Falmouth Multi-Hazard Mitigation Plan
FINAL DRAFT

Prepared For:
Town of Falmouth
59 Town Hall Square
Falmouth, MA 02540

Prepared By:
Woods Hole Group, Inc.
81 Technology Park Drive
East Falmouth, MA 02536

March 2017

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Virtually every type of weather has been and will be experienced on Cape Cod. From freezing temperatures and blizzard conditions in the winter to heat and humidity in the summer, Falmouth must plan for the worst. The old adage of "if you don't like the weather, wait a minute" certainly applies.

In addition to potentially severe weather, Falmouth's location along the Atlantic coast is situated near the intersection of the warm-water Gulf Stream flowing north from the Gulf of Mexico and the cold-water Labrador Current flowing south from the Arctic Ocean. These ocean currents, coupled with a variable jet stream capable of bringing any combination of cold, warm, dry and moist air masses results in a constantly changing climate capable of producing any number of natural hazards.

In addition to these regional weather factors, Falmouth has approximately 25 miles of shoreline open to Vineyard Sound and Buzzard's Bay. The combination of these factors results in the potential for unique natural hazards associated with ocean based storm events, such as flooding and coastal erosion.

Natural hazards of all kinds can result in injury, loss of life, damage to buildings and infrastructure, which can have significant adverse impacts on the Town's economic, social and environmental resources. Through the development and implementation of this Mutli-Hazard Mitigation Plan, the Town of Falmouth is proactively trying to prepare for and mitigate potential impacts from the various natural hazards.

1.1 Purpose of the Plan

The Federal Emergency Management Agency (FEMA) defines hazard mitigation as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from (natural) hazards", such as floods, hurricanes, winter storms, tornadoes, earthquakes, etc. Hazard mitigation may include both structural measures, such as flood control structures, and nonstructural measures, such as regulations and bylaws, to prevent flooding. Local planning and mitigation efforts allow communities to evaluate existing critical infrastructure susceptible to hazards and identify improvements to reduce damage from natural disasters. The Town of Falmouth developed this Local Multi-Hazard Mitigation Plan for the entire Town with the goal of providing sustained actions to reduce or eliminate risk to human life and property damage from a natural hazard event. Objectives of this plan are as follows:

A1.b

- Describe the planning process including formation of the Local Emergency Planning Committee (LEPC) sub-committee and input from the general public;
- Identify relevant background information on the Town, including geography, climate, land use, and infrastructure;
- Identify natural hazard risks and areas in town most likely to be impacted;
- Complete a risk assessment to profile hazard events, inventory assets, and estimate potential losses;
- Identify existing disaster mitigation measures already in place;
- Develop proposed mitigation measures and a mitigation strategy based on the risk assessment;
- Design a mechanism to keep the plan updated to reflect current conditions and establish a schedule for monitoring, evaluating, and updating the plan; and
- Define the process where Falmouth formally adopts the mitigation plan.

Preparation of this Local Multi-Hazard Mitigation Plan before a major disaster occurs will help the community prevent property damage and loss of life associated with natural hazards, save money by instituting mitigation measures to protect against natural hazards, allow funding through FEMA for post-disaster remediation, and expedite disaster recovery. The Plan will also help to reduce or eliminate repetitive flood losses.

1.2 The Planning Process

A1.a

An open public involvement process is essential to the development of an effective plan, and the most successful mitigation plans are developed after participation by a wide range of stakeholders who play a role in identifying and implementing mitigation actions. During preparation of this Local Multi-Hazard Mitigation Plan, the planning process included the following:

- An opportunity for the public to comment on the plan during the drafting state and prior to final approval;
- An opportunity for local and regional agencies, academic institutions, and other private industries to be involved in the planning process; and
- Review and incorporation of existing plans, studies, reports and information.

A1.c A1.d A3

The Local Emergency Planning Committee (LEPC), which had a large role in the development of this Multi-Hazard Mitigation Plan, consists of various Town officials, business leaders, and other interested agencies and organizations, and was able to provide critical local knowledge of the community to facilitate development of this Plan. The LEPC had three public meetings in 2014, and one in 2017, that directly addressed the Local Multi-Hazard Mitigation Plan and its development:

- September 25, 2014
- October 23, 2014
- November 20, 2014
- January 26, 2017

Copies of the agendas and minutes from these four meetings, as well as a master list of LEPC members are provided in Appendix B. These materials provide a foundation for understanding the planning process and major decisions made along the way, and can help provide crucial background information the next time the LEPC meets to review and update the Falmouth Multi-Hazard Mitigation Plan.

A2.a

A working group of the LEPC was formed by the Town Manager, which included the Chiefs of the Police and Fire Departments, the Town Engineer, the Town Planner and GIS Coordinator. This "Local Planning Team" (LPT) brought the working documents to the full committee for its comments and contributions.

The following steps were taken during the planning process:

1) Develop a Local Planning Team in charge of completing this Plan;
2) Define the potential natural hazards that could affect Falmouth;
3) Determine high hazard locations and critical infrastructure potentially affected;
4) Conduct a vulnerability assessment of buildings and infrastructure;
5) Outline existing hazard mitigation measures in place;
6) Determine gaps in hazard mitigation preparedness;
7) Define proposed hazard mitigation measures to fill these gaps;
8) Evaluate the feasibility of and prioritize mitigation measures;

The above steps will allow implementation of proposed mitigation measures with a goal of reducing damage and improving public safety during a natural disaster. This Local Multi-Hazard Mitigation Plan underwent initial review by the Massachusetts Emergency Management Agency (MEMA), and Federal Emergency Management Agency. After review by MEMA and FEMA, and prior to final adoption by the Town, public comment was solicited a second time and the Plan was sent to neighboring towns to gather any final feedback. To solicit public comment, the draft final Plan was posted on the Town of Falmouth website, with a notification on the Town's homepage, a direct link to the plan, and directions for how to submit questions or comments. Announcements were made on the website, in the local newspaper and on social media that public comment was being sought. Screenshots documenting the Town's website posting and a copy of a local newspaper article are provided in Appendix B. The original draft plan was available for comment for over a year, during this time, no comments were received. The revised draft plan was posted on the website for an additional 30 days in 2017 prior to finalization. Comments received during this time, and responses to these comments are provided in Appendix B.

A1.d A2.b A2.c

The Plan was also sent to Town Planners in Bourne, Mashpee, Sandwich, and all the communities on Martha's Vineyard.

Although Martha's Vineyard does not directly border Falmouth, because ferry and boat traffic to and from Falmouth is one of the major ways on and off the island, hazard mitigation planning in Falmouth can have a significant impact on Martha's Vineyard communities. A copy of the letter sent to neighboring towns soliciting their feedback on the Plan is also provided in Appendix B.

A4

During preparation of this Plan, several existing studies and documents relative to Falmouth and the surrounding area were reviewed. Preparation of this Plan borrowed from the following plans and documents where appropriate:

- Massachusetts State Hazard Mitigation Plan (2013);
- CCC Multi-Hazard Mitigation Plan (March 19, 2010);
- Falmouth Local Comprehensive Plan; and
- Local bylaws and regulations.

In 2013, the State Hazard Mitigation Team, comprised of staff from the MEMA and Department of Conservation and Recreation, updated its existing Commonwealth of Massachusetts State Hazard Mitigation Plan. This was the plan's seventh revision from its initial preparation in 1986. The planning team worked with a number of state and federal agencies to develop a plan outlining actions that should be taken by federal, state, local governments and the general public to manage the risks of natural hazards.

In 2010, the Cape Cod Commission prepared a Multi-Hazard Mitigation Plan for Barnstable County. The Commission worked with all 15 communities, including Falmouth, to assess hazards, evaluate vulnerable areas, and recommend planning and infrastructure improvements. Although this 2010 Barnstable County Plan has not yet been approved by FEMA, it does provide a great deal of background information about local hazards and assessing vulnerability.

The Falmouth Local Comprehensive Plan was prepared by the Local Planning Committee as a tool to communicate community goals to Town boards, departments, committees, commissions, and other interested parties. The document outlines goals and policies on fourteen elements from Land Use to Arts & Culture and was last updated by the Planning Board at town meeting in 2013.

Various town departments and boards have implemented and updated bylaws and regulations as necessary to control development and ensure safe construction methods that adhere to current best management practices. Bylaws and regulations are discussed further in Chapter 5. Technical information from the plans, regulations and bylaws described above was incorporated into the Falmouth Multi-Hazard Mitigation Plan in a number of ways, including:

A4.b

1. Guide the planning process;
2. Help develop mitigation actions;
3. Provide recent data on various hazards and their impacts; and
4. Ensure that mitigation actions in this plan were consistent with current activities and plans already in place at the state and local level.

1.3 Plan Description

FEMA developed a "Local Mitigation Review Guide" (Guide) to ensure Local Hazard Mitigation Plans meet the requirements of the Stafford Act and Title 44 Code of Federal Regulations (CFR) 201.6. This Guide was used as a tool in developing this Plan. For ease of assessment, when the text addresses an element of the Guide, it is identified in a colored box in the margin.

Chapter 2 Local Profile

One of the first steps in hazard mitigation planning is to determine the Town's assets. Without a detailed and accurate understanding of the social, historical, infrastructure and environmental resources present within the Town, it is impossible to develop a plan to protect them. The goal of this chapter is to develop a local profile, detailing the community's assets, which summarizes the history of Falmouth, the Town's geography and climate, an overview of the Town's environmental resources, particularly its water resources, the Town's land use and demographic patterns, the locations of major infrastructure and critical facilities, historical locations throughout Town, and a description of Repetitive Loss Properties.

Although all community assets may be affected by hazards, some assets and infrastructure are more vulnerable because of their physical characteristics, location, or socioeconomic uses. This asset inventory will help support the vulnerability analysis conducted in Chapter 4, which will identify specific vulnerable assets within the Town of Falmouth.

2.1 HISTORY

The first European settlers came to Saconesset in the 1660s, buying land from the Native Americans with the consent of the Court of Plymouth Colony. Their first houses, farm lots, and common grazing lands were on the neck between Salt and Fresh Ponds. The township was incorporated in 1686. Within eight years, the name was changed to Falmouth in honor of Bartholomew Gosnold's home port. Gosnold had landed in Falmouth in 1602 and may have been the first English explorer of the narrow land that he named Cape Cod.

Isaac Robinson and other early proprietors founded Falmouth on principles of religious tolerance, deliberately separating themselves from the rigid church-state of Plymouth Colony. Quakers soon migrated overland from Sandwich, finding a place in West Falmouth where they could worship in their own manner.

The settlers cleared land, built houses, planted corn, raised sheep, and fished in the local waters. The present town boundaries were established in 1725. The town had 600 inhabitants by 1749 when the Village Green was set aside from common land as a meetinghouse lot and training field. Following costly, but successful, standoffs in the Revolutionary War and the War of 1812, residents returned to farming, fishing, shipbuilding, whaling and trading. Salt works distilled crystals from seawater, an industry that peaked in the 1840s. In 1863 the Pacific Guano Company began to manufacture fertilizer at a factory on Long Neck (Penzance Point) in Woods Hole. Agriculture continued to be important in Falmouth with the strawberry and cranberry industries developing at the end of the nineteenth century.

The railroad was extended from Monument Beach in Bourne to Woods Hole by 1872. The Old Colony Railroad inaugurated a special train to serve the route, "The Flying Dude," in 1884; the trip from Boston could be made in 1 hour, 48 minutes, and Falmouth grew into a summer resort for the wealthy. Ferry service from Woods Hole to Martha's Vineyard and Nantucket expanded to meet the demand of more travelers. As more people had the time and money for leisure in the late 1800s, Falmouth attracted a growing number of vacationers. Distinctive village neighborhoods evolved as families visited throughout consecutive summers.

The United States Commission of Fish and Fisheries (now the National Marine Fisheries Service) built the nation's first Federal Fisheries Laboratory in Woods Hole in 1885, choosing the village for its deep-water harbor and ready access to marine life in the unpolluted waters of Vineyard Sound and Buzzards Bay. With this beginning Woods Hole became a world-leader for its oceanographic research centers. The Marine Biological Laboratory, a privately endowed institute, opened in 1888, and in 1930 the Woods Hole Oceanographic Institution was chartered with a one million dollar gift from the Rockefeller Foundation. A branch of the United States Geological Survey opened an office in the early 1960s, and more recently, The National Academy of Sciences opened a center for summer seminars on a range of issues involving science and public policy. In combination, these organizations have made Woods Hole an internationally recognized center for oceanographic research.

Falmouth, along with the rest of Cape Cod experienced significant population growth pressure through the 1980s, and land was rapidly subdivided for summer homes and condominium projects. The explosive

growth resulted in the creation of the Cape Cod Commission with the mission of planning a more sustainable future for Barnstable County. Falmouth also enacted numerous zoning changes in the 1980s and instituted a building permit cap to better control the rate of growth and plan for necessary public services. While the 1990s and early 2000s showed significantly slower rates of growth, the town continued to plan for additional population, especially for those people choosing to retire to Falmouth. As a result of the large influx of elderly residents, the Falmouth Hospital and medical support offices are among the leading industries in town.

2.2 GEOGRAPHY

Falmouth is the most southwestern town on Cape Cod, 73 miles south of Boston and 75 miles east of Providence, Rhode Island. It is approximately 44 square miles in area, and is the second largest town, both in population and area, in Barnstable County. Falmouth is bordered on the north by the towns of Bourne and Sandwich, on the east by Mashpee, on the west by Buzzards Bay, and Vineyard Sound is to the south.

Falmouth is composed of eight distinct villages: Falmouth Center, East Falmouth, Hatchville, North Falmouth, Teaticket, Waquoit, West Falmouth and Woods Hole. It is a coastal community with many beaches, freshwater ponds, forested areas, and some remaining agricultural lands.

Falmouth shares many natural features with neighboring towns, including surface, groundwater and coastal resources. The Cape Cod aquifer, which supplies fresh water to the entire Cape, was designated as a "sole source aquifer" by the Environmental Protection Agency in 1986, in recognition of the shared hydrogeological features of the region and the public reliance on groundwater as a source of drinking water. A subset of the aquifer, the Sagamore Lens, lies under the towns of Sandwich, Bourne, Mashpee, Barnstable and Falmouth. The groundwater flows south and southeast from the top of the lens in Bourne, passing through Falmouth before reaching the ocean. A consequence of the groundwater flow is that it is easily contaminated, and contaminates are carried in plumes away from the source of the pollutant. Therefore, the quality of Falmouth's groundwater is affected by activities in Bourne and other up-gradient towns. Falmouth works closely with neighboring towns and the Cape Cod Commission to protect the quality of this vital resource.

Falmouth shares the waters of Buzzards Bay with thirteen other communities in the watershed. Through involvement with the Buzzards Bay Action Committee, a non-profit alliance of officials from the thirteen towns, and the Buzzards Bay Project, a regional agency initiated under the federal National Estuaries Program, Falmouth has joined in efforts to protect and improve the waters of Buzzards Bay. Recognizing the importance of the bay, Falmouth has contributed to the development and implementation of the Buzzards Bay Comprehensive Conservation Management Plan (1991) and is a signatory to the Buzzards Bay Action Compact.

Falmouth and the Town of Mashpee share the waters of Waquoit Bay, a sensitive and important resource. Both towns have implemented water resource overlay zoning districts to protect the health of the bay. In addition to Mashpee, Falmouth also shares a border with the Town of Sandwich. The Commonwealth of Massachusetts owns more than 1,000 acres of land in Falmouth along the town line, which is bordered by the Massachusetts Military Reservation in Sandwich. In addition to the directly abutting towns, Falmouth also cooperates

with the Cape Cod Commission and the policies found in the Regional Policy Plan regarding open space and recreation.

2.3 CLIMATE

Falmouth averages approximately 46 inches of rain per year with an average annual snowfall of 32 inches. Average temperatures range from highs in the upper 70's and low 80's during the summer months to lows in the low to mid 20's during winter months. Falmouth's location along the Atlantic Ocean generally keeps temperatures cooler in the summer and warmer in the winter than other nearby, inland Massachusetts communities.

2.4 NATURAL ENVIRONMENT

Falmouth's natural environment and natural resources are important to the Town's identity and quality of life. Natural resources, including water bodies, beaches, forests, wetlands and others, support the economy through tourism and recreation, in addition to a variety of other ecosystem services, such as clean air and water. The natural environment also increases resiliency and reduces hazard impacts, through flood attenuation as wetland and riparian areas absorb flood waters, through stormwater management as rainwater drains through the soil, and through erosion control as vegetation secures soil along coastal banks and beaches.

Of Falmouth's natural environment, perhaps one of its most important and noticeable natural features are its many bodies of water. Falmouth's water bodies include salt ponds and bays, great ponds and lesser ponds. Massachusetts defines ponds measuring ten acres or more, as "great ponds." Land under a pond is held in public ownership and controlled by the state, and these ponds are generally open to the public. In some cases, as with the Town Forest that surrounds Long Pond, significant areas of shoreline are also in public ownership. Ponds less than ten acres are designated as "lesser ponds" and can be privately owned. In the 1960s the Conservation Commission began a program to acquire land for public access to every pond in Falmouth. While limited, most ponds are accessible to the public for fishing, canoeing or swimming. Tables 2-1, 2-2 and 2-3 provide information on the waterbodies in Falmouth. For additional information about the water bodies in Falmouth, refer to the Cape Cod Pond and Lake Atlas (2003) produced by the Cape Cod Commission.

Figure 2-1. View of Chappaquoit Point from across West Falmouth Harbor.

Table 2-1. Salt Ponds and Bays of Falmouth

Pond or Bay	Size (acres)	Public Use
Waquoit Bay	931	Beach/Conservation
Eel Pond	208	Marina/Landing
West Falmouth Harbor	198	Marina/Landing
Great Pond	180	Landing/Beach
Bourne's Pond	152	Beach
Green Pond	128	Marina
Hamblin Pond	120	None
Little Pond	70	None
Oyster Pond	65	Open Space
Salt Pond (2)	58	Open Space
Siders Pond	36	Open Space
Perch Pond	25	Open Space
Eel Pond(Woods Hole)	12	Landing
Quissett Harbor	*	Open Space/Landing
Megansett Harbor	*	Beach/Landing
Wild Harbor	*	Landing
Fiddlers Cove	*	Marina
Rands Canal	*	None
Nobska Pond	9	None
Flume Pond	7	None
Caleb Pond	6	None
Beach Pond	4	None

***Areas not calculated because these are not closed bodies of water.**

Figure 2-2. Eel Pond in Woods Hole, one of Falmouth's salt ponds.

Table 2-2. Great Ponds of Falmouth

Pond or Bay	Size (acres)	Public Use
Coonamessett	157.5	Beach
Long Pond	149.7	Water Supply
Jenkins Pond	86.4	Landing
Ashumet Pond	56.1	Landing
Crooked Pond	36	None
Mares Pond	29.9	Open Space
Deep Pond	26.8	Beach
Wing Pond	25.2	Open Space
Flax Pond	23	Conservation
Cedar Lake	21.8	Park
Spectacle Pond	19.9	Open Space
Morse Pond	17.1	Open Space
Mill Pond (East Falmouth)	15	None
Jones Pond	12.9	Open Space
Grews Pond	12.5	Park & Beach
Shallow Pond	11.6	None
Round Pond	11	Open Space/Golf
Shivericks Pond	10.8	Open Space
Bourne Pond (2)	10.7	None

Figure 2-3. Some of the ponds in East Falmouth between Gifford Street and Sandwich Road.

Table 2-3. Lesser Ponds of Falmouth

Pond or Bay	Size (acres)	Public Use
Deer Pond	8.7	None
Dam Pond	8	None
Fresh Pond	7.7	None
Flashy Pond	7.6	None
Crocker Pond	7.2	None
Miles Pond	6.9	None
Nye Pond	6	Open Space
Pickerel Pond	5.7	None
Weeks Pond	5.3	Open Space
Sols Pond	4.7	None
Trout Pond	4.1	None
Palmer Pond	4	None
Punch Bowl	2.9	Conservation
Crowell Pond	2	None
Shanks Pond	1.7	None
Two Ponds (2)	1	None
Turtle Pond	0.7	None
Frog Pond	0.3	None

2.5 LAND USE

The most visible aspect of Falmouth's population growth is the rapid development that occurred between 1980 and 2010. In 1974, William MacConnell wrote in his report: *Remote Sensing: 20 Years of Change in Barnstable, Dukes, and Nantucket Counties, Massachusetts, 1951-1971*, that Falmouth had 'suffered severe losses in open space and agricultural land, and predicted that this trend is very likely to continue."

Although demographics data described in Section 2.6 show a decline in recent years in the year-round population, Falmouth continues to experience demand for retirement, vacation and second homes. Construction of limited access highways, such as Route-28, encourage people to locate in Falmouth and commute north and west to work, and the remaining vacant farmland and forest is vulnerable to development if not protected.

Figure 2-5 shows major land uses throughout Falmouth. The numbers of parcels and areas within each land use category are summarized in Table 2-4. The majority of Falmouth's area is residential, with more than 11,000 acres. The next largest categories by acreage are open space and vacant land. According to remotely derived land use data from the MacConnell Aerial Land Use Surveys, developed land (consisting of 5 sub-categories including: residential, commercial, industrial, transportation, and institutional uses) occupied 6,879 acres, or 23.4% of the total area of the town in 1971. By 1990, developed land increased to 10,706 acres and 36% of the total area. Conversely, forested land comprised 60% of the area in 1971 and 46% in 1990.

In 1994 single-family residential use occupied 31.94% of the town's land area (excluding ponds and harbor areas). In 2016, 41% of the area was used for single-family residential development, indicating that the steady development growth has continued. From 1994 to 2013 the amount of vacant, developable, residentially zoned land decreased by 8.82%. Therefore more than half of the developable residential land was allocated to use other than single-family housing. Much of this land was acquired as open space, including golf courses and conservation land, or developed as multifamily housing under chapter 40B.

Table 2-4. Land Use Summary for Falmouth (based on the 2015 Assessor's parcel dataset).

Land Use Category	# of Parcels	Total (acres)
Residential (Single Family)	18,410	10,362.3
Residential (Multi-Family)	806	1,075.5
Commercial (Retail/Offices/Services)	389	664.7
Commercial (Manufacture/Distribution)	90	620.9
Public Services	269	1,453.9
Temporary Lodging (i.e. Hotels, Inns)	48	105.9
Agriculture	31	386.0
Open Space	802	5,745.7
Vacant	2,248	3,889.8
Recreation	61	1,093.3

Figure 2-4. Main Street, Falmouth, one of the main commercial sections of Town.

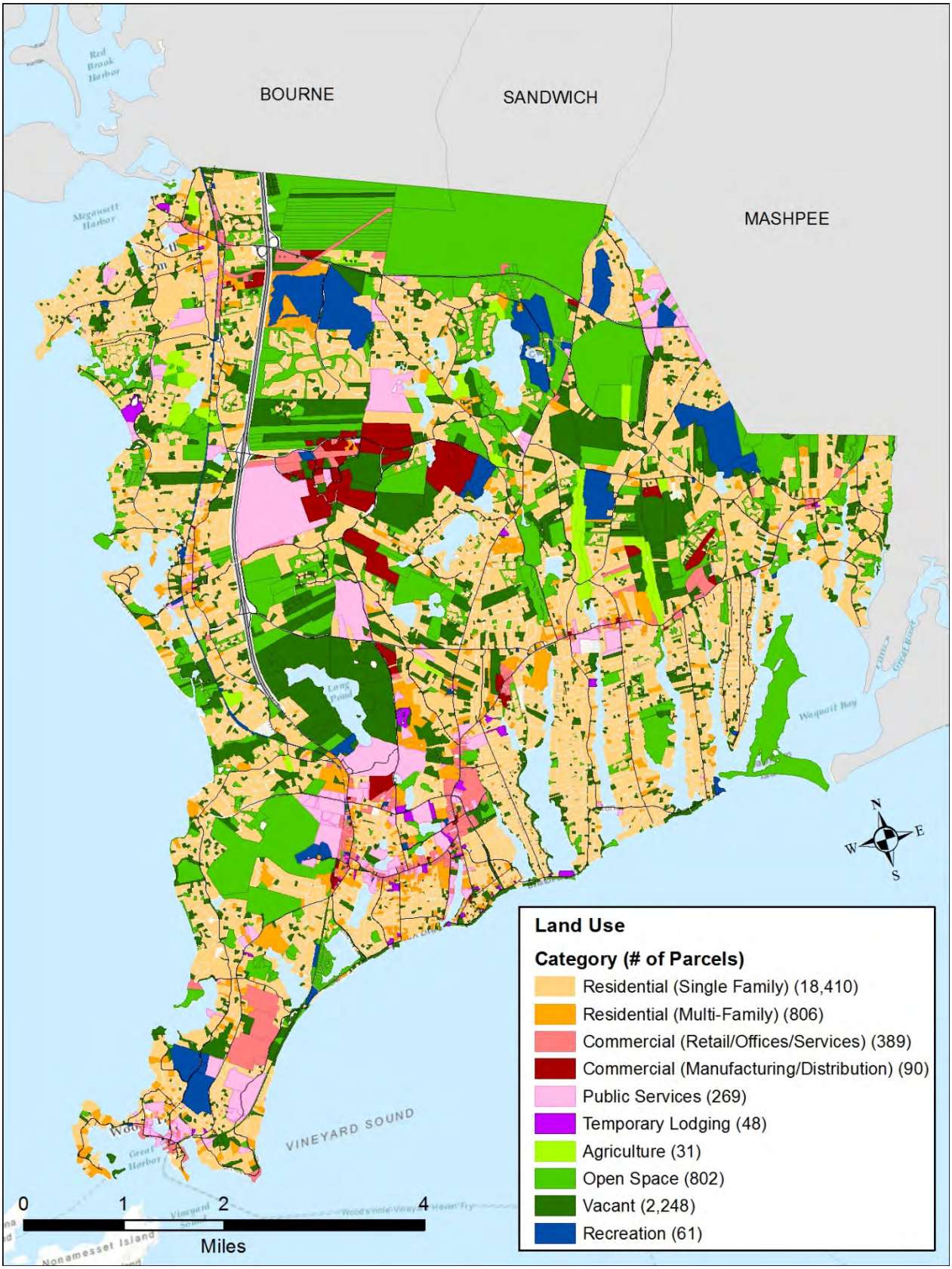

Figure 2-5. Land Use in Falmouth (based on the 2015 Assessor's parcel dataset).

2.6 DEMOGRAPHICS

In July of 2012, the U.S. Census estimated the population of Falmouth to be 31,589 year-round residents. This represents a decrease of 2,234 residents since the 2003 Census estimate, which was approximately a -3.3% rate of growth, per year (Figure 2-6). The population density, based on the 2012 Census estimate, was roughly 717 people per square mile; this was a decrease of 51 people per square mile from the 2000 Census. The summer population, with the influx of summer residents and tourists is considerably higher. Estimates for the total summer population of Falmouth are over 100,000.

The UMass Donahue Institute (UMDI) at the University of Massachusetts, Amherst released the most recent population projections for Falmouth (Renski et al. 2015). As shown in Figure 2-7, the projection is for a steady decline in year-round residents through 2035.

Falmouth is also an aging community; in the 2010 Census, over a quarter (26%) of the residents reported their age as 65 years or older, which makes Falmouth approximately twice the state median of 13.8%. The median age is also steadily increasing. In 1970, the median age was 30.8 years; in 1980 it was 34.1 years; in 1990 it was 38.6 years; in 2000 it was 45 years; and in 2010 the median age was 51.8. The increasing age of the population is influencing the types of recreation activities that are in demand.

The median income in the Town of Falmouth has also risen steadily since 2000. The household median income of $61,244 in 2010 was slightly above the Barnstable County median of $58,616.

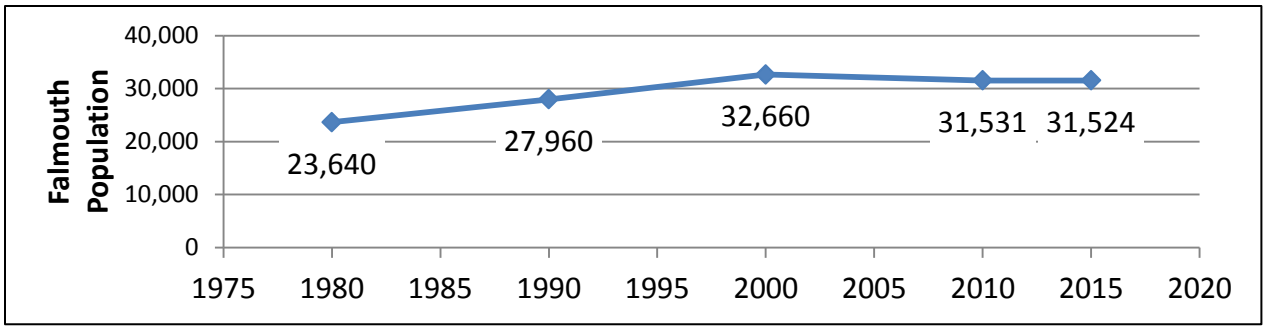

Figure 2-6. Falmouth population from U.S. Census between 1980 and 2015.

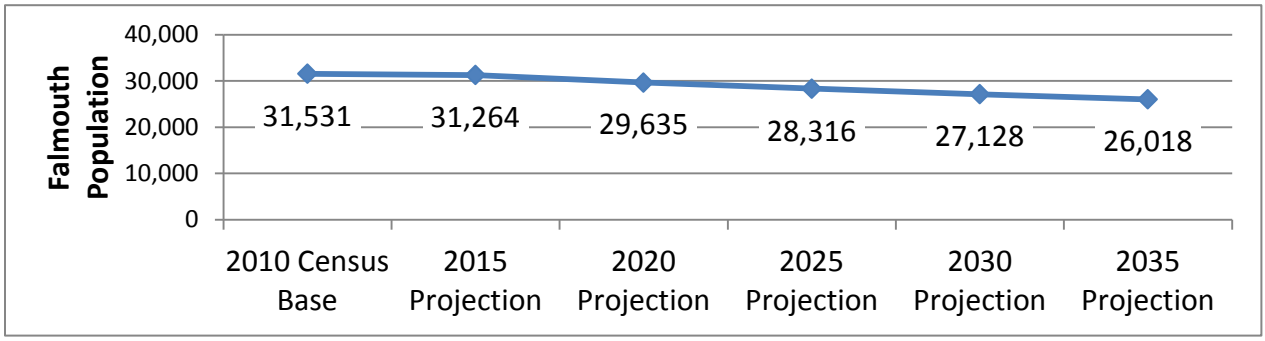

Figure 2-7. Projected population in Falmouth from UMDI.

2.7 GOVERNMENT

The Town of Falmouth is governed by a charter which grants power to a Representative Town Meeting with 270 representatives elected by residents at an election held each year. Town Meetings are typically held two or three times a year to act on the legislative needs of the community. The Town has a full time administrative governmental structure that operates on a day-to-day basis at the Town Hall. The Executive Branch of Government is comprised of a 5 member Select Board that meets weekly. Town departments and boards are headed by both elected and appointed officials.

2.8 INFRASTRUCTURE

According to the Department of Revenue, Falmouth contains approximately 347 miles of road, consisting at 25 miles of state highway, 220 miles of public streets and 102 miles of private roads. The road network operates satisfactorily during the off-season months; however, due to the large population increases in the summer months, there is considerable congestion on some of the arterial roadways in Falmouth Village, Woods Hole, Teaticket and East Falmouth. Some of these major roads also function as evacuation routes during an emergency. Figure 2-8 highlights the Town's current evacuation routes in red. The routes were chosen to disperse the traffic to a number of different major pathways to minimize congestion to the extent practical.

Falmouth is also a port for many of the visitors who travel to Martha's Vineyard through The Steamship Authority station in Woods Hole, or the Island Queen station in Falmouth Harbor. The ferry service generates additional traffic on Falmouth roadways and requires large amounts of land to be set aside for parking lots to accommodate the vehicles that are not taken to the island. The scientific institutions in Woods Hole also experience peak traffic demands during the summer months, which coincide with the increased traffic from the tourist industry and vacationers to the Vineyard.

The dispersed population (717 people per square mile), and low-density development pattern in Falmouth cannot support a full-service mass transit system; however, the Cape Cod Regional Transit Authority (CCRTA) offers three bus lines that serve Falmouth. The Sea Line provides a daily, year-round fixed route service from the Hyannis Transportation Center to the Woods Hole Steamship Authority. In addition to Woods Hole, this bus makes stops at the Falmouth Mall, East Falmouth Library and the Bonanza Bus Depot (on request). In the summer season (June through Labor Day), the Woods Hole Trolley (WHOOSH) runs a fixed route service from Falmouth Mall to Woods Hole. The third service is the B-Bus, which provides door-to-door, ride-by-appointment service for any reason. Fixed-route and B-Buses can carry up to 19 passengers, and are lift-equipped for handicapped individuals and operate on a year-round basis.

Falmouth has an exclusive bikeway, as well as designated bike routes on selected roadways. The Shining Sea Bikeway is a paved path that occupies the former railroad right-of-way between Woods Hole and North Falmouth Village. This bikeway is 10.8 miles, running through residential neighborhoods and by the Trunk River and Surf Drive beaches, to County Road in North Falmouth. The Shining Sea Bikeway is very popular with bicyclists, runners, walkers and roller-bladers, particularly in the summer months. The bikeway is a town and regional recreational destination.

Figure 2-8. Emergency evacuation routes in Falmouth.

Falmouth bike routes are identified only by signs and users must share the road with vehicular traffic. There are twenty-four miles of designated bike routes on Sippewissett Road, Quaker Road, Shore Street, Davisville Road, Central Avenue, Brick Kiln Road and others. These routes link the villages and provide bike connections to Bourne and Mashpee.

Municipal water is supplied to more than 90% of Falmouth residents, while sparsely populated areas, such as Hatchville, are served by private wells. In some cases, water main pipes are fitted alongside low-elevation, vulnerable coastal bridges (Figure 2-9). Half of the Town's drinking water is drawn from Long Pond, a surface water supply. The wells at Coonamessett Pond, Fresh Pond, Crooked Pond and Mares Pond pump 4.6 million gallons per day. The town is able to access up to 1.0 million additional gallons per day from the Massachusetts Military Reservation regional supply wells. The water is distributed through more than 400 miles of main, and four storage tanks.

Figure 2-9. Water main on Bourne's Pond Bridge.

2.9 CRITICAL FACILITIES

Critical infrastructure facilities are essential to the health and welfare of the Town and are especially important for response and recovery following hazard events. Critical infrastructure includes buildings and infrastructure such as emergency operations centers and shelters, critical municipal buildings, transportation features, utilities and communications infrastructure, water and wastewater facilities, etc. The LPT developed a list of critical infrastructure and facilities, which is provided in Appendix C. Due to the potential for compounded adverse impacts if they were compromised during a natural hazard, facilities containing hazardous materials and gas stations within the flood plain were also included in the critical facilities list. The critical facilities in Falmouth are shown in Figure 2-10. For a discussion about the tiered classification of critical infrastructure, see the vulnerability assessment methodology discussion in Chapter 4. Only a portion of critical infrastructure facilities are located within high hazard areas, such as floodplains, however due to the importance of these facilities, special care must be taken to ensure continued operation even during disaster events.

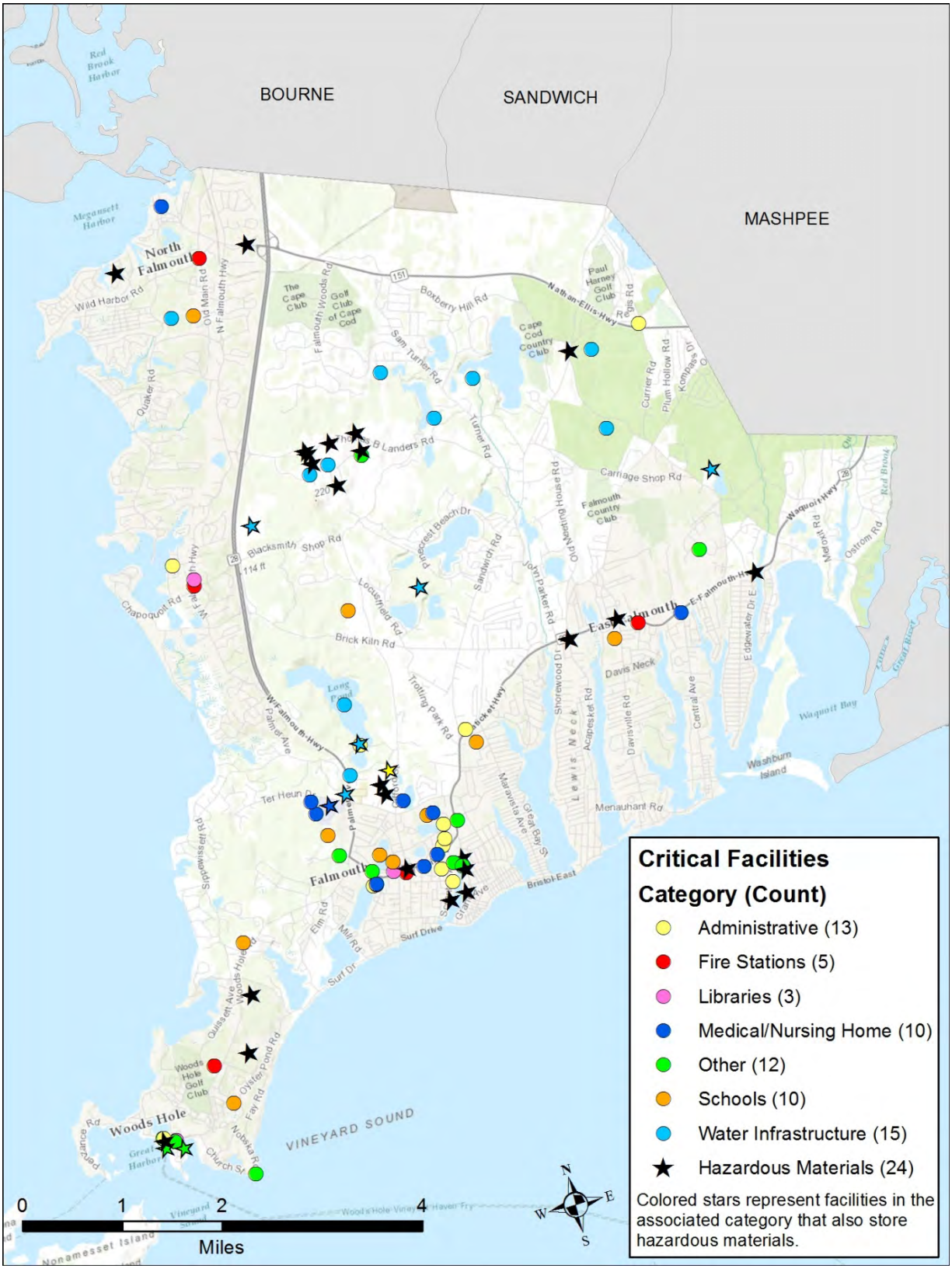

Figure 2-10 Critical infrastructure locations in Falmouth.

2.10 HISTORIC PROPERTIES

Falmouth has a rich history that is reflected in a wide-range of historic and archaeological resources. The Falmouth Historical Commission maintains 550 buildings, cemeteries, neighborhoods and sites of historical or architectural significance, ranging in date from 1686 to 1954. The property list is comprehensive on structures built before 1850, is continually updated and expanded to include more post-1850 properties.

Falmouth has 11 individual properties and four districts on the National Register of Historic Places (Figure 2-12). The individually listed properties are:

1) Josiah Tobey House, East Falmouth
2) School Administration Building, Teaticket
3) Central Fire Station, Falmouth Village
4) Lawrence Academy, Falmouth Village
5) Poor House, Falmouth Village
6) Pumping Station, Falmouth Village
7) The Nye House, North Falmouth
8) Bourne Farm, West Falmouth
9) Nobska Lighthouse, Woods Hole (Figure 2-11)
10) Woods Hole School, Woods Hole
11) Cleveland Light, Buzzards Bay

Eleven more historic areas have been identified as eligible for the National Register and more than 120 buildings and sites are individually eligible for the Register. Approximately 76 of the individually eligible sites are included in the identified historic districts.

Falmouth has seven local historical districts identified in Figure 2-12. Four of them are also listed on the National Register. The districts range from 100 to 200 feet in width on each side of the road: They include:

1) North Falmouth along Old Main Road and part of 28A,
2) West Falmouth along 28A,
3) Woods Hole--Church Street to lighthouse, Water Street to Eel Pond Bridge,
4) Woods Hole Road, School Street and Luscombe Avenue,
5) Falmouth Village along Palmer, Locust, Main and Shore streets and Depot Ave.,
6) Davisville along a section of Davisville Road,
7) Waquoit around the Congregational Church on Rte. 28,
8) Quissett along Quissett Avenue and Quissett Harbor Road.

All of the buildings on the National Register and in local historical districts are automatically included in the state Register of Historic Places.

Figure 2-11. Nobska Lighthouse

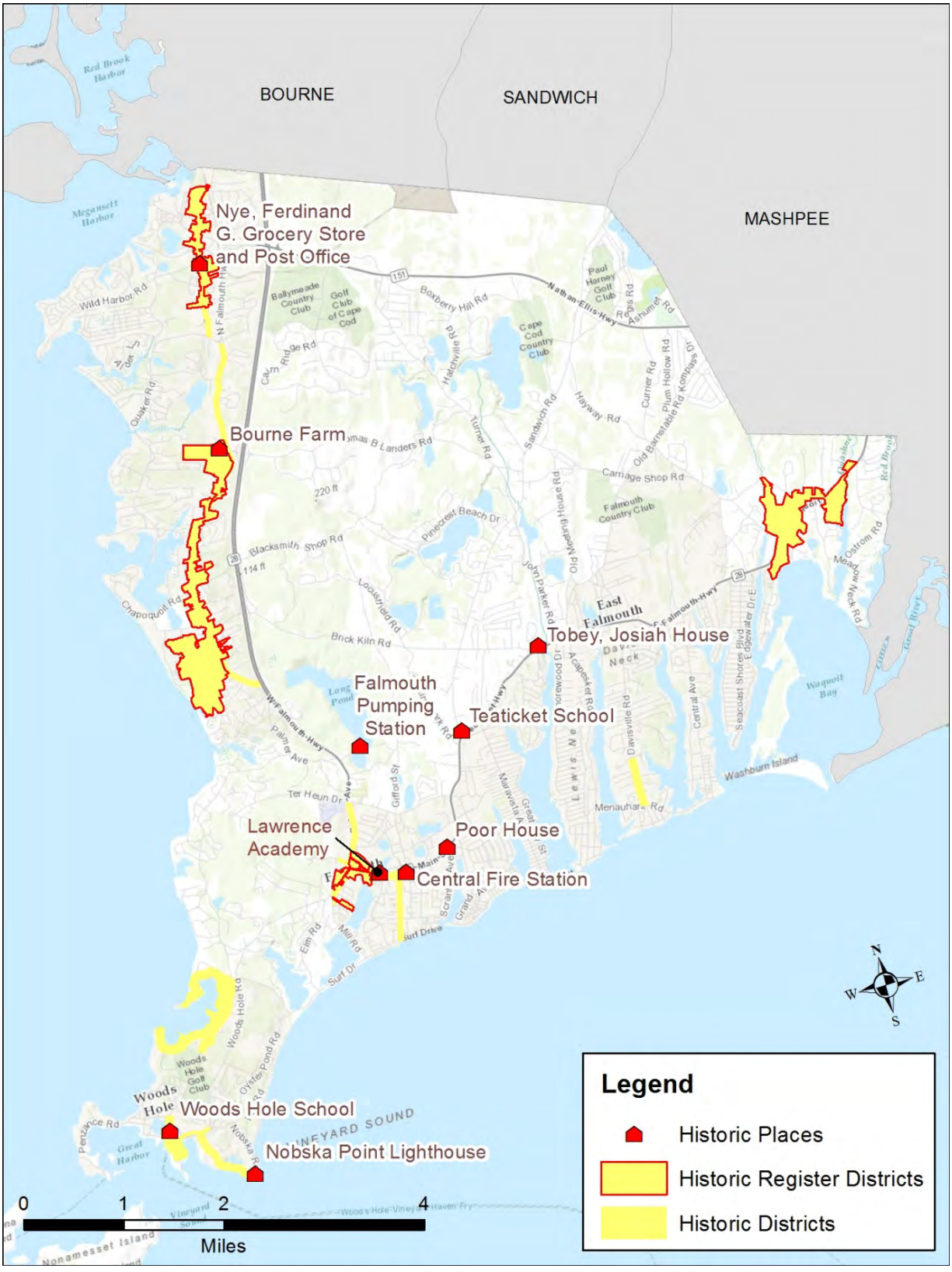

Figure 2-12. Historic places and districts in Falmouth.

B4.a

2.11 REPETITIVE LOSS PROPERTIES

Repetitive Loss Properties are 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 ten year period since 1978. The Town of Falmouth has 26 Repetitive Loss Properties; 20 of these properties are single-family residential, 4 are commercial/retail, and 2 are condominium common land.

All Repetitive Loss Properties in Falmouth are located on or near the coast. In almost all cases, the flooding has been caused by storm surge. Storm surge is a temporary increase in the elevation of the water level caused by a storm, which can cause extreme flooding in coastal areas particularly when the storm surge coincides with a normal high tide. Many of these repetitive loss structures are located below 10 ft of elevation (NAVD88) and are within a velocity zone (VE), which makes them particularly susceptible to the hazards of storm surge and coastal flooding. Low-lying Repetitive Loss Areas with-in a VE Zone, that contain clusters of Repetitive Loss Properties, include New Silver Beach, West Falmouth Harbor, Black Beach, Surf Drive, Megansett Harbor, and Falmouth Heights Beach.

Other Repetitive Loss Areas, such as the end of Point and Chapoquoit Roads, are slightly higher in elevation, but due to their exposed geographic position, are also prone to flooding. Point Road, for example, extends along a peninsula into Buzzards Bay, resulting in a fetch that can be between 5 miles long (from directly across Buzzards Bay) to more than 50 miles long (from the SW direction, along the main axis of Buzzards Bay to Block Island). These exposed areas are impacted not only by storm surges, but also heavy surf, which can produce high wave heights, resulting in damages at higher elevations.

It is important to note the emphasis on Repetitive Loss "Areas", as opposed to specific properties. While locating specific repetitive loss properties is important for some purposes, these properties only appear on FEMA's list because the structure had flood insurance and received two or more claims of at least $1,000 during any ten-year period. Other nearby structures may have been uninsured during the floods, may have only had one flood insurance claim, or may have had multiple claims under different policies. The properties that are listed by FEMA as Repetitive Loss Properties simply represent a sampling of Falmouth's repetitive flooding problem, and are a good indication of the Town's vulnerable and repetitively flooded areas.

Figure 2-13. Repetitive Loss Map from the Massachusetts State Hazard Mitigation Plan 2013.

Falmouth is vulnerable to a wide range of natural hazards that can threaten the people, the economy, the infrastructure and the natural resources of the Town. As suggested under FEMA planning guidance, the Town of Falmouth reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan, which included:

1) *Flooding*
2) *Coastal Erosion*
3) *Hurricanes and Tropical Storms*
4) *Severe Nor'easters*
5) *Severe Winter Weather (snow, blizzards, and ice storms)*
6) *Severe Weather (thunder-storms, wind, drought, extreme temperatures, and tornadoes)*
7) *Fire*
8) *Dam/Culvert Failure*
9) *Landslide*
10) *Earthquake*
11) *Tsunami*

In addition to the hazards above, the Town of Falmouth also included Sea-Level Rise as an additional hazard. This chapter provides a description of each hazard, the location(s) within Falmouth that are impacted by each hazard, previous occurrences of each hazard, the possible magnitude of each hazard, the probability of each hazard occurring in a given year, and some of the impacts that can happen in the event that hazard occurs.

FEMA defines a hazard as an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing. All natural disasters pose hazards to property, loss of human life, and have the ability to limit access to power, communication services, water, wastewater/collection/ treatment and transportation. Down trees and limbs also limit emergency access and complicate cleanup efforts. Through development of this Plan, Falmouth is taking steps to protect its infrastructure from natural disasters as much as possible, such that essential utilities and services continue when most needed. Hazards associated with natural disasters typically encountered in Falmouth include high winds, heavy rains/snows and coastal flooding. Natural disasters occurring less frequently, such as tornadoes, earthquakes or forest fires, pose other hazards and present unique challenges to residents and community officials, given a relatively short-term institutional memory. Tables 3-1 and 3-2 list the major disaster and emergency declarations for Barnstable County.

Table 3-1. Major Disaster Declarations for Barnstable County

Date	Incident Description	Disaster Number
January 26-28, 2015	Severe Winter Storm/Flooding	4214
February 8, 2013	Severe Winter Storm	4110
December 19, 2012	Hurricane Sandy	4097
September 3, 2011	Tropical Storm Irene	4028
April 15, 2007	Severe Storm/Coastal Flooding	1701
January 24, 1996	Blizzard	1090
December 11, 1992	Winter Coastal Storm	975
October 30, 1991	Severe Coastal Storm	920
August 26, 1991	Hurricane Bob	914
October 28, 1985	Hurricane Gloria	751
February 10, 1978	Coastal Storm, Flood, Ice, Snow	546

Table 3-2. Emergency Declarations for Barnstable County

Date	Incident Description	Disaster Number
October 28, 2013	Hurricane Sandy	3350
August 26, 2011	Hurricane Irene	3330
September 2, 2010	Hurricane Earl	3315
September 13, 2005	Hurricane Katrina Evacuation	3252
February 17, 2005	Snow	3201
January 15, 2004	Snow	3191
March 11, 2003	Snowstorm	3175
March 16, 1993	Blizzard, High Winds, Snow	3103

B1.a The 2013 Massachusetts State Hazard Plan identifies 11 natural hazards that could have an impact or have a history of impacting communities in the Commonwealth of Massachusetts. These hazards are:

1) Flooding
2) Coastal Erosion
3) Hurricanes and Tropical Storms
4) Severe Nor'easters
5) Severe Winter Weather (including snow, blizzards, and ice storms)
6) Severe Weather (including thunderstorms, high wind, drought, extreme temperatures, and tornadoes)
7) Fire
8) Dam Failure
9) Landslide
10) Earthquake
11) Tsunami

B1.b As suggested under FEMA planning guidance, the Town of Falmouth reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan. Also, because more than two-thirds of the Town of Falmouth's boundaries border Buzzards Bay and Vineyard Sound, sea-level rise was considered separately as an additional hazard in this plan. The Local Planning Team did not believe the topography in Falmouth would be able to produce landslides, and as such, this hazard was not addressed directly in this plan. In addition to the 2013 Massachusetts State Hazard Mitigation Plan, other resources consulted during the drafting of this plan included the 2010 Barnstable County Multi-Hazard Mitigation Plan, news articles and media sources, and local knowledge from Local Emergency Planning Committee members. All resources are referenced in the text of each hazard profile.

Figure 3-1. Waves pounding the Bureau of Marine Fisheries building in Woods Hole during the 1938 hurricane.

3.1 FLOODING

OVERVIEW

Two major types of flooding occur in Falmouth: coastal flooding and blocked drainage during heavy rainfall. The most dangerous type of flooding occurs from coastal storm surges, which occur when water is pushed onshore during powerful storms, such as hurricanes and nor'easters. These storms often cause a storm surge, which can raise the water level by several feet. Storm surges are easily capable of inundating low-lying areas, and waves associated with coastal storms can be highly destructive as they move inland, battering buildings, structures, and infrastructure in their path. Major hurricanes are capable of producing VE zones with base flood elevations as high as 25 feet. However, the magnitude of flooding is strongly influenced by the tides; storm surge that occurs during a high tide will inundate a larger area than if the same surge occurs at low tide. A storm surge coinciding with a high tide event can devastate coastal features such as piers, floats, docks, and boats.

Falmouth, like most of Cape Cod, does not experience riverine flooding. What flooding that does occur is typically isolated and associated with storm run-off that overwhelms the carrying capacity of storm water infrastructure. This is usually exacerbated by poor design or poor maintenance. Flooding from blocked drainage occurs in flat or depressional areas where runoff or rain collects and cannot drain out. Drainage systems are made up of ditches, storm sewers, retention ponds and other infrastructure designed to transport storm water away from roadways and parking lots, to receiving streams, lakes, or the ocean. When most of these systems were built, they were designed to withstand a 10-year storm event. Larger storms can overwhelm these systems, and blocked or clogged drainage ditches and grates can inhibit the flow of water, resulting in back-ups and ponding. Water will remain in an area until it infiltrates into the soil, evaporates, the blockage is cleared, or the water is actively pumped out.

HAZARD LOCATION

B1.c

The 2013 Massachusetts Hazard Mitigation Plan identifies southwest Cape Cod as particularly vulnerable to storm surge due to the constricted nature of the Buzzards Bay estuary. Figure 3-2 shows the 2014 FEMA Flood Insurance Rate Map (FIRM) for Falmouth. This map depicts the areas of Falmouth in VE and AE zones and within the 0.2% flood area (an area expected to be inundated during a 500-year storm event).

Localized flooding as a result of blocked drainage occurs in specific areas of town. Examples of this are the culvert at Maravista Avenue near the entrance to the Falmouth Mall, and in front of Friendly's at the corner of Falmouth Heights Road and Main Street, which flood even during minor events.

