TOWN OF CHARLESTOWN
RHODE ISLAND
NATURAL HAZARD MITIGATION PLAN

Remnants of a dwelling on Charlestown Beach Road destroyed during Superstorm Sandy 2012
Photo credit: Matt Dowling, Environmental Scientist

TOWN OF CHARLESTOWN, RHODE ISLAND NATURAL HAZARD MITIGATION PLAN

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Formal Adoption Letter

(Town Council)

Inserted after RIEMA/FEMA approval of Natural Hazard Mitigation Plan

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Executive Summary

The Natural Hazard Mitigation Plan's mission is to preserve and enhance the quality of life, property and resources by identifying natural hazard risks and implementing hazard mitigation actions to protect the people of Charlestown and its historical, cultural and natural resources. To address these risks and vulnerable areas, this Plan puts forth a clear mission, distinct goals and specific mitigation actions.

The objective of this Plan is to recommend actions and policies for the Town of Charlestown that minimize the social and economic loss or hardships resulting from natural hazard events. The Charlestown Natural Hazard Mitigation Committee (CNHMC) has been formed to ensure the successful completion of the hazard mitigation plan update. This is an ongoing process that requires continuous evaluation, implementation and revisions. It is intended that this Plan and the ongoing efforts of the CNHMC will preserve and enhance the quality of life, property and resources for the Town of Charlestown.

Once Federal Emergency Management Agency FEMA approves the Charlestown Natural Hazard Mitigation Plan, the town will receive credit points under the FEMA Community Rating System to lower homeowner flood insurance premiums. Moreover, the approved FEMA plan makes Charlestown eligible for federal hazard mitigation grants through RI Emergency Management Agency (RIEMA) and gives funding priority to Charlestown mitigation projects.

The Plan takes the reader through the process of creating meaningful and cost effective actions that achieve the goals set forth by the CNHMC. The CNHMC determined what is vulnerable and then identified action items to mitigate the negative effects of natural disasters specific to each vulnerable area. The CNHMC studied local natural events and described them in terms of location on the landscape, the scale or intensity of the event, the history of the natural disaster and the probability of the natural disaster occurring again. Once the hazard profiles were complete, the CNHMC studied the impacts of natural hazards on the community assets (that is, population, infrastructure, natural environment and the economy) to determine what was vulnerable and to determine the level of risk. The proposed mitigation actions are designed to lessen the impact of natural disasters in vulnerable areas.

This Plan is designed to implement mitigation actions to reduce risk. Public participation is critical to the success of this Plan, not only because citizens need to know what to do before an emergency, but citizens also must be made aware of what actions their town government is taking toward a more resilient community. As illustrated in the following pages, town employees are highly skilled in emergency management planning and completing mitigation actions.

In the course of this update, the hazard mitigation capabilities of the town departments were evaluated. Over the last five years, the town has invested, implemented and performed actions that help mitigate natural hazard situations, including enforcement

of the State Building Code. The town implements and enforces the State Building Code and participates in the NFIP through the Building/Zoning Department. The entire State of Rhode Island is under the latest International Building Code (IBC) and will be adopting the IBC 2015 with Rhode Island amendments in July of 2016. The State Building Codes were updated in 2000 requiring all new structures to withstand a minimum of 110 mph winds (up from 90 mph winds). The town also revised FEMA Flood Insurance Rate Maps in 2013. Moreover, the town follows the new RI Stormwater Design and Installation Standards Manual which went into effect on January 1, 2011, which uses low impact development techniques as the primary method of stormwater control.

CNHMC findings on the impacts of natural disasters in Charlestown indicate that Charlestown is vulnerable to diverse events including coastal flooding, riverine flooding, heavy rains, storm surge, high winds (hurricanes), coastal erosion and shoreline change. The discussion in the Plan puts the likelihood of these events into historical perspective and recognizes that the probability of these events may be higher due to the impacts from climate change and accelerated sea level rise.

The greatest risk from natural disasters in Charlestown occurs south of Route 1 along the coast of Rhode Island. This is an area of high population density. The focus of the mitigation actions represent adaptation to a dynamic coastline due to accelerated sea level rise, storm surge, coastal erosion, hurricanes and loss of wetlands through salt marsh migration.

Charlestown is poised to take the lead in addressing climate change by implementing actions as detailed in this Plan. The town also has a unique opportunity through the Comprehensive Plan update and other plans (for example, harbor management and stormwater plans) to fortify local ordinances, policies and procedures to build coastal resiliency.

In 2014, the Resilient Rhode Island Act was passed to recognize the threat that climate change presents to Rhode Island's communities, businesses and residents. A changing climate leads to changes in the frequency, intensity, duration and timing of extreme weather and climate events, which may result in unprecedented extreme weather and climate events. In the past, while structural protection has been suggested as mitigation actions (for example, building a sea wall), issues such as sea level rise may negate this type of action. The focus of mitigation solutions are presently moving towards non-structural protection actions. These include evacuation, emergency planning, land use control and public awareness campaigns. The Plan actions present a comprehensive range of structural and non-structural activities to address the range of natural hazards that impact Charlestown.

The town has extensive legislative and regulatory support from the RI State Legislature, the RI Coastal Resource Management Council (CRMC), RI Emergency Management Agency (RIEMA) and the Federal Emergency Management Agency (FEMA). The RI CRMC Shoreline Change Special Area Management Plan (SAMP) recognizes the need for comprehensive planning to address the impacts of storm surge, flooding, sea level

rise and erosion. The SAMP is a valuable management tool for municipalities to tackle challenging coastal issues such as water quality and coastal development patterns. The RIEMA Mitigation Office provided solid guidance through its hazard mitigation process.

This update is part of an ongoing five (5) year update cycle. As the local climate changes, new risks can be revised, added or removed. Furthermore, once mitigation actions are complete, they will become town capabilities that have reduced risk. Public input is essential to the hazard mitigation planning process and the committee will continue to engage the public though the planning, implementation and evaluation process. Additionally, stakeholder coordination among local, state and federal levels of governments will ensure that this Plan remains current and viable for years to come.

Adoption Documentation

Recommended for Town Council adoption by the Charlestown Director of Emergency Management. Adopted by the Charlestown Town Council: pending FEMA approval

SECTION 1.0 – Background

Natural hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and their property from the effects of natural hazards (for example, wind, storm surge, floods, hurricanes, climate change, etc.). Mitigation activities may be implemented prior to, during or after an incident. However, hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that has been developed before a disaster occurs.

1.1 What Mitigation Can Do for Charlestown

An important benefit of hazard mitigation is that money spent today on preventive measures can significantly reduce the cost of post-disaster cleanup tomorrow. By planning ahead, Charlestown will minimize the economic and social disruption that can result from hurricanes, sea level rise and other natural disasters.

During this Plan update, members of the Charlestown Natural Hazard Mitigation Committee (CNHMC) assessed the risks to the town and updated mitigation actions that address a mix of structural initiatives to minimize the effects of future hazards (for example, retrofitting existing structures and elevating vulnerable structures) and non-structural initiatives (for example, building code enforcement, educational programs, preventing construction in high-hazard areas, and enforcing regulations). By creating a mitigation methodology, Charlestown has established an ongoing process that will make hazard mitigation a routine part of municipal government. The Town Council is committed to the process through the establishment of a permanent internal hazard mitigation committee that meets once a year and after every major event, to review the plan and to move forward with solving natural hazard issues within the town.

Many of the changes made to the Plan were a direct result of natural hazard events such as the March 2010 flooding, Tropical Storm Irene (2011), Superstorm Sandy (2012) and Winter Storm Nemo (2013). All these events caused damage to the Town, but none more than Superstorm Sandy's major coastal erosion, and wide-spread flooding which destroyed many homes and businesses along the coast. To assist with the costs associated with the storm, the Town of Charlestown received over $265,000 in FEMA reimbursements, in addition to the assistance provided to homeowners and businesses impacted by the storm.

As a direct result of the damage caused by Superstorm Sandy, as well as some of the damage caused by Tropical Storm Irene, many homeowners have decided to retreat and rebuild their homes further back from the shoreline or rebuild the structure on elevated foundation systems.

Formal adoption and implementation of this updated natural hazard mitigation strategy will help Charlestown maintain credit points under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS) Program, which provides discounts

on the National Flood Insurance Program (NFIP) insurance premiums for residents of communities that voluntarily participate in this program.

The adoption of this mitigation strategy also increases Charlestown's eligibility for federal grants for hazard mitigation, including FEMA's pre-disaster Flood Mitigation Assistance (FMA) Program, FEMA's post-disaster Hazard Mitigation Grant Program (HMGP), and Pre-Disaster Mitigation (PDM). In addition, the Rhode Island Emergency Management Agency (RIEMA) gives funding priority to municipalities that have completed a risk assessment and established mitigation projects with detailed information on the cost, timeline, and municipal department responsibility for completing the project. Regulations pertaining to FEMA's flood mitigation grants and local hazard mitigation plans are provided in the Code of Federal Regulations (CFR), Title 44, Part 201.

1.2 Charlestown's Mission Statement

The mission of the Charlestown Natural Hazard Mitigation Plan is to preserve and enhance the quality of life, property and resources by identifying vulnerable areas at risk from natural hazards and implementing strategies to mitigate their effects to Charlestown's population, infrastructure, and historical, cultural and natural resources.

1.3 Goals

The goals developed by the Charlestown Natural Hazard Mitigation Committee (CNHMC) are related directly to the mission, and described further in Charlestown's Natural Hazard Mitigation Plan Section 5.0 Mitigation. These goals include:

1. Protect the public health, safety and welfare from all hazards;
2. Reduce present and future property damages caused by hazard impact;
3. Protect critical infrastructure (i.e. dams, roads, utilities and essential services);
4. Increase public understanding and support for natural hazard mitigation through public education;
5. Protect cultural, historical, natural and economical environments; and
6. Reduce the dependence and need for disaster assistance funding after disasters.

1.4 Community Planning Area

a. Location, Geography and Land Use

The Town of Charlestown is located between the south shore of Rhode Island and the Pawcatuck River. It is bounded to the west by the Towns of Westerly and Hopkinton, to the east by the Town of South Kingstown, and to the north by the river which defines its boundary with the Town of Richmond. It has a total area of 59 square miles which includes approximately 1,900 acres of land owned by the Narragansett Indian Tribe.

U.S. Interstate Route 1 divides the town into the southern shore area and northern upland area. The southern coastal area has several salt ponds including: Quonochontaug Pond, which lies partially in Westerly; Ninigret Pond; and a small portion of Green Hill Pond, which lies mostly in South Kingstown. This south shore area was the location of early plantations and the village of Cross Mills, and later became a popular area for summer homes. It is now the most heavily developed area of Charlestown with numerous residential developments and supporting businesses.

The northern area of town is much hillier than the south shore area and has winding narrow country roads. This area of Charlestown was slow to develop and is still sparsely populated. In the past, the Pawcatuck River provided power and served as a focus for several mill villages that were built during the Industrial Revolution. These villages remain densely developed settlements today. Overall Charlestown has a distinctive rural character with the small villages located in both the northern and southern areas of town with a sparsely developed interior with large protected open space areas which includes the Narragansett Indian's tribal lands. While there is commercial development in town, mostly along Route 1 and Route 1A, there is no area that serves as a downtown or town center.

Charlestown's villages and neighborhoods are as follows: Carolina, Burdickville, Town Hall area, Charlestown Beach, Columbia Heights, Cross Mills, Kenyon, Ocean Ridge, Old Coach/Narrow Lane, Quonochontaug, Ross Hill/Klondike Area, Sea Lea Colony, Shady Harbor, Shannock/Kenyon, and Watchaug.

b. Demographics, Census and Housing

According to the 2010 U.S. Census, Charlestown had 7,827 full time residents who were 50% female and 50% male. Ethnically, Charlestown residents were 94.9% white, 1.9% American Indian, 1.6% Hispanic or Latino, and 1.7% two or more races. The median age of residents was 47 years old which is slightly older than the state average of 42 years old. Key demographic indicators from the 2010 U.S. Census are presented in the tables below.

Table 1 Charlestown Population by Age, 2010 US Census

	Total	% of Total
Under 5 years	339	4.3%
5 to 19 years	1,348	17.2%
20 to 34 years	995	12.7%
35 to 49 years	1,668	21.4%
50 to 64 years	2,094	26.8%
65 to 79 years	1,059	13.5%
80 + years	324	4.1%
Total	7,827	100.0%

Table 2 Charlestown Demographics and Housing, 1990 to 2010, US Census

	1990	2000	2010
Population	6,478	7,859	7,827
Median Age of Resident	34.0	40.8	47.0
Total Housing Units	4,256	4,797	5,151
Number of Year-Round Units	4,240	3,318	3,497
Average Household Size	2.6	2.46	2.4
Seasonal, Recreational or Occasional Use Units	1,541	1,479	1,654

Of the 5,151 total housing units counted in 2010, 3,250 were occupied, 1,654 were seasonal and 247 homes were vacant. Of the 3,250 occupied units, 83.8% were owner occupied and 16.2% were rentals. The 1,654 units that were identified as seasonal, recreational or occasional use houses – the "beach homes" for which Charlestown is famous, represent 32% of the total housing units[1].

c. Infrastructure

There are no public water supply systems in Charlestown thus potable water is obtained by individually owned wells and by community wells. Community wells include the Central Beach Water Association and the East Beach Water Association for their respective fire districts in the Quonochontaug peninsula.

The town relies entirely on onsite waste water treatment which it regulates through a Wastewater Management District encompassing all of Charlestown. This regulation helps to protect groundwater quality, an important natural resources, such as inland surface waters and coastal salt ponds from adverse impacts due to failing or poorly maintained septic systems. The Wastewater Management Office manages a septic system maintenance program which tracks the status of all systems in town through a required inspection process with records maintained in a comprehensive database. When funding is available, the District makes low interest loans available for repairs to malfunctioning systems and cesspool replacements through the Community Septic System Loan Program.

The reliance on private sewage disposal and private water supply limits the density and location of development. Development is generally prohibited in areas with a high water table because the soils do not allow on-site wastewater systems to function properly.

[1] United States Census Bureau. (2010). *Charlestown Demographics and Housing, 1990 – 2010.* Retrieved from http: http://www.census.gov/2010census/

d. Community Development and Development Trends

The Charlestown Tax Assessor provided the summary of land use changes in Table 3. In the period from 2003 to 2012, 271 new housing units were constructed in the town. This is an average of 24 housing units per year. In 2013, 25 new dwelling permits were issued and in 2014, 23 were issued. Residents are also converting "seasonal" property to year-round use.

Table 3 Summary of Land Use Changes in Charlestown

Land Use	2004 Acres	Parcel Count	Percent	2015 Acres	Parcel Count	Percent
Residential	6,714	4,885	30.94%	7,066	5,107	32.41%
Commercial	549	92	2.53%	512	101	2.35%
Agricultural	1,877	70	8.65%	1,782	68	8.17%
Exempt Properties*	8,923	205	41.12%	9,378	255	43.02%
Undeveloped						
	3,376 (Resid)	962	15.56%	2,893 (Resid)	836	13.27%
	261 (Comm)	38	1.20%	168 (Comm)	42	0.77%
Total Land in Town	21,700	6,252	100%	21,799**	6,409	100%

* Exempt Properties = Public or non-profit ownership
** Total acreage based on updated surveys

e. Historic, Natural Resources and Environmental Significance

Historic Significance

According to the Historic and Architectural Resources of Charlestown[2], historical places are found throughout the town (see Appendix D for historical listings). Some consist of specific houses and some are mill villages such as Carolina and Shannock, which grew up along the Pawcatuck River. Developed in the mid-nineteenth century, the houses, churches and stores are relatively well preserved and integral to the villages that arose during Rhode Island's industrial growth. The area north of Route 1 has surviving farms and farmhouses that serve as reminders of the town's once important agricultural economy and heritage. Other cultural resources dispersed throughout the interior include mill sites, old cart paths, a former granite quarry, summer colonies, a wildlife refuge, and a state park (now Burlingame) developed by the Civilian Conservation Corps in the 1930s.

The coastal area south of Route 1 is the earliest area settled and has always been the most prosperous part of Charlestown. It contains the largest number of cultural resources which are mostly located along the Old Post Road (Route 1A). In this region are found historic houses, former stagecoach taverns, churches, schoolhouses, an historic Indian fort, summer cabins, motels, a former Naval Air station and several large estates.

[2] Historic and Architectural Resources of Charlestown, RI: A Preliminary Report, RI Historical Preservation Commission, (1981). Retrieved from http://www.preservation.ri.gov/survey/publications.php

Narragansett Indian Tribe

The Narragansett Indian Tribe is a significant part of both Charlestown's history and its present day residents. The Narragansett Indian Tribe has been recognized as a Sovereign Nation since federal legislation in 1983. The current Charlestown population includes approximately 2,400 tribal members. The majority of Tribal members live in Rhode Island, but members also live in other states and countries[3].

An excerpt from the Historical and Architectural Resources of Charlestown describes the Narragansetts of Charlestown:

> The Native Americans in Charlestown, the Narragansetts, witnessed many changes over the centuries. By 1880, what little land remained in Narragansett Indian hands--tracts centering on the Cedar Swamp and School House Pond--was acquired by the state and the tribe ceased to exist as a legal entity. But, Charlestown remained the center of tribal activity and Indian occupation and today the Narragansetts represent a strong and vocal minority in the town's population, linking present-day activities with the distant past in a way unknown elsewhere in Rhode Island.

Under the Stafford Act and the National Flood Insurance Act, Indian Tribal governments must have an approved and adopted Tribal Mitigation Plan to meet the eligibility requirements for certain types of assistance. At this time, the Narragansetts are autonomous and do not wish to coordinate with the Town of Charlestown on hazard mitigation planning.

Natural Resources and Environmental Significance

Charlestown has several natural resource features that define its character. The unusually large amount of conservation and recreation land in Charlestown reflects the amount of important natural resources in the town. Burlingame State Park, Ninigret Wildlife Refuge, Ninigret Park, and East Beach comprise approximately 20 percent of the total land area of the town and protect wetlands, fresh and salt ponds, a barrier beach system, and other valuable habitats. Charlestown contains a considerable amount of fresh water wetlands including the Pawcatuck River, three sizable ponds, smaller "kettle" ponds, and many swamps and marshes. Ninigret Pond and Quonochontaug Pond are coastal salt ponds located behind a barrier beach system. They are connected to the ocean the Charlestown and Quonochontaug breachways that are maintained by both RI Department of Environmental Management (RIDEM) and the town. The coastal ponds, fronted by barrier beaches, provide a recreational resource for the state as well as the town attracting visitors and serving as focal points for development.

Barrier beaches play an important role in Charlestown's coastal system. They protect the salt ponds from the effects of the waves, providing sheltered harbors and diverse

3 Nationhood/Tribal Genealogy. Retrieved January 01, 2016, from http://www.narragansett-tribe.org/nationhoodtribal-genealogy.html

habitats. They are an important part of Charlestown's attraction to visitors. The barrier beaches serve as a buffer between the coastal communities to the north of the salt ponds and absorb energy from storm waves. Rising sea levels will tend to push the barrier beaches back toward the base of the recessional moraine over time, compressing the salt ponds and increasing the frequency of flooding in these coastal communities. As sea level rises, salt marsh wetlands cannot migrate upland into hard structures and steep slopes. The result is that the salt marsh wetland is destroyed[4].

The Charlestown barrier beaches are a part of the John H. Chafee Coastal Barrier Resources System which is a collection of specific units of land and associated aquatic habitats that serve as barriers protecting the Atlantic coast. In the 1970s and 1980s, Congress recognized that certain federal actions and programs have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources; threats to human life, health, and property; and the expenditure of millions of tax dollars each year. To remove the federal incentive to develop these areas, the Coastal Barrier Resources Act (CBRA) of 1982 designated relatively undeveloped coastal barriers along the Atlantic and Gulf coasts as part of the John H. Chafee Coastal Barrier Resources System (CBRS), and made these areas ineligible for most new federal expenditures and financial assistance. CBRA encourages the conservation of hurricane-prone, biologically-rich, coastal barriers by restricting federal expenditures that encourage development.

Additionally, the RI Natural Heritage Program considers the coastal plain pond shore habitat surrounding these ponds as some of the best in the state. Habitats of this type are found almost exclusively in Washington County south of the recessional moraine. The habitat is characterized by widely fluctuating water levels, sandy substrate, and gently sloping shorelines.

f. Commerce, Industry, and Academic

The Town of Charlestown's economy is principally tourism based. Its beaches, salt ponds and abundant open space are a great attraction to the residents of Rhode Island and nearby states. The town's seasonal population is characterized not only by day visitors, but also by summer vacationers who rent by the week or month and by residents of nearby states who own second homes in Charlestown. The Charlestown Chamber of Commerce estimates that the daily summer population of the town swells to more than three times the number of year-round residents. According to the 2010 Census, approximately 32% of its housing stock is seasonal.

Apart from the tourist industry, Charlestown has a limited employment base of small businesses with few employees. For the year round residents, it is essentially a commuter town. Residents work in surrounding cities and towns throughout the Rhode Island and eastern Connecticut. The demand for commercial enterprises is driven by the needs of residents and the preferences of tourists. Charlestown has undeveloped

[4] Narragansett Bay Estuary Program (Fall 2014). *Narragansett Bay Journal*, Special Issue #28, Salt Marshes & Sea Level Rise. Retrieved from http://www.nbep.org/bayjournal-currentissue.html

industrially-zoned land, an indication of a low demand for industrial development. Agriculture and aquaculture are growing sectors of the economy.

There are no institutions of higher learning in Charlestown, but it is in close proximity to the University of Rhode Island in Kingston, RI.

g. Highlights of the National Flood Insurance Program (NFIP) and Community Rating System (CRS) Program

National Flood Insurance Program (NFIP)

All of Rhode Island's 39 municipalities participate in the NFIP. This program is a direct agreement between the federal government and the local community that flood insurance will be made available to residents in exchange for community compliance with minimum floodplain management regulations. In return for community adoption of these standards, any structure in that community is eligible for protection by flood insurance which covers property owners from losses due to inundation from surface water of any source. The Charlestown NFIP program is discussed in detail in Section 4.2.

NFIP Community Rating System (CRS)

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary federal program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. The following CRS goals are met through Charlestown's community actions:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP; and
3. Encourage a comprehensive approach to floodplain management.

The Town of Charlestown has been working diligently to meet the goals of CRS. On May 1, 2015, the town was officially accepted into the CRS Program by the Federal Emergency Management Agency. More details on the CRS program can be found in Section 4.2.

1.5 Significant Events Since the last Plan Update

Severe weather includes nor'easters, hurricanes, blizzards, and severe thunderstorms. These hazards can result in flooding and high winds causing damage to residential homes, businesses, historical buildings, dams, bridges and other critical infrastructure and facilities.

Severe Weather since 2010

The Great Flood of 2010 (FEMA 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 Wood Rivers. The 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 areas in the state included Warwick, West Warwick, Coventry and Cranston, which are located around the Pawtuxet River. Westerly and Charlestown were also hit hard because of the Pawcatuck River that flows along their borders. The total damage to Charlestown equaled $126,628.34 caused mostly by floodwater damage to roadways.[5]

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.

The impact of the 2010 flooding in Charlestown, as described by one local advocacy group, "Three days of record-breaking rain at the end of March 2010 poured onto soils already saturated from previous rain storms. Fifteen inches of rain fell in Charlestown, RI that spring of 2010. Wetlands absorbed the rain at first and then spilled over flood plains. The Pawcatuck River rose and Shannock Falls impressed all those who ventured out to see and hear the pounding water. Some pumped out flooded basements, others had more devastating losses. We all learned lessons in wetland protection and storm water management."[6]

Tropical Storm Irene – August 2011 (FEMA-4027)

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

[5] P. Anderson, Charlestown Treasurer, personal communication, October 2015
[6] Charlestown Citizens Alliance (February 15, 2016). Retrieved from http://charlestowncitizens.org/.
[7] National Centers for Environmental Information (NCEI) formerly known as National Climatic Data Center (NCDC) (February 15, 2016). Retrieved from http://www.ncdc.noaa.gov/

In Southern New England, the storm surge experienced along the coast was generally in the two to four foot range with a high of 4.78 feet at Fox Point in Providence, Rhode Island. Sustained winds over a 6 to 12 hour long duration resulted in widespread tree damage and resulted in power outages to roughly half a million customers throughout the state. Some of these customers did not get their power back until the Friday following the storm (some five days later). During the passage of Tropical Storm Irene, the response and recovery efforts cost Charlestown $65,611.[8]

The collective effects of Tropical Storm Irene on August 28, resulted in 1 fatality, 0 injuries, and $127.3M in property damage in the following counties: Barnstable, Bristol, Essex, Franklin, Hampden, Hampshire, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, and Worcester (all in MA), Hartford, Tolland, and Windham (all in CT), Cheshire and Hillsborough (all in NH), and Bristol, Providence, Kent, Washington, and Newport (all in RI)[9].

Superstorm Sandy – October 2012 (FEMA-4089)

Superstorm Sandy made landfall in New Jersey on Monday, October 29, 2012. Its dimensions (tropical force winds spanned almost 900 miles) created widespread devastation and affected approximately 300,000 Rhode Island residents, or 28% of the State's population. Fortunately, there were no fatalities. Mandatory local evacuations were ordered in eight communities. Approximately 122,000 homes and businesses in RI lost electricity as a result of the storm. An estimated 40,000 remained without power for two or more days. The highest concentration of damages resulting from Superstorm Sandy and its storm surge were located in the southern coastal communities of Washington and Newport County municipalities including Charlestown, Westerly, New Shoreham, South Kingstown, Narragansett, and Newport. The majority of the damages in these areas occurred from storm surge and wind damage[10].

The storm surge destroyed houses and businesses, damaged pilings and deck supports, demolished building walls on lower levels, and moved significant amounts of sand and debris into homes, businesses, streets and adjacent coastal ponds. Septic systems were damaged and underground septic tanks were exposed creating potential hazardous material exposure. Wind damage left downed trees and branches on homes, businesses, utility lines, and roadways. The Town of Charlestown restricted entry to the Charlestown Beach Road area due to the devastation[11].

In addition to severe impacts to homes and businesses, public buildings, roads, bridges, and related infrastructure experienced extensive impacts. Total infrastructure damage to Charlestown was $354,390.04[12]. Large scale disruptions of normal community functions and services resulted. Superstorm Sandy's storm surge, damage and debris

[8] P. Anderson, Charlestown Treasurer, personal communication, October 2015.
[9] National Centers for Environmental Information (NCEI) formerly known as National Climatic Data Center (NCDC)(February 15, 2016). Retrieved from http://www.ncdc.noaa.gov/.
[10] Ibid.
[11] Ibid.
[12] P. Anderson, Charlestown Treasurer, personal communication, October 2015.

closed local and state roads along the coast for varying lengths of time. Sections of Surfside Avenue in Charlestown, Charlestown Beach Road in Charlestown and South Kingstown, Atlantic Avenue in Westerly, Corn Neck Road in New Shoreham, and Sachuest Point Road in Middletown were inaccessible by vehicle. The State's ports were temporarily closed and ferry service to New Shoreham was cancelled for several days[13].

The U.S. Fish and Wildlife Refuge at Sachuest Point remained closed for over six months due to the storm's impacts. Sections of Newport's famous Cliff Walk and Narragansett's seawall were severely damaged. In Washington County, Charlestown, Narragansett, New Shoreham, South Kingstown, and Westerly suffered extensive beach erosion. Beaches needed to be restored in order to ensure the viability of the tourism, hospitality, and fishery industries. Public facilities, beaches, and parks must be restored to attract the visitors that support these local industries[14].

Severe Winter Storm/Snowstorm – February 2013 (FEMA-4107)

A major disaster declaration (DR - 4107) was declared on March 22, 2013 due to a severe winter storm and snowstorm in Washington, Kent, Newport, Providence and Bristol Counties. 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. The total cost for snow removal and police details in Charlestown was $172,605.37[15].National Grid estimated more than 180,000 customers lost power. By Saturday night, 129,000 customers in Rhode Island remained without power[16].

Severe Winter Storm/Snowstorm – January 2015 (FEMA-4212)

An historic winter storm brought heavy snow to southern New England with blizzard conditions to much of Rhode Island and eastern Massachusetts starting on the day of Monday, January 26, 2015 and lasting into the early morning hours of Tuesday, January 27, 2015. The highest snowfall totals, averaging two to three feet, extended from extreme northeast Connecticut and northwest Rhode Island into much of central and northeast Massachusetts, including greater Boston. Much of southeast Massachusetts and the rest of Rhode Island received one to two feet of snow. Totals dropped off dramatically west of the Connecticut River Valley where 4 to 8 inches were observed[17].

The storm was well-forecast with Blizzard Watches and Winter Storm Watches issued two days before the snow began. Low pressure tracked northeast from the Carolinas and strengthened rapidly as it slowly passed southeast of Nantucket on Monday

[13] National Centers for Environmental Information (NCEI) formerly known as National Climatic Data Center (NCDC)(February 15, 2016). Retrieved from http://www.ncdc.noaa.gov/.
[14] Ibid.
[15] P. Anderson, Charlestown Treasurer, personal communication, October 2015.
[16] National Centers for Environmental Information (NCEI) formerly known as National Climatic Data Center (NCDC)(February 15, 2016). Retrieved from http://www.ncdc.noaa.gov/.
[17] Ibid.

evening, January 26. All of the precipitation fell as snow with this storm. At its peak, snowfall rates of 2 to 3 inches per hour were common[18].

In Rhode Island, blizzard conditions were officially reported in Westerly (5 hours), Newport (4 hours), and at T.F. Green State Airport in Warwick (3 hours). In Providence, the total of 19.1 inches was the fourth highest on record (previous record dated back to 1904) while in Boston the total of 24.6 inches was the sixth highest on record (previous record dated back to 1872). The Blizzard of January 2015 produced very strong winds late Monday into Tuesday near the Massachusetts and Rhode Island coasts where gusts of 50 to 65 mph were common[19].

[18] National Centers for Environmental Information (NCEI) formerly known as National Climatic Data Center (NCDC)(February 15, 2016). Retrieved from http://www.ncdc.noaa.gov/.
[19] Ibid.

SECTION 2.0 – Planning Process

2.1 Purpose, Overview and Background

As required by 44 CFR Part 201.6(d) (3), local jurisdictions must review, revise, and resubmit their local multi-hazard mitigation plans to FEMA every five years. This is an update of the FEMA approved 2010 local hazard mitigation plan and is the result of a multi-step process. The update was initiated in October 2015 by the Town Administrator and an established Charlestown Natural Hazard Mitigation Committee (CNHMC), described below.

This 2016 updated Charlestown Natural Hazard Mitigation Plan has substantially changed from the 2010 Plan. The revised Plan includes descriptions of recent storms as described in Section 1.0. Other changes include a new methodology and plan format to address FEMA requirements including, but not limited to, hazard identification, risk assessment, and new and completed mitigation actions. Mitigation actions and a cost benefit analysis are provided in the Plan for the public to comment. Additionally, the CNHMC has aligned the hazard mitigation plan with other strategic planning in Charlestown.

2.2 Building Support: Community Involvement, Roles and Responsibilities

a. The Planning Team, Technical Assistance and Local Leadership

In October 2015, the CNHMC was re-established to prepare a new mitigation strategy methodology. Over the next eight months the CNHMC met to define natural hazards in terms of location, the scale or intensity of the event, the history of the natural disaster in town, action items and the probability of the natural disaster occurring again. The natural hazard mitigation committee meetings were also posted on the town's website calendar.

The CNHMC planning team is comprised of the Town Administrator, Building/Zoning Department/Floodplain Manager, Town Planner, Emergency Management Director, Town Treasurer, Police Chief, Director of Public Works, Harbor Master, Wastewater Management Director, and GIS Manager. Technical assistance was sought from, RI Coastal Resources Management Council (CRMC), RI Emergency Management and the Federal Emergency Management Agency.

b. Stakeholders

Copies of the Plan have been provided to surrounding communities (Westerly, Hopkinton, Richmond and South Kingstown) and the Narragansett Tribe (Tribal Planner). The U.S. Fish and Wildlife Service (Ninigret), RI Department of Environmental Management (Burlingame), CRMC (coastal geologist) have also had an opportunity to review and comment on the Plan. Notification was posted in the kiosk in the entrance of Town Hall for public participation and in The Pipeline (May 2016), a

community newsletter sent biannually to every resident of Charlestown. All comments are incorporated into this update.

c. Public

An online survey instrument, dated November 2015, was created to receive public comments regarding perceived threats from natural disasters. These natural disasters were chosen by the CNHMC by probability of occurrence. The online survey was implemented via email to all residents through "Constant Contact" (an email marketing software). Public comments from this survey were used to prioritize the natural hazard threats in the updated Plan. Once the natural hazards were identified, the CNHMC looked at the impacts to community assets (e.g. population, infrastructure, natural environment and the economy).

A second, additional online survey was created in December 2015 requesting that the public identify community assets and the best way to protect these assets from natural disaster. In January 2016, the CNHMC Chair presented the draft hazard mitigation plan to the Coastal Ponds Management Commission to solicit comments from a harbor management perspective. The CNHMC Chair also held a public workshop at the Cross Mills Public Library on January 28, 2016 to review the draft, obtain comments and address concerns from the public (see Appendix B). The final plan was posted to the town's website in April 18, 2016 and a public information hearing was advertised and held on April 27, 2016. All public comments and suggestions from meetings, workshops and online surveys were incorporated into the update.

In addition, the CNHMC posted and announced the draft risk assessment matrix on the town's Building/Zoning Official's website page to allow for public comment where it remains until the full Plan is available April 18, 2016. Furthermore, a public notice was placed in The Pipeline (May 2016) to announce the availability of the draft Plan and to solicit public comments. The final 2016 Charlestown Hazard Mitigation Plan is available at the Cross Mills Library and at Charlestown Town Hall.

2.3 Understanding the Community's Risk

a. Discovery and Gathering of Resources

This updated Plan has incorporated knowledge resources and comments from town employee interviews, and information contained within the Charlestown Emergency Operations Plan, Charlestown Comprehensive Plan, and Charlestown Harbor Management Plan, as appropriate. The CNHMC reviewed the 2010 Hazard Mitigation Plan, the mitigation accomplishments, the changes in programs and policies since 2010 and incorporated changes into the 2016 Plan. To develop a new mitigation strategy, the CNMHC relied on experience and guidance from RIEMA staff, other FEMA-approved municipal hazard mitigation plans, the 2014 RI State Hazard Mitigation Plan and the 2013 FEMA Mitigation Planning Handbook.

Dr. Jon Boothroyd's extensive work on coastal geologic hazards and sea-level rise has been incorporated into the hazard profiles[20]. Input has also been sought from contacts at the Charlestown Chamber of Commerce, the Salt Ponds Coalition and the Wood Pawcatuck River Association.

b. Review and Incorporation of Information with Stakeholder and Public Exchange

Each section of the Plan is initiated, tracked and updated through the CNHMC while incorporating public comments. The public has been provided many opportunities to be involved and have had input to affect the Plan's content. Public participation was initiated through several public events, two separate internet-based surveys and online resources. The on-line surveys were available from November 3, 2015 to January 3, 2016. Surveys were distributed through the town's Constant Contact program and Survey Monkey, an online survey tool.

Public Opinion Survey #1

The first survey which asked participants to rank the perceived threat of sixteen (16) potential weather events in Charlestown was sent to 992 emails of which 508 opened the survey (59.1%) and 227 participated, a 44.7% response rate.

The wide distribution of survey respondents throughout the entire town indicates a successful survey instrument (see Figure 1). Respondents were asked to rate sixteen (16) weather events on a scale of one (1) low threat to three (3) high threat. A weighted average response was calculated for each weather event and the results are presented in Figure 2. The data for all sixteen (16) weather events are included in Table 4. The top six (6) weather events that ranked as a high threat include: Hurricanes, Nor'easters, High Winds and Thunderstorms, Ice Storms, Blizzards, and Heavy Snow. Climate Change and Sea-Level Rise, Storm Surge and Coastal Flooding scored in the Medium Threat category. The low threats were Lightning, Hail, Flash Flood (dam breach),

[20] Coastal Geologic Hazards and Sea-Level Rise: Climate Change in RI, Presented to the Charlestown Town Council April 13, 2013 by Dr. Jon C. Boothroyd and Bryan A. Oakley.

Extreme Heat and River/Stream Flooding. The low threat can be explained by low frequencies of occurrences and the geographic effects.

There is a clear upland and coastal demarcation of natural hazard issues and the responses were geographically based. If a coastal weather event was presented, this event rated higher in the coastal communities than for inland residents. Inland residents rated inland weather events as a higher threat than did coastal residents. Weather events that affected the entire community ranked as the highest threat for all respondents.

Other miscellaneous responses by survey participants for hazards included: flooding due to super-saturation of the soil and mudslide type erosion, drought, fire from lightning, loss of electricity, Green Hill Pond becoming full of silt, power outages and the lack of potable water and micro burst.

The results of the surveys are graphically displayed in the attached charts.

Figure 1 Percentage of Respondents by Neighborhood

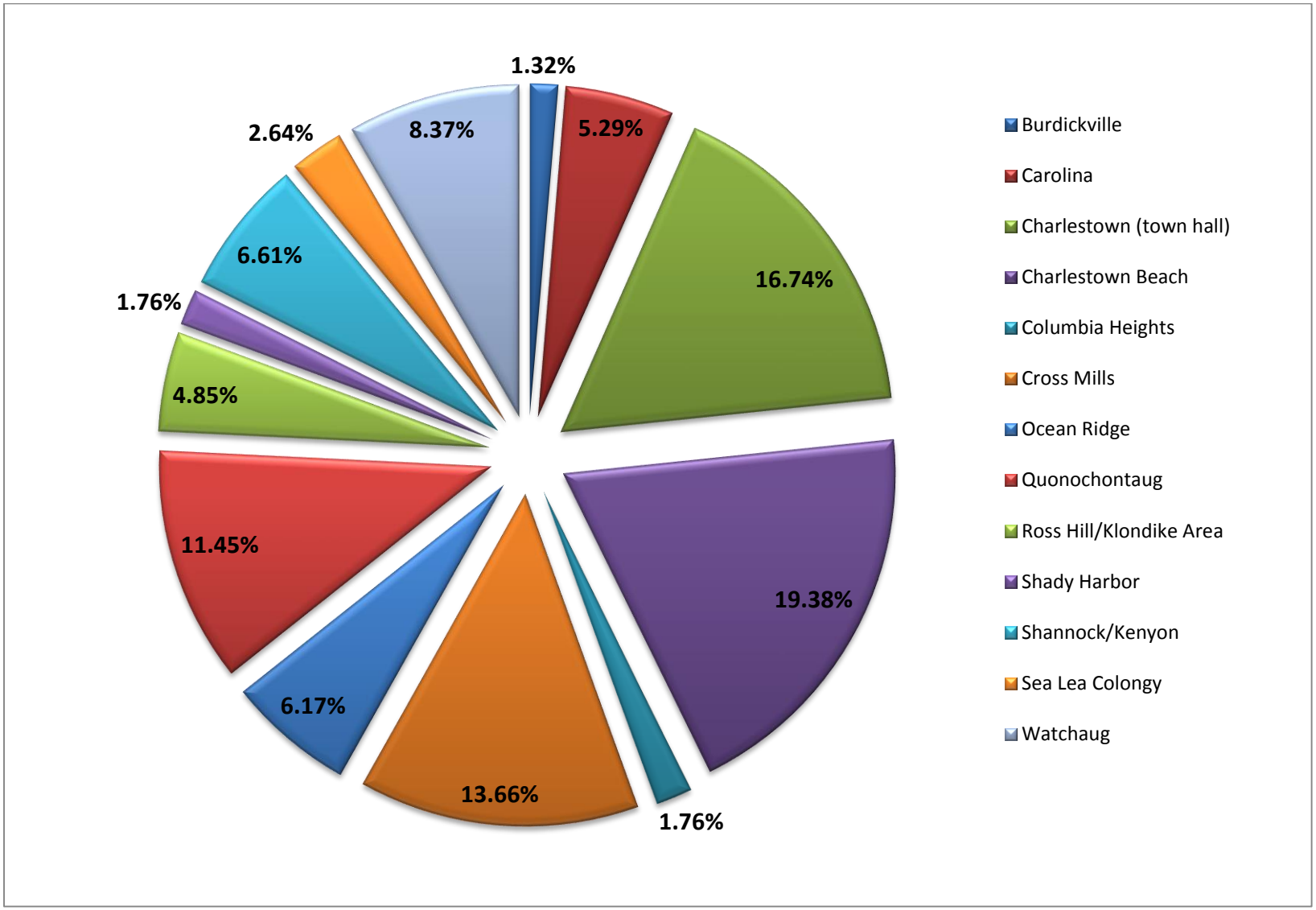


Figure 2 Weighted Average of Weather Events

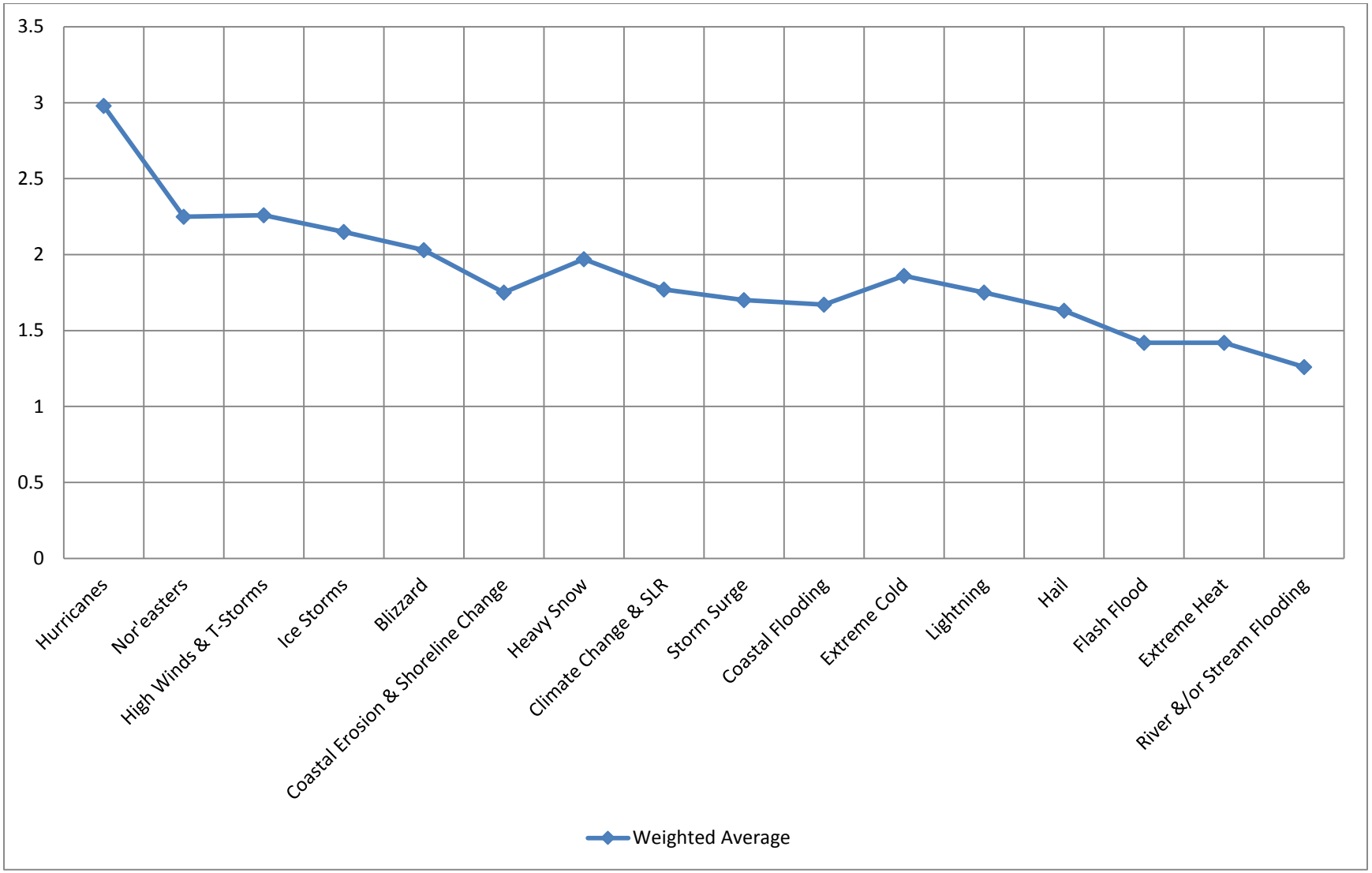


Table 4 Percentage Survey Respondents to Natural Hazard Threat

	Low Threat (1)	Medium Threat (2)	High Threat (3)
Coastal Flooding	54.63%	23.79%	21.59%
River and/or Stream Flooding	79.30%	16.74%	4.41%
Flash Flood (Dam Breach)	65.20%	28.63%	6.61%
Storm Surge	53.30%	23.35%	23.35%
Coastal Erosion & Shoreline Change	51.10%	22.47%	26.43%
Hurricanes	4.85%	37.44%	58.15%
Extreme Heat	63.88%	29.96%	6.17%
High Winds & Thunderstorms	11.89%	49.78%	38.33%
Climate Change & SLR	46.26%	30.40%	23.35%
Heavy Snow	29.52%	46.26%	25.11%
Nor'easters	13.66%	47.14%	39.21%
Ice Storms	19.38%	49.34%	32.16%
Extreme Cold	36.56%	43.61%	20.70%
Blizzard	27.31%	42.29%	30.40%
Hail	47.58%	42.73%	10.13%
Lightning	40.53%	44.05%	15.43%

Public Opinion Survey #2

The second survey was sent to 992 emails, 486 opened the survey (56.6%) and 140 participated in the town's survey (28.8% response rate) regarding public perceptions and opinions regarding natural hazards in the community. The survey asked the public how they prefer to reduce risk and losses to community assets.

The general findings of the second survey were:

- Citizens receive information through The Pipeline newsletter regarding how to make their homes safer.
- Survey respondents preferred email communication versus public workshops or meetings to receive natural disaster information. One respondent recommended dedicating "A place on the town website exclusively for natural disasters."
- The respondents overwhelmingly chose the Town of Charlestown as an entity which provides trusted information on how to be safer from natural disasters.
- Prior to receiving the survey, 30% of those that were surveyed were aware of the Charlestown Natural Hazard Mitigation Plan.
- The survey respondents thought all community assets were equally vulnerable to natural disasters. Police, fire, ambulance and small businesses ranked as very important to protect against natural disasters with the Senior Center and daycare facilities as neither very important nor of low importance. Other assets and concerns considered in the survey included: churches, the animal shelter, clean well water (and electricity to run it), the ability to get out on roads after storms

(snow, trees down, floods), quick response to emergencies, local businesses and natural areas, and impact on beaches, salt ponds and conservation lands.

- The survey respondents generally agreed with supporting both regulatory and non-regulatory approaches to reducing risk; policies that prohibit development in areas subject to natural hazards; use of tax dollars to reduce risks and losses from natural disasters; protecting historical and cultural structures; making residents more disaster-resistant; improving the disaster preparedness of local schools; creating an at-risk building and infrastructure inventory; and full disclosure of natural hazards risk during real estate transactions. One respondent states, "We cannot go on as 'business as usual' although personal property rights are important, community good is as or more important [sic], and costs of disasters can be lessened with procedures in place."

2.4 Bringing the Plan to Life: Implementation and Plan Maintenance

a. Implementation (Monitoring)

The CNHMC will meet annually and after each major event to monitor and track the status of the hazard mitigation actions. The progress will be documented on the Mitigation Action Progress Form (see Appendix D). Each meeting will ensure that the Plan is still current and will track any actions submitted for the Mitigation Action Progress Form. The Mitigation Action Progress Form will be maintained by the Building Official to record the progress of each mitigation action. Each responsible agency in the mitigation action section will be required to report progress to the Building Official who will have overall coordination with each department/agency and maintain the documented progress. Any new mitigation actions or hazard areas that are identified through these review sessions will be added to the yearly revision/update of the Plan. In addition, the CNHMC will complete a full update of the Plan every five years. All updates or revisions to the Plan will be coordinated with RIEMA to insure the State Hazard Mitigation Strategy also remains current.

b. Plan Review, Updates and Continued Public Involvement

Presentations on the Plan's progress to the Town Administrator and to the public will be scheduled annually. Online survey instruments can be created and sent out to the public prior to the progress report which may include the public's feedback regarding the hazard mitigation plan update. The annual progress reports may include updates on subjects including:

- Natural hazard profiles accounting for new major disasters,
- Status of mitigation action items and the identification of any implementation issues, and
- Evaluation of the risk assessment matrix to determine if any vulnerable area should be added or deleted from the matrix.

