



NATURAL HAZARDS

CHARLESTOWN COMPREHENSIVE PLAN

A description of the natural hazards facing Charlestown, issues and opportunities related to storms and climate change, and recommendations to achieve the goals of adaptation and sustainability.

Maps

NH-1 Flood Zones and Hazard Areas

NH-2 Sea Level Rise Scenarios

Cover Photo: Frances Topping

NATURAL HAZARDS CHAPTER

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CHARLESTOWN COMPREHENSIVE PLAN
CHAPTER 7. NATURAL HAZARDS AND CLIMATE CHANGE

Planning Commission Final Draft; December 2019

INTRODUCTION

Due to its location and geographical characteristics, Charlestown is vulnerable to coastal storms including the impacts of high winds and storm surges, coastal and riverine flooding, and severe winter weather. Changing weather patterns due to climate change also require that Charlestown, like other communities, prepare for the impacts of sea level rise and the increased severity of storm events.

This chapter is based on the Town of Charlestown Natural Hazard Mitigation Plan (NHMP) adopted by the Town Council and approved by the Federal Emergency Management Agency (FEMA) in 2017. The NHMP contains significant detail on the natural hazards that Charlestown will likely be confronted with in the future, including climate change and sea level rise. Its approval by FEMA ensures Charlestown’s continued eligibility and participation in the federal National Flood Insurance Program (NFIP). FEMA acceptance of the plan also makes the town eligible for federal and state grant programs to help address natural hazard impacts in vulnerable areas of the community. This chapter presents a summary of the risk analysis included in the NHMP and includes the planning related recommendations and actions, and addresses the requirements detailed in the RI State Guide Plan concerning natural hazards and climate change. Interested parties are encouraged to review the Natural Hazard Mitigation Plan which is available in electronic form on the Town of Charlestown website.

RELATIONSHIP TO OTHER CHAPTERS

The contents of this chapter is related to that in several others.

Natural Resources Chapter

Charlestown’s beaches, salt ponds, water bodies and forests, as described in the Natural Resources chapter, both support resiliency and can be at risk from natural disaster events. Protecting natural resources also means preparing for natural hazards and adapting to climate change.

Services and Facilities Chapter

Natural hazards and climate change impact local infrastructure and the provision of municipal services, as described in the Services and Facilities chapter. The long term effects of sea level rise and climate change must also be considered in planning for infrastructure and local service efforts, especially for at-risk populations.

Energy Chapter

Climate change is driven by energy use; it is a result of energy production from conventional sources like fossil fuels, although it occurs on a macro rather than micro scale. A discussion on energy use and solutions for greater sustainability is contained in the Energy chapter.

EXISTING CONDITIONS

Overview – Partnerships for Natural Hazard and Climate Change Mitigation

The overall objective of this chapter is to establish goals and recommend policies and actions for the town that minimize the ecological, economic and social impacts resulting from natural hazard events. More than almost any other issue, planning for natural hazard mitigation and adaptation to the impacts of climate change and anticipated sea level rise require the coordinated efforts of all levels of government, and all members of the community. It is a concern of local government, the state government and federal agencies as well as non-profit environmental advocacy organizations. In this regard the town has extensive partnerships and relationships with diverse agencies including the RI Department of Environmental Management (RI DEM), the RI Coastal Resources Management Council (CRMC), the RI Emergency Management Agency (RI EMA) and the Federal Emergency Management Agency (FEMA). In particular, the 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 Shoreline SAMP is a valuable management tool for municipalities to address challenging coastal issues such as water quality, sea level rise and coastal development patterns.

Charlestown also has an opportunity through the comprehensive plan update to coordinate with the two other major planning documents: The Natural Hazard Mitigation Plan and the Harbor Management Plan, both adopted in 2017. All three documents have consistent language, goals and recommendations relating to overall community resiliency.