PREVIOUS OCCURRENCES & EXTENT

B1.c
B2.a

Below is a list of rain, flooding and coastal flooding events in Falmouth from 2007 to 2015, from NOAA's NCDC Storm Events Database. This database lists a number of specific flooding incidents for Falmouth:

On April 15, 2007 a particularly strong and slow moving coastal storm brought a variety of impacts to southern New England, including widespread river and stream flooding, and significant coastal flooding through several tide cycles, due to the combination of strong onshore winds, high seas, and astronomically high tides. In eastern Massachusetts, the worst coastal flooding occurred with the evening high tide on April 17th.

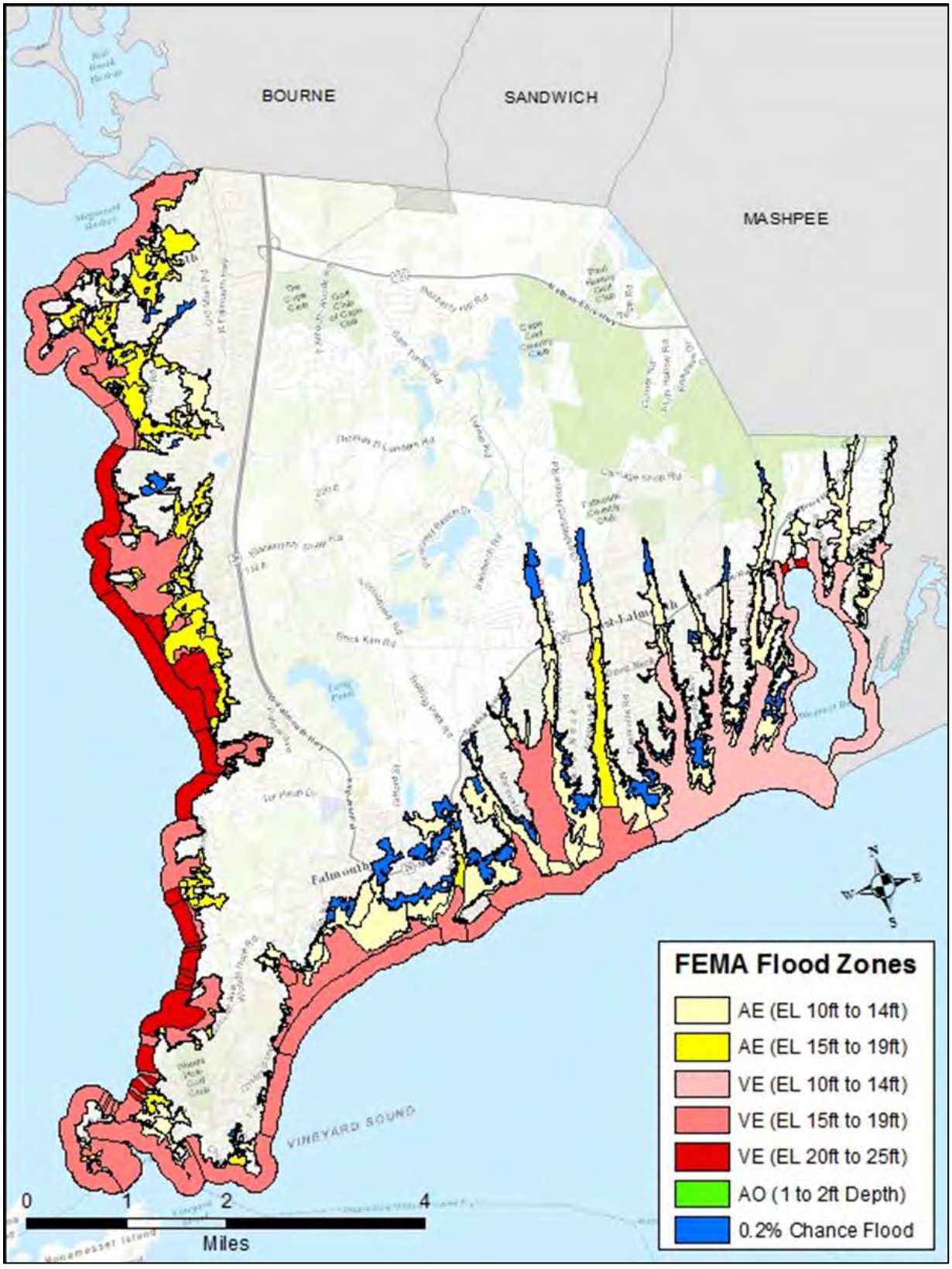

Figure 3-2. FEMA Special Flood Hazard Areas in Falmouth (effective 2014).

On April 13, 2011 a coastal storm caused as much as six inches of rain to fall over parts of Cape Cod. This resulted in flooded roads throughout Falmouth, necessitating the Falmouth Fire Department to make several trips to rescue people from cars in water up to three feet deep. Specifically, parts of Route 28 along Main Street experienced significant flooding. This particular event resulted in approximately $40,000 worth of property damage.

On August 28, 2011, Tropical Storm Irene produced a significant storm surge as it passed through New England. A storm surge of 3.01 feet impacted coastal Barnstable County, flooding Surf Drive in Falmouth.

Between October 29 and 30, 2012, Tropical Storm Sandy brought high winds and significant coastal flooding to coastal Massachusetts. Along the south coast of Massachusetts, the storm surge was 4 to 6 feet, and seas from 30 to a little over 35 feet were observed in the outer coastal waters. In Falmouth, water spilled over the bulkhead and into the parking lot at Falmouth Harbor. Sand and gravel washed onto the shore roads at Falmouth Harbor. Surf Drive at the Salt Pond entrance was closed because it was flooded with water and overwash material (Figure 3-3). The bike path near Trunk River Beach was undermined and damaged. Coastal flooding damaged stairs, walkovers, bulkheads, and seawalls along Menauhant Road east of Great Pond Bridge.

On December 27, 2012, a low pressure system moved up the coast over Southern New England from the mid-Atlantic, bringing a mixture of wintry precipitation, strong winds, and coastal flooding. In Falmouth, Menauhant Road was closed due to coastal flooding.

PROBABILITY

B2.b

Based on the flood frequency of occurrence predicted in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that flooding will occur in Falmouth.

IMPACT

B3.a

Below is a list of possible impacts for a flooding event in Falmouth:

- **People:** People can be knocked down or washed off their feet while walked in floodwaters. Injury or death can result from people being trapped in their vehicles during a flood event. People can be displaced from their homes due to post-flood safety and health hazards.

- **Emergency Response:** Flooded roadways can inhibit emergency response access.

- **Infrastructure:** Flooding cause deposit debris and sediment on town infrastructure and roads. Storm surges and associated waves can damage utility poles, roadways, water mains, sewer pipes and other town infrastructure.

- **Buildings:** Moving water associated with floods can damage buildings and other structures. Building foundations on or near the beach can be undermined by the velocity of floodwaters. Debris carried by flood waters can act as battering rams and damage buildings. Buildings can float off their foundations if not anchored properly. Basements can flood or can collapse due to external water pressure.

- **Economy:** Communication and infrastructure systems damaged during floods can disrupt economic activities and close businesses. Roadway disruptions due to flooding can reduce customer base. There can be economic losses associated with reduced value on coastal properties damaged by flooding.

- **Natural Systems:** Floods can deposit sediment and debris onto parks, beaches, marshes, and estuaries.

- **Transportation:** Floods can wash out bridges and culverts. Debris lodged in culverts can inhibit flow, causing additional flooding on the upstream side. There can be major disruptions to transit or ferry services.

Figure 3-3. Flooding on Surf Drive during Hurricane Sandy.

3.2 Coastal Erosion

Overview

Coastal shorelines—especially beaches, dunes and banks—change constantly in response to winds, waves, tides and other factors including seasonal variations, sea level rise and human alterations to the shoreline system. Every day, winds, waves and currents move sand, pebbles and other materials along the shore or out to sea. This dynamic and continuous process of erosion, sediment transport and accretion shapes the coastal shoreline. Shorelines change seasonally, tending to accrete gradually during the summer months when sediments are deposited by relatively low energy waves, and erode dramatically during the winter when sediments are moved offshore by high energy storm waves and currents, such as those generated by nor'easters.

B1.c

Hazard Location

The Massachusetts Office of Coastal Zone Management (CZM) has documented the rate of change of all ocean-facing shorelines of Massachusetts through their Shoreline Change Project (2013). Shorelines were delineated and evaluated to demonstrate trends from the mid-1800s to 2009. These data were then incorporated into MORIS, the Massachusetts Ocean Resource Information System, to provide better access to the shoreline change data and to allow the public to view the data using the online tool.

Figure 3-4 displays the long-term shoreline change data in Falmouth from CZM's Shoreline Change Project. Figure 3-4 shows the long-term rates of change, from 1845 to 2009, in feet per year, where negative values indicate erosion and positive values indicate accretion. From these data, it is evident that the majority of the Town's coastline (69.8%) is experiencing some level of coastal erosion. Additionally, there are localized sections of Town, specifically the southeastern coastline fronting Green Pond, Bournes Pond and Eel Pond, where the long-term rates of erosion are significantly higher (i.e. more than 2.5 feet per year).

B2.a

As shown in Figure 3-4, based on CZM's Shoreline Change Project data, coastal erosion has been occurring along much of the Falmouth coastline since at least the 1800s. However, this erosion is often episodic, as a result of significant storm flooding and wave impacts, rather than continuous erosion. The rates of shoreline change between 1975 and 2009 are shown in Figure 3-5.

The Report of the Massachusetts Coastal Erosion Commission tabulated the average shoreline change rate, in feet/year, for all coastal communities (CEC 2005). Due to Falmouth's unique geography, averages were given for the entire town, as well as for the Nantucket Sound and Buzzards Bay shorelines separately. Table 3-3 shows these averages calculated by the Coastal Erosion Commission. The values with an asterisk, along the Vineyard Sound coastline, are among the top 20 short- (1970-2009) and long-term (mid-1800s-2009) erosion rates for a region in Massachusetts. Both CZM and CEC reports show erosion rates are greater in recent years than they have been historically.

Table 3-3. Shoreline change data summary (CEC 2005).

Town Sub-region	Short-Term Rate Mean (ft/yr)	Long-Term Rate Mean (ft/yr)
Entire Town	-0.5	-0.3
Vineyard Sound Shoreline Only	**-1.1***	**-0.7***
Buzzards Bay Shoreline Only	-0.3	-0.1

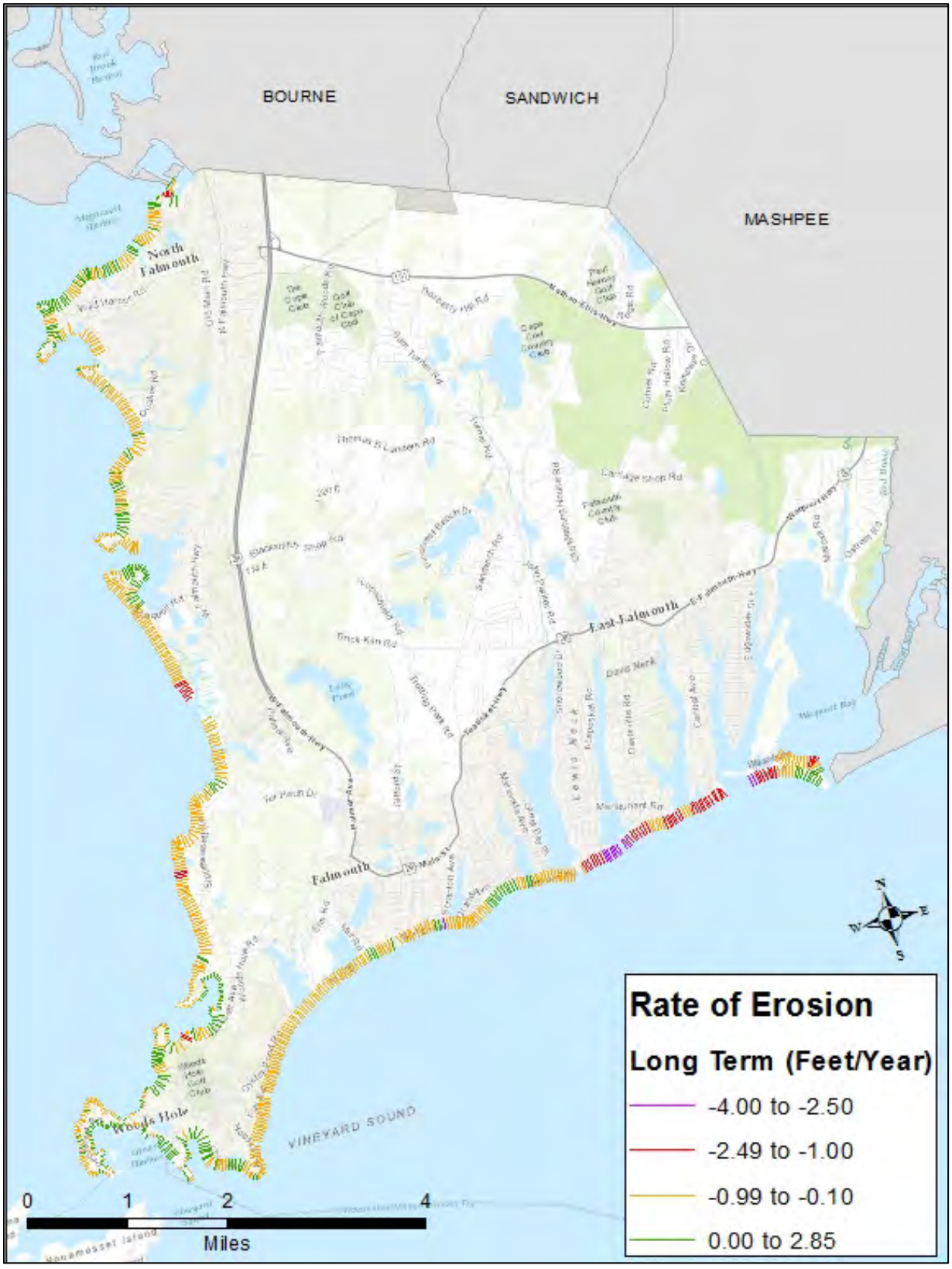

Figure 3-4. CZM Shoreline Change Project data from 1845 to 2009 in Falmouth.

Figure 3-5. CZM Shoreline Change Project data from 1975 to 2009 in Falmouth.

B2.b PROBABILITY

Based on the coastal erosion frequency of occurrence predicted in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that significant losses due to coastal erosion will occur in Falmouth.

B3.a IMPACT

Below is a list of possible impacts that could result from coastal erosion:

- **People:** Public safety is jeopardized when buildings and structures collapse due to coastal erosion.
- **Emergency Response:** Erosion can collapse or damage roadways, which would reduce the response time of emergency vehicles.
- **Infrastructure:** Erosion can expose septic systems, and break sewer pipes and water mains. Accreting sand can block outfall pipes, causing drainage issues and exacerbating flooding.
- **Buildings:** Erosion can undermine the foundations of buildings, making them more susceptible to settlement, lateral movement, or overturning. Buildings and debris from buildings that are damaged due to coastal erosion can be swept out to sea. Seawalls and other hard structures installed to reduce the effect of coastal erosion in one location can cause sediment losses at a downdrift area, affecting additional properties.
- **Economy:** Coastal erosion can adversely impact businesses if a business's building is damaged by erosion. Relocation costs would be an additional economic burden to anyone forced to move to avoid coastal erosion impacts.
- **Natural Systems:** If engineered structures are used to stabilize shorelines, the natural process of erosion is altered, changing the amount of sediment available and the erosion rates at adjacent areas. The town's natural ecosystem attractions (i.e. beaches, dunes, salt marshes and estuaries) would also be threatened as sand sources that supply and sustain them are eliminated.
- **Transportation:** Roadways can become damaged through erosion.

Figure 3-6. The coastal bank fronting Grand Ave. at Falmouth heights immediately after the Hurricane of 1938 (top) and following restabilization (bottom).

3.3 Sea-Level Rise

Overview

Sea-level rise refers to the increase in mean sea level over time. Global mean sea level (MSL) has been rising since the end of the last ice age approximately 11,000 years ago. However, when a more recent time period is considered, sea-level rise (SLR) rates have accelerated, with unprecedented rates along the northeastern U.S. since the late 19th century (Kemp et al., 2011). Global sea-level rise is driven by a number of factors, including thermal expansion of ocean water and freshwater inputs from melting glaciers and ice fields. Local relative sea-level rise is a combination of two phenomena:

- Eustatic changes: Global scale changes, including thermal expansion of sea water as it warms and the addition of water volume from melting glacial ice sheets.
- Isostatic changes: Localized changes in land surface elevations, such as subsidence or uplift.

Sea level sets a baseline for storm surge. As local sea level rises, it allows coastal storm surge to extend farther inland. With the higher sea levels predicted in 2050 and 2100, areas much farther inland will be at risk of being flooded. Although sea-level rise plays a substantial role, local flooding also depends on tides, natural and artificial barriers, and the contours of the land along the coast (Figure 3-7).

Hazard Location

B1.c

The entire coast of Falmouth is vulnerable to sea level rise. Figure 3-8 presents potential areas of inundation based on elevation data for Falmouth, adjusted to Mean Higher High Water (MHHW). The sea-level rise is shown as a simple representation of a change in water elevation, commonly referred to as a "bathtub" model, without accounting for the effects of velocity and resulting erosion caused by wave action.

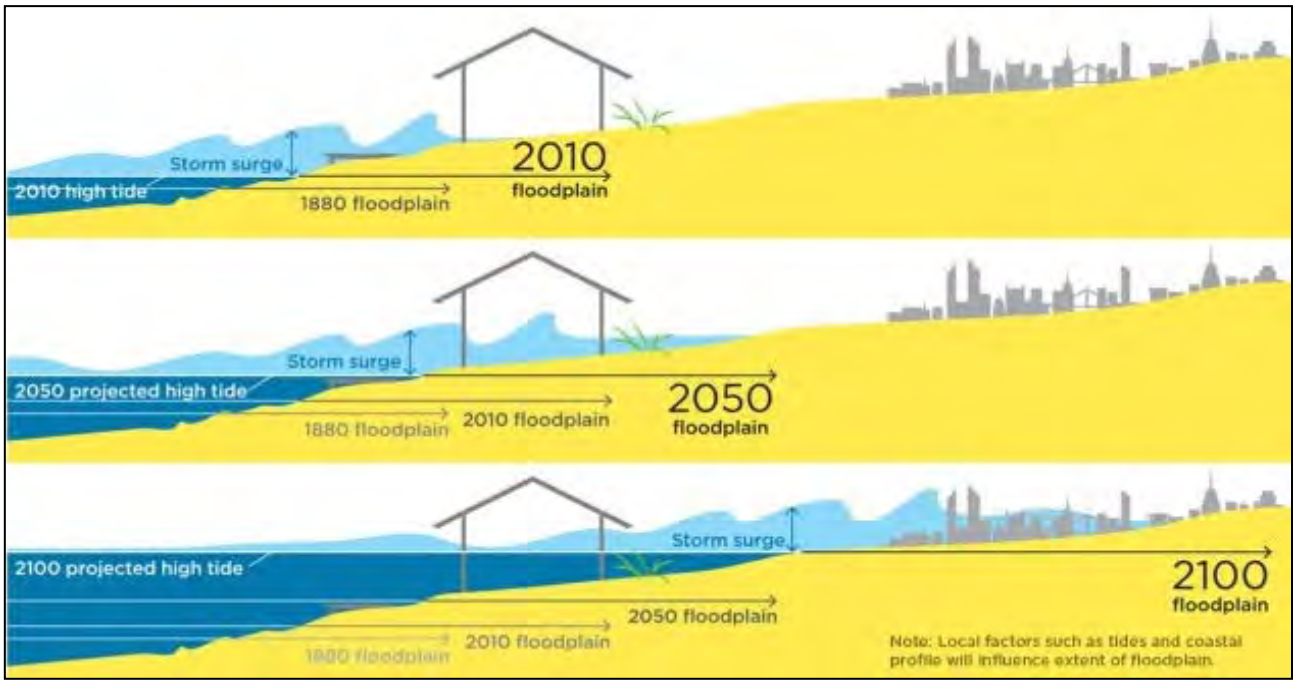

Figure 3-7. Storm surge and high tides magnify the risks of local sea-level rise (UCS 2015)

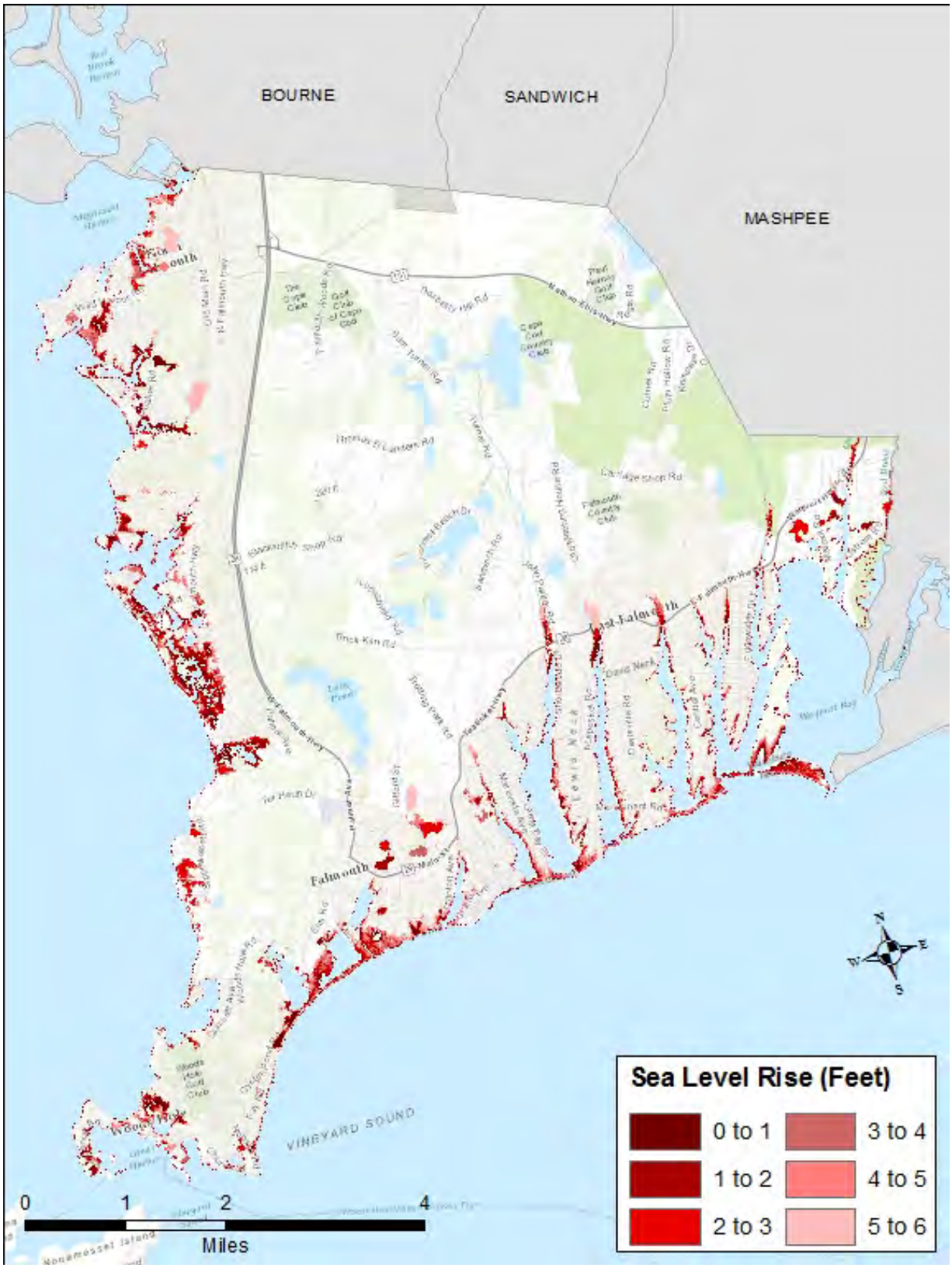

Figure 3-8. Projected inundation given varying degrees of sea-level rise (relative to MHHW).

B1.c
B2.a

Previous Occurrences & Extent

According to the National Academy of Sciences, the Earth's surface temperature has risen by about 1° Fahrenheit in the past century, with accelerated warming during the past two decades. As average temperatures increase, sea level is expected to rise as freshwater inputs from glacier and ice sheet melting occurs. The National Oceanic and Atmospheric Administration's (NOAA) Center for Operational Oceanographic Products and Services maintains a series of tide gages along the coast of Massachusetts. Records from NOAA's Woods Hole tide gage indicate that our relative sea level has risen at a rate of 2.81 mm/yr, resulting in a change of approximately 9 inches between 1932 and 2016 (Figure 3-9). As sea level rises, low-lying coastal areas will be particularly vulnerable to coastal storm hazards such as erosion and flooding. While some low-lying areas may be permanently inundated, other inland areas not currently subject to coastal storm impacts may be impacted by storm surge and other flooding events.

B2.b

Probability

Based on the sea-level rise frequency of occurrence predicted in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that sea-level rise will occur in Falmouth.

There is still some uncertainty, however, about the magnitude of future sea-level rise. Projections of increase in global sea-level by 2100 range from an additional 0.2 m (0.7 ft) to 2.0 m (6.6 ft) (Figure 3-10). A consortium of government agencies has completed a National Climate Assessment (Parris et al., 2012) that provides guidance on the appropriate selection of sea-level rise (SLR) scenarios. Under this guidance, four (4) projected rates of sea-level rise (highest, intermediate-high, intermediate-low, and low) have been developed. Given the range of uncertainty in future global SLR, using multiple scenarios encourages experts, planners and decision makers to consider a range of future conditions and to develop multiple response options. The highest scenario from Parris et al. (2012) combines

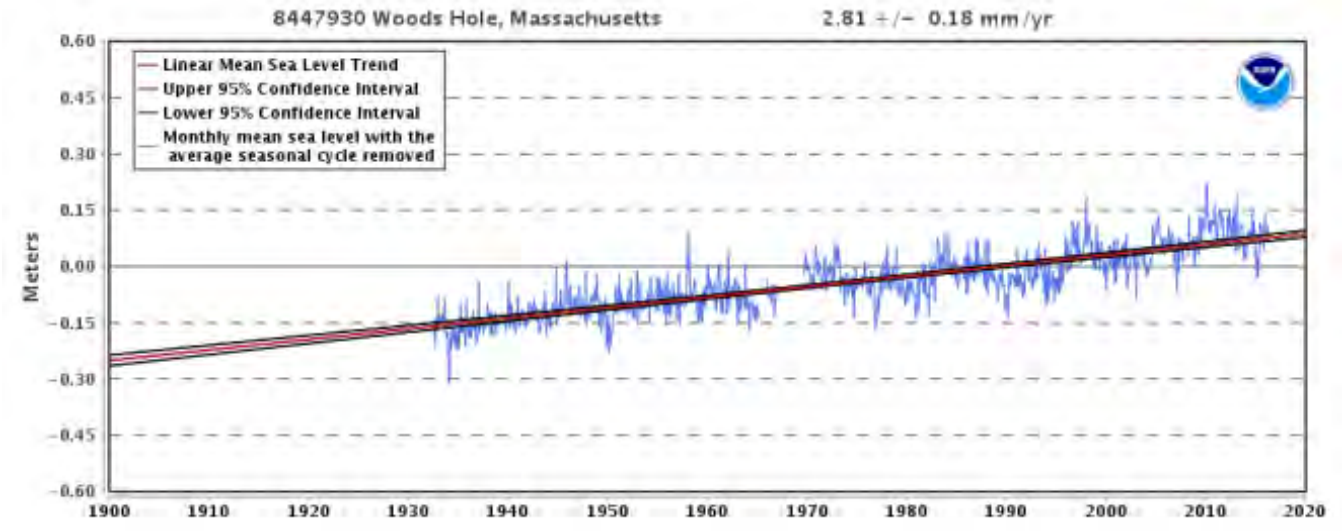

Figure 3-9. Sea-level rise trend from Woods Hole, MA (NOAA 2016).

thermal expansion estimates from Intergovernmental Panel on Climate Change (IPCC) SLR projections with the maximum possible glacier and ice sheet loss by the end of the century, and is therefore useful to consider in situations where there is little tolerance for risk. A recent article by Bamber and Aspinall (2013) supports using a high sea-level rise projection based on the likely impact of glacier ice sheet melting. Various Commonwealth of Massachusetts agencies, such as the Office of Coastal Zone Management (CZM), Massachusetts Department of Transportation (MassDOT) and Massport also rely on the projections produced by Parris et al. (2012). The SLR scenarios presented by Parris et al. (2012) for the U.S. National Climate Assessment are presented in Figure 3-10.

IMPACT

B3.a

As relative sea level rises, high water lines will move landward, coastal shorelines will retreat, and low-lying areas will be increasingly exposed to erosion, tidal inundation, and coastal storm flooding. Developed parts of the coast are especially vulnerable because of the presence of infrastructure that can be damaged or destroyed by coastal storms. In addition, development often impedes the ability of natural coastal systems to buffer inland areas from storm damage, further exacerbating the problem. Many coastal habitats are also vulnerable to rising sea levels, including salt marshes, beaches, and dune systems, because they are generally at or within a few feet of existing sea level.. These areas provide significant environmental benefits, including habitat value, filtering of pollutants for improved water quality, protection of inland areas from flooding and storm surge, and extensive recreational opportunities.

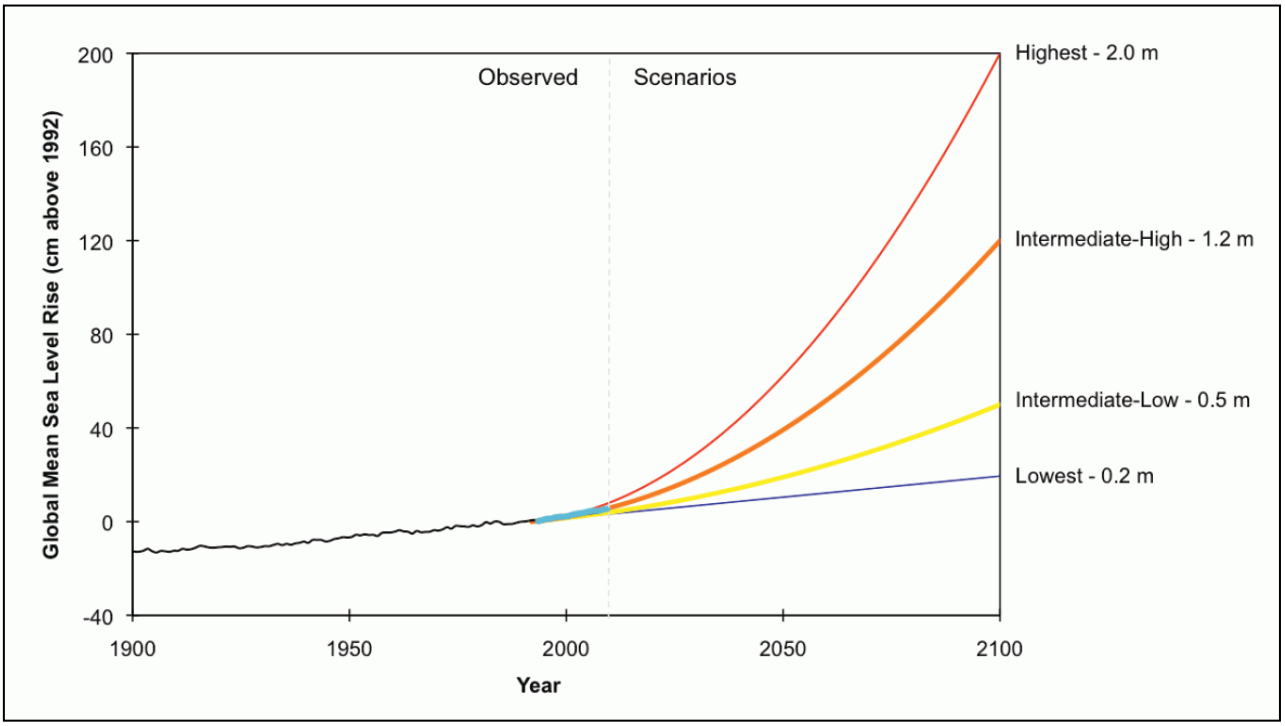

Figure 3-10. Sea-level rise projections from the National Climate Assessment (Parris et al. 2012).

B1.c

3.4 Hurricanes and Tropical Storms

Overview

A tropical cyclone is a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters. The hurricane season for the Atlantic Ocean extends from June 1st to November 30th, with the peak from mid-August to late October. However, deadly hurricanes can occur anytime during the hurricane season. Tropical cyclones are classified as follows (NHC 2016a), depending on their intensity:

- **Tropical Depression:** A tropical cyclone with maximum sustained winds of 38 mph (33 knots) or less.
- **Tropical Storm:** A tropical cyclone with maximum sustained winds of 39 to 73 mph (34 to 63 knots).
- **Hurricane:** A tropical cyclone with maximum sustained winds of 74 mph (64 knots) or higher. In the western North Pacific, hurricanes are called typhoons; similar storms in the Indian Ocean and South Pacific Ocean are called cyclones.
- **Major Hurricane:** A tropical cyclone with maximum sustained winds of 111 mph (96 knots) or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale.

Hurricanes are typically fast-moving storms (typically lasting 6 to 12 hours) with high winds in excess of 74 miles per hour and torrential rains averaging 6 to 8 inches, but possibly dropping as much as 15 to 20 inches of rainfall during a single event.

Hazard Location

The entire Town of Falmouth is vulnerable to hurricanes and tropical storms. Coastal areas are extremely susceptible to damage due to a combination of wind and storm surge. However, even inland areas can be affected by the flooding, strong winds and heavy rains associated with tropical cyclones.

Storm surge happens when water is pushed towards shore by the force of storm generated winds. An advancing storm surge combines with the water elevation of the normal tides to create a hurricane storm tide, which can increase water levels in Falmouth by as much as 10 ft. In addition, wind generated waves are superimposed on the storm surge. This rise in water level can cause severe flooding in coastal areas, especially when a storm surge coincides with a high tide. A general schematic showing the components of storm surge is displayed in Figure 3-11.

The US Army Corps of Engineers (USACE) New England Division, in cooperation with FEMA, prepared Sea, Lake and Overland Surge from Hurricanes (SLOSH) inundation maps. SLOSH maps show the extent of potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. However, the model considers only storm surge height and does not consider the effects of waves. When selecting model parameters, the USACE considered the highest wind speed for each category, the highest surge level, and the worst-case forward motion of the storm to develop a "worst case" scenario. The resulting inundation areas are grouped in Category 1 and 2, Category 3, and Category 4. Figure 3-13 shows the SLOSH results for Falmouth.

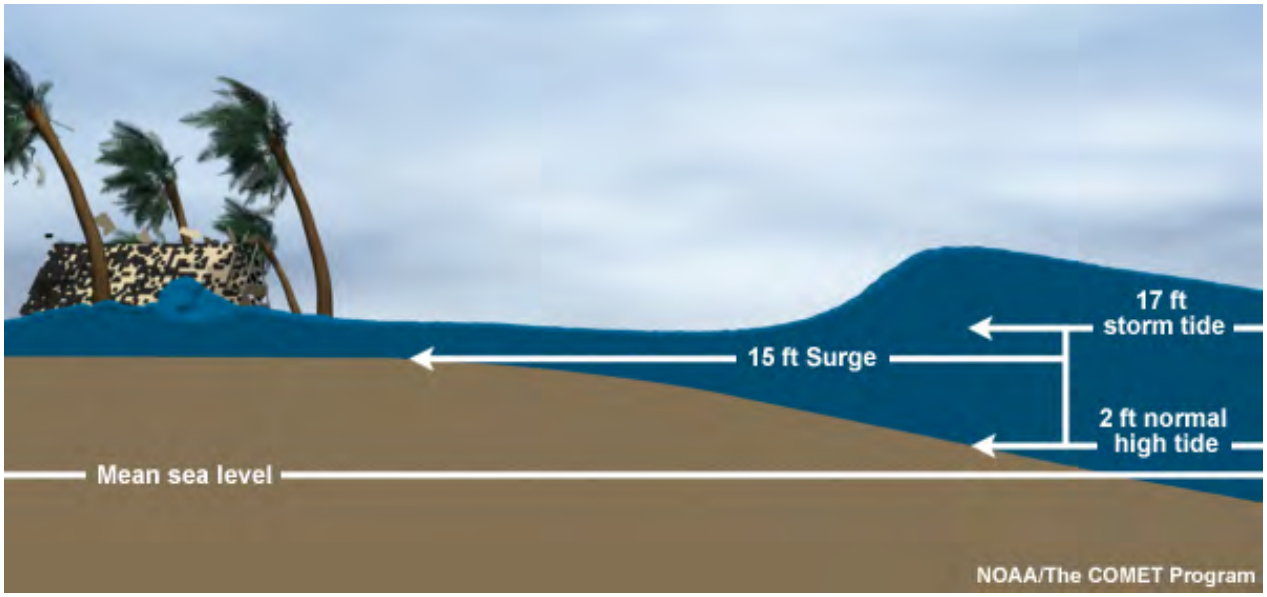

Figure 3-11. Schematic image of a storm surge and storm tide affecting a shoreline (NHC 2016c)

B1.c B2.a

Previous Occurrences & Extent

A hurricane has not made landfall in Falmouth for more than 25 years, with a major hurricane not occurring for more than 60 years. Smaller tropical storms and depressions have affected the area, generally inflicting minor damage such as some downed tree limbs, power outages, and limited damage to boating-related infrastructure. Table 3-4 provides a summary of historic hurricanes that have impacted the Town of Falmouth.

However, due to the large diameter of many hurricanes and tropical storms, and the far reaching effects of storm surge, even storms that don't make landfall in New England can have significant hazard impacts on Massachusetts, and on Falmouth. To illustrate the frequency of these storms, Figure 3-12 shows all hurricanes and tropical storms that have passed through the region between 1950 and 2016. Note that although major hurricanes occur approximately once every ten or twenty years in New England (Table 3-4), tropical storms (represented by the thin blue lines in Figure 3-12) are relatively common, occurring every few years.

Table 3-4. Major New England hurricanes.

Date	Name	Intensity
August 19, 1991	Hurricane Bob	Category 2/3
September 27, 1985	Hurricane Gloria	Category 2
September 12, 1969	Hurricane Donna	Category 2/3
September 11, 1954	Hurricane Edna	Category 3
August 31, 1954	Hurricane Carol	Category 3
September 15, 1944	Unnamed	Category 3
September 21, 1938	Unnamed	Category 3

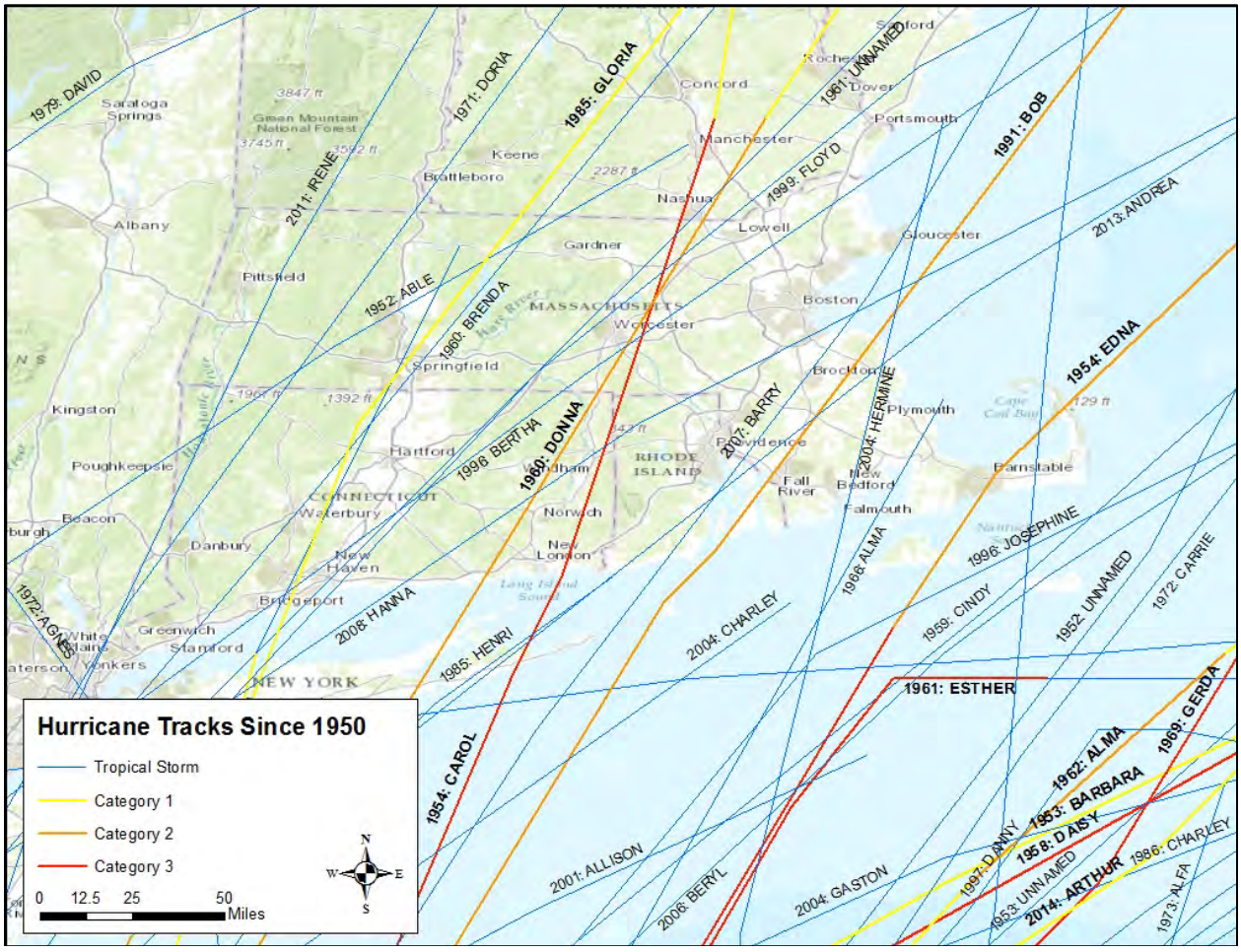

Figure 3-12. Hurricane and tropical storm tracks in the vicinity of Massachusetts between 1950 and 2016.

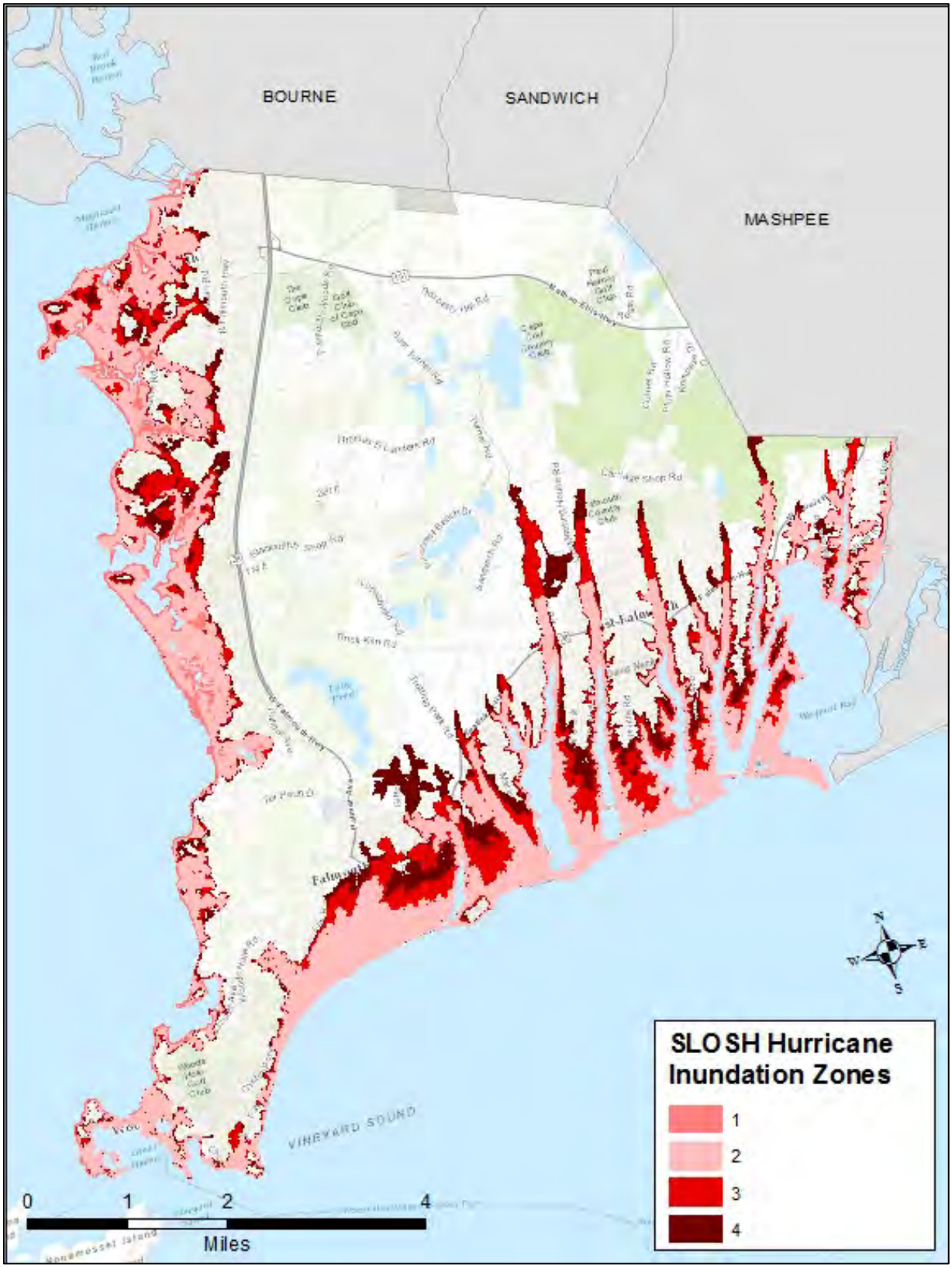

Figure 3-13. SLOSH categories for Falmouth.

The Saffir-Simpson Hurricane Wind Scale is often used to classify tropical cyclones. The Saffir-Simpson Scale, described in Table 3-5, outlines a rating system from 1 to 5 based on the hurricane's sustained wind speed. This scale is then used to estimate potential property damage. Hurricanes classified as a Category 3 or higher are considered major hurricanes due to their potential for devastating or catastrophic damage and loss of life.

Table 3-5. Saffir-Simpson Hurricane Wind Scale (NHC 2016b).

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	75-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

B2.b PROBABILITY

Based on the hurricane and tropical storm frequency presented in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is likely (between 10 and 100% probability in the next year) that a hurricane or tropical storm will impact Falmouth.

B3.a IMPACT

Below is a list of possible impacts that could result from a hurricane or tropical storm:

- **People:** Public safety is jeopardized when buildings and structures collapse due to coastal erosion, or emergency response is blocked by flooded roadways.

- **Emergency Response:** Heavy rains and flooding associated with hurricanes and tropical storms, as well as downed trees and branches caused by the high winds, can reduce the response time of emergency vehicles, or block access entirely.

- **Infrastructure:** High winds, heavy rains and coastal storm surge can cause widespread power outages, limited access to other utilities such as drinking water and communications, and limited transportation.

- **Buildings:** High coastal winds and storm surge can cause substantial damage to homes and businesses, and devastate coastal infrastructure such as marinas.

- **Economy:** Hurricanes and/or tropical storms can adversely impact businesses if a business's building is damaged by the storm, or if utilities or road access are affected.

- **Natural Systems:** Storm surge and wave action often associated with hurricanes and tropical storms can cause coastal erosion, potentially harming the town's natural ecosystem attractions (i.e. beaches, dunes, barrier beaches, salt marshes and estuaries). Over time, coastal erosion can reduce the ability of coastal landforms to provide storm damage and flooding protection.

- **Transportation:** Roadways can become damaged through shoreline erosion or be made impassible due to flooding.

Figure 3-14. Menahaunt Yacht Club before (top) and during (bottom) Hurricane Bob in 1991.

3.5 NOR'EASTERS

OVERVIEW

Snow storms and blizzards are common events in New England. A nor'easter is a particular kind of cyclonic winter storm that moves along the east coast of North America, from south to north; once these storms reach New England, they often intensify. It is called a nor'easter because the winds associated with the storm blow from a northeasterly direction. Sustained wind speeds of 20 to 40 mph are common during a nor'easter, with gusting often reaching 50 to 60 mph. In some cases the wind speed may actually meet or exceed hurricane force. These storms are often accompanied with heavy rain and/or snow, as well. Most nor'easters bring both storm surge and high winds to Cape Cod, making the coastline particularly vulnerable to damage.

B1.c

HAZARD LOCATION

Coastal areas of Falmouth are particularly susceptible to damages from wind, snow and storm surge during a nor'easter. However, it is also important to note that nor'easters can also bring heavy snow and flooding to the entire Town.

B1.c
B2.a

PREVIOUS OCCURRENCES & EXTENT

Nor'easters have the potential to inflict more damage than many hurricanes because the high storm surge and high winds can last anywhere from 12 hours to 3 days, while hurricanes usually last for a much shorter period of time. The most severe winter storm to ever hit New England was the Blizzard of 1888, which occurred in March of that year. Snow accumulations reached 30 to 50 inches where precipitation was entirely snow. Boston received a mix of snow and rain creating up to nine inches of slush. The Blizzard of 1978 resulted in 24 to 38 inches of snow across New England, immobilizing the infrastructure and blocking major highways, and causing thousands of motorists to abandon their cars on the road. Two weeks were required to remove the snow. The blizzard of 1978 resulted in a federal disaster declaration for many counties in Massachusetts, including Barnstable county (FEMA DR-546). A large nor'easter occurring in late October/early November in 1991 became known as the "Perfect Storm" after joining with Hurricane Grace and strengthening in intensity. During that nor'easter, winds measured over 80 mph with offshore waves over 30 feet high. The 1991 nor'easter resulted in a federal disaster declaration for many counties in Massachusetts, including Barnstable county (FEMA DR-920). More recent blizzards and snowstorms occurred in March 1993, February 1996, March 2001, January 2005, February 2013 (Winter Storm Nemo) and January 2015 (Winter Storm Juno).

Winter Storm Juno, in January 2015 was a powerful nor'easter that impacted the northeast. A state of Emergency was declared in Massachusetts and travel bans were issued in preparation for the storm. Other actions taken included opening all emergency shelters in Barnstable County, and cancelling transit and ferry services. The storm produced winds that gusted to 75 mph, a rain/snow mix that resulted in 15 to 18 inches of snowfall, coastal flooding that caused erosion in many areas across Cape Cod, and multi-day loss of electricity for most properties. This nor'easter resulted in a federal disaster declaration for many counties in Massachusetts, including Barnstable county (FEMA DR-4214).

B2.b PROBABILITY

New England generally experiences at least one or two nor'easters each year with varying degrees of intensity. Therefore, it is highly likely (near 100% probability in the next year) that a nor'easter will occur in Falmouth.

B3.a IMPACT

- **People:** Nor'easters often produce a significant amount of flooding, and the impacts are similar to that of the flooding impacts.
- **Emergency Response:** Snow and trees felled by high winds can reduce emergency vehicle response time.
- **Infrastructure:** Water infrastructure can be damaged (i.e. frozen and burst pipes). Utility outages can result from nor'easters.
- **Buildings:** Wind and flooding from storm surge can damage buildings. Also, because nor'easters often produce a significant amount of flooding, and the impacts are similar to that of the flooding impacts.
- **Economy:** Utility outages and damaged buildings can result in loss of business function. Roads blocked by snow and trees downed by high winds can reduce the potential customer base.
- **Natural Systems:** Snow and ice accumulation can negatively impact vegetation and natural habitat. Trees and tree limbs can be knocked down by the weight of accumulated snow, by high winds, or both. Beaches, coastlines and inlets can be reshaped by waves and storm surge associated with nor'easters.
- **Transportation:** Roadways can become impassable from storm surge, debris, and accumulated snow.

Figure 3-15. Residents digging out the day after Winter Storm Nemo (February 2013).

3.6 Severe Winter Event

Overview

Snow storms and blizzards are common events in New England. These storms are often high duration events with significant winds and heavy snowfall. Sleet and ice storms result when temperatures are appropriate for precipitation to fall as frozen or mostly frozen raindrops, or liquid rain that freezes upon contact with structures and objects on the ground. Travel is often limited and disruptions to power and other utility delivery are a high potential. Coastal flooding can occur during these events, especially with westerly winds. On average Falmouth receives 31.76 inches of snow per year and on average has a one in five chance of at least one snow event greater than one foot.

In addition to many of the same hazards posed by other natural disasters, winter storms have the added hazard associated with cold weather for prolonged periods of time. Unlike disasters occurring during the summer months such as hurricanes, power outages may result in extended periods of no heat. Prolonged contact with low temperatures can cause pipes to freeze and burst, damaging homes and businesses. Winter storms pose additional health problems with the added strain of contact with freezing temperatures, especially for the elderly.