During the 5-year update process, a draft update will be available on the Town's website for public comment. Respondents may comment via email or by phone directly

to the Building Official. Hard copies will be available to the public at the Town Clerk's office and at the Cross Mill Library.

Once the updated Plan is completed and approved, it will be posted to the Town's website and it will be available for the public to comment. Furthermore, additional data collection methods will be explored to gain public input, such as interviews or assessments following real events that occur in Charlestown, targeting impacted residents and businesses. In addition, the public will be invited to attend each revision meeting and their input will be included in further updates. The public education and outreach actions throughout this Plan will also provide further opportunities for the public to be involved in future mitigation.

c. Evaluation and Updating

The Town Administrator, or designee, shall evaluate the effectiveness of the Plan at achieving its stated purpose and goals. The Town Administrator, or designee, shall convene the CNHMC annually to evaluate the Plan and prior to the 5-year update.

SECTION 3.0 – Risk Assessment

3.1 Defining Terms and Methodology

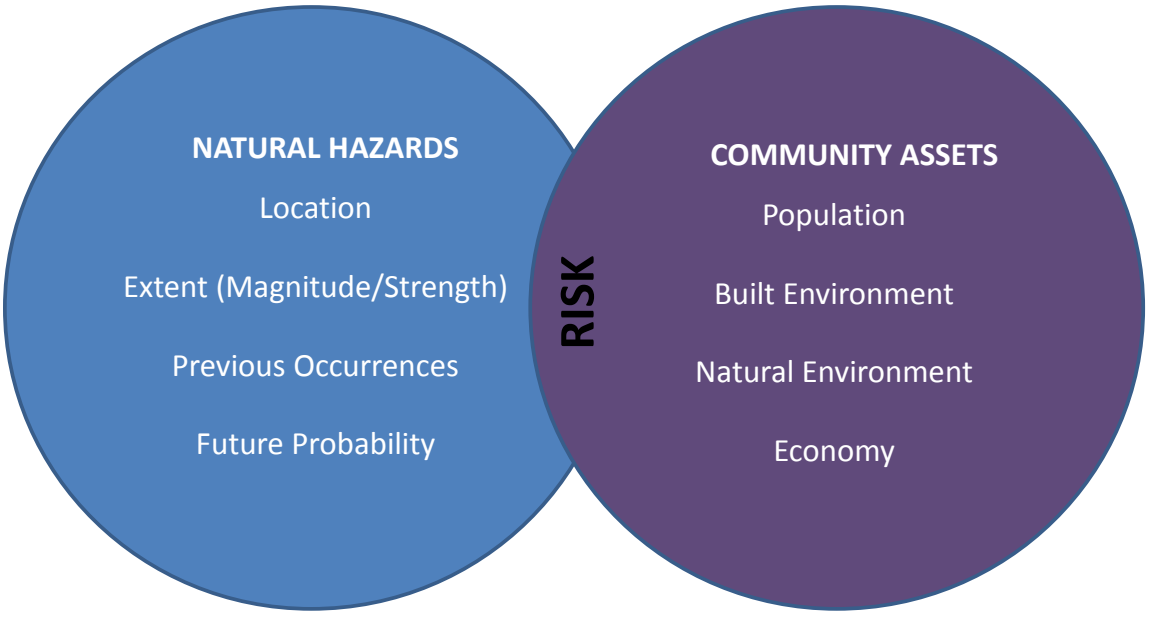
The Charlestown Natural Hazard Mitigation Committee (CNHMC) conducted a risk assessment to determine the potential impacts of hazards to the built and natural environments, the citizens and the local economy. The risk assessment tool provides the foundation for the rest of the mitigation planning process, which is focused on identifying and prioritizing mitigation actions to reduce risks to hazards. This tool involves a risk and vulnerability assessment. A risk and vulnerability assessment allows decision makers to compare and evaluate potential hazards, set priorities on what kinds of mitigation are possible, and determine where to focus resources and further study.

A natural hazard is defined by the Federal Emergency Management Emergency Management Institute 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."[21] A natural hazard can also be exacerbated by societal behavior and practice, such as building in a floodplain. Natural hazards are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely through enforcing building code standards, and reinforcing community preparedness.

The assessment of risk in Charlestown was determined by the intersection or overlap of natural hazards and community assets; the greater the overlap the greater the risk (see Figure 3). Risk is defined in hazard mitigation planning as the potential for damage, loss or other impacts created by the natural hazard, destruction to people, homes, businesses and everyday life routines. Furthermore, vulnerability is defined as a characteristic of a community asset that makes it more susceptible to damage from a given hazard.

[21] Chapter 4: Flood Risk Assessment. Retrieved March 01, 2016, from https://training.fema.gov/.

Figure 3 FEMA Intersection of Natural Hazards and Community Assets



Note: Modified from FEMA Local Mitigation Planning Handbook, March 2013, & U.S. Geological Survey and Oregon Partnership for Disaster Resilience Models.

The CNHMC identified sixteen (16) hazard types, assessed the probability of future events of these hazard types, the geographic area affected, and possible effects of the hazard and risk priority (Table 5). The CNHMC determined probability of future events using historical occurrences of natural hazards. A profile was conducted on each hazard through the process of defining and describing the hazard, including its physical characteristics, magnitude and severity, probability and frequency, and locations or areas affected. The Risk Assessment Matrix is a combination of the CNHMC's work to identify and rank the vulnerable areas with the associated natural hazard impacts and effects, with a summary statement of the mitigation benefit (see Table 23 Risk Assessment Matrix).

3.2 Natural Hazards

a. Natural Hazard Identification

The natural hazards identified in this plan are designed to fulfill the planning guidelines outlined in Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000).[22] Therefore, this plan only addresses natural hazards, and does not consider man-made hazards (for example, structural fires, hazardous materials, chemical spills or weapons of mass

[22] Disaster Mitigation Act of 2000 - How is Disaster Mitigation. Retrieved March 01, 2016, from http://acronyms.thefreedictionary.com/Disaster Mitigation Act of 2000

destruction). The Probability of Local Hazards in Table 5 lists the most frequently occurring natural hazards in Charlestown.

Hazards Excluded from Risk Assessment

The following natural hazards were excluded from the risk assessment given the location, geography and/or geology of Charlestown: avalanche, drought, earthquake, expansive soils, flash floods, land subsidence, landslide, tornado, tsunami, urban flooding, volcano, and wildfire.

The CNHMC concluded that these events are possible, but the likelihood and/or magnitude are minimal. Therefore, the lack of frequency in which these hazards occur, minimal probability, and the lack of resources to devote any amount of time to further research hereby excludes them from further consideration. If one of these events should occur in Charlestown, it will be incorporated in the next update to this plan.

Charlestown Risk Probability

The CNHMC used probability to:

1. express whether the natural hazard will occur within a calendar year,
2. prioritize local natural hazards; and,
3. exclude certain hazards based on the rank of event probability (high, medium, low)

Table 5 Probability of Local Hazards

	Hazard Types	Probability of Future Events[23]	Geographic Area Affected[24]	Speed of Onset	Seasonal Pattern	Possible Effects	Risk Priority
FLOOD RELATED HAZARDS	Coastal Flooding	Highly likely	Limited	24hrs	Any season	Coastal erosion, flooding, property damage, power outages, loss of life	High
	Coastal Erosion & Shoreline Change	Highly likely	Significant	Storms may exacerbate erosion	Any season	Permanent removal of coastal features; loss of public and private property; salt water intrusion	High
	Climate Change & Accelerated Sea Level Rise	Highly likely	Significant	Gradual but persistent	Any season	Accelerated sea level rise; intense heat waves; Landward migration of salt marshes and increase inland flooding; loss of public and private property; salt water intrusion	High
	Heavy Rains	Highly likely	Limited	12-24 hrs.	Spring and Summer	Flooding, property damage, roads closed	High
	Riverine Flooding	Likely	Significant	24hrs	Any season	Road closure, flooding, property damage, power outages, loss of life	High
	Dam Failure/Breach	Unlikely	Limited	Immediately after significant 100 year event	Spring	Flooding	Low

[23] Highly likely=near 100% probability within the next year; Likely: between 10% and 100% probability within the next year or at least one chance in next 10 years; Possible=between 1% and 10% probability within the next year or at least one chance in next 100 years; Unlikely=less than 1% probability in next 100 years

[24] Extensive=more than 50% of community affected; Significant=25 to 50% affected; Limited=10-25% affected; Negligible=less than 10% affected.

	Hazard Types	Probability of Future Events[25]	Geographic Area Affected[26]	Speed of Onset	Seasonal Pattern	Possible Affects	Risk Priority
WIND RELATED HAZARDS	Storm Surge	Highly likely	Significant	High winds and storms	Any season	Landward migration of salt marshes and increase inland flooding; loss of public and private property; salt water intrusion	High
	High Winds and Thunderstorms	Highly likely	Significant	12-24 hrs.	Any season	Coastal erosion, power outages, downed trees and limbs, property damage	High
	Lightning Strikes	Highly likely	Negligible	6-12 hrs.	Spring, summer, fall	Property damage, fire	Low
	Hurricane	Likely	Significant to Extensive	24+ hrs.	June-Nov. with Aug. & Sept. most likely	Coastal erosion, flooding, property damage, power outages, loss of life	High
	Hail	Possible	Negligible	6-12 hrs.	Summer	Property damage	Low

[25] Highly likely=near 100% probability within the next year; Likely: between 10% and 100% probability within the next year or at least one chance in next 10 years; Possible=between 1% and 10% probability within the next year or at least one chance in next 100 years; Unlikely=less than 1% probability in next 100 years

[26] Extensive=more than 50% of community affected; Significant=25 to 50% affected; Limited=10-25% affected; Negligible=less than 10% affected.

	Hazard Types	Probability of Future Events[27]	Geographic Area Affected[28]	Speed of Onset	Seasonal Pattern	Possible Affects	Risk Priority
WINTER RELATED HAZARDS	Snowstorm: Snow, Ice, and/or Extreme Cold	Highly likely	Limited	12-24 hrs.	Winter	Power outages, roof collapse, high winds, coastal flooding	Medium
ADDITIONAL HAZARDS	Extreme Heat	Likely	Extensive	24hrs	Summer	Heat exhaustion; heat stroke; death	Medium
	Earthquake	Possible	Extensive	Minimal	Any	Property damage, loss of life	Low

[27] Highly likely=near 100% probability within the next year; Likely: between 10% and 100% probability within the next year or at least one chance in next 10 years; Possible=between 1% and 10% probability within the next year or at least one chance in next 100 years; Unlikely=less than 1% probability in next 100 years

[28] Extensive=more than 50% of community affected; Significant=25 to 50% affected; Limited=10-25% affected; Negligible=less than 10% affected.

Charlestown's Hazard Profiles and Probability Scale

Table 6 presents a description of each type of natural hazard Charlestown may expect to experience, as determined by the CNHMC. An in-depth discussion of each local natural hazard can be found in the sub-section of the plan. A separate section on climate change and accelerated sea level rise is also discussed following the hazard profile section.

Table 6 Charlestown Specific Hazard Profiles

Flood Related Hazards	Wind Related Hazards	Winter Related Hazards	Additional Hazards
Coastal Flooding	Hurricane	Snow	Extreme Heat
Coastal Erosion & Shoreline Change	Storm Surge	Ice	
Heavy Rains & Riverine Flooding	High Winds & Thunderstorms	Extreme Cold	
Dam Failure/Breach			

The hazards are profiled according to location (geographic area affected), maximum probable extent (magnitude/strength on a scientific scale), previous occurrences, severity of impact, and probability of future events. The following probability scale (Table 7 Probability Scale) was used in the probability of future events sections.

Table 7 Probability Scale

Level	Definition
Highly likely	near 100% probability within the next year
Likely	between 10% and 100% probability within the next year or at least one chance in next 10 years
Possible	between 1% and 10% probability within the next year or at least one chance in next 100 years
Unlikely	less than 1% probability in next 100 years

b. Natural Hazard Profiles

Flood Related Hazards

Coastal Flooding

Description

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. Escape routes, particularly from barrier islands, may be cut off quickly, stranding residents in flooded areas and hampering rescue efforts.[29]

Location

According to the Charlestown GIS online mapping tool, Charlestown has approximately 29 miles of coastline and is subject to coastal flooding. Coastal flooding occurs south of the US Rte. 1 and the natural moraine, in the low lying features around neighborhoods of Ocean Ridge, Charlestown Beach, Quonochontaug and Shady Harbor.

Extent

Standard definitions of the FEMA Zones on the map below (Figure 4) were taken from the RI National Flood Insurance Program. There are three Special Flood Hazard Areas (SFHA) along the coast and one Special Flood Hazard Area Inland. The three coastal SFHA zones are: Zone VE, Coastal AE Zone and AE Zone. Each zone represents a particular zone on the coastal landscape. The VE Zone includes the sand beach, the shoreline and the sea level with wave height greater than or equal to 3 ft. Coastal Zone AE is the area within the overland wind fetch with wave height from 1.5 ft. to 3.0 ft. Zone AE is the limit of flooding and waves with wave height less than 1.5 ft. The Inland Zone A is the area effected by riverine flooding.

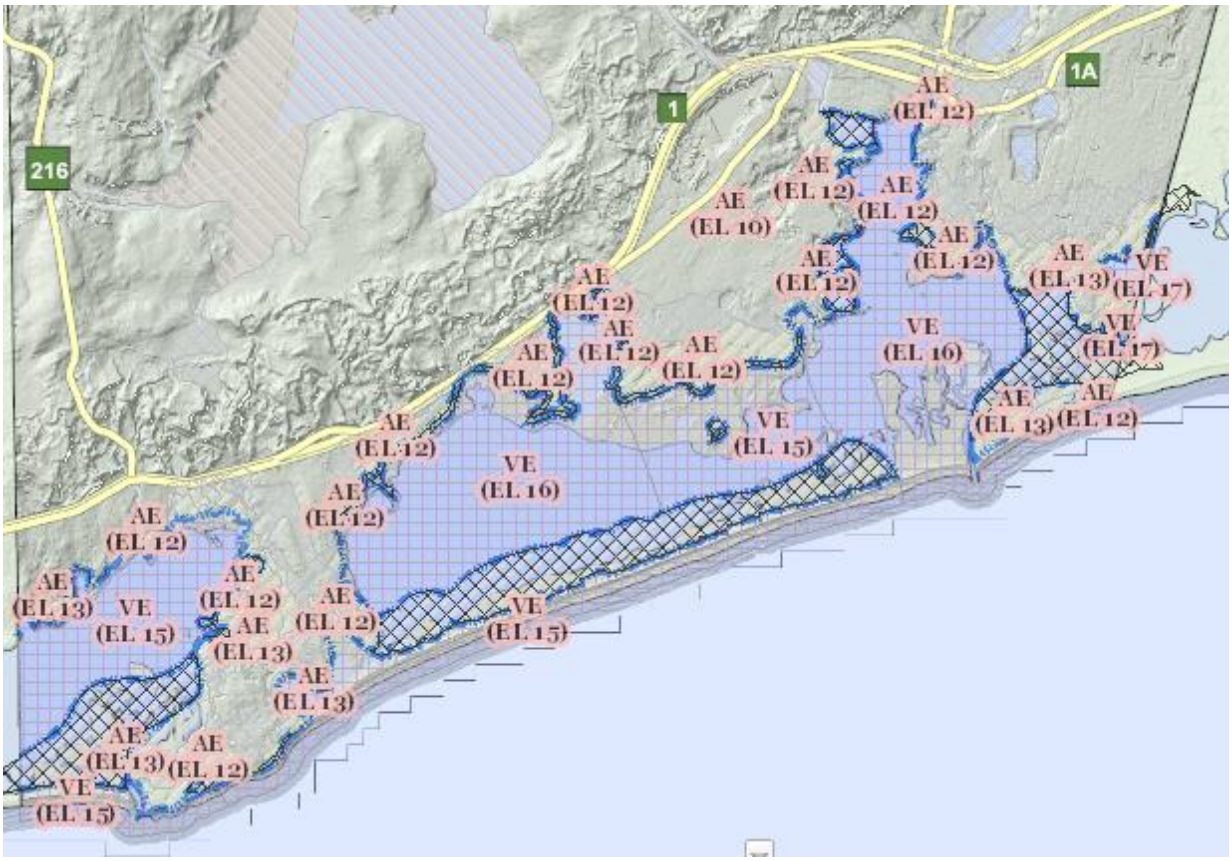
All structures in AE and VE Zones are required through state building code to be constructed one foot above base flood elevation (BFE). Not shown on the map is the SFHA Inland A Zone in Charlestown (no elevations) for the area north of Route 1.

[29] *RI 2014 Hazard Mitigation Plan Update*. RI Emergency Management Agency. Retrieved March 01, 2016, from http://www.riema.ri.gov/resources/emergencymanager/mitigation/documents/RI HMP_2014_FINAL.pdf

Previous Occurrences and Probability of Future Events

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. Sea level rise 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 natural hazards at one time or another and will experience them in the future.

Figure 4 RIEMA/FEMA Zones with elevations



Coastal flooding and associated inundation can cause extensive and expensive damage to coastal properties and small business, and, in extreme cases, may debilitate the coastal community. Impacts from coastal flooding is immediate for Charlestown. Damages include flooding of coastal properties; road closures along the coast from wash-over; disruption of evacuation, rescue or fire efforts; treacherous driving due to standing water; power outages which disrupt pumps for private drinking water supplies and wastewater treatment; and other public and private property damage. Severe infrastructure damage from flooding can result in the loss of tourism dollars.

Coastal flooding is the most prevalent natural hazard in Charlestown's coastal zone and has a highly likely probability (Table 5) of a future event. Based on historic coastal

flooding events and probability of future events, the degree of coastal flooding can range from minor to catastrophic. The longer the duration of an event, the greater the amount of damage from coastal flooding.

Coastal Erosion and Shoreline Change

Description

Coastal zones are dynamic areas that are constantly undergoing change in response to a multitude of factors, including sea-level rise (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, and tropical storms all increase the risk exposure along developed coastal lands. Storm impacts, SLR and long-term erosion threaten 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.

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 natural condition.

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 move further inland, waterfront homes, public infrastructure such as roads, bridges, on-site wastewater treatment systems, 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. [30]

Location

The RI Coastal Resources Management Council (CRMC) has determined that the headlands and barriers of the south shore from Watch Hill in Westerly to Charlestown 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.

Extent

[30] Summary of the Heinz Center Report on Coastal Erosion. Retrieved March 01, 2016, from http://connection.ebscohost.com/c/articles/8835140/summary-heinz-center-report-coastal-erosion-national-flood-insurance-program

According to the CRMC, fifty percent of Rhode Island's shoreline sediments are susceptible to erosion and a significant portion of the State's shoreline is eroding.[31] Erosion rates are calculated by comparing the shoreline location from historic aerial photographs to the most recent shoreline position.

The CRMC has adopted shoreline change maps showing changes from Narragansett to Little Compton inclusive of Narragansett Bay and its islands (see CRMC website http://www.crmc.ri.gov/maps/maps_shorechange.html). These shoreline change maps detail erosion rates for the shoreline, and are further detailed into shoreline segments for each map. However, the rates provided within the shoreline change maps should be used with caution because of the abrupt changes in shoreline due to storms.

Previous Occurrences and Probability of Future Events

The degree of coastal erosion is extreme; the extended duration of coastal erosion can result in catastrophic damage and permanent uninhabitable conditions. Coastal erosion occurs both slowly over time, at varying rates. It can also occur dramatically as the result of a storm event. Coastal erosion is the result of abrupt changes due to storms. Indirect economic losses also occur due to the loss of sand (and cost of replacement sand) on the southern beaches.

Future coastal erosion has a highly likely probability of occurrence (see Table 5) based on the relationship to other hazard events. The impacts of coastal erosion affects people, disrupts potable water supplies and wastewater utilities, and threatens coastal properties.

Heavy Rains and Riverine Flooding

Description

Flooding is the most frequent and costly natural hazard in the United States, and has caused more than 10,000 deaths since 1900. Approximately, 90 percent of presidentially declared disasters result from natural hazard events with flooding as a major component.[32]

Floods are generally the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time; and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is determined by the following: a combination of stream and river basin topography and physiography; hydrology, precipitation and weather patterns, recent soil moisture conditions, and the degree of vegetative clearing. General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine and coastal and to

[31] http://www.crmc.ri.gov/coastalerosion.html, accessed 3/1/2016
[32] National Hurricane Center, http://apps.nhcgov.com/EPLAN/WEBVER/NHMit/NHMitSec4.htm, accessed 3/1/16.

a much lesser extent, flash flood. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river.

Location

Charlestown's proximity to the coast and the several rivers and brooks makes a large portion of the town extremely susceptible to flooding. The Pawcatuck River, for example, causes several roads to be affected during periods of heavy rains and the Charlestown and Quonochontaug Breachways are also prone to flooding, causing property, economic and ecological losses. According to the RI Emergency Management Agency, FEMA Zone A encompasses approximately 17% of the land mass in Charlestown. Zone A is mostly undevelopable wetlands that are protected through the RI Department of Environmental Management. Because detailed flooding analyses are not performed for such areas, no depths or base flood elevations are available within these zones.

Extent

Floods are defined as an overflow of water onto lands that are subject to human development and not normally covered by water. Floods have two essential characteristics: the land is adjacent to and inundated by overflow from a river, stream, lake or ocean; and the inundation of land is temporary. The United States Geological Service (USGS) measures and reports the current conditions for Rhode Island streamflow including height of water in rivers and the discharge, which is the volume of water that passes a given location within a given period of time. The USGS has a station in Washington County in the Pawtuxet River Basin. The gage height of the water surface is measured above a gage datum (zero point). Gage height is used interchangeably with the term river stage.

Previous Occurrences, Disasters, and Probability of Future Events

According to the CNHMC, the probability of riverine flooding is likely while the probability of heavy rains is highly likely. Impact of heavy rains that lead to riverine flooding are immediate and include road closures along the main evacuation routes causing disruption of evacuation, rescue or fire efforts; treacherous driving due to standing water; power outages which disrupt pumps for private drinking water supplies and wastewater treatment; and other public and property damage.

In 2010, a series of later winter/early spring heavy rain events arrived in rapid succession. The majority of the rainfall occurred while the ground was still frozen and no transpiration was in process as the local trees had not leaved out for the season. The Pawcatuck River (Charlestown's northern boundary) overflowed its banks and in many places normal, non-wetland areas had reached their saturation point. This resulted in water settling and/or flowing into basements and other low lying areas that had historically been dry. Other significant heavy rain/flooding events in Washington County are listed in Table 27 (Appendix D).

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[33] 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

Dam Failure/Breach

Description

Dam failures can result from natural events, human-induced events, or a combination of the two. 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 operational failure. 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 the RI Department of Environmental Management (RIDEM) according to 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 operational failure of the dam; however, it does not relate to the current condition or the likelihood of failure of the dam.

Location

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

According to the RIDEM Office of Compliance and Inspection, Charlestown has two (2) Significant and nine (9) Low Hazard dams.[34] The table below describes the ownership of the dam, the dam's location and the impacts in the event of failure for only the two significant dams as listed below. Note, that Horseshoe Falls (Shannock #249) was just rebuilt this past year.

Table 8 RIDEM Significant Dams in Charlestown

Name/State ID	Ownership	Location	State Classification	Failure/Breach Impacts
Horseshoe Falls (Shannock #249)	Charlestown/Richmond	Border of Charlestown and Richmond on Pawcatuck River	Significant	Flooding in residential areas/businesses and local roads
Cross Mills (#758)	Private home owner adjacent to dam	Head of Ninigret Pond	Significant	Flooding of State highway, residents, businesses and local roads

Extent

The hazard classifications are defined in the Rhode Island Dam Safety Regulations as follows:

- High Hazard – means a dam where failure or operational failure will result in a probable loss of human life.

- Significant Hazard – means a dam where failure or operational failure 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. Examples of major economic loss include washout of a state or federal highway, washout of two or more municipal roads, loss of vehicular access to residences, (for example, a dead end road whereby emergency personnel could no longer access residences beyond the washout area), or damage to a few structures.

- Low Hazard – means a dam where failure or operational failure 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

[34] P. Guglielmino, RIDEM Compliance and Inspection, Water/Dam Safety, personal communication 12/9/15.

breaches can take much longer to occur, from days to weeks, as a result of debris jams or the accumulation of melting snow.

Previous Occurrences and Probability of Future Events

Charlestown does not have a history dam failures. The CNHMC states the probability of future events of dam failure/breach at unlikely and the risk priority is low. However, climate scientists predict that we will experience more severe storms and heavy rainfall. A report entitled *Climate Change in Rhode Island: What's Happening Now & What You Can Do*[35] indicates that bridges, roads and dams will be more susceptible to flood damage because of more severe storms and heavy rainfall.

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.

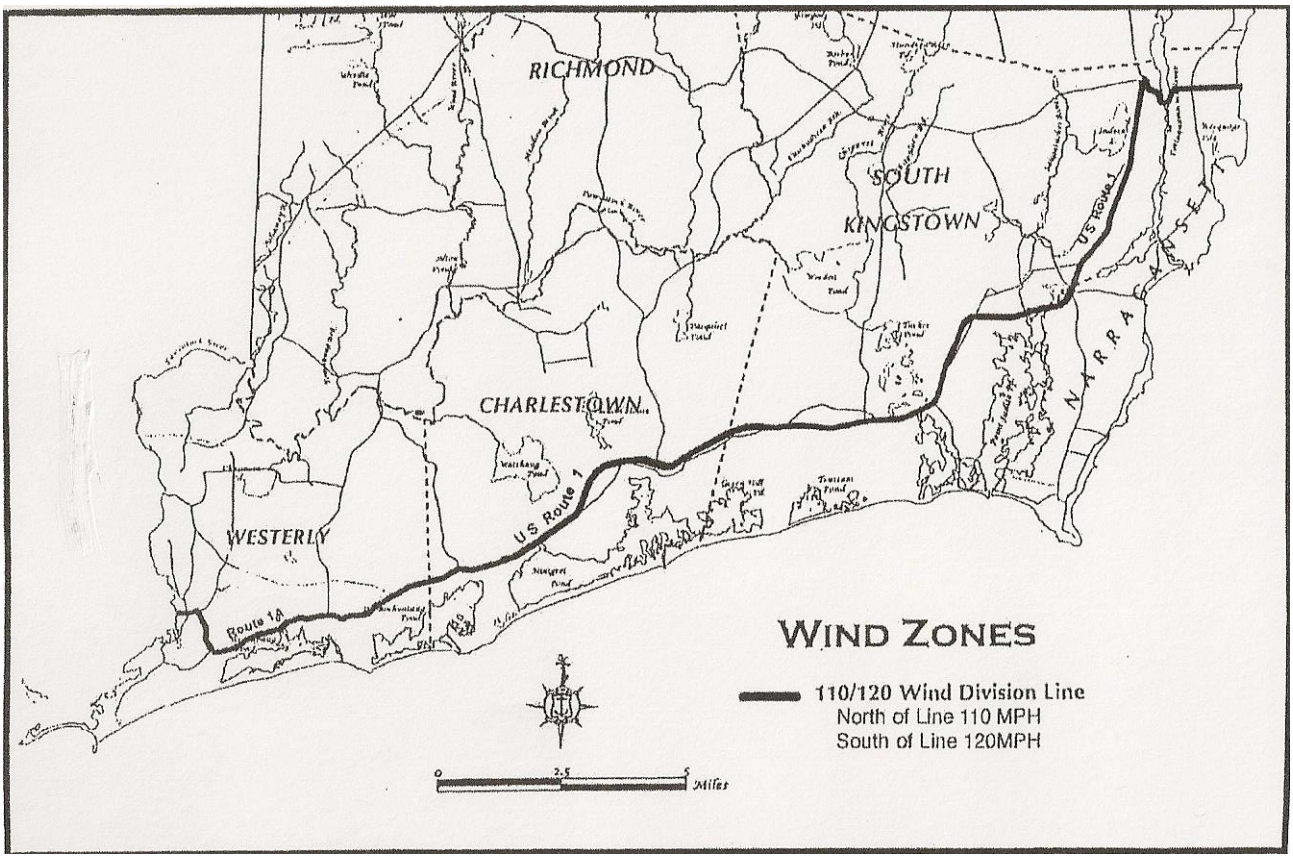
Rhode Island wind events can produce damage often associated with thunderstorms or microbursts. In some instances, these events have been associated with weakening tropical weather systems, including downgraded tropical and sub-tropical storm systems. The risks associated with damaging wind events in Charlestown are combined with hurricanes, storm surge and thunderstorms.

From the Rhode Island Residential Code (2013) (see Figure 5), all of Charlestown is equally at risk from wind. The wind zone in Charlestown is measured and demarcated along Rte. 1 N/S. South of Rte. 1 there is a potential for wind to reach 120 mph and North of Rte. 1 that speed is 110 mph, denoting a significant risk of wind damage during any extreme weather.

Wind events are quite normal in Southern New England and happen regularly each year. In the winter months the area is susceptible to high winds from nor'easters and winter storms. Spring and summer seasons usually bring a number of severe thunderstorms to the region. During the late summer and fall seasons the area is at risk from hurricane winds. Based on the probability of future events, the CNHMC put the likelihood of high winds as highly likely in Charlestown within the next year.

[35] Climate Change in Rhode Island - National Ocean Service. 02 Mar. 2016. N Accessed from http://oceanservice.noaa.gov/education/pd/climate/teachingclimate/climate_change_in_rhode_island.pdf.

Figure 5 RI Wind Zones



The RI State Hazard Mitigation Plan examined the entire state NCDC data and concludes 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.[36]

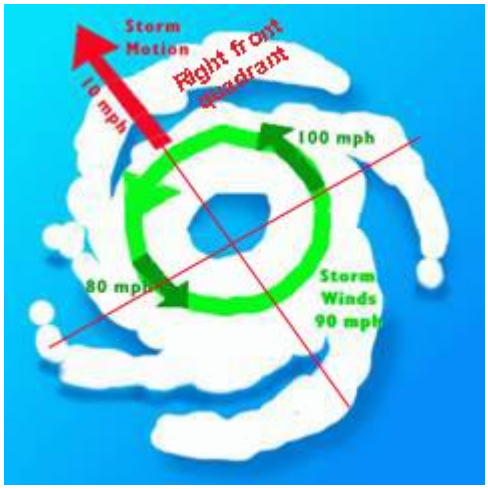
[36] *RI 2014 Hazard Mitigation Plan Update*. RI Emergency Management Agency. Retrieved March 01, 2016, from http://www.riema.ri.gov/resources/emergencymanager/mitigation/documents/RI HMP_2014_FINAL.pdf

Hurricane

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.



In the Northern Hemisphere, the most destructive section of the storm is usually in the eyewall area to the right of the eye, known as the right-front quadrant. Based on the direction of movement of a hurricane during landfall, this section of the storm tends to have higher winds, seas, and storm surge (see insert).

The "right side of the storm" is defined with respect to the storm's motion: if the hurricane is moving to the west, the right side would be to the north of the storm; if the hurricane is moving to the north, the right side would be to the east of the storm, and so on. In general, the strongest winds in a hurricane are found on the right side of the storm because the propagation of the hurricane also contributes to its winds. For example, a hurricane with 145 km/h (90 mph) winds while stationary would have winds up to 160 km/r (100 mph) on the right side and only 130 km/h (80 mph) on the left side if it began propagating at 16 km/hr (10 mph).

The reduction of atmospheric pressure within the storm system results in a 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.

Location

The entire state is vulnerable to hurricanes and tropical storms, depending on the storm’s track. The exact location of a hurricane’s impact varies from storm to storm and can be felt many miles inland from the point of impact. All of Charlestown is equally at risk from hurricanes. Major locational impacts are to Charlestown’s shoreline

neighborhoods of Quonochontaug, Shady Harbor, Cross Mills, Ocean Ridge and Charlestown Beach Road.

Extent

Hurricanes are categorized according to the Saffir/Simpson scale (see Figure 6) 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 within 24 hours or less.

Figure 6 Saffir-Simpson Hurricane Wind Scale

Saffir-Simpson Hurricane Wind Scale

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Previous Occurrence, Disasters, and Probability of Future Events

Although Rhode Island has not been hit by catastrophic intense hurricanes (Category 4 or 5) as seen in other parts of the East Coast, we have had our share of major hurricanes that have caused extensive damage to our state. In the sixteen-year period from 1938 to 1954, Rhode Island experienced three major hurricanes that caused a tremendous amount of damage and resulted in almost 300 deaths across the state. The great un-named hurricane of 1938 devastated Rhode Island and caused $100 million dollars in property damage and took 262 lives. The 1938 Hurricane made landfall west of Rhode Island as a Category 3 with a forward speed in excess of 50 miles per hour. Because the center of the 1938 storm made landfall in Connecticut, the Rhode Island shoreline experienced the highest storm surge levels. Hurricane Carol in August of 1954 caused similar damage dollar-wise, but resulted in the loss of 19 lives.

Based on historical analysis and data presented in Table 9, the CNHMC calculates the probability of future hurricanes as likely. The RI State Hazard Mitigation Plan estimates that Rhode Island may experience a hurricane every four years, or 22.8 percent annually.[37] Even though Rhode Island has not had hurricanes as severe in recent history, in 2012 Superstorm Sandy swept up the east coast and caused extensive damage to the Town. Considering Charlestown's with 29 miles of shoreline, and overall proximity to the coast as well as the damage experienced by Tropical Storm Irene and Superstorm Sandy, hurricanes pose a great risk to the town.

Table 9 Significant Hurricanes for Rhode Island

Date	Name	Category[38]	Winds at landfall	Property Damage ($ million)	Deaths
September 21, 1938	N/A	3	95 mph	100	262
September 14, 1944	N/A	3	82 mph	2	0
August 31, 1954	Carol	3	110 mph	90	19
September 11, 1954	Edna	3	40 mph	0.1	0
September 12, 1960	Donna	2	58 mph	2.4	0
September 27, 1985	Gloria	2	81 mph	19.8	1
August 19, 1991	Bob	2	100 mph	1.5	0
August 27, 2011	Irene	1	71 mph	9.6	0
October 29, 2012	Sandy	1	70 mph	31.1	0

Source: 1998 Journal Bulletin: Rhode Island Almanac, 112th Annual Edition
Rhode Island Hurricanes and Tropical Storms: A Fifty-Six Year Summary, National Weather Service Office, Providence, RI
Rhode Island Hazard Mitigation Plan 2014 Update

[37] *RI 2014 Hazard Mitigation Plan Update*. RI Emergency Management Agency. Retrieved March 01, 2016, from http://www.riema.ri.gov/resources/emergencymanager/mitigation/documents/RI HMP_2014_FINAL.pdf

[38] Category 1 74-95 mph winds, 4'-5' storm surge; Category 2 96-110 mph winds, 6'-8' storm surge; Category 3 111-130 mph winds, 9'-12' storm surge; Category 4 131-155 mph winds, 13'-18' storm surge; Category 5 winds greater than 155 mph, with a storm surge of greater than 18'
Source: Saffir-Simpson Hurricane Scale.

Storm Surge

Description

Storm surge, which is an elevation of water beyond the typical tidal range that occurs as the result of the wind and high pressure forces of a major storm event, can result in flooding when storm winds push the elevated ocean water toward the coastline. The storm surge combined with the normal tidal elevation is the storm tide, or the observed level of the ocean during a storm event. 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.

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.

During a storm event like a hurricane, a storm surge forms on top of normal tide levels. The resulting storm tide can cause extensive coastal inundation if winds push the ocean water toward the shoreline. 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 (see Figure 7).[39]

Figure 7 Storm Surge and Normal Tide Levels

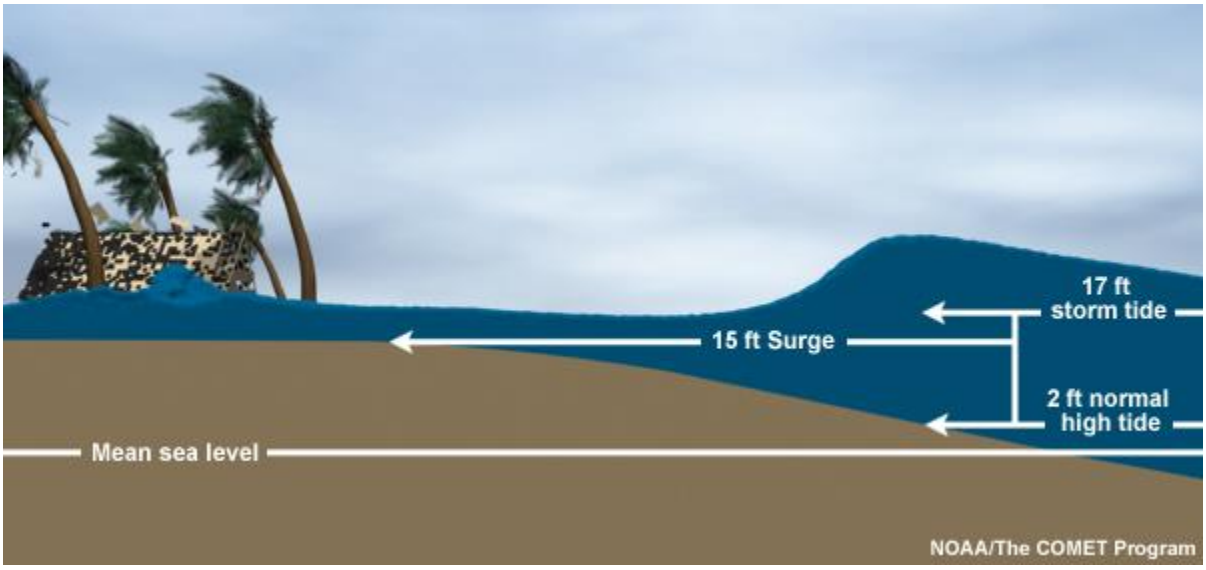


Image source: www.nhc.noaa.gov/surge/

[39] Oceans & Coasts. Oceans & Coasts. 07 Mar. 2016. Accessed from http://www.tulane.edu/~sanelson/eens1110/oceans.htm

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 (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.[40]

Nor'easter Storm Surge

An extra-tropical coastal storm, known as a nor'easter, is typically a large, counterclockwise 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 104 MPH are common during a nor'easter, with short term wind speeds gusting up to 70 MPH.[41]

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. Back to back storms do not

[40] Hurricanes: Science and Society: Hurricane Impacts Due to Storm Surge, Wave, and Coastal Flooding. *Hurricanes: Science and Society: Hurricane Impacts Due to Storm Surge, Wave, and Coastal Flooding*. 07 Mar. 2016. http://www.hurricanescience.org/society/impacts/stormsurge/.

[41] *RI 2014 Hazard Mitigation Plan Update*. RI Emergency Management Agency. Retrieved March 01, 2016, from http://www.riema.ri.gov/resources/emergencymanager/mitigation/documents/RI HMP_2014_FINAL.pdf

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.

Extent

The Rhode Island Emergency Management Agency utilizes the Sea, Lake and Overland Surges from Hurricanes (SLOSH) model to evaluate the potential impact of storm surge. The data is available to local emergency managers to identify at-risk populations and determine evacuation areas.

Previous Occurrences and Probability of Future Events

The CNHMC calculated the probability of future storm surge as highly likely. The storm surge can cause extensive damage to coastal property and is a serious hazard during coastal storms and hurricanes. The impact in Charlestown from storm surge is potential damage to the coastal beaches and properties, and to on-site wastewater treatment facilities, as well as potential for saltwater contamination to the water supply.

Electrical utilities and communications as well as transportation infrastructure are vulnerable to coastal flooding. Damage to power lines or communication towers have 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.

Thunderstorms

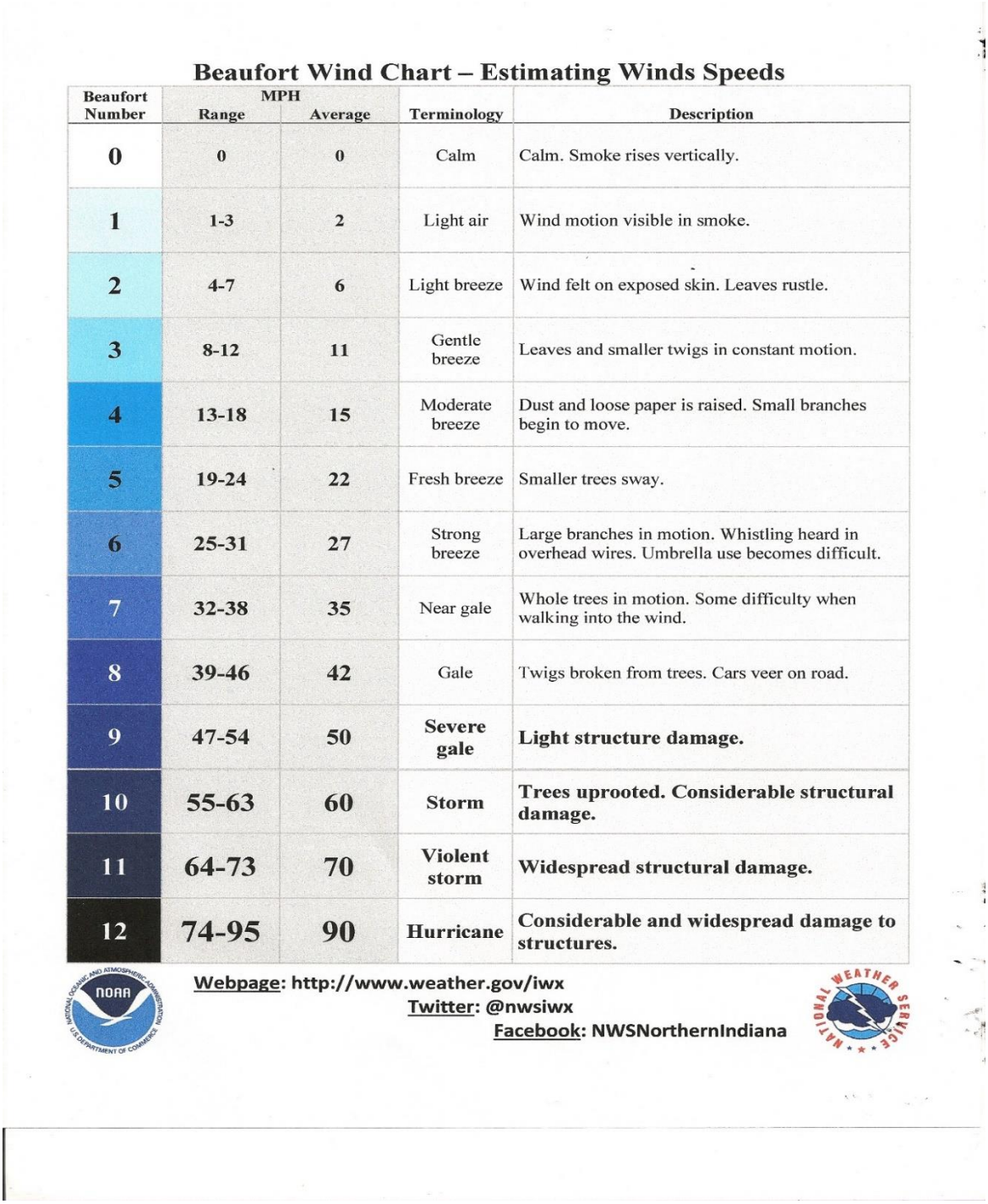
Location

Severe wind poses a threat to Rhode Island in many forms, including those produced by severe thunderstorms and tropical weather systems. Areas especially those on floodplains, are also at risk for flooding and wind damage. Low-lying coastal areas in close proximity to the shore, salt ponds or estuaries are exposed to the threat of flooding from wind events and storm surge.

Extent

Thunderstorms are scientifically measured on the speed of the wind, size of hail, amount of rainfall, and lightning strikes. The Beaufort Wind Chart (Figure 8 and Figure 9), measures the magnitude of wind speed and hail sizes.

Figure 8 NWS Beaufort Wind Chart



Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH Range	MPH Average	Terminology	Description
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	**Severe gale**	**Light structure damage.**
10	55-63	60	**Storm**	**Trees uprooted. Considerable structural damage.**
11	64-73	70	**Violent storm**	**Widespread structural damage.**
12	74-95	90	**Hurricane**	**Considerable and widespread damage to structures.**

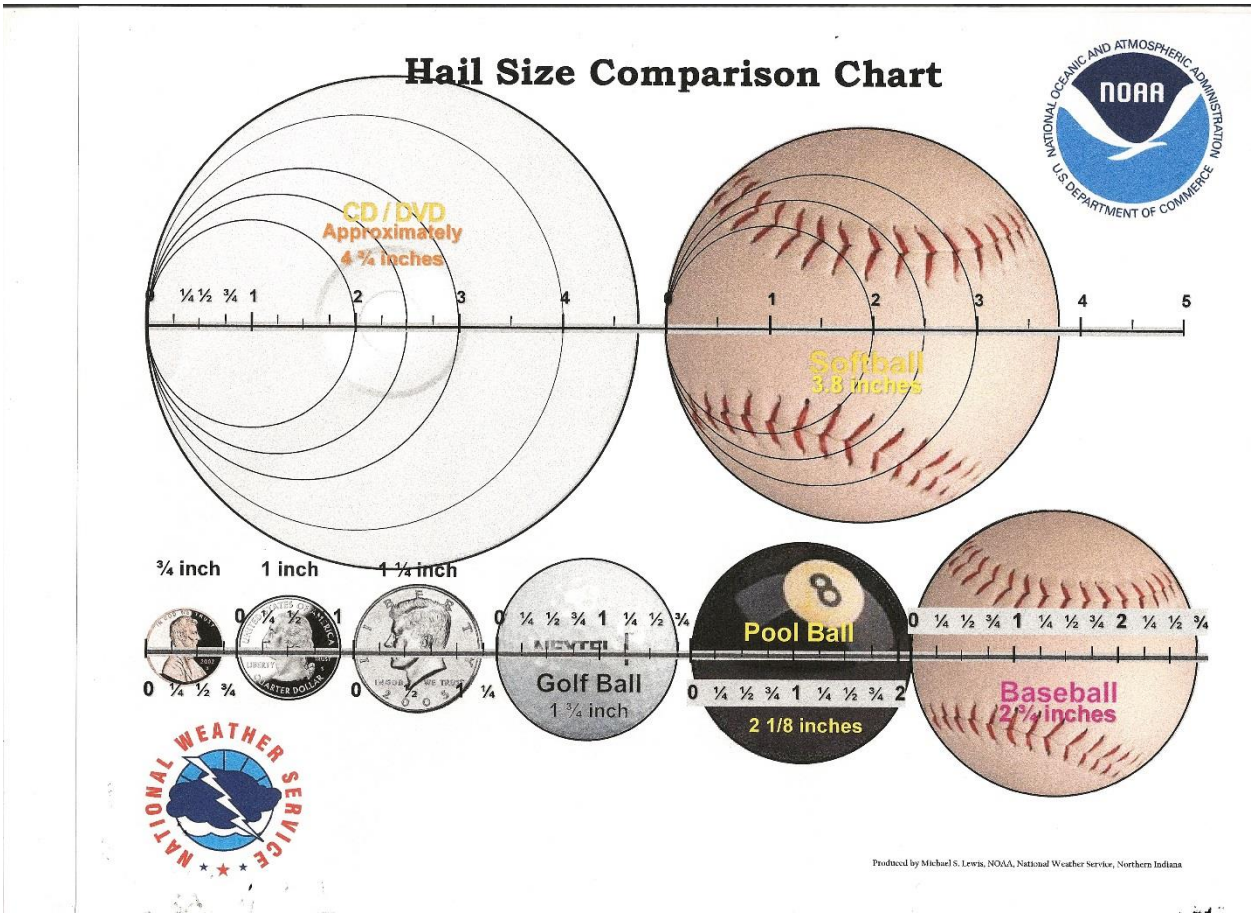
Webpage: http://www.weather.gov/iwx
Twitter: @nwsiwx
Facebook: NWSNorthernIndiana

Previous Occurrences, Disasters, and Probability of Future Events

Since Charlestown is located along the southern coast of Rhode Island, it is susceptible to high wind damage during several types of weather events including hurricanes, tropical storms and severe thunderstorms (no tornados have been reported in this area, but their effects would fall into this category). The wind damage that affect Charlestown

can cause major damage to beachfront properties as well as cause beach erosion from the high surf. Properties away from the coast can be affected by power outages and downed trees and limbs. Critical structures that are in the wind zone (120 mph) are the police station, ambulance barn, community center/senior center and the Cross Mills Fire Station. The CNHMC determined that the probability of high winds, thunderstorms and lightning strikes at highly likely (see data in Table 28, Appendix D).

Figure 9 NWS Hail Size Comparison Chart



Lightning Strikes

Lightning often strikes outside of areas where it is raining, and may occur as far as 10 miles away from rainfall. Lightning can strike from any part of the storm, and may even strike after the storm has seemed to pass. An event occurred on June 11, 2001 when a severe thunderstorm downed several large trees in the area and lightning from this storm struck the Charlestown Rescue Squad causing $10,000.00 in damage (see Table 10). One of the committee members recalled an event in December 2000 in which lightning struck the Charlestown Town Hall/Police Department causing damage and disrupting normal operations. See Appendix D for newspaper article that outlines this event.

