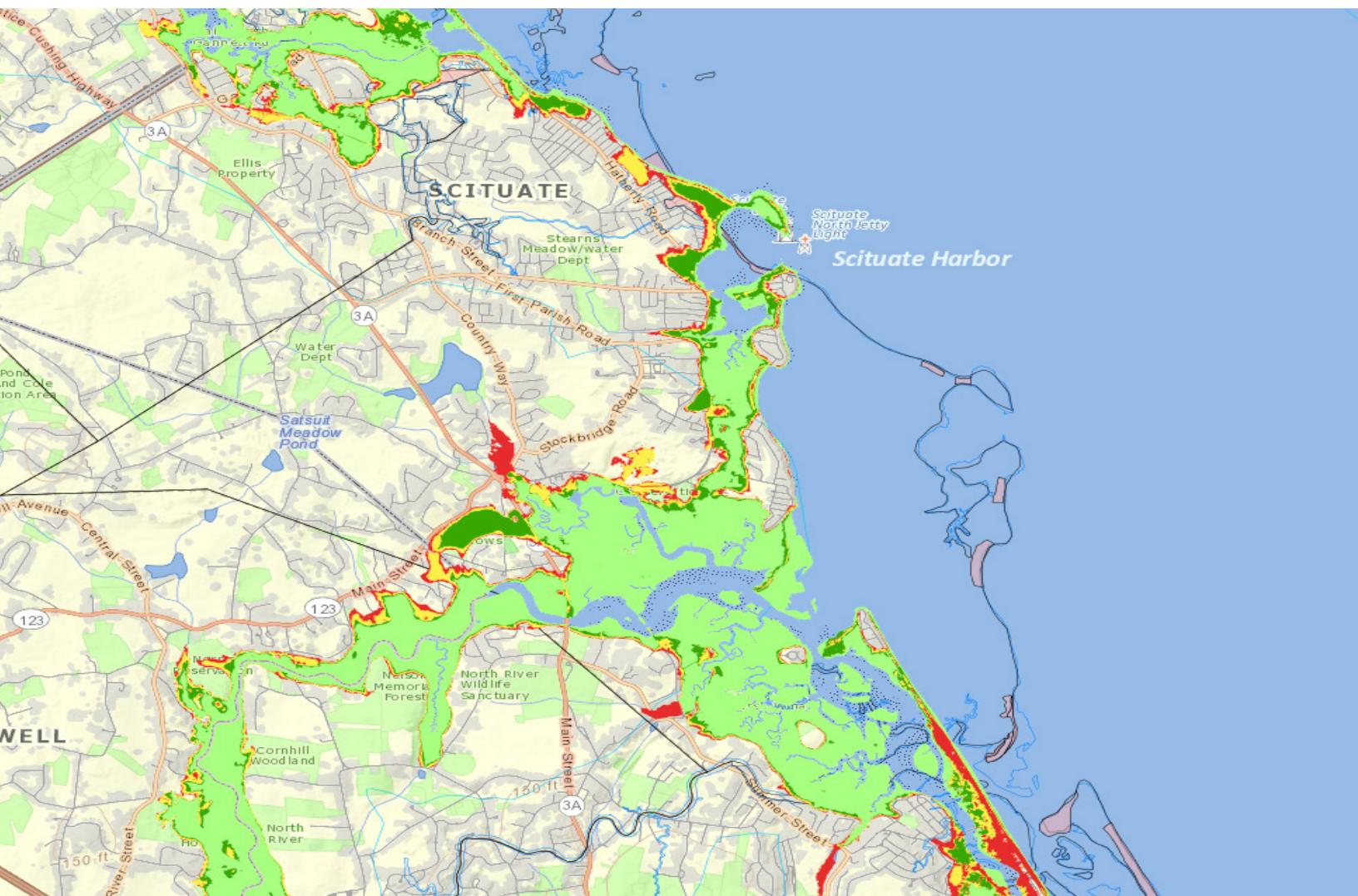


# Natural Hazard Mitigation Plan

## Scituate, Massachusetts

AUGUST 2, 2016



PREPARED BY



# ***Natural Hazard Mitigation Plan Update***

**Scituate  
Massachusetts**

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Prepared for      **The Town Scituate**  
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                        Scituate, MA 02066

Prepared by      The Scituate Hazard Mitigation Committee

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August 2, 2016

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# Table of Contents

<b>Executive Summary.....</b>	<b>1</b>
<b>Adoptio</b>	
.....	4
<b>1.0 Background .....</b>	<b>5</b>
1.1    Introduction to Hazard Mitigation .....	5
1.2    Community Planning Area .....	7
1.2.1    Location Information & Geography .....	7
1.2.2    Demographics/Census.....	8
1.2.3    Land Use and Infrastructure.....	8
1.2.4    Community Development & Development Trends.....	9
1.2.5    Historic and Natural Resource/Environmental Significance.....	11
1.2.6    Commerce, Industry, Academic.....	12
1.2.7    NFIP, CRS Community (highlights).....	13
1.3    Significant Events .....	13
<b>2.0 Planning Process .....</b>	<b>16</b>
2.1    Purpose, Overview and Background .....	16
2.2    Building Support: Community Involvement, Roles & Responsibilities .....	17
2.2.1    Stakeholders .....	17
2.2.2    Public .....	17
2.2.3    Neighboring Communities.....	19
2.3    Understanding the Community's Risks.....	19
2.4    Developing & Updating the Mitigation Strategy .....	20
2.4.1    Identification & Review of Goals, Actions, Priorities, Changes Progress....	20
2.5    Brining the Plan to Life: Implementation & Maintenance .....	21
2.5.1    Monitoring .....	21
2.5.2    Evaluation .....	21
2.5.3    Updates.....	22
<b>3.0 Risk Assessment.....</b>	<b>23</b>
3.1    Defining Risk & Methodology.....	23
3.2    Hazards.....	23
3.2.1    Hazard Identification .....	24
3.2.2    Hazard Profiles.....	26
3.2.3    Climate Change .....	48
3.3    Vulnerability .....	48
3.3.1    Community Assets .....	49
3.4    Risk Analysis and Assessment .....	55
3.4.1    Methodology .....	55

3.4.2 Exposure Analysis .....	56
3.4.3 Historical Analysis.....	56
3.4.4 Vulnerability Summary.....	57
3.4.5 Risk Assessment Matrix.....	63
<b>4.0 Capability Assessment .....</b>	<b>64</b>
4.1 Purpose .....	64
4.2 Types and Evaluation of Capabilities.....	64
4.2.1 Local Government and Program Areas .....	66
<b>5.0 Mitigation Strategy.....</b>	<b>77</b>
5.1 Vision and Goals.....	77
5.2 Existing Mitigation Actions.....	78
5.3 Update of the Mitigation Strategy and Actions.....	88
5.4 Prioritization.....	89
5.4.1 STAPLEE.....	91
5.5 Mitigation Actions.....	92
<b>6.0 Moving Towards a Safe, Resilient, and Sustainable Community .....</b>	<b>99</b>
6.1 Evaluation: Progress and Challenges.....	99
<b>References.....</b>	<b>101</b>
<b>Appendix A: Assessing Risk – Maps.....</b>	<b>103</b>
<b>Appendix B: HAZUS- MH Hurricane Event Report.....</b>	<b>112</b>
<b>Appendix C: Public Outreach .....</b>	<b>120</b>
<b>Appendix D: Technical and Financial Assistance for Mitigation .....</b>	<b>127</b>
<b>Appendix E: Glossary.....</b>	<b>130</b>
<b>Appendix F: FEMA Letter of Approval .....</b>	<b>135</b>
<b>Final Local Mitigation Plan Review Tool .....</b>	<b>135</b>

# Executive Summary

**PURPOSE:** The purpose of the Natural Hazard Mitigation Plan update is to identify local policies and actions that can be implemented to have long term impacts to reduce risk and future losses from hazards. These mitigation policies and actions are identified based on an assessment of hazards, vulnerabilities, and risks and the participation of a wide range of stakeholders and the public in the planning process.

Hazard Mitigation is a sustained action taken to permanently reduce or eliminate long-term risk to people and their property from the effect of natural hazards. Mitigation actions help safeguard personal and public safety, and can significantly reduce the impact of future disasters.

Pre-disaster planning and investment in preventative measures can significantly reduce the cost of tomorrow's post-disaster recovery and help post-disaster operations become more efficient. By planning ahead, Scituate minimizes the economic and social disruption that results from natural hazards including floods, severe weather and hurricanes which can result in the destruction of property, loss or interruption of jobs, loss of business and loss of life.

Mitigation strategies include a mix of physical initiatives to limit the impacts of natural hazards, such as rebuilding riprap walls to protect against coastal erosion, as well as regulatory/planning initiatives such as revised zoning ordinances, and maintaining land use regulations.

The previous plan, adopted on June 28, 2011 was part of a regional effort led by the Metropolitan Area Planning Council (MAPC). This update has been developed as a single plan focusing on Scituate. The 2011 HMP consisted of nine hazard mitigation goals with 20 supporting mitigation measures. Eight of the 20 measures were carried forward from the 2005 HMP.

**STRATEGY:** The Scituate Hazard Mitigation Strategy advocates the concepts of disaster resilient and sustainable communities. Scituate is building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes.

Additionally, Scituate is striving to be a disaster resilient city, and therefore, safer community, through the implementation of mitigation programs and policies. The town implements and institutionalizes hazard mitigation through its human, legal and fiscal resources; the effectiveness of intergovernmental coordination and communication; as well as with the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning.

The Scituate mitigation strategy provides a coordinated, consistent set of goals for reducing or minimizing: human and property losses; major economic disruption; degradation of ecosystems and environmental critical habitats; destruction of cultural and historical resources from natural and technological disasters.

- Provide a basis for intergovernmental coordination in hazard mitigation programs at the state and local level;
- Develop partnerships between the town and private sector, local communities and non-profit organizations in order to coordinate and collaborate hazard mitigation programs;
- Identify and establish close coordination with local government departments and agencies responsible for implementing the sound practices of hazard mitigation through building standards and local land use development decisions and practices; and,
- Provide for a continuing public education and awareness about the risks and losses from natural and technological disasters, in addition to hazard mitigation programs, policies and projects.

**GOALS:** To support the implementation of the Scituate Mitigation Strategy, nine (9) goals have been developed.

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Maintain existing mitigation infrastructure in good condition.
4. Continue to enforce existing zoning and building regulations.
5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Encourage future development in areas that are not prone to natural hazards.
8. Educate the public about natural hazards and mitigation measures.
9. Make efficient use of public funds for hazard mitigation.

**ACTIONS:** The types of activities which were considered when developing new actions to reduce the community's vulnerability have been divided into the following categories:

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

Ten primary actions have been developed.

1. Elevate Repetitive Loss Structures
2. Protect Key Roads and Bridges
3. Foreshore Protection
4. Drainage and Culvert Repairs, Improvements, and Upgrades
5. CRS Participation
6. Complete Coastal Assessment
7. Implement Recommendations of Coastal Assessment
8. Beach and Berm Nourishment and Replenishment
9. Install Strategic Power Grid Shutoffs
10. Installation of Generators at Critical Municipal Facilities

Though the community is still recovering from previous storms, we have made significant strides to reduce our vulnerability to the forces of nature. Following through on the actions and programs in this plan also contributes to the continued benefits of our participation in the Community Rating System (CRS). Currently a class 8 community, Scituate residents save 10% on their annual National Flood Insurance Program (NFIP) premiums, approximately \$242,937 in 2015.

# Adoption Documentation

**TOWN OF SCITUATE  
BOARD OF SELECTMEN**



600 Chief Justice Cushing Hwy.  
Scituate, Massachusetts 02066  
Telephone (781) 545-8740  
Fax (781) 545-8704

## CERTIFICATE OF ADOPTION

### A RESOLUTION ADOPTING THE TOWN OF SCITUATE HAZARD MITIGATION PLAN

WHEREAS, a Local Hazard Mitigation Planning Committee, composed of staff from a number of different Town departments, worked with Vanasse Hangen Brustlin, Inc. (VHB) to prepare the Hazard Mitigation plan; and

WHEREAS, the Town of Scituate Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Scituate, and

WHEREAS, a duly-noticed public meeting was held by the Board of Selectmen on July 19, 2016 and

WHEREAS, the Town of Scituate authorized responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of Scituate Board of Selectmen adopts the Town of Scituate Hazard Mitigation Plan in accordance with Article 5, Section 5-1 of the Charter of the Town of Scituate.

ADOPTED AND SIGNED THIS  
DATE July 19, 2016

Martin J. O'Toole, Chairman

Anthony V. Vezzani, Vice Chairman

Maura C. Curran, Clerk

TOWN of SCITUATE  
BOARD of SELECTMEN

John F. Danehey

Shawn Harris

# 1.0 Background

## 1.1 Introduction to Hazard Mitigation

Hazard Mitigation is a sustained action taken to permanently reduce or eliminate long-term risk to people and their property from the effect of natural, technological, or man-made hazards. Mitigation actions help safeguard personal and public safety, and can significantly reduce the impact of future disasters.

Pre-disaster planning and investment in preventative measures can significantly reduce the cost of tomorrow's post-disaster recovery and help post-disaster operations become more efficient. By planning ahead, Scituate minimizes the economic and social disruption that results from natural hazards including floods, severe weather Nor'easters and hurricanes which can result in the destruction of property, loss or interruption of jobs, loss of business and loss of life.

Mitigation strategies include a mix of physical initiatives to limit the impacts of natural hazards, such as rebuilding revetments, jetties, and seawalls to protect against coastal erosion, as well as regulatory/planning initiatives such as revised zoning ordinances, and maintaining land use regulations.

The purpose of this plan is to identify actions and policies for the Town of Scituate to minimize the social and economic loss and hardships resulting from natural hazards. These hardships include the loss of life, destruction of property, damage to crucial infrastructure and critical facilities, loss/interruption of jobs, loss/damage to businesses, and loss/damage to significant historical structures. To protect present and future structures, infrastructure and assets, and to minimize the social and economic hardships, the Town of Scituate will implement the following general actions and policies:

- Incorporation of the policies and action items from the Hazard Mitigation Plan into the town's Master Plan
- Incorporation of hazard mitigation into the site plan review process, flood plain special permit approvals and other action by the ZBA and Planning Board
- State and local building code review
- Public education/outreach
- Post-disaster recovery opportunities/strategies

Formal adoption and implementation of this document will allow Scituate to continue to participate in the NFIP which is vital to protecting coastal property which constitutes 9% of the town's assessed valuation and sustain credit points under the National Flood Insurance Program (NFIP) Community Rating System (CRS), which provides discounts on NFIP premiums for property owners in communities that participate in this voluntary program. 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.

Scituate participates in the National Flood Insurance Program (NFIP). The NFIP is a Federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the Federal Government. This insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and replacing their contents.

FEMA's Community Rating System (CRS) program allows residents of the Town of Scituate to gain credit points that will result in discounts on National Flood Insurance Program (NFIP) premiums. Scituate is currently rated a CRS Class 8 saving NFIP policy holders in the Special Flood Hazard Area 10% on their annual premiums. This equates to an approximate savings of \$242,937 in 2015 annual premiums.

Adoption of this Hazard Mitigation Plan will also protect Scituate's eligibility for federal grants available through FEMA's Hazard Mitigation Assistance Programs, including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Pre-Disaster Mitigation (PDM).

FEMA's Pre-Disaster Flood Mitigation Assistance Program makes grants available for communities to implement flood mitigation planning and activities such as acquisition, relocation, and retrofitting of structures. This program is only available for communities having a pre-existing approved hazard mitigation plan.

FEMA's Post-Disaster Hazard Mitigation Grant Program is only available for communities after a federally declared disaster. An approved mitigation plan expedites the application process for pre- and post-federal mitigation funding, as well as, assists in ensuring a funded project is eligible and technically feasible.

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

### Losses Associated With Inaction

#### Initial Damages

- Casualties including residents, rescue personnel, and pets.
- Infrastructure damage, potential road closures and prolonged interruption of utility services.
- Temporary and permanent business closings.
- Damage to buildings and property.
- Loss of vital government records and documents.
- Loss of personal property including items of irreplaceable sentiment.

#### Expenses and After-Effects

- Emergency response costs, such as evacuation of persons in danger, maintaining the town's emergency shelter and triage supplies.
- Facility and infrastructure repairs.
- Debris and contamination cleanup.
- Depreciated real estate values.
- Lost wages and sales tax revenue.
- Reluctance of new business starts.
- Permanent environmental damage via secondary "technological" hazards.
- Condemning houses beyond repair, assistance to homeowners rebuilding.
- Home rebuilding costs and homeowner relocation costs.

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## 1.2 Community Planning Area

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### 1.2.1 Location Information & Geography

Scituate was settled in 1627 and incorporated in 1636. The town name refers to the Wampanoag term for cold brook, *satuit*. Scituate is a mid-sized seacoast community located equidistant between Boston and Plymouth. The town has a total area of 31.8 square miles, including 17.6 square miles of land and 14.2 square miles of water. According to the 2010 US Census, there are 18,133 year round residents. Scituate is bordered by Cohasset to the northwest, Norwell and Hingham to the west and Marshfield to the south. The Humarock portion of town is only accessible through the Town of Marshfield.

In the nearly 400 years since its incorporation, it has evolved from a summer colony to a residential community. Ocean-related recreational activities make

it a very desirable place in which to live and to raise families. Its Town Pier accommodates a working fishing fleet and three business areas.

Summer temperatures tend to be in the 53°-76° F/12°-24° C range. There are some 90°+F/32°+C days, mostly in the inland areas in July, but the afternoon sea breeze keeps most summer highs in the low 80's F/27°C. September and October are generally clear, with highs in the mid 60's to 70°s F/ 17°-23° C. Winter is wet, sometimes snowy, icy and chilly (5° to 37° F/-8° to -3°C).

Storms have had a profound impact on the nature of the town. In November of 1898, the shores of Scituate were struck by the Portland Gale, one of the most severe storms of the century. Continuous, intense wave action during this extreme storm breached the connection between a long peninsula of barrier beach to the south and the rest of the town. This resulted in the separation of Humarock, which has remained part of Scituate but is accessible only through the Town of Marshfield.

The town has one of the largest number of repetitive loss properties in the state, reflecting the continuing impact of storms and flooding on the town.

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## **1.2.2 Demographics/Census**

Based on the US Census, Scituate has seen a small increase in population from 17,863 people in 2000 to 18,133 people in 2010. While the greatest percent of the population falls in the 50-54 grouping, the median age is 45 years old. Twenty-seven percent of the population is under 19. Sixty-two percent of the population over 16 years of age reported that they are employed. Almost 50% of the employed population is in a management, business, science, or arts occupation. The median annual household income is estimated to be \$99,034 (2013 dollars).

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## **1.2.3 Land Use and Infrastructure**

The town Master Plan provides a blueprint for land use practices and goals for maintaining the character of the community while allowing development in a coordinated and managed process. The majority of dwellings (83.5%) consist of single family owner-occupied homes. Less than 3% of the total land area is zoned for business, commercial, or multi-family development.

Approximately 1,815 acres are protected as open space (Table 1). In addition, several of the zoning districts restrict development due to environmentally sensitive areas. A 2014 MAPC analysis identified only 255 acres of vacant land as potentially developable (Scituate Economic Development Study, 2014).

## 1.2.4 Community Development & Development Trends

The 2014 Scituate Economic Development Report determined that based on historical development patterns in Scituate, commercial activity has been concentrated in village settings – Scituate Harbor, North Scituate, Greenbush and Humarock (Table 2). These areas, along with limited opportunities along 3A, continue to provide the best opportunity for development of new business within town. Although they comprise only 3 percent of total land area in Scituate, they are zoned for commercial and mixed-use development and include enough land potentially available for development or redevelopment to accommodate the total additional square footage projected. However, some minor adjustments to the boundaries of the Village Business Overlay districts and other existing districts could provide additional opportunities to best encourage and achieve desired development types and patterns without incurring an increase in vulnerability to natural hazards.

Projections developed by MAPC suggest Scituate will grow by approximately 700 households by 2030. Many of these will be smaller households – young singles and families and retirees – who often prefer alternatives to single family housing units. Previous studies, including the 2008 Housing Production Plan, identified need for additional rental options within the community, and the need for more multifamily units. These would provide affordable options for existing and future households at densities that would better support more pedestrian-oriented village areas. The housing market could support higher density rental housing in North Scituate (if sewer can be extended) and Greenbush, as well as additional luxury condominiums in

Scituate Harbor. Greenbush in particular holds the most potential for higher-density rental housing because there is more land suitable for larger-scale development or redevelopment that is close to Route 3A and the commuter rail station. Additionally, zoning should be modified to allow for and encourage the creation of smaller attached or detached single family homes often preferred by retirees or first-time home buyers looking to enter the market.

**Table 1. Protected Open Space**

Type	Acreage
Town of Scituate Conservation Commission	1,308
Town of Scituate DPW Water Division	323
Private Land Trust	24
North and South River Watershed Association	82
State	76
FEMA	3

Source: Scituate Economic Development Study, 2014

**Table 2. Scituate Zoning Districts**

District	Acreage	Percent of Town
<b>Base Districts</b>		
General Business GB	87	1%
Harbor Business HB	32	<1%
Commercial C	218	2%
Residence R-1	3962	36%
Residence R-2	3789	34%
Residence R-3	1602	15%
Residence Multifamily	0	0%
Saltmarsh and Tideland Conservation	1321	12%
<b>Overlay Districts</b>		
Village Business Overlay District	99	1%
Humarock Village Residential Overlay District	5	<1%
Residential Cluster District	50	<1%
Planned Development District	298	3%
Flood Plain and Watershed Protection District	3449	31%
Water Resources Protection District	3923	36%
Wireless Communication District	462	4%

Source: Scituate Economic Development Study, 2014

Under current zoning, the Town of Scituate is largely built out. Much of the land area is occupied by existing subdivisions, commercial areas, conservation land, and undevelopable wetlands and floodplain areas. The development that is occurring in the town is largely infill development of small subdivisions with up to 20 new single family homes on parcels reflecting a suburban development pattern. Development pressure on this remaining open developable land is strong.

Town staff were consulted to determine areas that are likely to be developed in the future, defined for the purposes of this plan as a ten year time horizon. These areas are described below in Table 3.

**Table 3. Relationship of Potential Development to Hazard Areas**

Parcel	Flood Zone
River Club (4 acres)	No
North River Marine redevelopment (<1 acre upland)	AE BFE16
Bartlett Fields, Chief Justice Cushing Highway (40 acres)	No
Front St., multiple properties, potential redevelopment	AE BFE15
South Shore Auto Parts/ MBTA and nearby properties, Driftway (3.5 acres, zoned Commercial)	No
Scituate Concrete Pipe (9 acres, zoned Commercial)	No
Proving Grounds/Goulston property, Hatherly Rd. (55 acres)	AE BFE15
Area off of 3A (Harrington property)	No
First Parish Road	26% in AE
Former Maritime Education Center Site	14.701615% in AE
Glades Estate	10% in AE

The following six parcels were identified as potential development areas in the town's 2011 Hazard Mitigation Plan: Clapp Road, Holly Crest, Whitcomb Pines, Deer Common, Tilden Woods, and Indian Trail. To date, the town acquired Clapp Road and Holly Crest parcels. The town also acquired a large tract and remaining smaller lots off of Indian Trail. The development of Tilden Woods parcel is 100% complete. Whitcomb Pines has been developed, with approximately 95% of the parcel's construction complete.

Approximately 30% of Deer Common has also been developed, including two homes, roads, and drainage. While none of the developments changed the risk or vulnerability of the town, enforcing drainage and building standards has been beneficial.

## 1.2.5 Historic and Natural Resource/Environmental Significance

Scituate was settled in 1627 and incorporated as a separate entity in 1636. In 1717 the western portion of town was separated and incorporated as the town

of Hanover. In 1849 another western section of town was separated to form the current town of Norwell. Storm surge from the Portland Gale of 1898 breached the land connecting Humarock to Third Cliff, separating it from the rest of the town. There are over 1,000 resources listed on the National Register Historic Districts or properties, and properties listed with the State Register of historic places. As one of the original Plymouth Colony settlements, there are a number of sites of historic prominence. Four of the most important are the Scituate Lighthouse, Lawson Tower, the Old Oaken Bucket House, and the Maritime and Irish Mossing Museum.

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### **1.2.6 Commerce, Industry, Academic**

Scituate has a relatively small economy. In 2011, there were 465 businesses in Scituate employing a total of 3,364 workers. Of jobs that are located in Scituate, the most prominent industry sectors (as defined by the North American Industry Classification System - NAICS) are education, health care and social assistance (33 percent of all jobs); accommodation and food services (18 percent); and retail (10 percent). The active harbor contributes significantly to the local economy; however, it is difficult to analyze because many maritime-related jobs are not easily identified when looking at basic industry codes. Maritime jobs are categorized under numerous industry categories including transportation and warehousing (e.g. boat hauling, support services for water transportation), of which there is a high percentage of jobs in Scituate but some also fall in sectors with lower listed employment including Construction (e.g. Ship Painting Contractors, Ship Joinery Contractors), Professional, Scientific and Technical Services (e.g. Boat Engineering Design Services), Manufacturing (Marine engines manufacturing), and others.

There are six public schools providing kindergarten through 12th grade. In addition, there is one private school providing programs from pre-kindergarten through grade 8. South Shore Regional Vocational Technical High School in Hanover provides vocational programs for grades 9 through 12.

## 1.2.7 NFIP, CRS Community (highlights)

As seen in Table 4, FEMA estimated that the value of property insured by the NFIP in Scituate is \$382,209,000.

**Table 4. Summary of National Flood Insurance Program Activity in Scituate as of 11/30/2015**

Total Policies	Total Premium	Value of Property Covered	A-Zone Policies	V-Zone Policies	Claims Since 1978
1,472	\$2,186,434	\$382,209,000	957	144	3,681

## 1.3 Significant Events

The Town of Scituate has experienced 22 natural hazards that triggered federal or state disaster declarations since 1978. These are listed in Table 5 below. The vast majority of these events involved flooding.

**Table 5. Federal or State Disaster Declarations in Scituate from 1991 to Present**

Disaster Name (Date of Event)	Type of Assistance	Declared Areas
Blizzard of 1978 (February 1978)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)

<b>Disaster Name (Date of Event)</b>	<b>Type of Assistance</b>	<b>Declared Areas</b>
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
October Flood (October 1996)	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
(1998)	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/ Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide

<b>Disaster Name (Date of Event)</b>	<b>Type of Assistance</b>	<b>Declared Areas</b>
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Counties of Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Counties of Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Hurricane Earl (September 1, 2010)	Protective Measures (Category B)	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, Worcester
Tropical Storm Sandy (October 27 – November 8, 2012)	FEMA Public Assistance	Counties of Barnstable, Bristol, Dukes, Nantucket, Plymouth, Suffolk
Severe Winter Storm – Nemo (February 8-9, 2013)	FEMA Public Assistance	Statewide
Severe Winter Storm – Juno (January 26-28, 2015)	FEMA Public Assistance	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Nantucket, Norfolk, Plymouth, Suffolk, Worcester

# **2.0 Planning Process**

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## **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 2011 local hazard mitigation plan and is the result of a multi-step process. The Scituate Hazard Mitigation Committee reviewed the 2011 plan in June/July 2015 and contributed information about changes in programs and policies since 2011 as well as about hazard mitigation accomplishments in the last 5 years. The revised plan includes recent storms such as Tropical Storm Sandy, Winter Storms Nemo and Juno, update of flood maps and ordinance as well as completed, continued and new mitigation actions. Since the regrouping, the Hazard Mitigation Committee has reviewed the impacts and results of more recent events and focused efforts on aligning the hazard mitigation plan with other strategic planning in the town.