B1.c

Hazard Location

The entire Town of Falmouth is at risk from snow, blizzards and ice. The Northeast Regional Climate Center has compiled 30-year annual snow totals in New England and the eastern United States. Figure 3-16 shows that the Falmouth area averaged 20 to 40 inches of snowfall annually between 1981 and 2010.

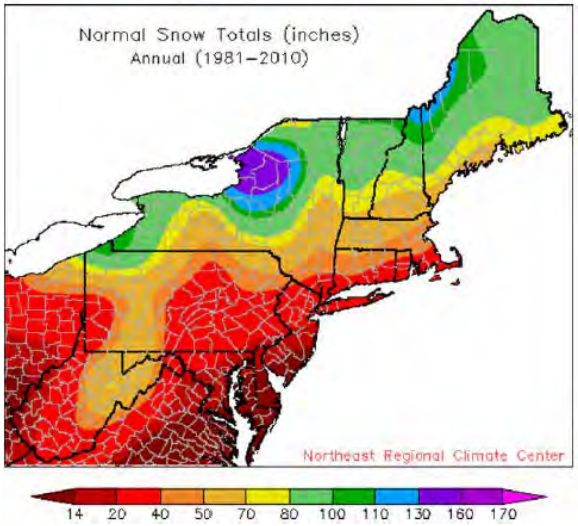

Figure 3-16. Normal annual snowfall from 1981 to 2010 (from 2013 MA State Hazard Plan).

Previous Occurrences & Extent

B1.c
B2.a

Winter storms occur quite frequently, but due to preparation by the town and its residents, typically amount to no more than a minor inconvenience. School delays and slow travel occur but crippling winter storms are a rarity. However, they do occur. Table 3-6 below provides a list of major winter storms from 2006 to 2016.

The Northeast Snowfall Impact Scale (NESIS) was developed by the National Weather Service to characterize and rank high-impact Northeast snowstorms. A "High-impact" snowstorm is one that produces large areas of 10 inch snowfall accumulations or greater.

Table 3-6. Major winter storms in New England (2006-2016).

Date	NESIS	Cat	Description
Feb 12-13, 2006	4.1	3	Major
Feb 12-15, 2007	5.63	3	Major
Mar 15-18, 2007	2.54	2	Significant
Mar 1-3, 2009	1.59	1	Notable
Dec 18-21, 2009	3.99	2	Significant
Feb 4-7, 2010	4.38	3	Major
Feb 9-11, 2010	4.1	3	Major
Feb 23-28, 2010	5.46	3	Major
Dec 24-28, 2010	4.92	3	Major
Jan 9-13, 2011	5.31	3	Major
Jan 26-27, 2011	2.17	1	Notable
Feb 1-3, 2011	5.3	3	Major
Oct 29-30, 2011	1.75	1	Notable
Feb 7-10, 2013	4.35	3	Major
Mar 4-9, 2013	3.05	2	Significant
Dec 13-16, 2013	2.95	2	Significant
Dec 30, 2013 - Jan 3, 2014	3.31	2	Significant
Jan 20-24, 2014	1.26	1	Notable
Jan 29-Feb 4, 2014	4.08	3	Major
Feb 11-14, 2014	5.28	3	Major
Nov 26-28, 2014	1.56	1	Notable
Dec 9-14, 2014	1.49	1	Notable
Jan 25-28, 2015	2.62	2	Significant
Jan 29-Feb 3, 2015	5.42	3	Major
Feb 8-10, 2015	1.32	1	Notable
Jan 22-24, 2016	7.66	4	Crippling

The NESIS has five categories: Notable, Significant, Major, Crippling, and Extreme (Table 3-7). This index differs from other meteorological indices, however, because it uses population information in additional to meteorological measurements; the NESIS gives a ranking to the societal impacts of a storm. NESIS values are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The largest NESIS values result from storms producing heavy snowfall over large areas that include metropolitan centers. These values are then converted into one of the five NESIS categories (NOAA 2016c).

Table 3-7. NOAA's Northeast Snowfall Impact Scale (NESIS).

Category	NESIS Value	Description
1	1 – 2.499	Notable
2	2.5 – 3.99	Significant
3	4 – 5.99	Major
4	6 – 9.99	Crippling
5	10+	Extreme

PROBABILITY

B2.b

Based on the snow frequency of occurrence predicted in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that snow will occur in Falmouth.

IMPACT

B3.a

- **People:** Walking and driving can become extremely dangerous due to icy roads and sidewalks, snow accumulation, and low visibility. Poor driving conditions often require people to shelter in place, and loss of utility function can result in dangerous conditions during extreme cold temperatures associated with snow events. Injury is also possible from slipping on ice, overexertion from shoveling, and frostbite.

- **Emergency Response:** Snow, icy roads, and trees felled by storm

conditions can reduce emergency vehicle response time.

- **Infrastructure:** Culverts and roads can be washed out during a heavy flow after a snowmelt. Ice and heavy snowfall can impact and cut off utilities, such as heating, power, and communication services, for several hours or days. Water pipes can burst due to extreme cold temperatures.

- **Buildings:** Buildings and roofs can experience structural failure as a result of heavy snow loads.

- **Economy:** Poor driving conditions and closed roads prohibit businesses from opening and people from going to work. Heavy snowfalls result in increased cost to the Town for plowing, snow removal, and treatment of roads.

- **Transportation:** Roadways can become extremely dangerous due to icy conditions, snow accumulation, and low visibility. Public transportation is also occasionally shutdown as a result of heavy snowfall.

Figure 3-17. Plowed road and shoveled sidewalks on Main Street after a snow storm.

3.7 Severe Weather

3.7.1 Thunderstorms & Lightning

Overview

A thunderstorm is a storm that produces lightning and thunder and is usually accompanied by gusty winds, heavy rain, and sometimes hail. The National Weather Service defines a severe thunderstorm as one that produces a tornado, winds of at least 58 mph (50 knots or ~93 km/h), and/or hail at least 1 inch in diameter**.** Structural wind damage may imply the occurrence of a severe thunderstorm. A thunderstorm wind equal to or greater than 40 mph (35 knots or ~64 km/h) and/or hail of at least ½ inch is defined as approaching severe. Lightning is one of the most dangerous aspects of a thunderstorm, and it can strike up to 10 miles away from the main thunderstorm location; however, because lightning occurs during every thunderstorm, its presence does not indicate a "severe" thunderstorm.

Three basic ingredients are required for a thunderstorm to form: moisture, rising unstable air (air that keeps rising when given a nudge), and a lifting mechanism. The sun heats the surface of the earth, which warms the air above it. If this warm surface air is forced to rise—by hills or mountains, or areas where warm/cold or wet/dry air bump together—it will continue to rise as long as it weighs less and stays warmer than the air around it. As the air rises, it transfers heat from the surface of the earth to the upper levels of the atmosphere (the process of convection). The water vapor it contains begins to cool, releasing the heat; and it condenses into a cloud. The cloud eventually grows upward into areas where the temperature is below freezing. Some of the water vapor turns to ice, and some of it turns into water droplets. Both have electrical charges. Ice particles usually have positive charges, and rain droplets usually have negative charges. When the charges build up enough, they are discharged in a bolt of lightning, which causes the sound waves we hear as thunder.

Hazard Location

B1.c

The entire Town of Falmouth is at risk from thunderstorms. NOAA has compiled data about the annual number of thunderstorms across the United States. Figure 3-18 shows the annual number of thunderstorms in the northeastern United States. The arrow shows that all of eastern Massachusetts, including Falmouth, falls in the darker blue area, which receives, on average, 10-20 thunderstorms per year.

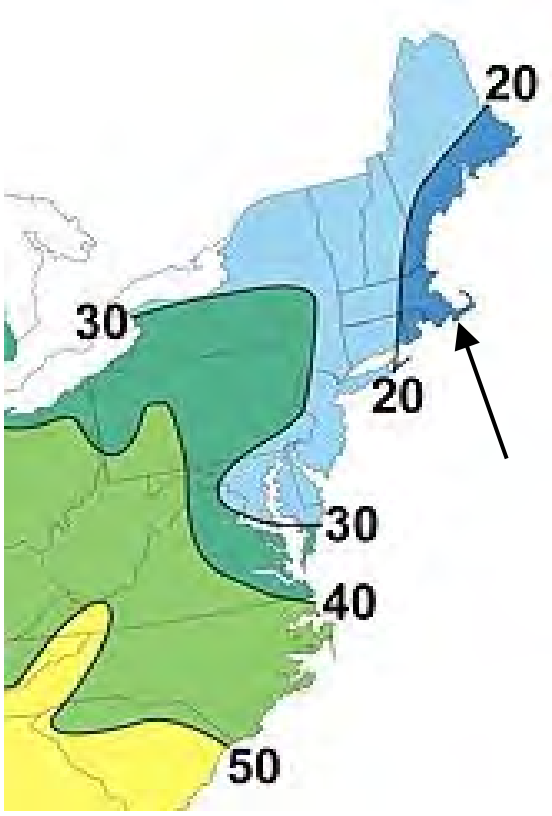

Figure 3-18. Annual number of thunderstorms.

B1.c
B2.a

Previous Occurrences & Extent

NOAA's National Center for Environmental Information maintains a Storm Events Database. In the last 10 years, 48 lightning and/or thunderstorm wind events were reported for Barnstable County (NOAA 2016a). The events with a location specific to the Falmouth area are summarized in Table 3-8.

There are a variety of types of thunderstorms:

- Single-cell thunderstorms, which are small, brief, weak storms that can develop and then dissipate within an hour. They are typically produced by heating on a summer afternoon. Single-cell storms produce brief, heavy rain and lightning.
- Multi-cell storms form along the leading edge of rain-cooled air. Although individual cells that comprise the multi-cell storm can only last 30-60 minutes, the entire multi-cell storm system can persist for many hours. Multi-cell storms may produce hail, strong winds, brief tornadoes and flooding.
- A squall line is a group of storms arranged in line, often associated with "squalls" of heavy wind and rain. These storms tend to pass quickly and are less likely to produce tornadoes than supercells. A squall line can be hundreds of miles long, but tend to only be 10-20 miles wide.
- A supercell is a highly organized, long-lived storm fueled by an updraft that is tilting and rotating. These tilting and rotating updrafts can produce severe tornadoes.

Table 3-8. Reported thunder and lightning weather events in Falmouth between 2006 and 2015.

Location	Date	Event Type
Falmouth	July 18, 2006	Thunderstorm Wind
East Falmouth	November 17, 2006	Thunderstorm Wind
Falmouth	March 5, 2008	Thunderstorm Wind
West Falmouth	August 11, 2008	Thunderstorm Wind
Woods Hole	August 12, 2008	Lightning
Falmouth	June 23, 2013	Thunderstorm Wind
East Falmouth	November 17, 2014	Thunderstorm Wind
Falmouth	June 23, 2015	Thunderstorm Wind
East Falmouth	June 23, 2015	Thunderstorm Wind
West Falmouth	June 23, 2015	Thunderstorm Wind
Woods Hole	June 23, 2015	Thunderstorm Wind
East Falmouth	July 1, 2015	Thunderstorm Wind
Falmouth	August 4, 2015	Thunderstorm Wind

B2.b

PROBABILITY

Based on the annual number of thunderstorm occurrences in Figure 3-10, as well as the likelihood of high winds and heavy downpours (both hazards heavily correlated with thunderstorms) listed in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that thunderstorms will occur in Falmouth.

B3.a

IMPACT

Below is a list of possible impacts that could result from thunderstorms:

- **People:** Thunderstorms can result in power outages, leaving people without heat or other utilities. Lightning may cause injury or death to people who are outdoors during the onset of a thunderstorm, if they are unable to seek shelter.
- **Emergency Response:** Trees and power lines felled by high winds and/or lightning can impede emergency vehicles.
- **Infrastructure:** Lightning and high winds can result in downed power lines. Heavy rains associated with thunderstorms can result in flooded roads and overwhelm drainage systems.
- **Buildings:** Wind and wind-born debris can damage roofs, windows and other portions of houses and buildings. Heavy rains and flooding can damage properties. Lightning strikes can start fires, which can threaten buildings and structures.
- **Economy:** Power outages can force businesses to close temporarily.
- **Natural Systems:** Heavy winds can bring down trees and branches.

3.7.2 High Wind

Overview

Major wind events are hurricanes and nor'easters. Tornadoes are extremely rare on Cape Cod, although they do occur. During Hurricane Bob in 1991 a small tornado was confirmed in Falmouth in the vicinity of Goodwill Park. Fortunately damage was limited. Water spouts have been seen in Cape Cod Bay. Thunderstorms, especially in the summer months, do occur and can bring localized damage due to wind, especially to summer cottages of poorer construction and old or rotted tree limbs (Figure 3-19).

B1.c

Hazard Location

In their effort to research potential sites for wind energy facilities, the Executive Office of Energy and Environmental Affairs (EOEEA) put considerable effort into measuring wind velocities in Massachusetts. These efforts produced four sets of data, representing mean wind speed at different elevations above the land's surface: 30, 50, 70 and 100 meters. The mean wind speed, in miles per hour, at 30 meters above the land's surface is shown for Falmouth in Figure 3-20.

The hatched area in Figure 3-20 shows the Falmouth Wind District, which represents the Wind Born Debris Region. This region encompasses all areas within one mile of the coastal mean high water line where the basic wind speed can be 110 miles per hour or greater. Basic wind speed measures a 3 second gust 10m above the surface. The magnitude of gust speeds (i.e. exceeding 100 mph) can far exceed the averages presented in Figure 3-20. Within this Wind District, specific building code regulations apply to mitigate for the potential impacts of high winds. It is clear from Figure 3-20 that high winds are a significant hazard along and near the coastline of Falmouth.

Figure 3-19. High winds can take down trees and branches, blocking roads and compromising utility lines (Photo credit: Carrie Gentile; Falmouth Enterprise)

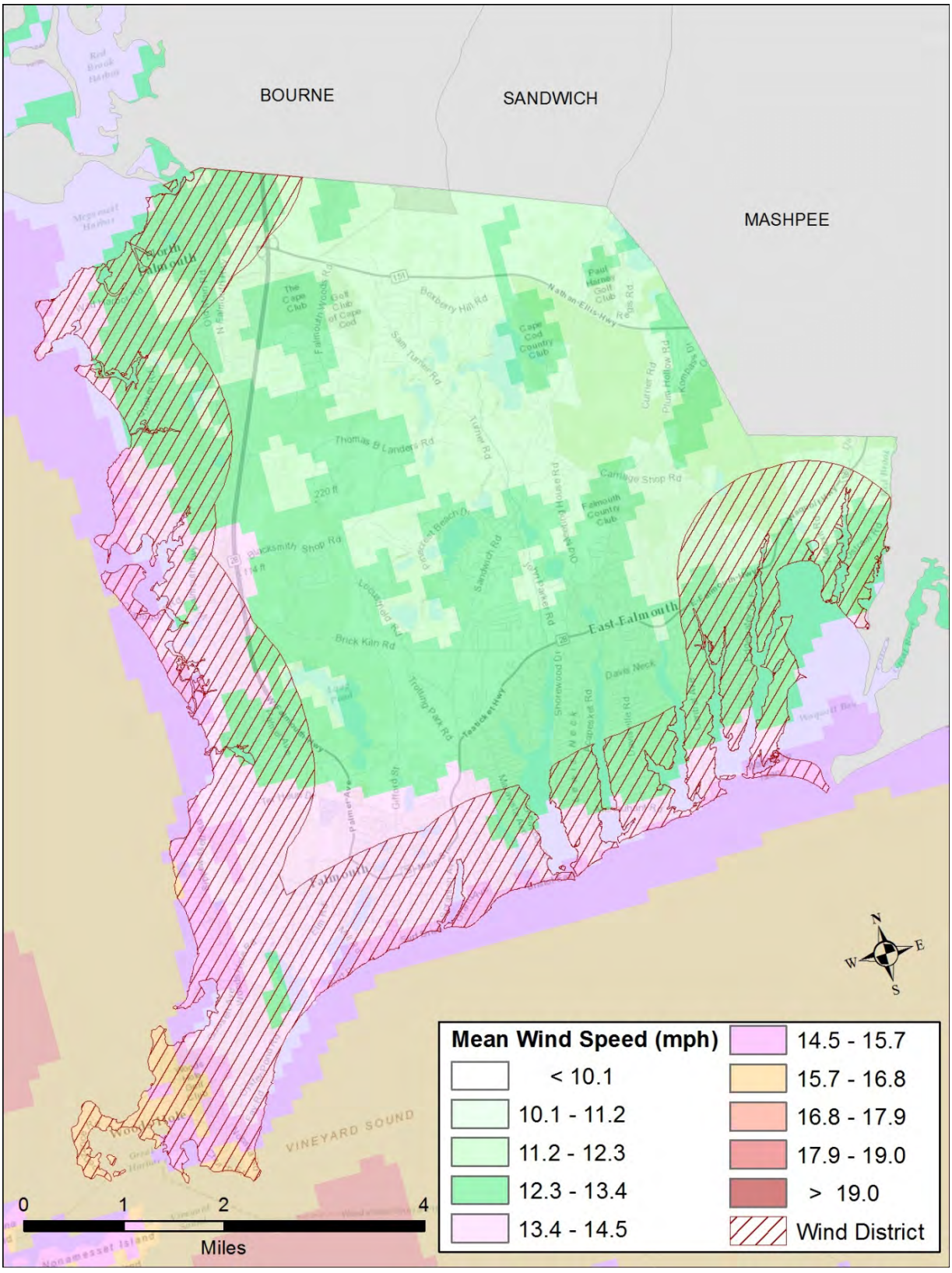

Figure 3-20. Mean wind speed (mph) at 30 meters above the surface.

B1.c
B2.a

Previous Occurrences and Extent

Wind speeds are recorded continuously in Waquoit Bay by NOAA. From January 1st, 2006 to January 1st, 2016 the average wind speed was reported at 15 minute intervals (Figure 3-21). The average wind speed between 2006 and 2016 was 4.03 mph. Maximum wind speeds are also reported during each 15 minute interval (Figure 3-21). The average maximum wind speed during this same time period was 9.65 mph. The graphs below, however, only represent daily averages, but each day may have winds of much higher or lower velocity. For example, the highest reported wind gust was recorded on March 26, 2014 at 45.19 mph. This gust occurred during a large blizzard which delivered 1-4 inches of snow to Falmouth.

In general, the average wind speed begins decreasing around March reaching its lowest points in July and August. The average speed then picks up with the onset of fall, peaking in the winter. The maximum wind speeds follow the same trend.

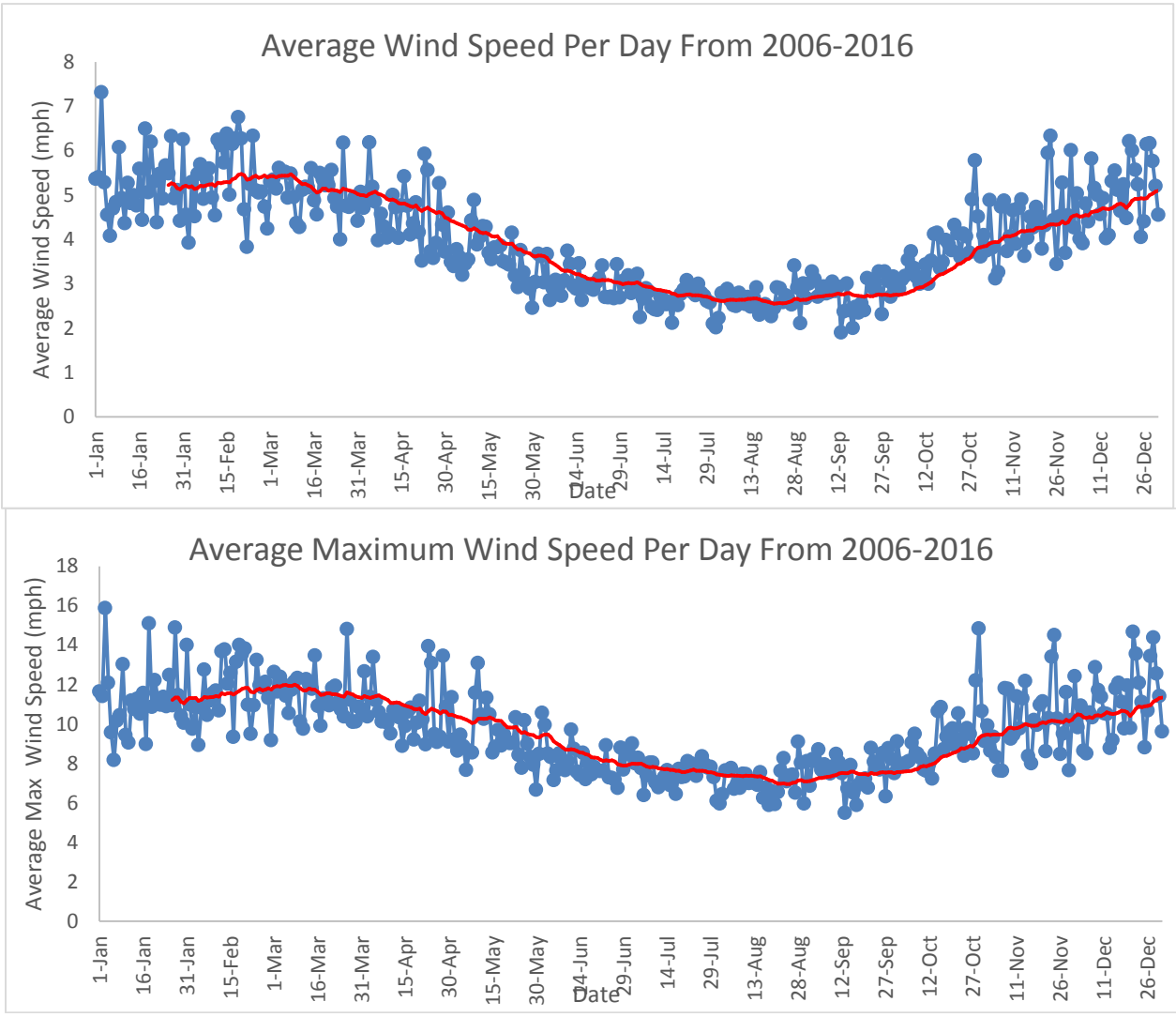

Figure 3-21. Average and average maximum wind speed per day from 2006-2016 from the Waquoit Bay Meteorological Station.

A summary of the high wind incidences at the Waquoit Bay meteorological station is provided in Table 3-9. Note that each "incidence" represents a data point from each 15-minute interval within the 10-year dataset.

Table 3-9. Summary of high wind incidences from Waquoit Bay Meteorological Station between 2006 and 2016.

Wind Speed (mph)	Number of Incidences the Average Wind Speed Was:	Number of Incidences the Maximum Wind Speed Was:
≥ 20.0	23	18,338
≥ 25.0	1	4,900
≥ 30.0	0	966
≥ 35.0	0	142
≥ 40.0	0	13
≥ 45.0	0	1

The National Weather Service issues a variety of warnings related to wind hazards. They are:

- High Wind Watch: Issued when the following conditions are *possible* – sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph for one hour or more.
- High Wind Warning: Issued when the following conditions are *occurring or imminent* – sustained winds of 40 mph or higher for one hour or more, or wind gusts of 58 mph for one hour or more.
- Hurricane Watch: Issued when a tropical cyclone containing winds of 74 mph or higher poses a *possible* threat, generally within 48 hours.
- Hurricane Warning: Issued when sustained winds of 74 mph or higher associated with a tropical cyclone are expected in 36 hours or less.
- Wind Advisory: Issued when the following conditions are expected for 3 hours or longer – sustained winds of 31 to 39 mph and/or wind gusts of 46 to 57 mph.
- Extreme Wind Warning: Issued for surface winds of 115 mph or greater associated with non-convective, downslope, derecho (not associated with tornado), or sustained hurricane winds are expected to occur within one hour.
- Small Craft Advisory: Issued when one or all of the following conditions are expected to occur within 36 hours – sustained winds of 18 to 33 knots or frequent gusts (with a duration of 2 hours or more) between 18 to 33 knots or waves of 4 feet or higher.
- Gale Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 34 to 47 knots or frequent gusts (with a duration of 2 hours or more) between 34 to 47 knots.
- Storm Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 48 to 63 knots or frequent gusts (with a duration of 2 hours or more) between 48 to 63 knots.

- Hurricane Force Wind Warning: Issued when one or both of the following conditions are expected to occur within 36 hours and is not directly associated with a tropical cyclone – sustained winds of 64 knots or greater or frequent gusts (with a duration of 2 hours or more) between 64 knots or greater.

B2.b PROBABILITY

Based on the frequency of occurrence listed for wind hazards in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that wind hazards will occur in Falmouth.

B3.a IMPACT

Below is a list of possible impacts that could result from wind:

- **People:** High wind events can result in power outages, leaving people without heat or other utilities.
- **Emergency Response:** Trees and power lines felled by high winds can impede emergency vehicles.
- **Infrastructure:** Lightning and high winds can result in downed power lines. High wind events can generate significant waves which can damage coastal infrastructure and moored/ docked vessels.
- **Buildings:** Wind and wind-born debris can damage roofs, windows and other portions of houses and buildings.
- **Economy:** Power outages can force businesses to close temporarily.
- **Natural Systems:** Heavy winds can bring down trees and branches.

Figure 3-22. The destruction of the roof at the Admiralty Apartment building from the wind gusts during Hurricane Bob.

3.7.3 Drought

Overview

Drought is an extended period of time where a region experiences a notable reduction in available water supply typically caused by a lack of precipitation. Drought can affect either surface water or groundwater sources. Though most droughts in Massachusetts last only a matter of months, it is possible for drought conditions to extend over a period of years due to reduced rainfall and snowfall accumulations contributing to lower groundwater and surface water levels.

B1.c

Hazard Location

The entire Town of Falmouth is equally vulnerable to drought.

B1.c B2.a

Previous Occurrences & Extent

Significant periods of drought have occurred in Barnstable County, and Falmouth specifically, in the past. Table 3-10 provides a summary of the historic long-term drought events in Barnstable County from the Massachusetts Department of Conservation and Recreation (DCR) precipitation database. DCR also compiles monthly Precipitation Composite water conditions reports, summarizing the rainfall and its diversion from average conditions for each of the 6 regions in the state (Cape Cod and Islands, Central, Connecticut River, Northeast, Southeast, and Western). Data for the Cape Cod and Islands region from the last twelve (12) months is summarized in Table 3-11.

The data in Tables 3-10 and 3-11 show that while a significant drought is relatively uncommon on Cape Cod (only 7 drought warnings in more than 80 years), and the total rainfall from the last twelve (12) months is within 0.07 inches of average, droughts do occur and they have occurred on Cape Cod and in Falmouth specifically.

Table 3-10. Historic drought event details for Barnstable County (1919 to 2002).

Number of Distinct Warnings	7
Number of Distinct Emergencies	4
Total Number of Months in Emergency	31

Table 3-11. Summary of Cape Cod and Islands rainfall from DCR Water Resources Data Collection Analysis Program (2015-2016)

Month-Year	Total Rainfall (inches)	Departure from normal (inches)
Jul-15	3.63	-0.23
Aug-15	2.72	-0.97
Sep-15	3.41	-0.16
Oct-15	6.2	2.47
Nov-15	4.2	-0.02
Dec-15	5.31	1.12
Jan-16	3.87	0.17
Feb-16	3.5	2.33
Mar-16	4.27	-0.61
Apr-16	4.02	0.37
May-16	4.02	-1.1
Jun-16	4.02	-3.44
Total	49.17	-0.07

There are five levels of drought that have been developed to characterize the severity of the event:

1) Normal
2) Advisory
3) Watch
4) Warning
5) Emergency

These levels are based on the regional conditions and are designed to provide information about the current status of water resources. A drought advisory calls for a heightened level of vigilance and increased data collection as conditions begin to deviate from normal. During a drought watch, increased assessment would continue, in addition to proactive public education about water conservation. Water restrictions might become necessary during the watch or warning stage, depending on the capacity and condition of each water supply system. A drought warning is issued during a severe situation and the possibility of a drought emergency may be issued. Finally, a drought emergency often requires mandatory water restrictions and/or the use of emergency water supplies (EOEEA 2013). These categories and their associated characteristics are summarized in Table 3-12.

Based on the categories outlined in Table 3-12, the Massachusetts Executive Office of Energy and Environmental Affairs has compiled information about past drought declarations at a regional level. Drought declarations from 2001 to 2014 for Cape Cod and the Islands are detailed in Table 3-13. There was a relatively long drought from December 2001 to November 2002, ranging in severity from an Advisory to a Watch, but since then only a single 2-month Drought Advisory was declared in 2014 (Table 3-13).

Table 3-12. Drought indices from the Massachusetts Drought Management Plan.

Drought Level	Precipitation	Groundwater	Streamflow	Reservoir
Normal	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for time of year
Advisory	2 month cumulative total below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index reservoirs below normal
Watch	1 of the following: 3 month cum. <65%; **or** 6 month cum. <70%; **or** 12 month cum. <70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index reservoirs below normal
Warning	1 of the following: 3 month cum. <65% and 6 month cum <65%; **or** 6 month cum. <65% and 12 month cum. <65%; **or** 3 month cum. <65% and 12 month cum. <65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
Emergency	Same Warning **and** previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions

B2.b PROBABILITY

Based on the data summarized above about past drought conditions on Cape Cod, the probability that a drought will occur in Falmouth in the future is possible (between 1% and 10% probability in the next year, or at least one chance in the next 100 years).

B3.a IMPACT

- **People:** Drought conditions can increase conflicts between water users. Water conservation actions may impact users' activities. Reduction in drinking water supply. Health related issues may arise due to dust inhalation.
- **Infrastructure:** Droughts can result in lower water levels in reservoirs.
- **Economy:** Farmers experience financial losses if a drought destroys their crops. Finances may need to be diverted to provide additional irrigation or drill new wells. Businesses that depend on farming may lose business. Food costs may increase.
- **Natural Systems:** Loss of fish habitat as streams, rivers, and ponds dry up. Lack of food and drinking water for wildlife. Wildlife may be forced to migrate to find adequate resources. Wildfires may become more common.

Table 3-13. Drought dates and levels from Massachusetts DCR for the Cape & Islands Region.

Year	Begin Date	End Date	Cape & Islands Drought Status
2001-2002	12/28/2001	2/28/2002	Advisory
2002	3/1/2002	5/31/2002	Watch
2002	6/1/2002	7/31/2002	Advisory
2002	8/1/2002	9/30/2002	Watch
2002	10/1/2002	11/30/2002	Advisory
2014	10/1/2014	11/30/2014	Advisory

3.7.4 Extreme Temperature

Overview

There is no defined cut-off for what defines extreme temperatures. Instead, extreme temperatures are considered relative to the usual weather in a region based on long-term climatic averages. According to the Massachusetts State Hazard Mitigation Plan, extreme heat for this region is usually defined as a period of three or more consecutive days with temperatures above 90°F. However, more generally it can be thought of as a prolonged period of excessively hot weather, which is often accompanied by high humidity. Similarly, extreme cold is also relative to normal climatic lows in the region. Temperatures that drop well below normal, especially when accompanied by high winds can produce dangerous wind-chill factors. The wind-chill is the perceived decrease in air temperature felt by the body on exposed skin due to the flow of air.

Since extreme temperatures are defined relative to normal conditions, it is important to know the average temperatures for the region for a particular season. The average winter temperature (Dec-Feb) for Massachusetts is 27.5°F, while the average summer temperature (Jun-Aug) is 68.2°F.

B1.c

Hazard Location

The entire Town of Falmouth is equally vulnerable to extreme temperature hazards.

B1.c
B2.a

Previous Occurrences & Extent

NOAA's National Centers for Environmental Information houses a Storm Events Database, which includes accounts of Cold/Wind Chill, Extreme Cold/Wind Chill, Heat, and Excessive Heat. Querying the data for these types of events for the past 10 years returned three occurrences of extreme temperature:

1) July 6, 2010: Temperatures neared 100°F with a high percent of relative humidity. Heat index values at main Cape Cod observation stations ranged from 100 to 102 degrees.

2) July 22, 2011: High temperatures and high humidity levels brought the heat index above 105 for a three hour period, as measured at the Coast Guard Air Station Cape Cod.

3) February 14, 2016: An arctic high pressure system brought strong northwest winds and extremely cold wind chills to southern New England. A wind chill of -32°F was reported in Falmouth.

NOAA's National Weather Service (NWS) has developed a Heat Index, which measures how hot it feels when relative humidity is considered along with the actual air temperature (Figure 3-23). Relative humidity is the amount of atmospheric moisture present relative to the amount that would be present if the air were fully saturated. For example, a 90°F day with 80% humidity would have a heat index of 113°F, and there is a dangerous likelihood of heat disorders with prolonged exposure or strenuous activity. The NWS issues alerts when the Heat Index is expected to exceed 105-110°F (depending on local climate) for at least 2 consecutive days.

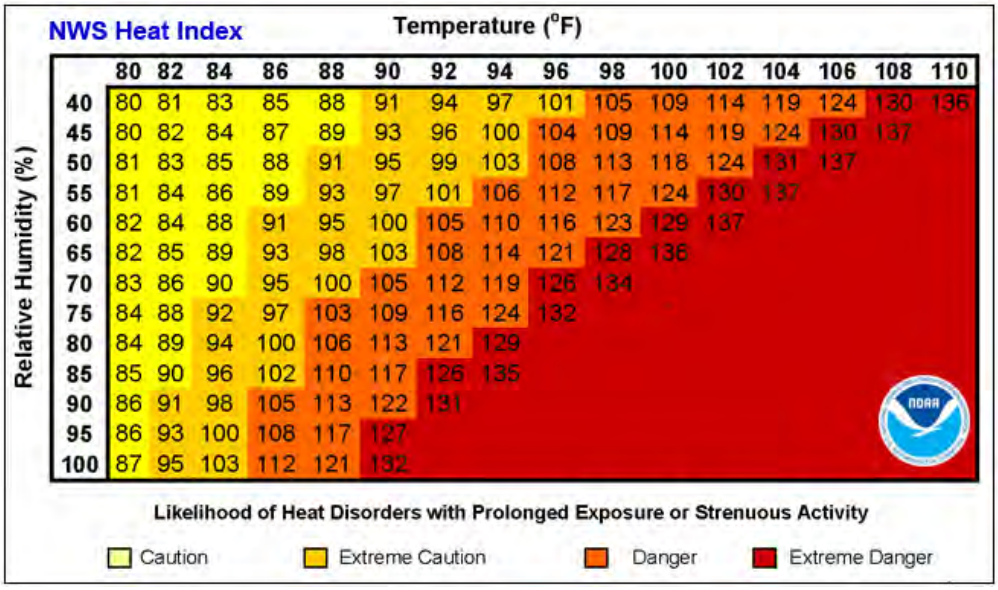

Figure 3-23. NWS's Heat Index.

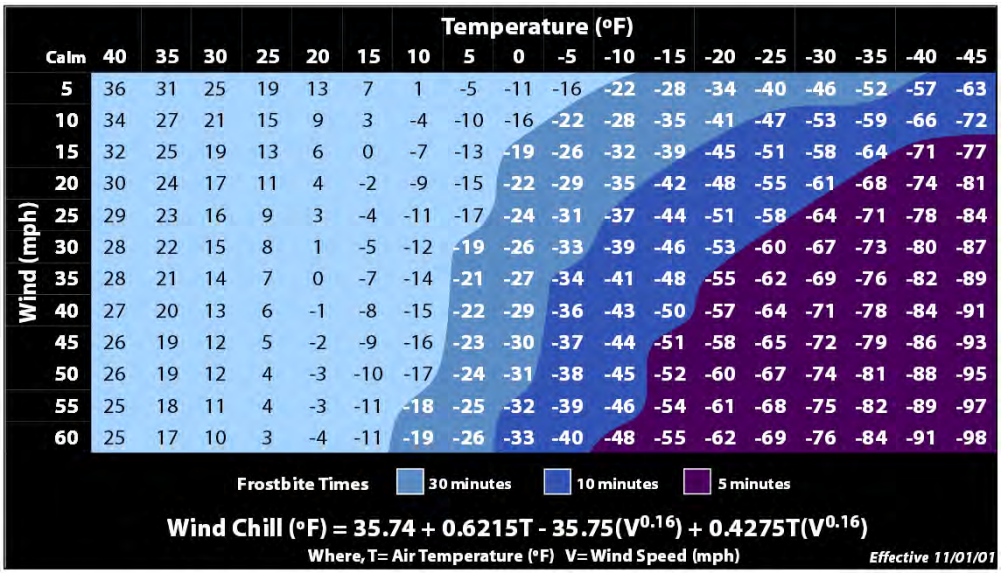

Figure 3-24. NOAA's Wind Chill Chart.

Windchill temperature indicates how cold it feels outside, based on the rate of heat loss from exposed skin caused by the combination of wind and cold. Because wind draws heat from the body, reducing skin temperature, as well as internal body temperature, the wind actually makes it feel colder than the absolute temperature would indicate. Frostbite is the result of body tissue (i.e. skin) freezing. The most vulnerable parts of the body are the fingers, toes, ears and nose. The National Weather Service's Windchill Temperature Index provides a useful method for calculating the dangers from extreme cold temperatures and winter winds, and the amount of time exposed skin will take to get frostbite (Figure 3-24). According to the chart in Figure 3-24, if it is 0°F with a 15 mph, the windchill temperature would be -19°F and it would take exposed skin 30 minutes to get frostbite. The index calculates wind speed at

an average height of 5 feet above the ground's surface, the typical height of a person's face, from the measured wind data collected from standard 33-foot high anemometers.

B2.b

PROBABILITY

Based on the data summarized above about past extreme temperature conditions on Cape Cod, and in Falmouth specifically, the probability that extreme temperatures will occur in Falmouth in the future is likely (between 10% and 100% probability in the next year, or at least one chance in the next 10 years).

IMPACT

B3.a

Below is a list of possible impacts that could result from extreme hot or cold temperatures:

- **People:** Excessive heat poses serious health risks, including death.
- **Emergency Response:** Stress will be placed on the cooling systems of emergency vehicles in extreme heat.
- **Infrastructure:** Highways and roads can be damaged by excessive heat as asphalt softens. Both extreme heat and extreme cold can put significant strain on power utilities, as users' energy needs increase to run air conditioners or heaters.
- **Economy:** Transported refrigerated goods experience a higher degree of spoilage during excessive heat conditions. Agriculture and livestock can be adversely impacted by extreme heat.
- **Natural Systems:** Extreme heat can reduce water levels in natural ponds and reservoirs, as well as increase surface water temperatures to dangerous levels. Both can have an adverse impact on fish and wildlife.

3.7.5 TORNADO

OVERVIEW

Tornadoes are a vortex of rapidly rotating air moving along the ground. Tornadoes typically occur during the spring, summer and fall months, usually during the afternoon. Tornadoes may occur in unusually severe thunderstorms, bringing hazards such as very high wind speeds (typically anywhere from 100 to 300 miles per hour) along a localized area, localized heavy rainfall and flooding, frequent lightning and damaging hail.

Tornadoes may be anywhere from less than 250 feet to over two miles in diameter. Typically, tornadoes dissipate after no more than a couple miles on the ground; however they have been known to stay on the ground for dozens of miles, causing substantial damage along the way. Although not common, tornadoes have occurred in every state of the U.S. In Massachusetts, tornadoes occur most frequently in and around Worcester County, however may occur wherever conditions are right. According to NOAA, Barnstable County is located in an area of very low probability of occurrence, with less than one tornado expected to occur every five years.

HAZARD LOCATION

B1.c

NOAA's National Weather Service maintains a database of tornado information in the United States. The data include information on date, start and end location, number of injuries and fatalities, and categories of property loss values from each storm. There have been 164 tornadoes documented in Massachusetts since 1951 (Figure 3-25); of these, only 3 have occurred in on the Cape and Islands, and 0 have occurred within the Town of Falmouth itself.

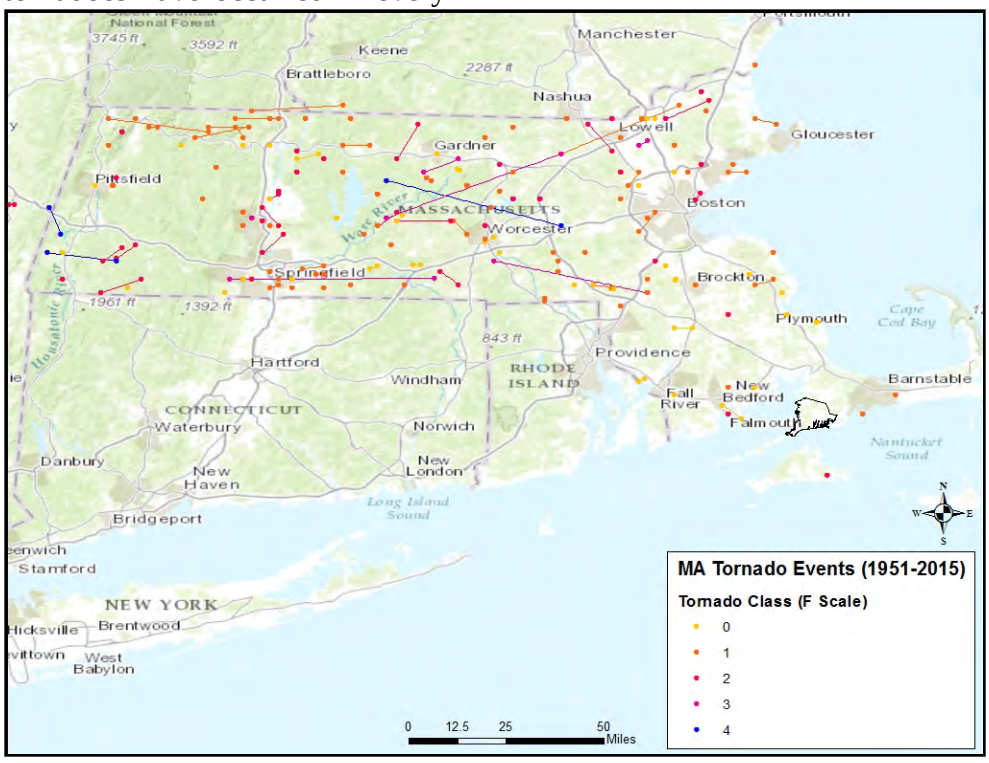

Figure 3-25. Recorded tornado events in Massachusetts between 1951 and 2015.

B1.c
B2.a

Previous Occurrences and Extent

Although no tornadoes have touched down within Falmouth, as noted above, three (3) tornadoes have occurred within Barnstable County since 1951: One in Edgartown in 1951, and two in Barnstable in 1968 and 1977. Table 3-14 documents the characteristics of the three Cape and Islands tornadoes; this table documents the F-scale (see description of the Fujita Tornado Damage Scale below) and size of the tornado, as well as the number of injuries and fatalities, and the value of any property loss associated with the event.

Table 3-14. Characteristics of tornadoes occurring on the Cape and Islands since 1951.

Date	Town	F-scale	Injuries	Fatalities	Property Loss	Length (miles)	Width (yards)
12/18/1951	Edgartown	2	0	0	Unknown	0.1	10
8/9/1968	Barnstable	1	0	0	$500-$5,000	0.1	10
8/22/1977	Barnstable	1	2	0	$5,000-$50,000	0.1	10

Table 3-15 shows the Fujita Tornado Damage Scale developed by Dr. T. Theodore Fujita for winds, including tornadoes, which relates the degree of damage to the intensity of the wind.

Table 3-15. Fujita Tornado Damage Scale.

Scale	Wind Estimate (mph)	Typical Damage
F0	< 73	Light damage: some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73-112	Moderate damage: peels surface off roads; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable damage: roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
F3	158-206	Severe damage: roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating damage: well-constructed houses level; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible damage: strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

B2.b PROBABILITY

Although tornadoes have not been recorded in Falmouth since NOAA's records begin in 1951, relatively small scale tornadoes do occur in Massachusetts on a regular basis, and less frequently within Barnstable County. As such, is it possible (between 1 and 10% probability in the next year) that a tornado will occur in Falmouth.

B3.a IMPACT

Below is a list of possible impacts that could result from tornadoes:

- **People:** Airborne debris can cause injury or death. Hazardous driving conditions can result from blocked roadways. Tornadoes can cause water contamination, which can affect drinking water quality and human health.

- **Infrastructure:** Tornadoes can damage power lines and other utility infrastructure, and can damage roads. Downed power lines can also cause electrical hazards.

- **Buildings:** Tornadoes that pass through highly developed areas can cause significant property damage, breaking windows, blowing off roofs, and in severe cases, leveling houses.

- **Economy:** Tornadoes can destroy farms and agricultural fields.

- **Natural Systems:** High winds associated with a tornado can break branches and snap or uproot trees. Wildlife can be killed or injured.

3.8 FIRE

OVERVIEW

Fire events can be broken into two major categories: urban fires and wildfires. Urban fires are the result of buildings and structures catching fire, with the potential for the fire to spread to neighboring properties. These events have a higher chance of spreading more rapidly in areas where residential and commercial buildings are clustered closely together. Urban fires tend to occur more frequently than wildfires, and often result from everyday activities such as cooking, smoking, or appliance malfunction.

A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, scrubland, or grassy area. Wildfires and forest fires are naturally occurring events, and part of a normal, healthy ecosystem. Naturally occurring fires help keep forest floors free of excessive debris buildup, thin crowded trees, encourage growth of new vegetation, and recycle nutrients into the soil. Forest fires may occur at any time of year, however typically occur during hot, dry summer months, or during windy conditions during the spring and fall. Natural ignition most frequently occurs as the result of a lightning strike.

In Massachusetts, wildfires are typically caused by lightning or human activity (i.e. discarded cigarettes, unattended camp fires, downed power lines, etc.). The Bureau of Fire Control estimates that nearly 98% of fires in Massachusetts are started by human carelessness. In 2012, the Cape Cod Cooperative Extension developed the Barnstable County Wildfire Preparedness Plan.

HAZARD LOCATION

B1.c

Wildfire has played a role in shaping the Barnstable County landscape for thousands of years. As a result, there is an abundance of fire-adapted ecosystems in the region. Fires continued to be abundant on Cape Cod until the early 1900s, when tourism became more popular, and the public opinion began to favor the suppression of all fires. The first fire tower on Cape Cod was built in Barnstable in 1913, and the first brush breakers were developed on Cape Cod in the 1930s to fight forest fires. Since then, forest fires have tended to burn fewer acres for shorter time periods.

The Barnstable County Wildfire Preparedness Plan (2012) evaluates various criteria, such as flame length, rate of spread, crown fire potential, population density, and proximity to a fire station, to categorize areas as having a low, moderate, high, or extreme wildland fire risk. Figure 3-26 shows the Wildfire Risk Map developed for this Plan for the Town of Falmouth. As seen in Figure 3-26, only 0.5% of the Town falls in the Extreme risk category (four small areas: 1. around the Little Sippewissett Marsh, 2. between Brick Kiln and Blacksmith Shop Roads, 3. in the vicinity of the North Falmouth Wooded Parcel, and 4. between the Quashnet River and Hamblin Pond near Waquoit Bay). Almost half of the Town falls in the High risk category (orange).

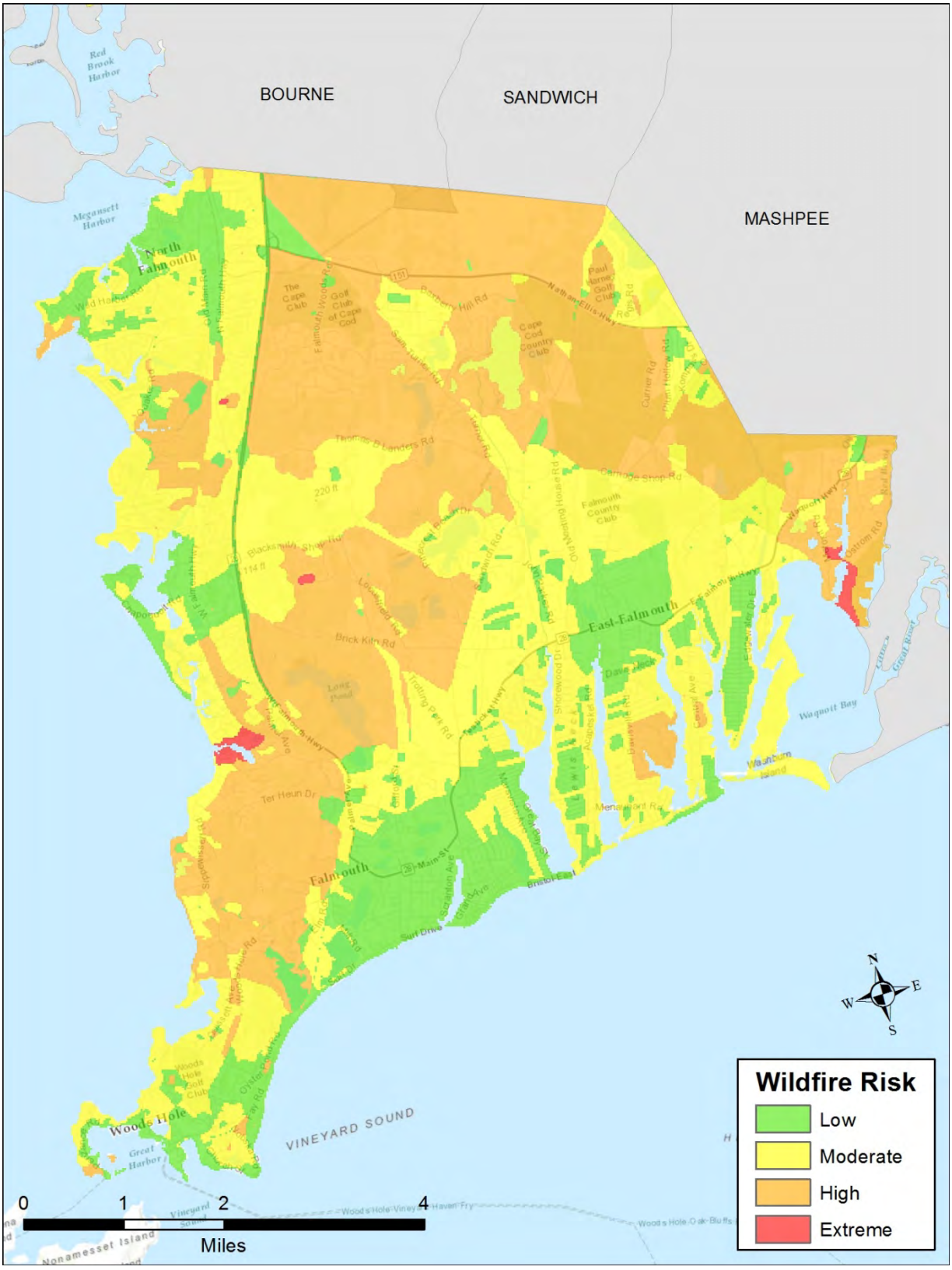

Figure 3-26. Town of Falmouth Wildfire Risk Map from the Barnstable County Wildfire Preparedness Plan.

B1.c
B2.a

Previous Occurrences & Extent

Forest fires vary in size, however thanks to modern detection and firefighting equipment methods, fires are typically kept to a reasonably small area. The Bureau of Fire Control estimates that the average fire 100 years ago consumed approximately 34 acres, while today the average fire burns only 1.2 acres. However, large fires have occurred nearby in the past, such as the 1957 fire in Myles Standish State Forest which burned over 18,000 acres, stopping only when it reached the ocean.

Another area particularly susceptible to wildfires is Beebe Woods. The Wildland Fire and Preparedness Plan for Beebe Woods and Peterson Farm Conservation Areas (Caljouw 2005) indicates that two to three small fires start each year within the general Beebe Woods area. Fortunately, most fires are quickly identified and suppressed, or extinguish themselves naturally due to wet weather conditions. The majority of wildfires occur in the spring, before "green-up", or in late summer, following periods of drought.

The largest fire reported for Falmouth occurred in 1947. The fire burned more than 1,150 acres and 9 firefighters were injured. The event began as a small brush fire in the vicinity of Sippewisset Road, southwest of Gunning Point Road, on October 23, during drought conditions. There had been no recorded rain for 45 days preceding the fire. The fire burned through much of Beebe Woods over the course of the next three days, nearly reaching the railroad tracks near Palmer Avenue, before finally being contained and then extinguished with the help of drenching rains.

Other smaller fires in Falmouth occurred in 1950, when approximately 500 acres north of Route 151 was burned, and in 1930, when an area of forest in Hatchville caught fire (Garrick 2009). Fires were also relatively frequent at the neighboring Joint Base Cape Cod (Mass Military Reservation) throughout the 1990s.

Once a fire starts, location of the fire and the type of fuel consumed determines how severe the fire will be. There are four types of wildfires (Table 3-16). These fire types range from ground fires, which tend to travel relatively slowly and are easier to control, to canopy fires, in which flames can jump from tree to tree through the canopy relatively quickly. These are the most difficult to control and extinguish.

Table 3-16. Forest fire types.

Type	Location	Typical Fuel
Ground	At or below ground surface	Underground roots, buried leaves or other organic matter
Surface	Ground surface	Surface leaves, grass, low lying vegetation, underbrush
Ladder	Between the surface and canopy	Underbrush, downed logs, vines and small trees
Canopy	In the tree canopy	Tall trees, vines and branches

Probability

B2.b

The 2013 Massachusetts Hazard Mitigation Plan identifies Cape Cod as susceptible to wildfires due to the availability of fuel, impacts from offshore winds, and increasing development within wooded areas. Therefore, it is possible (1 – 10% probability in the next year) that a wildfire will occur in Falmouth.