During the height of winter storm NEMO (February 2013), the Charlestown Emergency Management Director attempted to set-up an overnight reception station for people who had lost their utilities. As equipment and supplies were being brought into the Charlestown Town Hall, a large blue flash of lightning occurred overhead in the sky. Shortly thereafter, it was found that electrical equipment had experienced a surge and overloaded. The fire alarm signaled a small fire in the Town Council Chambers and a 150kw emergency power generator failed. The fire was quickly extinguished with minimal damage. The building was abandoned and another site was used. The town's primary communications in the form of radio repeaters and email servers were offline. These critical communications remained offline until power was restored.

Rare Significant Weather Event

According to the National Weather Service, on August 4th, 2015 a line of severe thunderstorms developed across Long Island, NY and raced toward Rhode Island. These storms caused significant wind damage across Rhode Island, resulting in widespread power outages and knocking down a significant amount of trees. Wind gusts were estimated to be between 60 to 80 mph, with T.F. Green Airport reporting a wind gust of 66 mph.[1]

Charlestown was one of the hardest hit RI communities by this rare event. An anemometer recorded a wind gust of 83 mph in Charlestown, where there were 10 minor injuries that occurred on a campground. The storm that impacted Charlestown grew in strength and rushed across southern RI bringing down trees in its wake all the way to Cape Cod.

Table 10 Significant Lightning Storms for Washington County

Date	Magnitude	Comments
December 17, 2000	Critical	Lightning struck Charlestown Town Hall/Police Department
June 11, 2001	Critical	Lightning struck Charlestown Rescue Squad
August 11, 2004	Critical	Lightning struck two men fishing at East Matunuck Beach; one of the men succumbed to his injuries
July 27, 2008	-	Line of strong thunderstorms brought lightning to the area which struck trees that landed on a house in Wakefield
February 8, 2013	Critical	Lightning struck during major winter storm damages electrical power infrastructure making the facility and town's main communications hub unusable.
September 1, 2013	Critical	Two horses died in a barn fire in Hopkinton caused by a lightning strike

Source: National Climatic Data Center

Hail

The data that is available through the National Climatic Data Center (hail is characterized on the Beaufort Wind Chart (shown in Figure 8) lists several hailstorms that have affected Washington County in the past with hail ranging in size from 0.75" to 2.75". 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. Hailstorms are typically associated with severe thunderstorms.

Table 11 Significant Hailstorms for Washington County

Date	Magnitude (size in inches)
June 20, 1995	1"
August 4, 1995	.75"
June 19, 1998	.75"
June 30, 1998	1"-2.75"
May 24, 2000	.75"-.88"
May 23, 2004	.75"
July 2, 2004	1"
July 18, 2006	1"
June 24, 2008	1.25"-1.75"
July 1, 2009	.75"
July 1, 2012	.75"
May 25, 2014	1.00"
July 24, 2015	.75"
July 28, 2015	1.00"

Source: National Climatic Data Center

Winter Related Hazards

Snow Storms and Ice Storms

Description

The entire town of Charlestown experiences some type of winter conditions. Winter weather includes heavy snows, ice, and extreme cold and can affect the entire state. 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.

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 supply and can surpass annual snow removal budgets, often before the end of the season. When utilities are affected and heaters do not work, water and sewer pipes can freeze and even rupture.

Extent

A heavy snow is generally defined as having more than eight (8) inches of accumulation in less than 24 hours. 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.

Previous Occurrences, Disasters, and Probability of Future Events

Most of the significant snow events result in hazardous road conditions, power outages, school/business closings and transportation disruptions. The majority of Rhode Island lies outside the heavy snow and ice regions of the northeast. Due to its maritime climate, Charlestown generally experiences cooler summers and warmer winters than inland areas. However, snow and ice do occur and can result in more extensive damage than one would expect. The two major threats from these hazards are loss of power due to ice on electrical lines, and snow loading on rooftops. The likelihood of winter conditions in Charlestown is highly likely.

One of the most memorable winter storms in the state was the “Blizzard of ’78” which stalled over the Town of Lincoln. The stormed delivered 24 to 38 inches of snow. Motorists abandoned their cars on interstate highways and local roads. The governor declared a state of emergency, closing highways and businesses for the week required to remove snow. Recent blizzards and major snowstorms occurred in 1996, 1997, 2001,

2005, 2010, 2013 and 2015 causing millions of dollars in damage, many collapsed roofs, the loss of power in some areas for days, and the loss of life.

A severe snowstorm on January 7, 1996, better known as “the blizzard of 96”, disrupted transportation systems, closed schools/businesses, and damaged commercial and residential property (see Table 29, Appendix D). Historically, significant storms for Charlestown have resulted in the canceling of schools, the closure of businesses, power outages, fallen tree limbs, downed telephone/power wires, poor road conditions and the collapse of several roofs.

Extreme Cold

Location

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.

Extreme cold events often accompany winter storms, precede severe winter storms or occur without any associated storm activity. The entire town of Charlestown experiences extreme cold within any particular year.

Extent

The wind chill index quantifies 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.[42] The National Weather Service issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.

Previous Occurrences, Disasters, and Probability of Future Events

The CNHMC put the probability of extreme cold as extremely likely. The greatest impacts 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. Secondary impacts are potholes frozen pipes, house fires and carbon monoxide poisoning as people use supplemental heating devices.

[42] National Weather Service, Wind Chill, http://www.srh.noaa.gov/oun/?n=faq-winter, Accessed 3/7/16.

Additional Hazards

Extreme Heat

Location

Except for the immediate coastline, extreme heat affects the entire town of Charlestown.

Extent

In the United States, definitions of an extreme heat wave vary by region; however, a heat wave is usually defined as a period of at least two or more days of excessively hot weather. In the Northeast, a heat wave is typically defined as three consecutive days where the temperature reaches or exceeds 90 °F (32.2 °C), but not always as this ties in with humidity levels to determine a heat index threshold.[43] The National Weather Service issues heat advisories and excessive heat warnings when unusual periods of hot weather are expected (see Figure 10).

Previous Occurrences, Disasters, and Probability of Future Events

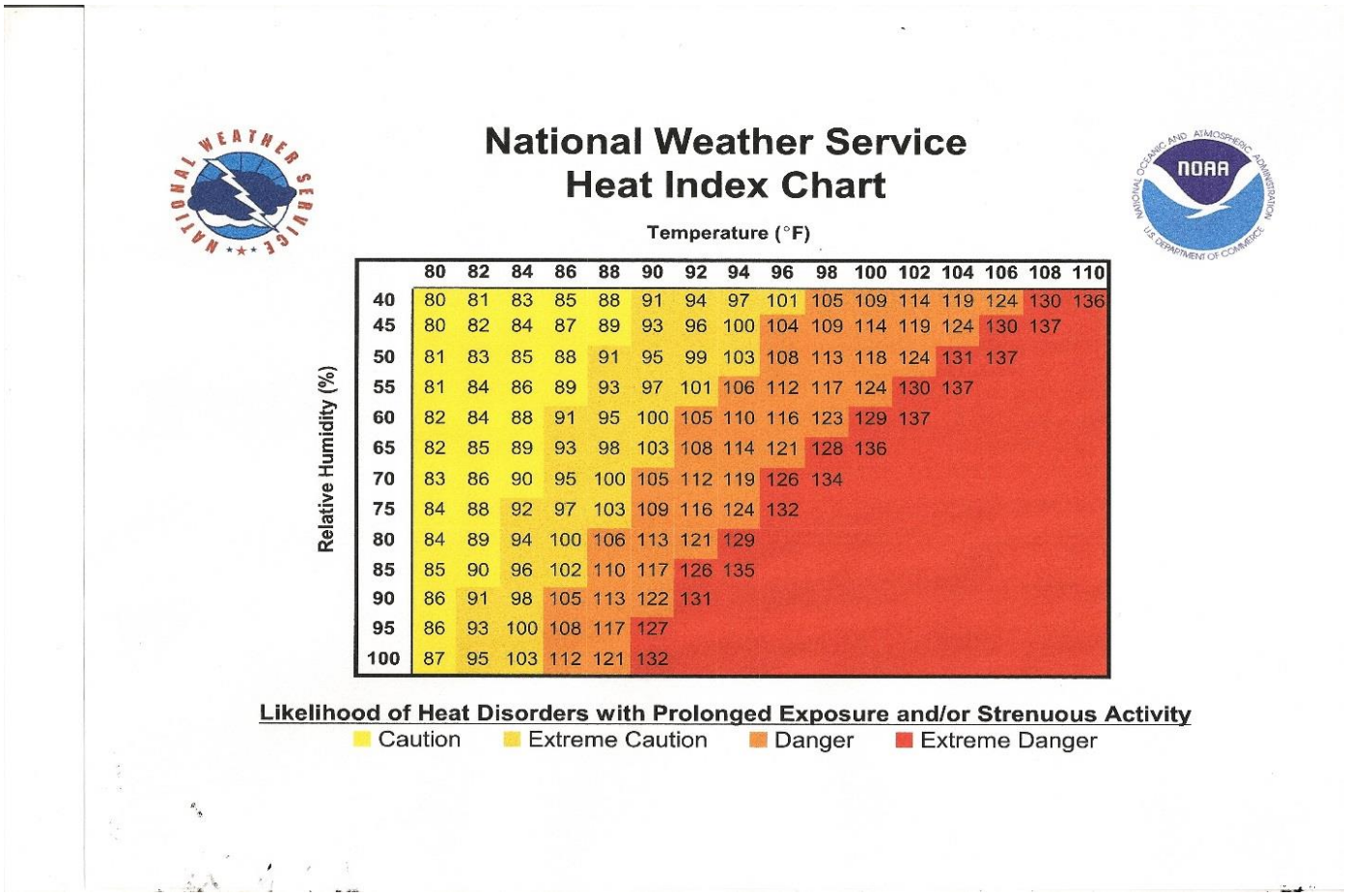
The CNHMC put the probability of extreme heat as likely. The body's most common response to extreme heat is dehydration. When exposed to direct sunlight and temperatures higher than 90 degrees Fahrenheit, the body can lose as much as half a gallon of water every 10 minutes.[44] This dehydration also can interfere with the body's internal thermostat, leaving it vulnerable to heat-related illnesses such as severe sunburn, heat cramps, heat exhaustion and heat stroke.

Charlestown residents are at risk to extreme heat, especially the elderly, the very young, and people with chronic diseases and/or mental illness. Even young and healthy individuals can succumb to heat if they take part in overly strenuous physical exercise outdoors during hot weather.

Heat waves also have the potential to cause blackouts in heavily-populated areas, due to the heavy use of air cooling devices. In some instances brownouts will occur either intentionally or unintentionally which results in electricity reduction. Brownouts are a drop in voltage in a power supply system that may be caused by a disruption of an electrical grid, or it may be imposed in order to prevent a blackout.

[43] Wikipedia, https://en.wikipedia.org/wiki/Heat_wave, accessed 3/8/16.
[44] The Weather Channel, https://weather.com/safety/heat/news/impact-heat-health-20120330, Accessed 3/9/16.

Figure 10 NWS Heat Index Chart



National Weather Service
Heat Index Chart

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure and/or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

3.3 Climate Change and Accelerated Sea Level Rise

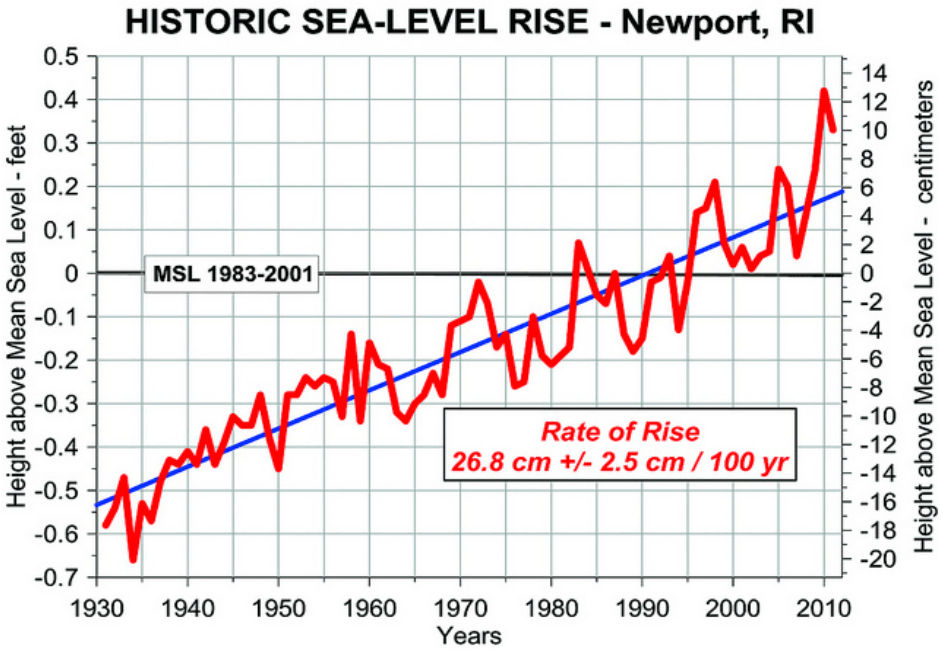
The science community has, for some time, been aware of global temperature changes throughout the earth's history. Geological evidence (for example, shown in soil borings and ice cores) document these gradual trends in temperature change that directly impact life on the planet.

During periods of global warming the earth's polar caps and glaciers melt, causing an addition of water into the oceans. Under this scenario there is a resultant net increase in the inland migration of coastal waters. Land areas abutting marine waters are directly impacted, demonstrating short term or permanent damage to residential and commercial structures, municipal infrastructure and critical facilities. As such, the impacts of sea level rise are of particular concern to Charlestown, given its 29 miles of coastline.

Based on prior trends of temperate changes it would be logical to expect global warming and associated sea level rise to occur over a long and gradual time period. However, it is the alarming increase in the recently accelerated rate of global warming and sea level rise that is cause for concern.

For example, historic sea level rise for Newport, RI (based on recorded tide gauge data) reveals a 9 +/- inch rise in sea level between 1930 and 2013. However, the rate of rise has increased over the past twenty years. Based on CRMC's guidance on sea level rise the following predictions for the applicable years are noted: 2030 (1 ft.); 2050 (2-3 ft.); and 2100 (5-7 ft.).

Figure 11 Historic Sea-Level Rise



The general consensus within the international science community finds the accelerated global warming a direct result of human practices. Specifically, increased concentrations of greenhouse gasses (carbon dioxide) in the atmosphere resulting from burning of fossil fuels are associated with industrial and transportation related activities. Studies indicate that anthropogenic emissions, such as carbon dioxide, have risen from a pre-industrial era of 280 ppm to 390 ppm in 2011. This last figure is the highest in 650,000 years.

The International Panel on Climate Change (IPCC) has determined that the rapid change in global climate has already resulted in acceleration of sea level rise; increase in ocean warming and acidity; and changes to regional weather patterns leading to more extreme weather events.

a. Risks and Vulnerability

The Town's GIS department has developed sea level rise projections for Charlestown using the STORMTOOLS tutorial and data developed by University of RI (URI), Coastal Resources Management Council (CRMC) and the ASA RPS Group. The projected 1', 3' and 5' sea levels for a 1% storm event (100 yr-storm) are as shown on the 100-year Storm Event with 1', 3' and 5' Sea-Level Rise found in Appendix A. It should be noted that information for a 4% storm event has not been finalized at this time. Data for a 25 yr. storm event under the three particular sea level rise projections will be addressed in subsequent Plan updates.

The tables below provide information regarding land areas and related populations affected from a 100 year storm event using the three sea level rise scenarios.

Table 12 Parcel and Population Impacts from Sea Level Rise (SLR)

SLR Scenario	Total Parcels Impacted (cumulative)	Developed Parcels Impacted (cumulative)	Affected Population (cumulative) *	Affected Population Change (per SLR scenario) *
Existing 100 yr base	1648	1152	2765	0
Base + 1' SLR	1746	1234	2962	+ 197
Base + 3' SLR	1910	1382	3317	+ 355
Base + 5' SLR	2066	1508	3619	+ 302

* assuming 2.4 persons per dwelling unit

Table 13 Property Values Within SLR Areas*

SLR Scenario	Total Land Value (cumulative)	Total Improvement Value (cumulative)	Total Value (cumulative)	Total Value Change (per SLR scenario)
Existing 100 yr base	698,000,000	268,000,000	966,000,000	0
Base + 1'SLR	730,000,000	285,000,000	1,015,000,000	+ 49,000,000
Base + 3' SLR	785,000,000	315,000,000	1,101,000,000	+ 86,000,000
Base + 5' SLR	826,000,000	338,000,000	1,164,000,000	+ 63,000,000

Source: Charlestown GIS
* in rounded dollars

Review of the graphic information indicates that, under the projected three sea level rise scenarios, the following impacts (beyond existing conditions) are evident.

- The following roads would be flooded to varying extents: Boulder Ave.; Lucas Ave.; Neptune Ave.; W. Niantic St.; Central St.; Hoxsie Ave.; and Hazen St.
- No critical facilities (Senior Center, police station, fire stations, etc.) would be impacted.
- Additional sections of main emergency access routes would be flooded. These include West Beach Rd., East Beach Rd. and Charlestown Beach Rd.
- Additional flooding would occur to many residential roads which utilize the three major emergency access corridors noted above.

b. Recommendations and Implementation

- It is imperative that the town's policies and regulations be in coordination and compliant with applicable federal and state agencies. The Town will work closely with these agencies in planning hazard mitigation policies and actions. These groups include: FEMA, Army Corps, USF&WS, RIEMA, RIDEM and CRMC.
- Town staff will continue to review government documents and scientific studies regarding global warming, sea level rise and related matters to remain abreast of pertinent information as it develops.

The state has developed documents and studies to assist communities in future proactive planning to address climate change and sea level rise.

A comprehensive overview of climate change impacts for areas such as the Charlestown coastal region is addressed in a URI Coastal Resources Center document, titled *Climate Change & Rhode Island's Coast: Past, Present, and Future*, published in 2012. The report provides a guide to municipalities in understanding climate change

and its potential impacts to communities, including on both the natural and manmade environment. These impacts include:

- increased vulnerability of infrastructure (i.e. drainage systems)
- reduction in the effectiveness and life of coastal structures
- reduced access to roadways, including evacuation routes
- risks to historical and cultural assets

The R.I. Coastal Resources Management Program (Redbook) addresses climate change and sea level rise under Section 145. Included is the stated policy that:

> *The Council recognizes that sea level rise is ongoing and its foremost concern is the accelerated rate of rise and associated risks to Rhode Island coastal areas today and in the future. Accordingly, for planning and management purposes it is the Council's policy to accommodate a base rate of expected 3 to 5 foot rise in sea level by 2100 in the siting, design, and implementation of public and private coastal activities . . . .*

Most recently CRMC has developed a draft Shoreline Change Special Area Management Plan (SAMP), dated 12/11/15. The document has been developed as a guidance and planning tool for local governments, specifically in planning for sea level rise, storms and coastal erosion.

The federal government has also developed a myriad of guidance documents to assist local decision makers regarding sea level rise impacts to their community. These important tools include the following.

- FEMA Hazard Mitigation Assistance and Sea Level Rise
- FEMA Incorporating Sea Level Rise (SLR) Into Hazard Mitigation
- NOAA Sea Level Rise Viewer
- U.S. Climate Resilience Toolkit
- EPA Climate Resilience Evaluation and Awareness Tool

The Town shall investigate the potential costs and benefits in implementing a 'retreat strategy' that would address relocating residential structures, municipal facilities and infrastructure further inland. In particular, the investigation would initially focus on those structures contiguous to the shoreline. Research to identify potential funding sources to implement mitigation strategies will be undertaken.

3.4 Vulnerability to Natural Hazards

Vulnerability is defined in hazard mitigation planning as the characteristic of the community asset that is most susceptible to exposure to loss from a natural hazard. The following discussion characterizes the vulnerabilities to natural hazards in the town's community assets.

Community Assets

The CNHMC defined Charlestown's community assets exposure to loss as vulnerable populations, the built environment, the natural environment and the local economy (see Figure 3). The overall vulnerability analysis identifies concentration of residents and vulnerable populations in consideration with natural hazards.

a. People

The CNHMC identified growing trends in elderly population, described visiting and seasonal populations, handicapped persons and mobile home residents. The result is an overview of Charlestown's vulnerable at risk populations.

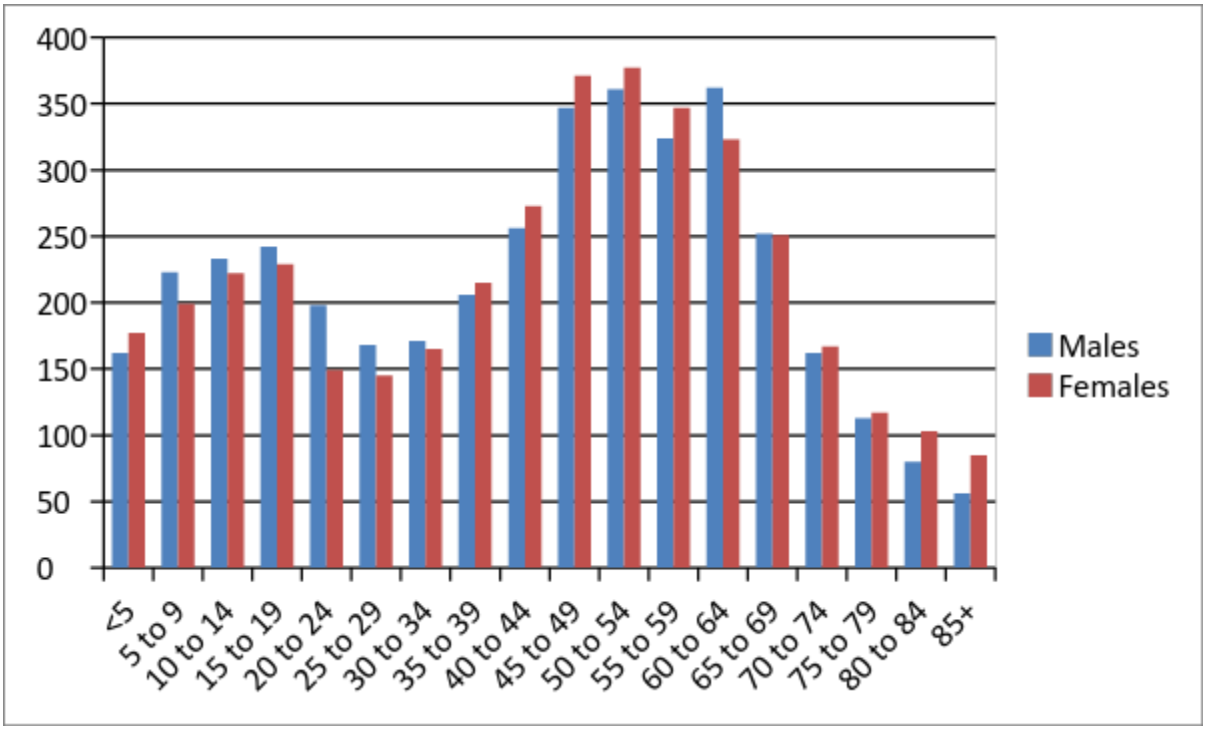
Population Density

The RI Coastal Resources Management Council (CRMC) land use category "Developed Beyond Carrying Capacity" defines lands which were developed at densities above carrying capacity, frequently at one residential or commercial unit per 1/8 to 2 acres. According to this CRMC land use category, the neighborhoods of Ocean Ridge, Charlestown Beach, Cross Mill, Watchaug, Quonochontaug and Shady Harbor have the greatest population densities. This area of land is mostly along the Charlestown coast line but some of the higher population densities can also be found immediately north of Route 1.

Growing Trends in Elderly Population

Figure 12 shows the distribution of the 2010 population by age. The age of residents shows two significant bulges, or waves, reflecting the aging of the post war "baby boom" generation, the subsequent "birth dearth", and then an "echo" or "boomlet", the children of the baby boomers.

Figure 12 Population Distribution Charlestown, RI Census 2010



Charlestown will continue to have an aging population, that is, the median age of Charlestown residents will continue to rise as the "boomers" age. This increase in the percentage of elderly residents will increase local demand for services related to aging, such as medical care, elder-care, and particularly the senior center. In terms of disaster response and preparedness, the elderly and special needs populations are considered to have unique vulnerabilities and may be less able to respond and recover during and after a disaster.

Visiting Populations

The CNHMC defined visiting populations for Charlestown as second home owners and annual visitors to Charlestown's special events. Visiting populations may be less familiar with the local environment and hazards, and less prepared to protect themselves against natural hazards.

Every year the Town of Charlestown Parks & Recreation Department hosts two major events at Ninigret Park (alongside the Ninigret National Wildlife Refuge). This area is vulnerable to coastal hazards and threats, and attracts a large number of concentrated people. The events are the Rhythm & Roots Festival and the Seafood Festival. The yearly average estimate population of the Rhythm & Roots festival event, held Labor Day Weekend, is 4,000 per day for 3-day concert goers. In addition there are 1,500 campers at Ninigret Park and 200 volunteers. The average total population for the Rhythm & Roots festival is 13,700 for this 3-day event. [45]

[45] V. Hilton, Personal communication, 11/9/15

The second major event in Ninigret Park is the Charlestown Chamber of Commerce Seafood Festival, the first weekend of August. The yearly average population count is estimated at 38,000 for daytime guests for the 3-day event, 150 campers and 200 volunteers for an estimated total of 38,350.[46]

Seasonal Population

The town's seasonal population is characterized not only by day visitors, but also by summer vacationers who rent by the week or month, and by residents of nearby states who own second homes in Charlestown.

In 2010, the U.S. Census counted 1,648 seasonal homes or about 32% of the total 5,142 housing units in Charlestown.[47] The total seasonal housing units are located mainly south of Route 1 in the general neighborhood areas of Shady Harbor, Quonochontaug, Cross Mills, Charlestown Beach and Ocean Ridge.

The typical tourist season runs from Memorial Day through Labor Day and continues moderately into the fall. The number of full time residents dramatically reduces in September every year, and increases again in May and June the following year.

Mobile Homes in Charlestown

Manufactured homes designed and installed according to the 1994 U.S Department of Housing and Urban Development (HUD) standards perform much better than older manufactured housing, particularly in areas with higher design wind speeds. However, even new manufactured homes are often damaged by high-wind events. The entire town of Charlestown is in a high wind zone area.

Damage to mobile homes can be grouped into two categories: direct damage to the home itself and damage that results from failures in the home's anchorage system. Although manufactured homes and site-built homes may have similar vulnerabilities to direct damage, some of the vulnerabilities to anchorage failures are unique to manufactured homes.[48]

According to the tax assessor records in 2015, there are 135 mobile homes in Charlestown located in 3 mobile home parks and some individual homes along Ross Hill Road (see Table 14). There are 109 mobile homes built before 1994 and 26 built after the 1994 HUD standards.[49] Mobile home are only permitted in mobile home parks, none of which are located in flood zones. All mobile home parks are in the 110 mph wind zone.

[46] Ibid.
[47] 2010 U.S. Census.
[48] FEMA, Understanding and Improving Performance of New Manufactured Homes During High-Wind Events HSFEHQ-07-J-0007, April 2007
[49] K Swain, Charlestown Tax Assessor, personal communication, November 3, 2015.

Table 14 Charlestown Mobile Homes and Parks

Name of Mobile Home Park	Location	Number of Units
Indian Cedar Mobile Homes	42 Old Mill Road	44
Border Hill	Jacob Perry Drive	54
Land Harbor	Land Harbor	34
Individual Mobile Homes	Ross Hill	3
Total		**135**

Access and Functional Needs Population

The access and functional needs population (group homes handicapped persons living independently) are cared for during emergencies exclusively by the Deputy Director of Charlestown Emergency Management Agency. The Deputy utilizes the RI Department of Health (HEALTH) Special Needs Registry, and the local police and ambulance to prioritize support services (oxygen delivery and accessible transportation) for this population well in advance of a natural disaster. The Deputy has no other duties assigned during the disaster.

According the RI Department of Health Special Needs Registry, Charlestown is home to seven (7) group homes specializing in traumatic brain injuries. The total population for all the group homes is estimated to be around 40 clients. Three of the homes either have a permanent generator or have a generator delivered to shelter in place during a natural disaster. These group homes are located in the following neighborhoods: Charlestown, Carolina, Cross Mills, and Wood River Junction.[50]

Child Care Facilities

The information on Charlestown's child care facilities listed below (Table 15) was compiled from the RI Department of Child and Family Services website. The maximum capacity total refers to the total amount of children allowed at all the facilities according to occupancy rates. Note that two of the six day care facilities are located south of Rte. 1 in the 120 mph wind zone.

Table 15 Charlestown Child Care Facilities

Name of Pre-school Facility	Address	Capacity
Arcadia YMCA at Charlestown School	363 Carolina Back Road	60
Charlestown Early Learning Center	4605 Old Post Road	18
Amy Emond – Day Care Home	4852 South County Trail	6
Hand-in-Hand Child Care Center	4477 South County Trail	32
South County Comm Act	4350 South County Trail	18
St. Andrew Preschool	15 East Beach Road	18
Maximum Capacity Total		**152**

Department of Child & Family Services. (2015, November 19). *RI Child Care Provider Directory*. Retrieved from http://www.dcyf.ri.gov/child_care_provider.php

[50] Dr. Michaud, CEMA Deputy Director, personal communication, November 24, 2015

RIDEM Campground Permit Data

According the RI DEM Parks and Recreation Division, Charlestown's campgrounds had the following number of overnight visitors in 2014 and 2015 (see Table 16).

Table 16 State Facilities in Charlestown

State Facility	2014	2015
Burlingame State Park	48,000	49,600
Charlestown Breachway	6,100	5,200
East Beach State Park	511	462
Total Visitors to State Parks	**54,611**	**55,262**

(RIDEM, personal communication, November 17, 2015)

Disaster Recovery: Health or Social Services

The CNHMC identified the following locations that provide health or social services that are critical to post-disaster response or recovery capabilities (see Table 17). The information on Charlestown's health or social facilities listed below was compiled from the RI Department of Health website. Note that four of the six health care facilities are located south of Rte. 1 in the high wind zone (>120 mph). The police station (4901 Old Post Road) and ambulance rescue station (4891 Old Post Road) are also located south of Rte. 1. Other critical emergency response facilities located in the high wind zone are the Cross Mills Fire Department (4258 Old Post Road), Dunn's Corners Fire Department Station-2 (1 Langworthy Rd, Westerly, RI), and Quonnie Grange (5664 Post Road).

Table 17 Health or Social Services

Name of Facility	Address	License Type
Narragansett Indian Health Center	4533 South County Trail	Allopathic Physician (MD)
South County Professional Treatment Center	4649A Old Post Road	Allopathic Physician (MD) - Psychiatry
Gateway Healthcare/South Shore Center	4705A Old Post Road	Allopathic Physician (MD) - Psychiatry
Stuart V. Demirs, MD Gina Cozzolino Mayo, NPP	4099 Old Post Road	Allopathic Physician (MD) – Internal Medicine Nurse Practitioner Prescriptive
Peter M. Small, MD	4960 South County Trail	Allopathic Physician (MD) – Family Practice
South County Center for Women's Health (South County Hospital)	3769 Old Post Road	Allopathic Physician (MD) – Women's Health

State of Rhode Island Department of Health. (2015, November 19). *Find Healthcare Providers in RI*. Retrieved from http://health.ri.gov/find/providers/

Charlestown Animal Shelter

The federal Pets Evacuation and Transportation Standards Act of 2006 (PETS Act) is intended to ensure that state and local emergency preparedness operational planning addresses the needs of individuals with household pets and service animals following a major disaster or emergency. The PETS Act authorizes FEMA to provide rescue, care, shelter and essential needs for individuals with household pets and service animals, and to the animals themselves following a major disaster or emergency.

The Charlestown EMA Director and the Town of Charlestown provide extra resources to the Charlestown Animal Shelter to mitigate the increased number of pets and families requiring assistance. Charlestown Animal Shelter serves as a temporary shelter for residents who need to evacuate prior to a natural disaster. When Charlestown's resources are overwhelmed, the state helps to mitigate the disaster. The PETS Act is operational when a federal disaster declaration has been made. The declaration serves as a "trigger" that provides for reimbursement for allowable, documented services utilized in an emergency event.

b. Economy

The CNHMC identified major employers, primary economic sectors and commercial centers in Charlestown. Furthermore, the CNHMC assessed the dependencies between the economic sectors and businesses, and the infrastructure needed to support them. The following are specific economic drivers that were important considerations when planning to reduce the impacts of hazards and disasters to the local economy.

In 2014, according to the RI Department of Labor and Training (RIDLT) State of the State (a statistical profile of RI's cities and towns publication) the largest sector of local employment in Charlestown is Accommodation & Food Services, followed by Government, Construction, Health Care and Social Assistance, and Retail Trade.[51]

Charlestown's natural, cultural and recreational resources are the greatest economic assets the town possesses. Its main attractions are its beaches, salt ponds, state parks and woodland scenery, open space, and natural and cultural resources. These need to be protected in order to encourage summer residents to return to Charlestown and to attract vacation and day visitors.

The Town's economy is highly dependent on tourism and associated activities. Charlestown's economy is therefore highly seasonal. The town has several inns, motels, and bed and breakfast establishments that provide both seasonal and year round accommodations. There are several convenience food stores and restaurants, art galleries, gift shops and marinas that serve residents and the tourist population in the summer. Tourism provides employment to local residents, revenues to local merchants and property taxes on seasonal homes to the Town.

[51] *A statistical profile of RI cities and towns*. RI Department of Labor and Training. 2014 RI State of the State.

According to the RIDLT, roughly two thirds of Charlestown residents work outside of Charlestown. Most of these work in either South Kingstown or in Westerly, adjacent coastal communities that have more commercial and industrial employment than does Charlestown. Therefore, natural disasters that impact the south shore can have a significant impact on employment and income in Charlestown even if the event does not directly strike Charlestown.

Apart from the tourism industry, Charlestown has a limited employment base of small businesses. Commercial uses, for the most part, are concentrated in Cross Mills and along Routes 1 and 1A and to a lesser extent Routes 2 and 216. Restaurants and construction contractors are the largest commercial sector businesses in the town. Retail establishments are strategically placed in village centers around the town, especially along Routes 1 and 1A, the town's major transportation arteries.

Outdoor recreation is an important part of the tourism economy. Hiking, bicycling, fishing, hunting, swimming, boating, canoeing, kayaking, star gazing, photography and bird watching are all popular outdoor activities that attract people to Charlestown. Public campgrounds at Burlingame Park and Charlestown Breachway, East Beach Campground and Ninigret Conservation Area (the DEM owned barrier beach) offer over 850 campsites.

The University of Rhode Island, in nearby South Kingstown, is one of the region's major employers and, because it is a state institution, workers there are categorized as state employees. In addition to local government employees, there are also state and federal employees in Charlestown and in neighboring communities staffing federal and state wildlife sanctuaries, parks and research institutions in Washington County.

One growing sector of the local economy is agriculture. New growth in agriculture is attributed to the sprouting interest in agro-tourism, a mechanism for both active farming and natural resource protection. The town's agriculture website lists 35 local farms, most of which are small family owned farms.[52]

At present, the sole manufacturing industry in Charlestown is Kenyon Mill, located on Route 2 alongside the Pawcatuck River. With over 300,000 square feet of processing space and operating three continuous shifts, Kenyon Industries does dyeing, finishing, coating and printing of woven synthetic fabrics. Kenyon also houses research and development facilities to create new, complex fabrics and maintains certified testing laboratories to evaluate fabric, dye and finishing performance.

Aquaculture is another very important local economic activity. According to RIDEM, aquaculture in the state has nearly doubled in the past few years, and the south shore salt ponds have been one of the major focuses for this industry. Aquaculture also contributes to employment and local purchases of equipment and supplies.

[52] http://www.charlestownri.org/

Economic Sectors and Town Infrastructure

Charlestown's tourist season produces both direct and indirect revenues for the town. Motels and inns charge state room tax, a portion of which is retained by the town. Beach parking fees and other recreational fees (except those from state facilities) are collected by the Town and also contribute to the town's general fund.

The Town's main revenue source is from residential property taxes, a significant portion of which is generated by seasonal residents. This is a benefit to Charlestown, since these seasonal residents place a limited demand on town services and facilities and do not make use of the school system.

According to the tax assessor, residential property types far outweigh the number of commercial and industrial properties in Charlestown. Residential property, one family and two to five family homes, contribute the largest percentage (97.8%) of property tax income the town. The commercial and industrial sectors contribute 2.2% of the total income to the infrastructure needed to support them.

c. Built Environment

The built environment includes existing structures, infrastructure systems, critical facilities and cultural resources. The committee identified types of buildings and determined the age and construction type of buildings to determine building codes in effect and quality of construction. Areas of future growth and development were also considered when assessing the built environment.

Existing Structures

Rhode Island adopted the 2000 International Building Code which incorporated new more restrictive criteria for structural design and wind loads. Table 18 presents the built environment pre- and post- 2000 RI Building Code.

Table 18 Charlestown Structure pre- and post-2000 Building Code

Type of Building	Structures Count Pre-2000	Structures Count Post-2000
Commercial	172	20
Industrial	9	0
Residential	5,196	716
Totals	**5,377**	**736**

(Personal communication, tax assessor's office 03/24/16)

Infrastructure and Critical Facilities

Charlestown's infrastructure and critical facilities are structures and institutions necessary for a community's response to and recovery from emergencies. Critical facilities must continue to operate during and following a disaster to reduce the severity of impacts and to accelerate recovery. The CNHMC developed an inventory of the location, construction standards, age and life expectancy of specific critical infrastructure systems and critical facilities. About 50% of the communication towers and critical facilities were established prior to the major revision of the 2000 RI Building Codes.

One of the key infrastructure systems are septic systems with advanced treatment which account for 12% of the types of wastewater treatment systems in Charlestown. Because advanced treatment systems depend on pumps to control the flow of wastewater, they are at risk from loss of operation due to interruption of power. Additionally, Charlestown residents are exclusively dependent on well water. A loss of electricity also results in a loss of access to potable water.

Critical Facilities

In Table 19, the CNHMC identified Charlestown's critical facilities and infrastructures. The CNHMC developed mitigation actions to address any structure that was identified to have risk and vulnerability to natural hazards (see Section 5).

Table 19 Critical Facilities and Infrastructure Systems

Critical Facilities	Infrastructure Systems
Police and fire stations/ Emergency operations center Evacuation shelter Medical Facilities Town Hall (Building Official, Department of Public Works & potable water source) Animal Shelter	Water and wastewater (private) Power utilities (private power company) Transportation (roads, railways, waterways) (public) Communication systems (telephone, cable, Internet and cellular systems)(private companies)

Roadway System

The Town of Charlestown is not on an interstate highway but is approximately five (5) miles from US Route Interstate 95. State highway Route 1 has the most influence on motor vehicle access west to Connecticut and east across southern Rhode Island before it proceeds north. A major arterial, Route 1 divides southern Charlestown from

northern Charlestown. In addition to Route 1, state highway Route 2, a minor arterial, provides Charlestown with its most natural connection north to the towns of Richmond, Exeter, North Kingstown and beyond.

The evacuation routes can be found in Appendix A.

Historic and Cultural Resources

The CNHMC reviewed state and natural historic registries and identified cultural assets in Charlestown. Based on the RI Historical Preservation and Heritage Commission online database, Charlestown has a comprehensive listing of historical and cultural assets (Appendix D). The information in Appendix D locates historic properties along the Charlestown Post Road Historic Corridor. None of these properties are located within the floodplain; however, they are vulnerable to wind events and 7' SLR.[53]

Limitations on Future Development

Drinking water is provided through individually owned wells, with the exception of two private community well systems in the Quonochontaug peninsula. The town relies entirely on onsite wastewater treatment. This reliance on private sewage disposal and private water supply limits the density and location of development. Development is generally prohibited in areas with a high water table, because the soils do not allow on-site systems to function properly.

Much of the remaining undeveloped land in Charlestown that is not protected as open space is zoned for low density – R-2A and R-3A, two and three acre minimum lot areas. When determining overall density of a parcel, all areas of wetlands and wetland buffers are subtracted (not counted towards the minimum area required for each lot). In addition, any subdivision of six or more lots is required to be developed as a cluster subdivision, which results in the protection of at least 40% of the developable land. New housing lots are required to be designed away from wetlands and flood zones.

Land Use and Ownership in Inland and Coastal Flood Zones

With the exceptions of a few small areas in the villages, most of the inland floodplains are sparsely developed. Burlingame Park and Management Area encompasses almost the entire Watchaug Pond floodplain system. The State of Rhode Island owns much of the Great Swamp floodplain area, and the rest is relatively inaccessible. Much of Cedar Swamp/Schoolhouse Pond floodplain is owned by the Narragansett Indian Tribe, the State of Rhode Island or the Town. Many of the remaining areas, including the Pasquiset Pond floodplain are wetlands, where development is strictly prohibited by RIDEM.

Public agencies also own large areas of the coastal floodplain, including Ninigret (East) Beach and Ninigret Park and Wildlife Refuge. The village of Cross Mills generally is

53 RIHPHC National Register, RI properties online 28DEC15, http://www.preservation.ri.gov/register/riproperties.php

outside the flood hazard areas. While there is a considerable amount of beach and coastal area around the salt ponds that has been developed for residential use, there is limited development potential. There have been no major subdivisions or land development projects proposed within the area south of Route 1 for many years, and none are foreseen in the immediate future. Some land has been restricted from development, including 19.7 acres in Cross Mills south of Route 1A, recently purchased by the RI Water Resources Board for potential future water supply. This purchase included the removal of a commercial building complex consisting of a number of post-WW II era buildings on 2.5 acres.

The Town of Charlestown has open space and conservation land in the Special Flood Hazard Areas in town. There is a total of 3,870 acres in the SFHA of which 1,895 acres are open space.

Open Space

Historically, the Town's priority for open space acquisition include the following criteria: serve as groundwater protection, support important habitats, provide opportunities for recreation, preserve farmland, have historic, cultural and scenic qualities and/or are connected to other protected parcels. The use of public bond money and/or grants, as well as conservation easements, may be expanded to apply to areas that are vulnerable to sea level rise, flooding and storm surges, and areas that should not be built on or rebuilt on.

Future Development Recommendation

Future development can be designed in a manner that eliminates or minimizes the risk from natural hazards. Local development and building regulations contained within the subdivision and land development regulations, and the zoning ordinance, as well as the town code of ordinances, can be modified or enacted to achieve the following (focusing on flood and coastal hazard areas):

- Controlling run-off and erosion by limiting impervious surfaces on individual lots
- Strengthening the standards for development in flood hazard areas
- Regulating uses and development standards in high risk areas through use of special overlay districts
- Requiring use of latest GIS modeling of projected sea level rise and storm surge impacts, as well as CRMC's shoreline change maps, when reviewing development proposals in the impacted coastal areas
- Requiring that all new critical public facilities be located outside of hazard areas

d. Natural Environment

Environmental assets and natural resources are important to Charlestown. These assets support the quality of life and the economy through agriculture, tourism, recreation, aquaculture, and a variety of other ecosystem services, such as clean air

and water. The natural environment also provides protective functions that reduce hazard impacts and increase resiliency. In addition, the town has identified and already protects critical habitat areas through local, state and federal legislation and ordinances. The following discussion identifies the most valuable areas that can provide protective functions to reduce the magnitude of hazard events.

Water Resources

Wetlands and riparian areas help absorb flood waters, while soils and landscaping contribute to stormwater management (see http://www.wpwa.org/ for the Wood Pawcatuck Watershed Flood Resiliency Management Plan), and natural undisturbed vegetation provides erosion control and reduces runoff. Conservation of environmental assets may present opportunities to meet mitigation and other community objectives, such as protecting sensitive habitat (salt ponds), developing parks and trails, and contributing to the economy.

According to town data, Table 20 below identifies the most valuable areas (critical habitats) of Charlestown along with the protective function the resource provides to reduce the magnitude of hazard events.

Table 20 Charlestown's Natural Areas

Valuable Natural Area	Function
Barrier Beach/Beaches/Dunes	Reduce storm surge and flooding, wind, waves and storm energy
Forested Lands	Stormwater attenuation
Salt Marshes	Absorb flood waters
Wetlands	Absorb flood waters
Ninigret Park & Wildlife Refugee	Reduce hurricane impacts/ reduce storm surge
Ninigret & Quonochontaug Ponds	Reduce hurricane impacts/ reduce storm surge
Other Coastal Ponds	Reduce hurricane impacts/ reduce storm surge
Shumankanuc Hill quagmire and wet meadow	Stormwater attenuation
Kings Factory Road wet meadow	Stormwater attenuation
Freshwater streams and floodplains	Absorb flood waters
Farmland	Stormwater attenuation

3.4 Risk Analysis and Assessment Matrix

a. Methodology

A vulnerability assessment was completed by the CNHMC to determine the likelihood of adverse impacts associated with specific natural hazards to the built, natural, business and social environments. The CNHMC's findings of risks and vulnerabilities is presented in the Risk Assessment Matrix below (Table 23).

The risk analysis involves evaluating vulnerable assets, describing potential impacts and estimating losses for each hazard. A qualitative scale was created to evaluate and measure the potential losses to the assets at risk. The following vulnerability qualitative scale compares the hazards in terms of likelihood, spatial extent, and potential impact (see Table 21). The four options for likelihood of occurrence were Highly Likely, Likely, Possible or Unlikely. For spatial extent, three options were offered to describe the area which might be affected: Large, Moderate or Small. For potential impact, the choices consisted of: Catastrophic, Critical, Limited or Minor. Table 21 provides the definition associated with each criteria.

Table 21 Vulnerability Qualitative Scale

	Assigned Value	Definition
Likelihood of Occurrence		
Highly Likely	4	Near 100% probability within the next year
Likely	3	Between 10 and 100% probability within the next year or at least one chance in the next 10 years
Possible	2	Between 1 and 10% probability within the next year or at least once chance in the next 100 years
Unlikely	1	Less than 1% probability in the next 100 years
Spatial Extent		
Large	3	More than 50% of area affected
Moderate	2	Between 10 and 50% of area affected
Small	1	Less than 10%of area affected
Potential Impact		
Catastrophic	4	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	3	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one week.
Limited	2	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than one day
Minor	1	Very few injuries, if any. Only minor damage and minimal disruption on quality of life. Temporary shutdown of facilities.

The values assigned for each hazard were added together to arrive at a total vulnerability rating. For example, a hurricane (tropical cyclone) is Likely (3) to occur, with a Large (3) spatial extent (>50% area affected), with a Catastrophic (4) potential impact (> 50% of properties affected). This gives Hurricane (tropical cyclone) a total vulnerability rating of 10 (11 being the highest possible score). This presents hurricane (tropical cyclone) as one of the highest vulnerability hazards to the community's assets.

Table 22 Vulnerability Rating Matrix

Hazard	Likelihood of Occurrence	Spatial Extent	Potential Impact	Vulnerability Rating
Hurricane (Tropical Cyclone)	3	3	4	10
Coastal Flooding	4	1	4	9
Coastal Erosion & Shoreline Change	4	1	4	9
Winter Related	4	3	2	9
Storm Surge	3	1	4	8
High Winds & Thunderstorms	4	2	2	8
Heavy Rains	4	3	1	8
Hail Storms	3	3	1	7
Riverine Flooding	3	2	1	6
Tornado	1	1	3	5
Earthquake	1	2	1	4
Dam Breach	1	1	1	3

Based on the previous risk hazard profiles and the qualitative scale, the following identified hazards have been chosen for a vulnerability analysis. It is important to note that this is based on best available data and represents a base-level assessment for Charlestown. Additional work will be done on an ongoing basis to enhance, expand and further improve the accuracy of the baseline established here.

Charlestown's Natural Hazards

- Flood Related Hazards
  - Coastal Flooding
  - Coastal Erosion and Shoreline Change
  - Storm Surge
  - Heavy Rains and Riverine Flooding
- Wind Related Hazards
  - Hurricane (Tropical Cyclone)
  - High Winds & Thunderstorms
- Winter Related Hazards
  - Snow

- Ice
- Extreme Cold

b. Vulnerability Summary

Identifying the risk and vulnerability of Charlestown to natural hazards is the primary factor in determining how to allocate finite resources to determine what mitigation actions are feasible and appropriate. The vulnerability analysis involves identifying the hazards that potentially threaten Charlestown, 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 hazard impacts.

