP 4027	Expired	8/26/2010
Hopkinton		Approved	11/10/2017
Jamestown	HMGP 4027	No Plan	
Johnston		Approved	5/10/2016
Lincoln	PDM 2010	Expired	5/23/2010
Little Compton	HMGP 4027	No Plan	
Middletown	PDM 2011	Expired	12/15/2011
Narragansett		Approved	2/11/2018
New Shoreham	PDM 2010	Expired	5/15/2011
Newport	PDM 2012	Expired	12/10/2013
North Kingstown	PDM 2010	Expired	6/13/2010
North Providence	HMGP 4027	No Plan	
North Smithfield	PDM 2010	Expired	8/26/2010
Pawtucket		Approved	7/10/2017
Portsmouth		Approved	5/28/2014
Providence		Approved	12/13/2018
Richmond		No Plan	
Scituate	HMGP 4027	No Plan	
Smithfield		No Plan	
South Kingstown		Approved	3/27/2017
Tiverton	HMGP 4027	Expired	1/26/2011
Warren	PDM 2010	Expired	6/28/2010
Warwick		Approved	8/14/2017

COMMUNITY	AWARD	PLAN STATUS	EXPIRATION DATE
West Greenwich	HMGP 4027	Expired	8/26/2010
West Warwick		Approved	3/26/2017
Westerly		Approved	12/7/2017
Woonsocket		Approved	7/24/2017

Local Hazard Identification and Risk Assessment

Local hazard rankings are highly variable; as a result each one has its own set of criteria to develop monetary loss values. These criteria were not consistent during the 2011 State plan update and this was the case with the 2014 plan update. This variability does not lend itself to comparison of relative loss values for each hazard in the statewide plan. To fully utilize the local plan efforts, Rhode Island will need to develop standardized procedures for estimating losses.

One continued goal of the State plan update is to standardize the data analysis process so that future State and local plan updates are consistent and utilize comparable methodologies. Some of the local plans used loss estimates derived from Worksheet #3a of FEMA 386-2, State and Local Mitigation Planning How-To Guide: Understanding Your Risks. This worksheet lists the total number of structures and the total value of structures. For each (the number and the value), a percentage in hazard-prone areas is identified. The values corresponding to the percentage in hazard areas correspond to the loss estimates for each category: residential, commercial, industrial, agricultural, religious/non-profit, government, education, and utilities. Variation can be partially attributed to the methods that the county used to determine a loss-estimate as well as what is being accounted for in the exposure and vulnerability.

Consistent with the CFR, the SHMP integrates HIRA information from local hazard mitigation plans. The previous section provided a summary of hazards identified in local hazard mitigation plans and a comparison between these findings and the State finding of prevalent hazards. The following examines data collected and risk assessment methodologies used in the local hazard mitigation plans.

The data used to assess risk in local hazard mitigation plans was relatively basic in terms of level of detail and inconsistent on a community by community basis. Data sources included:

- Consulting with local officials regarding past hazard occurrences;
- Checking historical records for confirmation of events and to identify trends in hazard occurrence and probability;
- Gathering information from other local plans and planning committees;
- Compiling climatic data from open data sources; and
- Referencing FEMA's State and Local Mitigation Planning "how-to" Guides (FEMA Publication Series 386).

Most of the plans incorporated GIS technology, though it is apparent that most GIS applications were limited to map production and did not utilize the full analytical potential of the technology and the wide array of data sets available for use.

There are varying degrees to which local hazard mitigation plans present risk assessment and/or loss estimation analysis or document the methodologies. In a number of the local hazard mitigation plans, loss estimation is presented in a general sense, e.g., identifying the type and providing qualitative estimates regarding the amount of damage that each hazard might cause. This approach is based on a combination of general components: structure loss, contents loss, structure use loss, and/or function loss. This information was then summarized to indicate the relative magnitude of anticipated losses for each of the hazards that the local hazard mitigation plans considered.

In some cases, methodologies based on FEMA's *how-to* series were utilized to determine generalized loss estimates. In addition, two communities utilized NOAA's Community Risk and Vulnerability Assessment tool which provides guidance and a case study for users in determining frequency, area of potential impact, and potential damage magnitude for a given hazard. This tool, which is available through NOAA's Coastal Services Center, is general in scope and contains a step-by-step manual for conducting a community risk and vulnerability assessment.

Some communities went into more depth in documenting a loss estimation methodology, as well as execution of that methodology. In these cases, multiple data sets were used to arrive at loss estimations; these data sets generally included local historical hazard data. This provided a basis for an analysis resulting in specific monetized loss estimates. However, this more detailed approach was unusual among the local hazard mitigation plans surveyed. Rather, the more general methodologies cited above were by far the more common choices. The low number of local hazard mitigation plans presenting rigorous loss estimation data made it impractical to integrate local loss estimation directly into the Plan update.

There were incongruities and inconsistencies in the data and methodologies used by local communities to develop HIRAs, making it impractical to directly incorporate the results of the local hazard mitigation plan analyses into this Plan Update.

Vulnerable areas identified in the plans vary significantly. Some communities included an in depth assessment of vulnerabilities of roads, infrastructure and other critical facilities. However, other communities simply make brief mention of a few areas that had some historic problems. All the plans reviewed differ significantly in compiling vulnerability data. Therefore, extracting this data just from the two extreme local examples would prove to support that a comprehensive vulnerability assessment cannot be made at this time. To do so would not have yielded a consistent risk assessment methodology providing a coherent comparison of risk from hazards between the communities. Integration of local hazard mitigation plan risk assessment results is only possible in a limited manner:

- Help the SIHMC prioritize grant awards based on the type of mitigation proposed, when considered in relation to the frequency of hazard identification in the local hazard mitigation plans; and
- Identify opportunities to improve the integration of local hazard mitigation plan data into the State Plan for future updates.

These opportunities present themselves in several areas:

- Establishing consistent hazard-identification terms, nomenclature and definitions;
- Establishing a system for creating and maintaining consistent data sources / GIS sources related to hazards, demographics, risk, etc.; and
- Establishing consistent risk assessment and loss estimation methodologies

These opportunities are reflected in specific recommendations that have been incorporated into the State Hazard Mitigation Action Strategy (Section 6) that will improve the quality of the local hazard mitigation plans, as well as the State's ability to integrate this information into future Plan Updates.

All of the prevalent hazards identified in the local hazard mitigation plans are addressed in the SHMP, either using the same hazard terminology or using comparable hazard terminology. See table on the following page. Some hazards identified in local hazard mitigation plans are not directly addressed in the Plan Update. Generally, these hazards appear in a small number of local municipal plans. There are three basic reasons why the Plan Update does not directly address mitigation for these hazards.

- These hazards may have profiles that lead to similar mitigation measures as hazards that are addressed directly by the Plan Update;
- These hazards may be sufficiently addressed by another State or federal agency or (local) entity; or
- These hazards may have been deemed by the SIHMC to not be among the most serious threats to the State.

A couple of plans included man-made hazards such as Communicable Diseases, HazMat Events, and Pandemic that are not shown in the table below. Appendix 5 includes a full-detail of the plans review for all hazards.

Hazards identified in local plans.

County	Municipality	Hurricanes	Earthquake / Geologic	Wildfires / Conflagration	Winter Storms	Tornadoes	Windstorm / Wind Related	Nor'easter	Hail	Heavy Rains and Floods	Lightning	Flooding	Dam Failure	Severe Thunderstorms	Drought	Ice storm	Coastal Erosion	Heat Wave	Extreme Temperature	Storm Surge
Bristol	Barrington	X	X	X	X	X	X		X	X						X				
	Bristol	X	X	X	X	X	X			X			X		X		X			
	Warren	M		L	H	H		H				H		H		H				
Kent	Coventry	X	X	X	X	X	X				X	X	X		X					
	East Greenwich	M	L	M-H	H	H		H				M	M	H		H				
	Warwick	X	X		X	X	X	X	X		X	X			X		X		X	X
	West Greenwich	M	L	M/H			H	H	L	M	M									
	West Warwick	X	X	X	X	X		X				X	X	X						
Newport	Jamestown																			
	Little Compton																			
	Middletown	H	L	L	H	H		H				M	M	H		H				
	Newport	X	X	X	X	X		X	X		X		X	X	X		X		X	X
	Portsmouth	X	X	X	X		X	X				X				X				
	Tiverton	H	L	L	H	H						M	M	H		H				
Providence	Burrillville																			
	Central Falls	M	L		H		M	H	L	H	L					H				

	Cranston		L	L	H	M			M	H	M			H						
	Cumberland	M	L	M	H	M	H	H	L	H	L				M	H		M		
	East Providence	X	X	X	X	X	X		X	X				X	X	X				
	Foster	M	L	M			M	M	L	M	H									
	Glocester	M	L	H			H	H	L	H	L									
	Johnston	X	X				X				X	X	X							
	Lincoln	M	L	M			H	H	L	M	L									
	North Providence	X	X	X			X	X	X	X	X									
	North Smithfield																			
	Pawtucket	X	X	X		X	X	X		X		X	X							
	Providence	X		X	X			X		X									X	
	Scituate	X			X		X		X		X									
	Smithfield	X	X	X	X	X						X								
	Woonsocket	H	L	M	H	H		H				M	M	H						
Washington	Charlestown	M	L	M	L		H		L	M	L									
	Exeter	X	X	X	X	X	X	X				X	X			X				
	Hopkinton	X	X	X	X	X	X		X	X			X	X	X			X		
	Narragansett	H	L	L	H	M		H				M	M	H	L	H		H		
	New Shoreham (Block Island)	X	X	X			X	X	X	X	X									
	North Kingstown	X	X	X	X	X									X					
	Richmond																			
	South Kingstown	H	L	M/L	H							H	M/ L		L		H			
	Westerly	X	X	X	X	X	X		X			X	X	X	X	X				

Local Growth and Development Trends

Local Plans have been reviewed to understand local growth and development trends throughout the state. Overall, towns in Rhode Island are seeing increased development. This means that it is essential to have land use regulations that prohibit development in hazardous areas. Although some communities have prohibited development in hazard areas, many have seen or predict development in the flood zones. These areas include: Town of Middletown, Town of Narragansett, Town of Barrington, Town of West Warwick, Town of Westerly, Town of South Kingstown, and the City of Providence.

Redevelopment or reuse of buildings has also caused an increase of population in high risk areas. The towns of Charlestown and South Kingstown have seen conversion of seasonal property to year-round use, which causes some high risk areas to be vulnerable year-round. The Town of West Warwick has documented that the conversion of old mills into housing is also a problem, as a majority of these buildings are located in flood zones. The Town of Westerly is seeing reconstruction and rehab of existing buildings in coastal areas vulnerable to flooding. A few towns, including Foster, Glocester, and Tiverton, are seeing increased development but have steered away from at risk areas.

Local Hazard Mitigation Draft Template

Future local plan updates will present an opportunity to address some of the ambiguity between hazard naming conventions, facility analysis and loss estimate methodology. RIEMA will encourage local plan revisions to approach classifying hazards in a similar fashion as used in this revised risk assessment.

RIEMA has worked with FEMA Region I to develop a local hazard mitigation template for local planners to use during local hazard mitigation plan creation/updates. This template is available in DRAFT form on the following pages. **Local planners should contact RIEMA for an up to date version of this template.**

Section 7 of this plan update includes a maintenance and implementation schedule that weaves in the local plan results during the Fourth Quarter meeting of the SIHMC. The tracking tools developed for the plan update will be used in tandem with RIEMA local plan review tool and guide.

Recommended Rhode Island Local Hazard Mitigation Plan Template

- **Cover Page**
  - Title (*City or Town of … Rhode Island Local Hazard Mitigation Plan*)
  - Jurisdiction info
    - Name(s) of participating jurisdiction(s)
    - New Plan or Update? Jurisdiction(s) previous FEMA approval date(s)
  - Version (with submittal dates)
  - Funding Assistance **[Optional]**
- **Table of Contents**
- **Executive Summary [Optional]**
- **Adoption Documentation**

SECTION 1 – Background [Optional]

1.1 Introduction to Hazard Mitigation and the HMP / HMP Update

1.2 Community Planning Area

a. Location info & Geography
b. Demographics / Census, Housing
c. Land Use & Infrastructure
d. Community Development & Development Trends
e. Historic and Natural Resource/Environmental significance
f. Commerce, Industry, Academic
g. NFIP, CRS Community (highlights)

1.3 Significant Events since the last plan update (major disasters, major developments, conditions effecting risk in the community)

SECTION 2 - Planning Process

2.1 Purpose, Overview and Background

2.2 Building Support: Community Involvement, Roles & Responsibilities

a. The Planning Team, Technical Assistance & Local Leadership
b. Stakeholders
c. Public

2.3 Understanding the Community's Risks

a. Discovery & Gathering of Resources
b. Review and Incorporation of Information with Stakeholder and Public Exchange
c. Developing / Updating the Risk Assessment (Continued in Section 3)

2.4 Developing & Updating the Mitigation Strategy (Continued in Section 4)

a. Identification & Review of Goals, Actions, Priorities, Changes, Progress
b. Review and Incorporation of Stakeholder and Public Exchange

2.5 Bringing the Plan to Life: Implementation & Maintenance

a. Method, Responsibilities, & Schedule
   i. Plan [Update] Review, Adoption, and Approval
   ii. Monitoring

DRAFT

iii. Evaluation (Additional documents in Appendices)
iv. Updates
b. Continued Public Involvement (Also see Appendix – Outreach Strategy)