IMPACT

B3.a

Below is a list of possible impacts that could result from fires:

- **People:** Death or injury can result if people are trapped by urban or wildfires. Smoke inhalation can cause health issues.
- **Infrastructure:** Utility services may be disrupted. Roads may become impassible and transportation may be disrupted.
- **Buildings:** Buildings and structures can be damaged or destroyed, either by the fire directly, or through ignition from flying sparks and embers.
- **Economy:** Indirect economic losses can result from lost tourism due to a major fire. Disrupted utilities may halt businesses and other economic activities.
- **Natural Systems:** Extensive areas of forests and other natural areas can be burned. Wildfires can strip slopes of vegetation, increasing the potential for runoff and erosion.

3.9 DAM/CULVERT FAILURE

OVERVIEW

A dam is any artificial barrier and/or any controlling structure that can or does impound or divert water. There are 2,901 public and privately owned dams in Massachusetts. Eight (8) of these are located in Falmouth (Figure 3-27).

Dam failure is any sudden, uncontrolled release of impounded water due to structural deficiencies in a dam. Dams can fail for a variety of reasons, including the dam being overtopped by floods that exceed its capacity, structural failure of the dam construction materials or the foundation supporting the dam, and inadequate maintenance and repair.

The hazards associated with a failing dam can also occur from culverts that act like dams during flooding events. A culvert is a structural opening under a roadway that allows water to pass from one side of the road to the other. They are typically made of concrete, steel or aluminum, and their size is calculated based on the location-specific volume of water expected to pass through that location. The primary function of a culvert is to prevent flooding during normal and extreme weather conditions and to provide proper road drainage. Culverts can fail due to the pipe becoming occluded by debris or improper maintenance, the pipe caving in due to structural deficiencies, or from a buildup of flood waters exceeding the capacity of the culvert.

B1.c

HAZARD LOCATION

Hazards associated with dam failure are confined to the areas around existing dams. There are no High Hazard Dams located within Falmouth; all High Hazard Dams in Massachusetts are located outside of Barnstable County. However, there are eight (8) dams located in Falmouth, and two of them are classified by the Office of Dam Safety as having the potential for Significant Hazard. Both Significant Hazard Potential Dams, Mill Pond Dam and Red Brook Road Dam, are privately owned (Figure 3-27). The other six (6) dams in Falmouth have not given a hazard code by the Office of Dam Safety.

There are more than 100 culverts in Falmouth (Figure 3-28). Significant and problematic locations include:

1. Salt Pond culvert under Surf Drive (drains Salt Pond and all contributories);
2. Fresh Pond culvert under Surf Drive (drains Siders Pond, Shivericks Pond, and all downtown drainage); and
3. Little Pond culvert under Menauhant Road.

These three culverts of concern are individually labeled and displayed in red in Figure 3-28.

Although technically not a dam or culvert, bridges, and specifically bridge failures can cause significant hazards through loss of transportation and flooding. The Town has identified four (4) bridge locations that are critical as evacuation routes, that could be vulnerable to damaging forces similar to those impacting culverts and dams. These locations include:

1. Great Pond bridge;
2. Green Pond bridge;
3. Bournes Pond bridge; and
4. Chapoquoit Bridge.

These locations are individually labeled and displayed in purple in Figure 3-28.

Three of the bridges mentioned above (Great Pond, Green Pond, and Bournes Pond), as well as the Little Pond culvert, also have "pipe crossings", which convey public utilities, such as drinking water. All of the pipes in these locations have appropriately located isolation valves, which could be closed as a pre-emptive move prior to a major event. In this event, utilities to the affected areas would be serviced from the Route 28 main pipeline. Details about each of these "pipe crossings" are provided below:

1. Little Pond: a 12 inch AC pipe installed in 1964.
2. Great Pond: an 8 inch cement lined cast iron pipe installed in 1945.
3. Green Pond: a 12 inch AC pipe installed in 1954.
4. Bournes Pond: a ductile iron cement lined 12 inch pipe installed in 2008. Disruption of flow through this pipe may result in a few homes on Foster Road being without water.

B1.c B2.a

Previous Occurrences & Extent

Although there is no record of dam failure specifically in Falmouth, in recent years, there have been a number of incidents involving failed culverts. Most recently, a 200-foot section of the Trunk River culvert, which passes under the Shining Sea Bike Path and a sewer main, failed. Additionally, both the Salt Pond culvert and the Fresh Pond culvert (shown in Figure 3-28) are poorly flushed structures, and have resulted in flooding to the surrounding areas when blocked.

The Massachusetts Office of Dam Safety, within the Department of Conservation and Recreation, maintains a database of all the dams in Massachusetts, classified by their hazard potential. This database divides dams into three categories:

High Hazard Potential Dam: A dam located where failure will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.

Significant Hazard Potential Dam: A dam located where failure may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways, or railroads, or cause interruption of use or service of relatively important facilities.

Low Hazard Potential Dam: A dam located where failure may cause minimal property damage to others, and loss of life is not expected.

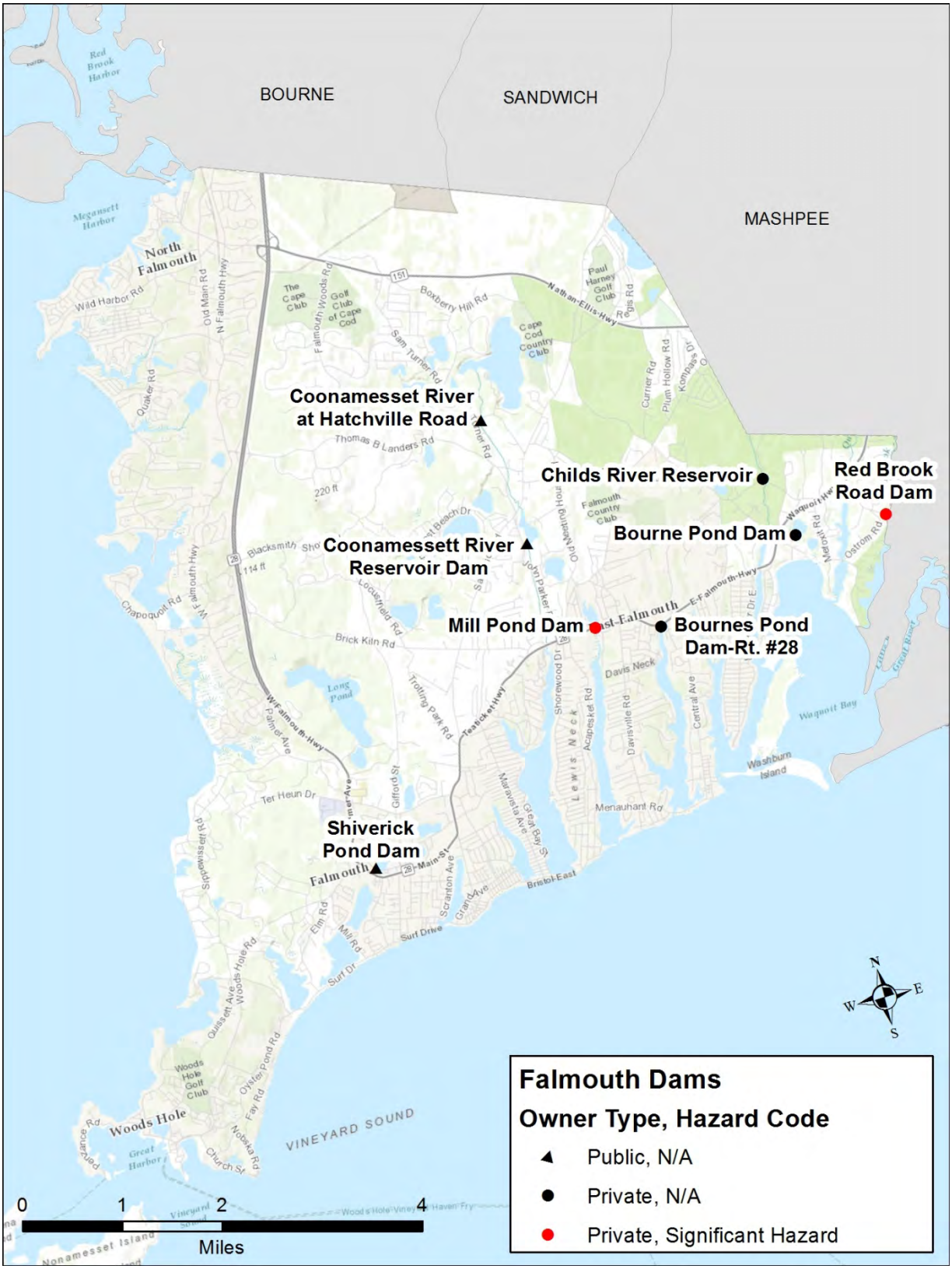

Figure 3-27. Locations of private and publically owned dams in Falmouth and their hazard rating as defined by the Office of Dam Safety.

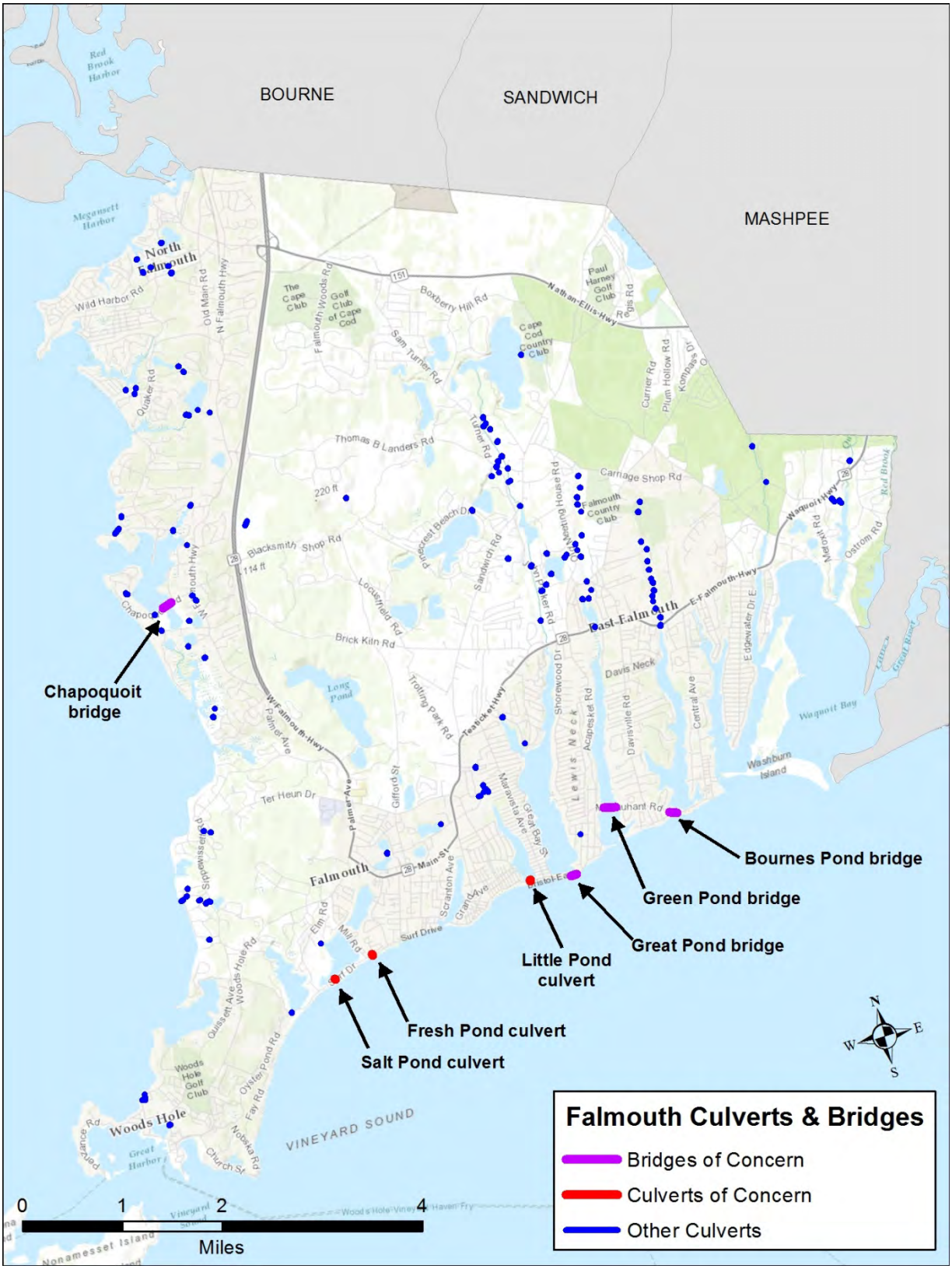

Figure 3-28. Locations of culverts and bridges of concern in Falmouth.

B2.b PROBABILITY

The 2013 Massachusetts Hazard Mitigation Plan identifies dam failure on Cape Cod as having a very low frequency of occurrence, but did not account for the possibility of culvert failure. Therefore, dam or culvert failure in Falmouth is possible (1-10% probability in the next year).

B3.a IMPACT

Below is a list of possible impacts that could result from dam or culvert failure:

- **People:** People could become trapped by blocked or flooded roads.
- **Infrastructure:** Utilities may be disrupted due to damaged pipes or power lines near the dam or culvert.
- **Buildings:** May be damaged by flooding caused by a failed dam or blocked culvert.
- **Economy:** Businesses could experience economic losses due to flooded or blocked roads prohibiting employees and or customers from accessing certain areas of town.
- **Natural Systems:** Dam and culvert failures can result in bank erosion. Debris and other materials can be deposited in natural systems.

Figure 3-29. Culvert at Little Pond inlet.

3.10 EARTHQUAKE

OVERVIEW

An earthquake is a sudden, intense shaking of the Earth's surface caused by the movement of large portions of the Earth's crust. These movements tend to occur along faults, which are fractures in the Earth's crust along which two plates of crust can move against each other. Earthquakes can occur suddenly at any time, with virtually no warning.

Earthquakes can occur at focal depths. A focal depth of less than 43.5 miles is considered to be a shallow earthquake; the majority of earthquakes fall into this category. Earthquakes originating at focal depths of 43.5 to 186 miles are considered intermediate. However, focal depths of earthquakes can reach depths of more than 435 miles. The epicenter of an earthquake is the location on the Earth's surface directly above the focal point of an earthquake.

New England is located in the middle of the North American tectonic plate; the western edge of this plate is along the west coast where it is pushing up against the Pacific Ocean Plate, and the eastern edge is in the middle of the Atlantic Ocean where it is spreading away from the European and African plates. Because New England is located a considerable distance from either edge of the North American plate, most earthquakes that occur here are due to the cracking of crustal rocks due to compression as the plate is slowly squeezed by the global movement of other plates.

HAZARD LOCATION

B1.c

Due to the configuration of the tectonic plates, the greatest threat from earthquakes in the United States occurs along the fault lines on the west coast. While earthquakes do occur in the eastern United States, they tend to be less frequent and less intense. Figure 3-30 shows earthquakes within 150 miles of the Town of Falmouth as reported by USGS. This data set only includes events with magnitudes 2.5 or greater.

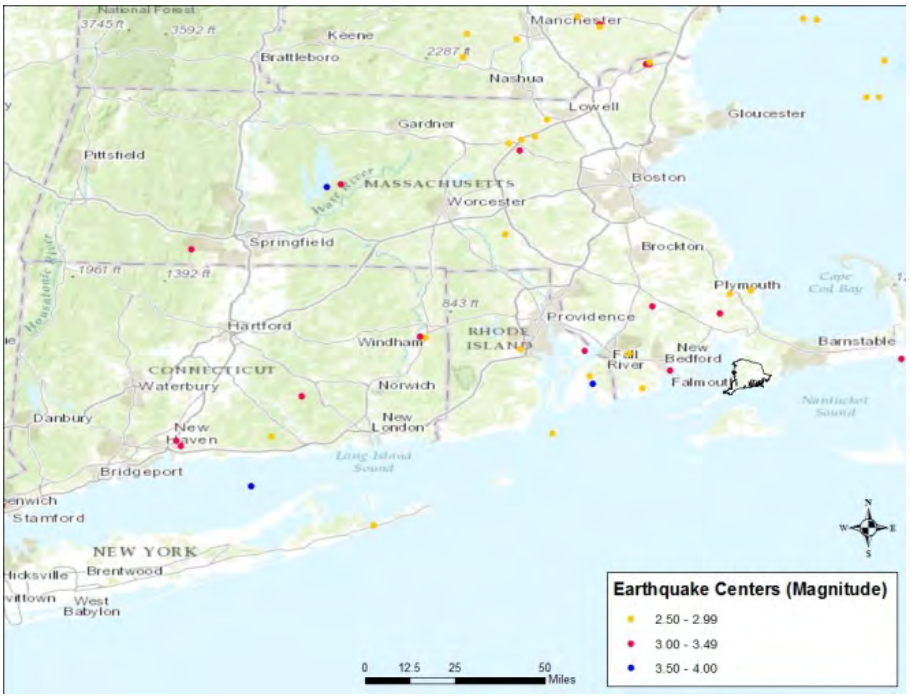

Figure 3-30. Earthquake occurrences within 100 miles of Falmouth.

B1.c
B2.a

Previous Occurrences & Extent

Although there are no recorded earthquakes within Falmouth itself, there have been 35 occurrences of earthquakes since the 1970s within 100 miles of Falmouth. The epicenter locations of these earthquakes are shown in Figure 3-30, and the date and magnitude of each event is detailed in Table 3-18. The Richter magnitude of these 35 events ranged from 2.5 to 3.5, which as described below, can often be felt, but only causes minor damage.

The Richter Scale (Table 3-17) is frequently used to measure the magnitude of earthquakes. It measures the maximum recorded amplitude of a seismic wave, which quantifies the ground motion and the energy released at the source of an earthquake.

Table 3-17. Richter Scale.

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

Table 3-18. Earthquake occurrences within 100 miles of Falmouth, as reported by the USGS.

Date	Magnitude	Town, State
8/10/1978	3.50	Atlantic Ocean
3/11/1976	3.50	Tiverton, RI
1/12/2015	3.30	Danielson, CT
10/2/1994	3.30	Hardwick, MA
1/10/1999	3.10	Amesbury, MA
3/22/1996	3.10	Bristol, RI
12/20/1977	3.10	Carver, MA
3/12/2002	3.00	Atlantic Ocean
1/10/1999	3.00	Merrimac, MA
8/24/1989	3.00	New Bedford, MA
10/15/1985	3.00	Boxborough, MA
6/17/1982	3.00	East Haddam, CT
1/27/1982	3.00	Lakeville, MA
3/14/1976	3.00	Chatham, MA
7/22/2003	2.98	Atlantic Ocean
1/8/1998	2.90	Atlantic Ocean
3/10/1992	2.80	Amagansett, NY
10/27/1982	2.80	Atlantic Ocean
9/3/1978	2.80	Atlantic Ocean
7/26/1978	2.80	Atlantic Ocean
10/13/1999	2.70	Westford, MA
10/11/1990	2.70	Plymouth, MA
4/3/1981	2.70	Tiverton, RI
5/10/1976	2.70	Dartmouth, MA
8/14/2014	2.66	Deep River, CT
1/13/2015	2.60	Moosup, CT
4/22/1996	2.60	Dartmouth, MA
4/16/1986	2.60	Merrimac, MA
11/1/1982	2.60	Atlantic Ocean
10/19/2007	2.50	Littleton, MA
11/17/2005	2.50	Plymouth, MA
6/7/2002	2.50	Milford, MA
1/23/1990	2.50	Harvard, MA
11/23/1980	2.50	N. Chelmsford, MA
10/1/1974	2.50	Warwick, RI

B2.b PROBABILITY

Given that earthquakes have occurred in Massachusetts and on Cape Cod specifically in recent years, it is possible (1-10% probability in the next year) that an earthquake could occur in Falmouth.

B3.a IMPACT

Below is a list of possible impacts that could result from an earthquake:

- **People:** Damage caused to buildings and other structures during an earthquake can lead to injury or loss of life.
- **Emergency Response:** Downed trees and power lines, as well as damaged roads caused by an earthquake can impede emergency vehicles.
- **Infrastructure:** Earthquakes can cause utility poles to fall and live wires to become exposed or to start fires. The shaking caused by an earthquake can also rupture gas lines and cause the release of flammable substances.
- **Buildings:** Earthquakes can damage foundations and buildings; most property damage is caused by the failure and collapse of structures during ground shaking. Concrete and masonry structures are brittle and thus more susceptible to damage and collapse.
- **Natural Systems:** Earthquakes can cause landslides and slope failure; this could have hazardous impacts on areas with steep slopes, such as coastal banks.

3.11 TSUNAMI

OVERVIEW

A tsunami is a series of ocean waves generated by earthquakes, a sudden displacement of the ocean floor, underwater landslides or volcanic activity. In the deep ocean, a tsunami wave may only be a few inches high. However, as the wave nears shore, tsunamis generate a devastating onshore surge of water. Major tsunamis are produced by large (greater than 7 on the Richter scale), shallow focal depth (< 30km) earthquakes associated with continental plate movement. The waves associated with a tsunami move hundreds of miles per hour in the open ocean and can come ashore with wave heights of 100 feet or more. However, even waves that are 10 to 20 feet high can be extremely destructive.

B1.c

HAZARD LOCATION

Although tsunamis most commonly occur in the Pacific Ocean, where dense oceanic plates slide under lighter continental plates, they can occur in the Atlantic as well.

B1.c
B2.a

PREVIOUS OCCURRENCES & EXTENT

Although there are no records of a tsunami occurring in Falmouth, there are six (6) reported tsunamis for the United States Atlantic coast and Gulf coast states in the last 200 years.

B3.a

PROBABILITY

There is no record of tsunamis ever occurring in Falmouth, and only six occurring along the Atlantic and Gulf coasts of the United States. Therefore, it is unlikely (less than a 1% probability over the next 100 years) that a tsunami hazard will occur in Falmouth.

B3.a

IMPACT

Below is a list of possible impacts that could result from a tsunami:

- **People:** The forces of a tsunami wave itself can injure people or lead to death. Floating debris can endanger human lives, and the effects of a tsunami may leave people without food or fuel.
- **Emergency Response:** Flooded roads and deposited debris may block emergency response.
- **Infrastructure:** Tsunami waves and floating debris can damage coastal infrastructure, breakwaters and piers. Ruptured utility pipes and storage containers can release oil and gas, resulting in fire hazards.
- **Buildings:** The force of the tsunami wave can destroy buildings, and floating debris can damage structures. Also, the scouring action of moving water can sweep away buildings.
- **Economy:** Utilities can be damaged and roadways can be blocked, which can adversely impact economic activities. Coastal systems impacted by tsunamis can also adversely affect the fishing industry.
- **Natural Systems**: Tsunamis can uproot trees and plants. Land animals can be killed by drowning, and marine life can be killed by pollution if toxic chemicals are washed into the ocean.

3.12 SUMMARY OF HAZARDS

As suggested by the FEMA planning guidance, the Local Planning Team reviewed the full range of natural hazards identified in the 2013 Massachusetts State Hazards Plan and identified natural hazards that could impact Falmouth in the future, or that have impacted the Town in the past (Chapter 3). The 15 individual hazards discussed in Chapter 3 are evaluated below in Table 3-19 based on the likelihood of occurrence, severity and area. Likelihoods for each hazard, as described in Chapter 3, are scored from 1 (unlikely) to 4 (highly likely). The severity of the hazard was scored on a scale of 1 to 4, with 1 being minor and 4 being catastrophic. Finally, whether the hazard was likely to have isolated impacts or a town wide effect was scored as 1 or 2 respectively. For both severity and area, an "X" was used in Table 3-19 to indicate the most likely severity, while a "P" indicates the anticipated severity of a worst case scenario. The value associated with the "X", rather than the "P", was used to calculate the estimated cumulative risk from that hazard. These determinations were made using local expertise from LEPC members, data from the 2013 Massachusetts State Hazards Plan and other resources.

The Local Planning Team selected only a subset of hazards from Table 3-19 to consider during the location-specific vulnerability analysis in Chapter 4. This selection was based on:

- Area of influence: If a hazard is expected to impact the entire town equally, all properties and critical facilities are equally vulnerable to this hazard and no specific vulnerability assessment is needed. Examples of this include severe winter weather, extreme temperature and earthquake.
- Lack of data: If spatial information about the likelihood of a hazard is not available, conducting a site-specific vulnerability assessment is not possible. Examples of this include thunderstorm and tornado.
- Low estimated cumulative risk: If the estimated cumulative risk from a particular hazard is low, fully developing a vulnerability assessment to address it may be unnecessary. An example of this is the tsunami hazard.

The hazards that were selected for site-specific vulnerability assessments are indicated in Table 3-19 in bold font with asterisks. Additional detail as to what data will be used to evaluate these selected hazards in the vulnerability assessment is provided in Section 4.1.

Table 3-19. Relative Risk of Hazards in Falmouth

	Likelihood				Severity				Area		Estimated Cumulative Risk†
	Unlikely	Possible	Likely	Highly Likely	Minor	Serious	Extensive	Catastrophic	Isolated	Town Wide	
Score	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	
Flooding*				X			X		X		12
Coastal Erosion*				X		X	P		X		8
Sea-Level Rise*				X			X	P	X		12
Hurricane & Tropical Storm*			X			X		P	X	P	6
Nor'easter				X		X	P			X	16
Severe Winter Weather				X		X	P			X	16
Thunderstorm				X	X				X	P	4
High Wind*				X			X	P	X	P	12
Drought		X			X					X	4
Extreme Temperature			X		X					X	6
Tornado		X			X				X		2
Fire*		X				X	P		X		4
Dam/Culvert Failure*		X				X			X		4
Earthquake		X				X		P		X	8
Tsunami	X				X			P	X		1

X indicates the believed value, while P indicates an extreme potential.

*These **bolded** hazards were selected for specific vulnerability analyses in Chapter 4.

† This value is based on the formula Likelihood*Severity*Area. The Likelihood of the hazard is based on a scale of 1 to 4, with 1 being unlikely and 4 being highly likely. The Severity of the hazard was based on a scale from 1 to 4, with 1 being minor and 4 being catastrophic. Area was given a value of 1 for isolated and 2 for town wide. The "P"s were not incorporated into the Estimated Cumulative Risk value.

Risk analyses involve evaluating vulnerable assets, describing potential impacts, and estimating the loss from each hazard. Chapter 2 of the Falmouth Multi-Hazard Mitigation Plan profiled the local assets and amenities, such as the natural resources, demographics, infrastructure and critical facilities, to document assets within the Town. Chapter 3 detailed the various natural hazards that have impacted or could impact the Town in the future. Chapter 4 combines the hazard descriptions and asset inventories to conduct an exposure analysis, that quantifies the number, type, and value of properties and critical facilities located in identified hazard areas.

This vulnerability assessment provides a foundation for the rest of the mitigation planning process, which is focused on identifying and prioritizing actions to reduce risks to hazards. In addition to informing the mitigation strategy, the vulnerability assessment also facilitates the establishment of emergency preparedness and response priorities, land use and comprehensive planning, and decision making by elected officials, city and county departments, businesses, and organizations in the community.

4.1 METHODOLOGY

This report includes three separate vulnerability assessments:

1) Vulnerability assessment of parcels and buildings;
2) Exposure assessment of critical facilities; and
3) Evaluation of evacuation routes

To estimate the total number of parcels, as well as both the value of the buildings on the property and the total property value (total property value is the sum of the value of the buildings, other structures, and the land itself within a given parcel), the planning team utilized the most current Assessor's Parcel dataset for the Town of Falmouth (2015). The dataset provides information about parcel size, land use type, assessed value, and building characteristics.

This large dataset was first classified into various land use types based on the Massachusetts Property Type Classification Codes. The outcome of this classification was presented in Table 2-4 where the number of parcels and total acreage within each land use category were quantified. Here, Table 4-1 details the Massachusetts Property Type Classification Codes that are encompassed by each land use type used in this report. Examples of the types of properties included within each Land Use classification are also shown in Table 4-1.

To determine each parcel's vulnerability, a GIS analysis was conducted by overlaying extent maps for a subset of the hazards shown in Chapter 3 with the parcel data. Below is a list of the hazard types selected for this vulnerability analysis, and a description of the data used for the evaluation if available (see also Table 3-19):

1) **Flooding**: FEMA Flood Hazard Maps (Effective 2014) (see Figure 3-1).
2) **Coastal Erosion**: Although rates of erosion were not applied for this analysis, waterfront parcels located on Buzzards Bay or Vineyard Sound were identified as having the potential for coastal erosion. Although this is indiscriminate among coastal properties in regards to level of risk, given that the rates of shoreline erosion can change over time and location, this method is a rough approximation of where it is possible to see risks of coastal erosion in the future. Note that parcels within Falmouth's Great Ponds were not included.
3) **Sea-level Rise**: A bathtub model developed by Woods Hole Group was used to estimate potential impacts to the Town from future sea-level rise (Figure 3-6). This assessment takes into account sea-level rise impacts only, and does not account for the combined flooding effects of future sea-level rise combined with storm surge.
4) **Hurricanes and Tropical Storms**: The extent of storm surge and flooding during a hurricane was estimated using the SLOSH model (Figure 3-10).
5) **Severe Nor'easters**: Location specific data within Falmouth is not available for this hazard. Therefore, a detailed vulnerability assessment could not be completed at this time.
6) **Severe Winter Weather**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

7) **Severe Weather (including thunderstorms, high wind, drought, extreme temperatures, and tornadoes)**: The Falmouth Wind District overlay (areas within 1 mile from the coast) was used for a high wind vulnerability analysis (Figure 3-15). Location specific data within Falmouth is not available for the other severe weather hazards. Therefore, a detailed vulnerability assessment could not be completed for thunderstorms, drought, extreme temperatures or tornadoes at this time.

8) **Wildfire**: Wildfire Risk Map from the Barnstable County Wildfire Prepared-ness Plan (Figure 3-19).

Table 4-1. Falmouth Land Use Classification Based on Massachusetts Codes

Land Use Type	Land Use Codes	Description
Residential - Single Family	101, 106	Residential single family lots
Residential - Multi-Family	013, 102, 104, 105, 109, 111, 112, 121, 123, 125, 959, 970, 996	Multi-Family units, apartments, condos, dorms, etc.
Commercial - Retail/Offices/Services	031, 318, 321, 323, 325, 326, 327, 330, 331, 332, 337, 340, 343, 356, 423, 900, 929	Retail stores and shops, offices, restaurants, automotive services, comercial parking lots, greenhouses, etc.
Commercial - Manufacturing/Distribution	310, 311, 313, 316, 333, 334, 400, 401, 402, 403, 404, 405, 410	Oil and gas storage, gas stations, lumberyards, and other storage and warehouse facilities
Public Services	140, 341, 342, 349, 350, 352, 354, 355, 384, 388, 424, 431, 433, 903, 906, 914, 931, 934, 935, 941, 943, 951, 952, 955, 956, 957, 960, 961, 962, 985	Banks, hospitals & medical offices, childcare services, schools, fire stations, buses, marinas, funeral services, electrical substation and other utility towers, town offices, post offices, churches, courthouses, libraries, etc.
Temporary Lodging	301, 302, 303, 304	Hotels, inns, resorts, nursing homes
Agricultural	014, 016, 017, 018, 710, 712, 714, 717, 719	Agricultural land, cranberry bogs, orchards, woodlots, etc.
Open Space	201, 210, 383, 385, 601, 720, 9035, 910, 911, 916, 919, 920, 928, 932, 950, 982	Residential open space, non-productive agricultural land, beaches, forested land, conservation land, etc.
Vacant	130, 131, 132, 390, 392, 393, 440, 442, 930, 933, 936, 946, 980, 997	Vacant developable, potentially developable, and undevelopable land
Recreation	038, 083, 805, 353, 369, 370, 375, 380, 381, 802, 804, 805, 9036, 905, 924, 954, 958	Golf courses, bowling, tennis, golf, ice skating, campground, boat ramps, bike paths, function halls, community centers, clubs and fraternal orgs

9) **Dam/Culvert Failure**: Parcels located within 1,000 feet of dams (data from MassGIS) and culverts (data from the Town of Falmouth) were considered potentially at risk from failure of these structures.

10) **Earthquake**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

11) **Tsunami**: Location specific data is not available for this hazard. A detailed vulnerability assessment could not be completed at this time.

Once the parcels affected by each hazard type were identified, the number of parcels in each land use category was totaled, as well as the value of the buildings and total property value associated with each parcel. In this way, the percent of the Town's parcels and the percent of the Town's property value potentially affected by each type of hazard was quantified. These results are summarized in Tables 4-2 to 4-23.

To assess the vulnerabilities of Falmouth's critical infrastructure, as discussed in Chapter 2, the planning team first developed a list of the critical facilities and structures. Each location was mapped in GIS (Figure 2-10). During the planning process, it became apparent that the list of critical infrastructure was extensive (Appendix C), making it impractical to respond to the needs of all facilities during or immediately after an emergency. Therefore, the LPT prioritized critical infrastructure into the following "tiers":

Tier 1: Emergency Response and Utilities

Tier 2: Municipal and Community Centers

Tier 3: Other

Tier 4: Hazardous Materials Sites

Tier 1 facilities are the most critical and include facilities such as police, fire and medical services, water and sewer infrastructure, department of public works facilities, and other important utilities. This infrastructure is necessary to maintain a minimal level of service to provide necessary utilities and emergency services to residents. Every feasible opportunity should be taken to ensure that these facilities remain functional and accessible at all times.

Tier 2 facilities are also important and include large municipal, public, semi-public and other gathering places servicing a proportionally large group of people. Infrastructure includes town offices and other municipal buildings, schools, nursing homes, and other miscellaneous buildings such as the post office.

Tier 3 facilities are generally less critical, however still important to the community as a whole. Infrastructure includes libraries, community buildings, the landfill, and private medical and educational companies and institutions.

Tier 4 facilities are those that are identified in Falmouth's Hazardous Materials Emergency Plan as having reported chemical inventories to the Local Fire Department, the State Emergency Response Commission, and the LEPC. Due to the potential for compounded adverse impacts, gas stations within the flood plain are also included in this category. In this case, the designation of "Tier 4" is not meant to imply these facilities are less critical to protect during an emergency, but is used simply to distinguish this locations from other that may also serve an emergency response or hazard mitigation purpose.

The same hazards that were mapped and applied to the parcel vulnerability assessment were again overlaid on the map of critical infrastructure (i.e. flooding, coastal erosion, sea-level rise, hurricanes,

wind, wildfire and dam/culvert failure). If a critical facility was located in a hazard area, that particular facility was considered to be exposed, and therefore vulnerable, to that particular hazard. For the same reasons listed above, potential impacts from other hazards, such as landslides, earthquakes and tsunamis were not directly evaluated.

Results from the vulnerability analysis for critical facilities are summarized at the bottom of each of the hazard table (Tables 4-2 to 4-23), as well as in Appendix C.

An evaluation of the Town's evacuation routes was conducted to determine whether any of the current evacuation pathways was susceptible to inundation due to flooding, hurricane storm surge, or sea-level rise. Although other hazards may impact these areas, the Local Planning Team determined that inundated roadways posed the largest threat to the safe and effective utilization of emergency evacuation routes. To address this, the extents of these three hazard areas were overlain on the existing evacuation routes, and vulnerable areas were identified. Impacts to evacuation areas are shown in Figures 4-29 and 4-30.

4.2 RESULTS

Table 4-2. Parcels and Buildings Vulnerable to Flooding in the VE Zone.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	1301	7%	$4,220,652,500	$575,066,600	14%	$9,128,817,000	$1,947,654,500	21%
Residential (Multi-Family)	806	70	9%	$269,636,450	$47,259,700	18%	$551,277,250	$161,520,600	29%
Commercial (Retail/Office/ Services)	389	17	4%	$158,277,300	$13,013,300	8%	$364,926,700	$44,941,600	12%
Commercial (Man./Dist.)	90	0	0%	$37,855,600	$0	0%	$96,474,700	$0	0%
Public Services	269	28	10%	$576,592,000	$32,957,100	6%	$825,852,200	$91,586,800	11%
Temporary Lodging	48	7	15%	$60,457,000	$16,054,000	27%	$117,341,600	$36,278,100	31%
Agriculture	31	0	0%	$3,973,800	$0	0%	$8,073,840	$0	0%
Open Space	802	225	28%	$1,946,300	$1,200,900	62%	$185,405,417	$58,190,290	31%
Vacant	2248	359	16%	$895,300	$0	0%	$407,311,800	$84,775,600	21%
Recreation	61	12	20%	$28,418,100	$4,974,000	18%	$66,922,731	$12,379,031	18%

Critical facilities that are vulnerable to flooding in the VE flood zone include the Coast Guard Station (Tier 1), the Harbor Master Shack and the Woods Hole Drawbridge Hut (Tier 2), and one HAZMAT location owned by WHOI.

Table 4-3. Parcels and Buildings Vulnerable to Flooding in the AE Zone.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	4619	25%	$4,220,652,500	$1,328,424,400	31%	$9,128,817,000	$3,531,486,800	39%
Residential (Multi-Family)	806	226	28%	$269,636,450	$88,152,200	33%	$551,277,250	$227,394,800	41%
Commercial (Retail/Office/ Services)	389	90	23%	$158,277,300	$56,192,100	36%	$364,926,700	$149,186,600	41%
Commercial (Man./Dist.)	90	10	11%	$37,855,600	$5,939,400	16%	$96,474,700	$11,964,400	12%
Public Services	269	86	32%	$576,592,000	$207,980,900	36%	$825,852,200	$328,174,900	40%
Temporary Lodging	48	21	44%	$60,457,000	$35,345,100	58%	$117,341,600	$70,768,000	60%
Agriculture	31	13	42%	$3,973,800	$912,000	23%	$8,073,840	$2,057,008	25%
Open Space	802	240	30%	$1,946,300	$1,394,100	72%	$185,405,417	$87,329,966	47%
Vacant	2248	599	27%	$895,300	$182,100	20%	$407,311,800	$137,005,100	34%
Recreation	61	16	26%	$28,418,100	$6,630,300	23%	$66,922,731	$15,784,762	24%

Critical facilities that are vulnerable to flooding in the AE flood zone include Town Hall, the Falmouth Harbor Master Building, and the Steamship Authority Ferry Terminal (Tier 1), the Island Queen Ferry Terminal (Tier 2), a number of Tier 3 facilities, including the Falmouth Senior Center, the Woods Hole Community Center, and the MBL/WHOI dorm facilities on Devils Lane, and a number of HAZMAT sites located at marinas.

Table 4-4. Parcels and Buildings Vulnerable to Flooding in Other Flood Zones (AO; 0.2% Chance Flood).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	2473	13%	$4,220,652,500	$578,999,300	14%	$9,128,817,000	$1,354,621,800	15%
Residential (Multi-Family)	806	88	11%	$269,636,450	$29,663,500	11%	$551,277,250	$61,434,300	11%
Commercial (Retail/Office/ Services)	389	88	23%	$158,277,300	$56,573,200	36%	$364,926,700	$130,473,600	36%
Commercial (Man./Dist.)	90	10	11%	$37,855,600	$6,175,900	16%	$96,474,700	$12,536,800	13%
Public Services	269	42	16%	$576,592,000	$218,004,700	38%	$825,852,200	$267,864,800	32%
Temporary Lodging	48	9	19%	$60,457,000	$15,885,400	26%	$117,341,600	$26,663,900	23%
Agriculture	31	6	19%	$3,973,800	$150,000	4%	$8,073,840	$508,118	6%
Open Space	802	89	11%	$1,946,300	$960,200	49%	$185,405,417	$42,589,296	23%
Vacant	2248	215	10%	$895,300	$19,400	2%	$407,311,800	$57,256,700	14%
Recreation	61	7	11%	$28,418,100	$2,151,800	8%	$66,922,731	$4,728,724	7%

Critical facilities that are vulnerable to flooding in the AO and 0.2% chance flood zones include the NS Treatment Plant and the Cape Cod Free Clinic & Community Health Center (Tier 1), the Falmouth Human Services Department and the Mullen Hall School (Tier 2), and the Falmouth Recreation Department (Tier 3), as well as the Stop and Shop gas station.

Table 4-5. Parcels and Buildings Vulnerable to Coastal Erosion.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	449	2%	$4,220,652,500	$287,022,000	7%	$9,128,817,000	$1,082,200,300	12%
Residential (Multi-Family)	806	41	5%	$269,636,450	$37,405,500	14%	$551,277,250	$131,609,100	24%
Commercial (Retail/Office/ Services)	389	23	6%	$158,277,300	$14,003,500	9%	$364,926,700	$48,759,300	13%
Commercial (Man./Dist.)	90	0	0%	$37,855,600	$0	0%	$96,474,700	$0	0%
Public Services	269	26	10%	$576,592,000	$32,381,400	6%	$825,852,200	$90,698,500	11%
Temporary Lodging	48	2	4%	$60,457,000	$11,928,100	20%	$117,341,600	$24,412,400	21%
Agriculture	31	0	0%	$3,973,800	$0	0%	$8,073,840	$0	0%
Open Space	802	93	12%	$1,946,300	$0	0%	$185,405,417	$32,749,590	18%
Vacant	2248	146	6%	$895,300	$0	0%	$407,311,800	$53,853,400	13%
Recreation	61	4	7%	$28,418,100	$2,979,300	10%	$66,922,731	$5,489,670	8%

Critical facilities that are vulnerable to coastal erosion (i.e. are located on a waterfront parcel) include the Falmouth Harbor Master Building, the Coast Guard Station, and the Steamship Authority Ferry Terminal (Tier 1), Pier 37 (Tier 3), and a number of waterfront HAZMAT locations, including marinas and a WHOI facility. There are no Tier 2 facilities located in waterfront parcels.

Table 4-6. Parcels and Buildings Vulnerable to a Sea-Level Rise of 1 Foot.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	1442	8%	$4,220,652,500	$573,829,200	14%	$9,128,817,000	$1,784,461,900	20%
Residential (Multi-Family)	806	73	9%	$269,636,450	$39,244,800	15%	$551,277,250	$135,036,000	24%
Commercial (Retail/Office/ Services)	389	13	3%	$158,277,300	$27,890,700	18%	$364,926,700	$66,607,600	18%
Commercial (Man./Dist.)	90	1	1%	$37,855,600	$55,500	0%	$96,474,700	$807,900	1%
Public Services	269	38	14%	$576,592,000	$68,507,000	12%	$825,852,200	$141,187,300	17%
Temporary Lodging	48	7	15%	$60,457,000	$15,734,600	26%	$117,341,600	$36,350,900	31%
Agriculture	31	4	13%	$3,973,800	$0	0%	$8,073,840	$56,780	1%
Open Space	802	245	31%	$1,946,300	$1,357,000	70%	$185,405,417	$60,745,196	33%
Vacant	2248	393	17%	$895,300	$19,400	2%	$407,311,800	$90,805,600	22%
Recreation	61	10	16%	$28,418,100	$1,516,100	5%	$66,922,731	$5,381,730	8%

There are no critical facilities located in the area of projected inundation due to a 1-foot rise in sea level.

Table 4-7. Parcels and Buildings Vulnerable to a Sea-Level Rise of 2 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	1840	10%	$4,220,652,500	$693,404,300	16%	$9,128,817,000	$2,143,814,000	23%
Residential (Multi-Family)	806	96	12%	$269,636,450	$47,395,300	18%	$551,277,250	$156,705,400	28%
Commercial (Retail/Office/ Services)	389	18	5%	$158,277,300	$29,900,300	19%	$364,926,700	$75,819,400	21%
Commercial (Man./Dist.)	90	1	1%	$37,855,600	$55,500	0%	$96,474,700	$807,900	1%
Public Services	269	49	18%	$576,592,000	$118,559,100	21%	$825,852,200	$208,710,100	25%
Temporary Lodging	48	7	15%	$60,457,000	$15,734,600	26%	$117,341,600	$36,350,900	31%
Agriculture	31	4	13%	$3,973,800	$0	0%	$8,073,840	$56,780	1%
Open Space	802	286	36%	$1,946,300	$1,357,000	70%	$185,405,417	$67,343,196	36%
Vacant	2248	478	21%	$895,300	$19,400	2%	$407,311,800	$105,570,600	26%
Recreation	61	12	20%	$28,418,100	$1,987,200	7%	$66,922,731	$7,655,730	11%

Critical facilities that are vulnerable to a sea-level rise of 2 feet include the Woods Hole Draw Bridge Hut (Tier 2), and one HAZMAT location (Bosun's Marina). There are no Tier 1 or Tier 3 facilities located in the area of projected inundation due to a 2-foot rise in sea level.

Table 4-8. Parcels and Buildings Vulnerable to a Sea-Level Rise of 3 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	2157	12%	$4,220,652,500	$781,293,900	19%	$9,128,817,000	$2,384,022,000	26%
Residential (Multi-Family)	806	110	14%	$269,636,450	$53,179,500	20%	$551,277,250	$173,483,200	31%
Commercial (Retail/Office/ Services)	389	29	7%	$158,277,300	$32,992,500	21%	$364,926,700	$90,900,400	25%
Commercial (Man./Dist.)	90	2	2%	$37,855,600	$2,578,800	7%	$96,474,700	$4,892,800	5%
Public Services	269	53	20%	$576,592,000	$147,722,300	26%	$825,852,200	$241,587,400	29%
Temporary Lodging	48	9	19%	$60,457,000	$19,318,700	32%	$117,341,600	$43,504,500	37%
Agriculture	31	7	23%	$3,973,800	$641,600	16%	$8,073,840	$1,222,423	15%
Open Space	802	324	40%	$1,946,300	$1,357,000	70%	$185,405,417	$73,412,996	40%
Vacant	2248	545	24%	$895,300	$19,400	2%	$407,311,800	$116,963,600	29%
Recreation	61	13	21%	$28,418,100	$1,987,200	7%	$66,922,731	$7,826,130	12%

Critical facilities that are vulnerable to a sea-level rise of 3 feet include the Woods Hole Draw Bridge Hut (Tier 2), and two HAZMAT locations (Bosun's Marina and East Marine). There are no Tier 1 or Tier 3 facilities located in the area of projected inundation due to a 3-foot rise in sea level.

Table 4-9. Parcels and Buildings Vulnerable to a Sea-Level Rise of 4 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	2487	14%	$4,220,652,500	$868,612,800	21%	$9,128,817,000	$2,635,240,400	29%
Residential (Multi-Family)	806	120	15%	$269,636,450	$57,109,500	21%	$551,277,250	$180,959,000	33%
Commercial (Retail/Office/ Services)	389	35	9%	$158,277,300	$34,218,500	22%	$364,926,700	$96,818,700	27%
Commercial (Man./Dist.)	90	3	3%	$37,855,600	$2,578,800	7%	$96,474,700	$5,279,000	5%
Public Services	269	65	24%	$576,592,000	$150,855,900	26%	$825,852,200	$255,855,000	31%
Temporary Lodging	48	10	21%	$60,457,000	$22,791,800	38%	$117,341,600	$48,764,800	42%
Agriculture	31	8	26%	$3,973,800	$641,600	16%	$8,073,840	$1,230,808	15%
Open Space	802	334	42%	$1,946,300	$1,357,000	70%	$185,405,417	$74,337,281	40%
Vacant	2248	584	26%	$895,300	$19,400	2%	$407,311,800	$122,743,500	30%
Recreation	61	15	25%	$28,418,100	$2,522,600	9%	$66,922,731	$9,167,030	14%

Critical facilities that are vulnerable to a sea-level rise of 4 feet include the Coast Guard Station (Tier 1), the Harbor Master Shack and the Woods Hole Draw Bridge Hut (Tier 2), and two HAZMAT locations (Bosun's Marina and East Marine). There are no Tier 3 facilities located in the area of projected inundation due to a 3-foot rise in sea level.

Table 4-10. Parcels and Buildings Vulnerable to a Sea-Level Rise of 5 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	2779	15%	$4,220,652,500	$942,734,900	22%	$9,128,817,000	$2,833,475,600	31%
Residential (Multi-Family)	806	136	17%	$269,636,450	$67,941,800	25%	$551,277,250	$206,744,800	38%
Commercial (Retail/Office/ Services)	389	46	12%	$158,277,300	$37,659,800	24%	$364,926,700	$110,857,100	30%
Commercial (Man./Dist.)	90	3	3%	$37,855,600	$2,578,800	7%	$96,474,700	$5,279,000	5%
Public Services	269	72	27%	$576,592,000	$168,218,100	29%	$825,852,200	$280,057,500	34%
Temporary Lodging	48	14	29%	$60,457,000	$27,768,900	46%	$117,341,600	$57,837,000	49%
Agriculture	31	8	26%	$3,973,800	$641,600	16%	$8,073,840	$1,230,808	15%
Open Space	802	344	43%	$1,946,300	$1,357,000	70%	$185,405,417	$75,011,281	40%
Vacant	2248	628	28%	$895,300	$182,100	20%	$407,311,800	$132,241,000	32%
Recreation	61	17	28%	$28,418,100	$3,516,700	12%	$66,922,731	$10,775,230	16%

Critical facilities that are vulnerable to a sea-level rise of 5 feet include the Coast Guard Station and the Steamship Authority Ferry Terminal (Tier 1), the Harbor Master Shack and the Woods Hole Draw Bridge Hut (Tier 2), the Woods Hole Community Center and the Falmouth Senior Center (Tier 3), and five HAZMAT locations, including marinas and a waterfront WHOI facility.

Table 4-11. Parcels and Buildings Vulnerable to a Sea-Level Rise of 6 Feet.

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	3132	17%	$4,220,652,500	$1,044,423,400	25%	$9,128,817,000	$3,082,066,100	34%
Residential (Multi-Family)	806	156	19%	$269,636,450	$92,198,200	34%	$551,277,250	$241,471,900	44%
Commercial (Retail/Office/ Services)	389	65	17%	$158,277,300	$46,501,400	29%	$364,926,700	$128,748,600	35%
Commercial (Man./Dist.)	90	4	4%	$37,855,600	$2,739,300	7%	$96,474,700	$5,759,900	6%
Public Services	269	80	30%	$576,592,000	$209,652,600	36%	$825,852,200	$328,259,600	40%
Temporary Lodging	48	17	35%	$60,457,000	$34,640,800	57%	$117,341,600	$69,391,300	59%
Agriculture	31	11	35%	$3,973,800	$641,600	16%	$8,073,840	$1,301,545	16%
Open Space	802	354	44%	$1,946,300	$1,357,000	70%	$185,405,417	$75,722,181	41%
Vacant	2248	675	30%	$895,300	$182,100	20%	$407,311,800	$141,711,900	35%
Recreation	61	19	31%	$28,418,100	$6,760,100	24%	$66,922,731	$16,392,131	24%

Critical facilities that are vulnerable to a sea-level rise of 6 feet include the Coast Guard Station and the Steamship Authority Ferry Terminal (Tier 1), the Harbor Master Shack and the Woods Hole Draw Bridge Hut (Tier 2), the Woods Hole Community Center and the Falmouth Senior Center (Tier 3), and five HAZMAT locations, including marinas and a waterfront WHOI facility.

Table 4-12. Parcels and Buildings Vulnerable to a Category 1 Hurricane (SLOSH 1).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	2895	16%	$4,220,652,500	$996,032,000	24%	$9,128,817,000	$2,993,476,900	33%
Residential (Multi-Family)	806	136	17%	$269,636,450	$69,320,400	26%	$551,277,250	$210,293,400	38%
Commercial (Retail/Office/ Services)	389	39	10%	$158,277,300	$18,764,700	12%	$364,926,700	$68,764,100	19%
Commercial (Man./Dist.)	90	3	3%	$37,855,600	$2,578,800	7%	$96,474,700	$5,279,000	5%
Public Services	269	65	24%	$576,592,000	$127,649,500	22%	$825,852,200	$228,756,000	28%
Temporary Lodging	48	12	25%	$60,457,000	$22,135,000	37%	$117,341,600	$48,266,300	41%
Agriculture	31	4	13%	$3,973,800	$641,600	16%	$8,073,840	$1,169,680	14%
Open Space	802	328	41%	$1,946,300	$1,288,800	66%	$185,405,417	$71,710,196	39%
Vacant	2248	626	28%	$895,300	$182,100	20%	$407,311,800	$133,003,800	33%
Recreation	61	17	28%	$28,418,100	$6,456,000	23%	$66,922,731	$16,179,931	24%

Critical facilities that are vulnerable to flooding during a Category 1 hurricane include the Coast Guard Station and the Steamship Authority Ferry Terminal (Tier 1), the Woods Hole Draw Bridge Hut (Tier 2), the Woods Hole Community Center (Tier 3), and five HAZMAT locations, including marinas and a waterfront WHOI facility.