Vulnerability is made up of the characteristics of a person or group and their situation that influence their capacity to anticipate, to cope with, resist and recover from the impact of a natural hazard. Social vulnerability is determined by various factors such as physical, social, economic and environmental factors or processes that increase the susceptibility of a community to the impact of hazards. Poverty, occupation, social class, ethnicity and inequities in material consumption of a society or community also enhance social vulnerability.

Community Asset: Population

Flood hazards affect residents at both ends of the socio economic scale. Lower income and elderly populations in Charlestown are more susceptible to damage from flood related hazards. Seniors may have limited income and therefore have lower quality homes or homes in disrepair thereby making them vulnerable to the impacts of floods, coastal erosion and/or high winds. Improper sanitation facilities, due to the loss of electricity, during and after a natural disaster will make homes uninhabitable. The cascading effect of loss of electricity from natural disaster impacts can lead to evacuation, loss of wastewater treatment and/or loss of potable water supply. Evacuation can be difficult for elderly who have mobility issues or strength and balance problems.

A second disadvantaged group in Charlestown include a number of traumatic brain injury homes, special needs population, and residents who have oxygen therapy or require medical machines for quality of life. This socioeconomic group is also at higher vulnerability risk due to lower economic status and possible residential location. A third disadvantaged socioeconomic group are the Native Americans. Their vulnerability to the effects of natural disasters is covered under the Narragansett Tribe Hazard Mitigation Plan.

Community Asset: Built Environment

Flooding and associated inundation can cause extensive and expensive damage to coastal and inland properties and small business. Impacts from coastal flooding is immediate for Charlestown. Damages include flooding of coastal properties; road

closures along the coast from wash over; disruption of evacuation, rescue or fire efforts; treacherous driving due to standing water; power outages which disrupt pumps for private drinking water supplies and wastewater treatment; and other public and property damage. Severe infrastructure damage from flooding can result in the loss of tourism dollars.

Electrical utilities and communications, as well as transportation infrastructure, are vulnerable to coastal flooding. Damage to power lines or communication towers have 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.

Inundation from storm surge damages transportation infrastructure including gravel road surfaces, roadway embankment and culverts. Bridge approaches and abutments can be eroded due to high velocity flow. Wind pressures and windborne debris impact traffic poles and equipment, overhead and roadside signs.

Homes built before 2000 building codes may not withstand wind damage and may sustain extreme damage. Intense population density in the coastal zone poses an increased risk to residents south of Route 1 in the FEMA Flood AE and VE Zones. Historical buildings south of Rte. 1 are vulnerable to high wind events and 7" sea level rise (SLR).

Wind damage affects Charlestown and can cause major damage to beachfront properties as well as cause beach erosion from high surf. Properties away from the coast can be affected by power outages and downed trees and limbs. Critical structures that are in the wind zone are the police station, ambulance barn, community center/senior center and the Cross Mills Fire Department (120 mph wind zone). Four of the six health care facilities are located south of Rte. 1 in the high wind zone (>120 mph). Other critical emergency response facilities located in the high wind zone are the Cross Mills Fire Department, Dunn's Corners Fire Department Station-2, and Quonnie Grange.

Mobile homes constructed before 1993 may not withstand hurricane force winds and may sustain extreme damage from a significant wind related disaster. Mobile home residents also tend to be in the lower income bracket. Given that all of Charlestown is in a high wind zone and taking in consideration that some mobile homes were built according pre-US Department of Housing and Development standards, this population is at a higher vulnerability risk than other mobile home residents.

Hurricane (Tropical Cyclone)

There are primarily three components of vulnerability from the impact of a tropical cyclone: 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 Charlestown because the waters can rise to high levels with the potential to cover roads

and bridges completely. If roads are inundated then it can eliminate evacuation routes; this can be of particular concern in frequently flooded areas such as coastal Charlestown.

High Wind and Thunderstorms

Wind vulnerability is based in large part on building construction and standards. Other factors, such as location and condition of the building, and even maintenance of trees in the immediate area play a significant role in determining vulnerability. The location and construction of facilities plays a role in how they are affected by high winds, lightning and hail incidents. Communications and power supplies may be compromised during thunderstorms, and some critical facilities might not be equipped with a backup power source.

Flooding and Repetitive Loss Properties

Charlestown's participation in the FEMA Community Rating System is reducing flooding vulnerabilities as well as homeowner insurance premium costs. From 1978 through 2013, there were 189 paid losses in Charlestown through the National Flood Insurance Program (NFIP) with over $2,606,728 in total payments to policyholders. Between the years of 2005 and 2013, 55 pre-FIRM structures in the special flood hazard area have been voluntarily elevated. As of December 31, 2015, FEMA lists that 747 properties in Charlestown are insured by the NFIP with a total value of approximately $204,949,900.[54]

Community Asset: Natural Environment

Natural resource depletion and resource degradation are key aspects of environmental vulnerability. Charlestown's economy is dependent on a healthy coastal zone and wetlands to attract summer tourists and residents and to continue to provide clean water supply. Wetlands are sensitive to increasing salinity from sea water, and pollution from stormwater runoff containing road salts and oils, fertilizers and pesticides, bacteria and nutrients and sediments.

Many protected natural areas including salt ponds, floodplains and wetlands reduce the risk of flooding in Charlestown. Continued protection of the environment is paramount to preserving wetlands that serve to absorb floodwater, infiltrate and treat stormwater and provide a natural buffer to the negative impacts of natural disasters on the built environment. Better watershed management upstream will reduce flood related problems for Charlestown residents.

The threat to natural areas also comes from increasing building pressure and fragmentation of the natural environment. Inadequate protection of environmental assets will increase vulnerability in natural areas and reduce the natural function of wetlands to reduce impacts from flooding. Fortunately, new development along coastal

[54] RI Emergency Management, NFIP Planner, personnel communication 3/7/16

areas in Charlestown is regulated by Coastal Resource Management Council (CRMC) and the Town of Charlestown. 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.

Coastal erosion can result in serious damage and permanent uninhabitable conditions to residential structures. Furthermore, storm surge can cause extensive damage to coastal property and is a safety hazard during coastal storms and hurricanes. The potential impact to Charlestown from storm surge damage to the coastal beaches and properties including repetitive loss, destruction of on-site wastewater treatment facilities and potential for saltwater contamination to potable water supply.

Winter Related Hazards: Snow, Ice, Extreme Cold

In general, Charlestown does not experience winter weather of the same significance and frequency with which it affects the northwestern areas of Rhode Island. However, effects from winter storms can still be severe. Electric 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. Once the power goes out cascading events begin such as loss of heating source and no wastewater treatment, lack of drinking water and no electricity to power life-saving equipment.

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. 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. Certain medications, medical conditions or the consumption of alcohol can also make people more susceptible to the cold. Secondary impacts may be house fires and carbon monoxide poisoning as people use supplemental heating devices.

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. When utilities are affected and heaters do not work, water and sewer pipes can freeze and even rupture.

Table 23 Risk Assessment Matrix

Rank	What is Vulnerable	Location	Ownership	Natural Hazard	Primary Problem/Effects	Mitigation Benefit	Risk Historic=H Potential=P	Action Item
HIGH	**Coastal properties** **Beaches** **Potable water supply** **OWTS**	South of Rte 1	Public and Private	Storm Surge High Winds & Thunderstorms Coastal Flooding Coastal Erosion/Shoreline Change Climate Change & Accelerated Sea Level Rise	*threat to life safety *loss/damage property & beaches *loss of electrical utility *loss of potable water & wastewater disposal capabilities *increased potential for impact by coastal storms *impacts to groundwater & surface water *loss of emergency communications *impact to health/social services *impacts to visitor population *loss of tax revenue	*protection of life and property *protection of potable water, septic & utilities *reduce contamination to water sources *prevent structural damage to residences and businesses *secure town tax revenue *protection of natural resources *protection of critical infrastructure	H & P	1-7, 15, 17
MEDIUM	**Inland properties** **Potable water supply** **OWTS**	North of Rte 1	Private and Private	Heavy Rain & Riverine Flooding High Winds & Thunderstorms	*loss of tax revenue *loss of life and property *economic and social hardships *septic system failure/leakage *loss of electrical utility *loss of emergency communications *loss of potable water & wastewater disposal capabilities	*protection of life and property *secure tax revenue *reduce contamination to water sources *Prevent structural damage to residences and businesses *protection of potable water, septic & utilities	H & P	1-8, 12, 15
HIGH	**Critical Facilities**	Town Hall Community Center/Senior Center	Public	High Winds & Thunderstorms	*threat to life safety *loss of critical infrastructure *loss of public safety equipment *disruption of emergency services *loss of emergency communications *school disruption *loss of electrical utility *loss of potable water & wastewater disposal capabilities	*protection of life and property *protection of essential services *protection of critical infrastructure *minimize disruption to emergency services *protection of power and communications lines, roads and public safety *maintain municipal services	H & P	10, 11
MEDIUM	**Critical Facilities (other)**	Police Department/EOC Fire/Rescue Depts. Town garage (DPW)						
HIGH	**Transportation Infrastructure**	Old Coach Rd Charlestown Beach Road Route 1A Kings Factory Primary & Secondary/Evacuation Routes Charlestown Breachway	Public and Private	Coastal Flooding Heavy Rain & Riverine Flooding	*loss of life and property *public safety concerns *disrupts evacuation routes *poor drainage *infrastructure damage	*protection of life and property *evacuation routes remain passable *reduce economic hardships *reduce cost to repair transportation infrastructure *increase public safety	H & P	8, 12, 13, 14, 15
HIGH	**Repetitive Loss Properties**	South of Rte 1	Private	Storm Surge High Winds & Thunderstorms Coastal Flooding Coastal Erosion/Shoreline Change Climate Change & Accelerated Sea Level Rise	*threat to life safety *loss/damage property & beaches *loss of electrical utility *loss of potable water & wastewater disposal capabilities *increased potential for impact by coastal storms *Impacts to groundwater & surface water	*protection of life and property *protection of potable water, septic & utilities *reduce contamination to water sources *prevent structural damage to residences and businesses *secure town tax revenue *protection of natural resources	H & P	5, 6, 8, 16
MEDIUM	**Historic National Registered Buildings**	Carolina Village Historic District District Schoolhouse No. 2 Historic Village of the Narragansetts Joseph Jeffrey House Shannock Village Historic District Royal Indian Burial Ground Fort Ninigret Joseph Stanton House/Wilcox Tavern General Stanton Monument Sheffield House Babcock House	Public	High Winds & Thunderstorms	*loss of life *loss of historical properties	*protection of life and property *historic preservation *reduce or eliminate economic and social hardship	P	9
MEDIUM	**Breachway Coastal**	Coastal Salt Ponds	Public	Coastal Erosion/Shoreline Change Storm Surge Climate Change & Accelerated Sea Level Rise	*loss of economiic resource *poor water quality	*improve naviation * improve water quality	H&P	6, 17, 18

SECTION 4.0 – Capability Assessment

4.1 Purpose

The Capability Assessment presents the primary mitigation programs currently in place, and addresses areas for improvement in Charlestown's overall natural hazard mitigation strategy. The purpose of the assessment is to complete the following: 1) to expand on certain capabilities through the passage and enforcement of codes and regulations and 2) to improve mitigation capabilities within departments. The Charlestown Natural Hazard Mitigation Committee (CNHMC) reviewed existing town plans, studies, programs and policies that focus on or include a component of hazard mitigation. This section highlights local capabilities to minimize risk and identifies shortcomings in the policies, programs and regulations.

4.2 Local Government Capabilities and Program Areas

a. Introduction

Several town departments provide services and perform activities which include a component of hazard mitigation, preparedness, response and/or recovery. The Town of Charlestown implements policies and procedures to promote the safety of its residents and minimize risk to community assets. Mitigation activity is generally addressed by the Charlestown Emergency Management Agency, with assistance from the Building/Zoning Official, the Department of Public Works and from several other departments. These other departments include the Town Administrator, Treasurer, Police, Fire and Rescue, Animal Shelter, Town Planner, GIS and Wastewater. The Town's mitigation strategy is also supported by several boards and commissions.

Form of government

The town is governed by Home Rule as allowed by an amendment to the RI state constitution that grants, municipalities and counties the ability to pass laws to govern themselves as they see fit, as long as they obey the state and federal constitutions. The Town of Charlestown has the power to enact ordinances and to make rules and regulations as necessary and for the proper execution of its powers. Such ordinances may be made enforceable by the imposition of fines, forfeitures and penalties.

The municipal government established by the Charlestown Charter is a Council-Administrator government. Town government is directed by a five member town council (Council) that is headed by a council president (President). The President is recognized as head of the town government (chief executive officer) for all ceremonial purposes and by the Governor for purposes of military law (RIGL Title 30, Chapter 20-15, Section 30-15-12).[55] The Council hires the Town Administrator to handle all personnel related issues for the town.

[55] Town of Charlestown Website eCode360 accessed 12/29/15, http://www.ecode360.com/CH1115

The Council has the authority in an emergency that affects the public peace, health, safety, comfort and welfare of the residents, to adopt an ordinance containing a declaration of emergency that takes effect upon its passage.[56] A declaration of emergency allows the Council to establish emergency ordinances and a procedure for refunds for allowable expenditures to handle the emergency and to reduce the losses from the natural hazards as described in Section 3.0.

Local Planning Integration and Regulatory Resources

In Charlestown, as with all cities and towns 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 Commission, Zoning Board and/or Town Council. The members of the Zoning Board are appointed by the Town Council and the Planning Commission is elected by residents. The Planning Department requires environmental reviews from RI Department of Environmental Management, Coastal Resources Management Council, or relevant agencies, and ensures that future development plans reflect the town's highest design and environmental protection standards. Hazard mitigation strategies are incorporated into new and existing subdivision and land use regulations.

In cooperation with state, federal and private organizations, the town has an active land acquisition and protection program which has prevented many vulnerable areas from being developed. According to the Building Official, 10,590 acres of the 23,140 acres in town are protected from development as they are categorized as open space, recreational or otherwise protected. Of the 3,870 acres in the special flood hazard area (SFHA), 1,895 acres are open space.[57]

I. CHARLESTOWN COMPREHENSIVE PLAN

The 2016 updated Charlestown Comprehensive Plan must identify the goals and policies of the municipality for its future growth and development and for the conservation of its natural and cultural resources. To fulfill those goals, the Comprehensive Plan provides a framework for everyday operations within the town. Charlestown has recognized that inclusion of mitigation initiatives (both pre-and post-disaster) into their Comprehensive Plan would not only benefit the community by reducing human suffering, damages and the costs of recovery, but would also help build and maintain sustainability and economic health of the community over the long term. This will also further involve the public in mitigation initiatives for the town.

The Comprehensive Plan goals and policies are related to and supportive of the Charlestown Natural Hazard Mitigation Plan. The updated Comprehensive Plan 2016 will specifically address natural hazards from a long-term planning perspective. For Charlestown, this will include identification of areas and issues related to sea-level rise and climate change, and how these affect coastal and inland flooding and storm

[56] Town of Charlestown Website eCode360 accessed 12/29/15, http://www.ecode360.com/8490022
[57] Town of Charlestown Building/Zoning Official, personal communication, 12/21/15

damage. The revised Comprehensive Plan will also include a future land-use map that clearly identifies natural hazard areas. In general, all natural resources (wetlands, flood plains, coastal areas including barrier beaches) are currently identified and mapped in the Comprehensive Plan. Specific capabilities from the Comprehensive Plan will be identified and referenced in this Natural Hazard Mitigation Plan.

The land-use policies in the Comprehensive Plan discourages development (and redevelopment) within natural hazard areas in flood and velocity zones, and on land with steep slopes over 15%. The Comprehensive Plan identifies land available for expected future growth in areas located outside natural hazards. Those areas identified most at risk also have some of the highest population densities. Increased density is allowed in the historic village areas but directed away from high risk areas.

II. ZONING ORDINANCE

The zoning regulations set forth in the Zoning Chapter 218, are adopted to be consistent with the Town of Charlestown Comprehensive Plan. The regulations are enforced to encourage the most appropriate use of land, with considerations of the natural characteristics of the land and promoting safety from fire, flood and other natural or man-made disasters. The zoning ordinance supports the implementation of the goals and policies of the Town of Charlestown Comprehensive Plan, the Natural Hazard Mitigation Plan and is consistent with the RI CRMC Special Area Management Plan (SAMP).

The zoning ordinance discourages development or redevelopment within natural hazard areas with restrictions on development. These restrictions on development include the town's rezoning procedures which recognizes the importance of protecting natural hazard areas and therefore limits zoning changes in these identified vulnerable areas. Below Route 1, zoning is restricted in the coastal areas to two and three acre zoning. This aligns with the Coastal Resources Management Council's Land Use Classifications of "Lands of Critical Concern" and "self-sustaining lands" in order to protect the salt ponds. Moreover, the zoning ordinance also controls future development in the coastal hazard area.

Additionally, in the zoning ordinance there is a special Flood Hazard overlay that restricts filling floodways and floodplains. There are also restrictions on septic system setbacks from wetlands and floodplains.

III. SUBDIVISION REGULATIONS

The subdivision of land within or adjacent to natural hazard areas are restricted specifically floodplains and coastal features. The subdivision regulations in Charlestown provide for low density "residential compounds" and cluster subdivisions which are mandatory for six (6) or more lots in order to provide open space and direct development to suitable land. While developmental standards in the subdivision regulations account for flood and velocity zones, there are no restrictions against, or

standards guiding, development in areas that will be subject to inundation due to sea level rise.

IV. Wood-Pawcatuck Watershed Association Flood Resiliency Management Plan

The Wood-Pawcatuck Watershed Association (WPWA) has obtained a grant from the US Department of the Interior and the US Fish & Wildlife to establish a regional management plan for the entire watershed. The goals of the project are to:

- Assess the vulnerability of the watershed to the growing risks from flooding, erosion, and associated storm related threats
- Develop a management plan that will protect and enhance the resiliency of the watershed communities from future flood damages
- Improve river and stream ecosystems, including water quality and habitat

Charlestown will utilize the management plan in future land use planning efforts in order to promote resiliency and protection of both manmade and natural systems from flooding. This management plan may provide future mitigation actions for updates to the hazard mitigation plan.

V. Building and Zoning

The Town of Charlestown has a very proactive Building/Zoning Department. Many policies and procedures established in town have been utilized as models for other communities throughout the state.

The Building/Zoning Official is a Certified Floodplain Manager (CFM) and administers the floodplain management for the town and is also the Community Rating System (CRS) Coordinator. The Floodplain Manager continues to investigate pre- and post-disaster financial incentives for mitigation, and distributes public information on the location of hazard-prone areas.

The latest Town Council adoption of the floodplain ordinance was on October 16, 2013 along with the flood insurance rate maps. As Floodplain Manager, he maintains copies of the town's Flood Insurance Rate Maps (FIRMs), both current and historical, within the Building/Zoning Department along with Flood Insurance Studies and Letters of Map Amendment. A FIRM is a map created by the National Flood Insurance Program (NFIP) for floodplain management and insurance purposes. A FIRM will generally show a community's base flood elevations, flood zones, and floodplain boundaries. The Floodplain Manager also has copies of completed FEMA Elevation Certificates on file for buildings constructed in the floodplain, and maintains a log of floodplain inquiries and determinations.

The town implements and enforces the State Building Code and participates in the NFIP through the Building/Zoning Department. The entire State of Rhode Island is under the

latest International Building Code (IBC) and will be adopting the IBC 2015 with Rhode Island amendments in July of 2016.

All building departments in the State are evaluated using the Building Code Effectiveness Grading Schedule (BCEGS). The BCEGS scores the building codes in effect in a particular community and how the community enforces its building codes with special emphasis on mitigation of losses from natural hazards. The BCEGS Score for Charlestown is eight (8). The scale is 1 (best) to 10 (no recognized building code enforcement) and is used for insurance ratings and underwriting purposes. Improving the BCEGS score cannot be done without the State implementing more stringent building code standards acceptable to the Insurance Services Office (ISO).

The Building/Zoning Official provides information to contractors and homeowners on the risks of building in hazard-prone areas, and the benefits of building and renovating to current standards, as well as advising builders on both flood-aversive and flood-proofing measures.

The Building/Zoning Department regularly informs the public about FEMA floodplain maps and other technical information developed by FEMA, state agencies and other qualified institutions to assist the public in understanding the risks and options for mitigation. Additional Floodplain Manager duties include:

- strictly enforcing floodplain standards for structures in VE Zone, Coastal AE and AE Zone and ensuring that areas below the base flood elevations are not used inappropriately after the certificate of occupancy is received
- developing strong criteria for variances to reduce the number issued in marginal locations and strictly enforcing 50 percent substantial improvement requirements
- continuing to educate the public about flooding and the consequences of improperly building a structure in a hazard zone
- working with residents in repetitive loss areas on preparedness, mitigation activities and FEMA grant applications, when applicable

Charlestown's Floodplain Management Program, under the direction of the Building/Zoning Official, continues to work toward the upgrade of the Town's participation in FEMA's Community Rating System. This is done through policies, planning, and regulations to reduce property losses and improve resiliency in coastal zones.

Repetitive Loss Area

There are nine repetitive loss properties in various areas of the flood zones in Charlestown. This number is down from twelve repetitive loss properties. The Building/Zoning Official continues to track and officially remove repetitive properties (RPL AW 501 forms) from the NFIP for properties that have been successfully elevated.

The continual educational outreach program includes all the structures located in the three designated repetitive loss areas.

Rapid Assessment Building Team (RABT)

The Building/Zoning Official formalized a disaster recovery team in cooperation with RI Emergency Management Agency (RIEMA) and Charlestown Emergency Management Agency (CEMA) to coordinate post-disaster procedures. The RABT is convened immediately following a disaster for conducting safety evaluations of buildings. The RABT follows the Applied Technology Council ATC 45 procedures to determine whether damaged or potentially damaged buildings are safe for use or if entry should be restricted or prohibited. This assessment is also used to collect basic storm damage data in support of requests for state or federal disaster declarations. If needed, the Building/Zoning Official can, through mutual aid, borrow other building officials, electrical and/or engineers to assist in the rapid assessment data collection.

VI. CHARLESTOWN EMERGENCY MANAGEMENT AGENCY

The Charlestown Emergency Management Agency (CEMA) is a town department that reports to the Town Administrator. CEMA's directive is to serve the town as described under the Town Charter. The CEMA Director is tasked as the liaison with other municipal departments and with federal and state agencies, including Federal Emergency Management Agency, RIEMA, the RI Department of Health and the RI Chapter of the American Red Cross.

Charlestown, as with many other RI communities, usually elevates a long time public servant to the position of local emergency management director. Since 1980, the current emergency management director has held various positions in town government. As a result, he is able to address specifics to community hazard mitigation including being, personally present for seven (7) local federally declared disasters. Charlestown's local EMA Director is also the current Vice President of the RI Association of Emergency Managers.

Charlestown participates in CodeRED Emergency Notification System which is an emergency alert system that sends out notifications for a variety of different situations. Town officials can notify Charlestown residents and businesses by telephone, cellular phone, text message, or email about time-sensitive emergency situations or important community alerts. The system is capable of sending messages to specific neighborhoods and to the entire town. In addition, the CodeRED Mobile Alert App delivers information from community officials in areas that are subscribed to the CodeRED. Furthermore, national public safety officials and police departments from other municipalities may utilize the system to send messages to targeted geographic areas.

Future uses of CodeRED could include augmenting critical alert messages from the federal government, such as those transmitted through Integrated Public Alert and Warning System (IPAWS). Federal, state, tribal, and local alerting authorities can use

IPAWS and integrate local systems that use Common Alerting Protocol (CAP) standards with the IPAWS infrastructure. IPAWS provides public safety officials with an effective way to simultaneously alert and warn the public about serious emergencies using the Emergency Alert System (EAS), Wireless Emergency Alerts (WEA), the National Oceanic and Atmospheric Administration (NOAA) Weather Radio, and other public alerting systems from a single interface.

In recent years, the CEMA has pursued and received preparedness and mitigation grants. Charlestown has installed hurricane shutters on the police department/emergency operation center, in an effort to harden the structure against the extremes of climate change.

Charlestown Emergency Operation Plan

The updated, adopted, and approved Emergency Operations Plan (EOP) addresses the response to extraordinary emergency situations associated with natural, technological and man-made disasters. The EOP further addresses pre- and post-disaster strategies to deal with the hazards addressed in this plan, such as hurricane and flooding evacuation, public warning and sheltering during natural disasters. The EOP directly addresses three out of four steps in emergency management: preparedness, response and recovery from natural disasters. The Natural Hazard Mitigation plan specifically addresses the fourth step in emergency management, that is, mitigation actions a municipality can take to reduce risk and vulnerabilities. Mitigation activities can reduce or eliminate the need for an emergency response and greatly reduce the recovery period.

VII. GEOGRAPHIC INFORMATION SYSTEM (GIS) DEPARTMENT

GIS maps are used throughout most town plans and programs as a decision making tool, and to illustrate ideas and impacts. Some examples of maps that have been created include: current and future land use, open space and conservation areas, soils and groundwater and Repetitive Loss Area maps. The GIS Department has created maps of stormwater drains and retention ponds for the stormwater management plan. The fire districts have also been mapped and hazard mitigation risk maps have been created. Other special mapping projects include a number of maps related to the salt ponds including dredging plans, eel grass restoration and marsh restoration for Ninigret Pond.

The GIS Department also maintains and updates the zoning map, as needed. The town web-GIS program provides easily accessible GIS data (lot areas, zoning, wetlands, and flood zones) that are very useful for review of land development and subdivision applications under the subdivision regulations. The GIS database includes locations of hazard prone structures and risk areas that are needed during development reviews.

The GIS database includes locations of hazard prone structures and risk areas, which are especially useful in identifying red flags when reviewing development proposals. A

list of historic and cultural resources (Charlestown Historical Society) at risk are also included, and data is provided when requested for any number of purposes, such as acquisition of open space areas, and evaluating areas for public recreation.

Data is also available and provided when requested for any number of purposes, such as acquisition of open space and public recreation. The GIS Department has established an interdepartmental GIS data sharing and retrieval system between the Charlestown Department of Public Works, Tax Assessor, Charlestown Emergency Management Agency, Wastewater and the Building Department to share real time information crucial in recovery.

HARBOR MASTER

The Harbor Master, in conjunction with the appropriate state and federal agencies, is responsible for coordinating all harbor activities related to preparation for, response to and recovery from, storm events affecting the coastal ponds. This is done in communication with the Charlestown Emergency Management Director, the Chief of Police and other town departments heads.

Harbor Management Plan

The Town of Charlestown is presently rewriting the Harbor Management Plan written in 1989. The current plan has interim approval from the CRMC which allows the Town to continue to enact and carry out all harbor management activities, and regulations. The new plan will address storm preparedness in the coastal pond community to prevent the loss of life and property. An objective of the Harbor Management Plan is to have cooperation and integration with harbor and shoreline users to ensure that a coordinated approach is applied to local hazard mitigation activities and programs. Another objective of the Harbor Management Plan will be to properly prepare citizens, boat owners and municipal staff regarding storm events through a completed and enforceable response and recovery plan. The published Harbor Management Plan will be available from the Planning Department in Town Hall.

VIII. WASTEWATER MANAGEMENT

The Town's Onsite Wastewater Management Program is widely recognized as a model for local groundwater protection programs in the state. The Onsite-Wastewater Management Office operate in accordance with the town Wastewater Management Ordinance. To protect Charlestown's groundwater as well as surface water bodies (the town's only potable drinking water source), the town required the inspection of approximately 1,000 septic systems. Failing systems are also identified. Notices of Intent to Enforce and/or Notices of Violation are issued. The Town's cesspool phase-out program has now successfully removed 99.9% of all polluting cesspools in Charlestown and has provided an excellent example for Rhode Island's statewide cesspool removal program.

The Wastewater Management Office sampled nearly thirty drinking water wells in densely developed areas of Charlestown for analysis of septic system related harmful nutrients and bacteria. The Wastewater Manager was an author of a successful $3.25 million grant for Salt Pond Dredging and Resiliency and obtained a separately funded $300,000 to be utilized as Low Interest Loans for the Community Septic System Loan Program (CSSLP), is a grant program that is made available to town residents through its established On-site Wastewater Management Plan.

The Wastewater Manager is responsible for developing and enacting local environmental policies that maintain and restore local ecosystems, and provide protection of groundwater, drinking water, surface water and wetlands/marshes. Ongoing public education is provided by the Wastewater Department through materials on stormwater and wastewater management. The Building/Zoning Official is responsible for on-site wastewater system enforcement, including upgrades to onsite wastewater treatment systems (OWTS) in flood zones and maintaining required setbacks from wetlands and floodplains.

IX. PUBLIC WORKS DEPARTMENT

The Charlestown Public Works Department (DPW) routinely addresses street flooding by regularly cleaning out catch basin and swales to allow unimpeded flow, and to reduce ponding on the roads. Most town roads have been repaired and designed with adequate drainage facilities. The Town has replaced failed catch basins with new pre-cast concrete basins with sumps. These improved materials and methods collect the sand to help maintain stormwater flow. The DPW street sweeping program is initiated in the spring to collect sand and debris to prevent clogging of the catch basins on major access roads only; secondary and residential roads are scheduled by telephone request. The DPW also maintains retention ponds on the Town's right of way.

The primary evacuation routes for Charlestown are Routes 1, 2 and 112 which serve as the principal evacuation roads for adjacent communities that may need to evacuate simultaneously. Many of the north/south arteries in the northern part of Charlestown will be required to carry the majority of the evacuating population. These roads are the only access from the east/west connectors. All evacuation routes have proper signage.

Recent Department of Public Works accomplishments include a major water quality stormwater best management project that is being finalized to address the Total Maximum Daily Load (TMDL) for Green Hill Pond. This project, slated to begin Spring 2016, will divert the water quality volume (first inch of runoff) collected from the catch basin at the intersection of Charlestown Beach Road and Marion Drive from Green Hill Pond to Tom's Pond located at the west end of Marion Drive.

In addition, the Public Works Department (DPW) supports the Stormwater Management and Wastewater Management Programs.

Stormwater Management Plan

Stormwater management for new subdivisions and developments is governed by the Charlestown subdivision regulations. Site plan review requirements include a review of the erosion and sediment control for stormwater runoff. Charlestown adheres to the standards in the RIDEM Stormwater Design and Installation Manual (December 2010, amended 2015) and the RI Soil Erosion and Sediment Control Handbook (revised 2014).

The Town's extensive Stormwater Plan addresses compliance with municipal stormwater (MS4) state and federal regulations which prioritize awareness of the concept of non-point and other stormwater pollution sources. The plan describes Best Management Practices (BMPs) for preventing and mitigating stormwater pollution including public education and outreach, public participation/involvement, illicit discharge detection and elimination, construction site run-off, post construction runoff and pollution prevention/good housekeeping.

Debris Management Plan (2006)

The objectives of the Debris Management Plan are to facilitate and coordinate the removal, collection and disposal of debris following a disaster; to mitigate against any potential threat to the health, safety and welfare of the impacted citizens; to expedite recovery efforts in the impacted area; and to address any threat of significant damage to improved public or private property.

In 2015, a multi-jurisdictional debris management plan was introduced by neighboring communities as part of a Washington County management plan. The new debris management plan will take advantage of economies of scale to remove large quantities of storm related debris at an agreed upon price and selected vendor(s) county-wide. The plan will be customized to the particular conditions, hazards and resources of Charlestown. The plan will also develop a list of resources (resource typing) and create a Request for Qualifications (RFQ) to be used to prequalify debris hauler contractors and debris management contractors for emergency contracting.

X. CAPITAL IMPROVEMENT PROGRAM

Charlestown's departments are eligible for capital improvements project funding, the authority to levy taxes for specific purposes, incur debt through private activities, and/or apply for community development block grants. The fees established through Capital Facilities Impact Fees in the Town Code and are intended to assist in the implementation of the Charlestown Comprehensive Plan and to assess new development of land so as to assure that new development bears a proportionate share of the cost of capital expenditures necessary to provide improvements to public facilities.

The Building/Zoning Official is charged with the administration of the impact fees. Historically, capital funding requests related to hazard mitigation have been geared toward resiliency projects such as the beach pavilions and hurricane shutters for the Police Department/Emergency Operations Center.

Other funding sources

Due to the town's small size and lack of public infrastructure, most of the recovery costs are borne often by private citizens and not by the municipality. Charlestown has a sizeable fund balance to use in case of natural disaster emergencies (approximately 20% of the Town's overall budget). If the tax base is destroyed in a natural disaster the fund balance will be used to rebuild after the storm damage.[58] Charlestown can also incur debt through general obligation bonds and/or special tax bonds for capital expenses.

Through the RIDEM state open space bond program, there is funding available for open space acquisition. Bond money is also made available for mitigation activities through the RI Coastal Resources Management Council (CRMC), RI Statewide Planning Program, and RI Emergency Management Agency (RIEMA).

XI. RI COASTAL RESOURCES MANAGEMENT COUNCIL (CRMC)

In June 2014, the CMRC was awarded $3.25 million in funding from the U.S. Department of the Interior (DOI) for habitat restoration and coastal resilience work in the State's salt ponds. The CRMC is restoring 30 acres of degraded salt marsh habitat within Ninigret Pond salt marsh barrier complex through the beneficial reuse of dredged materials. The CRMC and the Town will also examine opportunities for additional similar projects in Quonochontaug.

The project involved planning dredged materials placed and dispersed on the marsh surface that resulted in elevation of the marsh which enhanced marsh vegetation and increased the lifespan of the marsh complex. The higher elevation will allow the marsh to continue to serve as a buffer to storm surge and provide a storage area for flooding. "The project will improve the resiliency of the region and help it withstand and adapt to the effects of climate change," RI Senator Jack Reed said, "Further, the project will help develop best practices for future marsh restoration projects in Rhode Island and along the Eastern Seaboard."[59]

National Flood Insurance Program (NFIP) and Community Rating System (CRS)

National Flood Insurance Program (NFIP)

The term 100-year flood is used by the National Flood Insurance Program (NFIP) as the basis for insurance requirements nationwide.[60] A 100-year flood is not a flood that

[58] P. Anderson, Charlestown Treasurer, personal communication,10/16/15
[59] http://www.crmc.ri.gov/news/2014_0616_saltpond.html, accessed 12/30/15
[60] National Flood Insurance Program (www.fema.gov), Accessed on 12/30/15

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 main flood recurrence intervals used on the Flood Insurance Rate Maps (FIRM) are shown in Table 24. In those FEMA Special Flood Hazard Areas (SFHA) or velocity zones (VE-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 24 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%

Source: 2014 SHMP RIEMA

NFIP Administration & Permitting

Charlestown entered into the NFIP on July 13, 1972. Currently, Charlestown is in good standing with NFIP and there are no outstanding compliance issues or current violations. The floodplain development regulations meet or exceed FEMA and State minimum requirements. According to the RIEMA NFIP Planner, there are currently 747 policies in force, with a total value of $204,949,900. This information is current as of December 31, 2015. Of those 747 polices, 8 are non-residential. Also of the 747 policies, 473 are in the 100-year flood zone.

The Town of Charlestown's Building Department is charged with floodplain administration for the town. Its goal is to bring as many structures as possible into compliance with the State Building Code and the code's requirement for flood resistant construction. As can be viewed on the town's website and in the Building Department, Charlestown has a very strong outreach program, as public knowledge is the first step in constructing a more resilient community.

The NFIP permitting process starts with a preliminary meeting with the homeowner, contractor, architect and/or engineer involved in the project. At this time a "Plan Review Worksheet" (see Appendix D) is completed informing all parties involved of the regulations they must comply with, including elevation requirements in a flood zone. If a resident is anticipating a project in which they are proposing to stay under the 50% substantial improvement requirement, they are informed of the potential flood insurance ramifications and a flood insurance education package is provided to them to be sure they are properly educated prior to proceeding. After reading the material most residents choose to modify the project to bring the structure into compliance. Once

plans are completed and submitted for review, all permit applications in the floodplain proceed through a rigorous two stage plan review process in which both the plan review staff and Floodplain Manager (Building/Zoning Official) review the application for compliance. Upon issuance of the permit, notes and comments are explained to the applicant and a Flood Zone Affidavit (see Appendix D), signed by the owner/contractor, is required, indicating construction of the building will not move forward until the Building Department receives confirmation by a licensed surveyor that the foundation is in compliance with the elevation requirements.

During the construction process all inspections, as required by the State Building Code are performed with no work proceeding unless corrections are made, if any, to be in complete compliance with the code. A Certificate of Occupancy is not issued until a completed Elevation Certificate is submitted and reviewed by the Floodplain Manager for compliance with the Code's requirement for flood resistant construction.

FEMA recently visited Charlestown with a "Community Assistance Visit" (Appendix D) affirming Charlestown NFIP compliance. The most recent Community Assistance Visit (CAV) was November 13, 2013. Per the recent assessment conducted by FEMA, Charlestown's local ordinances regarding floodplain regulations are compliant with the NFIP minimum standards, and were updated when the new flood insurance rate maps were released in 2013. To maintain compliance to the NFIP and CRS programs, the Town has appointed a national certified floodplain manager (Building/Zoning Official) which will ensure that the Town remains in compliance with NFIP standards.

Community Rating System (CRS)

The Community Rating System (CRS) recognizes and encourages community floodplain management activities that exceed the minimum NFIP standards. Depending upon the level of participation in CRS, flood insurance premium rates for policyholders can be reduced by up to 45%. Besides the benefit of reduced insurance rates, CRS floodplain management activities enhance public safety, reduce damages to property and public infrastructure, avoid economic disruption and losses, reduce human suffering, and protect the environment. Participating in the CRS provides an incentive to maintaining and improving a community's floodplain management program over the years. Implementing some CRS activities can help projects qualify for certain other Federal assistance programs.

On May 1, 2015, the Town was officially accepted into the CRS Program by the Federal Emergency Management Agency. The Town has achieved a Class 7 rating, the first in the State of Rhode Island and the second community to receive such a great rating in the entire Northeast. The Class 7 rating qualifies all property owners with a "standard" flood insurance policy, for a 15% discount on their flood insurance premiums. The Class 7 rating will save property owners in the Town of Charlestown a total of $172,850.00 per year. As more policies are purchased and as premiums increase, so will the savings. The CRS class can be improved by formal adoption of the Natural

Hazard Mitigation Plan and fulfilling the requirements of the other activities in the Program.

Because the Building Department spearheaded the application to FEMA for entry into the Community Rating System (CRS), the staff has a thorough knowledge of the requirements and procedures to maintain and improve our standards that exceed the NFIP requirements.

Education and Outreach

Ongoing public education and information program for the National Flood Insurance Program is accomplished by the local Floodplain Manager and through Community Rating System (CRS) outreach, town website, newsletters (The Pipeline), and through the Wastewater Department Stormwater Management outreach programs.

In 2012, the Building Department sent an information packet to every resident that would be affected by the adoption of the new FIRMs and also held a public informational meeting to field any questions or concerns. Post Superstorm Sandy informational packets were given to property owners containing information on disaster assistance, inspection placards, rebuilding, OWTS repair, drinking water and insurance coverage. The community wide newsletter The Pipeline is distributed to every property owner in town. As part of the public outreach for the CRS program, the June 2014 and the September 2015 issue of The Pipeline, contained the article “Flood Insurance and What You Should Know”. These informative articles addressed the importance of flood insurance and other protection measures. In another recent Pipeline dated June 2015, the article “15% Flood Insurance Discounts!” announced the town’s acceptance into the CRS program.

The Building Department will continue to provide public outreach on storm and flood related topics on a yearly basis. The department also continually provides information about storms, flooding, insurance and resiliency efforts through a large volume of brochures and handouts as well as a large selection of materials on the town’s website.

4.3 Capability Needs and Challenges – Summary

Overall the Town of Charlestown has very good capability to respond to and mitigate the impacts of natural disasters. The existing mitigation program allows for the utilization of various environmental and planning policies, plans and program areas with precise execution and clear inter-departmental communication. Additional needs and challenges are described below.

Comprehensive Plan

Improvements in hazard mitigation planning can be developed through the Comprehensive Plan update and corresponding amendments to zoning and subdivision regulations. Subdivision and land development review include consideration of projected levels of sea level rise (using the latest GIS software online application) within the VE and AE zones. CRMC's shoreline change maps depicting past coastal erosion could also be used in calculating and tracking rate of change to coastal erosion in the design of proposed infrastructure.

The Town could propose to regulate development in potential hazard areas by using special regulations such as a sea level rise (SLR) overlay district to designate high-risk areas and specify the conditions for the use and development of these areas. This action could reduce property losses and improve resiliency in the coastal zone.

The Town should establish a policy of not encouraging or expanding transportation infrastructure in hazard areas. This will be included in the updated Comprehensive Plan and updated in the capabilities assessment of the Natural Hazard Mitigation Plan. Additionally, all improved town capabilities will be listed in this section in future updates of the hazard mitigation plan.

GIS

A GIS capability improvement could include the establishment of a community asset management program. This program would inventory Charlestown's infrastructure in the VE, Coastal AE, and AE Zones including tax assessor data for baseline residential and business values (estimating dollar loss) with current condition of community assets (prior to events) to estimate potential loss in future natural disasters.

Scenario based events could be established to estimate the physical impacts of natural disasters, such as SLR and coastal erosion. Additionally, natural disaster damage data (severity of the event and cost damage) can be recorded in the town's GIS database. This information can be used to assess local vulnerability and develop future mitigation priorities.

Charlestown GIS could also utilize HURREVAC, a hurricane modeling tool to assist the community in tracking hurricanes to assess the potential impact on the community and plan evacuation or other activities in advance of the approaching storm. The Town

currently has available maps of hurricane evacuation routes from RI Emergency Management Agency (see Appendix A).

SLOSH (Sea, Lake and Overland Surges from Hurricanes) is another inundation model used by federal agencies, and available through RIEMA, to determine the potential for storm surge. The National Hurricane Center developed a SLOSH model for Narragansett Bay using the bathymetry of the Bay and the topography of coastal Rhode Island to predict the coastal flooding effect from hurricanes that could be experienced in the region. There were two category zones determined for potential storm surges:

- Category A
    - Category 1 and 2 hurricanes with forward wind speeds up to 40 mph
    - Category 3 hurricanes with forward wind speeds up to 20 mph
- Category B
    - Category 4 and 5 hurricanes and forward wind speeds.

Charlestown Historical Society

The Charlestown Historical Society has a dozen properties listed on the National Register of Historic Properties. The National Flood Insurance Program (NFIP) contains provisions that provide relief for "historic structures" in Special Flood Hazard Areas. However, there are potentially twenty-two (22) other qualifying historical properties not listed on the National Register and, therefore, not protected under the (NFIP) (see Appendix D). It is suggested that a volunteer effort be organized to file the necessary paperwork with the RI Historical Preservation and Heritage Commission to formally place all of Charlestown's historic properties on the federal National Register of Historic Properties.

Campgrounds

The campgrounds of Charlestown are owned and operated by state and federal agencies. However, the 2014 RI State Hazard Mitigation Plan does not provide recommendations or mitigation actions to protect these vulnerable community assets in Charlestown. There is little interagency coordination between the Town and the state and federal managers for campground evacuation and other natural emergency protocols. It is suggested that the State begin a dialog with Charlestown to address and coordinate hazard mitigation for campgrounds as part of the next update to both the State and local hazard mitigation plans.

Potable Water Supply

Charlestown's coastal potable water rely entirely on groundwater supplies that could be impacted by salt water intrusion from sea level rise or coastal flooding. While there are

currently no withdrawal limits on groundwater supplies, the RI Water Resources Board is currently conducting an assessment of safe and sustainable withdrawal rates.[61]

The RI Department of Health recognizes that Charlestown does not have a significant community wide water supply system and that nitrate contaminants are a threat especially south of Route 1.[62] Furthermore, the drinking wells are not protected against road contaminants along Route 1.

The Charlestown Natural Hazard Mitigation Committee (CNHMC) recommends short term educational water conservation initiatives and that studies be conducted for future updates of this plan. There studies could include retrofitting and relocating critical water utilities, increasing water efficiencies through water metering, water loss control, and establishing variable water rates based on actual usage.

Understanding that the Town's drinking water supply is under significant stress in certain areas of Town, the Charlestown Town Council established the "Charlestown Potable Water Working Group" (PWWG) in December 2014.

This focus group, consisting of over 15 diverse representatives of the community has been charged with further identifying impacts the groundwater resource, ascertaining potential mitigation measures, obtaining advisories from state agencies, academics, and town boards and commissions and making recommendation to the Town Council.

The PWWG identified a “Charlestown Coastal Groundwater Protection District” using data published from the RI Coastal Resources Management Council, URI and the RI Department of Environmental Management. The district consists of the Coastal Pond Watershed and contains the highest groundwater Nitrogen concentrations, measured and modeled in Charlestown. The PWWG developed and field posted a Drinking Water Supply Area signage in over 30 areas in the district. Outreach by the PWWG has also included establishing a Town of Charlestown Recommended Landscaper Process to promote best management practices in lawn care and landscaping to protect critically sensitive and impacted groundwater and surface water resources. The PWWG also established additional guidelines and policies in the critical nutrient reduction zones relating to wastewater management.

Climate Change

To identify the impacts to Charlestown’s natural resources and infrastructure from climate change, to consider these impacts in policy decisions, the CNHMC recommends Charlestown coordinate with the CRMC under Climate Change and Sea Level Rise Policy on local climate change issues.

[61] EPA (Environmental Protection Agency). 2012b. *Water Efficiency Strategies*. Available online: http://water.epa.gov/infrastructure/sustain/wec_wp.cfm.
[62] June Swallow RIDOH Water Quality January 14, 2016, personal communication.

Scientific observations and modeling indicate Rhode Island can expect an increase in sea level rise of between three and seven feet by the end of the century. The coastal monitoring work of the late Dr. Jon Boothroyd, coastal geologist at URI, has provided the science needed to plan for future changes in the coastline and to address coastal erosion. In addition, the CRMC adopted Shoreline Change maps in 2007, updated in 2016, and has been working to develop the forthcoming Shoreline Change (Beach) SAMP – which focuses on obtaining the scientific data and information necessary to support policy decisions around coastal erosion and inundation events.

Coordination with Local Business Community

The local business community will have an opportunity to review, discuss and provide comment on this updated natural hazard mitigation plan. Coordination and input from the Charlestown Economic Improvement Commission and Charlestown Chamber of Commerce will be included in future natural hazard mitigation updates.

5.0 Natural Hazard Mitigation Strategy

5.1 Overview

The mitigation strategy recommended by CNHMC includes strengthening existing ordinances in order to achieve infrastructure resiliency. The Charlestown Natural Hazard Mitigation Committee (CNHMC) recommends education outreach to citizens and small business owners to increase awareness and to strengthen civic commitment among the public. In particular, the CNHMC recommends the Town address the impact of sea level rise and climate change in its ordinance amendments. Overall, the mitigation actions reflect a move toward protecting (hardening) critical facilities and infrastructure to be able to recover faster from a natural hazard, and to take proactive measures to protect the community assets and ultimately to reduce risk.

The goals developed by the CNHMC in this plan are to identify the following: natural hazards and risks; existing capabilities; and activities that can be undertaken to prevent loss of life and reduce property damages associated with the identified hazards. The overall strategy for mitigation was conducted by the (CNHMC) in a three step process.

The first step was to investigate natural hazards that affect Charlestown in terms of location, extent, event history and probability of future events. Charlestown's natural hazards are geographically specific. The CNHMC refined the hazard in response to the results of the public surveys. South of Route 1, natural hazards impact the coastal zone and include effects of climate change and accelerated sea level rise. North of Route 1, natural hazards include river flooding, high winds and the effects of climate change.

Next, the CNHMC considered the community's assets. The CNHMC defined the community's assets by the characteristics of the population (at-risk populations), the built environment (existing infrastructure), protected open space (natural resources), and the local tourism economy.

Finally, the Committee evaluated the Town's capabilities in terms of its ability to mitigate natural hazards as they relate to the community's assets. The CNHMC found that the town has relatively low risk because Charlestown is a rural community with a smaller population than in surrounding towns, and has fewer buildings and infrastructure to be at risk. The largest vulnerable area is the changing coastline; the people living along the coast face the greatest impacts from natural disasters.

The results of the CNNMC's have been two-fold: 1) recommendations to increase the Town's mitigation capabilities through improvements in municipal governmental processes and 2) mitigation actions that focus on protecting people and community assets. The mitigation actions identify plans to minimize or eliminate impacts to people, property, and natural resources from natural hazards.

The planning process for infrastructure resiliency is an ongoing process – one that is inherently linked to community planning, zoning and land development regulations,

code development and public input. The need to regularly update and re-strategize resiliency approaches in planning guidance documents is accomplished through the 5-year update of the hazard mitigation plan.

5.2 Mitigation Action Plan

Mitigation actions in the previous planning cycle for the prior FEMA approved plan are either completed, modified to be included in the 2016 mitigation actions or have been removed (see Table 26). The vulnerabilities listed in the Risk Assessment Matrix (Table 23) are addressed in new hazard mitigation actions presented in Section 5.4.