SECTION 3 - Risk Assessment
3.1 Defining Risk & Methodology
3.2 Hazards
a. Hazard Identification
i. Statewide Hazards & Jurisdiction's Identification Table (to be provided by State)
ii. Hazards Excluded from Risk Assessment/explanation
b. Hazard Profiles (each applicable hazard)
i. Natural
1. Description (standard description to be provided by the State)
2. Location
3. Extent
4. Previous Occurrence, Disasters, and Probability of Future Events
ii. Technological and Human-Caused **[Optional]**
1. Description (standard description to be provided by the State)
2. Location
3. Extent
4. Previous Occurrence, Disasters, and Probability of Future Events
c. Climate Change (this could be addressed separately here)
3.3 Vulnerability
a. Community Assets (exposure to loss)
i. People
ii. Economy
iii. Built Environment
1. Existing structures
2. Infrastructure
3. Critical facilities
4. Historic and Cultural resources
5. Future development
iv. Natural Environment
1. Water Resources, Watershed
2. Protected Natural Areas
3. Other
3.4 Risk Analysis & Assessment Matrix
a. Methodology
i. Exposure Analysis
ii. Historical Analysis
1. Repetitive & Severe Repetitive Loss Properties
iii. Scenario Analysis (if applicable)
iv. Changes in Development Analysis [For Plan Update]
b. Vulnerability Summary (for each hazard)
i. Identified Risk in the Community
ii. Matrix

SECTION 4 – Capability Assessment
4.1 Purpose – Capabilities for both existing and future risk

DRAFT

4.2 Types & Evaluation of Capabilities (this can be outlined by program areas, or recommended by authorities, policies, programs, resources, community support/leadership, and the ability to expand/improve)
   a. Local Government & Program Areas - Highlight applicability of local authorities, staffing, funding, and planning tools or mechanisms for hazard mitigation including but not limited to:
      i. Form of government (town council, selectboard, planning board, home rule, MPO, etc.)
      ii. Planning, Building, Housing - Community Development
      iii. Transportation, Public Works, Utilities,
      iv. Floodplain Management/Stormwater, Open Space, Land Conservation, Local Forestry
      v. Emergency Management
      vi. Economic (Re-)Development
      vii. Health
      viii. GIS (including database, modeling abilities of HAZUS, SLOSH, planning scenarios)
      ix. Dam Safety
   b. National Flood Insurance Program, CRS
   c. Partnerships and Other Community Affiliations, Programs, Resources
4.3 Integration with Existing Plans & Local Processes (Other Planning Mechanisms)
   a. Accomplishments
   b. Opportunities and Process for Integration
      i. Community Planning Mechanisms or Activities (e.g. next Comp Plan Update)
      ii. Method & Timeline
4.4 Capability Needs/Challenges - Summary

SECTION 5 - Mitigation Strategy

5.1 Goals (and Vision, Objectives if available)
5.2 Development & Update of Strategy & Actions – Methodology (or in Section 2)
   a. Identifying Types of **Mitigation** Actions (identify Preparedness separately or consider in Appendix)
      i. Existing & New Actions
      ii. Existing & Future Development
      iii. NFIP
      iv. Climate Change Adaptation – Future Risk
   b. Analysis of Actions
   c. Prioritization
      i. STAPLEE
5.3 For Plan Updates: 2008-2013 Actions: Meeting Targets & Progress
5.4 2013-2018 Action Plan
   a. Actions Using Risk Assessment Matrix by Vulnerable Area
      i. Descriptions
      ii. Action Type
      iii. Pre or Post Disaster
      iv. Priority Level (low, medium, high)
      v. *Change in Priority [For Plan Update]*
      vi. Lead
      vii. Supporting
      viii. Time Frame
      ix. Financing Options

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x. Cost Estimate
xi. Benefit

5.5 Table/Matrix

SECTION 6 – Moving towards a safe, resilient, and sustainable Rhode Island community

6.1 Evaluation: Progress & Challenges [For Plan Update]
- a. Involvement, Capabilities, Meeting Goals & Targets
- b. Changes in Development – Impacts to Risk
- c. New Disasters – Changes in Risk

6.2 Changes in Priorities [For Plan Update]

6.3 Success Stories and Best Practices **[Optional]**

References

Appendices

A. Assessing Risk - Maps
B. Building Support: Planning Process Additional Documentation
   1. Outreach Strategy & Materials
   2. Meeting Summaries, Notes, Sign-In Sheets
   3. Invites, Public Mtg Announcements, Web/Ad postings
   4. Surveys, Questionnaires, Evaluations, etc.
C. Capability Assessment [Additional documentation, if needed]
D. Determining Technical and Financial Assistance for Mitigation and Climate Change Adaptation
E. Emergency/Preparedness Strategy Actions **[Optional]**
F. Final Local Mitigation Plan Review Tool from Approved Plan
G. Glossary

DRAFT

Local Plan Capabilities Assessment

Local municipalities have primary authority over land use and development in Rhode Island. With regard to hazard mitigation, local government has the primary role in developing policy, making all land use decisions, establishing annual capital budgets, and implementing hazard mitigation and floodplain management activities. The table on the next page includes an overview of the local departments and/or organizations that have a responsibility in overseeing and/or implementing the local hazard mitigation projects, programs and policies within each community, and the evaluation of the function as it relates to risk reduction.

Evaluation of Departments/Organizations Supporting Hazard Mitigation

Function	Description	Opportunities	Evaluation and Effect on Loss Reduction
Building Officials	The Building Inspector implements and enforces the RI Building Code which incorporates the NFIP construction criteria. The RI Building Code also includes sections on wind, snow loading, structural loads and seismic retrofitting. The building official also enforces locally adopted ordinances (e.g. zoning and subdivision ordinances)	RIEMA continues to provide training opportunities in coordination with the State Building Commissioners Office for all building officials and inspectors regarding floodplain regulations.	Ensures that the NFIP standards and other construction standards are consistently applied statewide.
Emergency Management Director	Each RI community has a local Emergency Management Director whose primary responsibility is local response and recovery.	Need to more strongly develop the relationship between the local EMA Director, NFIP Coordinator, Building Official and Community Planner in order to leverage assets/resources to strengthen the effectiveness of hazard mitigation	EMA Directors play a critical role in the development of the Local Emergency Operations Plan and the Hazard Mitigation Plan. Both of these plans address opportunities to minimize loss of life and property damage.
Hazard Mitigation Committee	Established at the onset of the local hazard mitigation planning process. Committee has a diverse representation linking together many community departments and the public and private sectors.	Depending upon the diversity of the Committee and its dedication to the implementation of the mitigation plan, hazard mitigation can be readily implemented in the consideration of all local land use decisions	This Committee has the primary responsibility of developing and updating the Local Hazard Mitigation Plan, and identifying potential mitigation projects for funding.
Local NFIP Coordinators	Each NFIP community has an appointed local NFIP Coordinator who oversees compliance with the NFIP. Flood determinations, mapping issues, and construction standards within SFHAs are all addressed by the NFIP Coordinator.	Should develop a stronger relationship between the planning, public works and building departments relative to floodplain management. Should also pursue and offer outreach activities regarding sound floodplain management practices (e.g. *No Adverse Impact)* and identifying and pursuing projects to address repetitive loss properties.	Implementation can occur at the local level typically by an official that has the knowledge of local land use and construction issues.

Public Works Departments	The local department of Public Works and/or Water and Sewer Departments, which are primarily responsible for municipal drainage and storm water management systems, take the lead in ensuring the communities' compliance with the EPA's Phase II Storm water Regulations.	Public works staff is integral in implementing local hazard mitigation plans, especially in identifying and implementing local hazard mitigation projects.	Because storm water flooding is one of the major flood hazards in Rhode Island, ongoing maintenance and upgrading of local storm water systems by local public works departments is critical to reducing flood risks.
Conservation Commissions	The Conservation Commission has primary responsibility for overseeing issues relating to natural resources areas, critical areas of concern (per local comprehensive community comprehensive plans) and other environmentally sensitive areas. Also primary implementers of soil and erosion control ordinances.	All new development and substantial improvement with potential impacts on any river, stream, ponds wetlands or coastal areas must be reviewed by the local Conservation Commission that plays an important role in enforcing regulations that minimize flood impacts.	Strong advocates for open space acquisition and preserving the natural and beneficial resources of wetlands and other SFHAs. Protection of wetland areas and buffer zones adds additional layer of protection to promote flood loss protection.
Planning Director/ Planning Boards	Per the State Enabling Act, the Planning Board, with the Town Planner, implements local subdivision regulations. The Planning Board responsibilities include recommending land use regulations to protect public health, safety and welfare. The Planning Board is the primary vehicle at the local level that ensures new development and substantial improvements incorporate	Planning boards can often bring in more holistic perspectives (i.e., watershed context and longer term issues of a sustainable community).	The Planner or Planning Board often coordinates with the NFIP Local Coordinator and the Local Hazard Mitigation Committee through the mitigation planning process and the implementation of the plans (particularly when land use is involved). Can provide expertise in grant development and drafting of local ordinances and bylaws.
Town/City Council	Rhode Island cities and towns are governed by Mayors, Town Managers and Administrators, and city/town councils. This body approves subdivision, zoning and land ordinances and bylaws. Also facilitates annual financial town meeting overseeing the local capital improvements budget and plan.	Much more education needed concerning the beneficial uses of floodplains, hazard mitigation and other national policies and programs such as Association of State Floodplain Managers (ASFPM)'s No Adverse Impact Initiative.	These bodies are comprised of the chief elected officials and provide leadership and approval for local hazard mitigation plans, projects, grants and programs.

Each community has unique programs, policies and organizations relating to hazard mitigation. The local hazard mitigation plans have been reviewed for this plan update and the table on the following page provides an overview of those capabilities identified in the local plans. As shown, many communities have a fully approved comprehensive plan, which can be utilized to implement hazard mitigation techniques throughout the community.

In an effort to sufficiently evaluate the capabilities of each local jurisdiction, a simplified version of the state capability assessment ranking (Table 54) was completed and summarized in the following table. The capabilities presented in the local hazard mitigation plans have been grouped into the following categories:

- Planning Capability
- Development Policy and Program Capability
- Staffing, Technical Assistance, and Training Capabilities
- Demonstration of Capabilities: Active mitigation projects
- Eligible for funding to complete mitigation actions

An evaluation of local capabilities was completed by determining if the community demonstrated capabilities for each of the five (5) categories listed above. The categories were then further reviewed in 12 fields outlined in the table below. Similar to the State capability assessment, effectiveness of local policies, programs, and capabilities were grouped into three (3) classifications of High, Medium, and Neutral. Communities whose capabilities totaled 11 or 12 were assigned a High ranking, communities with values of 9 or 10 received an effectiveness of Medium and communities that either have plans in development or have expired plans received a neutral effectiveness.

The following communities have been ranked with a High capability to effectively implement hazard mitigation:

- Bristol County
    - Barrington
    - Bristol
- Kent County
    - Coventry
- Providence County
    - Cranston
    - Pawtucket
- Washington County
    - South Kingstown
    - Westerly

The highest ranking communities, receiving scores of 12, were Bristol, Cranston and Westerly representing their commitment to mitigation planning and implementation.

It should be noted that the capabilities shown are solely based on the information in the local hazard mitigation plans and may not be a complete representation of all capabilities, at the local level, related to mitigation.

RIEMA is currently working with communities undergoing updates to ensure local capabilities are captured and to expand on the effectiveness of existing local mitigation policies, programs and capabilities. RIEMA will work closely with communities that received a Neutral ranking to determine how to increase mitigation effectiveness for the locality.

Identified Capabilities by Municipality/County

County	Municipality	Planning				Development Policies and Programs			Staffing, Technical Assistance, Training			Demonstration of Capabilities: Active Mitigation Projects & Improvements	Eligible for Mitigation Funding	Effectiveness of Local Mitigation Policies, Programs, and Capabilities
		Approved LHMP	Approved Comprehensive Plan	Municipal Plans*	Emergency Shelter Facilities	Building Codes	Regulations / Ordinances/ Policies / Zoning	NFIP Compliant	Training (Fire Safety, Emergency Management, Planning)	GIS Modeling (HURREVAC, HAZUS, SLOSH)	Outreach Initiatives			
Bristol	Barrington	X	X	X	X	X	X	X	X	X	X		X	High
	Bristol	X	X	X	X	X	X	X	X	X	X	X	X	High
	Warren			X	X	X	X	X	X	X				Neutral
Kent	Coventry	X		X	X	X	X	X	X	X	X	X	X	High
	East Greenwich			X	X	X	X	X	X	X				Neutral
	Warwick	X		X	X	X	X	X	X	X	X		X	Medium
	West Greenwich			X		X	X	X	X	X				Neutral
	West Warwick	X		X	X	X	X	X	X	X		X	X	Medium
Newport	Jamestown			X	X	X	X	X	X	X	X			Neutral
	Little Compton		X	X	X	X	X	X	X	X				Neutral
	Middletown			X	X	X	X	X	X	X	X			Neutral
	Newport			X	X	X	X	X	X	X	X			Neutral
	Portsmouth	X		X	X	X	X	X	X	X			X	Medium

	Tiverton		X	X	X	X	X	X	X	X	X			Neutral
Providence	Burrillville		X	X	X	X	X	X	X	X				Neutral
	Central Falls			X	X	X	X	X	X	X				Neutral
	Cranston	X	X	X	X	X	X	X	X	X	X	X	X	High
	Cumberland	X		X	X	X	X	X	X	X		X	X	Medium
	East Providence	X		X	X	X	X	X	X	X	X		X	Medium
	Foster			X	X	X	X	X	X	X				Neutral
	Glocester			X	X	X	X	X	X	X				Neutral
	Johnston	X	X	X	X	X	X	X	X	X			X	Medium
	Lincoln			X	X	X	X	X	X	X				Neutral
	North Providence			X	X	X	X	X	X	X				Neutral
	North Smithfield			X	X	X	X	X	X	X	X			Neutral
	Pawtucket	X	X	X	X	X	X	X	X	X		X	X	High
	Providence	X		X	X	X	X	X	X	X	X		X	Medium
	Scituate			X	X	X	X	X	X	X				Neutral
	Smithfield			X	X	X	X	X	X	X				Neutral
	Woonsocket	X	X	X	X	X	X	X	X	X			X	Medium
Washington	Charlestown			X	X	X	X	X	X	X	X			Neutral
	Exeter			X	X	X	X	X	X	X				Neutral
	Hopkinton	X	X	X		X	X	X	X	X		X	X	Medium
	Narragansett	X		X	X	X	X	X	X	X	X		X	Medium
	New Shoreham			X	X	X	X	X	X	X				Neutral
	North Kingstown			X	X	X	X	X	X	X	X			Neutral
	Richmond		X	X	X	X	X	X	X	X				Neutral
	South Kingstown	X		X	X	X	X	X	X	X	X	X	X	High
	Westerly	X	X	X	X	X	X	X	X	X	X	X	X	High

*Types of municipal plans included at least one of the following: Debris Management, Evacuation, Engineering, EOP, Water Supply, Medical, Facilities, Open Space, Wastewater

Local Plan Mitigation Strategy

The table below lists the jurisdictions that have not reported any completed actions since the 2011 Rhode Island SHMP. In many cases, the plans for these communities are in the process of being updated. It is likely that mitigation actions have in fact been implemented and relevant information will be included in the local plan updates and future updates of the SHMP.