Table 4-13. Parcels and Buildings Vulnerable to a Category 2 Hurricane (SLOSH 2).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	4697	26%	$4,220,652,500	$1,433,166,300	34%	$9,128,817,000	$3,984,169,000	44%
Residential (Multi-Family)	806	218	27%	$269,636,450	$92,632,600	34%	$551,277,250	$259,720,800	47%
Commercial (Retail/Office/ Services)	389	89	23%	$158,277,300	$59,639,300	38%	$364,926,700	$156,683,200	43%
Commercial (Man./Dist.)	90	11	12%	$37,855,600	$6,333,700	17%	$96,474,700	$12,720,200	13%
Public Services	269	90	33%	$576,592,000	$208,461,500	36%	$825,852,200	$333,297,700	40%
Temporary Lodging	48	21	44%	$60,457,000	$34,873,900	58%	$117,341,600	$71,159,300	61%
Agriculture	31	11	35%	$3,973,800	$641,600	16%	$8,073,840	$1,301,545	16%
Open Space	802	361	45%	$1,946,300	$1,457,700	75%	$185,405,417	$102,097,937	55%
Vacant	2248	765	34%	$895,300	$182,100	20%	$407,311,800	$165,781,400	41%
Recreation	61	20	33%	$28,418,100	$6,689,500	24%	$66,922,731	$16,773,331	25%

Critical facilities that are vulnerable to flooding during a Category 2 hurricane include the Coast Guard Station, the Steamship Authority Ferry Terminal, the Falmouth Harbor Master Building, and the NS Treatment Plant (Tier 1), the Woods Hole Draw Bridge Hut (Tier 2), the Woods Hole Community Center, the Falmouth Recreation Department, and the WHOI/MBL dorms on Devils Lane (Tier 3), and seven HAZMAT locations, including marinas and a waterfront WHOI facility.

Table 4-14. Parcels and Buildings Vulnerable to a Category 3 Hurricane (SLOSH 3).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	6706	36%	$4,220,652,500	$1,842,963,600	44%	$9,128,817,000	$4,857,573,400	53%
Residential (Multi-Family)	806	305	38%	$269,636,450	$117,760,800	44%	$551,277,250	$305,636,900	55%
Commercial (Retail/Office/ Services)	389	150	39%	$158,277,300	$84,088,200	53%	$364,926,700	$206,096,800	56%
Commercial (Man./Dist.)	90	15	17%	$37,855,600	$7,367,500	19%	$96,474,700	$16,194,500	17%
Public Services	269	111	41%	$576,592,000	$309,001,400	54%	$825,852,200	$445,925,400	54%
Temporary Lodging	48	25	52%	$60,457,000	$39,414,800	65%	$117,341,600	$78,606,500	67%
Agriculture	31	15	48%	$3,973,800	$1,062,000	27%	$8,073,840	$2,439,177	30%
Open Space	802	397	50%	$1,946,300	$1,457,700	75%	$185,405,417	$105,587,666	57%
Vacant	2248	917	41%	$895,300	$260,700	29%	$407,311,800	$195,006,600	48%
Recreation	61	21	34%	$28,418,100	$7,012,800	25%	$66,922,731	$17,299,431	26%

Critical facilities that are vulnerable to flooding during a Category 3 hurricane include Town Hall, the Cape Cod Free Clinic & Community Health Center, the Coast Guard Station, the Steamship Authority Ferry Terminal, the Falmouth Harbor Master Building, and the NS Treatment Plant (Tier 1), the Teaticket Elementary School, the Mullen Hall School, the Woods Hole Draw Bridge Hut and the main Falmouth Post Office (Tier 2), the Woods Hole Community Center, the Falmouth Recreation Department, and the WHOI/MBL dorms on Devils Lane (Tier 3), seven HAZMAT locations, including marinas and a waterfront WHOI facility, and the Stop and Shop gas station.

Table 4-15. Parcels and Buildings Vulnerable to a Category 4 Hurricane (SLOSH 4).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	8329	45%	$4,220,652,500	$2,160,819,500	51%	$9,128,817,000	$5,495,766,500	60%
Residential (Multi-Family)	806	405	50%	$269,636,450	$166,133,600	62%	$551,277,250	$382,011,000	69%
Commercial (Retail/Office/ Services)	389	211	54%	$158,277,300	$112,542,800	71%	$364,926,700	$260,835,600	71%
Commercial (Man./Dist.)	90	21	23%	$37,855,600	$10,078,200	27%	$96,474,700	$23,356,000	24%
Public Services	269	135	50%	$576,592,000	$327,634,900	57%	$825,852,200	$480,846,200	58%
Temporary Lodging	48	35	73%	$60,457,000	$45,477,700	75%	$117,341,600	$90,233,200	77%
Agriculture	31	17	55%	$3,973,800	$1,221,100	31%	$8,073,840	$2,852,301	35%
Open Space	802	429	53%	$1,946,300	$1,457,700	75%	$185,405,417	$108,127,066	58%
Vacant	2248	1045	46%	$895,300	$260,700	29%	$407,311,800	$214,783,100	53%
Recreation	61	23	38%	$28,418,100	$7,629,100	27%	$66,922,731	$21,088,455	32%

Critical facilities that are vulnerable to flooding during a Category 4 hurricane include Town Hall, the West Falmouth Fire Station, the Falmouth Housing Authority, the Cape Cod Free Clinic & Community Health Center, the Coast Guard Station, the Steamship Authority Ferry Terminal, the Falmouth Harbor Master Building, and the NS Treatment Plant (Tier 1), the Teaticket Elementary School, the Mullen Hall School, the Falmouth Public Library, the Woods Hole Draw Bridge Hut and the main Falmouth Post Office (Tier 2), Cape Cod Ambulance Medical, Pier 37, the Woods Hole Community Center, the Falmouth Recreation Department, and the WHOI/MBL dorms on Devils Lane (Tier 3), eight HAZMAT locations, including marinas, a concrete company and a waterfront WHOI facility, and the Stop and Shop gas station.

Table 4-16. Parcels and Buildings Vulnerable to High Winds (within Wind District).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	10777	59%	$4,220,652,500	$2,786,186,600	66%	$9,128,817,000	$6,696,833,500	73%
Residential (Multi-Family)	806	492	61%	$269,636,450	$177,040,200	66%	$551,277,250	$410,501,700	74%
Commercial (Retail/Office/ Services)	389	244	63%	$158,277,300	$109,513,600	69%	$364,926,700	$258,432,700	71%
Commercial (Man./Dist.)	90	22	24%	$37,855,600	$6,185,600	16%	$96,474,700	$16,074,600	17%
Public Services	269	168	62%	$576,592,000	$324,413,100	56%	$825,852,200	$495,830,600	60%
Temporary Lodging	48	39	81%	$60,457,000	$43,173,700	71%	$117,341,600	$85,109,000	73%
Agriculture	31	12	39%	$3,973,800	$1,423,100	36%	$8,073,840	$3,141,885	39%
Open Space	802	473	59%	$1,946,300	$1,537,800	79%	$185,405,417	$114,739,066	62%
Vacant	2248	1326	59%	$895,300	$182,100	20%	$407,311,800	$278,187,900	68%
Recreation	61	30	49%	$28,418,100	$9,064,300	32%	$66,922,731	$22,057,708	33%

Critical facilities that are vulnerable to high winds include the West Falmouth Fire Station, the North Falmouth Fire Station, Emergency Operations Center (Headquarters), Woods Hole Fire Station, Falmouth Housing Authority, Town Hall, the Falmouth Harbor Master Building, Falmouth Police Department, the Coast Guard Station, the Steamship Authority Ferry Terminal, the NS Treatment Plant, and nursing and medical facilities including JML Care Center, Inc., Royal Megansett Nursing and Retirement Home, Royal Nursing and Alzheimer's Center, and Cape Cod Free Clinic & Community Health Center (Tier 1), the main Falmouth Public Library, the main Post Office, the Human Services Department, Cape & Islands NPR Radio, Lawrence Jr. High School, North Falmouth Elementary School, Mullen Hall School, the Falmouth Recreation Department, the Woods Hole Drawbridge Hut, and Nobska Lighthouse (Tier 2), 9 Tier 3 facilities and 10 HAZMAT sites (see comprehensive results table in Appendix C).

Table 4-17. Parcels and Buildings Vulnerable to Wild Fire (with Low Risk).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	7343	40%	$4,220,652,500	$1,539,593,700	36%	$9,128,817,000	$3,642,730,700	40%
Residential (Multi-Family)	806	407	50%	$269,636,450	$129,463,900	48%	$551,277,250	$293,353,200	53%
Commercial (Retail/Office/ Services)	389	260	67%	$158,277,300	$121,084,400	77%	$364,926,700	$273,908,700	75%
Commercial (Man./Dist.)	90	23	26%	$37,855,600	$7,705,300	20%	$96,474,700	$21,265,000	22%
Public Services	269	171	64%	$576,592,000	$478,495,000	83%	$825,852,200	$655,236,900	79%
Temporary Lodging	48	37	77%	$60,457,000	$45,439,100	75%	$117,341,600	$89,629,900	76%
Agriculture	31	10	32%	$3,973,800	$1,034,100	26%	$8,073,840	$2,280,747	28%
Open Space	802	216	27%	$1,946,300	$1,253,000	64%	$185,405,417	$55,759,320	30%
Vacant	2248	668	30%	$895,300	$241,300	27%	$407,311,800	$132,692,600	33%
Recreation	61	22	36%	$28,418,100	$10,806,400	38%	$66,922,731	$27,080,152	40%

Critical facilities that have a low risk of wildfire include the Falmouth Hospital, the Emergency Operations Center (Headquarters), the East Falmouth Fire Station, the Falmouth Housing Authority, Town Hall, the Falmouth Harbor Master Building, the Falmouth Police Department, the Steamship Authority Ferry Terminal, and various medical and nursing facilities (i.e. Royal Nursing and Alzheimer's Center, Cape Cod Free Clinic & Health Center) (Tier 1), the Falmouth Pubic Library, the main Post Office, the Human Services Department, Cape & Islands NPR Radio, East Falmouth Elementary School, Lawrence Jr. High School, Morse Pond Middle School, Mullen Hall School, the MBL/WHOI dorms, the Falmouth Recreation Department, the Woods Hole Drawbridge Hut, and Nobska Lighthouse (Tier 2), a number of Tier 3 facilities (see comprehensive results table in Appendix C), 9 HAZMAT sites (see comprehensive results table in Appendix C), and the Stop and Shop gas station.

Table 4-18. Parcels and Buildings Vulnerable to Wild Fire (with Moderate Risk).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	9462	51%	$4,220,652,500	$2,198,608,200	52%	$9,128,817,000	$4,758,969,100	52%
Residential (Multi-Family)	806	358	44%	$269,636,450	$140,742,650	52%	$551,277,250	$285,961,150	52%
Commercial (Retail/Office/ Services)	389	142	37%	$158,277,300	$65,961,800	42%	$364,926,700	$155,247,700	43%
Commercial (Man./Dist.)	90	49	54%	$37,855,600	$27,149,100	72%	$96,474,700	$59,279,800	61%
Public Services	269	118	44%	$576,592,000	$252,733,300	44%	$825,852,200	$375,704,700	45%
Temporary Lodging	48	14	29%	$60,457,000	$29,159,800	48%	$117,341,600	$56,913,100	49%
Agriculture	31	16	52%	$3,973,800	$1,588,700	40%	$8,073,840	$3,497,833	43%
Open Space	802	457	57%	$1,946,300	$1,755,500	90%	$185,405,417	$99,566,564	54%
Vacant	2248	1232	55%	$895,300	$104,200	12%	$407,311,800	$196,232,300	48%
Recreation	61	29	48%	$28,418,100	$10,013,000	35%	$66,922,731	$26,394,733	39%

Critical facilities that have a moderate risk of wildfire include the West Falmouth Fire Station, the North Falmouth Fire Station, the Woods Hole Fire Station, the Falmouth School Administration, the Wastewater Treatment Facility, the NS Treatment Plant, the Mass Highway Department, the Department of Public Works, the Water Plan Pumping Station, Atria Woodbriar, and the Royal Megansett Nursing and Retirement Home (Tier 1), North Falmouth Elementary School, Teaticket Elementary School, and the Bonanza Bus Lines Terminal (Tier 2), a number of Tier 3 facilities (see comprehensive results table in Appendix C), and 11 HAZMAT sites (see comprehensive results table in Appendix C).

Table 4-19. Parcels and Buildings Vulnerable to Wild Fire (with High Risk).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	3617	20%	$4,220,652,500	$990,272,000	23%	$9,128,817,000	$1,868,996,500	20%
Residential (Multi-Family)	806	130	16%	$269,636,450	$47,308,700	18%	$551,277,250	$88,258,400	16%
Commercial (Retail/Office/ Services)	389	28	7%	$158,277,300	$5,977,500	4%	$364,926,700	$18,792,000	5%
Commercial (Man./Dist.)	90	33	37%	$37,855,600	$11,209,400	30%	$96,474,700	$36,530,400	38%
Public Services	269	59	22%	$576,592,000	$208,582,200	36%	$825,852,200	$280,937,800	34%
Temporary Lodging	48	3	6%	$60,457,000	$17,334,800	29%	$117,341,600	$33,550,300	29%
Agriculture	31	21	68%	$3,973,800	$3,468,600	87%	$8,073,840	$6,403,512	79%
Open Space	802	330	41%	$1,946,300	$1,227,800	63%	$185,405,417	$116,383,007	63%
Vacant	2248	613	27%	$895,300	$654,000	73%	$407,311,800	$130,226,100	32%
Recreation	61	24	39%	$28,418,100	$16,517,700	58%	$66,922,731	$37,872,455	57%

Critical facilities that have a high risk of wildfire include the Department of Natural Resources, the Crooked Pond Treatment Plant, the Mares Pond Well, the Fresh Pond Well, the Coonamessett Well, the Ashumet Well, Crooked Pond Well, Long Pond Reservoir, two Sewer Pumping Stations, two Water Towers, Heritage at Falmouth, and the JML Care Center, Inc. (Tier 1), the Falmouth High School (Tier 2), a number of Tier 3 facilities, including Falmouth Academy, Sea Education Association, Inc., and 4 HAZMAT sites (see comprehensive results table in Appendix C).

Table 4-20. Parcels and Buildings Vulnerable to Wild Fire (with Extreme Risk).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	84	0%	$4,220,652,500	$36,611,700	1%	$9,128,817,000	$80,313,300	1%
Residential (Multi-Family)	806	2	0%	$269,636,450	$521,700	0%	$551,277,250	$1,646,500	0%
Commercial (Retail/Office/ Services)	389	0	0%	$158,277,300	$0	0%	$364,926,700	$0	0%
Commercial (Man./Dist.)	90	0	0%	$37,855,600	$0	0%	$96,474,700	$0	0%
Public Services	269	0	0%	$576,592,000	$0	0%	$825,852,200	$0	0%
Temporary Lodging	48	0	0%	$60,457,000	$0	0%	$117,341,600	$0	0%
Agriculture	31	0	0%	$3,973,800	$0	0%	$8,073,840	$0	0%
Open Space	802	14	2%	$1,946,300	$0	0%	$185,405,417	$984,500	1%
Vacant	2248	10	0%	$895,300	$0	0%	$407,311,800	$2,257,300	1%
Recreation	61	1	2%	$28,418,100	$0	0%	$66,922,731	$1,110,700	2%

There are no critical facilities that have an extreme risk of wildfire.

Table 4-21. Parcels and Buildings Located within the Wild Fire Mitigation Focus Areas

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	3448	19%	$4,220,652,500	$944,595,800	22%	$9,128,817,000	$1,742,258,900	19%
Residential (Multi-Family)	806	103	13%	$269,636,450	$34,817,300	13%	$551,277,250	$55,639,300	10%
Commercial (Retail/Office/ Services)	389	16	4%	$158,277,300	$3,963,000	3%	$364,926,700	$8,599,700	2%
Commercial (Man./Dist.)	90	27	30%	$37,855,600	$8,631,100	23%	$96,474,700	$30,497,300	32%
Public Services	269	46	17%	$576,592,000	$187,651,600	33%	$825,852,200	$243,673,300	30%
Temporary Lodging	48	2	4%	$60,457,000	$12,049,300	20%	$117,341,600	$23,515,700	20%
Agriculture	31	21	68%	$3,973,800	$3,468,600	87%	$8,073,840	$6,403,512	79%
Open Space	802	302	38%	$1,946,300	$1,133,400	58%	$185,405,417	$113,646,222	61%
Vacant	2248	568	25%	$895,300	$654,000	73%	$407,311,800	$123,910,400	30%
Recreation	61	20	33%	$28,418,100	$16,278,200	57%	$66,922,731	$35,915,920	54%

Critical facilities located within the Wildfire Mitigation Focus Areas include the Department of Natural Resources, the Crooked Pond Treatment Plant, the Mares Pond Well, the Fresh Pond Well, the Coonamessett Well, the Ashumet Well, Crooked Pond Well, two Sewer Pumping Stations, two Water Towers, Heritage at Falmouth, and the JML Care Center, Inc. (Tier 1), the Falmouth High School (Tier 2), and a number of Tier 3 facilities, including Falmouth Academy, and Sea Education Association, Inc., and 4 HAZMAT sites (see comprehensive results table in Appendix C).

Table 4-22. Parcels and Buildings Vulnerable to Dam Failure (within 1000 feet of a dam).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	327	2%	$4,220,652,500	$61,026,600	1%	$9,128,817,000	$103,030,000	1%
Residential (Multi-Family)	806	42	5%	$269,636,450	$10,217,600	4%	$551,277,250	$17,487,500	3%
Commercial (Retail/Office/ Services)	389	48	12%	$158,277,300	$19,988,600	13%	$364,926,700	$34,613,800	9%
Commercial (Man./Dist.)	90	1	1%	$37,855,600	$0	0%	$96,474,700	$386,200	0%
Public Services	269	24	9%	$576,592,000	$107,584,900	19%	$825,852,200	$124,374,800	15%
Temporary Lodging	48	1	2%	$60,457,000	$307,800	1%	$117,341,600	$580,000	0%
Agriculture	31	1	3%	$3,973,800	$0	0%	$8,073,840	$54,844	1%
Open Space	802	34	4%	$1,946,300	$851,600	44%	$185,405,417	$9,897,700	5%
Vacant	2248	53	2%	$895,300	$0	0%	$407,311,800	$6,112,400	2%
Recreation	61	4	7%	$28,418,100	$982,400	3%	$66,922,731	$1,776,132	3%

Critical facilities that are vulnerable to dam failure (are within 1,000 feet of a dam) include Town Hall and the Cape Cod Free Clinic & Community Health Center (Tier 1), and the Falmouth Public Library, the main Post Office, the Human Services Department, the Lawrence Jr. High School and the Mullen Hall School (Tier 2). There are no Tier 3 critical facilities within 1,000 feet of a dam.

Table 4-23. Parcels and Buildings Vulnerable to Culvert Failure (within 1000 feet of a culvert).

	Number of Parcels			Value of Buildings			Value of Total Property		
Land Use	Total	Total in Hazard	% in Hazard	Total Value	Total Value in Hazard	% Value in Hazard	Total Value	Total Value in Hazard	% Value in Hazard
Residential (Single Family)	18410	3156	17%	$4,220,652,500	$757,593,300	18%	$9,128,817,000	$1,744,120,600	19%
Residential (Multi-Family)	806	170	21%	$269,636,450	$56,003,800	21%	$551,277,250	$112,994,800	20%
Commercial (Retail/Office/ Services)	389	89	23%	$158,277,300	$49,763,700	31%	$364,926,700	$115,459,300	32%
Commercial (Man./Dist.)	90	24	27%	$37,855,600	$12,408,100	33%	$96,474,700	$26,917,500	28%
Public Services	269	74	28%	$576,592,000	$268,521,900	47%	$825,852,200	$344,704,700	42%
Temporary Lodging	48	10	21%	$60,457,000	$23,024,700	38%	$117,341,600	$44,311,600	38%
Agriculture	31	17	55%	$3,973,800	$962,700	24%	$8,073,840	$2,228,657	28%
Open Space	802	271	34%	$1,946,300	$610,200	31%	$185,405,417	$64,573,996	35%
Vacant	2248	482	21%	$895,300	$260,700	29%	$407,311,800	$76,777,500	19%
Recreation	61	24	39%	$28,418,100	$4,550,500	16%	$66,922,731	$16,691,564	25%

Critical facilities that are vulnerable to culvert failure (are within 1,000 feet of a culvert) include the West Falmouth Fire Station, the Wastewater Treatment Facility, and the Center for Optimum Care/Harborside Health Center (Tier 1), the Falmouth Public Library, Cape & Islands NPR Radio, the Lawrence Jr. High School, Morse Pond Middle School, Mullen Hall School, the Falmouth Recreation Department and the Woods Hole Drawbridge Hut (Tier 2), Falmouth Senior Center, the West Falmouth Public Library, the Woods Hole Library, and the Woods Hole Community Center (Tier 3), 2 HAZMAT sites (a WHOI facility and Associates of Cape Cod), and the Stop and Shop Gas Station.

The results of the evacuation route evaluation identified a number of locations along Falmouth's coastline where inundation from flooding or hurricane storm surge could impede traffic and access. For reference, Figure 2-8, in Section 2.8 shows the location of the evacuation routes. Below, Figure 4-1 shows black circles around the portions of the evacuation routes that would likely be inundated during a 100-year storm as predicted by FEMA. These include 6 locations along Route 28 in East Falmouth where the road crosses the heads of Falmouth coastal ponds, an area of Route 28A in West Falmouth, and a section of Sippewissett Road in Quisset.

Figure 4-2 shows a similar evaluation for the areas of Falmouth's evacuation routes that would be potentially inundated by storm surge during hurricanes of various categories as predicted by the USACE SLOSH modeling. Storm surge produced by a hurricane is projected to impact similar areas as identified through the flood zone analysis, however, there are additional sections of the evacuation routes potentially impacted by hurricanes. This is particularly true for the areas that would be impacted by the storm surge from a Category 3 or 4 hurricane. The vulnerable areas identified in Figure 4-2 are the same as those identified in Figure 4-1, with two exceptions: the vulnerable area of Route 28A in West Falmouth is more wide spread, and there is an additional vulnerable area in the vicinity of Jones Road.

The impact of sea-level rise on the Town's evacuation routes was also assessed. The results indicated that sea-level rise on its own will not directly impact any of the current evacuation routes designated by the Town. However, sea-level rise in combination with flooding from a 100-year storm or a hurricane is a threat to the continued utilization of a number of these evacuation routes. This scenario causes additional areas of roadway to become impacted. Additionally, areas projected to be inundated by one of these hazards today will experience even greater depths of inundation as sea level rises in the future.

This assessment indicates that the evacuation routes in Town should be re-evaluated. Elevations of bridges could be checked and confirmed to determine whether the threat of flooding projected along Route 28 in East Falmouth is real. Because this is a state road, the Town should consider discussing future mitigation options with the Massachusetts Highway Department. Additional evacuation routes could be designated to direct traffic away from potentially inundated areas. Finally, if alternatives cannot be found, some roads, particularly those leading from Woods Hole, may need to be raised or fortified to ensure safe passage if necessary.

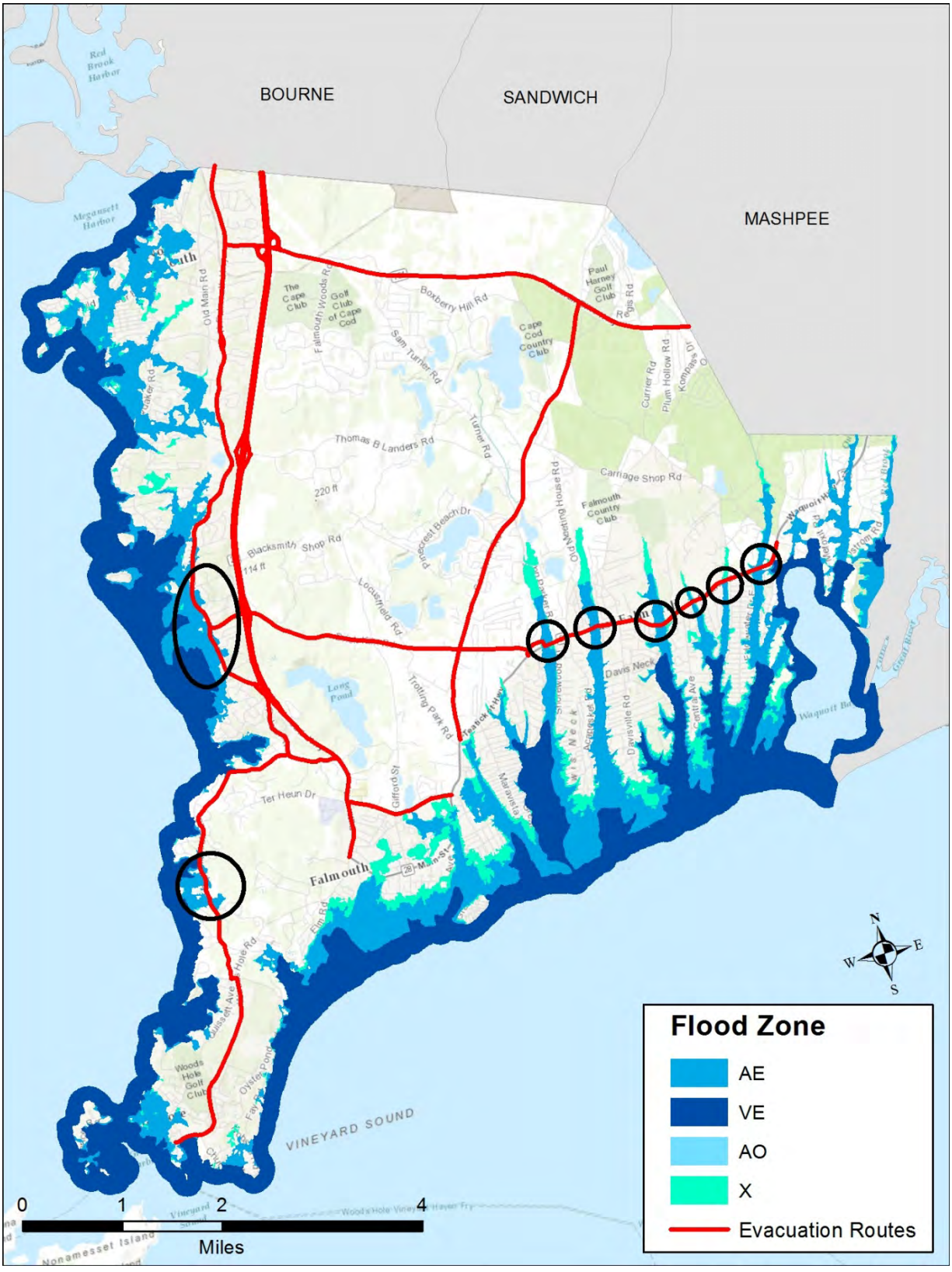

Figure 4-1. Potentially inundated evacuation routes due to the 100-year storm.

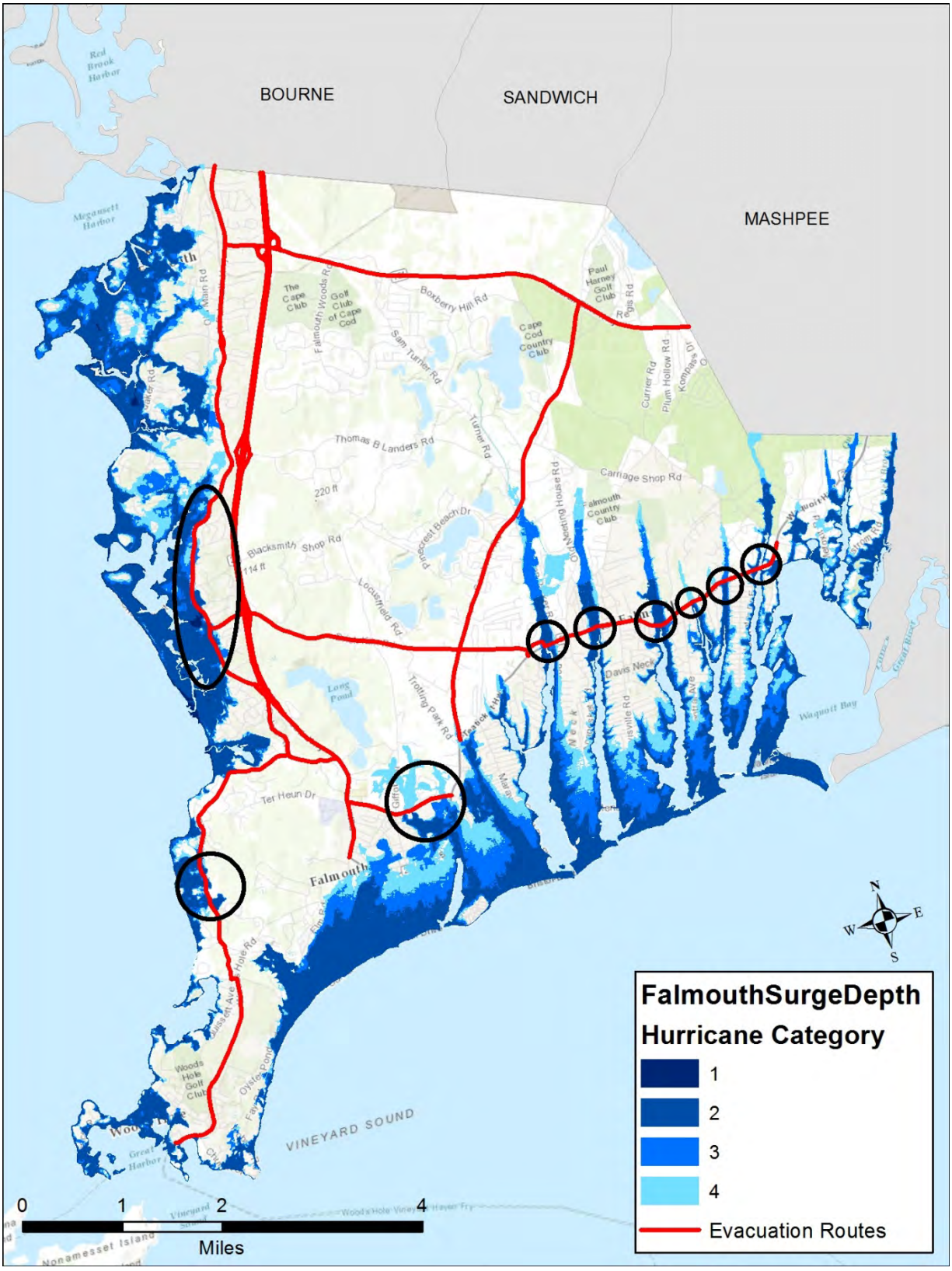

Figure 4-2. Potentially inundated evacuation routes due to hurricane storm surge.

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4.3 Vulnerable Properties & Critical Facilities

Although the tables in Section 4.2 provide a detailed summary of the potential impacts from each type and magnitude of risk analyzed, this section will summarize the main findings from this analysis. The findings include hazards that have the potential to harm the most properties or cost the most economic damage, critical facilities that are impacted by the most hazards, and vulnerabilities of the highest concern to the Town. This summary will also be used to direct the development of mitigation actions.

When looked at individually, based on the risk area maps utilized for this analysis, flooding and hurricanes have the potential to cause the most damage, in terms of the total value of all properties and buildings affected. Tables 4-2, 4-3, and 4-4 summarize the number of parcels that overlap with the VE, AE, or other types of flood zones, respectively. However, these tables are not additive. A single property can contain both a VE and an AE zone, for example, and would therefore be double counted. However, when all parcels overlapping with any portion of the SFHA are summed, the total value of all structures and property is approximately $5.9 billion. Additionally, because flooding often causes more permanent damage to structures than to the land itself, it is worth noting that the total value of buildings within the SFHA in Falmouth is approximately $2.25 billion. At a similar magnitude of financial impact, the surge inundation (i.e. flooding) that would result from a Category 2 hurricane would impact properties with building and total property values totaling approximately $1.85 billion and $5.1 billion, respectively (Table 4-13). Finally, although based on the mapping criteria alone, it appears that flooding can cause more damage than hurricanes, this does not account for the Town-wide impacts that hurricanes can produce from heavy rains and high winds; these additional forces would likely make the financial impacts of a Category 2 hurricane much more substantial than would be expected with flooding alone.

Of the critical facilities impacted by flooding, the Coast Guard Station, the Harbor Master Shack and the Woods Hole Drawbridge Hut are Tier 1 and 2 facilities located within a VE flood zone, while the Steamship Authority and Island Queen Ferry Terminals, and the West Falmouth Post Office are all Tier 1 and 2 facilities located within an AE flood zone. It is worth noting that the Woods Hole Drawbridge Hut flooded during Tropical Storm Sandy and has been retrofitted with a closed bulkhead to provide additional freeboard to avoid such flooding in the future (Figure 4-3). Similar flood mitigation measures should be considered for these other facilities.

Figure 4-3. Woods Hole Drawbridge Hut flooded immediately after Tropical Storm Sandy (top) and after bulkhead construction (bottom).

It is also worth acknowledging the breakdown of land use types impacted by these hazards. The inundation projected from a Category 2 hurricane will impact primarily single-family residential properties (4,697 parcels out of a total of 23,305 total parcels in Falmouth); 4,697 single-family residential parcels represent 26% of that land-use category. Additionally, although only 21 Temporary Lodging parcels are projected to be inundated, this number represents 44% of that land use category. As a Town with high visitor numbers, particularly during the summer, which overlaps with hurricane season, this could result in a many hotels and other lodging facilities unable to adequately house their guests after a hurricane event.

For this analysis, all coastal waterfront properties were assumed to be vulnerable to coastal erosion. The total building and total property values for all coastal parcels sums to approximately $388 million and $1.5 billion, respectively. Although, single-family residential parcels accounted for the highest number of coastal parcels (449 parcels), this number represented only 2% of the number of single-family residential land in Town. At 93 and 146 parcels, coastal Open Space and Vacant Land represents 12% and 6% of each of those categories, respectively. This indicates that many of the coastal parcels in Falmouth are open space, comprised of beaches and marshes. Coastal erosion in these instances would not necessarily threaten structures, but will likely have an adverse impact on coastal habitat quality, coastal resilience, and aesthetics. It is worth noting, as discussed in Section 3.2, coastal erosion impacts different areas of the coast at different rates. However, a detailed assessment of which parcels and structures in Town would be adversely impacted by significant coastal erosion was beyond the scope of this analysis.

Sea-level rise was considered as potential increases above current day MHHW. Depending on which sea-level rise scenario the Town considers for future planning purposes, these increases can be roughly correlated to dates based on Figure 3-10. For example, 1 foot of sea-level rise is projected to occur by approximately 2030 according to a High sea-level rise scenario, but not until approximately 2075 under an Intermediate-Low scenario. Similarly, 3 feet of sea-level rise is projected to occur by approximately 2065 under a High sea-level rise scenario, but not until approximately 2080 under an Intermediate-High scenario. Additionally, 6 feet of sea-level rise is only projected to occur by 2100 under the High scenario.

For this discussion, impacts from 3 feet and 6 feet of sea-level rise were considered. With 3 feet of sea-level rise above today's MHHW, 3,249 parcels (14% of the total parcels in Falmouth) with total property values totaling more than $3 billion would experience some additional inundation, particularly during high tide. The majority of these parcels are single-family residential (2,157). As mentioned above, this would be expected to occur by approximately 2065 under a High sea-level rise scenario, but not until approximately 2080 under an Intermediate-High scenario. With 6 feet of sea-level rise, these numbers increase to 4,513 total parcels (19.5% of all the parcels in Falmouth) with property values totaling approximately $4 billion.

The real hazard lies in the combination of sea-level rise and all of the hazards discussed so far (i.e. flooding, hurricanes and coastal erosion); these hazards will all be exacerbated by sea-level rise as time goes on.

As shown in Figure 3-20, high winds are most likely within 1-mile of the coast (i.e. Wind District). This area encompasses

13,708 parcels; almost 60% of all parcels in Falmouth. This number includes 10,777 single-family residential parcels, representing 59% of that land use type, but also 168 parcels classified as public services and 39 parcels classified as temporary lodging (62% and 81% of those land use types, respectively) (Table 4-16). It is important to note the simplification of this analysis: all parcels within 1 mile of the coast are included, but not all properties and structures in that zone are equally vulnerable to wind. Some properties will be sheltered by hills and other variations in topography, and there is a wide range of building construction and maintenance practices that might make certain buildings more resilient to high wind. There are a significant number of Tier 1 critical facilities within Falmouth's Wind District; these facilities should be assessed for adequate construction to mitigate any impacts from high winds.

In terms of risk from wildfire, it is worth noting that based on Figure 3-26, which shows the Town of Falmouth Wildfire Risk Map from the Barnstable County Wildfire Preparedness Plan, the entire Town is at some risk to wildfire. However, this discussion will focus on the parts of Town with a High or Extreme risk of wildfire. There are 4,858 parcels within the High Risk Area for wildfire, with a combined total value of approximately $2.6 million. Although the majority of parcels within the High Fire Risk area are classified as single-family residential parcels, these 3617 parcels only represent 20% of that category. There are only 21 Agricultural parcels in the High Fire Risk area; these parcels represent 68% of the agriculture parcels, and 79% of their value (Table 4-19). There are also a number of wells and water reservoirs and treatment facilities within this High Fire Risk Area (i.e. Crooked Pond Treatment Plant, Mares Pond Well, Coonamessett Well, Long Pond Reservoir, Pumping Stations and Water Towers). Although a wildfire may not harm water reservoirs directly, drinking water can become contaminated from chemicals and microorganisms that enter a fire damaged well system. Additionally, fire retardants used to control a wildfire can discolor the water supply, and although generally harmless to humans, they can cause toxicity to some aquatic organisms. There are also a number of schools and education facilities within this High Fire Risk area (i.e. Falmouth High School, Falmouth Academy, Waquoit Nursery School, etc.).

The Extreme Fire Risk areas are the smallest of all the fire risk categories. As discussed in Chapter 3, these are located in four small areas: 1. Little Sippewissett Marsh area, 2. between Brick Kiln and Blacksmith Shop Roads, 3. in the vicinity of the North Falmouth Wooded Parcel, and 4. between the Quashnet River and Hamblin Pond near Waquoit Bay. There are 111 parcels within these zones, with combined property values totaling over $88 million. Of these parcels, 84 are single-family residential parcels, 14 open space parcels, 10 vacant parcels, and 1 recreation parcel.

The Barnstable County Wildfire Risk Map also identifies a number of Fire Mitigation Focus Areas. There are a number of Tier 1 and 2 critical facilities that fall within these areas, as well as within a High Fire Risk area; The Department of Natural Resources Building, the West Falmouth Post Office, the Falmouth High School, Heritage at Falmouth, JML Care Center, Inc., the Crooked Pond Treatment Plant, Crooked Pond Well, Mares Pond Well, Fresh Pond Well, Coonamessett Well, Ashumet Well, two Sewer Pumping Stations and two Water Towers.

A number of critical facilities were also identified that could be potentially harmed by a wide range of natural hazards:

1. Surf Drive Bath House (Beach Committee Building): This coastal building is vulnerable to flooding (located in a VE flood zone), to sea-level rise (will experience some inundation with only 3 feet of sea-level rise, even in the absence of storms), to inundation during a hurricane of any category, and to coastal erosion.
2. Woods Hole Drawbridge Hut: The building that houses the mechanics to open and close the drawbridge is vulnerable to flooding (located in a VE flood zone), to sea-level rise (will experience some inundation with only 2 feet of sea-level rise, even in the absence of storms), to inundation during a hurricane of any category, and to high wind.
3. Coast Guard Station: The Coast Guard Station is vulnerable to flooding (located in a VE flood zone), to sea-level rise (will experience some inundation with 4 feet of sea-level rise, even in the absence of storms), to inundation during a hurricane of any category, and to coastal erosion.

Figure 4-4. Woods Hole Coast Guard Station

4. Steamship Authority Ferry Terminal: The terminal building is vulnerable to flooding (located in a AE flood zone), to sea-level rise (will experience some inundation with 5 feet of sea-level rise, even in the absence of storms), to inundation during a hurricane of any category, and to high wind.

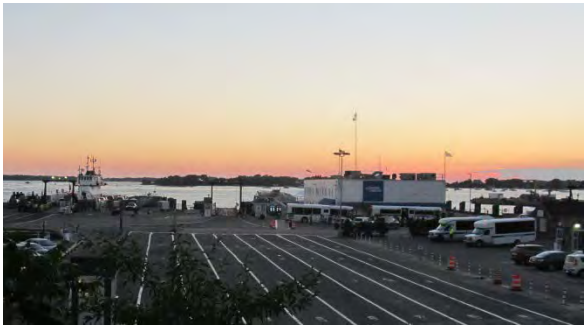

Figure 4-5. Steamship Authority Ferry Terminal

B3.b

4.4 Vulnerable Populations

Falmouth has a number of vulnerable populations, including residents of isolated coastal communities, areas with a high concentration of elderly residents, and centers of tourism and visitor lodging.

Isolated Coastal Communities

With over 70 miles of shoreline, Falmouth is an attractive place to live for both year-round and summer residents. For many, their enjoyment of the coastline is contingent on a sense of privacy or exclusivity that would result in some coastal communities becoming "isolated" during a storm event or similar occurrence. This isolation is the result of being located on long, dead end roads with no secondary means of access when/if the primary road become impassable. Table 4-24 lists fifteen of these isolated coastal communities, as well as the number of residences that would be isolated during an event and the length of roadway involved. These areas range in size from Seacoast Shores, with 900 residences, to Upalong Road in Davisville with five. The long dead end roads are at least a quarter mile long, with Seacoast Shores Boulevard approaching nearly two miles in length. The vulnerable roads leading to these communities are shown in Figure 4-6 in red.

Concentrations of Elderly or Disabled People

Falmouth's aging population is approaching a median age of 55. To meet the housing needs of elderly residents, there are a number of sixty-two and older communities. These places, in addition to senior care and nursing facilities, would need special attention during emergencies or if evacuations become necessary. Table 4-25 lists these areas of concentrated elderly populations. These locations are also shown in Figure 4-6 in green.

There are also disabled individuals who live in Falmouth. While some of these individuals may reside in sixty-two and older communities, or senior care and nursing facilities, it is likely that there are also many disabled residents residing in single- or multi-family homes throughout Town. Disabled residents may need additional help to exit buildings during an emergency, particularly those in wheel chairs and on a floor above the ground level.

Visitor/Tourist Centers

Falmouth is home to over forty hotels, motels, inns, B&B's and other commercial accommodations. Nearly one-third of these businesses are located in flood hazard zones, including four that are in velocity zones. Table 4-26 lists the addresses of each of these locations vulnerable to flooding. These locations are also shown in Figure 4-6 in pink.

During "Race Weekend" (Falmouth Road Race) the population of Falmouth triples with visitors utilizing these accommodations and a multitude of other "air B&B's". In 1991 Hurricane Bob hit Falmouth two days after the race. Had it occurred 48 hours earlier, a more challenging situation would have evolved. Preparations for this worse-case scenario should be in place.

Table 4-24. List of isolated coastal communities.

Street Name	Length (LF)	# of Homes
Point Rd	2,370	25
Bay Shore Rd	1,150	6
Little Island Rd	4,040	28
Associates Rd/Chapoquoit Rd	4,400	42
Little Neck Bars Rd / Blackbeach Hills Rd / Drift Rd	3,800	33
Wood Neck Rd / Maker Ln	1,900	19
Carey Ln / Quissett Harbor Rd	2,650	25
Gansett Rd	1,575	10
Penzance Rd / Windhover Ln	5,800	35
Church St / Nobska Rd	5,800	32
Fells Rd	1,450	19
Metoxit Rd	1,490	15
Upalong Rd	1,250	5
Davis Neck Rd	1,100	35
Seacoast Shores Blvd	8,980	900

Table 4-25. List of elderly communities.

Street Name	Address	# of Units/Beds
Royal Family Nursing and Rehabilitation Center	545 Main St.	25
Atria Woodbriar	339 Gifford St.	6
Royal Megansett Nursing Home	209 County Rd.	28
Falmouth Center	359 Jones Rd.	42
Bayberry House	Rose Morin Ln.	33
JML	384 Ter Heun Dr.	19
Dillingham Place Condominiums	110 Dillingham Ave.	25
Heritage at Falmouth	140 Ter Heun Dr.	10
James L. Conley Tataket Apartments	138 Teaticket Hwy.	35
Royal Megansett Nursing Home	209 County Rd.	32
UCC Apartments	62 Locust St.	19

Table 4-26. List of visitor lodging in flood zones.

Type	Address	Flood Zone
Inn	321 Shore Street	AE
Motel	267 Clinton Ave	VE
Bed & Breakfast	88 Menauhant Rd	VE
Bed & Breakfast	197 Grand Ave	AE
Motel	134 Menauhant Rd	VE
Bed & Breakfast	495 W. Falmouth Hwy	AE
Motel	350 Quaker Rd	VE
Bed & Breakfast	17 Chase Rd	AE
Motel	263 Grand Ave	AE
Motel	7 Harbor Ave	AE
Motel	824 Main Street	AE
Motel	28 Falmouth Heights Rd	AE
Motel	134 Acapesket Rd	AE

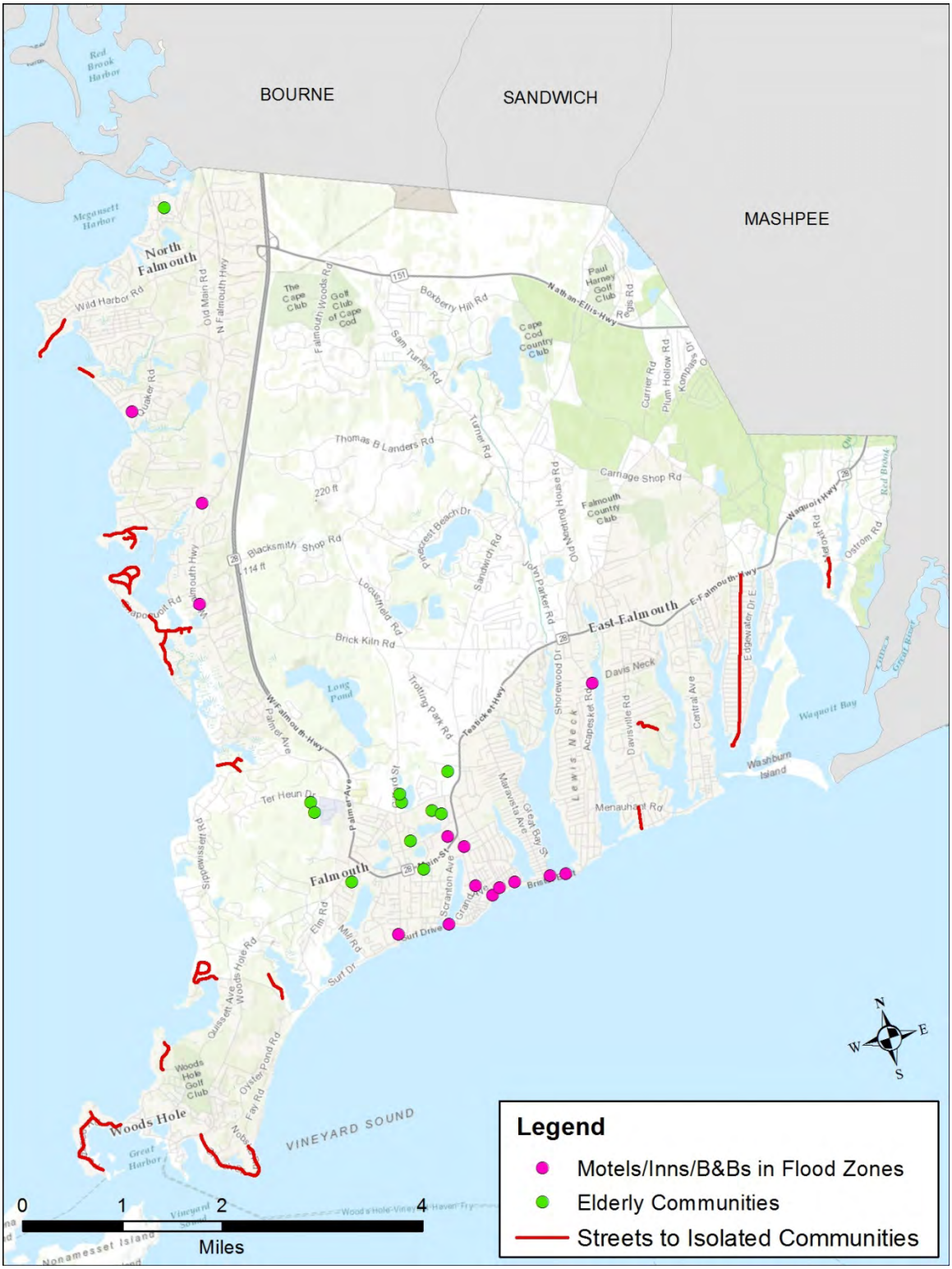

Figure 4-6. Locations of vulnerable populations in Falmouth.

Chapter 5 Mitigation Measures

The first sections of this plan discuss the potential hazards that could occur in Falmouth and some of the potential losses and vulnerabilities associated with each of these hazards. An important next step in hazard mitigation planning is to develop specific strategies and actions that will help mitigate or minimize the risk to these natural hazards. A mitigation action is a specific action, project, activity, or process taken to reduce or eliminate short- or long-term risks to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals. These mitigation strategies are the heart of the mitigation plan. They describe how Falmouth will accomplish their mitigation goals.

This chapter documents Falmouth's mitigation goals and existing and ongoing mitigation actions, as well as its proposed mitigation actions within six categories: 1. Prevention and Resource Protection; 2. Public Safety; 3. Property Protection; 4. Structural Projects; and 5. Public Information and Communications. The purpose, responsibility, priority and timeline is detailed for each of the proposed mitigation actions.

C3.a
C3.b

5.1 Mitigation Goals and Objectives

During Local Emergency Planning Committee (LEPC) meetings, the Local Planning Team developed general goal statements to guide Falmouth's hazard mitigation actions and to reduce impacts and losses due to hazards associated with natural disasters. The following goals were established to minimize the impacts of natural disasters on residents, businesses and infrastructure:

1) Provide residents with adequate access to emergency shelters equipped with sufficient provisions, climate control and emergency electricity during natural disaster events;
2) Improve communications between private citizens, businesses, utility companies, and town, regional, state, and federal agencies before, during and after a natural disaster;
3) Maintain adequate access to public utilities such as electricity, drinking water, and communications during and after a natural disaster;
4) Maintain an adequate Level of Service (LOS) on all roadways during and after natural disasters, particularly on major roadways;
5) Reduce or eliminate damage to buildings and infra-structure from natural hazards;
6) Develop public education outlets and materials to inform residents about what to expect during natural disasters, particularly regarding natural disasters such as hurricanes; and
7) Make improvements to existing practices based on experience gained during disaster response and recovery.

5.2 Existing Capabilities

C1.a
C6

Falmouth has a unique set of capabilities, including Town plans, policies, staff, funding, and other resources available to accomplish mitigation and reduce short- and long-term vulnerability. These capabilities are summarized here, as well as in the Capability Assessment Worksheet included in Appendix C.

Town Plans and Policies

Falmouth has a series of planning documents that address natural hazards. These documents include measures associated with the Town's mitigation strategy, and could be useful when implementing mitigation actions. Through the implementation of these plans, Falmouth can guide and manage growth and development within the Town, with the goal of reducing hazard vulnerability. These plans include:

1. Local Comprehensive Plan (updated 2016)
2. Capital Improvement Planning Policy
3. Comprehensive Emergency Management Plan (created 2016)

Many of the existing Town policies and ordinances also provide an effective means of mitigating hazards. Falmouth has Zoning, Subdivision, and Floodplain ordinances.

Finally, the Falmouth Fire Department received an Insurance Services Office (ISO) score of 60.72 out of 100. In terms of Receiving and Handling Fire Alarms, Fire Department, and Water Supply, the Falmouth Fire Department received ratings of Class 4, 5, and 2, respectively, resulting in an overall community classification of 4, with 1 being the best and 10 the worst.

Town Staff

The Town of Falmouth has a very capable staff that includes a Chief Building Official, an Emergency Manager, a Town Planner, a GIS Coordinator, and a Chief Engineer. Together these staff allow the Town to effectively plan for and implement specific mitigation actions. In addition, the Town has a Local Emergency Planning Committee and a Local Planning Subcommittee, which are instrumental in developing and coordinating mitigation actions.

Financial Capabilities

Financial capabilities are the resources that a Town has to fund mitigation actions. The costs to implement mitigation activities vary from relatively low cost to relatively high cost activities. Low cost actions include building assessment or outreach efforts, which require little to no costs other than staff time and existing operating budgets. Alternatively, higher cost actions, such as the acquisition of flood-prone properties, could require a substantial monetary commitment from local, state, and federal funding sources.

The Town's annual revenue from taxes can be used to fund some mitigation actions, but other larger actions may need additional outside funding, such as from state and federal grant programs.

5.3 Existing Mitigation Measures

Recent natural disaster response has been adequate, with generally good communication and cooperation between various Town departments. Communication efforts have been improved over the years to better prioritize problem areas and expedite responses. Falmouth has implemented a number of existing hazard mitigation measures in response to previous disaster situations. Existing measures primarily include regulations and bylaws to protect existing structures and future development, however other measures are also in place. This section will discuss the existing mitigation measures.

1. **Establish an Emergency Operations Center**

   In 2002, Falmouth established an Emergency Operations Center (EOC) at the Fire Department Headquarters Building at 399 Main Street. The EOC is activated in the event of a natural or other disaster, and provides emergency services such as providing auxiliary communications, lighting, and transportation as needed. The EOC operates under the general direction of the Chief of the Fire Department.