The first public meeting specifically to address this hazard mitigation plan was conducted on August 18, 2015. A subsequent public meeting was held on March 1, 2016. However, the community actively participates in many related public planning and discussion forums. Input from these forums was also considered by the Hazard Mitigation Committee. The plan was sent to MEMA for an informal draft review on March 10, 2016. The State returned the plan on April 26, 2016 with comments noted in the FEMA Plan Review Tool. The town addressed the noted comments and resubmitted the plan to MEMA on May 16, 2016. MEMA accepted the modifications and forwarded the plan to FEMA Region I.

A notice of Conditional Approval was received from FEMA on June 16, 2016. The plan was adopted by the Board of Selectmen on July 19, 2016. After adoption, the plan was delivered to MEMA, DCR, and FEMA Region 1. FEMA issued a Final Approval as of August 2, 2016 (see Appendix F).

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## **2.2 Building Support: Community Involvement, Roles & Responsibilities**

The development of this mitigation strategy has been a result of the much appreciated work by the Hazard Mitigation Committee. This working group consists of members of town government who represent the various interests and needs of the community. The diverse membership enabled the demographics of the group to reflect the permanent and transient demographics of the town. Planning in this fashion created a mitigation strategy that fully encompasses all aspects of disaster impact, from concerns of the residency, business continuity, and local disaster response and recovery activities.

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### **2.2.1 Stakeholders**

The Scituate Hazard Mitigation Committee (see page i) is comprised of town officials representing planning, permitting, maintenance, infrastructure, safety and emergency planning and response. The personnel serving on the committee have changed slightly, however the offices represented have been consistent. In addition to this representative group, key stakeholders from the business, development, environmental and public sectors have been invited to participate in the planning process. While the core of the committee is consistent, participants from neighborhoods, business groups, or community organizations may be added to address specific needs or actions. To facilitate continuity, stakeholder input from other planning endeavors, such as the Master Plan and the 2014 Scituate Economic Development Study, have been reviewed and incorporated where appropriate.

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### **2.2.2 Public**

The public has been encouraged to participate throughout the planning process (Table 6). Input and feedback provided at these public meetings were gathered and reviewed by members of the Hazard Mitigation Committee to be incorporated in the Plan where appropriate (see Appendix C).

A public forum and input meeting was held at the Scituate High School on August 18, 2015. The general public, business community, and other interested parties were invited to comment on the 2011 Plan and projected changes for the 2016 update. The meeting was publicized on the Scituate website and advertised in the local newspaper. Approximately 20 members of the public participated in this meeting. This forum was extremely engaging and interactive. Participants expressed views and suggestions regarding a variety of topics and challenges. Input received was categorized and reviewed by members of the Hazard Mitigation Committee for insertion where appropriate in the plan. Input that did not necessarily pertain to the

development of the Hazard Mitigation Plan were provided to the appropriate town departments for consideration and action. The draft Hazard Mitigation Plan was published on the town Flood Hazard website on August 1, 2015 for review and comment.

A second hazard mitigation specific public forum was held on March 1, 2016. This forum was publicized on the town website, Facebook blasts, posted flyers in Town Hall and various markets, emailed to residents, emailed to department heads to send to their committees and commissions. Twenty members of the community participated in this forum. The meeting included a presentation of the draft plan and draft mitigation actions. Community participants actively engaged throughout the forum. The ensuing discussion was beneficial to shaping elements of the current plan as well as impacting the process of maintaining the plan moving forward.

On March 8, 2016 the draft plan was presented to the Board of Selectmen during an open public meeting.

Another important component to the overall program is education. In 2015 a flood preparedness informational meeting was held in the fall at the Scituate High School with over 60 attendees. In addition, six other meetings were held on a variety of coastal issues which all included information on flood mitigation practices, emergency preparedness and management of flood hazards, protection of property and infrastructure, responsible development and construction, protection of natural resources, and debris control.

**Table 6: Public Meetings Contributing to this Plan**

Public Informational Meeting Topics	Date
Hazard Mitigation Elevation Presentation	April 28, 2015
Coastal Processes: Erosion, Storm Damage and Protection Options	June 16, 2015
Building Coastal Resiliency	August 11, 2015
Hazard Mitigation Plan	August 18, 2015
North Scituate Beach Nourishment	September 1, 2015
CRS/Flood Information Workshop	September 29, 2015
Hazard Mitigation Plan	March 1, 2016
Board of Selectmen Meeting	March 8, 2016

Public involvement will be maintained through the implementation of this plan through regular outreach and educational opportunities. Mitigation strategies and actions will be addressed at the meetings of the appropriate town bodies. Several of the Primary Mitigation Actions included in this update are based on developing, maintaining and increasing public awareness and outreach. Each of these mitigation actions will have an outreach component of the implementation plan.

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## **2.2.3 Neighboring Communities**

The Town Planners from Cohasset, Norwell, Hingham, and Marshfield were invited to participate in the initial public forum on August 18, 2015 and subsequent meeting on March 1, 2016. The Marshfield Town Planner attended and participated in the meeting. Input was again solicited via email to the abutting Town Planners on February 5, 2016. Input from neighboring communities was evaluated by the Hazard Mitigation Committee. Particular emphasis is placed on mitigation actions and measures that benefit multiple communities. Representatives and citizens from neighboring communities participated and provided input at several of the parallel planning efforts (see Table 6) that have a more regional scope.

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## **2.3 Understanding the Community's Risks**

The risk assessment portion of the Hazard Mitigation Plan contributes to the decision-making process for allocating available resources to mitigation projects. 44 CFR Part 201.6(c)(2) of FEMA's mitigation planning regulations requires local municipalities to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. Risk includes the characteristics of the hazard and takes into account the magnitude, duration, distribution, area affected, frequency and probability of an event. This section focuses on assessing the community's risk to natural hazards by identifying which natural hazards affect Scituate, taking a look at Massachusetts' hazard history and taking a look at Scituate's hazard history. This section also takes a look at Scituate's capabilities and the mitigation efforts that the town currently has in place.

For the purposes of this mitigation plan, the following definitions have been used:

- **Hazard** – a source of potential danger or adverse conditions that may occur.
- **Risk** – the estimated impact that a hazard would have on people, services, facilities, and structures in the community. The natural hazard risk assessment describes the magnitude, duration, and probability of potential natural hazard events occurring in town.
- **Vulnerability** – the exposure or susceptibility of the town to the effects of the identified hazards.

## **2.4 Developing & Updating the Mitigation Strategy**

The Town of Scituate has incorporated an active approach to mitigation planning and implementation. The town strategy is to reduce vulnerability through proactive risk reduction measures and improved communication and coordination. This strategic approach supports a strong hazard mitigation program, as well as an enhanced preparedness, response, and recovery posture. During the development of this plan update, hazard mitigation goals and actions have been reviewed, and when possible, aligned to synergize with other existing planning endeavors such as the Emergency Operations Plan, the Master Plan, the Economic Development Study, and the Open Space and Recreation Plan.

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### **2.4.1 Identification & Review of Goals, Actions, Priorities, Changes Progress**

Preserve and enhance the quality of life, property, and resources by identifying areas at risk from natural hazards and implementing hazard mitigation actions to protect Scituate's population, infrastructure, and historical, cultural, and natural resources.

Scituate established the following mitigation goals:

- Ensure that critical infrastructure sites are protected from natural hazards.
- Protect existing residential and business areas from flooding.
- Maintain existing mitigation infrastructure in good condition.
- Continue to enforce existing zoning and building regulations.
- Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
- Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
- Encourage future development in areas that are not prone to natural hazards.
- Educate the public about natural hazards and mitigation measures.
- Make efficient use of public funds for hazard mitigation.

## **2.5 Brining the Plan to Life: Implementation & Maintenance**

The Hazard Mitigation Committee realized that assigning a time frame to each recommended mitigation action is important so that actions can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide inputs to a project plan used for tracking the progress of all activities.

The Town of Scituate and the Scituate Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updated revisions to this plan. Also realized is the importance of integrating appropriate sections of the plan into the town's other strategic planning efforts. It is intended that this plan and the ongoing efforts of the Hazard Mitigation Committee will preserve and enhance the quality of life, property, and resources for the Town of Scituate.

The updated plan was adopted by the Board of Selectmen on July 19, 2016. Adoption and implementation of this hazard mitigation strategy maintains Scituate's credit points under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS) which provides discounts on National Flood Insurance premiums. Adoption of this mitigation strategy also maintains Scituate's eligibility for federal hazard mitigation grants. These grants originate from FEMA's Pre-Disaster Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) and post-disaster Hazard Mitigation Grant (HMGP) Programs.

### **2.5.1 Monitoring**

The Town Administrator, on behalf of the Board of Selectmen is responsible for oversight of this plan. The Hazard Mitigation Committee, will meet annually to monitor the actions contained in the plan. At each meeting the committee members will discuss the progress of their actions to ensure that they are on schedule. Meetings will also be held following significant events.

### **2.5.2 Evaluation**

The Scituate Hazard Mitigation Committee meets annually to evaluate the plan. The agenda for the meeting will include a review of the prioritized recommended actions, documentation of progress, obstacles encountered, an inventory of resources secured and needed to carry out remaining actions, and an evaluation based on whether or not the plan has met the following criteria: increased public awareness/education, reduction in hazard damage, actions being implemented in the designated time frames, and actions staying within the cost estimate. A status report will be submitted to the Town Administrator, who will in turn submit the report to the Board of Selectmen. The Board of Selectmen will involve the public in the plan evaluation process by including

the topic at an annual advertised public meeting in order to review the evaluation and solicit input.

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### **2.5.3 Updates**

The Hazard Mitigation Committee will also evaluate and update the plan annually, after a disaster, as funding opportunities arise for the actions and projects identified in the plan, or as actions are completed in order to re-prioritize. Any updates to the plan will be reviewed and submitted to MEMA upon local approval. The Board of Selectmen will involve the public in the plan revision process by holding an annual advertised public meeting to present recommended revisions and solicit input. Revised plans will also be sent to the Town Planners of all abutting communities.

In addition, the town will initiate actions to satisfy the requirement for a 5 year plan update and FEMA review. The update process will be continuous throughout the life of this plan with the actual updating process to begin in year 3 of this plan and a submission to MEMA by the end of year 4.

# **3.0 Risk Assessment**

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## **3.1 Defining Risk & Methodology**

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

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

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## **3.2 Hazards**

A natural hazard is defined as “an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.” A natural hazard can also be exacerbated by societal behavior and practice, such as building in a floodplain, along a sea cliff or an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

The Town of Scituate identified hazards, assessed the degree of vulnerability to the hazards throughout the town, examined the possible impacts of the hazards and assessed future risk. Scituate has mapped the hazard risks within the town. The map identifies critical facilities (such as emergency shelters and emergency response facilities) and the potential hazard risks in Scituate. The potential hazard risk data presents land uses, flood zones, public infrastructure, and social and economic risk areas. Table 7 identifies 16 potential hazards Scituate faces.

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### **3.21 Hazard Identification**

In order to fulfill the planning guidelines outlined in Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000), this NHMP addresses only natural hazards, and does not consider man-made hazards (i.e., structural fires, hazardous materials, chemical spills, and weapons of mass destruction).

Keeping in line with Massachusetts State Hazard Mitigation Plan risk assessment, the natural hazards have been grouped into the following categories and are listed in order of frequency and impact, starting at the top of the list with the most frequently occurring natural hazards. Based on the Massachusetts SHMP and previous versions of the town plan the following hazards will be discussed and analyzed in this report:

**Table 7. Natural Hazards Assessed For Scituate Hazard Mitigation Plan, Grouped by Category**

Flood Related Hazards	Wind Related Hazards	Winter Related Hazards	Geologic Related Hazards	Additional Hazards
Riverine Flooding	Storm surge	Snow	Earthquakes	Wildfire
Flash Flooding	Hurricanes	Ice		
Coastal Flooding	Tornadoes	Extreme Cold		
Climate Change and Sea Level Rise	High Winds	Nor'easters		
Coastal Erosion				
Dam Failure				

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#### **3.21.1 Hazards & Jurisdiction's Identification**

The Scituate Hazard Mitigation Committee leveraged the information contained in the 2011 Hazard Mitigation Plan developed by MAPC and the 2013 Massachusetts State Hazard Mitigation Plan, as well as a review of the recent natural hazard activity, to identify the hazards that are most likely to affect Scituate and the potential level of impact those hazards may have.

Table 8 identifies the hazards posing the greatest risk to Scituate, including their probability of occurring over a five-year period and potential severity. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. The statewide assessment was modified to reflect local conditions in Scituate using the definitions for hazard frequency and severity listed below. The Hazard Mitigation Committee discussed other hazards and deemed them to be of negligible risk to the community based on historical data and a low probability of occurring within the next five years. However,

these hazards were included in the profiles for reference purposes.

**Table 8. Hazards Affecting Scituate**

Hazard	Probability (Next 5 Years)	Severity
Flood	High	Serious
Dam Failure	Low	Serious
Coastal Erosion	High	Serious
Wind		
Hurricane	Medium	Serious
Tornado	Low	Serious
Winter Storm	High	Serious
Nor'easter	High	Serious
Geologic		
Earthquake	Low	Minor
Landslide	Low	Minor
Wildfire	Low	Minor
Extreme Cold	Low	Minor

High = 90% - 100% chance of occurrence

Medium = 10% - 90% chance of occurrence

Low = 1% - 10% chance of occurrence

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### **3.2.1.2 Hazards Excluded from Risk Assessment/ Explanation**

Based on the review of hazards it should be noted that the hazards in paragraph 3.2.1 are not a complete listing of hazards that may impact Scituate. The Hazard Mitigation Committee agreed that this listing accurately represents those hazards that impact Scituate most frequently and have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. The following hazards will not be addressed in the Scituate Hazard Mitigation Plan because they are not commonly recognized to impact Scituate:

- Avalanche
- Drought
- Extreme Heat
- Expansive soils
- Hail
- Land Subsidence
- Landslides
- Volcanoes
- Tsunamis

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

- Lack of frequency in which they occur;
- The minimal probability of their occurrence; and / or
- The lack of resources to devote any amount of time to further research the likelihood or potential occurrence or impact.

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### **3.2.2 Hazard Profiles**

The following subsections present a description of each type of natural hazard Scituate may expect to experience.

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#### **3.2.2.1 Flood Related Hazards**

Flooding was the most prevalent serious natural hazard identified by local officials in Scituate. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and, thunderstorms. Sea level rise has the potential to exacerbate these issues over time.

##### **Regionally Significant Floods**

There have been a number of major floods that have affected the South Shore region over the last fifty years. Significant historic flood events in Scituate have included:

March 1968  
The Blizzard of 1978  
January 1979  
April 1987  
October 1991 (“The Perfect Storm”)  
October 1996  
June 1998  
March 2001  
April 2004  
May 2006  
April 2007  
March 2010  
Tropical Storm Sandy, 2012  
Winter Storm Nemo, 2013  
Winter Storm Juno, 2015

##### **Overview of Town-Wide Flooding**

The Town of Scituate is subject to two kinds of flooding; coastal flooding where wind and tide exacerbates flooding along the shore, and tidal waterways and inland flooding where the rate of precipitation or amount of water overwhelms the capacity of natural and structured drainage

systems to convey water causing it to overflow the system. These two types of flooding are often combined as inland flooding is prevented from draining by the push of wind and tide driven water. Both types of flooding can be caused by major storms, known as Nor'easters and hurricanes. Nor'easters can occur at any time of the year but they are most common in winter. Hurricanes are most common in the summer and early fall. Scituate, being north of Cape Cod, is particularly vulnerable to Nor'easters because the area is not protected by the sheltering arm of Cape Cod.

Nor'easters cover a larger area than hurricanes although the winds are not as high. They also generally last long enough to include at least one high tide, which causes the most severe flooding. Large rain storms or snowfalls can also lead to inland flooding.

The frequency and locations of flood hazard events in Scituate can be estimated based on the reported loss occurrences for repetitive loss properties and from local knowledge captured through discussion with local staff and the public during identification of local flood hazard areas. Based on these factors, flooding occurs most often along the coast in the low area behind the seawalls and former dunes, with particular frequency at Cedar Point, Surfside Road, Glades Road, Peggotty Beach, Oceanside Drive, Turner Road, The Basin's (The Ave's and Jericho Road) Edward Foster Road and Humarock.

Reported losses on repetitive loss properties indicate that a flood event resulting in property damage occurs on average nearly twice a year, though there are stretches of time over the last 30 years of up to a couple years during which flooding of this extent did not occur. In particular, winter storms in 1978, 1979, 1987, 1991, 1992, 2001, 2003 (twice), 2007, 2010, 2013, and 2015 all led to extensive flood insurance claims in Scituate's coastal areas.

### **Potential Flood Hazard Areas**

Information on potential flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones (draft) are shown on Map 2 in Appendix A. The second was discussions with local officials. The Locally Identified Areas of Flooding described below were identified by town staff as areas where flooding is known to occur (Table 9). These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone.

**Table 9. Locally Identified Areas of Flooding**

<b>Local Area of Flooding</b>	<b>Impact or Action</b>
1. Glades & Gannett Roads – (Minot Beach, North Scituate Beach)	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes. Debris collects on roads limiting access, with expensive removal costs.
2. Surfside Road, Seagate Circle and Musquashicut Pond	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes. Debris collects on roads limiting access, with expensive removal costs.
3. Mann Hill Road, Egypt Beach, Pricilla and Alden Avenue	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes.
4. Oceanside Drive and Turner Road	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes. Debris collects on roads limiting access, with expensive removal costs.
5. Rebecca Road, Lighthouse Road and Lighthouse Point	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes.
6. The Basin's (The Ave's and Jericho Road Basins)	This is a low area that collects overwash routinely. Improvements to subsurface infrastructure have contributed to faster drainage in this area.
7. Scituate Harbor (Cole Parkway, Front Street and Old Dock Street)	While the Harbor jetties provide some protection, flooding of parking and businesses occurs regularly with coastal storms.
8. Edward Foster Road (including the bridge and low point south of the Maritime Center)	While the Harbor jetties provide some protection, its bridge which provides the main access to First and Second Cliff can often flood during coastal storms.
9. Peggotty Beach (Inner Harbor Road and Town Way Extension)	This exposed area has adjacent homes on small lots which are very vulnerable. A number were purchased by FEMA.
10. Gilson Rd. (culverts)	This road crosses a low area where culverts need to be enlarged to carry stormwater to prevent serious road flooding during coastal storms.
11. Humarock (Central Ave, Atlantic Ave, roads parallel to the beach including Humarock Beach)	During coastal storms seawater washes over sea walls, then collects in low areas. The energy from overwash water and debris routinely damages homes. Debris collects on roads limiting access, with expensive removal costs.
12. Buttonwood Road and Bayberry Road	This is a low area subject to flooding.
13. Maple Street	Some flooding occurs where the road crosses First Herring Brook.
14. Jericho Road (from Rebecca to Foam Road, including the Jericho boat Ramp parking lot)	This is a low area that collects overwash routinely. Improvements to subsurface infrastructure have contributed to faster drainage in this area.
15. Satuit Brook (in front of the Bank of America)	Front St. crosses the Satuit Brook in a low area where culverts need to be enlarged to carry stormwater to prevent serious road flooding during coastal storms.
16. Hatherly Road (near the Musquashicut Pond)	Hatherly Rd. at Musquashicut Pond crosses a low area where culverts need to be enlarged to carry stormwater to prevent serious road flooding during coastal storms.
17. Bailey's Causeway	Bailey's Causeway often floods during coastal storms. It is a main access to the Glades/Minot area.

## **Repetitive Loss Structures**

There are 520 repetitive loss structures in Scituate, an increase from the 503 structures identified in the 2011 plan. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10- year period since 1978.

The majority of the repetitive loss properties in Scituate are single family homes, though several multi-family and commercial structures can be found in the FEMA flood zone A and other areas identified for frequent flooding. The table below shows the breakdown of structure type by FEMA designated and locally identified flood zones.

It should be noted that the repetitive loss properties in FEMA flood zones and locally identified areas of flooding do not necessarily match the total number of repetitive loss properties in the community as there is considerable overlap between the two types of flood area and not all repetitive loss properties are located in an identified flood zone or have flood insurance.

## **Sea Wall Failure and Coastal Erosion**

Sea wall failure and coastal erosion are related issues increasingly impacting towns along the Massachusetts coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of sea walls, some of which in the Boston region are many decades old. Sea walls protect the buildings behind them from storm damage and their failure can lead to increased property damage. Similarly, intact beaches with dunes dissipate wave energy, protecting buildings behind them. As the beaches erode away, this protection is lost. In some cases, sea walls can accelerate beach erosion. In April 2015, 80 feet of sea wall in the neighboring Town of Marshfield collapsed due to undermining of its foundation from erosion. Sea wall damage in various locations was reported in Scituate as a result of the January, 2015 storm.

FEMA has indicated in their latest rules post hazard event reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive this funding, the town must maintain records of maintenance and repair activities that demonstrate the status of each structure. In addition, the town recently conducted a drone imagery of the entire coastline prior to pending damage.

## **Dams and Dam Failure**

The Department of Conservation and Recreation (DCR) Office of Dam Safety lists six dams in Scituate. Three of the dams are rated as non-jurisdictional, two of these dams are rated as Significant Hazard and one is rated as High Hazard.

Dam failure can arise from two types of situations. Dams can fail because of structural problems independent of any storm event. Dam failure can follow an earthquake by causing structural damage. Dams can fail structurally because of flooding arising from a storm or they can overspill due to flooding.

In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

The Massachusetts DCR has three hazard classifications for dams:

- **High Hazard:** Dams located where failure or misoperation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
- **Significant Hazard:** Dams located where failure or misoperation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.
- **Low Hazard:** Dams located where failure or misoperation may cause minimal property damage to others. Loss of life is not expected.

In general, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years. All of the dams listed below are inspected annually.

First Herring Brook Dam – DCR lists the First Herring Brook Dam as a High Hazard dam. Owned by the town, this dam is an old earthen dam.

Mordecai Lincoln Road Dam – The Mordecai Lincoln Road dam is privately owned and listed by DCR as a significant hazard. The dam is primarily an earthen structure with a road and was rebuilt four to five years ago.

Old Oaken Bucket Pond Dam – The Old Oaken Bucket Pond Dam is listed by DCR as a significant hazard. The dam is an earthen structure and owned by the town. Old Oaken Bucket Pond is the primary source of drinking water for the town.

Scituate has not experienced a dam failure in recent history and while the dams listed above are categorized as high or significant hazards, the likelihood of a failure is considered low.

In addition to dams located within the town, the Bound Brook Control Dam located in Cohasset could have an impact on Scituate, should it fail. The predicted inundation zone of this dam includes the North Scituate area. Recent studies of the dam indicate it is in need of repair with the potential for dam failure. The Town of Cohasset has identified the replacement of this dam as a high priority action and is actively taking steps to address this issue.

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### **3.2.2.2 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. As with many communities, falling trees that result in downed power lines and power outages are an issue in Scituate.

Massachusetts coastal wind events can produce damage often associated with thunderstorms or tornadoes. In some instances, these events have been associated with weakening tropical weather systems, including downgraded tropical and sub-tropical storm systems. This section examines the risks associated with damaging wind events with emphasis on hurricanes, tornadoes, and thunderstorms.

Nor'easters, while often a less dramatic storm than a hurricane, are far more frequent in Massachusetts, and can still produce considerable damage. On average, one to two nor'easters a year hit Massachusetts with a storm surge equal or greater than two feet. The duration of high surge and winds during a nor'easter can last from 12 hours to three days, while the duration of hurricane conditions generally lasts only six to 12 hours.

Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as "cyclones" due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage.

There are three categories of tropical cyclones:

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

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

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

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

Hurricanes are categorized according to the Saffir/Simpson scale (Table 10) 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.

**Table 10. Saffir/Simpson Scale of Hurricane Intensity**

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

Source: NWS NCDC

Southern New England has been affected by 41 tropical weather systems since 1900; 25 hurricanes and 16 tropical storms. Nine of the 25

hurricanes made landfall along the southern coastline of Rhode Island and Massachusetts. In 1954, New England endured three hurricanes; Carol, Edna, and Hazel. There has been one recorded hurricane track through Scituate, Hurricane Bob, recorded in 1991. This category 2 storm passed across the northern end of the town. The town experiences the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. Tropical Storm Irene (2011) and Hurricane Sandy (2012) both caused minor to moderate damage in the form of localized flooding. Because the town is relatively small (averaging 4.25 miles from the coast to the western boundary) the damage from tropical depressions is throughout the community.

Some of the hurricanes that have passed through the region include:

Great New England Hurricane*	September 21, 1938
Great Atlantic Hurricane*	September 14-15, 1944
Hurricane Dog	September 11-12, 1950
Hurricane Carol*	August 31, 1954
Hurricane Edna*	September 11, 1954
Hurricane Hazel	October 15, 1954
Hurricane Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991

\*Category 3

Based on historical frequency of occurrence, Massachusetts may experience a hurricane every six years, or 22.8 percent annually which can be related to a Medium-Low probability of occurrence. Long-term global climate models under Intergovernmental Panel on Climate Change (IPCC) warming scenarios indicate that it is possible that hurricanes will become more intense, with stronger winds and heavier precipitation through the 21st century.

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### **3.2.2.3    Storm Surge**

Storm surge is the abnormal rise in water level caused by the wind and pressure forces of a hurricane or nor'easter. Nationally, storm surge flooding has caused billions of dollars in damage and hundreds of deaths. Given today's ever increasing population densities in coastal communities, the need for information about the potential for flooding from storm surge has become even more important. Storm surge heights in Massachusetts range from a few feet higher than normal tides during nor'easters to more than 10 feet during hurricanes. The breaking wave height is related to

water depth so that as water depth over a given surface increases with storm surge, larger waves can be generated.

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

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

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

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

The reduction of atmospheric pressure within the storm system results in another surge-producing phenomenon known as the "inverted barometer" effect. Within the region of low pressure the water level will rise at the approximate rate of 13.2" per inch of mercury drop. This can account for a rise of one (1) to two (2) feet near the center of the hurricane. This effect

is considered to be a more important factor in the open ocean where there is no depth related restrictions to water flow.