A hazard mitigation action refers to any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazardous conditions. The CNHMC has analyzed many actions to reduce the impacts of hazards identified in the risk assessment. The projects were aligned and prioritized with regards to public input, public health risks, evacuation and mass care considerations, disruption of essential services and potential economic losses to the Town. These actions, which comprehensively address the key issues, combine to create the hazard mitigation strategy to be implemented.

Action items for this plan were further developed via research of successes in other local communities, input from town staff and constituent public outreach. Each mitigation action is briefly described and includes implementation in terms of:

- A brief description
- STAPLEE Priority Score
- Lead and Supporting (responsible parties)
- Timeframe
- Financing Options
- Cost Estimate
- Description of expected mitigation benefits

The actions are intend to be implemented once the plan is approved by FEMA and adopted by the Town Council. The time frame used for this strategy is as follows:

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

The recommended actions include cost estimations and identification of responsible parties to lead the efforts. Other relevant departments/agencies that can offer support to the project are also identified, as well as funding options.

The CNHMC used the following monetary ranges to estimate the cost of the action(s):

- Less than 10,000
- $10,000 - $50,000
- $50,000 - $100,000
- Greater than $100,000

Evaluation/Selection of Mitigation Actions

After reviewing the Town's identified risks and vulnerabilities to natural hazards, the input/feedback from the public workshop and recommendations from town staff, and the local Capability Assessment (See Section 4.0), the CNHMC selected the actions in Section 5.4 to incorporate into the 2016 Update.

Prioritization of Actions

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

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

Documentation of the Process

The CNHMC utilized a Qualitative Prioritization Method (STAPLEE) and Relative Scores to conduct the cost benefit analysis.

STAPLEE Criteria

1. **S**ocial: Is the action compatible with present and future local community needs and values?
2. **T**echnical: Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
3. **A**dministrative: Does the community have the administrative capacity to implement the action?
4. **P**olitical: Is there strong public support to implement and maintain the action?
5. **L**egal: Does the community have the legal authority to implement the action?
6. **E**conomic: Is the action cost-effective?
7. **E**nvironmental: Does the action impact environmental resources, and is the impact positive, negative, or neutral?

The STAPLEE Benefit-Cost Review was employed to prioritize the planning recommendations and mitigation actions. Each planning recommendation and mitigation action was scored against each of the STAPLEE criteria outlined above with a numerical score. These numbers were then totaled and developed into an overall priority score. The ranking of the Priority Score is a guideline for what order the town should begin addressing the identified actions (see Table 25).

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

Table 25 STAPLEE Matrix

April 15, 2016

Action No	Mitigation Action	Social	Technical	Administrative	Political	Legal	Economic	Environmental	TOTAL	Priority: High, Medium or Low
	Develop and Implement Public Education, Outreach and Incentives									
PR1	Increase circulation of Pipeline to realtors, campgrounds, public venues	3	3	3	3	3	3	3	21	High
PR2	Delineate critically impacted groundwater protection zones	2	3	3	3	3	3	3	20	High
1	Implement groundwater protection and conservation of water resources	2	2	2	2	3	2	2	15	Low
2	Sample private wells to determine levels of nitrogen in densely developed areas	1	2	2	2	2	2	2	13	Low
3	Assist homeowners with costs associated with design and installation of OWTS	3	3	2	3	3	3	3	20	High
4	Monitor nitrogen reducing OWTS to reduce nutrients to drinking water	2	2	2	2	3	1	3	15	Low
	Incorporate Hazard Mitigation into Project Review									
5	Create GIS map of drainage system and list of components	3	2	2	3	3	3	3	19	High
6	Use GIS software in project review for projects involving sea level rise	1	2	2	2	2	3	3	15	Low
7	Upgrade, add and enhance existing GIS database after natural disasters	3	3	3	3	3	3	3	21	High
	Open Space									
8	Acquire open space properties subject to natural hazards	3	2	3	1	2	2	3	16	Medium
	Protect Historical Properties									
9	Promote Fortified Program to storm proof historic archeological sites	3	3	2	2	3	2	2	17	Medium
	Resiliency in Existing Infrastructure									
PR3	Evaluate the long term viability through redesign of roads that intersect sea level rise scenarios	2	2	1	2	3	1	3	14	Low
10	Completed installation of hurricane shutter entry door on police station	3	3	3	3	3	3	3	21	High
11	Purchase and install generators at Town Hall and animal shelter	3	1	3	2	3	2	3	17	Medium
12	Upsize culverts on public transportation infrastructure	3	3	2	2	3	3	3	19	High
13	Upgrade bridge and elevate roadway to prevent washout on Kings Factory Rd.	2	2	2	2	3	2	2	15	Low
14	Remove outdated stormwater discharge system on Charlestown Beach Road and replace it with LID BMP	3	3	2	3	3	2	3	19	High
	Floodplain Management									
15	Incorporate No Adverse Impact Floodplain Management policy into local floodplain management programs and municipal plans	2	2	2	2	3	3	3	17	Medium
	Repetitive Loss Properties									
16	Encourage elevation of RLP through state and federal grants	2	2	1	2	3	2	2	14	Low
	Mitigate Environmental Systems to Enhance Natural Protection									
17	Mitigate storm damaged dunes with overwash materials or implement non-structural alternatives to shoreline protection	3	3	2	2	2	3	3	18	Medium
18	Implement dredging of breachway and deltas in ponds to maintain and improve flow	2	2	2	2	2	3	3	16	Medium
	Ordinance and/or plan amendment									
PR4	Develop sedimentation and erosion control plan	2	3	2	2	3	3	3	18	Medium
PR5	Limit the percentage of allowable impervious surface within developed parcels by amending zoning ordinance	1	2	3	2	3	3	3	17	Medium
PR6	Require all new critical facilities to be located outside of flood-prone areas	3	3	3	3	3	3	3	21	High
PR7	Modify subdivision regulations to include easements for fire breaks and installation of concrete water tanks	2	2	2	2	3	3	3	17	Medium

5.3 Planning Recommendations

PR#1: Increase circulation of The Pipeline to realtors, campgrounds, public venues and other affected citizenry. (The Pipeline is a printed and electronic newsletter that is provided by the Town of Charlestown to share critical emergency information with residents and visitors.)

- Priority Score: High
- Lead: Administrator's Secretary
- Supporting: CEMA, Building/Zoning Department, Wastewater Department
- Time Frame: Short Term
- Financing Options: Town Budget
- Cost Estimate: < $10,000/year
- Benefit: Strengthen citizen participation and commitment to disaster recovery processes. Protection of life and property.

PR#2: Based on the work of the Potable Water Working Group, delineate the critically impacted groundwater protection zones and coordinate the implementation of drinking water protection programs and policies related to OWTS, stormwater control, use of fertilizer and responses to sea level rise and climate change through public information materials.

- Priority Score: High
- Lead: Wastewater/Environmental Department, Planning Department
- Supporting: GIS, Administration
- Time Frame: Long Term
- Financing Options: Town Budget, Grants, URI Cooperative Extension (NEMO)
- Cost Estimate: <$10,000
- Benefit: Protect public health safety and welfare by mitigating impacts to potable groundwater resource in critically impacted zones of town.

PR#3: For municipal roads that intersect sea level rise scenarios, evaluate the long term viability by determining necessary redesign requirements to maintain this infrastructure over the long-term.

- Priority Score: Low
- Lead: Public Works Department
- Supporting: GIS
- Time Frame: Long Term
- Financing Options: RIEMA, FEMA, EPA
- Cost Estimate: $10,000 - $50,000
- Benefit: Protect life and property. Reduce areas subject to flooding. Reduce cost of repair to transportation infrastructure

PR#4: Develop sedimentation and erosion control plan in accordance with the RI Soil Erosion & Sediment Control Handbook.

- Priority Score: Medium
- Lead: Planning, Wastewater/Environmental Department
- Supporting: Wastewater Management Commission, Planning Commission, Town Council
- Time Frame: Medium Term
- Financing Options: Staff Time
- Cost Estimate: <$10,000
- Benefit: Reduces property losses and improves resiliency particularly in the coastal zone.

PR#5: Limit the percentage of allowable impervious surface within developed parcels by amending the zoning ordinance to include total lot coverage standards.

- Priority Score: Medium
- Lead: Planning Department and Building/Zoning Department
- Supporting: Planning Commission, Town Council
- Time Frame: Medium Term
- Financing Options: Staff Time
- Cost Estimate: <$10,000
- Benefit: Reduces stormwater runoff and flooding, in developed areas, protects water quality.

PR#6: Through ordinance amendment, require all new critical facilities including emergency operations centers (EOC), police stations, and fire departments to be located outside of flood-prone areas, including the 500-yr floodplain.

- Priority Score: High
- Lead: Building/Zoning Department, Town Council
- Supporting: CEMA, Administration
- Time Frame: Short Term
- Financing Options: Staff Time
- Cost Estimate: <$10,000
- Benefit: Protection of community assets

PR#7: Modify subdivision regulations to include granting of easements for fire breaks and installation of concrete water storage tanks for firefighting purposes.

- Priority Score: Medium
- Lead: Planning Department, Building/Zoning Department

- Supporting: Town Council and Planning Commission
- Time Frame: Long Term
- Financing Options: Staff Time
- Cost Estimate: <10,000
- Benefit: Protect life and property

5.4 Mitigation Actions

Action #1
Pilot projects targeted to the community regarding groundwater (drinking water) protection and conservation of water resources including promoting rain water infiltration and harvesting by the installation of rain barrels, and landscape conservation by reducing impervious cover in critically impacted portions of the Watershed.

- Priority Score: Low
- Lead: Wastewater / Environmental Department
- Supporting: GIS, Wastewater Management Commission
- Time Frame: Long Term
- Financing Options: Budget, Grants, URI and State Agencies
- Cost Estimate: >$100,000
- Benefit: Protection of public health safety and welfare through potable water resource impact mitigation

Action #2
The Town will sample private wells to determine levels of risk in densely developed areas of Charlestown. Groundwater nitrogen concentrations in densely developed areas of Charlestown commonly exceed the EPA action limit for drinking water of >0.5 parts per million (ppm) and in some areas exceed the drinking water thresholds of 10 ppm, representing a public health hazard.

- Priority Score: Low
- Lead: Wastewater / Environmental Department, Wastewater Management Commission
- Supporting: Finance, Administration, RIDEM, RICWFA, RI Housing
- Time Frame: Long Term
- Financing Options: Town Budget
- Cost Estimate: $10,000 - $50,000
- Benefit: Protect public health, safety and welfare through the mitigation of wastewater impacts to the potable groundwater resource. Further, improve the aquatic health of surface water bodies.

Action #3
To assist homeowners with costs associated with the design and installation of updated on-site wastewater treatment system (OWTS), the Town will offer low interest loans to qualifying homeowners under the Community Septic System Loan Program.

- Priority Score: High
- Lead: Wastewater / Environmental Department, Wastewater Management Commission
- Supporting: Finance, Administration, RIDEM, RI Infrastructure Bank (RICWFA), RI Housing
- Time Frame: Long Term
- Financing Options: State Revolving Fund Financing
- Cost Estimate: >$100,000
- Benefit: Protect public health, safety and welfare through the mitigation of wastewater impacts to the potable groundwater resource. Further, improve the aquatic health of surface water bodies.

Action #4
RIDEM requires the use of nitrogen (N)-reducing OWTS in the coastal watershed for all new OWTS installations. Discharge from these systems often exceeds the discharge threshold limits. The Town will establish a program to monitor N-reducing OWTS to facilitate optimization and reduction of nutrients to the drinking water to mitigate public health hazards.

- Priority Score: Low
- Lead: Wastewater / Environmental Department, Wastewater Management Commission
- Supporting: Finance, Administration, GIS
- Time Frame: Long Term
- Financing Options: Town Budgetary Process, Grants
- Cost Estimate: >$100,000
- Benefit: Protect public and environmental health by nutrient reduction of drinking water and surface water bodies in critically impacted zones of town.

Action #5
Create a GIS map of the entire drainage system and list of components.

- Priority Score: High
- Lead: GIS, Public Works Department
- Supporting: Wastewater/Environmental Department, Building/Zoning Department
- Time Frame: Short Term
- Cost Estimate: <$10,000

- Benefit: Reduces property damages and losses. Information to be used in updating the FEMA CRS program.

Action #6
Implement projected levels of sea level rise using the latest GIS software and online application in the planning review for, and development of, public and private projects.

- Priority Score: Low
- Lead: GIS, Planning Department, Building/Zoning Department
- Supporting: Planning Commission
- Time Frame: Medium Term
- Financing Options: Staff Time
- Cost Estimate: <$10,000
- Benefit: Prevents structural damage to residents and businesses.

Action #7
Upgrade existing GIS databases after natural disasters, where applicable.

- Priority Score: High
- Lead: GIS, CEMA
- Supporting: Planning Department, Building/Zoning Department
- Time Frame: Long Term
- Financing Options: Grants
- Cost Estimate: >$100,000
- Benefit: Protection of life and property. Better planning for future natural hazard events.

Action #8
Acquire more open space properties subject to natural hazards and land subject to flood or prone to flooding.

- Priority Score: Medium
- Lead: Town Council, Planning Commission, Conservation Commission
- Supporting: Planning Department, Administration, Land Trust
- Time Frame: Long Term
- Financing Options: Bonds, Grants, Federal and State Agencies
- Cost Estimate: >$100,000
- Benefit: Protects natural resources. Reduces property losses and improves resiliency in coastal zone.

Action #9
Promote the Fortified Program to storm proof historic archeological sites on the National Historic Registry.

- Priority Score: Medium
- Lead: Charlestown Historical Society
- Supporting: RI Historical Preservation & Heritage Commission, National Park Service
- Time Frame: Long Term
- Financing Options: Historical Society volunteers
- Cost Estimate: >$100,000
- Benefit: Provides a balance between historic preservation and mitigation.

Action #10
Complete the installation of hurricane shutter entry doors (Storm Guardian) on the Police Station and Emergency Operations Center (EOC).

- Priority Score: High
- Lead: CEMA
- Time Frame: Short Term
- Financing Options: Proposed FY17 CIP
- Cost Estimate: $10,000 - $50,000
- Benefit: Building resiliency into existing critical infrastructure. Minimize disruption to emergency services. Maintain municipal services. Protect power, communication lines, road and public safety.

Action #11
Purchase and install generators at Town Hall and animal shelter.

- Priority Score: Medium
- Lead: Charlestown Emergency Management Agency (CEMA)
- Time Frame: Short term
- Financing Options: Proposed FY17 CIP, RIEMA, FEMA
- Cost Estimate: >$100,000
- Benefit: Building resiliency into existing critical infrastructure. Minimize disruption to emergency services. Maintain municipal services. Protect power, communication lines, road and public safety.

Action #12
Upsize culverts on public transportation infrastructure, utilizing the Wood Pawcatuck Study to determine which culverts are in need.

- Priority Score: High
- Lead: Public Works Department
- Supporting: Finance, Administration

- Time Frame: Long Term
- Financing Options: Town Budget, RIEMA, FEMA
- Cost Estimate: >$100,000
- Benefit: Protect life and property. Reduce areas subject to flooding. Reduce cost of repair to transportation infrastructure.

Action #13
Upgrade the bridge and elevate the roadway to prevent washout on Kings Factory Road where it crosses Straight Brook.

- Priority Score: Low
- Lead: Public Works Department
- Supporting: Finance, Administration
- Time Frame: Long Term
- Financing Options: Town Budget
- Cost Estimate: >$100,000
- Benefit: Protect life and property. Reduce areas subject to flooding. Reduce cost of repair to transportation infrastructure

Action #14
Remove the outdated stormwater discharge system on Charlestown Beach Road and replace it with a low impact design (LID) best management practice (BMP) stormwater management system.

- Priority Score: High
- Lead: Department of Public Works
- Supporting: Finance, Administration
- Time Frame: Short Term
- Financing Options: CIP FY17 and State Grants
- Cost Estimate: >$100,000
- Benefit: Protection of life and property. Reduce areas subject to flooding. Improve water quality.

Action #15
Incorporate the Association of State Floodplain Managers (ASFPM) “No Adverse Impact Floodplain Management” policy into local floodplain management programs and municipal plans.

- Priority Score: Medium
- Lead: Building/Zoning Department (Floodplain Manager)
- Supporting: Planning Department
- Time Frame: Medium Term
- Financing Options: Staff Time

- Cost Estimate: <$10,000
- Benefit: Supports comprehensive mitigation actions to reduce risks and vulnerabilities that affect Charlestown.

Action #16
Encourage elevation through grants for damaged, repetitive loss properties.

- Priority Score: Low
- Lead: Building/Zoning Department
- Supporting: Planning Commission, RIEMA, FEMA
- Time Frame: Short Term
- Financing Options: Grants
- Cost Estimate: >$100,000
- Benefit: Prevents future flood damage to Repetitive Loss properties and removal from the Repetitive Loss list.

Action #17
Mitigate storm damaged dunes with overwash materials, and as an alternative, implement non-structural alternatives to shoreline protection through the beneficial reuse of dredged materials, per approval of the CRMC.

- Priority Score: Medium
- Lead: Public Works Department, Building/Zoning Department, GIS
- Supporting: Administration, Town Council
- Time Frame: Short Term
- Financing Options: Grants
- Cost Estimate: $50,000 - $100,000
- Benefit: Prevents structural damage to coastal properties.

Action #18
Implement dredging of breachway and deltas in the salt ponds to maintain and improve flow and enhance circulation. Inspection, after a natural disaster, of coastal structures and existing jetties to ensure structural stability.

- Priority Score: Medium
- Lead: Harbor Master, GIS
- Supporting: Administration, Coastal Ponds Commission, RIDEM, CRMC
- Time Frame: Medium Term
- Financing Options: Grants
- Cost Estimate: >$100,000
- Benefit: Ensure the storm surge mitigation effects of the salt ponds.

Table 26 2010/2016 Charlestown Natural Hazard Mitigation Actions Update

2010/2016 Charlestown Natural Hazard Mitigation Plan Action Item Status Report		
2010 Action Item	**Objective/Benefit**	**2016 Status of 2010 Proposed Mitigation Actions**
1	**Incorporate Hazard Mitigation into Project Review**	
	Create Charlestown GIS Database	Added to Capabilities Section "completed GIS locations of hazard prone structures and risk areas to be utilized during development reviews in the comprehensive plan". Modified and added new (2016) Action #7: The GIS Department would like the ability to upgrade, add and/or enhance current existing GIS databases after a natural disasters with future mitigation funding, where applicable.
2	**Develop & Implement Public Education & Outreach**	
	a) Pre- & Post Financial Incentives for mitigation	Implemented and will continue. Added to Capabilities Section "The Floodplain Manager/CRS coordinator continues to investigate pre- and post-financial incentives for mitigation, distribute information on the location of hazard-prone areas, support public & private financial partnerships, continue to sustain and upgrade ISDS systems in flood zones, local boards and officials continue to participate in natural hazards and hazard mitigation trainings, and sustain a complied list of homeowners in self-inspection of their property.
	b) Distribute information on location of hazard-prone areas	
	c) Support Public/Private Partnerships to create financial incentives	
	d) Provide information on ISDS Upgrade Options	
	e) Provide Training Programs for natural hazard mitigation	
	f) Develop a list of appropriate techniques for homeowners	

2010 Action Item	Objective/Benefit	2016 Status of 2010 Proposed Mitigation Actions
3	**Determine Post-Disaster Mitigation Opportunities**	
	a) See Action 5	The Building Official continues to implement these actions. Added to Capabilities Section.
	b) Implement structural & non-structural retrofit programs	
	c) Document areas of destruction & risk post-disaster	
4	**Develop a shoreline overlay**	
	a) Develop a hazard zoning overlay	Completed.
5	**Acquire Land in Hazard-Prone Regions**	
	a) Establish a revenue source to purchase hazard-prone property	Combined and Modified into (2016) Action #8.
	b) Acquire vulnerable properties subject to natural hazard risk	
	c) Identify opportunities for post-disaster open space acquisition in a pre-disaster time frame	
6	**Floodplain Management Program**	
	Establish a FMP; participant in CRS	Completed. Added to Capabilities Section.
6 [sic]	**Incorporate Hazard Mitigation into Project Review**	
	Strictly enforce floodplain standards for structures in V and A zones	Building Official continues to enforce. Added to Capabilities Section.
7	**Provide Public Education Materials**	
	Landscaping to reduce erosion and damage from wind	Completed. Added to Capabilities Section.
	Evacuation maps and signs posted along state roads	Completed. Added to Capabilities Section.
	Building Inspector discusses current regulations and standards on building, renovation and floodplain management	Completed. Added to Capabilities Section.

2010 Action Item	Objective/Benefit	2016 Status of 2010 Proposed Mitigation Actions
8	**Identify Post-Disaster Mitigation Opportunities**	
	Property Acquisition	Modified into (2016) Action #8
	Encourage Retrofit of damage property (repetitive loss properties)	Modified into (2016) Action #17
	Implement non-structural alternatives to shoreline protection (nourishment or dune planting)	Modified into (2016) Action #18
	Build the barrier using sand overwash	Modified into (2016) Action #14
9	**Enhance Public Beach Facilities and Public Access**	
	Develop dune/beach nourishment program for barrier beaches	Modified into (2016) Action #18
	Upgrade public beach facilities	Completed. Added to Capabilities Section.
10	**Enhance Disaster Preparedness**	
	Develop post-storm recovery plan	Completed Established Rapid Assessment Building Team Added to Capabilities Section.
	Formalize Mutual Aid with neighboring towns for post disaster inspections	Completed. Added to Capabilities Section.
	Maintain a disaster recovery team	Completed. Added to Capabilities Section.
11	**Enhance Circulation in Coastal Ponds**	Combined (2010) Action 11 and (2010) Action 12 into new (2016) Action #19
	Evaluate options to improve flow and examine the existing structural integrity of existing jetties	
12	**Improve navigation facilities**	
	Charlestown Breachway	
	Inspect Shoreline Structures to ensure structural stability	

2010 Action Item	Objective/Benefit	2016 Status of 2010 Proposed Mitigation Actions
13	**Incorporate Hazard Mitigation into Project Review**	
	Incorporate BMPs into Public Works improvement projects	Completed. Added to Capabilities Section.
14	**Develop and Implement Public Education and Outreach**	
	Evacuation Routes	Completed.
15	**Determine Post-Disaster Mitigation Opportunities**	
	Document problems with disasters for future mitigation activities	Completed.
	Evaluate the appropriateness of replacing under-sized culverts with adequate culverts	Modified to new (2016) Action #12 (Wood Pawcatuck Study)
	Reevaluate Evacuation Plan	Completed.
	Incorporate adequate drainage facilities for road repair	Modified to new (2016) Action #13
16	**Project Development/Capital Facilities Budget**	
	Incorporate mitigation infrastructure improvements (new subdivisions, repaving of roads) into ongoing and new public works projects	Modified to new (2016) Action #13
17	**Incorporate Hazard Mitigation into Land Development Review**	
	Develop standardized policies for risk area	Completed.
	Maintain adequate fire breaks and access to and within forested area	Modified and added to Capabilities.
	Subdivision and land development plans to include granting of easement for fire breaks and installation of concrete water tanks	Modified and added to Planning Recommendations.
18	**Develop and Implement Public Education and Outreach**	
	Educate public about safe fire practices	Completed (function of fire department).
19	**Improve Fire Fighting Capability**	Completed (function of fire department).

SECTION 6.0 – Moving toward a safe, resilient, and sustainable RI community

6.1 Implementation, Evaluation and Revisions of Plan

Implementation

The Charlestown Natural Hazard Mitigation Committee has assigned a project lead and supporting role for each mitigation action. The CNHMC will meet annually and after every major natural disaster to collect updated information on the action items and/or to add new mitigation actions. If major problems occur with implementation or execution of the action item(s), a special meeting can be convened to adjust the action.

Evaluation

The CEMA director, or designee, will submit an annual progress report on action items to the Town Council. The timing of the annual review should coincide with the Town's annual budget process so any locally funded projects can be considered in the budget process.

Revisions

As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities, and resubmitted for approval within 5 years the Town Council adoption date in order to be eligible for mitigation project grant funding. In order to ensure that the Plan remains current, the CNHMC will meet annually and after a major disaster. The Plan will also be evaluation and updated as funding opportunities arise for the actions and projects identified in the Plan. Any updates will be reviewed and submitted to RIEMA upon local approval to ensure that the state hazard mitigation strategy remains current.

The Town of Charlestown Mitigation Plan will be referenced in the town's Comprehensive Plan for consistency and Capital Improvement Plan (CIP) for potential funding of projects.

6.2 Continued Public Involvement

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

- The approved/adopted Plan will be posted on the Town's web site;
- Hard copies will be available at the Town Hall Clerk's Office and in the Town Library;
- The annual meeting of the Charlestown Natural Hazard Mitigation Committee to review the implementation status of the Plan will be posted/advertised as a public meeting per Town guidelines.
- The Charlestown Natural Hazard Mitigation Committee will include the public in the preparation of the five-year Plan update using public surveys, public workshops, press releases in the local newspaper and Constant Contact.

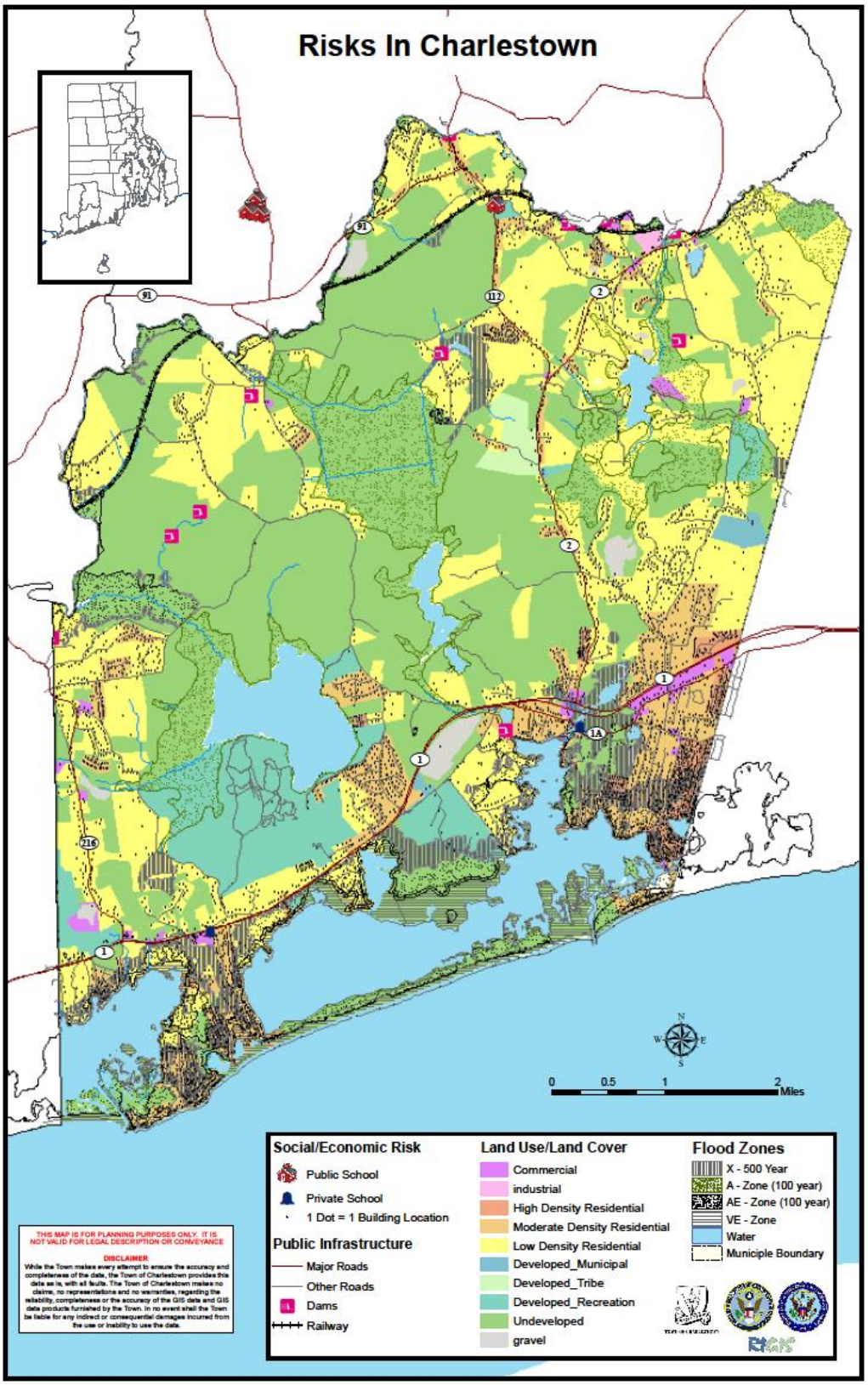
Appendix A – Maps

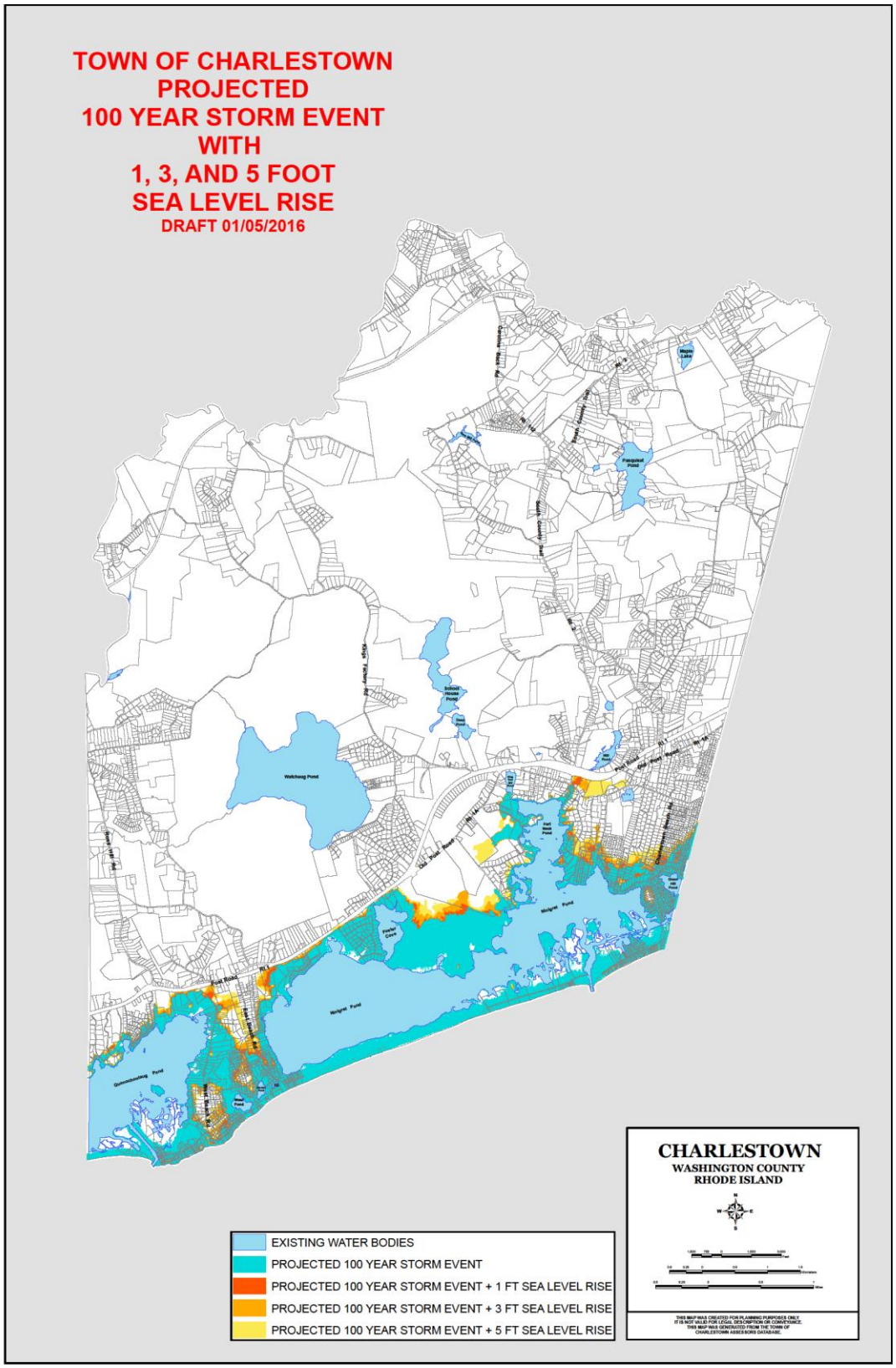
Risks in Charlestown

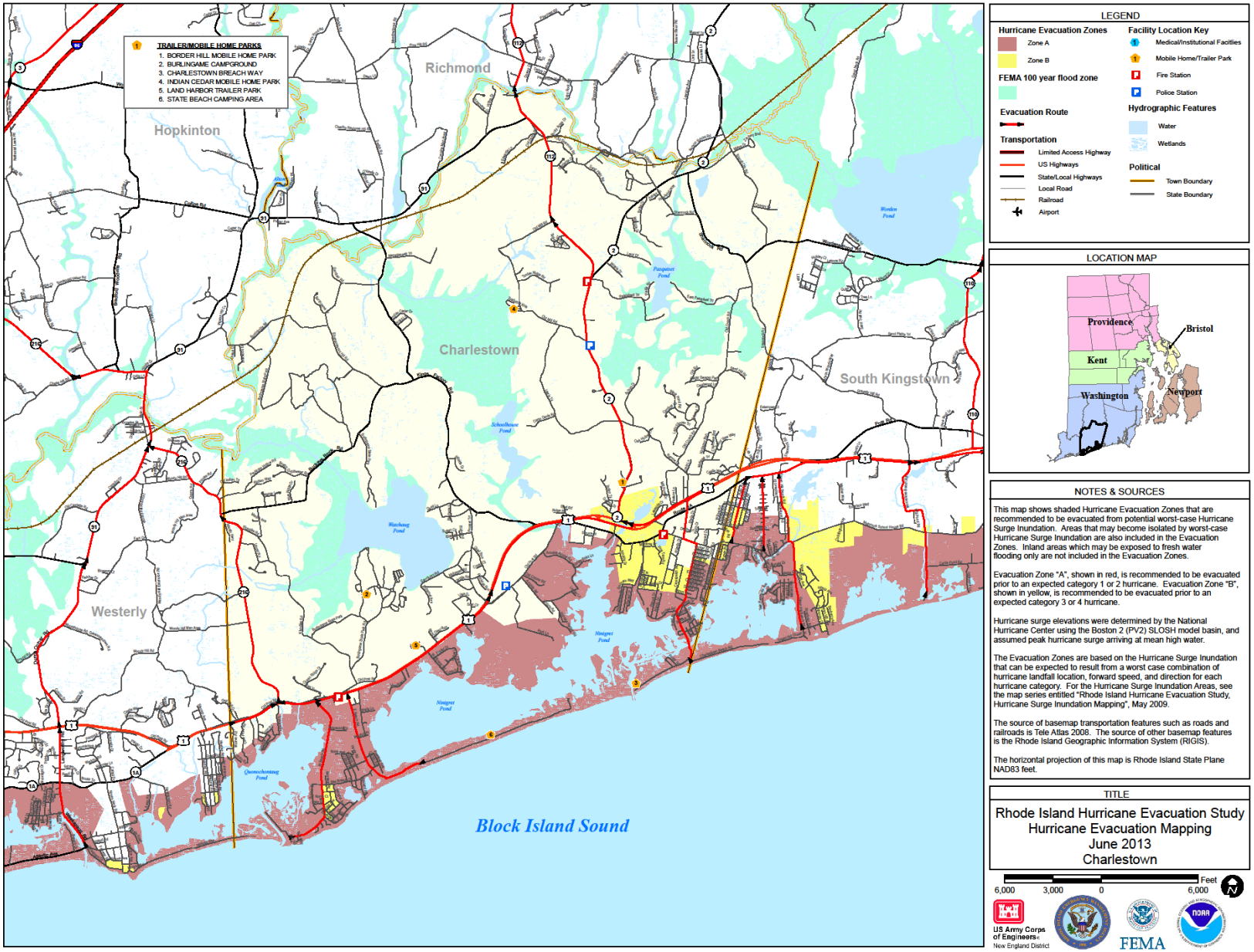
100-year Storm Event with 1', 3' and 5' Sea-Level Rise

RI Hurricane Evacuation Study (Evacuation Route)

2015 Listing of Critical Facilities (Redacted for Homeland Security)


Risks In Charlestown
0 0.5 1 2 Miles
Social/Economic Risk
Public School
Private School
1 Dot = 1 Building Location
Public Infrastructure
Major Roads
Other Roads
Dams
Railway
Land Use/Land Cover
Commercial
industrial
High Density Residential
Moderate Density Residential
Low Density Residential
Developed_Municipal
Developed_Tribe
Developed_Recreation
Undeveloped
gravel
Flood Zones
X - 500 Year
A - Zone (100 year)
AE - Zone (100 year)
VE - Zone
Water
Municiple Boundary
THIS MAP IS FOR PLANNING PURPOSES ONLY. IT IS NOT VALID FOR LEGAL DESCRIPTION OR CONVEYANCE
DISCLAIMER
While the Town makes every attempt to ensure the accuracy and completeness of the data, the Town of Charlestown provides this data as is, with all faults. The Town of Charlestown makes no claims, no representations and no warranties, regarding the reliability, completeness or the accuracy of the GIS data and GIS data products furnished by the Town. In no event shall the Town be liable for any indirect or consequential damages incurred from the use or inability to use the data.


TOWN OF CHARLESTOWN
PROJECTED
100 YEAR STORM EVENT
WITH
1, 3, AND 5 FOOT
SEA LEVEL RISE
DRAFT 01/05/2016
EXISTING WATER BODIES
PROJECTED 100 YEAR STORM EVENT
PROJECTED 100 YEAR STORM EVENT + 1 FT SEA LEVEL RISE
PROJECTED 100 YEAR STORM EVENT + 3 FT SEA LEVEL RISE
PROJECTED 100 YEAR STORM EVENT + 5 FT SEA LEVEL RISE
CHARLESTOWN
WASHINGTON COUNTY
RHODE ISLAND


TRAILER/MOBILE HOME PARKS
1. BORDER HILL MOBILE HOME PARK
2. BURLINGAME CAMPGROUND
3. CHARLESTOWN BREACH WAY
4. INDIAN CEDAR MOBILE HOME PARK
5. LAND HARBOR TRAILER PARK
6. STATE BEACH CAMPING AREA
Richmond
Hopkinton
Charlestown
South Kingstown
Westerly
Block Island Sound
LEGEND
Hurricane Evacuation Zones
Zone A
Zone B
FEMA 100 year flood zone
Evacuation Route
Transportation
Limited Access Highway
US Highways
State/Local Highways
Local Road
Railroad
Airport
Facility Location Key
Medical/Institutional Facilities
Mobile Home/Trailer Park
Fire Station
Police Station
Hydrographic Features
Water
Wetlands
Political
Town Boundary
State Boundary
LOCATION MAP
Providence
Bristol
Kent
Washington
Newport
NOTES & SOURCES
This map shows shaded Hurricane Evacuation Zones that are recommended to be evacuated from potential worst-case Hurricane Surge Inundation. Areas that may become isolated by worst-case Hurricane Surge Inundation are also included in the Evacuation Zones. Inland areas which may be exposed to fresh water flooding only are not included in the Evacuation Zones.
Evacuation Zone "A", shown in red, is recommended to be evacuated prior to an expected category 1 or 2 hurricane. Evacuation Zone "B", shown in yellow, is recommended to be evacuated prior to an expected category 3 or 4 hurricane.
Hurricane surge elevations were determined by the National Hurricane Center using the Boston 2 (PV2) SLOSH model basin, and assumed peak hurricane surge arriving at mean high water.
The Evacuation Zones are based on the Hurricane Surge Inundation that can be expected to result from a worst case combination of hurricane landfall location, forward speed, and direction for each hurricane category. For the Hurricane Surge Inundation Areas, see the map series entitled "Rhode Island Hurricane Evacuation Study, Hurricane Surge Inundation Mapping", May 2009.
The source of basemap transportation features such as roads and railroads is Tele Atlas 2008. The source of other basemap features is the Rhode Island Geographic Information System (RIGIS).
The horizontal projection of this map is Rhode Island State Plane NAD83 feet.
TITLE
Rhode Island Hurricane Evacuation Study
Hurricane Evacuation Mapping
June 2013
Charlestown
Feet
6,000
3,000
0
6,000
US Army Corps of Engineers
New England District
FEMA

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Appendix B –Documentation

Table 27 Significant Heavy Rain/Flooding for Washington County

Table 28 Significant Wind Damage for Washington County

Table 29 Significant Snow Events for Washington County

List of Charlestown National Register of Historic Places

List of Other Historic Properties

Table 27 Significant Heavy Rain/Flooding for Washington County

Date	Rainfall (inches)	Comments
April 1, 1993	Flashflood	Pawcatuck River flooding onto Driftwood Dr.
September 18, 1996	2”-3.5”	Early season coastal storm
December 7, 1996	2”	No damage reported
January 10, 1997	Coastal flood	A new moon in combination with strong SE winds resulted in a 2’-4’ storm tidal surge in Narragansett Bay.
August 29, 1997	2.5”-5”	Extensive flooding along Route 1
November 1, 1997	2”- 3”	No damage reported
February 18, 1998	2”-3.5”	Flooding in poor drainage areas
March 8, 1998	2”-3”	Flooding in poor drainage areas and flood prone property
April 1, 1998	2”	No damage reported
June 13, 1998	6”-8”	Numerous small streams flooded their banks
May 23, 1999	3.15”	No damage reported
September 10, 1999	2”-5”	No property damage reported
September 16, 1999	2”-5”	Several trees downed, no flood damage reported
March 29, 2003	2”-3”	Flooding in poor drainage areas
October 15, 2005	2.5-4.5”	Heavy rain caused flooding across the region and forced some roads to close as a result
October 28, 2006	0 NBV2-4”	Rainfall produced significant urban flooding and caused some minor flooding of rivers and streams
March 2, 2007	2-3”	Snow quickly changed to heavy rain and caused widespread urban and small stream flooding
April 16, 2007	3-5”	Slow moving coastal storm produced heavy rain and gusty winds, minor to moderate coastal flooding
March 8, 2008	2-3”	Heavy rain coinciding with snowmelt caused some river flooding. Along the coast high astronomical tides combined with rough seas and storm surge to produce minor coastal flooding
August 22, 2009	2-4”	Tropical depression cause heavy rain and high surf in the area. Several driveways on Charlestown Beach Road were flooded with ocean waters
March 14, 2010	3-6”	Heavy rain caused flooding of small steams, urban and poor drainage areas. Strong winds associated with the storm also downed trees, limbs and wires
March 29, 2010	5-10”	The Pawcatuck River set a record of nearly 15 ½’ and overflowed its banks in Charlestown closing Route 91 and Shannock Road. Numerous roads and basements were flooded. The entire state was impacted by this event and a Presidential Disaster Declaration was made. It is estimated that there were over $26 million in damages.

Date	Rainfall (inches)	Comments
August 10, 2012	Wind Damage	Southerly winds drew tropical moisture over the area, resulting in very heavy rain in showers and thunderstorms that developed. In addition, strong winds in the upper levels and 30-40 knots of deep layer shear resulted in wind damage with the strongest of these storms
June 7, 2013	3-6”	Three to six inches of rain fell across Washington County. In Charlestown, Route 1, Route 112, Old Coach Road, and Klondike Road all were flooded.
March 30, 2014	2-5”	Anywhere from two to five inches of rain fell across southern New England with the highest amounts falling along the south coast of Rhode Island and Massachusetts. This resulted in flash flooding across much of this area.
July 15, 2015	Flood/Flash Flood	Showers and thunderstorms developed across the area as a result of an upper level disturbance and a cold front. A couple of these slow moving storms resulted in flooding or flash flooding.
July 28, 2015	Damaging winds/heavy rains	A strong upper level disturbance sparked showers and thunderstorms across much of southern New England. A few of these storms became severe, producing damaging winds. Others produced heavy rain that resulted in flooding.

Source: National Climatic Data Center

Table 28 Significant Wind Damage for Washington County

Date	Magnitude (kts or mph)	Comments
January 19, 1996	63 kts.	Minor property damage, scattered power outages
January 27, 1996	55 kts.	No damage reported
February 25, 1996	70 kts.	Scattered power outages due to falling tree limbs, minor property damage
January 13, 1996	64 kts.	Falling trees and limbs caused scattered
October 19, 1996	70 kts.	None reported
March 6, 1997	50-62 mph gusts	Scattered power outages, minor property damage
March 26, 1997	30-40 mph	No damage reported
March 31, 1997	60-70 mph gusts	Scattered power outages
April 1, 1997	35 mph	Scattered power outages
July 25, 1997	30-40 mph gusts	No damage reported
August 21, 1997	60 mph gusts	Scattered power outages, boats sunk and broke loose from moorings
November 1, 1997	68 kts	Scattered power outages
November 27, 1997	50 mph gusts	No damage reported
December 2, 1997	40-50 mph gusts	No damage reported
December 14, 1997	40-55 mph gusts	No damage reported
December 29, 1997	40-55 mph gusts	No damage reported
February 4, 1998	40 mph	Minor beach erosion
February 24, 1998	52 mph gusts	No damage reported
March 9, 1998	40-55 mph	No damage reported
March 21, 1998	35-50 mph	No damage reported
March 26, 1998	35-50 mph	No damage reported
June 27, 1998	35-45 mph	Some small boats capsized, no injuries reported
September 27, 1998	50 kts	No damage reported
November 11, 1998	40-50 mph	No damage reported
November 26, 1998	30-40 mph	No damage reported
January 3, 1999	40-50 mph	Minor damage reported
January 18, 1999	55 mph	No damage reported
March 4, 1999	40-50 mph	Few downed tree limbs
March 22, 1999	40-50 mph	No damage reported
September 16, 1999	50 kts.	No damage reported
October 14, 1999	40-50 mph	No damage reported
October 18, 1999	45-55 mph gusts	No damage reported
November 2, 1999	50 mph gusts	Downed tree limbs, scattered power outages
January 16, 2000	5-55 mph gusts	No damage reported
January 21, 2000	45-50 mph gusts	No damage reported
February 14, 2000	55 mph gusts	No damage reported
December 12, 2000	60 mph	Downed tree limbs and wires
December 17, 2000	60 mph	Downed trees and limbs and power lines
December 30, 2000	40-50 mph gusts	No damage reported
February 10, 2001	45-55 mph gusts	No damage reported
June 11, 2001	50 kts.	No wind damage reported
November 13, 2003	50 kts.	Downed trees and power lines
September 29, 2005	40-60 mph gusts	High winds caused power outages and knocked down trees, limbs, power poles and wires across the region
January 15, 2006	30-35 mph gusts	Strong gusty northeast winds were strongest across the south coast
February 18, 2008	40 mph	Trees, branches and wires were downed by the winds resulting in power outages in some areas
March 8, 2008	50 mph gusts	Multiple tress were downed causing scattered power outages
July 27, 2008	50 kts	Severe with damaging thunderstorms winds and occasional hail

Date	Magnitude (kts or mph)	Comments
December 3, 2009	50 kts	Trees and branches were downed in Charlestown.
January 25, 2010	50 kts	Strong to damaging winds across much of Rhode Island.
March 13, 2010	50 kts	A telephone pole and wires were downed and the door of a backyard shed was torn off in Charlestown
December 27, 2010	55 kts	A strengthening winter storm passed southeast of Nantucket and brought a period of high winds to portions of southern New England, along with heavy snow and coastal flooding.
February 25, 2011	50 kts	Multiple trees were downed on Shumankanuc Hill Road in Charlestown
December 8, 2011	59 kts	A mesonet site in Charlestown recorded a wind gust to 68 mph
January 13, 2012	50 kts	A strong low level jet (up to 80 kts) resulted in high winds across much of southern New England.
August 10, 2012	50 kts	Strong winds in the upper levels and 30-40 knots of deep layer shear resulted in wind damage
October 29, 2012	75 kts	Superstorm Sandy, a hybrid storm with both tropical and extra-tropical characteristics, brought high winds and coastal flooding to southern New England. 70 to 80 mph along coast of Rhode Island
December 27, 2012	53 kts	Low pressure moving up the coast produced a period of strong winds during the early morning hours.
January 31, 2013	50 kts	Strong low level jet (up to 80 kts) resulted in high winds across much of southern New England
February 8, 2013	55 kts	Blizzard of 2013; also produced a prolonged period of very strong winds along RI coasts
November 24, 2013	40 kts	Strong pressure rises behind a cold front coupled with cold air advection resulted in strong to damaging winds across much of southern New England
November 27, 2013	51 kts	Low pressure moving up the coast produced a period of strong winds during the early morning hours
January 11, 2014	40 kts	Strong southerly winds gusting as high as 55 mph ahead of a cold front produced minor damage along the South Coast
October 22, 2014	40 kts	Low pressure moving up the east coast brought a soaking rain and strong winds
November 17, 2014	50 kts	Low pressure moving over southern New England brought heavy rain, strong to damaging winds, and a convective line of showers and thunderstorms to the region
January 9, 2015	51 kts	An upper level disturbance brought strong, damaging winds to southeastern New England.
March 18, 2015	45 kts	An arctic cold front moving into southern New England brought rain and snow showers to the region, followed by strong, damaging winds.
April 4, 2015	41 kts	Strong gusty northwest winds across the region
June 23, 2015	50 kts	Severe Thunderstorms producing strong to damaging winds
June 28, 2015	40 kts	Damaging winds, bringing down trees and wires
July 24, 2015	50 kts	A tree was downed onto wires on Carolina and Nooseneck Roads by thunderstorm winds
July 28, 2015	50 kts	Storms became severe, producing damaging winds
August 4, 2015	72 kts	An amateur radio operator recorded an 83 mph wind gust on an anemometer. A few minutes later reports were received of dozens of trees downed in Burlingame State Park.
September 30, 2015	40 kts	A cold front moved across southern New England bringing heavy rain, strong winds, and periods of coastal flooding along the south coast. Branches and wires were downed throughout Charlestown

Table 29 Significant Snow Events for Washington County

Date	Snowfall (inches)	Comments
January 7, 1996	12”-24”	Schools closed, transportation systems disrupted
February 2, 1996	6”-8”	Difficult travel
February 16, 1996	5”-7”	Highway travel disrupted
March 2, 1996	6”-11”	Many minor accidents reported
April 9, 1996	6”-10”	Heavy wet snow with scattered power outages
April 1, 1997	4”-7”	Heavy wet snow with scattered power outages
February 25, 1999	9”-12”	Hazardous travel, schools closed
March 15, 1999	11”	Poor travel conditions, schools closed
February 18, 2000	3”-5”	None noted
December 5, 2002	6”	No storm damage or injuries reported
February 7, 2003	6”-8”	No major problems reported
February 17, 2003	15”-20”	Storm fell on President’s Day so only minor accidents reported
March 6, 2003	6”-10”	Dozens of minor accidents
December 5, 2003	10”-20”	Major disruption to transportation due to poor visibility
January 27, 2004	4”-8”	No major problems reported
December 26, 2004	6-10”	Powerful winter storm brought heavy snow and strong winds to the region with 50 mph gusts along the coast and numerous accident due to poor visibility and slick roads
January 22, 2005	15-25”	Major winter storm brought heavy snow, high winds and coastal flooding to the area creating near blizzard conditions and making travel impossible at the height of the storm
February 24, 2005	5-8”	Heavy snow
March 1, 2005	4-8”	Heavy snow and gusty winds, no major damage reported
February 12, 2006	9-14”	Nor’easter produced heavy snow and windy conditions.
March 16, 2007	4-7”	Winter storm brought heavy snow and sleet to the area before changing to sleet, freezing rain and then all rain
December 19, 2008	10”	Heavy snow and high winds were associated with this storm
December 31, 2008	5-7”	Fast moving system brought snow along with very cold temperatures, strong winds and bitterly cold wind chills.
March 1, 2009	11-12”	This late season storm affected most of the east coast and resulted in hundreds of flight cancellations as well as numerous car accidents.
December 19, 2009	18”	Snow and wind created blizzard conditions at times across the area and resulted in numerous flight cancellations; school closings and a struggle by plows to keep the roads clear.