Charlestown Efforts to Mitigate the Risks of Natural Hazards

Charlestown has been active in areas relating to mitigating natural hazard risks. Such actions have included:

- Enforcement of the State Building Code
- Participation in the National Flood Insurance Program
- Adoption of revised FEMA Flood Insurance Rate Maps (FIRMS) in 2013
- Implementation of low impact development (LID) techniques consistent with the RI Stormwater Design and Installation Standards Manual
- Amendment of the zoning ordinance to prohibit structural fill in flood hazard areas

The town has also undertaken a number of specific steps to mitigate the impacts of storm events and flooding. It has created a GIS map of the entire drainage system in the community, including an inventory of all major system components. It has worked to remove an outdated stormwater discharge system on Charlestown Beach Road and replace it with a low impact design (LID) and best management practices (BMP) stormwater system. It has identified town roadways vulnerable to wash-out and developed plans to upgrade the infrastructure, including replacing a bridge and elevating a roadway where needed (Kings Factory Road where it crosses Straight Brook). Rain gardens have been installed in the town owned Ninigret Park and there are plans to include installation of more in several paved areas of town to remove impervious surfaces and promote stormwater infiltration.

In 2019 the town amended the flood hazard regulations in its zoning ordinance to prohibit filling in a floodplain for development (only non-structural fill for grading purposes allowed), and to require that all new public safety buildings be located outside of the 500 year floodplain. Both of these were recommended actions of the 2017 Hazard Mitigation Plan.

Community Rating System (CRS) Program

Most significantly however, has been Charlestown's efforts to achieve a high community rating under the National Flood Insurance Program (NFIP). Since 2015 Charlestown has been accepted into the Community Rating System (CRS) Program by FEMA, a voluntary program that recognizes communities for floodplain management activities that exceed the minimum NFIP standards. Upon acceptance into the program, property owners in the Town of Charlestown receive discounts on their Flood Insurance Premiums based on the "Class" rating in the CRS program.

Charlestown has achieved a Class 7 rating, the first in the State of Rhode Island and the second community to receive such a high 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 high rating is based on efforts that the town has taken to go above the minimum requirements for floodplain management. These include the categories of floodplain mapping and regulations, flood damage reduction, flood preparation and public outreach. It is also reflective of the large amount of special flood hazard area which is protected as open space; as of 2019, of the 3,870 acres of special flood hazard area in Charlestown, 2,060 acres is considered open space, protected either through regulation or ownership.

Currently there are nearly 800 NFIP policies in effect in the Town of Charlestown. The Class 7 rating saves property owners in the Town of Charlestown upwards of \$200,000 a year in combined premiums. As more policies are purchased and premiums increase, so will the savings.

Charlestown Risk Profile

Table NH-1 provides a summary of current land usage by general category in Charlestown for the years 2004 and 2015. This data is presented to illustrate the distribution of improved and undeveloped properties that might be impacted by natural disaster events, sea level rise and climate change. It is noteworthy that the town has experienced modest growth over the time increment illustrated in the table, most of which occurred in the residential sector (222 properties added).

**Table NH-1
Summary of Land Use Changes in Charlestown**

Land Use	2004			2015		
	Acres	Parcel Count	Percent	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 (Res) 261 (Com)	962 38	15.56 % 1.20 %	2,893 (Res) 168 (Com)	836 42	13.27 % 0.77 %
Total Land in Town	21,700	6,252	100 %	21,799**	6,409	100 %

* Exempt Properties = Public or non-profit ownership, does not include roads and other infrastructure.

** Total acreage based on updated surveys

Charlestown Hazard Profiles

Tables NH-2 and NH-3 present a description of the types of natural hazards, by broad classification, that Charlestown may expect to experience. A separate section on climate change and accelerated sea level rise is discussed in the Issues and Opportunities section of this chapter.

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.

This process has utilized recent events to inform and focus its recommendations and action strategies, including the March 2010 flood events, Tropical Storm Irene (2011), Superstorm Sandy (2012) and the severe winter storm and snowstorms of 2013 and 2015, respectively. All these events caused damage to the town, but none more than Superstorm Sandy's major coastal erosion, and wide-spread flooding which destroyed or damaged homes and businesses along the coast.