Storm surge is by far the most destructive force acting on the Scituate coast. Scituate has experienced damaging storm surge in conjunction with a number of tropical depressions and winter storms. Storm surge from the Portland Gale of 1898 breached the land connecting Humarock to Third Cliff, separating it from the rest of the town. The highest storm surge tide recorded in the Boston area was approximately 15 feet MLLW during the Blizzard of 1978. This storm also produced 25 foot waves which caused extensive damage to homes, infrastructure and flooding. The probability of a storm surge event is relative to the probable occurrence of tropical storms or nor'easters.

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#### **3.2.2.4 Tornado Hazards**

New England does not frequently suffer destruction from tornados, with the region's most serious' tornado event occurring in Worcester Mass., on July 9, 1953. In that event, 90 people were killed and 1,300 injured. From 1950 to the present approximately 20 tornadoes were reported in or near Massachusetts, but none of them was as devastating as the Worcester event. In 2011 a series of tornados occurred in western and central Massachusetts, with another reported in southern Maine. The most serious tornado, an EF-3, struck Springfield Massachusetts, killing 3 people, injuring 300 and destroying the homes of 500. The most recent tornado in Massachusetts occurred on July 28, 2014. An EF-0 damaged an area 2 miles long and half a mile wide in Revere. The most recent tornado near Scituate occurred in Plymouth on July 24, 2012. Originating as a series of waterspouts, the system moved onshore and an EF-0 tornado touched down in Manomet. A tornado is reported in southern New England, on average, once every two-to-three years.

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

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

begins to rise and becomes saturated, it will continue rising to great heights and produce a thunderstorm cloud, if the atmosphere is unstable. An unstable atmosphere is one where the temperature decreases rapidly with height.

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

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

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

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

The Fujita scale, introduced in 1971 by Dr. Ted Fujita, provided a way to characterize tornadoes based on the damage they produced and relating that damage to the fastest quarter-mile wind at the height of a damaged structure. An Enhanced Fujita scale became operational in 2007 and improves upon the original scale by including more damage indicators, taking into account construction quality and variability, and providing a more definitive correlation between damage and wind speed (Table 11).

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

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

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

**Table 11. Fujita Scale and Enhanced Fujita Scale**

Fujita Scale		Enhanced Fujita Scale		
F Number	Fastest 1/4 mile (MPH)	3 Second Gust (MPH)	EF Number	3 Second Gust (MPH)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Massachusetts ranks 22<sup>nd</sup> out of the 43 tornado affected states for the occurrence of tornadoes. Based on data from 1950 through 2014, the State had 162 tornadoes: resulting in 1561 injuries and 109 fatalities. While rare in the New England region, a powerful tornado outbreak occurred on June 1, 2011, that spanned southwest and south-central Massachusetts and southern Maine (NOAA 2011). Four tornadoes, one ranked as an EF3, touched down in Massachusetts causing three deaths, over 200 injuries, and cost over \$140 million in property damages (Spotts 2011; Turner 2011; Yee 2011).

In 2014, a storm system that wreaked havoc across the eastern half of the U.S. spawned a tornado that ripped roofs off homes in suburban Boston, uprooted trees and forced businesses to close.

The tornado, a rarity in Massachusetts, touched down in Revere, a coastal city of nearly 52,000 residents just north of Boston, on Monday morning. City officials said several people suffered minor injuries, including a baby who was in a car and was hurt by flying glass and an elderly woman who suffered cuts.

"Given the magnitude of the storm, it's really a miracle that no one sustained more serious injuries," Mayor Daniel Rizzo said. The tornado was spawned by a powerful storm that moved through the Boston area shortly after 9 a.m., causing significant flooding. The National Weather

Service said it was a relatively modest EF-2 on the Enhanced Fujita Scale of 0 to 5.

The tornado carved a 2-mile path, generated maximum wind gusts of up to 120 mph and was about three-eighths of a mile wide at its peak, the weather service said. It touched down at 9:32 a.m. near the Chelsea-Revere line and was on the ground about 4 minutes.

Thus, while uncommon, tornadoes occurring in New England are capable of inflicting substantial damage.

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### **3.2.2.5    High Wind and Thunderstorms**

Thunderstorms are formed when the right atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. Thunderstorms occur any time of the day and in all months of the year, but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. The NWS classifies a thunderstorm as severe if it produces hail at least one inch in diameter, winds of 58 MPH or greater, or a tornado. About 10 percent of the estimated 100,000 annual thunderstorms that occur nationwide are considered severe (NOAA). Thunderstorms affect a smaller area compared with winter storms or hurricanes, but they can be dangerous and destructive for a number of reasons. Storms can form in less than 30 minutes, giving very little warning; they have the potential to produce lightning, hail, tornadoes, powerful straight-line winds, and heavy rains that produce flash flooding.

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

large downburst that can extend greater than 2.5 miles with winds up to 134 MPH and can last five (5) to 30 minutes.

All thunderstorms produce lightning, and therefore all thunderstorms are dangerous. Lightning often strikes outside of areas where it is raining, and may occur as far as 10 miles away from rainfall. It can strike from any part of the storm, and may even strike after the storm has seemed to pass.

Hundreds of people across the nation are injured annually by lightning, most commonly when they are moving to a safe place but have waited too long to seek shelter. Lightning strike victims often suffer long-term effects such as memory loss, sleep disorders, weakness and fatigue, chronic pain, depression and muscle spasms. Lightning has the potential to start both house fires and wildfires. Lightning causes an average of 55-60 fatalities, 400 injuries, and over \$1 billion in insured losses annually nationwide.

Hail is formed in towering cumulonimbus clouds (thunderheads) when strong updrafts carry water droplets to a height at which they freeze. Eventually, these ice particles become too heavy for the updraft to hold up, and they fall to the ground at speeds of up to 120 MPH. Hail falls along paths called swaths, which can vary from a few square acres to up to 10 miles wide and 100 miles long. Hail larger than  $\frac{3}{4}$  inch in diameter can do great damage to both property and crops, and some storms produce hail over two (2) inches in diameter. Hail causes about \$1 billion in damages annually in the U.S.

The Northeast does not experience severe thunderstorms with the same frequency as the Midwestern and Southeastern states, but there has been a number of destructive wind, hail, and lightning events in recent history. Since 1950 there has been only one reported injury from a lightning strike. In 2008 a man was struck while walking on the beach during a thunderstorm. In the past 15 years there have been 3 recorded hail events in Scituate. Though no injury or damage was reported, in 2012 a thunderstorm produced hail 1.75 inches in diameter. High winds resulting from thunderstorms remains the most damaging byproduct. There have been at least 4 events in Scituate that resulted in property damage. The most recent occurred in June 2012 causing \$15,000 in damage from downed tree limbs.

Based on historical records and current NOAA predictions, the probability of a damaging high wind or thunderstorm related event is medium.

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### **3.2.26 Winter Related Hazards**

Winter storms are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and

ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Because Scituate's coast faces the northeast it is more vulnerable than other coastal communities. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as a result of malfunctioning tide gates.

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The average annual snowfall for most of the town is 36.1 - 48 inches.

The most significant winter storm in recent history was the "Blizzard of 1978," which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. Historically, severe winter storms have occurred in the following years:

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2005
Severe Snow Storm	December 2010
Severe Snow Storm	January 2011
Winter Storm Nemo	February 2013
Winter Storm Juno	January 2015

Massachusetts experienced a record year for snowfall in 2015 with a total accumulation of 110.6 inches. With 64.8 inches, February 2015 broke the record for the snowiest month by 21.5 inches.

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

The storm radius of a nor'easter 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 10-40 MPH are common during a nor'easter, with short term wind speeds gusting up to 70 MPH. Unlike hurricanes and tropical storms, nor'easters can sit off shore, wreaking damage for days. Nor'easters are a common winter occurrence in New England and repeatedly result in flooding, various degrees of wave and erosion-induced damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs. The erosion of coastal features commonly results in greater potential for damage to shoreline development from future storms.

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

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

The term "ice storm" is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain, which is rain that becomes super-cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. If extreme cold conditions are combined with low/no snow cover, the cold can better penetrate downward through the ground and potentially create problems for underground infrastructure as well. When utilities are affected and heat is not available, water and sewer pipes can freeze and it is not uncommon for them to rupture.

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

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature

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

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

All of Scituate is susceptible to the effects of winter storms. Averaging only 4.25 miles wide, the inland portions of the community are easily impacted by nor'easters and other coastal storm events.

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### **3.2.27 Wildfire Hazards**

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

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

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

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In

eastern Massachusetts, common factors leading to large fires include short-term drought, humidity below 20%, and fuel type.

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

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

The U.S. Forest Service has established the National Fire Danger Rating System (NFDRS) to determine the daily risk to fire experienced by different regions of the country (Table 12). The system uses mathematical formulas including wind speed and fuel type to determine a fire index. The fire indexes are grouped into five groups based on severity, and each group has an associated class rating (Classes 1 through 5) and an associated fire risk level. A fire index of zero occurs when there is snow on the ground or there has been a prolonged period of substantial rain.

**Table 12. National Fire Danger Rating System**

Fire Index	Rating	Description
0	Class 1	No rating
1-30	Class 2	Low danger
31-60	Class 3	Medium danger
61-80	Class 4	High danger
81+	Class 5	Extreme

The Scituate Fire Department responds to approximately 7 - 10 wildfires annually. Scituate's forests are primarily composed of pitch pine, mixed conifer, oak, and oak mixed, which are considered by the State fire officials to be the forest types at highest risk for wildfires. Much of Scituate's forested area is wetlands, which has limited the ability of these fires to grow and spread.

Within the past year there were no wildfires that resulted in significant property damage. The most common cause of fires in Scituate is the careless disposal of smoking materials. Wildfires are not considered a significant hazard in Scituate and are handled as a matter of routine by the Fire Department.

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### **3.2.2.8 Geologic Related Hazards: Earthquake**

An earthquake is thought to be caused by a sudden displacement of tectonic plates within the earth. Strong and destructive earthquakes usually result from the rupturing or breaking of great masses of rocks far beneath the surface of the earth. All earthquakes produce both vertical and horizontal ground shaking. This ground movement begins at the focus or hypocenter, deep in the earth, and spreads in all directions. The felt motion is the result of several kinds of seismic vibrations. The primary, or P, waves are compressional. The secondary, or S, waves have a shear motion. These body waves radiate outward from the fault to the ground surfaces where they cause ground shaking.

The fast moving P waves are the first waves to cause the vibrations of a building. The S waves arrive next and may cause a structure to vibrate from side to side. Rayleigh and Love waves (surface waves), which arrive last, cause low-frequency vibrations and are more likely than P and S waves to cause tall buildings to vibrate. Surface waves decline less rapidly than body waves, so as the distance from the fault increases, tall buildings located at relatively great distances from the epicenter can be damaged.

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

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

earthquake is the point on the Earth's surface directly above the focus. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth.

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

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

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

1. Hard Rock: Due to the geological makeup of New England's base rock, seismic energy is conducted on a greater scale (four (4)-10 times that of an equivalent Richter magnitude earthquake in California)
2. Soft Soil: Many coastal regions of New England are made up of soft soils. These soils can magnify an earthquake as much as two times.
3. Structures: The New England region, being one (1) of the first settled areas of the United States, has an abundance of older, unreinforced masonry structures that are inherently brittle and very vulnerable to seismic forces.
4. Low Public Awareness of Vulnerability: Little public recognition of earthquake threat, and no established system of educating or informing the public of the threat or how to prepare for or respond during an earthquake. Therefore, higher losses will occur here than in other regions of the country.

**Table 14. Scales for Evaluating the Intensity and Effects of Earthquakes**

Richter Magnitude Scale	Modified Mercalli Intensity Scale
1.0 - 3.0	I
3.0 - 3.9	II – III
4.0 - 4.9	IV – V
5.0 - 5.9	VI – VII
6.0 - 6.9	VIII – IX
7.0 and higher	X and higher

**Table 15. Intensity and Effects of Earthquakes defined by the Modified Mercalli Intensity Scale**

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

Earthquakes in New England are a greater risk than most people realize. There have been 31 recorded earthquakes in this state over the last 220 years. Massachusetts has experienced several minor earthquakes in the last few years, but no extensive damage has occurred.

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC). The region has experienced larger earthquakes, including a magnitude 6.0 quake that struck in 1755 off the coast of Cape Ann. More recently, a pair of damaging earthquakes occurred near Ossipee, NH in 1940.

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### **3.2.3 Climate Change**

Climate change is not addressed as a separate hazard. However, all of the natural hazards discussed in this section of the Scituate Hazard Mitigation Plan will be exacerbated by the changing climate. The most widely accepted consequence of climate change is global warming; which, in turn, is causing a sea level rise. Climate change will also cause the weather to become more unpredictable and, in some cases, more extreme.

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## **3.3 Vulnerability**

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. This section focuses on Scituate's vulnerable areas in regards to the identified hazards, what is at risk in these areas (structures, population, natural resources) and what the impacts will be (loss of life, environmental damage, inconvenience to residents). The Risk Assessment Matrix (Table 23) summarizes the major vulnerable areas in Scituate. This section also takes a look at Scituate's population at risk, the potential economic losses and future development trends.

### **Repetitive Loss Properties**

Repetitive loss properties are considered by FEMA as those for which two or more losses of at least \$1,000 each have been paid under the National Flood Insurance Program (NFIP) within any 10-year period since 1978. These are distinct from properties which FEMA categorizes as "Severe Repetitive Loss" which include properties for which 4 or more separate claim payments have been made under flood insurance coverage with each claim exceeding \$5,000 and a cumulative amount exceeding \$20,000; or a property with at least 2 separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure. According to information provided by DCR, there are 520 repetitive loss properties, 18 commercial buildings and 502 residential properties (including 17 residential properties with 2-4 units).

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### **3.3.1 Community Assets**

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#### **3.3.1.1 People**

Children and the elderly may require additional assistance during an emergency. It is important to know the number of people that are considered to be at a higher risk in a natural hazard event. According to the 2010 U.S. Census, the population of Scituate is 18,133. This includes approximately 3700 children under the age of 15 and 3100 people 65 or older. The population is projected to experience modest growth over the next few decades (2010 US Census).

Residents with disabilities may need assistance in case of an evacuation order; to expedite assistance response, each group home will be identified and evaluated in terms of its capacity and access to evacuation routes, thereby ensuring that any residents of those facilities can be assisted in the event of a natural disaster or evacuation.

Scituate has ten facilities to provide assisted living and/or elder care services. None of these facilities are located in a flood zone nor have they been identified as susceptible to moderate or high risk from landside disasters.

There are six public and one private school in town. None of the schools are located in a flood zone nor have they been identified as susceptible to moderate or high risk from landside disasters. Scituate High School is the primary community shelter

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#### **3.3.1.2 Economy**

As noted in Section 1.2.6, Scituate has a small economic base, accounting for less than 4% of municipal revenues. As a primarily residential community, the town is heavily reliant on residential taxpayers for revenue. While the largest employment sector is in the Accommodation and Food Service industries, the sector with the most publicly reported revenue is Retail Trade. Scituate's harbor contributes significantly to local economic activity and is perhaps one of the most vulnerable assets in the community.

Scituate has three village centers located on the train line and on the harbor that include small business zones at two key rail locations, and a working waterfront. While retail business has grown and modernized with the evolving economy, Scituate contains few of the office/commercial business activities of many other communities in the Boston area. The

Scituate economy consists largely of convenience and specialty retail activities, smaller professional offices and light industrial activities, resource-based activities, and a small tourism sector.

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### **3.3.1.3      Built Environment**

The damage to and destruction of the built environment, particularly in the critical lifeline sectors (communications, emergency services, energy, healthcare and public health, transportation, water) represents enormous economic, social, and general functional costs to a community, while also impeding emergency response and recovery activities. Since Scituate is a coastal community, it has increased vulnerability to extreme weather events like hurricanes and Nor' Easters. To better prepare for natural hazard events this report examines elements of Scituate's built environment and addresses vulnerabilities in the action section.

#### **Existing Structures**

As of the 2010 Census, there were 7,691 housing units in Scituate with the vast majority (88%) being single unit structures. Thirty-five percent of the housing was constructed between 1950 and 1969. Another 25% of the existing housing is over 80 years of age.

The following six parcels were identified as potential development to hazard areas in the town's 2011 Hazard Mitigation Plan: Clapp Road, Holly Crest, Whitcomb Pines, Deer Common, Tilden Woods, and Indian Trail. To date, the town acquired Clapp Road and Holly Crest parcels. The town also acquired a large tract and remaining smaller lots off of Indian Trail. The development of Tilden Woods parcel is 100% complete. Whitcomb Pines has been developed, with approximately 95% of the parcel's construction is complete. Approximately 30% of Deer Common has also been developed, including two homes, roads, and drainage.

The development of updated FIRM Maps has increased the number of total parcels within the FEMA flood zones. Tables 16 through 18 provide a comparison of the 2012 Firm Coverage to the 2015 FIRM Coverage.

**Table 16. Scituate, MA Parcels mapped within FEMA 0.2% Annual Chance Flood Hazard Area**

Land Use	2012 Current FIRM Coverage	2015 Preliminary FIRM Coverage
Agricultural land (cranberry bog)	1	1
Recreational Land (golf course)	1	0
Government-owned or other non-taxable property	6	3
Residential House	35	16
Vacant Residential Land	17	11
Unidentified Land Use	6	4
<i>Total Number of Parcels</i>	<i>66</i>	<i>35</i>

**Table 17. Scituate, MA Parcels mapped within FEMA Zone VE, 1% Annual Chance Flood Hazard Area with Coastal Flood and Velocity Hazard**

Land Use	2012 Current FIRM Coverage	2015 Preliminary FIRM Coverage
Government-owned or other non-taxable property	51	60
Residential Apartment	1	1
Residential House	614	763
Multi-Use, Primarily Residential	2	2
Vacant Residential Land	78	131
Commercial Retail	2	3
Multi-Use, Primarily Commercial	1	1
Vacant Commercial Land	3	3
Outdoor Recreational Properties (Marinas)	4	4
Unidentified Land Use	34	42
<i>Total Number of Parcels</i>	<i>790</i>	<i>1010</i>

**Table 18. Scituate, MA Parcels mapped within FEMA Zones A, AE, and AO, 1% Annual Chance Flood Hazard Area**

Land Use	2012 Current FIRM Coverage	2015 Preliminary FIRM Coverage
Agricultural Land (Pasture)	1	1
Outdoor Recreational Properties (Marinas and Golf Courses)	7	5
Recreational Land (Golf Course)	3	3
Government-owned or other non-taxable property	118	117
Industrial/Utility Properties	2	2
Hotels and Nursing Home	1	3
Residential Apartment	4	7
Residential House	1687	1805

Multi-Use, Primarily Residential	9	12
Vacant Residential Land	339	317
Commercial	40	47
Multi-Use, Primarily Commercial	14	17
Vacant Commercial Land	10	11
Unidentified Land Use	124	119
<i>Total Number of Parcels</i>	<i>2359</i>	<i>2466</i>

### **3.3.1.4 Public Water Supply**

The Scituate Water Division is responsible for the operation and maintenance of the water treatment plant, six water wells, two booster stations, two water storage tanks, four corrosion control stations, three surface water supplies, 300 acres of watershed, 124 miles of water distribution system, 754 fire hydrants, and 7690 water meters. Overlay zoning districts like the Water Resources Protection District safeguard and protect the water supply by restricting some uses associated with potential contaminants.

### **3.3.1.5 Wastewater Treatment**

Wastewater treatment is accomplished through the town treatment plant, supported by six pump stations and 32 miles of sewer. The Scituate Sewer Division operates and maintains the Sewer Collection System. The majority of the treatment plant is outside of the designated flood zones (2012 FIRM) and is not susceptible to significant risk from landside events. However, a larger portion of the treatment plant falls within the AE Zone, but outside the Limit of Moderate Wave Action depicted on the Preliminary Update dated 11/06/2015.

### **3.3.1.6 Roads and Bridges**

The Scituate road network is susceptible to coastal and inland flooding. Key intersections may be unpassable following rapid precipitation or significant coastal surge. The major bridges in town do not appear to be susceptible to flood damage, however, several feeder roads are. The road network on Humarock are particularly vulnerable to coastal flood and storm surge. A mitigation action identified in the previous Hazard Mitigation Plans called for the elevation of key intersections and road segments to facilitate continued use and access by emergency and response vehicles.

### 3.3.1.7 Critical Facilities

Each jurisdiction classifies “critical facilities” based on the relative importance of that facility’s assets for the delivery of vital services, the protection of special populations, and other important functions. If damaged, the loss of that critical facility would present an immediate threat to life, public health, and safety. Protection of critical facilities is also important for rapid response and recovery of a community, its neighborhoods, and its businesses. In Scituate, the following critical facilities have been identified (Table 19):

**Table 19. Critical Facilities**

Name	Address	Type
<b>Central Park Housing</b>	Central Park Dr.	Elderly Housing
<b>Lincoln Park Elderly Housing</b>	791 Country Way	Elderly Housing
<b>Wheeler Park I</b>	9 Common St.	Elderly Housing
<b>Wheeler Park II</b>	9 Common St.	Elderly Housing
<b>Meeting House Estates</b>	12 Meeting House Lane	Independent Living (Elderly)
<b>Community Residence</b>	412 First Parish Rd.	Assisted Living – persons with disabilities
<b>Community Residence</b>	664 Country Way	Assisted living – persons with disabilities
<b>Community Residence</b>	129 Vernon Rd.	Assisted living – persons with disabilities
<b>DDS Group Home</b>	31 Lawson Rd.	Assisted living – persons with disabilities
<b>Scituate High School</b>	606 Chief Justice Cushing Hwy.	School/Emergency Shelter
<b>Gates Jr. High School</b>	327 First Parish Rd.	School
<b>Wampatuck Elementary School</b>	266 Tilden Rd.	School
<b>Cushing Elementary School</b>	1 Aberdeen Dr.	School
<b>Jenkins Elementary School</b>	61 First Parish Rd.	School
<b>Hatherly School</b>	72 Ann Vinal Rd.	School
<b>INLY School</b>	46 Watch Hill Drive	School
<b>Police Dept.</b>	604 Chief Justice Cushing Hgwy.	Police Station
<b>Fire Dept.</b>	596 Chief Justice Cushing Hgwy.	Fire Station
<b>Fire Dept.</b>	143 First Parish Rd.	Fire Station
<b>Fire Dept.</b>	4 River St. Humarock	Fire Station
<b>Scituate Reservoir</b>	Chief Justice Cushing Highway	Surface Drinking Water Supply
<b>Scituate Water Treatment Plant</b>	Chief Justice Cushing Hwy.	Water Treatment Plant
<b>Walnut Hill Booster Pump Station</b>	27 Woodworth Lane	Water Booster Pump Station
<b>Mann Lot Booster Station</b>	Mann Lot Rd. & Creelman Dr.	Water Booster Pump Station

Name	Address	Type
Well #10	87A Corner Stetson Rd.	Public Drinking Water Well
Well #11	87 Corner Stetson Rd.	Public Drinking Water Well
Well #18B	Widow's Walk Golf Course	Public Drinking Water Well
Well #19	381 Chief Justice Cushing Highway	Public Drinking Water Well
Well #17A	98 Tack Factory Pond Rd.	Public Drinking Water Well
Well #22	66 Old Forge Rd.	Public Drinking Water Well
Water Division Standpipe	164 Maple St.	Drinking Water Storage
Water Division Standpipe	Mann Lot Rd. & Creelman Dr.	Drinking Water Storage
North River Waste Water Pollution Control Plant	161 Driftway	Sewer Treatment Facility
Chain Pond Pump Station	42°13'13.42"N, 70°44'52.76"W	Sewer Pump Station
Musquashicut Ave Pump Station	42°13'47.08"N, 70°45'46.71"W	Sewer Pump Station
Otis Road Pump Station	42°12'29.07"N, 70°43'33.07"W	Sewer Pump Station
First Parish Pump Station	42°11'48.51"N, 70°46'6.11"W	Sewer Pump Station
Country Way Pump Station	42°11'29.11"N, 70°45'5.43"W	Sewer Pump Station
Herring Brook Pump Station	42°10'35.99"N, 70°44'54.16"W	Sewer Pump Station
Collier Road Pump Station	42°10'28.42"N, 70°42'53.17"W	Sewer Pump Station
Peggotty Beach Pump Station	42°11'23.82"N, 70°43'9.13"W	Sewer Pump Station
Edward Foster Pump Station	42°11'47.90"N, 70°42'58.94"W	Sewer Pump Station
Transfer Station	280 Driftway	Solid Waste Transfer Station
Old Oaken Bucket Pond Dam	Country Way	Holds back Old Oaken Bucket Pond
Herring Brook Reservoir Dam	Chief Justice Cushing Highway	Protects state highway
Hunters Pond Dam	Mordecai Lincoln Rd.	Holds back waters of Hunters Pond, also is part of Mordecai Lincoln Rd.
State Launch Ramp	Between 44 & 66 Jericho Road	Emergency Boat Access
Cole Parkway Launching Ramp	Cole Parkway	Emergency Boat Access
MBTA Greenbush Station	Off Driftway	Transportation Facility; Layover for Greenbush line
Sea St. & Francis R. Powers Bridges	Marshfield Ave. & Julian St., Humarock	Access to Humarock
Edward Foster Bridge	Edward Foster Road	Access to First and Second Cliffs
Cell Towers	600 & 1010 Chief Justice Cushing Highway 1010, 143 First Parish Rd., off Thomas Clapp Rd.	Citizen & Emergency Communication
CVS Pharmacy	92 Front Street	Pharmacy
Scituate Pharmacy	372 Gannet Street	Pharmacy
Scituate Marketplace	71 Front Street	Food Market
St Mary's Hall	2 Edward Foster Road	Church/ Possible Shelter (to be explored)

Name	Address	Type
<b>St Mary's Church</b>	1 Kent St.	Church/ Possible Shelter (to be explored)
<b>Christ Lutheran Church</b>	460 Chief Justice Cushing Highway	Church/ Possible Shelter (to be explored)
<b>St. Luke's Church</b>	465 First Parish Rd.	Church/ Possible Shelter (to be explored)
<b>First Parish Unitarian Universalist Church</b>	<b>330 First Parish Rd.</b>	<b>Church/ Possible Shelter (to be explored)</b>

## 3.4 Risk Analysis and Assessment

The Scituate Hazard Mitigation Committee assessed the town's risks to natural disasters in terms of population, property, economic resources, and probability of occurrence. The committee considered public health/safety, structural damage, area or town-wide evacuation, and structures that house people with special needs. The committee began by identifying specific areas and structures that are vulnerable to natural hazards.

Vulnerable areas were determined by considering past and potential natural hazards that pose a threat to the population, property, and economic resources of the town. For example, the town's population, residential/commercial properties, schools, bridges and historical buildings were identified as vulnerable areas to natural hazardous events.

The rankings were determined by considering the historical or potential occurrence of natural disasters, the primary threat to the town, and the mitigation benefit that would be received if an appropriate mitigation action was implemented.

### 3.4.1 Methodology

Evaluating the number of times that the natural hazard has impacted Scituate in the past provides a measure of the likelihood of the event occurring again in the future. This rating is derived from an investigation of trends in the long-term (30 years at least) data (Table 20). Examination of past events helps to determine the probability of similar events occurring in the future. This evaluation also considered the effects of changes in the regional climate.