Communities with No Identified Completed Mitigation Actions Since 2011

Communities with No Identified Completed Mitigation Actions Since 2011			
Bristol	Foster	North Kingstown	Tiverton
Burrillville	Glocester	North Smithfield	Warren
Central Falls	Johnston	Pawtucket	West Greenwich
Charlestown	Lincoln	Portsmouth	Westerly
Cumberland	Little Compton	Providence	Woonsocket
East Greenwich	Middleton	Scituate	
Hopkinton	Newport	Smithfield	
Exeter	New Shoreham	South Kingstown	

Several communities have completed mitigation actions, including the Town of Coventry, Town of Middletown, Town of Barrington, City of Cranston, City of East Providence, City of Warwick, Town of West Warwick, and Town of New Shoreham. The SIHMC reviewed these actions for compatibility with the SHMP, and found that all completed actions are in accord with the goals described in this update. The table below provides a description of each completed mitigation action, organized by community and project type.

Implemented Hazard Mitigation Actions Identified in Local Hazard Mitigation Plans

Town of Coventry (2010 Plan Update)	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Planning and Regulatory Activities	Dam Safety Officer appointed Development in flood-prone areas discouraged Enforcement of regulations regarding underground utilities for new construction
Pre-Mitigation Activities	Dam identification has been implemented, with repair recommendations made for some, pending funding Maps showing probable flood areas produced Locations for temporary levees identified
Public Education and Outreach	Coordination to facilitate notification to those in hazard areas completed Completed public education and notification regarding elevation of flood waters, transportation assistance for evacuation, status of road closures and location of shelters CERT team established
Preparedness Measures to Reduce Loss	Labor force and materials for sandbagging secured

City of Cranston	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Planning and Regulatory Activities	Adopted changes to flood ordinance language to bring ordinance into compliance Subdivision enforcement
Pre-Mitigation Activities	Completed Storm Preparedness and Hazard Mitigation Plan Hired part-time planner for hazard mitigation coordinator
Structural Mitigation Measures	Completed Stillhouse Cove Erosion Control Project
Non-Structural Mitigation Measures	Tennessee Gas Metering Station Clear Zone project completed / ongoing
Training and Exercise Measures	Flood hazard training workshops
Town of Narragansett	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Public Education and Outreach	Outreach and Incentive Programs - Plan and Signage
Town of Barrington	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Structural Mitigation Measures	Relocate police station
City of East Providence	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Structural Mitigation Measures	Culvert improvement
City of Warwick	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Structural Mitigation Measures	Repair roof or Thayer area.
Pre-Mitigation Activities	New EMA Procedures established
Non-Structural Mitigation Measures	Annual cooperative program implemented
Pre-Mitigation Activities	Municipal infrastructure inventory
Structural Mitigation Measures	Critical road reconstruction
Public Education and Outreach	Public information campaign and materials published on city website
Town of West Warwick	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Planning and Regulatory Activities	Enforce NFIP guidelines
Planning and Regulatory Activities	Develop pre-disaster evacuation plans
Non-Structural Mitigation Measures	Acquire new pump for the fire department
Planning and Regulatory Activities	Review water mitigation plan

Town of New Shoreham	
Mitigation Project Type	**Implemented Actions per Local Hazard Mitigation Plan**
Structural Mitigation Measures	Town hall rebuilt
Pre-Mitigation Activities	Sprinkler system installed
Structural Mitigation Measures	Dock rebuilt
Structural Mitigation Measures	Rescue building built

These completed mitigation actions are a marker by which RIEMA and the SIHMC can determine the State's progress towards achieving and maintaining its mitigation goals. These completed actions can also serve as examples or case studies to other communities, who may be interested in discussing or considering new or different types of mitigation actions as they update their own mitigation plans.

Prioritizing Local Assistance

The process used by the State of Rhode Island to review, evaluate and select projects for the various mitigation grant programs is based on years of public participation and supports the State's home-rule form of government. Home rule provides that government at the lowest-possible level is the one best prepared to make decisions that affect it the most - including hazard mitigation projects.

Rhode Island's concept is to support all local mitigation efforts. Typically, hazard mitigation funds following a disaster are available to all eligible agencies and organizations statewide for projects that reduce the risk of future damage, regardless of the hazard being addressed (i.e., funds available following an hurricane disaster can address problems presented by other hazards).

Potential projects are evaluated using a scoring process emphasizing protection of life and property, reduction of risk, and cost-effectiveness. Cost-benefit workshops will continue to be held on an annual basis prior to each grant funding cycle. As indicated in the Capability Assessment, RIEMA staff will work with each potential grant applicant to ensure that proposed projects provide as great a public benefit as possible.

When mitigation planning funds are available to support local plan updates, however, funds will be distributed according to State priorities:

- The expiration date of the plan
- Recent Presidential Declared areas
- Number of RL structures in the region
- Land development rates in the area
- Demonstrated need for funding

All local plans are reviewed by RIEMA staff and forwarded onto FEMA Region I for final approval. While some plans addressed all hazards that have even the most remote chance of occurring in Rhode Island, generally the strategies proposed in the local plans and in the State plan are very similar. As these plan updates are completed and submitted to FEMA for review

and approval, the local hazard mitigation measures will be incorporated into the SHMP. The following subsection explains RIEMA criteria for project funding eligibility and selection.

Criteria for the Prioritization of Mitigation Grants

In evaluating hazard mitigation applications for grant funding, a scoring system is used to prioritize projects according to both federal eligibility criteria and the State eligibility criteria as published in the grant application guidance. For each round of grant funding, RIEMA reviews the applications.

When prioritizing grant applications, the seriousness of risk is emphasized when considering an applicant's response to the following federal and State eligibility criteria. Among the criteria receiving greatest weight in scoring are those dealing with reduction of risk posed by hazards, prevention of RLs, and protection of critical areas including frequently flooded areas and geologically hazardous areas.

Project Eligibility

The State criteria used for prioritizing local eligible projects for pre-disaster and post-disaster hazard mitigation funding in Rhode Island requires that the project:

1. Must be in conformance with a FEMA-approved local and/or multi-jurisdictional all hazards mitigation plan which meets the mitigation planning requirements per the DMA 2000. (Note: this criterion became effective November1, 2004).
2. Must be in conformance with the Rhode Island SHMP developed as a requirement of the DMA2000. Rhode Island places a priority on local mitigation projects that involve non--structural, or "low cost" solutions (i.e. updating and enforcing local flood ordinances), retrofitting high-risk structures (i.e. elevating residences in coastal flood zones) and/or the acquisition of RL structures.
3. Must be located in, or have a beneficial impact upon, past declared disaster areas; or in a high risk area for potential impacts from one or more natural hazards, such as a floodplain, high wind area, coastal zone, etc. This high risk area should be identified in either the local, regional or State mitigation plan.
4. Must be in compliance with all existing Rhode Island Laws and Regulations for construction, land alterations, and natural resource protection, such as the Rhode Island State Building Code, the Rhode Island Coastal Resources Management Plan, and all legislation pertaining to the protection and preservation of wetlands. Must be in compliance with municipal ordinances and zoning regulations
5. Must be in conformance with 44 CFR, Part 9, Floodplain Management and Protection of Wetlands, and 44 CFR, Part 10, Environmental Considerations.
6. Must provide a solution to a problem independently, or provide a significant functional portion of a solution being addressed in a combined project. If the project constitutes a significant functional portion of a solution being addressed, the status of any associated dependent or supporting projects must be given. There must be reasonable assurance that the total mitigation project will be completed. The identification or analysis of a problem does not automatically qualify for eligibility.
7. Must meet FEMA's cost-effective criteria such as the need to substantially reduce the risk of future damage, hardship or losses resulting from a major disaster. Documentation will be required that demonstrates that:
    - The problem is repetitive and/or poses a significant risk if left unsolved. Therefore, a

brief history of previous occurrences of the problem at the project location, including dates and impact of each event, and/or an analysis of projected potential damages if the project is not completed must be given.

- Sufficient information to allow comparison of the cost of the project with the anticipated value of future direct damage reduction or negative impacts to the area.
- Sufficient information to allow comparison of the cost of the project with the anticipated value of future direct damage reduction or negative impacts to the area.
- The proposal has been determined to be the most practical, effective, and environmentally sound alternative found after consideration of all available options.
- The project contributes to the long-term solution of the problem it addresses. Therefore, an estimate of the effective life of the project and a listing of influence factors should be included.
- Development of the project considers any long-range alterations to the area and the entities that it protects, has future maintenance requirements that are financially feasible and can be modified, if necessary, without changing the impact on the area.

Preference is given to projects that exhibit greater cost-effectiveness as established by a benefit cost ratio calculated using the FEMA Benefit-Cost Analysis software as suggested in requirement eight (8) above, and to projects or plans that contribute the greater solutions to stated problems as suggested in requirement seven (7) above. Preference is given to communities with the highest risk. When ranking potential projects, particular consideration will be given for projects that address repetitive flood loss. Finally, particular consideration will be given to projects proposed by communities with the most intense development pressure.

Project Selection

Available federal funds for pre-disaster and post-disaster HMA will most likely not be sufficient to support all eligible project applications. An attempt will be made to award grants to the maximum number of eligible projects.

Recommendations for funding will be made to the FEMA Region I office by the SHMO in consultation with NFIP State Coordinator, under advisement by the SIHMC. FEMA will make the final selection of grants to be awarded. The mitigation measure proposed should not be intended to only replace what was damaged, but rather should provide more protection to life and property than what existed prior to the storm.

Technical Assistance

The RIEMA has worked with local jurisdictions to encourage and support local hazard mitigation planning since the recovery efforts after Hurricane Bob in 1991. At that time, every effort was made to address future losses through the reduction of damages to property by integrating ongoing growth management, sustainability and land use management initiatives with hazard mitigation planning. Rhode Island has mandated that communities develop local hazard mitigation plans (approximately ten years prior to the passing of the federal Disaster Mitigation Act 2000) that address land use issues and can be implemented through existing local comprehensive community plans.

Technical assistance to communities has consisted of statewide planning workshops to train locals on how to develop a hazard mitigation plan (prior to DMA 2000) and providing those Geographical Information Systems (GIS) maps of the communities' risks and vulnerabilities. FEMA contractors facilitated one and two day workshops on how to develop local hazard mitigation plans and how to identify sound hazard mitigation projects. Tabletop exercises were also held with local officials in which a simulated "real time" hurricane and/or flood exercise hit a community and the participants were expected to respond and identify the proper actions to take throughout the response and recovery process. Based on that experience, participants were asked to identify mitigation actions, policies, programs and projects that they would take to lessen the impact of disasters the next time the hazard hit their community.

RIEMA encourages a community to establish a Local Hazard Mitigation Committee (LHMC) prior to receiving technical assistance. This committee usually consists of various municipal officials including the community's planner, emergency management director, NFIP Coordinator, fire chief, engineer, building official, town administrator and public works director, or any other local official who may have a role or will be responsible for implementing the strategy. The committee is responsible for identifying the hazards, incorporating public input, developing and prioritizing mitigation actions and implementing and revising the strategy.

Sixteen local plans included mitigation actions related to acquiring lands/repetitive loss structures in hazard prone areas. RIEMA will continue to provide technical assistance those communities without such an action and those without hazard mitigation plans to address repetitive loss properties.

Monitoring and Tracking Local Hazard Mitigation Plans

All of Rhode Island's communities are working toward completing their plans and receiving approval from FEMA. Once the local hazard mitigation plans have been completed, they will be reviewed by the State for hazard risk and vulnerability locations, mitigation actions, local capacity assessments, programs, policies and projects.

Since 1993, Rhode Island has been providing technical assistance to communities in the manner of assisting in local hazard mitigation planning, training and statewide workshops on hazard mitigation planning for local cities and towns. The first efforts to develop local hazard mitigation plans commenced in 1993 when RIEMA formed a partnership with RISG to develop two prototype hazard mitigation strategies: a coastal community plan and a riverine community plan. Guidance was developed so that other communities could write their local plans and become involved and ultimately integrated into neighboring communities' hazard mitigation process planning efforts and initiatives. Pre-disaster funding from FEMA to local communities for hazard mitigation was not available until Project Impact in 1998.

Several communities have expired plans (15 communities) or do not have (6 communities) hazard mitigation plans developed. RIEMA has made it a priority to work with these communities to provide technical assistance related to plan development.

In addition to the technical assistance and monitoring activities, RIEMA will monitor the progress of local hazard mitigation plans and projects through the 3rd Quarter SIHMC meeting, quarterly reports, site visits, phone calls, workshops, questionnaire, mitigation project tracking database, and the State Grants Administrative Plan. The table below summarizes the various activities that RIEMA uses to monitor and evaluate local mitigation plans.

Monitoring program for local mitigation plans.