**Table NH-2
Charlestown Specific Hazards**

Flood Related Hazards	Wind Related Hazards	Winter Related Hazards	Additional Hazards
Coastal Flooding	Hurricane	Snow	Extreme Heat/ Drought
Heavy Rains and Riverine Flooding	Thunderstorms	Ice	Sea Level Rise (SLR)
Dam Failure/Breach		Extreme Cold	Climate Change

**Table NH-3
Probability of Local Hazards**

Flood Related Hazard	Probability	Potential Effects	Risk Priority
Coastal Flooding	Highly likely	Erosion, flooding, property damage power outages, loss of life	High
Coastal Erosion/Shoreline Change	Highly likely	Loss of coastal features, property damage salt water intrusion	High
Climate Change/SLR	Highly likely	Accelerated sea-level rise, heat waves landward migration of coastal features flooding, property loss, salt water intrusion	High
Heavy Rains/Thunderstorms	Highly likely	Flooding, property and infrastructure damage	High
Riverine Flooding	Likely	Infrastructure flooding/damage property damage	High
Wind Related Hazard	Probability	Potential Effects	Risk Priority
Storm Surge	Highly likely	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	Coastal erosion, power outages downed trees and limbs, property damage	High
Hurricane	Likely	Coastal erosion, flooding, property damage power outages, loss of life	High
Winter Related Hazard	Probability	Potential Effects	Risk Priority
Snowstorm: snow, ice and/or extreme cold	Highly likely	Power outages, roof collapse, high winds coastal flooding	Medium
Other Hazard Type	Probability	Potential Effects	Risk Priority
Extreme Heat/Drought	Likely	Heat exhaustion, heat stroke, death Potable water impacts during drought	Medium

Table Note: 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

NATURAL HAZARDS IN CHARLESTOWN: ISSUES AND OPPORTUNITIES

Charlestown is vulnerable to diverse events including coastal flooding, riverine flooding, heavy rains, storm surge, and high winds (hurricanes). The town is also subject to anticipated effects of sea level rise (SLR) and climate change. The greatest risk area in Charlestown occurs south of Route 1 along the coast of Rhode Island. This is an area of higher population density and future development pressure.

The following is a summary of the natural hazards impacting Charlestown; for more detail, please see the Hazard Mitigation Plan.

Coastal Flooding

Coastal flooding is typically a result of storm surge and wind-driven waves, which erode the coastline, as well as from intense rainfall. 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.



Charlestown Police Department

Coastal Flooding during Tropical Storm Irene, August 2011

Coastal flooding occurs south of US Route 1 and the natural moraine in the low-lying areas around the salt ponds, some of which are densely developed. Charlestown has approximately 29 miles of coastline that makes it susceptible to coastal flooding. The coastline is altered most during big storms such as nor'easters and hurricanes. High waves wash away or damage dunes that protect inland property. Narrow barrier beaches, such as the Ninigret Pond barriers (East Beach and

Charlestown Beach) and the Quonochontaug Pond barrier, can dramatically shift position. Low-lying coastal areas in close proximity to the shore or estuaries are then exposed to the threat of flooding from storm surges and rainfall. Areas bordering rivers may also be affected by large discharges caused by heavy rainfall over upstream areas.

The FEMA designated Special Flood Hazard Areas in Charlestown’s coastal area are shown on Figure NH-1 below – the AE and VE Zones and the corresponding flood elevations. See Map NH-1 *Flood Zones and Hazard Areas* which shows the flood zones in the entire town.