**Table 20. Risk Frequency Score**

Approximate Annual Probability	Subjective Description	Frequency Score
90-100%	Frequently recurring hazards, multiple recurrences in one lifetime	Highly Likely
10-90%	Probability of occurrence in the next year or a recurrence interval of 1 to 10 years	Likely
1-10%	Probability of occurrence in the next year or a recurrence interval of 11 to 100 years.	Occasional
<1%	Less than 1% probability occurring in the next year or recurrence interval greater than 100 years	Unlikely

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### 3.4.2 Exposure Analysis

A second criteria used in evaluating the risk of Scituate to natural hazards is to determine the area of impact. Some hazard events impact only a small region, while others can affect the entire area. The area of impact determination, shown in Table 21, indicates how much of the immediate area may be effected by a single event. Again, historical and predictive data were used to investigate/predict damage and loss. Records of previous hazard events helped to develop an estimate of the amount of property damage that may occur from future events.

**Table 21. Exposure Analysis (Location)**

Subjective Description	Area Score Impact
Less than 10 percent of planning area or isolated single-point occurrences	Negligible
10 to 25 percent of the planning area or limited single-point occurrences	Limited
25 to 75 percent of planning area or frequent single-point occurrences	Significant
75 to 100 percent of planning area or consistent single-point occurrences	Extensive

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### 3.4.3 Historical Analysis

Intensity or magnitude criteria are used to determine the range of the severity of damage (from minor to devastating) expected from a single event. Previous damage reports and other historical data (e.g. newspaper articles, personal accountings, video clips, etc.) are used in assigning this number, which is shown in Table 22.

**Table 22. Extent**

Subjective Description	Extent Score
Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage	Weak
Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days	Moderate
Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months	Severe
Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions	Extreme

### **Repetitive and Severe Repetitive Loss Properties**

The Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the National Flood Insurance Program. Under this program the riskiest SRL properties could be targeted and owners would be offered financial help to get their buildings high and dry: either moved to a safer location or elevated well above the flood elevations. However, the SRL program was eliminated by July 2013 based on the Biggert Waters Flood Insurance Reform Act of 2012.

Scituate has 502 residential and 18 commercial repetitive loss properties. These properties have been targeted for high priority mitigation actions. Although the SRL program has been terminated, applicants with eligible properties are still able to apply for assistance under the Flood Mitigation Assistance (FMA) Program. Residential or non-residential properties currently insured with the NFIP are eligible to receive FMA funds and must meet the definitions of either a repetitive loss property or severe repetitive loss property.

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#### **3.4.4 Vulnerability Summary**

The measure of vulnerability of a community includes the potential for direct damage to residential, commercial, and industrial property, as well as to schools, government, and critical facilities. It also includes the

potential for disruption of communication and transportation following disasters. Any disruption of the infrastructure, such as a loss of electric power or a break in gas lines, can interrupt business activity and cause stress to affected families, particularly if they are forced to evacuate their residences and are subject to shortage of basic supplies. If the destruction of the infrastructure causes additional damage (e.g., property destroyed by fires caused by breaks in the gas lines), this vulnerability needs to be taken into account. One also has to consider the exposure of the population to each hazard type and the potential number of fatalities and injuries to different socioeconomic groups.

### Hurricanes

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

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

There are primarily three components of vulnerability from the impact of a hurricane: storm surge (coastal flooding); ability to evacuate in a timely manner; and shelter capacity. Storm surge has the potential to create a serious problem in Scituate because the waters can rise to high levels with the potential to flood coastal properties, cover roads completely with water. If roads are inundated with water evacuation routes can be eliminated, which can be of particular concern in frequently flooded areas

such as Humarock, First and Second Cliff, Rebecca, The Ave's and Glades.

Electrical utilities and communications, as well as transportation infrastructure, are vulnerable to significant coastal events. Damage to power lines or communication towers has the potential to cause power and communication outages for residents, businesses and critical facilities. In addition to lost revenues, downed power lines present a threat to personal safety. Furthermore, downed wires and lightning strikes have been known to spark fires.

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

### Tornadoes

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

### High Wind and Thunderstorms

The impact of wind can be measured in financial terms as well as fatalities and injuries. Wind vulnerability is based in large part on building construction and standards. Other factors, such as location, condition, and maintenance of trees, also plays a significant role in determining vulnerability. All facilities within Scituate are considered equally vulnerable to thunderstorms. The location and construction of a facility plays a role in how it will be affected by lightning and hail incidents. If a structure is located on a hilltop, is tall or has other tall structures around it, or has large exposed windows, it may be damaged during a storm. Communications and power supplies may be compromised during thunderstorms, and some critical facilities might not be equipped with a backup power source.

Property damages from wind, lightning, and hail can be very costly. According to the National Climatic Data Center, since 1990 Plymouth County has had \$4.47 million in property damages. It should be noted that the NCDC loss estimates are only available at the county level and are believed to be an underrepresentation of the actual losses experienced due to hazards as losses from events that go unreported or that are difficult to quantify are not likely to appear in the NCDC database.

### Winter

Historically, winter storms have had an enormous impact on Scituate. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large- scale emergency response. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as a result of malfunctioning tide gates.

Human vulnerability is based on the availability, reception and understanding of advanced warnings of impending significant winter weather events (i.e. Winter Storm Watches and Warnings issued by the NWS) and heeding the advice of local officials. In some cases, despite having access to technology (computer, radio, television, etc.) that allow for the reception of a watch or warning, language differences are sometimes a barrier to individuals understanding and responding to them. Winter storms, ice storms, and extreme cold can adversely affect people, some more than others. Infants and those persons 65 years of age or older are especially vulnerable.

### Flood

Scituate continues to be vulnerable to coastal and inland flooding and the impacts associated with this natural hazard. Scituate is a water-rich community in that, in addition to the majestic coastline, it has many rivers, streams, and brooks flowing within its boundaries. Past land use patterns and the continued use of structures within areas vulnerable to flooding will continue to promote future risk and vulnerability of flood impacts to structures and people. Local land use regulations and ordinances have done much to curb unregulated development within flood hazard areas. However, Scituate is an old community that developed around the coast and there is a substantial amount of residential and commercial properties located within coastal flooding areas.

### Coastal Erosion

As referenced in the Massachusetts Climate Change Action Report (2011), Scituate's coastline is a classic example of a developed coastline that faces east or northeast and is vulnerable to nor'easters, which are common winter storms in Massachusetts. Existing foreshore protection stands landward of sediment starved beaches and is not capable of withstanding projected future conditions. Potential over wash, undermining and collapse by higher sea levels and storm surge are serious concerns, particularly since at normal high tides there is no beach present to absorb wave energy or to stabilize the structure.

The South Shore shoreline in the vicinity of Scituate consists of both glacial deposits and underlying bedrock outcrops, causing the undulating shape of the shoreline typified by pocket beaches punctuated with headlands. These headlands often consist of boulder/cobble lag deposits that are left behind as finer-grained clays/silts/sands are washed away. These more erosion-resistant deposits can act as natural armoring, thereby reducing or, in some cases, eliminating the landform as a sediment source to downdrift beaches. In addition, extensive armoring of the shoreline within Scituate also has eliminated many of the sediment sources.

Based on recent work performed by the MA Department of Conservation & Recreation (MADCR) for the state-wide coastal structure inventory, repairs to the existing seawall infrastructure fronting many of Scituate's shoreline will require approximately \$70,000,000. These repairs will re-establish the 'hardened' shoreline that prevents erosion of the upland; however, this approach does not address the longer-term concerns regarding on-going shoreline migration and lowering of the beaches fronting the seawalls. Specifically, the increased water depth fronting the seawalls during coastal storms allows larger waves to impact the coastal infrastructure.

With significant damage along many of our east-facing beaches, with total FEMA claims in excess of \$61.8 million from 1978 to March 2015. On-going threats to public and private infrastructure continue to be a major concern for the town, as both long-term coastal erosion and relative sea-level rise in the coming decades will continue to exacerbate regional storm damage.

### Dam Breach

Safety, liability, and environmental hazards of aging dams are issues for virtually every community in Massachusetts. Most of these structures do not fulfill their original purpose, but have become a permanent fixture in the landscape. Depending on the location and population density around a dammed area, a dam failure can cause loss of life in addition to the inevitable economic damages associated with dam failure. Those who live

downstream from a significant or high risk dam should be aware of designated evacuation routes and preplanned actions that can be taken in the event of a dam failure.

There are three (3) dams in Scituate rated as Significant Risk. In addition, the Bound Brook Control Dam located in Cohasset could have an impact on Scituate, should it fail. The predicted inundation zone of this dam includes the North Scituate area. Recent studies of the dam indicate it is in need of repair with the potential for dam failure. The Town of Cohasset has identified the replacement of this dam as a high priority action and is actively taking steps to address this issue.

#### Fire

Greater than 50 percent of the structures in Scituate were built prior to 1950, and the majority of those structures are predominantly wooden and situated in high housing density areas. While wildfires are not especially common in Scituate and are less likely in the mostly developed areas of town, urban fires still pose a risk to the town. The enforcement of proper zoning and quality emergency response are the best way to minimize the effects of urban fires.

#### Geologic

Geologic hazards include earthquakes, landslides, sinkhole, subsidence, and unstable soils such as fill, peat, and clay. Although new construction under the most recent building codes generally will be built to seismic standards, there are still many structures which pre-date the most recent building code. An earthquake risk assessment is difficult because of the challenge to monetize potential damages accurately. FEMA software suite HAZUS-MH is designed for estimating potential losses to natural disasters. The HAZUS-MH earthquake model was utilized to estimate damage and loss to buildings, lifelines, and essential facilities from deterministic (scenario-based) and probabilistic earthquakes. Though the projected economic impacts resulting from these simulations may appear low, the results do indicate that attention does need to be given to potential economic impacts as a result of earthquakes.

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

### 3.4.5 Risk Assessment Matrix

**Table 23. Hazard Risk Summary**

Hazard	Location (Geographic Area Affected) (Table 21)	Maximum Probable Extent (Magnitude/Strength) (Table 22)	Risk Frequency (Table 20)	Overall Significance Ranking
Coastal Erosion	Significant	Extreme	Highly Likely	High
Dam Failure	Limited	Extreme	Unlikely	Low
Earthquake	Extensive	Weak	Unlikely	Low
Extreme Cold	Extensive	Moderate	Occasional	Medium
Flood	Extensive	Severe	Highly Likely	High
Hurricane	Significant	Severe	Likely	Medium
Sea Level Rise	Extensive	Extensive	Highly Likely	High
High Wind	Significant	Severe	Likely	Medium
Winter Weather	Extensive	Extensive	Highly Likely	High
Storm Surge	Extensive	Extensive	Highly Likely	High
Tornado	Limited	Moderate	Unlikely	Low
Wildfire	Negligible	Weak	Unlikely	Low

# 4.0 Capability Assessment

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## 4.1 Purpose

Reviewing the capabilities that currently exist in Scituate enables the Hazard Mitigation Committee and the community at large to identify those that have been successfully used to reduce vulnerability and loss, and which capabilities should be leveraged to address hazard mitigation activities in the future. This review also provides an opportunity to identify community capabilities that inadvertently increase risk or exposure to natural hazards. Scituate has the capability to implement and institutionalize hazard mitigation through its human, legal, and fiscal resources, the effectiveness of intergovernmental coordination and communication, and with the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning. The capabilities outlined in this section reflect the ‘as is’ condition. The town has the capacity to expand on certain capabilities through the passage and enforcement of additional codes and regulations. By coordinating with the many groups active in addressing the impacts of current and future weather on the Scituate environment, the town also has the capacity to continually grow the stakeholders involved in the Hazard Mitigation Committee to reflect growth and change in the community.

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## 4.2 Types and Evaluation of Capabilities

For the purpose of this hazard mitigation plan, the primary capabilities that have been considered for reducing vulnerability through long range mitigation planning include the following types:

- Planning and Regulatory- Capabilities that are based on the implementation of ordinances, policies, local laws and State statutes, and plans and programs that relate to guiding and managing growth and development.
- Administrative and Technical- The community’s staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions.
- Financial- The resources that a jurisdiction has access to or is eligible to use to fund mitigation actions.

- Education and Outreach- Education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

## 4.2.1 Local Government and Program Areas

Local plans and policies were consulted for the creation of this Natural Hazard Mitigation Plan, including those prepared by or on behalf of the town as well as those prepared by citizen driven groups and committees.

Additionally, the public services and facilities provided by the town are crucial resources for the preparation of natural hazard events, as well as the response to and mitigation of such events. The following is a partial list of the central documents used to source and coordinate the development of this plan:

**Table 24. Plan Review**

Plan Review Coastal Remedies and Issues						
Goals, Objectives & Key Action Items in Coastal Areas	Master Plan 2004	Scituate Waterways Plan	MAPC Sea Level Rise Report 2011	Kleinfielder Sea Level Rise Report 2013	Scituate Open Space Plan 2009	Hazard Mitigation Plan 2011
reserve Scituate's coastline and water views	X (pg 13)				X (pg 95)	
Reinvigorating the Harbor (including land beyond the harbor)		X (pg 14)	X (pg 4)		X (pg 129)	
Revise zoning for flood protection by consolidating two zoning districts	X		X (pg 18)			
Develop Programs to educate the public about natural resources and mitigation measures		X (pg 19)		X (pg 27)		X (pg 45)
Manage Sewage in a way that protects sensitive resources		X (pg 20)				
Continue to implement policies to encourage careful stormwater management	X (pg 20)	X (pg 5)	X (pg 19)			
Continue to discourage, enforce and educate new construction in the floodplain		X (pg 21)		X (pg 19)		X (pg 2)

Plan Review Coastal Remedies and Issues						
Support residents use of the harbor and beaches	X (pg 21)	X (pg 4)				
Pursue permanently reopening productive shellfish beds (and/or aquaculture)	X (pg 21)	X (pg 5)				
Protect (and promote) coastal recreational resources - beaches and harbors	X (pg 3 op)	X (pg 4)			X (pg 100)	
Explore soft solutions to coastal flooding, beach management plan	X (pg 3 op)					
Encourage conservation restrictions and easements	X (pg 13 op)		X (pg 26)			
Planned Foreshore Protection improvements	X (pg 2 PF)			X (pg 128)		X (pg 56)
Protect environmental quality of harbor and rivers		X (pg 4)				
Identify and map erosion "hot spots"		X (pg 55)				
Conduct grain size analysis of the material existing on the beach - for dredge and beach nourishment		X (pg 55)		X (pg 130)		
Debris removal		X				
Raise roadways in high hazard areas				X (pg 128)		
Alternative protection measures (WADs, off shore break walls				X (pg 128)		
Hurricane barrier across Scituate Harbor entrance				X (pg 128)		
Feasibility study of the "Avenues"				X (pg 129)		
Home buyout program (retreat)		X (pg 19)	X (pg 129)		X (pg 54)	

Plan Review Coastal Remedies and Issues						
Conduct a study on the health and maintenance of the saltmarshes			X (pg 25)	X (pg 129)		
Elevate public and private buildings - i.e. community center			X (pg 19)	X (pg 129)		
Rolling easements			X (pg 26)	X (pg 129)		
Prepare a coastal management plan to include the maintenance, use, and accessibility to all coastal resources					X (pg 99)	X (pg 61)
Work with surrounding communities to ensure regional cooperation and solutions for hazards			X (pg 29)			X (pg 3)
Make efficient use of public funds for hazard mitigation						X (pg 3)
Protect private and public infrastructure from flooding						X (pg 45)
Maintain existing mitigation infrastructure						X (pg 45)
Encourage future development in areas that are not prone to flooding						X (pg 45)
Develop system of coordination and prioritization of Hazard Mitigation efforts by Town departments to update Flood Hazard Mitigation Plan and PDM Natural Hazards Plan						X (pg 54)
Continue with GIS mapping activities for preparation of Flood Hazards Plan						X (pg 54)
Reconstruct Culverts on Oceanside Drive and behind Turners Road						X (pg 54)

Plan Review Coastal Remedies and Issues						
Elevate and enhance drainage and/or flood prevention structures for key intersections as specified on the flood mitigation map						X (pg 54)
Culvert Cleaning & Maintenance in several neighborhoods						X (pg 55)
Key Town employees should participate in FEMA training in Emmetsburg, MD or other locations where available						X (pg 55)
CRS participation						X (pg 66)
Peggotty Beach Plan						X (pg 66)
Zoning - Transfer of Development Rights				X (pg 27)		
Educate - municipal, residents, local businesses, real estate agents, developers, and engineers						X (pg 28-29)
Funding options: FEMA, NOAA, CZM, DCR, EOHD						X (pg 30)
Regulations: Wetlands, Land Subject to Coastal Storm Flowage, Conservancy District and Floodplain Management						X (pg 25-26)

As plans are updated or new plans or studies are undertaken, the Hazard Mitigation Plan will be incorporated as appropriate. The Hazard Mitigation Plan recognizes the ongoing relevance and importance of zoning regulations, land use and study projects. As described previously, all reviews of the Hazard Mitigation Plan will include a corresponding review of the relevant sections contained in other community planning documents. The long range impacts of changing climate and the resulting increased storm activity have been ingrained in the planning and assessment process. Members of the Hazard Mitigation Committee also serve on other committees throughout the town and act as liaisons between planning bodies. The Town Administrator provides oversight to ensure that mitigation is a consideration in all other appropriate efforts.

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#### **4.2.1.1 Form of Government**

Scituate has an open town meeting form of government led by a five member board of selectmen who are elected to three year terms. The board of selectmen are responsible for the efficient and orderly operation of the town government, including the establishment of personnel and operating policies of all agencies of the town except those under the direction of another separately elected town agency. To assist the board of selectmen in all of the above functions, a town administrator is appointed as chief administrative officer.

The town administrator is responsible for the daily operations of the town and for the efficient and orderly conduct of the departments, offices, and functions placed in their charge. The town business is supported through numerous departments and several boards and commissions, as well as a variety of community-based groups and organizations.

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#### **4.2.1.2 Planning, Building, Housing – Community Development**

The Scituate Planning Board is responsible for approval of many types of new development. These include divisions of land to create new buildable lots and site plans for new commercial and multi-family development. The town development review process works to ensure that residential, commercial, and industrial developments have minimal impact on surrounding land uses and the environment. The plan review process includes technical review by staff members of the planning, building, and public works.

Scituate implements and enforces the state building code, International Residential Code and International Building Code. The Massachusetts amendments to the International Code Council (ICC) Building Code Base Volume were last updated in August 2010. Amendments to the Residential code were published in February 2011. The next edition of the state building code is currently under development and includes several enhancements which address development and improvement of structures in a designated flood zone. In addition, Scituate has implemented several zoning bylaws which place even greater restrictions on certain types and locations of development. In conjunction with the Massachusetts Building Code, the Scituate Zoning Bylaw there are 430 standards that exceed the standards of the NFIP. Scituate also has a town-designated Flood Plain and Watershed Protection District where new construction is prohibited, except for water related uses and accessory uses to pre-existing dwellings.

The Planning Board also oversees or maintains a number of the strategic planning efforts that are instrumental to decision making and mitigation planning including the Master Plan (2004), Open Space and Recreation Plan (2009), and the Sea Level Rise Study for the communities of Marshfield, Duxbury, and Scituate (2013).

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#### **4.2.1.3 Transportation, Public Works, Utilities**

The Scituate Department of Public Works provides engineering design, construction, maintenance and repair of streets, sidewalks, sewer, water and storm drainage systems, surveying and mapping, maintenance and repair of vehicles and equipment, maintenance of parks, cemeteries, athletic fields, beaches, public buildings and off-street parking facilities, public refuse collection and disposal, snow plowing and ice control, administration of construction contracts, review of subdivision projects; inspection of construction projects and the operation of the Wastewater and Water Treatment plants and Transfer Station.

Electric and gas utilities are provided by several companies depending on the location. The two primary sources are National Grid for the majority of town and EverSource for Humarock.

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#### **4.2.1.4 Floodplain Management/Stormwater, Open Space, Land Conservation**

Scituate has an aggressive floodplain management program and has maintained a Flood Mitigation Action Plan since 2001. As part of the management plan, the town has established a bylaw prohibiting building in the wetland and no new buildings allowed in the SFHA. The town continues to pursue funding through Federal, state and local opportunities including our capital budget and grant applications for drainage projects, retrofitting and repairing of structures vulnerable to storm damage and the acquisition of land in full, or in part as a means of preserving or expanding open space in floodplains. The town has successfully used Flood Mitigation Assistance grants for home elevation projects. Through 2013, 16 elevation projects had been approved for funding, nine of them were for properties that had been classified as Severe Repetitive Loss. In 2015 the town submitted 14 more applications under the HMGP.

The town through its Planning Board, Conservation Commission, and Building Department continue exercising an extremely high level of regulatory control over new and proposed renovations in flood prone areas. Such things as the requirements of freeboard in flood zones and pile/pier foundations on barrier beaches are strictly enforced. In addition, the town has adopted an Open Space Residential Design Bylaw in order to maintain wetlands and protect flood-prone areas from being developed. In

2009 the town published an update to the Open Space and Recreation Plan (OSRP). The OSRP and the process of putting it together sought to accomplish the following general goals:

- Provide a decision-making guide for the Conservation Commission, Recreation Committee, and other Town Boards in regarding Conservation and Recreation issues of concern
- Establish a land use matrix that includes information regarding town recreation facilities, open space, and natural resources to provide a “roadmap” for land use protection planning
- Generate updated information about land use, recreation facilities, open space needs/opportunities, and the natural resources
- Educate Scituate residents about the town’s open space and recreation opportunities, conflicts, and constraints
- Build a broad-based constituency for future open space and recreation projects in Scituate
- Reinforce the town’s commitment to open space planning and protection

Scituate participates in the NFIP with 1,472 policies in force as of the November 30, 2015; an increase of 27 policies since the previous mitigation plan update. The following information is provided for the Town of Scituate:

Flood insurance policies in force ( as of November 30, 2015)	1,472
Coverage amount of flood insurance policies	\$382,209,000
Premiums paid	\$2,186,434
Total losses (all losses submitted regardless of the status)	3,681
Closed losses (Losses that have been paid)	3,287
Open losses (Losses that have not been paid in full)	1
CWOP losses ( Losses that have been closed without payment)	393
Total payments (Total amount paid on losses)	\$63,140,162.80

The town complies with the NFIP by enforcing floodplain regulations, maintaining up- to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

The Town of Scituate participates in the Community Rating System (CRS) program, gaining a reduction in flood insurance rates for property owners in the town in exchange for mitigation actions taken to reduce the town’s potential vulnerability to flooding. The program functions on a rating system, with an individual community’s rating being based on the number of points they receive, with points allocated for each flood mitigation measure enacted. The Town of Scituate currently has a rating of Class 8,

resulting in a 10% reduction in flood insurance rates in the town. This equates to an approximate savings of \$242,937 in 2015 annual premiums.

Participating in the CRS helps the community save money, protect the environment, and improve the overall quality of life. For example, when the town preserves open space in the floodplain, the residents will be able to enjoy the natural beauty of the land. If there is a flood, participating in the CRS brings the following benefits:

- Prevent property damage
- Avoid lost jobs and economic devastation caused by flooding in offices, factories, farms, stores, and other businesses
- Prevent damage and disruption to roads, schools, public buildings, and other facilities people rely on every day
- Possibly reduce casualties if setbacks decrease impact to physical structures

Another important component to the overall program is education. In 2015 a flood preparedness informational meeting was held in the fall at the Scituate High School with over 60 attendees. In addition, six other meetings were held on a variety of coastal issues which all included information on flood mitigation practices, emergency preparedness and management of flood hazards, protection of property and infrastructure, responsible development and construction, protection of natural resources, and debris control.

**Table 25: Public Meetings on Flood Preparedness**

Public Informational Meeting Topics	Date
Looking Back at the Blizzard of 1978	March 3, 2015
Hazard Mitigation Elevation Presentation	April 28, 2015
Coastal Processes: Erosion, Storm Damage and Protection Options	June 16, 2015
Building Coastal Resiliency	August 11, 2015
Sharks Amongst Us	August 15, 2015
Hazard Mitigation Plan	August 18, 2015
North Scituate Beach Nourishment	September 1, 2015
CRS/Flood Information Workshop	September 29, 2015

The town also provided the Flood Information brochure, Scituate Alliance Natural Disaster Services (SANDs) brochure, Homeowners Handbook to Prepare for Coastal Hazards, Fact Sheet for Elevation Grants, Building and other departmental requirements related to construction in the floodplain, and Stormsmart Coast – Raise Your Home, Lower Your Monthly Payments with Freeboard. The Flood Information brochure was also mailed to all homeowners in the flood prone areas. A Repetitive Loss Letter was mailed to all of the Repetitive and Severe Repetitive Loss properties in the town. Lending, Real Estate and Insurance Agency's

received a letter with information about the flood information services the town offers.

#### **Emergency Management**

Protective and emergency services for Scituate are provided by the Fire Department, Police Department, Harbormaster's office, and Emergency Management (under the direction of the Fire Chief).

#### **Police Department**

The Scituate Police Department occupies a 60 year old facility adjacent to Town Hall. The Police, along with the Fire Department are scheduled to move into a new public safety complex by March 2017. From this facility, the department deals with a full range of law enforcement services. The Scituate Police Department strives to be a proactive force in the community, with the vision of helping to improve the quality of life for residents and visitors through partnerships with groups and individuals within the Scituate area. The Scituate Police Department plays a critical role in disaster preparation and recovery.

#### **Fire Department**

The Scituate Fire Department provides fire, Emergency Medical Service (EMS), and other emergency services. The department is staffed with a career firefighting force consisting of 40 firefighters, 4 Lieutenants, 4 Captains, 1 Deputy Chief, 1 Chief. The Chief of Department also serves as Emergency Management Director for the town. The mission of the Scituate Fire Department is to preserve lives and property within the community by providing services directed at the prevention and control of fires, accidents, and other emergencies. The apparatus consists of three engine companies, one ladder truck, one rescue/ambulance, and one command vehicle. The department also maintains two reserve engines/pumpers, a reserve forest truck, a dive truck, and an inflatable rescue boat. A regional reserve rescue/ambulance is also housed by the Department. The department responds to approximately 3,200 incidents per year operating from three stations located throughout the town. The Fire Department Headquarters is scheduled to move to the new public safety complex with the Police Department in March 2017.

#### **Harbormaster**

The principal functions of the Harbormaster office are as follows: to provide an efficient system of managing and regulating moorings and anchorage areas; to provide public safety services on the water, in cooperation with the Scituate Police and Fire Departments, the United States Coast Guard, and the Massachusetts Environmental Police.

The Scituate Harbormaster's Office is staffed year round by three individuals. During the recreational boating season (May 15th – October

15th) the staff is augmented by an additional 14 Assistant Harbormasters. The Harbormaster and his Assistant Harbormasters are responsible for insuring water safety, maritime law enforcement, the assignment of moorings and slips, and Chapter 91 licenses administered by the Town of Scituate.