2. **Develop Emergency Management Plans**

   Falmouth developed a Comprehensive Emergency Management Plan (CEMP) in January 2016 to document mitigation, preparedness, and response and recovery actions to be taken by the Town in the event of an emergency. The plan evaluates both natural and manmade hazards, and addresses coordination between multiple departments and agencies within the area to provide for the safety and welfare of Falmouth citizens. The plan will be periodically updated in the future to reflect the most up-to-date information available.

   Falmouth has also developed a Hazardous Materials Emergency Plan (HMEP) to outline planning and response actions in the event of an incident involving hazardous

chemicals. The plan describes actions to be taken to minimize hazards to life and the environment, establishes coordination procedures for multiple agencies, and identifies emergency response actions.

3. Compliance with Federal and State Regulations

Development in Falmouth must adhere to all applicable Federal and State regulations, as set forth by the appropriate agencies. These agencies include, but are not limited to:

- United States Environmental Protection Agency (EPA);
- United States Army Corps of Engineers (USACE);
- Federal Emergency Management Agency (FEMA);
- Massachusetts Department of Environmental Protection (MassDEP);
- Massachusetts Department of Fire Services (DFS); and
- Massachusetts Department of Public Safety (DPS).

All development in town is subject to the minimum requirements set forth by federal and state regulatory agencies. Some regulations and bylaws have been developed that outline more stringent requirements. Applicable local regulations and bylaws are discussed below.

4. Development of Local Regulations and Bylaws

Falmouth currently has a number of bylaws and regulations in place. Some of these bylaws and regulations provide for water quality and resource area protection in an effort to maintain the health and stability of wetlands, marshes, and other environmentally sensitive areas. These areas provide critical water storage during flood events that help alleviate potential property damage and loss of life. Applicable local bylaws and regulations include:

- General Legislation Bylaws:
  - Chapter 87: Beaches;
  - Chapter 110: Disaster and Emergency Management
  - Chapter 123: Fire Prevention
  - Chapter 231: Waterways
  - Chapter 235: Wetlands Protection
  - Chapter 240: Zoning
  - Chapter 305: Subdivision Regulations
- Department of Public Works (DPW) Construction Specifications (2009)
- Falmouth Wetland Regulations (FWR 10.00)

Zoning Bylaws also contain several relevant sections on overlay districts, including the Wetlands and Water Resource Protection District. Regulatory documents such as the Subdivision Regulations and Wetland Protection Bylaw Regulations generally contain design standards to ensure proper design and construction of sites to minimize flooding and other damage.

Town agencies, including the Building Department, Conservation Commission, and Planning Board enforce existing local regulations, as well as state and federal regulations set forth by the Massachusetts Department of Fire Services,

Massachusetts Department of Public Safety, Environmental Protection Agency, Army Corps of Engineers, Federal Emergency Management Agency, and Massachusetts Department of Environmental Protection. If existing bylaws and regulations prove ineffective, or additional measures are developed that better protect infrastructure and the environment, changes should be adopted to maintain adequate protection. The Massachusetts State Building Code, enforced locally by the Building Department, contains many standards governing proper construction methods and techniques. Many of the standards are in place to help ensure buildings and other structures can withstand natural hazards such as high winds, heavy rains, snow loads, and high waters. The Building Department requires that permits be obtained for many construction-related projects, and permits must be obtained before occupying the building.

5. Backup Power Supplies

Much of Falmouth's critical drinking water, wastewater collection, pumping, and treatment infrastructure is equipped with onsite backup power sources. Falmouth's wastewater treatment plant has backup generators for emergency use, while all sewer pump stations are equipped with emergency generators. Water treatment facilities and many drinking water supply wells also have backup generators. The water storage tanks function automatically by gravity to maintain flows and pressures throughout the water system, with backup power only required for instrumentation purposes (i.e. communicate tank water levels). Generators are powered by onsite fuel sources such as above ground diesel tanks or propane tanks, and may be refueled as needed by conventional methods. The Town routinely tests backup generators, either utilizing automatic test methods such as on DPW's water and sewer pump station generators or manual weekly tests such as on those located at schools and the police station. The locations of backup power supplies are listed in Appendix C.

6. Emergency Shelters & Mutual Aid

Falmouth has established the following emergency shelters for use in the event of a natural disaster:

Primary – Falmouth High School, Gifford Street

Secondary – Otis Air Force Base Regional Shelter

Typically, the High School building is opened first, with the Air Base available should the capacity of the High School be exceeded. Both shelters are equipped with emergency generators in the event of a power outage, as well as other vital supplies such as food, water, blankets, etc.

Falmouth and neighboring towns currently have an informal mutual aid agreement, however nothing formal is in place.

7. Storm Preventative Maintenance and Response

The Department of Public Works typically performs several preventative maintenance items directly preceding an expected storm

event. First, they pre-clean known problem catch basins and other drainage structures to ensure adequate flow of storm water and to prevent flooding. Second, they deploy orange barrels and DPW saw horses in advance of the emergency at known flooding areas to allow easier closing of roadways if necessary. Smaller roadways may be closed in part or completely by deploying barrels and other barriers as necessary. In addition the DPW maintains an adequate amount of sand, salt and other road maintenance materials to ensure safe transportation routes if a snow or ice event occurs.

Inmates at the Barnstable Co. House of Corrections are available to perform certain operations, such as filling sand bags for use around critical infrastructure. Given enough advanced notice, a substantial number of sand bags may be filled. In addition, NSTAR periodically performs tree trimming throughout Falmouth in an effort to minimize damage to power lines and poles from falling tree limbs.

After large storm events, the Department of Public Works collects downed branches and other debris from around Town, as well as accepts storm debris from residents, at the Compost Facility located at 555 Blacksmith Shop Road. Brush and debris material get stored in the lower level area until a contractor can be obtained to process and remove the material.

8. Structural Upgrades

Mill Road culverts have been recently upgraded at Surf Drive to help alleviate flooding during large storm events at these locations. Culverts at both locations allow additional water to flow below the roadways, thereby reducing the frequency and severity of flooding events. However, other culverts along Walker Street continue to flood and impact Surf Drive. The Town will continue to watch these culverts to evaluate any worsening conditions.

9. Public Outreach

Falmouth has implemented several programs as a means of reaching out to the public prior to and during an emergency. The town routinely distributes information via the local cable channels managed by Falmouth Community Television (FCTV). FCTV operates three channels, 14, 15 and 16 on the Comcast Cable System and live streams channels 14 and 15 on their website at www.fctv.org. These communication resources are used to convey information to the public before, during and after natural disasters. Information typically includes closed roadways, power company response information, contact information for local, regional and state resources and preparedness information. FCTV also utilizes social media to disseminate vital information including Facebook, Twitter and Constant Contact. FCTV has the ability to update information from remote locations should the ability to travel be hindered. Should power and cable television be down, the ability to go live from the LEPC exists for all three channels simultaneously.

Falmouth uses the town website as a means of conveying information to

the public. The website also provides links to applicable emergency agencies, such as Falmouth Police, Fire and Emergency operations Center. The website also provides emergency management maps such as flood insurance and hurricane maps. If necessary, Falmouth Police can also hand deliver informational items to residents in affected areas. The Falmouth Local Emergency Management Communications Sub-Committee, working with FCTV has established social media resources through Facebook (https://www.facebook.com/FalmouthEmergencyPreparedness) and Twitter (@BeReadyFalmouth) which are used as an additional means of reaching the public to provide preparedness information and to convey vital information in a timely manner.

C2.a

5.3.1 Participation in the National Flood Insurance Program (NFIP)

Falmouth currently participates in FEMA's NFIP. Per FEMA's Local Multi-Hazard Mitigation Planning Guidance document, the NFIP has three basic aspects:

1) Floodplain identification and mapping – adopt flood maps depicting hazards;
2) Floodplain management – adopt and enforce floodplain management regulations; and
3) Flood insurance – require property owners to purchase insurance in exchange for floodplain management regulations that reduce future flood damages.

Flood Hazard Boundary Maps (FHBMs) were first established in 1979, with flood insurance rate maps (FIRMs) following in 1981. The Falmouth FIRMs were recently amended with an effective date of July 16, 2014. As of November 30, 2016, Falmouth has 2,358 flood insurance policies in force, with a total insurance value of $631,684,100.

Loss statistics for January 1, 1978 through March 31, 2013 include 643 total losses. All 643 cases were closed, however, 154 cases were closed without payment. Of the 489 cases that did receive payment, the total payments amounted to $9,446,300.60.

Falmouth has floodplain management regulations as part of its Wetlands Bylaw (FWR 10.38). The Falmouth Wetlands Bylaw and regulations protect existing and future infrastructure located in flood-prone areas. The Town updates its bylaws as necessary to reflect any changes to flood-prone areas.

As part of ongoing NFIP requirements, Falmouth regulates new development within the Special Flood Hazard Area (SFHA). The Town follows NFIP regulations and guidelines for all new construction, as well as substantial improvements to existing structures, within the flood plain.

Falmouth also works with nearby communities to establish mutual aid agreements to address administration of the NFIP following a major storm.

The NFIP also has a Community Rating System (CRS), which recognizes community efforts beyond those minimum standards by reducing flood insurance premiums for the community's property owners. CRS discounts on flood insurance premiums range from 5% (for a rate class of 9) up to 45% (for a rate class of 1) (FEMA

2015. The Town of Falmouth has not applied to be part of the CRS program, and as such currently has a rate class of 10, which affords no insurance discount. With the completion of this plan, however, the Town will be able to apply to the CRS program, if desired.

5.4 Proposed Mitigation

5.4.1 Planning Process

C4.a C5.a C5.b

To identify, evaluate and prioritize specific mitigation actions and projects to reduce the effects of a natural disaster, the LPT used a prioritization method focusing on four key themes as follows, and as provided in Appendix C:

- **Benefits**: Determine whether the proposed mitigation measure will improve property protection, natural resource protection, technical capacity, public awareness, or post-hazard emergency response;
- **Feasibility**: Determine whether the proposed mitigation measure is feasible in terms of Town staffing, public and Town support, and whether it is technically feasible;
- **Economic**: Evaluate each mitigation measure in terms of estimated cost and potential funding sources; and
- **Regulatory:** Evaluate each mitigation measure for consistency with local, state and federal permitting/ regulatory requirements and goals.

Each proposed mitigation action presented in Section 5.4.2 was given a score based on 13 subcategories within these four larger categories documented above (i.e. Benefits, Feasibility, Economic, Regulatory). For each of these subcategories, the proposed action was given a score of 3 if the action was thought to be a "good" fit with a particular category (likely to provide the benefit under consideration, required little additional training or funding, feasible, etc.), 2 if it was "average", or 1 if it was "poor" (did not provide the benefit under consideration, difficult to permit, costly, etc.). For a detailed overview of how each action was scored, please see Appendix C.

During the planning meetings where potential mitigation measures were discussed and prioritized, a number of proposed actions were dismissed from the final Plan. These actions are documented in Appendix C, along with an explanation for dismissal.

5.4.2 Proposed Mitigation Actions

Proposed mitigation actions developed during the planning process were divided into the following categories:

C4.a C4.b C4.c C5.c

1. Prevention and Resource Protection – Regulatory modifications to bylaws and regulations to prevent damage and preserve or restore natural resources;
2. Public Safety – Improvements to protect residents during a disaster;
3. Property Protection – Modifications or removal of infrastructure to protect from a hazard;
4. Structural Projects – Construction projects to reduce hazard impacts; and
5. Public Information and Communications – Actions to better provide information during a disaster and procedures for facilitating better communications.

1. Prevention and Resource Protection

The following proposed disaster mitigation measures should be explored in an effort to preserve natural resources for added environmental protection. These actions range from regulatory reform, to property acquisition and wetland restoration, to construction projects.

1a. Create a comprehensive wetlands restoration plan and begin reconstruction in the most vulnerable areas.

Purpose: This measure is one of the action items from the Local Comprehensive Plan Coastal Resiliency Goals voted at town meeting in November 2014. Implementation of this action would enhance flood protection and shoreline erosion control, among other benefits. Wetland restoration activities would provide additional trees, root mats and other wetland vegetation that would act to slow the speed of flood waters and distribute them more slowly over the floodplain throughout the coastal areas of Falmouth.

Responsibility: *Lead*: Conservation Commission; *Support*: Planning Department, Town Meeting, DPW.

Potential Funding Sources: Grants.

Priority: MEDIUM.

Timeline: Short-term and ongoing; begin restoration within the next two years.

Mitigation Goal(s) Addressed: 5.

1b. Study the range of options and ideas found in the winning proposals of the "Rebuild By Design" competition and identify how they may be modified and implemented in Falmouth.

Purpose: "Rebuild By Design" (www.rebuildbydesign.org) is an innovative competition model aimed at connecting design, funding, and implementation strategies for a more resilient environment. Winning proposals may offer unique and effective solutions to enhance coastal resilience and mitigate against a variety of natural hazards that could impact Falmouth.

Responsibility: *Lead*: Board of Selectmen; *Support*: Planning Board, Conservation Commission, DPW.

Potential Funding Sources: Grants.

Priority: MEDIUM.

Timeline: Short-term; begin study immediately.

Mitigation Goal(s) Addressed: 5 & 7.

1c. Maintain a list of municipal construction projects, bylaw/code revisions, and properties to acquire to reduce risk from natural hazards; develop priority ranking.

Purpose: A regularly updated list of important projects, regulatory updates, and potential property acquisitions, increases Falmouth's long-term resiliency by identifying and prioritizing the most effective next steps involved with hazard mitigation.

Responsibility: *Lead*: DPW, *Support*: Conservation Commission, Planning Department, Town Manager, Town Meeting, Board of Selectmen, Clerk.

Potential Funding Sources: Town Operating Budget.

Priority: MEDIUM.

Timeline: Short-term; begin immediately.

Mitigation Goal(s) Addressed: 5.

1d. Integrate municipal mitigation and adaptation projects into the Town's operating and capital budgets.

Purpose: Vital mitigation and adaptation projects and actions will only be able to be implemented if they can be funded; integrating them into the Town's operating and capital budgets ensures there is a dedicated funding source for these projects.

Responsibility: *Lead*: Finance Committee, *Support*: Finance Director, Town Manager, Board of Selectmen, Town Meeting.

Potential Funding Sources: Town operating and capital budgets.

Priority: MEDIUM.

Timeline: Mid-term and ongoing; within the next 5 years.

Mitigation Goal(s) Addressed: 1, 3, 4, 5 & 7.

1e. Review and revise local codes and bylaws as necessary to increase the resiliency of construction projects, and lobby for changes in the state building code.

Purpose: Revising local codes and bylaws to increase the resiliency of construction projects will ensure that future buildings and structures constructed in Falmouth will be more resilient, and less likely to experience damage in the event of a natural hazard.

Responsibility: *Lead*: Planning Board, *Support*: Zoning Board of Appeals, Town Meeting, Town Planner, Building Commissioner and Inspectors.

Potential Funding Sources: Town Meeting Article, Grants, Town Operating Budget.

Priority: MEDIUM.

Timeline: Mid-term and ongoing; within the next 5 years.

Mitigation Goal(s) Addressed: 5 & 7.

1f. Revise Conservation Commission Wetlands Regulations to be consistent with the Coastal Resiliency goals and policies.

Purpose: The Coastal Resiliency goals and policies focus on preserving, restoring, and enhancing coastal ecosystems to better absorb impacts from natural hazards, with an emphasis on resiliency and adaptability. Revising the Conservation Commission Wetland Regulations to reflect this will reinforce these goals and ensure consistency across planning and regulatory documents.

Responsibility: *Lead*: Conservation Commission, *Support*: Town Manager, Town Meeting.

Potential Funding Sources: Town Operating Budget.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 7.

1g. Train fire department staff and other emergency responders in wildland fire training.

Purpose: Wildland fire training, in the form of county- or state-level classes and/or participation in prescribed burns will provide Falmouth fire fighters with valuable hands on experience concerning wildfire response, allowing them to more efficiently extinguish a wildfire if it occurs in Falmouth.

Responsibility: Fire Department.

Potential Funding Sources: Operating Budget.

Priority: HIGH.

Timeline: Short-term and ongoing; within the next 2 years.

Mitigation Goal(s) Addressed: 3 & 7.

1h. Conduct fuel management activities in Fire Hazard Mitigation Focus Areas as identified in the Barnstable County Wildfire Preparedness Plan.

Purpose: Fuel management treatments can alter fuel loads to reduce wildfire hazard by changing fire behavior. These actions can increase public and firefighter safety while also reducing fire response and suppression costs. Focus areas should also include high risk areas in Beebe Woods around the hospital, and around water treatment facilities in heavily forested areas. The Town should coordinate with DCR on state-owned property.

Responsibility: Fire Department.

Potential Funding Sources: Grants.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 5.

1i. Conduct a thorough evaluation of the Town's most at-risk critical facilities identified in the Vulnerability Analysis, and evaluate potential mitigation techniques for protecting each location to the maximum extent possible.

Purpose: Now that the Town's vulnerable critical facilities have been identified, the next step is to identify and prioritize actions and projects that will provide additional protection to these structures.

Responsibility: Town Manager; Board of Selectmen.

Potential Funding Sources: Grants.

Priority: LOW.

Timeline: Within the next 2-5 years.

Mitigation Goal(s) Addressed: 5 & 7.

2. Public Safety

The following proposed disaster mitigation measures should be explored in an effort to preserve public safety in the event of a natural hazard event.

2a. Establish evacuation procedures

Purpose: Fortunately, Falmouth has never needed to perform a large-scale evacuation. However, should one ever be required, Town officials should document procedures and routes to provide the most efficient evacuation possible.

Responsibility: Police Department.

Potential Funding Sources: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 1, 2 & 7.

When establishing evacuation procedures, consideration should be given to:

- Procedures for voluntary and mandatory evacuations for different areas of town;
- Potential duration of an evacuation;
- Procedures to disseminate public information concerning evacuations;
- Role of emergency personnel to facilitate a smooth process;
- Areas most likely in need of evacuation, such as those located in coastal areas or areas prone to isolation; use of MEMA Evacuation Flood Maps.
- Stagger evacuation from different areas of town to reduce congestion during peak flows;
- Control of traffic at critical roadways and intersections;
- Provide alternate transportation such as buses for those otherwise unable to leave affected areas; agreements with CCRTA and First Student bus company;
- Periodic status updates; and
- Special considerations should also be given to elderly populations, those with special medical needs, people with disabilities, etc. to ensure all people can evacuate safely.

2b. Incorporate evacuation procedures into the Emergency Response Plan.

Purpose: To integrate evacuation procedures with other necessary emergency response actions into a single plan.

Responsibility: Emergency Operations Center; Fire Department.

Potential Funding Sources: Town Operating Budget.

Priority: MEDIUM.

Timeline: Within the next 2-5 years.

Mitigation Goal(s) Addressed: 1 & 7

2c. Maintain an adequate supply of sand, salt and other road treatment materials.

Purpose: To ensure Town roads can be treated quickly and effectively to maintain safe transportation routes in the event of a snow event.

Responsibility: DPW

Potential Funding Sources: Town Operating Budget; Snow & Ice Budget.

Priority: MEDIUM.

Timeline: Short-term and ongoing.

Mitigation Goal(s) Addressed: 4.

3. Property Protection

The following proposed disaster mitigation measures should be explored to preserve and protect existing property and infrastructure in the event of a natural hazard event.

3a. Design and reconstruction of the Falmouth Heights Bluff shore protection located on the seaward side of Grand Avenue between Vernon Avenue and Gertrude Avenue. Approx length = 1,300'.

Purpose: The bluff at Falmouth Heights continues to experience erosion, and the sea wall at the base is in need of repairs. Severe erosion of the bluff will threaten Falmouth Heights Road and the residential properties across the street.

Responsibility: DPW.

Potential Funding Sources: Town Meeting Article; Grant.

Priority: LOW

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 4 & 5.

3b. Design and reconstruction of shore protection along the Chapoquoit Road causeway from Chapoquoit Beach to end at stone pillars. Approx length = 900'.

Purpose: The existing revetment along Chapoquoit Road is failing. Part of the structure has already been repaired and reinforced, but additional work is necessary.

Responsibility: DPW.

Potential Funding Sources: Town Meeting Article.

Priority: MEDIUM.

Timeline: Within the next 3 years.

Mitigation Goal(s) Addressed: 4 & 5.

3c. Consider the feasibility of beach nourishment along Chapoquoit Beach.

Purpose: Chapoquoit Beach has a history of significant erosion, as well as repeated necessary repairs to the seawall and revetment. As a result, the remaining beach is very narrow, and in some cases no high tide beach is present. This leaves Chapoquoit beach vulnerable to the impacts of storm surge, wave action, and flooding.

Responsibility: Town Manager.

Potential Funding Sources: Grants.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 5 & 7.

3d. Begin talks with private organizations and businesses in Woods Hole (i.e. Steamship Authority, WHOI, MBL, etc.) about hazard mitigation, flood prevention, and traffic control.

Purpose: A number of the Tier 1 and 2 Critical Facilities are owned by these entities, and are at risk from a number of hazards including flooding, hurricanes, sea level rise, and coastal erosion. Hazard mitigation actions to protect these facilities will require a plan and financial investment from these entities, but the Town can facilitate and coordinate planning to lead an integrated mitigation effort in Woods Hole.

Responsibility: Town Manager.

Potential Funding Sources: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 2-3 years.

Mitigation Goal(s) Addressed: 2.

3e. Work with local land trusts to identify repetitive loss properties that these entities would be willing to buy out in the event of substantial damage, with the intent that these properties would be restored to their natural state and managed by the non-profit.

Purpose: By transitioning a repetitive loss property back to its natural state, the potential for future structural damage is removed and a restored natural system can improve coastal resilience and storm protection capacity of the property.

Responsibility: GIS.

Potential Funding Sources: Town Operating Budget.

Priority: MEDIUM.

Timeline: Within the next 1-3 years.

Mitigation Goal(s) Addressed: 5 & 7.

3f. Develop pre- and post-storm response plans for Falmouth public beaches, as described in Beach Management Plan.

Purpose: To minimize risks of storm damage to wetland resources and public/private infrastructure, and to avoid adverse impacts to resources during post-storm clean-up.

Responsibility: *Lead*: Beach Department; *Support*: DPW, Fire Department, Police Department, Emergency Preparedness Department, Conservation Commission.

Potential Funding Sources: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 3 years.

Mitigation Goal(s) Addressed: 7.

3g. Evaluate alternatives for protecting, relocating, or abandoning vulnerable sections of Surf Drive.

Purpose: Surf Drive is located along an extremely vulnerable section of coastline. The roadway is regularly flooded and/or damaged during storms. With continued erosion, increased storm frequency and intensity, and ongoing sea-level rise, it will be necessary to find alternatives to the status quo. These alternatives may include raising or further protecting the road, relocating it, or abandoning sections of it altogether.

Responsibility: Board of Selectmen, DPW, Planning, and Conservation Commission.

Potential Funding Sources: Grants; Town Meeting Article.

Priority: LOW.

Timeline: Within the next 5-10 years.

Mitigation Goal(s) Addressed: 4, 5 & 7.

3h. Evaluate alternatives to minimize flooding and sand overwash on Menauhant Road during a storm, particularly in the vicinity of Bristol Beach, Inn Season Resorts, Surfside, and Menauhant Beach.

Purpose: Identify action that can reduce the flooding and accumulation of sand on the road during and after a storm.

Responsibility: Board of Selectmen, DPW, Planning, and Conservation Commission.

Potential Funding Sources: Grants; Town Meeting Article.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 4.

4. Structural Projects

The following structural projects are proposed as a way to alleviate potential flooding damage to buildings and infrastructure within Falmouth.

4a. Reconstruction of the Fresh River Outlet on Surf Drive, including a roadway culvert and outlet groin.

Purpose: Fresh River Outlet is a poorly flushed culvert, and is regularly damaged during storms, resulting in culvert collapse and damage to the road. Reconstruction of this outlet would minimize these events in the future.

Responsibility: *Lead*: DPW; *Support*: Conservation Commission.

Potential Funding Sources: Town Operating Budget; Town Meeting Article.

Priority: HIGH.

Timeline: Within the next 3 years.

Mitigation Goal(s) Addressed: 4 & 5.

4b. Reconstruction of the Salt Pond Outlet on Surf Drive including the roadway culvert and outlet groin.

Purpose: The Salt Pond Outlet is an undersized, poorly flushed culvert, and is often obstructed by sediment deposits during storms. To improve efficiency, and reduce the risk of flooding and damage to the road, the outlet should be reconstructed.

Responsibility: *Lead*: DPW; *Support*: Conservation Commission.

Potential Funding Sources: Town Meeting Article.

Priority: HIGH.

Timeline: Within the next 3 years.

Mitigation Goal(s) Addressed: 4 & 5.

4c. Reconstruction of the Trunk River Outlet under the bike path.

Purpose: The Trunk River Outlet is a poorly flushed culvert that is been damaged and repaired in the past, most recently in 2012. There is also a sewer main crossing at the same location, damage of which would result in a variety of adverse impacts.

Responsibility: *Lead*: DPW; *Support*: Conservation Commission.

Potential Funding Sources: Town Meeting Article.

Priority: HIGH.

Timeline: Within the next 3 years.

Mitigation Goal(s) Addressed: 3 & 5.

4d. Reconstruct high school gymnasium glass roof with solid surface roof and install storm shutters on cafeteria windows.

Purpose: The Falmouth High School services as the Town's Emergency Shelter location, but requires reinforcing of the structure to improve public safety.

Responsibility: School Department; Emergency Operations Center.

Potential Funding Sources: Grant; Town Meeting Article.

Priority: HIGH.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 1 & 5.

4e. When bridges require maintenance, assess the vulnerability of water mains and other utility infrastructure, and potentially upgrade or reinforce infrastructure during bridge repair.

Purpose: Falmouth's water mains carry the Town's drinking water. In areas where communities are separated by waterbodies, these water mains are located alongside bridges. In many coastal areas, these bridges get inundated during storms and are subject to wave actions and impacts from floating debris that could damage the water mains.

Responsibility: DPW.

Potential Funding Sources: Town Meeting Article; Grants.

Priority: LOW.

Timeline: Within the next 5-10 years and ongoing.

Mitigation Goal(s) Addressed: 3, 4 & 5.

4f. Explore stormwater best management practices (BMPs) to address sections of roadway that regularly flood after heavy rains (i.e. east end of Thomas Landers Road; Route 28 near Friendly's, etc.).

Purpose: Some roadway areas routinely flood after heavy rains due to ponding water or backed up storm drains. Stormwater BMPs, such as regularly cleaning catch basins and directly treating stormwater runoff in vegetated swales, could reduce the ponding in the roads.

Responsibility: DPW.

Potential Funding Sources: Annual allotment through Town Meeting.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 4.

4g. Verify the location of each repetitive loss property. If it cannot be located, is located in another jurisdiction, or has been mitigated, notify FEMA to get the property removed from the town's repetitive loss list.

Purpose: The number of repetitive loss properties influences the requirements of the Town in reference to hazard mitigation and CRS planning. If properties appear erroneously on this list, they should be removed to reflect the true repetitive loss status of the Town.

Responsibility: GIS.

Potential Funding Sources: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 1 year.

Mitigation Goal(s) Addressed: 7.

4h. Contact all owners of repetitive loss properties annually, and inform them of financial assistance available for structural mitigation such as elevation and acquisition.

Purpose: If homeowners know about financial incentives for mitigating their flood risk, it is more likely they will perform the necessary work to remove their property from the repetitive loss list, while also avoiding future damage.

Responsibility: Town Manager; Board of Selectmen.

Potential Funding Sources: Grants (i.e. FEMA's Hazard Mitigation Grants; USDA Natural Resource Conservation Service's Emergency Watershed Protection – Floodplain Easement Option).

Priority: MEDIUM.

Timeline: Within the next 2-5 years.

Mitigation Goal(s) Addressed: 6.

5. Public Information and Communications

The following proposed disaster mitigation measures should be explored to enhance the availability of information and improve communications.

5a. Expand use of social media and other public outreach channels, such as Facebook, Twitter, YouTube, and an updated website to provide information about hazard preparedness, as well as a method to provide real-time updates during and following a major natural hazard.

Purpose: Large populations of residents and visitors can be reached through the internet and social media outlets at very little cost to the Town, so information can be disseminated widely. These communication methods also occur in real-time, which is crucial for updates during a natural hazard.

Responsibility: Emergency Operations Center; Fire Department.

Potential Funding Source: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 1 year.

Mitigation Goal(s) Addressed: 6.

5b. Develop an informational brochure that highlights the key points of this plan for residents, which could be made available at Town Hall and on the Town website.

Purpose: Easily accessible information in the form of an educational brochure will inform both residents and visitors on the types of natural hazards possible in Falmouth, and the ways they can reduce their vulnerability.

Responsibility: Town Manager.

Potential Funding Source: Town Operating Budget.

Priority: MEIDUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 6 & 7.

5c. Improve interdepartmental and inter-agency communications.

Purpose: Emergency preparedness and response will be coordinated and more efficient if all departments and agencies communicate effectively with each other.

Responsibility: DPW, Police, Fire should continually evaluate ways to improve communication, and utilize Combined Dispatch.

Potential Funding Source: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 1 year.

Mitigation Goal(s) Addressed: 2 & 7.

5d. Establish town-wide radio station per LEPC recommendation.

Purpose: A town-wide radio station would provide an additional means of communication leading up to, during, and following a natural hazard. In the event of a loss of power, radios run on batteries could potentially allow isolated residents access to crucial emergency information they wouldn't otherwise have.

Responsibility: Emergency Operations Center.

Potential Funding Source: Grants.

Priority: HIGH.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 6.

5e. Establish town-wide mass notification warning system (commercial program of sirens and loud speakers) to notify residents.

Purpose: A town-wide mass notification system would provide a method to disseminate information and alert all residents and visitors.

Responsibility: Emergency Operations Center.

Potential Funding Source: Grants.

Priority: MEDIUM.

Timeline: Within the next 5 years.

Mitigation Goal(s) Addressed: 6.

5f. Formalize mutual aid agreements.

Purpose: Falmouth and its neighbors should formalize their mutual aid agreements to provide community support in the event of a disaster.

Responsibility: Emergency Operations Center.

Potential Funding Source: Town Operating Budget.

Priority: HIGH.

Timeline: Within the next 2-3 years.

Mitigation Goal(s) Addressed: 1, 3, 4, 6 & 7.

Documentation and mutual aid agreements should include, but are not limited to:

- Intercommunity and interagency communications procedures;
- Emergency agency support (fire, police, medical, etc.), personnel and equipment, mutual aid agreement for fire and EMS;
- Backup water supply connections;
- Heavy equipment for debris clearing;
- Portable emergency backup power sources and deployment;
- Use of Department of Fire Services and Barnstable County Sheriff's Office communication van and Incident Support Unit in the event of radio communications failure;
- Agreement with Barnstable County Regional Emergency Preparedness Committee pertaining to events, assets (CCRTA, Red Cross, MRC, sheltering, etc.)
- Preparation and training for personnel responsible for plan implementation; and
- Periodic plan updates.

Chapter 6
Plan Maintenance Process

The Falmouth Multi-Hazard Mitigation Plan is not meant to be a static document. As conditions change, new information becomes available, or mitigation actions progress or are completed over the life of the plan, adjustments and updates may be necessary to maintain its relevance. This chapter describes how the Plan will be tracked, updated and enhanced in the coming years. The plan must be fully reviewed and revised as necessary at least once every five years. Keeping the plan up-to-date also means continuing to provide opportunities for public involvement and comment on the plan and its implementation.

As required by FEMA, this Plan must outline a maintenance process to ensure the Plan remains active and relevant to the current conditions of the Town. The process must identify the following items:

- Plan Monitoring, Evaluation and Updates – Method and schedule for monitoring, evaluating and updating the plan at least once every five years;
- Incorporation of Mitigation Strategies – Explanation of how local governments will incorporate mitigation strategies into existing mechanisms; and
- Continued Public Involvement – Requirements that public participation continue throughout the plan maintenance process.

This section details how Falmouth will meet these Plan maintenance requirements.

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6.1 Plan Monitoring, Evaluation and Updates

As required by FEMA, the written plan will be evaluated and updated at least once every five years by the departments, boards, agencies and other organizations listed under the Local Emergency Planning Committee. In the interim, select members of the LEPC will conduct annual reviews to track implementation progress and update as necessary. If a major disaster occurs in the interim, the plan may be evaluated or updated if Town personnel feel that the plan failed in some way, or imminent changes are required to better respond to future disasters. As necessary, LEPC members and/or organizations may be added or removed from the LEPC to obtain the most accurate and applicable information possible.

Evaluations and updates will take place in much the same way as development of this original plan. The process will include meetings of the LEPC, review of goals and objectives, updating community profile information, review and modification of potential hazards to the Town, review of existing hazard-prone areas and the addition of any new areas, updating existing and planned hazard mitigation measures, and an evaluation as to the effectiveness of the plan to date.

6.2 Incorporation of Mitigation Strategies

Mitigation strategies outlined in this Plan will be incorporated into existing mechanisms such as plans, bylaws and regulations as feasible, according to the priority and timeline developed for each action. During Plan updates, existing and proposed mitigation actions will be evaluated for effectiveness, level of completion, and continued appropriateness.

6.3 Continued Public Involvement

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During the periodic five year update process, the LEPC will hold at least one public workshop or similar meeting to solicit feedback from the general public on the progress made to date. Concerned citizens will also be invited to revise the revised Plan and submit any additional comments or recommendations for improving the Plan. All events will be publicly advertised in the local newspaper and/or similar method. Copies of the Plan will be provided in public places such as the Town Hall and/or Public Libraries. The Plan will also be made available to the general public via the Town's website.

Once the draft of the Falmouth Multi-Hazard Mitigation Plan was reviewed by the Local Planning Team, stakeholders and the general public, the plan was approved by the Falmouth Board of Selectmen. Following adoption, the Town will submit the plan for reviewed by the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency (FEMA). If approved by MEMA and FEMA, the Plan will then enter into the five year "maintenance" phase. This chapter describes the process of plan adoption and includes documentation for plan adoption by the Falmouth Board of Selectmen.

E1 At the conclusion of planning efforts conducted by the Local Emergency Planning Committee, the final Local Multi-Hazard Mitigation Plan was reviewed and informally approved by all applicable Town departments, boards, and other agencies identified as members of the LEPC. The plan was the adopted by the Falmouth Board of Selectmen. Proof of plan adoption is included in Appendix D. The Plan was then sent to the State Hazard Mitigation Officer (SHMO) of the Massachusetts Department of Resource Conservation, the Massachusetts Emergency Management Agency (MEMA) and the FEMA for review and approval.

Upon receiving final approval from MEMA and FEMA, the Plan will the Plan will then enter into the five year "maintenance" phase. Proof of final approval will be included in Appendix D.

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Appendix A: Local Mitigation Plan Review Guide

Local Mitigation Plan Review Guide

October 1, 2011

FEMA

4.1 ELEMENT A: PLANNING PROCESS

Requirement §201.6(b)	An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
§201.6(b)(1)	(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
§201.6(b)(2)	(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
§201.6(b)(3)	(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
§201.6(c)(1)	[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
§201.6(c)(4)(i)	[The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
§201.6(c)(4)(iii)	[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Overall Intent. The planning process is as important as the plan itself. Any successful planning activity, such as developing a comprehensive plan or local land use plan, involves a cross-section of stakeholders and the public to reach consensus on desired outcomes or to resolve a community problem. The result is a common set of community values and widespread support for directing financial, technical, and human resources to an agreed upon course of action, usually identified in a plan. The same is true for mitigation planning. An effective and open planning process helps ensure that citizens understand risks and vulnerability, and they can work with the jurisdiction to support policies, actions, and tools that over the long-term will lead to a reduction in future losses.

Leadership, staffing, and in-house knowledge in local government may fluctuate over time. Therefore, the description of the planning process serves as a permanent record that explains how decisions were reached and who involved. FEMA will accept the planning process as defined by the community, as long as the mitigation plan includes a narrative

description of the process used to develop the mitigation plan—a systematic account about how the mitigation plan evolved from the formation of a planning team, to how the public participated, to how each section of the plan was developed, to what plans or studies were incorporated into the plan, to how it will be implemented. Documentation of a current planning process is required for both new and updated plans.

ELEMENT	REQUIREMENTS
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? ***44 CFR 201.6(c)(1)*** ***Intent****: To inform the public and other readers about the overall approach to the plan's development and serve as a permanent record of how decisions were made and who was involved. This record also is useful for the next plan update.*	a. Documentation of how the plan was prepared **must** include the schedule or timeframe and activities that made up the plan's development as well as who was involved. Documentation typically is met with a narrative description, but may also include, for example, other documentation such as copies of meeting minutes, sign-in sheets, or newspaper articles. ***Document*** *means provide the factual evidence for how the jurisdictions developed the plan.* b. The plan **must** list the jurisdiction(s) participating in the plan that seek approval. c. The plan **must** identify who represented each jurisdiction. The Plan **must** provide, at a minimum, the jurisdiction represented and the person's position or title and agency within the jurisdiction. d. For each jurisdiction seeking plan approval, the plan **must** document how they were involved in the planning process. For example, the plan may document meetings attended, data provided, or stakeholder and public involvement activities offered. Jurisdictions that adopt the plan without documenting how they participated in the planning process will not be approved. ***Involved in the process*** *means engaged as participants and given the chance to provide input to affect the plan's content*. This is more than simply being invited (*See* "***opportunity to be involved in the planning process***" in A2 below) or only adopting the plan. e. Plan updates **must** include documentation of the current planning process undertaken to update the plan.
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? ***44 CFR 201.6(b)(2)***	a. The plan **must** identify all stakeholders involved or given an opportunity to be involved in the planning process. At a minimum, stakeholders **must** include: 1) Local and regional agencies involved in hazard mitigation activities; 2) Agencies that have the authority to regulate development; and 3) Neighboring communities. *An* ***opportunity to be involved in the planning process*** *means that the stakeholders are engaged or invited as participants and given the chance to provide input to affect the plan's content.*

ELEMENT	REQUIREMENTS
***Intent**: To demonstrate a deliberative planning process that involves stakeholders with the data and expertise needed to develop the plan, with responsibility or authority to implement hazard mitigation activities, and who will be most affected by the plan's outcomes.*	b. The Plan **must** provide the agency or organization represented and the person's position or title within the agency. c. The plan **must** identify how the stakeholders were invited to participate in the process. Examples of stakeholders include, but are not limited to: • Local and regional agencies involved in hazard mitigation include public works, zoning, emergency management, local floodplain administrators, special districts, and GIS departments. • Agencies that have the authority to regulate development include planning and community development departments, building officials, planning commissions, or other elected officials. • Neighboring communities include adjacent counties and municipalities, such as those that are affected by similar hazard events or may be partners in hazard mitigation and response activities. • Other interests may be defined by each jurisdiction and will vary with each one. These include, but are not limited to, business, academia, and other private and non-profit interests depending on the unique characteristics of the community.
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? ***44 CFR 201.6(b)(1) and 201.6(c)(1)*** ***Intent**: To ensure citizens understand what the community is doing on their behalf, and to provide a chance for input on community vulnerabilities and mitigation activities that will inform the plan's content. Public involvement is also an opportunity to educate the public about hazards and risks in the community, types of activities to mitigate those risks, and how these impact them.*	a. The plan **must** document how the public was given the opportunity to be involved in the planning process and how their feedback was incorporated into the plan. Examples include, but are not limited to, sign-in sheets from open meetings, interactive websites with drafts for public review and comment, questionnaires or surveys, or booths at popular community events. b. The opportunity for participation **must** occur during the plan development, which is prior to the comment period on the final plan and prior to the plan approval / adoption.

ELEMENT	REQUIREMENTS
A4. Does the Plan document the review and incorporation of existing plans, studies, reports, and technical information? *44 CFR 201.6(b)(3)* ***Intent**: To identify existing data and information, shared objectives, and past and ongoing activities that can help inform the mitigation plan. It also helps identify the existing capabilities and planning mechanisms to implement the mitigation strategy.*	a. The plan **must** document *what* existing plans, studies, reports, and technical information were reviewed. Examples of the types of existing sources reviewed include, but are not limited to, the state hazard mitigation plan, local comprehensive plans, hazard specific reports, and flood insurance studies. b. The plan **must** document *how* relevant information was incorporated into the mitigation plan. ***Incorporate** means to reference or include information from other existing sources to form the content of the mitigation plan*.
A5. Is there discussion on how the community(ies) will continue public participation in the plan maintenance process? *44 CFR 201.6(c)(4)(iii)* ***Intent**: To identify how the public will continue to have an opportunity to participate in the plan's maintenance and implementation over time.*	a. The plan **must** describe how the jurisdiction(s) will continue to seek public participation after the plan has been approved and during the plan's implementation, monitoring and evaluation. ***Participation** means engaged and given the chance to provide feedback.* Examples include, but are not limited to, periodic presentations on the plan's progress to elected officials, schools or other community groups, annual questionnaires or surveys, public meetings, postings on social media and interactive websites.
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)? *44 CFR 201.6(c)(4)(i)* ***Intent**: To establish a process for jurisdictions to track the progress of the plan's implementation. This also serves as the basis of the next plan update.*	*a.* The plan **must** identify how, when, and by whom the plan will be monitored. ***Monitoring** means tracking the implementation of the plan over time. For example, monitoring may include a system for tracking the status of the identified hazard mitigation actions.* *b.* The plan **must** identify how, when, and by whom the plan will be evaluated. ***Evaluating** means assessing the effectiveness of the plan at achieving its stated purpose and goals.* *c.* The plan **must** identify how, when, and by whom the plan will be updated. ***Updating** means reviewing and revising the plan at least once every five years.* d. The plan **must** include the title of the individual or name of the department/ agency responsible for leading each of these efforts.

4.2 ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Requirement §201.6(c)(2)(i)	[The risk assessment shall include a] description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
§201.6(c)(2)(ii)	[The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:
§201.6(c)(2)(ii)(A)	(A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
§201.6(c)(2)(ii)(B)	(B) An estimate of the potential dollar losses to vulnerable structures identified in … this section and a description of the methodology used to prepare the estimate.
§201.6(c)(2)(ii)(C)	(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Overall Intent. The risk assessment provides the factual basis for activities proposed in the strategy that will reduce losses from identified hazards. A quality risk assessments makes a clear connection between the community's vulnerability and the hazard mitigation actions. In other words, it provides sufficient information to enable the jurisdiction(s) to identify and prioritize appropriate hazard mitigation actions.

Local risk assessments do not need to be based on the most sophisticated technology, but do need to be accurate, current, and relevant. During a plan update, local jurisdictions assess current and expected future vulnerability to all hazards and integrate new hazard data such as recent hazard events and new flood studies. In the mitigation plan review, FEMA looks at the quality of the information in the risk assessment, not the quantity of information in the risk assessment.

The Mitigation Planning regulation includes several "optional" requirements for the vulnerability assessment. These are easily recognizable with the use of the term "should" in the requirement (*See* §201.6(c)(2)(ii)(A-C)). Although not required, these are strongly recommended to be included in the plan. However, their absence will not cause FEMA to disapprove the plan. These "optional" requirements were originally intended to meet the overall vulnerability assessment, and this analysis can assist with identifying mitigation actions.

ELEMENT	REQUIREMENTS
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction? *44 CFR 201.6(c)(2)(i) and 44 CFR 201.6(c)(2)(iii)* ***Intent**: To understand the potential and chronic hazards affecting the planning area in order to identify which hazard risks are most significant and which jurisdictions or locations are most adversely affected.*	a. The plan **must** include a description of the natural hazards that can affect the jurisdiction(s) in the planning area. *A **natural hazard** is a source of harm or difficulty created by a meteorological, environmental, or geological event*[3]*.* The plan **must** address natural hazards. Manmade or human-caused hazards may be included in the document, but these are not required and will not be reviewed to meet the requirements for natural hazards. In addition, FEMA will not require the removal of this extra information prior to plan approval. b. The plan **must** provide the rationale for the omission of any natural hazards that are commonly recognized to affect the jurisdiction(s) in the planning area. c. The description, or profile, **must** include information on location, extent, previous occurrences, and future probability for each hazard. Previous occurrences and future probability are addressed in sub-element B2. The information does not necessarily need to be described or presented separately for location, extent, previous occurrences, and future probability. For example, for some hazards, one map with explanatory text could provide information on location, extent, and future probability. ***Location** means the geographic areas in the planning area that are affected by the hazard.* For many hazards, maps are the best way to illustrate location. However, location may be described in other formats. For example, if a geographically-specific location cannot be identified for a hazard, such as tornados, the plan may state that the entire planning area is equally at risk to that hazard. ***Extent** means the strength or magnitude of the hazard*. For example, extent could be described in terms of the specific measurement of an occurrence on a scientific scale (*for example*, Enhanced Fujita Scale, Saffir-Simpson Hurricane Scale, Richter Scale, flood depth grids) and/or other hazard factors, such as duration and speed of onset. Extent is not the same as impacts, which are described in sub-element B3.

[3] DHS Risk Lexicon, 2010 Edition. http://www.dhs.gov/xlibrary/assets/dhs-risk-lexicon-2010.pdf

ELEMENT	REQUIREMENTS
	d. For participating jurisdictions in a multi-jurisdictional plan, the plan **must** describe any hazards that are unique and/or varied from those affecting the overall planning area.
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? *44 CFR 201.6(c)(2)(i)* ***Intent**: To understand potential impacts to the community based on information on the hazard events that have occurred in the past and the likelihood they will occur in the future.*	a. The plan **must** include the history of previous hazard events for each of the identified hazards. b. The plan **must** include the probability of future events for each identified hazard. ***Probability** means the likelihood of the hazard occurring and may be defined in terms of general descriptors (for example, unlikely, likely, highly likely), historical frequencies, statistical probabilities (for example: 1% chance of occurrence in any given year), and/or hazard probability maps.* If general descriptors are used, then they **must** be defined in the plan. For example, "highly likely" could be defined as equals near 100% chance of occurrence next year or happens every year. c. Plan updates **must** include hazard events that have occurred since the last plan was developed.
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? *44 CFR 201.6(c)(2)(ii)* ***Intent**: For each jurisdiction to consider their community as a whole and analyze the potential impacts of future hazard events and the vulnerabilities that could be reduced through hazard mitigation actions.*	a. For each participating jurisdiction, the plan **must** describe the potential impacts of each of the identified hazards on the community. ***Impact** means the consequence or effect of the hazard on the community and its assets. Assets are determined by the community and include, for example, people, structures, facilities, systems, capabilities, and/or activities that have value to the community.* For example, impacts could be described by referencing historical disaster impacts and/or an estimate of potential future losses (such as percent damage of total exposure). b. The plan **must** provide an overall summary of each jurisdiction's vulnerability to the identified hazards. The overall summary of vulnerability identifies structures, systems, populations or other community assets as defined by the community that are susceptible to damage and loss from hazard events. A plan will meet this sub-element by addressing the requirements described in §201.6(c)(2)(ii)(A-C). Vulnerable assets and potential losses is more than a list of the total exposure of population, structures, and critical facilities in the planning area. An example of an overall summary is a list of key issues or problem statements that clearly describes the community's greatest vulnerabilities and that will be addressed in the mitigation strategy.

ELEMENT	REQUIREMENTS
B4. Does the Plan address NFIP insured structures within each jurisdiction that have been repetitively damaged by floods? *44 CFR 201.6(c)(2)(ii)* ***Intent**: To inform hazard mitigation actions for properties that have suffered repetitive damage due to flooding, particularly problem areas that may not be apparent on floodplain maps. Information on repetitive loss properties helps inform FEMA hazard mitigation assistance programs under the National Flood Insurance Act.*	a. The plan **must** describe the types (residential, commercial, institutional, etc.) and estimate the numbers of repetitive loss properties located in identified flood hazard areas. ***Repetitive loss properties** are 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.* ***Severe repetitive loss properties** are residential properties that have at least four NFIP payments over $5,000 each and the cumulative amount of such claims exceeds $20,000, or at least two separate claims payments with the cumulative amount exceeding the market value of the building.* Use of flood insurance claim and disaster assistance information is subject to The Privacy Act of 1974, as amended, which prohibits public release of the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance. However, maps showing general areas where claims have been paid can be made public. If a plan includes the names of policy holders or recipients of financial assistance and the amount of the claim payment or assistance, the plan cannot be approved until this Privacy Act covered information is removed from the plan.

4.3 ELEMENT C. MITIGATION STRATEGY

Requirement §201.6(c)(3)	[The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
§201.6(c)(3)(i)	[The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
§201.6(c)(3)(ii)	[The hazard mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.
§201.6(c)(3)(iii)	[The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
§201.6(c)(3)(iv)	For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.
§201.6(c)(4)(ii)	[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvements, when appropriate.

Overall Intent. The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Stafford Act directs Local Mitigation Plans to describe hazard mitigation actions and establish a strategy to implement those actions.[4] Therefore, all other requirements for a Local Mitigation Plan lead to and support the mitigation strategy.

[4] Section 322(b), Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, 42 U.S.C. 5165.

The mitigation strategy includes the development of goals and prioritized hazard mitigation actions. Goals are long-term policy statements and global visions that support the mitigation strategy. A critical step in the development of specific hazard mitigation actions and projects is assessing the community's existing authorities, policies, programs, and resources and its capability to use or modify local tools to reduce losses and vulnerability from profiled hazards.

In the plan update, goals and actions are either reaffirmed or updated based on current conditions, including the completion of hazard mitigation initiatives, an updated or new risk assessment, or changes in State or local priorities.

ELEMENT	REQUIREMENTS
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? *44 CFR 201.6(c)(3)* ***Intent**: To ensure that each jurisdiction evaluates its capabilities to accomplish hazard mitigation actions, through existing mechanisms. This is especially useful for multi-jurisdictional plans where local capability varies widely.*	a. The plan **must** describe each jurisdiction's existing authorities, policies, programs and resources available to accomplish hazard mitigation. Examples include, but are not limited to: staff involved in local planning activities, public works, and emergency management; funding through taxing authority, and annual budgets; or regulatory authorities for comprehensive planning, building codes, and ordinances.
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? *44 CFR 201.6(c)(3)(ii)* ***Intent:** To demonstrate flood hazard mitigation efforts by the community through NFIP activities. Where FEMA is the official administering Federal agency of the NFIP, participation in the program is a basic community capability and resource for flood hazard mitigation activities.*	a. The plan **must** describe each jurisdiction's participation in the NFIP and describe their floodplain management program for continued compliance. Simply stating "The community will continue to comply with NFIP," will not meet this requirement. The description could include, but is not limited to: • Adoption and enforcement of floodplain management requirements, including regulating new construction in Special Flood Hazard Areas (SFHAs); • Floodplain identification and mapping, including any local requests for map updates; or • Description of community assistance and monitoring activities. Jurisdictions that are currently not participating in the NFIP and where an FHBM or FIRM has been issued may meet this requirement by describing the reasons why the community does not participate.

ELEMENT	REQUIREMENTS
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? *44 CFR 201.6(c)(3)(i)* ***Intent**: To guide the development and implementation of hazard mitigation actions for the community(ies). Goals are statements of the community's visions for the future.*	a. The plan **must** include general hazard mitigation goals that represent what the jurisdiction(s) seeks to accomplish through mitigation plan implementation. ***Goals** are broad policy statements that explain what is to be achieved.* b. The goals **must** be consistent with the hazards identified in the plan.
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? *44 CFR 201.6(c)(3)(ii) and 44 CFR 201.6(c)(3)(iv)* ***Intent**: To ensure the hazard mitigation actions are based on the identified hazard vulnerabilities, are within the capability of each jurisdiction, and reduce or avoid future losses. This is the heart of the mitigation plan, and is essential to leading communities to reduce their risk. Communities, not FEMA, "own" the hazard mitigation actions in the strategy.*	a. The plan **must** include a mitigation strategy that 1) analyzes actions and/or projects that the jurisdiction considered to reduce the impacts of hazards identified in the risk assessment, and 2) identifies the actions and/or projects that the jurisdiction intends to implement. ***Mitigation actions and projects** means a hazard mitigation action, activity or process (for example, adopting a building code) or it can be a physical project (for example, elevating structures or retrofitting critical infrastructure) designed to reduce or eliminate the long term risks from hazards.* This sub-element can be met with either actions or projects, or a combination of actions and projects. The mitigation plan may include non-mitigation actions, such as actions that are emergency response or operational preparedness in nature. These will not be accepted as hazard mitigation actions, but neither will FEMA require these to be removed from the plan prior to approval. *A **comprehensive range** consists of different hazard mitigation alternatives that address the vulnerabilities to the hazards that the jurisdiction(s) determine are most important.* b. Each jurisdiction participating in the plan **must** have mitigation actions specific to that jurisdiction that are based on the community's risk and vulnerabilities, as well as community priorities. c. The action plan **must** reduce risk to existing buildings and infrastructure as well as limit any risk to new development and redevelopment. ***With emphasis on new and existing building and infrastructure** means that the action plan includes a consideration of actions that address the built environment.*

ELEMENT	REQUIREMENTS
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? *44 CFR 201.6(c)(3)(iii) and 44 CFR (c)(3)(iv)* ***Intent**: To identify how the plan will directly lead to implementation of the hazard mitigation actions. As opportunities arise for actions or projects to be implemented, the responsible entity will be able to take action towards completion of the activities.*	a. The plan **must** describe the criteria used for prioritizing implementation of the actions. b. The plan **must** demonstrate when prioritizing hazard mitigation actions that the local jurisdictions considered the benefits that would result from the hazard mitigation actions versus the cost of those actions. The requirement is met as long as the economic considerations are summarized in the plan as part of the community's analysis. A complete benefic-cost analysis is not required. Qualitative benefits (*for example*, quality of life, natural and beneficial values, or other "benefits") can also be included in how actions will be prioritized. c. The plan **must** identify the position, office, department, or agency responsible for implementing and administering the action (for each jurisdiction), and identify potential funding sources and expected timeframes for completion.
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? *44 CFR 201.6(c)(4)(ii)* ***Intent**: To assist communities in capitalizing on all available mechanisms that they have at their disposal to accomplish hazard mitigation and reduce risk.*	a. The plan **must** describe the community's process to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms. b. The plan **must** identify the local planning mechanisms where hazard mitigation information and/or actions may be incorporated. ***Planning mechanisms** means governance structures that are used to manage local land use development and community decision-making, such as comprehensive plans, capital improvement plans, or other long-range plans.* c. A multi-jurisdictional plan **must** describe each participating jurisdiction's individual process for integrating hazard mitigation actions applicable to their community into other planning mechanisms. d. The updated plan **must** explain how the jurisdiction(s) incorporated the mitigation plan, when appropriate, into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts. e. The updated plan **must** continue to describe how the mitigation strategy, including the goals and hazard mitigation actions will be incorporated into other planning mechanisms.