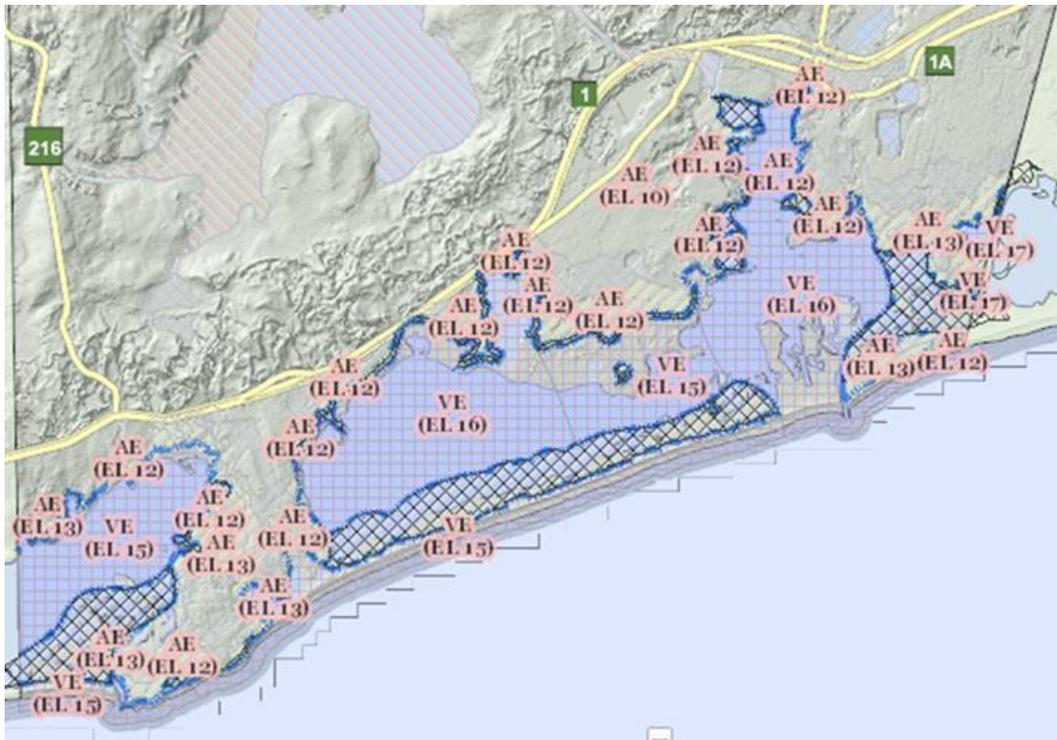


Figure NH-1 Special Flood Hazard Areas in Charlestown Coastal Region
Source: FEMA

The RI 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. Furthermore, properties on the east side of the Charlestown Breachway are the most susceptible to erosion. As shown on the ARCGIS RI Shoreline Change Map, some locations are eroding at a rate of up to 3.85 feet per year. This trend has major implications for Charlestown Beach Road and the residents and visitors that live or rent along Charlestown Beach Road in this location.

Another location of significant erosion is the Quonochontaug Headlands. According to the RI CRMC Salt Pond Region Special Area Management Plan (SAMP), these headlands contain small

bedrock outcrops and are fronted by beaches but not backed by a marine environment such as a coastal lagoon. Erosion rates at the Quonochontaug Headlands range from 1.07 feet per year to 1.34 feet per year (see ARCGIS RI Shoreline Change Map).

Sea level rise (SLR) and the expected increased intensity of storm surge due to climate change will contribute to the impacts of flooding in the community. Coastal flooding has a highly likely probability of a future event as shown on the table above. Based on historic coastal flooding events and probability of future events, the degree of coastal flooding can range from minor to catastrophic. See Map NH-2 *Sea level Rise Scenarios*.

Riverine Flooding

Floods are generally the result of excessive precipitation and can be classified under two categories: general floods and flash floods.

Charlestown's coastal orientation and presence of several rivers and brooks make a large portion of the community susceptible to flood events. 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 on a periodic basis. According to the FEMA, the Zone A flood designation encompasses approximately 17% of the land area in Charlestown, although it is mostly undevelopable wetlands that are protected through the RI DEM.



Frances Topping

Kenyon Mills in the March 2010 Flood

Though there is no distinct flood season in Rhode Island and major river flooding can occur in any month of the year, National Oceanic and Atmospheric Administration (NOAA) has studied a number of past floods from the 1990's to 2000 and has noted three 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.