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#### **4.2.1.5 Dam Safety**

As noted in Section 3.2.2.1, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years. All dams listed below are inspected annually.

**First Herring Brook Dam** – DCR lists the First Herring Brook Dam as a High Hazard dam. Owned by the town, this dam is an old earthen dam.

**Mordecai Lincoln Road Dam (aka Hunters Pond Dam)** – The Mordecai Lincoln Road dam is privately owned and listed by DCR as a significant hazard. The dam is primarily an earthen structure with a road and was rebuilt four to five years ago.

**Old Oaken Bucket Pond Dam** – The Old Oaken Bucket Pond Dam is listed by DCR as a significant hazard. The dam is an earthen structure and owned by the town. Old Oaken Bucket Pond is the primary source of drinking water for the town.

**First Herring Brook Dam and Old Oaken Bucket Pond Dams**  
The Department of Public Works commissioned Comprehensive Environmental Inc. (CEI) to complete an Emergency Action Plan for the First Herring Brook Reservoir Dam. This plan was completed in October, 2007 and revised in December, 2014. The First Herring Brook Dam is located at latitude 42°-11.2' and longitude 70 °-45.3'. It is a 700' long earth embankment which is 20' wide at the top and 21.5' in height.

The report lists possible causes of failures as flow erosion, slope protection damage, embankment leakage, foundation leakage and cracking. Water from the First Herring Brook Reservoir is released to fill the Old Oaken Bucket Pond where drinking water is drawn off.

The Old Oaken Bucket Pond Dam supports Country Way, a public road, and impounds water for the water treatment plant. According to the Emergency Action Plan, it is in good condition, but could be vulnerable to a failure of the First Herring Brook Reservoir Dam which lies upstream. The Emergency Action Plan describes the recommended course of action

to control the water level, prevent damage to homes and evacuate nearby areas in case of a breach,

### **Hunters Pond Dam**

The Mordecai Lincoln Dam (aka Hunters Pond Dam) is slated to be removed, restoring a natural waterway which will have many ecological benefits. The upstream inlet will be reconfigured and existing impoundment vegetated as natural floodplain. A feasibility study was completed in 2013 with the assistance of \$40,000 from GOMC/NOAA funds. Permitting is expected to be completed in May, 2017. The total cost of permitting will be over \$150,000; this is expected to be covered by grants the town has already received from four separate programs.

# **5.0 Mitigation Strategy**

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## **5.1 Vision and Goals**

The Scituate Hazard Mitigation Strategy advocates the concepts of a disaster resilient and sustainable community. Scituate is building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes and by restricting the infringement on sensitive lands.

As Scituate is striving to be a more resilient community, it is becoming a safer community, through the implementation of mitigation programs and policies. The town implements and institutionalizes hazard mitigation through its human, legal and fiscal resources; the effectiveness of intergovernmental coordination and communication; and the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning.

The Scituate mitigation strategy provides a coordinated, consistent set of goals for reducing or minimizing: human and property loss; major economic disruption, and the degradation of ecosystems and environmental critical habitats from natural and technological disasters by integrating policy and action across functional areas and working with the citizenry to maintain the delicate balance with nature.

The following nine goals were originally developed for the 2005 Hazard Mitigation Plan. They were continued in the 2011 update and, with minor adjustments are still relevant today.

1. Ensure that critical infrastructure sites are protected from natural hazards.
2. Protect existing residential and business areas from flooding.
3. Maintain existing mitigation infrastructure in good condition.
4. Continue to enforce existing zoning and building regulations.

5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.
6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Encourage future development in areas that are not prone to natural hazards.
8. Educate the public about natural hazards and mitigation measures.
9. Make efficient use of public funds for hazard mitigation.

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## 5.2 Existing Mitigation Actions

Scituate has taken an extremely proactive approach to hazard mitigation. Some existing actions have been in place for decades, while others have been implemented as situations change and new vulnerabilities must be addressed.

2015 has seen an aggressive effort of the Town of Scituate to anticipate, regulate development in, and mitigate activities along high hazard coastal areas and inland Flood Ways. Because of the completion of the Phase VIII of the Coastal Mitigation Grant program, additional homes have been elevated so that the tops of their foundations and utilities are now a minimum of one to three feet above their base flood elevation. This makes a total of over 69 residences permitted to date. The town continues to pursue funding through Federal, state and local opportunities including our capital budget and grant applications for drainage projects, retrofitting and repairing of structures vulnerable to storm damage and the acquisition of land in full, or in part, as a means of preserving or expanding open space in our floodplains.

The town has continued to apply for Flood Mitigation Assistance grants to help property owners elevate homes in the floodplain. The grants were not available in 2011, since no funds were appropriated by Congress. Both home elevations funded by a grant received in 2012 are now completed and those in 2013 are underway. Many of these properties have been classified as Severe Repetitive Loss and are located within the V zone. Of the fourteen properties funded by a grant received in 2013, nine are Severe Repetitive Loss. The town applied for FMA Elevation funding in July,

2015 for four properties and applied for seven more under the HMGP Grant due November 23, 2015. Reflecting the success of the program, the town hired a Coastal Resource Officer in July, 2014 whose responsibilities include managing the grant program.

The town has been very proactive in its efforts to reduce flooding, aggressively addressing major problems such as seawall repairs, beach nourishment, sea level rise, coastal erosion and tide gate repairs, while continuing to explore the provision of pumping stations in a flood prone area to mitigate future flooding. The town continues to provide information and documentation to FEMA for approval on damage that occurred from the Sandy, Nemo and Juno. (Table 24).

**Table 26. Town of Scituate Coastal Grants Update 2013-2015**

Planned and Designed Coastal Grants	“Ask” Requested	Amount Requested	Outcome
FEMA	Roadway damages from Hurricane Sandy	\$237,409.06	Awarded
Executive Office of Energy and Environmental Affairs (EOEEA) & Coastal Zone Management (CZM) Resiliency Grant	Engineer and study for beach nourishment on N. Scituate Beach	\$118,000.00	Awarded
Executive Office of Energy and Environmental Affairs (EOEEA) & Coastal Zone Management (CZM) Resiliency Grant	Engineer and study for beach nourishment on N. Scituate Beach	\$241,163.00	Awarded
EOEEA Dam and Levee	Repair to 760+/-feet of seawall along Oceanside Drive	\$4,000,000.00	Awarded
Environmental Protection Agency Resiliency Grant	Technical Assistance for flood resiliency in coastal communities	\$50,000.00	Awarded
Executive Office of Energy and Environmental Affairs (EOEEA) & Coastal Zone Management (CZM) Resiliency Grant	Assessing Coastal Erosion, Sediment Transport & Prioritization Management Strategy for Shoreline Protection	\$180,000.00	Awarded
MAPC Planning Assistance Grant	Scituate and Duxbury coastal climate plan	\$34,375.00	Awarded
Executive Office of Energy and Environmental Affairs Seawall Grant	Reconstruction of Oceanside Drive Seawall cont.	\$3,000,000.00	Awarded
			<b>\$7,860,947.06</b>
Pending Planned and Designed Projects	“Ask” Requested	Amount Requested	Outcome
FEMA (Nemo)	Foreshore damages from Winter Storm Nemo	\$5,900,137.50	Pending
FEMA (Sandy)	Foreshore damages from Hurricane Sandy	\$2,240,600.00	Pending

MEMA (Juno)	Foreshore damages from Winter Storm Juno	\$2,272,900.00	Pending
MEMA (HMGP)	Hazard Mitigation for drainage improvements on Oceanside Drive	\$200,000.00	Submitted November 2015
FEMA (FMA) Elevation Grants	4 Properties (2 SLR, 2RL)	\$479,242.00	Pending
<b>\$11,092,878.50</b>			

The town continues to improve its outreach and education programing effort. New this year is the Program for Public Information, A Blueprint for Outreach and Education in Flood Prone Areas report. The goal of this Report is to provide guidance to target the right audience with the appropriate message in order to educate residents about floodplain management measures. Research shows that when public information efforts are actively planned and well-coordinated, people will take the necessary steps to protect themselves from flood damage. The town needs to utilize available outreach resource in a responsible and effective manner. The programs provided were well attended and received, revealing targeted messaging can bring about a successful outcome.

The town also provided the Flood Information brochure, Scituate Alliance Natural Disaster Services (SANDs) brochure, Homeowners Handbook to Prepare for Coastal Hazards, Fact Sheet for Elevation Grants, Building and other departmental requirements related to construction in the floodplain, and Stormsmart Coast – Raise Your Home, Lower Your Monthly Payments with Freeboard. The Flood Information brochure was also mailed to all homeowners in the flood prone areas. A Repetitive Loss Letter was mailed to all of the Repetitive and Severe Repetitive Loss properties in the town. Lending, Real Estate and Insurance Agency's received a letter with information about the flood information services the town offers.

The Towns of Scituate and Marshfield, respectively, submitted appeals of the preliminary revised Flood Insurance Rate Map (FIRM) issued for Plymouth County, Massachusetts by FEMA on May 1, 2013. The appeals focused on narrow geographic locations and technical issues. In Scituate, the appeal involved areas in the vicinity of coastal transects PL-40 and PL-49 from the Flood Insurance Study (FIS). The technical issues disputed in both appeals are the incident wave height and wave period used to compute the wave setup along those transects. Altering the wave setup alters the wave height and wave run-up computed in the final Base Flood Elevations and flood zones. The towns were successful in one of the two appeals and we are currently waiting on the revised maps from FEMA.

The town had also obtained FIRM data layers for existing and proposed FEMA flood zones during this time. Both of these were added to the

Pictometry software used by the Building, Planning, Coastal Resource and Conservation departments. This became the platform for the community to provide mapping information to residents, Real Estate agents, interested home buyers, insurance agencies and lenders. The information on existing and proposed flood zones is now readily available until the final appeal is determined.

Regulating development in flood-prone areas is a critical component in flood hazard mitigation and is a requirement for participating in the National Flood Insurance Program. The town through its Planning Board, Conservation Commission, and Building Department continue exercising an extremely high level of regulatory control over new and proposed renovations in flood prone areas. Such things as the requirements of freeboard in flood zones and pile/pier foundations on barrier beaches are strictly enforced.

In general, the existing developmental rules and regulations have been determined as adequate to regulate or prevent development in the most vulnerable areas of Scituate. The town has discussed potential future actions. The following items are being implemented to enhance the mitigation process:

All foreshore protection structures have been and continue to be evaluated. The town continues its contract with CLE Engineering to maintain a current evaluation of the seawalls, dikes and jetties and natural barriers to determine which ones are in need of repair, replacement, or nourishment and what the likely impacts of their failure would be. The projects listed below are either underway, permit and design phase or in need of a funding source:

- North Scituate Beach Nourishment Project
- Oceanside Drive Seawall Reconstruction (two projects will be implemented in Spring 2016)
- Edward Foster Road Seawall Reconstruction
- South River Dredge and Beach Nourishment Project
- HMGP Oceanside Drive Drainage Improvement Project

Staff continue its' system of coordination through meetings each week where one of the topics has been the flood mitigation plan and its priorities and use. Sparked by the technical assistance provided by the EPA Coastal Resiliency Grant opportunity held last summer a Coastal Team of all key staff was established. A Coastal Team Meeting of all key staff was held in September, 2015 to discuss current projects, what the challenges are, and who are our partners of which a list of action items were revealed. The next meeting was held March 2, 2016 to discuss actions and update on projects.

- Approach Gas Company concerning safe location and securing of Propane tanks in the SFHA;
- Universal letter to residents to prepare for winter;
- Debris Management Plan investigation;
- Overlay 1972 Floodplain Regulatory Maps, Sea Level Rise and current FIRM Mapping layers in order to determine areas of conflict;
- Strengthen General Bylaws;
- High Hazard District (Septic Regulations);
- Expand Harbormaster Communications around coastal issues/enforcement;
- Review Executive Summary, Goals, Objectives and Action on all previous shelf plans.
- Review current regulations for improvements, amendments, and changes.

The town continues reconstructed or rehabilitated, and/or replaced seawalls in several neighborhoods throughout the town.

The town is maintaining a web-based program of education, including the vital flood mitigation information on the town web-site and recently added a Facebook page for the same purpose.

Dune stabilization efforts (in the form of spring planting brigades) continue in different areas of town by neighborhood groups in Humarock, the Rivermoor section of Third Cliff, and Peggotty Beach.

The DPW assists in the town's CRS efforts. The engineering department maintains and updates a town-wide system of elevation benchmarks tied to the USGS elevation system that is used by engineers and surveyors for their work. The highway division has a program that on an annual basis cleans and maintains the storm water drainage system for the town. This includes repairs to structures as well as cleaning of pipes, culverts and channels. There is also a street sweeping program in place that included all public ways.

Builders and contractors are required to meet the most stringent flood proofing practices in the area through the efforts of the different town departments. The Planning Board and the Conservation Commission require that all new subdivisions meet the new storm water regulations, and this has been incorporated into the permitting process. The Building Department requires all new additions or storm damage repairs to buildings in the flood plain comply with flood plain regulations whether the work be on flood proofing designed foundation with elevated utilities.

The office of the Building Commissioner has continued to keep elevation certificates on file; in addition, these are also available upon request. We continue to provide map information and encourage residents inside identified flood zones to purchase flood insurance policies. Letters are sent out each year to real estate offices, insurance agencies and mortgage companies with information concerning this service. This office in cooperation with the Coastal Resource Officer also offer guidance on retrofitting existing structures, encouraging homeowners who are remodeling to consider flood proofing as a major consideration in their plans.

The current FIRM as adopted July 17, 2012 and is currently being utilized until the final appeal has been approved by the town. The dFirm was obtained from FEMA for integration into the town's mapping software so that Permitting Departments and citizens can see the relationship of flood zones to their properties on an ortho photo base map available in town hall.

In conjunction with the mapping effort, the Conservation Commission continues to permit projects in the flood zones in compliance with the FEMA flood zone mapping and performance standards. All permits are shared with the Building Department to insure compliance with the federal, state and local building codes. The content of the regulations is posted on the town webpage. Property owners are being encouraged to elevate their homes and existing structures are required to be on pile driven piers if elevated. The Conservation Commission is working with the Massachusetts Department of Environmental Protection (DEP) agency toward the establishment of performance standards for projects proposed in Land Subject to coastal Storm Flowage and will incorporate their standards into local regulations when finalized by DEP.

The State of Massachusetts adopted the 8th edition State Building Codes on August 6, 2010, which was amended to reflect the 2009, International Building Code. This imposed stricter building standards in the coastal zone especially in dune areas in flood zones.

The town's website has been used for rotating informational pages on flood mitigation matters including: (1) publication of the Hazard Mitigation Plan Update; (2) Proposed and adopted copies of changes to the Wetlands Rules and Regulations, and; (3) Proposed and adopted changes to the subdivision rules and regulations and other informational material on the impacts of floods and flooding; (4) Sea Level Rise Reports; (5) Elevation Grant Program Information; (6) Storm ready activities and a variety of other valuable topics. All this information was and is duplicated in hard form at the town library, posted in the Town

Hall. Copies our Repetitive Loss Letter and the Floodplain brochure was distributed in a mailing to homes town-wide and in flood hazard areas.

This past year the town experienced one major storm, Juno on January 27, 2015. Flooding, roaring winds and as much as three feet of snowfall combined with surging flood waters from the coast pushed across New England. The storm brought heavy snow, hurricane-force winds and coastal flooding to the Scituate coastline. The town, as a whole, was better prepared for such an event than any time in the past and with time and our continued efforts we can make even more significant strides in this regard.

Another tool that the town continues to use working through the Plymouth County Sheriff's Department is the reverse 911 system and CODE RED alert system which sends out a pre-recorded message to homes, cell phones, and emails of occupants in hazard areas alerting them to situations that could impact their safety. The system has been operational for several years. The Massachusetts Emergency Management Agency (MEMA) in partnership with the National Oceanic and Atmospheric Administrations (NOAA) provides Massachusetts Alerts, a free public safety alerting app. alerting users based on their location, proximity to an event or incident, and the references selected. Users receive real-time information.

The repetitive losses to residences over the last 10 years has been held to a minimum as a result of the success of the CRS program, the FEMA Hazard Mitigation Elevation grant program, and the elevation of flood prone structures and the availability of flood proofing information on the town website.

The town strives to enhance coastal inundation forecasting for Scituate by participating in two separate but related studies.

One is in conjunction with the National Weather Service in Taunton, MA and the NOAA Coastal Services Center in South Carolina. Scituate was chosen as one of two coastal communities in the country for this effort to more closely define, on the ground, areas of coastal flooding.

The other with UMass-Dartmouth and Woods Hole Oceanographic Institution involves the construction of an inundation model grid. This grid will include the near-shore area off the beach and all the land area that can flood during storms. Available LIDAR and other ocean bathymetry/land elevation data have been collected. The forecast from this model will be used to drive the high-resolution Scituate forecast inundation model.

WeatherFlow is working in partnership with the insurance industry, university researchers, utilities, NOAA, and The National Hurricane Center on a project to gather data during extreme wind events. The

Northern end of Edward Foster Road at the entrance to Scituate Harbor was identified as a suitable site for one of the hurricane hardened weather stations, which was installed in 2009. The data is now available over the internet in various forms.

Floodplain Zoning District – Zoning is intended to protect the public health and safety through the regulation of land use. The Scituate Zoning Bylaw includes a Flood Plain and Watershed Protection District (Section 470). The purposes of this district are:

- To protect the health and safety of persons against those hazards, which may result from unsuitable development in marshes, bogs and lowlands, or along ponds or watercourses, or in areas subject to flooding.
- To conserve the values of lands and buildings in such flood-prone areas.
- To facilitate the adequate protection of the community water supply through preservation and maintenance of the ground water table.
- To protect and preserve the inland marshes, bogs, ponds, and watercourses and their adjoining wetland soils in order to safeguard the purity of inland and coastal waters and for the protection and propagation of the food chain supportive of marine life.
- To encourage the most appropriate and suitable use of the land.
- To preserve and increase the amenities of the town.

The Flood Plain & Watershed Protection District is an overlay district, covering an area shown on the map entitled "Town of Scituate, Massachusetts, Flood Plain and Watershed Protection District, 1972" and kept on file in the Town Engineer's Office. Within this District, no new residential or commercial structures may be built and existing structures may only be modified by special permit requiring compliance with the National Flood Insurance Program and the Massachusetts State Building Code. The district predates the Federal Flood Insurance Rate Map (FIRM) of the town, so the boundaries do not coincide with the FIRM Zone A. The regulations for this district equal or exceed the requirements of FEMA. New FIRM maps are expected to be issued in 2016, and the town expects to adopt zoning needed to comply with the NFIP.

Subdivision Rules and Regulations - The Scituate Subdivision Rules and Regulations contain provisions that serve to reduce the impacts of floods and erosion. Through its design and layout standards, the regulations contribute to the town's overall efforts to mitigate the risks for damage through flooding.

**Stormwater Bylaw** – The purpose of the Stormwater Bylaw (Scituate General Bylaws Section 32050) is in part to mitigate flooding through site design and structural improvements that promote the infiltration of stormwater on site or otherwise retain stormwater in areas of new development where there is a significant increase in impervious surfaces and/or a change in drainage patterns.

**Wetlands Protection By-Law** – The purpose of the Wetlands Protection By-Law (Article 30700) is to further protect the town's shores, ponds, rivers, and wetlands for, among other reasons, flood control, erosion and sedimentation control, and public safety. The by-law requires review of all development, excavation, or fill activities in or within 100 feet of any wetland, shoreline, coastal feature, etc., and also any land subject to tidal action, coastal storm flowage, or flooding.

**Salt Marsh and Tidelands Conservation District** – The Salt Marsh and Tidelands zoning district (section 460) restricts development so as to protect the natural character of salt marsh and tidelands areas in the town.

**Elevating Repetitive Loss Properties** - The town has an active elevation grant program for residents to elevate their homes or utilities that has served more than 50 property owners since 1997. This program uses grant funding from FEMA, utilizing the Flood Mitigation Assistance, Hazard Mitigation, and Severe Repetitive Loss grant programs.

**Seawalls, Jetties, and Dikes** – Portions of the Town of Scituate coastline is protected by a series of seawalls, jetties and dikes, which are in need of continued monitoring and maintenance.

**Public Education** – The town Community Rating System Coordinator conducts annual flood awareness meetings as well as distributing information on the hazards presented by flooding in the town through print and web resources.

#### Existing Wind Hazard Mitigation Measures

**Massachusetts State Building Code** – The town enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high.

**Tree-trimming program** – The town conducts its own tree maintenance and also uses its own equipment to trim and remove trees as needed.

### Existing Winter Hazard Mitigation Measures

Snow disposal –The town conducts general snow removal operations with its own equipment. Where necessary, snow is removed and dumped on other town properties.

### Existing Brush Fire Hazard Mitigation Measures

Burn Permits – The town Fire Department requires a written permit for outdoor burning, which includes explanation of the related regulations and precautions for the permit-holder to take. The permit-holder must call the Fire Department on the proposed burn day to confirm weather conditions are suitable for outdoor burning and receive verbal permission to proceed.

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development projects.

### Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1613). Section 1613.1 (Mass Amendments, Eighth Edition) states that the purpose of these provisions is “to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of high occupancy assembly and education buildings as compared to ordinary buildings, and to improve the capability of essential facilities to operate during and after an earthquake.” This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety.

The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

Section 1613.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 1613.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

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## **5.3 Update of the Mitigation Strategy and Actions**

In the process of preparing this update, the town has continued to review past and ongoing actions to determine their relevance in the future. The types of activities that were considered when developing new actions to reduce the community's vulnerability have been divided into the following categories:

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Programs

The Hazard Mitigation Committee conducted several reviews of the 2011 Mitigation Plan Actions. The 2011 actions were assessed for their continued relevance and value to the community in light of changes in the community and events that have occurred since the previous plan was implemented. During this review, several changes were made to the mitigation actions. Actions were again realigned and modified to address current needs and future development trends. The newly formatted actions were presented to the public for comment and input. Based on input from the public and the Hazard Mitigation Committee, the actions listed in the following sections will be implemented. Table 27 outlines the outcome of the action review process.

**Table 27.** 2011 Mitigation Action Disposition

<b>2011 Action #</b>	<b>2011 Action Description</b>	<b>2016 Action #</b>	<b>2016 Disposition</b>
A	Elevate Repetitive Loss Structures	1	Program Continued
B	Hazard Mitigation Plan Coordination	X	Moved to capabilities section
C	GIS Flood Area Mapping	X	Completed
D	Protect Key Road Intersections	2	Continued
E	High Hazard Area Buy-Outs	X	Removed. Determined to be not economically feasible
F	Sea Wall Repairs	3	Rolled into a broader approach
G	Culvert Maintenance	4	HMGP grant submitted
H	CRS Participation	5	Modified to include implementation of new elements
I	Peggotty Beach Management Plan	6	Rolled into a more comprehensive planning effort
J	Public Education	5	Rolled into Action #5
K	Emergency Power Generators	10	Continued
L	Floodplain Management	X	Moved to capabilities section
M	Floodplain Mapping	X	Completed
N	Acquisition of Vacant Flood Prone Lands	X	Completed
O	FEMA Training	X	Moved to capabilities section
P	Building Department Mutual Aide	X	Moved to capabilities section
Q	Municipal Building Assessment	X	Moved to capabilities section
R	Phragmites Control	X	Moved to capabilities section
S	Boat Launch Repair	X	Completed

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## 5.4 Prioritization

The overall program priorities for the town have not changed since the 2011 plan. Coastal related vulnerabilities emanating from a variety of potential hazard events remains the primary focus. Once all the possible actions were on the table, the committee used some basic evaluation

criteria to decide which actions will work best to achieve those priorities. Following the period of public input, the Hazard Mitigation Committee assigned priorities to each mitigation action. The most important criterion is whether the proposed action mitigates the particular hazard or potential loss. Each action was also examined for conflict with other community programs or goals, and for how the action will impact the environment, as it is very important to consider whether the proposed action will meet state and local environmental regulations. Other considerations included whether the mitigation action affects historic structures or archeological areas or whether it helps achieve multiple community objectives. Another important issue is timing, and how quickly the action has to take place to be effective, as well as which actions will produce quick results. It is particularly important to consider if funding sources have application time limits, whether it is the beginning of storm season, or if the community is in the post-disaster scenario, where everyone wants to recover at maximum speed.

Each of the considered actions was given a priority score based upon the STAPLEEE criterion as described in Section 5.4.1. The scores were then translated into a relative priority ranking. Highest priority was placed on those actions given a ranking of 1. Those actions scoring the same were given equal ranking and may be accomplished simultaneously or at the very least they should be given equal consideration for implementation.

This prioritization exercise helped the Committee evaluate seriously the new hazard mitigation strategies that had been developed throughout the Hazard Mitigation Planning process. While all the actions would help improve the town's resilience, funding availability will be a driving factor in determining what and when new mitigation strategies are implemented. For example, while elevating structures out of the 100-year floodplain will definitely decrease floodplain losses, the cost of this project may require the project be put off until funding is made available. In contrast, the town can distribute preparedness information to the public at a much lesser cost, making this project more reasonable as a short-term goal. This type of cost to benefit analysis was taken into account when prioritizing each action.

Each mitigation action has been given an expected timeframe for implementation. The assigned timelines are based on a combination of factors that includes the relative priority of the action, the availability of resources needed to complete the action, and the status of any requisite projects that may impede the completion of the action. This committee worked to set goals and objectives that are bounded by a time frame following plan adoption, are compatible and consistent with state hazard mitigation goals and availability of funding. The time frames used for these strategies are as follows:

- Near-term = 0 to 6 Months
- Medium-term = 6 to 18 Months
- Long-term = 18 Months to 5 Years

### **5.4.1 STAPLEE**

The Scituate Hazard Mitigation Committee developed and refined hazard mitigation actions using evaluation criteria based on the concept of STAPLEE. STAPLEE is an acronym for a general set of criterion common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political Legal and Economic/Environmental criterion for making planning decisions. The Hazard Mitigation Committee ranked each of the new or improved mitigation strategies by utilizing the STAPLEE criterion. The Committee asked and then answered questions in order to determine the acceptability of the proposed mitigation action when being viewed in terms of six distinct criteria. See Table 28 for further explanation of the STAPLEE criterion.

**Table 28. STAPLEE Criteria for Prioritizing Mitigation Actions**

Criteria	Explanation
Social	Is the proposed action socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly? Will the action cause social disruption?
Technical	Will the proposed action work? Will it create more problems than it solves? Does it solve a problem or only a symptom? Is it the most useful action in light of the community goals?
Administrative	Can the community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff, and technical support available? Are there ongoing administrative requirements that need to be met?
Political	Is the action politically acceptable? Is there public support both to implement and to maintain the project? Will the Mayor, his Cabinet, County Council and other decision-making political bodies support the mitigation measure?
Legal	Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? Is enabling legislation necessary? Are there any legal side effects (e.g. could the action be construed as a taking)? Will the community be liable for action or lack of action? Will the activity be challenged?
Economic	What are the costs and benefits of this action? Does the cost seem reasonable for the size of the problem and the likely benefits? Are maintenance and administrative costs taken into account as well as initial costs? How will this action affect the fiscal capability of the community? What burden will this action place on the tax base or the

	local economy? What are the budget and revenue effects of this action? Does the action contribute to other community goals, such as capital improvements or economic development? What benefits will the action provide?
Environmental	Sustainable mitigation actions should not have an adverse effect on the environment, they should comply with federal, state, and local environmental regulations and should be consistent with the community's environmental goals.