Monitoring Activity	Agency(ies) or Organization(s)	Responsibility	Timeframe
Site Visits	RIEMA	Evaluate the potential project, to monitor progress, and to ensure that the contracted work has been completed	Before a grant is awarded, during construction, and upon completion of a project
Questionnaire	RIEMA	Send out a questionnaire to participating communities to determine and document progress on the mitigation planning progress as well as the mitigation project and gather information to evaluate successes/area of needed improvement	Completion and approval of local hazard mitigation plans.
Quarterly Reports	RIEMA	Each recipient of a mitigation grant must file quarterly reports with RIEMA	Quarterly
Mitigation Project Tracking System & Database	RIEMA	Review current mitigation grant and project guidelines and make updates as appropriate, specifically as federal regulations are updated or amended Monitor expiration date of local mitigation plans and identify communities without current plans	Immediate upon plan approval by FEMA
State Grant Administration Plan	RIEMA	Review current mitigation grant and project guidelines and make updates as appropriate, specifically as federal regulations are updated	Must be updated after every disaster declaration or every three years

This plan and Local Hazard Mitigation Plans are living documents. Contact RIEMA for an up to date version of the Local Mitigation Tracker Tool as this tool is revised following the quarterly SIHMC meetings and review of Local Hazard Mitigation Plans.

Appendix 6: Mitigation Strategy

Project Closeout

Project Closeout is the process that finalizes a completed mitigation project that FEMA has funded. Project Closeouts will continue to be conducted based on FEMA Region I closeout procedures in accordance with national and regional FEMA guidance along with Rhode Island financial management procedures. Projects and activities funded through other federal or state grant programs, state general funds or that can be achieved without targeted funding will be completed as dictated by the funding source or state program with administrative oversight for the activity of the project. The following description provides an overview of the closeout process. Details are included in the Rhode Island State Hazard Mitigation Grants Administrative Plan, included in Appendix 6.

The sub-grantee will notify the SHMO when a project is ready to be closed. It is recognized that, based upon performance period deadlines, the SHMO may suggest project closure to FEMA.

The seven steps to closure of a project are:

1. Agreement between the sub-grantee and the State that the project is ready to be closed. Should either not agree, the project manager or the SHMO would request an extension, in writing, outlining the justification for the request.

2. The sub-grantee, the State, and FEMA will coordinate to make sure that funds advanced through the program balance with funds expended by the State and sub-grantee. If there is disagreement between the expended funds and the grant amount, FEMA and the State take steps to reconcile and adjust final project expenditures and Grantee Management Costs.

3. The State will submit a final project report that includes:

    a. Final Financial and Progress Report to FEMA (if applicable)

    b. Final Letter of Credit Payment Request.

    c. FEMA Form 20-18, Report of Government Property

    d. Photos, Property Survey Inventory spreadsheet, etc. to validate expenditures.

4. The State will conduct site visits for all projects to ensure the approved scope of work was completed. Will provide FEMA with a letter confirming final inspection and that all final payments have been made to project.

5. Sub-grantee shall have 30 days to appeal if it does not agree with the State and FEMA's findings. The appeal process previously mentioned will be employed to appeal matters relating to closeout.

6. FEMA and the State will coordinate their financial systems to record the amount and date of the final payment(s). Financial files will be closed and excess funds will be de-obligated.

7. The State will provide FEMA with a letter requesting closure of the project. The information and enclosures:

    a. Project name, Federal Project number, State identification number.

    b. Financial summary of the project.

    c. Certifications:

        i. All eligible funds paid to sub-grantee.

        ii. All work completed according to FEMA and State requirements.

        iii. All costs incurred as the result of eligible work.

        iv. All work completed in accordance with provisions of the FEMA/State and State/Local agreements.

        v. All payments made according to Federal and State legal and regulatory requirements.

            - No bills are outstanding.

            - No further requests for funding will be made for the project.

Program Closeout

When all projects under a single disaster are closed, the entire program is ready for closure. The steps that comprise program closeout are as follows:

1. Any mission assignments and technical assistance contracts will be closed out.
2. There will be agreement between FEMA and the State on the Final Claim Amount and concurrence date. The State will submit a concurrence letter and sign FEMA Form 425.
3. The HMGP will be closed in program and financial systems. FEMA and the SHMO are responsible for ensuring that Federal and State records are available in the event of an audit.
    - State specific responsibilities for the HMGP closeout process may be found in the 2010 HMA Unified Guidance Part VI, D.1, D.2 and D.2.1
    - All records will be maintained for a minimum three years.

Reporting

The sponsors of projects and actions funded through the FEMA HMA Program provide quarterly progress reporting to RIEMA throughout the duration of the project. RIEMA consolidates these reports into a quarterly summary that is provided to FEMA. Projects that support specific aspects of the Mitigation Plan will be tracked on the Mitigation Action Tracker spreadsheet so

that specific FEMA-funded initiatives are tracked to achievement of Mitigation Plan Strategies. A copy of the Mitigation Action Tracker and brief narrative summary of progress will be provided annually to FEMA Region I.

Mitigation Action Status since 2011

A comprehensive evaluation of 2011mitigation actions was completed during several meetings throughout the planning process. SIHMC feedback was gathered during the kick-off and subsequent WebEx meetings. The mitigation action tracking spreadsheet was provided to SIHMC to update with current status. RIEMA provided additional insight and structure to the mitigation action evaluation. The following tables summarize:

- Mitigation actions completed
- Mitigation actions not started or completed and continued in the 2014 plan update
- Cancelled mitigation actions due to lack of interest or need
- Ongoing mitigation actions that have been integrated into Section 4 in the Capabilities Assessment
- Complete listing of the 2014 prioritized mitigation actions

The individual 2014 mitigation action worksheets are available following the table of the complete listing of the 2014 actions. The Microsoft Excel spreadsheet is available through RIEMA.

Completed mitigation actions.

2011 ID	Strategy Description
2.1.7	Encourage all relevant State, local and Federal agencies and professional associations to assist in the establishment of a Rhode Island Floodplain Management Association in coordination with the ASFPM
2.2.6	Improve efficiency in tracking and storing NFIP-related data by: a) Developing a statewide community database, including NFIP administrator contact and ordinance information b) Developing a NFIP Technical Assistance database to track issues and needs c) Developing and maintaining accurate and current statewide Repetitive Loss databases d) Maintaining current and archived FIS/FIRM files, including map changes
3.3.3	Work with DEM Division of Dam Safety to garner additional resources/staff needed to develop dam inundation maps in areas that pose greatest threat and for those dams that have been classified as high hazard and significant hazard dams. Also obtain information from DEM Dam Safety on when and what dams have had breeches.

Not started and work-in progress mitigation actions (Continued as actions in 2014 update).

ID	Strategy Description
2.1.1	Incorporate the new local hazard mitigation data and capability assessment (hazard profiles, risk and vulnerability assessments, mitigation actions/strategies, etc.) into the State Hazard Mitigation Plan.
2.1.12	Work with USACE and USGS to incorporate data collected during March 2010 floods into new Flood Insurance Studies and Flood Insurance Rate Maps
3.1.7	Use the information collected for vulnerability regarding State owned/operated facilities, critical facilities and infrastructure to estimate losses for all identified hazards addressed in the Plan.
4.1.4	Develop a web based site (on the existing RIEMA web site) for public education and outreach initiatives.
4.2.1	Develop partnerships with businesses to provide a public-private link for coordinated mitigation, preparedness, response and recovery. Partnerships should include critical businesses involved in recovery from natural hazard events (e.g., utilities, communications, food suppliers, medical facilities) and those businesses that would impact the local and State economy.
3.1.1	Develop and track joint mitigation/conservation projects with NRCS, CRMC, DEM, land trusts, EDC and other environmental groups.
3.1.3	Improve coordination with the RI Department of Environmental Management and RI Department of Transportation in addressing storm water management and other riverine and floodplain management-related issues and determine the probability for urban/stormwater flooding. Obtain information to develop a statewide database of historic areas of past events of urban/stormwater flooding.

Cancelled mitigation actions.

2011 ID	Strategy Description
1.1.2	Educate and assist the Rhode Island General Assembly in developing State legislation that will further hazard mitigation efforts.
1.1.3	Educate and assist the Rhode Island General Assembly in developing State legislation that will further hazard mitigation efforts.
1.1.7	Maximize the utilization of best technology through the incorporation of a progressive geographical information system (GIS) as the primary tool for spatial data management and as a recognized essential tool in land use decision making
1.2.1	Add a minimum of two (2) additional full time staff to the RIEMA Mitigation and NFIP programs and seek additional resources through more State funding and additional contract services. Identify and secure funding to support two additional personnel within RIEMA mitigation and NFIP programs.
1.2.2	Provide high quality training to members of Mitigation and Homeland Security Divisions in order to “cross train” more staff to be used more efficiently.
1.2.3	Improve organization efficiency and lines of communication within RIEMA by holding regular staff meetings with all branches of the agency in order to not only support mitigation efforts, but to also identify ways in which mitigation and homeland security can commingle efforts.
1.2.6	When appropriate, provide membership fees for professional organizations for RIEMA staff.

2011 ID	Strategy Description
1.3.2	Educate and provide training to new and existing State Interagency Hazard Mitigation Committee members
2.1.3	Increase awareness and knowledge of hazard mitigation principles and practices among local public officials and R.I. Legislators through outreach efforts and educational presentations and materials.
2.1.4	Conduct hazard mitigation and community outreach educational programs and training courses for local government and stakeholder groups and the general public
2.1.5	When available, allocate federal grant funding to local governments (or other eligible recipients) for the purposes of implementing eligible hazard mitigation projects.
2.1.8	Provide technical assistance to municipalities for development of local recovery plans from natural disasters.
2.1.9	Work with local communities/planners to identify and put into use common definitions and terminology for hazard profiling and identification. Implementation of this action will allow for seamless integration of hazard data from local hazard mitigation plans into future updates of the State Hazard Mitigation Plan and ensure full compliance with DMA 2000.
2.1.10	Work with local communities/planners to develop, define and put into practice consistent methodologies regarding hazards, asset identification, vulnerability assessments, risk assessments, and loss estimation. Implementation of this action will allow for seamless integration of risk assessment data from local hazard mitigation plans into future updates of the State Hazard Mitigation Plan and ensure full compliance with DMA 2000.
2.1.11	Work with local communities/planners to develop and define common mitigation priorities, goals, objectives, and project types. Implementation of this action will allow for seamless integration from local hazard mitigation plans into future updates of the State Hazard Mitigation Plan and ensure full compliance with DMA 2000.
2.2.4	Integrate the broad principles of sustainable development into State and local hazard mitigation practices, policies and programs by coordinating with organizations responsible for promoting and/or implementing sustainable development or “smart growth” initiatives.
2.2.5	Ensure that hazard mitigation is recognized in any community programs that target “smart-growth” or sustainable development practices.
3.1.5	Work with the Rhode Island Water Resources Board to complete an assessment of the probability of future drought occurrences. As important is a clarification from the WRB of what communities /regions in Rhode Island are potentially affected by drought and what are the economic impacts.
3.3.1	Coordinate data collection and sharing with other statewide initiatives such as the Homeland Security Grants and Planning process.
4.1.1	Develop statewide inventory of local hazard risks and vulnerabilities based on local hazard mitigation plans
4.1.2	Develop a statewide inventory of local hazard mitigation projects
4.1.3	Develop programs to increase public awareness of the importance of mitigating the damage caused by natural hazards, through a coordinated effort with multiple stakeholders.
4.2.2	Develop and conduct mitigation training for building, design, and construction professionals.
4.2.3	Develop a set of public sector incentives to implement mitigation measures in collaboration with private sector financial incentives. Public sector incentives could include tax incentives and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

Ongoing mitigation actions incorporated into Capability Assessment (integrated into Section 4).

2011 ID	Strategy Description
1.1.1	Identify and secure funding to administer and implement pre-disaster mitigation programs.
1.1.4	Target representatives of local communities that are most vulnerable to natural hazards and provide information about the risks their community faces and how and where their community is vulnerable to natural hazards.
1.1.5	Invite State and local officials to hazard mitigation workshops, meetings and all other relevant functions in which they can learn more about hazard mitigation programs, polices and projects
1.1.6	Cooperate and coordinate with partners at all government levels in planning and use of best technology.
1.1.8	Encourage State agency and local government officials involved in floodplain management, community planning, building inspection, emergency services, or enforcement of land use planning to take the FEMA Independent Study Courses related to flooding, flood mitigation, and floodplain management.
1.1.9	Ensure that hazard mitigation is recognized in any state-level programs that targets “smart-growth” or sustainable development practices.
1.2.4	Encourage professional development and certification through outside continuing education programs (e.g. CFM certification, EMAP program accreditation).
1.2.5	Allow staff members, and local EMA Directors and NFIP Coordinators to travel and attend relevant conferences, workshops and professional meetings
1.3.1	Add members to the State Interagency Hazard Mitigation Committee that will represent federal, State and local agencies and more relevant stakeholders from both non-profit and the private sector.
2.1.2	Provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities.
2.1.6	Work in coordination with other State and local agencies and organizations to acquire and connect hazard-prone or environmentally sensitive lands throughout the State.
2.2.1	Provide floodplain management resources to local government such as: an updated Local Administrator’s Handbook; quick guide for floodplain management; updates segment of Floodplain management on the EMA website; a guidebook for local public officials with recommendations for incorporating higher regulatory standards into local flood damage prevention ordinances to enhance local capability to manage floodplain development.
2.2.2	Improve compliance with the NFIP through better understanding by local officials of the NFIP criteria and therefore fewer variance approvals.
2.2.3	Increase participation with the CRS and improve the ratings of current communities.
3.1.2	Develop a list of potential hazard mitigation projects and strategies that support the mission and goals of the State Hazard Mitigation Plan and the FEMA approved local hazard mitigation strategies.
3.2.1	Educate State and local organizations on the theory and practice of hazard mitigation, and help them to identify how mitigation can become incorporated into land use decisions and other routine functions and activities.
3.2.2	Agree to address relevant hazards and the risks they pose in any state-level land use decisions, including plans for State-owned property development. The State will also encourage adoption of local land use plans that incorporate hazards into decision-making.
3.3.2	Continue to support existing statewide mitigation planning initiatives especially the CAP-SSE, the NFIP, and the FEMA Mapping and Modernization Program.