Date	Snowfall (inches)	Comments
February 10, 2010	5-8”	Heaviest snow fell across southern RI and was accompanied by strong winds which resulted in numerous downed trees and power lines, knocking out power to many
December 26, 2010	8-12”	High winds brought down wires as this storm brought heavy snow and strong winds to the area along with blizzard-like conditions.
February 8-9, 2013	18”-24”	Blizzard conditions with hurricane force winds, downed trees and power lines
January 2, 2014	7-8”	Heavy snow, bitter cold temperatures, and strong winds
January 21, 2014	3-10”	Strong winds and heavy snow
February 15, 2014	6-9”	Strong winds and heavy snow
January 26, 2015	12” -21”	Blizzard conditions occurred with gusty winds and limited visibilities
February 2, 2015	2”-8”	Snow and gusty winds
February 9 -10, 2015	3-6”	Low pressure moved off the mid-Atlantic coast becoming a Nor’easter as it approached southern New England.
February 14, 2015	5-9”	Blizzard conditions and flooding of coastal areas
February 21, 2015	1-6”	Wintry precipitation
February 24, 2015	2-5”	Accumulating snowfall
March 1, 2015	4-8”	Accumulating snowfall
March 5, 2015	8-12”	Accumulating snow

Source: National Climatic Data Center

Charlestown National Register of Historic Places

Name of Building	When Established	Address	North or South of Rte 1
Joseph Stanton House/Wilcox Tavern and General Stanton Monument	1730	5153 Old Post Road	North
Carolina Village Historic District	1802	Intersection of Rte 112 and Shannock Hill Rd to the north and the intersection of Rte 112 and 91 is the southern limit	North
District Schoolhouse No. 2	1838	Old Post Road, Cross Mills	South
Historic Village of the Narragansetts	1709-1880	Rtes 2 and 112 to the east, Rte 1 to the South, Kings Factory Rd to the west and 91 to the north	North
Joseph Jeffrey House	1709	Rte 112 Town House Road	North
Shannock Village Historic District	1850-1900	Main Street, North Shannock Road and West Shannock Road	North
Royal Indian Burial Ground	18th century and before	Narrow Lane	North
Fort Ninigret	1620 (early archeological excavation 700AD)	Fort Neck Road	South
Coronation Rock	1700's and earlier	Post Road	South
Sheffield House	1685-1713	Quonochontaug	North
Babcock House	1685-1713	Quonochontaug	North
Foster Cove Archaeological Site	5000 years and back further	Vicinity of Rte 1	

Sources:
Charlestown Historical Society, Personal Communications Pam Lyons, 2014 & 2015.

The National Register of Historical Places, RIHPHC National Register, RI properties online 28DEC15, http://www.preservation.ri.gov/register/riproperties.php

Charlestown Planning Board Document, Description of Historic Houses Along the Old Post Rd., Rte 1, Charlestown – Cross Mills Village through the Post Office

Historic and Architectural Resources of Charlestown, RI: A Preliminary Report, RI Historical Preservation Commission 1981

Other Historical Properties

Name of Building	When Established	Address	North or South of Rte 1
The Albert Sission House	1893-1898	4021 Old Post Road	South
The Macomber House	1690, rev 1710	4029 Old Post Road	South
The Blue Parrot Tea Room	1840	4210 Old Post Road	South
The Stagecoach House	1720	4229 Old Post Road	South
Ocean House	1848	60 Town Dock Road	South
Cross Hall	1855	4459 Old Post Road	South
Cross Patch House	1848	10 Town Dock Road	South
First Baptist Church of Cross Mills	1873	4403 Old Post Road	South
First Baptist Church of Charlestown	1840	5073 Old Post Road	South
Hathaways	1863	4470 Old Post Road	South
Capt. Taber House	1840	10 Town Dock Road	South
Card House	circa 1750	4436 Old Post Road	South
Charles Church House	circa 1860	4419 Old Post Road	South
Cross Mills Public Library	1913	4417 Old Post Road	South
Cross Mills Baptist Church	1870	Post Road	South
Samuel Ward House	circa 1840	Old Post Road	South
Stagecoach House	circa 1720	4299 Old Post Road	South
House	1600-1700	4259 Old Post Road	South
1780 House	1780	289 Narrow Lane	South
The Betsy Babcock House	1685	4051 Old Post Road	South
General Stanton Inn	circa 1730	4115 Old Post Road	South
Joseph Stanton House	circa 1730	5193 Old Post Road	North

Sources:

Charlestown Historical Society, Personal Communications Pam Lyons, 2014 - 2016.

Charlestown Planning Board Document, Description of Historic Houses Along the Old Post Rd., Rte 1, Charlestown – Cross Mills Village through the Post Office

Historic and Architectural Resources of Charlestown, RI: A Preliminary Report, RI Historical Preservation Commission 1981

RIHPHC National Register, RI properties online 28DEC15, http://www.preservation.ri.gov/register/riproperties.php

(Complied on 6/10/14; revised 2/11/16)

Appendix C – Public Information and Outreach

Coastal Ponds Management Commission, January 4, 2016

Public Workshop #1: January 28, 2016

Public Workshop #2: April 27, 2016

COASTAL PONDS MANAGEMENT COMMISSION MEETING

Monday

January 4th, 2016

Police Station

4901 Old Post Road

Charlestown, RI

7:30 PM

Call to Order
Roll Call
Minutes
- November 2, 2015

Financial
- Monthly Report
- Budget Review 2016/17

Harbormaster Report

Old Business
- Harbor Management Plan
  - Progress Report
    - DOI Grant Dredging Project Update

New Business
- Hazard Mitigation Plan Presentation
  - Dorian Boardman

Public Comment

Adjournment

The public is welcome to any meeting of the Coastal Ponds Management Council . If communication assistance (readers/interpreters/captions) is needed or any other accommodation to ensure equal participation, please contact (711-364-1240) at least three (3) business days prior to the meeting.
In accordance with Federal law and U.S. Department of Agriculture policy, the Town of Charlestown is prohibited from discrimination on the basis of race, color, national origin, sex, age or disability. (Not all prohibited bases apply to all programs.) To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington DC 20250-0410 or call 800-795-3272 (voice) or 202-720-6382 (TDD).

INTRODUCTION

Background: Education and Experience: RIEMA & CEMA

Why is the plan important to Charlestown?

National Flood Insurance Program/Community Rating System

Class 7: $172,850 annual savings insurance premiums

Class 6: $231, 530 annual savings

Some Federal Mitigation Future Dollars for Mitigation Project previously identified

Mitigation projects must be in plan BEFORE next disaster

RISK ASSESSMENT

Methodology FEMA/RIEMA Regulations/Local Approved HAZMIT Plans

Natural Hazards

Location

Extent (Magnitude/Strength)

Previous Occurrences

Future Probability

Community Assets

Population 55,000 RIDEM campground + 52,000 Ninigret festivals Visitors: 55,000 RIDEM, 52,000 R&R and Seafood

Census Growth in Elderly Population; decline in younger population

Built Environment

High Wind Zone (110 mph/120 mph)

Buildings pre-2000

Commercial + Residential = 5619

Post 2000= 498

Critical facilities & Infrastructure Systems

Police, Fire, Town Hall: Building Official and DPW

Transportation: evacuation and response

Water and wastewater

Natural Environment

Benefits to protection

Economy

Tourism

Risk Assessment Matrix

Vulnerable Areas: the characteristics of the community assets (prioritized) that make them susceptible to damage from a given hazard

Risk : the potential for damage, loss or other impacts created by the intersection of natural hazards with community assets

CAPABILITIES

Local Government Capabilities

Departments/People: Town Council, CEMA, Building/Zoning, Planning, Public Works, GIS

Plans: Wastewater, Stormwater, Comprehensive Plan, Harbor Management Plan, Washington County Debris Management Plan, Capital Improvement Plan

Accomplishments: NFIP/CRS (May 1, 2015); Fuss & Oneil TMDL of Green Hill Pond (culvert/stormwater redirect);2014 RICRMC Habitat Restoration and Coastal Resilience work in the salt ponds

MITIGATION ACTIONS

Committee: risk and vulnerability analysis (risk assessment matrix); basis for mitigation actions

Will be considering projects and actions (and prioritize) to reduce Charlestown's risk and vulnerability

Identified goals and objectives could be met by considering actions aligned to the following:

- Planning and Regulations

- Property Protection, Structural Projects and Maintenance (acquisition, elevation, flood gates, repairs)

- Public Information and Outreach, Incentive Programs

- Emergency Services (Protection of Critical facilities)

- Post Disaster Opportunities

- Community Rating System

Pope's thoughts turn to 'human evil' on New Year's. A7

BRUINS TUMBLE

Montreal soars past Boston at Gillette. B1

WESTERLY THE SUN
SUN PUBLISHING CO. thewesterlysun.com

TODAY

Mostly sunny and very cool, then cold at night. Highs near 40, lows 25-30 Forecast, A8.

WESTERLY, R.I. Saturday, January 2, 2016 $1.0

Hazard panel is updating its plan

Charlestown seeks compliance to keep discounts, funding.

By CATHERINE HEWITT
Sun Staff Writer

CHARLESTOWN — The Hazard Mitigation Committee is in the process of updating of the town's 2010 Natural Hazard Mitigation Plan so the town will continue to qualify for federal disaster funds and flood-insurance discounts.

The Natural Hazard Mitigation Plan is part of the town's comprehensive plan, which is also being updated.

The town is required to update the Natural Hazard Mitigation Plan every five years in order to qualify for Federal Emergency Management Agency funding after a disaster.

In addition, the update is needed to maintain Charlestown's class "7" rating in the National Flood Insurance Program's Community Rating System, which qualified property owners to receive a 15 percent discount on their flood insurance premiums as of May 1, 2015.

"We need to have actions already in the plan in order to receive FEMA dollars when the next incident comes — [the update is] not a requirement if you don't want federal dollars," said Dori Boardman, who chairs the Charlestown Hazard Mitigation Committee. "And, every year the CRS comes out to see how well Charlestown is performing and one of the standards is an

See Plan / Page A6

Plan

From Page A1

approved Hazard Mitigation Plan."

Part of updating the plan involves delineating every aspect of Charlestown's natural hazards, Boardman said.

"We had to identify the natural hazards' locations, impacts, extent or scale of the hazard, previous occurrences, and future probability," she said.

Joseph Warner, Charlestown's building/zoning official and flood-plain manager, who is a member of the Natural Hazard Mitigation Committee, said that the update will include the types of severe storms the area has seen in the past five years and predictions of environmental changes.

"We've had so many different weather events — Sandy, Nemo, nor'easters, the microburst in Burlingame — and we're going to incorporate all of these when we update the hazards," he said. "And we're going to take into account sea-level rise and climate change."

Though the rankings could change, the hazards were categorized into high, medium, and low threats. High threats were coastal erosion and shoreline change, hurricanes, high winds and thunderstorms, heavy snow, nor'easters, ice storms, extreme cold, and blizzards.

Medium threats were climate change and sea-level rise, storm surge, and coastal flooding.

Low threats were lightning, hail, dam breaches caused by flash flooding, extreme heat, and river and/or stream flooding.

Boardman said Charlestown's property assets were also ranked as high, medium, and low-risk, depending on location and type.

"The highest ranking risks are in the coastal areas including the marinas and the critical facilities — the DPW, the fire department, the animal shelter," she said. "The medium risks were the inland properties, commercial properties, state- and federal-owned properties, beach pavilions, and historic national registered buildings."

The town roads were considered lower risks because they are well-maintained by Charlestown's Department of Public Works, she said.

The committee's next steps include developing mitigation actions and community policies out of the risks that will reduce the effects of natural hazards.

Depending on the future needs of the town, the Natural Hazard Mitigation Plan will continue to transform with every five-year update, Boardman said.

"We learn a lot with every disaster," she said. "This is a living document, it's constantly changing, and part of why it's a five-year update is priorities change, goals change, and things come up that need to be addressed, so it's definitely an evolving plan — it's not just a dust-collector."

Boardman has also sent out two natural-hazard mitigation surveys to town residents, but said she is seeking more comments from the public.

"I do need the public input — the public is a very important part of the process," she said.

Residents can contact Boardman at Charlestown Town Hall at 401-364-1200 or by email at dboardman@charlestownri.org.

chewitt@thewesterlysun.com

FOR IMMEDIATE RELEASE

Charlestown Emergency Management Agency
4540 South County Trail
Charlestown, RI

Kevin Gallup, Director
Sara Michaud, Deputy Director

CHARLESTOWN, RI. – Tuesday, January 05, 2016 - The Charlestown Natural Hazard Mitigation Committee (CNHMC) is updating the local natural hazard mitigation plan. A public meeting to review the draft Charlestown Natural Hazard Mitigation Plan (Plan) is scheduled for Thursday, January 28, 2016 from 4:00pm to 5:00pm in the Cross Mills Public Library located at 4417 Old Post Road, Charlestown.

During the meeting, the public is invited to make comments and/or suggestions. An emergency management official will be on hand to answer questions. All comments received from the public will be documented and considered for inclusion in the Plan.

According to Dori Boardman, Chair of the CNHMC, the Plan is a process designed to reduce the loss of life and property during time of natural disaster events.

"This Plan is being completed through a cooperative effort of town officials," Boardman said. "Once it meets approval of Town Council and the public, it will be submitted to the RI Emergency Management Agency (RIEMA) for review and comment then will be given to the Federal Emergency Management Agency (FEMA) for final review."

Boardman says the Plan is designed to mesh with and support RIEMA's statewide Hazard Mitigation Plan (2014). This will help increase coordination between local, state, and federal agencies during times of disaster. In addition, by completing a hazard mitigation plan, Charlestown is entitled to apply for future federal relief dollars to fund specific mitigation projects, continue to provide reduced insurance premiums through the Community Rating System (CRS) Program, and reduce and/or eliminate vulnerabilities resulting from disaster events throughout Charlestown.

Please visit http://www.charlestownri.org click Town Departments, then on drop-down menu click Building/Zoning Official's page to see a draft copy of the committee's Risk Assessment Matrix; an integral component of the draft Plan.

Charlestown,RI

Search

4540 South County Trail, Charlestown RI 02813

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Hazard Mitigation Committee

Thursday, January 28, 2016 at 4:00 PM

Cross Mills Public Library, Old Post Road

Town of Charlestown, RI

Natural Hazard Mitigation Plan Update
Public Workshop
January 28, 2016
Cross Mills Library

Why Hazard Mitigation Planning?

- Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future disaster mitigation grants"
- Reduce or eliminate long-term risk to life, property, and the environment
- Four stages of Emergency Management
- Public Participation and Input

Charlestown Local Hazard Mitigation Committee

- Mark Stankiewicz, Town Administrator
- Pat Anderson, Treasurer
- Joe Warner, Building/Zoning Official, Floodplain Manager
- Jane Weidman, Town Planner
- Kevin Gallup, Charlestown EMA Director
- Matt Dowling, Wastewater Manager
- Steve McCandless, GIS Specialist
- Jess Stimson, State Hazard Mitigation Officer
- Dori Boardman, Chair Hazard Mitigation Committee

Mitigation process

- Assess Community's Risk
- Establish Goals
- Identify Actions & Projects
- Submit plan for local, state and federal approval
- Update & Maintain Plan

What we have accomplished...

- **Community Risk from Natural Hazards**
  - Hazard Identification
  - Hazard Event Profiles
  - *Identify Community Assets*
  - Assess Risks and Determine Vulnerabilities
- Assess Community Capabilities
- Preliminary Mitigation Measures

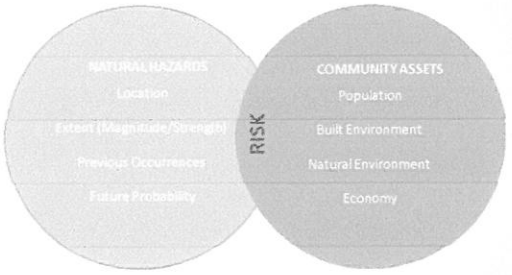
Hazards Affecting Charlestown

- Flood Related
  - Coastal Flooding
  - Coastal Erosion
  - Heavy Rains
- Wind Related
  - Hurricanes
  - Storm Surge
  - High Winds & Thunderstorms (Micro-burst)

Hazards Affecting Charlestown

- Climate Change
  - Sea-level rise has been observed and will likely continue
  - Heat waves will increase in intensity, duration and frequency, predisposing large regions to severe droughts
  - Severe weather hazard frequency is likely to decrease, but intensity of hazards may increase.
  - Hurricane impacts are expected to worsen and normal paths and regions of formation are likely to change

Community Risk from Natural Hazards



Note: Modified from FEMA Local Mitigation Planning Handbook, March 2013. & U.S. Geological Survey and Oregon Partnership for Disaster Resilience Models.

Hazard Vulnerability Assessment

- Economic and Social Vulnerability
  - At risk populations like seniors and seasonal populations
- Historical and Cultural Resource Areas
  - Many historical and cultural resources are not listed on the Historic National Registered Buildings
- Public Infrastructure and Critical Infrastructure
  - Transportation Infrastructure: Charlestown Beach Road
  - Loss of electricity leads to loss in heat/cooling, drinking water supply and septic system functionality
- Repetitive Loss Structures
  - Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the NFIP within any 10-year period since 1978
  - According to the Building Official, Charlestown has nine repetitive loss structures

What we have accomplished…

- Community Risk from Natural Hazards
  - Hazard Identification
  - Hazard Event Profiles
  - Identify Community Assets
  - Assess Risks and Determine Vulnerabilities
- **Assess Community Capabilities**
- Preliminary Mitigation Measures

Develop Goals and Objectives Mitigation Goal…

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

Develop Goals and Objectives Mitigation Objectives…

- Informing citizens and business owners how to protect themselves, their property, and their livelihood
- Building resiliency through upgrades in the Town's built environment and municipal systems
- To achieve a robust infrastructure that can withstand impacts of hazards without significant damages or lack of function
- To the extent feasible, elevate repetitively damaged structures

Develop Comprehensive Range of Actions and Projects

- Public Education and Awareness
- Property Protection
- *Natural Resources Protection*
- Structural Projects

What we have accomplished…

- Community Risk from Natural Hazards
  - Hazard Identification
  - Hazard Event Profiles
  - Identify Community Assets
  - Assess Risks and Determine Vulnerabilities
- Assess Community Capabilities
- **Preliminary Mitigation Measures**

Preliminary Mitigation Measures

PUBLIC EDUCATION AND AWARENESS

- *Increase circulation of The Pipeline, and registration in Code RED and RI* Department of Health Special Needs Registry
- Outreach to residents to keep storm drains clear of debris in front of their homes
- Public outreach regarding evacuation procedures, routes and notifications
- Encourage FORTIFIED Home Program, a voluntary, hazard specific standard that adds protection upgrades to building code requirements.

PLANNING AND PREVENTION

- Implement good floodplain management techniques into the comprehensive plan
- Provide zoning incentives for building above the required freeboard minimum
- Consider projected sea-level rise in the planning for and development of future public and private projects

Preliminary Mitigation Measures

NATURAL RESOURCE PROTECTION

- Consider open space acquisition in special flood hazard areas and conservation easements when practicable
- Complete GIS stormwater mapping to better understanding flooding
- Assist homeowners with the cost of upgrading on-site wastewater treatment systems
- Collect data on drinking wells to determine the extent of risk to groundwater by nitrogen concentrations

STRUCUTRAL PROJECTS

- Purchasing emergency generators for critical facilities
- Requiring all new critical facilities located outside of flood-prone areas

Preliminary Mitigation Measures

Additions?

Next Steps…

- Refine preliminary mitigation measures
- Conduct a cost/benefit review of the measures
- Submit final draft copy to public and other municipalities
- Finalize and submit to the RI Emergency Management Agency
- Receive comments from RIEMA, edit plan accordingly and submit to the Federal Emergency Management Agency for final approval
- Adoption by the Charlestown Town Council

Contact Us…

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

Dori Boardman
Chair, Natural Hazard Mitigation Committee
Town of Charlestown
4540 South County Trail
Charlestown, RI
dboardman@charlestownri.org

THANK YOU!

Superstorm Sandy 2012

Superstorm Sandy 2012

Charlestown Natural Hazard Mitigation Plan Update

Public Workshop

Cross Mills Public Library Conference Room
4417 Old Post Road, Charlestown

Sign-in Sheet

January 28, 2016

Name	Email Address	Phone
Frances Topping	fmtopping@gmail.com	401 364 8002
Michael T Vaughan	vaughanmt93@gmail.com	401-207-4250
Catherine Hewitt	chewitt@thewesterlysun.com	401-340-0221
Bonnie Van Slyke (Town of Charlestown)	bonnie.vanslyke@charlestownri.org	401/419-4828

Workshop provides outlet for officials to share Charlestown mitigation plan

Published: January 29, 2016 | Last Modified: January 29, 2016 08:26AM

By CATHERINE HEWITT Sun Staff Writer

0 Comments

CHARLESTOWN — With climate change and sea level rise increasing the dangers of natural hazards along Rhode Island's shoreline, town officials are taking action to make sure the community is prepared.

Natural Hazard Mitigation Committee Chair Dori Boardman led a public workshop on the town's Natural Hazard Mitigation Plan at Cross' Mills Library Thursday afternoon. The workshop provided an opportunity to educate the public about updates to the plan, which is currently in draft form, and to ask for public input as required by Federal Emergency Management Agency.

"The plan is used to reduce or eliminate risks to life, property and the environment," Boardman explained.

Charlestown's natural hazards include coastal flooding and erosion, heavy rains, hurricanes, storm surge, high winds, thunderstorms and microbursts.

A newly identified natural hazard for Charlestown is climate change, which is quite different from other categories, Boardman said.

"Climate change is a hazard that spreads out over time — it's not quick like a hurricane or a flood, it's really gradual change," she said.

Boardman said, quoting CRMC Director Grover Fugate, that sea levels could rise 12 inches in the next 20 years.

"That could have a lot of impact on our coastal properties — a lot of vulnerability along our coastline," she said.

Other hazards related to climate change include heat waves, increased intensity of severe storms and worsening hurricane impacts.

In assessing Charlestown's vulnerabilities, Boardman identified at-risk populations such as seasonal visitors, a population that can increase by 10,000 each summer, and seniors.

"The population in Charlestown according to the 2010 census is 7,800 and the elderly population is expected to increase," she said.

The town's public and critical infrastructure, such as police and fire facilities, is considered less vulnerable because the buildings are relatively new and are located out of flood-prone areas.

However, the town is highly vulnerable to a loss of electricity, which leads to larger problems such as lack of drinking water and septic-system malfunctionality. The town needs to look at increasing its facilities for clean water during power outages, Boardman said.

"If you look at what the town does, it opens up the town hall for drinking water," she said. "So, that facility needs to become more robust and we need to mitigate those actions so that water is available for people to use."

Through outreach to residents, the town is working to increase public education and awareness of natural hazards, Boardman said.

"'The Pipeline' newsletter goes out to every citizen — it has a lot of critical information about what to do in natural disasters," she said. "I'd like to increase the circulation to include the campgrounds and the senior center."

Boardman also encouraged the audience to register with Code RED, which notifies residents in the event of emergency situations. She also recommended the FORTIFIED Home Program, which is a voluntary hazard-specific building standard that adds protection upgrades to homes.

View more Spotted photos!

Community Calendar

Today's Events

Community Calendar

Community Artists Program
10 a.m. - 4 p.m. Charlestown

Basic Computer Instruction
2 p.m. - 3 p.m. Charlestown

Yoga for Beginners
4 p.m. - 5:15 p.m. Charlestown

Stargazing Nights
6 p.m. - 11:30 p.m. Charlestown

The next steps toward approval of the plan include submitting the draft to the Rhode Island Emergency Management Agency, receiving comments back and editing the plan accordingly.

After that, the plan will be submitted to FEMA for final approval, and the final step will be adoption by the Town Council.

Planning Commission member Frances Topping, who attended the workshop, said she was pleased that the Hazard Mitigation Committee had taken a proactive approach to the town's future risks and needs. .

"It's great that they're looking into potential hazards and hazard mitigation with a long-term vision in mind," she said.

Town Councilor Bonnie Van Slyke, who also attended, said she thought the plan was thorough and that the committee had done a great job.

"The amount of work that's gone into it is obvious — it's very impressive," she said.

chewitt@thewesterlysun.com

Back to LatestNews

Top Stories of the Week

Finding solace in the fight: Dorian Murray, family raise awareness ...

WESTERLY — Dorian Murray loves chocolate, meatballs and sausage-and-bacon pizza from Domino's. He has tons of Legos and more than a thousand Pokemon trading cards. ... *more* ...

Westerly officials say town gave lifeguard service free to a ...

WESTERLY — The town provided more than $30,000 worth of lifeguard services for free over a period of two-and-a-half summers to the owner of a ... *more* ...

Suspended Chariho High teacher returns to work ...

WOOD RIVER JCT. — A Chariho High School English teacher returned to work Monday after a two-week unpaid suspension resulting from an off-color video he ... *more* ...

It's been quite the journey ...

PAWCATUCK — Doug Holland spent most of his adult life beating himself up with alcohol and drug abuse. After

Music Together
9:30 a.m. - 10:30 a.m. Westerly

... View all of today's events

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FOR IMMEDIATE RELEASE

Charlestown Emergency Management Agency
4540 South County Trail
Charlestown, RI

Kevin Gallup, Director
Sara Michaud, Deputy Director

CHARLESTOWN, RI. – Monday, April 18, 2016 - The Charlestown Natural Hazard Mitigation Committee (CNHMC) is updating the local natural hazard mitigation plan. A public informational meeting on the Charlestown Natural Hazard Mitigation Plan (Plan) is scheduled for Wednesday April 27, 2016 from 6:00 pm to 7:00 pm in the Cross Mills Public Library located at 4417 Old Post Road, Charlestown.

During the meeting, public comments and/or suggestions are welcome and an emergency management official will be on hand to answer questions. All comments received from the public will be documented and considered for inclusion in the Plan.

According to Dori Boardman, Chair of the CNHMC, the Plan is a process designed to reduce the loss of life and property during time of natural disaster events.

"This Plan is being completed through a cooperative effort of town officials," Boardman said. "Once it meets approval of the Town Council and the public, it will be submitted to the RI Emergency Management Agency (RIEMA) for review and comment, then the Plan will be submitted to the Federal Emergency Management Agency (FEMA) for final review."

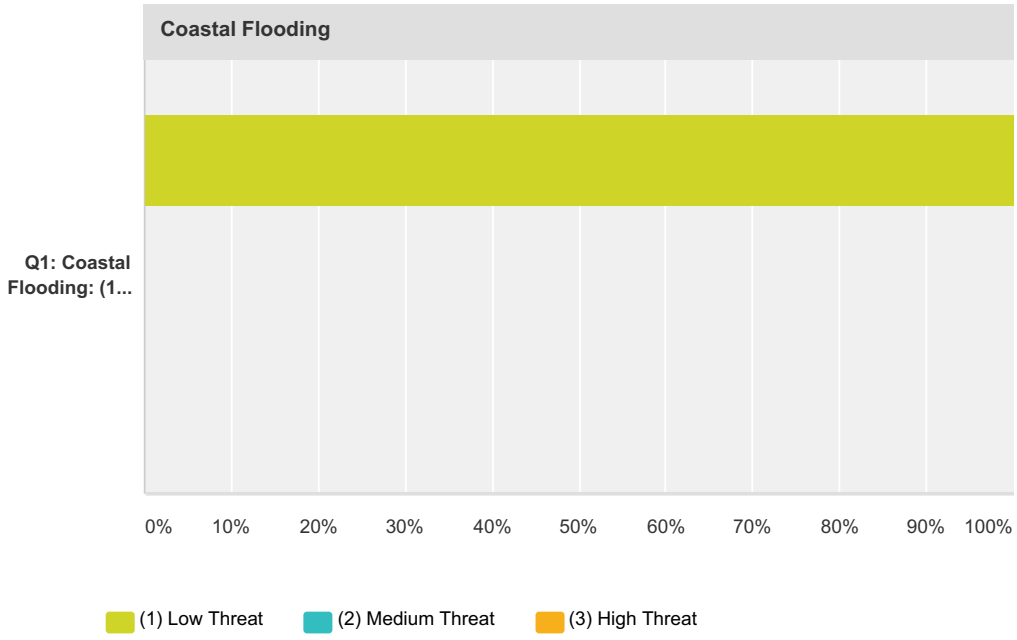
Ms. Boardman states that the Plan is designed to mesh with and support RIEMA's statewide Hazard Mitigation Plan (2014). This will help increase coordination between local, state, and federal agencies during times of disaster. In addition, by completing a hazard mitigation plan, Charlestown is entitled to apply for future federal relief dollars to fund specific mitigation projects, continue to provide reduced insurance premiums through the Community Rating System (CRS) Program, and reduce and/or eliminate vulnerabilities resulting from disaster events throughout Charlestown.

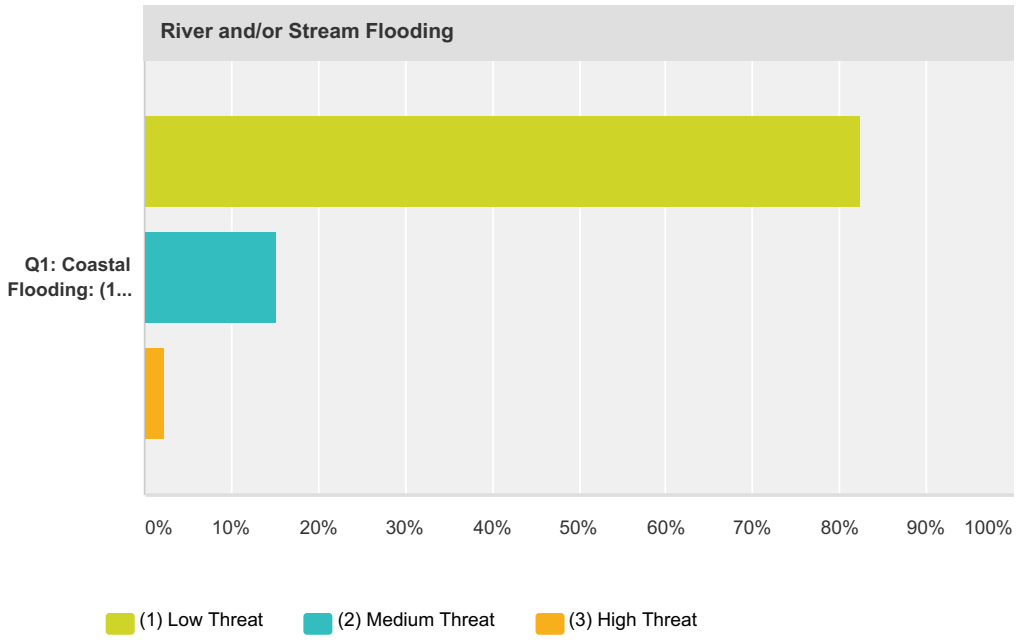
Please visit http://www.charlestownri.org to see the full Charlestown Natural Hazard Mitigation Plan. Non-circulating copies will be provided at Town Hall and at the Cross Mill Public Library.

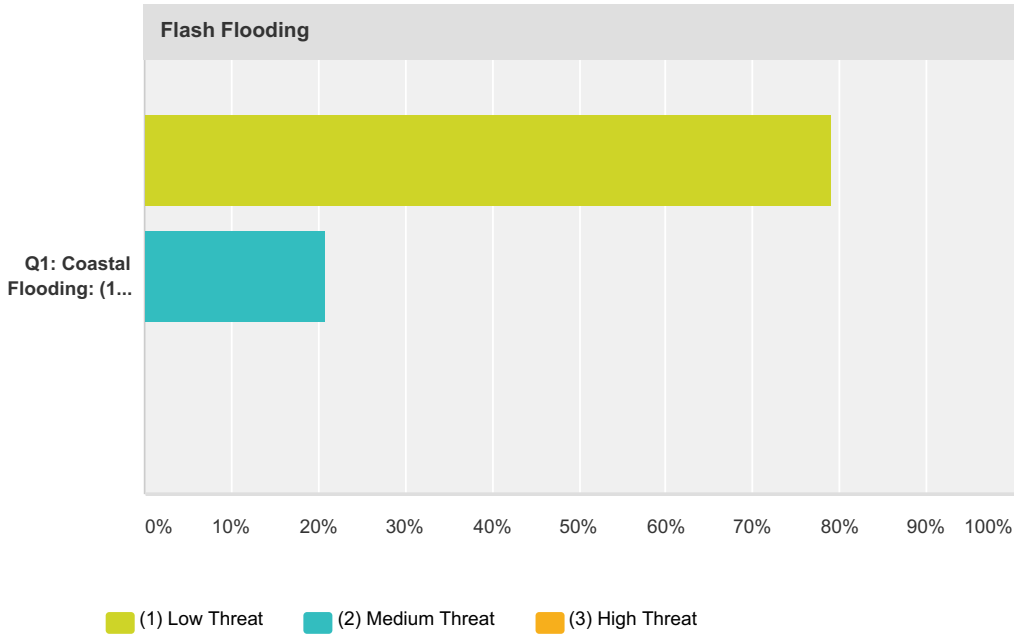
Appendix D - Online surveys

Q1 On a scale from 1 (low threat) to 3 (high threat), please rate the threat of the following weather events in Charlestown, RI. By rating, we mean how positively or negatively you think the weather threat is to you and your property or business. The higher the threat, the higher you should rate it. The lower the threat, the lower the number will be.

Answered: 124 Skipped: 0






Flash Flooding
Q1: Coastal Flooding: (1...
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(1) Low Threat
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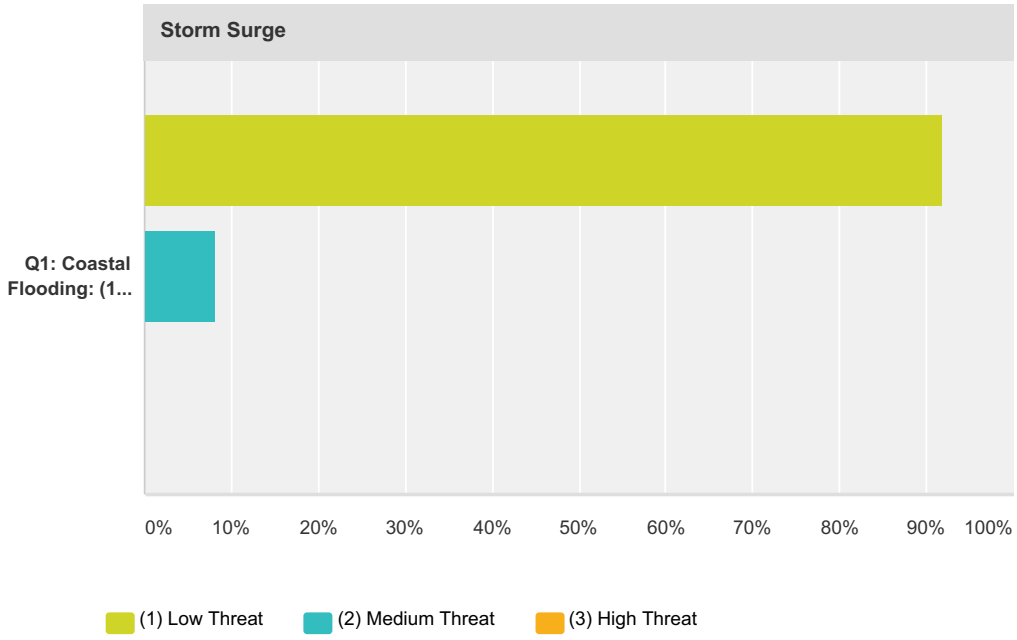
Storm Surge
Q1: Coastal Flooding: (1...
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(1) Low Threat
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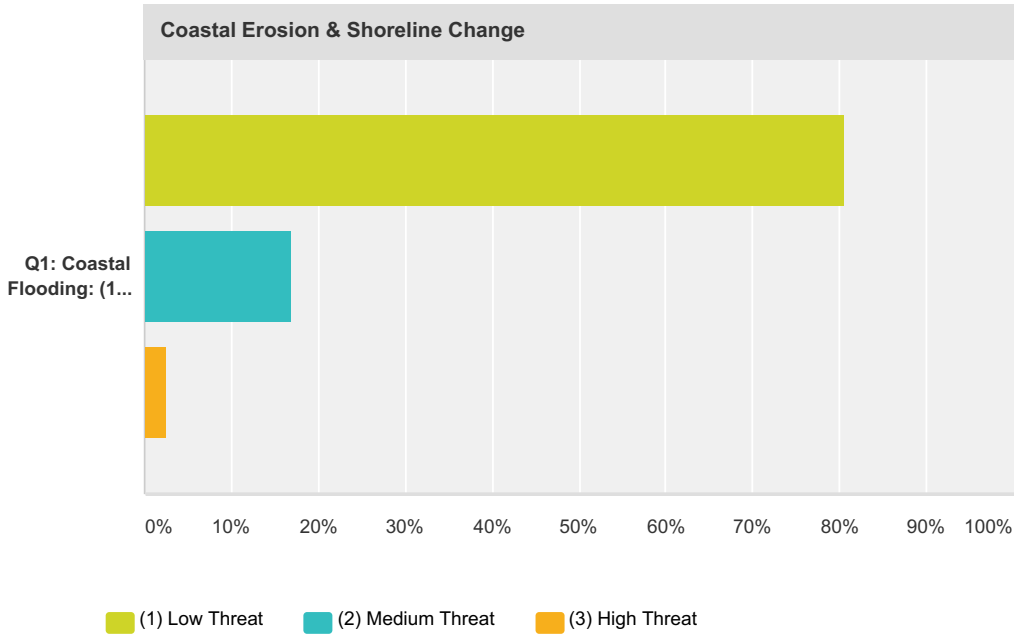
Coastal Erosion & Shoreline Change
Q1: Coastal Flooding: (1...
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(1) Low Threat
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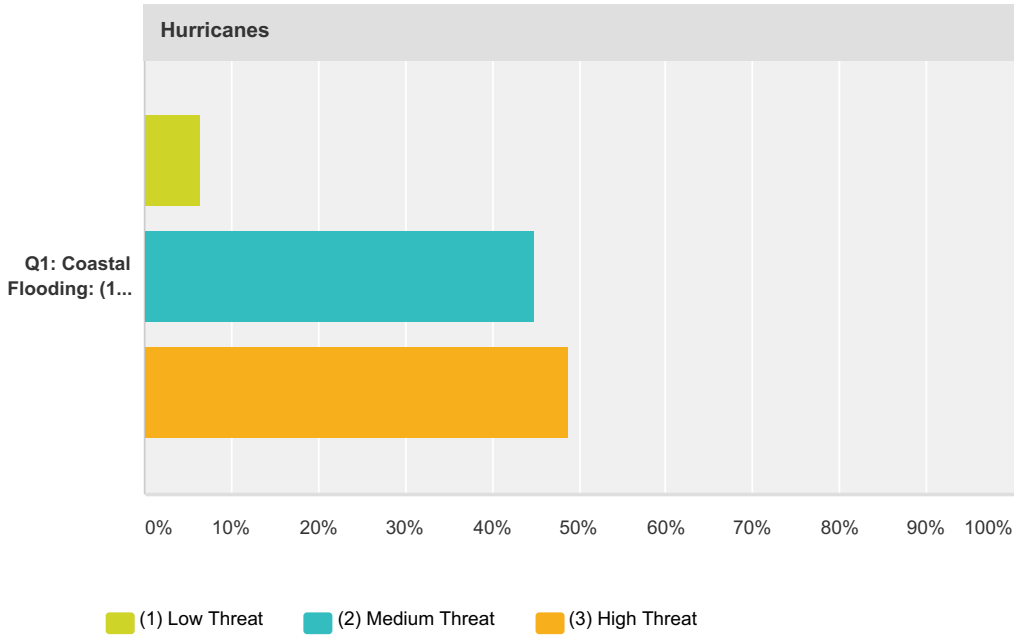
Hurricanes
Q1: Coastal Flooding: (1...
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(1) Low Threat
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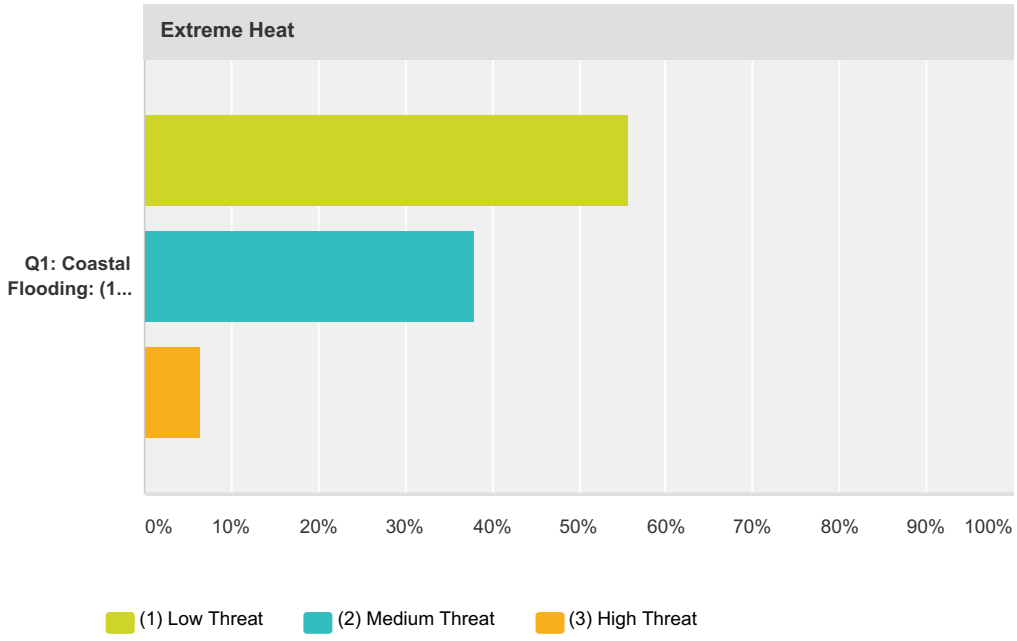
Extreme Heat
Q1: Coastal Flooding: (1...
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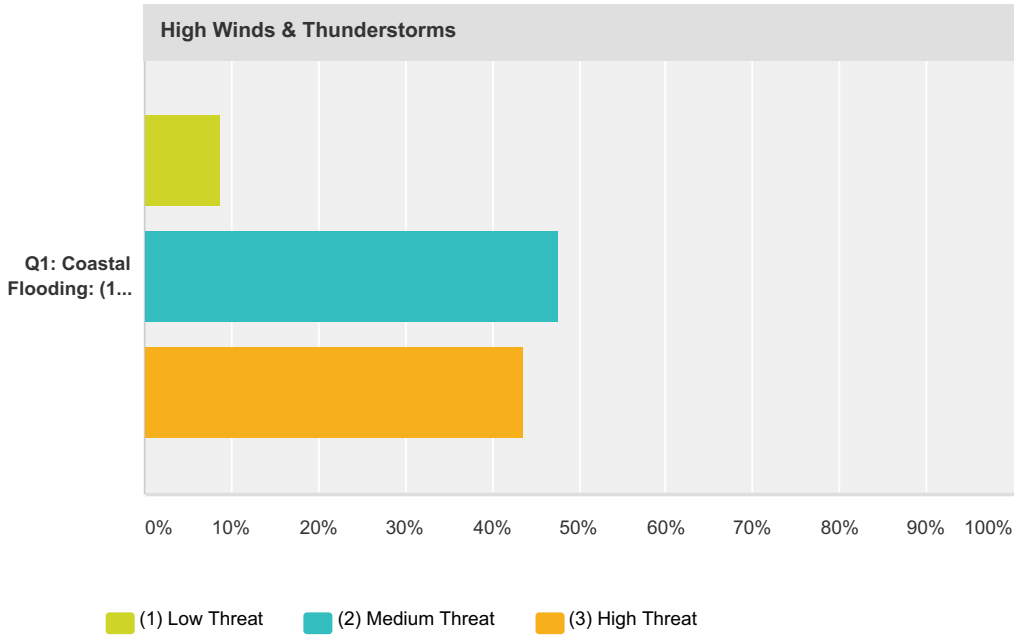
(1) Low Threat
(2) Medium Threat
(3) High Threat


High Winds & Thunderstorms
Q1: Coastal Flooding: (1...
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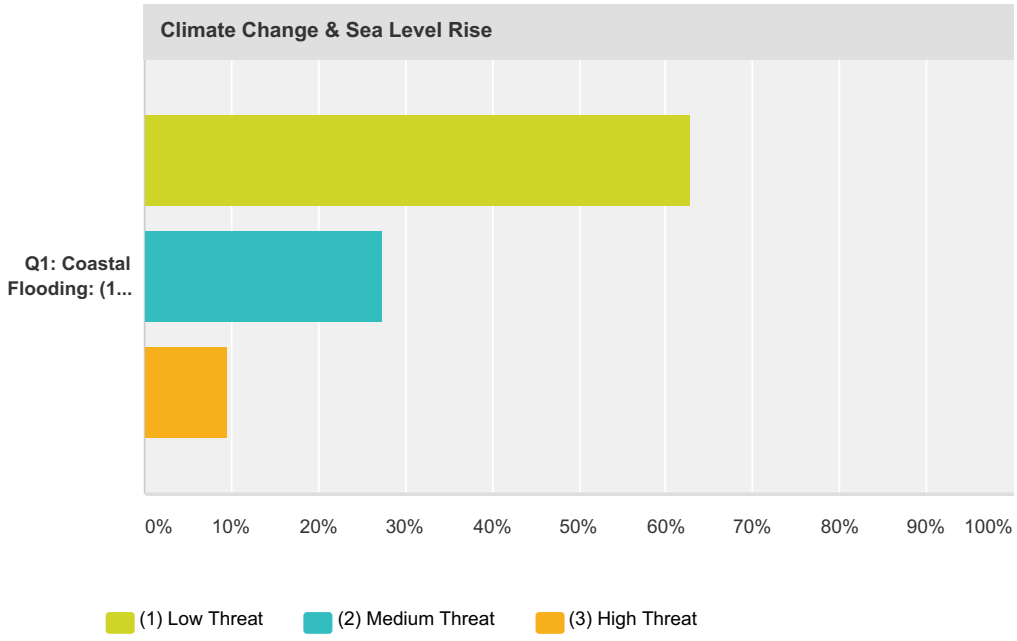
(1) Low Threat
(2) Medium Threat
(3) High Threat