The Committee responded to each of these above listed criteria, with a numeric score of “1” (indicating low impact), a “2” (indicating medium impact), and a “3” (indicating high impact). These numbers were then totaled and developed into an overall priority score.

A total of 10 actions were developed by the Scituate Hazard Mitigation Committee along with input from stakeholders and the general public.

## 5.5 Mitigation Actions

The following actions have been identified for implementation during the five year span covered by this plan. The actions will continually be assessed and evaluated for their continued relevance throughout the period.

### **ACTION #1** Elevate Repetitive Loss Structures

The town has completed or permitted 69 home and utility elevations to date. Eleven additional applications are pending. This program has proven generally popular and the town plans to continue to offer funding obtained through FEMA Grants to assist owners of Repetitive and Severe Repetitive Loss properties in elevating their homes and/or their utilities in order to reduce the vulnerability to flooding and storm surge. The program criteria will be modified as needed throughout the life of this plan.

Priority: High

Pre or Post Disaster: Pre-disaster

Type of Activity: Structure and Infrastructure Projects

Responsible Departments: Coastal Resources, Building Department, Planning Department, and Conservation Department

Funding Resources: FEMA Grant, Town Budget

Cost: Average cost per home elevation is \$145,000-\$175,000

Timeframe: Medium-term

## **ACTION #2** Protect Key Roads, Bridges and Intersections

Elevate and enhance drainage, roads, bridges and/or flood prevention structures to facilitate ingress and egress during storm events. Some improvements to roads, bridges and intersections have been concluded, however the town needs to continue the program to support critical transportation networks in other areas.

Priority: Medium

Pre or Post Disaster: Pre-disaster

Type of Activity: Structure and Infrastructure Projects

Responsible Departments: Public Works, Coastal Resources, Conservation Department

Funding Resources: Town Operating Budget, FEMA Grants, Chapter 90 Program, MassDOT, MAPC

Cost: Cost to be determined by project

Timeframe: Near-term

## **ACTION #3** Foreshore Protection

Repair and replace seawalls and revetments to improve resilience from storm surge, coastal flooding and sea level rise. Approximately 6 miles of protection currently require repair or replacement.

Priority: High

Pre or Post Disaster: Pre-disaster

Type of Activity: Structure and Infrastructure Projects

Responsible Department: Public Works, Coastal Resources

Funding Resources: FEMA Grants, MEMA, EOEEA, CZM, Seawall and Dam Safety

Cost: Approximately \$4,000-\$7,000 per linear foot

Timeframe: Near-term

## **ACTION #4** Drainage and Culvert Repairs, Improvements and Upgrades

Upgrade, repair and improve undersized culverts and drainage systems to reduce or eliminate stormwater related flooding. Current priority is culvert on Oceanside Drive. The town recently submitted an HMGP grant application for Phase I, design and engineering for the Oceanside Drive drainage. Phase II will consist of implementation. The town continues to address drainage improvements due to the frequent flooding. There are other areas in town where drainage needs upgrades and improvements to provide the necessary mitigation from flooding.

Priority: Medium

Pre or Post Disaster: Both

Type of Activity: Structure and Infrastructure Projects  
Responsible Department: Public Works, Coastal Resources, Conservation Department  
Funding Resources: FEMA Grants, FHWA Grants, MassDOT, MEMA, Town Operating Budget  
Cost: Oceanside Drive \$200,000  
Timeframe: Medium-term

#### **ACTION #5 CRS Participation/Implementation of Public Information Program**

Improve the current Rate in the Community Rating System program by implementing PPI Actions related to flood awareness and prevention as outlined in the 2015 Town PPI Action Plan, documentation of town-wide efforts, mapping open space, flood zones, and natural functions. The PPI Action Plan provides a review of activities that occurred throughout 2015, as well as, updated tables to reflect individuals/agencies responsible for each of the Elements of Public Information, the target audience, desired outcome, and schedule. This table also lists the projects relating to each element.

Priority: High  
Pre or Post Disaster: Pre-disaster  
Type of Activity: Education and Awareness  
Responsible Departments: CRS Coordinator, Coastal Resources, Building, Planning Department, Public Works, Engineering, Conservation Department, Emergency Management  
Funding Resources: Town Operating Budget  
Cost: Staff time. 2015 NFIP premium savings estimated at \$242,937  
Timeframe: Near-term

#### **ACTION #6 Complete Coastal Assessment**

Scituate received \$180,000 Coastal Resiliency Competitive Grant to complete a Coastal Assessment. This action is the preparation of a comprehensive assessment of coastal erosion and engineering for flood protection measures along the entire coast with recommendations and plan to implement best methods for protection.

Priority: High  
Pre or Post-Disaster: Pre-Disaster  
Type of Activity: Local Plans and Regulations, Natural Systems Protection  
Responsible Departments: Coastal Resources, Public Works, Conservation Department, Planning Department, Engineering  
Funding Resources: CZM Coastal Resiliency Grant

Cost: \$180,000  
Timeframe: Near-term

#### **ACTION #7** Implement Recommendations of Coastal Assessment

The comprehensive assessment of coastal erosion and engineering for flood protection measures along the entire coast will be completed in June, 2016. At that point the town will begin to identify funding sources for each of the actions outlined. Implement actions created from Assessing Coastal Erosion report.

Priority: High  
Pre or Post-Disaster: Pre-disaster  
Type of Activity: Local Plans and Regulations, Natural Systems Protection  
Responsible Departments: Coastal Resources, Town Administrator, Board of Selectmen, Town Meeting, Public Works, Planning, Conservation, Building, Emergency Management  
Funding Resources: FEMA Grants, MAPC, Chapter 90, MassDOT, EOEEA, CZM, Seawall and Dam Safety  
Cost: To be determined  
Timeframe: Medium-term

#### **ACTION #8** Beach & Berm Nourishment & Replenishment

Design, develop and replenish beach and cobble berm protection measures. The goal of the nourishment project is to place a natural material on the coastline to prevent erosion and undermining of the existing seawalls and reduce flooding in the adjacent residential neighborhoods. In addition, the stone berm located on Shingle Beach is critical to protecting Musquashicut Pond and adjacent roadways and homes. The town has recently replaced the Musquashcut Pond Berm and is in the process of acquiring the necessary permits for beach nourishment on North Scituate Beach

Priority: High  
Pre or Post-Disaster: Pre-disaster  
Type of Activity: Natural Systems Protection  
Responsible Departments: Public Works, Conservation, Coastal Resources  
Funding Resources: FEMA, CZM, CPC  
Cost: \$300,000  
Timeframe: Near-term

#### **ACTION #9** Install strategic power grid shutoffs

Install power grid shutoffs to isolate flood-prone and storm damage sensitive coastal areas. Focusing the shut off zones reduces the recovery and restoration time.

National Grid: The town has asked National Grid to break the coastal streets into zones. From Lighthouse point to the north end of Oceanside will be broken down into 6 zones. Most of the power shut offs are right on the coastal roads. National Grid engineers are going to move these shut offs to the side streets that the town believes will be in a safe area far away enough from flooding but close enough to minimize the homes impacted.

Eversource: Chief Murphy met with Eversource engineers last summer to see how the town could make the northern end of Central Ave safer during the storms Scituate endures. The final agreement includes putting in a remote shut off at the location of 200 Central Ave that could power down the area north of this in case of hazardous conditions during a coastal storm. Eversource agreed to put this project on their capital plan.

Columbia Gas: Chief Murphy contacted Columbia gas to inquire about natural gas flow limiters. These are installed between the main in the street and the service meter, if the meter were damaged & leaking this would limit the flow with an inline check valve.

Priority: Medium

Pre or Post-Disaster: Both

Type of Activity: Structure and Infrastructure Projects, Local Plans and Regulations

Responsible Departments: Fire Department, Emergency Management

Funding Resources: National Grid, Eversource, and Columbia Gas

Cost: Private

Timeframe: Near-term

#### **ACTION #10** Installation of generators

Installation of generators for critical municipal facilities to support continuity of operations and community emergency supportive measures.

Priority: High

Pre or Post-Disaster: Pre-disaster

Type of Activity: Structure and Infrastructure Projects

Responsible Departments: Public Works, Facilities

Funding Resources: FEMA/Town Operating Budget

Cost: \$7,000 - \$10,000

Timeframe: Medium-term

**Table 29. Primary Mitigation Actions**

ACTION #	VULNERABLE AREA	PRIORITY	HAZARD TYPE	POTENTIAL PROGRAM	DESCRIPTION OF STRATEGY	AFFECTED LOCATION	TYPE OF ACTIVITY	FUNDING SOURCES	TIMEFRAME	RESPONSIBLE DEPARTMENT	STATUS	NEW, CONTINUED, MODIFIED FROM PREVIOUS PLAN
1	Property	High	Hurricane, Winter Storm, Coastal Storm and Flood	Elevation Repetitive Loss Structures	Offer the grant program to assist floodplain property owners in elevating their homes and/or utilities.	Coastal Areas	Structure and Infrastructure Projects	FEMA Grant, Town Budget	Medium-term	Coastal Resources Officer, Building Department, Planning and Conservation	FEMA grants were approved for one utility elevation and 15 home elevations from 2010 – 2015. Seven of the home elevations were completed during this period. Grant guidelines were also updated to reflect new FEMA regulations.	Continued
2	Road Network	Medium	Hurricane, Winter Storm, Coastal Storm and Flood	Protect Key Roads, Bridges and Intersections	Elevate and enhance drainage, roads, bridges and/or flood prevention structures	Town-wide	Structure and Infrastructure Projects	Town Budget, FEMA Grants, Chapter 90 Program, MassDOT, MAPC	Near-term	Public Works, Coastal Resources, Conservation	Some improvements to roads, bridges and intersections have been concluded, the Town needs to continue in other areas.	Modified
3	Coastal Property	High	Hurricane, Winter Storm, Coastal Storm and Flood	Foreshore Protection	Repair and replace seawalls and revetments to improve resilience from storm surge, coastal flooding and sea level rise	Coastal Areas	Structure and Infrastructure Projects	FEMA Grants, MEMA, EOEEA, CZM, Dam and Seawall	Near-term	Public Works, Coastal Resources	Easements being obtained	Modified
4	All	Medium	Hurricane, Winter Storm, Coastal Storm and Flood	Drainage and Culvert Repairs, Improvements and Upgrades	Upgrade, repair and improve undersized culverts and drainage systems to reduce or eliminate stormwater related flooding	Town-wide	Structure and Infrastructure Projects	FEMA Grants/FHWA Grants, MEMA, MassDOT, Operating Budget	Medium-term	Public Works, Conservation, Coastal Resources	The Town recently submitted an HMGP grant application for Phase I, design and engineering for the Oceanside Drive drainage. Phase II will consist of implementation. The Town continues to address drainage improvements due to the frequent flooding. There are other areas in Town where drainage needs upgrades and improvements to provide the necessary mitigation from flooding.	Continued
5	All	High	All	CRS Participation	Improve the current Rate in the Community Rating System program by including PPI Actions related to flood awareness and prevention, documentation of Town-wide efforts, mapping open space, flood zones, and natural functions	Town-wide	Education and Awareness	Operating Budget	Near-term	CRS Coordinator, Key Departments: Coastal Resource Officer, Building, Planning, DPW, Engineering, Conservation, Emergency Management	Improve the CRS Rating and the benefits received from these actions in areas of flooding.	Modified

Action #	Vulnerable Area	Priority	Hazard Type	Potential Program	Description of Strategy	Affected Location	Type of Activity	Funding Sources	Timeframe	Responsible Department	Status	New, Continued, Modified from Previous Plan
6	Coastal Area	High	Flood, Coastal Storms	Complete Coastal Assessment	Prepare a comprehensive assessment of coastal erosion and engineering for flood protection measures along the entire coast with recommendations and plan to implement best methods for protection	Coastal Areas	Local Plans and Regulations Natural Systems Protection	CZM Coastal Resiliency Grant	Near-term	Coastal Resources Officer/ Public Works/ Conservation/ Planning/ Engineering	Received \$180,000 Coastal Resiliency Competitive Grant to complete a Coastal Assessment	New
7	Coastal Area	High	Flood, Coastal Storms	Implement Recommendations of Coastal Assessment	Implement actions created from Assessing Coastal Erosion report	Coastal Areas	Local Plans and Regulations Natural Systems Protection	FEMA Grants, MAPC, Chapter 90, MassDOT, EOEEA, CZM, Seawall and Dam Safety	Medium-term	Coastal Resources Officer, Town Administrator, Board of Selectmen, Town Meeting, Public Works, Planning, Conservation, Building, Emergency Management	A comprehensive assessment of coastal erosion and engineering for flood protection measures along the entire coast will be completed in June, 2016. At that point the Town will begin to identify funding sources for each of the actions outlined.	New
8	Coastal Areas	High	Hurricane, Winter Storm, Coastal Storm and Flood	Beach & Berm Nourishment & Replenishment	Design, Develop and replenish beach and cobble berm protection measures	Coastal Areas	Natural Systems Protection	FEMA, CZM, CPC	Near-term	Public Works, Conservation, Coastal Resources	The Town has recently replaced the Musquashcut Pond Berm and is in the process of acquiring the necessary permits for beach nourishment on North Scituate Beach	New
9	Coastal Areas	Medium	Hurricane/ Flood and Winter Storm	Install strategic power grid shutoffs	Install power grid shutoffs to isolate flood-prone and storm damage sensitive coastal areas	Coastal Areas	Structure and Infrastructure Projects Local Plans and Regulations	National Grid and Eversource	Near-term	Fire Department, Emergency Management	Lighthouse Point, Sand Hills, Egypt area surveys completed with National Grid	New
10	Critical Facilities	High	All	Installation of generators	Installation of generators for critical facilities	Town-wide	Structure and Infrastructure Projects	FEMA	Medium-term	Public Works, Facilities		New

# **6.0 Moving Towards a Safe, Resilient, and Sustainable Community**

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## **6.1 Evaluation: Progress and Challenges**

Disaster resilient communities employ a long-range community-based approach to mitigation. Mitigation enables communities to proactively address potential damage that could occur from hurricanes, coastal erosion, earthquakes, flooding and other natural hazards. When hazard mitigation is combined with the standards of creating sustainable communities, the long-term beneficial result is smarter and safer development that reduces the vulnerability of populations to natural disasters while reducing poverty, providing jobs, promoting economic activity, and most importantly, improving people's living conditions (Munasinghe and Clarke 1995). In addition to a community's sustainability criteria for social, environmental and economic protection, there is also the criterion that development must be disaster resistant (FEMA 1997; Institute for Business and Home Safety 1997).

Resilient communities may bend before the impact of disaster events, but they do not break. They are constructed so that their lifeline systems of roads, utilities, infrastructure, and other support facilities are designed to continue operating in the midst of high winds, rising water, and shaking ground. Hospitals, schools, neighborhoods, businesses, and public safety centers are located in safe areas, rather than areas prone to high hazards. Resilient and sustainable communities' structures are built or retrofitted to meet the safest building code standards available. It also means that their natural environmental habitats such as wetlands and dunes are conserved to protect the natural benefits of hazard mitigation that they provide.

The Scituate Hazard Mitigation Strategy embraces the concepts of disaster resilient and sustainable communities. Scituate is committed to building a disaster resistant community and achieving sustainable development through the commitment of state and local government and its policymakers to mitigate hazard impacts before disaster strikes. Additionally, Scituate will achieve a disaster resilient, and therefore, safer community, through the process of completing its Hazard Risk and Vulnerability Assessment (RVA), and Multi-Hazard Mitigation Strategy

(HMS) and through the implementation of mitigation programs and policies. The town will have the capability to implement and institutionalize hazard mitigation through its human, legal and fiscal resources, the effectiveness of intergovernmental coordination and communication, and with the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning.

# References

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# **Appendix A: Assessing Risk – Maps**

**Map 1 – 2012 Flood Coverage**

**Map 2 – 2015 Preliminary Flood Coverage**

**Map 3 – HAZUS Category 2 Hurricane Predictive**

**Map 4 – Evacuation Zones**

**Map 5 – Hurricane Inundation Zones**

**Map 6 – Shoreline Stabilization**

**Map 7 – Sea Level Rise**

**Map 8 – HAZUS 1938 Hurricane Scenario**



vhb

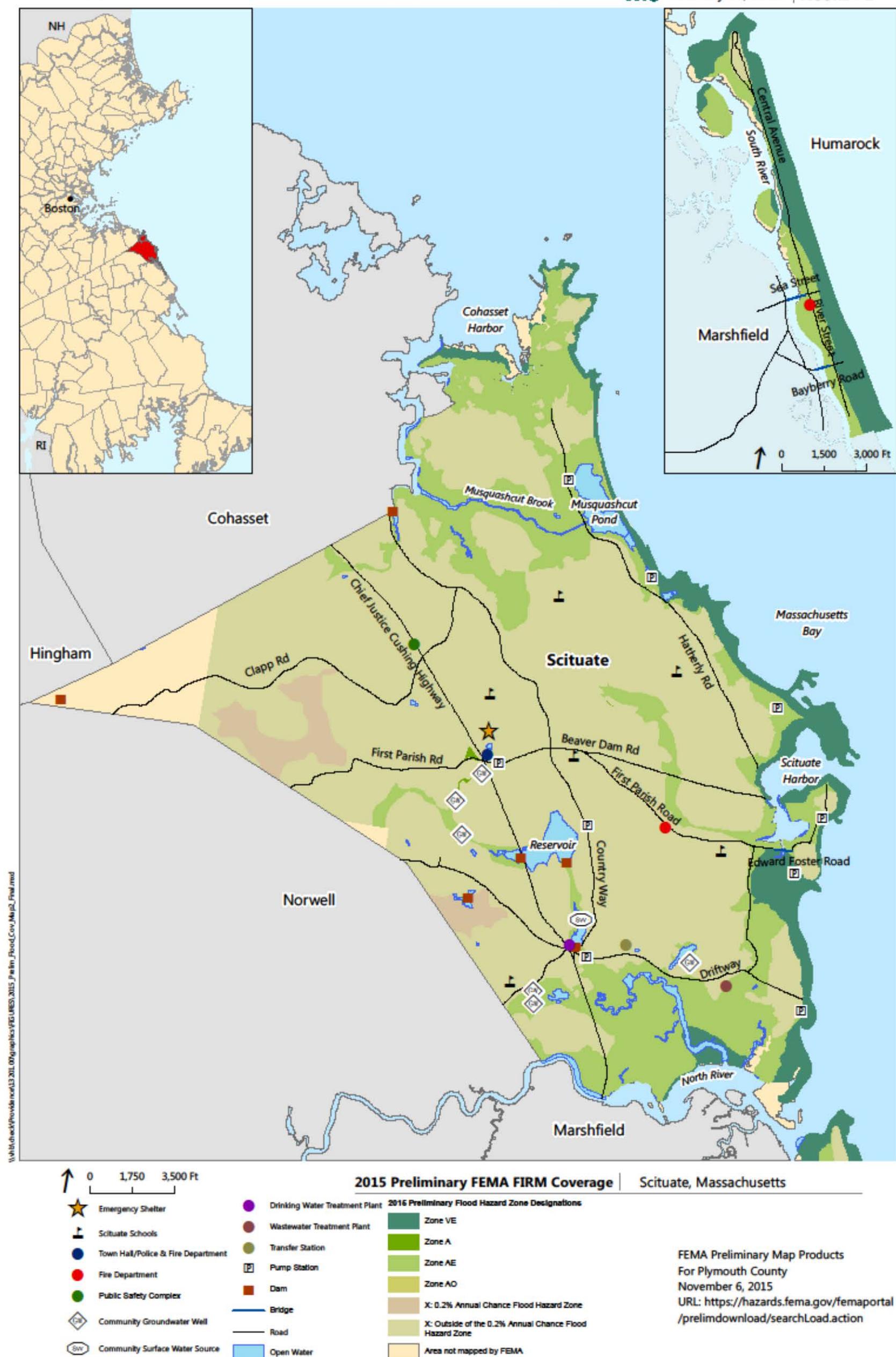
February 25, 2016 | FIGURE # 1





vhb

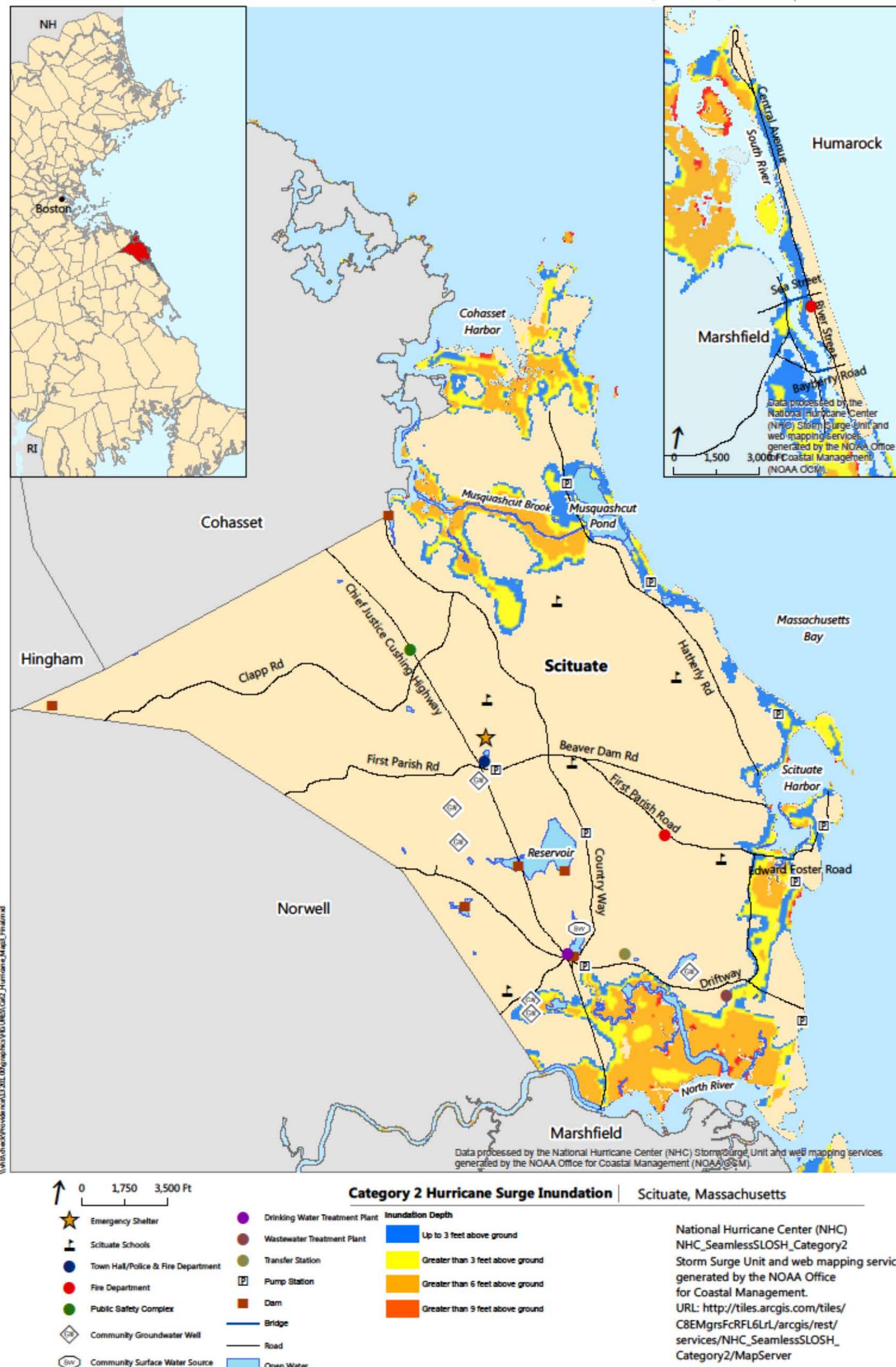
February 26, 2016 | FIGURE # 2





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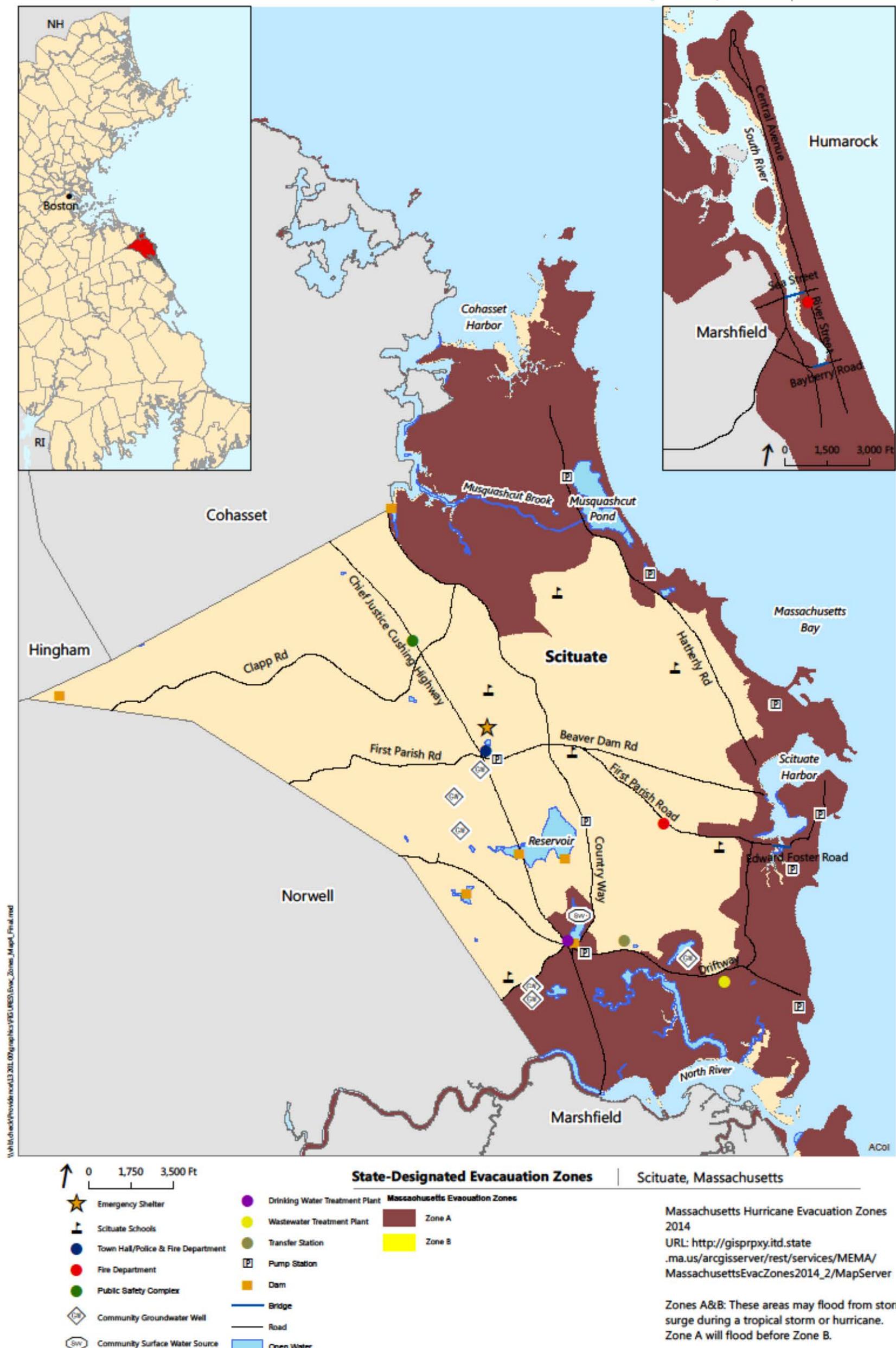
February 26, 2016 | FIGURE # 3