2014 Mitigation Actions and Prioritization

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2011 Activity Number	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit	Timeframe for Completion	Date if Known	Flood Related	Wind Related	Winter Related	Extreme Heat	Drought	Wildfire	Geologic Related	Climate Change/SLR	Other
HIGH	1, 2, 3,4	1.3.; 2.1; 2.2; 2.3; 3.1; 3.2; 3.3; 4.1; 4.2		2014.34	Rhode Island Shoreline Change Special Area Management Plan	The RI Coastal Resources Management Council's Shoreline Change Special Area Management Plan (Beach SAMP) is a collaborative effort with the URI and the RI Sea Grant Program. The goal is to prepare a state management plan that provides the best available science on the projected impacts of coastal erosion, storm flooding and SLRSLR and develop best practices, as well as regulatory policies to address both the short and long term changes to Rhode Island's shoreline. Particular attention will be paid to how erosion, flooding and SLR will impact the built environment along the coast including public and private infrastructure, roads, ports, and public safety issues. In addition to developing the management plan, an extensive public outreach and educational campaign will be conducted to inform stakeholders of their risk, as well as present a range of options to local officials and property owners on actions they can take to increase their preparedness or hazard resilience.	State and local roadways and bridges; critical municipal facilities including those used to support first responders and public health and safety; residential or commercial properties vulnerable to coastal erosion, flooding from a major storm event (e.g. Category 3 hurricane) and projected SLR scenarios possible for the next 100 years.	CRMC	Partially funded by grants from: Rhode Island's Bays, Rivers and Watersheds Coordination Team, Rhode Island Sea Grant, URI Coastal Institute and the Rhode Island Foundation	No Cost Benefit to be Completed	Long-Term (>2 years)		X						X	X	
HIGH	2	2.1	3.1.3	2014.2	Stormwater and Floodplain management Coordination	Improve coordination with State agencies in addressing storm water management and other riverine and floodplain management-related issues.	Lack of information statewide of historic areas of past events of urban/stormwater flooding.	DEM DOT RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Short-Term (0-6 months)		X							X	
HIGH	5	5.1		2014.10	Repetitive Loss Property Mitigation	Identify and devise mitigate strategy for repetitive loss and severe repetitive loss properties.	Properties at risk for flooding	RIEMA	Agency fiscal budget	Cost Benefit To Be Completed	Medium-Term (18 - 24 months)		X							X	
HIGH	2	2.1, 2.2, 2.3		2014.26	SLR Policies	Based on SLR modeling, develop and propose policies to reduce risks for new development, including consideration towards relocating structures or reducing existing hazards within inundation areas with increasing risk. Policies should also address appropriate use of federal and state mitigation monies.	Structure vulnerability to SLR	CRMC URI CRC	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X							X	
HIGH	2, 4	2.3 and 4.1	2.1.6	2014.3	Floodplain Management Education and Training	Work in coordination with other State, local municipalities and organizations to mitigate damage in hazard prone areas through acquisition, elevation or relocation. Conduct outreach and training to community leaders specifically focusing on the floodplain easement program.	Properties at risk for flooding	DEM NRCS RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X							X	
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.3	3.1.4 and 3.1.6	2014.14	Natural Hazard and Climate Change Vulnerability Database	Work with the National Weather Service and local communities to develop a statewide database of how natural hazards impact communities throughout Rhode Island. Includes documenting frequency and intensity of past hazards and future probabilities. Assessment of hazard events to include vulnerability to climate change. Hazard-prone or environmentally sensitive lands will be made available to local communities to ensure integration with local risk assessments and mitigation activities.	Lack of scientific methodology for hazards and assessment of this vulnerability with increasing temperatures. Assessment of vulnerability to climate change.	CRMC NWS RIEMA SIHMC	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X	X	X	X	X	X	X	
HIGH	1, 2, 3	1.1, 2.1, 2.3, 3.1	2.1.1 and 3.2.1	2014.15	Hazard Mitigation Training	Increase awareness and knowledge of hazard mitigation principles and practices. Develop programs (i.e. website, PSA) to increase public awareness of the importance of mitigating the damage caused by natural hazards, through a coordinated effort with multiple stakeholders. Determine and schedule training focused on hazard mitigation education, and invite all appropriate state, legislators, and local organizations to participate.	Integration of mitigation programs with other state and local organizations	RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X	X	X	X	X	X	X	X	

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2011 Activity Number	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit	Timeframe for Completion	Date if Known	Flood Related	Wind Related	Winter Related	Extreme Heat	Drought	Wildfire	Geologic Related	Climate Change/SLR	Other
HIGH	2, 3, 4,	2.3,3.1, 3.2, 3.3, 4.1		2014.31	Enhance coordination between Fed, State and local partners in regards to evacuation routes, zones and planning.	Identify floodprone evacuation routes and simulated inundation surfaces for SLR. Develop viable mitigation actions to reduce the risk associated with flooding. Use the RI Simulated Inundation Surfaces tool to aid in the development of evacuation routes for tropical and extra-tropical storms. Pilot projects in North Kingstown and Newport to look at vulnerabilities to SLR flooding. The goal is for all coastal communities to look at SLR vulnerability for transportation and other critical infrastructure. This tool would determine what sections of evacuation routes will flood first, potentially cutting off the access. Develop evacuation protocol training and disseminate to local communities.	Examination of vulnerability to flooding along segments of evacuation routes. Potential for prioritization of road improvement projects.	CRMC DOT RIEMA RI Sea Grant State Police	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X							X	
HIGH	2	2.2		2014.3	THIRA & HMP Integration	Integrate the findings of the Threat and Hazard Identification and Risk Assessment into the RI Hazard Mitigation Plan. Ensure the THIRA is updated on a yearly basis in accordance with FEMA guidance.	THIRA and HIRA updates not aligned	RIEMA SIHMC	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X	X	X	X	X	X	X	X	
HIGH	1, 2	1.1, 1.2, 2.3, 3.1	1.3.1,2.1.1 and 3.1.2	2014.11	State Interagency Hazard Mitigation Committee	Add members to the SIHMC that will represent Federal, State and local agencies and additional relevant stakeholders from both non-profit and the private sector. Establish a regular meeting schedule for the SIHMC occur quarterly. Invite State and local officials to hazard mitigation workshops, meetings and all other relevant functions in which they can learn more about hazard mitigation programs, polices and projects. Members of the State Interagency Hazard Mitigation Committee identify other planning initiatives that may relate to hazard mitigation and reach out to those committees to attend a meeting and discuss this action. Adhere or modify the method and schedule for monitoring, evaluating and updating the mitigation plan set forth in the 2013 plan update. Update and maintain 2013 Mitigation Action Tracker spreadsheet. Incorporate and integrate reports for vulnerabilities and capabilities assessments that are currently underway into 2017 plan update	Determine if more frequent meetings are required to accomplish mitigation actions, and develop smaller committees as appropriate. Concurrent analysis and reports not available for plan update	RIEMA SIHMC	Agency fiscal budget	No Cost Benefit to be Completed	Short-Term (0-6 months)		X	X	X	X	X	X	X	X	
HIGH	2, 3, 4, 5	2.1, 2.2, 3.1, 3.2, 4.1, 4.2, 5.1		2014.27	Newport Climate Change Outreach for Vibrant Waterfronts	Mapping exposure to SLR to transportation, infrastructure, and real property. Providing outreach to the public and targeted stakeholder groups	Identify and map exposure of SLR to transportation, infrastructure, and real property	URI CRC City of Newport	Private Foundation	No Cost Benefit to be Completed	Short-Term (0-6 months)	12/31/2013	X							X	
MEDIUM	2	2.3		2014.5	Coordination Between Utilities and State Agencies	Enhance coordination between National Grid and Public Utility capabilities and State initiatives	Lack of coordination	DPU National Grid RIEMA	N/A	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X	X	X		X	X	X	
MEDIUM	3	3.1		2014.6	Local Mitigation Plan Integration	Develop a standardized methodology for local hazard mitigation plan creation and updates. Local mitigation plan review will include focused on how to develop "best practices" and common practices that should be regionalized.		RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Short-Term (0-6 months)		X	X	X	X	X	X	X	X	
MEDIUM	4, 5	4.3, 5.1, 5.2		2014.33	Assessment of facility generator needs	Acquire and install emergency generators at state-owned critical facilities. Draft an infrastructure safety and reliability document, focusing on substation hardening.	Power outages and maintaining care of critical needs populations	DPU	Agency fiscal budget	Cost Benefit To Be Completed	Long-Term (>2 years)		X	X	X	X					
MEDIUM	1, 3, 5	1.1, 2.1, 5.1, 5.2		2014.17	Ongoing Infrastructure, Safety and Reliability (ISR) program for National Grid Gas	In an effort to mitigate storm outages an annual filing is made with the Commission/Division to address equipment replacement, load growth/migration, feeder and sub-station hardening, cutout replacement the vegetation management program, inspection and other activities deemed necessary to maintain system viability. The ISR program is mandated	Potential storm damage, flooding at sub-station locations, load growth and/or migration, damage from falling trees/limbs	DPU	Annual funding is generated by ratepayers as approved by the Commission.	Cost Benefit Completed	Long-Term (>2 years)		X	X	X	X					

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2011 Activity Number	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit	Timeframe for Completion	Date if Known	Flood Related	Wind Related	Winter Related	Extreme Heat	Drought	Wildfire	Geologic Related	Climate Change/SLR	Other
						in R.I.G.L. §39-1-27.7.1 which as enacted in 2010. The cost/benefit analysis is an integral part of the annual review. FY 14 funding is set at $59.6 million.															
MEDIUM	1, 2, 3, 4, 5	1.3, 2.1, 3.3, 4.1, 5.1		2014.21	In the long term, better protection of PWS infrastructure from hazards as a result of better PWS response to and hazards identification from emergencies.	The SafeWater RI project identified risks that climate change poses to public water systems. Effective responses to these risks to help minimize impacts on public water systems were identified, evaluated and prioritized. The next step is outreach to encourage the use of these adaptation strategies.	The use of these adaptive strategies will minimize infrastructure loss from hazards as well as ensure adequate water supplies.	DWQ HEALTH	DWQ budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X			X			X	
MEDIUM	2	2.2		2014.4	Comprehensive Planning Guidance Integration	Integrate natural hazards section into comprehensive planning guidance and provide workshops to disseminate guidance.	Guidance currently in development phase	RI Statewide Planning	Agency fiscal budget	No Cost Benefit to be Completed	Short-Term (0-6 months)		X	X	X	X	X	X	X	X	
MEDIUM	1, 2	1.3, 2.1	1.1.1	2014.18	Mitigation Funding Opportunities	Identify additional funding resources to accomplish mitigation actions, and determine ways to make those funds more accessible to those who need them (i.e. SIHMC or Technical Assistance). Determine feasibility of incentivizing hazard mitigation for both business and the general public. Identify and secure funding to administer and implement pre-disaster mitigation programs.	Reducing long-term risk through available mitigation funds	CRMC DEM DOA HEALTH DOT RIEMA SIHMC Universities	FEMA HMA grants	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X	X	X	X	X	X	X	X	
MEDIUM	1, 2,3,5,	1.3, 2.1, 2.2, 2.3, 3.1, 5.1, 5.2	3.1.7 and 1.1.6	2014.19	Facilities database and vulnerability	Perform a more comprehensive examination of state and critical facility vulnerability to natural hazards, using the 2014 HIRA results as a baseline. State facilities data is currently being updated and revised by RIEMA; coordinate efforts of the Interagency Hazard Mitigation Committee to determine facility attribute collection that will be able to feed into vulnerability analysis (i.e.. first floor elevation, construction material, roof type, building and contents value, occupancy, Hazus-MH attributes). Coordinate with the RI Division of Public Utilities and Carriers to determine what/how facilities are prioritized during power outages and how utilities report back on as a result of storms, and how this can be improved and used in the vulnerability assessment. Maximize the utilization of best technology through the incorporation of a progressive geographical information system (GIS) as the primary tool for spatial data management.	This action will create and maintain a complete list of facilities and building specific information. Once complete, it will allow for better characterization (via HIRA and THIRA analysis) of the facilities at risk and provide data for local plan assessments.	DPU RIEMA SIHMC	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)											X
MEDIUM	1, 2, 5	1.1, 2.1, 5.1, 5.2		2014.16	Ongoing Infrastructure, Safety and Reliability (ISR) program for National Grid Gas	Replacement of leak prone gas pipe, upgrading pressure regulating systems, and extension of high pressure service which is less prone to flood water incursion. The ISR program is mandated in R.I.G.L. §39-1-27.7.1 which was enacted in 2010. The cost/benefit analysis is an integral part of the annual review. The FY 14 Program budget is set at $36.5 million.	Flooding and overall system viability	DPU	Annual funding is generated by ratepayers as approved by the Commission	Cost Benefit Completed	Long-Term (>2 years)		X		X							
LOW	1, 2, 4	1.3, 2.1, 4.3		2014.22	Rhode Island Mitigation Resources and Technical Assistance	Develop a website/clearinghouse of mitigation resources in Rhode Island. Identify what utilities are vulnerable to hazards throughout the state. Determine a list of interested parties that should contribute to this initiative and be a recipient of its products. Increase capacity of all state agencies to be able to provide technical assistance.	Limited centralized location for RI institutionalized knowledge of hazard mitigation	DPU National Grid RIEMA SIHMC	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X	X	X	X	X	X	X	
LOW	2, 3,4,5	2.1, 2.2, 3.3, 4.1, 4.2, 5.1		2014.28	Resilient Coastal Communities	Build the capacity of targeted sectors or community decision-makers to identify general strategies and implement actions which they can put in practice to increase their resiliency to SLR and storminess. This will be done through outreach, technical assistance and sharing of	SLR, floods and storms	URI CRC RI Sea Grant	Private Foundation and NOAA Sea Grant	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X						X	