Climate Change & Sea Level Rise
Q1: Coastal Flooding: (1...
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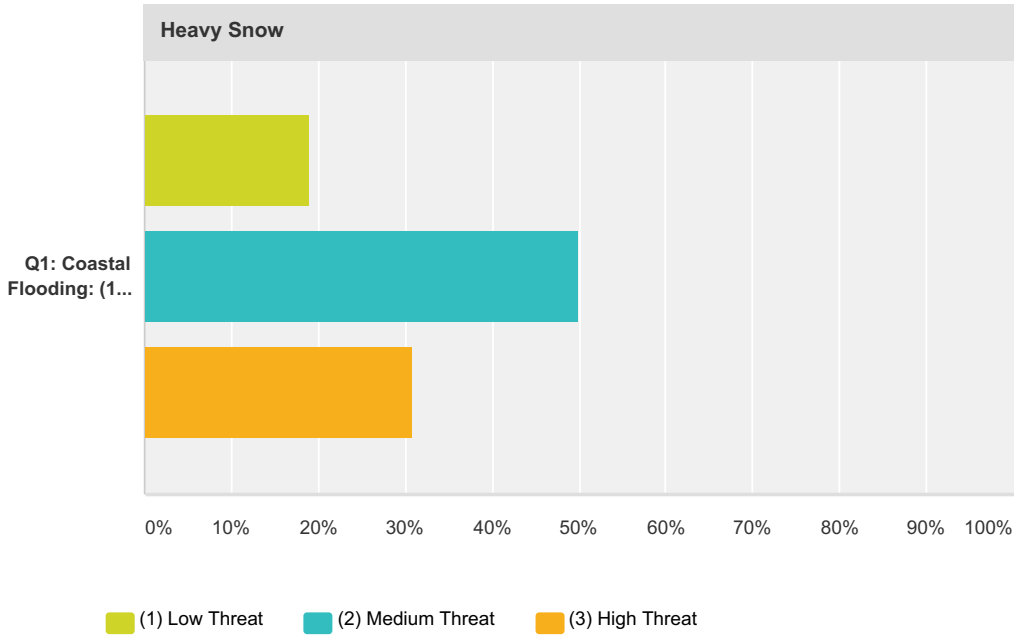
(1) Low Threat
(2) Medium Threat
(3) High Threat


Heavy Snow
Q1: Coastal Flooding: (1...
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(1) Low Threat
(2) Medium Threat
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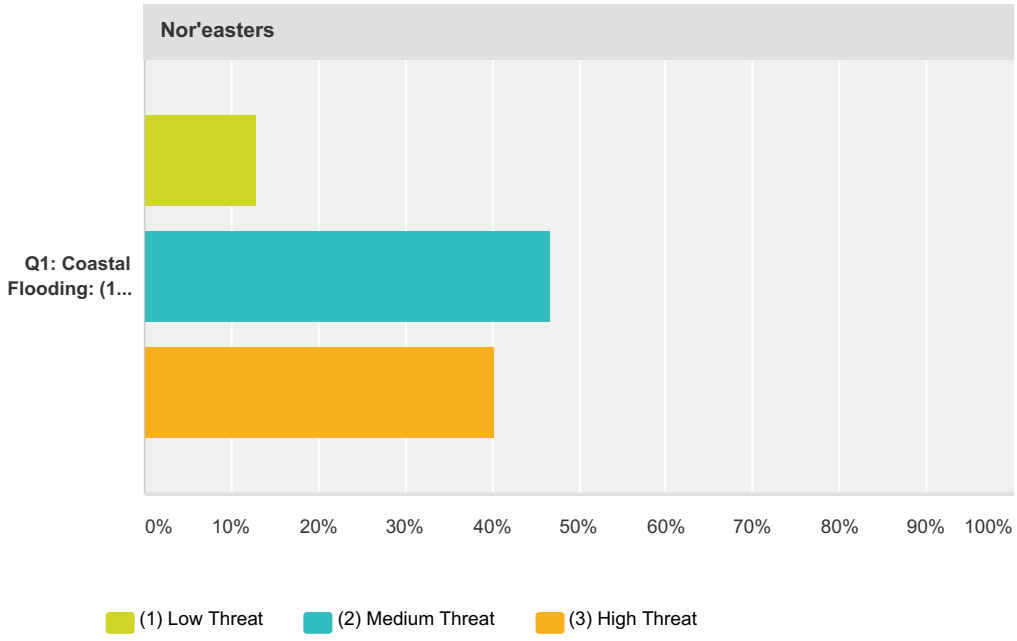
Nor'easters
Q1: Coastal Flooding: (1...
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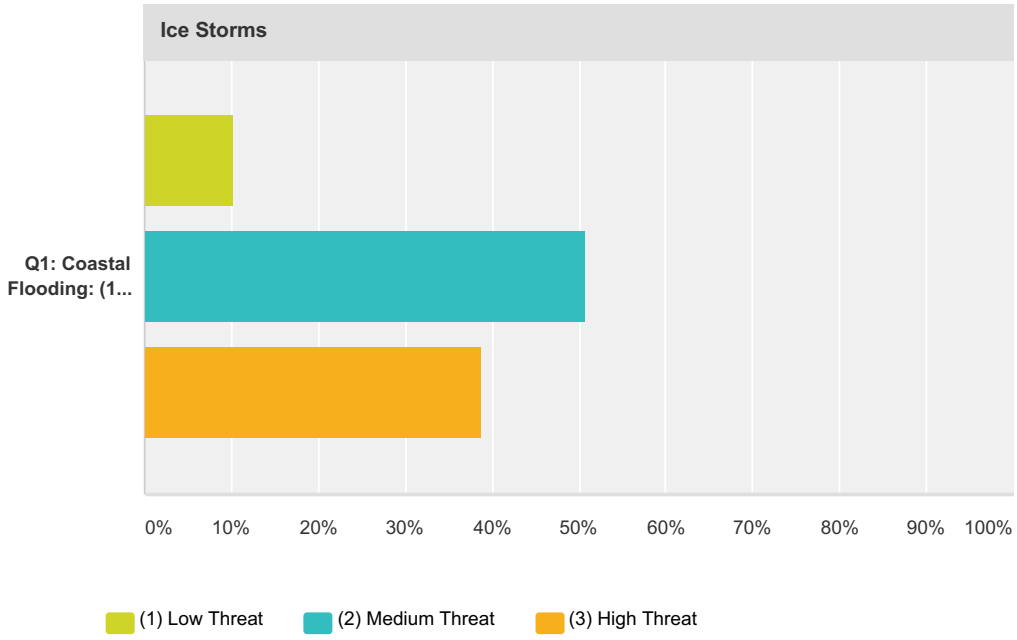
Ice Storms
Q1: Coastal Flooding: (1...
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(1) Low Threat
(2) Medium Threat
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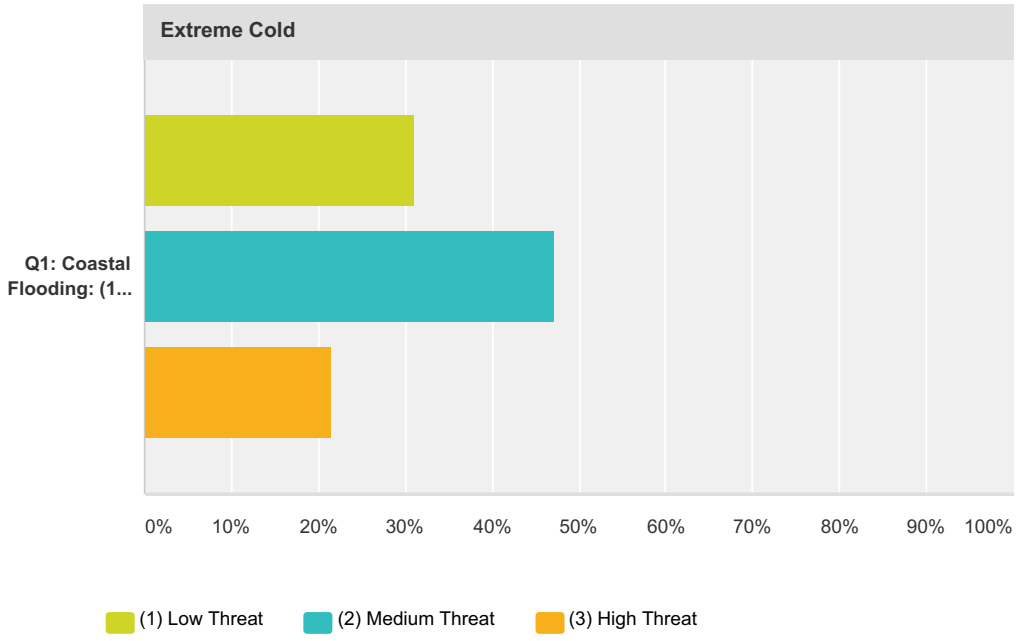
Extreme Cold
Q1: Coastal Flooding: (1...
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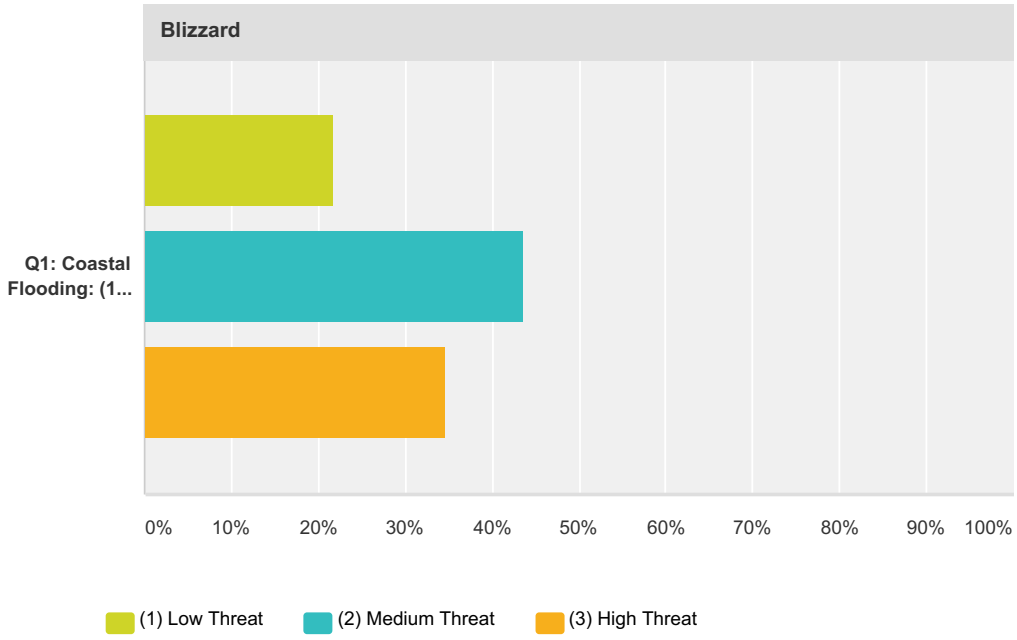
(1) Low Threat
(2) Medium Threat
(3) High Threat


Blizzard
Q1: Coastal Flooding: (1...
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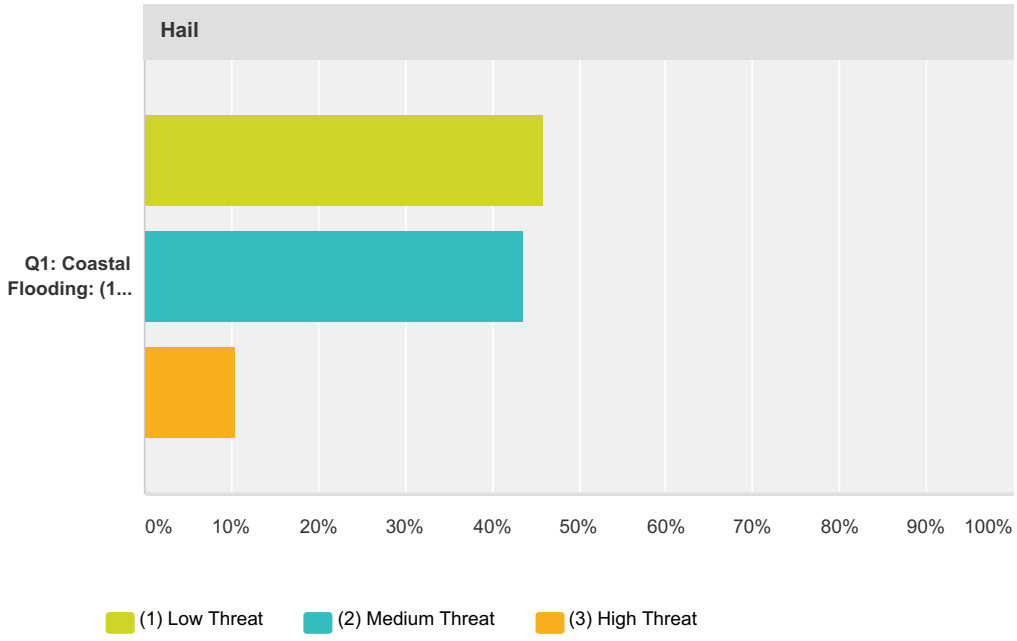
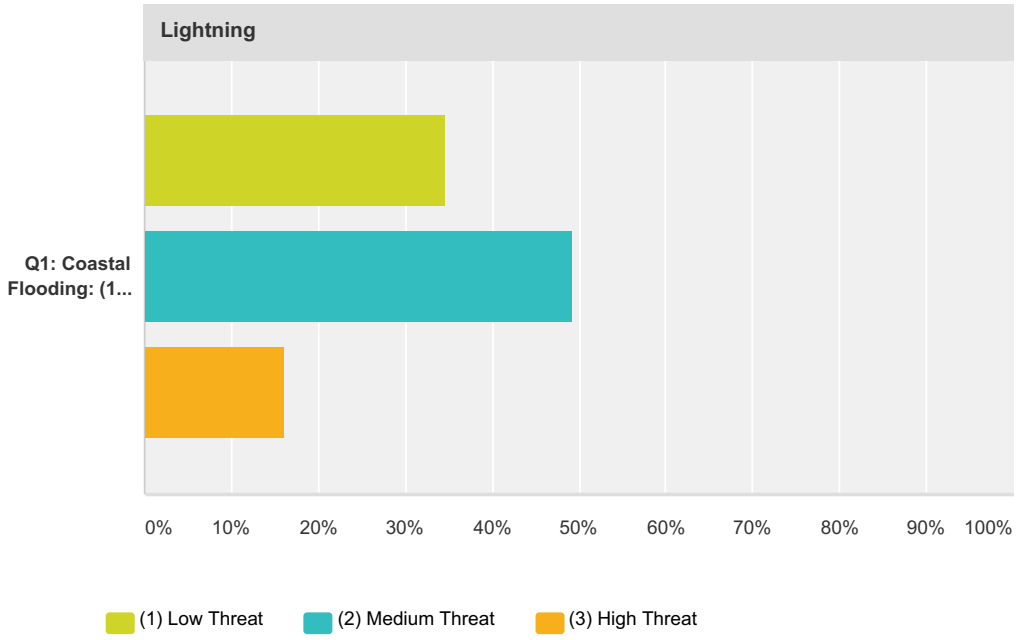
(1) Low Threat
(2) Medium Threat
(3) High Threat





Coastal Flooding				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**100.00%** 124	**0.00%** 0	**0.00%** 0	**100.00%** 124

River and/or Stream Flooding				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**82.40%** 103	**15.20%** 19	**2.40%** 3	**100.81%** 125

Flash Flooding				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**79.20%** 99	**20.80%** 26	**0.00%** 0	**100.81%** 125

Storm Surge				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**91.94%** 114	**8.06%** 10	**0.00%** 0	**100.00%** 124

Coastal Erosion & Shoreline Change				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**80.65%** 100	**16.94%** 21	**2.42%** 3	**100.00%** 124

Hurricanes				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**6.40%** 8	**44.80%** 56	**48.80%** 61	**100.81%** 125

Extreme Heat				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**55.65%** 69	**37.90%** 47	**6.45%** 8	**100.00%** 124

High Winds & Thunderstorms				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**8.87%** 11	**47.58%** 59	**43.55%** 54	**100.00%** 124

Climate Change & Sea Level Rise				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**62.90%** 78	**27.42%** 34	**9.68%** 12	**100.00%** 124

Heavy Snow				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**19.05%** 24	**50.00%** 63	**30.95%** 39	**101.61%** 126

Nor'easters				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**12.90%** 16	**46.77%** 58	**40.32%** 50	**100.00%** 124

Ice Storms				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**10.32%** 13	**50.79%** 64	**38.89%** 49	**101.61%** 126

Extreme Cold				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**31.20%** 39	**47.20%** 59	**21.60%** 27	**100.81%** 125

Blizzard				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**21.77%** 27	**43.55%** 54	**34.68%** 43	**100.00%** 124

Hail				
	(1) Low Threat	(2) Medium Threat	(3) High Threat	Total

Q1: Coastal Flooding: (1) Low Threat (A)	**45.97%** 57	**43.55%** 54	**10.48%** 13	**100.00%** 124

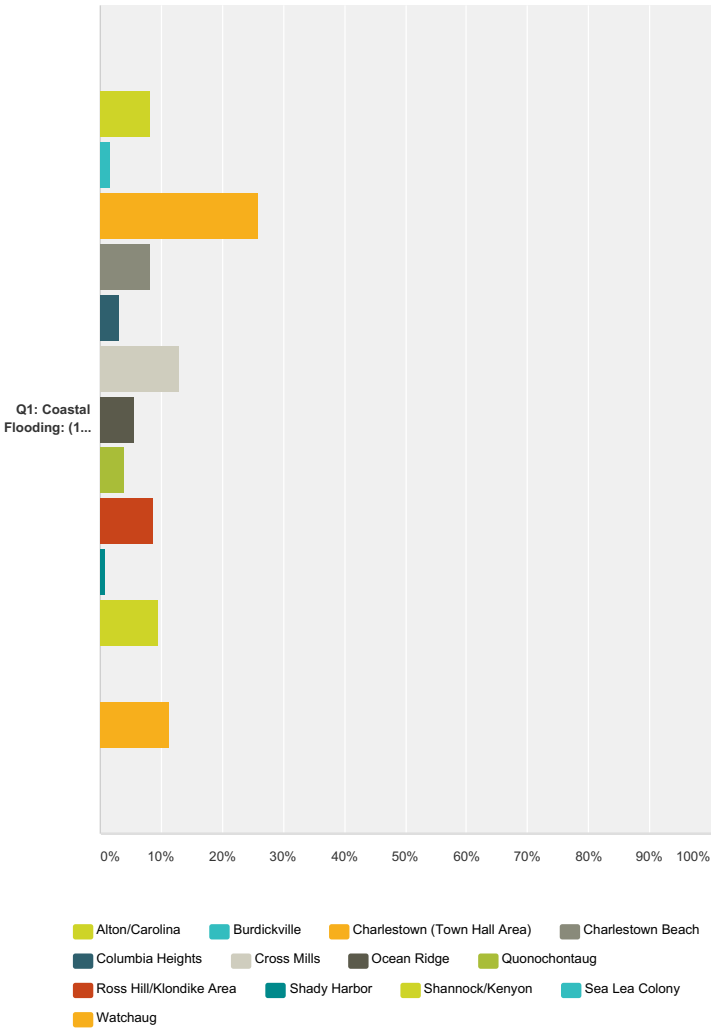
Lightning				
	(1) Low Threat	**(2) Medium Threat**	**(3) High Threat**	**Total**
Q1: Coastal Flooding: (1) Low Threat (A)	**34.68%** 43	**49.19%** 61	**16.13%** 20	**100.00%** 124

	Q1: Coastal Flooding: (1) Low Threat	Total
Other (please specify and rate the threat 1 to 3)	**5**	5

#	Q1: Coastal Flooding: (1) Low Threat	Date
1	meteor strike 1, earthquake 1, volcanic eruption 1, pandemic 2	11/6/2015 9:48 AM
2	Fire e.g. from lightning,if it happened, as trees close to house (1)	11/6/2015 6:54 AM
3	The biggest threat is anything that results in the loss of electricity for more than one day.	11/5/2015 7:19 PM
4	average 1-2	11/5/2015 4:15 PM
5	Micro Burst - 2	11/5/2015 3:45 PM

Q2 Please select the area of town where you live or own a business?

Answered: 124 Skipped: 0



	Alton/Carolina	Burdickville	Charlestown (Town Hall Area)	Charlestown Beach	Columbia Heights	Cross Mills	Ocean Ridge	Quonochontaug	Ross Hill/Klondike Area	Shady Harbor	Shannock/Kenyon	Sea Lea Colony	Watchaug	Total
Q1: Coastal Flooding: (1) Low Threat (A)	**8.06%** 10	**1.61%** 2	**25.81%** 32	**8.06%** 10	**3.23%** 4	**12.90%** 16	**5.65%** 7	**4.03%** 5	**8.87%** 11	**0.81%** 1	**9.68%** 12	**0.00%** 0	**11.29%** 14	**100.00%** 124
Total Respondents	10	2	32	10	4	16	7	5	11	1	12	0	14	124

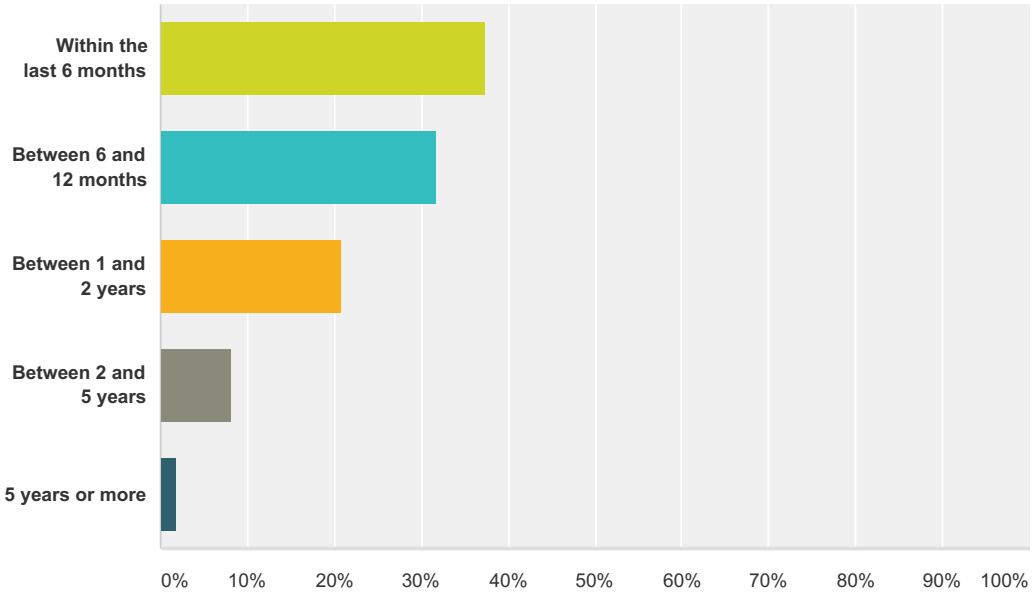
	Other (please specify)	Total
Q1: Coastal Flooding: (1) Low Threat (A)	0	0

#	Q1: Coastal Flooding: (1) Low Threat	Date
1	Pasquisett Pond Area	11/16/2015 11:02 AM
2	Wordens Pond/Old Coach Area	11/10/2015 7:59 AM
3	Sand Hills or Old Coach rd.	11/8/2015 6:42 PM
4	The Arches	11/6/2015 4:10 PM
5	Fort Neck	11/6/2015 3:46 PM
6	South Arnolda/Ninigret	11/6/2015 11:01 AM
7	Ninigret Cove	11/6/2015 10:55 AM
8	East Beach/Ninigret	11/6/2015 7:10 AM
9	Old Coach Rd north (not included in list!)- trees, and high wind on power lines and falling on house/car. Freezing hot water heating system when power is out and loss of water from electrically driven well pump are main dangers. We are high and dry otherwise. Flooding on roads for access occasional problem	11/6/2015 6:54 AM

10	Burlingame state park. Number 2 did not work	11/5/2015 10:26 PM
11	Foster Cove	11/5/2015 10:21 PM
12	Sometimes the threat may bring about restricted access to my property or interruption and repair of utilities, in addition to concern about structural damage.	11/5/2015 9:43 PM
13	Old Coach Road	11/5/2015 6:48 PM
14	black pond area	11/5/2015 6:11 PM
15	Old Mill Rd area	11/5/2015 4:46 PM
16	Our EMA Director Kevin Gallup does a great job!	11/5/2015 4:32 PM
17	Old Coach ROAD	11/5/2015 4:30 PM
18	Arnold's east shoreline	11/5/2015 3:58 PM
19	Hill pastures	11/5/2015 3:57 PM
20	I do not live near the coast.	11/5/2015 3:46 PM

Q1 Have you ever received information about how to make members of your household and your home safer from natural disasters? If YES, answer below. If NO, Skip to Question 5.

Answered: 110 Skipped: 21

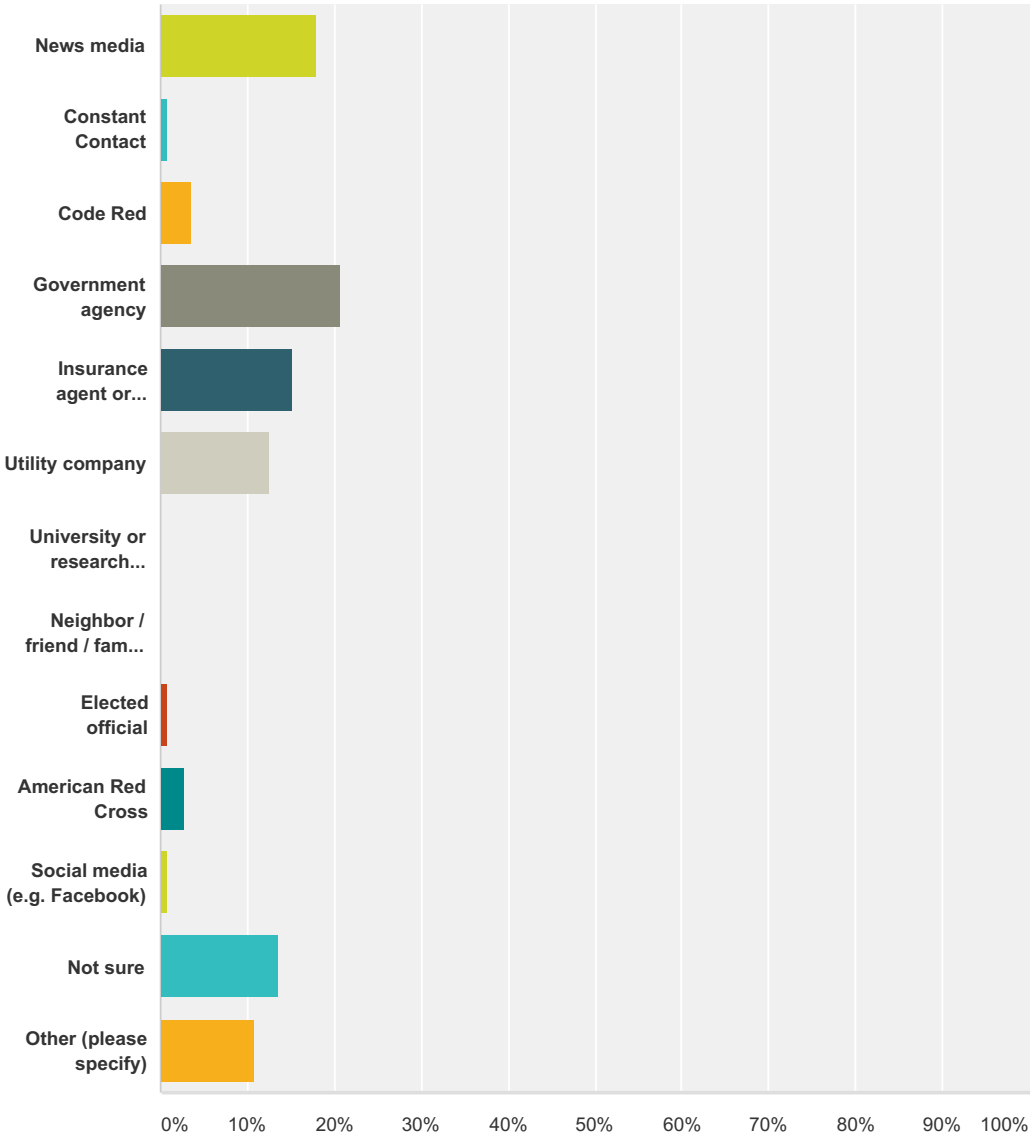


Answer Choices	Responses	
Within the last 6 months	**37.27%**	41
Between 6 and 12 months	**31.82%**	35
Between 1 and 2 years	**20.91%**	23
Between 2 and 5 years	**8.18%**	9
5 years or more	**1.82%**	2
Total		**110**

#	Other (please specify)	Date
1	no	12/15/2015 5:27 AM
2	Always info from town via email	12/14/2015 7:52 PM
3	Unsure	12/14/2015 4:07 PM
4	I honestly do not remember when.	12/14/2015 2:59 PM

Q2 From whom on the list below did you last receive information about how to make members of your household and your home safer from natural disasters? (Please check only one)

Answered: 111 Skipped: 20



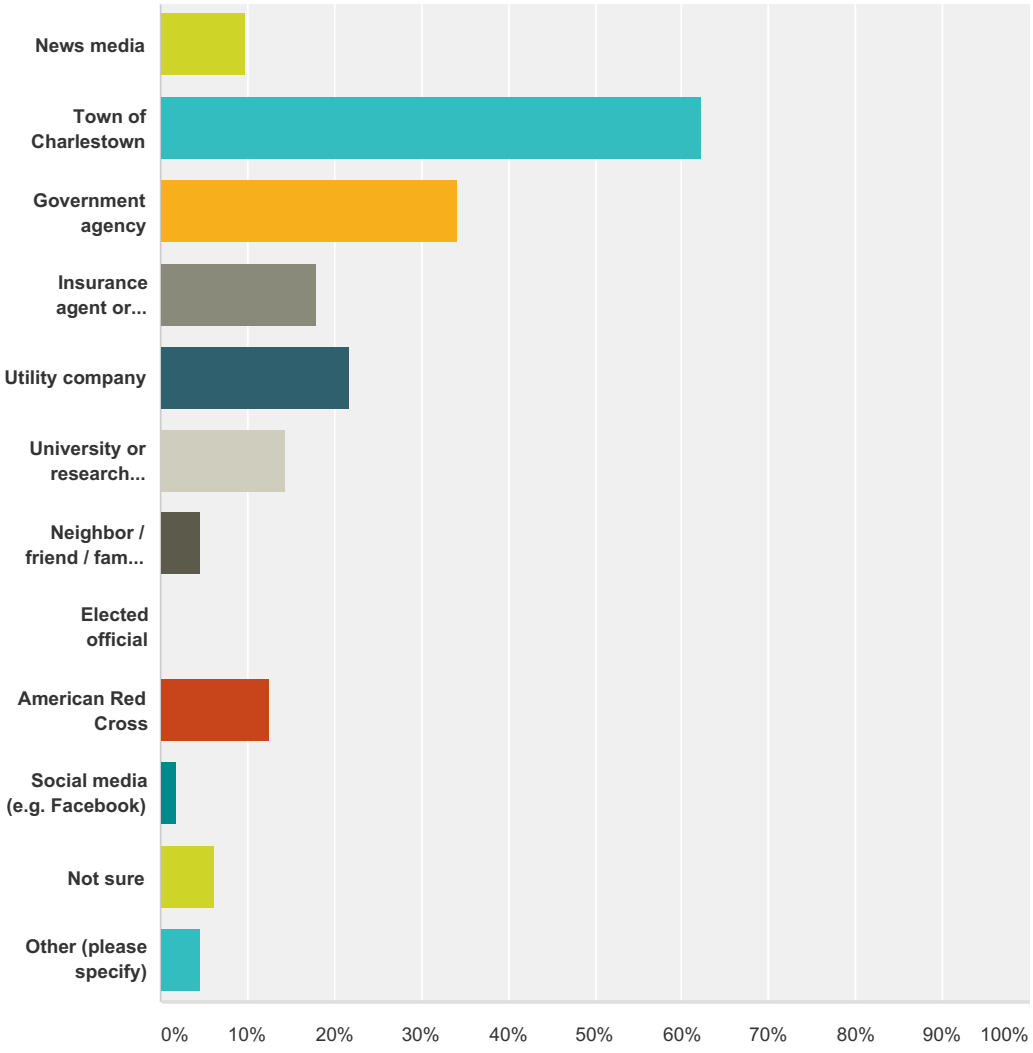
Answer Choices	Responses	
News media	**18.02%**	20
Constant Contact	**0.90%**	1
Code Red	**3.60%**	4
Government agency	**20.72%**	23
Insurance agent or company	**15.32%**	17

Utility company	**12.61%**	14
University or research institution	**0.00%**	0
Neighbor / friend / family member	**0.00%**	0
Elected official	**0.90%**	1
American Red Cross	**2.70%**	3
Social media (e.g. Facebook)	**0.90%**	1
Not sure	**13.51%**	15
Other (please specify)	**10.81%**	12
Total		**111**

#	Other (please specify)	Date
1	Charlestown Pipeline	12/16/2015 9:34 PM
2	from a variety of sources	12/15/2015 10:54 PM
3	Pipeline	12/15/2015 3:59 PM
4	town of charlestown	12/15/2015 12:05 PM
5	town of Charlestown	12/15/2015 9:38 AM
6	Town council meeting	12/14/2015 8:16 PM
7	employer	12/14/2015 5:05 PM
8	cable provider	12/14/2015 5:02 PM
9	Town of Charlestown publication - The Pipeline	12/14/2015 4:48 PM
10	I thought I got a newsletter from the Town of Charlestown	12/14/2015 4:19 PM
11	The Pipeline	12/14/2015 4:16 PM
12	I do not remember but guess Red Cross	12/14/2015 2:59 PM

Q3 Whom would you most trust to provide you with information about how to make your household and home safer from natural disasters? (Please check up to three)

Answered: 111 Skipped: 20



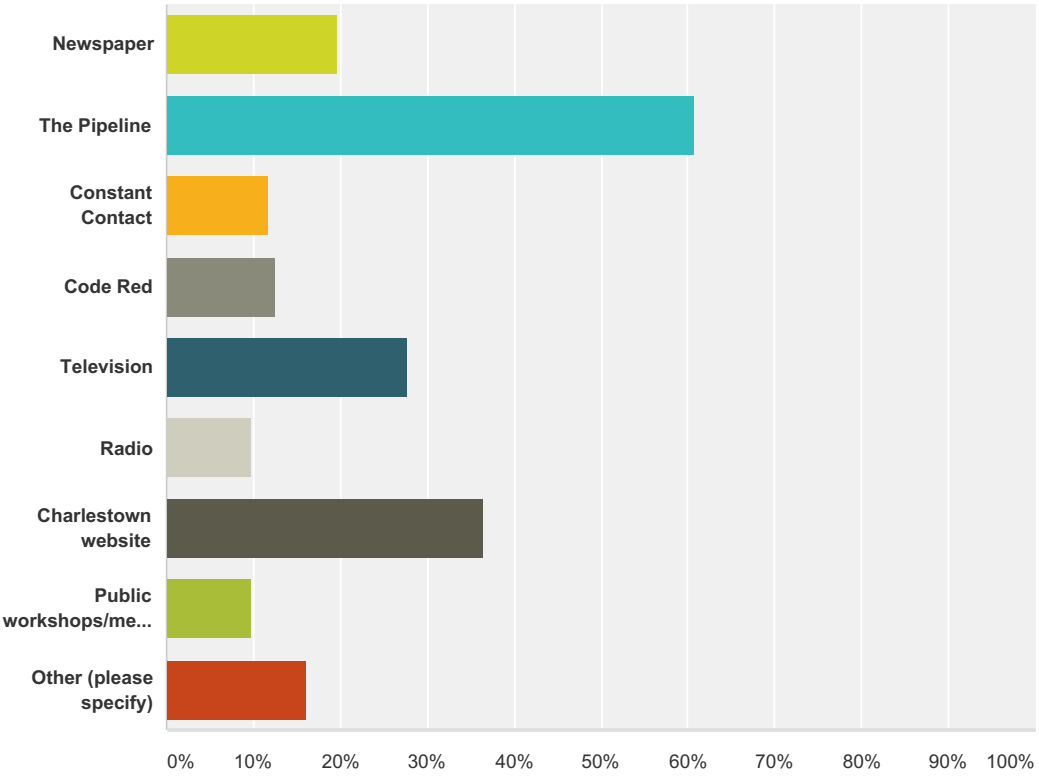
Answer Choices	Responses	
News media	**9.91%**	11
Town of Charlestown	**62.16%**	69
Government agency	**34.23%**	38
Insurance agent or company	**18.02%**	20
Utility company	**21.62%**	24
University or research institution	**14.41%**	16

Neighbor / friend / family member	**4.50%**	5
Elected official	**0.00%**	0
American Red Cross	**12.61%**	14
Social media (e.g. Facebook)	**1.80%**	2
Not sure	**6.31%**	7
Other (please specify)	**4.50%**	5
Total Respondents: 111		

#	Other (please specify)	Date
1	a varierty of sources .. more information is best information	12/15/2015 10:54 PM
2	myself	12/14/2015 8:33 PM
3	online research	12/14/2015 7:05 PM
4	my own information search	12/14/2015 4:01 PM
5	Myself	12/14/2015 3:47 PM

Q4 What is the most effective way for you to receive information about how to make your household and home safer from natural disasters? (Please check up to three)

Answered: 112 Skipped: 19



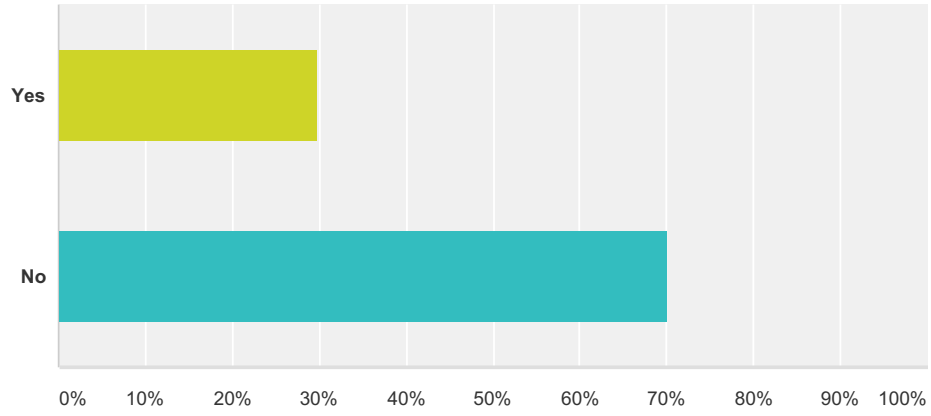
Answer Choices	Responses	
Newspaper	19.64%	22
The Pipeline	60.71%	68
Constant Contact	11.61%	13
Code Red	12.50%	14
Television	27.68%	31
Radio	9.82%	11
Charlestown website	36.61%	41
Public workshops/meetings	9.82%	11
Other (please specify)	16.07%	18
Total Respondents: 112		

#	Other (please specify)	Date
1	again, all information is good information	12/15/2015 10:54 PM

2	Social media	12/15/2015 10:38 PM
3	email	12/15/2015 12:43 PM
4	Social media	12/15/2015 8:43 AM
5	email bulletin	12/15/2015 8:34 AM
6	Email	12/14/2015 10:44 PM
7	Email	12/14/2015 10:21 PM
8	Emails	12/14/2015 10:19 PM
9	online research	12/14/2015 7:05 PM
10	e-mail....	12/14/2015 5:53 PM
11	Email	12/14/2015 5:23 PM
12	email	12/14/2015 5:05 PM
13	Internet websites	12/14/2015 4:12 PM
14	web	12/14/2015 4:07 PM
15	A place on the town website exclusively for natural disasters	12/14/2015 4:05 PM
16	Mailings	12/14/2015 4:03 PM
17	cell phone & internet	12/14/2015 3:49 PM
18	postal mailing	12/14/2015 3:19 PM

Q5 Prior to receiving this survey, were you aware of the Charlestown Natural Hazard Mitigation Plan (CNHMP)?

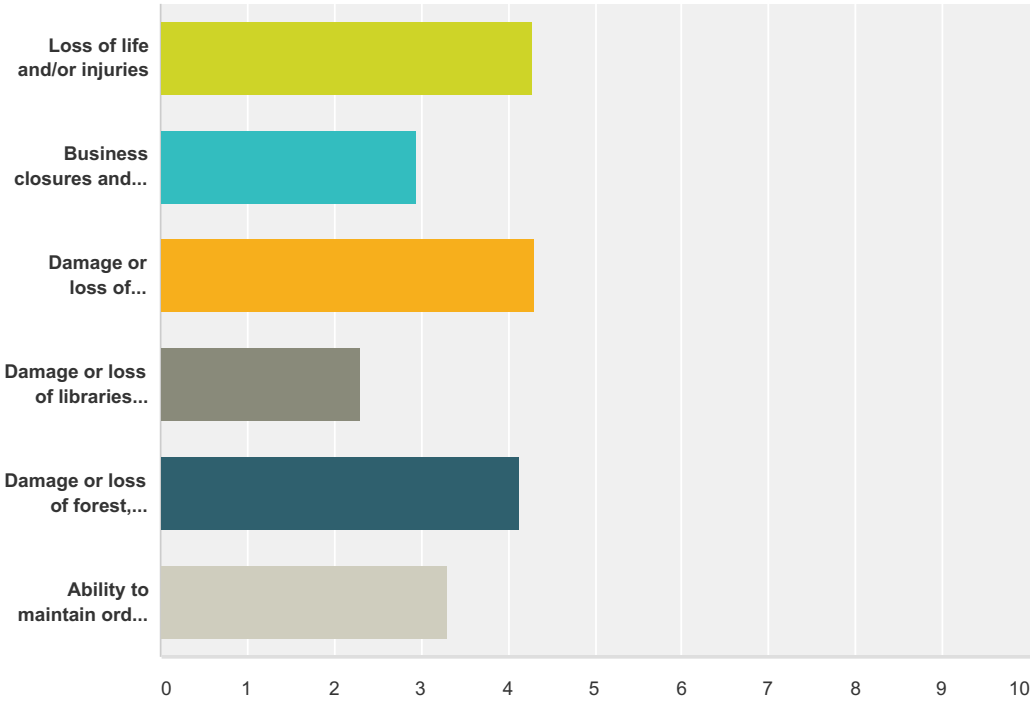
Answered: 131 Skipped: 0



Answer Choices	Responses	
Yes	**29.77%**	39
No	**70.23%**	92
Total		**131**

Q6 Community assets are features, characteristics, or resources that either make a community unique or allow the community to function. In your opinion, which of the following categories are most susceptible to the impacts caused by natural hazards in Charlestown? Please rank the community assets in order of vulnerability. Using a scale of 1 to 6, 1 being the most vulnerable and 6 being least vulnerable, use a single number only once.