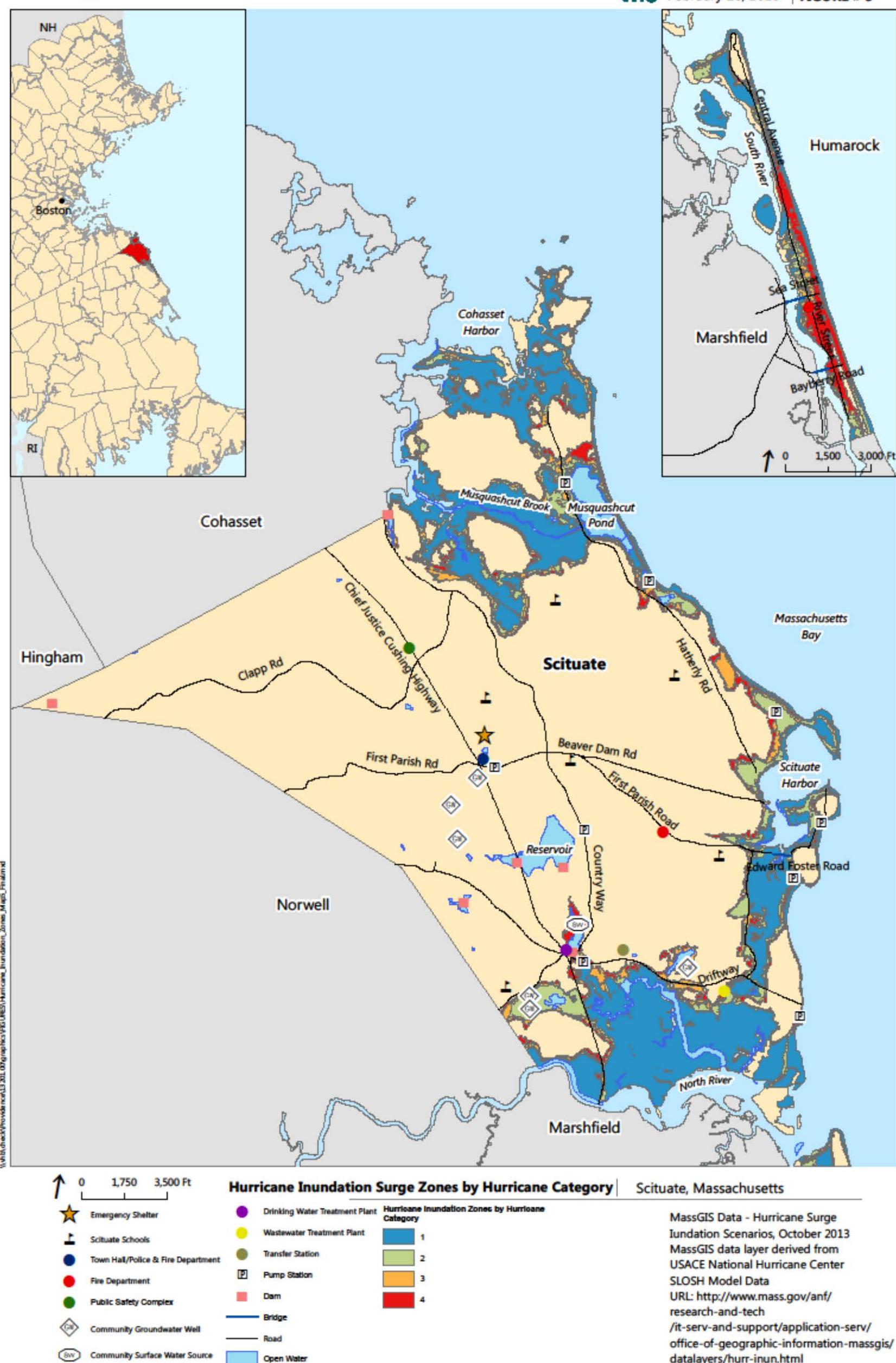
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February 26, 2016 | FIGURE # 4





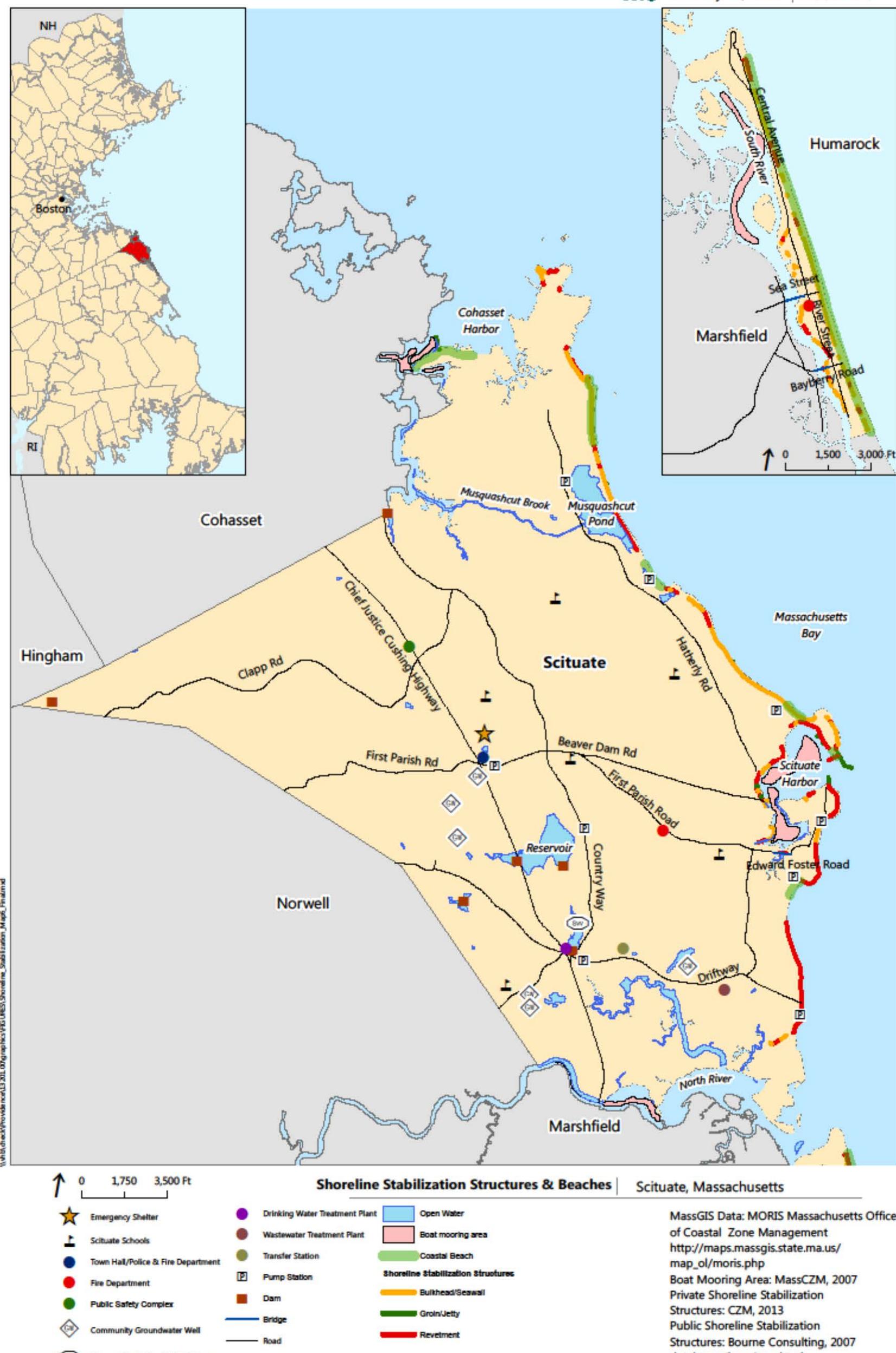
vhb February 26, 2016 | FIGURE # 5





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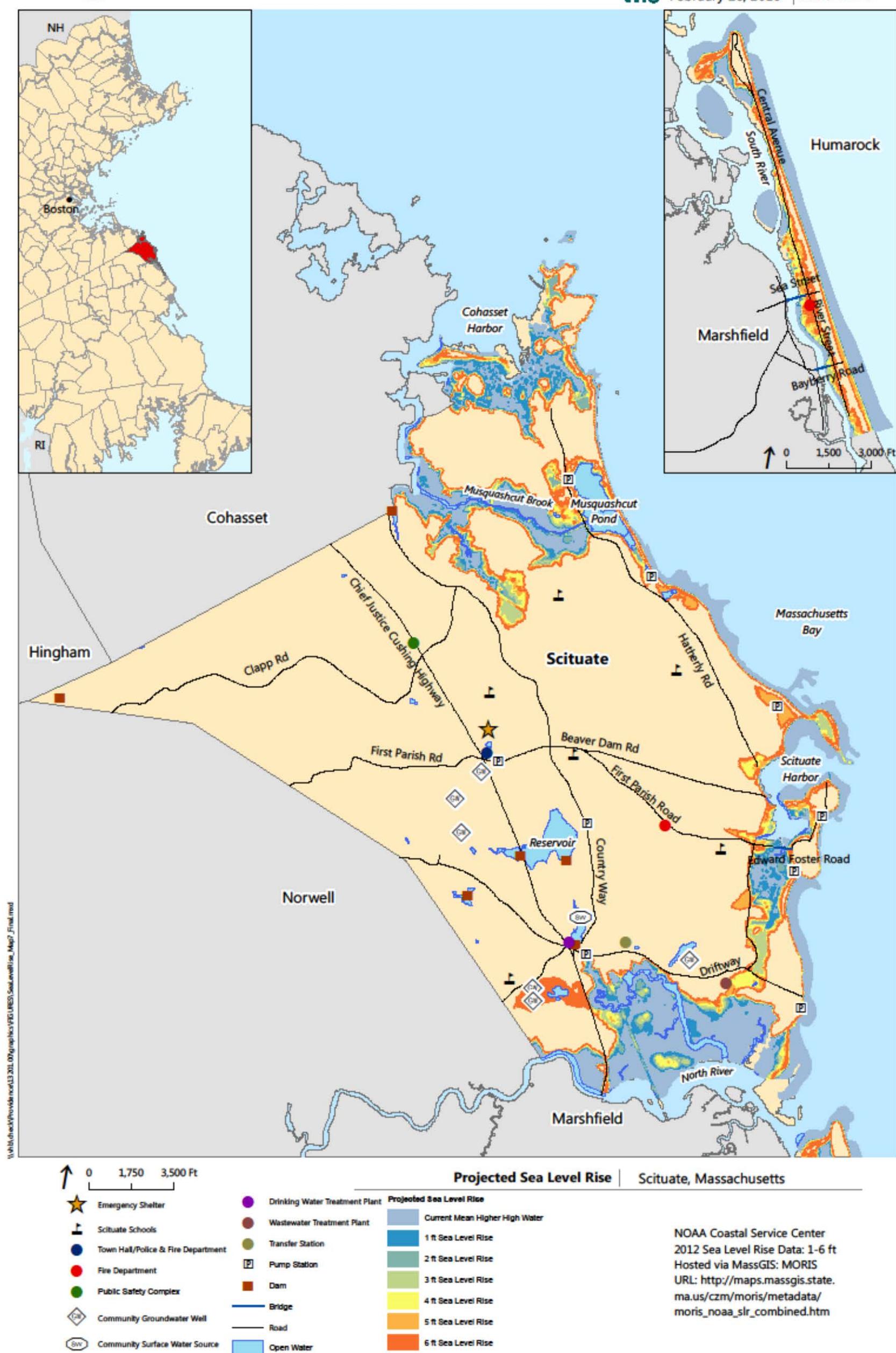
February 26, 2016 | FIGURE # 6





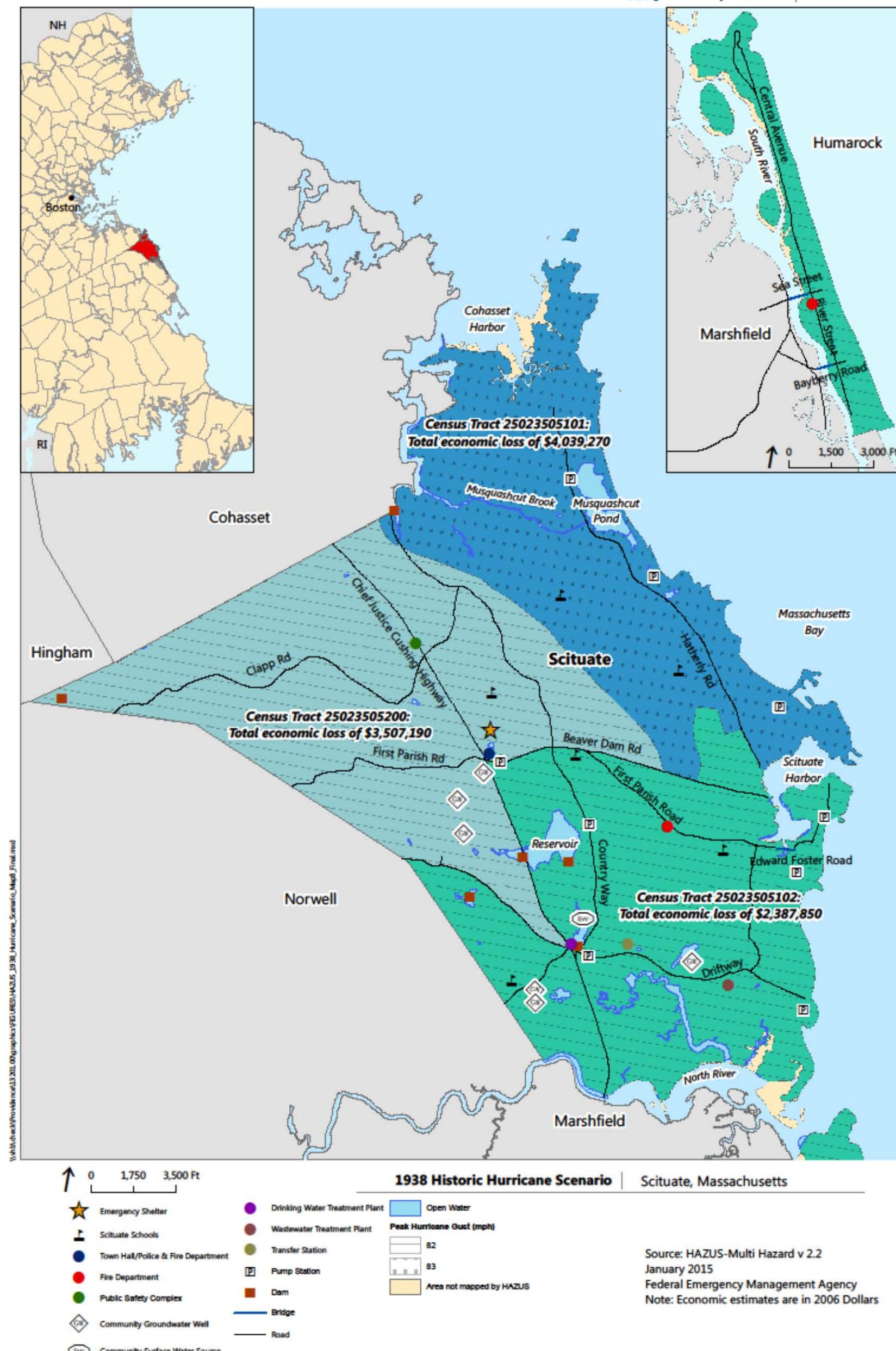
vhb

February 26, 2016 | FIGURE # 7





vhb February 26, 2016 | FIGURE # 8



# **Appendix B: HAZUS- MH Hurricane Event Report**

## **Hazus-MH: Hurricane Event Report**

**Region Name:** Scituate\_MA

**Hurricane** UN-NAMED-1938-4

**Scenario:**

**Print Date:** Thursday, December 03, 2015

***Disclaimer:***

*This version of Hazus utilizes 2010 Census Data.*

*Totals only reflect data for those census tracts/blocks included in the user's study region.*

*The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.*

## Table of Contents

<b>Section</b>	<b>Page #</b>
<b>General Description of the Region</b>	<b>3</b>
<b>Building Inventory</b>	<b>4</b>
General Building Stock Essential	
Facility Inventory	
<b>Hurricane Scenario Parameters</b>	<b>5</b>
<b>Building Damage</b>	<b>6</b>
General Building Stock Essential	
Facilities Damage	
<b>Induced Hurricane Damage</b>	<b>8</b>
Debris Generation	
<b>Social Impact</b>	<b>8</b>
Shelter Requirements	
<b>Economic Loss</b>	<b>9</b>
<b>Building Losses</b>	

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Massachusetts

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 17.52 square miles and contains 3 census tracts. There are over 6 thousand households in the region and has a total population of 17,863 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 8 thousand buildings in the region with a total building replacement value (excluding contents) of 1,905 million dollars (2010 dollars). Approximately 93% of the buildings (and 85% of the building value) are associated with residential housing.

## **General Building Stock**

Hazus estimates that there are 8,492 buildings in the region which have an aggregate total replacement value of 1,905 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

**Table 1: Building Exposure by Occupancy Type**

<b>Occupancy</b>	<b>Exposure (\$1000)</b>	<b>Percent of Tot</b>
Residential	1,625,664	85.4%
Commercial	192,910	10.1%
Industrial	43,281	2.3%
Agricultural	4,529	0.2%
Religious	18,912	1.0%
Government	7,161	0.4%
Education	12,056	0.6%
<b>Total</b>	<b>1,904,513</b>	<b>100.0%</b>

## **Essential Facility Inventory**

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 7 schools, 3 fire stations, 1 police stations and no emergency operation facilities.

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

**Scenario Name:** UN-NAMED-1938-4

**Type:** Historic

**Max Peak Gust in Study Region:** 83 mph

## **General Building Stock Damage**

Hazus estimates that about 8 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

**Table 2: Expected Building Damage by Occupancy**

<b>Occupancy</b>	<b>None</b>		<b>Minor</b>		<b>Moderate</b>		<b>Severe</b>		<b>Destruction</b>	
	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>
Agriculture	25	97.83	0	1.90	0	0.21	0	0.06	0	0.00
Commercial	389	98.11	7	1.73	1	0.15	0	0.01	0	0.00
Education	14	98.18	0	1.78	0	0.04	0	0.00	0	0.00
Government	11	98.23	0	1.74	0	0.03	0	0.00	0	0.00
Industrial	120	98.08	2	1.81	0	0.09	0	0.02	0	0.00
Religion	30	98.40	0	1.55	0	0.05	0	0.00	0	0.00
Residential	7,718	97.78	168	2.13	7	0.09	0	0.00	0	0.00
<b>Total</b>	<b>8,305</b>		<b>178</b>		<b>8</b>		<b>0</b>		<b>0</b>	

**Table 3: Expected Building Damage by Building Type**

<b>Building</b>	<b>None</b>		<b>Minor</b>		<b>Moderate</b>		<b>Severe</b>		<b>Destruction</b>	
	<b>Type</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>	<b>(%)</b>	<b>Count</b>
Concrete	92	97.77	2	2.18	0	0.05	0	0.00	0	0.00
Masonry	717	96.96	19	2.63	3	0.40	0	0.02	0	0.00
MH	6	99.98	0	0.02	0	0.00	0	0.00	0	0.00
Steel	288	98.13	5	1.73	0	0.13	0	0.01	0	0.00
Wood	7,205	97.91	149	2.03	4	0.06	0	0.00	0	0.00

## **Essential Facility Damage**

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

**Table 4: Expected Damage to Essential Facilities**

Classification	Total	# Facilities		
		Probability of at Least Moderate Damage > 50%	Probability of Complete Damage > 50%	Expected Loss of Use < 1 day
Fire Stations	3	0	1	1
Police Stations	1	0	0	1
Schools	7	0	0	7

## **Debris Generation**

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/ Wood, b) Reinforced Concrete/ Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 4,356 tons of debris will be generated. Of the total amount, 2,049 tons (47%) is Other Tree Debris. Of the remaining 2,307 tons, Brick/ Wood comprises 19% of the total, Reinforced Concrete/ Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 17 truckloads (@25 tons/ truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,870 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

The total economic loss estimated for the hurricane is 9.9million dollars, which represents 0.52 % of the total replacement value of the region's buildings.

## **Building-Related Losses**

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also includethe temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 10 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 98% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

**Table 5: Building-Related Economic Loss Estimates**

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
<u>Property Damage</u>						
	Building	6,831.28	109.45	19.33	19.73	6,979.79
	Content	2,613.90	9.97	3.16	0.92	2,627.96
	Inventory	0.00	0.23	0.74	0.07	1.04
	<b>Subtotal</b>	<b>9,445.19</b>	<b>119.64</b>	<b>23.23</b>	<b>20.73</b>	<b>9,608.79</b>

---

**Business Interruption Loss**

Income	0.00	9.67	0.00	0.00	9.67
Relocation	209.21	7.10	0.13	0.24	216.69
Rental	91.97	3.76	0.00	0.00	95.73
Wage	0.00	3.43	0.00	0.00	3.43
<b>Subtotal</b>	<b>301.18</b>	<b>23.98</b>	<b>0.13</b>	<b>0.24</b>	<b>325.53</b>
<b>Total</b>	<b>9,746.37</b>	<b>143.62</b>	<b>23.37</b>	<b>20.97</b>	<b>9,934.33</b>

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# **Appendix C: Public Outreach**



# SCITUATE HIGH SCHOOL AUGUST 18<sup>TH</sup> HAZARD MITIGATION PLAN COMMUNITY WORKSHOP

We need your input. There will be a discussion about how to keep your community, neighbors and family safe! Provide input on the Town of Scituate's Hazard Mitigation Plan Update. Participate in discussions about natural hazards.

**WE NEED YOUR  
INPUT!**

**Join us for a  
community  
meeting to learn  
more and share  
your ideas**

**For more  
information check  
out our website  
or contact Nancy  
Durfee  
below**

**We look forward  
to seeing you!**

**SCITUATE HIGH  
SCHOOL**

606 Chief Justice Cushing  
Highway  
[ndurfee@scituatema.gov](mailto:ndurfee@scituatema.gov)  
or  
[Scituatema.gov](http://Scituatema.gov)

AUGUST 18<sup>TH</sup>, 6-8pm

## **Scituate, MA Public Meeting # 1 for the Local Hazard Mitigation Plan**

August 18, 2015

- 1.) Concerns about saltmarsh encroachment/loss from storms
- 2.) The plan should emphasize hurricane preparedness, not only from a coastal standpoint but also the hazards that can occur inland (e.g. tree damage to power lines).
- 3.) There's a document in the town that designates different flood risk and evacuation areas, there should be an emphasis in this hazard mitigation plan to "know your zone."
- 4.) Many voiced concerns about evacuation routes and whether they were feasible, as some routes may flood or become too crowded (specific routes mentioned were Ferry Street, Sea Avenue, and Bayberry Road). One attendee recommended implementing short-term and long-term evacuation route. A suggestion was made to review the Emergency Action Plan for the town. It was also recommended that special consideration be given to key intersection vulnerabilities that may become impassable in certain storm or flooding scenarios.
- 5.) Special consideration should be taken about selecting municipal buildings as emergency shelters, e.g. buildings that are within flood zones or storm surge areas should not be used.
- 6.) There should be an action to make repairs and carry out maintenance throughout the town to reduce hazards, e.g. tree trimming.
- 7.) Sea wall damage is a major concern as many of the seawalls are nearing the end of their useful life. Many were poorly constructed to begin with and have suffered a great deal of damage from recent storms. Revetments are also in need of repair. It was noted that FEMA post-disaster funds may not cover repairs to the entire length of the wall as the damage has to be attributable to the specific disaster that caused the damage.
- 8.) Wave attenuation devices (WADs) were suggested as a means of controlling coastal storm damage.
- 9.) Beach enrichment and dune building were suggested as a means of controlling coastal storm damage.
- 10.) Elevation grants should be considered as part of a structure mitigation package.
- 11.) Informed citizenry is also an important component of a natural hazard mitigation plan. People need to know what precautions to take and where the emergency shelters are well before a storm hits. There should be an alert system in place.
- 12.) Some residents experienced severe negative consequences from a power isolation event (i.e. preemptive power shut-off) initiated by the town during a winter storm (e.g. frozen pipes that needed replacement). Residents expressed the need for a better informed decision-making process for future power isolation event and substantial advanced notification to the affected residents. One resident suggested using grant money to purchase and install drainage/dump valves at homes that may be targeted in future power isolation events so that pipes may be emptied before the power is shut off.
- 13.) Fire safety precaution are another concern as a result of power isolation – some may use candles for light and this could lead a fire hazard.
- 14.) The town should have a list of residents that are reliant on electronic home Medicaid devices so that there can be sufficient planning time in the event of evacuation or power isolation.
- 15.) Informed emergency personnel should be a priority – they should be aware of the evacuation routes, the locations of shelters, etc.
- 16.) Solutions are needed for hazardous road erosion areas (e.g. River Street). Who is responsible for the repair of private roads if the damage is due to storm surge from the river? Electronic signage for hazardous areas should be used.
- 17.) Drainage solutions are an important aspect of flood mitigation and should be included in the hazard mitigation plan. Mark drains with some type of sign that will be visible about flood waters so that they can be found and unclogged during flooding events.
- 18.) Drainage maintenance is also an important aspect of flood mitigation. Drainage culverts should be cleaned because they can clog and/or freeze and prevent the drainage the flood waters.

19.) Residents should take personal responsibility to store and secure personal items (e.g. grills, garbage cans, etc.) that can be easily blown/swept away during storms events. Securing these items will result in less damage and less debris post-storm.

20.) Having a stock of sufficient supplies is important prior to a storm event. A suggestion was made for the town to improve gas supplies because currently only one gas station in town has a backup generator that allows it to operate without power. This could potentially be solved through public-private partnerships. Ice and water supply are also critical supplies to have in stock.