Hurricanes

Tropical storms and hurricanes are low pressure systems that usually form over the tropics. These are characterized by 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:

- Tropical depression: maximum sustained surface wind speed is less than 39 mph
- Tropical storm: maximum sustained surface wind speed from 39-73 mph
- 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 (north/east portion of the storm path). During a hurricane, a storm surge forms on top of normal tide levels and the resulting storm tide can cause extensive coastal inundation. 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.

Hurricanes 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 may 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.

The probability of future hurricanes affecting Charlestown is likely. Superstorm Sandy which swept up the east coast in October 2012 caused extensive damage across the town and region.

Snow and Ice Storms

Annually, Charlestown experiences a variety of winter conditions including snow and ice storms. 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. The term “ice storm” is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations.



Charlestown Police Department

Charlestown Beach after Superstorm Sandy, November 2012

All of Charlestown is equally at risk for snow and ice storms. Based on the data collected from 1981-2010, the average annual snowfall for Rhode Island is 33.8 inches, which exceeds the national average of 22.4 inches. Significant snow events result in hazardous road conditions, power outages, school/business closings and transportation disruptions. Due to its maritime climate, Charlestown generally experiences cooler summers and warmer winters than inland locations. However, snow and ice do occur and can result in more extensive damage than one would expect.

Extreme Cold

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 typically experiences extreme cold conditions each year, during the winter and shoulder seasons (spring and fall).

Extreme Heat/Drought

Extreme heat conditions are defined by summertime weather that is substantially hotter and/or more humid than average for a location at that time of year. In Rhode Island, when the outside temperature goes above 90 degrees for three (3) or more days, it is a heat wave.

Except for the immediate coastline, extreme heat affects the entire Town of Charlestown and may have a secondary impact as to the availability of potable water for residential and commercial/industrial use given the town's reliance on groundwater resources for drinking and process water. Water conservation and resource management are critically important during periods of extreme heat and/or drought conditions. The probability of extreme heat and heat waves are likely. Charlestown residents most at risk to extreme heat are the elderly, very young, and people with chronic diseases and/or mental illness.

Climate Change and Accelerated Sea Level Rise

It is accepted science that climate change (global warming) is resulting in environmental impacts and challenges, particularly for coastal locations like Charlestown due to expected sea level rise. Land areas and improved properties abutting marine waters are or will be directly impacted.

Based on prior trends of temperate changes it is expected that global warming and associated sea level rise will continue 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 the greatest cause for concern. Based on CRMC's guidance, predicted sea level rise over current levels will be as follows:

- Year 2030: one (1) foot
- Year 2050: two (2) to three (3) feet
- Year 2100: five (5) to seven (7) feet

It is a matter of consensus within the science community that the acceleration of global warming is 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.

Risks and Vulnerability

The Charlestown GIS Department has developed sea level rise projections for Charlestown using STORMTOOLS, a simplified flood inundation model developed by University of Rhode Island in conjunction with the CRMC. It is an interactive mapping program using the state GIS (RIGIS) database which illustrates both the extent and depth of flooding from various storm surge and sea level rise scenarios. The projected 1, 3, 5 and 7 foot sea levels for a 100 year storm potentially

impacting Charlestown are shown on a Map NH-2. The map shows that marsh areas inside the breachways to both coastal ponds are already underwater at mean higher high water (average of the higher high water height of each tidal day over the National Tidal Datum Epoch, a 19 year period) and that the barrier beaches, most of both ponds' shore areas, as well as the Ninigret National Wildlife Refuge and much of the Quonochontaug Peninsula, are already potentially impacted by a 100 year storm. This is in the absence of rising sea levels.

Tables NH-4 and NH-5 provide information regarding land areas and related populations affected from a 100-year storm event using the 1, 3 and 5 foot sea level rise scenarios.