4.4 ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION *(Plan Updates Only)*

Requirement §201.6(d)(3)	A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

Overall Intent. In order to continue to be an effective representation of the jurisdiction's overall strategy for reducing its risks from natural hazards, the mitigation plan must reflect current conditions. This will require an assessment of the current development patterns and development pressures as well as an evaluation of any new hazard or risk information. The plan update is an opportunity for the jurisdiction to assess its previous goals and action plan, evaluate progress in implementing hazard mitigation actions, and adjust its actions to address the current realities.

Where conditions of growth and revisions in priorities may have changed very little in a community, much of the text in the updated plan may be unchanged. This is acceptable as long as it still fits the priorities of their community, and it reflects current conditions. The key for plan readers to recognize a good plan update is documentation of the community's progress or changes in their hazard mitigation program, along with the community's continued engagement in the mitigation planning process.

ELEMENT	REQUIREMENTS
D1. Was the plan revised to reflect changes in development? ***44 CFR 201.6(d)(3)*** ***Intent****: To ensure that the mitigation strategy continues to address the risk and vulnerabilities to existing and potential development, and takes into consideration possible future conditions that can impact the vulnerability of the community.*	a. The plan **must** describe changes in development that have occurred in hazard prone areas and increased or decreased the vulnerability of each jurisdiction since the last plan was approved. If no changes in development impacted the jurisdiction's overall vulnerability, plan updates may validate the information in the previously approved plan. ***Changes in development*** means recent development (*for example*, construction completed since the last plan was approved), potential development (*for example*, development planned or under consideration by the jurisdiction), or conditions that may affect the risks and vulnerabilities of the jurisdictions (*for example*, climate variability, declining populations or projected increases in population, or foreclosures). Not all development will affect a jurisdiction's vulnerability.

ELEMENT	REQUIREMENTS
D2. Was the plan revised to reflect progress in local mitigation efforts? *44 CFR 201.6(d)(3)* ***Intent**: To evaluate and demonstrate progress made in the past five years in achieving goals and implementing actions outlined in their mitigation strategy.*	a. The plan **must** describe the status of hazard mitigation actions in the previous plan by identifying those that have been completed or not completed. For actions that have not been completed, the plan **must** either describe whether the action is no longer relevant or be included as part of the updated action plan.
D3. Was the plan revised to reflect changes in priorities? *44 CFR 201.6(d)(3)* ***Intent**: To ensure the plan reflects current conditions, including financial, legal, and political realities as well as post-disaster conditions.*	a. The plan **must** describe if and how any priorities changed since the plan was previously approved. If no changes in priorities are necessary, plan updates may validate the information in the previously approved plan.

4.5 ELEMENT E. PLAN ADOPTION

Requirement §201.6(c)(5)	[The plan shall include…] Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County commissioner, Tribal Council). For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Overall Intent. Adoption by the local governing body demonstrates the jurisdiction's commitment to fulfilling the hazard mitigation goals and actions outlined in the plan. Adoption legitimizes the plan and authorizes responsible agencies to execute their responsibilities. Updated plans also are adopted anew to demonstrate community recognition of the current planning process, changes that have occurred within the previous five years, and validate community priorities for hazard mitigation actions.

ELEMENT	REQUIREMENTS
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? ***44 CFR 201.6(c)(5)*** ***Intent****: To demonstrate the jurisdiction's commitment to fulfilling the hazard mitigation goals outlined in the plan, and to authorize responsible agencies to execute their responsibilities.*	a. The plan **must** include documentation of plan adoption, usually a resolution by the governing body or other authority. If the local jurisdiction has not passed a formal resolution, or used some other documentation of adoption, the clerk or city attorney **must** provide written confirmation that the action meets their community's legal requirements for official adoption and/or the highest elected official or their designee **must** submit written proof of the adoption. The signature of one of these officials is required with the explanation or other proof of adoption. Minutes of a council or other meeting during which the plan is adopted will be sufficient if local law allows meeting records to be submitted as documentation of adoption. The clerk of the governing body, or city attorney, **must** provide a copy of the law and a brief, written explanation such as, "in accordance with section ___ of the city code/ordinance, this constitutes formal adoption of the measure," with an official signature. If adopted after FEMA review, adoption **must** take place within one calendar year of receipt of FEMA's "Approval Pending Adoption." See Section 5, *Plan Review Procedure* for more information on "Approvable Pending Adoption."

ELEMENT	REQUIREMENTS
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? *44 CFR 201.6(c)(5)* ***Intent**: To demonstrate the jurisdiction's commitment to fulfilling the hazard mitigation goals outlined in the plan, and to authorize responsible agencies to execute their responsibilities.*	a. Each jurisdiction that is included in the plan **must** have its governing body adopt the plan prior to FEMA approval, even when a regional agency has the authority to prepare such plans. As with single jurisdictional plans, in order for FEMA to give approval to a multi-jurisdictional plan, at least one participating jurisdiction **must** formally adopt the plan within one calendar year of FEMA's designation of the plan as "Approvable Pending Adoption." See Section 5, *Plan Review Procedure* for more information on "Approvable Pending Adoption."

Appendix B: Planning Process and Public Outreach

1. Local Emergency Planning Committee Member List
2. LEPC 9-25-14 Meeting Agenda
3. LEPC 9-25-14 Meeting Minutes
4. LEPC 10-23-14 Meeting Agenda
5. LEPC 10-23-14 Meeting Minutes
6. LEPC 11-20-14 Meeting Agenda
7. LEPC 11-20-14 Meeting Minutes
8. LEPC 01-27-17 Meeting Agenda
9. LEPC 01-27-17 Meeting Minutes
10. Screenshot of Town Homepage with Link to Draft Report
11. Copy of Newspaper Announcement
12. Letters Sent to Neighboring Towns
13. Comment Response Document

LOCAL EMERGENCY PLANNING COMMITTEE

NAME	TITLE	AFFILIATION
ABSTEN, CHAD	CAPTAIN	FIRE RESCUE DEPT.
ARSENAULT, BOB	DIRECTOR	FALMOUTH HOUSING
BIDWELL, TODD	GENERAL MGR.	ISLAND QUEEN
BONFARDECI, JOHN	ADMINISTRATION	HARBORSIDE
BRODEUR, JEFFREY	LCDR	USCG
BROWN, HENRY	BOARD MEMBER	FARA
CARDEIRA, KAREN	DIRECTOR	HUMAN SERVICES
CARIGNAN, DAVID	HEALTH AGENT	TOWN OF FALMOUTH
CLEMENTS, GREG	CAPTAIN	FIRE RESCUE DEPT.
COWAN, CHRISTOPHER	FIREFIGHTER	FIRE RESCUE DEPT.
DEMELLO, BOYD	FIRE PREVENTION INSPECTOR	FIRE RESCUE DEPT.
DEROSIER, DAVE	FACILITY MANAGER	WHOI
DINARDO, DAN	DIRECTOR	FALMOUTH CERT
DIOGO, DAVE	COMMUNICATIONS ADMIN.	COMMUNICATIONS DEPT.
DUNNE, ED	CHIEF	POLICE DEPARTMENT
ENDICOTT, GREG		STEAMSHIP AUTHORITY
FERREIRA, LARRY	SECURITY DIRECTOR	STEAMSHIP AUTHORITY
GIFFORD, GREG	PORT CAPTAIN	STEAMSHIP AUTHORITY
GIROUARD, BRUCE	LIEUTENANT	FIRE RESCUE DEPT.
GORDON, JOSEPH	E.M. DIRECTOR	BC SHERIFF'S DEPT.
GRIFFIN, BOB	ASST. HARBOR MASTER	TOWN OF FALMOUTH
HEUFLEDER, KATHLEEN	NURSE	FAL. HOSP. & MRC
HOFFER, DON	SUPT.	BEACHES
JACK, RAY	DIRECTOR	PUBLIC WORKS
JENSEN, ERIC	EHS MANAGER	MBL
KENNEDY, GREG	DIRECTOR	SCHOOL TRANSPORTATION
MARTIN, ANNE	SAFETY REP	GOSNOLD
MARTIN, RICK	SECURITY OFFICER	GOSNOLD
MARTINSEN, CHUCK	ASSISTANT	NATURAL RESOURCES
MAURER, WILLIAM	RESIDENT/VOLUNTEER	CERT
MCCONARTY, PETER	ASST. DPW SUPT.	DPW
MEADE, FRED	CLERGY	N. FAL. CONGREGATIONAL
MOTTA, PHILIP	MEMBER	CAPE COD FAIRGROUNDS
MURPHY, PATRICK	DIR. OF FINANCE & FACILITIES	SCHOOL DEPARTMENT
MURPHY, PAUL	PORT SECURITY SPECIALIST	USCG GROUP WOODS HOLE
NEWTON, SHARDELL	MANAGER	FACILITIES MAINTENANCE
O'CONNOR, VALERIE	IT DIRECTOR	INFO. TECHNOLOGY DEPT.
O'MALLEY, CRAIG	EMS SUPERVISOR	FIRE RESCUE DEPT.

NAME	TITLE	AFFILIATION
REIF, RONALD	ENV. HEALTH & SAFETY MGR.	WHOI
RICHARSON, JOHN	SECURITY SUPERVISOR	WHOI
ROGERS, DEB	DIRECTOR	FCTV
ROZUM, MARK	DIR. TERMINALS & PARKING	STEAMSHIP AUTHORITY
RUSSELL, MARIE	DIR. OF FACILITIES & SERVICES	MBL
SHEA, BOB	DIRECTOR	GIS
SMALL, MIKE	FIRE CHIEF	FIRE RESCUE DEPT.
SMITH, TIM	DEPUTY CHIEF	FIRE RESCUE DEPT.
SPARKS, WILLIAM	SUPERVISOR	WHOI
SUSO, JULIAN	TOWN MANAGER	TOWN OF FALMOUTH
SWAIN, BRENDA	DIRECTOR	SERVICE CENTER
SYKES, STEVE		MBL
TAYLOR, MIKE	MAINTENANCE	GOSNOLD
THRASHER, SCOTT	A/DEPUTY CHIEF	FIRE RESCUE DEPT.
TORRES, DAVID	HOUSING AUTHORITY	HOUSING AUTHORITY
TROTT, MEL	FIRE PREVENTION OFFICER	FFRD
VEZINA, HELEN	ASST. DIRECTOR	FALMOUTH CERT
WEINSTEIN, EVAN	MEDICAL DIRECTOR	FALMOUTH HOSPITAL
WETHERBEE, RICHARD	ED DIRECTOR	FALMOUTH HOSPITAL
WYMAN, GEOFF		FCTV

LOCAL EMERGENCY PLANNING COMMITTEE
MEETING NOTICE & AGENDA

The Town of Falmouth Local Emergency Planning Committee meets in the EOC Meeting Room, 2nd floor, 399 Main Street on the fourth Thursday of the month at 2:00 PM.

DATE: SEPTEMBER 25, 2014

TIME: 2:00 PM

LOCATION: Fire Rescue Headquarters – 2nd Floor Training Room

SUBJECT: LEPC Meeting

• Guest Speaker Brian Curry
-Multi-Hazard Mitigation Plan

• Guest Speaker Tara McEnroe-Kent
-Mass Maritime Academy Emergency Management Software Tools

• Overview of Emergency Preparedness Resources

• Subcommittee Updates

-Communications
-CERT

-NOTES-

** Next Meeting: October 23, 2014

9/25/14 LEPC meeting

02:00pm Fire Chief Mark Sullivan Introduced Town Planner Brian Curry and the basic ideas of the mitigation plan.

02:01pm Mr. Curry passed out relevant chapters of MHM

02:02pm Mr. Curry introduced the multi-hazard mitigation plan. Expressed need for community support based on FEMA requirements. Introduced the draft plan and chapters 6, 7, and 8 since these will be relevant to LEPC. Introduced deadline for MHM grants.

02:04pm Mr. Curry Introduced Chapter 6. Chap. 6 is about critical facilities. Mr. Curry asked for assistance modifying the list he created either moving facilities between tiers, adding or subtracting to the list.

02:08pm Mr. Curry Introduced chapter 7. Chap. 7 is about mitigation that has taken place or are taking place every day. Defined what type of hazard mitigations should be put into the plan like replacing the culvert on Maravista Ave.

02:11pm Mr. Curry Introduced chapter 8. Chap. 8 is about the goals and objectives as well as what non-structural projects the town might need money for like public outreach. Mentions updating existing laws or procedures that are out of date such as hurricane evacuation routes or preparation for wildfires.

02:16pm Mr. Curry opened the floor for questions. One gentleman asked whether the facilities in chapter 6 should include privately owned facilities or should be limited to public government type facilities. Mr. Curry explained that any facility that might be necessary in an emergency should be included.

02:17pm Mr. Curry went into more detail about the multi-hazard portion of the plan, that the town needs to think about a broad spectrum of hazards, both man-made and natural and are not limited to snowstorms and hurricanes. They need to consider earthquakes and other disasters as well.

02:18pm Chief Sullivan asked whether chapter 6 facilities should include important non-building facilities such as roads or the bike path. Mr. Curry mentioned the forced water main to Woods Hole. All infrastructure needed in an emergency should be included.

02:19pm Chief Sullivan asks about whether there is a need for matching local funds. Brian mentions that there may be a need but there are also other pathways and grants.

02:20pm Chief Sullivan asks if Mr. Curry should do a brainstorming session with WBNERR since they are working on a very similar plan for Waquoit Bay. Mr. Curry says they've been in touch and are looking at broadening the cooperation there.

02:22pm Mr. Curry wrapped up.

02:23pm Chief Sullivan provided a few comments about using existing hazard plans that have mitigation and introduced the next speaker: Tara McEnroe-Kent from Mass. Maritime academy.

02:26pm Ms. McEnroe-Kent offered software discount if there's interest from LEPC

02:27pm Ms. McEnroe-Kent introduced herself and the Emergency Management Software from MA Maritime Academy.

02:28pm Ms. McEnroe-Kent gave a basic overview of several of the software programs utilized at the academy.

02:33pm Gentleman asks how “real-time” CAMEO is. Ms. McEnroe-Kent explained that there is a lag between a tier 2 response being reported and CAMEO being updated so that it includes it, but she isn’t aware what that lag is. She also noted there can be discrepancies in the data due to poor user input, misspelled roads etc.

02:34pm Ms. McEnroe-Kent continued through the software programs.

03:02pm Ms. McEnroe-Kent wrapped up with Google Earth. Talked about the history of workshops with MMA and local communities for training using these Emergency management programs, briefly.

03:03pm Chief Sullivan asked the subcommittees to give an update on work with communications committee.

03:10pm Covered progress on setting up of the shelter, inventory and floor plan etc.

03:13pm Chief Sullivan reminded everyone that Saturday the 4th of October is the Emergency preparedness fair and asked for assistance.

03:16pm Chief Sullivan thanked everyone and closed the meeting.

LOCAL EMERGENCY PLANNING COMMITTEE
MEETING NOTICE & AGENDA

The Town of Falmouth Local Emergency Planning Committee meets in the EOC Meeting Room, 2nd floor, 399 Main Street on the fourth Thursday of the month at 2:00 PM.

DATE: OCTOBER 23, 2014

TIME: 2:00 PM

LOCATION: Fire Rescue Headquarters – 2nd Floor Training Room

SUBJECT: LEPC Meeting

• Guest Speaker Ralph Swenson
-Low Power Emergency Radio Station

• Multi-Hazard Mitigation Plan-
-Review/Input on Chapters 6 – 8

• Overview of Emergency Preparedness/Fire Prevention Fair

• Subcommittee Updates

-Communications
-CERT

-NOTES-

** Next Meeting: November 20, 2014 - Make note that this meeting is a week earlier than usual.

***No meeting in December.

10/23/14

02:00 Chief Sullivan started by introducing everyone:

- Mark Sullivan – Fire Chief, Emergency management Director
- Kim Strohm – Falmouth Fire Rescue
- Henry Brown – Falmouth Amateur Radio
- Phil Motta – Cape Cod Fairgrounds
- Ralph Swenson – Barnstable County Sherriff's Office
- Dan DiNardo – Town of Falmouth CERT Coordinator
- Helen Vezina – Town of Falmouth Assistant CERT Coordinator
- Scott Arishaw – Coast Guard Station Woods Hole
- Greg O'Malley – Falmouth Fire
- Bob Shea– Falmouth GIS
- Bob Arsenault– Falmouth Housing
- Pat Murphy – Falmouth Public Schools
- Bob Griffin – School Department
- Rich O'Connor – Professor of Homeland Security, Mass. Maritime Academy
- John Lyons – Falmouth Highway Superintendent
- James Marcello – MBL Health and Safety Manager
- Will Demello - Falmouth Fire Rescue
- Ron Reif – Woods Hole Oceanographic
- Greg Gifford – Steamship Authority
- Larry Ferreira – Steamship Authority
- Debbie Rogers - Falmouth Community Television

02:02 Chief Sullivan introduced guest speaker Ralph Swenson, Chief of Communication at Barnstable County Sherriff's Office, who will speak about low power emergency radio station.

02:02 Chief Swenson introduced himself further and introduced what he looked into for low power emergency radio for the communications subcommittee of LEPC. Talked about existing examples and applications of the radio, Steamship Authority, Disney and Municipal information dissemination.

02:05 Chief Swenson suggests 300 watt transmitter.

02:06 Chief Swenson introduced several possible locations for the tower, water towers, schools etc.

02:08 Chief Swenson introduced companies and costs associated with building and implementing the tower and broadcast system.

02:11 Chief Swenson estimates about $17,000 to get the hardware purchased and installed.

02:12 Chief Swenson estimates overall cost at around $32,000. Opened the floor to questions

02:12 Mr. DiNardo asked what the expected range would be. Chief Swenson explained they need to pick sites and run software to determine what the foot print will be. He then explained the advantages of the

high school. Mr. DiNardo asked for more information about how much of Falmouth will be covered and Chief Swenson explained it will not be 100%, but it will reliably and consistently cover most of Falmouth.

02:14 Mr. Murphy asked about Chief Swenson's comment of providing regular radio broadcasts to socialize the community with the tower asking if the chief had examples of local communities who have done this well. Chief Swenson answered that the subcommittee has been given examples and was looking into it. He offered the history of 911 as an example of why this education process needs to be done.

02:16 Chief Sullivan asked why the tower would broadcast in FM and not AM. Chief Swenson explained that FM tends to broadcast further and in a wider swath than AM. FM is also more clear and resilient against storms and other forms of interference and the equipment is more cost effective. Chief Sullivan asked if the existing tower at the fire station was considered. Chief Swenson explained it was but due to a ridge north of the station, the coverage for north Falmouth could be compromised and the high school should be a better alternative.

02:18 Mr. Murphy asked whether the antenna and the transmitter need to be close together. Chief Swenson said yes, within a couple hundred feet. Mr. Murphy asked how a water tower would work. Chief Swenson explained that the transmitter could exist in the shelter for the pump equipment etc. and the wire could run up the tower from there.

02:19 Chief Sullivan asked about routine maintenance and costs. Chief Swenson mention there is obviously a cost of electricity, there may be maintenance but if they keep the equipment cared for the cost of maintenance will be minimal. Chief Sullivan asked about the cost of the FCC licensing. Chief Swenson said they still need to look into it.

02:20 Mr. Murphy asked whether the tower was large enough that putting it on top of the high school would require modification to the high school building. Chief Swenson explained that it isn't a large, heavy tower and the building would support it as is.

02:21 Ms. Rogers spoke about populating radio programming outside of emergency information. FCT is happy to take the lead on running programming over the radio station.

02:23 Chief Sullivan explained the communications subcommittee has been tasked with researching possible programming to be played on the radio station. Opened the floor to questions/comment about ideas for programming.

02:24 Mr. DiNardo spoke for the committee mentioning that it is very important that the ability to walk into a facility and physically broadcast from the tower itself in case some kind of remote access is impossible.

02:25 Chief Sullivan raised the issue of funding. Ms. Strohm explained that the subcommittee is researching as many avenues as possible to find funding in the event the town doesn't want to pay. She asked for official go ahead from LEPC to begin trying to find funding as well as researching different locations for the tower etc.

02:28 Chief Sullivan asked Chief Swenson whether surrounding communities such as Mashpee could benefit from the tower as well. Chief Swenson said it depends on power.

02:29 Mr. O'Connor asked if it might be a good idea to run some kind of a survey of Falmouth residents to see how many people think this is a good idea to then get the finance committee to buy into the idea. Mr. Murphy thought there might be a way to tie this into something with the high school.

02:32 Chief Sullivan asked Mr. Motta whether he was aware of other communities who might provide information about their towers.

02:33 Chief Sullivan asked for a vote about whether the subcommittee should move forward, the motion was voted to go forward.

02:34 Chief Sullivan introduced the next order of business which was the Multi-Hazard Mitigation Plan, he opened the floor to questions and comments. John Lyons talked about a meeting they had about the resiliency of the town. They discussed what each department would need in the event of a storm or emergency. Mr. Griffin mentioned getting all the departments to agree on an MOU.

02:37 Mr. Sullivan talked about the tiered list of important places pointing out several things he believed should be included and why.

02:39 Ms. Strohm mentioned a couple other emergency management plans that together, should have all the facilities that should be listed in this MHM. Mr. Shea added that he needed the list at some point to make a map of the tiered facilities.

02:40 Chief Sullivan moved on to the emergency preparedness fair. Ms. Strohm covered a few slides to sum up the success of the fair. The fair was larger than 2013 and had about 250 participants walk through.

02:47 Ms. Strohm wrapped up and Chief Sullivan transitioned to making comments on the overall success of the fair, as well as making a few comments about things to consider for next year.

02:49 Mr. Demello commented about a recent use of social media to disseminate an emergency weather warning. He commented specifically about how the timing seemed to increase following of the announcements.

02:52 Mr. DiNardo made a few comments about CERT's success with the emergency preparedness fair.

02:53 Chief Sullivan made a few closing remarks as well as commented on changes to the November meeting agenda. Meeting was closed.

LOCAL EMERGENCY PLANNING COMMITTEE
MEETING NOTICE & AGENDA

The Town of Falmouth Local Emergency Planning Committee meets in the EOC Meeting Room, 2nd floor, 399 Main Street on the fourth Thursday of the month at 2:00 PM.

DATE: NOVEMBER 20, 2014

TIME: 2:00 PM

LOCATION: Fire Rescue Headquarters – 2nd Floor Training Room

SUBJECT: LEPC Meeting

• Table Talk Brainstorm and Discussion

• Subcommittee Updates

-Communications
-CERT

-NOTES-

*No meeting in December.

11/20/14

02:00 Chief Sullivan opened the meeting with a few random comments, then gave the floor to Bob Griffin to speak about the table talk exercise he was a part of involving the school and covering a lock down procedure.

02:01 Mr. Griffin started with the comprehensive emergency plan for the schools. Mr. Griffin covered some of the issues with a catastrophic emergency at a school that the meeting addressed such as developing and practicing a plan as well as re-uniting children with their parents.

02:07 Mr. Griffin asked Greg O'Malley to add to his comments on the table talk. Mr. O'Malley commented how the table talk answered many questions but lead to so many more.

02:08 Mr. Griffin took the floor back continuing off the comments Mr. O'Malley made. He then asked Pat Murphey if he had anything to add. Mr. Murphey commented on the fact that the schools are pretty comfortable and have given much thought to the ability of police and fire to respond immediately after an incident occurs, but they discovered other areas that need much more thought such as a scenario where a parent gets a social media alert from a child and responds faster than police or fire rescue or the area of recovery.

02:10 Mr. Griffin made a few closing comments about the plan.

02:12 Fred Meade (Pastor of North Falmouth Congregational Church) commented that in addition to site visits to access the emergency preparedness of the schools, that there should be site visits to the satellite locations, in this case the church, where kids may be evacuated to. Mr. Griffin noted that they plan on this. Dan DiNardo commented that the high school is often picked as the shelter or evacuation point, but that they need to make sure they consider a scenario where the high school is the compromised location, where would the reuniting of students and parents take place then? Mr. Griffin commented that they will look at that.

02:13 Chief Sullivan took the floor back. Made a few comments about being prepared for emergencies.

02:15 Chief Sullivan commented about everyone being given papers, he asked that everyone take a moment to brain storm and right down topics for future table talks or guest speakers that they think would be useful. Kim Strohm added that she wanted people to also include a list of community organizations that should be included in the LEPC outreach program.

02:16 Mr. Dinardo asked Ms. Strohm about a software package that was going to allow people to enter in that they need help during or after a storm and connect them to people who entered that they would help. Ms. Strohm explained that after considering the package they chose not to invest because they weren't comfortable with the securities of it.

02:19 Chief Sullivan gave several updates on LEPC like social media and the radio tower. He thanks the communications sub-committee for their use of social media to update the community about issues such as the mulch fire on Blacksmith Shop Rod.

02:23 Chief Sullivan asked for sub-committee updates. Phil Motta mentioned they've been in contact with Chief Swenson of Barnstable County Sheriff's office about the emergency radio tower. He talked about the formation of a Standard Operating Guide and what that entailed.

02:25 Chief Sullivan informed the communications sub-committee that he has mentioned the tower to the town to get funds.

02:26 Ms. Strohm commented that she wants to keep communication open with FCC and the schools about their possible participation in radio programming. Mr. Murphey commented that the school has been having internal discussions regarding their participation.

02:28 Chief Sullivan asked Mr. DiNardo if CERT had any updates. He talked about their development of SOPs for the shelters and that they had met with engineers about the plans and the details of their public outreach.

02:36 Chief Sullivan mentioned the release of an SOP for Ebola and some of the key aspects revolving around that.

02:39 Chief Sullivan closed the meeting.

LOCAL EMERGENCY PLANNING COMMITTEE

MEETING NOTICE & AGENDA

The Town of Falmouth Local Emergency Planning Committee meets in the EOC Meeting Room, 2nd floor, 399 Main Street on the fourth Thursday of the month at 2:00 PM.

DATE: JANUARY 26, 2017

TIME: 2:00 PM

LOCATION: Fire Rescue Headquarters – 2nd Floor Training Room

SUBJECT: LEPC Meeting

- Review of Hazardous Mitigation Plan for Finalization- Elise Leduc/Brian Currie
- Review LEPC Bylaws and potential change of meeting schedule - Chief Small
- Subcommittee Updates –

-Communications Sub-Committee

-CERT

-NOTES-

** Next Meeting: TBD

01/26/17

02:00 Chief Small opened the meeting with a few comments, then gave the floor to Brian Currie to introduce the meeting's speaker.

02:01 Mr. Currie started by describing the history of Falmouth's MHMP process, and explained that Woods Hole Group had be retained as the Town's consultant to complete the MHMP for final MEMA/FEMA submittal. Mr. Currie introduced Elise Leduc from Woods Hole Group who was at the LEPC meeting to present the changes and updates that have been made to the plan.

02:05 Ms. Leduc took the floor to deliver her presentation titled "Falmouth Multi-Hazard Mitigation Plan". The presentation covered 1.) the overall timeline and process of the Plan's development, 2.) major changes and additions that have been made to the Plan to ensure it meets all the MEMA/FEMA requirements, 3.) a general review of all sections and material contained within the plan, and 4.) the next steps required to finalize the plan and move it forward towards submittal and acceptance. Ms. Leduc also emphasized the importance of public review and comment of the plan and announced that the Draft Final Plan is currently available on the Town's website and that public comments would be accepted for the next 30 days.

02:27 Ms. Leduc asked if there were any questions or comments from the audience.

Questions from the group included:

Q: Does FEMA rank Town's different depending on whether they have ranked themselves more or less vulnerable to various hazards?
A: No. FEMA simply requires that Town's determine their risk and vulnerability as a requirement for plan development, but FEMA will not treat Towns differently if they rank themselves more vulnerable to certain hazards than other Towns.

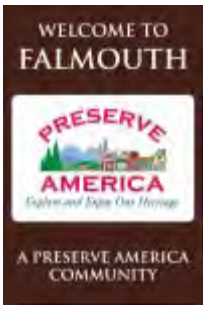
Q: Does FEMA check to see if the Town has followed the schedule outlined for various mitigation actions?
A: FEMA will not check back year-to-year, but the Town will have to account for which actions it has completed when it performs its 5-year update of the plan.

Comments from the group included:

- We should acknowledge the cooperation and collaborative efforts of various private entities (i.e. WHOI, the Falmouth hospital, etc), which also have their own hazard mitigation plans and activities.
- We should perform careful record keeping about mitigation actions listed in this Plan to facilitate documentation during the 5-year update process.

02:38 Ms. Leduc gave the floor back to Chief Small, who discussed LEPC bylaw issues and a potential change in upcoming meeting schedules.

02:43 Chief Sullivan closed the meeting.





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WebSite Tip
See What's New? for timely announcements.

Home

Important Announcements

Trash Pick-up

TRASH / RECYCLING HOLIDAY SCHEDULE Trash and Recycling will be picked up on the normal Monday – Friday schedule both the weeks after Christmas and New Year's. Please call Republic Services at 1-800-352-7808 if you need further assistance.

TOWN HALL VOICE MAIL

Town Hall is currently experiencing technical difficulties with the phone system. Voicemail and the Automated Attendant are currently unavailable. We are working diligently to resolve these issues as quickly as possible.
In the meantime, we ask that you dial directly to the department you are trying to reach rather than calling the main Town Hall number. Please do not leave any voicemail at this time as they cannot be retrieved.
Please use the **Town Directory link** to access the direct dial numbers for the department you are trying to reach. Thank you for your patience and support.

ANNUAL TOWN MEETING MONDAY April 3, 2017

Warrant Schedule

OPEN BURNING SEASON

Open Burning Permits are now available. **Click here for details**

LITTLE POND SEWER SERVICE AREA PROJECT

Information, Road Closures, Apply for Permit

Most Popular

Tax Bill Information | **Pay Bills Online** | **Property Values** | **Public Interactive GIS Site** | **Street/Trash pickup information** | **Recycle Week Calendar** | **Print Water Bills & Check Payment Status** | **Express Permit** | **Burning Permit** | **Register for Recreation Programs** | **Emergency Preparedness Facebook Page** | **FEMA Draft Hazard Mitigation Plan - 2016** | **Interactive Beach Map**

Visitor & Business Information

Falmouth Chamber of Commerce & Visitor Center | **Falmouth EDIC** | **Falmouth Housing Trust** | **League of Women Voters** | **Falmouth in Focus (LWV)** | **Cape Cod Chamber** | **Falmouth Enterprise** | **Cape Cod**

Times | **Falmouth Bulletin** | **Falmouth Historical Society** | **Falmouth Business Links** | **Other Falmouth Links**

Current Topics

Olympic Village Concept Study | **Little Pond Sewer Project** | **Long Pond WTP Locus Map** | **2015 Town of Falmouth Bike Plan** | **Town Meeting Article #9 (Fall 2014)** | **HOME Consortium 2014 Plan** | **Fertilizer Fact Sheet** | **Drawings for 1-22-2014 RFP** | **2015 Water Quality Report** | **Falmouth Wind Information** *(updated 4/4/2016)* | **Affordable Housing Opportunities** | **Updated Bikeway Map** | **Official Town Bid Requests** | **Official Notices** | **Town Calendar** |
Steamship Authority Preliminary Report - Feasibility of Freight Service Between New Bedford and Martha's Vineyard |

Departments

Harbor Master | **Local Planning Subcommittee** | **Town Manager** **Zoning Board of Appeals** | **More...**

Meetings and Agendas

Committee Vacancies List | **Town Meeting** | **Local Planning Subcommittee** | **Zoning Board of Appeals**
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Property & Other Information *moved to Most Popular at the top of this page* ↑

Permits & Stickers

Fee Schedule | **Beach Sticker** | **Dump Sticker** | **Building Permit** | **Burning Permit**
Conservation & Wetlands | **Fishing License** | **Shellfishing Permit**
Yard Sale Information & Map

Election & Voting Information

Election Results | **Next Election** | **Voter Registration** | **Voting Locations** **Absentee Voting** | **Ballots** | **Campaign Finance Reports**

Community & Youth Activities

Falmouth Schools | **Falmouth Libraries** | **Recreation** | **Road Races / Events**
Interactive Beach Map | **Falmouth Service Center** | **Safe Disposal of Needles/Syringes** | **Games**

Town Employees

Town Webmail | **Ethics Quiz**

Town Hall: 59 Town Hall Square, Falmouth, MA 02540. Ph 508-548-7611, Weekdays 8:00 am to 4:30 pm
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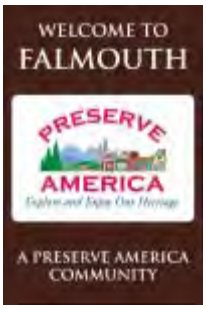


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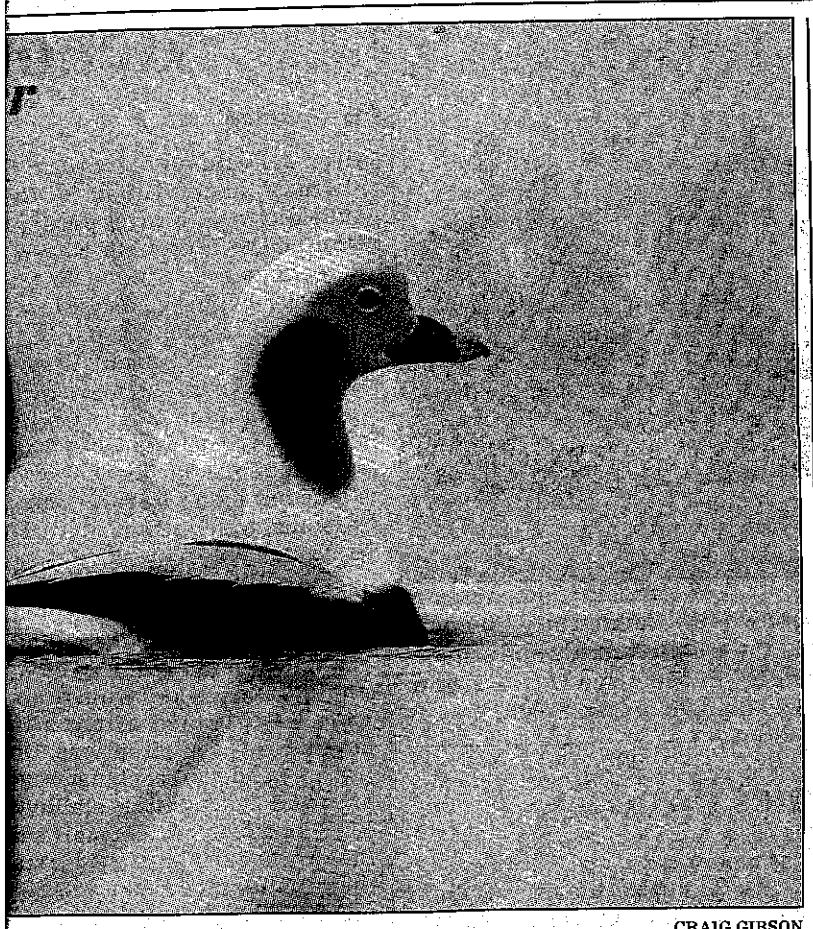
FEMA Draft Hazard Mitigation Plan

Click here to view Fema Draft Hazard Mitigation Plan

Any questions or comments please email **planning@falmouthmass.us**



CRAIG GIBSON

g duck usually only seen from a distance offshore in winter months duck may dive to depths of more than 200 feet in search of small in distinctive nonbreeding plumage, has a white head, large buff atches on the sides of its head, pale neck and belly, black breast dark wings, and a long dark tail. This one was recently seen while Harbor. Go to www.falmouthbirds.com for more information.

Return To Fell Trees nservation Project

dollars in machine rental and clearing costs. Many of the trees will be used for the Coonamesett River restoration project, laid along the river banks to help carve out a winding waterway that will provide habitat for native fish species and other wildlife.

The project will once again serve as a training exercise for ten new students, who will start the weekend off in the classrooms at the Waquoit Bay National Estuarine Research Reserve.

Paul F. Kelly, regional operations manager for Team Rubicon, said that team members must be able to operate heavy machinery to help with demolition and recovery work in the aftermath of disasters such as earthquakes, hurricanes and tornados. The local conservation project serves as a "sterile" environment to gain the practical experience necessary, he said.

Case Construction Equipment will donate the needed machinery for the Falmouth project, through a partnership with the Bureau of Land Management and Team Rubicon. Mr. Kelly said the equipment alone would cost the town about $185 an hour, plus about another $185 for the cost of operators. By partnering with Team Rubicon, however, the town and the wildlife refuge will get the machinery and work for free.

The team plans to begin work today and work through the weekend, maybe continuing on Monday and Tuesday as well. The Falmouth Department of Public Works will also aid in the project, transporting the felled trees to the Coonamessett River work areas.

Mr. Kelly said there are about 30 to 40 trees that need to be removed, though he was not yet sure how many could be removed with the medium excavators, which can handle up to 30,000 pounds. Some of the trees will be taken down whole, with the root systems intact, while others will be portioned into logs.

A primary goal of the project will be to expose and dig out an abandoned tennis court on the property, previously the site of the original Coonamessett Inn.

One of Team Rubicon's first tasks, however, will be to complete a training obstacle course. Mr. Kelly said the course, which will be built on the field out of built-up debris piles and traffic cone patterns, will give the new students a feel for driving the excavators.

Mr. Kasprzyk said that staff from the department of public works may be called away from the project in the case of inclement weather, but Mr. Kelly said his team will complete their portion of the project no matter the weather.

"It's heavy equipment; we'll just move the snow out of the way to do what we have to do," he said, speaking for the team of veterans. "We're going to get stuff done; that's what we do."

am Of Studies Nights

Parents of current 8th graders are invited to attend the following Monday, also at 6:30 PM.

Both events will be in the Falmouth High School auditorium at 874 Gifford Street.

Families will learn about the academic, athletic and co-curricular opportunities that are offered at Falmouth High School. They will also review the time line and procedures for course registration.

A hard copy of the 2016-2017 FHS Program of Studies will be available at the event. The program will also be available at fhs.falmouth.k12.ma.us—click on "Academics."

Hazard Mitigation Plan Eight Years In The Making

Recommendations Include Structural Projects Along Coastline

By BRITTANY FELDOTT

The town has completed a 150-page multihazard mitigation plan, which outlines the potential for a host of natural disasters in Falmouth and includes suggestions to better guard the town from flooding, sea level rise and other dangers.

Suggested projects include rebuilding a failing section of Chapoquoit Road, renourishing Chapoquoit Beach and rebuilding a 1,300-foot-long portion of the Falmouth Heights bluff to bolster the resiliency of the coastline.

The mitigation plan addresses a wide variety of potential hazards for Falmouth, including flooding, fire, coastal erosion, hurricanes and tropical storms, dam and culvert failure, sea level rise and severe weather events including wind and snow.

Other possible hazards usually considered by the Federal Emergency Management Agency (FEMA), such as tsunamis and landslides, were considered unlikely to occur or cause significant damage in Falmouth.

Town planner Brian A. Currie said that although the town has prepared operational procedures in the event of major weather disasters, there is currently no plan in place to proactively mitigate the effects of a natural disaster before it happens.

The draft mitigation plan is written according to FEMA guidelines as part of the National Flood Insurance Program's Community Rating System, a voluntary incentive program designed to reduce insurance rates for individuals in towns that prepare for flood hazards. Flood zone protection is of particular concern in Falmouth, where about two thirds of town borders lie on the water.

A product of the town planning and conservation departments, the multihazard mitigation plan has also received input from a wider emergency planning committee of about 100 individuals that includes key players such as the Falmouth police and fire chiefs and public works staff.

The mitigation plan is the work of eight years and multiple generations of town officials. Mr. Currie said he first began working on the plan with previous Falmouth Fire Chief Paul D. Brodeur, and the plan has since progressed in "fits and starts."

An earlier draft of the plan was submitted to the Massachusetts Emergency Management Agency (MEMA) last year for feedback, and Mr. Currie said the agency responded with a list of additional requests reflecting changing federal regulations.

Now, with the added help of the Woods Hole Group, the plan is in its final drafting stages and the town is poised to take advantage of federal grants to better armor Falmouth's coastline and other vulnerable structures.

Included in the plan is a list of "critical buildings" that provide essential resources to civilians. According to the plan, three of those buildings are in particularly vulnerable situations: the Woods Hole Drawbridge Hut, Coast Guard Station Woods Hole and the Steamship Authority Ferry Terminal. All three buildings sit within flood zones, would be partially submerged given five feet of sea level rise or less and would be vulnerable in a hurricane of any level. In addition, the Coast Guard station is also at risk of significant damage with increased coastal erosion.

Additionally, the plan shows that a 100-year storm would likely cause flooding that would block evacuation routes at six locations along Route 28 in East Falmouth, where the road is near coastal ponds susceptible to flooding and storm surge.

In light of the compromised routes, the plan suggests that the town partner with the Massachusetts Highway Department to re-evaluate current evacuation routes with an eye to either raising existing bridges above flood zones, altering the routes themselves or raising the at-risk roads.

In addition to identifying particular risks, the plan includes 34 mitigation measures that the town could take to minimize future harm, rated from low to high priority.

"It's an attempt to be proactive," Mr. Currie said. "Obviously, we can't do all that stuff. But we might be able to prioritize a few over the next few fiscal years."

One of those mitigation measures is the design and reconstruction of the 900-foot portion of Chapoquoit Road stretching from Chapoquoit Beach to the stone pillars marking the entryway to Chapoquoit Island.

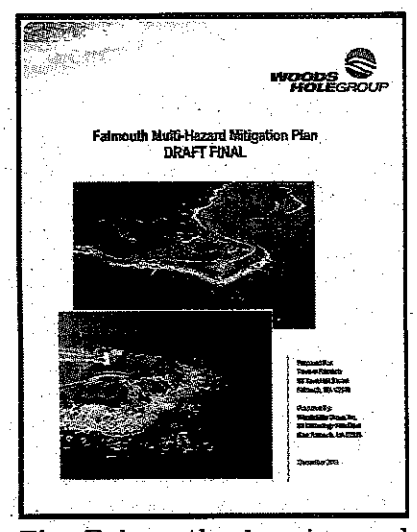
The plan also suggests considering the feasibility of renourishing Chapoquoit Beach. The shoreline has experienced significant erosion over the years, and portions of the beach are entirely submerged at peak high tides. The extensive erosion has left the area vulnerable to storm surge and wave action, and rebuilding the beach could stymie the impacts of flooding in the area.

Another potential coastal project is the reconstruction of 1,300 feet of the Falmouth Heights bluff between Vernon and Gertrude avenues, which would be a project of the town department of public works. According to the study, severe erosion in that area poses a threat to the scenic Falmouth Heights Road, and the sea wall at the base of the bluff.

The future of Surf Drive, which is frequently flooded during severe weather events, was also included in the mitigation plan, though it was labeled as a "low" priority. The plan proposes considering options for protecting, relocating or abandoning vulnerable sections of the street, but only in the next 5 to 10 years.

A "high" priority listed is training fire department staff and other first responders to fight wild land fires, a task which it suggests should be completed in the next two years. According to the plan, it is possible (between 1 and 10 percent probability) that a wildfire will occur in Falmouth in the next year, with Beebe Woods being the most susceptible area.

A high-priority capital project included in the plan is replacement of the glass roof of the Falmouth High School Gymnasium with a solid surface and addition of storm shutters to the school cafeteria. The plan suggests completing renovations in the next five years to better protect the structure from storms.



The Falmouth planning and conservation departments completed a final draft of a multihazard mitigation plan last week, summing up eight years of work. The plan is currently available for public review and is slated for submission to the Federal Emergency Management Agency this spring.

Mr. Currie said that he, the police and fire chiefs and public works administrator prioritized the action items based on what they judged would best serve the community.

"This is our best thinking," he said.

Although the plan offers specific suggestions for addressing vulnerable infrastructure in Falmouth, Mr. Currie said it does not constitute the final word on how to protect Falmouth's coastline.

"Some of the more difficult decisions have to be reached," and they go beyond assessing risks, Mr. Currie said. "How often do we replace Surf Drive and the bike path... what is the longer-term policy decision about whether we want to be resilient, reinforced or retreat?"

Those "tough decisions" will ultimately need to be made by the board of selectmen, conservation commission and planning board, Mr. Currie said. In the meantime, he said the multihazard mitigation plan will serve as a resource to better inform those decisions.

"I don't think this will sit on the shelf," he said of the nearly completed plan.

The public is invited to review the multihazard mitigation plan and submit comments online at http://www.falmouthmass.us/deppage.php?number=516.

The plan was also submitted to the other Upper Cape and Martha's Vineyard planning departments, and Mr. Currie said his office had already received comments from Mashpee. Public comment will be compiled and addressed in a final draft of the mitigation plan.

The local emergency planning committee will review the revised plan during a public meeting on January 26 at 2 PM at the Falmouth Fire and Rescue Department headquarters, located at 399 Main Street. There will also be an opportunity for public comment.

After the meeting, the plan will go before the Falmouth Board of Selectmen for approval to resubmit it to MEMA, in hopes of having it approved by FEMA later in the spring.

FALMOUTH PLANNING BOARD
59 TOWN HALL SQUARE
FALMOUTH, MASSACHUSETTS 02540
(508) 495-7440 • FAX (508) 495-7443
E-Mail: planning@falmouthmass.us

January 3, 2017

Coreen V. Moore, Town Planner
Town of Bourne
24 Perry Avenue
Buzzard's Bay, MA 02532

Dear Coreen,

Hope this note finds you well.

Below is a link to the Town of Falmouth Draft Multi-Hazard Mitigation Plan, revised December 2016. As you may know, FEMA requires that the plan be made available to neighboring communities for review and comment before being finalized. If you could take a moment to review on behalf of your town and return to me any comments or suggestions you may have it would be most appreciated.

Thanks and hope to see you soon.

Sincerely,

Brian A. Currie (mm)

Brian A. Currie, AICP
Town Planner

http://www.falmouthmass.us/planning/mhmp_report_draftfinal_121616_wappendices.pdf

FALMOUTH PLANNING BOARD
59 TOWN HALL SQUARE
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(508) 495-7440 • FAX (508) 495-7443
E-Mail: planning@falmouthmass.us

January 3, 2017

F. Thomas Fudala, AICP
Town of Mashpee
16 Great Neck Road
Mashpee, MA

Dear Tom,

Hope this note finds you well.

Below is a link to the town of Falmouth Draft Multi-Hazard Mitigation Plan, revised December 2016. As you may know, FEMA requires that the plan be made available to neighboring communities for review and comment before being finalized. If you could take a moment to review on behalf of your town and return to me any comments or suggestions you may have it would be most appreciated.

Thanks and hope to see you soon.

Sincerely,

Brian A. Currie (mm)

Brian A. Currie, AICP
Town Planner

http://www.falmouthmass.us/planning/mhmp_report_draftfinal_121616_wappendices.pdf

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(508) 495-7440 • FAX (508) 495-7443
E-Mail: planning@falmouthmass.us

January 3, 2017

Blair Haney, Town Planner
Town of Sandwich
130 Main Street
Sandwich, MA 02563

Dear Blair,

Hope this note finds you well.

Below is a link to the Town of Falmouth Draft Multi-Hazard Mitigation Plan, revised December 2016. As you may know, FEMA requires that the plan be made available to neighboring communities for review and comment before being finalized. If you could take a moment to review on behalf of your town and return to me any comments or suggestions you may have it would be most appreciated.

Thanks and hope to see you soon.

Sincerely,

Brian A. Currie (mm)

Brian A. Currie, AICP
Town Planner

http://www.falmouthmass.us/planning/mhmp_report_draftfinal_121616_wappendices.pdf

FALMOUTH PLANNING BOARD
59 TOWN HALL SQUARE
FALMOUTH, MASSACHUSETTS 02540
(508) 495-7440 • FAX (508) 495-7443
E-Mail: planning@falmouthmass.us

January 3, 2017

Mr. Adam Turner, Executive Director
Martha's Vineyard Commission
33 New York Avenue, P.O. Box 1447
Oak Bluffs, MA 02557

Dear Mr. Turner,

Below is a link to the Town of Falmouth Draft Multi-Hazard Mitigation Plan, revised December 2016. As you may know, FEMA requires that the plan be made available to neighboring communities for review and comment before being finalized. If you could take a moment to review on behalf of the Commission and return to me any comments or suggestions you may have it would be most appreciated.

Thank you for your time and efforts.

Sincerely,

Brian A. Currie (mm)

Brian A. Currie, AICP
Town Planner

http://www.falmouthmass.us/planning/mhmp_report_draftfinal_121616_wappendices.pdf

Falmouth Multi-Hazard Mitigation Plan (DRAFT FINAL) Comments – Comment Deadline 2/24/17

Commenter Name: Michael Mendoza, Building Commissioner, Town of Mashpee

Comment 1: I did not see any clear plan regarding the storing and removal of debris from the storm/flooding/snow, etc. As with all events, that create debris, what plan is in place to address this?

- Response 1: *After large storm events, the Department of Public Works collects and accepts storm debris at the Compost Facility located at 555 Blacksmith Shop Road. Brush and debris material get stored in the lower level area until a contractor can be obtained to process and remove the material. Existing Mitigation Measure #7 in Section 5.3 has been retitled to Storm Preventative Maintenance and Response, and a discussion of this debris removal and collection has been added.*

Comment 2: Mutual aid. In case they need mutual aid, in the way of DPW workers, building officials, etc., should the community have a plan in place with their neighbors in case there is a need?

- Response 2: *The goal of the proposed mitigation action 5f (Formalize mutual aid agreements) intends to do exactly this. Ideally within the next few years the Town of Falmouth can work cooperatively with neighboring communities, including Mashpee, to develop such a plan.*

Comment 3: In the case of a very bad event - in which the bridges have been compromised, should there be an area where boats from the mainland (which hold supplies, personnel, etc.) are designated to dock and work out of to assist said community?

- Response 3: *Fully addressing this comment is beyond the scope of a local plan, since there are no Town-owned deep water docks in Falmouth. However, the Town is currently working cooperatively with WHOI to redesign their dock, and perhaps this could lead to discussions concerning the use of their faiclitiies for emergency measures such as this in the future.*

Commenter Name: E. Robert Thieler, 108 Colonial Way, Falmouth

Comment 4: All public comments on this report should be compiled and presented in an appendix to the final report, so that all public input is recorded and available. Responses and revisions to the report as a result of public comments should also be included in the appendix.

- Response 4: *This comment response document has been developed to record all public input.*

Comment 5: The comment period for this report should be stated publicly, at a minimum on the web page for submitting comments (http://www.falmouthmass.us/deppage.php?number=516).

- Response 5: *The public comment was clearly posted on the website following the January LEPC Meeting. The public comment deadline was February 24, 2017.*

Comment 6: The hazard probability assessments used in this report should follow standard usage and expression of likelihoods and outcomes. The language and categorization follows that used in the 2010 Barnstable multihazard plan, but the usage in that report does not follow standard usage and expression, and does not provide a citation to the source of the frequency of occurrence categorization. As a result, the likelihoods of hazard occurrence are either or both poorly defined and of minimal practical use. In some cases, they are combined with other language that leads to unsupported assertions or characterization of the hazard. For example, page 3-11, Section B2.b states "Based on the coastal erosion frequency of occurrence predicted in the 2010 Barnstable County Multi-Hazard Mitigation Plan, it is highly likely (near 100% probability in the next year) that significant losses due to coastal erosion will occur in Falmouth."

There is no supporting evidence for this assertion. Using the information provided in the report about past coastal erosion and storms, one can reasonably conclude that the annual likelihood of "significant losses" is much less than "near 100% probability in the next year." In addition, no definition of "significant" is provided. Such terms require definition in terms of economic value, loss of use, or other metric; definitions should be provided in the text or an appendix.

The most widely used likelihood classification for hazards and outcomes is Mastrandrea et al. (2010) and should be adopted throughout this report. The report could reproduce Table 1 in Mastrandrea et al. in the text or an appendix. An alternative classification would be that used by the National Climate Assessment, which is nearly equivalent (see http://nca2014.globalchange.gov).