21.) After the storm when electric supplies need to be inspected it may be practical for the town to hire local electricians to make the power restoration efforts more efficient.



**G.A.R. HALL**  
**MARCH 1, 2016**  
**HAZARD MITIGATION**  
**PLAN COMMUNITY**  
**WORKSHOP**

We need your input. Hazard mitigation is “any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards”. There will be a discussion about the draft mitigation plan that outlines steps to keep your community, neighbors and family safe! Provide input on the Town of Scituate’s Hazard Mitigation Plan Draft Update. Participate in discussions about natural hazards that affect the Town of Scituate.

**POVIDE INPUT ON  
THE DRAFT HMP  
UPDATE!**

**Join us for a  
community  
meeting to learn  
more and share  
your ideas**

**For more  
information  
contact Nancy  
Durfee  
below**

**We look forward  
to seeing you!**

**G.A.R. HALL**  
353 Country Way  
[ndurfee@scituatema.gov](mailto:ndurfee@scituatema.gov)  
or  
781-783-2806

March 1, 6-8pm

The public meeting held on March 1, 2016 involved significant discussion between community members and representatives from the town. The meeting included a presentation of the elements comprising the hazard mitigation plan, the process that has been used to develop the update, and the draft primary actions that have been proposed for inclusion in this version of the plan.

Members of the public sought information that was particular to their specific location in town as well as information that could have town-wide impacts. Particular notes that were recorded for consideration in this plan update include:

- Have Humarock re-defined as a Fully Developed Barrier Beach. This item was discussed as a possible solution to the approach FEMA uses for barrier island residential areas.
- During routine storms residents of certain parts of Humarock lose public services because of beach debris blocking access roads. Chief Murphy explained a plan to preposition fire apparatus on North Humarock pre-storm to facilitate response when access roads are impassable. He also mentioned a possibility of establishing a temporary shelter at the Humarock Beach Association to provide residents a facility closer to their homes.
- The town and FEMA should consider the potential consequences of elevations such as increased exposure of neighboring (foundation) homes and additional debris passing beneath elevated homes. Secondary and tertiary consequences should be included in the process of evaluating all mitigation actions.
- The concept of using new and emerging technology to reduce or eliminate hazards and/or vulnerability was encouraged.
- A resident stated that flooding in his neighborhood could be significantly reduced if DPW closed the area flood gates.
- Using back-up generators to sustain critical municipal infrastructure including pumps and wastewater systems. This is a mitigation action included in the current update. Chief Murphy explained that the generators will be placed at critical facilities and infrastructure that are needed for the town to recover.
- Programs to sustain the functionality and capacity of existing drainage systems. Residents discussed the need to keep existing drainage systems fully functional and clear of debris to prevent failure.

**AGENDA**  
**MEETING OF THE BOARD OF**  
**SELECTMEN TUESDAY, MARCH 8,**  
**2016 6:00 P.M. SELECTMEN'S**  
**CHAMBERS -TOWN HALL**

6:00 MEETING CALLED TO ORDER/ACCEPTANCE OF AGENDA

WALK INS

6:05 REPORT OF THE TOWN ADMINISTRATOR

- Public Facilities Update
- FEMA Update

**SCHEDULED ITEMS:**

6:15 DISCUSS Cable TV License Renewal Process, Al Bangert, Special Projects Coordinator

6:30 DISCUSSNOTE Purchase & Sale Clapp Road

6:40 PRESENTATION/DISCUSSION Draft Hazard Mitigation Plan, Laura Harbottle, Town Planner, Nancy Durfee, Coastal Resource Officer, Peter Cusolito, Vanasse Hangen Brustlin, Inc. (VHB)

7:15 DISCUSS Community Preservation Committee Funding Recommendations, Karen Connolly, Chairperson

8:15 FY 17 Budget Non-Monetary & Warrant Article Reviews

1. General Bylaw Amendment: Non-Criminal Disposition, Laura Harbottle
2. General Bylaw Amendment: Stormwater, Laura Harbottle
3. General Bylaw Amendment: Time of Town Meeting, Patrice Metro
4. General Bylaw Amendment: Community Preservation Committee Tenn, Patrice Metro
5. Other Items: FYI7 Budget Priorities and Capital Plan Follow Up, Patricia Vinchesi

**NEW BUSINESS:**

1. DISCUSSNOTE Board and Committee Appointment for Scituate Harbor Cultural District
2. VOTE Articles for Warrant

**OTHER BUSINESS:**

1. Correspondence
2. Acceptance of Meeting Minutes
3. Adjournment and Signing of Documents

# Appendix D : Technical and Financial Assistance for Mitigation

## Federal Resources

Federal Emergency Management Agency  
Region I Office  
99 High Street, 6<sup>th</sup> Floor  
Boston, MA 02109  
(617) 956-7506  
[www.fema.gov](http://www.fema.gov)

U.S. Army Corps of Engineers  
New England District  
696 Virginia Road  
Concord, MA 01742-2751  
(978) 318-2751  
[www.nae.usace.army.mil](http://www.nae.usace.army.mil)

U.S. Department of Agriculture  
Natural Resources Conservation Service  
(formerly Soil Conservation Service)  
451 West Street  
Amherst, MA 01002  
(413) 253-4362  
[www.soils.usda.gov](http://www.soils.usda.gov)

U.S. Department of Commerce  
National Weather Service  
Forecast Office  
445 Myles Standish Boulevard  
Taunton, MA 02780  
(508) 823-2262  
[www.nws.noaa.gov](http://www.nws.noaa.gov)

Economic Development Administration  
Philadelphia Regional Office  
The Curtis Center  
601 Walnut Street, Suite 140 South  
Philadelphia, PA 19106-3323  
(215) 597-8822  
[www.eda.gov](http://www.eda.gov)

U.S. Department of the Interior  
National Park Service  
U.S. Custom House  
200 Chestnut Street, 5<sup>th</sup> Floor  
Philadelphia, PA 19106  
(215) 597-7013  
[www.nps.gov](http://www.nps.gov)

U.S. Fish and Wildlife Service  
New England Field Office  
70 Commercial Street, Suite 300  
Concord, NH 03301-4986  
(603) 223-2541  
[www.fws.gov](http://www.fws.gov)

U.S. Department of Housing and Urban  
Development  
Region 1 Providence Field Office  
121 South Main Street  
Providence, RI 02903  
(401) 277-8300  
[www.hud.gov](http://www.hud.gov)

United States Small Business Administration  
Region 1  
10 Causeway Street, Suite 265A  
Boston, MA 02222  
(617) 565-8416  
[www.sba.gov](http://www.sba.gov)

U.S. Environmental Protection Agency  
Region I – New England Headquarters  
5 Post Office Square  
Suite 100  
Boston, MA 02109-3912  
1-888-372-7341  
[www.epa.gov](http://www.epa.gov)

## **National/Regional Resources**

### **New England States Emergency Consortium (NESEC)**

Lakeside Office Park

<http://www.serve.com/NESEC>

NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Brochures and videotapes are available on such topics as earthquake preparedness, mitigation, and hurricane safety tips.

### **The New England Floodplain and Stormwater Managers Association (NEFSMA)**

Tel: (617) 727-0488

<http://www.seacoast.com/~nefsma>

Professional organization for New England floodplain and stormwater managers, that provides workshops, conferences, and a newsletter to members, interested individuals and companies.

### **The Association of State Floodplain Managers (ASFPM)**

A professional association with a membership of almost 1,000 state employees that, assists communities with the NFIP. ASFPM has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many mitigation “success stories” have been documented through these resources and provide a good starting point for planning.

### **Natural Hazards Center at the University of Colorado, Boulder**

Tel: (303) 494-6818

<http://www.colorado.edu/hazards>

The Natural Hazards Center is an international/national information center that provides information on natural hazards and human adjustments to hazards and disasters, by providing information dissemination, free library and referral services, research, and an annual workshop.

### **Flood Relief Funds**

After a disaster, local businesses, residents, and out-of-town groups often donate money to local relief funds. They may be managed by the local government, or by one or more churches. No government disaster declaration is needed. Local officials should recommend that the finds be held until an applicant exhaust all sources of public disaster assistance. Doing so allows the funds to be used for mitigation and other projects that cannot be funded elsewhere.

### **Volunteer Organizations**

Organizations, such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith, and the Mennonite Disaster Service, are often available to help after disasters. Service organizations, such as the Lions, Elks, and VFW are also available. These organizations have helped others with food shelter, clothing, money, etc. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings incorporating mitigation or flood proofing concepts. The offices of individual organizations can be contacted directly, or the FEMA Regional Office may be able to assist.

**Institute for Business and Home Safety (IBHS)**

<http://www.ibhs.org>

An insurance industry-sponsored, nonprofit organization dedicated to reducing losses-deaths, injuries, and property damage resulting from natural hazards. IBHS efforts are directed at five specific hazards: floods, windstorms, hail, earthquakes, and wildfires. Through its public education efforts and information center, IBHS communicates the results of its research and statistical gathering, as well as mitigation information, to a broad audience.

# Appendix E: Glossary

**Accretion** – the deposition of sediment, sometimes indicated by the seaward advance of a shoreline indicator such as the water line, the berm crest, or the vegetation line.

**Active beach** – the portion of the littoral system that is frequently (daily or at least seasonally) subject to transport by wind, waves, and currents.

**Algal bloom** – a sudden increase in the amount of marine algae (seaweed) often caused by high levels of phosphates, nitrates, and other nutrients in the near shore area.

**Armoring** - the placement of fixed engineering structures, typically rock or concrete, on or along the shoreline to reduce coastal erosion. Armoring structures include seawalls, revetments, bulkheads, and rip rap (loose boulders).

**Backshore** – the generally dry portion of the beach between the berm crest and the vegetation line that is submerged only during very high sea levels and eroded only during moderate to strong wave events.

**Beach** – an accumulation of loose sediment (usually sand or gravel) along the coast.

**Beach loss** – a volumetric loss of sand from the active beach.

**Beach management district** – a special designation for a group of neighboring coastal properties that is established to facilitate cost sharing and streamline the permitting requirements for beach restoration projects.

**Beach narrowing** – a decrease in the useable beach width caused by erosion.

**Beach nourishment** – the technique of placing sand fill along the shoreline to widen the beach.

**Beach profile** – a cross-sectional plot of a shore-normal topographic and geomorphic beach survey, usually in comparison to other survey dates to illustrate seasonal and longer-term changes in beach volume.

**Berm** – a geomorphologic feature usually located at mid-beach and characterized by a sharp break in slope, separating the flatter backshore from the seaward-sloping foreshore.

**Building setback** – the country-required seaward limit of major construction for a coastal property. Building setbacks on Maui vary from 25 feet to 150 feet landward of the certified shoreline.

**Coastal dunes** – dunes within the coastal upland, immediately landward of the active beach.

**Coastal erosion** – the wearing away of coastal lands, usually by wave attack, tidal or littoral currents, or wind. Coastal erosion is synonymous with shoreline (vegetation line) retreat.

**Coastal plain** – the low-lying, gently-sloping area landward of the beach often containing fossil sands deposited during previously higher sea levels.

**Coastal upland** – the low-lying area landward of the beach often containing unconsolidated sediments. The coastal upland is bounded by the hinterland (the higher-elevation areas dominated by bedrock and steeper slopes).

**Day-use mooring** – a buoy or other device to which boats can be secured without anchoring.

**Deflation** – a lowering of the beach profile.

**Downdrift** – in the direction of net longshore sediment transport.

**Dune** – a landform characterized by an accumulation of wind-blown sand, often vegetated.

**Dune restoration** – the technique of rebuilding an eroded or degraded dune through one or more various methods (sand fill, drift fencing, re-vegetation, etc.).

**Dune walkover** – light construction that provides pedestrian access without trampling dune vegetation.

**Dynamic equilibrium** – a system in flux, but with influxes equal to outfluxes.

**Erosion** – the loss of sediment, sometimes indicated by the landward retreat of a shoreline indicator such as the waterline, the berm crest, or the vegetation line.

**Erosion hotspots** – areas where coastal erosion has threatened shoreline development or infrastructure. Typically, the shoreline has been armored and the beach has narrowed considerably or been lost.

**Erosion watchspots** – areas where the coastal environment will soon be threatened if shoreline erosion trends continue.

**Foreshore** – the seaward sloping portion of the beach within the normal range of tides.

**Hardening** – see Armoring.

**Inundation** – the horizontal distance traveled inland by a tsunami.

**Improvement districts** – a component of a beach management district established to help facilitate neighborhood-scale improvement projects (e.g., beach nourishment).

**Land banking** – the purchase of shoreline properties by a government, presumably to reduce development pressure or to preserve the parcel as a park or as open space.

**Littoral budget** – the sediment budget of the beach consisting of sources and sinks.

**Littoral system** – the geographical system subject to frequent or infrequent beach processes. The littoral system is the area from the landward edge of the coastal upland to the seaward edge of the near-shore zone.

**Longshore transport** – sediment transport down the beach (parallel to the shoreline) caused by longshore currents and/or waves approaching obliquely to the shoreline.

**Lost beaches** – a subset of erosion hotspots. Lost beaches lack a recreational beach, and lateral shoreline access is very difficult if not impossible.

**Monitoring** – periodic collection of data to study changes in an environment over time.

**Nutrient loading** – the input of fertilizing chemicals to the nearshore marine environment, usually via non-point source runoff and sewage effluent. Nutrient loading often leads to algal blooms.

**Offshore** – the portion of the littoral system that is always submerged.

**Overwash** – transport of sediment landward of the active beach by coastal flooding during a tsunami, hurricane, or other event with extreme waves.

**Revetment** – a sloping type of shoreline armoring often constructed from large, interlocking boulders. Revetments tend to have a rougher (less reflective) surface than seawalls.

**Risk** – refers to the predicted impact that a hazard would have on people, services, specific facilities and structures in the community.

**Risk management** – the process by which the results of an assessment are integrated with political, economic, and engineering information to establish programs, projects and policies for reducing future losses and dealing with the damage after it occurs.

**Scarp** – a steep slope usually along the foreshore and/or at the vegetation line, formed by wave attack.

**Scarping** – the erosion of a dune or berm by wave-attack during a storm or a large swell.

**Sea bags** – large sand-filled geotextile tubes used in coastal protection projects.

**Seawall** – a vertical or near-vertical type of shoreline armoring characterized by a smooth surface.

**Shoreline setback** – see Building setback.

**Siltation** – the input of non-calcareous fine-grained sediments to the nearshore marine environment, or the settling out of fine-grained sediments on the seafloor.

**Storm surge** – a temporary rise in sea level associated with a storm's low barometric pressure and onshore winds.

**Urban runoff** – the input of hydrocarbons, heavy metals, pesticides and other chemical to the near shore marine environment from densely populated areas.

**Vulnerability** – the characteristics of the society or environment affected by the event that resulted in the costs from damages.

**Vulnerability assessment** – the qualitative or quantitative examination of the exposure of some component of society, economy or the environment to natural hazards.

## Acronyms

CRS	Community Rating System
DCR	Department of Conservation and Recreation
FEMA	Federal Emergency Management Agency
HUD	Housing and Urban Development
MassDOT	Massachusetts Department of Transportation
MEMA	Massachusetts Emergency Management Agency
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

# **Appendix F: FEM A Letter of Approval**

## **Final Local Mitigation Plan Review Tool**

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



FEMA

AUG 11 2016

Kurt Schwartz, Director  
Massachusetts Emergency Management Agency  
400 Worcester Road  
Framingham, MA 01702-5399

Dear Mr. Schwartz:

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

With this plan approval, the Town of Scituate is eligible to apply to Massachusetts Emergency Management Agency for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at <http://www.fema.gov/national-flood-insurance-program-community-rating-system>, or through your local floodplain administrator.

The Natural Hazard Mitigation Plan Update Scituate Massachusetts must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of August 2, 2016** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Kurt Schwartz  
Page 2

AUG 11 2016

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,



Paul F. Ford  
Regional Administrator

PFF: ms

cc: Joy Duperault, SHMO and NFIP Coordinator  
Sarah White, Mitigation Grants Supervisor, MEMA  
Beth Dubrawski, Hazard Mitigation Contract Specialist, MEMA

Enclosure

# LOCAL MITIGATION PLAN REVIEW TOOL

## Town of Scituate, MA

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

<b>Jurisdiction:</b> Scituate, MA	<b>Title of Plan:</b> Natural Hazard Mitigation Plan Update, Scituate Massachusetts	<b>Date of Plan:</b> May 1, 2016
<b>Single or Multi-jurisdiction Plan?</b> Single		<b>New Plan or Plan Update?</b> Update
<b>Local Points of Contact:</b> Nancy Durfee, Coastal Resource Officer Town of Scituate <a href="mailto:ndurfee@scituatema.gov">ndurfee@scituatema.gov</a> ;		<b>Local Points of Contact:</b> Anthony Vagnani, Board of Selectmen, Chairman <a href="mailto:avegnani@scituatema.gov">avegnani@scituatema.gov</a>  Laura Harbottle, Town Planner <a href="mailto:lharbottle@scituatema.gov">lharbottle@scituatema.gov</a>  Peter Cusolito, Consultant Support <a href="mailto:pcusolito@vhb.com">pcusolito@vhb.com</a>

<b>State Reviewer:</b> Marybeth Groff Sarah White	<b>Title:</b> State HM Planner	<b>Date:</b> 3/12/2016 5/16/2016
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<b>FEMA Reviewer:</b> Barbara Ellis David Mendelsohn Melissa A. Surette	<b>Title:</b> HM Community Planner RSV Community Planner Senior Planner	<b>Date:</b> 6/9/16 6/10/16 6/16/16
<b>Date Received in FEMA Region I</b>	5/16/16	
<b>Plan Not Approved</b>		
<b>Plan Approvable Pending Adoption</b>	6/16/16	
<b>Plan Approved</b>	8/2/16	

## SECTION 1: REGULATION CHECKLIST

**INSTRUCTIONS:** The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been ‘Met’ or ‘Not Met.’ The ‘Required Revisions’ summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is ‘Not Met.’ Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST		Location in Plan (section and/or	Met	Not Met
<b>Regulation</b> (44 CFR 201.6 Local Mitigation Plans)				
<b>ELEMENT A. PLANNING PROCESS</b>				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	p. i Section 2 pp 15-21	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Section 2.2.3 pp 17-18	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Section 2.2.2 pp 16-17 Section 3.2.2.1 p26 Appendix C	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2.2.1 p. 16 Section 2.4 pp 18-19 Section 4.2.1 pp 64-67 References pp 99-100 Cited throughout the plan	X		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Section 2.5.2 p 20 Section 2.5.3 p 20-21	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Section 2.5.3 p 20-21	X		
<b><u>ELEMENT A: REQUIRED REVISIONS</u></b>				

<b>1. REGULATION CHECKLIST</b>		<b>Location in Plan (section and/or part)</b>	<b>Met</b>	<b>Not Met</b>
<b>Regulation</b> (44 CFR 201.6 Local Mitigation Plans)				
<b>ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT</b>				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Chapter 3 pp 23-65	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 3 pp 23-65	X		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	pp.2, 90 Section 3.3 p 49-50	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(iii))	Section 3.2.2.1 pp 27-28 Section 3.3 p 47 Section 3.4.3 p 56 Section 5.2 pp 76-77	X		
<b>ELEMENT B: REQUIRED REVISIONS</b>				
<b>ELEMENT C. MITIGATION STRATEGY</b>				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 4 p 63-74	X		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	p. 6 Section 1.2.7, p. 12 Section 4.2 pp 69-71 Section 5.2 p 76	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Ex. Summ. p 2 Section 2.4.1 p 19 Section 5.1 pp 75-76	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Section 5 pp 76-96	X		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Section 5.4 pp 87-89	X		

<b>1. REGULATION CHECKLIST</b>		<b>Location in Plan (section and/or part)</b>	<b>Met</b>	<b>Not Met</b>
<b>Regulation</b> (44 CFR 201.6 Local Mitigation Plans)	C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Section 2.5 pp 19-20 Section 4.2.1 p 67	X	
<b><u>ELEMENT C: REQUIRED REVISIONS</u></b>				
<b>ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION</b> (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 1.2.4 pp 9-11; Section 4.2.1.2 pp 69-70	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 5.3 pp 86-87	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Section 5.4 p 87	X		
<b><u>ELEMENT D: REQUIRED REVISIONS</u></b>				
<b>ELEMENT E. PLAN ADOPTION</b>				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	p 4	X		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	N/A			
<b><u>ELEMENT E: REQUIRED REVISIONS</u></b>				
<b>ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)</b>				
F1.				
F2.				

## **SECTION 2: PLAN ASSESSMENT**

### **A. Plan Strengths and Opportunities for Improvement**

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

#### **Element A: Planning Process**

##### ***Strengths:***

- The plan contains a list of “losses associated with inaction”, demonstrating the importance of having and implementing a hazard mitigation plan.
- Excellent use of maps and tables of information.
- Scituate’s plan in general is broad in scope and detail. It shows knowledge of the vulnerabilities of the community and provides an excellent vision of how the Town plans to mitigate those hazards.

#### **Element B: Hazard Identification and Risk Assessment**

##### ***Strengths:***

- The plan details the reasoning for excluding some hazards from the risk assessment.
- The use of a table (Table 9) gives clear and detailed information about locations and impacts of flooding in Scituate.
- HAZUS was used to estimate Scituate’s vulnerability to hurricanes.
- The description for extent of storm surge is excellent.

##### ***Opportunities for Improvement:***

- *In the next update consider using HAZUS to estimate vulnerability to earthquake damage.*
- *When developing the next update consider explaining the numbers in the Fire Index column in Table 12 (National Fire Danger Rating System).*
- *Provide more detail of the STAPLEE Analysis.*

#### **Element C: Mitigation Strategy**

##### ***Strengths:***

- The Town’s capabilities are well documented.
- The plan describes in excellent detail the past and current mitigation actions and demonstrates a deep understanding of mitigation principles.
- There is an excellent plan content flow from risk assessment, through goal setting to mitigation action development.

## **Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)**

### **Strengths:**

- The plan details how Scituate “has taken an extremely proactive approach to hazard mitigation.” With the completion of Phase VII of the Coastal Mitigation Grant program, more homes have been elevated above their BFE’s and more than 69 residences have been permitted for elevation in Scituate as of the writing of this plan.
- At the beginning of the plan’s section on Mitigation Strategy there is an excellent discussion of the town’s vision for being a more resilient community.

## B. Resources for Implementing Your Approved Plan

Consider a variety of sources for grants, guidance, and partnerships, including academic institutions, non-profit foundations, community organizations, and businesses, in addition to governmental agencies.

- The Massachusetts State Hazard Mitigation Officer (SHMO) and State Mitigation Planners can provide guidance regarding grants, technical assistance, available publications, and training opportunities. Contact Joy Duperault, Massachusetts State Hazard Mitigation Officer (SHMO); and Massachusetts State NFIP Coordinator at [joy.duperault@massmail.state.ma.us](mailto:joy.duperault@massmail.state.ma.us) and Sarah White, Mitigation Grants Supervisor MEMA at [Sarah.White@state.ma.us](mailto:Sarah.White@state.ma.us)
- The **2013 Massachusetts State Hazard Mitigation Plan** identifies potential technical assistance and funding resources for various mitigation activities as well as explaining the statewide approach to natural hazard mitigation.

### Federal Funding Opportunities

<http://reconnectingamerica.org/resource-center/federal-grant-opportunities/>

### **U.S. Federal Grants**

- **FEMA 2013 Hazard Mitigation Guidance**, HMA Guidance, FEMA requirements regarding HMGP, PDM, and FMA grants.  
<http://www.fema.gov/media-library/assets/documents/33634?id=7851>
- **USDA, Natural Resources Conservation Service (NRCS)**  
Conservation Technical Assistance  
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/cta>  
Financial Assistance <http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/>  
Conservation Innovation Grant Programs  
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs>
- **HUD CDBG Disaster Recovery Assistance** provides flexible grants to help cities, counties, and States recover from presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.  
[http://portal.hud.gov/hudportal/HUD?src=/program\\_offices/comm\\_planning/communitydevelopment/programs/dri](http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs/dri)

**HUD Sustainable Housing and Communities Initiative** supports regional planning efforts integrating housing and transportation decisions, and increasing state, regional, and local capacity to incorporate livability, sustainability, and social equity values into land use plans, zoning and infrastructure investments. These efforts are compatible with flood plan management. Information is available at

[http://portal.hud.gov/portal/page/portal/HUD/program\\_offices/sustainable\\_housing\\_communities](http://portal.hud.gov/portal/page/portal/HUD/program_offices/sustainable_housing_communities)

## **FEMA publications**

**New FEMA REGION I resource online!** <http://www.fema.gov/about-region-i/about-region-i/hazard-mitigation-planning-webliography>

The following documents can be downloaded from <http://www.fema.gov>.

*Mitigation Ideas: A Resource for Reducing Risk to National Hazards*, FEMA, January 2013. <http://www.fema.gov/media-library/assets/documents/30627?id=6938>

*Local Mitigation Planning Handbook*, FEMA, March 2013

<http://www.fema.gov/media-library/assets/documents/31598?id=7209>

The publications below can be downloaded from <http://www.fema.gov/library>. Search in the FEMA library by title/number or use the web links below.

*Managing Floodplain Development through the NFIP* provides guidance to municipal officials considering changes to local regulations and zoning. A copy can be downloaded from <http://www.fema.gov/library/viewRecord.do?id=2108>

FEMA B-797, *Hazard Mitigation Field Book – Roadways*

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4271>

FEMA P-787, *Catalog of FEMA Wind, Flood & Wildfire Publications, Training Courses & Workshops* (2012)

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3184>

*Flood Hazard Mitigation Handbook for Public Facilities*

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3724>

FEMA 386-6, *Mitigation Planning How To #6: Integrating Historic Property & Cultural*

*Resource Considerations into Hazard Mitigation Planning*, provides guidance regarding how to involve community-based organizations in mitigation planning.

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1892>

FEMA P-787, *Catalog of FEMA Wind, Flood & Wildfire Publications, Training Courses & Workshops* (2012)

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3184>

FEMA P-754, *Wildfire Hazard Mitigation Handbook for Public Facilities*

<http://www.fema.gov/media-library/assets/documents/16568?id=3723>

***The following FEMA publications are especially useful in public information/outreach programs and can be ordered in hard copy for public distribution.***

FEMA P-737, *Home Builder's Guide to Construction in Wildfire Zones*

<http://www.fema.gov/media-library/assets/documents/15962?id=3646>

FEMA 232, *Homebuilders' Guide to Earthquake-Resistant Design and Construction* provides seismic design and construction guidance for one- and two-family light frame residential structures that can be utilized by homebuilders, homeowners, and other non-engineers.

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2103>

FEMA 347, *Above the Flood: Elevating your Flood-prone House*

This large publication (69 pages) could be placed in the reference section of a local public library or at a City or Town Hall for lending. <http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1424>

#### **Private non-profit information sources**

National Fire Protection Association (NFPA) Firewise Program

<http://www.firewise.org>

NFPA codes and standards

[www.nfpa.org/freeaccess](http://www.nfpa.org/freeaccess)