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2011 Activity Number	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit	Timeframe for Completion	Date if Known	Flood Related	Wind Related	Winter Related	Extreme Heat	Drought	Wildfire	Geologic Related	Climate Change/SLR	Other
						lessons learned.															
LOW	1, 3, 5'5	1.3, 3.3, 5.1		2014.23	Update the HEALTH/Drinking Water Quality Emergency Operations Plan	A rewrite of DWQ's EOP to streamline the process of responding to emergencies concerning public water systems. The EOP will work as a tool to assists DWQ staff to implement its response and assistance to a PWS rapidly and effectively in an all-hazards environment.	In the long term, better protection of PWS infrastructure from hazards as a result of better PWS response to and hazards identification from emergencies.	DWQ HEALTH	DWQ budget	No Cost Benefit to be Completed	Short-Term (0-6 months)		X	X	X	X	X	X	X	X	
LOW	5	5.1		2014.9	Dedicated funding source for beach replenishment projects and/or property buyouts in high hazard areas	Explore ways to fund (at least the local cost share) for beach replenishment as a tool to reduce risks in some of the high hazard coastal areas and/or buyout at risk properties. Create some dedicated funding to do things differently after the next storm.	Coastal Erosion and flooding	CRMC RI Sea Grant	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X						X	X	Shoreline Change
LOW	1, 2, 3, 4	1.1, 1.3, 2.1, 3.3, 4.1		2014.13	Coastal Bluff Erosion	Develop mapping protocols for examining bluff erosion rates and identifying critical erosion areas.	Coastal Erosion	CRMC RI Sea Grant URI Geosciences	Some funding under the Shoreline Change Special Area Management Plan	No Cost Benefit to be Completed	Long-Term (>2 years)								X		Shoreline Change
LOW	1, 4	1.3, 4.1, 4.3		2014.25	Expand the flood and erosion hazards identification on real estate disclosure forms	Investigate the feasibility of real estate disclosure forms to incorporate the Biggert Waters Act changes, identify if there is an elevation certificate for the property, amount of freeboard (or how far below the BFE), erosion rates for coastal properties . Tap into the Beach SAMP and RIAR in the Coalition of Community Leaders.	Coastal Erosion and flooding, insurance expenses	CRMC RIAR RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X						X		Shoreline Change
LOW	1, 2,3, 4,5	1.1, 1.3, 2.1, 2.2, 2.3, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2		2014.12	Transportation and Infrastructure Based Climate Change Adaptation Planning for the Town of North Kingstown	Collaboratively with North Kingstown and the state a comprehensive community plan element to address climate change adaptation as it relates to transportation and land use issues. Prepare with the town and the state a detailed listing of priority transportation and land use projects that support the climate change adaptation effort and are appropriate for inclusion in Transportation Improvement Program (TIP) and Capital Improvement Program (CIP) proposals. This is phase II of a project that looked at NK as a pilot community to identify exposure to SLR and then identify ways to adapt.	Built environment transportation and infrastructure, private property.	North Kingstown Planning Department Statewide Planning URI CRC	Statewide Planning Challenge Grant	No Cost Benefit to be Completed	Short-Term (0-6 months)	8/31/2013	X							X	
LOW	1, 2, 3	1.3, 2.1, 3.2, 3.3		2014.2	Tools and strategies to address Salt Marsh Migration with SLR	Develop maps for all 21 coastal communities showing salt marsh migration (persistent, new and lost marsh) with 1',3', 5' SLR scenarios. CRMC Policy recommendations as well as general recommendations that can support efforts of other state agencies, local communities and non-profits.	Will identify salt marshes likely to persist, be lost or created with 1',3', 5' SLR scenarios.	CRMC Narragansett Bay National Estuarine Research Reserve The Nature Conservancy URI CRC	Existing Grant from NOAA	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)	6/30/2014								X	
LOW	3	3.3	2.2.3	2014.7	Increase participation in National Flood Insurance Program (NFIP) Community Rating System (CRS)	Increase CRS participation through education and outreach as a means for local communities to soften the likely increase in many flood insurance policy rates resulting from new reforms to the National Flood Insurance Program (NFIP) enacted by the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12).	Lack of communities within CRS	RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X	X						X	
LOW	4	4.3		2014.8	Partnerships with High Education	Develop a partnership between institutes of higher education, focusing on hazard mitigation. Identify points of contacts within each institute of higher education to join SIHMC.	Increase partnerships with institutes of higher education	RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)										
LOW	1, 3, 5	1.3, 3.3, 5.1		2014.24	Small Public Water System Emergency Preparedness Planning	To assist small public water systems in development and implementation of emergency preparedness plans and communication and public notification strategies.	In the long term, better protection of PWS infrastructure from hazards as a result of better PWS response to and hazards identification from emergencies.	DWQ HEALTH URI	DWQ budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)		X	X	X	X	X	X	X	X	

Prioritization	Supports 2014 Goals	Supports 2014 Objectives	2011 Activity Number	2014 Activity Number	Title	Activity Description	Vulnerabilities Addressed	Lead Agency	Current and Potential Funding Sources	Cost Benefit	Timeframe for Completion	Date if Known	Flood Related	Wind Related	Winter Related	Extreme Heat	Drought	Wildfire	Geologic Related	Climate Change/SLR	Other
LOW	1	1.3	1.2.4	2014.1	State and Local Professional Development	Encourage professional development and certification through outside continuing education programs (e.g. CEM certification, CFM certification, EMAP program accreditation, HAZUS certifications). Create master list of personnel with current licenses and certifications.	Educate locals on mitigation related programs	RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)										
LOW	2, 4	2.2, 4.1		2014.29	Water Conservation	Encourage municipalities to adopt local water use restriction ordinances to ensure that proper water conservation measures are implemented during periods of severe to extreme drought and other water emergencies.	Drinking water shortages		Agency fiscal budget	No Cost Benefit to be Completed	Medium-Term (18 - 24 months)					X	X	X			
LOW	4	4.1, 4.2, 4.3	4.2.1	2014.32	Partnerships with Private and Non-Profits	Develop partnerships with businesses to provide a public-private link for coordinated mitigation, preparedness, response and recovery. During initial outreach to businesses, inquire about Business Continuity Plans and if they have one.	Increase partnerships with businesses and business continuity	RIEMA	Agency fiscal budget	No Cost Benefit to be Completed	Long-Term (>2 years)		X	X	X	X	X	X	X	X	

This plan is a living document. Contact RIEMA for an up to date version of the State Mitigation Strategies Tracker Tool as it will be revised following the quarterly SIHMC meetings.

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Appendix 7: Plan Maintenance & Implementation

FEMA State HMP Crosswalk

Standard State Hazard Mitigation Plan Review and Approval Status

State Point of Contact: Jessica Stimson	**Address:** 645 New London Avenue Cranston, RI 02920
Title: Rhode Island State Hazard Mitigation Officer/Floodplain Mapping Coordinator	
Agency: Rhode Island Emergency Management Agency	
Phone Number: (401) 462-7115	**E-Mail:** jessica.stimson@ema.ri.gov

FEMA Reviewer:	**Title:**	**Dates:**
Nan Johnson Brigitte Ndikum-Nyada Marilyn Hilliard Julie Grauer	Region I Community Planner Region I Community Planner Region I Senior Planner Region I Natural Hazards Specialist – FM&I	1st review meeting: 1/29/2014 2nd review meeting: 2/6/2014 3rd review meeting: 2/13/2014 Conference Call Review – January 2014 Plan Review March 26 thru 28 – 2014 Final Adopted Plan Review *April 8, 2014*
EPA Federal Partner Reviewer: Rosemary Monahan, Ph.D.	Smart Growth Coordinator, EPA New England Office	February 2014
Date Received in FEMA Region I	**January 16, 2014; Resubmitted w/Revisions March 26, 27 & 28, 2014; Final Plan w/Adoption received April 7, 2014**	
Plan Not Approved	**February 19, 2014 – Requires Revisions**	
Plan Approved	**Yes (Approvable Pending Adoption - March 28, 2014)**	
Date Approved	**Approval Letter – March 28, 2014**	

STANDARD STATE HAZARD MITIGATION PLAN SUMMARY CROSSWALK

The plan cannot be approved if the plan has not been formally adopted.

Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a **"Needs Improvement"** score.

SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Prerequisite	NOT MET	MET
Adoption by the State: §201.4(c)(6) and §201.4(c)(7)		x

Planning Process	N	S
Documentation of the Planning Process: §201.4(c)(1)		x
Coordination Among Agencies: §201.4(b)		x
Program Integration: §201.4(b)		x

Risk Assessment	N	S
Identifying Hazards: §201.4(c)(2)(i)		x
Profiling Hazards: §201.4(c)(2)(i)		x
Assessing Vulnerability by Jurisdiction: §201.4(c)(2)(ii)		x
Assessing Vulnerability of State Facilities: §201.4(c)(2)(ii)		x
Estimating Potential Losses by Jurisdiction: §201.4(c)(2)(iii)		x
Estimating Potential Losses of State Facilities: §201.4(c)(2)(iii)		x

Mitigation Strategy	N	S
Hazard Mitigation Goals: §201.4(c)(3)(i)		x
State Capability Assessment: §201.4(c)(3)(ii)		x
Local Capability Assessment: §201.4(c)(3)(ii)		x
Mitigation Actions: §201.4(c)(3)(iii)		x
Funding Sources: §201.4(c)(3)(iv)		x

Coordination of Local Mitigation Planning	N	S
Local Funding and Technical Assistance: §201.4(c)(4)(i)		x
Local Plan Integration: §201.4(c)(4)(ii)		x
Prioritizing Local Assistance: §201.4(c)(4)(iii)		x

Severe Repetitive Loss Mitigation Strategy *(only required for 90/10 under FMA & SRL)*	N	S
Repetitive Loss Mitigation Strategy: §201.4(c)(3)(v)		x
Coordination with Repetitive Loss Jurisdictions §201.4(c)(3)(v)		x

Plan Maintenance Process	N	S
Monitoring, Evaluating, and Updating the Plan: §201.4(c)(5)(i)		x
Monitoring Progress of Mitigation Activities: §201.4(c)(5)(ii) and (iii)		x

STANDARD STATE HAZARD MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED	
PLAN APPROVED	x

See Reviewer's Comments: **FEMA OVERVIEW COMMENTS To Be Forthcoming**

GENERAL COMMENTS:

The Rhode Island State has presented a multi-hazard mitigation plan update that is representative of a continuing commitment to identify and reduce or eliminate its long term risks and vulnerabilities from natural hazards through sustained actions. The following comments present an overview of the updated 2014 plan and planning process strengths and challenges determined within the FEMA Region I reviews. FEMA Region I reviewers included: Nan Johnson, Community Planner; Brigitte Ndikum-Nyada, Community Planner; Marilyn Hilliard, Senior Planner and Julie Grauer, Natural Hazards Specialist - Floodplain Management & Insurance Branch. The review was also extended to the Region I Environmental Protection Agency (EPA). EPA comments will be observations and recommendations which was not considered required revisions to this Update. Technical assistance comments using recommendations are included.

The submitted Rhode Island State Hazard Mitigation Plan Update for 2014 may serve as a model State Plan for our Region. This Plan demonstrates Rhode Island's commitment to the process through participation by each of the State agencies as well key stakeholders. This involvement resulted in innovative development and use of tools for the plan that in turn benefits State agencies and local communities. Other strengths include well-developed State vision, goals, and objectives as part of the substance of the plan; integration with climate change and local planning; and the State's ability to critically evaluate its process, capabilities and its progress.