Answered: 130 Skipped: 1

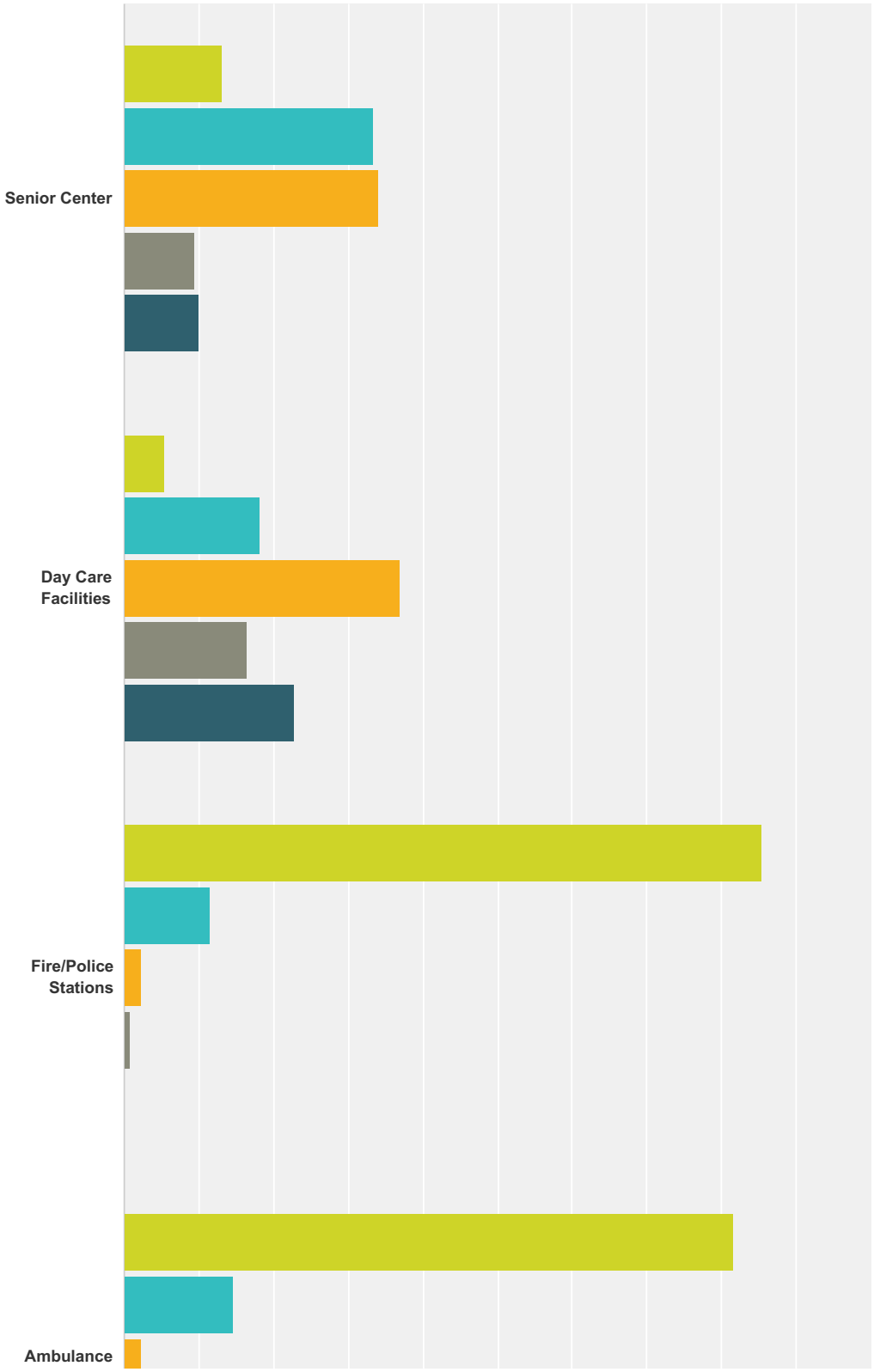


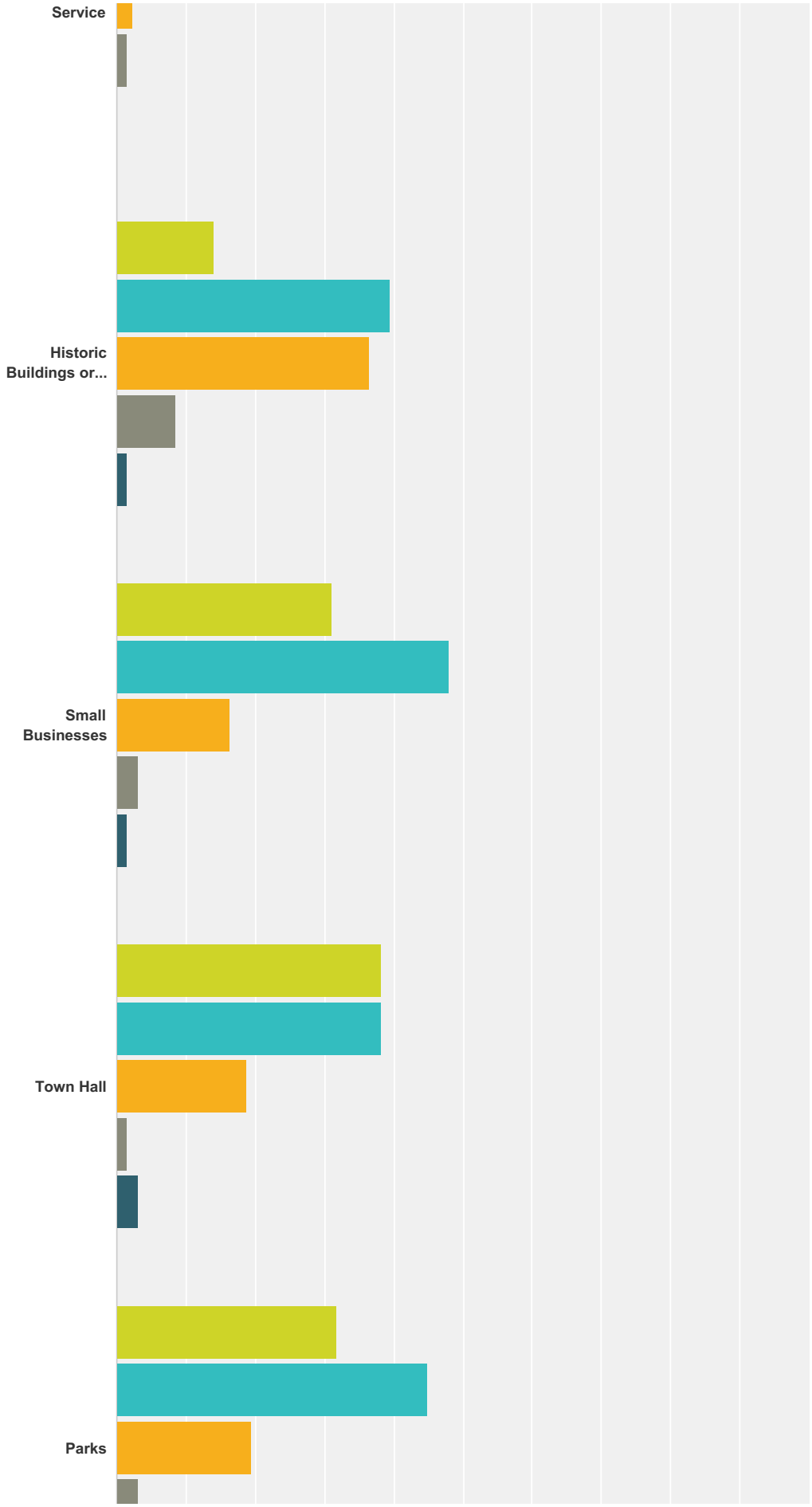
	1	2	3	4	5	6	Total	Score
Loss of life and/or injuries	40.71% 46	9.73% 11	15.04% 17	14.16% 16	12.39% 14	7.96% 9	113	4.28
Business closures and/or job losses	3.60% 4	7.21% 8	20.72% 23	32.43% 36	19.82% 22	16.22% 18	111	2.94
Damage or loss of bridges, roads, utilities, school	17.24% 20	35.34% 41	23.28% 27	13.79% 16	5.17% 6	5.17% 6	116	4.30
Damage or loss of libraries and historic places	2.52% 3	6.72% 8	13.45% 16	10.08% 12	29.41% 35	37.82% 45	119	2.29
Damage or loss of forest, farmland, waterways, beaches, etc.	28.57% 34	21.01% 25	12.61% 15	17.65% 21	14.29% 17	5.88% 7	119	4.14

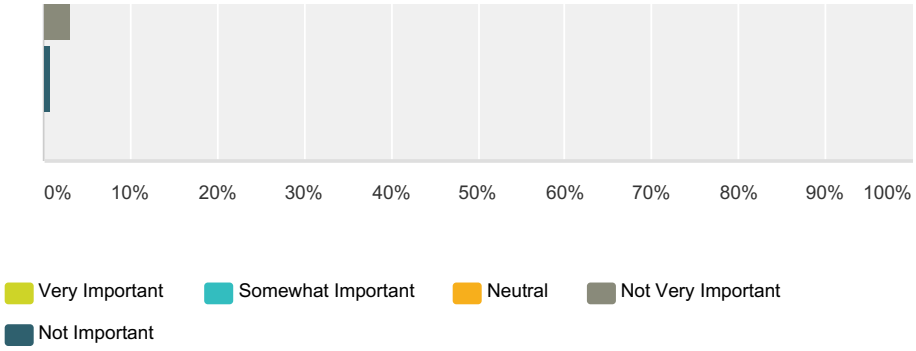
Ability to maintain order and/or provide public amenities and services	**8.80%** 11	**22.40%** 28	**17.60%** 22	**14.40%** 18	**15.20%** 19	**21.60%** 27	125	3.30

Q7 Next we would like to know what specific types of community assets are most important to you. (Check the corresponding box for each asset)

Answered: 131 Skipped: 0




Service
Historic Buildings or...
Small Businesses
Town Hall
Parks

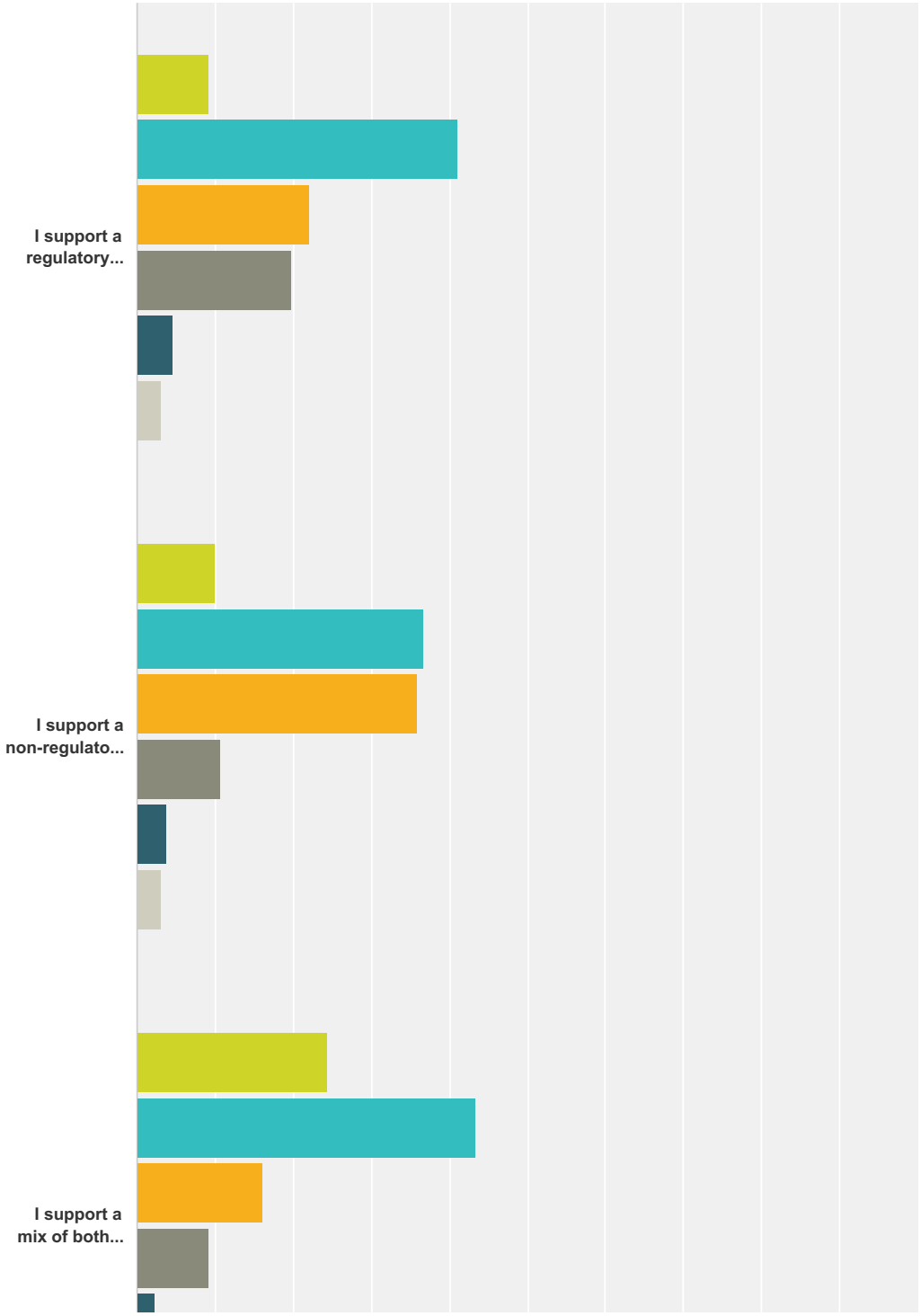


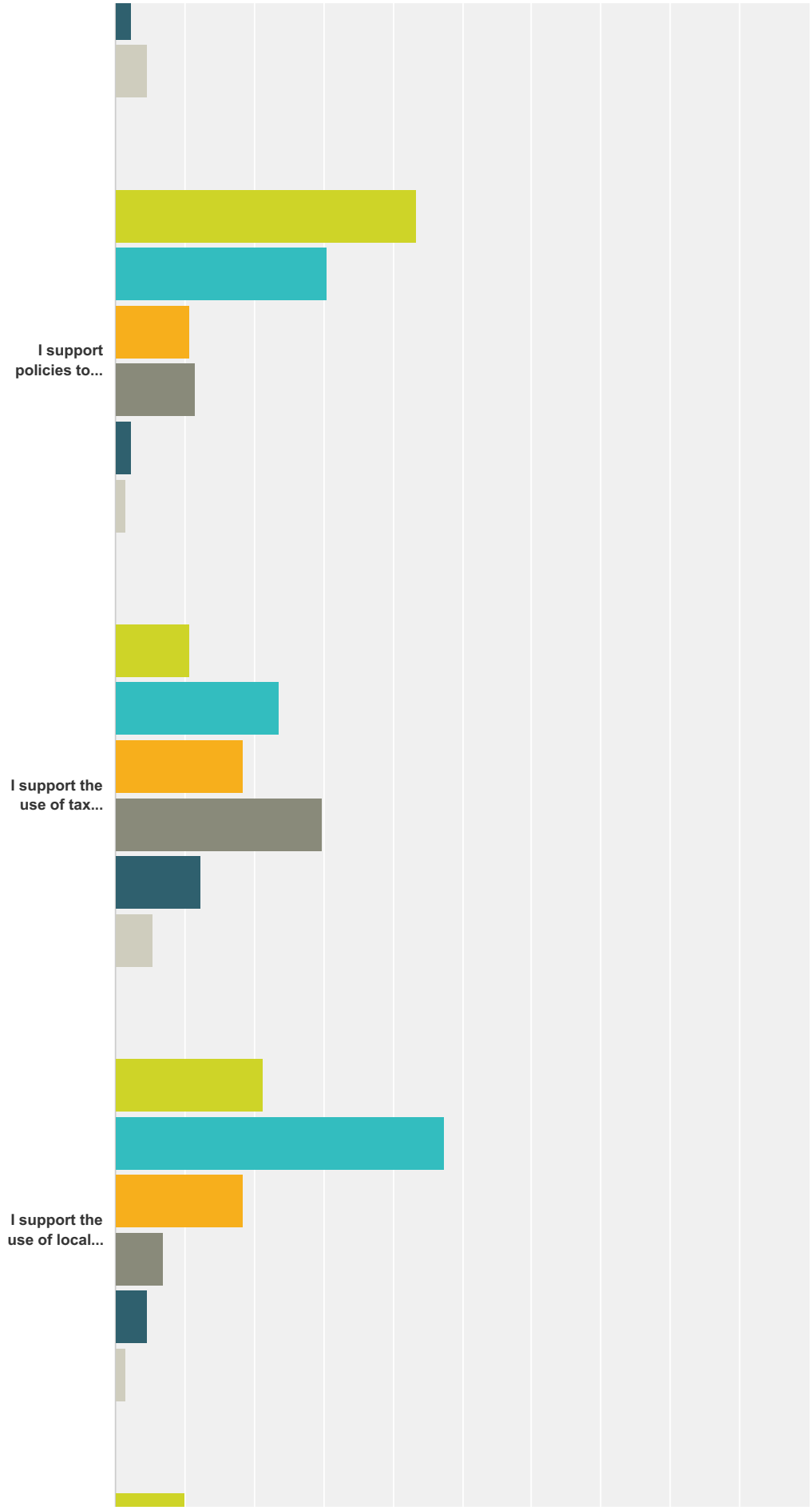
	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important	Total
Senior Center	**13.18%** 17	**33.33%** 43	**34.11%** 44	**9.30%** 12	**10.08%** 13	129
Day Care Facilities	**5.51%** 7	**18.11%** 23	**37.01%** 47	**16.54%** 21	**22.83%** 29	127
Fire/Police Stations	**85.38%** 111	**11.54%** 15	**2.31%** 3	**0.77%** 1	**0.00%** 0	130
Ambulance Service	**81.54%** 106	**14.62%** 19	**2.31%** 3	**1.54%** 2	**0.00%** 0	130
Historic Buildings or Places	**13.95%** 18	**39.53%** 51	**36.43%** 47	**8.53%** 11	**1.55%** 2	129
Small Businesses	**31.01%** 40	**48.06%** 62	**16.28%** 21	**3.10%** 4	**1.55%** 2	129
Town Hall	**38.28%** 49	**38.28%** 49	**18.75%** 24	**1.56%** 2	**3.13%** 4	128
Parks	**31.78%** 41	**44.96%** 58	**19.38%** 25	**3.10%** 4	**0.78%** 1	129

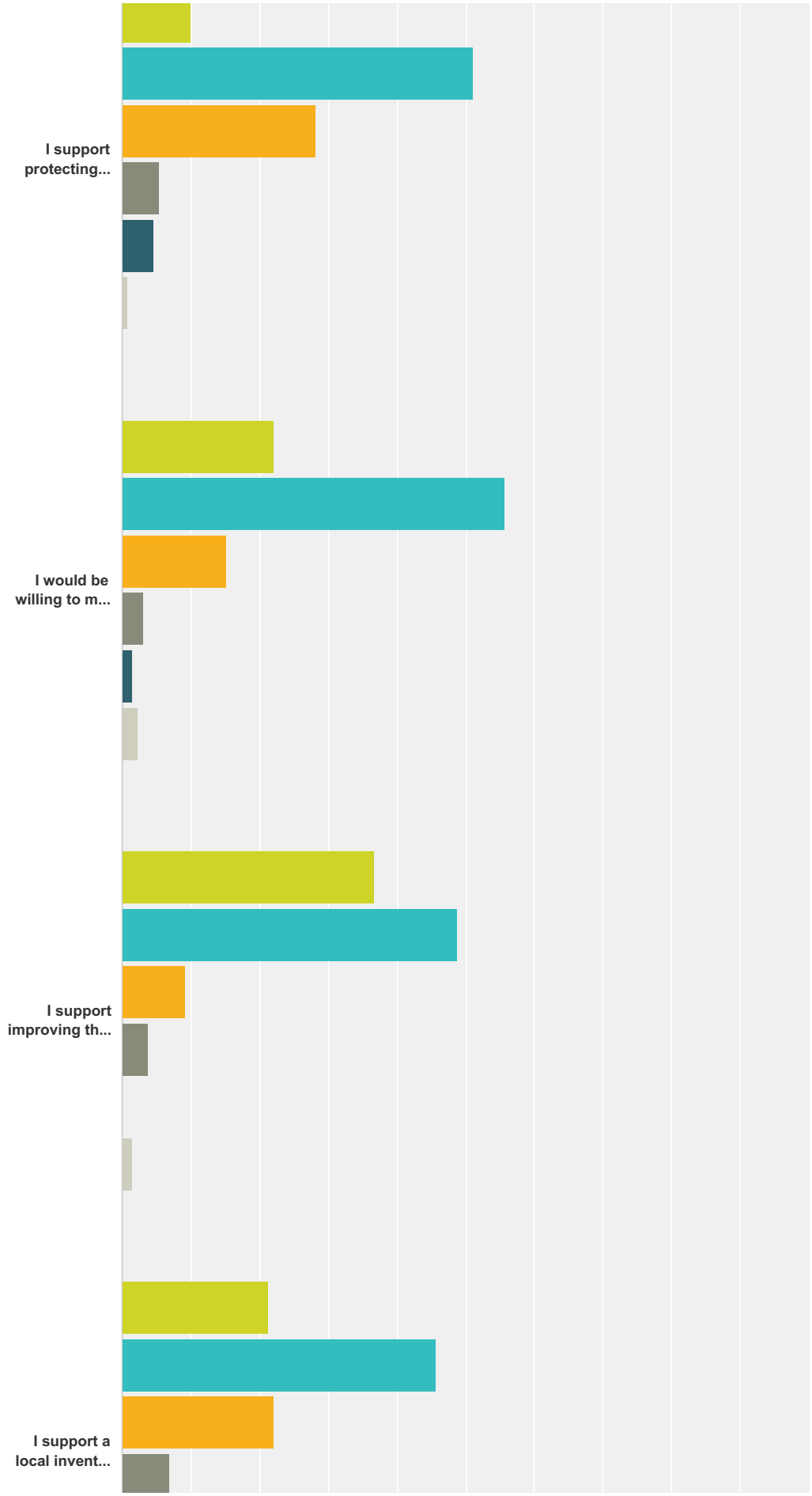
#	Other (please specify)	Date
1	Animal Shelter	12/15/2015 12:43 PM
2	clean well water (and electric to run it), ability to get out on roads after storms (snow, trees down, floods), quick response to emergencies, local businesses, natural areas,	12/15/2015 9:11 AM
3	passable roads	12/15/2015 8:34 AM
4	Beaches are a huge part of our town and tax base. Very important	12/14/2015 6:49 PM
5	natural assets e.g salt ponds, conservation lands	12/14/2015 4:19 PM
6	Our beaches and main roads to beaches	12/14/2015 4:05 PM

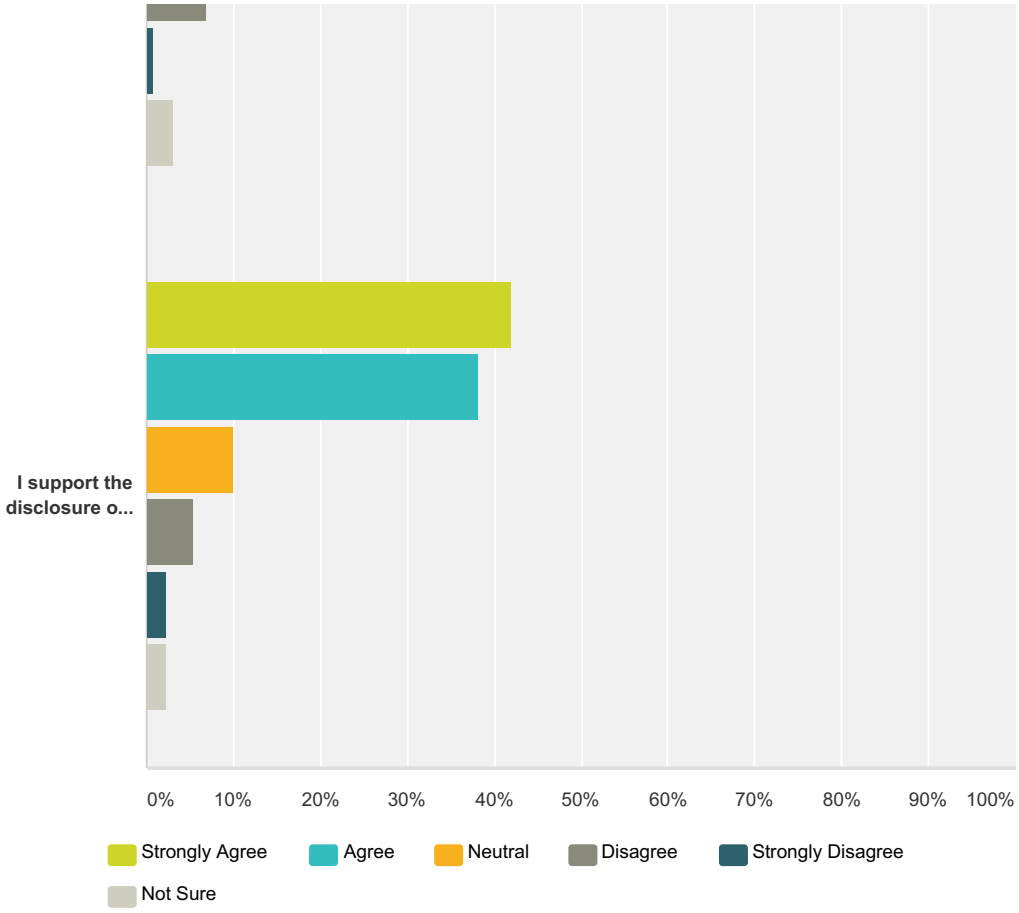
Q8 A number of activities can reduce your community's risk from natural hazards. These activities can be both regulatory and non-regulatory. Please check the box that best represents your opinion of the following strategies to reduce the risk and loss associated with natural disasters.

Answered: 131 Skipped: 0




I support policies to...
I support the use of tax...
I support the use of local...


I support protecting...
I would be willing to m...
I support improving th...
I support a local invent...

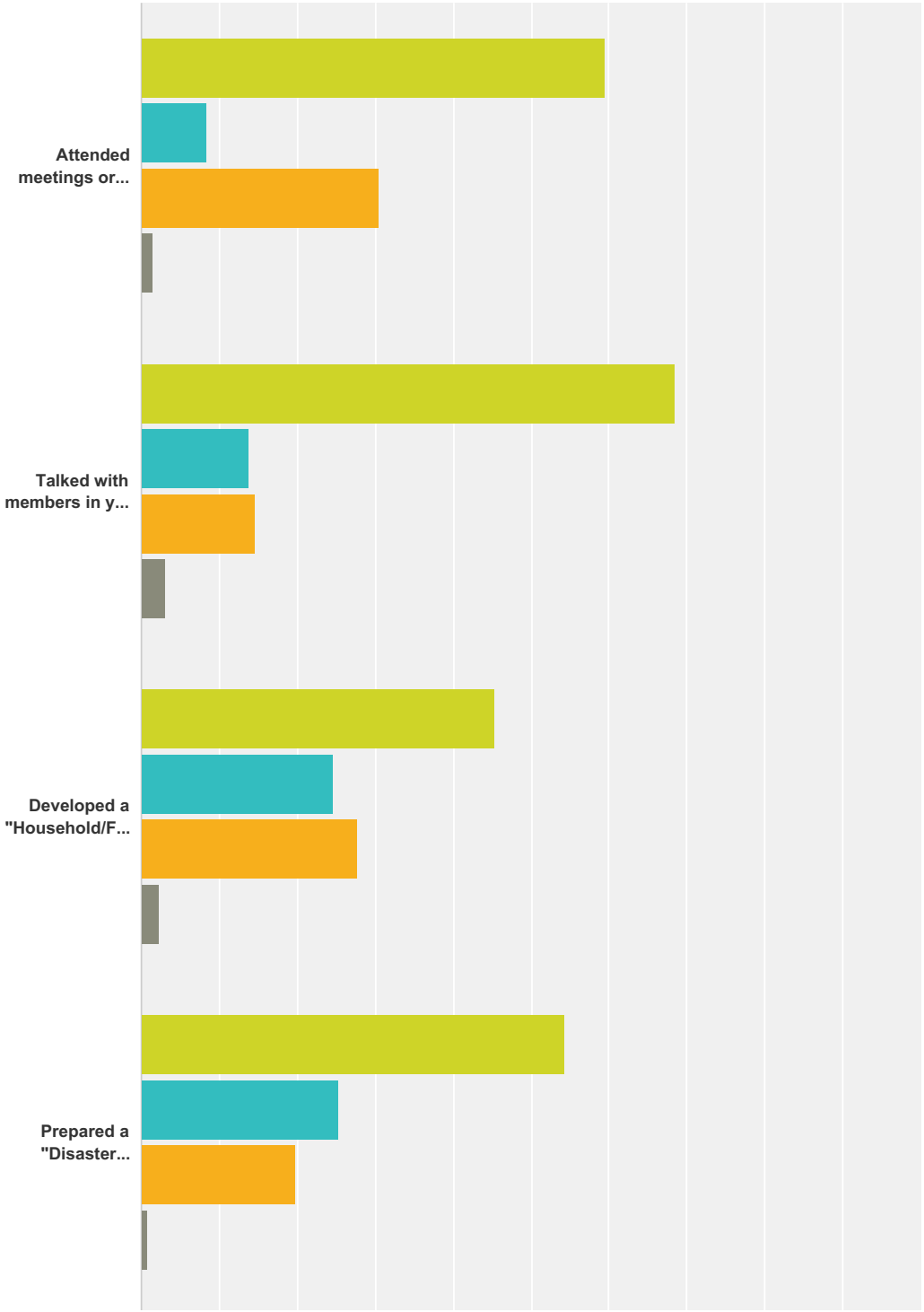


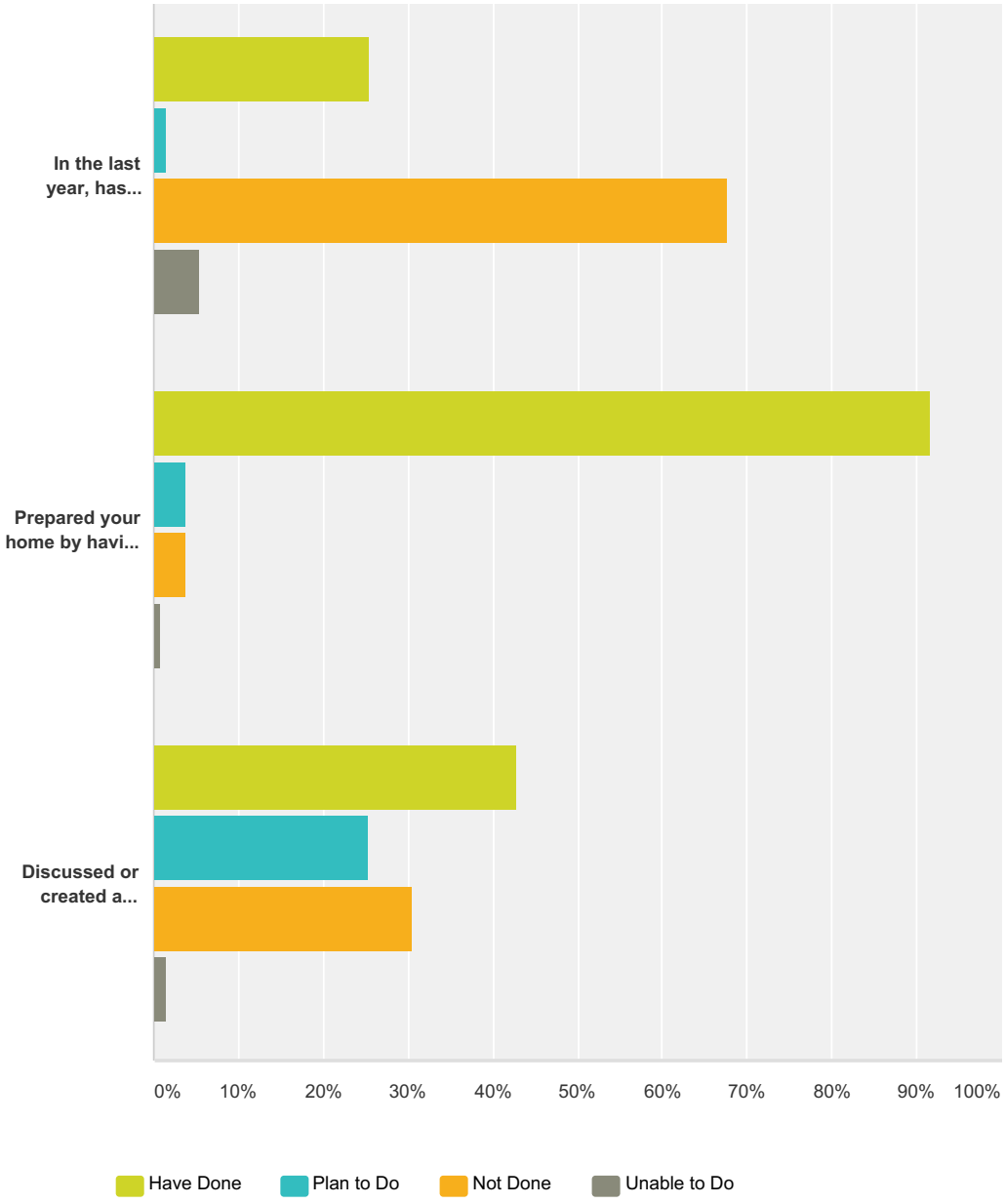
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Sure	Total
I support a regulatory approach to reducing risk	**9.16%** 12	**41.22%** 54	**22.14%** 29	**19.85%** 26	**4.58%** 6	**3.05%** 4	131
I support a non-regulatory approach to reducing risk	**9.92%** 13	**36.64%** 48	**35.88%** 47	**10.69%** 14	**3.82%** 5	**3.05%** 4	131
I support a mix of both regulatory and non-regulatory approaches to reducing risk	**24.43%** 32	**43.51%** 57	**16.03%** 21	**9.16%** 12	**2.29%** 3	**4.58%** 6	131
I support policies to prohibit development in areas subject to natural hazards	**43.51%** 57	**30.53%** 40	**10.69%** 14	**11.45%** 15	**2.29%** 3	**1.53%** 2	131
I support the use of tax dollars (federal and/or local) to pay land owners for not developing in areas prone to natural hazards (hurricanes, flooding)	**10.69%** 14	**23.66%** 31	**18.32%** 24	**29.77%** 39	**12.21%** 16	**5.34%** 7	131
I support the use of local tax dollars to reduce risks and losses from natural disasters	**21.37%** 28	**47.33%** 62	**18.32%** 24	**6.87%** 9	**4.58%** 6	**1.53%** 2	131
I support protecting historical and cultural structures	**9.92%** 13	**51.15%** 67	**28.24%** 37	**5.34%** 7	**4.58%** 6	**0.76%** 1	131
I would be willing to make my home more disaster-resistant	**22.14%** 29	**55.73%** 73	**15.27%** 20	**3.05%** 4	**1.53%** 2	**2.29%** 3	131
I support improving the disaster preparedness of local schools	**36.64%** 48	**48.85%** 64	**9.16%** 12	**3.82%** 5	**0.00%** 0	**1.53%** 2	131
I support a local inventory of at-risk buildings and infrastructure	**21.37%** 28	**45.80%** 60	**22.14%** 29	**6.87%** 9	**0.76%** 1	**3.05%** 4	131
I support the disclosure of natural hazards risks during real estate transactions	**41.98%** 55	**38.17%** 50	**9.92%** 13	**5.34%** 7	**2.29%** 3	**2.29%** 3	131

#	Other (please specify)	Date
1	We cannot go "busness as usual" although personal property rights are important community good is as or more important and costs of disasters can be lessened with procedures in place.	12/15/2015 9:11 AM
2	I own land with no residence, Willing to support 1st responders and infrastructure, preferably without raising taxes	12/14/2015 4:54 PM

Q9 In the following list, please check those activities that you have done in your household, plan to do in the near future, have not done or unable to do. (Please check one answer for each preparedness activity). In your household, have you or someone in your household:

Answered: 131 Skipped: 0





	Have Done	Plan to Do	Not Done	Unable to Do	Total
Attended meetings or received written information on natural disasters or emergency preparedness?	**59.54%** 78	**8.40%** 11	**30.53%** 40	**1.53%** 2	131
Talked with members in your household about what to do in case of a natural disaster or emergency?	**68.46%** 89	**13.85%** 18	**14.62%** 19	**3.08%** 4	130
Developed a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	**45.38%** 59	**24.62%** 32	**27.69%** 36	**2.31%** 3	130
Prepared a "Disaster Supply Kit" (stored extra food, water, batteries, or other emergency supplies)?	**54.20%** 71	**25.19%** 33	**19.85%** 26	**0.76%** 1	131
In the last year, has anyone in your household been trained in First Aid or Cardio-Pulmonary Resuscitation (CPR)?	**25.38%** 33	**1.54%** 2	**67.69%** 88	**5.38%** 7	130
Prepared your home by having smoke detectors on each level of the house:	**91.60%** 120	**3.82%** 5	**3.82%** 5	**0.76%** 1	131

Discussed or created a utility shutoff procedure in the event of a natural disaster?	**42.75%** 56	**25.19%** 33	**30.53%** 40	**1.53%** 2	131

#	Other (please specify)	Date
1	installed full house generator	12/15/2015 12:43 PM
2	Have had CPR and First aid in past, do look at material and assess needs, need to think about it again.	12/15/2015 9:11 AM
3	Not applicable, land only	12/14/2015 4:54 PM
4	emergency generator and hookup installed, well power available	12/14/2015 4:07 PM
5	installed a standby generator.	12/14/2015 2:59 PM

Appendix E – Miscellaneous

Building Official's Plan Review Worksheet

Building Official's Flood Zone Affidavit

FEMA Community Assistance Visit (November 19, 2013)

Mitigation Action Progress Report Form

Charlestown Town Hall Lightning Strike – Westerly Sun (December 28, 2000)

Coastal Geologic Hazards and Sea-Level Rise: Climate Change in RI

TOWN OF CHARLESTOWN

Date:
Reviewer:

Plan Review Worksheet

Contact Information:

Owner: _____ Contact: _____

Property Address: _____

Property Information:

Plat: _____ Lot: _____ Zoning District: _____ Overlay District: _____

Lot Area: _____ Lot Frontage: _____ Dimensional Requirements for _____ Zone

Lot Area from: Tax Card ____ Stamped Site Plan by _____

Property Use (Zoning):

Current Use: _____

Proposed Use: _____ Permitted Use: Yes / No / SUP

Dimensional Requirements:

	Primary Structure		Accessory Structure		Lot Coverage (Estimated from Tax Card Yes/No)	
	Allowed	Proposed	Allowed	Proposed		
Front:	_____	_____	_____	_____	Existing:	_____ sq. ft.
Rear:	_____	_____	_____	_____	Allowed:	_____ %
Sides:	_____	_____	_____	_____	Allowed:	_____ sq. ft.
Height:	_____	_____	_____	_____	Proposed:	_____ sq. ft.

ISDS: Permit # _____ Bedroom design # ___ Date Permitted _____

Installed prior to April 9, 1968 – see DEM Rule 17.4.2
Installed after April 9, 1968 – see DEM Rule 17.4.1 A & C
Installed prior to February 6, 2002 & in the SAMP area – see DEM Rule 17.4.1 B

CRMC: CRMC Review Required: Yes / No / CRMC to Determine

Flood Zone: Map Panel #_____ DFE _____

Zone VE (EL_____) | Zone AE (EL_____) | Zone A | Zone X (0.2%) | Zone X

Coastal A Zone: Yes / No CBRS Area: Yes / No

Comments: _____

Flood Zone Affidavit

All construction in a Flood Zone must comply with Section R-322 of the State of Rhode Island Building Code (SBC-2-2013) and ASCE 24-05. Pay special attention to the following:

- R322.1.6 - All plumbing, mechanical and electrical systems shall be elevated to or above the design flood elevation (DFE), unless designed and approved for use below.
- R322.1.8 - All materials used below the design flood elevation (DFE) must be flood resistant material
- R322.2.2 - Flood vents in A Zones must be no more than 1 foot above adjacent grade
- ASCE 24-05 - In A Zones the top of the lowest floor must be elevated one (1) foot above base flood elevation (BFE). Note: This is the minimum elevation requirement and will require flood resistant material in the floor system and no plumbing, mechanical or electrical below the subfloor (see R322.1.6 & R322.1.8).
- ASCE 24-05 - In Coastal A Zones and V Zones the lowest structural members must be elevated one (1) foot above the base flood elevation.
- Section 117-4 Town Code - In Coastal A Zones and V Zones non-supporting breakaway walls are permitted provided they do not exceed an enclosure area of 300 sq. ft. and have an engineered design to withstand a safe loading resistance of not less than 10 or more than 20 pounds per square foot.

THERE ARE OTHER REQUIREMENTS FOR BUILDING IN FLOOD ZONES AND THESE CAN BE FOUND IN THE APPLICABLE CODES (IRC 2013, ASCE 24-05 & Chapter 117 of the Town Code)

THE BUILDING OFFICIALS OFFICE REQUIRES A LICENSED LAND SURVEYOR TO VERIFY THE TOP ELEVATION OF THE FOUNDATION. THIS VERIFICATION *MUST BE SUBMITTED TO THE BUILDING INSPECTOR'S OFFICE PRIOR TO THE START OF FRAMING*. THIS CAN BE DONE BY LETTER FROM THE LICENSED LAND SURVEYOR.

UPON COMPLETION OF THE STRUCTURE, A FLOOD ELEVATION CERTIFICATE WILL BE REQUIRED PRIOR TO THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY FOR THE STRUCTURE.

I have read and understand the above and will notify the appropriate parties or contact the Building Officials office if I have any questions.

_____ _____

Signature of owner or representative Date

U.S. Department of Homeland Security
Region I
99 High Street, 6th Floor
Boston, MA 02110-2320

FEMA

November 19, 2013

Joseph L. Warner Jr.
Building and Zoning Official
Town of Charlestown
4540 South County Trail
Charlestown, RI 02813

Subject: Community Assistance Visit follow-up

Dear Mr. Warner:

This letter is a follow-up to the Community Assistance Visit (CAV) held on November 14, 2013 in the Town of Charlestown, RI. I greatly appreciate you taking time out of your busy schedule to meet with us to discuss Charlestown's administration of its Flood Hazard regulations. I hope the meeting provided a better understanding of the National Flood Insurance Program (NFIP) and the resources that are available to you through the Federal Emergency Management Agency (FEMA) and the Rhode Island Emergency Management Agency (RIEMA).

The November 14th visit included a discussion of Charlestown's Flood Hazard regulations, an assessment of development in the Special Flood Hazard Area (SFHA), a review of the permitting and enforcement processes, and discussion of the Town's Flood Insurance Study and Flood Insurance Rate Map (FIRM).

FEMA conducts CAVs for the purpose of maintaining periodic contact with communities participating in the NFIP in order to assess their need for technical assistance and coordination, as necessary. In addition, the visits provide an opportunity for assessing the effectiveness of local floodplain management ordinances and enforcement practices.

At the meeting we also discussed Charlestown's application to participate in the Community Rating System (CRS). A successful CAV is required before a community can participate in CRS. We are pleased to inform you that we found no issues with the floodplain management program in Charlestown and there is no follow-up required from Charlestown at this time. We have informed ISO, FEMA's CRS contractor, that they may proceed in assisting you with the town's CRS application.

FEMA would like to commend Charlestown for the proactive actions that have been taken to ensure sound floodplain management. Several structures have been elevated above base flood elevation and/or moved back away from the shore. This reflects that you are effectively communicating flood risk and flood insurance implications to your residents.

We'd like to take this opportunity to reemphasize some of the items we discussed during the visit.

Permitting Procedures
We discussed Charlestown's procedures for permitting development in its adopted SFHAs. Specifically, NFIP minimum standards require permits for all development in the SFHA. *Development* is defined as "any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment and materials." Note that this definition does include other activities not associated with structures. We discussed your review procedures for various kinds of non-structural development.

Communities are required to keep as-built documentation on file for all new or substantially improved structures in order to confirm that they have been built with a lowest floor elevation at or above Base Flood Elevation. Charlestown uses Elevation Certificates (ECs) to capture elevation information. Use of Elevation Certificates is required for all communities participating in CRS.

Flood Insurance Study and Flood Insurance Rate Maps
Charlestown's current maps are part of the Washington County maps, which have two effective dates: October 16, 2013 for the coastal panels and October 19, 2010 for the non-coastal panels. You indicated that in general, the new maps accurately reflect flood risk and that there were only a few areas that didn't make sense or were confusing.

Local Ordinances
The Town of Charlestown's floodplain regulations, found in the Town Ordinance under Chapter 117: Flood Damage Prevention, are compliant with NFIP minimum standards. The ordinance was last updated when the new maps became effective.

Flood Insurance
The Town of Charlestown currently has 820 flood insurance policies in force, accounting for $219,929,000 in coverage. Since the beginning of the program, there have been 189 paid losses totaling $2,606,728.

Repetitive Loss
During the visit, we discussed the repetitive loss properties in Charlestown. As you know, the number of repetitive loss properties in town will determine what repetitive loss category Charlestown will be in for CRS purposes. Having more than 10 repetitive loss structures would make Charlestown a Category C community, which carries additional requirements for participation in CRS. We discussed how you are working on the AW-501 forms for the properties that have been mitigated. The ISO representative will assist you in determining the number of repetitive loss properties in order to determine what category Charlestown should be classified as.

Grants
As a benefit of participation in the NFIP, Charlestown is eligible to apply for grant funds under FEMA's Hazard Mitigation Assistance (HMA) program. These grants can be used to mitigate floodprone structures. A fact sheet that discusses the types of projects eligible under the HMA program may be found here: http://www.fema.gov/library/viewRecord.do?id=3648. For more information on HMA grants, please call Jessica Stimson, the State Hazard Mitigation Officer, of Rhode Island Emergency Management Agency at 401-462-7115 or jessica.r.stimson.nfg@mail.mil.

Training
FEMA offers training opportunities at FEMA's Emergency Management Institute (EMI) facility in Emmitsburg, Maryland, such as *Managing Floodplain Development Through the NFIP* and the *NFIP Community Rating System*. FEMA covers the cost of lodging and travel; the only cost to municipal officials is for a meal ticket. EMI offers many courses related to floodplain management, hazard mitigation and emergency management. It is recommended that local officials involved in floodplain administration attend course E273 "Managing Floodplain Development through the National Flood Insurance Program." For more information please visit EMI's website at: http://training.fema.gov/index.asp. To apply for a course please contact Michelle Burnett at RIEMA at 401-462-7048 or michelle.f.burnett.nfg@mail.mil.

Summary
We appreciate your community's continued commitment to the NFIP and managing development in its floodplains. Thank you for taking the time out of your busy schedule to accommodate the visit. We hope that the information discussed during the meeting will be helpful to your community.

FEMA, in conjunction with the RIEMA, provides technical guidance and support to Rhode Island communities regarding floodplain management regulations and requirements. If there is any additional information I can provide regarding floodplain management and the NFIP in general, or the recommendations/information provided for the CAV in particular, please do not hesitate to call me at (617) 956-7618 or contact me via e-mail at: karl.anderson@fema.dhs.gov.

Sincerely,

Karl Anderson
Natural Hazards Specialist
FEMA Region I

cc: Michelle Burnett, State NFIP Coordinator, RIEMA (via email)
Chris Markesich, CRS Coordinator, FEMA Region I (via email)
Julie Grauer, Natural Hazards Specialist, FEMA Region I (via email)
Ivy Frances, Chief, Floodplain Management & Insurance Branch, FEMA Region I (via email)

Mitigation Action Progress Report Form

Progress Report Period	From Date:	To Date:
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	❑ Project completed ❑ Project canceled ❑ Project on schedule ❑ Anticipated completion date: _____ ❑ Project delayed Explain _____	

Summary of Project Progress for this Report Period

1. What was accomplished for this project during this reporting period?

_____

_____

2. What obstacles, problems, or delays did the project encounter?

_____

_____

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

_____

_____

4. Other comments

_____

_____

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2. What obstacles, problems, or delays did the project encounter?

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

4. Other comments

Charlestown police continue to assess damage caused by lightning strike

By Tim Ryan
The Sun

Charlestown – It's been a long week for Sgt. Patrick McMahon, and not only because of the holidays.

McMahon has been in every day since the Charlestown Police Station was struck by lightning Dec. 17, damaging the computer system, and phones. He and the rest of the force, along with some outside technical help, have been working to get everything back to normal.

"It's been non-stop," he said. "I've yet to have a day off."

The damages to the department's equipment have been estimated at between $100,000 and $150,000, although no solid numbers will be known until everything is repaired, said McMahon.

The department lost 10 computers, the closed-circuit television system, five of the six base radios, and the phone lines, McMahon said. The town hall building also lost five computers in the storm.

The phone lines were repaired with nearly non-stop work from Sunday to Tuesday. Despite the difficulty of working with just one phone line for a few days, the department was able to continue service, with help from other departments and the state police.

"Services were not affected," McMahon said.

Nor was any data from the computers lost, though a temporary system has been difficult for members of the force to use because of its slowness. Several computer support people, and some town officials are working to get the computers working again.

The temporary annoyance actually has a positive upside, said McMahon.

"All the equipment that was damaged will be replaced with new equipment," he said.

Everything should be back to normal by Dec. 30, McMahon said.

"Nobody wants to be here on New Year's Eve," he said. "We want to be up and running by the end of this week."

The department has been hit by lightening before, said McMahon.

"We've been hit before," he said. "Usually we can recover quickly. It's usually not a problem."

Serving all areas in Southern Rhode Island and Southeastern Connecticut
Westerly, R.I. Thursday, December 28, 2000

Charlestown,RI

4540 South County Trail, Charlestown RI 02813

Search

The Pipeline Newsletter

Charter and Ordinances

Agendas and Minutes

Boards and Commissions

Senior/Community Center

Town Jobs

Town Bids

Calendar of Meetings/Events

Disclaimer

Site Map

In Town Departments:

- Administration
- Animal Control
- **Building/Zoning**
  - Flood docs
- Finance
- GIS
- Harbor Management & Boating
- Municipal Court
- Parks & Recreation
- Planning
- Public Works
- Residential Collection Center
- Tax Assessor
- Tax Collector
- Town Clerk
- Wastewater Management

Building/Zoning

Joseph L. Warner Jr. jwarner@charlestownri.org
Building/Zoning Official
Floodplain Manager

Frank Judge fjudge@charlestownri.org
Alternate Building Official

John Day IV Jday@charlestownri.org
Electrical Inspector
Minimum Housing Inspector

Mary Goff mgoff@charlestownri.org
Building/Zoning Assistant

Office hours are 8:30 a.m. to 4:30 p.m., Monday through Friday.
Telephone: 401-364-1215, Fax: 401-364-1238

Listed under the FEMA Technical Bulletins are several links to various pages and documents including the new Flood Maps, Building and Inspection Requirements, Zoning Information as well as other storm and flooding preparedness information. If you do not have software loaded on your computer to view pdf forms you may go to the Adobe website and download the software for free.

FEMA TECHNICAL BULLETINS

- User's Guide to Technical Bulletins
- Openings in Foundation Walls and Walls of Enclosures
- Flood Damage-Resistant Materials Requirements
- Non-Residential Floodproofing – Requirements and Certification
- Elevator Installation
- Free-Of-Obstruction Requirements
- Below-Grade parking Requirements
- Wet Floodproofing Requirements
- Corrosion Protection for Metal Connectors in Coastal Areas
- Design and Construction Guidance for Breakaway Walls

Should you have any questions or need additional assistance in determining your flood zone - please contact the Building Department at (401)364-1215.

Rhode Island Floodplain Mapping Tool: http://www.riema.ri.gov

Click Here to access additional FLOOD PROTECTION INFORMATION

Click Here for FLOOD MAPS Adopted October 16, 2013

Click Here for Hazard Mitigation Risk Assessment Matrix (draft)

Links of Interest

Looking for the status of your ISDS permit application? Use the State's online ISDS Search service to see an up-to-date history of your application

ORDINANCES and REGS

Click Here for an Explanation of the Hazard Mitigation Risk Assessment Matrix

Questions, comments and/or input on the Hazard Mitigation Risk Assessment Matrix can be directed to Dori Boardman at Charlestown Town Hall dboardman@charlestownri.org

BUILDING PERMITS & INSPECTION REQUIREMENTS

State of Rhode Island blank permit forms: Building, Electrical, Mechanical, Plumbing

ZONING INFORMATION

MISCELLANEOUS FORMS

RI DEPT OF ENVIRONMENTAL MANAGEMENT & COASTAL RESOURCE MANAGEMENT COUNCIL

STORM & FLOODING

Town Hall hours Monday - Friday 8:30 AM to 4:30 PM

COASTAL GEOLOGIC HAZARDS AND SEA-LEVEL RISE: CLIMATE CHANGE IN RHODE ISLAND

Charlestown Town Council Workshop
18 April 2013

Jon C. Boothroyd[1,2] and Bryan A. Oakley[3]

(1) Rhode Island Geological Survey
(2) Department of Geosciences, University of Rhode Island, Kingston RI 02881
(3) Environmental Earth Science Department, Eastern Connecticut State University, Willimantic, CT 06226