Reference cited:

Mastrandrea, M.D., C.B. Field, T.F. Stocker, O. Edenhofer, K.L. Ebi, D.J. Frame, H. Held, E. Kriegler, K.J. Mach, P.R. Matschoss, G.-K. Plattner, G.W. Yohe, and F.W. Zwiers, 2010: Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. Intergovernmental Panel on Climate Change (IPCC). Available at <http://www.ipcc.ch>.

- Response 6: *There are numerous ways to classify likelihoods. The comment above points out an alternative approach, presented by Mastrandrea et al. (2010). While this may be the preferred method for a scientific document, the LPT has worked collectively through the planning process to develop this document to evaluate likelihoods using a method employed in other approved municipal hazard mitigation plans. This alternative likelihood evaluation method may be something that can be considered in future revisions of the Plan, but it is important to remember that this is a planning document based on science, not a scientific document.*

  In response to the statement that "there is not supporting evidence for this assertion [that there is near 100% probability in the next year that coastal erosion will occur]," we

relied heavily on the CZM shoreline change data. Although the CZM shoreline change results are average rates over time, based on the number of highly eroding transects along much of the Town's coast, it is highly likely that coastal erosion will occur somewhere in Falmouth in the next year.

Commenter Name: Blair Haney, Planning Department Director, Town of Sandwich

Comment 7: The Town of Sandwich Planning Dept has reviewed your draft document and does not have any comments. Thank you for allowing us the opportunity to comment. Best of luck.

- Response 7: *Thank you for taking the time to review the Plan.*

Commenter Name: William Maurer, 140 Gifford St, Falmouth

Comment 8: I noticed Pilgrim Nuclear Power Plant was not included. Attached is a Safety Performance Analysis that compares the NRC Safety Performance rating of Entergy as a corporation and Pilgrim alone to the safety performance records of the rest of the commercial nuclear energy industry. Below is a copy of the email we sent to Governor Baker, AG Maura Healey, etc with a copy of the study. The email summarizes the study for a quick overview.

- Response 8: *The hazards related to the proximity to a nuclear facility, while potentially significant, do not fall into the category of "natural" hazards, which are the topic of this plan. There are certainty other hazards, including nuclear disaster, terrorism, etc. that are outside of the scope and intent of this particular document.*

Commenter Name: Mark Cool, Fire Tower Road, Falmouth

Comment 9: Relative to Chapter 5.3.1: Since the draft section identifies that Falmouth currently participates in FEMA's the National Flood Insurance Program (NFIP), wherein Falmouth has (or should have) been categorized based upon existing efforts to reduce the risk to life/property in floodplain areas, I suggest adding the current NFIP classification and the expected classification upon Hazard Plan acceptance. A community earning 4500 points is ranked as Class 1 and property owners get a 45% discount, where a community earning at least 500 points, property owners get only a 5% discount (FEMA/NFIP, 2010) It might provide a means to both inform and incentivize property owners to the fiscal benefit of Falmouth's Hazard Plan. Given the changing climate (environmentally and fiscally) property owners ought to be given a broad-based awareness of Falmouth' comparative NFIP ranking/classification, existing versus anticipated. After all, the NFIP ranking determines the amount of discount received on their property insurance, and there's no better way to encourage floodplain taxpayer support and participation than by a strategy that reduce the costs of protecting their lives and properties. This Hazard Plan, with this inclusion, would provide this general information and perhaps the 'carrot'.

- Response 9: *Language has been added to this section describe the NFIP's Community Rating System (CRS), and Falmouth's current rating – as of right now, the Town of Falmouth is not part of the CRS program and has a rating of 0 (providing a 9% discount for flood insurance premiums). With the completion of this plan, the Town of Falmouth will have the option to apply to the CRS program.*

Comment 10: Relative to Chapter 5.4.2 1.Prevention and Resource Protection: 1a. captures a Wetlands restoration plan. Perhaps 1a should expand on this mitigation action. The visionary planning process (primarily the Planning Board/Dept./Staff) should be tasked to develop a conservancy planning/bylaw strategy. Would it be possible to first include in 5.4.2 that in Falmouth's coastal floodplain, an effort be concentrated to establish a mitigation action tailored to plans beyond specific situations identified in the Hazard Plan's draft of proposed mitigation suggestions? If we're talking about comprehensive strategies specific in this case to flooding, coastal sea surge and erosion(the highest threat risk), then the protection of people and property, and a reduced financial strain on local business, private property owners and municipal budget is best served by local regulatory dictates and an authority that is consistent with state and federal permitting, but more important, with Falmouth's vision of a sustainable future.

- Response 10: *Proposed mitigation action 1a (Create a comprehensive wetlands restoration plan and begin reconstruction in the most vulnerable areas) is a broad goal, and one that multiple departments, including the Planning Department, will need to be involved with. The Planning Department has been added to the list of responsible departments.*
  In response to the portion of the comment suggesting that this action address "Falmouth's coastal floodplain" and "plans beyond specific situation", the phrase "throughout the coastal areas of Falmouth" has been added to the "Purpose" description. Additionally, the intent of this proposed action is to look holistically at the Town, and develop a comprehensive wetland restoration for the entire Town.

Commenter Name: Les Garrick, Box 467, Woods Hole

Comment 11: Has there been some thought as to how the town's decision makers will be able to use the information in Table 3-19, Relative Risk of Hazards in Falmouth, to produce an integrated mitigation plan?

- Response 11: *This is an important question. As the first iteration of a Multi-Hazard Mitigation Plan for the Town of Falmouth, how some of this information will be used has not yet been determined. However, determining how to best apply the risk information will be an important part of applying this version of the Plan over the next five years.*

Comment 12: Please include a list of Literature Cited.

- Response 12: *A references section has been added to the end of the Plan.*

Comment 13: With reference to section 3.4, Hurricanes, newer information (e.g. Donnelly, Jeffrey, Geomorphology 109 (2009) 36–45) will expand the list of hurricanes beyond the written record. Donnelly is at WHOI. What is the source of the stated probability (10 to 100 percent) for tropical storm and hurricanes? Can these probabilities be separated since their impact can be very different?

- Response 13: *The paper suggested by the above comment (Madsen et al. 2009. A chronology of hurricane landfalls at Little Sippewissett Marsh Massachusetts USA using optical dating. Geomorphology. 109: 36-45) focuses on dating sediments from historic overwash event in Little Sippewissett Marsh dating back 600 years before the present. Incorporation of data from this article would not change the current likelihood or hazard ranking of hurricanes, or the identification of vulnerable properties or critical facilities within the Town. As such, estimated storms prior to the 1938 recorded storm are not included in this Plan.*
  The source of the state probability of likely (between a 10 and 100% probability in the next year) for tropical storms and hurricanes was taken from the 2010 Barnstable County Multi-Hazard Mitigation plan. This information has been added to the report. Because hurricanes and tropical storms are treated together in this Plan (as well as in the State and County plans) the probability is given for either event occurring. Perhaps in future revisions of the Plan, if deemed useful for planning purposes by the Town, the hurricane and tropical storm hazards can be addressed separately.

Comment 14: with reference to section 3.8, Fire. Attached is an article that appeared in the Falmouth Bulletin in 2009 entitled "Is Falmouth Prepared for a Forest Fire", which I researched and wrote after reading about the Beebe Woods fire of 1947 and the numerous fires that swept through Bourne, Sandwich and northern parts of Falmouth, especially Hatchville since the 1920s. (attached list of Cape Cod Forest Fires) To better understand where the Upper Cape was in its forest fire fighting capabilities, I interviewed the late Falmouth Fire Chief Paul Brodeur. Chief Brodeur arranged for me accompany district fire officials into the field to see the effects of planned burns and to attend a conference on fire hazards. When it came to the issue of Beebe Woods, Chief Brodeur had a lot to say.

In section 3.8 reference is made to Caren Caljouw's 2005 report – Wildland Fireand Preparedness Plan for Beebe Woods and Peterson Farm Conservation Areas Falmouth, Massachusetts. It was written for the Town of Falmouth and the Cape Cod Cooperative Extension. The Primary Management Goal in this report was to reduce wildfire hazards within Beebe Woods and Peterson Farm through an integrated and proactive land management program. However, by 2009, that management goal had not been implemented, which frustrated Chief Brodeur. He said that he was unable to get consensus on removing the tinder from Beebe Woods or for widening the roads so that the brushbreaker trucks could get near a fire. Moreover, the residents abutting Beebe Woods on the southeast were not willing to follow the Firewise program and remove trees and shrubs near their homes. Their argument was that if they cleared the vegetation people would enter and exit the woods through their property.

From the ecological perspective, the late Beth Schwarzman contributed the following to the discussion of forest fire risk: The forests in town today are not the forests of the 20s and 30s because they contain more hardwood trees and fewer pines and they are cut by more roads and rights of way which may act as firebreaks. She also said that soils on the moraine hold water much better than soils on the outwash plains, I haven't followed the situation in Beebe Woods

since 2009; maybe you could ask Chief Sullivan to see if Caljouw's recommendations have been followed. If you require more information about land use in Hatchville, see my book – Historic Hatchville (2014), The History Press, available at Eight Cousins Books and online.

- Response 14: *The sources provided were reviewed. Much of the general information in the newspaper article was already included in the plan. Additional "past occurrences" of wildlife were added to section 3.8 based on the attached list of Cape Cod Forest Fire. In response to the comment concerning the fact that the Wildland Fire and Preparedness Plan for Beebe Woods and Peterson Farm Conservation Areas contained recommended actions that have not yet been implemented, this Plan currently contains a proposed mitigation action to conduct fuel management activities (1h), as well as another proposed mitigation action to train fire department staff in wildland fire response (1g) to hopefully address these issues in the near future.*

Commenter Name: Kathleen J. Haynes, Chairperson of the Falmouth Commission on Disabilities

Comment 15: As the chairperson of the Falmouth Commission on Disabilities, it would be remiss of me, not to call attention to the lack of even a slight mention of the disabled people who reside in Falmouth, who have the potential of complicating the Multi-Hazard Mitigation Plan. How many disabled individuals reside in Falmouth? Does anyone involved in preparing this plan know? I doubt it. The disabled are an under-represented population in the Town of Falmouth. The plan notes there are 11 elderly communities. How many are disabled in those communities? Are the Police and Fire Departments trained in helping to move a wheelchair bound resident to safety in the event of flooding, Worse, severe winter weather when the electricity, heat, and phone services are down? Who know where a disabled person is sitting in a single family, or even multi-family residence besides an elderly housing community. For those of us who do live in a multi-family residents, not an elderly community, does anyone involved in helping people get to a shelter know where a disabled person is and cannot call for help? Without phone lines, rescue devices such as "Life Line" are not functional.

My own example should show the planners of this report the lack of failsafe measures for the disabled. In the recent blizzard, I was alone in the dark, a day after back surgery. I still had sutures in two different areas of my back, and am a fall risk, with a Life Line Rescue Device. It was left non-functioning. Had I fallen, no one would have had any idea, let alone where I reside. A call to the police department was answered with a "what do you want us to do?" Had the electricity stayed off indefinitely, and cell phones only hold out for just so long, would anyone even bother to see I got to a shelter. And what if I failed to answer door because I was on the floor bleeding out from torn stitches?

Yes, the experience I mention, although true is an exception and a rarity. But removing a very large person from any residence, who cannot walk and needs assistance, does the fire department have the kind of rescue equipment that is necessary in a flood or winter weather emergency. At times like these, a stretcher might not work--then what? Can the rescue personal

get someone who needs their power-chair in a shelter situation, to a shelter--say there are 100 of these individuals-how do you find them, let alone transport them.

I plan on proposing to the selectman a study whose aim is to find out the actual number of disabled people in Falmouth, and their location as part of te town's strategic plan. I also think those planners of the multi-Hazard Mitigation Plan take a second look at the numbers they have reported and at least have a sense of how many disabled do reside in the highest flood zone, severe winter-weather zones rather than lump them into just a single residence, multi-family, or especially an elderly community.

A couple of other important thoughts. Say a large number of people are in fact sent to shelters around Falmouth. At the risk of sounding like I am discriminating against groups of people, does a quiet room exist for autistic children or adults who would be overwhelmed simply by the sheer numbers of people. Do hand squeeze toys exist for those individuals or the mentally, developmentally or intellectually challenge who might regress when forced to exist with large numbers of people? Yes, again these are what-ifs, but they are what if's that need to be considered. Moving people to shelters seems pretty simplistic, but for a disabled person it could be a recipe for disaster. Group homes with disruptive teenagers, group homes where residents have cerebral palsy, or challenged in other ways--do we depend on limited staff to get these individual's to safety and watch over them in what could be an overwhelming situation? I question whether these were thoughts in the minds of the writers of the Mitigation Plan. I have actually read the report, to my chagrin that there was no mention at all of the very vulnerable population--the disabled.

- Response 15: *It is clear that this is an understudied vulnerable population in Town. If the plan you propose to the Board of Selectman is conducted, and a study is done to find out the actual number of disabled people in Falmouth, and their location, then this information will be incorporated into future revisions of this Plan. For now, given the lack of details on number of specific locations of this population, a discussion has been added to Section 4.4 to at least acknowledge and address that this vulnerable community exists in Falmouth and may need additional planning and assistance in the event of a hazard situation.*

Commenter Name: Leslie Fields, 66 Emmons Road, Falmouth

Comment #16: The Town should consider adding an addition mitigation action in the Prevention and Resource Protection category that says: Allocate responsibility to Town staff for record keeping required for FEMA CRS program.

- Response #16: *The Town of Falmouth has not yet made the decision to join the CRS program. If and when the Town does apply to join the program, this or a similarly intentioned action will be added to a future revision of this Plan.*

Appendix C: Town Assets and Vulnerability

1. HAZMAT Facilities
2. Capabilities Assessment
3. Critical Facilities List
4. Critical Facilities Vulnerabilities
5. Mitigation Actions Prioritization
6. Removed Mitigation Actions

ID	HAZMAT FACILITY NAME	CONTACT Person/Address	PHONE NUMBER	E-Mail	HAZARDOUS SUBSTANCE
1	Accurate Plastics	Joseph Roy 33 Tech Drive, Falmouth, MA	1-800-222-8759 ext.112 24-hr 508-326-1761	joe@acculam.com	Brominated Epoxy Resin, Phenolic Novalac Blend, Phenolic Resin Solution,Acculam Epoxyglas,
2	Associates of Cape Cod (*)	Michael Lewandowski 124 Bernard E. Saint Jean Drive E. Falmouth, MA	24-hr 508-250-6971 508-540-3444	mlewadowski@acciusa.com	Sulfuric Acid, Untra Low Sulfur Diesel,
3	Bosun's East Falmouth Marina 1209 East Falmouth Hwy (*)	Timothy Leedham 1209 East Falmouth Hwy Falmouth MA 02536	24-hr 774-836-5203 508-477-4626	tleedham@bosuns.com	Battery, Diesel Fuel, Gasoline, Kerosene,
4	Bosun's East Falmouth Marina Boat Storage Lot 614 East Falmouth Hwy (*)	Timothy Leedham 1209 East Falmouth Hwy, Falmouth MA 02536	24-hr 774-836-5203 508-477-4626	tleedham@bosuns.com	Battery, Diesel Fuel, Gasoline,
5	Brewer Fiddler's Cove Marina (*)	Fred Sorrento 42 Fiddler's Cove Rd. N. Falmouth, MA (Scott Carpenter)	24-hr 508-292-0880 508-564-6327	fcmservice@byy.com	Diesel fuel,Gasoline, Sulfuric Acid
6	Cape Cod Aggregates – Falmouth 486 Thos. Landers Road	Robert Umbrello 62 Devon Lane Marston Mills	24-hr 774-994-0995 508-775-3716	bob@capecodagg.com	CAS: 68476-30-2, Sand,
7	Crooked Pond Water Treatment Facility 50 Twin Oaks Drive	Stephen Rafferty 416 Gifford St.	508-958-3346 508-457-2543 x 3017	srafferty@falmouthmass.us	Potassium Hydroxide Solution, Potassium Permanganate, Solium Hypochlorite Solution
8	East Marine 89 Falmouth Heights RD & Island Queen Lot Windsor Road	David Casiles	24-hr 508-566-0638 508-540-3611	service@eastmarine.com	Diesel fuel, Gasoline,
9	Falmouth Highway Department 416 Gifford Street	Michael Souza	24-hr 774-353-6942	msouza@falmouthmass.us	Calcuim Chloride, Diesel Fuel, Gasoline, Soduim Chloride
10	Falmouth Hospital 100 Ter Huen DR	Jeff Dykens	24-hr 774-836-3436 508-548-5300	jdykens@capecodhealth.org	Fuel Oil, Oxygen, Liquid, Liquid Oxygen, Sulfric Acuid,
11	Falmouth Ice Arena 9 Technology Park Drive (*)	Tom Peterson	508-367-8576 508-548-7080	falmouthice@aol.com	Ammonia, Ethylene Glycol, Sulfric Acid,
12	Falmouth Marine & Yachting Center 278 Scranton Ave (*)	Paul Porter	24-hr 617-291-0880 508-548-4600	Service@falmouthmarine.com	Diesel Fuel, Gasoline, Sulfric Acid
13	Falmouth Ready Mix 475 Thos Landers Rd	Albert Moniz	24-hr 508-776-3889 508-548-6100	falmouthreadymix@aol.com	Heating fuel, Engine Lubricating Oil, Diesel Fuel Oil, Hydraulic Oil, Sulfuric Acid
14	Falmouth TRACON (FMH) Bldg #130-Otis AFB	Jeff Cook	24-hr 617-519-1612 978-725-3521	Jeffrey.cook@faa.gov	Battery acid, diesel fuel
15	Falmouth Main WWTF,154 Blacksmith Shop RD	Charlie Pires Amy Lowell	508-958-4291 508-221-1077	cpires@falmouthmass.us alowell@falmouthmass.us	Fuel oil no. 2, Sodium Hydroxide,
16	Falmouth WWTF – JP Lift Station 454 Palmer Ave.	Charlie Pires Amy Lowell	508-958-4291 508-221-1077	cpires@falmouthmass.us alowell@falmouthmass.us	Sodium Hypochlorite,
17	Falmouth WWTF – Woods Hole Lift Station 0 Water Street Falmouth, MA 0243	Charlie Pires Amy Lowell	508-958-4291 508-221-1077	alowell@falmouthmass.us	Sodium Hypochlorite,

ID	HAZMAT FACILITY NAME	CONTACT Person/Address	PHONE NUMBER	E-Mail	HAZARDOUS SUBSTANCE
18	First Student (*)	Michael McLeavy 536 Thomas B. Landers Road, East Falmouth, MA	24-hr 508-521-4371 508-540-6433	Michael.mcleavy@firstgroup.com	Diesel fuel NO. 2 (low sulfur)
19	Fresh Pond Well Carriage Shop Road	Stephen Rafferty	508-958-3346 508-457-2543 x 3017	srafferty@falmouthmass.us	Potassuim Hydroxide, Sodium Hypochlorite Solution
20	Lawrence Ready-Mixed Concrete 396 Rear Gifford Street	Linda Charpentier	617-227-9000 x228 617-759-3143	lcharpentier@bostonsand.com	Concrete Cement-Plastic State Daraccel, Grancem/Slag, Polarset, Portland Cement
21	Long Pond Water Treatment Facility 65 Pumping Station Rd (*)	Stephen Rafferty	508-958-3346 508-457-2543 x 3017	srafferty@falmouthmass.us	Chlorine,Potassuim Hydroxide Solution
22	MacDougalls' Cape Cod Marine Service 145 Falmouth Heights Road (*)	Michael Meehan	24-hr 774-313-6098 508-548-3146 ext. 152	mmeehan@macdougalls.com	Diesel Fuel, Gasoline, Sulfuric Acid
23	Mares Pond Well 401 Pinecrest Beach Drive	Stephen Rafferty	508-958-3346 508-457-2543 x 3017	srafferty@falmouthmass.us	Potassium Hydroxide Solution, Sodium Hypochlorite Solution
24	North Marine 53 Falmouth Heights Road	Michelle Ostiguy	508-477-7000	mostiguy@northmarinefalmouth.com	Diesel Fuel, Gasoline
25	NSTAR Station 967 Old County Rd	Eric LaMontagne	781-441-3803 339-987-7018	Eric.lamontagne@nstar.com	MODF, Sulfuric Acid (in Batteries)
26	NSTAR Station 933 61 Stephens Lane Falmouth, MA	Eric LaMontagne	781-441-3803 339-987-7018	Eric.lamontagne@nstar.com	MODF
27	NSTAR Station 936 1096 Sandwich Rd Falmouth, MA	Eric LaMontagne	781-441-3803 339-987-7018	Eric.lamontagne@nstar.com	MODF, Sulfuric Acid (in Batteries)
28	The Fuel Co. Inc. 7 Acapesket Road	Rick Swain	774-238-0053 800-922-8026	Rs_fuelco@comcast.net	Heating Oil, Ligh
29	The Fuel Co. Inc. 11 Acapesket Road	Rick Swain	774-238-0053 800-922-8026	Rs_fuelco@comcast.net	Fuel Oil no 2,
30	Town of Falmouth Hwy Dept of Public Works	Michael Souza	24-hr 774-353-6942 508-457-2543	msouza@falmouthmass.us	DE-ICE-IT, Diesel Fuel, Gasoline, Sodium Chloride.
31	Steamship Authority 1 Railroad Ave.	Carl Walker	24 hr 508-889-8081 508-548-5011 x 288	cwalker@steamshipauthority.com	Fuel oil No. 2
32	Upper Cape Regional Water Supply Cooperative connection Falmouth Sandwich Road Mashpee, MA	Stephen Rafferty	508-958-3346 508-457-2543 x 3017	srafferty@falmouthmass.us	Sodium Hydroxide (liquid), Sodium Hypochlorite Solution
33	Upper Cape Regional Transfer Station 33001 Generals Boulevard, Sandwich, MA	Michael Souza	24-hr 774-353-6942 508-495-7342	msouza@falmouthmass.us	Diesel Fuel,
34	USCG Sector Southeast New England– formerly Group Woods Hole 1 Little Harbor Road Woods Hole, MA	Phillip Wolf	508-457-3211		Diesel Fuel, gasoline
35	Verizon Falmouth Co. (VZ-MA536206) 400 Main & Gifford Streets (*)	Robert Poznauskis	800-386-9639 617-253-9940	robert.a.poznauskis@verizon.com	Lead Acid Batteries, Kerosene
36	Verizon Falmouth Co. (VZ-MA458978) 674 Thos. Landers Rd. (*)	Robert Poznauskis	800-386-9639 617-253-9940	robert.a.poznauskis@verizon.com	Lead Acid Batteries, Kerosene

ID	HAZMAT FACILITY NAME	CONTACT Person/Address	PHONE NUMBER	E-Mail	HAZARDOUS SUBSTANCE
37	102nd Intelligence Wing 197 Granville Ave Otis ANG Base, MA 02542	Thurman Deane Env. Mgt. Office	24-hr 508-968-4879 508-221-1120	Thurman.deane@ANG.AF.MIL	Acetylene, AFF3% Concentrate, Diesel Fuel, Gasoline,JP-8 Jet Fuel, Lubricating Oil, Potassium Carbonate
38	WHOI 44 Water St. / 266 Woods Hole Rd. / 360 Woods Hole Rd., Woods Hole	David Derosier	508-289-2289 774-836-0606	dderosier@whoi.edu	Tetraflouroethane, chlorodiflouromethane, diesel fuel oil, gasoline, lead, methanol, propane, propylene glycol, refrigerant, sodium chloride
39	Woods Hole, Martha's Vineyard and Nantucket Steamship Authority One Railroad Ave, Woods Hole	Greg Endicott	24 Hr Phone: 508-560-7172	cwalker@steamshipauthority.com	Fuel Oil
40	Wynne Fuel Oil Co. 8 Old Meetinghouse Road	William Bearse	24-hr 508-728-2875	wynneoil@aol.com	Diesel Fuel, Heating Oil PlusKerosene

Capability Assessment Worksheet

Jurisdiction: _____

Local mitigation capabilities are existing authorities, policies, programs, and resources that reduce hazard impacts or that could be used to implement hazard mitigation activities. Please complete the tables and questions in the worksheet as completely as possible. Complete one worksheet for each jurisdiction.

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes/No Year	Does the plan address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan	Y	indirectly, yes, yes
Capital Improvements Plan	Y	indirectly, yes, yes
Economic Development Plan	Y	no, no , no
Local Emergency Operations Plan	Y	yes, no, yes
Continuity of Operations Plan	Y	no, no, no
Transportation Plan	Y	indirectly, no, no
Stormwater Management Plan	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Coastal Ponds Management

Worksheet 4.1
Capability Assessment Worksheet

Building Code, Permitting, and Inspections	Yes/No	Are codes adequately enforced?
Building Code	Y	Version/Year: State Building Code
Building Code Effectiveness Grading Schedule (BCEGS) Score	?	Score:
Fire department ISO rating	?	Rating:
Site plan review requirements	Y	Yes
Land Use Planning and Ordinances	**Yes/No**	**Is the ordinance an effective measure for reducing hazard impacts?** **Is the ordinance adequately administered and enforced?**
Zoning ordinance	Y	Y, Y
Subdivision ordinance	Y	Y, Y
Floodplain ordinance	Y	Y, Y
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Stormwater, slope in zoning bylaw
Flood insurance rate maps	Y	Y, Y
Acquisition of land for open space and public recreation uses	Y	Y, Y
Other		

How can these capabilities be expanded and improved to reduce risk?

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. For smaller jurisdictions without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.

Administration	**Yes/No**	**Describe capability** **Is coordination effective?**
Planning Commission	Y	Very capable. Yes.
Mitigation Planning Committee	Y	Very Capable, Yes
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Very Capable. N/A.
Mutual aid agreements	Y	Very capable Yes.
Staff	**Yes/No FT/PT[1]**	**Is staffing adequate to enforce regulations?** **Is staff trained on hazards and mitigation?** **Is coordination between agencies and staff effective?**
Chief Building Official	Y	N, Y, Y
Floodplain Administrator	N	
Emergency Manager	Y	N/A, Y, Y
Community Planner	Y	N/A, Y, Y
Civil Engineer	Y	N/A, Y, Y
GIS Coordinator	Y	N/A, Y, Y
Other		

1 Full-time (FT) or part-time (PT) position

Worksheet 4.1
Capability Assessment Worksheet

Technical	Yes/No	Describe capability Has capability been used to assess/mitigate risk in the past?
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Variable Message Boards. Yes.
Hazard data and information	Y	Sophisticated GIS Department. Yes.
Grant writing	Y	Sophisticated Management. Yes.
Hazus analysis	?	
Other		
How can these capabilities be expanded and improved to reduce risk?		

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/ Eligibility (Yes/No)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Yes. Water and Wastewater, facilities. Yes.
Authority to levy taxes for specific purposes	Y	Captial/Debt exclusions. Yes.
Fees for water, sewer, gas, or electric services	Y	No. No.
Impact fees for new development	N	N/A
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Yes. General Government, Schools
Incur debt through private activities	N	N/A
Community Development Block Grant	Y	Yes. Housing Rehab. No.
Other federal funding programs	Y	DOI, CZM grants. Yes.
State funding programs	Y	C.90
Other		

How can these capabilities be expanded and improved to reduce risk?

Worksheet 4.1
Capability Assessment Worksheet

Education and Outreach

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

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Land acquisition, Yes
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	LEPC ,Yes
Natural disaster or safety related school programs	Y	School Department, Yes
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	Y	LEPC, Yes
Other		

How can these capabilities be expanded and improved to reduce risk?

Critical Facilities List

FID	Facility	Type	Address	Tier
	Accurate Plastics	HAZMAT	33 Tech Drive	4
93	Ashument Well	Water	1095 Sandwich Road	1
	Associates of Cape Cod	HAZMAT	124 Bernard E. Saint Jean Dr	4
95	Atria Woodbriar	Medical / Nursing	339 GIFFORD ST	1
153	Bonanza Bus Lines Terminal	Other	59 Depot Ave	2
	Bosun's Marina	HAZMAT	1209 East Falmouth Hwy	4
82	Brewer's Fiddler Cove Marina	HAZMAT	42 Fiddlers Cove Road	4
29	Cape & Islands NPR Radio	Other	3 Water St	2
	Cape Cod Aggregates	HAZMAT	486 Thomas Landers Road	4
24	Cape Cod Ambulance Medical	Medical	Main St	3
100	Cape Cod Free Clinic & Community Health Center	Medical	65C Town Hall Square	1
134	Center for Optimum Care or Harborside Health Care	Medical/Nursing	359 Jones Road	1
151	Coast Guard Station	Other/HAZMAT	30 Little Harbor Road	1
92	Coonamessett Well	Water		1
42	Crooked Pond Treatment Plant	Water	50 Twin Oaks Dr	1
107	Crooked Pond Well	Water	Geggatt Road	1
2	Department of Natural Resources	Admin	65 Pumping Station Rd.	1
19	Department of Public Works	Admin/HAZMAT	416 Gifford St.	1
118	Drawbridge Hut	Admin	Woods Hole	2
45	East Falmouth Elementary School	School	33 Davisville Rd.	2
6	East Falmouth Fire Station	Fire	505 East Falmouth Hwy	1
	East Marine	HAZMAT	89 Falmouth Heights Rd	4
5	Emergency Operations Center (Headquarters)	Fire	399 Main St.	1
46	Falmouth Academy	School	7 Highfield Dr.	3
110	Falmouth Airpark	Other	67 Airpark Drive	3
15	Falmouth Harbor Master Building	Admin	180 Scranton Ave	1
57	Falmouth High School	School	847 Gifford St.	2
0	Falmouth Hospital	Medical/HAZMAT	100 Ter Heun Dr.	1
8	Falmouth Housing Authority	Admin	115 Scranton Ave	1
	Falmouth Ice Arena	HAZMAT	9 Technology Park Drive	4
80	Falmouth Landfill	Other	700 Thomas B Landers Rd	3
84	Falmouth Marine	HAZMAT	278 Scranton Ave	4
20	Falmouth Police Dept	Admin	750 Main St	1
11	Falmouth Public Library	Library	123 Katherine Lee Bate Rd.	2
	Falmouth Ready Mix	HAZMAT	475 Thomas Landers Road	4
21	Falmouth Recreation Department	Admin	790 East main St.	3
13	Falmouth School Administration	Admin	340 Teaticket Hwy.	1
76	Falmouth Senior Center	Admin	300 Dillingham Ave.	3
	First Student	HAZMAT	536 Thomas Landers Road	4
90	Fresh Pond Well	Water/HAZMAT		1
117	Harbor Master Shack	Admin	Old Dock Road	2
158	Hayway Water Tower	Water	276 Hayway Road	1
96	Heritage At Falmouth	Medical / Nursing	140 TER HEUN DR	1
27	Human Services Dept	Admin	Town Hall Sq	2
155	Island Queen Ferry Terminal	Other	75 Falmouth Heights Road	2
97	JML Care Center, Inc.	Medical / Nursing	184 TER HEUN DR	1
47	Lawrence Jr. High School	School	113 Lakeview Ave.	2
	Lawrence Ready Mix Concrete	HAZMAT	396 Rear Gifford Street	4

Critical Facilities List

FID	Facility	Type	Address	Tier
108	Long Pond Reservoir	Water		1
109	Long Pond Sewer Pumping Station	Water/HAZMAT	65 Pumping Station Road	1
85	MacDougall's Cape Cod Marine Service	HAZMAT	145 Falmouth Heights Rd.	4
89	Mares Pond Well	Water/HAZMAT	Pattee Road	1
18	Mass Highway Dept	Admin	1132 Nathan B. Ellis Hwy.	1
131	MBL/WHOI Dorms	School	Devil's Lane	3
50	Morse Pond Middle School	School	323 Jones Rd.	2
58	Mullen Hall School	School	140 Katharine Lee Bates	2
154	Nobska Lighthouse	Other	233 Church Street	2
51	North Falmouth Elementary School	School	62 Old Main Rd.	2
4	North Falmouth Fire Station	Fire	204 Old Main Rd.	1
83	North Marine	HAZMAT	53 Falmouth Heights Rd.	4
157	NS Treatment Plant	Water	Williams Road	1
	NSTAR Station 933	HAZMAT	61 Stephens Lane	4
	NSTAR Station 936	HAZMAT	1096 Sandwich Road	4
	NSTAR Station 967	HAZMAT	Old County Road	4
32	Overlook - Visiting Nurse	Medical	East Falmouth Hwy	3
123	Pier 37	Boats	64 Scranton Ave	3
23	Post Office	Other	120 Main St	2
98	Royal Magansett Nursing and Retirement Home	Medical / Nursing	209 County Rd.	1
99	Royal Nursing and Alzheimer's Center	Medical / Nursing	545 Main St.	1
74	Sea Education Association Inc	School	171 Woods Hole Rd.	3
91	Sewer Pumping Station	Water/HAZMAT	454 Palmer Ave.	1
152	Steamship Authority Ferry Terminal	Other/HAZMAT	0 Railroad Ave	1
	Stop & Shop Gas Station	Gas Station	43 Davis Straits	4
54	Teaticket Elementary School	School	45 Maravista Ave.	2
	The Fuel Co. Inc	HAZMAT	7 Acapesket Road	4
	The Fuel Co. Inc	HAZMAT	11 Acapesket Road	4
14	Town Hall	Admin	59 Town Hall Sq.	1
	Verizon	HAZMAT	400 Main and Gifford Street	4
	Verizon	HAZMAT	674 Thomas Landers Road	4
17	Wastewater Treatment Facility	Water/HAZMAT	154 Blacksmith Shop Rd.	1
44	Water Plant Pumping Station	Water	10 Pumping Station Rd.	1
156	Water Tower	Water	64 Technology Park Drive	1
159	Water Tower	Water	28 Bernard St Jean Drive	1
3	West Falmouth Fire Station	Fire	555 West Falmouth Hwy	1
12	West Falmouth Public Library	Library	575 West Falmouth Hwy.	3
	WHOI	HAZMAT	44 Water Street	4
	WHOI	HAZMAT	266 Woods Hole Road	4
	WHOI	HAZMAT	360 Woods Hole Road	4
31	Woods Hole Community Center	Other	68 Water St.	3
7	Woods Hole Fire Station	Fire	419 Woods Hole Rd.	1
28	Woods Hole Library	Library	581 Woods Hole Rd.	3
	Wynne Fuel Oil Co.	HAZMAT	8 Old Meetinghouse Road	4

Point ID	Name of Facility	Category	HAZMAT site	Tier	Flood Hazard Area (VE)	Flood Hazard Area (AE)	Flood Hazard Area (Other)	SLR 1ft	SLR 2ft	SLR 3ft	SLR 4ft	SLR 5ft	SLR 6ft	SLOSH Cat 1	SLOSH Cat 2	SLOSH Cat 3	SLOSH Cat 4	Wind District	Low Fire Risk	Moderate Fire Risk	High Fire Risk	Extreme Fire Risk	Fire Mitigation Focus Area	Dam within 1000ft	Culvert within 1000ft	Coastal Erosion
Administrative																										
1	Department of Natural Resources	Admin		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
2	Falmouth Housing Authority	Admin		1	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	0	0	0	0	0	0	0
3	Falmouth School Administration	Admin		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
4	Town Hall	Admin		1	0	X	0	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	X	0	0
5	Falmouth Harbor Master Building	Admin		1	0	X	0	0	0	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	X
6	Mass Highway Dept	Admin		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
7	Falmouth Police Dept	Admin		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0
8	Falmouth Recreation Department	Admin		3	0	0	X	0	0	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	X	0
9	Human Services Dept	Admin		2	0	0	X	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	X	0	0
10	Falmouth Senior Center	Admin		3	0	X	0	0	0	0	0	X	X	0	X	X	X	X	X	0	0	0	0	0	X	0
11	Harbor Master Shack	Admin		2	X	0	0	0	0	0	X	X	X	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Drawbridge Hut	Admin		2	X	0	0	0	X	X	X	X	X	X	X	X	X	X	X	0	0	0	0	0	X	0
13	Department of Public Works	Admin	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	X	0	0	0	0	0	0
Fire Stations																										
14	West Falmouth Fire Station	Fire		1	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	X	0	0	0	0	X	0
15	North Falmouth Fire Station	Fire		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
16	Emergency Operations Center (Headquarters)	Fire		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0
17	East Falmouth Fire Station	Fire		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0
18	Woods Hole Fire Station	Fire		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
Hazardous Materials Sites																										
19	Brewer's Fiddler Cove Marina	HAZMAT	Yes	4	0	X	0	0	0	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	0
20	North Marine	HAZMAT	Yes	4	0	X	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	0	X
21	Falmouth Marine	HAZMAT	Yes	4	0	X	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	0	X
22	MacDougall's Cape Cod Marine	HAZMAT	Yes	4	0	X	0	0	0	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	X
23	Accurate Plastics	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
24	Associates of Cape Cod	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	X	0
25	Bosun's Marina	HAZMAT	Yes	4	0	X	0	0	X	X	X	X	X	X	X	X	X	X	X	0	0	0	0	0	0	0
26	Cape Cod Aggregates	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
27	East Marine	HAZMAT	Yes	4	0	X	0	0	0	X	X	X	X	X	X	X	X	X	X	0	0	0	0	0	0	0
28	Falmouth Ice Arena	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
29	Falmouth Ready Mix	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
30	First Student	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
31	Lawrence Ready Mix Concrete	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	X	0	0	0	0	0	0
32	NSTAR Station 967	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
33	NSTAR Station 933	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
34	NSTAR Station 936	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
35	The Fuel Co. Inc	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
36	The Fuel Co. Inc	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
37	Verizon	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0
38	Verizon	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
39	WHOI	HAZMAT	Yes	4	X	0	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	X	X
40	WHOI	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
41	WHOI	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
42	Wynne Fuel Oil Co.	HAZMAT	Yes	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0
Libraries																										
43	Falmouth Public Library	Library		2	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	0	0	0	0	X	X	0
44	West Falmouth Public Library	Library		3	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	X	0
45	Woods Hole Library	Library		3	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	X	0
Medical/Nursing Homes																										
46	Cape Cod Ambulance Medical	Medical		3	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	0	0	0	0	0	0	0
47	Overlook - Visiting Nurse	Medical		3	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
48	Cape Cod Free Clinic & Community Health Center	Medical		1	0	0	X	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	X	0	0
49	Atria Woodbriar	Medical / Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
50	Heritage At Falmouth	Medical / Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0

Point ID	Name of Facility	Category	HAZMAT site	Tier	Flood Hazard Area (VE)	Flood Hazard Area (AE)	Flood Hazard Area (Other)	SLR 1ft	SLR 2ft	SLR 3ft	SLR 4ft	SLR 5ft	SLR 6ft	SLOSH Cat 1	SLOSH Cat 2	SLOSH Cat 3	SLOSH Cat 4	Wind District	Low Fire Risk	Moderate Fire Risk	High Fire Risk	Extreme Fire Risk	Fire Mitigation Focus Area	Dam within 1000ft	Culvert within 1000ft	Coastal Erosion
51	JML Care Center, Inc.	Medical / Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	X	0	X	0	0	0
52	Royal Magansett Nursing and Retirement Home	Medical / Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
53	Royal Nursing and Alzheimer's Center	Medical / Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0
54	Falmouth Hospital	Medical	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0
55	Center for Optimum Care or Harborside Health Care	Medical/Nursing		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	X	0
Other																										
56	Post Office	Other		2	0	0	0	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	X	0	0
57	Cape & Islands NPR Radio	Other		2	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	X	0
58	Woods Hole Community Center	Other		3	0	X	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	X	0
59	Falmouth Landfill	Other		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
60	Falmouth Airpark	Other		3	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
61	Pier 37	Other		3	0	0	0	0	0	0	0	0	0	0	0	0	X	X	X	0	0	0	0	0	0	X
62	Bonanza Bus Lines Terminal	Other		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
63	Nobska Lighthouse	Other		2	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0
64	Island Queen Ferry Terminal	Other		2	0	X	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	Stop & Shop Gas Station	Other		4	0	0	X	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	0	X	0
66	Coast Guard Station	Other	Yes	1	X	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	0	0	X
67	Steamship Authority Ferry Terminal	Other	Yes	1	0	X	0	0	0	0	0	X	X	X	X	X	X	X	X	0	0	0	0	0	0	X
Schools																										
68	East Falmouth Elementary School	School		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0	0
69	Falmouth Academy	School		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
70	Lawrence Jr. High School	School		2	0	0	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	0	0	X	X	0
71	Morse Pond Middle School	School		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	X	0
72	North Falmouth Elementary School	School		2	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0	0	0	0
73	Teaticket Elementary School	School		2	0	0	0	0	0	0	0	0	0	0	0	X	X	0	0	X	0	0	0	0	0	0
74	Falmouth High School	School		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
75	Mullen Hall School	School		2	0	0	X	0	0	0	0	0	0	0	0	X	X	X	X	0	0	0	0	X	X	0
76	Sea Education Association Inc	School		3	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	X	0	X	0	0	0
77	MBL/WHOI Dorms	School		3	0	X	0	0	0	0	0	0	0	0	X	X	X	X	X	0	0	0	0	0	0	0
Water Infrastructure																										
78	Crooked Pond Treatment Plant	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
79	Water Plant Pumping Station	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
80	Coonamessett Well	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
81	Ashument Well	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
82	Crooked Pond Well	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
83	Long Pond Reservoir	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0
84	Water Tower	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
85	NS Treatment Plant	Water		1	0	0	X	0	0	0	0	0	0	0	X	X	X	X	0	X	0	0	0	0	0	0
86	Hayway Water Tower	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
87	Water Tower	Water		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	0	0
88	Wastewater Treatment Facility	Water	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	0	0	0	X	0
89	Mares Pond Well	Water	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
90	Fresh Pond Well	Water	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
91	Sewer Pumping Station	Water	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0
92	Long Pond Sewer Pumping Station	Water	Yes	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X	0	X	0	0	0

Each item can be scored as 3=Good; 2=Average; 1=Poor

		Benefits					Feasibility				Economic		Regulatory			
	Mitigation Actions	Protects Properties and Structures	Protects Natural Resources	Technical Capacity Improvement to Improve Hazard Response	Improves Public Awarene	Improves Emergency Response or Public Protection Immediately after Emergency	Staffing	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available	Permitting/Regulatory	Consistent with Local, State, & Federal Goals	**Total Score**	**Ranking**
1	**Prevention and Resource Protection**															
1a	Create a comprehensive wetlands restoration plan and begin reconstruction in the most vulnerable areas.	2	3	1	2	1	2	3	2	3	2	1	1	3	**26**	MEDIUM
1b	Study the range of options and ideas found in the winning proposals of the "Rebuild By Design" competition and how they may be modified and implemented in Falmouth.	1	1	3	1	1	3	3	2	3	3	2	3	3	**29**	MEDIUM
1c	Maintain a list of municipal construction projects, bylaw/code revisions, and properties to acquire to reduce risk from natural hazards, ranked by highest priority.	2	1	1	1	1	2	3	2	3	3	2	3	3	**27**	MEDIUM
1d	Integrate municipal mitigation and adaptation projects into the Town's operating and capital budgets	2	2	3	1	1	2	3	2	3	3	2	2	3	**29**	MEDIUM
1e	Review and revise local codes and bylaws as necessary to increase the resiliency of construction projects, and lobby for changes in the state building code.	3	1	3	1	1	2	3	2	3	3	2	2	3	**29**	MEDIUM
1f	Revise Conservation Commission Wetlands Regulations to be consistent with the Coastal Resiliency goals and policies.	1	3	2	1	1	2	3	2	3	3	2	2	3	**28**	MEDIUM
1g	Train fire department staff and other emergency responders in wildland fire training.	2	2	3	1	2	3	3	2	2	2	2	3	3	**30**	HIGH
1h	Conduct fuel management activities in Fire Hazard Mitigation Focus Areas as identified in the Barnstable County Wildfire Preparedness Plan.	3	3	1	2	1	2	3	2	2	2	2	3	3	**29**	MEDIUM
1i	Conduct a thorough evaluation of the Town's most at-risk critical facilities identified in the Vulnerability Analysis, and evaluate the potential mitigation techniques for protecting each location to the maximum extent possible.	2	1	1	1	1	2	3	2	2	2	2	3	3	**25**	LOW
2	**Public Safety**															
2a	Establish evacuation procedures.	1	1	3	2	3	2	3	3	3	2	2	3	3	**31**	HIGH
2b	Incorporate evacuation procedures into the Emergency Response Plan.	1	1	3	2	3	2	3	2	2	2	2	3	3	**29**	MEDIUM
2c	Maintain an adequate supply of sand, salt and other road treatment materials.	2	1	1	1	3	3	3	3	3	1	2	3	3	**29**	MEDIUM
3	**Property Protection**															
3a	Design and Reconstruction of the Falmouth Heights Bluff located on the seaward side of Grand Avenue between Vernon Avenue and Gertrude Avenue. Approximate length = 1,300'.	3	2	1	2	1	2	2	3	3	1	2	1	2	**25**	LOW

Ranking Classification

22-25 = LOW
26-29 = MEDIUM
30-35 = HIGH

Each item can be scored as 3=Good; 2=Average; 1=Poor

		Benefits					Feasibility				Economic		Regulatory			
	Mitigation Actions	Protects Properties and Structures	Protects Natural Resources	Technical Capacity Improvement to Improve Hazard Response	Improves Public Awarene	Improves Emergency Response or Public Protection Immediately after Emergency	Staffing	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available	Permitting/Regulatory	Consistent with Local, State, & Federal Goals	**Total Score**	**Ranking**
3b	Design and Reconstruction of the Chapoquoit Road causeway from Chapoquoit Beach to end at stone pillars. Approximate length = 900'.	3	2	1	2	3	2	2	3	3	1	2	1	2	**27**	MEDIUM
3c	Consider the feasibility of beach nourishment along Chapoquoit Beach.	3	3	1	2	1	2	3	2	3	2	2	2	3	**29**	MEDIUM
3d	Begin talks with private organizations and businesses in Woods Hole (i.e. Steamship Authority, WHOI, MBL, etc.) about hazard mitigation and flood prevention.	2	2	3	3	3	3	3	2	2	3	3	3	3	**35**	HIGH
3e	Work with local land trusts to identify repetitive loss properties that these entities would be willing to buy out in the event of substantial damage, with the intent that these properties would be restored to their natural state and managed by the non-profit.	3	3	1	1	1	1	3	1	2	2	2	3	3	**26**	MEDIUM
3f	Develop pre- and post-storm response plans for Falmouth public beaches, as described in Beach Management Plan.	2	3	2	2	3	3	3	2	3	2	2	3	3	**33**	HIGH
3g	Evaluate alternatives for protecting, relocating, or abandoning vulnerable sections of Surf Drive.	2	3	2	2	2	1	1	1	2	1	2	1	2	**22**	LOW
3h	Evaluate alternatives to minimize flooding and sand deposits along Menauhant Road during a storm, particularly in the vicinity of Bristol Beach, InnSeason Resorts Surfside, and Menauhant Beach.	2	2	1	1	3	2	1	3	3	2	2	2	3	**27**	MEDIUM
4	**Structural Projects**															
4a	Reconstruction of the Fresh River Outlet on Surf Drive, including a roadway culvert and outlet groin.	3	3	1	2	2	2	3	3	3	1	2	2	3	**30**	HIGH
4b	Reconstruction of the Salt Pond Outlet on Surf Drive including a roadway culvert and outlet groin.	3	3	1	2	2	2	3	3	3	1	2	2	3	**30**	HIGH
4c	Reconstruction of the Trunk River Outlet under the bike path.	3	3	1	2	2	2	3	3	3	1	2	2	3	**30**	HIGH
4d	Reconstruct high school gymnasium glass roof with solid surface roof and install storm shutters on cafeteria windows.	3	1	3	2	3	2	3	3	2	1	2	3	3	**31**	HIGH
4e	When bridges require maintenance, assess the vulnerability of water mains and other utility infrastructure, and potentially upgrade or reinforce infrastructure during bridge repair.	3	2	1	1	1	2	2	2	2	1	1	2	3	**23**	LOW
4f	Explore stormwater best management practices (BMPs) to address sections of roadway that regularly flood after heavy rains (i.e. east end of Thomas Landers Road; Route 28 near Friendly's, etc.).	2	2	1	1	2	2	3	2	2	2	1	3	3	**26**	MEDIUM

Each item can be scored as 3=Good; 2=Average; 1=Poor

		Benefits					Feasibility				Economic		Regulatory			
	Mitigation Actions	Protects Properties and Structures	Protects Natural Resources	Technical/Capacity Improvement to Improve Hazard Response	Improves Public Awarene	Improves Emergency Response or Public Protection Immediately after Emergency	Staffing	Technically Feasible	Public Support	Town/Political Support	Cost	Funding Available	Permitting/Regulatory	Consistent with Local, State, & Federal Goals	**Total Score**	**Ranking**
4g	Verify the location of each repetitive loss property. If it cannot be located, is located in another jurisdiction, or has been mitigated, notify FEMA to get the property removed from the town's repetitive loss list.	2	1	3	2	1	3	3	2	2	3	3	3	3	**31**	HIGH
4h	Contact all owners of repetitive loss properties annually, and inform them of financial assistance available for structural mitigation such as elevation and acquisition.	2	1	1	3	1	2	3	2	2	2	2	3	3	**27**	MEDIUM
5	**Public Information and Communications**															
5a	Expand use of social media and other public outreach channels, such as Facebook, Twitter and YouTube, to provide information about hazard preparedness, as well as a method to provide real-time updates during and following a major natural hazard.	1	1	2	3	3	2	3	3	3	3	3	3	3	**33**	HIGH
5b	Develop an informational brochure that highlights the key points of this plan for residents, which could be made available at Town Hall and on the Town website.	1	1	1	3	1	2	3	2	2	2	2	3	3	**26**	MEDIUM
5c	Improve interdepartmental and inter-agency communications.	1	1	3	1	3	2	3	3	3	2	2	3	3	**30**	HIGH
5d	Establish town-wide radio station per LEPC recommendation.	1	1	2	3	3	2	3	3	3	2	2	3	3	**31**	HIGH
5e	Establish town-wide mass notification warning system (commercial program of sirens and loud speakers) to notify residents.	1	1	3	3	3	2	2	2	2	1	2	3	3	**28**	MEDIUM
5f	Formalize mutual aid agreements.	2	2	3	2	3	2	3	3	3	2	2	3	3	**33**	HIGH

Potential Mitigation Actions That Were Considered but Removed from the Final Plan:

1. Explore the creation of "Greenways": Work with the Cape Cod Commission to create the Little Pond Greenway.
    a. Purpose: Flood storage and the protection of property in the vicinity of the Falmouth Mall.
    b. Reason Removed: Not a priority at this time.

2. Establish road closures along the coast prior to a storm.
    a. Purpose: In areas where roads are regularly inundated during a storm, establishing closures prior to the onset of a storm will eliminate the risk of vehicles trying to pass through the flood waters. Drivers are often unaware of how deep the water is and how dangerous attempting to travel across such areas can be. Closing these roads ahead of time will improve public safety and eliminate the need for rescue and emergency vehicles during dangerous storm conditions.
    b. Reason Removed: Action already performed by Town.

3. Maintain adequate supplies at emergency shelter location.
    a. Purpose: Emergencies are not always planned. To ensure that the Town shelter can be activated quickly, and function effectively, key supplies (i.e. water, food, blankets, batteries, etc.) should be maintained at the shelter location.
    b. Reason Removed: Action already performed by Town.

4. Assess vulnerability of water mains on low-elevation coastal bridges; reinforce or relocate vulnerable pipes.
    a. Purpose: Falmouth's water mains carry the Town's drinking water. In areas where communities are separated by waterbodies, these water mains are located alongside bridges. In many coastal areas, these bridges get inundated during storms and are subject to wave actions and impacts from floating debris that could damage water mains.
    b. Reason removed: Replaced with "When bridges require maintenance, assess the vulnerability of water mains and other utility infrastructure, and potentially upgrade or reinforce infrastructure during bridge repair."

Appendix D: Plan Adoption

TOWN OF FALMOUTH

Office of the Town Manager & Selectmen

59 Town Hall Square, Falmouth, Massachusetts 02540
Telephone (508) 495-7320
Fax (508) 457-2573

Resolution to Adopt Falmouth Multi-Hazard Mitigation Plan

Whereas, the Town of Falmouth, Massachusetts recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S. Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards; and

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

Whereas, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the Town of Falmouth, Massachusetts has fully participated in the FEMA prescribed mitigation planning process to prepare this Multi-Hazard Mitigation Plan; and

Whereas, the Town of Falmouth desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Falmouth Multi-Hazard Mitigation Plan; and

Whereas, adoption by the governing body for the Town of Falmouth, Massachusetts demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Multi-Hazard Mitigation Plan; and

Whereas, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan; and

Now, therefore, be it resolved, that the Falmouth, Massachusetts Board of Selectmen adopts the "Falmouth Hazard Mitigation Plan" as an official plan; and

Be it further resolved, the Town of Falmouth, Massachusetts will submit this Adoption Resolution to the appropriate FEMA/related federal officials to enable the plan's final approval.

Passed on this 3rd day of April, 2017:

Doug Jones, Chairman

Megan English Braga

Susan L. Moran, Vice Chairman

Douglas C. Brown

Samuel H. Patterson

FALMOUTH BOARD OF SELECTMEN