COMPLETE FEMA OVERVIEW COMMENTS To Be Forthcoming

PREREQUISITE

Adoption by the State

Requirement §201.4(c)(6): *The plan **must** be formally adopted by the State prior to submittal to [FEMA] for final review and approval.*

Requirement §201.4(c)(7): *The plan **must** include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d).*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Has the State formally adopted the **new or updated** plan?	Adoption & Assurances section (page xi and xii)	Yes. A signed adoption letter dated April 4, 2014 is included with the submitted final plan.		x
B. Does the plan provide assurances that the State will **continue to** comply with all applicable Federal statutes and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 13.11(c), and will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in 44 CFR 13.11(d)?	Adoption & Assurances section (page xi and xii)	Yes.		x
		SUMMARY SCORE		x

PLANNING PROCESS: *§201.4(b): An effective planning process is essential in developing and maintaining a good plan.*

Documentation of the Planning Process

Requirement §201.4(c)(1): *[The State plan **must** include a] description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan provide a narrative description of how the **new or updated** plan was prepared?	Sec 2 (p 9-20)	Yes.		x
B. Does the **new or updated** plan indicate who was involved in the **current** planning process?	Acknowledgements (page vii) Sec 2 (p 9-16) App 2 (p 302-308)	Yes. Incorporating the general comments from the survey results was well done.		x

C. Does the **new or updated** plan indicate how other agencies participated in the **current** planning process?	Sec 2 (p 11-16) App 2 (p 306-308)	Yes. The coordination, communication, understanding between State agencies, offices and stakeholders is one of strongest strengths of this Plan Update. The Plan clearly discusses and provides a better understanding of how the individual State agencies, offices and stakeholders saw this process as an opportunity to bring their specific programs and responsibilities to the RI SHMP's Strategy for implementing their own agencies/offices actions.		x
D. Does the updated plan document how the planning team reviewed and analyzed each section of the plan?	Sec 2 (p 9 -16) App 2 (p 306-308)	Yes.		x
E. Does the updated plan indicate for each section whether or not it was revised as part of the update process?	Sec 1 (p 4-8) Sec 2 (p 10-12) Sec 3 (p 22) Sec 4 (p171) Sec 5 (p245) Sec 6 (p253-254) Sec 7 (p271)	Yes.		x
		SUMMARY SCORE		x

Coordination Among Agencies

Requirement §201.4(b): *The [State] mitigation planning process* ***should*** *include coordination with other State agencies, appropriate Federal agencies, interested groups, and … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe how Federal and State agencies were involved in the **current** planning process?	Sec 2 (p 9-12) App 2 (p 302-306) Sec 4 (p 172-182) App 4 (page 384)	Yes. The involvement of a large array of stakeholders, Federal agencies included, is considered one of reason for the success of this Plan Update. *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
B. Does the **new or updated** plan describe how interested groups (e.g., businesses, non-profit organizations, and other interested parties) were involved in the **current** planning process?	PP. 286 Sec 2 (p 9-12) App 2 (p 302-306) Sec 4 (p 172-182) App 4 (page 384) App 4 (p 384) Sec 7 (p 275)	Yes. Incorporation of comments from participants is well done. Page 41 Sect 3 and great documentation of NESEC's data. Excellent inclusion of the Blackstone River Watershed Council (BRWC), Partners of the Kickemuit River Council, Narragansett Bay watershed Council to participate in the next planning process and plan updates *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
C. Does the updated plan discuss how coordination among Federal and State agencies changed since approval of the previous plan?	Sec 2 (p 9-12) App 2 (p 302-306) Sec 4 (p 172-	Yes. Great discussion of state agency profiles and their roles in mitigation planning. The discussion is somewhat deficient for the Federal coordination and changes (besides FEMA).		x

	242) App 4 (page 384)	**Recommended Revision:** Include how the other key federal agencies and the field offices of these federal agencies are working with the State in identifying vulnerabilities and reducing risk (or could be). For example, RI DOT and the DOT/FHWA. Also, the regional federal offices such as with HUD, USGS, EPA, USACE, NRCS, etc. *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		
		SUMMARY SCORE		x

Program Integration

Requirement §201.4(b): *[The State mitigation planning process **should**] be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe how the State mitigation planning process is integrated with other ongoing State planning efforts?	Sect 4 (p 241 - 244) Tables 57-58	Yes. Great job demonstrating State program integration with other ongoing State planning efforts through these Tables - 57 and 58. *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
B. Does the **new or updated** plan describe how the State mitigation planning process is integrated with FEMA mitigation programs and initiatives?	Sec 2 (p 10-12) Sec 4 (p 173-237)	Yes. Great discussion on Sect 2 page 2 about the THIRA not directly impacting the development of the State of RI HM Plan Update. *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
		SUMMARY SCORE		x

RISK ASSESSMENT: *§201.4(c)(2): [The State plan must include a risk assessment] that provides the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments.*

Identifying Hazards

Requirement §201.4(c)(2)(i): *[The State risk assessment **shall** include an] overview of the type … of all natural hazards that can affect the State … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan provide a description of the type of **all natural hazards** that can affect the State? If the hazard identification omits (without explanation) any hazards commonly recognized as threats to the State, this part of the plan cannot receive a Satisfactory score.	Sec 3 (p 28-35) App 5 (p 397-401) PP. 109-110 & 397-402	Yes. Hazards identification in local Plans is nicely done. Great maps of hazards. The following is an excellent addition to plan: *"It should also be noted that local Comprehensive Plans are now required to consider SLR and guidance is being developed on how to integrate natural hazards." It* is great that the State regulations require that over 600 dams in Rhode Island must be inspected annually.		x
		SUMMARY SCORE		x

Profiling Hazards

Requirement §201.4(c)(2)(i): *[The State risk assessment **shall** include an overview of the] location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the risk assessment identify the **location** (i.e., geographic area affected) of each natural hazards addressed in the **new or updated** plan?	Sec 3 (p 38 -40, 53, 67 – 69, 75, 81, 90 – 92, 116-117, 122, 126, 134,143 – 146, 157 - 158 Figures 7, 17, 19 & 22. Table 8, 16 & 43	Yes. Great maps/ figures & tables…SFHA map is excellent. Well done. **Recommended Revisions:** Local plans require extent and the State Guide could be a helpful source of this information. Clarify extent/severity from vulnerability and impacts. Provide extent information for the local plans such as hurricane scales, etc. Provide the FEMA definition of extent and offer examples.		x
B. Does the **new or updated** plan provide information on **previous occurrences** of each hazard addressed in the plan?	Sec 3	Yes.		x
C. Does the **new or updated** plan include the **probability of future events** (i.e., chance of occurrence) for each hazard addressed in the plan?	Sec 3 pg 37, 165 -166 54-58; 69-71 ; 75-76; 82-84 & 92-96 118-120; 123-124; 127-128; 135-137; 146-149; 159-162	Yes. Classifications for probability are defined. **Recommended Revisions:** Include a discussion of the method and information used to arrive at these probabilities. Provide a summary table to compare the different probabilities for the identified hazards. If using low, medium, high ranges then these must be defined as to what these are and mean for the probability.		x

	Table 7, 37 & 51			
		SUMMARY SCORE		x

Assessing Vulnerability

Requirement §201.4(c)(2)(ii): *[The State risk assessment **shall** include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State owned critical or operated facilities located in the identified hazard areas shall also be addressed…*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development…

Assessing Vulnerability by Jurisdiction

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe the State's vulnerability based on estimates provided in local risk assessments as well as the State risk assessment?	Sec 2 (p 20) Sec 3 (p 35-39) Sec 5 (p 247-250) App 5 (p 397 – 402)	Yes. Table 51, excellent hazard ranking summary. Great job in developing a local plan upload tool for the assessment of Plans and important in assisting the State in its tracking. On page 6 of Sect 3 the Plan distinctly differentiates between the State Risk assessment and performing local risk assessments.		x
B. Does the **new or updated** plan describe the State's vulnerability in terms of the jurisdictions most threatened and most vulnerable to damage and loss associated with hazard event(s)?	Sec 3 (p 40, 44, 165-171 Table 52 58-66; 71-73; 77-79; 84-86-92; 96-109; 119-120 & 124; 129-132 137-141; 150-154; 162-164 App 5 (p 397 – 402)	Yes. Counties and municipalities with increased risk and vulnerability have been added to narrative for each hazard on pages 40-44.		x
C. Does the updated plan explain the process used to analyze the information from the local risk assessments, as necessary?	Sec 2 (p 20) Sec 3 (p 35-39) Sec 5 (p 247-250) App 5 (p 397 – 402)	Yes.		x
D. Does the updated plan reflect changes in development for jurisdictions in hazard prone areas?	Sec 3 (p 25-28, 35 – 39, **171**	Yes.		x

	Section 4 (p 203 – 205) Sec 5 (p 248-251) App 5 pg 404			
		SUMMARY SCORE		x

Assessing Vulnerability of State Facilities

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe the types of State owned or operated critical facilities located in the identified hazard areas?	Sec 3	Yes. Figure 4 is quite complementary to the narrative.		x
		SUMMARY SCORE		x

Estimating Potential Losses

Requirement §201.4(c)(2)(iii): *[The State risk assessment **shall** include an] overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development…

Estimating Potential Losses by Jurisdiction

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan present an overview and analysis of the potential losses to the identified vulnerable structures?	Sec 3 (p 40, 44, 165-171 Table 52 58-66; 71-73 77-79; 84-86 & 92; 96-109, 119-120; 124; 129-132; 137-141; 150-154; 162-164 App 5 (p 397 –	Yes. Added narrative for data gaps on page s 40-44 and community information in each hazard section.		x

	402)			
B. Are the potential losses based on estimates provided in local risk assessments as well as the State risk assessment?	Sec 2 (p 20) Sec 3 (p 35-39) Sec 5 (p 247-250) App 5 (p 397 – 402)	Yes.		x
C. Does the updated plan reflect the effects of changes in development on loss estimates?	Sec 3 (p 25-28, 35 – 39, 171 Section 4 (p 203 – 205) Sec 5 (p 248-251) App 5 pg 404	Yes.		x
		SUMMARY SCORE		x

Estimating Potential Losses of State Facilities

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan present an estimate of the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities in the identified hazard areas?	Sec 3 (40 – 45, 58-66, 71-73 77-79, 84-86 92, 96-109 119-120, 124, 129-132, 137-141, 150-154 162-164) App 3 (p 363-367) PP 41.	Yes		x
		SUMMARY SCORE		x

MITIGATION STRATEGY: *§201.4(c)(3) [To be effective the plan must include a] Mitigation Strategy that provides the State's blueprint for reducing the losses identified in the risk assessment.*

Hazard Mitigation Goals

Requirement §201.4(c)(3)(i): *[The State mitigation strategy **shall** include a] description of State goals to guide the selection of activities to mitigate and reduce potential losses.*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan provide a description of State mitigation **goals** that guide the selection of mitigation activities?	Sec 6 (p 256-260)	Yes. **Excellent** State Hazard Mitigation goals!!		x
B. Does the updated plan demonstrate that the goals were assessed and either remain valid or have been revised?	Sec 6 (p 256-260)	Yes		x
		SUMMARY SCORE		x

State Capability Assessment ***Requirement §201.4(c)(3)(ii):*** *[The State mitigation strategy **shall** include a] discussion of the State's pre-and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas [and] a discussion of State funding capabilities for hazard mitigation projects … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan include an evaluation of the State's **pre-disaster** hazard management policies, programs, and capabilities?	Sec 4 (p 175-183 Table 54 Sec 4 Agency Profiles (p183-240)	Yes – Table 54 was expanded to include evaluation. Narrative explaining evaluation is on page 184-3 in Section 4.		x
B. Does the **new or updated** plan include an evaluation of the State's **post-disaster** hazard management policies, programs, and capabilities?	Sec 4 (p 175-183 Table 54 Sec 4 Agency Profiles (p183-240) Page	Yes – The State is applauded for celebrating its success by mentioning that the results of Coastal Resources Management Council regulation have decreased vulnerability and potential losses due to shoreline erosion in Rhode Island. .		x
C. Does the **new or updated** plan include an evaluation of the State's policies related to **development in hazard prone areas**?	Sec 4 (p 175-183 Table 54	Yes – Table 54 was expanded to include evaluation. Narrative explaining evaluation is on page 181 in Section 4.		x

	Sec 4 Agency Profiles (p183-240)			
D. Does the **new or updated** plan include a discussion of State **funding capabilities** for hazard mitigation projects?	Sec 4 (p 175-183 Table 54 Sec 4 Agency Profiles (p184-240) Sec 4 (p 241 – 243)	Yes.		x
E. Does the updated plan address any hazard management capabilities of the State that have changed since approval of the previous plan?	Sec 4 p 174-175, Agency Profiles (p183-240)	Yes.		x
		SUMMARY SCORE		x

Local Capability Assessment

Requirement §201.4(c)(3)(ii): *[The State mitigation strategy **shall** include] a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan present a general description of the local mitigation policies, programs, and capabilities?	Sec 5 (p 248-254) App 5 (p 409 – 415)	Yes. An excellent example of the State working with the local jurisdiction is provided in the State's mitigation goal. It states, *"to build and support such local capability and commitment to mitigate planning."* It is also commendable that the Plan reports that "RIEMA is currently working with communities undergoing updates to ensure local capabilities are captured." Consider encouraging communities to expand on existing local mitigation policies, programs and capabilities and reflect changes on over-all local mitigation efforts.		x
B. Does the **new or updated** plan provide a general analysis of the effectiveness of local mitigation policies, programs, and capabilities?	Sec 5 (p 248-254) App 5 (p 409 – 415)	Yes. Table on page 414 of Appendix 5 was expanded to include evaluation. Narrative explaining evaluation is on page 412-414.		x
		SUMMARY SCORE		x

Mitigation Actions

Requirement §201.4(c)(3)(iii): *[State plans **shall** include an] identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section **should** be linked to local plans, where specific local actions and projects are identified.*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan identify cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering?	Sec 6 (p 260-266) App 6 (p 429-433)	Yes. Excellent! A comprehensive range of mitigation actions have been identified that includes actions for many of the State agencies and is clearly addressing the risk assessment as well as the goals. The fact that the State Agencies are identifying their actions indicates the sharing of responsibilities that is present in this plan and the State's planning process for risk reduction. This is our Region's first State Plan Update to present its mitigation actions so well defined and meet these Elements A-E! Well done!!! Great summary of the statuses of 2011 mitigation actions page 8 Sect 6 and excellent documentation of committee's participation in reviewing/prioritizing actions and how these agencies can support their respective identified mitigation actions. Information presented on Table 61 is excellent and user-friendly. It is excellent to see that this State HM Plan Update actually discusses the results of the survey calling out Response and Preparedness actions and highlighting the differences between mitigation activities versus preparedness and response.		x
B. Does the **new or updated** plan evaluate these actions and activities?	Sec 6 (p 260-266) App 6 (p 429-433)	Yes		x
C. Does the **new or updated** plan prioritize these actions and activities?	Sec 6 (p 260-266) App 6 (p 429-433)	Yes		x

D. Does the **new or updated** plan explain how each activity contributes to the overall State mitigation strategy?	Sec 6 (260-266) App 6 (p 429-433) Sec 4 Agency Profiles (p183-240)	Yes		x
E. Does the mitigation strategy **in the new or updated** section reflect actions and projects identified in local plans?	Sec 5 (p 251-253) App 5 (p 415-417) Sec 6 (p 256-257)	Yes. Excellent presentation on page 415-417 of the Appendix 5. *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
		SUMMARY SCORE		x