**Table NH-4
Parcel and Population Impacts from Sea Level Rise**

SLR Scenario	Total Parcels Impacted (cumulative)	Developed Parcels Impacted (cumulative)	Affected Population (cumulative) *	Affected Population Change (per SLR scenario)
Existing 100 year base	1,648	1,152	2,765	0
Base + 1' SLR	1,746	1,234	2,962	+ 197
Base + 3' SLR	1,910	1,382	3,317	+ 355
Base + 5' SLR	2,066	1,508	3,619	+ 302

* Assume 2.4 persons per dwelling unit per US Bureau of the Census data (2010)

**Table NH-5
Property Values within Predicted Sea Level Rise Areas***

SLR Scenario	Total Land Value (cumulative)	Total Improvement Value (cumulative)	Total Value (cumulative)	Total Value Change (per SLR scenario)
Existing 100 year base flood areas	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 (2016)

* In rounded dollars.

Climate Change and the Coast

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; and
- Risks to historical and cultural assets.

The town will 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.



Charlestown Police Department
Vulnerable Homes along the Barrier Beach after Superstorm Sandy

Climate Change and Increased Precipitation

Climate change will also result in increased average precipitation and storm events with greater ferocity. In coastal areas of Charlestown, increased precipitation along with rising sea levels will result in rising groundwater levels, which decreases the separation distance between septic systems and the groundwater. This may result in inadequate treatment of wastewater leading to contaminated drinking water. Increased precipitation in addition to dramatic precipitation events will increase the likelihood of flooding events in all parts of town, especially northern Charlestown where the soils are not as well drained. In response to an ever-changing climate, the town will need to regularly review and amend its land use regulations to provide resiliency against these challenges, as well as to incorporate the latest scientific data when reviewing projects. The town must also coordinate with state regulatory agencies to ensure that they are incorporating changing groundwater levels and other conditions into their own regulations in response to climate change.

NATURAL HAZARDS AND CLIMATE CHANGE: GOALS, POLICIES AND ACTIONS

There are two ways to address the future impacts of natural hazards and climate change within a comprehensive plan:

- 1. Planning for adaptation to natural hazards and climate change impacts. Examples include: land use policies that avoid development in vulnerable areas, and public education regarding adaptation and sustainability.
- 2. Planning for mitigation of climate change. Examples include: retrofitting of public buildings for energy efficiency and hardening against natural hazards, and raising or relocating vulnerable roadways.

GOALS

- Goal 1 Protect and enhance critical coastal and inland environmental resources.**
- Goal 2 Integrate resiliency from natural hazards into all community actions.**

POLICIES AND ACTIONS

The following policies and actions have been developed to implement the goals of this chapter. Those action items that are also included or addressed in the Hazard Mitigation Plan are noted by an asterisk.

- Goal 1 Protect and enhance critical coastal and inland environmental resources.**
- Policy 1.1 Preserve natural resources and improve community resiliency through land conservation and protection.**

Action 1* Develop an acquisition strategy for properties in the town’s most vulnerable areas, including determination of appropriate funding sources.

Charlestown will continue to identify and secure open space properties that are associated with landforms that contribute not just to the quality of life and economic viability of the town, but can provide a resilient environment for its residents. This means acquiring properties subject to flooding, both coastal and inland, by easement or by title, and permanently restricting these properties as open space.

Action 2 Review land uses in vulnerable areas to determine whether restrictions are necessary to prevent or lessen potential losses during large storm events or as a result of sea level rise.

Charlestown will evaluate the allowable future land uses in those vulnerable areas that cannot or are not likely to be acquired or permanently protected. In addition to evaluating permitted uses, this should involve working closely with state agency partners to define, evaluate and communicate rebuilding restrictions in such areas.

Policy 1.2 Educate the public on the probabilities and risks associated with natural hazards and climate change, and on methods of community resilience, with technical assistance provided if possible.

Action 1 Develop and disseminate an educational campaign for the public on actions that can be taken to reduce risks to private property and to improve resiliency, particularly in coastal hazard and flood prone areas.