Funding Sources

Requirement §201.4(c)(3)(iv): *[The State mitigation strategy **shall** include an] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan identify **current** sources of Federal, State, local, or private funding to implement mitigation activities?	Sec 4 (p 174 – 182, 240-242) Table 53, 54, 58 Agency Profiles (p183-240) Section 5 p 253	Yes.		x
B. Does the **new or updated** plan identify **potential** sources of Federal, State, local, or private funding to implement mitigation activities?	Sec 4 (p 174 – 182, 240-242) Table 53, 54, 58 Agency Profiles (p183-240) Section 5 p 253)	Yes.		x
C. Does the updated plan identify the sources of mitigation funding used to implement activities in the mitigation strategy since approval of the previous plan?	Sec 4 (p 174 – 182, 240-242) Table 53, 54, 58 Agency Profiles (p183-240) Section 5 p 253	Yes.		x
		SUMMARY SCORE		x

COORDINATION OF LOCAL MITIGATION PLANNING

Local Funding and Technical Assistance

Requirement §201.4(c)(4)(i): *[The section on the Coordination of Local Mitigation Planning* ***must*** *include a] description of the State process to support, through funding and technical assistance, the development of local mitigation plans.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan provide a description of the State process to support, through funding and technical assistance, the development of local mitigation plans?	Sec 4 (p174-182) Agency Profiles (p183-240) Table 54 Sec 5 (p 253) App 5 (p 417-423)	Yes.		x
B. Does the updated plan describe the funding and technical assistance the State has provided in the past three years to assist local jurisdictions in completing approvable mitigation plans?	Sec 4 (p 206-211) Sec 5 (p 253)	Yes. Great job. 2011 action – "provide direct technical assistance to local public officials and help communities obtain funding for mitigation planning and project activities" has been incorporated into State Capability.		x
		SUMMARY SCORE		x

Local Plan Integration

Requirement §201.4(c)(4)(ii): *[The section on the Coordination of Local Mitigation Planning* ***must*** *include a] description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan provide a description of the **process and timeframe** the State established to **review** local plans?	Sec 5 (p 247-253) App 5 (p 420-422 App 7 (p 435-437)	Yes.		x
B. Does the **new or updated** plan provide a description of the **process and timeframe** the State established to **coordinate and link** local plans to the State Mitigation Plan?	Sec 6 (p 256-258) Sec 7 (p 273-282) Sec 5 (p 247-253) App 5 (p 420-422 App 7 (p 435-437)	Yes.		x
		SUMMARY SCORE		x

Prioritizing Local Assistance

Requirement §201.4(c)(4)(iii): *[The section on the Coordination of Local Mitigation Planning **must** include] criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which **should** include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures.*

*Further, that for non-planning grants, a principal criterion for prioritizing grants **shall** be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.*

Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities…

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan provide a description of the criteria for prioritizing those communities and local jurisdictions that would receive planning and project grants under available mitigation funding programs?	Sec 5 (p 253-255) App 5 (p 417-423)	Yes.		x
B. **For the new or updated plan, do** the prioritization criteria include, for non-planning grants, the consideration of the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated cost?	Sec 5 (p 253-255) App 5 (p 417-423)	Yes.		x
C. **For the new or updated plan, do** the criteria include considerations for communities with the highest risk?	Sec 5 (p 253-255) App 5 (p 417-423)	*Yes.* *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
D. **For the new or updated plan, do** the criteria include considerations for repetitive loss properties?	Sec 5 (p 253-255) App 5 (p 417-423)	*Yes.* *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
E. **For the new or updated plan, do** the criteria include considerations for communities with the most intense development pressures?	Sec 5 (p 253-255) App 5 (p 417-423)	*Yes.* *Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.*		x
		SUMMARY SCORE		x

PLAN MAINTENANCE PROCESS

Monitoring, Evaluating, and Updating the Plan ***Requirement §201.4(c)(5)(i):*** *[The Standard State Plan Maintenance Process **must** include an] established method and schedule for monitoring, evaluating, and updating the plan.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe the method and schedule for monitoring the plan? (e.g., identifies the party responsible for **monitoring**, includes schedule for reports, site visits, phone calls, and/or meetings)	Sec 7 (p 273-284) App 7 (p 435-437)	Yes.		x
B. Does the **new or updated** plan describe the method and schedule for **evaluating** the plan? (e.g., identifies the party responsible for evaluating the plan, includes the criteria used to evaluate the plan)	Sec 7 (p 273-284) App 7 (p 435-437)	Yes.		x
C. Does the **new or updated** plan describe the method and schedule for **updating** the plan?	Sec 7 (p 273-284) App 7 (p 435-437)	Yes.		x
D. Does the updated plan include an analysis of whether the previously approved plan's method and schedule worked, and what elements or processes, if any, were changed?	Sec 6 (p 268-271) Sec 7 (p 273-274)	Yes. Great improvement!		x
		SUMMARY SCORE		x

Monitoring Progress of Mitigation Activities ***Requirement §201.4(c)(5)(ii):*** *[The Standard State Plan Maintenance Process **must** include a] system for monitoring implementation of mitigation measures and project closeouts. Requirement **§201.4(c)(5)(iii):*** *[The Standard State Plan Maintenance Process **must** include a] system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the **new or updated** plan describe how mitigation measures and project closeouts will be monitored?	Sec 6 (p 267-271) App 6 (p 423-424)	Yes.		x
B. Does the **new or updated** plan identify a system for reviewing progress on achieving goals in the Mitigation Strategy?	Sec 6 (p 255-263, 267-271) Sec 7 (p 274-282)	Yes.		x
C. Does the updated plan describe any modifications, if any, to the system identified in the previously approved plan to track the initiation, status, and completion of mitigation activities?	Sec 6 (p 267-271) Sec 7 (p 271)	Yes.		x
D. Does the **new or updated** plan identify a system for reviewing	Sec 6 (p 267-	Yes.		x

progress on implementing activities and projects of the Mitigation Strategy?	271) Sec 7 (p 274-282)			
E. Does the updated plan discuss if mitigation actions were implemented as planned?	Sec 4 (p 174, 242-243) Sec 6 (p 267-271)	Yes. Great summary of the statuses of 2011 mitigation actions page 271 Sect 6. *Note: Related to §201.4 (c)(3)(iii)*		x
		SUMMARY SCORE		x

SEVERE REPETITIVE LOSS STRATEGY *(only required for 90/10 under FMA & SRL)*

Repetitive Loss Mitigation Strategy

Requirement §201.4(c)(3)(v): *A State may request the reduced cost share authorized under §79.4(c)(2) of this chapter for the FMA and SRL programs, if it has an approved State Mitigation Plan … that also identifies specific actions the State has taken to reduce the number of repetitive loss properties (which* ***must*** *include severe repetitive loss properties), and specifies how the State intends to reduce the number of such repetitive loss properties.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the new or updated plan describe State mitigation goals that support the selection of mitigation activities for repetitive loss properties (see also Part 201.4(c)(3)(i))?	Sec 6 (p 258) Goal 1	Yes. Excellent. Goal #1 highly prioritized to Identify and devise mitigation strategy for repetitive loss and severe repetitive loss properties. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
B. Does the new or updated plan consider repetitive loss properties in its evaluation of the State's hazard management policies, programs, and capabilities and its general description of the local mitigation capabilities (see also Part 201.4(c)(3)(ii))?	Sec 4 Sec 5 Sec 6	Yes. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
C. Does the new or updated plan address repetitive loss properties in its risk assessment (see also Part 201.4(c)(2))?	Sec 3 page 431 & 121	Yes. RIEMA will continue to provide technical assistance to those communities without mitigation actions related to acquiring lands/repetitive loss structures in hazard prone areas. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
D. Does the new or updated plan identify, evaluate and prioritize cost-effective, environmentally sound, and technically feasible mitigation actions for repetitive loss properties (see also Part 201.4(c)(3)(iii))?	Sec 6 App 6	Yes. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
E. Does the new or updated plan describe specific actions that have been implemented to mitigate repetitive loss properties, including actions taken to reduce the number of severe repetitive loss properties?	Sec 4 App 6	Yes. This 2011 action – 'Developing and maintaining accurate and current statewide Repetitive Loss databases' has been		x

		completed. **Recommended Revisions**: The numbers of RL properties is provided on page 78 Sect 3, also consider providing SRL properties total too. Ensure that structure types are included. **Recommended Revisions:** It would be great to incorporate or include this repetitive loss databases into the State HM Plan Update. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		
F. Does the new or updated plan identify current and potential sources of Federal, State, local, or private funding to implement mitigation activities for repetitive loss properties (see also Part 201.4(c)(3)(iv))?	Sec 4 App 6	Yes. The Plan identifies these agencies, US, HUD and CDBG with funding capabilities to support mitigation activities at the community level under certain conditions. **Recommended Revisions:** The State needs to do a little be more research in locating potential sources of funding from private entities such as foundation etc. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
		SUMMARY SCORE		x

Coordination with Repetitive Loss Jurisdictions

Requirement §201.4(c)(3(v): *In addition, the plan* ***must*** *describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan provide a description of the State process to support, through funding and technical assistance, the development of local mitigation plans in communities with severe repetitive loss properties (see also Part 201.4(c)(4)(i))?	Sec 4 Sec 5 App 5	Yes. See comment in Element A above. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
B. Does the new or updated plan include considerations for repetitive loss properties in its criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available mitigation funding programs (see also Part 201.4(c)(3)(iii))?	Sec 4 Sec 5 App 5	Yes. This is clearly considered. ***[Note: Only required for SRL 90/10 under FMA & SRL]***		x
		SUMMARY SCORE		x

Matrix A: Profiling Hazards

This matrix can assist FEMA in scoring each hazard. States may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the State. **Completing the matrix is not required.**

Note: First, check which hazards are identified in requirement §201.4(c)(2)(i). Then, place a checkmark in either the N or S box for each ***applicable*** *hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.4(c)(2)(i)	A. Location		B. Previous Occurrences		C. Probability of Future Events	
	Yes	N	S	N	S	N	S
Avalanche	☐	☐	☐	☐	☐	☐	☐
Coastal Erosion	☒	☐	☐	☐	☐	☐	☐
Coastal Storm	☒	☐	☐	☐	☐	☐	☐
Dam Failure	☒	☐	☐	☐	☐	☐	☐
Drought	☒	☐	☐	☐	☐	☐	☐
Earthquake	☒	☐	☐	☐	☐	☐	☐
Expansive Soils	☐	☐	☐	☐	☐	☐	☐
Extreme Heat	☒	☐	☐	☐	☐	☐	☐
Flood	☒	☐	☐	☐	☐	☐	☐
Hailstorm	☒	☐	☐	☐	☐	☐	☐
Hurricane	☒	☐	☐	☐	☐	☐	☐
Land Subsidence	☒	☐	☐	☐	☐	☐	☐
Landslide	☒	☐	☐	☐	☐	☐	☐
Levee Failure	☐	☐	☐	☐	☐	☐	☐
Severe Winter Storm	☒	☐	☐	☐	☐	☐	☐
Tornado	☒	☐	☐	☐	☐	☐	☐
Tsunami	☐	☐	☐	☐	☐	☐	☐
Volcano	☐	☐	☐	☐	☐	☐	☐
Wildfire	☒	☐	☐	☐	☐	☐	☐
Windstorm	☒	☐	☐	☐	☐	☐	☐
Other - Climate Change	☒	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐	☐	☐

To check boxes, double click on the box and change the default value to "checked."

Legend:
§201.4(c)(2)(i) Profiling Hazards
A. Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the **new or updated** plan?
B. Does the plan provide information on previous occurrences of each hazard addressed in the **new or updated** plan?
C. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the **new or updated** plan?

Matrix B: Assessing Vulnerability

This matrix can assist FEMA in scoring each hazard. States may find the matrix useful to ensure that their plan addresses each requirement. Note that this matrix only includes items for Requirements §201.4(c)(2)(ii) and §201.4(c)(2)(iii) that are related to specific natural hazards that can affect the State. **Completing the matrix is not required**.

Note: First, check which hazards are identified in requirement §201.4(c)(2)(i). Then, place a checkmark in either the N or S box for each ***applicable*** *hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

To check boxes, double click on the box and change the default value to "checked."

Hazard Type	Hazards Identified Per Requirement §201.4(c)(2)(i)	§201.4(c)(2)(ii) Assessing Vulnerability					§201.4(c)(2)(iii) Estimating Potential Losses				
		1. Vulnerability by Jurisdiction		2. Vulnerability to State Facilities			3. Loss Estimate by Jurisdiction		4. Loss Estimate of State Facilities		
	Yes	N	S	N	S		N	S	N	S	
Avalanche	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Coastal Erosion	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Coastal Storm	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Dam Failure	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Drought	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Earthquake	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Expansive Soils	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Extreme Heat	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Flood	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Hailstorm	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Hurricane	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Land Subsidence	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Landslide	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Levee Failure	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Severe Winter Storm	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Tornado	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Tsunami	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Volcano	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Wildfire	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Windstorm	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Other – Climate Change	☒	☐	☐	☐	☐		☐	☐	☐	☐	
Other _____	☐	☐	☐	☐	☐		☐	☐	☐	☐	
Other _____	☐	☐	☐	☐	☐		☐	☐	☐	☐	

Legend

§201.4(c)(2)(ii) Assessing Vulnerability by Jurisdiction (see element B)

1. Does the **new or updated** plan describe the State's vulnerability in terms of the jurisdictions most threatened and most vulnerable to damage and loss associated with hazard event(s)?

§201.4(c)(2)(ii) Assessing Vulnerability to State Facilities (see element A)

2. Does the **new or updated** plan describe the types of State owned or operated critical facilities located in the identified hazard areas?

§201.4(c)(2)(iii) Estimating Potential Losses by Jurisdiction (see element A)

3. Does the **new or updated** plan present an overview and analysis of the potential losses to the identified vulnerable structures?

§201.4(c)(2)(iii) Estimating Potential Losses of State Facilities (see element A)

4. Does the **new or updated** plan present an estimate of the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities in the identified hazard areas?