Action 2 Continue to maintain the emergency and disaster preparedness page on the municipal website with information on minimizing risk to private property and on general preparedness.

Action 3 Continue to offer property owners online resources and updates related to changes or amendments to the local Flood Insurance Rate Maps (FIRMs) and the National Flood Insurance Program (NFIP).

Charlestown has a strong public educational program on preparing for natural hazards and building in flood zones, and this will be continued and enhanced as needed. However, there is a need to prepare residents for the longer-term impacts of climate change. It is also important that town staff, particularly the floodplain manager, stay informed of federal and state policy changes related to flooding and floodplain management so that property owners make the best decisions regarding use of their property, particularly over the long-term.

Goal 2 Integrate resiliency from natural hazards into all community actions.

Policy 2.1 Ensure that the local Hazard Mitigation Plan is up-to-date and utilizes the most recent available technical data for natural hazards and climate change.

Action 1 Continue to improve community resilience in order to improve or maintain the town's current Community Rating System score.

Action 2 Ensure that there is adequate funding and administrative support to implement the recommendations of the Charlestown Hazard Mitigation Plan.

Policy 2.2 Incorporate resiliency planning into governmental functions.

Action 1* Develop a municipal review process for developments proposed within the areas projected to be exposed to sea level rise.

Projections of sea level rise are continuously being modified to adjust for new empirical data. Nonetheless the town should identify areas likely to be impacted over a 20 year time frame, and develop a review process for development within these areas. This process should include policies and standards that will provide resilience protection for the developments under review, both public and private.

Action 2 Maintain a separate database of building permits for all properties within the Special Flood Hazard Areas and the projected sea level rise areas.

This database can be used to monitor issues with building and rebuilding in vulnerable areas. At a minimum there should be a mechanism for flagging these properties so that special attention can be applied during the building process.

Action 3* Upgrade existing GIS databases after natural disasters, where applicable.

All GIS databases should be updated to include changing flood elevations, SLR projections, areas that are inundated, and/or properties that are damaged after storm events. Property damage can include both structural damage and inundated septic systems that were inoperable after an event.

Action 4 Evaluate the impact of storm-related structural losses on local municipal tax revenues in the annual budget.

The damage to buildings from severe storm events and SLR has a direct impact on Charlestown's tax base. Using the database above, the loss of the assessed values of damaged or destroyed buildings can also be monitored. The cumulative impact of this eventual loss of tax base can be translated to the town budget. This work requires the expertise of the tax assessor and the finance director.

Policy 2.3 Incorporate resiliency into governmental projects.

Action 1* Identify municipal roads that intersect sea level rise scenarios, determine their long-term viability and initiate the redesign (or relocation) efforts necessary to maintain their transportability for the foreseeable future.

This is a longer term effort which not only identifies the most vulnerable roads in Charlestown, but considers both the condition of the road and the expected rate of SLR in order to determine the most cost-effective solution. This effort should also address roads impacted by riverine flooding.

Action 2* Improve the functioning and resiliency of municipal roads through regular maintenance and by identifying and upsizing drainage culverts as needed through the annual capital improvement program.

Action 3* Implement non-structural alternatives to shoreline protection through the reuse of dredged materials, or other emerging best practices.

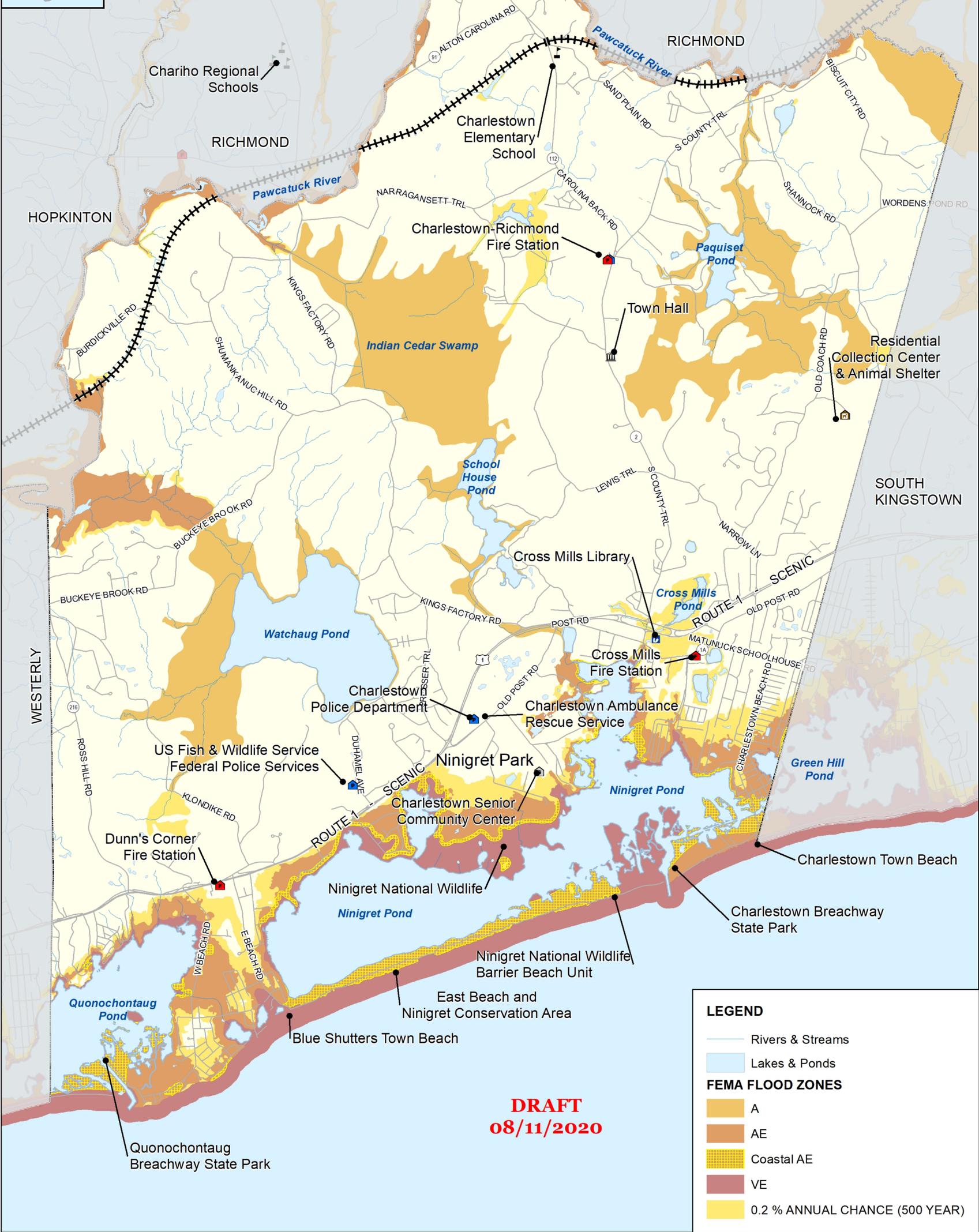
Policy 2.4 Review and amend local development regulations to incorporate sustainability practices.

Action 1* Limit the percentage of allowable impervious surface within developed parcels by amending the zoning ordinance to include total lot coverage standards.

Action 2 Regularly review local regulations as they relate to rising groundwater levels and flooding potential, and maintain close contact with appropriate state agencies in this regard.



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



LEGEND

- Rivers & Streams
- Lakes & Ponds
- FEMA FLOOD ZONES**
- A
- AE
- Coastal AE
- VE
- 0.2 % ANNUAL CHANCE (500 YEAR)



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DRAFT
08/11/2020

Map Sources:



TOWN OF CHARLESTOWN
RHODE ISLAND



Prepared by:
Town of Charlestown

COMPREHENSIVE PLAN, 2020

SEA LEVEL RISE
SCENARIOS

Map NH-2